CHAPTER IX.

TYER'S BLOCK SIGNALS.

123. FIG. 41 is a sketch of a complete set of instruments for working both the up and down traffic, as fixed at one end of a section. It consists of—

I. A bell or gong, embracing a relay.

II. An indicating instrument, embracing—*a*. Two indices (or arms), the one to register the incoming, the other the outgoing, signals—*b*. a pair of plunger keys, the one for the *block*, the other for the *clear* signal.

III. A ringing key for bell or gong signals only.

The set of instruments for working the other end of the section would be identical, except that it would be provided with a bell in the place of the gong.

The lower index is coloured red, and is in circuit with the upper or black index, at the next signal box. The red index indicates the last signal sent; the black the last signal received. On the movement of either, the gong or the bell, as the case may be, should be sounded, so that any change made on the outgoing signal ought not to occur without the signalman at the next station being warned.

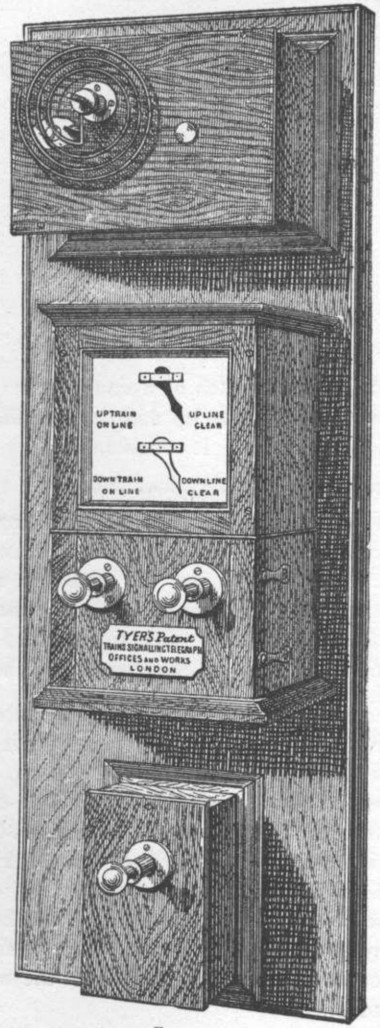

FIG. 41.

The plungers are so arranged that, although they send reverse currents, and consequently change the position of the indices to correspond, they leave the commutator fixed, so that any number of strokes may be subsequently sounded by the bell or gong plunger without altering the position of the indicator.

The bell is rung by means of a relay, which being merely an electro-magnet with soft iron armature, is actuated by every current irrespective of its direction or character.

The magnetic circuit of the registering index for the outgoing signals is placed between the battery and the earth, whilst that belonging to the index for the incoming signals is disconnected from the battery by means of the key and commutator.

The indices are maintained in the position in which they have been last placed by the **residual magnetism of the electro-magnets.**

Now, supposing it is necessary to send a negative current so as to work the index at the distant station, we must first press plunger K′, Fig. 50, which sets the commutator as shown in the figure. This places (Fig. 42) spring *a* in contact with *b*, *c* with *d*, and pressing the latter separates contact 3 (Fig. 53) from contact 4.

124. **The course of the current** may now be traced from Figs. 42, 43, and 44, as follows :—

Commencing from the positive pole of the battery,
to terminal P,
through the magnetizing coils M C¹, M C²,
to terminal Q,
" " V,
" spring *b*,
" " *a*,
" terminal 9,

to terminal 10,
through the coils S S' actuating the red index,
to terminal 11, and thence to earth ;

and from the negative pole of the battery

To terminal Z,
„ spring *c*,
„ „ *d* and terminal 3,
„ terminal 2 and K B (on the key),
„ „ K A and terminal 1,
„ line.

Arriving at the next station it would enter at terminal 1, pass

to K A,
„ K B.
„ 2,
„ 3,
„ *d*,
„ 4,
„ 5,
through coils R R' (actuating the black indicator),
to 6,
„ 7,
„ relay coils (sounding gong),
„ 8,
„ earth,

and thus complete the circuit.

