

# NEW ELECTRICAL APPARATUS OF THE UNITED STATES SIGNAL CORPS.

BY C. H. CLAUDY.

In accordance with acts of Congress in recent years, the coast defenses of the United States have been materially improved and strengthened. In no particular has more progress been made than in the electrical devices by which the fire from heavy guns is directed and controlled by the various artillery officers who constitute the chain of command in artillery districts.

It is the duty of the Signal Corps to furnish the devices which are required, and this corps has been very busy developing the necessary special apparatus. Much has also been done toward perfecting various means of communication between bodies of men in the field; but the electrical equipment for artillery fire control and direction claims first interest. Of the various electrical systems employed, the telephones to and from the gun, to the range-finding station, and the various artillery commanders, the electrical circuits for doing the thousand and one things in connection with a coast defense system, can be but mentioned in a story of the length of this one. The most striking application of electricity in this connection is the use of the telautograph, which, as most people know, is an instrument for sending and reproducing a written message. The operator writes on a roll of paper with a pencil, especially provided, and a mechanical pen at the other end of the line reproduces the message in the very handwriting of the sender.

The modern coast defense gun may be fired without the gunner having any idea as to what he is shooting at, or in any way "sighting" his gun. In days gone by, and so late as the civil war, gunners trained their guns as a markman aims his rifle—allowed so much for wind, so much for elevation, and so much for movement of the object, as experience, intuition, and judgment dictated. But now the great size and range of the guns render it imperative that the system be scientific.

Ranges are obtained now with range-finding instruments, all working on the parallax principle; that is, two sights or more are taken from two or more different points, the angle graphically calculated, and the exact distance and azimuth of the object thus ascer-

cated to the gunners, who train their gun according to the range given them, and fire at a signal. Other things being equal, the shot, correctly calculated, strikes home. About ninety per cent of hits is the average in coast defense practice. Some causes of misses may be inaccuracy of calculation, inaccuracy of charge, explosive not working as it should, more or less wind at time of shot than during calculation, and such factors which cannot be entirely eliminated.

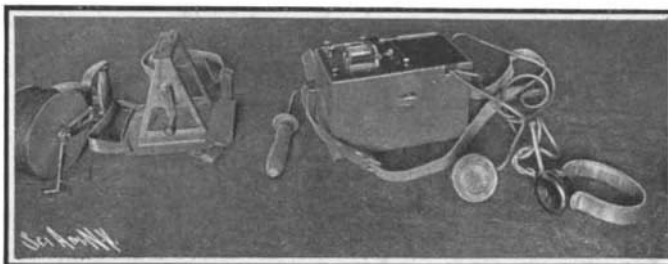
It costs a great deal of money to fire a big coast defense gun, and a miss may mean not only a waste of capital, but a waste of opportunity. A single shot has before now decided a battle. Consequently, there must be no possibility of mistake that can be avoided; hence, not only is the range communicated to the gunner through a telephone clamped to his ear by a head band, but the telautograph is used as well to put the figures before the gunner's eyes.

The writing pencil of the telautograph is connected with two flexible jointed arms, controlling two rheostats. These rheostats in turn control electric currents which, according to their strength, actuate in a greater or less degree two suspended solenoids which are pulled, more or less strongly, into tubular electromagnets. These solenoids, by similar jointed flexible arms, control a pen, which traces on the paper of the recording instrument the message as it is written.

The sending pencil cannot be moved without moving the rheostat controller on at least one side of the instrument, and in most movements without moving both. The controllers cannot move without altering the currents, and the currents when altered must affect the solenoids, and hence the recording pen. The pen must be inked. Consequently, before a message can be sent, a button must be pressed by the sender, and it can only be pressed by the sending pencil. This button occupies the same position relative to the writing space that the ink bottle does to the recording writ-



Portable Wireless Telegraph Station in Use in Cuba.



Portable Field Buzzer with Reel.

