CHAPTER XVII.

INTERLOCKING SIGNAL LEVERS.

ELECTRICAL engineers would appear to have given but little attention to the application of electricity to **locking signal levers,** for very little has been done in this direction.

204. In 1870 the method illustrated by Figs. 109 & 110 was introduced, and is still employed on the London and South Western Railway, in conjunction with Preece's three-wire system of block-signals (§ 110), which it will be remembered is so arranged that gravity produces the *danger*, and a constant current the *all clear* signal.

Fig. 109 is a sectional side view, and Fig. 110 an end representation of the arrangement, which consists of a pair of coils E, an armature pivoted at F, to which is fixed a bar B, having suspended from its extreme end a small rod A, to which is attached a block of steel or other hard metal, C. The bar B is provided with a sliding weight G, the object of which is to counteract the weight of the metal block C, and so produce as nearly as possible a state of equilibrium in the rocking lever B, the preponderancy being such as to merely withdraw the armature from the cores of the coils, and so allow the metal block C to drop within the slot H of

the iron frame to which the instrument is fixed, and which is placed immediately in front of the lever to be locked. A slot is cut in the iron frame for the

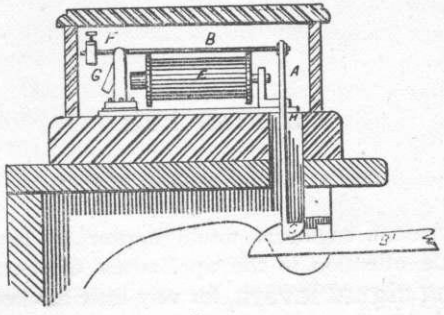

FIG. 109.

accommodation of the rod A and metal block C, so that, when the condition is that shown in the figure, and an attempt is made to draw over the signal-lever, the

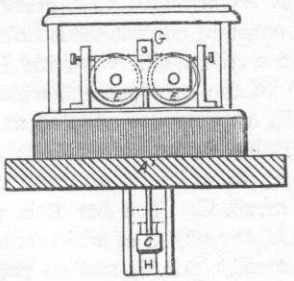

FIG. 110.

locking bar B′ may engage with C, which, banking against the shoulder pieces seen in Fig. 110, will prevent B′ being further withdrawn.

Now, on a current being passed through the coils E, the armature will be attracted, G will be depressed and C raised sufficient to admit of the locking-bar B′, attached to the signal lever, being withdrawn from the slot H in the iron framework through which it has to pass whenever the lever is placed in the danger position.

The instrument may be worked in circuit with the semaphore block signal, or by relay in connection with it.

It may be employed for locking either signal or point levers, in connection with the block-signals, or independent of them, for shunting and yard purposes.

205. A somewhat similar arrangement is also employed by Messrs. Tyer and Norman. It is represented in Fig. 111. A is the signal lever, B a rod connecting it with another lever or bar centred at C, provided with a catchpiece D, which is supplied with a tripping projection so weighted that in its normal condition it shall engage with the lever E working upon an independent centre G. To the lever E is attached the wire in connection with the signal, and when D is at liberty to engage with E, the lever A, on being drawn over to the *off* position, will raise it, draw in the wire, and so lower the signal.

H is an electro-magnet in circuit, by relay or otherwise, with the distant signal box. K is its armature centred at L. When the lever A is drawn over to the *off* position K is lifted up by the lever centred at C to the vertical position, and, if a current is flowing through H, it will be held there, but if no current is flowing it will fall back and, resting upon the tripping projection of D, prevent it from engaging with lever E, and consequently will not admit of the wire being drawn in and the signal lowered to the "clear" or "caution" position.

