CHAPTER XIX.

POINT INDICATORS.

214. POINTS are occasionally worked at a considerable distance from the signal-box. The greater the distance, the less is the chance of their correct action being *felt* from the lever. In such cases it is quite possible for a stone to get between the point and the permanent metal and prevent the former from being brought into its proper position. Mechanical indicators have been frequently tried, but from the effects of the variation of temperature on the metal rods and wires by which they are worked or locked, and from other causes, they have not been found so reliable as is desirable.

Electricity, on the other hand, is peculiarly qualified to meet what is required. By its aid the movement of any object may be measured with the greatest accuracy, far greater than is needed to record the faithful action, or otherwise, of any set of points.

That facing points are, when unprotected and beyond the actual vision of the man working them, a source of danger, is patent to every one acquainted with railway working, and needs no demonstration here. All points have two positions—*open* and *shut*, or *open* and *closed*—and when in either position should lie close to the sister

metal, so as to form as truly as possible a continuous and firm metal road. Any departure from this is liable

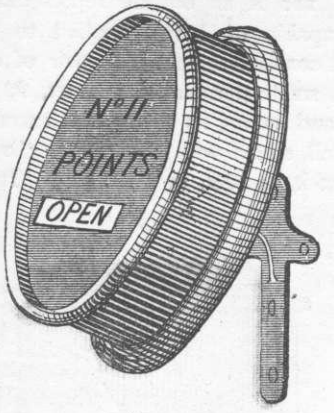

FIG. 120.

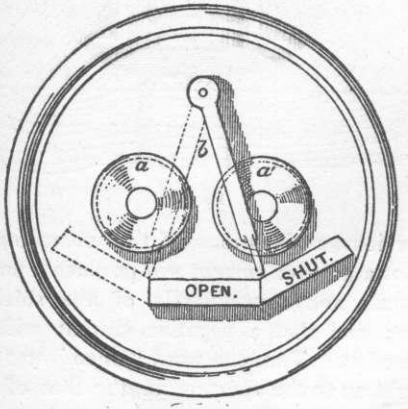

FIG. 121.

to lead to a casualty. It is therefore desirable that the record should be such as to afford both these indications,

and to record that required **only when the point is in its proper position.**

215. Fig. 120 is an outside representation of an instrument capable of being applied to this purpose. Internally it consists merely of a pair of coils, *a a'* Fig. 121, with a small permanent magnet, *b*, pivoted at its upper end, and having its lower end extended so as to carry a small shield with the words "open," "shut," printed upon it, as seen in the figure. It will be clear,

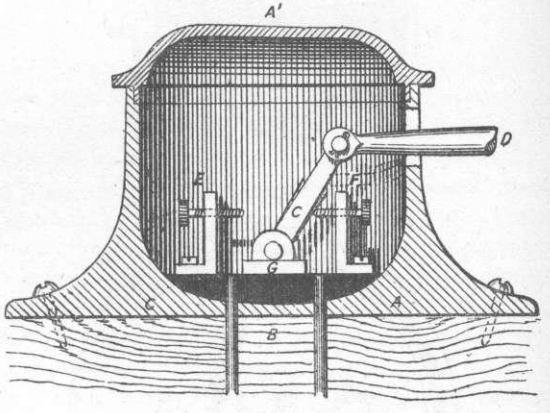

FIG. 122.

from previous explanations of this character of instrument, that a positive current will produce a movement of the magnet, and consequently of the shield, in one direction; and that a negative current will have the opposite effect. Thus the word "open" or "shut" may be brought up to the aperture in the face of the instrument, by the reversal of the current, at pleasure.

