(No Model.) 4 Sheets—Sheet 1.

B. F. REX.

ELECTRIC RAILWAY SIGNAL.

No. 518,511. Patented Apr. 17, 1894.

Fig. 1.

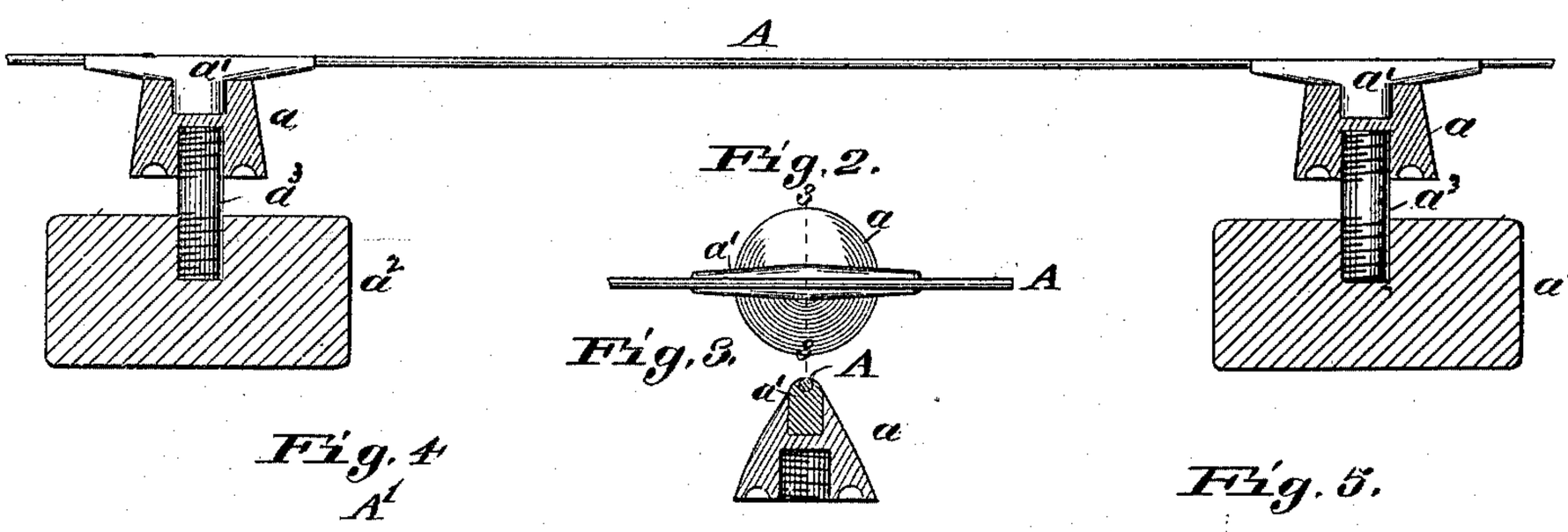


Fig. 2.

Fig. 3.

Fig. 4

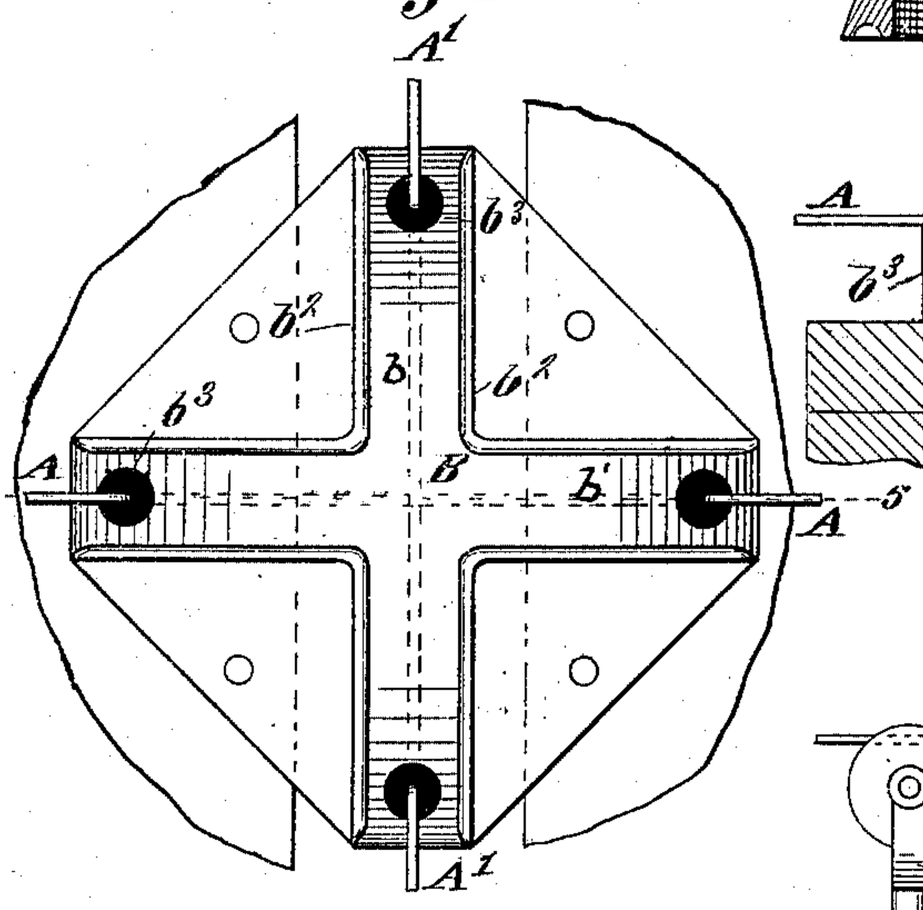


Fig. 5.

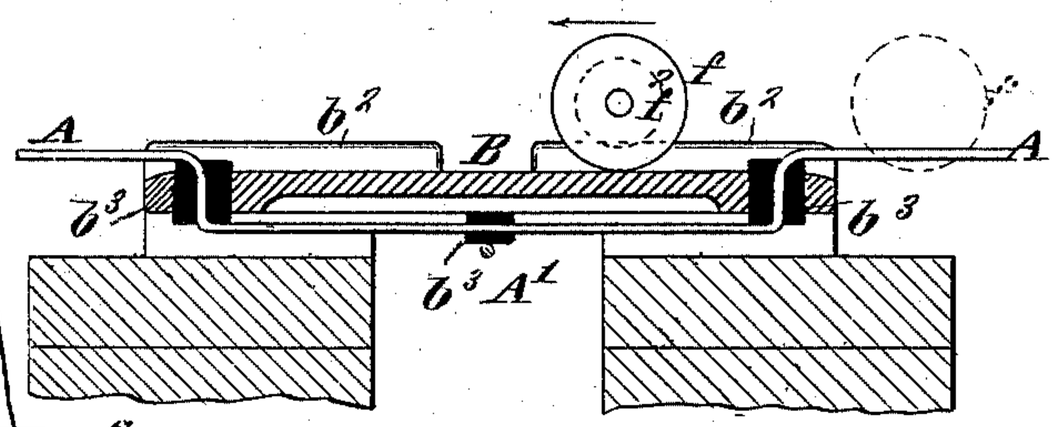


Fig. 8.

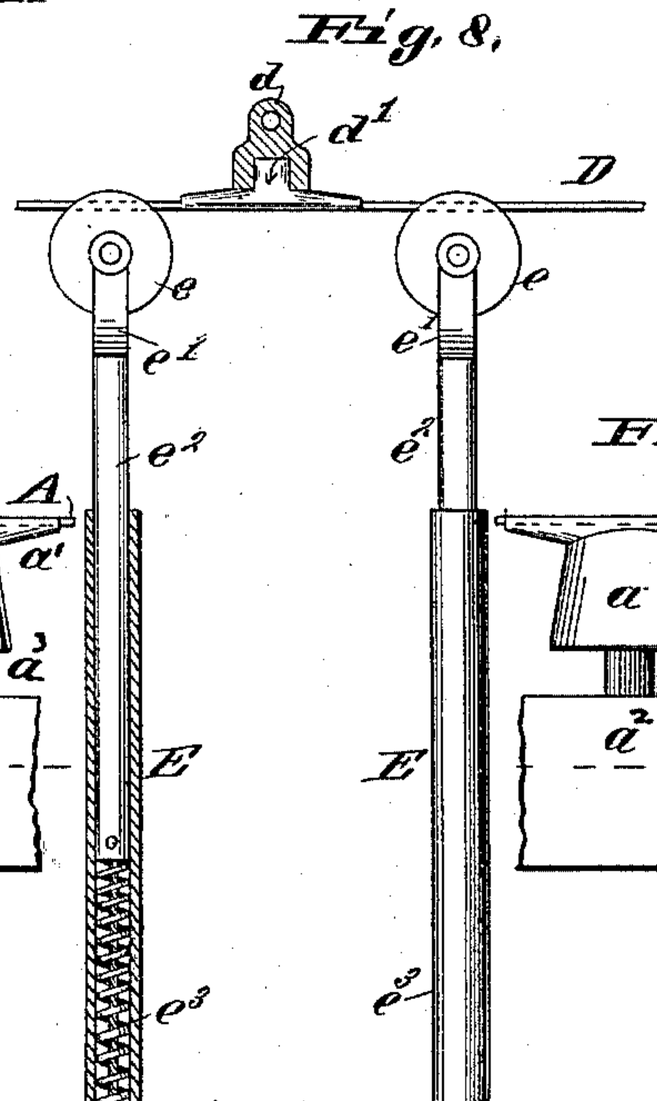


Fig. 6.

