solid. To prove that the liquid he was manipulating with such freedom was really liquid hydrogen Professor Dewar put a light to a small quantity, a brilliant burst of flame being the prompt result. Of its exceedingly small density he gave an idea by showing that a light material like cork would not float on its surface, but sank to the bottom as if it were lead. The lowness of its temperature he illustrated by a number of experiments. Thus a solid body immersed in it for a short time was shown to become so cold that the air round it was liquefied and ran off in drops, while when a tube containing liquid air was plunged into it the air immediately became solid. On this tube being lifted out again a double effect was seen, for the melting of the solid within it yielded liquid air, which was also formed by condensation on its outside surface. An empty vessel placed for a short time in the cold atmosphere just above this liquid, filled with solid air in the form of snow, soon melted into liquid. Oxygen in a sealed tube when lowered into it quickly became solid, and when lifted out it could be seen, as heat was absorbed, to assume first the liquid and then the gaseous form. A sponge of porous material, soaked in liquid hydrogen and brought into a magnetic field, apparently behaved as if it were magnetic. That, however-was due to the condensation of the oxygen of the air, which, of course, was magnetic, and, though an observer might in this way be easily deceived into thinking hydrogen magnetic, Professor Dewar said he was satisfied that it was nearly neutral or diamagnetic.

Speaking of the real temperature of this liquid, he said it had taken him nearly a year to come to a definite conclusion on that point because he could not get any two thermometers to agree. Pure platinum resistance thermometers gave 35° absolute (or 238° below zero Centigrade), one of the platinum-rhodium alloy 27°, while hydrogen itself in a gas thermometer gave 21°, a reading nearly identical with one obtained with a German-silver electrical thermometer. The last part of the lecture was devoted to the extraordinarily low vacua obtainable by the use of liquid hydrogen. Thus, by immersing one end of a closed tube in it for a short time and then sealing it off in the middle, a vacuum was formed in the upper part which was substantially perfect, as was shown by the fact that the electrical charge could not be made to pass. In conclusion, Professor Dewar, after exhibiting several other beautiful experiments, including one to illustrate the rapidity with which gases were discharged into a vacuum, claimed that the liquefaction of hydrogen was a triumph for theory not less than for practice.

Lord Kelvin, in moving a vote of thanks to Professor Dewar for his brilliant, beautiful and splendidly interesting lecture, said that if those present wished to measure the importance of the occasion, let them think what Count Rumford, or Davy, or Faraday would have thought, could they have been present. They could not have hoped for their scientific dreams and prophecies to be so splendidly verified within the century. The end of experiment in research at low temperatures had by no means been reached, and perhaps in a few years substances yet unknown and more refractory than hydrogen would have been found which would bring the experimenter to within five degrees of the absolute zero.

AUTOMATIC SHIP-PROPULSION.

AUTOMATIC ship-propulsion is once more proposed, this time by M. Linden, Secretary of the Naples Zoological Station, according to Sr. Menard in *Cosmos* of December 17, 1898. He attaches elastic plates to the bow and stern of the boat, which act precisely as does the tail of a fish. They are bent by the pitching of the boat in a seaway, and the reaction of their forcible unbending, as well as that of their motion against the water while being bent, produces forward motion in the boat, in effect as the fish drives himself forward by springing its tail in lateral movements. Thus every motion of the boat on the surface of the waves produces greater or less acceleration.

The boat employed is stated to be four meters (13 feet) long, its driving plates 50 centimeters long (20 inches) and one-half that width. They are thicker at the point of support than toward their extremities, giving a proper flexure when pressed by the water into their impelling

curves. Other experiments have been made, also, at Berlin, which are thought to offer some encouragement, and it is suggested that such a plan may prove satisfactorily operative with large vessels.

The idea is, however, very old; no one knows where or when it originated. Some twenty-five years ago Mr. Gerner, a then well-known inventor and patent attorney, of New York, proposed a somewhat similar scheme, employing rafts or floats at the stern and on either side, which, with the rolling and pitching of the vessel, and the relative motion thus produced, should operate levers on board the vessel, and through them a system of mechanism which should drive a screw and thus impel the ship. Nothing came of it, however.

R. H. T.

REMEASUREMENT OF THE ARC OF PERU.

Under date of May 12th the Minister of Public Instruction and Fine Arts announced to the French Academy of Sciences the coming departure from Bordeaux, on the 26th of May, of M. Maurain, captain of engineers, and M. Lacombe, captain of artillery, for Quito. These two officers constitute a commission to visit the stations of the old arc of Peru, measured between 1736 and 1739 by Bouguer, La Condamine and Godin, with the view of a remeasurement of the arc and its extension so as to comprise from five to six degrees of latitude.

This action is hailed with pleasure by geodesists everywhere. It is the direct outcome of the renewal of the suggestion for its remeasurement made at the last meeting of the International Geodetic Association, at Stuttgart, in October, 1898.

The proposition that the work should be soon undertaken was brought up by the American delegate, Mr. E. D. Preston, of the U. S. Coast and Geodetic Survey, at that Conference, and his action was interpreted to mean that if France would not undertake it some other nation, probably ours, would take steps towards the remeasurement of the arc whose revision is considered of such great importance to geodesy.

LELAND STANFORD JR. UNIVERSITY.

By the recent gifts of Mrs. Stanford, Leland Stanford Jr. University becomes the richest university in the world, far surpassing in its resources Harvard, Columbia or any foreign university. Situated where the development of civilization has been most rapid, and where its future promise is unlimited, under a wise and far-sighted administration, the University will become within a generation one of the greatest universities in the world. Correct details of the gifts and bequests of Senator Stanford, and of the gifts of Mrs. Stanford, will be of interest to readers of this Journal.

The resources of the University consist of three great farms, aggregating 95,000 acres of land, deeded by Act of Legislature. On one of these farms, which constitutes the University Campus, buildings to the value of $1,000,000 were erected before Senator Stanford's death. By his will the University received $2,500,000 in cash, invested in interest-bearing bonds. During the litigation following his death Mrs. Stanford deeded to the University her own private fortune, amounting to about a million dollars. The bulk of his fortune was left by Senator Stanford by will to his wife, with the understanding between them that in case she survived him she would do all for the institution that he would have done. This wish she has carried out to the letter, although, as a matter of fact, idle litigation has prevented her from doing anything until very recently. By her recent gift she transferred the residue of the estate to the University, it being necessary to do this by deed of gift under the laws of the State. Mr. Stanford's purpose was a chivalrous one, emphasizing the equality of his wife in their mutual work. The property just turned over has a commercial value—judging from the revenue stamps put upon the deeds—of $35,000,000. It would probably bring in the market about $13,000,000. What its actual value may be only the future can determine. The income arising from this final gift is at present relatively small, as by agreement among the railroads, in bonds and stock of which it largely consists, the earnings are for a time to be used in freeing the property from debt and in making improvements.