2 Sheets--Sheet 1.

F. L. POPE.

Improvement in Electric Signaling Apparatus for Railroads.

No. 129,425. Patented July 16, 1872.

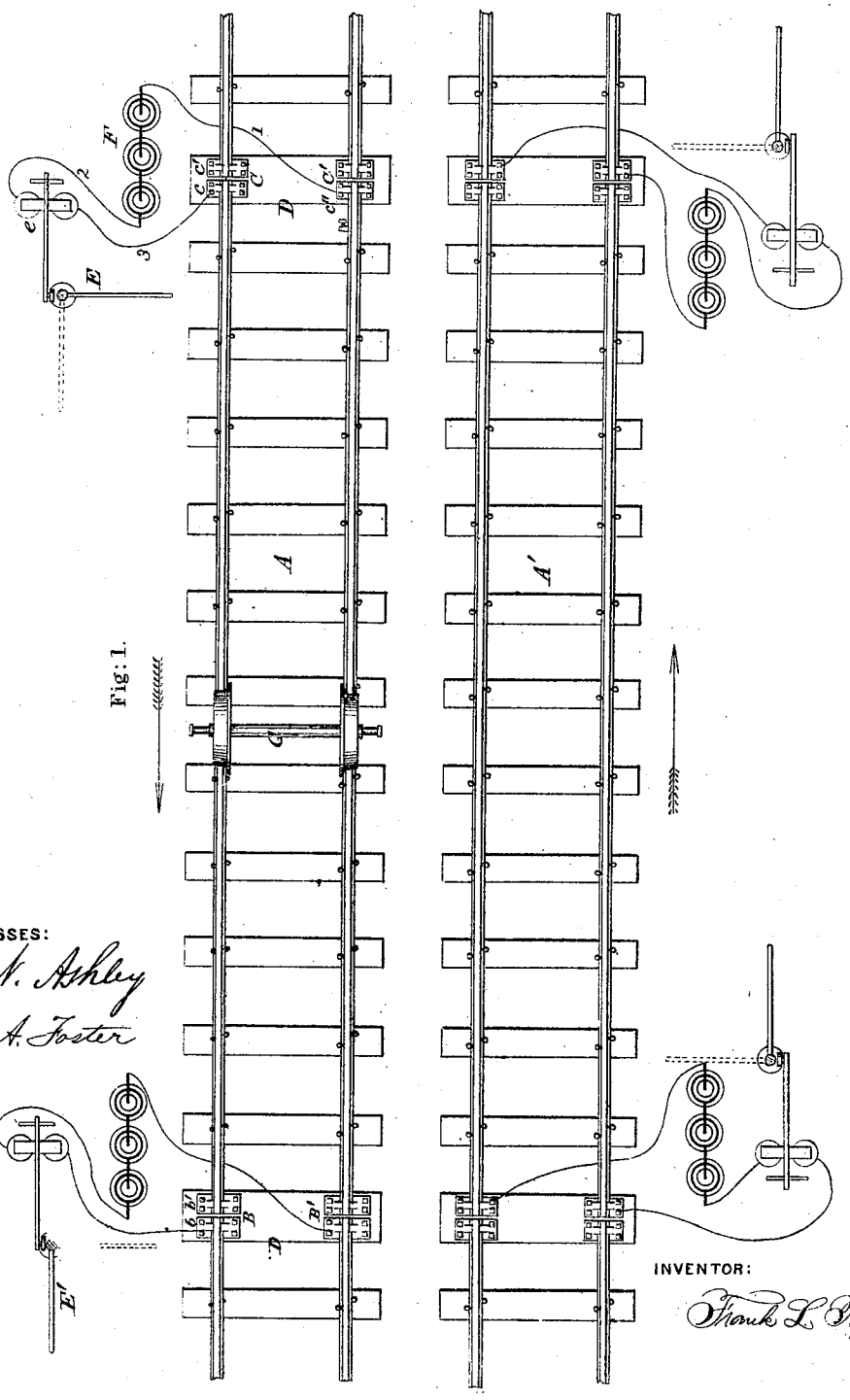

Fig: 1.

WITNESSES:

J. N. Ashley

F. A. Foster

INVENTOR:

Frank L. Pope.

