Feb. 17, 1953 L. J. A. LE GOFF 2,628,572

MAGNETIC CONTROL SYSTEM FOR RAILWAY TRAFFIC

Filed March 13, 1947 5 Sheets-Sheet 1

Fig. 1

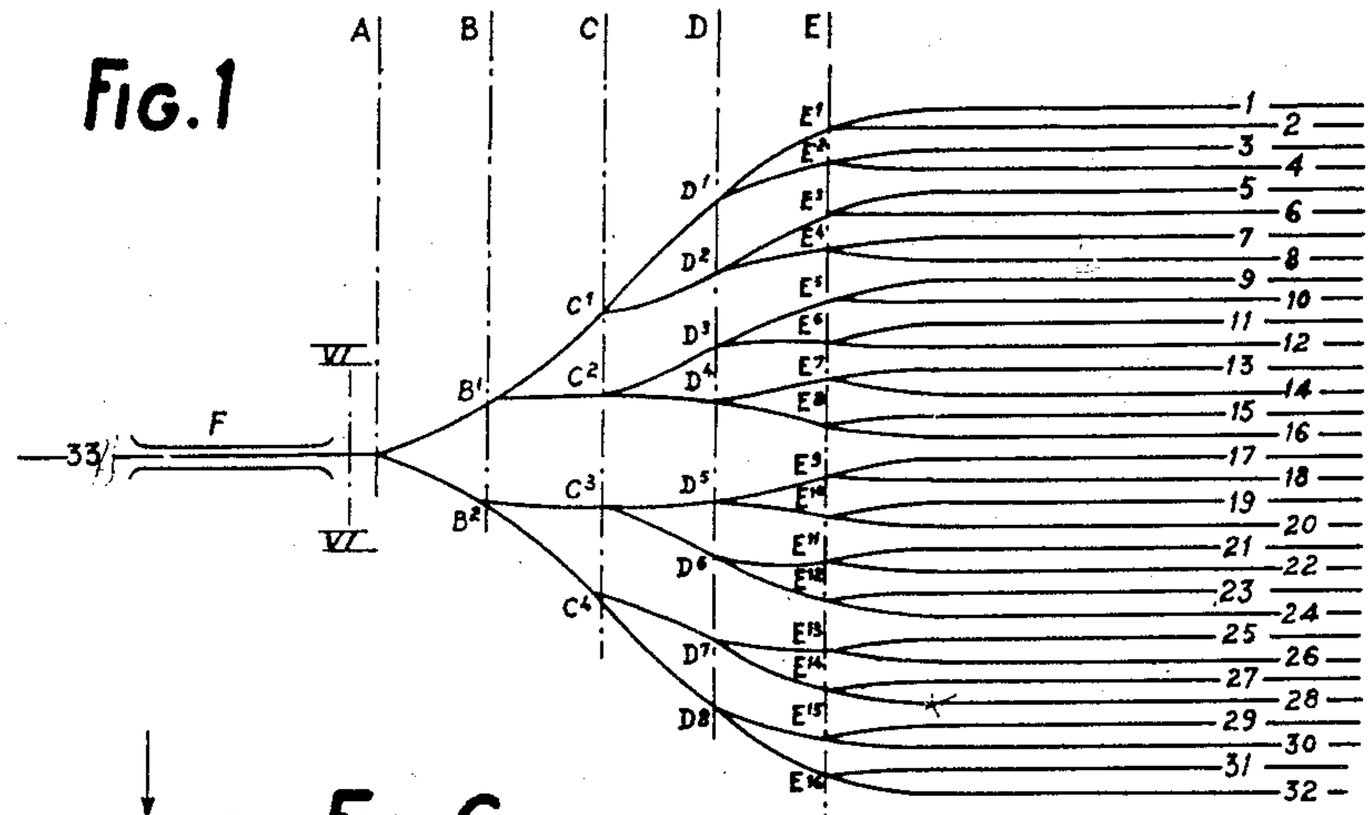
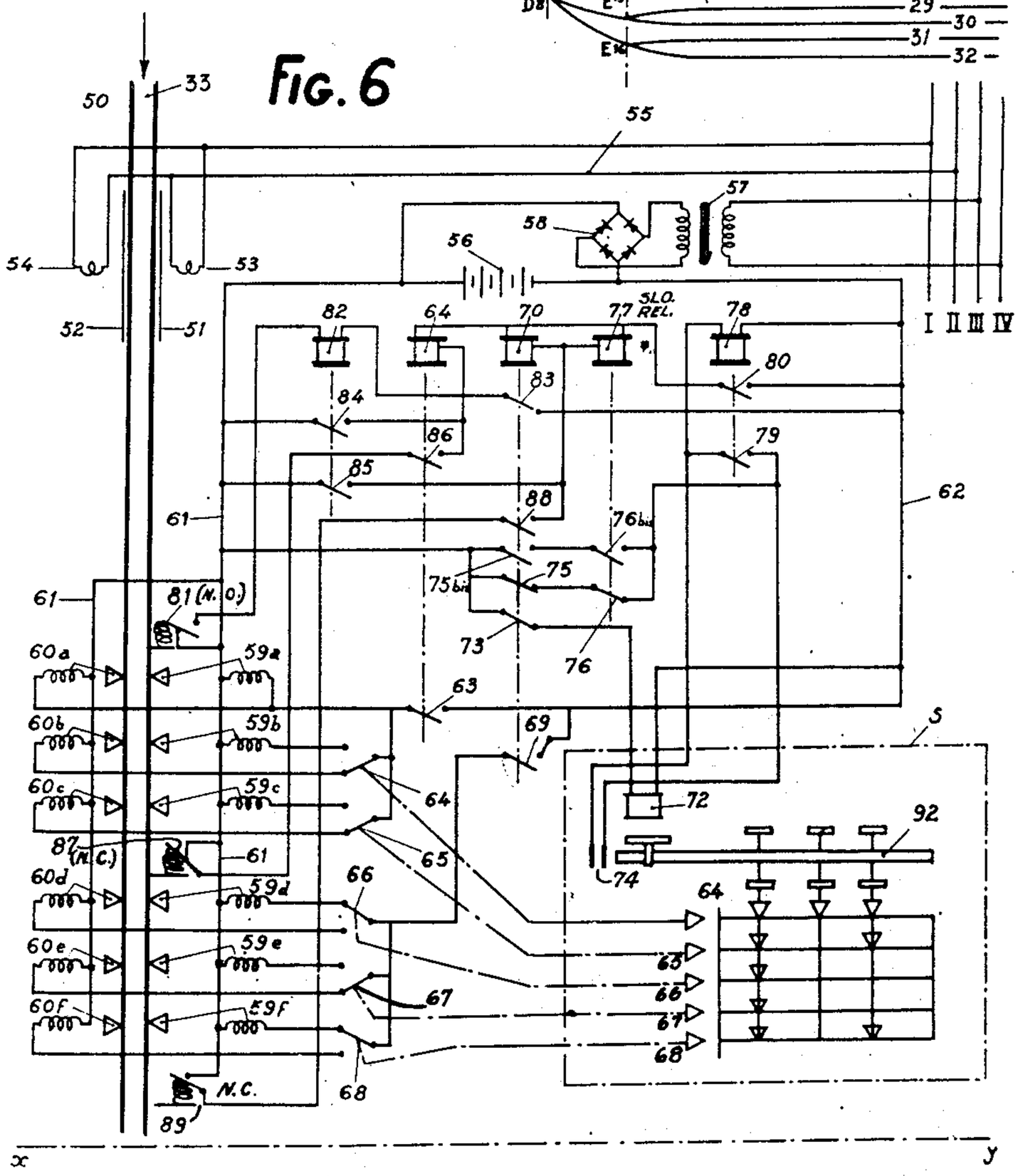