216. To produce this reversal in accordance with the movement of the points, we require a **commutator**

which shall be actuated by the points. Such an instrument is shown in section by Fig. 122. A is a circular cast iron box some nine inches in diameter, having a movable lid A', fixed by screws in order to prevent its being tampered with. Upon a piece of metal, insulated one from the other, are placed the two cocks, E, F, and between them an insulated socket piece, G, upon which works the lever C, in connection with a strong rod, D, of from 1″ to 1½″ diameter, which is connected directly with the points to be recorded. Holes are provided through the bottom of the box for the admission of the wires which have to be connected with the insulated pieces, E, F, G. To E is connected the copper pole of a battery, the other pole of which is connected to one end of the coils of the indicating instrument. To F is attached the zinc pole of another battery, the opposite pole of which is also connected to the aforesaid end of the coils of the indicating instrument, and to G is attached the line wire in connection with the remaining end of the coils, all of which is shown in Fig. 123.

The iron commutator-box A, is firmly fixed to a framework of wood, or to one of the transverse sleepers employed for the rails; and the lever C is provided with small flat springs on either side so as to secure a good rubbing contact with the adjusting contact pins in con nection with E and F.

217. Now it will be evident that so long as the lever C is in connection with F (Fig. 123), the current will be flowing from battery *a* along the wire *k*, through the instrument, out at *j*, which wire it will traverse and enter the commutator at C, which it will again leave by the contact F, completing the circuit by means of the wire *h*.

If the points are moved over into the opposite

position, we shall have C in contact with E, when the current will flow from battery *b* by way of wire *i*, to the contact stud E, lever C, wire *j*, entering the instrument at this point and completing the circuit by means of the wire *k*.

But should the points not go home, the lever C, will fail to make contact with either of the studs E, E, as the case may be; no current will flow through the coils, and the indicator instead of exhibiting the word "open" or "closed" will exhibit a portion only of each, making no signal at all, or rather a confused indication only.

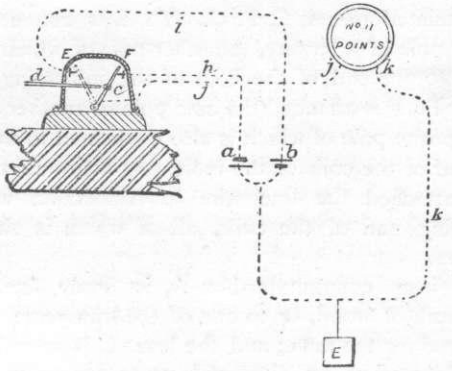

FIG. 123.

The indicating instrument should be fixed immediately behind the lever which works the points, and the commutator as near as may be convenient to the points themselves. When placed in the four foot it should be so arranged that a loose carriage coupling shall not strike the box, as such a blow might possibly break it. If desirable, however, the rod in connection with the points may be carried any reasonable distance so as to place the

commutator out of the way of shunting operations; but wherever the distance is such as to admit of any appreciable expansion or contraction of the rod from atmospheric causes, compensation levers should be inserted.

Such a commutator as that described is useful for many purposes, as, for instance, for automatically intimating at certain points the approach of a train—a treadle being used to actuate it in the place of the points.

Level Crossings.

218. It is desirable that the gate houses or gate boxes of all level crossings should be provided with a means by which the gate-keeper may receive intimation of the approach of trains.

This is usually effected by inserting a single stroke bell on the bell or signal wire used for block purposes; but where there are three or four such crossings within the same section it is advisable to employ a small relay at the crossing boxes, and by its aid work the bell fixed there, in a local circuit. When this course is pursued the signals are stronger and large trembling, instead of single stroke bells, may be employed. More than one trembling bell cannot be employed, in the same circuit, with satisfaction, as it is difficult to secure a perfectly synchronous movement of the armatures, and without this the make-and-break arrangement of the one would tend to interrupt that of the other.