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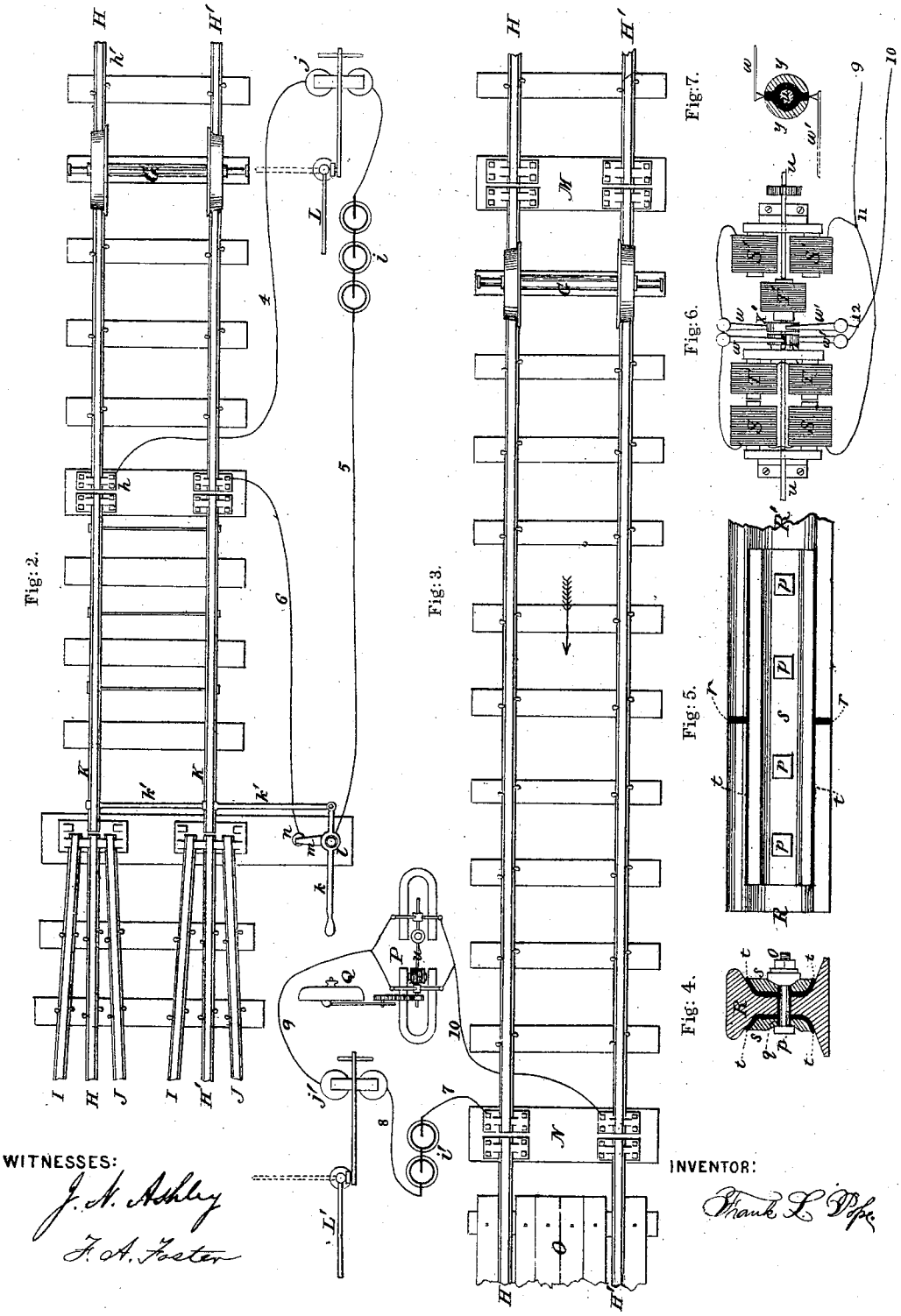

Fig: 2.

Fig: 3.

Fig: 4.

Fig: 5.

Fig: 6.

Fig: 7.

WITNESSES:

J. N. Ashley

F. A. Foster

INVENTOR:

Frank L. Pope

UNITED STATES PATENT OFFICE.

FRANK L. POPE, OF ELIZABETH, NEW JERSEY.

IMPROVEMENT IN ELECTRIC SIGNALING APPARATUS FOR RAILROADS.

Specification forming part of Letters Patent No. 129,425, dated July 16, 1872.

SPECIFICATION.

To all whom it may concern:

Be it known that I, FRANK L. POPE, of Elizabeth, in the county of Union and State of New Jersey, have invented certain new and useful Improvements in Electric Signals; and I do hereby declare that the following is a full, clear, and exact description thereof, reference being had to the accompanying drawing forming part of this specification.

