General Meeting of the Institution
HELD AT
The Institution of Electrical Engineers
Wednesday 13th, April 1932.

The President (Mr. C. CARSLAKE) in the Chair.

The Minutes of the last meeting having been read and confirmed :

The **President** announced that the Summer Meeting would be held on Friday and Saturday, June 24th and 25th, as to which particulars would shortly be issued to the Members.

The **President** then called upon Mr. T. S. Lascelles to read his paper.

The Reform of the Signal Aspects on the French Railways.

By T. S. LASCELLES (Member of Council).

(*Inset Sheets Nos.* 7-9).

That the signal indications and operating arrangements used in the various European countries often differ from one another in many respects is well known to students of railway working, and does not require to be pointed out to members of this Institution. These differences are sometimes very marked, even between the practice in countries closely associated with each other ; not infrequently they extend to the fundamental principles on which the methods of train operation employed are based. Probably nothing strikes the observant British traveller more, if he takes an interest in such things, when he first makes a railway journey in France, than the totally different appearance of the signals, compared with what he has been accustomed to see in this country. Not only are the shapes of the signals quite unlike those seen on this side of the Channel, but there are so many of them and they are, in turn, coloured

in so many ways, that it is very difficult to understand them without a good deal of explanation. When the passenger finds himself at a large station where there are signal gantries or bridges, he feels well nigh bewildered by the spectacle presented to his astonished eyes, and in all probability wonders how drivers ever manage to interpret such a seemingly involved language of signs, the principles of which are not in the least apparent to a mere onlooker, familiar though he may be with the signalling methods employed in Great Britain.

At night-time his astonishment if anything increases, for he sees so many lights—of four or five colours too—and some signals exhibiting apparently contradictory colours, such as red and green simultaneously from one semaphore arm, which is presumably indicating "danger." At a junction he sees a signal which seems to be pointing out the direction which the approaching train is to take, but when the train comes along it takes the exactly opposite direction to what he expects. Another puzzle which he cannot unravel is that his train sometimes stops at signals which he knows to be at "line clear". On starting again, which it does at once, it soon gets up to full speed and the stop appears to have been to no purpose at all. Faced with these difficulties he takes refuge, more often than not, in the popular notion that they are very behindhand on the Continental railways and we have nothing to learn from them, while he also believes (though it is not a particularly comforting idea just then) that there are a great many accidents on the French lines. On approaching his destination and happening to look out of the carriage window, he sees a light signal with nine lenses and decides that the whole subject is beyond him.

On both occasions when the Institution held its summer meeting in France, in 1927 and again last year, many members found the signal aspects puzzling and questions were being asked constantly as to the meaning of this or that particular one. This circumstance, and the fact that a complete change in the present signal indications has at length been decided on, a change which will, however, take a long time yet to carry to completion, suggested the thought that a paper on the subject might be welcome this session, while last year's visit and the interesting installations which we were privileged to see were still fresh in one's memory.

It is not proposed to describe any apparatus in this paper,

except so far as may be absolutely essential to an understanding of the uses of the various signals. There is probably as much variety of design to be seen in France as there is in Great Britain. The signalling on the French lines naturally has developed from simple beginnings, changing gradually as the increasing requirements demanded, and all types are represented, from the simplest on the light railways and branch lines to the most advanced on the main lines. As is well known, on the latter many of the fastest trains in Europe are run; and this could not be done, day after day, if the signalling were not, in the results obtained at least, quite as good as that found on the trunk lines in England. That different types of signals and different methods of using them have sprung up in France, is due in part to the fact that different principles of working were used to begin with, from which, by a logical order of thought, the present systems have come into being.

Railways were laid down fairly early in France and the main lines were built almost at the same period as those in Great Britain. By the fifties the main line of the Nord from the coast to Paris was open and the journey from London to Paris *via* Folkestone was made in about ten hours, which was quite a creditable performance, if the stops necessary for refreshments and changing engines are taken into account. Although there were comparatively few trains then, nevertheless the necessity for some signal protection at stations soon made itself felt, for it was there that collisions were most likely to occur during shunting operations, as when a slow train had to be put into a siding for an express to overtake it. Some means of protecting a station against an oncoming train was essential, and as only hand brakes existed, any signal had necessarily to give its warning a long way from the point of obstruction, if it was to be effective. From this circumstance arose the round red disc signal, which has continued in use to the present day, and is the one signal which possesses no exact equivalent in British practice. For a long time it occupied a very important place in French railway working, but of recent years it has receded somewhat into the background and been superseded in some of its functions by other signals.

The round red disc signal, known for convenience as "*le disque*" is a stop signal which commands a stop, not at itself but at some point farther on, laid down in the regulations

according to circumstances, and is thus intended effectively to protect any obstruction in advance of such point. In England it was originally the custom to have very high signals in order that they might be seen a long way off and acted on in good time. The French did not follow this, but placed the red disc on a level with the driver's eye and set it a long way back from the obstruction, so that it might be passed at "danger" and yet leave ample distance in which to pull up. In using a disc as a signal, the French were of course, only following early British practice, in which discs of various shapes were quite common. Probably the best known examples were the disc and cross-bar signals of the Great Western Railway. Discs were used as distant signals for some time on the Midland line, but generally speaking the semaphore early took the place of the disc for all running signals in Great Britain, whereas in France it was reserved for certain definite functions only, the majority of the signals having remained discs to this day.

As requirements increased other signals were created, the most important being a home absolute stop signal for use at stations, while some simple forms of point signal were also introduced. A form of semaphore was utilised at junctions to show the way in which the points were set, and with the introduction of the block system in place of time interval working, semaphores were adopted to protect the entrance to a block section. We must remember that interlocking appeared in France about the same time as in England. Vignier, a workman on the old Ouest railway, which was taken over by the State at the end of 1908, made a simple interlocking apparatus in 1855, rather before Saxby in this country. As he consistently refused to patent anything his name has remained almost unknown to signal engineers in other countries and is never mentioned in British works on signalling. Frames on the Vignier, and later on the Saxby principle, came into use and development proceeded on parallel lines to that in other countries where heavy traffic obtained. So much so that in 1867 two writers, Brame and Aiguillon, were able to bring out a fair-sized book on railway signalling. The second edition of their work appeared in 1883*, and apparently remains the only one of its kind, the student

*" *Etude sur les Signaux des Chemins de fer francais* ", by E. Brame and L. Aiguillon, Dunod, Paris, 1883.

who wishes to investigate the whole subject being obliged to consult one of the courses on railway engineering professed at technical colleges and subsequently printed in a series.