219. A very simple form of *relay* is all that is required. It may consist of one or two small coils; the armature of which, when attracted to the cores of the coils by the passing current, shall complete the local circuit. Such an arrangement is represented in Fig. 124. A, B are the sectional block signal stations, and C, D, level crossings;

a, *b*, the bell keys at the former, and *c*, *d*, the relays at the latter. If the spring of the bell key at *a* is pressed, a current will flow along the line wire, passing through the relays *c*, *d*, the armatures of which will be attracted, and the local circuits completed during the passage of the current. If one current only is sent from A to B only one stroke will be rung on the bell at C, and one series of rings on the bell at D; the bell at *c* being a single stroke bell, and that at D a large trembling bell. Should B ring to A precisely the same effect would be produced. As the armatures of the relays are not polarized it is

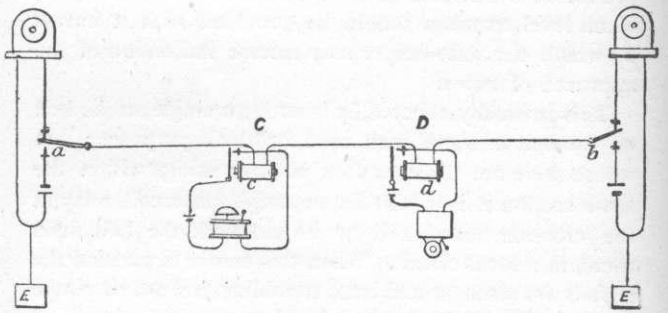

FIG. 124.

immaterial whether the current from either of the terminal stations is positive or negative — the attraction of the armatures, and consequently the closing of the local circuits, will be the same in either case.

It will be observed that in neither case has the level crossing any power over the signals, nor can they be interfered with by the gateman. He simply hears the signals passed upon the wire, and, being acquainted with the code in use, readily recognises the *departure*, from other signals.

Yard Working.

220. It is almost impossible to indicate the various requirements of a busy station-yard service. Nor are they to be dealt with by rule, for that which is perfectly applicable in one case may be wholly unsuitable in others. What is required should first be ascertained. This done it is easy to meet the want.

Generally, however, it will be found that some means of communication between the ground-men, shunters, and others, and the signal-box which has command of the yard points is necessary. Despatch is thereby secured, much shouting avoided, and a greater degree of safety obtained.

Some central or convenient point should be selected to which the yard foreman or shunter should have access, and here a bell and bell-key should be fixed, communicating by wire with a similar arrangement in the signal-box. By the use of a code of signals the shunter's wants may then be made known to the signalman, and if all is safe for him to proceed with his work an *all clear* signal may be sent him from the signal-box, the signalman there setting his signals and points accordingly. The bell and bell-key may be placed within a small box, fixed upon a lamp post or other convenient support; or the bell may be placed in a box with holes bored in it to afford free emission to the sound, and the bell-key in a smaller case within easy reach of those who have to use it. Such a box or case should be provided with the ordinary carriage-door lock. The single-stroke bell should be used.

221. Much convenience frequently attends the employment of similar arrangements between busy *station*

departure platforms, and the station or yard signal-box. Intimation of the readiness of the train to depart can be signalled a moment or so before such is absolutely the case, and on receipt of the clear signal the train can be started. Where the traffic is irregular such a system is of great advantage in facilitating the yard work, as under it there is no necessity for stopping conflicting work until the *warning*, or the *train ready* signal is received.

Platform Bells.

222. Reference has already been made to platform

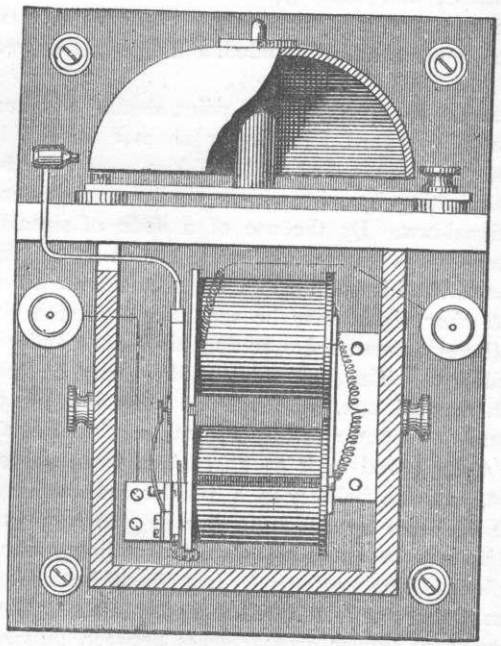

FIG. 124*a*.

