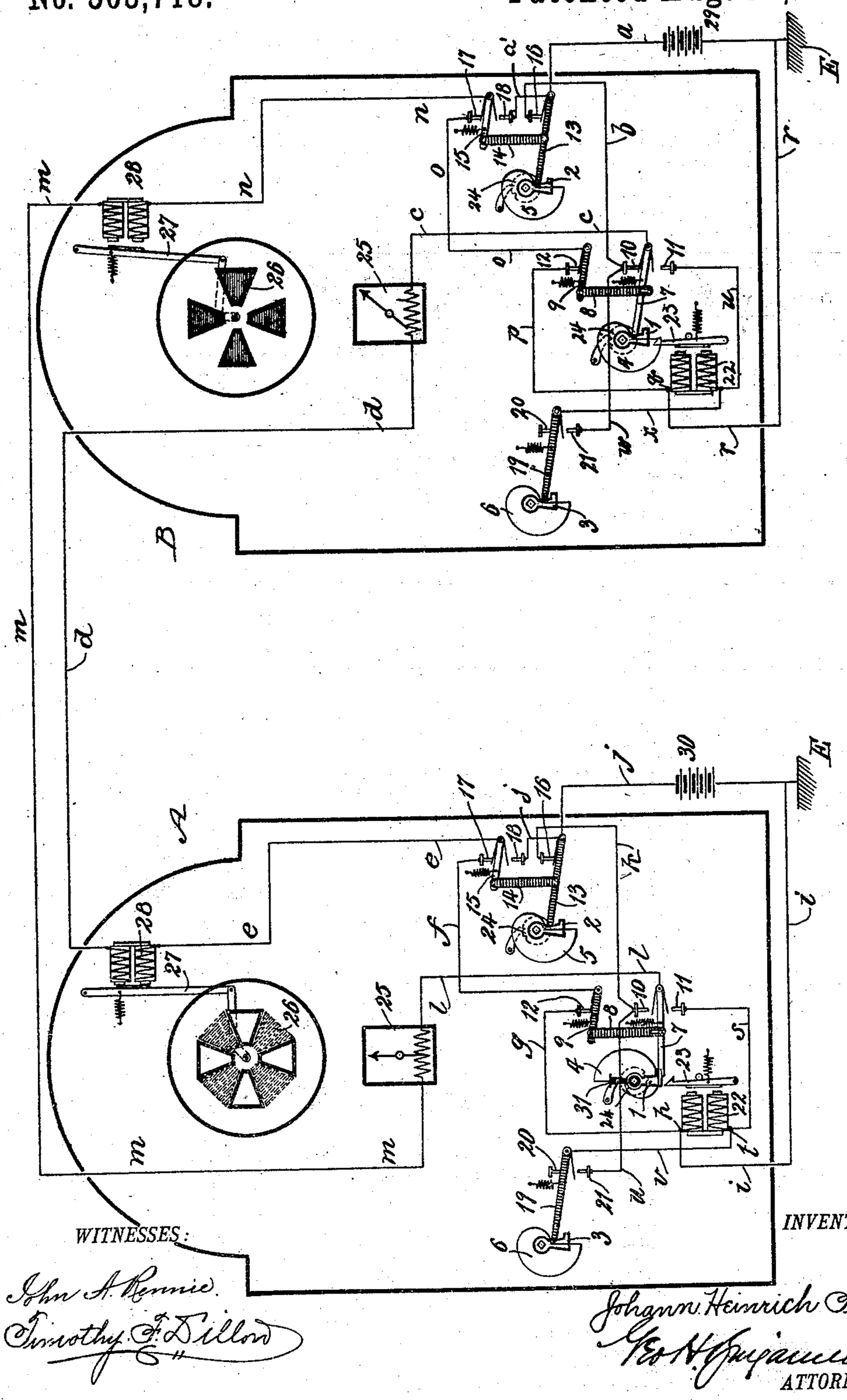
(No Model.)

J. H. FRISCHEN.

BLOCK SIGNAL INDICATING MECHANISM.

