2 Sheets—Sheet 1.

G. WHYTE.

ELECTRO-MAGNETIC RAILROAD-SIGNAL.

No. 174,043. Patented Feb. 22, 1876.

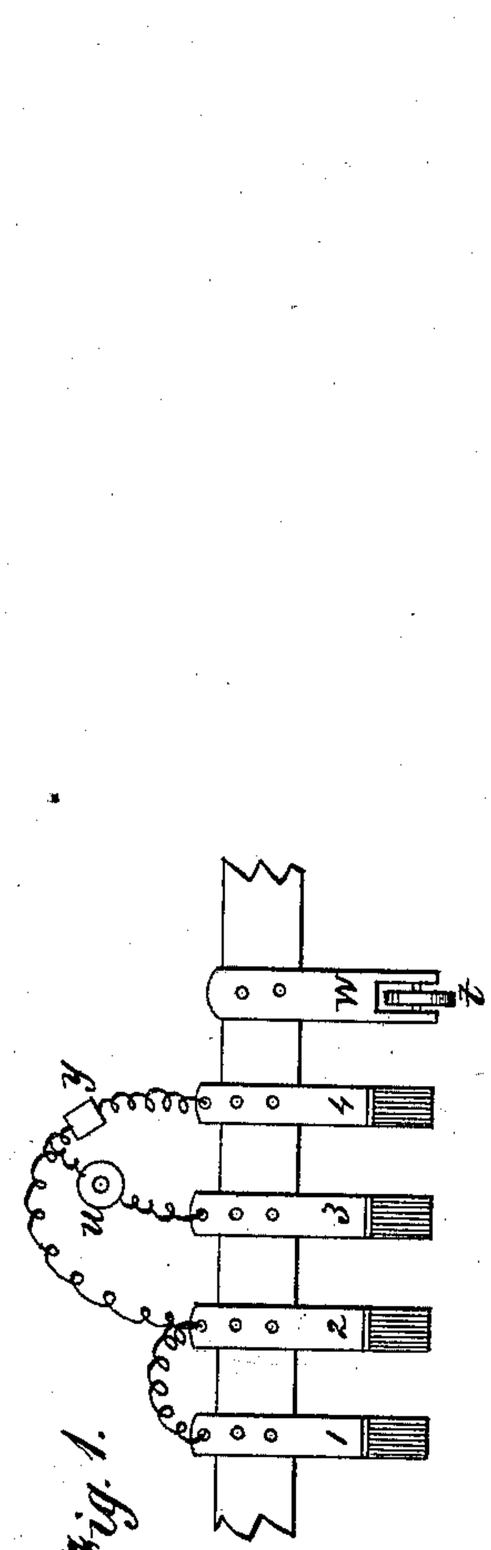

Fig. 1.

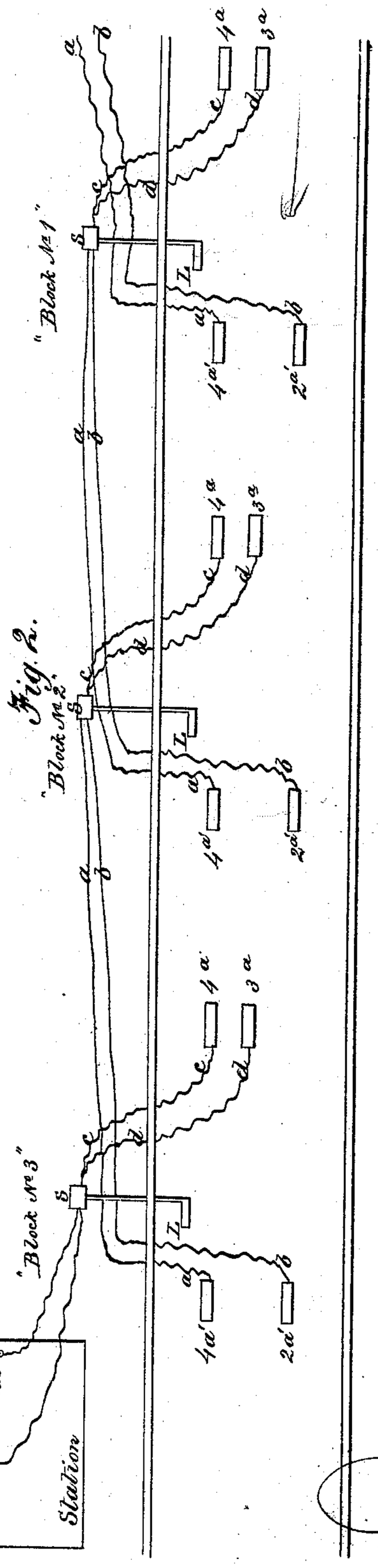

Fig. 2.