Fig. 6



Inventor

Lucien Joseph Armand Le Goff

by his attorneys

Howson and Howson

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MAGNETIC CONTROL SYSTEM FOR RAILWAY TRAFFIC

Filed March 13, 1947 5 Sheets-Sheet 2

FIG. 1a

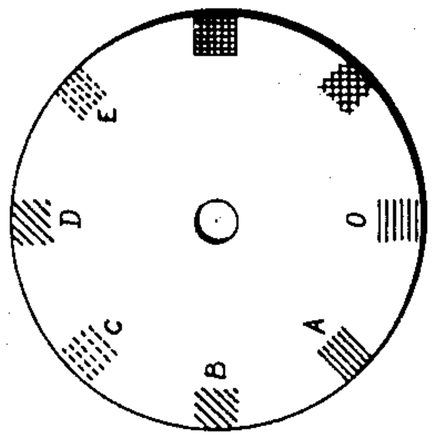
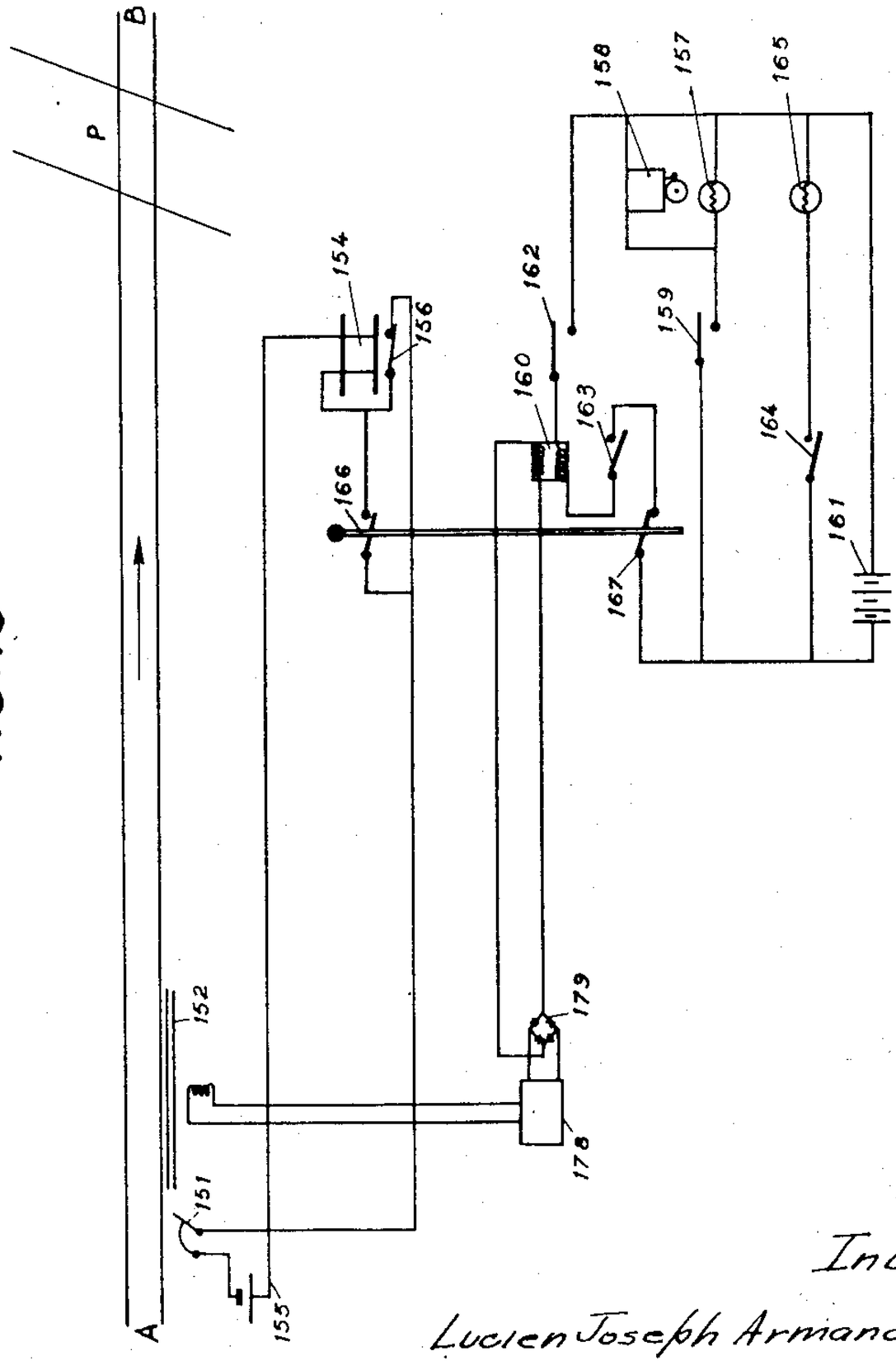