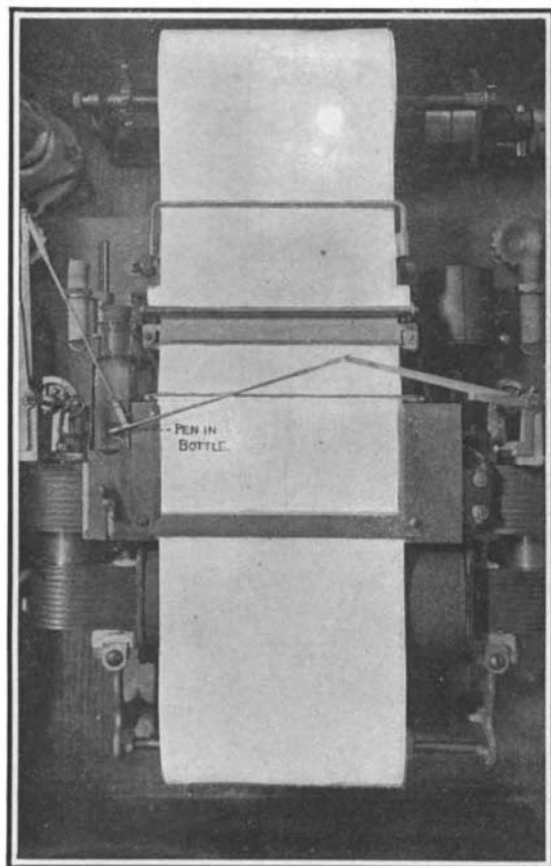
tained. Ready tables carefully computed show all the corrections at a glance, and wind and tide (in sea shooting to be factored on account of elevation), wind azimuth, speed of object, etc., all enter into the calculation with mathematical accuracy. Such a corrected range, now obtained in a few seconds, is communi-



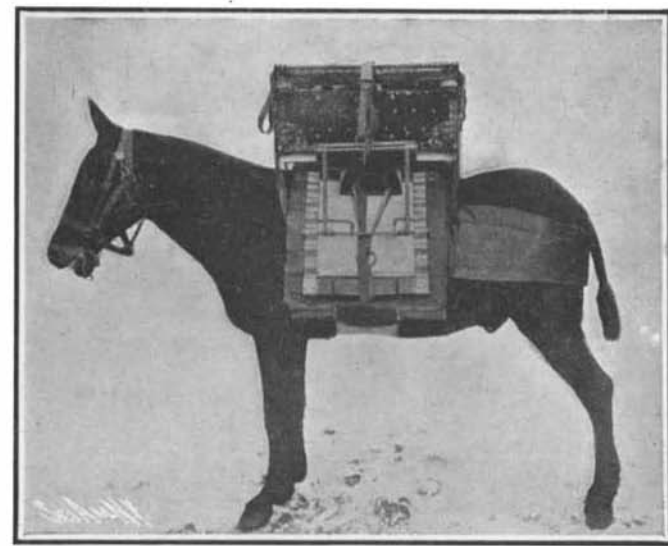
Portable Field Telephone Switchboard.



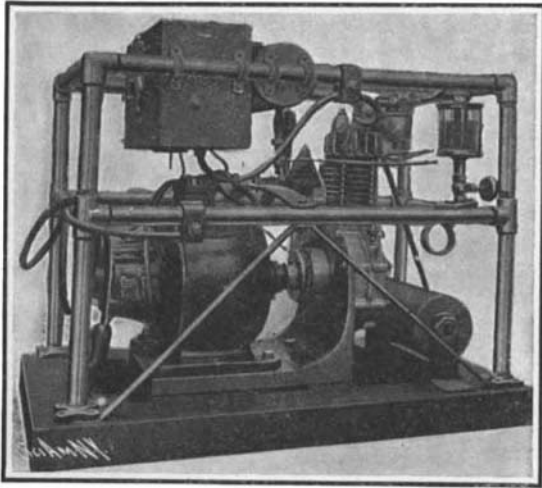
King Kite Used for Raising Antennæ Wire.



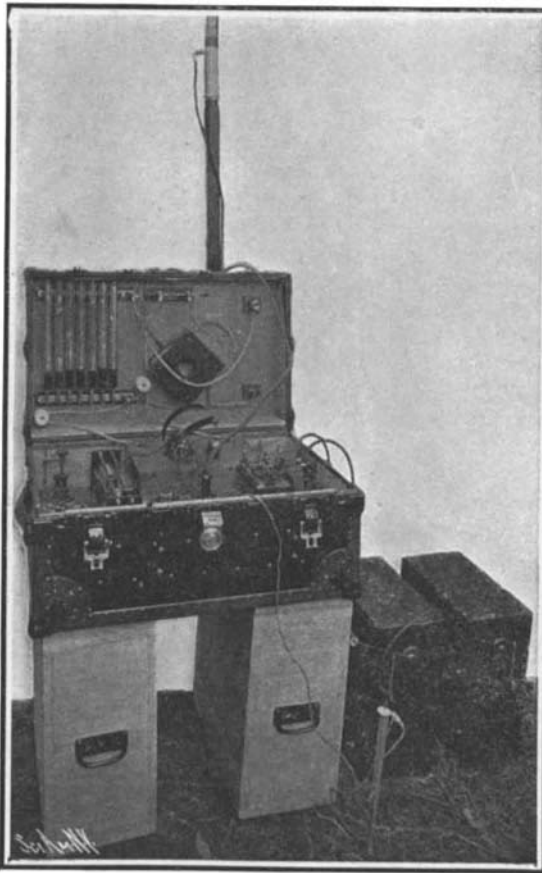
Telautograph Used for Transmitting Gun Ranges.