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Fig. 3.

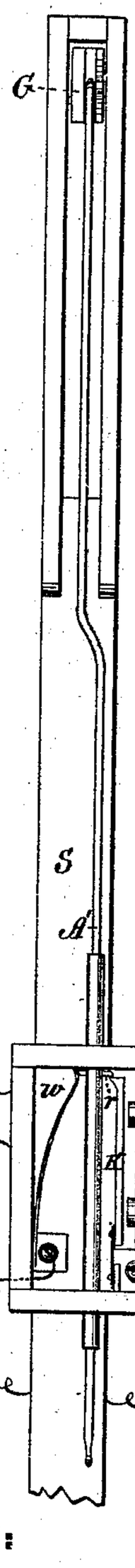


Fig. 4.

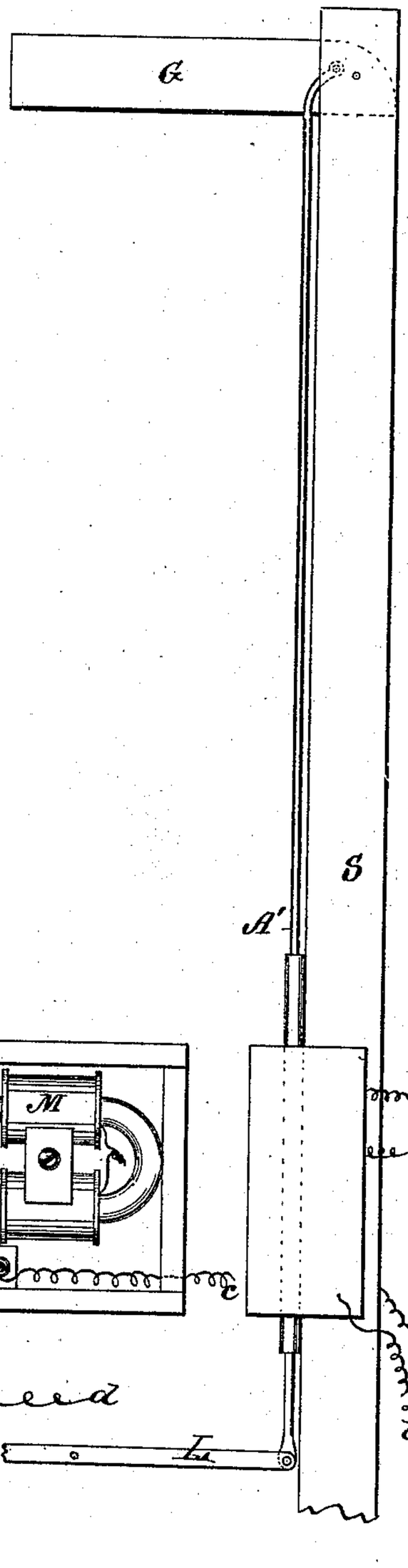
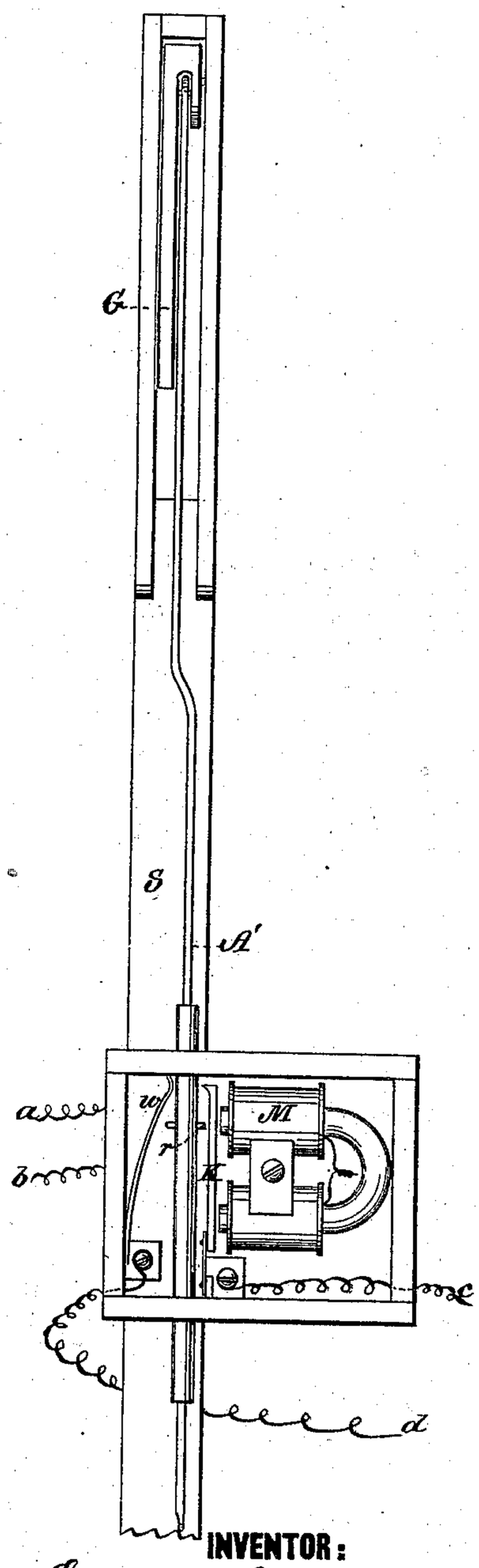


