ARMY SIGNALING.

THE open order system of organization, which gives to modern armies their great flexibility and mobility, renders rapid and accurate communication between their different divisions and subdivisions of vital importance in preserving unity of command, concentration of attack and security of individuals.

This necessity, which has been coincident with the development of electricity and the bicycle, has led to the creation of the Signal Corps, which since the war, has steadily grown in importance as a factor in military operations.

The Signal Corps is a body of highly trained soldiers whose duty it is to provide the methods of communication between the different forces of an army, so that the commander can rapidly transmit orders and receive reports from even the most distant outposts. An army with all its trains occupies a great area of country, and the work of the signal corps is often most difficult. For example, an army corps of forty-two thousand men has four divisions of infantry, eight to twelve batteries, at least four regiments of cavalry, and on the march on a single road with all its trains it would stretch out at least twenty-two and one-half miles, or a distance which would take a mounted messenger moving from the head of the column to the rear, if he made good speed and met with no obstruction, at least three hours to make, or moving from the rear nearly half a day.

Great difficulties often present themselves to prevent communication over such large areas by day and night, in sunshine, fog or rain, or, as at Brooklyn, in the dead of winter.

Signaling is the transmission of a pre-arranged code as accurately and rapidly as mechanical or other means admit. The code used in the United States is that known as the American Morse, which is the ordinary code used in commercial telegraphy. Messages are transmitted by dots and dashes, short and long flashes, or waves of flags to right, left and front. This code, which was adopted several years ago as the army signal code, for the reason that it was the telegraph code, is a violation of the fundamental principles upon which signal codes should be built, is ill adapted to army signaling, is an impossible code for the navy, and has no excuse for its existence save that Morse, the inventor of the telegraph, so fashioned it, yet a change now, which would involve the great army of commercial operators, is almost impossible.

The army and navy should certainly use the same code. The code now in use in the navy is the "Myer Code," invented by General Myer, the first Chief Signal Officer of the Army. This code, which contains no "space" letters, is held by many eminent authorities on signaling to be the most satisfactory code for the united service.

The limitations of military signaling are distance, meteorology, topography and the enemy. The methods of signaling available are messengers, visual signals, phonetic signals and the telegraph and telephone. Messengers have been much used for short distances, since the advent of the bicycle in the military service.* The bicycle is especially adapted for use by signalmen on account of its speed, noiselessness, and ease of concealment. It is used by the United States Signal Corps and by Connecticut, Ohio, Colorado, Illinois, New York and some other States.

Visual signaling embraces flags, heliograph, torch, flash light, etc. Flags are useful at short ranges, the letters of the Morse code being sent by a wave to the right for a dot, to the left for a dash, and to the front for a space.

The torch, which is a copper cylinder on the end of a pole, having a wick of

* See "Military Cycling," OUTING, December, 1890.

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cotton ravelings, burns with a fierce flame as it is swung through the air. It is used in the same way as the flag. Flash lanterns have not yet been perfected, and are limited to short ranges. They send a short flash for a dot, and a long flash for a dash, like a heliograph.

The heliograph is the most perfect, serviceable and powerful instrument for visual signaling. It consists of a tripod carrying a bar having a mirror at one end and a sighting rod at the other. The mirror, which is about four inches square in the service instrument, has a small unsilvered spot in the centre. To adjust it for use the bar is pointed in the direction of the distant station, the operator from behind the mirror looks through the unsilvered spot and aims the bar by means of the apex of the sighting rod, which is like a gun sight, at the distant station; the bar is then clamped in place, the disk of the sighting rod is turned up to coincide with the sight, a small piece of white paper is slipped in the disk and the mirror turned by means of slow motion screws till the "shadow spot" made by the unsilvered spot in its centre falls on the. centre of the disk of the sighting rod. The flash is then visible at the distant station. The shadow spot must be kept in the centre of the disk while signaling, as it constantly tends to move off, owing to the motion of the earth. The circle of illumination or space within which the flash can be seen is 16 2-3 yards in diameter at a distance of one mile, and increases 16 2-3 yards for every mile of distance, so that it is equally easy to adjust for long as for short ranges.