The relay would, at the same time, complete the local circuit by joining N to O ; *i.e.*, the current starting from the positive pole of the battery would pass

to P,
through the coils M C', M C²,
to Q.
„ N,
„ relay armature,

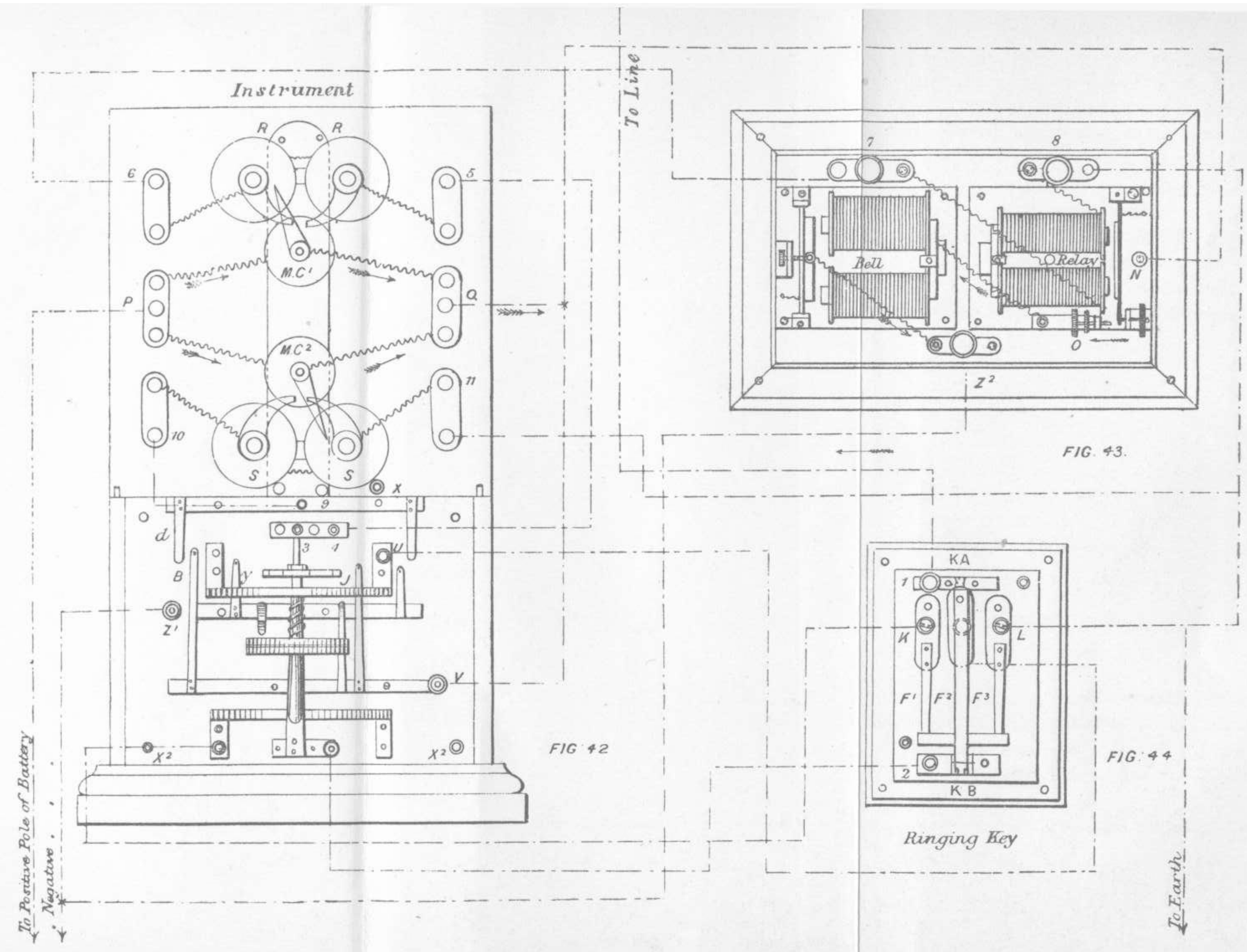

FIG 42

FIG. 43.