No. 503,718. Patented Aug. 22, 1893.



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JOHANN HEINRICH FRISCHEN, OF BERLIN, GERMANY, ASSIGNOR TO SIEMENS & HALSKE, OF SAME PLACE.

BLOCK-SIGNAL INDICATING MECHANISM.

SPECIFICATION forming part of Letters Patent No. 503,718, dated August 22, 1893.

Application filed May 1, 1893. Serial No. 472,533. (No model.) Patented in Germany October 14, 1890, No. 57,764; in Austria-Hungary November 14, 1890, No. 51,605 and No. 3,905; in England February 7, 1891, No. 2,289; in Belgium February 10, 1891, No. 93,720; in France February 12, 1891, No. 211,362; in Switzerland February 20, 1891, No. 3,326, and in Italy February 23, 1891, No. 29,149.

To all whom it may concern:

Be it known that I, JOHANN HEINRICH FRISCHEN, a subject of the Emperor of Germany, residing at Berlin, Germany, have invented new and useful Improvements in Block-Signal Indicating Mechanism, (for which I have obtained the following Letters Patent: in Great Britain, No. 2,289, dated February 7, 1891; in France, No. 211,362, dated February 12, 1891; in Germany, No. 57,764, dated October 14, 1890; in Austria-Hungary, No. 51,605 and No. 3,905, dated November 14, 1890; in Italy, No. 29,149, dated February 23, 1891; in Belgium, No. 93,720, dated February 10, 1891, and in Switzerland, No. 3,326, dated February 20, 1891,) of which the following is a specification.

This invention relates to an improved construction and adaptation of electrical block signaling apparatus, and has for its object to promote safety of travel over single track railways.

The invention consists in an arrangement of duplicate electric signaling devices at adjacent or successive stations of the railway, each device comprising three electric switches operated or controlled by a key in the hands of the conductor or guard of a train on leaving one station and after entering the next station beyond, or after returning to the same station without traveling the full distance between two stations.

The invention will first be described and then will be defined in claims hereinafter set forth.

Reference is to be had to the accompanying drawing forming a part of this specification and which represents the electric signaling devices at two adjoining stations of the railway, and the electric circuits.

The apparatus at the respective stations A, and B, is in duplicate. Hence a detailed description of the devices at one station will suffice.

The electrical devices are protected in a suitable frame or casing indicated by the heavy black line and having at its face three keyholes 1, 2, 3, for insertion of the conductor's key to rotate respectively the cams 4, 5, 6, which control electric switch devices comprising a system of levers each carrying one or more spring contacts adapted for electrical connection with adjacent contacts to which the line or circuit wires are connected. The levers themselves are insulated electrically from their spring contacts and the circuit wires. Hence, it will be understood that where in this specification the electric circuits are more briefly described as passing to or from the levers, the circuits pass through the spring contacts of the levers.

The switch devices controlled by the cam 4, consist of a primary duplex lever comprising a lever 7, coupled by a rod 8, to another lever 9. Said lever 7, which is acted on directly by the cam, is adapted to contacts 10, 11, and the lever 9, is adapted to a contact 12. The rod 8, is attached to the lever 7, by a pin and slot connection allowing lever 7, to be carried from the contact 10, without disconnecting lever 9, from contact 12, during the semi-rotation of the cam 4.

The switch devices controlled by the cam 5, consist of a secondary duplex lever comprising a lever 13, which is acted on directly by the cam and is linked by a rod 14, to a lever 15, the lever 13 being adapted to a contact 16, while the lever 15, is adapted to either one of two contacts 17, 18. The switch device controlled by the cam 6, comprises a single lever 19, adapted to either one of two contacts 20, 21. Suitable springs normally lift the switch levers to the cams and contacts, as shown in the drawing. An electro magnet 22, has a spring drawn armature 23, carrying a hook head which is adapted to engage the switch lever 7, and lock it in the lowermost position to which it is depressed by full rotation of the cam 4. The shafts or axles of the cams 4, 5, each carry a suitable ratchet stop device 24, engaged by a pawl in a manner preventing movement to the left hand of the cam and also preventing withdrawal of the operating key after it is inserted in the keyhole and turned partly around to the right hand, or until after a full revolution of the cam is completed. A galvanome-