Up to the time when the second edition of Brame and Aiguillon's treatise was published, the various railway companies, and the small State system which then existed also, had adopted different arrangements of signals. Even when the appearance of a signal was the same on more than one line the rules governing the action to be taken by the driver often differed considerably. This was notably the case in connection with the red disc. The government, through the "*service du Contrôle*," a department roughly corresponding to the old railway department of the Board of Trade, was already exercising a certain surveillance in such matters, in the interests of safe working. Accordingly, after pressing the matter on the attention of the companies for some time, owing it is said to difficulties having arisen with train working during the Franco-German war, the government proceeded to draw up, in conjunction with the various administrations, a "*Code des Signaux*," with the object of unifying the practice on the various railway systems. It was thought that this would be particularly useful in the event of war, when drivers might have to run over foreign companies' lines at short notice. In spite of a certain degree of opposition to the step—each company naturally preferring its own signals and hesitating at incurring the expense involved in any change—this Code was finally published and declared to be binding in 1885. It still forms, at all events in theory, the basis of the signalling arrangements, but it is about to be superseded by new regulations, which have in fact already received the approval of the Minister of Public Works, though as yet a new Code has not been formally published.

The regulations of 1885, though defining certain signal aspects fairly clearly, were intended to lay down general rules for the companies' guidance, leaving it to them to adopt such apparatus as they thought most adapted to their requirements. Notwithstanding that uniformity was the aim the practical result has been that divergencies have again crept in; indeed signals not in the original regulations at all have been allowed to be brought into existence, while the rules of working are also far from uniform. The code of course applied to France as she was territorially after the Treaty of Frankfort in 1871. The signalling in Alsace-Lorraine became entirely German after that time and

bears now no resemblance to the signalling in the rest of France. Whenever France is spoken of in this paper therefore, Alsace-Lorraine is not included unless the fact is specially pointed out. We may now proceed to review the different signals used to-day and it may be useful to mention that the trains run on the left in France, contrary to the custom with the road vehicles, except on the Paris Metropolitan Railway. The signalling of this line is somewhat special in character and need not concern us in this paper.

It must be borne in mind that the line is regarded as being —and must be kept— normally clear, and that in the absence of any signal it may be taken to be so. This is a fundamental principle of French railway working. The use of disc signals conforms to this as they are to all intents and purposes invisible at " line clear " and so really give no indication. The employment of the white light is likewise consistent with the same notion, since white being the colour of the ordinary lights seen about the line it has no particular signification for the trains.

Figs. 1 to 17 illustrate the signals now seen. Light signals need not be shown, as they of course merely consist of lenses arranged to reproduce the night indications of the ordinary types. Fig. 1 is the red disc signal (*disque*). It shows one red light when presented to the train and is rotated on a vertical axis, as are all the other disc signals, so as to present its edge to the driver when " off ". A white light is then shown from the uncovered lantern. The coloured glasses in these disc pattern signals are usually carried behind openings in the disc itself but the latest pattern of signal used on the Est line has the lantern above the target and a form of spectacle gear. The red disc, as already explained, is a deferred stop signal. It is followed by an indicating post (Fig. 1a) fixed at full braking distance ahead, marked " Limit of the Protection of the Disc." A train standing beyond it is considered as sufficiently protected by the red disc at " danger " and the guard need not go back to warn anything following if he can be sure that the signal is " on." A driver meeting the red disc presented must at once bring his train under full control and be in a position to stop at latest before reaching the limit post. If there is then nothing in front of him he may continue to go forward but he must in any case come to a stand at the first fouling point or stop signal, even though it and any other signals may be at " line clear."

A stop must be made therefore if the red disc is passed in the "on" position, regardless of subsequent signals. This is really a legacy from the time when the disc was the only signal at a station and the train, after stopping, was brought in under the stationmaster's instructions. On some single branch lines this condition still obtains and a post, with suitable inscription, marks the stopping point. (Fig. 1b). The rules under which the train starts again vary on the different lines but generally include an exchange of hand signals between drivers, guards and signalmen. The Orleans railway has never used this red disc signal. Its outer signals at stations are absolute stop signals, as in British India.

The red discs are put to "danger" automatically when an engine passes them by a mechanical reversing mechanism and treadle known as the "*pédale Aubine*," from the inventor, who patented the device in England in 1884 (Patent No. 8677) but had actually made it some years before that. This automatic protection of trains by the red disc has generally been regarded as a particularly valuable safeguard, and undoubtedly for many years it was one, for reasons which will become apparent as we proceed. But as we shall see, the signal has given place to others in recent years as the attempt to make it perform more than its original functions led to traffic delays on busy lines and had a tendency to diminish the value of the "danger" indication. Other types of signal are also frequently put to the "on" position automatically, a far greater use being made of reversing mechanism in France than in this country.

Fig. 2 shows the signal which is probably the best known to the foreign traveller and is perhaps to be regarded as the most important of all, the square red and white chessboard (*carré*). This signal is used where home or starting signals are used at stations in England—except where they are purely block signals—*i.e.*, as an interlocked stop signal. It exhibits two red lights side by side and is in the strictest sense an absolute stop signal, since it must never be passed on any consideration, short of its being defective, not even by a shunting movement. It therefore governs all movements in an interlocked area and when at "danger" overrules any other signal applying to the same line. There is a special reason for this which will shortly appear. The two lights are usually obtained from one lamp by a reflecting arrangement, but on one railway two lanterns are often found.

It will be seen therefore that whereas two red lights command an absolute stop at the signal, one red light orders a deferred stop at some point in advance. The red and white chessboard is frequently equipped with a detonator placer.

Some railways, such as the State and P L.M., use this signal for running lines only and employ a special form (Fig. 2a) with yellow disc (square or round) and one yellow light for controlling movements on engine and carriage lines, sidings, etc. ; its function is exactly the same as that of the red and white chessboard.

The third form of stop signal met with is the semaphore, Fig. 3 (*sémaphore*). It consists usually of an open-work arm, projecting to the left of the post. At " danger " it is horizontal and shows a red and a green light side by side. It falls nearly to the post for " line clear." It is a permissive stop signal and is only used to indicate the condition of a block section. Block working has always been, with the exception of about one railway, permissive in France, a train being allowed to enter a block section after a certain interval under a written order. Hence the signal has its red light qualified by green, as a sign of this permissive quality. It is purely a block signal and has nothing to do with the points, where any exist, a red and white chessboard being required to guarantee safe movements through them. The semaphore may be " off " because the section is clear, but the chessboard be " on," but, as explained, the latter overrules the former. The actual working of the block will be briefly described farther on.