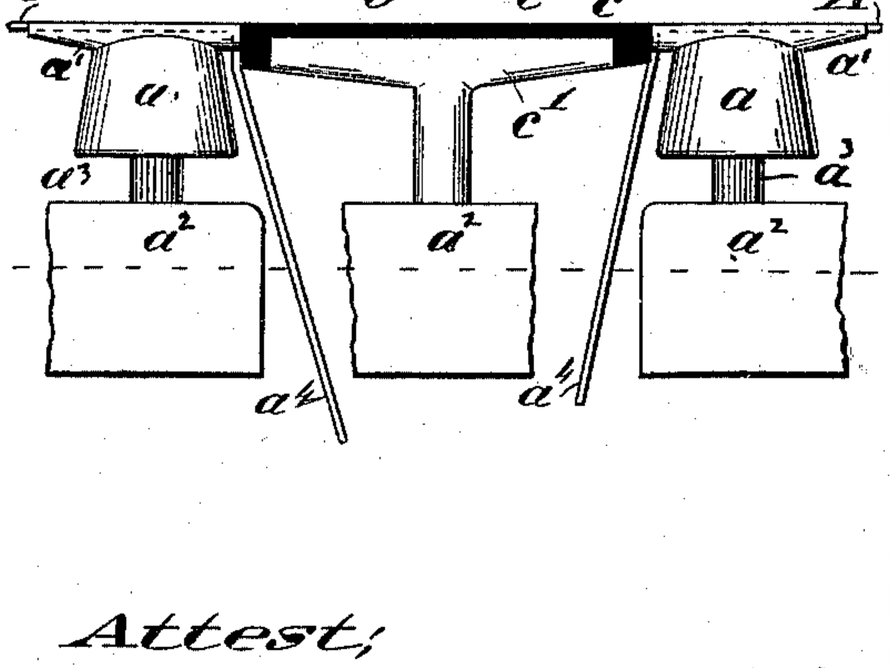
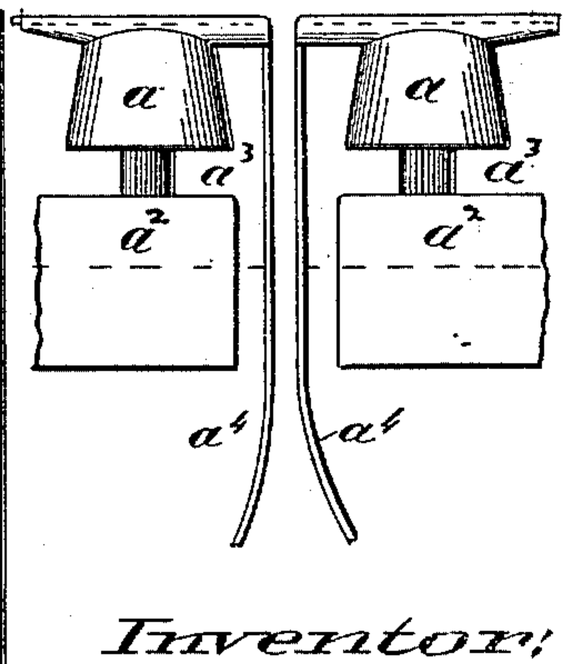


Fig. 7.



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ELECTRIC RAILWAY SIGNAL.

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Fig. 9.

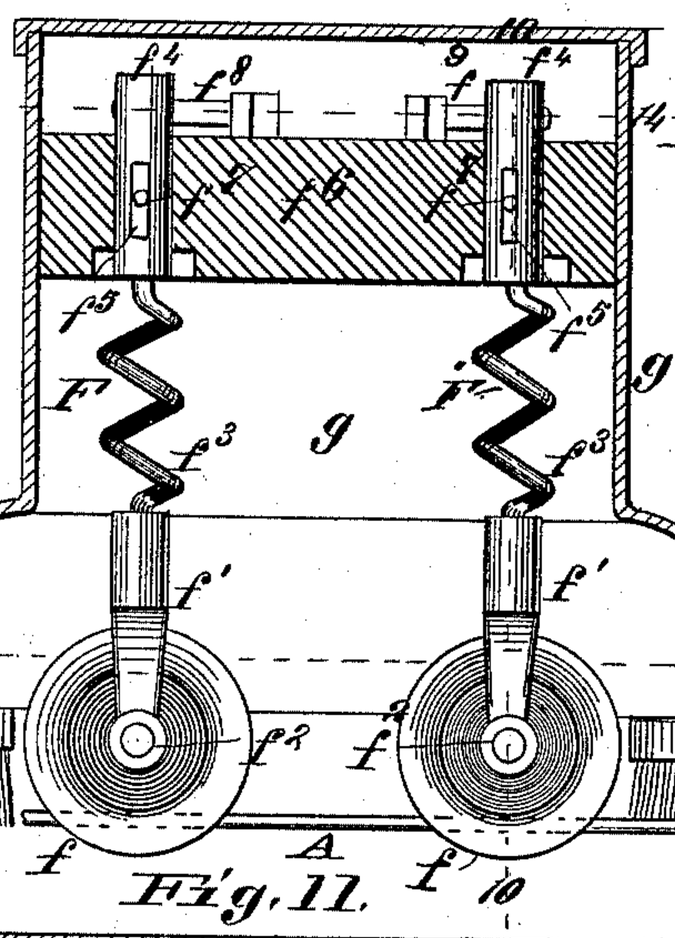


Fig. 10.

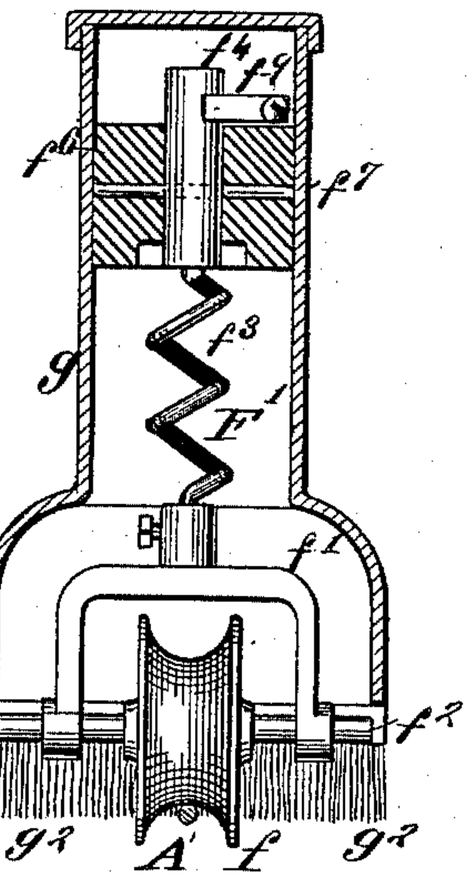


Fig. 15.