ter 25, serves as an indicator notifying the conductor operating the signal devices at one station of proper action of the devices at the next station. The signal proper consists preferably of a disk 26, arranged behind a frame having openings or transparent faces forming a Maltese cross, said disk having painted on it a similarly formed red cross which by turning of the disk may be made to appear to indicate "danger" or stop, or to disappear to show white for indicating "safety" or all clear. Suitable crank and rod connections between the signal disk shaft and the armature 27, of an electro magnet 28, will when the magnet is energized, turn the disk to indicate "safety" as at station A, and when the magnet is out of circuit any suitable spring or weight device not necessary to show or describe will, as the armature falls away from the magnet, pull the disk around to indicate "danger" as shown at station B.

The electric circuits will be manifest from the following explanation of the operation of the apparatus. Normally, the cams 3, 4, 5, of both stations A, B, have positions indicated at station B, and both magnets 28, attract their armatures 27, and both signal disks show white or "safety" and both galvanometer needles have inclined positions. In these normal adjustments, the current from the local battery 29, at station B, will take the wire *a*, to switch lever 13, the contact 16, wire *b*, to contact 10, thence to lever 7, and by wire *c*, to galvanometer 25, of B, and thence by line wire *d*, from station B, to electro magnet 28, of station A, thence by wire *e*, to lever 15, to contact 17, and wire *f*, to switch lever 9, contact 12, and wire *g*, to the point *h*, and thence by wire *i*, to earth at E. The current from station A, to station B, will flow from the battery 30, over wire *j*, to switch lever 13, thence by contact 16, to wire *k*, to contact 10, which lever 7, at this time normally touches, and from lever 7, *via* wire *l*, to galvanometer 25, of station A, and thence by line wire *m*, to electro magnet 28, of station B, and thence by wire *n*, to switch lever 15, and to contact 17, and by wire *o*, to lever 9, and contact 12, and thence by wire *p*, to the point *q*, and wire *r*, to earth at E. The electro magnets 22, of both stations are without current and are therefore normally inoperative because the levers 7, and 19, do not touch the contacts 11, 21. Suppose a train were to start from station A, toward station B, the conductor or guard of the train at A, will insert the key 31, in the signal frame hole 1, and will give a half turn to the cam 4, thereby removing lever 7, from contact 10, which breaks the circuit through the wire *m*, to the electro magnet 28, of station B. Hence the spring or weight at the disk 26, of station B, will turn this disk to red or "danger," this being the relative adjustments of parts shown in the drawing. This operation of cam 4, at station A, by thus causing the signal disk to be set to "danger" at station B, is a notification at the latter station that a train is to take the track at or from station A, and that trains should not enter the line from station B, and that the signal devices at B, are not to be operated. When the signal at B, is thus set to "danger" this will be announced or indicated at A, by the galvanometer needle taking the vertical position shown. As the key 31, can be conveniently turned by one hand only about one half a revolution to give a corresponding half-turn to the cam 4, prior to releasing the key and taking a new hold of it by the fingers to complete the revolution, there will be caused a temporary stop or "dwell" of the parts in the above described relations long enough to effect at station A, the notification above named. As the train conductor gives the compulsory full rotation of the key 31, prior to withdrawing the key and the cam 4, is thereby given a complete turn, the switch levers 7, 9, at station A, will be drawn downward together thereby disconnecting 9, from contact 12, and connecting lever 7, with contact 11, while at the same time the armature 23, of magnet 22, will catch and retain the lever 7, in lowermost position to which it had been adjusted by the passage of the highest point of the cam 4. The electric circuit through the magnet 28, of station A, through the wires *f*, *g*, now is broken at 12, and allows the disk 26, of station A, to be set to "danger" as the armature 27, falls away from the magnet and while the signals show "danger" at both stations A, B, the train may now safely enter the line at A, and proceed to B. When the train arrives at station B, the conductor or guard will insert his key at the hole 2, of its apparatus and will turn the cam 5, thereby removing the switch levers 13, 15, from the respective contacts 16, 17, and connecting 15, with the contact 18, thereby causing current from the battery 29, to flow through wire *a*, lever 13, wire *a'*, contact 18, and lever 15, to wire *n*, and electro magnet 28, of B, energizing it and attracting its armature 27, and changing the signal 26, from red or "danger" to white or "safety." Through this magnet the current flows *via* wire *m*, to station A, thence through its galvanometer 25, the wire *l*, lever 7, contact 11, wire *s*, to point *t*, and thence through the magnet 22, and *h*, *i*, to earth at E. The magnet 22, being thus energized attracts its armature 23, and thereby releases lever 7, and allows levers 7, 9, to again be drawn by their springs to the contacts 10, 12, respectively, thus reestablishing the circuit through wires *e*, *f*, *g*, *i*, to earth at station A, and energizing its magnet 28, and causing its armature 27, to readjust its signal disk 26, to white or "safety" immediately the full turn of the cam 5, at station B, by the key had permitted the spring to draw the levers 13, 15, to the contacts 16, 17. The original normal adjustments are thus again attained and the signal disks 26, at both stations A, B, again show white or "safety." Should the train be run in oppo-