On the P.L.M. the semaphore has a solid arm similar to our own (Fig. 3a). It has only one light, which is half red and half green. Contrary to the practice on the other railways the P.L.M. keeps all the signals at " danger " until a train is announced but the block apparatus is worked on the normally clear principle, thus resembling the working on the old London & South Western Railway. Of course this only refers to double lines. On single lines the block cannot be kept normally clear. In recent years the Est has installed a large amount of automatic signalling and the semaphore used for this purpose in seen in Fig. 3b. There are two lights, which appear red at a distance, but on arriving at the signal the driver can see a very small piece of green in one of them, as a permissive sign.

The consequence of these principles is that where a cabin is closed at intervals the semaphores must be supported by red and

white chessboards, to give an absolute stop indication when the cabin is open. Near large centres, however, where cabins are always open and the sections very short, absolute block working by means of successive chessboards is often seen.

The question of distant, or repeating, signals has now to be considered. The red disc is often called a distant signal in accounts of French railway working but is really a peculiar kind of outer home. The French term "*signal avancé*" is often mistranslated as "advance signal"; actually the English term means something totally different. When block working was introduced and intermediate block posts were created, the necessity arose for some signal to warn the driver that he was approaching a semaphore at "danger." This was done by treating the block posts as stations and covering them with a red disc, which was kept at "danger" all the time the semaphore was in the same condition. The disc was thus made to serve as a warning for the semaphore, as well as to protect anything standing at it. This practice continued for a long time, but it possessed the serious disadvantage of causing unnecessary stops if traffic was at all frequent, since a driver finding the red disc against him was obliged by the rules to stop at the semaphore, although it might go to "line clear" before he reached it. To escape from this difficulty and provide a real repeater signal the green and white chessboard (*indicateur à damier vert et blanc*; *damier*) was introduced (Figs. 4, 4a, b, c). It was included in the 1885 code as a fixed warning sign for a junction, or in the rear of an absolute stop signal, but its use before semaphores came much later. It is mounted square fashion when at regulation distance from the signal it repeats, and cornerwise when it is not. In the latter case it frequently carries an illuminated number plate showing how many hundred metres exist between it and the stop signal.

On some railways, the Nord among them, this signal is a transparency lighted from the rear at night, but on others it is a painted target and shows two green lights, horizontal for the square, vertical for the other mounting. The P.L.M. made no use of this signal at all as a repeater until a year or two ago, when they decided to substitute it for the red discs before their semaphores, for the reasons given. The Nord also decided some few years ago to make a similar change, but thought it better to introduce a new signal altogether, the green and white chessboard

already being used by them as a speed reduction signal at junctions, as well as a repeater of red and white chessboards. The new signal created as a repeater for the semaphores (Fig. 5) is an arm, painted green and pivotted in the centre, carrying a row of mirrors which are illuminated from the front by a lantern equipped with spectacle gear. At night the arm appears as a band of green light when "on," as a band of white light when "off," when it is at 40° to the horizontal. Known officially as "*la palette S.E.M.*," this signal is said to give great satisfaction. The painting of the green and white chessboards is not uniform everywhere, but some lines arrange the light and dark squares the opposite way to the same squares on the red and white chessboards (compare Figs. 2 and 4), so that it is easy to tell the difference, quite apart from the colouring. The Orleans railway cut off the corners of their repeater signals (Fig. 4c) to make an extra distinction.

None of these signals gives any indication in itself of route or direction at junctions. It is clear too that it would not be satisfactory to set, say, two red and white chessboards side by side, similar to a splitting signal in Great Britain, for it would be difficult to tell at a distance which signal was "off," seeing that the discs simply disappear for "line clear." In any case the French would not agree to passing the other chessboard at "danger" and hence only one absolute stop signal can be set up before junction facing points. The route must be signalled by something else. This is the origin of the direction indicators (*indicateurs de direction*) and junction semaphores (*sémaphores de bifurcation*) shown in Figs. 6, 6a, b, c. The first named (Figs. 6, 6a) can only serve for two directions. A fishtailed arm, painted violet, and a violet light appear on the side towards which the route is not set, no arm and a white light on the other. This is obviously in accordance with the French principle that no signal means "line clear." The junction semaphore, which some lines use exclusively, even when there are but two directions to control, consists of similar fishtailed arms placed one above the other, the top arm applying to the most left-hand direction. In this case, of course, the arm does not disappear, but is merely lowered to 45°, a green or white light being shown according to whether speed has to be reduced or not. The figures will make this quite clear. On the Est railway the arms are equipped with mirrors, on the same principle as the "*palette S.E.M.*" of the

Nord, and appear as luminous bars of violet, white or green light, as the case may be. The visibility of the violet lights, is poor and the signal is not a satisfactory one for main line working, from several points of view. It is sometimes worked directly from the points, at other times by separate levers.

These facts, as well as other considerations, make it necessary to have some means of indicating in the rear of a junction whether a speed reduction is called for and the train is being directed to a deviating route. For this purpose the Nord railway uses the green and white chessboard, the old approach indicator of the code, keeping it " on " when speed is to be reduced. For many years the P.L.M. made use of a modified form of this signal, shown in Fig. 7, in which the green panels disappeared behind the white, which formed part of the post (*signal de passage en vitesse*). On other lines the round green disc was used, Fig. 8 (*disque vert de ralentissement*), to warn the driver to reduce speed and the P.L.M. has now adopted this practice. On the Nord this green disc is used to serve as an additional reminder at the actual point where the reduced speed is necessary, in specially important cases, as in going through crossover junctions. From all this you will see that we are far from the uniformity sought for in 1885.

As an example of junction signalling, Fig. 9 is given, indicating the practice on the P.L.M. It must be remembered, however, that the green and white chessboards are only now being put in, this line having had no true repeater signals until recently. Taking the signals in order we have :—

The red disc *a*, as a protection to a train stopped at the junction, the green and white chessboard *b*, repeating the junction home signal, the green disc *c* which when " on " commands a speed reduction, the home signal *d*, and the repeater *e* over it, repeating the block semaphores *f*, with, at the points, the direction semaphores *g*. The aspects of the signals when cleared for a main line train are shown in Fig. 9a. This system of junction signalling is very complicated, to British ideas, and indeed a great simplification will be effected in the coming reforms. Before we refer to these, a brief reference may be made to some other signals now seen.