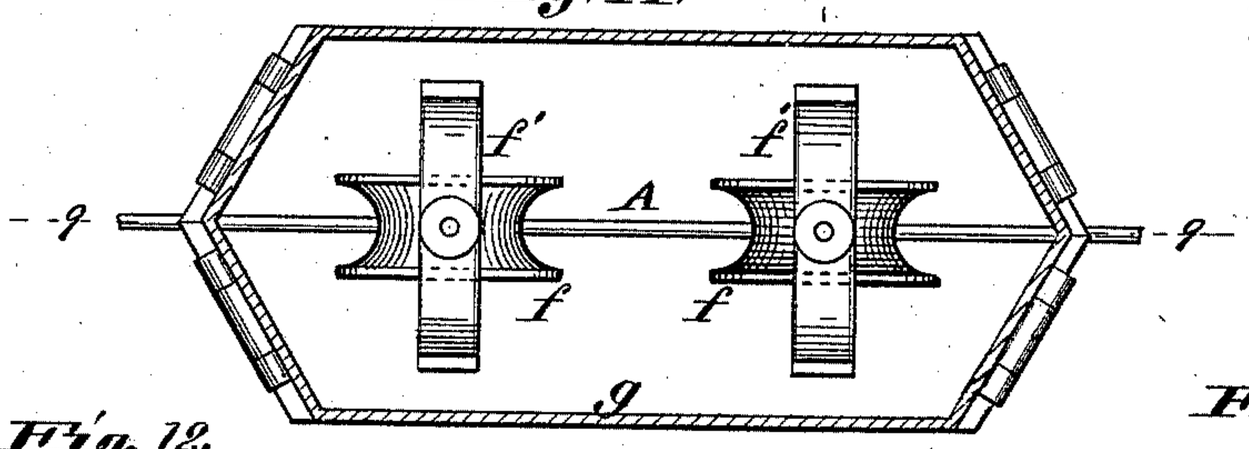


Fig. 12.

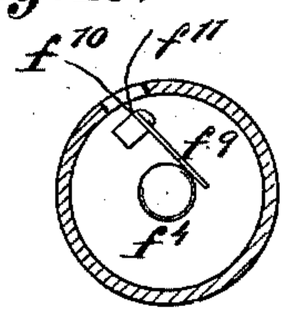


Fig. 13

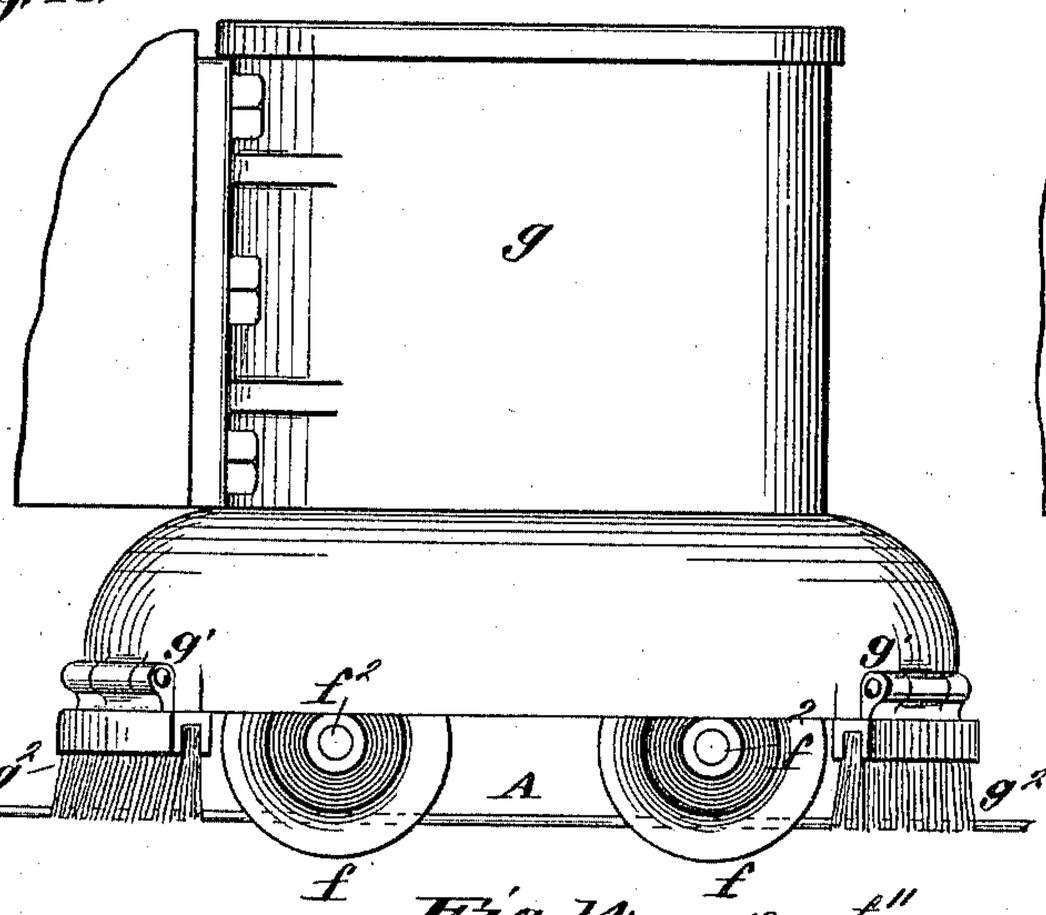
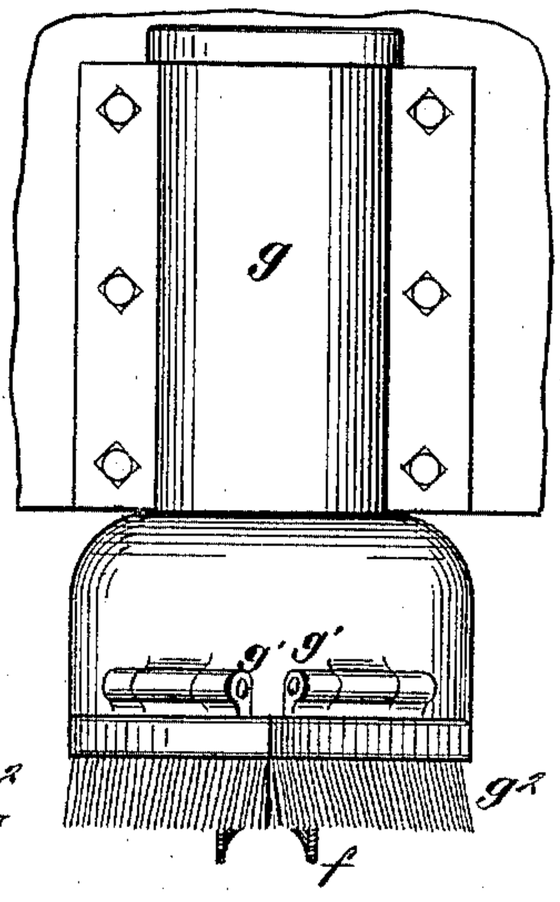
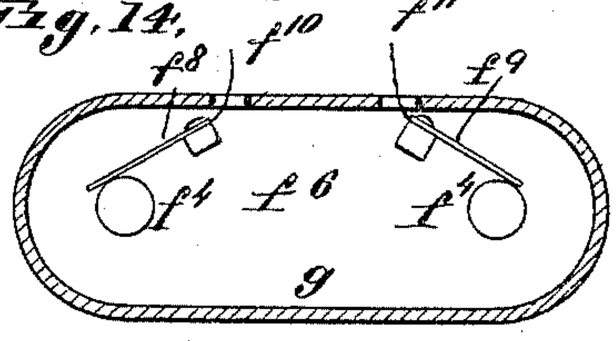


Fig. 14.





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No. 518,511. Patented Apr. 17, 1894.

Fig. 16.