FIG. 44

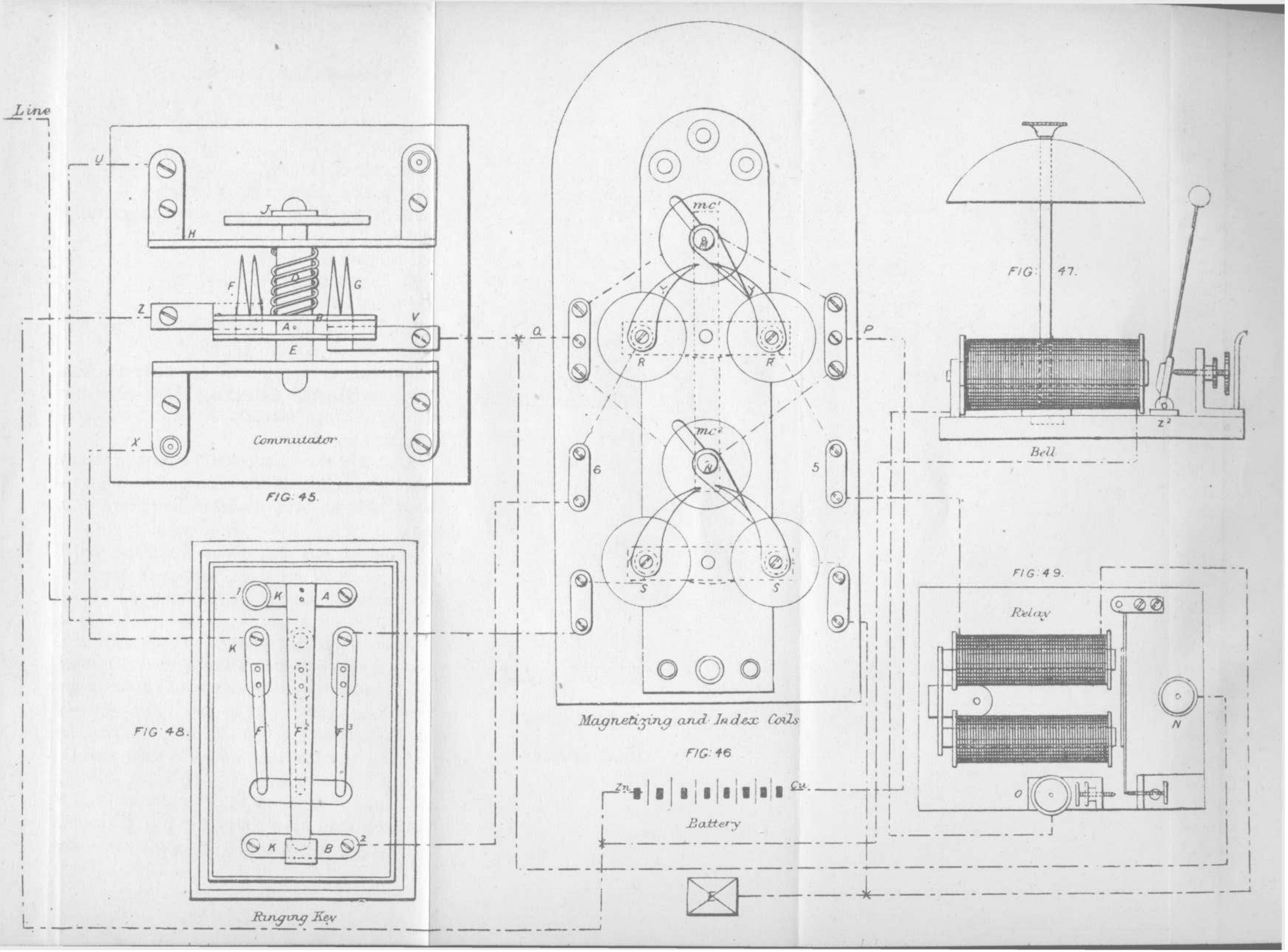

FIG. 45. Commutator

FIG. 46. Magnetizing and Index Coils — Battery

FIG. 47. Bell

FIG. 48. Ringing Key

FIG. 49. Relay

to O,

„ bell coils (causing the hammer to strike the gong),

„ terminal Z^2,

and to negative pole of battery.

