A BLAST OF DYNAMITE AND HOW IT WAS PHOTOGRAPHED.

BY ARTHUR INKERSLEY.

Though giant powder is frequently used to remove rocks, tree stumps, and other obstacles to cultivation or construction, it is not an easy thing to get a satisfactory photograph showing the actual explosion of a blast. The photographer must be near enough to the center of activity to secure a detailed picture; he must watch the progress of the explosion, and expose the plate at just the right instant; and, besides all this, he must be able to save himself and his camera from the stones and débris flying through the air.

The photograph here reproduced was made in a little town named Stirling City, in California. The blast was designed to remove a stump in the roadway. The camera was set up in a partly-finished house about twenty-five yards from the stump. When the fuses were lighted, the photographer stood with one hand on the bulb and the other holding the tripod head. After exposing the plate in the camera, he retired behind the walls, dragging his photographic apparatus with him. A moment later the stones and dirt that had been thrown up into the air came rattling down upon the house, some even coming through the window from which the picture had been made. The resulting picture is certainly a successful one, being clear in detail and filling the plate satisfactorily.

PHOTOGRAPH OF A BLAST OF DYNAMITE.

NEW 25-KNOT BRITISH SCOUTS.

The spirited picture of the new British scout "Sentinel," herewith shown, represents one of a class of eight vessels which have been designed solely to do scouting work. They carry only sufficient armament to drive off or destroy an enemy's torpedo boats or destroyers. Should this vessel meet with a hostile cruiser, it would not attempt to fight, but would instantly turn and run; or cruise in the offing out of gunshot range, but keeping in touch with and observing the enemy. The prime requisites for a vessel of this class are that it shall be very fast, faster, indeed, than any protected or armored cruiser; that it shall be of sufficient size and power to maintain its speed in heavy weather; that, compatible with the preceding requirements, it must be as small and inconspicuous as possible; and that it must be thoroughly staunch and seaworthy. Its armament need only be heavy enough to defeat any craft such as a destroyer or torpedo boat that is fast enough to overtake it; and it need carry but a moderate coal supply, its sphere of action being always within easy steaming of the main fighting fleet and its attendant colliers.