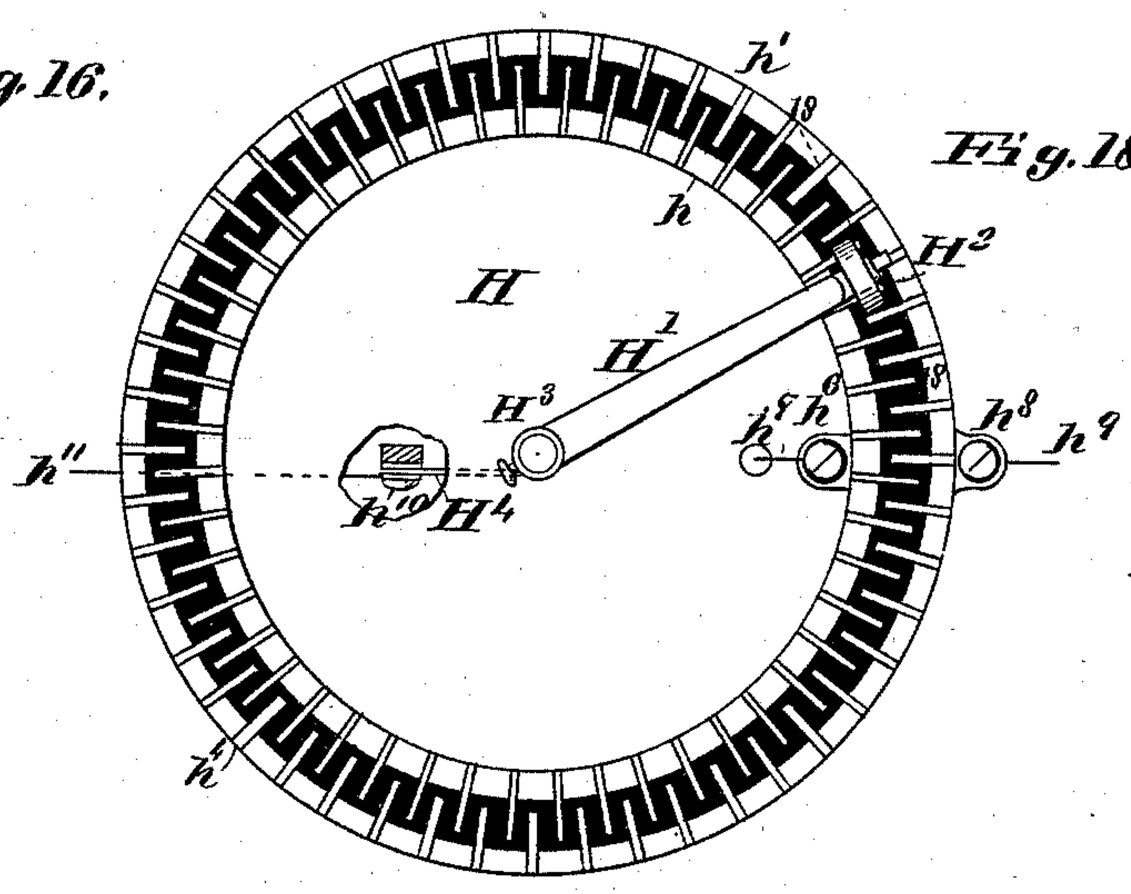


Fig. 18.

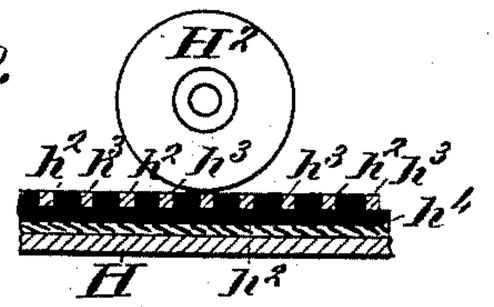


Fig. 19.

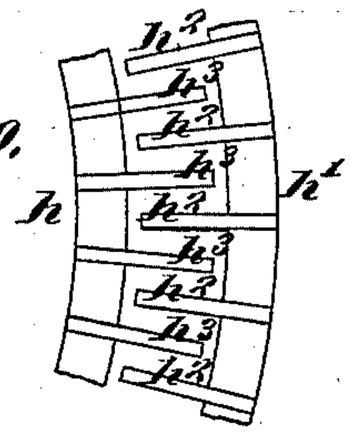


Fig. 17.

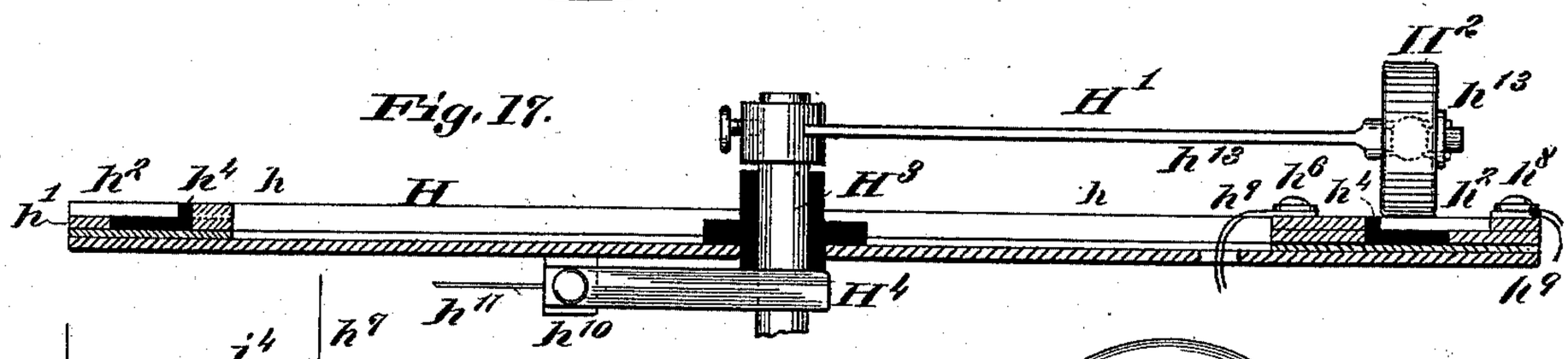


Fig. 20

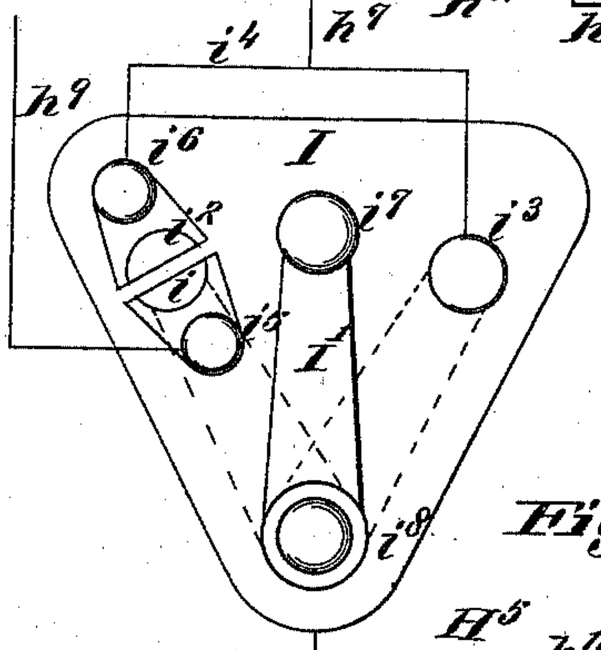
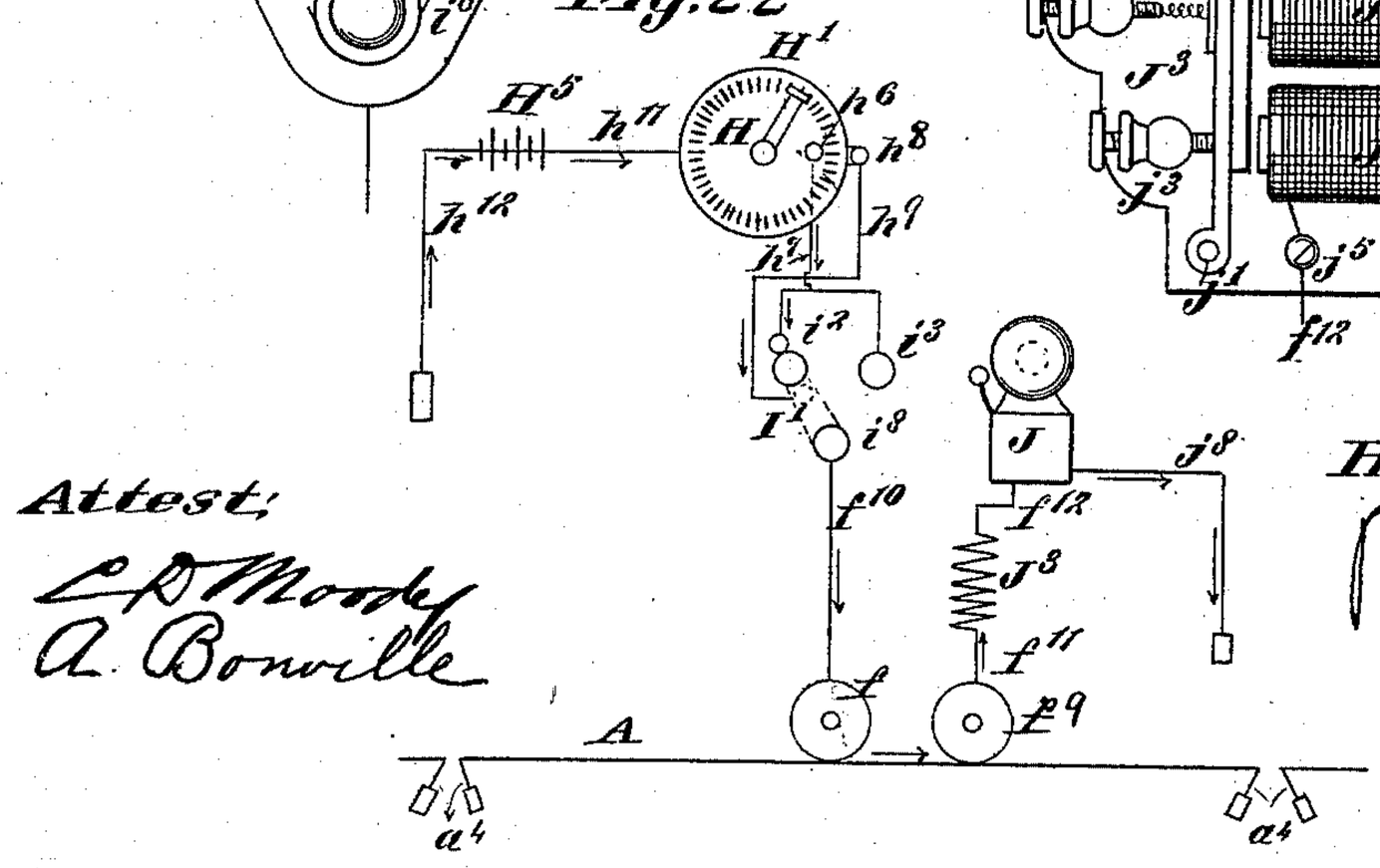