Thus, having pressed plunger K^1, we have—

I. Magnetized the cores of our own magnetizing coils M C^1, M C^2,

II. Moved our own red index.

Whilst at the distant station we have—

I. Moved the black index,

II. Completed the local circuit, sounded the gong, and magnetized the cores of coils M C^1, M C^2.

125. If, however, it is required **to sound the gong only, without altering the indicators,** instead of pressing plungers K^1 K^2, the ringing key only must be pressed.

To understand how this is effected it is first necessary to comprehend the action of the plungers on the commutator, which will be seen in detail by reference to Figs. 45 to 54.

A (Figs. 45 and 54) is a disc of insulating material, B and C are two pieces of metal on the upper side of it, C being also continued through to the lower side. B is connected with the upper part D of the insulated axle, and C with its lower part E (Fig. 51). Springs F and G (Figs. 50 and 52) are connected with the battery through the terminals Z and V, whilst the upper and lower bridge pieces H and I, in contact with D and E respectively, are connected with springs F^1 and F^2 of the ringing key (Figs. 45 and 48). By pressing plunger K^1, the stud L^1, Fig. 50, will press against the yoke J (Figs. 45 and 51), turning round the disc B C, and put F in contact with B, and G in contact with C. It will also (Fig. 53) disconnect 3 and 4. When K^1 is released, 3 will again come into contact with 4, but F will still remain in contact with B, because there is nothing to bring the yoke J and the disc B C back. On the contrary (Fig. 51), the spiral spring around the axle D, and the two springs F G, tend to keep it in its place. Thus, according whether we press plunger K^1 or K^2, so shall we set the commutator

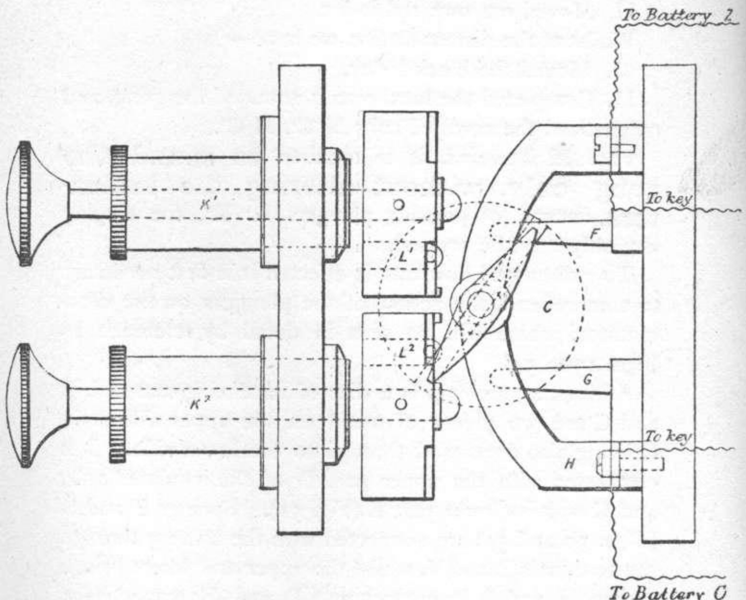

FIG. 50.

to send positive or negative currents upon the pressure of the ringing key.

Of this ringing key, Fig. 55 is an elevation, and Fig. 48 the plan; K A is the ordinary key plate in connection with the line, K B the contact from it to the instrument,

and W its plunger. Below the plate are three springs; F^3 connected to earth through the sending indicator coils, and F^1 and F^2 connected through H and I to the commutator. Thus when it is required to sound the bell or gong independently of the indices, on pressing down plunger W the key plate K A is joined to spring F^2, and spring F^1 is also joined to spring F^2.