site direction or from station B, to A, the operation would be substantially the same as above described and on final operation of the cam 5 at A, by the key inserted at the hole 2, the electric current will flow from battery 30, along wire *j*, to lever 13, wire *j'*, contact 18, lever 15, wire *e*, to magnet 28, of A, thus changing its signal 26, to white or "safety" and thence the current passes *via* wire *d*, to station B and its galvanometer 25, the wire *c*, retained lever 7, contact 11, wire *u*, through magnet 22, of B, and from *q*, and through wire *r*, to earth at E; thereby releasing lever 7, and allowing 7 and 9, to again be drawn by their springs to contacts 10, and 12, and re-establishing normal electric circuits and again changing signal 26, of station B, to white or "safety;" the signals at both stations A, and B, now being at normal "safety" adjustments. If, by chance, both apparatus at stations A, B, be operated at once by keys inserted by conductors of two approaching trains at the holes 1, both circuits will be broken at the contacts 10, and each operator will find that the signal disk of his own apparatus which at the first half-turn of the key should show a white cross will show a red cross. In this case the conductor of the train having by previous agreement the right of way, will bring his train into the line. On passing out of the line at the farther station the conductor must operate his key at the hole 2, as usual but no change will be effected in the signals by this operation. The contact lever 7, of the apparatus of the station from which the train started will by this means be released but the lever 7, of the apparatus at the station where the train is waiting to enter still remains held by its electro magnet. The waiting train can therefore now enter the line which is protected by the two red signals, and on passing out at the other station the conductor uses his key at the hole 2, whereby the normal adjustments of the two apparatus will be restored, showing the white cross or "safety" signals at both stations. If, after a train has entered the line between the two stations A, B, it does not travel the whole distance but returns from an intermediate point, the apparatus at the station the train left will have been operated at the key hole 1, as above described, but as the train returns to this station the conductor will insert his key into the hole 3, of the apparatus (which hole is normally sealed or closed while making all usual straightway runs between two stations) and the key will turn the cam 6, and thereby will carry the lever 19, from the contact 20, to the contact 21, thus causing the current of battery 30, at station A, for instance, to pass through wire *j*, lever 13, contact 16, wire *k*, contact 10, wire *u*, to contact 21, lever 19, and wire *v*, to *t*, thence through electro magnet 22, point *h*, and wire *i*, to ground at E, thereby energizing magnet 22, and attracting the armature 23, and releasing the lever 7, to allow 7, 9, to be drawn by the springs to the contacts 10, 11, to again restore the apparatus to normal adjustments or condition. Should the train leave and return to station B, operation of its cam 6, at the hole 3, would send the current of battery 29, through *a*, 13, 16, *b*, 10, wire *w*, 21, 19, and wire *x*, to the electro magnet and thence by wire *r*, to earth at E, and the signal at B, would be restored to normal condition. The conductor's key 31, has a hole fitting the square or flat sided spindle of the cams 3, 4, 5, and the key has an ordinary ward which when the key is inserted and turned, lies behind the front of the casing of the apparatus as in ordinary locks, and as the pawl and ratchet devices 24, prevent turning backward of the cam, it is obvious that the key cannot be withdrawn after rotation of the cam is begun, until after a complete turn of the cam is effected by the key. In the drawing the key 31, is represented with its ward uppermost, merely to illustrate how it cannot then be withdrawn from the casing.