Fig. 21

Fig. 22



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ELECTRIC RAILWAY SIGNAL.

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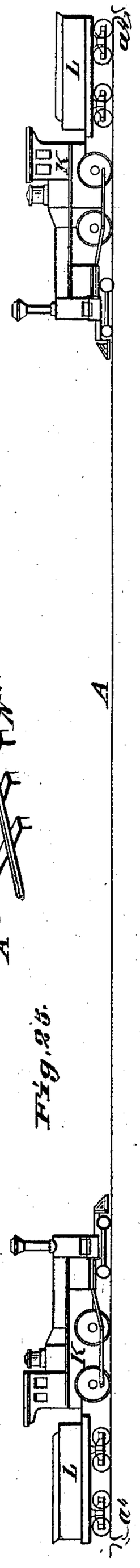

Fig. 23.

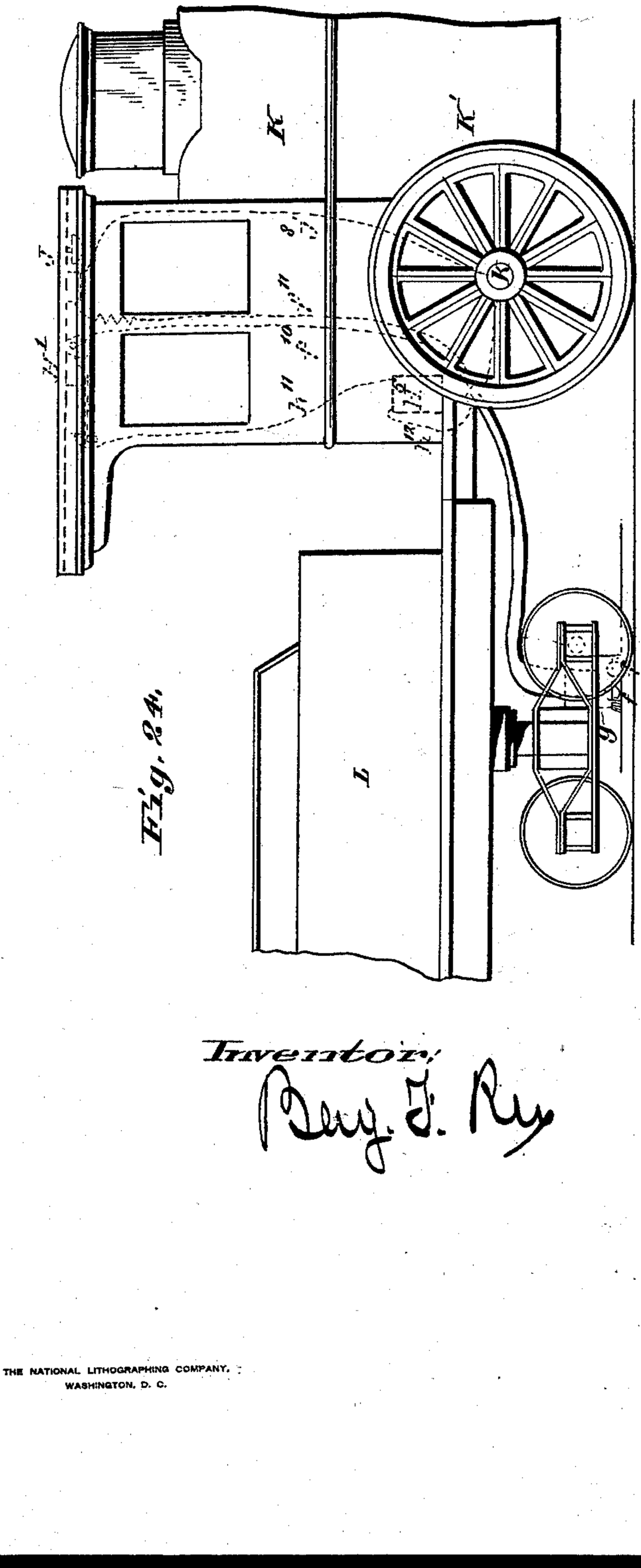

Fig. 24.

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UNITED STATES PATENT OFFICE.

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ELECTRIC RAILWAY-SIGNAL.

SPECIFICATION forming part of Letters Patent No. 518,511, dated April 17, 1894.

Application filed March 4, 1892. Serial No. 423,804. (No model.)

To all whom it may concern:

Be it known that I, BENJAMIN F. REX, a citizen of the United States, residing at the city of St. Louis, in the State of Missouri, have invented certain new and useful Improvements in Electric Railway-Signals, of which the following is a specification.

My invention relates to a block system and its chief objects are, first, to provide means by which, when a locomotive is about to enter an occupied block, the engineer in charge of such locomotive will be warned of the fact that the block is occupied before he reaches it; second, to provide means for notifying any engineer whose locomotive enters an occupied block, that there is another locomotive on the block, and continuing the warning until one of the locomotives leaves the block, and, also for notifying the engineers in charge of locomotives on a block whenever another locomotive enters it; and, third, to provide means by which warning of stoppages may be given.

In carrying out my invention I preferably supply the locomotive of each train with an electric battery or dynamo, an automatic contact breaker making and breaking contact at intervals differing in each instrument from all the others, and an electro magnetic alarm bell, and I arrange a system of conductors in such a way, that each alarm bell rings whenever contact is made by the contact breaker on the same locomotive or other motor, except when passing from one block to another, and also rings whenever any other contact breaker upon a locomotive on the same block, makes contact between a break and make of the one on the same locomotive as the alarm, so that when two locomotives are on the same block, each engineer will be warned of the presence of the other engineer's locomotive by the increased rapidity and also usually, the irregularity of the strokes of his own alarm bell. I also preferably arrange a stationary electric alarm and an electric lamp some distance out from each end of each block close to the track of the railroad and so connected with the main conductor of the block that the passage of the current of electricity through such conductor will cause the lamps to send forth a flash of light each, and the bells to strike. The exact locations of said signals are not essential; where used they may be located directly at block terminations if desired. I also preferably place a shield back of each lamp so as to either color the rays passing through it or prevent the rays which strike it from being seen by any one at a distance on the block with which it is connected. I prefer to mark each terminal point of each block by a visible mark or sign. I also prefer to use an arrangement by which each engineer can readily increase the number of makes and breaks per minute of his contact breaker and thus give warning when he stops his engine or it breaks down.