My invention consists, first, in a method of limiting the extent of an electrical circuit, wherein the rails of a railroad track and the axle and wheels of a passing locomotive or car become a part of the circuit by arranging the ends of the abutting rails in separate chairs, either with or without an insulating medium between said ends. My invention consists, secondly, in the combination of an audible or alarm signal with the rails of a railroad track, when the said rails form a portion of an electrical circuit, which includes the electro-magnet or magnets that operate the alarm. My invention consists, thirdly, in the combination of a visual or semaphoric signal—so constructed and arranged as to be seen from a distance, say, by the engineer of an approaching train—with the rails of a railroad track, when the said rails form a portion of an electrical circuit which includes the electro-magnet or magnets that operate the said signal. My invention consists, fourthly, in the combination of a circuit-closer of any suitable construction, with an electrical circuit composed of wires or suitable conductors, and the rails of a railroad track and the axle and wheels of a passing locomotive or car, whereby the position of the rails will be correctly indicated to the engineer of the approaching train. My invention consists, fifthly, in an electro-motor of an improved construction.

In the accompanying drawing, Figure 1 represents my improved method of operating signals as applied to a double-track railroad, and designed to operate on what is technically called the "block system." Fig. 2 represents the same applied to a railroad switch. Fig. 3 represents the same applied to a road-crossing, in connection with an alarm and signal. Fig. 4 is a detached enlarged view, showing a cross-section of an insulated rail-joint; and Fig. 5 is a side elevation of the same. Fig. 6 represents the electro-motor for operating the alarm; and Fig. 7, a detached view of the commutator forming a part of said electro-motor.

A and A′ (refer to Fig. 1) represent the two tracks of an ordinary double-track railroad. On the track A the trains run from right to left, and on the track A′ from left to right, as indicated by the arrows. The rails of the track A are divided at the joints B, B′, C, and C′, and the ends are secured to metallic chairs, as at *b b′ c c′*, resting upon wooden ties or sleepers D D. Thus it will be understood that the rail of the track is continuous, so as to form a metallic electrical conductor from B to C, and also from B′ to C′; but the metallic continuity does not extend beyond B B′ and C C′ in either direction. The opposite rails of the track are also insulated sufficiently from each other by means of the non-conducting wooden ties D D, &c. The section of track embraced between B B′ and C C′ may be of any required length, according to circumstances; or, if desirable, the whole length of the railroad may be divided into similar sections of convenient extent adjacent to each other. At the end of the section which is first reached by a train moving in the proper direction is placed a signal, E, operated by an electro-magnet, *e*. This signal may be arranged as described in the Letters Patent No. 115,610, granted to Stephen C. Hendrickson on the 6th of June, 1871, or in any other suitable manner, the precise arrangement used being immaterial. A conducting-wire, which may be protected by a suitable insulating coating, is attached to the chair *c″*, or in any other manner, so as to be in metallic connection with the rail B′ C′, and its other extremity is connected with one pole of a galvanic battery, F. From the other pole of said battery F a wire, 2, leads to the electro-magnet *e*, from which a wire, 3, is conducted to the chair *c*, so as to be in metallic connection with the other rail of the track B C. It will be understood that when the circuit is completed by the metallic axle and wheel G of a locomotive or car the electro-magnet *e* will be charged and the signal E exhibited at right angles to the track, as shown in Fig. 1, and that the said signal will remain displayed during the time that the axle and wheels G (representing a train) are passing from C C′ to B B′; but after passing beyond B B′ the circuit will be interrupted, and the signal E will cease to be displayed and will assume the po-

sition shown by the dotted lines. When the train enters upon the section commencing at B B′ the signal E will be displayed in the same manner. Therefore the engineer of a train, on arriving at the point C C′ and finding the signal E displayed, will be made aware that a preceding train is occupying the track of the section in advance of him, but will be notified, by the withdrawal of the signal, whenever the preceding train has passed beyond the limits of the section in advance, thereby enabling him to proceed with safety. The sections of the return track A′ are arranged in precisely the same manner as is shown in the drawing, and, therefore, no further explanation is required.