Any other devices may be employed instead of the cams 4, 5, 6, to actuate the switch levers for controlling the electric circuits of the signal apparatus within the scope of my invention, but the cams combined with the turning keys as above described, are preferred in practice.

Any desired source of electricity or electric energy may be substituted for the station batteries 29, 30, as will readily be understood.

I claim as my invention—

1. An electric block signal apparatus for railways, comprising sets of switch levers at two stations, each set having primary and secondary duplex contact devices consisting of four levers coupled in pairs by two rods, contacts to which the primary and secondary duplex levers are adapted, an electro magnet at each station having an armature adapted to catch the actuated primary duplex lever thereof, a signaling device at each station, an electro magnet having an armature controlling said signaling device, a battery at each station and wires connecting the two stations, their batteries, electro magnets, contacts and switch levers, substantially as described.

2. An electric block signal apparatus for railways, comprising sets of switch levers at two stations, each set having primary and secondary duplex contact devices consisting of four levers coupled in pairs by two rods, contacts to which the primary and secondary duplex levers are adapted, an electro magnet at each station having an armature adapted to catch the actuated primary duplex lever thereof, a signaling device at each station, an electro magnet having an armature controlling said signaling device, a galvanometer at each station, a battery at each station and wires connecting the two stations, their batteries, electro magnets, contacts, switch levers and galvanometers, substantially as described.

3. An electric block signal apparatus for railways, comprising sets of switch levers at

two stations each set having primary and secondary duplex contact devices consisting of four levers coupled in pairs by two rods, contacts to which the primary and secondary duplex levers are adapted, an electro magnet at each station having an armature adapted to catch the actuated primary duplex lever thereof, a signaling device at each station, an electro magnet having an armature controlling said signaling device, a battery at each station, wires connecting the two stations, their batteries, electro magnets, contacts and switch levers; and cams operative by keys inserted at the casings and actuating the duplex lever contacts for controlling the electric circuits, substantially as described.

4. An electric block signal apparatus for railways, comprising sets of switch levers at two stations each set having primary and secondary duplex contact devices consisting of four levers coupled in pairs by two rods, contacts to which the primary and secondary duplex levers are adapted, an electro magnet at each station having an armature adapted to catch the actuated primary duplex lever thereof, a signaling device at each station, an electro magnet having an armature controlling said signaling device, a battery at each station, wires connecting the two stations, their batteries, electro magnets, contacts and switch levers, cams operative by keys inserted at the casings and actuating the duplex lever contacts for controlling the electric circuits, and stop devices preventing withdrawal of the key until after full revolution of the cams is effected, substantially as described.

5. An electric block signal apparatus for railways, comprising sets of switch levers at two stations, each set having primary and secondary duplex contact devices consisting of four levers coupled in pairs by two rods, a third lever, contacts to which the primary, secondary and third levers are adapted, an electro magnet at each station having an armature adapted to catch the actuated primary duplex lever thereof, a signaling device at each station, an electro magnet having an armature controlling said signaling device, a battery at each station, wires connecting the two stations, their batteries, electro magnets, contacts and above named switch levers, substantially as described.