Fig. 10 shows the block signal of the old Ouest line. It is an arm, painted chessboard fashion, which when horizontal and showing two red lights is an absolute stop signal. To allow a

train to pass permissively the arm is concealed leaving an illuminated sign "ATTON" (*attention*). The Midi railway has a very large amount of automatic signalling and uses the signals shown in Figs. 11 and 12. The discs are metal vanes moving on a vertical axis in enclosed glass protected cases, after the fashion of the Sykes' banner signal. The square signal is, in function, a "semaphore" and shows the corresponding lights therefore. The signal shown in Fig. 13 is used by the P.L.M. and Orleans railways for shunt back movements. The disc is blue and when showing authorises the shunt. The junction approach boards, Figs. 14 and 15, buffer board Fig. 16, and dead end road indicator, Fig. 17 call for no comment.

Although the subject is outside the scope of this paper, a few remarks on block working may be helpful. It is hoped to present a paper on it on another occasion. On some lines there are what we call block instruments, as on the P.L.M., interlocked with the ordinary signal levers but on others, the Nord being one, a system of working is used which is quite unlike anything seen in this country and is somewhat of a puzzle to the traveller who only knows British practice. Its origin dates back to 1875, when the question of lock-and-block was attracting attention. The inventors of the system used on the Nord, Lartigue, Tesse and Prudhomme, when approaching the lock-and-block problem adopted the view that it was unnecessary to interlock the block apparatus with the levers if the block indicators could be made so large that the driver could see them. This was done in their "electro-semaphores," which remain the standard block signal apparatus on the Nord to-day. Each semaphore is nothing but a large block instrument put out of doors and once this fact is grasped there is no difficulty in understanding the working of the system. One or two figures will make the principle plain.

The semaphores are usually mounted for opposite directions on the same post, especially at intermediate block posts (Fig. 18). The arms are normally down. Two small arms, with which the drivers are not concerned, are mounted lower down, at x and are normally concealed. At the foot of the post are the mechanism boxes with their handles. (Sometimes these are operated by chains from a cabin nearby). There is an electrical interlocking mechanism between these boxes and the levers of the distant signals. The action is as follows :—

Let us suppose we have three block posts A, B, C (Fig. 19) and that a train has just passed block post A. The signalman there places the semaphore arm to "danger" by giving a three-quarter turn to the relative handle at the base of the signal-post. The semaphore becomes locked in this position and an electric current is sent to B, causing the miniature arm "*x*" applying to the line concerned to come into view and a gong to sound by means of a mechanical trip gear. This is the "train on line" signal. When the train passes the distant signal (*palette S.E.M.*) *b* the mechanical treadle mechanism restores it to "caution" and if the lever working it be now returned to normal it will become automatically locked. The train now passes B and the signalman puts his semaphore to "danger" and causes the small "train on line" arm to appear at C. Having verified the presence of the tail-signal he conceals his own minature arm by operating the relative handle three-quarters of a turn which sends a current to A and unlocks the semaphore, which falls to "clear" without A having to do anything. The gong at A also sounds. B cannot conceal the small arm unless he has first put the semaphore to "danger" and his distant lever back to "caution." When the train passes C the action is repeated and the semaphore at B falls. This unlocks B's distant signal lever, which he then pulls over.

From this it will be seen that the semaphores are in the true sense out-door two-position block instruments and that the working is extraordinarily simple, there being no bell-code ringing or other formalities. On some lines electric treadle control is superimposed, giving a full lock-and-block action. At stations one semaphore serves for all trains leaving, each separate road having its interlocking signals, as in Fig. 20, while the stationmaster can intervene to cut out the succession locking and allow, say, the small arm to be concealed for a train which shunts for another to pass without the semaphore having to be first operated.

From time to time, for many years, suggestions had been made for changing the signal aspects but nothing came of them, until at length, after the war, the changing traffic conditions and rapid development of signalling apparatus brought the matter into increasing prominence. Towards the end of 1926 a committee of nine members was appointed to deal with it and their report was submitted to the authorities at the end of the following year,

when, after certain formalities, the proposals were accepted. The Assistant Traffic Superintendent of the P.L.M., *M.* Tuja, a member of the committee, has written a very clear and instructive account of them.*

Let us now turn to the new code of aspects, covered by Figs. 21 to 39. As the existing signals have been explained fairly fully the changes intended can be easily dealt with. The two leading principles governing them are (1) the adoption of a definite shape for each class of signal, and (2) the adoption of a positive night indication for "line clear," *viz.*, a green light, with the consequent use of yellow lights for cautionary indications. At present some signals have the same shape, though their meanings are quite different, the colour alone distinguishing them. This is not satisfactory in a bad light, when the painting is not readily discernible.

The new signals will be :—

1—Absolute Stop Signal (Fig. 21), red and white chessboard, with two red lights, which may be arranged horizontally or vertically (*carré*).

2—Absolute Stop Signal (Fig. 22) for subsidiary tracks, violet square board, one violet light (*carré de manœuvre*). (This signal will show a *white* light at "clear," to prevent main line drivers from being confused by green lights on sidings, etc.)

3—Permissive Stop (Block) Signal (Fig. 23), semaphore arm of any pattern, one red light (*sémaphore*). The use of a three-position upper quadrant semaphore for automatic block is also permissible under the new scheme.

4—Deferred Stop Signal (Fig. 24), round red disc, yellow light beside red light (*disque*). (This signal will be used less and less as time goes on).

5—Repeater, or Warning, Signal (Fig. 25), yellow diamond, one yellow light (*damier*).
(The "*palette S.E.M.*" will continue to be used on the Nord but will be painted yellow and show a bar of yellow light when "on", green when "off.")

6—Reduce Speed Signal (Fig. 26) yellow triangle, two yellow lights placed horizontally (*signal de ralentissement*).

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* "*La Nouvelle Signalisation des Chemins de fer français*," "Revue générale des chemins de fer," January, 1931.

7—Reduced Speed Reminder Signal (Fig. 27), yellow triangle point downwards, two yellow lights placed vertically (*signal de rappel de ralentissement*).

8—Direction Indicating Signal (Fig. 28), bluish-white fishtailed arms showing no light normally. One arm lowered with lunar white light indicates first route from the left, two arms lowered indicate second route from the left, and so on (*signal de direction*). (Direction Signals will only be used in future where it seems specially desirable).

In addition to the red and white chessboard—violet signal on sidings—an absolute stop may be commanded by a semaphore with a short arm below (Fig. 29) and two red lights. The clearing of the lower arm, leaving one red light, makes the signal permissive, both arms being lowered for "clear."