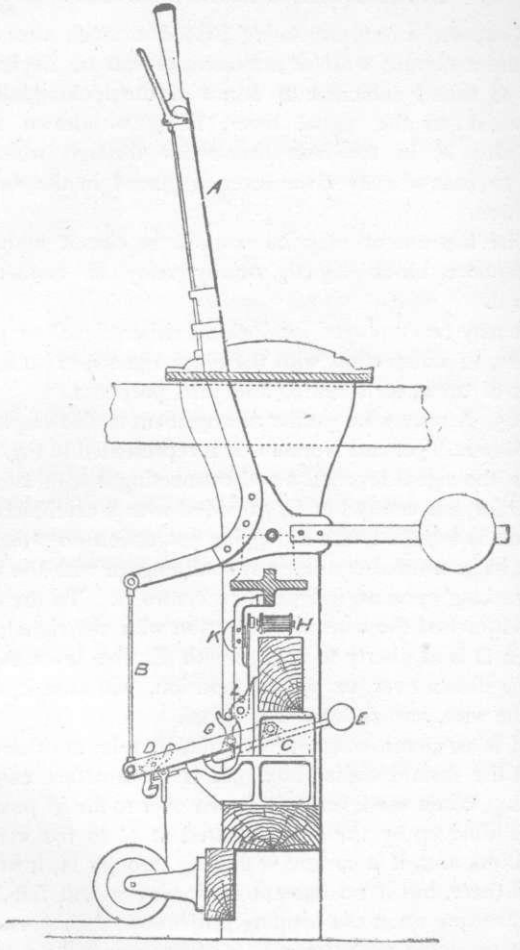

FIG. 111.

CHAPTER XVIII.

BELLS.

206. NUMEROUS kinds of bells have from time to time been employed on railways and for railway purposes. The earliest was *electro-mechanical* in arrangement. The bell was sounded by a set of beaters which were revolved by means of a train of wheels under the influence of a spring, the mechanism being set in motion by the disengagement of the armature of an electro-magnet. So long as the armature was held down by the current and the mechanism was under the influence of the spring, the bell would continue to ring, and thus it emitted a series of rings somewhat similar to a mechanical house-bell, but of better tone and greater uniformity. On the current releasing the armature, the mechanism brought into position a trigger or catch-piece, with which the armature engaged, when the motion ceased. The action of the bell was dependent, in the first place, on the spring being kept wound up; secondly, on the adjustment of the trigger or armature; and thirdly, on the strength of the current. Such bells were unreliable for obtaining any specified number of beats, as not on all occasions did the trigger and armature engage; in which case the wheel carrying the beaters would make another

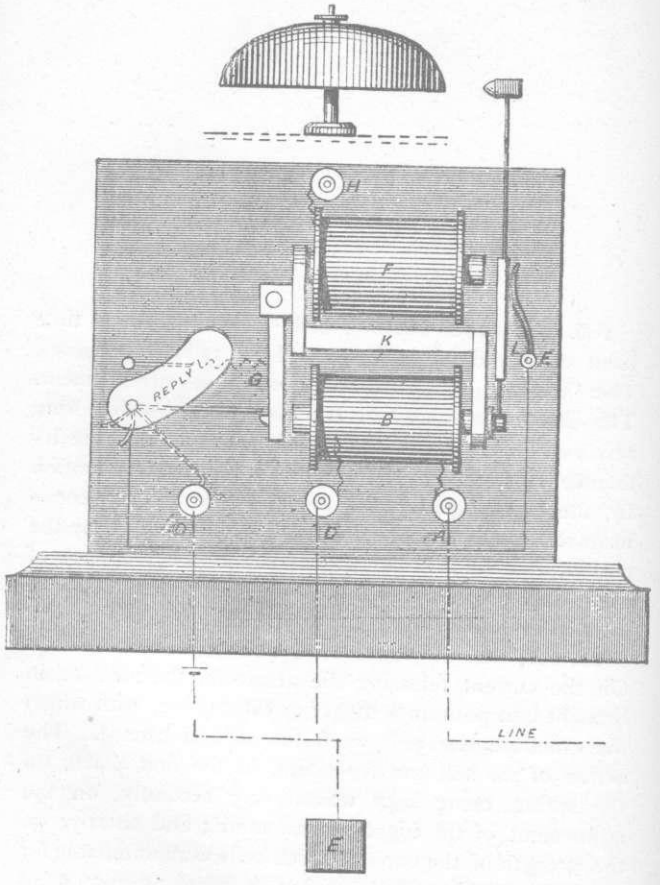

FIG. 112.