Fig. 5.



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UNITED STATES PATENT OFFICE.

GEORGE WHYTE, OF ELGIN, SCOTLAND.

IMPROVEMENT IN ELECTRO-MAGNETIC RAILROAD-SIGNALS.

Specification forming part of Letters Patent No. **174,043,** dated February 22, 1876; application filed October 28, 1875.

To all whom it may concern:

Be it known that I, DR. GEORGE WHYTE, of Elgin, in the county of Elgin, Scotland, have invented a new and Improved Electric Railway-Signal Apparatus; and I do hereby declare that the following is a full, clear, and exact description of the same, reference being had to the accompanying drawings, forming part of this specification.

This invention relates to the establishment of an absolute block system of railway-signaling by means of electricity along the entire length of a line of railway.

The apparatus which I use for the above purposes is an electro-magnetic apparatus consisting of separate portions or parts, one portion or part of which is to be applied to and placed on the engine or tender, or some vehicle of the train, and the other portion or part of the said apparatus is to be applied to the roadway between or so near to the rails of the permanent way as to act on or be acted on by the portion of the apparatus on the train.

The portion of the apparatus which I attach to the train, and which I call the "train apparatus," consists of a series of metallic contacts, with signal apparatus attached thereto. The portion of the apparatus which is applied to the road, and which I call the "road apparatus," is placed along the line and at suitable intervals apart, and either between the rails or at some convenient position on, over, or by the side of the permanent way, so that the respective portions of the said road apparatus may act, or be acted on, by the corresponding portion of the train apparatus, and which road apparatus, when so acted on by the train apparatus, shall effect a block system of signaling.

Having now described the nature of said invention, I shall proceed to describe more particularly the mode and apparatus in and by which my said invention may be performed or carried into effect, and for this purpose, I will make use of the drawings hereunto annexed, in each of the figures of which the same letters or figures of reference indicate similar parts of the apparatus.

Figure 1 is a view of the train apparatus; Fig. 2, a plan view of the roadway and the road apparatus; Fig. 3, a front elevation of the semaphoric mast, with the signal-arm elevated; Fig. 4, a side elevation of the same. Fig. 5 is the same view as Fig. 3, with the signal-arm down.

Train apparatus.—The train apparatus, as shown by Fig. 1, consists of a series of metallic contacts, three or more in number. I have shown four in Fig. 1, marked, respectively, 1, 2, 3, 4; but more may be added without departing from the principle of my invention. These contacts are attached to some portion of the engine or tender, or some vehicle of the train, and are constructed and arranged in such a manner that they shall come down so near to the roadway as to come in contact with corresponding metallic contact-plates of apparatus fixed on the said roadway. Each of the ends of these contacts nearest the road is furnished with either a metallic brush or a piece of metal, hinged, and with springs so as to allow a backward and forward movement, so that when the train passes they shall make contact with the plates of the road apparatus without offering so much resistance as to injure either themselves or the said plates. Of these contacts, Fig. 1, numbers 1 and 2 are metallically connected, numbers 2 and 4 are also metallically connected, having a battery, *y*, in circuit, and numbers 3 and 4 are also metallically connected, having an electric bell, *w*, and the battery *y* in circuit. The contact 3, as shown in Fig. 1, is placed on the center line of the engine or vehicle of the train, numbers 1 and 2 being placed between contact 3 and the wheels. Between contact 4 and the wheels on the other side is placed a stud, W, terminated by a small wheel, *t*, for the purpose of depressing the lever L, Fig. 2, on the permanent way. The stud W should be so arranged that when the train goes backward the lever L may not be depressed. This may be accomplished either by having the stud W hinged, or else by means of an arrangement for having it removed out of the way.