The preferred forms of mechanism by means of which I attain said objects are illustrated in the accompanying drawings, in which—

Figure 1 is a side elevation of a portion of a main conductor such as runs through each block. Fig. 2 is a top view of a section of the same conductor, an insulator and a metallic connection between them. Fig. 3 is a vertical transverse section of the conductor insulator and connection above mentioned on line 3—3 of Fig. 2. Fig. 4 is a top view of a conductor crossing. Fig. 5 is a vertical section of the said crossing along the line 5—5 Fig. 4. Fig. 6 is a side elevation of two opposite ends of two conductors of adjoining blocks, each end being grounded and two conductors being connected by a bridge of insulating material. Fig. 7 is a similar view without any intervening bridge between the conductors. Fig. 8 is a side elevation of two trolleys designed for use in connection with an overhead conductor. Part of one of the trolleys is shown in vertical longitudinal section. Fig. 9, is a side elevation of a pair of trolleys designed for use in connection with a conductor located between the rails of a railway near the ground. A housing for said trolleys is shown in vertical longitudinal section along the line 9—9 Fig. 11. Fig. 10 is a front elevation of a trolley, showing the housing in vertical cross section along the line 10—10 Fig. 9. Fig. 11 is a horizontal section on the line 11—11 of Fig. 9. Fig. 12 is a side elevation of said housing. Fig. 13 is a front elevation of said housing. Fig. 14 is a horizontal cross section of said housing along the line 14—14 Fig. 9. Fig. 15 is a modification, in cross section showing a method of con-

necting the alarm and contact breaker hereinafter mentioned, with the trolley where a single trolley is used. Fig. 16 is a face view of the dial of a contact breaker. Fig. 17 is a central section of said dial. Fig. 18 is a sectional view of said dial along the line 18—18 Fig. 16. Fig. 19 is a view of a number of contact plates and portions of the rings to which they are attached. Fig. 20 is a top elevation of a switch. Fig. 21 is a front elevation of an electro magnetic single tap alarm. Fig. 22 is a diagrammatic view showing the relations of a single set of the parts above mentioned and the course followed by a current of electricity issuing from the battery there shown. Fig. 23 is a view in perspective showing a railway track at a point where two blocks terminate, and also a post marking the terminating point, two conductors running between the rails and stationary signals connected with said conductors. Fig. 24 is a side elevation of a rear end of a locomotive and the forward end of its tender, showing the preferred location of parts of my apparatus connected with the locomotive and designed to move therewith. Fig. 25 is a side elevation of two locomotives with their tenders approaching each other from opposite directions, on the same track and within the limits of the same block.

A, A, A, (Figs. 1, 2, 3, 4, 5, 6, 7, 9, 10, 11, 12, 13, 22, 23, 24, and 25) are conductors preferably located between the rails of a railroad. They are shown attached to sleepers and running with the track near the ground.

A road to which my system is applied is divided up into blocks. The blocks may be of any desired length. One mile is a suitable length for a block. I prefer to make the blocks of substantially uniform length but that though desirable is not essential. A conductor (A or D) runs substantially from one end to the other of each block.

In speaking of blocks in my claims I do not include spaces between main conductors. The block conductors are insulated from each other, they are also preferably insulated from the ground except at the ends of blocks; their ends may be either insulated or grounded. Where stationary signals are used they are preferably connected with the ground unless a return wire is used.

A′ (Figs. 4 and 5) is a conductor, crossing one of the conductors A.

a is an insulator of a common type.

a' is a metallic support uniting a conductor and insulator.

a^2 is a sleeper of a railway track.

a^3 is a pin one end of which is inserted in the insulator which it supports and the other in the sleeper beneath.

a^4 a^4, &c., (Figs. 6, and 7,) are grounded ends of conductors.

a^5 a^5 (Fig. 23) are extensions of conductors A A designed to connect them with electric alarms J^4 J^4 and electric lamps M M. The lamps and alarms are connected together by suitable conductors not shown.

a^6 a^6 are conductors connecting said alarms and lamps with the ground.

a^7 is a post marking the opposing ends of two adjoining blocks.

B (Figs. 4 and 5) is a conductor crossing.

b and b' are crossing tracks along which a trolley may run on its rim.

b^2 b^2, &c., are the sides of tracks and are designed to prevent trolleys from escaping therefrom.

b^3 b^3, &c., are insulators.

The conductors should be insulated from each other either in the manner shown or otherwise but it is not absolutely essential that both should be insulated from the crossing. Where the crossing is formed through out of insulating material, separate insulators are of course unnecessary. The most essential part of the crossing shown is the central part, the tracks beyond are not essential though useful.

C is a bridge which may be used to connect conductors of adjoining blocks so as to make a substantially continuous track for a trolley or brush.

c is an upper surface of insulating material.

c' is a support.

The form of said bridge may be varied in many ways but should not be so constructed as to conduct electricity from one block conductor to another. The space between conductors may be made so narrow as to make a bridge unnecessary. Such an arrangement is shown in Fig. 7.

D (Fig. 8) is an overhead conductor suspended over the track high enough above the rails to permit trains to pass under it. It may be used instead of a conductor running near the ground. The rules as to insulation are the same in both cases and the conductor preferably extends from one end of its block to the other whether it runs overhead or near the ground. The crossing B, may be used in connection with overhead conductors by simply turning it upside down.

d is an insulator for an overhead conductor.

d' is a metallic connection between the conductor and insulator.

E E′ are trolleys which may be used in connection with overhead conductors. They are preferably located on top of the cab of the locomotive with which they are connected.

e e are trolley wheels. e' e' are stirrups in which said wheels are hung. e^2 e^2 are rods supporting said stirrups and wheels. e^3 e^3 are tubes into which said rods, e^2 e^2 telescope.

e^4 is a spiral spring connected with the lower end of the rod e^2 at one extremity and the support e^5 at the other. Its function is to press the trolley wheel firmly against the conductor D and keep it normally in line therewith.

e^5 and e^6 are bases to which the trolleys E and E′ are respectively attached. They are preferably made of conducting material and

insulated from the top of the locomotive cab.

e^7 and e^8 are contact screws.

F F′ (Figs. 9, 10, 11, and 12) are forms of trolleys designed for use in connection with conductors running between the rails of a railway track at about their level.

f f are the trolley wheels. f' f' are stirrups in which said wheels are hung. f^2 f^2 are the pivots of said wheels. They may be rigidly attached to said wheels and so journaled in the stirrups as to allow the wheels lateral play as shown in Fig. 10, or the pivot may be fixed and the wheel allowed to run loose upon it. One arrangement is the equivalent of the other.

f^3 f^3 are spiral springs formed of conducting material. f^4 f^4 are pins to which said springs have their upper ends respectively attached and which play vertically in their sockets. f^5 f^5 are vertical slots in said pins. f^6 (Figs. 9 and 10) is a part supporting said trolleys. In the construction shown it is formed of insulating material but as will be obvious the special method of insulating the path of the current through the trolley is immaterial. f^7 f^7 are horizontal pins passing through the slots f^5 f^5 in said pins f^4 f^4 and preventing said pins from revolving.

f^8 and f^9 (Figs. 9, 10, and 15) are brushes making contact with the pins f^4 f^4 of the trolleys F and F′ respectively. Said brushes are attached to the support f^6 (Figs. 9, 10, 14 and 15). f^{10} is a conductor leading from the brush f^8 to a switch.

f^{11} is a conductor leading to a resistance coil interposed between it and an electro magnetic alarm.

In the arrangement shown in Figs. 9 and 10 the conductors f^{10} and f^{11} lead to brushes f^8 and f^9 respectively. In the modification illustrated by Fig. 15 in which a single trolley is used both wires connect with the same brush.

g (Figs. 9, 10, 11, 12, 13, 14, and 15) is a housing designed to protect the trolleys. It is preferably attached to the front truck of the tender as shown in Figs. 12, 13 and 22, but may be attached together with the trolleys contained therein, to the locomotive truck instead, its exact location not being material. g' g' g' g' are pivots upon which brushes attached to the said housing swing. g^2 g^2 g^2 g^2 are the brushes pivoted to said housing. They swing outward and are designed to sweep the conductor free from snow and other obstructions.

H (Figs. 16, 17, and 18) is the dial of the contact breaker which I prefer to use.

h and h' (Figs. 16, 17, and 19) are rings formed of conducting material. They are insulated from each other.

h^2 h^2, &c., (Figs. 18, and 19) are contact plates attached to the ring h'.

h^3 h^3, &c., are contact plates attached to the inner ring h. h^4 (Figs. 16, 17 and 18) is insulating material in which said contact plates are set. It comes up flush with the outer surfaces of said plates and divides the plates attached to different rings from each other and also separates plates attached to the same ring, from each other except where the ring unites them. In the row of contact plates shown in the drawings (Figs. 16 and 19) the plates attached to the different rings alternate with each other but as will be obvious that precise arrangement is not the only one which may be adopted. Two or more plates attached to one ring may be inserted between each pair of plates attached to the other or the rings may be separated from each other far enough to avoid the necessity of inserting these plates attached to one ring between those attached to the other. In the latter case the contact wheel is preferably broadened or two contact wheels may be used. I prefer however to use a single wheel. I will refer to the contact plates attached to both rings as a row whether arranged in a double or single row and where the word "row" is used in connection with them, in my claims I desire to be so understood unless a different meaning is clearly indicated.

h^6 is a contact screw by means of which the ring h is connected with the wire h^7.

h^8 is a contact screw by which wire h^9 is connected with ring h'.