The uses of these signals will be fairly evident from what has been explained in connection with the older types, but the signalling of junctions requires to be made clear, as here radical alterations are contemplated, leading to considerable simplification. Speed signalling advocates will be glad to know that speed is to be considered the basic factor in arranging the signals and that routes will only be signalled when traffic conditions appear specially to require it. The various speeds permitted will of course be expressed in kilometres per hour and always in multiples of 10. The reduce speed signal (Fig. 26) and the reminder signal (Fig. 27) will command a speed limit of 40 kilometres per hour—25 miles per hour—irrespective of the class of train. The present green disc prescribes a lower limit for goods than for passenger trains and the new arrangement will not be brought into use until the former are fitted with continuous brakes. Any speed limit, except one applying to all routes equally, below 60 k.p.h. will be regarded as a 40 k.p.h. limit and so signalled. For a limit of 60 k.p.h. or over the signals mentioned will not be used but illuminated speed boards, fixed or movable, according to requirements, will be adopted, and the same arrangement will be used when a lower limit than 60 k.p.h. applies to *all* trains, that is to say the triangular yellow signals will only be seen where the condition ahead cannot be known with certainty beforehand.

Thus in Fig. 30 there is a 50 k.p.h. limit on both routes and a fixed speed board is installed. In Fig. 31 the branch line has a 40 k.p.h. limit and therefore the yellow signals are employed,

being pulled off for a movement along the direct route. In Fig. 32 the limit on the branch line is 70 k.p.h. and therefore a movable sign is used, while Fig. 33 represents a combination of these arrangements. It is intended, before bringing the new system into use, to give special attention to improving the construction of facing points and their locking and detecting gear.

One improvement which the new signals will bring will be simplification of the night indications where signals are grouped. At present, where two or three signals are situated at the same spot, each exhibits its own lights and, in mechanical installations at all events, there is no slotting between them, so that one may see a red and white chessboard " on " with a semaphore, disc or repeater—even all three—alongside showing " clear." Of course, as explained, the chessboard overrules the others, which by day are practically invisible, but at night the white lights have a strong tendency to drown the red ones, and drivers have been misled at times in this way. It is for this reason that light signals, which show the most restrictive indication for the time being and no other, have considerably simplified matters in this respect and made the working safer.

In the new system it is proposed to do away with this difficulty by arranging slotting and spectacle mechanism so that no unnecessary lights appear, as shown in Fig. 34. It should be added that the approach to a junction will be indicated by a " Y " sign in the facing, and a " BIFUR " sign in the trailing direction.

The signalling in Alsace-Lorraine, which, as explained, is German, will be modified to conform to some extent with the arrangements already described. German signalling is exceedingly simple* compared with French, consequently the end of the war saw an extraordinary difference between the two provinces and the rest of French territory. The trains run on the right and the semaphore arms operate in the upper right-hand quadrant. Discs are only used for distant, or repeater, signals. Figs. 35 to 37 show the changes proposed. Ordinary one arm signals remain unaffected, for green lights are already used for " line clear." The German junction signal, with the lower arm closed up in the post, will have the speed reduction reminder signal substituted for the lower arm, giving the two yellow

* See " *Railway Signalling in Germany,*" Proceedings, I.R.S.E., Session, 1926/1927.

lights when a branch line route is signalled. At "line clear," for the direct route, the junction signal will resemble any other stop signal, as now. The distant signal will have a diamond shaped disc, made in two halves, separately operated and will give the three indications, diamond, triangle or vanished disc, to correspond to the junction signal, as shown. In this way a minimum of change will be involved.

The reforms are estimated to cost some 60 to 70 millions of francs (say about £500,000 at par), and will occupy three to five years to carry out. About 70,000 signals will be affected. The changes will be made in five stages, *viz.* :—

1—Replacement of yellow siding stop signals by new violet signal.

2—Abolition of green lights in all warning signals and introduction of yellow.

3—Abolition of green in the semaphores, leaving red only.

Up to this stage white lights will be kept for "line clear" and when it is completed green lights will have disappeared. This situation will be allowed to continue for a time to allow drivers to forget the old warning meaning of green.

4—Introduction of green instead of white for "line clear."

5—Modification of direction indicators and introduction of the reminder signals.

When the change is complete the P.L.M. junction shown in Fig. 9 will appear as in Fig. 38, or as in Fig. 39 when light signals are used.

Such are the principal facts involved in the costly transformation of the signal aspects which our French neighbours propose to undertake in the very near future. That many improvements are possible and desirable cannot be disputed, but in view of the heavy outlay involved it may be asked whether it would not have been better to abolish the disc pattern of signal altogether and introduce a simple system using semaphores only, or at least to have extended the less involved methods seen in Alsace-Lorraine to the rest of the country.

DISCUSSION.

The **President** thought they would agree with him that the Author was to be highly congratulated on his very interesting paper and also for the remarkably clear way in which he had explained things to them.

The paper was particularly interesting to himself, following, as it did, Mr. Bound's paper on Multiple Aspect Signalling. One felt inclined to consider the aspects shown in the present paper as "Multiplied Multiple Aspect Signalling." The proposals, as outlined in Mr. Bound's paper, appeared simplicity itself, compared to some of the signalling they had been shown that evening.

The various types of signals, together with the varying light indications, appeared, on the face of it, to be extremely difficult to follow and one would imagine that the drivers on French Railways must find difficulty in memorising the numerous indications. In view, however, of the high speed maintained on French Railways to-day it was obvious that the signalling must be effective, and, from one's knowledge of the French nation, they must have had sound logical reasons for signalling their lines in the way they had. At the same time it did seem to him that the semaphore signalling in this country appeared to be very much more simple. As the paper pointed out, the French were considering the question of simplifying their signalling and it did seem a pity—particularly in view of the fact that the French drivers had already found out how simple the signalling was in the Alsace-Lorraine territory—that they did not go the whole way and use semaphore signals or colour-light signals throughout.

There was one point he would like to mention; that is, in connection with the disc signal:—

(1) How did they manage with short-section working?
(2) What exactly was the disc signal for?
(3) Was there definite braking distance between the disc and the stop signal?

In the case of short-section working that must create a good deal of difficulty.

One other point was that an illuminated number plate was given showing speeds. The figures thereon appeared so remarkably small that he would imagine that drivers must have a

difficulty in picking up the speed figures in time to act on them.

With regard to the distant signal referred to on page 158, he would be glad to know what actually was the difference between the distant signal and the disc ?