6. An electric block signal apparatus comprising duplicate devices at two railway stations, said devices at each station comprising switch levers 7, 8, 9, and 13, 14, 15; 7 being coupled to 8, by a pin and slot connection, contacts 10, 11, 12, for levers 7, 9, contacts 16, 17, 18, for levers 13, 15, an electro magnet 22, having an armature 23, adapted to catch the lever 7, a disk 26, adapted to display "safety" and "danger" signals, an electro magnet 28, having an armature 27, coupled to the disk 26, for actuating it, and wire connections between the two stations and the above named switch levers, electro magnets, and contacts, substantially as described.

7. An electric block signal apparatus comprising duplicate devices at two railway stations, said devices at each station comprising switch levers 7, 8, 9, and 13, 14, 15; 7 being coupled to 8, by a pin and slot connection, contacts 10, 11, 12, for levers 7, 9, contacts 16, 17, 18, for levers 13, 15, an electro magnet 22, having an armature 23, adapted to catch the lever 7, a disk 26, adapted to display "safety" and "danger" signals, an electro magnet 28, having an armature 27, coupled to the disk 26, for actuating it, a galvanometer at each station and wire connections between the two stations including the above named switch levers, electro magnets, contacts and galvanometers, substantially as described.

8. An electric block signal apparatus comprising duplicate devices at two railway stations, said devices at each station comprising switch levers 7, 8, 9, and 13, 14, 15; 7 being coupled to 8, by a pin and slot connection, contacts 10, 11, 12 for levers 7, 9, contacts 16, 17, 18 for levers 13, 15, an electro magnet 22, having an armature adapted to catch the lever 7, a disk 26, adapted to display "safety" and "danger" signals, an electro magnet 28, having an armature 27, coupled to the disk 26, for actuating it, wire connections between the two stations and the above named switch levers, electro magnets and contacts, and cams 4, 5, operative by keys inserted at the casings, substantially as described.

9. An electric block signal apparatus comprising duplicate devices at two railway stations, said devices at each station comprising switch levers 7, 8, 9, and 13, 14, 15; 7 being coupled to 8, by a pin and slot connection, contacts 10, 11, 12, for levers 7, 9, contacts 16, 17, 18, for levers 13, 15, an electro magnet 22, having an armature adapted to catch the lever 7, a disk 26, adapted to display "safety" and "danger" signals, an electro magnet 28, having an armature 27, coupled to the disk 26, for actuating it, wire connections between the two stations and the above named switch levers, electro magnets and contacts, cams 4, 5, operative by keys inserted at the casings and stop devices 24, compelling full rotation of the cams before the key can be withdrawn from the casings, substantially as described.

10. An electric block signal apparatus comprising duplicate mechanism at two railway stations, said devices at each station comprising switch levers 7, 8, 9; 13, 14, 15; and 19; 7 being coupled to 8, by a pin and slot connection; contacts 10, 11, 12, for levers 7, 9, contacts 16, 17, 18, for levers 13, 15, contacts 20, 21, for lever 19; an electro magnet 22, having an armature adapted to catch the lever 7, a disk 26, adapted to display "safety" and "danger" signals, an electro magnet 28, having an armature 27, coupled to the disk 26, for actuating it, and wire connections between the two stations and the above named

switch levers, electro magnets and contacts, substantially as described.

11. An electric block signal apparatus comprising duplicate mechanism at two railway stations, said devices at each station comprising switch levers 7, 8, 9; 13, 14, 15; and 19; 7 being coupled to 8, by a pin and slot connection; contacts 10, 11, 12, for levers 7, 9, contacts 16, 17, 18, for levers 13, 15, contacts 20, 21, for lever 19; an electro magnet 22, having an armature adapted to catch the lever 7, a disk 26, adapted to display "safety" and "danger" signals, an electro magnet 28, having an armature 27, coupled to the disk 26, for actuating it, wire connections between the two stations and the above named switch levers, electro magnets and contacts, and cams operative by keys inserted at the casings and actuating the lever contacts for controlling the electric circuits, substantially as described.

In testimony whereof I affix my signature in the presence of two witnesses.

JOHANN HEINRICH FRISCHEN.

Witnesses:
MAX WAGNER,
GEO. H. BENJAMIN.