Fig. 2 shows the application of my improved method of operating signals in connection with a switch. H and H′ represent the rails of the main track of a railroad. I I and J J are the rails of two branch tracks or sidings. K K are the movable rails of the switch, and are capable of being adjusted in line with the main or with either of the branch tracks by means of a lever, *k*, which is pivoted at *l* and connected with the movable rails K K by connecting-rods *k′ k′*. A section of the main track, *h h′*, which may be at any desired distance from the switch and of any suitable length, is insulated from the adjacent portions of the track in the manner previously described, and provided with a signal, L, operated by an electro-magnet, *j*, in any suitable manner. A circuit-closing arm, *m*, projects from the lever *k* of the switch, and is so arranged in reference to the metallic stud *n* as to be in contact therewith when the movable rails K K are adjusted in line with the rails of the main track H H′; but if moved into line with either the rails I I or J J of the sidings, the arm *m* will be moved out of contact with the stud *n*. An insulated wire, 5, extends along the line of the railroad track, one end of which connects with the arm *m*, and the other end proceeds to the battery *i* and thence to the electro-magnet *j*, from which a wire, 4, proceeds to one rail of the insulated section of track at *n*. A wire, 6, connects the other rail of the insulated section of track with the stud *h*. If the switch is adjusted in its normal position in line with the main track, as shown in Fig. 2, the circuit between *m* and *n* will be uninterrupted, and the closing of the circuit between H and H′ by the advancing train G will cause the signal L to assume the position shown in the drawing, indicating "safety;" but at all times when no train is passing over the insulated section of the track the circuit will be broken, and the signal L will remain in the position shown by dotted lines, indicating "danger." But if the switch be adjusted in line with one of the branch tracks I I or J J, the circuit at *m n* will be interrupted, and the closing of the circuit between H and H′, by an advancing train, will have no effect upon the signal L, which will continue to indicate "danger" until the circuit is closed at *m n*, when it will again resume the position shown in the drawing, indicating "safety."

Fig. 3 shows the application of my improved system of signaling to a road-crossing. H H′ are the rails of the track, the section between M and N representing a distance of half a mile, more or less, being insulated from the remaining portions of the track, as hereinbefore described. O is the road-crossing adjacent to the end of the insulated section of track at N. L′ is a suitable signal, which is displayed by the action of an electro-magnet, *j′*. P is an electro-motor, the construction of which will hereinafter be particularly described. Q is an alarm-bell, designed to be sounded by the action of the electro-motor P when the latter is in motion. The electrical circuit in this instance may be traced as follows: From the rail H of the track, by the wire 7, through battery *i′*, wire 8, electro-magnet *j′*, wire 9, electro-motor P, and wire 10 to the opposite rail of the track H′. When the train G, moving in the direction indicated by the arrow, reaches the point M, the electric circuit between H and H′ will be completed and the signal L′ displayed at the crossing O by the action of the electro-magnet *j′*. At the same time the electro-motor P, included in the same circuit, will be set in motion, and will cause the bell Q to be rung continuously until the train reaches the point N, when the circuit will be interrupted, causing the signal L′ to assume the position shown by the dotted lines, and the electro-motor P to cease its action upon the bell Q.

The arrangement for insulating a rail of the track from the adjacent rail, as shown at *b b′*, in Fig. 1, and elsewhere, is designed more especially for use on railroads which employ the mode of securing the ends of the rails by what is technically termed a "chair," and in this case, if necessary, a thin plate of wood, vulcanite, or other suitable insulating material may be placed between the ends of the adjacent rails to prevent them from coming in contact with each other. For railroads where the so-called "fish-joint" is employed, I have devised the mode of insulation shown in Figs. 4 and 5. R and R′, Fig. 5, are the ends of two adjacent rails, which are to be electrically insulated from each other. A plate of vulcanite or other suitable insulating material *r* is interposed between the ends of the rails R and R′. The plates or bars *s s*, Figs. 4 and 5, which are of a well-known construction, are secured to each other and to the rails by bolts *p p p p* and nuts, as shown at *o*, Fig. 4. The plates or bars *s s*, Figs. 4 and 5, are kept from metallic contact with the rails by insulating-plates *t t;* and the bolts *p p* passing through slotted holes in the rail, are insulated by the sheathing of suitable insulating material *q*, Fig. 4.