bells under § 208. Such bells are now recognized as a necessity at all busy stations, and are generally worked from the station signal-box. When so worked the large trembling bell, Fig. 124*a*, is the best suited to the purpose, but where the bell is inserted in the block-signal bell-wire a single-stroke bell must be used, unless a relay is employed to work it. The former arrangement is to be preferred as it involves no unnecessary or superfluous ringing which is inexplicable to the passengers. A platform bell should be regarded much in the place of the hand bell, and should be rung on the near approach of the train—up stopping, down stopping, up through, and down through trains, all being indicated by a recognized code applicable to the entire service, so that passengers as well as officials may become acquainted with it, and thus, each alike, be prepared for the arrival of the train.

Where trembling bells are used the bell-key should be pressed somewhat longer than is usual for ordinary block signalling purposes, and the pauses between the signals should be of greater duration, so as to render the *series of rings* on the bell more durable and distinct.

Movable Bridges.

223. Wherever movable or swing bridges intersect a line of railway, the maximum of security is only to be

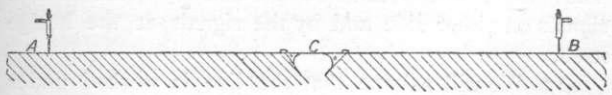

FIG. 125.

obtained by the employment of block signals and inter-

locking frames for the section of line over which the danger exists.

Let A, Fig. 125, be one station, B the adjoining station, and C the movable bridge between them. If the line is worked under the block, then such block signals should be so arranged in connection with the bridge, that when it is in any other position than that suitable and safe for a train to pass over it, the block signals for trains approaching from either A or B shall stand at danger. Where the line is not worked under the block, then it is desirable special communication should be provided similar to that explained under siding working, § 187.

224. Thus the **points to be secured** are—

1. That the officer in charge of the bridge shall under no circumstances unlock it with a view to opening it for the water traffic, without the concurrence of the signal station on either side.

2. That before doing so he shall block the roads on either side of him, and only on receipt of the acknowledgment *that they are blocked* shall he proceed to open the bridge.

In addition to this, as a further precaution, the lever locking the bridge gear should interlock with signal levers, so that before the bridge is opened, the line signals, worked from that point, must be set to danger. The bridge would thus be protected by the station signals on either side and by the signals at the bridge itself.

225. We will assume that the line is worked under the block system, and in the first instance that the system in use is a three wire system.

Of all three wire systems Preece's is the most suitable for the work, inasmuch as with it the danger signal being produced by gravity and the all clear signal by the action of the current, we have in this arrangement the element of safety, viz., *the absence of the agency by which the all clear signal is produced resulting in the danger signal*, and *the active presence of the agency employed resulting in the production of the all clear signal*, a result highly desirable where neglect, oversight, or accident are calculated to produce casualties of an alarming nature. In all such cases the advantage of the **all clear** signal being produced by the

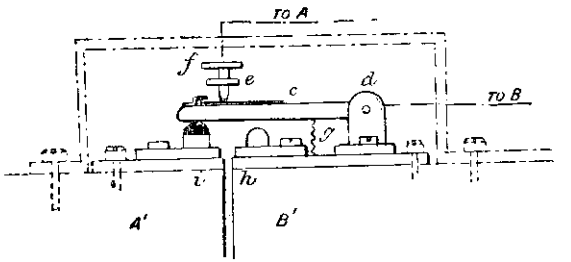

FIG. 126.

presence of the agency by which the signals are worked, is too evident to require remark.

226. Dealing then with Preece's, or any other system under which *the danger signal is produced by gravity*, and the all clear signal by the constant action of the current, all that is needed is that the bridge shall, when in the least removed from its position for railway traffic, break the semaphore, or block line-wire circuit. Thus, let A' Fig. 126, represent one end of the bridge, and B' that portion of the permanent-way adjoining it. At B' is

placed a commutator or key having a lever *c*, centred at *d*, and an upper contact piece *e*, with adjusting screw *f*, the lever *c* having a downward inclination under the influence of the spiral spring *g*. At *h* is an insulated stud which limits the downward movement of the lever.