H′ (Figs. 16 and 17) is a contact hand bearing at its outer end the contact wheel H^2 and attached at its inner end by means of a set screw to a pivot. Said hand is preferably formed of steel and shaped as shown in the drawings (Fig. 17) so as to make it elastic and flexible. I prefer to attach said contact wheel H^2 to it by means of a ball and socket joint so as to allow the wheel to bear squarely upon said contact plates, even when said hand is attached to its pivot so far in as to cause the part between the pivot and contact wheel to assume an angular position. Said ball and socket joint is shown in dotted lines and lettered h^{13} (Fig. 17). H^3 is a pivot to which said hand H′ is attached. It is caused to revolve at a fixed rate by means of clock work not shown. Said clock work may be of any ordinary type such as any skilled clock maker can construct.

H^4 (Fig. 17) is a brush making contact with the pivot H^3. h^{10} is a contact screw. h^{11} is a wire attached to said brush by means of said screw h^{10} at one end and to a battery at the other.

H^5 is an electric battery. h^{12} is a wire connecting the negative pole of said battery with the journal of the driving wheel K′ of the locomotive K (Fig. 23) through which wheel and the rails of the track it is connected with the ground.

I (Fig. 20) is a switch preferably having three contact pieces i i^2 and i^3 and a pivoted lever I′ making contact with contact pieces i and i^2 when in the position indicated by dotted lines on the left and making contact with contact piece i^3 when in the position indicated by dotted lines on the right. i^2 and i^3

are connected together by a conductor i^4 in the construction shown, and both are connected with the ring h of the contact breaker by means of the said conductor i^4 and the wire h^7 in the instrument shown in the drawings. Contact piece i is connected with the ring h' of the contact breaker by means of the wire h^9. It is insulated from the contact pieces i^2 and i^3. i^5 is a contact screw by means of which contact piece i is connected with the wire h^7.

i^6 is a contact screw by means of which the conductor i^4 is connected with the contact piece i^2.

i^8 is the pivot of the switch lever and is in contact with the conductor f^{10}.

i^7 is an insulated knob by means of which the switch lever, I′ may be moved. When said lever I′ is in the position shown in the drawings (Fig. 20) the contact breaker is out of circuit. When said lever is in contact with contact piece i^3 the inner ring (h) with all its contact plates h^3, h^3, &c., is connected with said wire f^{10} and indirectly with the main conductor A. When said lever is in contact with the contact pieces i and i^2 both contact rings (h and h') with all their contact plates are connected with said wire f^{10} and indirectly with said main conductor A, consequently when said switch lever is in the first mentioned position the number of times the circuit is broken at each revolution of the contact hand H′ will be equal to the number of plates (h^3) connected with the ring h and when said switch lever is in contact with the parts i and i^2, the number of times the circuit will be broken at each revolution of the contact hand H′, will be equal to the total number of plates connected with said rings h and h', in said row. In either case the current will pass out over the conductor A each time a plate in circuit with said wire f^{10}, is passed over by said contact wheel H^2.

J, is a single tap electro magnetic alarm of a common type.

J′ is a magnet. $j\,j$ are the coils of the magnet. J^2 is a bell. J^3 is an armature. j' is a pivot upon which said armature J^3, swings to and from said magnet. j^2 is a spring designed to withdraw said armature from said magnet when the circuit is broken. j^3 is a stop. j^4 is a hammer attached to said armature and which is caused to strike said bell every time said magnet is energized and said armature is attracted by it. j^5 and j^6 are contact screws. The current for energizing said magnet enters the coil wire through contact screw j^5 and leaves the coil wire through the wire j^6 and contact screw j^7. The contact screw j^5 is connected with the conductor A by appropriate means which in the preferred form of my apparatus consist in the wire f^{12}, the resistance coil J^3 the wire f^{11} the brush f^9 and the trolley f. The contact screw j^7 is preferably connected by means of the wire j^6 with the coils $j\,j$ of the magnet and by wire j^8 with the journal k' of the driving-wheel of the locomotive k and through said wheel and the railway track with the ground. Any other form of ground connection will answer the same purpose.

K K K are locomotives.

L L L are locomotive tenders.

N N are the rails of a railway track (Fig. 23).

K′ K′, &c., are driving wheels.

M M are electric lamps. (Fig. 23.)

M′ M′ (Fig. 23) are reflectors designed to shield the lamps with which they are connected from the view of persons on the block through whose wire the lamps are supplied with electricity, and throw the light forward along the adjoining block, as shown in Fig. 23. A simple shield may be used instead of a reflector and it may be either opaque or of colored glass. Where a single trolley is used as shown in Fig. 15 the wire f^{10} from the contact breaker and the wire f^{11} from the alarm, connect with the same brush (f^9) and by means of it with the same trolley. The precise method of making the connection with said brush or with the trolley, in case no brush is used, is immaterial. Where overhead trolleys of the sort shown in Fig. 8, are used no brush is needed and the wires f^{10} and f^{11} are connected with the trolleys preferably, by means of the contact screws E^7, E^8.

The preferred form of my apparatus operates as follows under ordinary circumstances, the switch lever I′ being in contact with the contact piece i^3 of the switch and connecting the conductors leading to the inner ring h of the contact breaker with the wire f^{10} and the hand H′ of said contact breaker being in motion. The current from the battery H^5 (Figs. 22 and 23) passes out from the positive pole along the wire h^{11} to the contact screw h^{10}, thence through the brush H^4 to and through the pivot H^3 to and through the hand H′ to said contact wheel H^2 of the contact breaker, and every time said hand H′, in the course of a revolution causes said wheel H^2 to pass over a plate (h^3) attached to said inner ring h, the current passes from said wheel H^2, to and through said plate and ring and thence through the wires h^7 and i^4, to the contact piece i^3 of the switch I, thence it passes through the switch lever I′ and its pivot to the wire f^{10} connected with said pivot; thence (where two trolleys are used) through said wire to the brush f^{10}, thence through the trolley F to the conductor A (Fig. 9). Then along said conductor in both directions, and where there is only one locomotive on the track within the limits of that block and stationary alarms and lamps are connected with said conductor A, part of said current passes from said conductor to said trolley f and through it to and through the brush f^9, thence through the wire f^{11} to and through the resistance coil J^3 (Fig. 22) thence through the wire f^{12} to the contact screw j^5, thence through the wire of the coils of the magnet j' thence through the contact screw j^7 to the wire j^8, thence through said wire and connections to the ground, thus en-

ergizing said magnet and causing the hammer j^4 to give the bell J^2 a ringing tap. The balance of the current passes through the conductor A to its extensions, a^5 a^5 and through them to the stationary electric lamps M M and alarms J^4 J^4 (Fig. 23) and then to the ground through wires a^6 a^6, and causing the lamps connected with said conductor A to send forth a flash of light and the alarm to strike. By having two trolleys connected with each locomotive, one for the battery and one for the alarm, the engineer is constantly kept posted by the strokes of his alarm, as to whether the current is flowing out from his battery to and through the main conductor, for his alarm only receives electricity after it has first passed through a part of that conductor. Where only a single trolley is used the engineer cannot tell while his engine is in motion whether his trolley wheel is on the main conductor (A) or not except where an overhead conductor is used and then only by looking at it, because the current from the battery does not then have to pass through the main conductor A, to reach the alarm. Where there are two locomotives and tenders on the same block, other things being the same, part of the current from each battery passes to the alarm on the locomotive carrying the other battery, and whenever the contact breaker connected with one battery makes contact between a break and make of the contact breaker connected with the other battery the alarm on the locomotive carrying the latter battery gives an extra stroke, and as the contact breakers break and make contact non synchronously, the alarms on both locomotives each give warning by the irregularity and increased rapidity of their strokes, of the fact that there is another locomotive on the block, and this warning continues as long as two or more locomotives remain on the same block. As soon as only one locomotive is left on the block its alarm by resuming the regularity of its strokes gives warning or notice that the block is clear. Where a stationary lamp and alarm is placed at each end of each block and a shield is arranged in connection with each lamp so as to prevent its being visible on its own block, an engineer approaching the end of a block is able to tell at night by both the lamp and alarm connected with the next block, whether it is occupied, before he reaches it. In the day time he receives the same warning from the alarm where a block is occupied, as at night but the light is usually not visible at a distance except at night. When an engine is stopped it is desirable to warn engineers on other locomotives about to enter the same block or on it of the fact of the stoppage, and that may be done where the preferred form of my apparatus is used, by simply throwing the lever I′ of the switch I to the left so as to cause it to make contact with the contact pieces i and i^2. The contact piece i being connected by means of the conductor h^9 with the ring h' and the contact piece i^2 being connected with the ring h by means of the wires i^4 and h^7 all the plates h^2 and h^3 are connected with the wire f^{10} when said lever I′ is in said last mentioned position and consequently the circuit is made every time the contact wheel H^2 makes contact with either of said contact plates and in this way the number of makes and breaks per minute is greatly increased over the number of makes and breaks where only the ring h is in circuit and the ringing of all alarm bells connected with the same block conductor as the battery is rendered much more rapid, and the ringing of alarms on other locomotives on the block, if any enter, is rendered so rapid and usually also so irregular as to at once give warning that there are either two other locomotives on the block or else that a locomotive has stopped on it. Under such circumstances if the entering engineer desires to ascertain to a certainty whether the alarm comes from an engine that has stopped, he can do so by throwing his switch lever I′ into the position in which it is shown in Fig. 20 thus throwing his own battery out of circuit. If the strokes of his bell are very rapid and at the same time regular he will understand that the alarm comes from an engine which has stopped on the block. The same information can be gained by listening to the strokes of the stationary alarm placed beyond the ends of the blocks. When the stationary alarms and lamps are both omitted but the ends of block conductors are grounded part of any electricity passing into them escapes into the ground at their ends. When the ends are not connected with the ground its only escape is through the alarms on locomotives and conductors connected therewith.