FIG. 1O



Inventor

Lucien Joseph Armand Le Goff

by his attorneys

Howson and Howson

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MAGNETIC CONTROL SYSTEM FOR RAILWAY TRAFFIC

Filed March 13, 1947 5 Sheets-Sheet 3

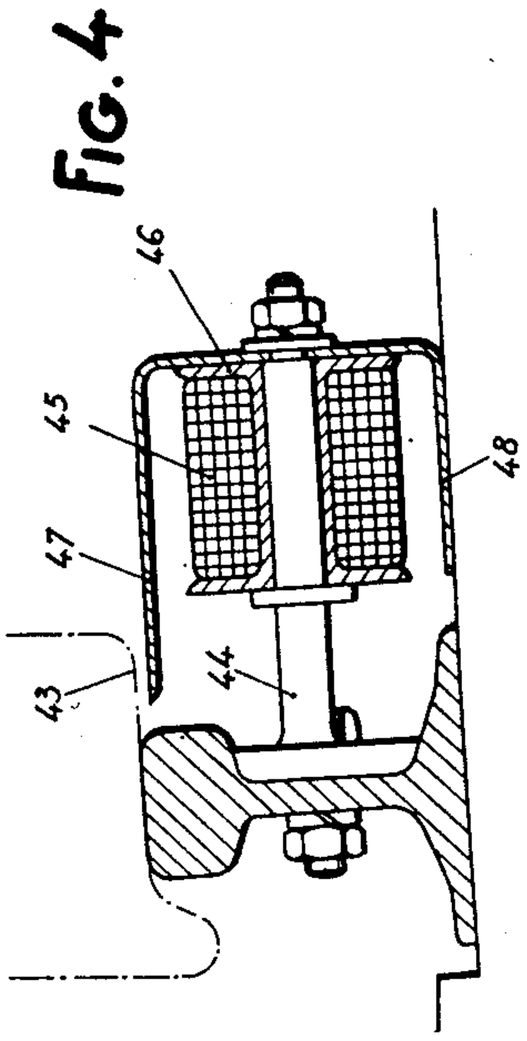


FIG. 4

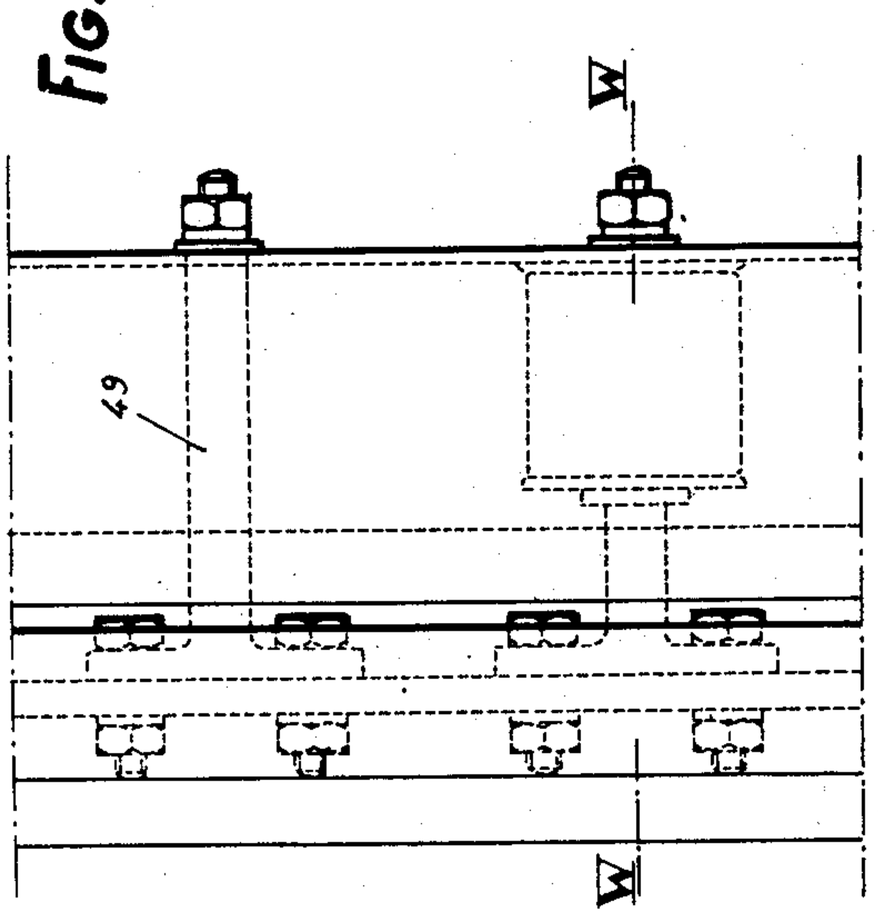


FIG. 5

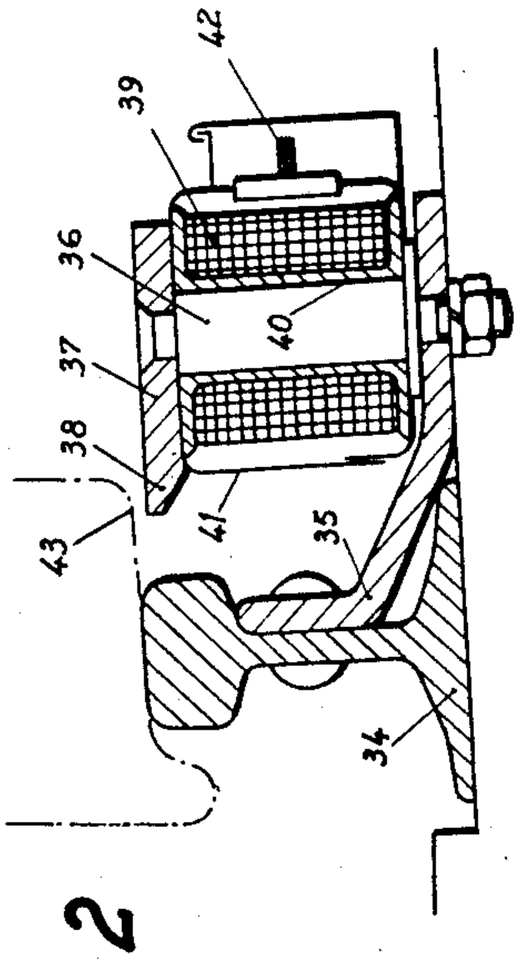


FIG. 2

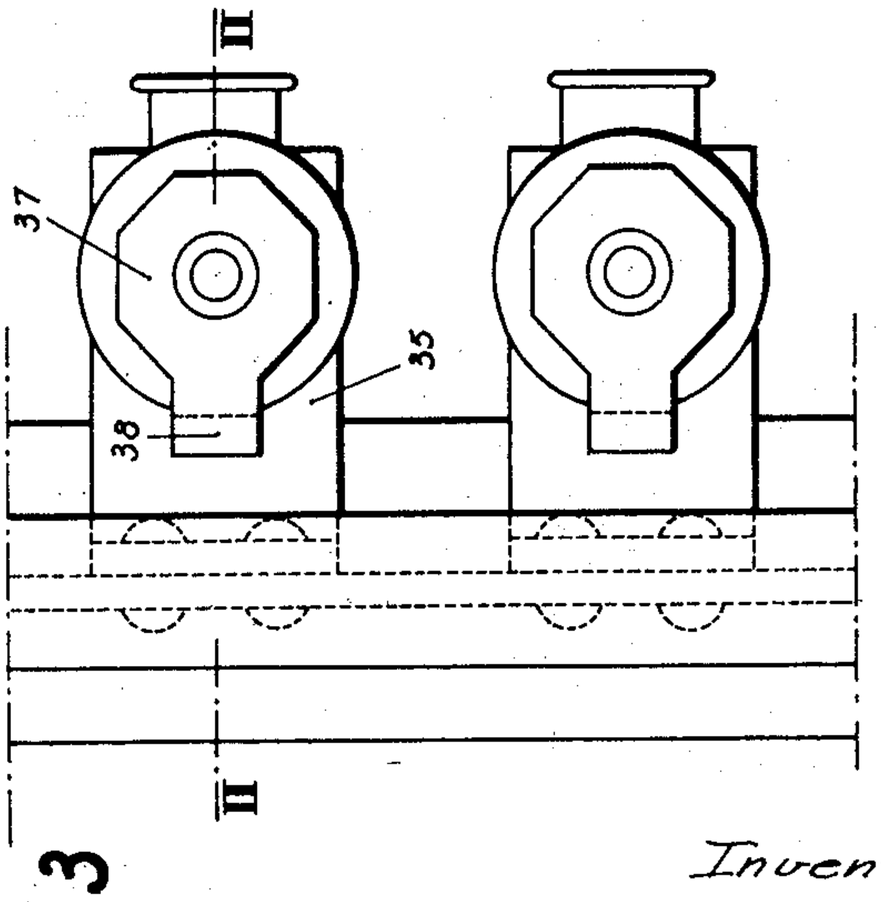


FIG. 3

Inventor
Lucien Joseph Armand Le Goff
