are manned according to the number of stations with which they communicate.

Signalling is used on most campaigns to a large extent. In the Tirah expedition, 1897 and 1898, one signal station received and sent, between the 1st and 18th November, as many as 980 messages by heliograph, some of which were 200 to 300 words in length. It is often used as an auxiliary to the field telegraph, especially in mountainous countries, and when the wire is liable to be cut and stolen by hostile natives. In the Waziri expedition, 1881, communication was maintained direct for a distance of 70 m. with a 5-in. heliograph. In the Boer War, 1899-1902, the system of heliographic signalling was employed very exten­sively by both sides.

In Germany the first army signalling regulations only appeared in 1902. The practice was, however, rapidly developed and towards the end of the 1905 campaign in South-West Africa, 9 signalling officers and 200 signallers were employed in that country. These usually worked in parties of 2 or 3, each party being protected by a few infantrymen or troopers. The apparatus used was heliograph *by* day and a very elaborate form of lamp by night, and work was carried on between posts separated by 60 and even 90 m. The signallers were employed both with the mobile forces and in a permanent net­work of communication in the occupied territory. In 1907-1908 fresh signalling regulations were issued to the home army, and each company, battery or squadron is now expected to find one station of three men, apart from the regimental and special instructors and staff. Some experiments were carried out at Metz to ascertain the mean distance at which signals made by a man lying down could be seen, this being found to be about 1000 yds. The new regulations allow of the use of flag and lamp signalling at 4 m. instead of as formerly at 1¾. Three flags are used, blue, white and yellow, and it is stated that the last is the most frequently useful of the three.

The enormous development of the field telegraph and telephone systems in the elaborate war of positions of 1904-1905 more or less crowded out, so to speak, visual signalling on both sides, and in any case the average illiterate Russian infantryman or the Cossack was not adaptable to signalling needs. Only about one-quarter of the signalling force (which consisted exclusively of engineer troops) in Kuropatkin’s army was employed in optical work, the other three- quarters being assigned to telegraph, wireless and telephone station work. The Italians, who are no strangers to colonial warfare, have a well-developed visual signalling system.

See British Official *Training Manuals: Signalling* (1907).

*Railway Signalling.—*In railway phraseology the term “ signal” is applied to a variety of hand motions and indications by lamps and other symbols, as well as to fixed signals; but only the last-named class—disks and semaphores, with lights, perman­ently fixed (on posts) at the side of the track—will be considered here. These may be divided into (1) interlocking signals, used at junctions and yards, and (2) block signals, for maintaining an interval of space between trains following one another. In both classes the function of a signal is to inform the engine-driver whether or not he may proceed beyond the signal, or on what conditions he may proceed, and it is essential to give him the information some seconds before it need be acted upon.

The semaphore signal, which is now widely used, consists of an arm or blade about 5 ft. long extending horizontally, at right angles to the line of the track, from the top of a post (wood or iron) 15 to 30 ft. high, and sometimes higher (fig. 4). This arm, turning on a spindle, is pulled down (“ off ”) to indicate that a train may pass it, the horizontal (or “ on”) position indicating "stop ”; sometimes, as on the continent of Europe, use is made of the position of the arm in which it points diagonally upwards, and on one or two English lines the arm in the safety position hangs down perpendicularly, parallel to, but a few inches away from, the post. A lamp is fixed to the side of the post about on a level with the blade, and by the movement of the blade is made to show at night red for “ stop " and green for go-ahead or “ all clear." The earlier practice, white for “ all clear," still prevails largely in America.

In the early days of railway signalling three positions of the semaphore arm were recognized:—(1) Horizontal, or at right angles to the post, denoting danger; (2) at a downward angle of 45 degrees, denoting caution; (3) hanging vertically downwards or parallel to the post, denoting all right. Corresponding to the position of the arm, three different lights were employed at night—red for danger, green for caution and white for all right. But now British railways make use of only two positions of the arm and two lights—the arm at right angles to the post and a red light, both signifying danger or stop; and the arm at about 60 degress (or vertical, as mentioned above) and a green light, both meaning all right or proceed. It is better to abolish the use of white lights for signalling purposes. The reason is obvious. There are many lights and lamps on the plat­forms, in signal-boxes and in the streets and houses adjacent to a rail­way; and if white lights were recognized as signals, a driver might mistake a light of this nature as a signal to proceed; in fact, accidents have been caused in this manner. A white light is not to be regarded as a danger signal, as is sometimes erroneously stated, but rather as no signal at all; and as there is a well-known rule to the effect that “the absence of a signal at a place where a signal is ordinarily shown must be treated as a danger signal,” it follows that a white light, when seen at a place where a red or green light ought to be visible, is to be treated as a danger signal, not because a white light *per se* means danger, but because in such a case it denotes the absence of the proper signal. Some companies have adopted a purple or small white light as a "danger ” signal for shunting purposes in sidings and yards; but this practice is not to be com­mended, since red should be the universal danger signal.

*Distant signals* are used to make it unnecessary for an engine­driver to slacken his speed in case the stop (*home)* signal is obscured by fog or smoke, or is beyond a curve, or for any reason is not visible sufficiently far away. Encountering the distant signal at a point 400 to 800 yds. before reaching the home signal, he is informed by its position that he may expect to find the latter in the same position; if it is "off " he passes it, knowing that the home signal must be in the same position, but if it is at danger he proceeds cautiously, prepared to stop at the home signal, if necessary. The arm of a distant signal usually has a fish-tail end. In Great Britain its colour indications are generally the same as for the home signal, but occasionally it shows yellow, and on some lines it is distinguished at night by an angular band of light, shaped like a fish-tail, which appears by the side of the red or green light. In America its night colour-indication is made different from that of the home signal. Thus, where white is used to indicate all clear (in both home and distant) the distant arm, when horizontal, shows a green light; where green is the all- clear colour a horizontal distant shows either a yellow light or (on one road) a red and a green light side by side. Two lights for a single arm, giving their indication by position as well as colour, have been used to a limited extent for both home and distant signals. *Dwarf signals (a* in fig. 5) are used for very slow movements, such as those to or from a siding. Their blades are about 1 ft. long, and the posts about 4 ft. high; the lower arm on post *c* being for slow movements, is also frequently made shorter than the upper one. Where more than two full-sized arms are used on a post, the custom in America is to have the upper arm indicate for the track of the extreme right, and the others in the order in which the tracks lie; in Great Britain the opposite rule prevails, the upper arm indicating for the extreme left. But the signals controlling a large number of parallel or diverging tracks are preferably arranged side by side, often on a narrow overhead bridge or gantry spanning the tracks.

All the switches and locks are con­nected with the signal cabin by iron rods (channel-iron or gas-pipe) supported (usually near the ground and often covered by boxing) on small grooved wheels set at suitable distances apart. The foundations of these supports are of wood, cast iron or concrete. Concrete foundations are comparatively recent, but are cheap and durable. For signals (but not for points) wire connexions are uni­versal in England, and are usual in America, being cheaper than rods. In changing the direction of a line of rodding a bell-crank is used, but with a wire a piece of chain is inserted and run round a grooved pulley. Wire connexions are shown at *a* and *b*, fig. *4,* the main or “ front " wire being attached at *a. By* this the signalman moves the arm down to the inclined or go- ahead position, to do which he has to lift the counter-