Fig. 6 shows the details of the construction of the electro-motor P, hereinbefore referred to. S and S′ are two fixed electro-magnets of the usual construction. T and T′ are two other electro-magnets of similar construction, fixed

at right angles to each other upon a shaft, *u u*, which is capable of revolution upon its axis, passing freely through the yokes of the magnets S and S′. The magnets T and T′ are so arranged that their poles revolve in close proximity to those of the magnets S and S′, respectively, as clearly shown in the drawing. Two commutators, X X′, are fixed upon the shaft *u u*, the construction of which is shown in detail in the enlarged cross-section, Fig. 7. Each commutator consists of two semicircular pieces of metal, *y y*, fixed upon opposite sides of the axis *u*, but insulated from that and from each other. To each of these segments is soldered one end of the wire of the helices of the adjacent magnet T or T′. The battery-current is conveyed to the electro-magnet by two springs, *w w′*, pressing upon opposite sides of the commutator, which are so arranged that the current through the magnet T or T′ is reversed at the instant its poles are opposite those of the stationary magnet S or S′. The electric current enters by the wire 9, and proceeds to the point 11, from which two branch circuits lead, respectively, through the stationary electro-magnets S S and S′ S′, and thence to the commutators X X′ by the springs *u u*. From the opposite springs *w′ w′* the branch circuits again unite at the points 12, and from thence by the wire 10, as hereinbefore explained.

The breaks in the respective commutators being arranged at right angles to each other, it will be understood that the circuit from 9 to 10 will at all times be complete through one of the two branch circuits, and that a signal may be operated in the same circuit without interference or interruption arising from the action of the electro-motor.

The manner in which a rotatory motion may be produced by the alternate attraction and repulsion between the poles of a revolving electro-magnet and a stationary magnet, which may be either an electro-magnet or a permanent magnet, is well known and requires no further explanation. Any suitable mechanism may be employed in connection with the motor P in order to sound the bell Q.

Where it is necessary to operate a switch or any additional signal, in addition to the "block-signal" system shown in Fig. 1, it may be accomplished by the use of an additional rail parallel with the usual rail of the track, and insulated therefrom, resting upon springs or otherwise, so that the wheels of the train may be brought in contact with both rails simultaneously, thus closing an additional circuit without interference with the primary circuit passing through the ordinary rail. If necessary the primary circuit, which includes the rail or rails, may be caused to actuate a relay of the usual construction, which may in turn actuate the signal by means of a secondary or local circuit from the same or an additional battery, in a manner well understood among those skilled in the art of telegraphy.

It will be observed that I do not make use of the earth as a part of the circuit in any of the hereinabove-described arrangements of conductors, but that the circuit, exterior to the battery when completed, consists entirely and exclusively of a series of metallic conductors in every instance. I prefer this arrangement on account of the difficulty of securing an adequate insulation between the rails and the earth, when both earth and rails are included in and form part of the circuit.

I do not limit myself to any particular mode of actuating a signal by means of an electro-magnet, as there are several devices for this purpose, any of which may be employed instead of the particular one shown in the drawing. Nor do I limit myself in the combination I have shown to the particular device M N, shown in Fig. 2, for closing the circuit at the switch, as there are many devices which may be made use of to accomplish this result. Neither do I claim, broadly, the method of producing rotatory motion by means of the attraction and repulsion between rotating and fixed magnets.

What I claim as my invention, and desire to secure by Letters Patent, is—

1. The arrangement of the ends of two abutting-rails of a railroad track in separate chairs upon a sleeper, whereby metallic contact between the said rails is prevented and the extent of an electrical circuit limited, substantially as and for the purpose herein specified.

2. The combination of an alarm or audible signal with the rails of a railroad track when the said rails form a portion of the electrical circuit, which includes the electro-magnet or magnets that operate the alarm, substantially as and for the purpose herein specified.

3. The combination of a visual signal with the rails of a railroad track when the said rails form a portion of the electrical circuit, which includes the electro magnet or magnets which operate the said signal, substantially as and for the purpose herein specified.

4. The combination of the circuit-closer *m n* with the electrical circuit 4 5 6 H H′ G, substantially as and for the purpose herein specified.

5. The combination, with the electrical circuit composed of wires and the ordinary rails of a railroad track and the axles and wheels of a railroad train, of an electro-motor for operating a visual signal or an audible alarm, either or both, substantially as and for the purpose herein specified.

6. An electro-motor, composed of the stationary magnets S S and S′ S′, the revolving magnets T T and T′ T′, and the commutators X and X′, when said magnets T T and T′ T′ are arranged at right angles to each other, and operate substantially in the manner herein specified.

FRANK L. POPE.

Witnesses:
J. N. ASHLEY,
F. A. FOSTER.