Block system of signaling.—Along the line, at intervals which may be found convenient, according to the character of the line and amount of traffic thereon—for example, at intervals of one mile, Fig. 2—are placed the

blocks marked, in Fig. 2, Block No. 1, Block No 2, and Block No. 3.

Each block consists of the following parts: Two insulated metallic plates, 3^a 4^a, with insulated metallic wires *c c d d* attached, (these wires proceed to and are attached to a semaphore, S;) a lever, L, for the purpose of raising the semaphore S; two insulated metallic plates, $2^{a\prime}$ $4^{a\prime}$, with insulated metallic wires *a a b b* attached, these wires proceeding to an electro-magnet in the semaphore at the preceding block, for the purpose of releasing the semaphore. The two insulated metallic plates 3^a 4^a are placed on the line and between the rails, so as to correspond with, and so as to act on or be acted on by the metallic contacts 3 and 4 of the train apparatus as the train passes over them. Attached to one end of each of these contact-plates is an insulated metallic wire, *c c d d*. These insulated metallic wires proceed to the semaphore S, to which they are connected in such a way that when the semaphore S is raised the wire *c c* is metallically connected to the wire *d d*, so that when the semaphore S is at danger the metallic contact-plates 3^a 4^a are metallically united through the insulated wires *c c d d*, and so form part of a metallic circuit, the circuit being completed when the contacts 3 and 4 of the train apparatus come in contact with the contact-plates 3^a 4^a, as the train passes over them.

Figs. 3, 4, and 5 show the particular construction of the semaphore and its apparatus, by means of which the above circuit is made.

M represents the electro-magnets, to which the wires *a b* are attached. G is the arm of the semaphore, which is raised by rod A′ and lever L. K is the armature of the magnets, mounted upon a spring and provided with a catch at the end. When the arm of the semaphore is up, indicating danger, a stud, *r*, upon the rod A′ rests above the catch of the armature, and electrical connection is made between the wires *c d* through the armature, rod A′, and spring *w*.

The semaphore S is placed by the side of the permanent way, and at a sufficient distance in front of the contact-plates 3^a 4^a to allow the train to stop before coming to the semaphore, should the train have received a signal at the contact-plates 3^a 4^a that the semaphore is at danger. The lever L is placed on the permanent way so as to be conveniently acted upon by the wheel *t* at the end of the stud W on the train apparatus. This lever L is attached to the semaphore S in such a way that when it is depressed by the wheel *t*, as the train passes over it, the semaphore is raised.

When the semaphore is raised by the lever L it is at once locked, and remains so till the train arrives at the next succeeding block, and, as above explained, the metallic contact-plates 3^a 4^a are maintained metallically united so long as the semaphore is up or at danger.

In front of the semaphore S and lever L are placed two insulated metallic contact-plates, $2^{a\prime}$ $4^{a\prime}$, between the rails on the permanent way, so as to correspond with and to be acted on by the contacts 2 and 4 of the train apparatus as the train passes over them. Attached to these contact-plates are insulated metallic wires *a a b b*, which go backward to be attached to the electro-magnet in the semaphore of the preceding block, (Fig. 2.)

When the electro-magnet M is acted on by the battery of the train apparatus, through the contact-plates $2^{a\prime}$ $4^{a\prime}$, by means of the contacts 2 and 4 of the train apparatus, the armature K is drawn to the poles of the electro-magnet, and the catch of the armature being withdrawn from beneath stud *r*, the semaphore falls. This will be easily understood by an inspection of Figs. 3, 4, 5, which show the arrangement by which the semaphore becomes locked when raised and unlocked when the armature K of the electro-magnet M is applied to the poles of the electro-magnet.

Fig. 5 shows the arrangement when the semaphore is down. If, while in this state, the lever L, by acting on the rod A′, raises semaphore, the stud *r* of the said rod passes above the catch at the top of the armature, and rests thereupon, holding the semaphore up, and indicating danger. Now, if the electro-magnet is excited, its armature with its supporting-catch is withdrawn from beneath the stud *r*, and the semaphore falls.