At A′ is placed an insulating pin, *i*, in such a position that when the bridge is in its true position, it shall press upon and lift the lever *c* from the stud *h*, and bring it into contact with the adjusting screw, *f*, of the cock *e*.

The block-signal line-wire is then divided, and one portion connected to the lever *c*, and the other to the cock *e*.

If now the bridge is the least depressed, or the metals are not in their true position, the stud *i* will not engage with *c*, and, impelled by the spring *g*, *c* will not form contact with *f*, and thus the line-wire will be interrupted.

One such contact arrangement will be requisite for each wire to be interrupted. Thus taking that represented to apply to the signal for trains from B, the line-wire B would be carried to the semaphore block signal there, and the line-wire to A to the switch at A working the block signal at B.

The other contact arrangement would be similar, but the line-wires would be connected up in the opposite manner, so that the line to A would be joined to the semaphore governing trains proceeding to A, and that to B, to the switch working the semaphore at A.

The contact arrangement should be strongly made and protected from the weather, or from rough usage, by an iron or thick wooden cover.

227. With block signals where the *danger signal is produced by a constant current*, as in the double needle

system, the contact arrangement must be of a somewhat more complicated character, as it is necessary when the bridge is in one position to complete the block signal circuit, and in the other case not only to sever it, but to interpose at the point of severance, a battery current of sufficient power to operate the signals at either end. In this case the arrangement will be that symbolically represented in Fig. 127. The lever in this case is extended on either side of its centre, and insulated at *a*. When in the position represented in the figure, the line wire is complete, by means of the contact studs *b*, *c*; but when the bridge is out of position, and the lever assumes the

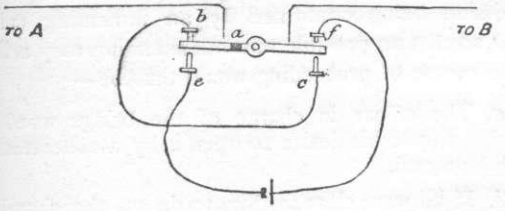

FIG. 127.

opposite position, the line wire is severed, and the battery *d*, interposed at the contact studs *e* and *f*. The line wires are in connection with the two portions of the lever.

A three wire block system is, under all circumstances, the most desirable for the purpose; but the arrangement shown in the last figure is also applicable to a *one wire system*, the connections at the adjoining signal boxes coinciding, with regard to the battery connections, with those of the bridge commutator; thus, in order to place the block signal at A at danger, B must employ a zinc current, and to place the signal at B at danger, A must make use of a copper current.

228. *When the block system in use is a single wire system*, the block signal produced by the movement of the bridge should be the result of a constant current as represented in Fig. 127, so that there may be no possibility of any change being made in the indication of the signal, from atmospheric or other causes.

229. Whatever the system employed, whenever the bridge is under the charge of an officer other than the signalman at A or B, such officer should have block signal communication with the signal stations on either side similar to that advocated for siding working (§ 187); That is he should be able to block both sides of him, and to ask permission, by bell signal, to open the bridge, such permission being confirmed by an indicating (visual) signal, so that no possible misunderstanding may arise.

The course of proceeding would thus be—

a. The officer in charge of the bridge would intimate his desire to open it by a concerted bell signal.

b. If all were clear for him to do so, the signal box communicated with would intimate such by the all clear signal.

This proceeding having been repeated to the station on the other side—

c. The officer at the bridge would proceed to block the stations on either side, and

d. When this was confirmed by the recognized acknowledgment of the block or obstruction signal, he would open the bridge.

If the line is worked upon the block system, the displacement of the bridge will also place the ordinary block signals at danger, confirming the local action of the bridge officer.

Train Describers.