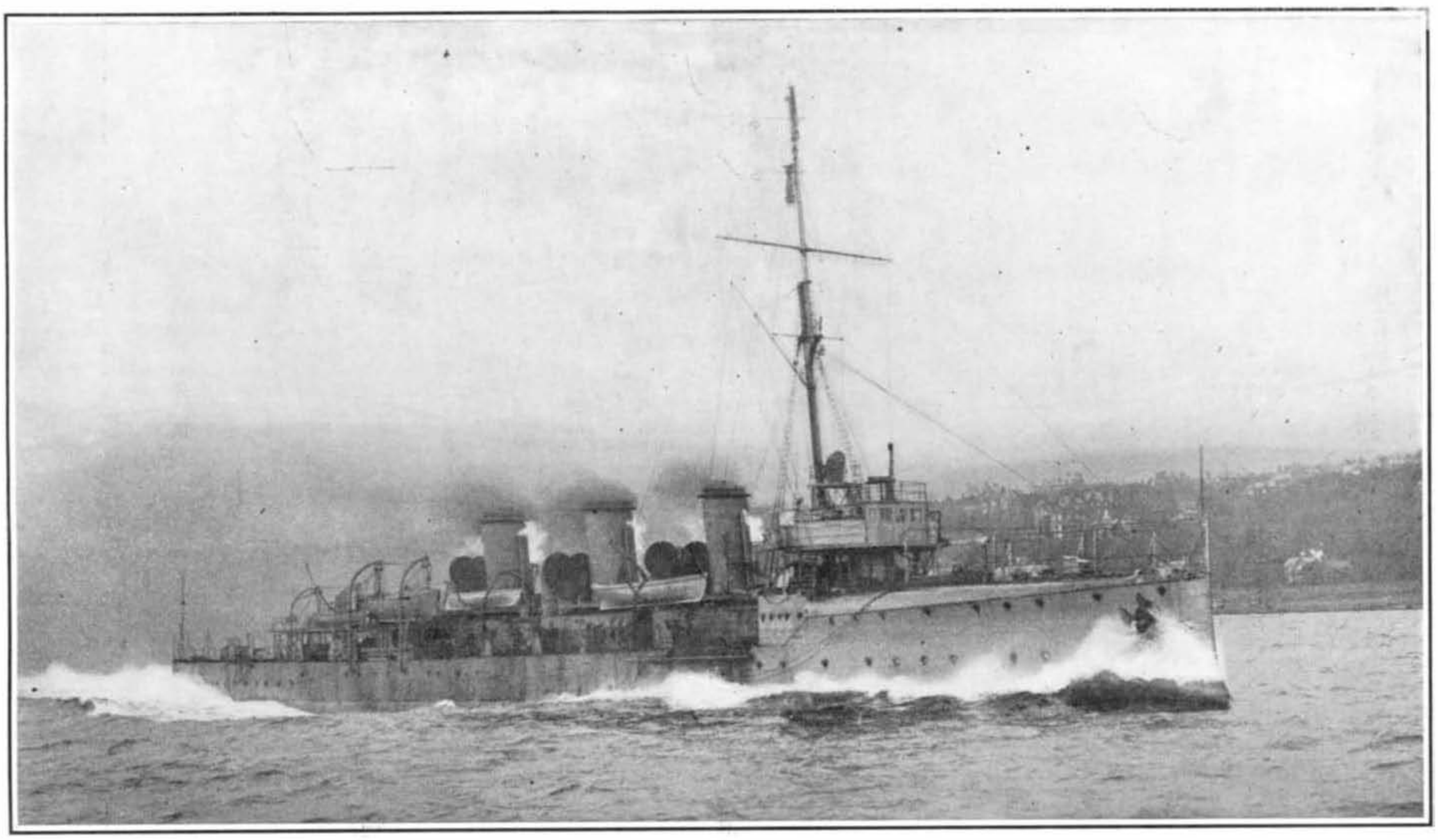
These vessels were laid down a few years ago in accordance with the modern policy of the British navy, which is to reduce the larger ships of the navy to three distinct types—the battleship, the armored cruiser, and the fast scout. The battleship will form the nucleus and the main fighting element of the fleet. Spread out fanwise beyond them will be the fast armored cruisers of 23 to 24 knots speed, and beyond these in a wider circle will stretch the scouts of 25 knots speed. Hitherto the extreme outpost duty or duties of reconnaissance have been performed by cruisers of large dimensions, 6,000 to 10,000 tons displacement or more. But the number of large vessels is limited by their great cost; and it was realized that by reducing the size, raising the speed, and trebling the number of vessels, the work of reconnaissance would be carried out over a far wider area, and by units that were in closer touch with one another and with the main body of the fleet.

Both the United States and Great Britain are building vessels of this type, or rather the British have built, and we are about to build them. In our issue of February 11 we illustrated the scouts designed for our navy, and a comparison of the two designs will be found very interesting. It will be seen from the accompanying table of dimensions that the British ship is smaller, faster, carries much less coal, and is considerably less conspicuous than our vessels. This is probably accounted for by the fact that our scouts are intended to act, if need be, on isolated duty, which may involve steaming over long distances, where there would be no access either to a collier or the coal pile.

The "Sentinel" is a vessel 360 feet in length and 40 feet in beam, displacing 2,920 tons. She has a high forecastle, to enable her to meet heavy seas, but otherwise she lies low in the water; her smokestacks are unusually short, and she is very inconspicuous—a valuable feature in scouting. She is provided with a single signaling mast, and indeed, in respect of her appearance, is merely a magnified torpedo-boat destroyer, her displacement being about seven or eight times greater than one of these craft. The steam trials prescribed by the Admiralty were that the vessel should steam for ninety-six hours at cruising speed, and that the rate of coal consumption on the latter half of this run should determine the quantity of fuel that the vessel was to carry when running at full power on her trial trip. She was to have sufficient fuel on board to enable her to steam at cruising speed for 1,500 miles; and with

COMPARISON OF BRITISH AND AMERICAN SCOUTS.

	British.	American.
Length, feet	360	420
Beam, feet	40	$46\frac{2}{3}$
Displacement, tons	2,920	3,750
Horse-power	17,500	16,000
Speed, knots	25.24	24
Normal coal supply, tons	150	500
Armament	Ten 3-inch, eight 3-pounders	[illegible] 3-inch
Torpedoes	Two 18-inch	[illegible] inch
Freeboard, forward	24 feet	[illegible]
Freeboard, aft	14 feet	[illegible]



Length, 360 feet. **Beam,** 40 feet. **Displacement** on trial, 2920 tons. **Horse-power,** 17,500. **Speed,** 25.24 knots. **Normal Coal Supply,** 150 tons. **Battery,** ten 3-inch guns, eight 3-pounders. **Torpedo tubes,** two 18-inch on deck. **Armor,** $1\frac{1}{2}$-inch deck.