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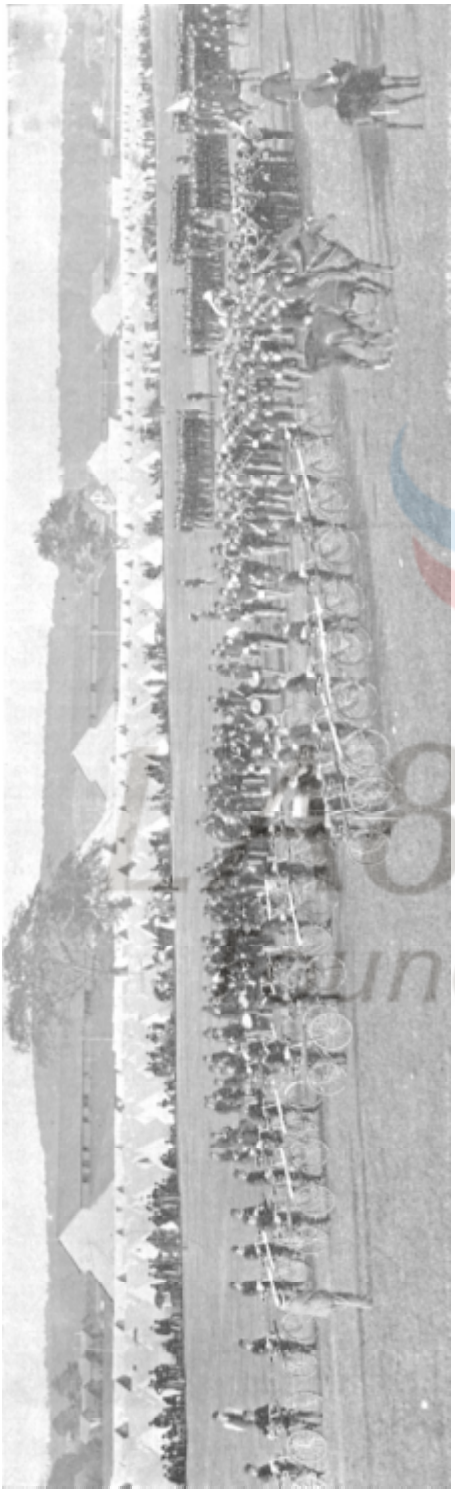
One mirror and the sighting rod can only be used when the sun is in front of the operator. When the sun is behind, two mirrors are used, one on each end of the mirror bar which is clamped diagonally across the line of sight. Adjustment is then secured by throwing the reflection of the distant station from the station mirror into the sun mirror, and then throwing the shadow spot from the sun mirror upon a small paper disk in the centre of the station mirror, the reflection of the paper disk, the unsilvered spot and the reflection of the distant station, at the time, coinciding as the operator looks into the sun mirror. The use of two mirrors calls for very careful adjustment. Signaling is effected by turning down a screen on a second tripod, set in the line of the flash, making short and long flashes.

While the effective range of flags is but five to ten or fifteen miles, the range of the heliograph is only limited by the convexity of the earth. A heliograph message was sent last summer by Captain Gassford, U. S. Signal Corps, over the longest distance ever covered by visual signals. The distance was 183 miles between Mt. Uncompahgre in Colorado, and Mt. Ellen in Utah. The feat involved exhaustive mountain climbing in rarified atmosphere, in the face of severe snow storms and terrific winds. It was only in early morning and evening when refraction brought the peaks into view that communication could be attempted. After reaching the



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stations the parties waited seven days in snow storms and cutting cold before an opportunity occurred to send the message. At a distance of 183 miles the heliograph flash appeared like a bright star. This achievement was remarkable from the fact that the two peaks are not in the same horizon, the flash being only brought into view by refraction lifting it over the curved surface of the earth.

For all extended operations, field or semi-permanent telegraph lines are brought into use, being more reliable than visual signals, as well as more rapid and more easily worked. Field telephones are coming to be much used for temporary lines. The U. S. Signal Corps has made extended experiments with different styles of field telephones and has now a satisfactory form, combining a receiver and transmitter in one piece, a telegraph key being used in place of the bell used in ordinary telephones. The wire used is double conductor insulated cable and commonly laid on the ground. It has a tensile strength capable of withstanding the passage of artillery. The "outpost cable cart," invented by Captain Kilbourne of the Signal Corps, is the most satisfactory device for laying and recovering the wire. The frame of the cart is constructed of bicycle tubing, the thirty-inch bicycle wheels have cushion tires, and the cart carries five reels of wire and one knapsack reel. It has an automatic spooling device for taking up the wire, and a field telephone may be kept in circuit so that communication may be had while the cart is running out the wire.