Author's reply to the President—

In short-section working difficulties do arise with the placing and operation of the red discs. When one red disc is not far enough away to protect a movement or obstruction the next in the rear is kept at " danger ". The purpose of the red disc is to protect an obstruction at a station or a train standing at an ordinary home signal. It is a kind of outer home a long way back and which may be over-run at " danger ". There is a definite braking distance between the disc and the limit post, that is, the point where the protection given is regarded as adequate. The number on the green and white chessboard does not indicate speeds but the number of hundred metres between it and the stop signal. It is true that it is not very visible and probably has little value. A distant signal differs from the red disc in that it does not compel a stop to be made and does not protect an obstacle ahead in the way the disc does.

Mr. B. F. Wagenrieder thought that the Author deserved their gratitude for the amount of trouble he had gone to in presenting such a complete picture of French signalling.

The French system described was apparently a permissive system, and he would like to ask whether it allowed only one, or more than one, train to follow after being stopped at the entrance to an occupied section, and then allowed to go forward. There was the question to consider of the visibility of tail lamps, perhaps reduced to a short view owing to obstruction of sighting distance. How was the section guaranteed to be clear after two or more trains had occupied it so that a following train could be given a clear run through it ?

The normally-clear system of block seemed likely to cause a good deal of blocking-back where there were siding points, etc., at the forward end of the section, as presumably the running line had, as in this country, to be occupied for shunting movements. If it was not so occupied, then it appeared that the French railways were better equipped for shunting accommodation than the railways of this country.

Author's reply to Mr. Wagenrieder—

The electro-semaphore block is a permissive system—at least

on most of the railways—and when trains are sent into the section under the permissive rule they are recorded on a slate and the electro-semaphores have to be operated as many times as there are trains admitted, in order to clear up the block. At one time a special apparatus called the " memory box " was used, in which metal tokens were inserted for each train, a driver entering the section permissively handing one to the signalman. This caused the apparatus to indicate the number of trains on the section and, in turn, controlled the electric lock on the red disc, which at that time preceded each semaphore. But, generally speaking, whenever permissive working becomes at all frequent the sections are shortened, so as to eliminate it as much as possible. There is no need to block-back with the normally-clear block as each station, or cabin where any shunting can occur has a red disc signal to protect it effectively.

Mr. F. R. Addis would also congratulate the Author on his wonderful effort.

There were one or two points which he would like to mention : What happened if the glass of the chessboard was broken by children throwing stones ? Did the signal show a white light-a clear aspect ? Further, some of the signals seemed to drop down parallel to the post. Was it possible for the arms to drop down if the signal wire broke and so show a " clear " aspect ? Was the illuminated "Attention " signal lighted by a lamp in the front ?

Author's reply to Mr. Addis—

If a red glass breaks of course a " clear " signal is given, which is a disadvantage of white lights. Nevertheless the danger seems to be much less than is imagined. It will be remembered that the Dutch use white lights and Mr. de Vos said the drivers wanted to keep them. The electro-semaphore arm would fall if the main operating rod broke but this is a very remote contingency. All other signals are balanced to go to " danger " as with us. The " attention " sign is illuminated by a lamp at the back of it.

Mr. M. G. Tweedie would like to ask : What signal or signals did a driver have to receive when starting away from a station. He had noticed that when a train was standing at a station, a bell was ringing continuously. What purpose was that for ? Had it any connection with the " disc de distance " ?

Author's reply to Mr. Tweedie—

The driver must, of course, get the signal, or signals, applying to his particular line and route and, if the Lartigue block is in use, must observe the electro-semaphore. The bells which Mr. Tweedie heard were signal repeaters, ringing all the time the red disc was at "danger". This is to give anyone dealing with shunting an assurance that the line is properly protected at the time.

Major R. Falshaw Morkill would like to add his congratulations to the Author for his paper and the remarkable way he had described it.

There was one question he would like to ask :—Were they to understand that the French railways were about to standardise their colour light signalling schemes.

Author's reply to Major Morkill—

Yes. The colour light installations will be standardised to conform to the new code of night signals. The last figure in the paper shows light signals at a junction.

Mr. F. Downes, after complimenting the Author on his paper, referred to the admirable way in which he had answered all the questions on the spur of the moment. He would like to ask : Was the block signal, operating from A to B, over an electrical wire ? What controlled the communications ; were the signals given by code bell signals or by telephone ?

Author's reply to Mr. Downes –

Block bell signals, as we understand them, are not given for regular movements, the signalman merely operating the electro-semaphores, as described in the paper. Train descriptions are given separately, when required, by telegraph or telephone, generally between stations, as are emergency messages. On the P.L.M. however, where block instruments are used and not electro-semaphores, there is a describer apparatus called the "Jousselin bell," with a pointer travelling round a dial, as with Walker's describer.

Mr. T. J. Aldridge would particularly like to add his sincere congratulations to those already tendered to the Author for the excellent paper he had given that evening, because he was in France for several months studying the French signalling systems, and could therefore fully appreciate the difficulties of the subject. As a matter of fact when he saw the title of the paper he looked through his notes with the hope of finding some signal which had

not been dealt with. He had read the paper carefully but could not find one single case of importance ; the Author had mentioned them all.

There was one general point and that was with regard to the signalling in Alsace-Lorraine. Did the Author think that the French were proposing to standardise what would still be a comparatively complicated system of signalling rather than develop along the lines of the simpler system used in Alsace-Lorraine because of political reasons ?

Author's reply to Mr. Aldridge—

Yes. No doubt there was much in what Mr. Aldridge said. He had noticed in a German technical paper at the time of the Rome International Railway Congress a sarcastic comment on the fact that a French reporter, who had to deal with the Alsace-Lorraine signals, could not bring himself to admit that the system was German but persisted in saying " Central European " system.

The **President**, in closing the discussion, considered that the Author deserved a very hearty vote of thanks for the paper he had given that evening. Many of them had been striving to understand it. Personally, he still felt that he would have to concentrate on the paper a good deal more before he could grasp the situation as well as the Author had done. He asked them to show their appreciation by a very hearty vote of thanks.

Mr. R. S. Griffiths said it would be a great pleasure to him were he allowed to second the proposition. Some of them had to deal with Continental signalling and all would thank him for a paper which had been so interesting.

The **Author**, replying, said that he thanked them all very much indeed. When Mr. Tweedie remarked that he was hard up for papers, he thought that one on that subject might prove interesting. There was a complete set of coloured diagrams on the table which he would be pleased for any to study at their leisure.

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REFORM OF SIGNAL ASPECTS ON FRENCH RAILWAYS (LASCELLES)

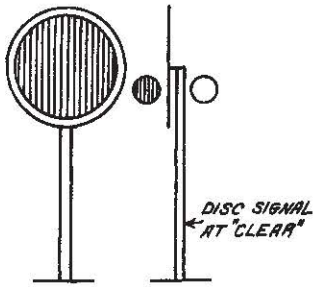

FIG. 1

FIG. 1a.