The eight vessels of this class are intended for the same duties as the new United States scouts, illustrated in our issue of February 11, with which they may be compared.

NEW $25\frac{1}{4}$-KNOT BRITISH SCOUT "SENTINEL," FASTEST CRUISER AFLOAT.

this allowance of coal, and a load equivalent to the prescribed weight of ammunition, guns, etc., the vessel was required to steam continuously for eight hours, at a speed of 25 knots an hour. In the cruising speed trials it was found that one ton of coal was sufficient to carry the ship for 11 sea miles. On the eight hours' full-power trial, the engines worked up to a collective indicated horse-power of 17,500, and the mean speed for the whole run of 202 knots was 25.24 knots per hour. Incidentally, it may be mentioned that the load thus propelled is more than five times the average weight of a freight train making about the same speed on the rails.

As a measure of the cost of high power, it may be mentioned that the records of the trial show that to increase the speed from 22½ knots to 25 knots involved doubling the power required for the former speed. And further, that the last knot, that is the advance from 24 to 25 knots, involved a quarter of the maximum power, or an addition of over 4,000 horse-power, which, by the way, proved sufficient to drive the vessel at 19 knots an hour.

As showing how largely the great increase in horse-power and speed of modern warships has contributed to their cost, it may be mentioned that during the course of the trials, the new scout steamed around one of the armored cruisers of sixteen years ago, which was being taken under tow to her moorings, where she is to lie as an obsolete ship until she is sold. This cruiser of sixteen years' standing cost only about 25 per cent more than the modern vessel, although she has a displacement tonnage three times as great as that of the "Sentinel." In the case of the cruiser, the proportion of power to tonnage is barely 1 horse-power to 1 ton; whereas the "Sentinel" has 5¾ horse-power per ton; and consequently, her cost per ton is very much greater than that of the older but larger ship.

MY SCIENTIFIC EDUCATION.

BY THE RT. HON. LORD KELVIN.

I am a child of the University of Glasgow. I lived in it sixty-seven years (1832 to 1899). But my veneration for the ancient Scottish University, then practically the University for Ulster, began earlier than that happy part of my life. My father, born in County Down, was for four years (1810 to 1814) a student of the University of Glasgow, and in his Irish home, as first professor of mathematics in the newly-founded Royal Belfast Academical Institution, his children were taught to venerate the University of Glasgow. One of my earliest memories of those old Belfast days is of 1829, when the joyful intelligence came that the Senate of the University of Glasgow had conferred the honorary degree of Doctor of Laws on my father. Two years later came the announcement that the Faculty of Glasgow College had elected him to the professorship of mathematics. My father's experiences as a Glasgow student are naturally of supreme interest to myself. There were no steamers, nor railways, nor motor cars in those days. Can young persons of the present time imagine life to be possible under such conditions? My father and his comrade students, chiefly aspirants for the ministry of the Presbyterian Synod of Ulster and for the medical profession in the North of Ireland, had to cross the channel twice a year in whatever sailing craft they could find to take them.

At the beginning of his fourth and last university session, 1813-14, my father and a party of fellow students, after landing at Greenock, walked thence to Glasgow. On their way they saw a prodigy—a black chimney moving rapidly beyond a field on the left-hand side of their road. They jumped the fence, ran across the field and saw to their astonishment Henry Bell's "Comet" (then not a year old) traveling on the river Clyde between Glasgow and Greenock. Their successors five years later found in David Napier's steamer "Rob Roy" (which in 1818 commenced plying regularly between Belfast and Glasgow) an easier, if a less picturesque and adventurous way between the college of Glasgow and their homes in Ireland. Those students who had experience of cross-channel passages before and after the advent of the "Rob Roy" may well have been grateful to their college, not only for what it did for themselves but for what sixty years before it did for steam navigation in giving to James Watt a scientific home and congenial friends, and a workshop in the old University territory adjoining to the High Street of Glasgow. In the course of his four student years my father attended the classes of humanity, moral philosophy, mathematics, natural philosophy, anatomy, divinity. Though his passion was for science, and especially mathematics and natural philosophy, he attended during his first three sessions and won prizes in the Latin class, then happily, as now, called humanity. It is scarcely possible to overestimate the life-long good gift presented to a scientific student one hundred years ago, as now, by universities in giving something of the *literæ humaniores* to all who can and will take it.

