**SIGNAL** (a word common in slightly different forms to nearly all European languages, derived from Lat. *signum,* a mark, sign), a means of transmitting information, according to some pre­arranged system or code, in cases where ' a direct verbal or written statement is unnecessary, undesirable, or impracticable. The methods employed vary with the circumstances and the purposes in view, and the medium into which the transmitted idea is translated may consist of visible objects, sounds, motions, or indeed anything that is capable of affecting the senses,' so long as an understanding has been previously effected with the recipient as to the meaning involved. Any two persons may thus arrange a system for the transmission of intelligence between them, and secret codes of this kind, depending on the inflections of the voice, the accent on syllables or words, the arrangement of sentences, &c., have been so elaborated as to serve for the production of phenomena such as are sometimes attributed to telepathy or thought transference. With the many private developments of such codes we are not here concerned, nor is it necessary to attempt an explanation of the systems of drum-taps, smoke-fires, &c., by which certain primitive peoples are supposed to be able to convey news over long distances with astonishing rapidity; the present article is confined to giving an account of the organized methods of signalling employed at sea, in military operations and on railways, these being matters of practical public importance.

*Marine Signalling.*—A system of marine signals comprises different methods of conveying orders or information to or from a ship in sight and within hearing, but at a distance too great to permit of hailing—in other words, beyond the reach of the voice, even when aided by the speaking-trumpet. The necessity of some plan of rapidly conveying orders or intelligence to a distance was early recognized. Polybius describes two methods, one proposed by Aeneas Tacticus more than three centuries before Christ, and one perfected by himself, which, as any word could be spelled by it, anticipated the underlying principle of later systems. The signal codes of the ancients are believed to have been elaborate. Generally some kind of flag was used. Shields were also displayed in a preconcerted manner, as at the battle of Marathon, and some have imagined that the reflected rays of the sun were flashed from them as with the modem heliograph. In the middle ages flags, banners and lanterns were used to distinguish particular squadrons, and as marks of rank, as they are at present, also to call officers to the admiral, and to report sighting the enemy and getting into danger. The invention of cannon made an important addition to the means of signalling. In the instructions issued by Don Martin de Padilla in 1597 the use of guns, lights and fires is mentioned. The introduction of the square rig permitted a further addition, that of letting fall a sail a certain number of times. Before the middle of the 17th century only a few stated orders and reports could be made known by signalling. Flags were used by day, and lights, occasionally with guns, at night. The signification then, and for a long time after,, depended upon the position in which the light or flag was displayed. Orders, indeed, were as often as possible com­municated by hailing or even by means of boats. As the size of ships increased the inconvenience of both plans became intolerable. Some attribute the first attempt at a regular code to Admiral Sir William Penn (1621-1670), but the credit of it is usually given to James II. when duke of York. Notwithstanding the attention paid to the subject by Paul Hoste and others, signals continued strangely imperfect till late in the 18th century. Towards 1780 Admiral Kempenfelt devised a plan of flag-signal­ling which was the parent of that now in use. Instead of in­dicating differences of meaning by varying the position of a solitary flag, he combined distinct flags in pairs. About the beginning of the 19th century Sir Home Popham improved a method of conveying messages by flags proposed by R. Hall Gower (1767-1833), and greatly increased a ship’s power of communicating with others. The number of night and fog­signals that could be shown was still very restricted. In 1867 an innovation of prodigious importance was made by the adop­tion in the British navy of Vice-Admiral (then Captain) Philip Colomb's flashing system, on which he had been at work since 1858.

In the British navy, which serves as a model to most others, visual signals are made with flags or pendants, the semaphore, flashing, and occasionally fireworks. Sound signals are made with fog-horns, steam-whistles, sirens and guns. The number of flags in use in the naval code, comprising what is termed a “set,” are 58, and consist of 26 alphabetical flags, 10 numeral flags, 16 pendants and 6 special flags. Flag signals are divided into three classes, to each of which is allotted a separate book. One class consists of two alphabetical flags, and refers to orders usual in the administration of a squadron, such as, for example, the flags LE, which might signify “ Captain repair on board flagship.” Another class consists of three alphabetical flags, which refer to a coded dictionary, wherein are words and short sentences likely to be required. The remaining refers to evolutionary orders for manœuvring, which have alpha­betical and numeral flags combined. The flags which constitute a signal are termed a "hoist.” One or more hoists may be made at the same time. Although flag signalling is a slow method compared with others, a fair rate can be attained with practice. For example, a signal involving 162 separate hoists has been re­peated at sight by 13 ships in company in 76 minutes. Semaphore signals are made by the extension of a man’s arms through a vertical plane, the different symbols being distinguished by the relative positions of the arms, which are never less than 45° apart. To render the signals more conspicuous the signaller usually holds a small flag on a stick in each hand, but all ships are fitted with mechanical semaphores, which can be worked by one man, and are visible several miles. Flag signalling being comparatively slow and laborious, the ordinary message work in a squadron is generally signalled by semaphore. The convenience of this method is enormous, and by way of example it may be of interest to mention a record message of 350 words which was signalled to 21 ships simultaneously at the rate of 17 words per minute. Flags being limited in size, and only distinguishable by their colour, signals by this means are not altogether satisfactory at long distances, even when the wind is suitable. For signalling at long range the British navy employs a semaphore with arms from 9 to 12 ft. long mounted at the top of the mast and capable of being trained in any required direction, and worked from the deck. Its range depends upon the clearness of the atmo­sphere, but instances are on record where a message by this means has been read at 16 to 18 m.

Night signalling is carried out by means of “ flashing,” by which is meant the exposure and eclipse of a single light for short and long periods of time, representing the dots and dashes composing the required symbol. The dots and dashes can be made mechanically by an obscuring arrangement, or by electro­mechanical means where magnets do the work, or by simply switching on and off specially manufactured electric lamps. The ordinary rate of signalling by flashing is from 7 to 10 words per minute. In the British navy, as in the army, dots and dashes are short and long exposures of light; but with some nations the dots and dashes are short and long periods of darkness, the light punctuating the spaces between them. The British navy uses the European modification of the so-called Morse code used in telegraphy, but with special signs added suitable to their code. The introduction of the “ dot and dash ” system into the British navy was entirely due to the perseverance of Vice-Admiral Colomb, who, in spite of great opposition, and even after it had once been condemned on its first trial at sea, carried it through with the greatest success. The value of this innovation made in 1867 may be gauged by the fact that now it is possible to handle a fleet with ease and safety in darkness and fog—a state of affairs which did not formerly exist. The simplicity of the dot and dash principle is its best feature. As the system only requires the exhibition of two elements it may be used in a variety of different manners with a minimum of material, namely, by waving the most conspicuous object at hand through short and long arcs, by exhibiting two different shapes, each representing one of the elements, or dipping a lantern in a bucket, and so on. Its