FIG. 1b.

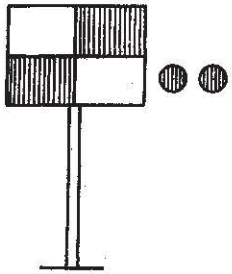
FIG. 2.

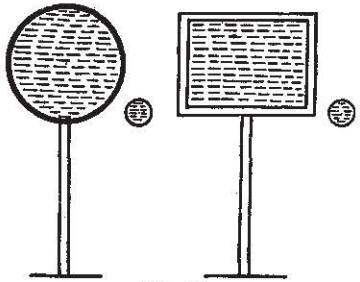
FIG. 2a.

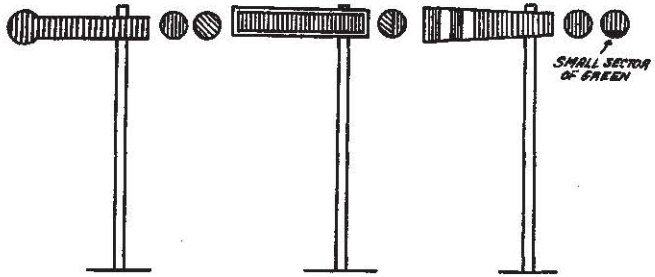

FIG. 3. FIG. 3a. FIG. 3b.

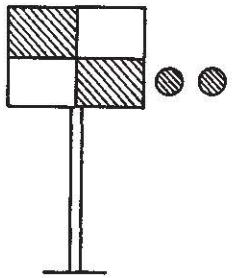
FIG. 4.

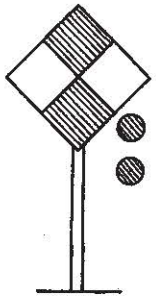
FIG. 4a.

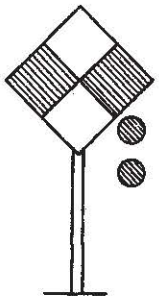
FIG. 4b.

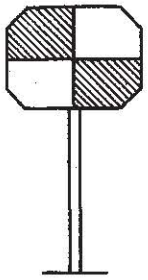
FIG. 4c.

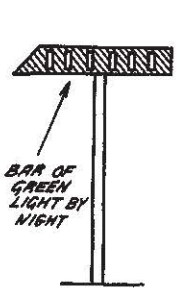

FIG. 5.

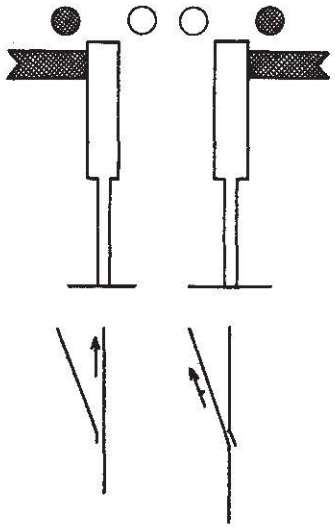
FIG. 6

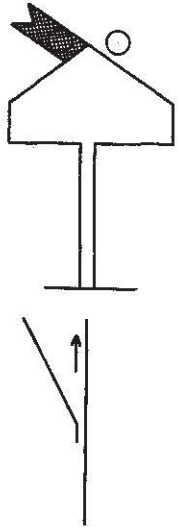
FIG. 6a.

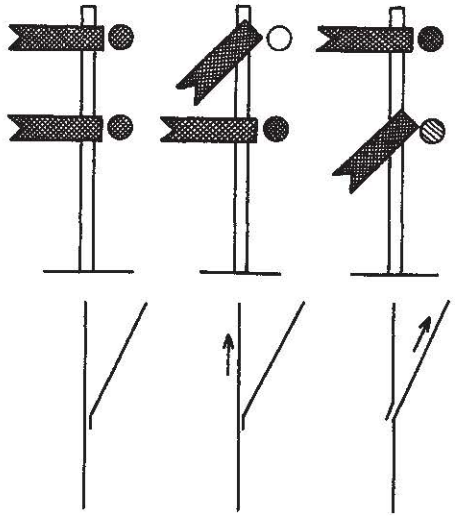
FIG. 6b.

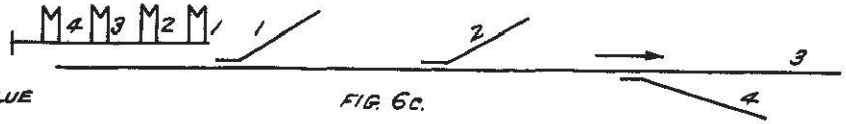

FIG. 6c.

RED GREEN YELLOW VIOLET BLUE

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REFORM OF SIGNAL ASPECTS ON FRENCH RAILWAYS (LASCELLES)

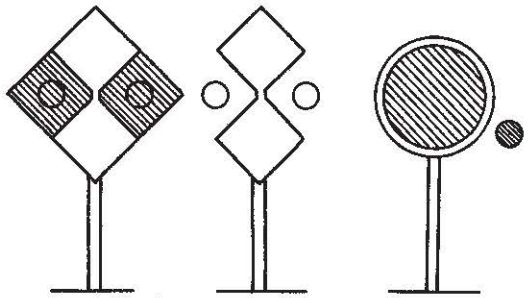

FIG. 7.

FIG. 8.

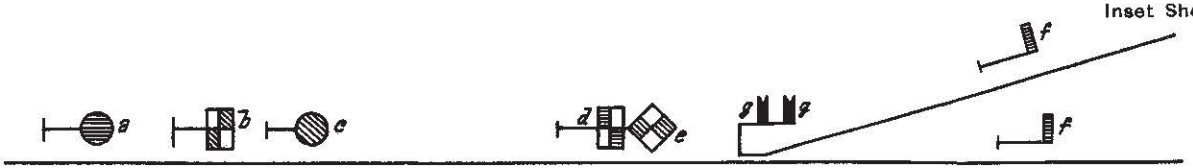

FIG. 9

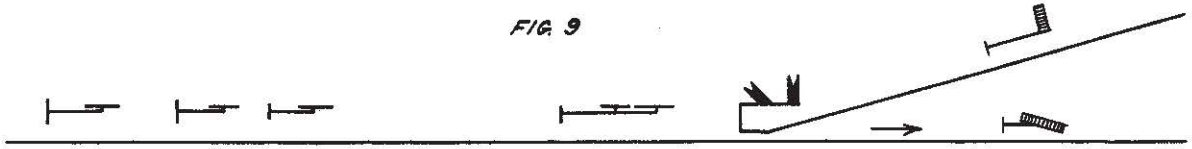

FIG. 9a.