It has been recently discovered by experiment that the insulated covering of telephone wires, heretofore considered indispensable to prevent the wires from coming in contact with substances which are conductors of electricity, is unnecessary and that bare wires can be used with equally good results. The discovery was made by Captain Charollois, of the French Army, who attributed it to the peculiar properties of the wire used. Experiments under the direction of the Chief Signal Officer, U. S. Army, have proved however that as good results follow the use of common copper wire, and tests have

demonstrated that bare wires laid on wet grass, in mud, or connected with perfect grounds such as a metal pipe running into a lake, transmit the sound as well as the best insulated cable.

Much attention is now being given to a new equipment for the Signal Service, the captive balloon. These balloons may be used for the purposes of signaling, observation, etc., the car being equipped with all necessary apparatus, including a telephone and camera, the telephone wire being the heart of the cable holding the balloon. The balloon train of the United States, now at Fort Logan, Colorado, is modeled after the English system. The balloon is a "skin balloon" made of silk and is inflated from portable cylinders containing hydrogen compressed under 120 atmospheres. The train comprises three wagons for tubes for charging, and one wagon for balloon and reel. The tube wagons each carry forty-five steel tubes. It requires one hundred and eight of these tubes to inflate a two-man balloon.

The Signal Corps of the United States Army at present consists of ten officers and fifty sergeants. The sergeants are instructed at the Signal School at Fort Riley, Kansas, where they receive theoretical and practical instruction in electricity, topography, photography and signaling and practice with the field telegraph and captive balloon.

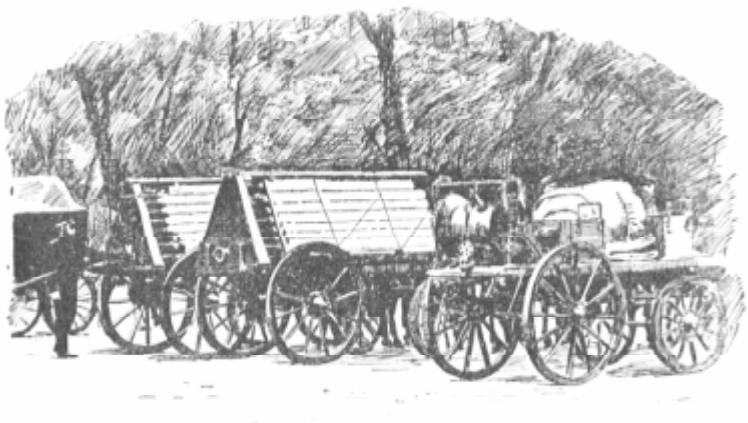
The number of trained signalmen is so small that in any considerable disturbance recourse would have to be had to the Signal Corps of the National Guard. A number of States are making commendable efforts to keep a few men instructed, but only New York, Connecticut, Massachusetts, Illinois and one or two other States have efficient Signal Corps of considerable size.

New York has four Signal Corps, each attached to a brigade and having a maximum of forty men each. They are all mounted on horses, well armed with revolvers and carbines, and excellently equipped with the necessary apparatus for signaling. The military law of New York requires all members of the Signal Corps to be telegraph operators, civil, electrical or mechanical engineers, or to have received instruction in one of those arts. The personnel is very fine, and the work of the corps most efficient.

The Signal Corps of Connecticut was the first military organization in the country to be mounted on military bicycles. This corps, like New York's, has a maximum of forty men, is finely mounted on bicycles, armed with Colt revolvers, equipped with web belts, leather leggins, field glasses, field telephones, heliographs, etc.

The service which the Signal Corps of New York and Connecticut performed last year in conjunction with the U. S. Cruisers *New York* and *San Francisco* off Fisher's Island has received most favorable comment from the Army and Navy, and brought this branch of the service into prominence as an important factor in modern military operations.

MAJOR HOWARD A. GIDDINGS.



THE BALLOON CARS.