The Wireless Chest Mounted on a Pack Mule.



Portable Generator for Charging Storage Batteries.



Field Wireless Set Ready for Operation.

ing space. So when the button is pressed with the recording pencil, the pen in the recording instrument jams itself into the ink bottle and is inked. A buzzer is included in the outfit, which keeps the parts slightly a-tremble, thus making the pen glide smoothly over roughnesses in the paper and tending to make the ink flow freely.

It is a curious sight to see in the laboratory of the Signal Corps in Washington a demonstration of this outfit. The experimenter presses the button, pulls a small lever, and writes, "R. 7890 A 220.38," or some similar combination of numbers and letters representing a range. On the other side of the room a lamp lights, a slight buzzing is heard, and beneath a glass window a pen dips into an ink bottle and beneath it on a roll of paper, appears in the handwriting of the sender, "R. 7890 A 220.38." The gunner thus has the range and azimuth written and spoken, and except for the personal equation always present there is no chance for a mistake. He may be deaf for the moment, or his attention distracted, but hardly blind—he may fail to see, but hardly to hear too, at the same instant. The range is where it belongs, the gun is trained, with the fifteen seconds of allowance for the path of the moving ship, the signal comes "Fire!" and another shell screams on its way to the vitals of the ship which has the temerity to attack such a system.

These telautographs are in use or being installed at Sandy Hook, Fortress Monroe (Hampton Roads), Fort Wadsworth, Fort Hamilton, Boston, Portland, Me., and will be shortly at San Francisco, and possibly in other places.

Possibly the most interesting production of the Signal Corps for field use is the new portable wireless telegraph station, which can be carried on mule back, and sent out with a scouting party, keeping it in touch with the main body for a distance of from fifteen to twenty-five miles, or which may be used for connecting armies or divisions. These outfits are extremely compact, and are supplied with power from two storage batteries or from other portable means. These batteries have a maximum output of ten hours' actual sending. It would seem that campaigning in the field is a poor place to get a battery recharged, but the portable generator and gasoline engine illustrated herewith solve the problem. This outfit weighs less than three hundred and fifty pounds, and must of course be carried in a wagon; but as all large bodies of troops must have supply trains, and as supply trains must have wagons and roads, the charging station can go wherever a division can go. And the parties sent out with the traveling equipment and the storage batteries must send in after a few days for supplies, when they can get new batteries or take out the old ones recharged. The portable generating station of two horse-power can of course be used to send messages from headquarters when not engaged in charging batteries. The antennæ are carried on a sixty-foot pole, which is in ten sections and which makes its own connections, section to section, as it is fitted together.

Field experiments with this outfit have demonstrated that not infrequently messages can be sent over a distance of twenty-five miles. Communication with a large station, such as that at Cape Henry, Sandy Hook, or Key West, can be maintained over a distance of one hundred and twenty miles.

But the wireless in portable form, useful as it is, is not designed to displace the other and older forms of apparatus. There is here illustrated a portable telephone switchboard, designed for camps or headquarters, and connecting various departments. The hospital, the kitchen, the stables, the storage-wagon station, etc., can each and all be connected with headquarters by wires put up in a hurry and adapted for only temporary use; and this portable switchboard, which a man can carry on his back, will take care of the service and connect each to another or any one to headquarters. Doing business thus direct instead of by telegraph or dispatch bearer cannot but expedite the slowest camp.