230. The object of a *Train Describer* is to give information of the description of approaching trains to certain points, at which such information is necessary in order to enable the officer at that point to dispose of them with despatch, and to place them in their proper position. For instance,—B has the disposal of all trains entering a station yard. If he is made aware of the character of the approaching train he is able to set the points so as to run it direct into its proper siding, or platform, without stopping or checking it in order to learn where it is for, or what it is; whether empties, an engine only, or a main-line, or branch train.

An instrument, such as that described under § 210, may be employed for the purpose, but it would require an independent wire for every two indications. It would, however, possess this advantage. Each indication would be certain, and any possibility of confusion arising from a wrong signal would be avoided. With single wire "describers," the indication must be produced by a step by step movement, the absence or loss of any one current causing the indicator to fall behind one step or one indication, and consequently to stop one indication, or space, in the rear of that required to be indicated.

231. Figs. 128 to 131 represent an instrument, designed by Mr. C. V. Walker, of the South-Eastern Railway, for this purpose. It is worked by a single wire, and is consequently based upon the step by step principle.

232. Fig. 128 gives an external representation, and Fig. 129 the internal arrangement, of the *Sender*. The wheel B is driven by clockwork contained within the frame A. This wheel is provided with 12 metal pins, which

project from it at right angles in such a manner as to intercept, as it revolves, the insulated spring C : the motion being in the direction indicated by the arrow.

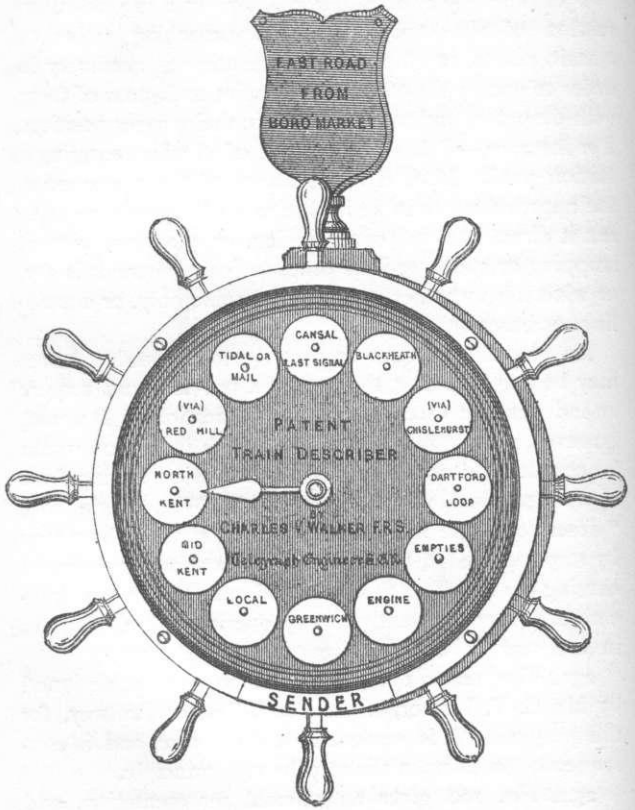

FIG. 128.

To the spring C is connected one pole of the battery, the other being to earth.

The sending instrument is provided with twelve handles, capable of giving twelve distinct signals. Each signal is rendered by drawing over, towards the operator, the handle opposite the signal required to be indicated, and thrusting back into its position of rest that last