revolution, and an additional number of beats, corresponding to the number of beaters on the wheel, would be sounded. As alarums for calling attention they were no doubt serviceable, but as signalling instruments nothing could be more unsuitable.

207. The Ragon bell is a bell somewhat similar in character as regards its delivery, the ringing being continuous until interrupted by the action of the attendant. It has however, this advantage over the electro-mechanical bell: it requires no winding up.

Its arrangement may be understood from Fig. 112. The instrument may be fitted with a key or not.

The current enters at terminal A and passes through the lower coil B, which is insulated from the framework. The armature G is attracted, and discharges the rod seen in connection with the indicator carrying the word "Reply," which falls upon, and makes circuit with, the stud D. The current from the local battery now flows by way of D to the framework of the instrument, and on to the spring E. Here it passes into the armature L, and thence by the cranked bar K to the coil F, which it leaves at H, and passes to earth.

When the lever which rests upon G is discharged, the disc—on which may be printed any instruction thought necessary—drops so as to become visible at an aperture provided for it in the outer case of the instrument. It is replaced by pressing down a stud arranged for that purpose on the top, or at the side of the instrument cover.

We will now suppose a current sent from the distant station. It passes through the coil B direct to earth. But immediately the armature G is attracted so as to discharge the indicator, the home battery comes into action, the armature is attracted and leaves the spring

E, and the circuit is then broken. The armature then falls back into its position of rest. L again comes into contact with E, by which the circuit is once more restored, when the armature is attracted as before, to fall back again as soon as the bell has been struck by the hammer attached to L. In this way a continuous ringing is kept up so long as the indicator remains visible at the aperture in the face of the instrument.

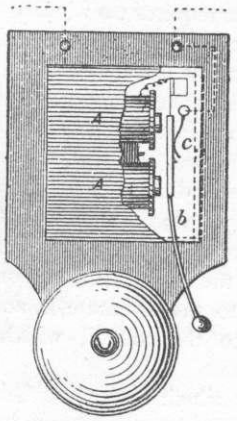

FIG. 113.

Such bells are very serviceable for obtaining the attention of those whose duties are of a mixed character.

208. The **trembling bell** is of a more simple construction, and for many purposes equally, if not even more serviceable than the Ragon bell. Its construction is shown in Fig. 113.

A A is a pair of coils, *b* the armature, and *c* the make-and-break spring pressing against the latter. On a current passing through the coils *b* is attracted and the bell is

sounded; but no sooner is this effected than *b* leaves *c*, and the circuit being broken, *b* again returns to its contact with *c*, and the movement is repeated. This continues so long as the current flows from the distant end. A series of rings may thus be sent, indicating various signals, such as—

2 series of rings—stopping train.
3 „ „ non-stopping train.

The spring *c* should be so adjusted that the armature *b* shall only break contact with it when striking the bell.

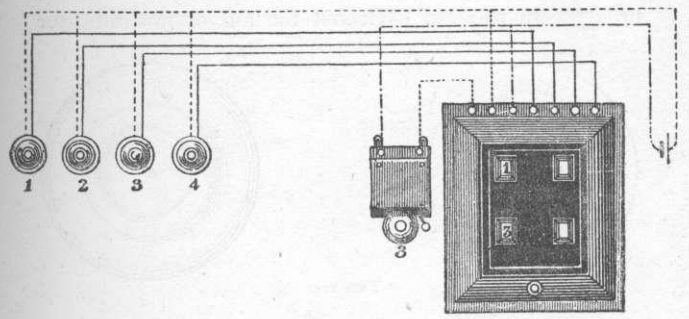

FIG. 114.