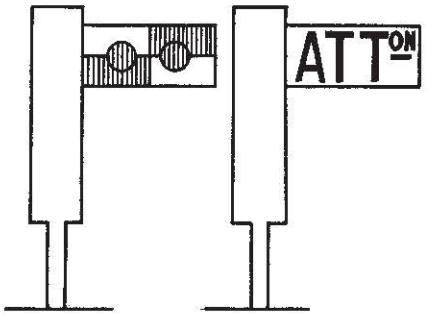

FIG. 10.

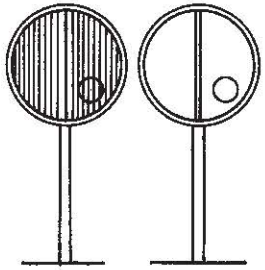

FIG. 11.

FIG. 12.

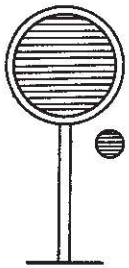

FIG. 13

FIG. 14.

FIG. 15.

FIG. 16.

FIG. 17

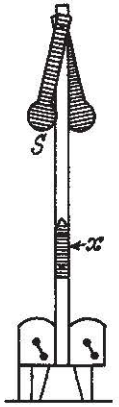

FIG. 18.

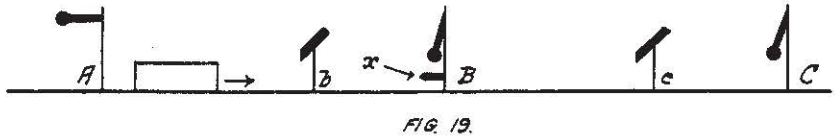

FIG. 19.

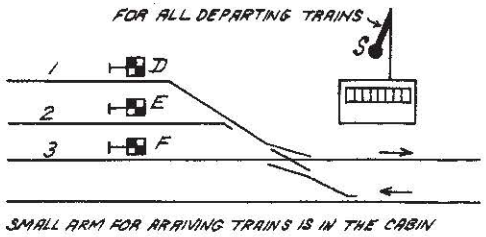

FIG. 20.

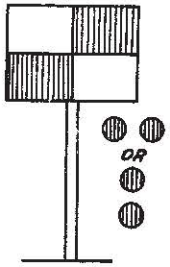

FIG. 21.

RED GREEN YELLOW VIOLET BLUE

REFORM OF SIGNAL ASPECTS ON FRENCH RAILWAYS (LASCELLES)

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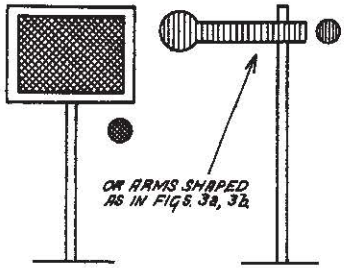

FIG. 22. FIG. 23.

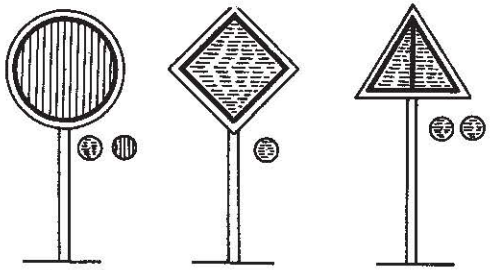

FIG. 24. FIG. 25 FIG. 26 FIG. 27

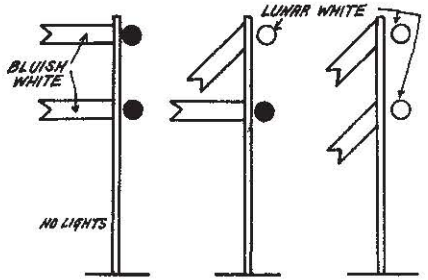

FIG. 28.

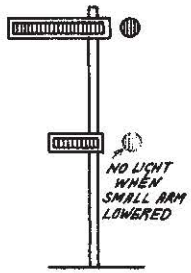

FIG. 29.

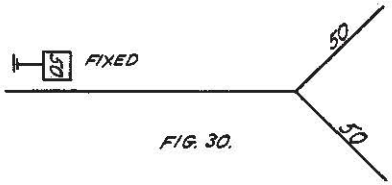

FIG. 30.

FIG. 31.

FIG. 32.

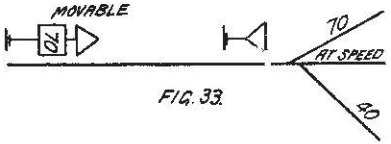

FIG. 33.

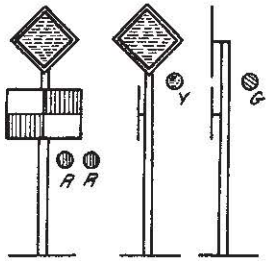

FIG. 34.

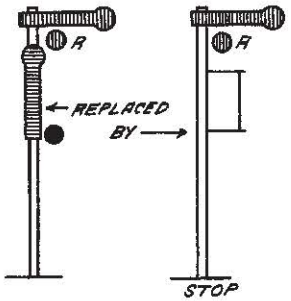

FIG. 35.

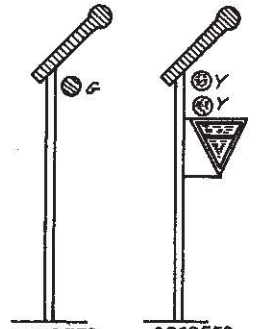

FIG. 36.

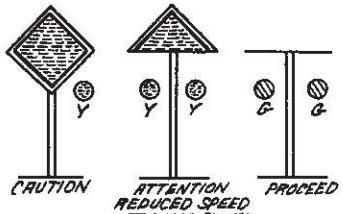

FIG 37.

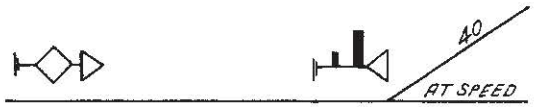

FIG. 38.

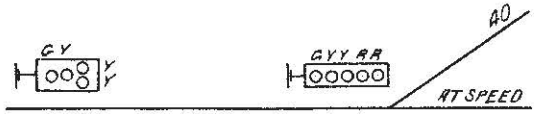

FIG. 39.

RED GREEN YELLOW VIOLET BLUE