by his attorneys
Howson and Howson

Feb. 17, 1953 L. J. A. LE GOFF 2,628,572

MAGNETIC CONTROL SYSTEM FOR RAILWAY TRAFFIC

Filed March 13, 1947 5 Sheets-Sheet 4

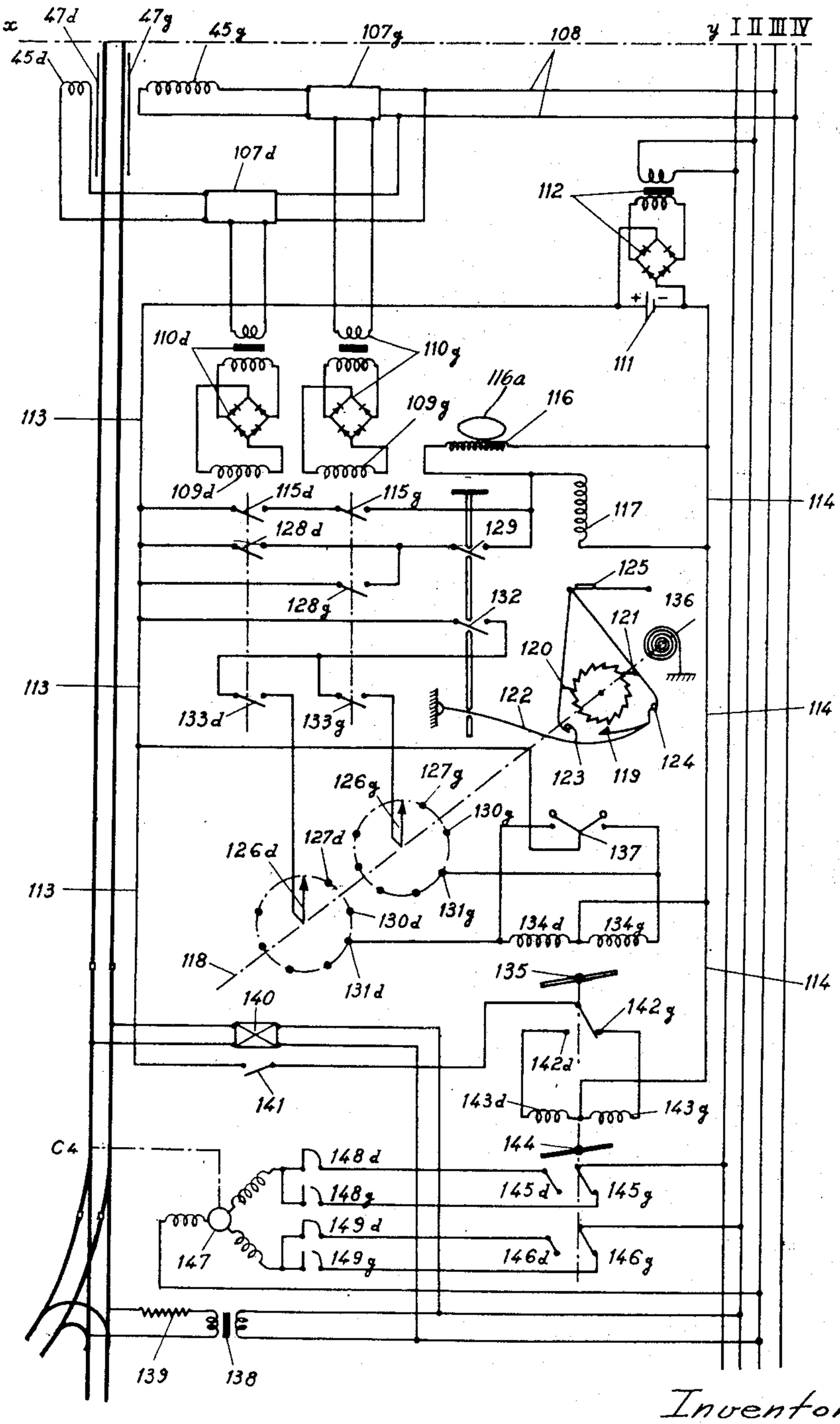


FIG. 6a

Inventor
Lucien Joseph Armand Le Goff