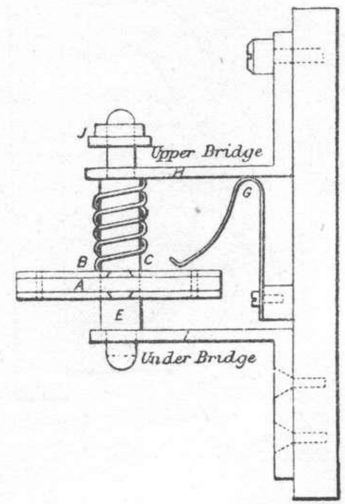

FIG. 51.

The current then traverses the following course; the commutator being set as shown in Fig. 45—*i.e.*, plunger K^1 having been last pressed.

From the positive pole of the battery—

to terminal P.

through the magnetizing coils $M C^1$, $M C^2$,

to Q,

to V,
,, spring G,
,, plate C of commutator,
,, pivot E,

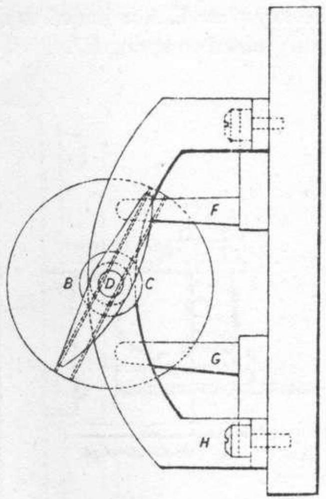

FIG. 52.

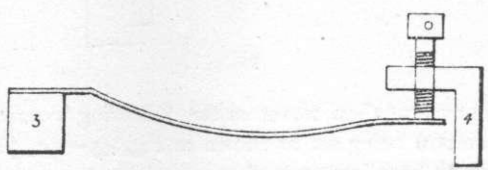

FIG. 53.

to bridge piece I,
,, terminal X,
,, ,, K,

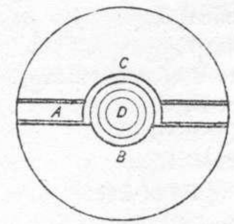

FIG. 54.

to spring F^1,
,, spring F^3,
,, terminal L,
,, earth.

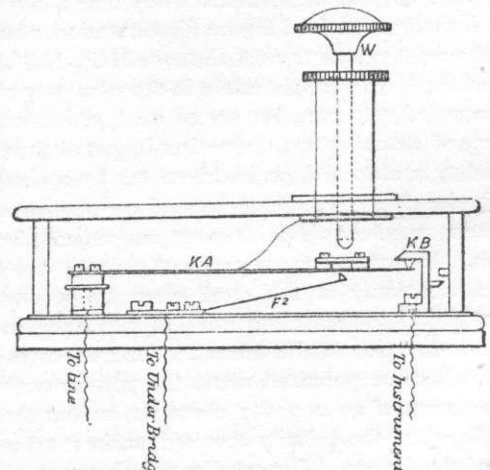

FIG. 55.

From the negative pole of the battery—
to terminal Z,
„ spring F,
„ plate B of commutator,
„ pivot D,
„ bridge piece H,
„ terminal U,
„ spring F^2 of key,
„ K A,
and to line.

Arrived at the distant station, the current will traverse the course which was last set for it by the commutator there.

126. The **main feature of these instruments** lies in the coils connected with the indices (Fig. 46), and in the employment of what is termed residual magnetism. It will be seen that every time a current is either sent to or received from a distant station, a battery current must first pass through the coils MC^1, MC^2. The cores of these coils are not made in the usual way of the best annealed soft iron, but are of steel, which has the property of retaining any magnetism imparted to it until it dies out, is absorbed, or is driven out by a charge of an opposite character. To these steel cores are attached soft iron needles, which become magnetized by induction. Hence every current sent through the coils induces a polarity in the steel cores by which it is transmitted to the soft iron needles, according to the nature or direction of the current. The steel cores having thus become polarized retain the polarity acquired, until a current of an opposite character is sent through the coils, when the polarity acquired under it takes the place of the former. The needles are, therefore, always charged with either positive or negative magnetism at their lower extremities, and will consequently be attracted to, or repelled from, the "horns" YY, Y^1Y^1, attached to the cores of the electro-magnets, RR^1, SS^1.