In 1834, two years after my father was promoted from Belfast to the Glasgow Professorship of Mathematics, I became a matriculated member of the University of Glasgow. The little tinkling bell in the top of the college tower, calling college servants and workmen to work at six in the morning; the majestic tolling of the great bell wakening at seven o'clock professors (and students, too, I believe, in the olden times, when students lived in college); then, again, the lively little tinkling bell calling the professors and students of moral philosophy and senior Greek and junior Latin at half-past seven to work in their classrooms. Woe to the student of Latin who reached the door ten seconds after the quick little bell's last stroke. He was shut out by the door-keeper, unfailingly ruthless, by inexorable order, and had to wend his way through the darkness to his lodging, sorrowfully losing the happy hour's reading of Virgil or Horace or Livy with his comrades, under their bright young professor, William Ramsay, and knowing that he had got an indelible black mark against his name. Rarely did even a single student of a large class experience this disaster. It was a sharp, healthy, beneficial discipline, rigorously maintained by one of the kindest and most considerate of all the professors who have ever guided students in the Scottish universities.

As to Latin, I followed my father's example and attended divisions of the class during three sessions. To this day I look back to William Ramsay's lectures on Roman antiquities and readings of Juvenal and Plautus as more interesting than many a good stage play that I have seen in the theater. Happy it is for myself that his name and a kindred spirit are with us still in my old friend and colleague our senior professor, George Ramsay, Greek, under Sir Daniel Sandford and Lushington, logic under Robert Buchanan, moral philosophy under William Fleming, natural philosophy and astronomy under John Pringle Nichol, chemistry under Thomas Thomson (a very advanced teacher and investigator), natural history (zoology and geology) under William Cooper, were, as I can testify by my own experience, all made interesting and valuable to the students of Glasgow University in the thirties and forties of the nineteenth century. Sandford, in teaching his junior class the Greek alphabet and a few characteristic Greek words, and the Scottish pronunciation of Greek, gave ideas and something touching on philology to very young students, which remains on their minds after the heavier grammar and syntax which followed have vanished from their knowledge. Logic was delightfully unlike the Collegium Logicum described by Goethe to the young German student through the lips of Mephistopheles. Even the dry bones of predicate and syllogism were made by Prof. Buchanan very lively for six weeks among the students of logic and rhetoric in Glasgow College sixty-seven years ago; and the delicious scholastic gibberish of *Barbara celarent* remains with them an amusing recollection. A happy and instructive illustration of the Inductive Logic was taken from Well's Theory of Dew, then twenty years old. My predecessor in the Natural Philosophy Chair, Dr. Meikleham, taught his students reverence for the great French mathematicians, Legendre, Lagrange, Laplace. His immediate successor in the teaching of the Natural Philosophy class, Dr. Nichol, added Fresnel and Fourier to this list of scientific nobles; and by his own inspiring enthusiasm for the great French school of mathematical physics, continually manifested in his experimental and theoretical teaching of the wave theory of light and of practical astronomy, he largely promoted scientific study and thorough appreciation of science in the University of Glasgow. As far back as 1818 to 1830 Thomas Thomson, the first professor of chemistry in the University of Glasgow, began the systematic teaching of practical chemistry to students, and by aid of the Faculty of Glasgow College, which gave the site and the money for the building, realized a well equipped laboratory, which preceded, I believe, by some years Liebig's famous laboratory of Giessen, and was the first of all the laboratories in the world for chemical research and the practical instruction of University students in chemistry.

In the province of the humanities the working power of the University for instruction and research has been largely augmented during the last fifty years by the foundation of new professorships, conveyancing, English language and literature, Biblical criticism, clinical surgery, clinical medicine, history (in my opinion the most important of all in the literary department), pathology, political economy. In mathematics and in the science of dead matter, professorships of naval architecture and geology; lectureships of electricity, of physics, and of physical chemistry; and demonstratorships and official assistantships in all departments have most usefully extended the range of study, and largely strengthened the working corps for research and instruction.