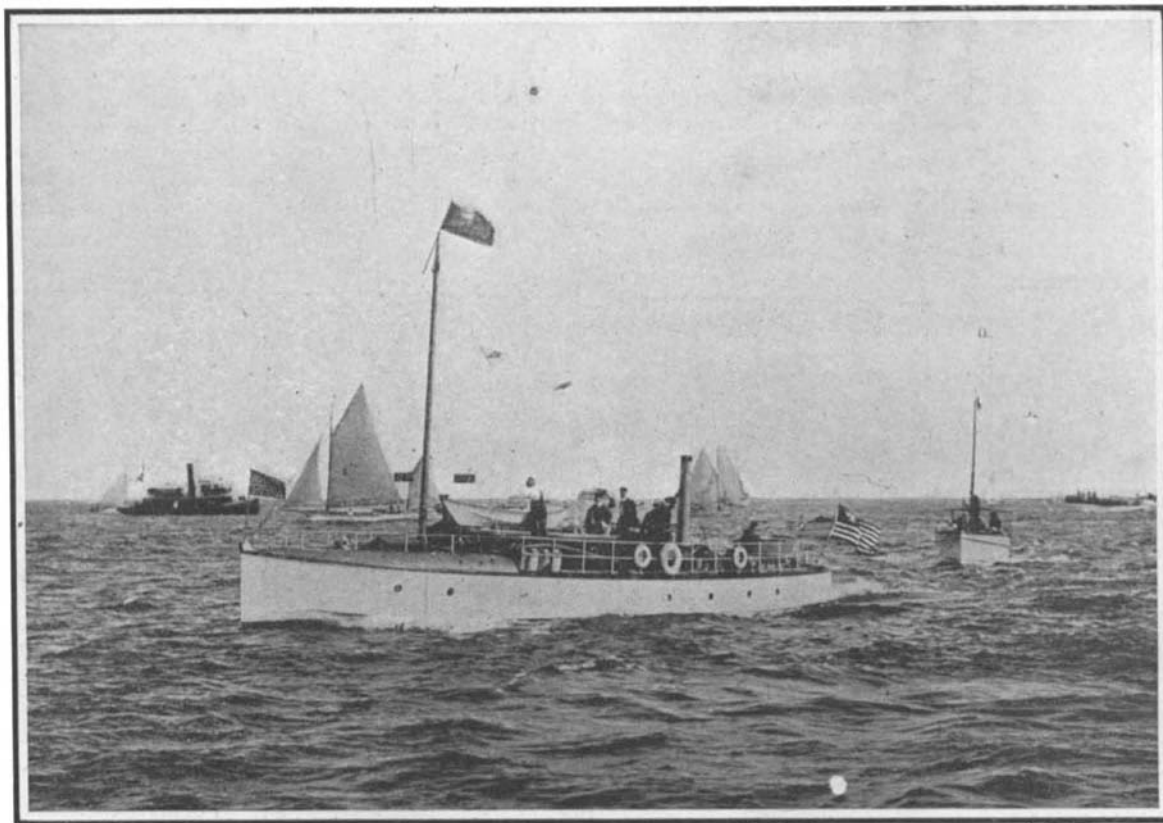
Most wonderful of all the intercommunicating devices, however, is the field buzzer, an English invention,

but neglected by its mother country and taken up and improved by our own Signal Corps until it is a practical and efficient instrument. The apparatus may be used for transmitting telegraphic as well as telephonic messages. The power is supplied from five tiny dry batteries, all of which can be easily carried in two hands.

The buzzer proper consists of a small vibrating hammer like the interrupter of an induction coil, and operated in the same way, and this makes a buzzing noise of a high pitch, hence the name. The high-frequency induced current has the faculty of finding its way across breaks and over leaks that would render totally inoperative the ordinary telegraphic devices, and finding its way to a circuit. Practically the only way of interrupting the operation of this instrument, within the limits of its range, is by making a number of gaps in the line. When the ground or foliage, or whatever the wire rests upon, is too dry, and the breaks too many for its power, the instrument of course refuses to work.

The principle of the buzzer is found in the sensitive action of the telephone receiver as a detector for feeble momentary currents and the comparatively high voltage developed at the terminals of an electromagnet when the current is suddenly interrupted.

The practical application of this outfit is obvious. A scouting party of one man, for instance, wishes to go forth and send back his information immediately. He gets on a horse, and holds in his hand a reel, carrying others in his saddle-bags. As fast as his horse can gallop, this stranded wire, two threads of copper and one of steel, for strength, is paid out.



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The Winner, the "Ailsa Craig," in the Foreground and the "Irene II" in the Distance.

#### COMPETING MOTOR BOATS IN THE RACE TO BERMUDA.

It falls on the ground, in the water, anywhere, it makes little difference. He finds out what he wishes to know, and goes to his little instrument and telephones. In the middle of his speech a wagon runs across his wires and cuts them. Speech stops, but the buzzer continues working. The enemy may see the wire and cut it, but it will probably make no difference, for a large part of the high-frequency current will leak across the gap and continue to the receiver.