Thus supposing the lower end of the needle to be always north, if a current be sent through the electro-magnet RR^1, in such a direction that R be made north and R^1 south, the needle will be repelled from R and attracted by R^1, and, on the current being reversed the needle will fly back to the opposite position. The lower needle which is also charged inductively by the local current, will be actuated in the same way by currents passing round the coils, SS^1. This accounts for the needles going over, and showing the direction of the currents sent through SS^1, or received through the coils RR^1.

The object of the horns YY, Y^1Y^1 is to concentrate and retain the residual magnetism.

127. A somewhat **later form of this instrument** is provided with a flap or shutter (Fig. 56), so constructed as to cover up either plunger of the instrument during the time it is not intended to be used; the object being to prevent the signalman **making use of the wrong plunger.** Another modification is that in which the ringing key is made to sever the line circuit from the indicating apparatus during its normal state, so that no current can enter the indicating coils without the action of the receiving signalman whose attention has thus to be first called upon the bell; whilst yet a further modification (Fig. 57) provides for an indication, showing "train in," or "train out," as the case may be. This latter form is used chiefly where the traffic is worked on the *affirmative* system—that is when the signals are nominally at "danger," and only lowered to the "clear" position on demand from the station from which the train is to come. The "train in" indicator is

worked by hand, but when turned to *train in* locks the "all clear" plunger, so that it cannot be used till the indicator is again set at "train out," which is done by the signalman on the train passing out of the station.

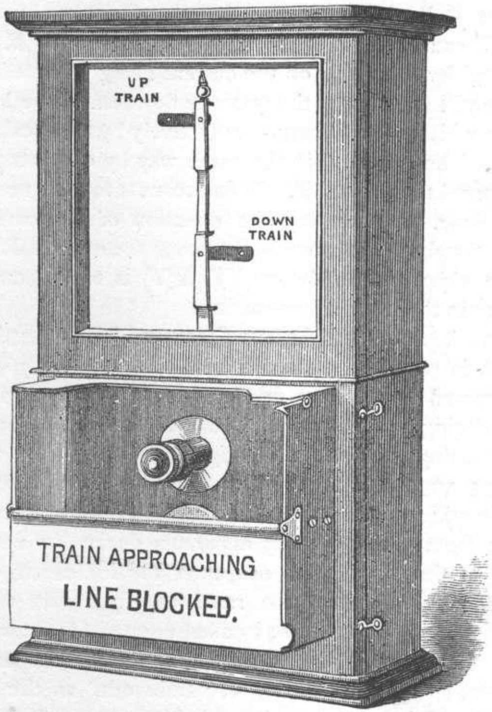

FIG. 56.

128. The **latest electrical arrangement** of Messrs. Tyers' instrument is shown in Figs. 58 and 59. A, A, A^1, A^1, are hollow cylinders; B, B, B^1, B^1, are deep

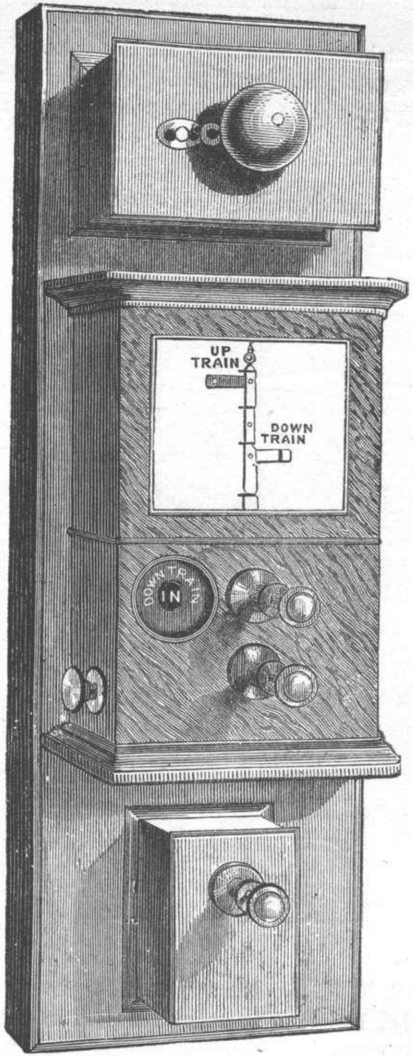

FIG. 57.