It is very necessary that the point of contact between them should be kept clean.

When made large, and the coils wound with insulated copper-wire of No. 18 B.W.G., they are very useful as platform-bells.

209. When of the smaller type they are chiefly serviceable for **office communication**; Fig. 114 shows the method of joining them up for this purpose.

1, 2, 3, 4 are separate offices, each provided with a small commutator termed a *button* (Fig. 115), which is fitted with two springs, *a* and *b*, the latter of which stands

out from the former, and is brought into contact with it by pressing the small ivory knob *c*. So long as *c* is pressed therefore *a* is in contact with *b*.

An indicator, a bell, and a battery are placed in the attendant's office, the wires are connected as shown in the figure, and from each of those leading from the bell and the battery, *leads* are made to the buttons 1, 2, 3, 4. The contact springs *a*, *b* (Fig. 115), being normally asunder, the circuit only becomes closed when either of the knobs, *c*, is pressed, when the bell is rung, and the indicator distinguishing the room requiring attention is brought up to view. Without the aid of this indicator

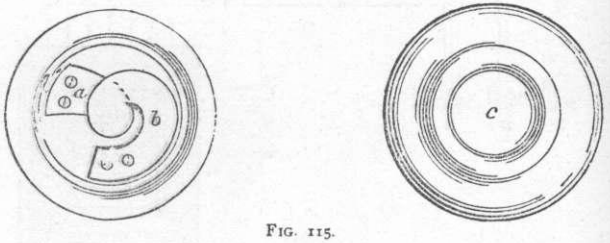

FIG. 115.

each office must adopt a different series of rings to indicate from which the call is made; thus 1 would press the button once, and one series of rings would be produced; 2 would press his button twice—that is, once, then give a slight pause, and then press again—and two series of rings would result.

210. Such an arrangement, minus the indicator, is not convenient for a number of offices, or where the attendant is not always within hearing of the bell. It is then desirable to supplement the bell by an *indicator*, the interior construction of which is shown in Fig. 116. The figure represents but four indices; but such an instrument may

be made to provide for any number. Each indicator is actuated by its own small electro-magnet, shown at index number one by the letters *c c'*. The indices are formed of thin cardboard or mica, upon which the numbers or names of the rooms or offices are inscribed. They are fixed upon a small permanent magnet, pivoted

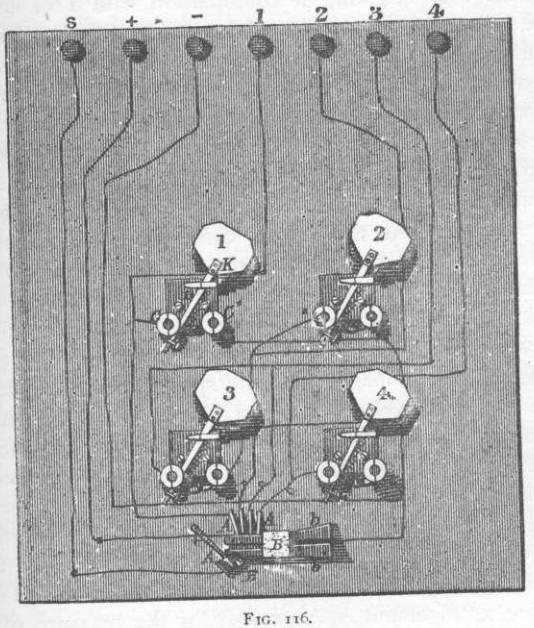

FIG. 116.

so as to move freely between the poles of the electro-magnet, and are furnished at their lower end with an adjusting weight to maintain the proper balance of the magnet and its index, so that it shall have no bias to fall always to one side. When a current passes through the

electro-magnet from left to right, the needle is thrown over in the same direction, the number of the index appearing in front of the opening provided for it in the front of the case, being retained in that position by the affinity between the magnet and the iron core of the electro-magnet until a reverse current is passed through the coils.