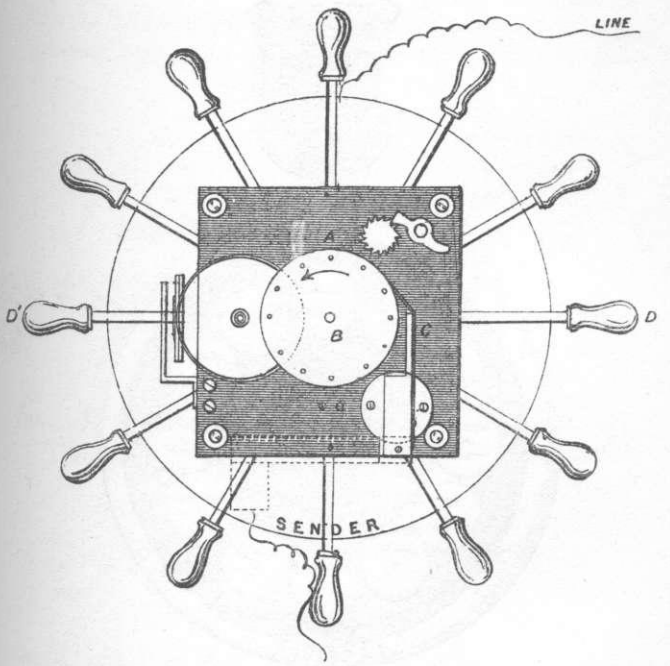

FIG. 129.

brought forward. The replacement of the latter releases the clockwork, and so causes B to revolve until it arrives at the handle which has been drawn over, by the displacement of which its motion is arrested. Supposing now the last indication made to have been by the handle

D, and that it is required to transmit another signal represented by D′. To do this the wheel B has to pass through half of a complete circuit, the space occupied by six handles. In traversing this space it will press six

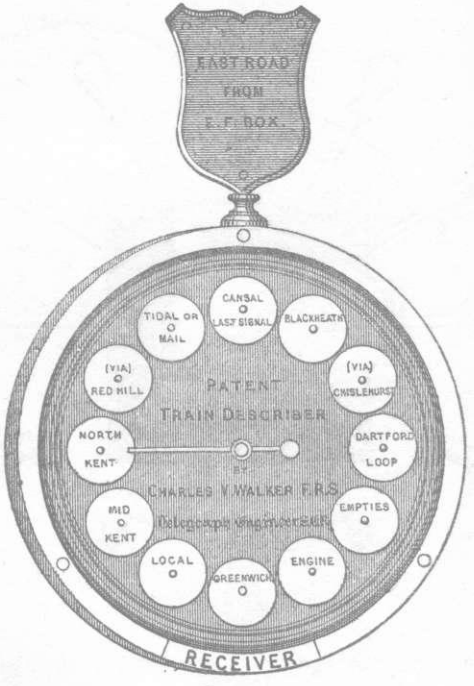

FIG. 130.

of the projecting pins with which it is fitted against C, and thus transmit six impulses or currents to the receiving station.

233. The *receiving instrument*, Figs. 130, 131, has

within it an electro-magnet A, to the armature of which is fixed a ratchet arrangement, *d*, which, when moved backwards and forwards, impels a small ratchet wheel, *c*, which has on its axis an indicator such as is shown in Fig. 130.

234. The *method of working* consists merely in first pushing back, into its position of rest, the handle last

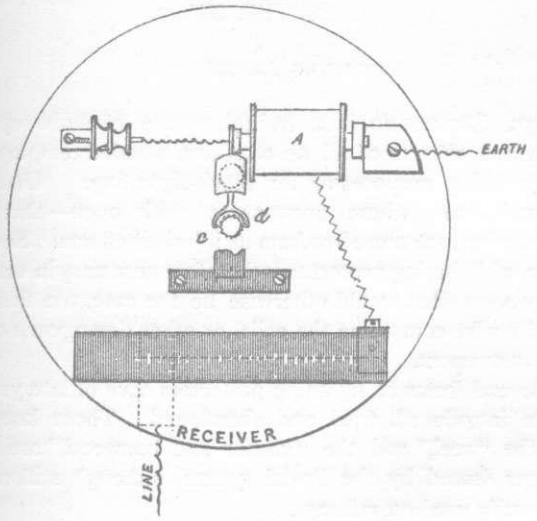

FIG. 131.

used, and then drawing over that which indicates the signal required to be rendered. This handle must then rest there till another signal has to be made; otherwise the mechanism would continue to revolve until run down. It is the replacement of the handle which starts the machinery, and the displacement of any one of them which stops it.