steps or notches; S, N, S^1, N^1, are the poles of the permanent magnets placed at right angles to the poles of the electro-magnets C, C, C^1, C^1. The poles of the permanent

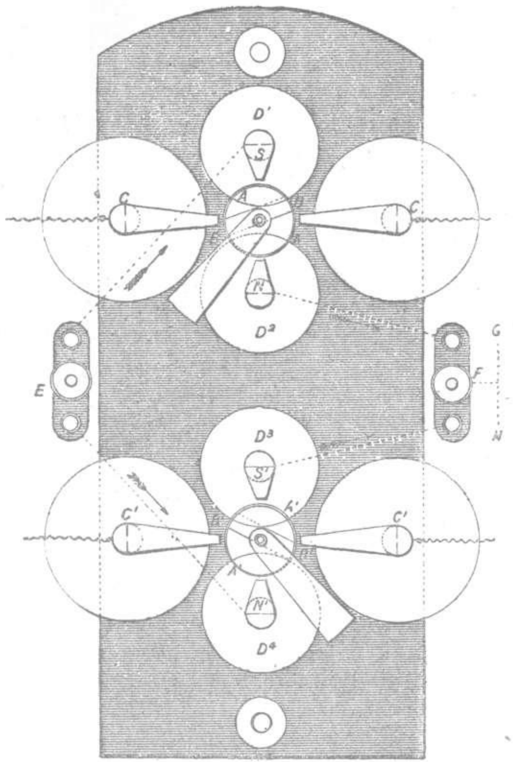

FIG. 58.

magnets S, N, S^1, N^1, are surrounded by coils of wire D^1, D^2, D^3, D^4, having their ends connected to the terminal

plates E and F. The wire from the positive pole of the battery is attached to the terminal plate E, where the electric current divides and traverses the coils D^1, D^2,

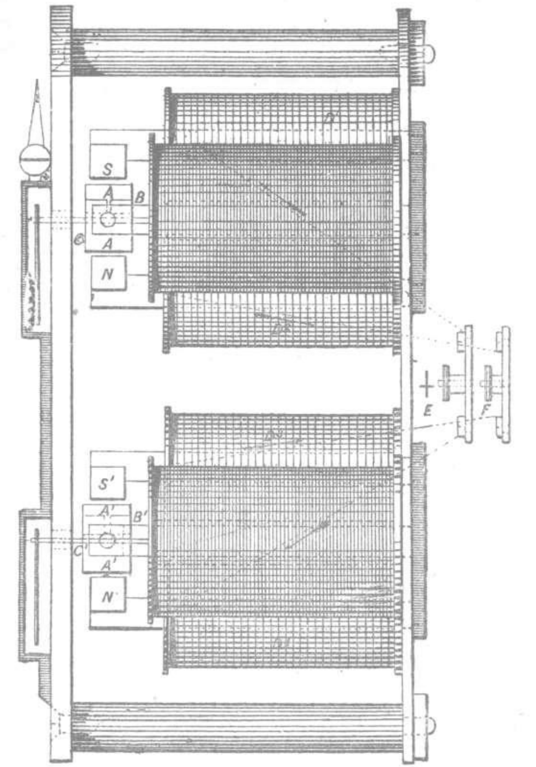

FIG. 59.

D^3, D^4, to the terminal plate F, thence by the wire G to a relay, and also by the wire H to the transmitting keys of the apparatus. Thus no current can be transmitted by such keys without first passing through the four coils surrounding the permanent magnets; neither can a signal be received from a distant station without passing through the relay that closes a local bell circuit through the same four coils. In both cases the permanent magnets are thereby kept replenished with magnetism to their fullest state of saturation, or to the extent of the battery power employed.