211. Fig. 114 will, in combination with 116, enable the course of the current to be easily traced. Taking the wire No. 1 in connection with the button No. 1, the current will enter the indicator instrument at terminal number one, and thence proceed to the electro-magnet *c*, through which it passes, and proceeds further to the spring *b'*, which is in contact with the piece E, and from thence it goes through the terminal *s* to the bell. Another wire is attached to that in connection with terminal number one before it reaches the electro-magnet *c*, which is carried down to the spring A, which, in the normal condition of the instrument remains insulated. The other wires can be similarly traced, each passing through their separate electro-magnets to the spring *b*, and thence to the bell, and having their own branch wires to distinct insulated springs A A. The positive pole of the battery is attached to the second terminal, +, from whence it proceeds to the plate A', which is also insulated from E and *b*. The negative pole is connected to the terminal —, and proceeds to the spring *b*, which is insulated and fixed, like *b'*, under the button B. The object of the spring arrangement A, A', *b*, *b'* is, by the pressure of B, to pass a current through each set of coils in the opposite direction to that followed by the current brought into action by the office buttons 1, 2, 3, 4. Thus the current from the office buttons brings forward the number or name of the office requiring attention, and the current from the pressure of B restores the indices to their normal position.

We will now trace the action of the instruments. Button number one is pressed : the current enters the indicator by terminal 1, passes through the electro-magnet *c c'*, throws the index over to the right, displaying its name or number, as shown in Fig. 114. It then passes to spring *b'*, through E and terminal S, to the bell, which it rings as long as the button is pressed. The attendant having heard the bell, sees by the index displayed the office requiring attention, and before leaving his lobby presses the button B, which brings *b'* into contact with A, and therefore with the positive pole of the battery; and *b*, which is the negative pole of the battery, into contact with A, which is in connection with the electro-magnet *c c'*. By this proceeding a current is sent through the coils in the reverse direction to that set in action by the office, which restores the index to its normal position. The stud B actuates all the indices at one and the same time, *i.e.*, a current passes through each of the coils whenever B is pressed, so that if two or more indices are exposed, they are all returned to their position of rest by this one action of the attendant's; but if desired each index may be provided with a separate restorative button, or a certain set of indices may be under the influence of one button, and another set under another.

The indicator may be fixed in one place, the bell in another, and the battery in a third, if desired. The shields or indices may, with equal convenience, indicate the names of individuals whose presence may be required by the senior officer, and thus save time and trouble in despatching messengers to and fro between the offices.

There are other forms of instruments which effect the same object, and which differ mainly in detail or in the form of index. The principle involved is the same.

Single-stroke Bells.

212. Perhaps no form of bell has done more service on railways than the **single-stroke bell.** Walker was the first to introduce them, and the bells employed by him on the South-Eastern Railway were invariably of a loud and full tone, such as bells for signalling purposes should be. The old "tapper" bell of Izant has also

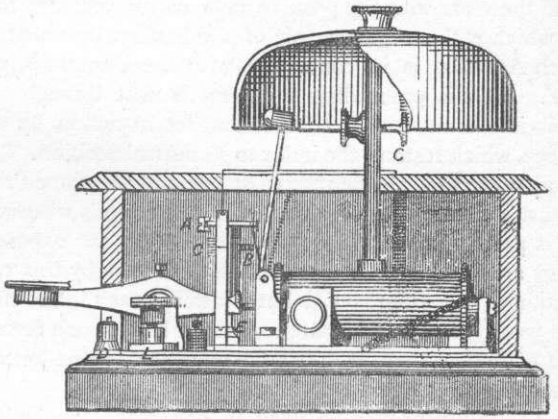

FIG. 117.

seen good service on railways, but, although calculated to work long distances, it lacked that force of sound so desirable for such work. The tapper and single stroke bells designed by Preece are perhaps the most useful, as they emit a fine tone, loud enough for all purposes, whilst they are capable of working through such distances as are necessary for railway-signalling.