The wire can be taken up by the same man with a swiftly-revolving intake reel, or can be abandoned. Ten miles of wire weighs but one hundred and forty pounds, and a ten-mile length is easily operated by the small batteries carried, even if the wire is cut or broken in several places.

In Lawton's advance through central Luzon, communication was constantly maintained with the buzzer between Cabanatuan, head of navigation on the Rio Grande, and San Jose, thirty miles north. Ten miles of the line was imperfectly insulated, and twenty miles was bare wire laid in earth, on trees, and over bushes. Part of the time heavy rains fell, which so flooded rivers as to prevent personal communication. In spite of these almost prohibitive conditions, the buzzer operated, faintly, it is true, but its signals were readable, and that was all that was required.

Henry Lemoine has not succeeded in producing the artificial diamonds within the time limit prescribed by the court. An extension of time until June 17 has been granted.

#### THE MOTOR-BOAT RACE TO BERMUDA.

In the motor-boat race to Bermuda this year there were but two competing craft—the "Ailsa Craig" of James Craig and the "Irene II" of S. W. Granbery. The former of these two boats ran in the race last year, and as a result of the trip, it had received some improvements, such as the fitting of a ventilator pipe for the engine room, etc. The latter boat, however, made its maiden voyage. This boat was launched only a few days before the race, and was hurriedly fitted with engine and equipment. In view of this fact, and also in view of the fact that the voyage was a rather rough one, the showing made by the "Irene II" was very good. Had its navigating officer been able to find his longitude, this boat would probably have won the race, as, although the gasoline feed pipe was broken by the heavy rolling of the boat a few hours before the finish, the crew managed to supply the engine with fuel from a tea cup and thus keep it running.

Our illustration shows the two boats just before the start. The "Ailsa Craig," which is shown in the foreground, has an over-all length of 59 feet 8½ inches. Its length on the load waterline is half an inch less, while its beam is 9 feet 8¾ inches and the draft 5 feet 3 inches. The midship section is 20 square feet. The engine used is a four-cylinder Craig marine motor, rated at 61½ horse-power, and the bore and stroke of the cylinders are respectively 9 and 10 inches.

The "Irene II," which is also shown in the picture, has an over-all length of 39 feet 11 inches and a load waterline length of 38 feet 8 inches. The beam is 10 feet and the draft 3 feet 3 inches. The midship section of this boat is 19.66 square feet. Its motive power consists of a three-cylinder Standard motor rated at 16.13 horse-power and having a bore and stroke of 6 and 8 inches respectively.

The race was started off Norton's Point, Coney Island, at 4:35 P. M. on Saturday, June 6. The "Irene II" crossed the line ten seconds later, and the "Craig" at 4:35:30. Ten minutes later the "Craig" had overhauled and passed the "Irene II," and in two hours' time she had gained so much that the latter boat was lost to view. The distance covered by the "Craig" up to noon of the second day was 190 nautical miles, while during the next day's run in the Gulf Stream, 248 nautical miles were covered. The total distance to Bermuda was 670 nautical miles, or 772.37 statute miles; and the "Ailsa Craig," despite rough seas and strong head winds, covered the distance in 66½ hours, arriving off St. David's Head at 11:45 A. M. (or 11 o'clock New York time)

on Tuesday, June 9. The time allowance which was given the "Irene II" was 20 hours, 23 minutes, and 24 seconds, and it was thought that this boat would stand a good chance of winning. Owing to the causes mentioned above, however, she did not finish until four hours later than the time allowed her; in 90 hours, 39 minutes, and 50 seconds. The actual time of the "Ailsa Craig" was 66 hours, 30 minutes, and 40 seconds. This corresponds to a speed of 10.07 knots, or 11.54 statute miles an hour. In last year's race this boat averaged 10.34 knots. The speed of the "Irene II" was 7.39 knots, or 8.52 statute miles an hour.

This race, although there were but two competitors, was an interesting one, as it demonstrated very well the ability of the larger cruising type of motor boat to make a successful ocean voyage, even when the weather conditions are not altogether favorable, as happened to be the case last year. It is to be hoped that if another race of this sort is run, there will be a larger number of competitors.

#### New Transatlantic Records.

In her last trip to the westward, the Cunard liner "Lusitania" covered the long route of 2,890 miles in 4 days, 20 hours and 8 minutes, at an average speed for the whole trip of 24.88 knots. Her best day's run was made from noon Sunday to noon Monday, when she covered the record distance of 641 miles. The weather was calm with light westerly winds until the last day, when the ship ran into a thunder squall succeeded by several hours of fog.