The operation of the apparatus where an overhead series of conductors is used does not differ materially from its operation where the conductors are attached to the sleepers. The overhead trolleys operate substantially in the same way as those already described, the chief difference being that the latter are pressed down upon the conductors by gravity while the former are kept in contact with the conductors by springs.

The only object of the bridge C is to insure the insulation of the conductor of one block from those of other blocks and at the same time carry trolleys passing from one block to another. The conductors may however be carried so close to each other as to render a bridge unnecessary. The crossing B operates thus:—The trolley wheel is carried by the conductor A or A′ as the case may be until it enters the track b or b' of the crossing, when it rolls off of the conductor onto said track and follows it rolling along preferably on its rim until it crosses the path designed for trolleys traveling on the conductor crossing the one first mentioned, and reaches its own conductor again, when it passes onto said conductor again and continues its course as

before. The tracks need not be extended as shown in Figs. 4 and 5 and where the point at which the trolley leaves its conductor is only far enough from the point at which it mounts it again to permit a trolley to pass between without touching, when crossing said conductor, the side pieces b^2 b^2, &c., may be dispensed with. It is essential that the conductors shall be insulated from each other but the special method of insulating them may be varied as will be obvious.

The special forms of mechanism and arrangements I have described, may be greatly varied without departing from the essence of my invention in its broader sense and so also the details of the different instruments may be modified by the substitution of equivalents which will suggest themselves to any skilled mechanic without departing from the essence of the improvements embodied in them. The locations of the parts, shown in the drawings are in no instance essential and may all be varied.

Where I speak of any device being connected and moving with a locomotive I do not wish to be understood as describing the locations shown in the drawings or confining myself to parts on the locomotive any more than those on or attached to the tender.

I do not wish to be confined to special devices or details except where my claims are limited to them expressly.

Where I speak of contact breakers making and breaking contact non synchronously I do not mean that they never make or break contact at the same time but merely that they do not always do so.

My improvements are applicable to all kinds of motors whether run by steam or not, though the special form of motor shown in my drawings is a locomotive.

When I speak in my claims of parts being connected, without describing how, I mean so related that a current of electricity may pass from one to the other.

I claim—

1. In combination with a railway track a series of two or more conductors of electricity insulated from each other and arranged in blocks, each block having a separate conductor extending substantially from one end of the block to the other, with the track, and a motor, on said track within the limits of one of said blocks, having connected and movable with it, an electric alarm electrically connected with the conductor of the block on which the motor is, an automatic circuit breaker and one or more contact parts connected and movable with said motor, in contact with the conductor of said block independently of the contact of the alarm connection and conducting an intermittent current of electricity to said conductor, substantially as described.

2. In combination with a railroad track, a series of two or more conductors of electricity, insulated from each other, and arranged in blocks, each block having a separate conductor extending substantially from one end of the block to the other, with the track, and a motor on said track having connected and movable with it a contact breaker, making and breaking contact at intervals automatically, and an electric alarm, both said contact breaker and said alarm being independently connected with the conductor of the block on which the motor is, substantially as described.

3. In combination with a railroad track, a series of two or more conductors of electricity, insulated from each other and arranged in blocks, each block having a separate conductor extending substantially from one end of the block to the other, and two or more motors on said track, each having connected and movable with it, a contact breaker making and breaking contact automatically at intervals, and an electric alarm, both connected with the conductor of the block on which the motor with which they move is, and said contact breaker making and breaking contact non-synchronously.

4. In combination with a railroad track, a series of two or more conductors of electricity, insulated from each other and arranged in blocks, each block having a separate conductor extending substantially from one end of the block to the other with the track and each block having at or near one or both ends an electric signal connected with the conductor of the block, and two or more motors on the track, each motor having connected with it and movable with it, a contact breaker making and breaking contact automatically at intervals, and an electric alarm, each connected with the conductor of the block on which the motor with which it is movable is, and said contact breakers making and breaking contact non synchronously substantially as described.

5. In combination with a railroad track, a series of two or more conductors of electricity, insulated from each other and arranged in blocks, each block having a separate conductor of electricity extending substantially from one end of the block to the other, with the track and two or more motors on said track, each having connected and movable with it an automatic contact breaker, making and breaking contact automatically at intervals, and an electro-magnetic single tap alarm, and each of said contact breakers and alarms being electrically connected with the conductor of the blocks on which the motors with which they are respectively movable are, and said contact breakers making and breaking contact non synchronously substantially as described.

6. In combination with a railroad track, a series of conductors insulated from each other and arranged in blocks, each block having a separate conductor running substantially from one end of the block to the other, with the track and a motor on said track, having connected and movable with it a contact

breaker making and breaking contact automatically at intervals, and an electric alarm, and said contact breaker and alarm being connected with separate movable contact parts and by them with the conductor of the block on which the motor is, substantially as described.

7. In combination with a railroad track, a series of conductors insulated from each other and arranged in blocks, each having a separate conductor running substantially from one end of the block to the other with the track, and a motor on said track having connected and movable with it a contact breaker and an electric alarm each connected with the conductor of the block on which such motor is, and a resistance coil interposed between said alarm and block conductor, substantially as described.

8. The combination of a conductor, a trolley wheel in contact with it, a stirrup supporting said wheel and allowing it lateral play, and a spring connecting said stirrup to its support, substantially as described.

9. In combination with the trolley *f*, a housing supporting and inclosing the same and brushes pivoted to the lower outside edges of said housing, substantially as described.

10. The combination in a contact breaker of a row of contact pieces and a hand having a contact wheel attached to it by a universal joint and making contact with said contact pieces when said hand is caused to revolve.

11. The combination in a contact breaker of a dial having arranged thereon a row of contact pieces, the contact wheel H^2 connected with a hand by a universal joint and said hand being flexible and movable upon and attached to its pivot substantially as described.

12. The combination of a contact breaker of two or more sets of contact pieces each set insulated from the other except when connected by a movable part of a switch, and each set being connected together by one or more conductors of electricity, a switch having two or more contact parts and a movable lever or other part making contact with different contact parts in different positions, and a movable contact part making contact when moved, with the contact pieces of said contact breaker substantially as described.

13. In combination with a railroad track, a series of two or more conductors of electricity insulated from each other and arranged in blocks, each block having a separate conductor extending substantially from one end of the block to the other with the track, a stationary object or mark, at or near each end of each block marking its termination, and two or more motors on said track, each supplied with a contact breaker making and breaking contact automatically at intervals and an electric alarm, both electrically connected with the conductor of the block on which the motor is, and said contact breakers making and breaking contact non synchronously substantially as described.

14. The combination of a railroad track, a conductor of electricity fastened in place and running with said track, a motor on said track, means for generating a current of electricity, a contact breaker making and breaking contact automatically at regular intervals, an electric alarm, and a resistance coil, located between said conductor and said alarm, and said means for generating a current being connected with said contact breaker and both said contact breaker and alarm being electrically connected with said conductor, and said contact breaker, alarm and resistance coil being attached to and movable with said motor substantially as described.

BENJAMIN F. REX.

Witnesses:
C. D. MOODY,
A. BONVILLE.