The operation of the block system is as follows: When a train passes along the line in the direction of the arrows, Fig. 2, the wheel *t* at the end of the stud W of the train apparatus depresses the lever L, which, acting by means of a rod or other suitable connection, raises the semaphore, which is at once locked, and when the semaphore is raised, the insulated metallic contact-plates 3^a 4^a are metallically united through the insulated wires *c c d d*, as above described, and remain so united as long as the semaphore is raised. It follows that, if a second train comes up to the first block while the semaphore is thus raised, as soon as the contacts 3 and 4 of the second train apparatus touch the contact-plates 3^a 4^a, the electric bell upon the engine, in connection with the train apparatus, will instantly ring, because the contacts 3 and 4 are themselves metallically united, having an electric bell and battery in circuit, and they complete an electric circuit the instant they touch the contact-plates 3^a 4^a, which are also metallically united through the insulated wires *c c d d*. Whenever the electric bell rings, the engine-driver or guard looks out for the semaphore on the line, slowing the train in the mean time, and if the semaphore is still up when he arrives at it, the train is to be stopped until it falls. As soon as it falls the engine driver or guard knows that the first train has passed the block in front, and he may go on with safety. As the second train passes the semaphore it is again raised, by the wheel *t* acting on and depressing the lever L, and only after the

semaphore is thus raised again does the train, by means of the contacts 2 and 4 of the train apparatus acting on the metallic contact-plates $2^{a\prime}$ $4^{a\prime}$, release the semaphore which it had set up at the preceding block. If, however, the first train has passed the second block, the semaphore of the first block will have been unlocked by the battery upon the first train acting upon the electro-magnet of the semaphore of the first block, by means of the contacts 2 and 4 coming in contact with the contact-plates $2^{a\prime}$ $4^{a\prime}$ through the insulated wires *a a b b*. In this case the electric bell on the second train will not ring when it comes to the first block, inasmuch as the contacts 3 and 4 of the train apparatus will not now complete an electric circuit when they come in contact with the contact-plates 3^{a} 4^{a}, these contact-plates being only metallically united when the semaphore is raised. The first train, immediately before it has unlocked the semaphore of the first block, has raised that of the second, so that the danger-signals of the second block are set before those of the first block are unset, and so on all along the line. The entire line being thus divided into sections, the train as it enters each section (as it were) double-blocks that section, so that no following train can enter that section until the first train has left it, without having an audible signal given on the train and a visible signal—namely, the raised semaphore—being exhibited on the line.

The semaphores used for the block system should not be large, and should be placed as near to the permanent way as possible, so that they may be easily seen by the engine driver or guard.

The semaphore may be raised in other ways than that above described without departing from the principle of my invention—as, for instance, at certain points on the line where it is thought advisable to place a man. In such a case, however, the man should be signaled by the train. Small guarded semaphores may be also raised by means of a powerful electro-magnet, using the battery of the train apparatus for that purpose. To effect this, two insulated contact-plates, to correspond with contacts 1 and 4 of the train apparatus, will require to be placed on the line, and connected to the electro-magnet by insulated wires, the armature of the electro-magnet being connected to the arm of the semaphore in such a way that when the armature becomes applied to the poles of the electro-magnet the semaphore will be raised. The flanges of the railway-wheels may also be used to act upon a lever, so as to raise the semaphore.

If required, relays may be used for unlocking the semaphores or raising semaphores.

The apparatus by means of which the engine-driver is warned that any semaphore is up may be applied to any semaphore wherever situated, and may be easily adapted to all semaphores now in use.

Having thus described my invention, what I claim as new is—

1. The combination of the contact points or brushes 1 2 3 4, located upon the train, and having a bell, *u*, and battery *y* in their electrical connection with the contact-points 3^{a} 4^{a}, electrically connected by the presentation of the semaphoric arm in front, the contact-points $2^{a\prime}$ $4^{a\prime}$, electrically connected through the magnets of the block in the rear, the semaphoric arm, and the releasing-magnets, substantially as and for the purpose described.

2. The combination, with the semaphoric arm and the rod A′, having a stud, *r*, of the magnets M, armature K, carrying a catch, the spring *w*, and the circuit-connections *a b* and *c d*, substantially as and for the purpose described.

GEO. WHYTE.

Witnesses:
WILLIAM SMITH,
JAMES WATSON.