A plan is under consideration by Salt Lake City authorities to provide automobile street sweepers.

A TACHOMETRIC WATCH FOR BICYCLES AND OTHER VEHICLES.

(*Continued from page 160.*)

The hand, then, does not budge relatively to the vehicle, and remains in an invariable position with respect to the handle bar of the bicycle, for instance, if the instrument is mounted on one of these. Since the velocity thus communicated to the case by the wheel does not vary, the rider is sure that he is moving at a constant velocity as long as the hand does not appear to have moved. If, after the hand has appeared to have moved, it is turned back to its original position, the rider is sure to have run on an average at a constant speed. This speed corresponds to the ratio of the gearing existing between the case and the wheel. The tachometric watch, therefore, supposing that it is proposed to travel at so many miles an hour, permits of gaining speed in a descent or of losing it in slowing up or stopping. If, afterward, the rider, by increasing or decreasing the speed, succeeds in bringing the hand back to its initial position with respect to the handlebar, he will be sure of having run at the mean speed corresponding to the ratio of the transmission. The hand considered is the hour one, or, generally, that of the seconds placed in the center of the dial. In this case, it is possible to read the deviations in speed to within a minute. It must be recalled, however, that the hand has lost or gained several revolutions, in order to bring it behind or before the exact number of revolutions by which it has varied. The mean speed that is obtained by keeping the hand apparently stationary depends upon the reducing ratio of the transmission. This ratio may be changed at will, without dismounting from the machine, in such a way as to cause a variation in the speed that it is desired to preserve on a gradient or on a level. With this object in view, the manufacturers, MM. Chateau et Fils, of Paris, are constructing two kinds of tachometric watches, one of them operating with a movable pinion and the other having a rubber belt for actuating the case.

The first type gives no error of transmission, since everything is done by gearing. To the axle of the front wheel of the bicycle is fixed a star-wheel, and a rod actuated by this controls an endless screw that drives a horizontal shaft having keyed to it a sharp-toothed pinion which can be slid along it. This pinion gears with a disk at different positions through apertures arranged in circles. Each circle is provided with a different number of apertures, and equal to the number of millimeters of its diameter. It is necessary, according to the circle with which the toothed wheel gears, to run with greater or less speed in order to keep the hand inoperative. Figures from 1 to 9 are marked upon a division, and the toothed wheel is arrested opposite figures corresponding to the speed in kilometers per hour, indicated opposite each figure upon a reckoning device. There can be no error except by reason of the imperfect regulation of the watch. If the latter varies 5 minutes a day, the error committed in the estimation of the speed will be 1-144, which error is therefore practically of no consequence.

The second type is more simple, but gives rise to errors due to slippage, amounting to about 0.02 at the most. The star-wheel is the same as in the other type. The watch is inclosed in a revolving case mounted on a collar which is screwed to the handlebar and is operatively connected with a drum actuated by a rubber belt passing over different channels, each of which corresponds to a determinate speed. The principle of the apparatus is the same as that of the preceding type.

Both types may be provided with a differential counter formed of two disks of 99 and 100 teeth that gear with the endless screw that actuates the case. The disks revolve in unison, and one of them is graduated from 0 to 100 and the other from 0 to 10,000. These numbers represent every twelve meters made by the wheel. A stationary index indicates up to 100 dekameters, and a movable one up to 10,000. The accuracy is within about 10 centimeters.

A 100-Mile Automobile Road Race in Cuba.

On the 12th instant the automobile racing invasion of Cuba was completed by the running of a 160-kilometer (99.36-mile) road race. The race was run over a fine stretch of road from Havana to San Cristobal and return, there being one neutralized stop at the turning point. On account of a collision a few days before, in which he was injured slightly and his mechanic Hawley rather seriously, E. R. Thomas was unable to compete with his 90-horse-power Mercedes. Tracy drove Major C. J. S. Miller's (formerly Mr. W. Gould Brokaw's) 30-horse-power Renault racer, and Fletcher drove an 80-horse-power De Dietrich. The race was won by Mr. E. K. Connill's 60-horse-power Mercedes, driven by Ernesto Carricaburn, a young Cuban. His time was 1 hour, 50 minutes, 53 3-5 seconds. The Renault was second in 1:52:26. This machine had trouble with the battery shaking loose, which delayed it somewhat. Otherwise, it would have undoubtedly won.