Fig. 117 is a representation of the "tapper" form. A

simple "single-stroke" bell would be similar in form and arrangement, with the exception that it would be void of the tapper, or key; and that the coils, bell-dome, and fittings in general would be arranged in the centre of the instrument. In construction both are excessively simple. The key, where used in combination with the bell, is an ordinary single-current key, the front contact D of which is in connection with one pole of the battery, the other being to *earth*. To the bridge or centre of the key is connected the line wire: the back stud E is in connection with the coils, the other end of which is put to *earth*.

The armature is held away from the coils by means of a flat, well-tempered spring, regulated by the adjusting screw G, against which it rests. The play of the armature, and consequently of the hammer which it carries, is governed by the adjusting screws C and A; the latter controlling its backward, and the former its forward movement, so that the hammer, whilst striking the bell-dome, may not *rest* against it, and thereby impair the clearness of its note.

An incoming current will enter at L, pass to the back stop E, and thence traversing the coils, go to *earth*. So long as the current flows through the coils the armature will be attracted, and the hammer caused to strike the bell-dome. On the cessation of the current the hammer will, under the influence of the spring, be carried away from the bell-dome until it rests against the end of the screw C, its normal position. Thus one stroke on the bell-dome is sounded for every current passed through the coils.

To signal to the adjoining signal-box the key has to be pressed down until its lever presses upon D. When in this position the back stud, E, and consequently the coils of the instrument, are disconnected; the back

portion of the key rising in a manner corresponding to the depression of the front portion. On the lever of the key making contact with D, a current will flow from the battery through D to L, and so on to the distant station. For each pressure of the key a current will be transmitted and the distant bell, or bells, in circuit, sounded.

This class of bell is extremely useful for yard purposes, shunting, and other operations which require co-operation on the part of others. It is frequently employed at

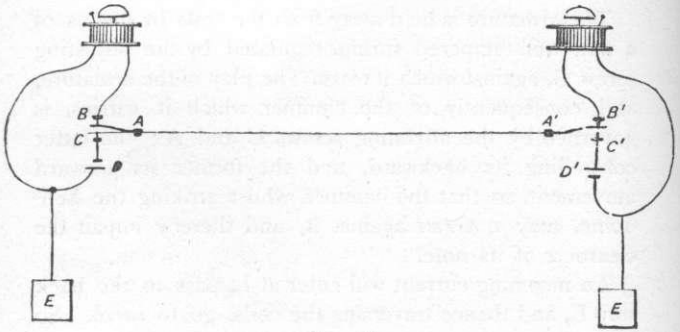

FIG. 118.

level crossings or on station platforms, for intimating the approach of trains.

213. Fig. 118 shows the mode of *joining up*. The apparatus at each station consists of a bell-key, bell, and battery. A is the lever of the bell-key, B its upper, and C its lower contact; D is the battery. On pressing A the battery current flows along the line-wire to the distant station, and entering at A′ passes to the stud B′, and through the bell coils to earth. In its normal

condition the line-wire is in communication with the bell and earth at both ends.

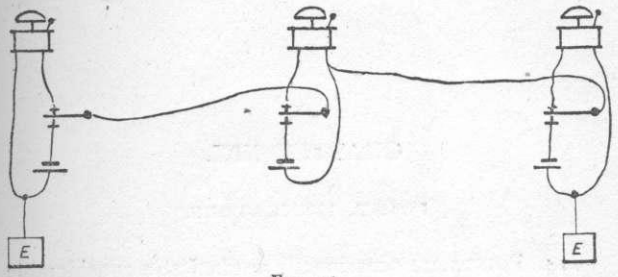

FIG. 119.

It is not usual for the circuit to consist of more than two sets of bells and apparatus, but Fig. 119 shows the electrical arrangement when such is required.