by his attorneys
Howson and Howson

Feb. 17, 1953 L. J. A. LE GOFF 2,628,572

MAGNETIC CONTROL SYSTEM FOR RAILWAY TRAFFIC

Filed March 13, 1947 5 Sheets-Sheet 5

FIG. 7

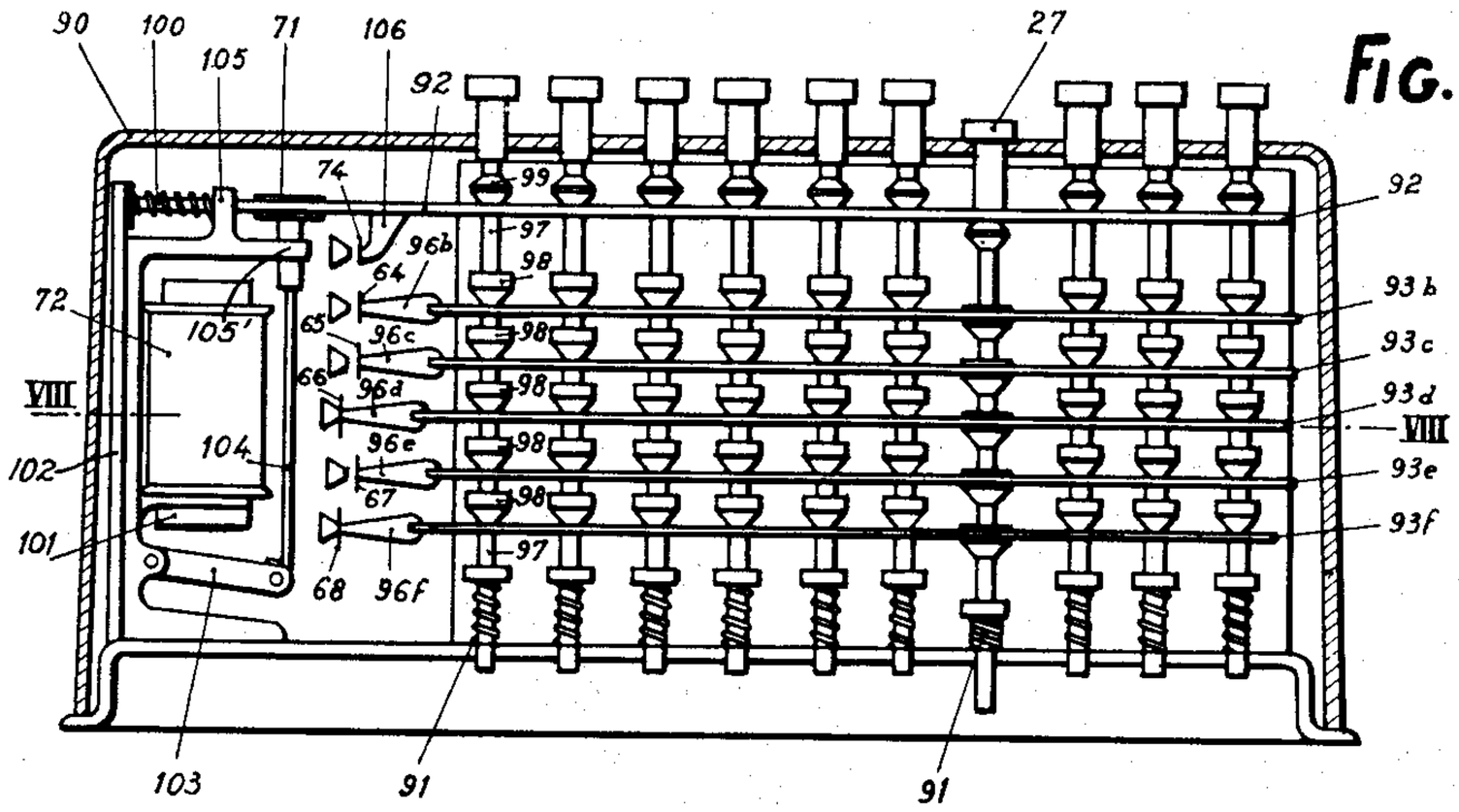


FIG. 8

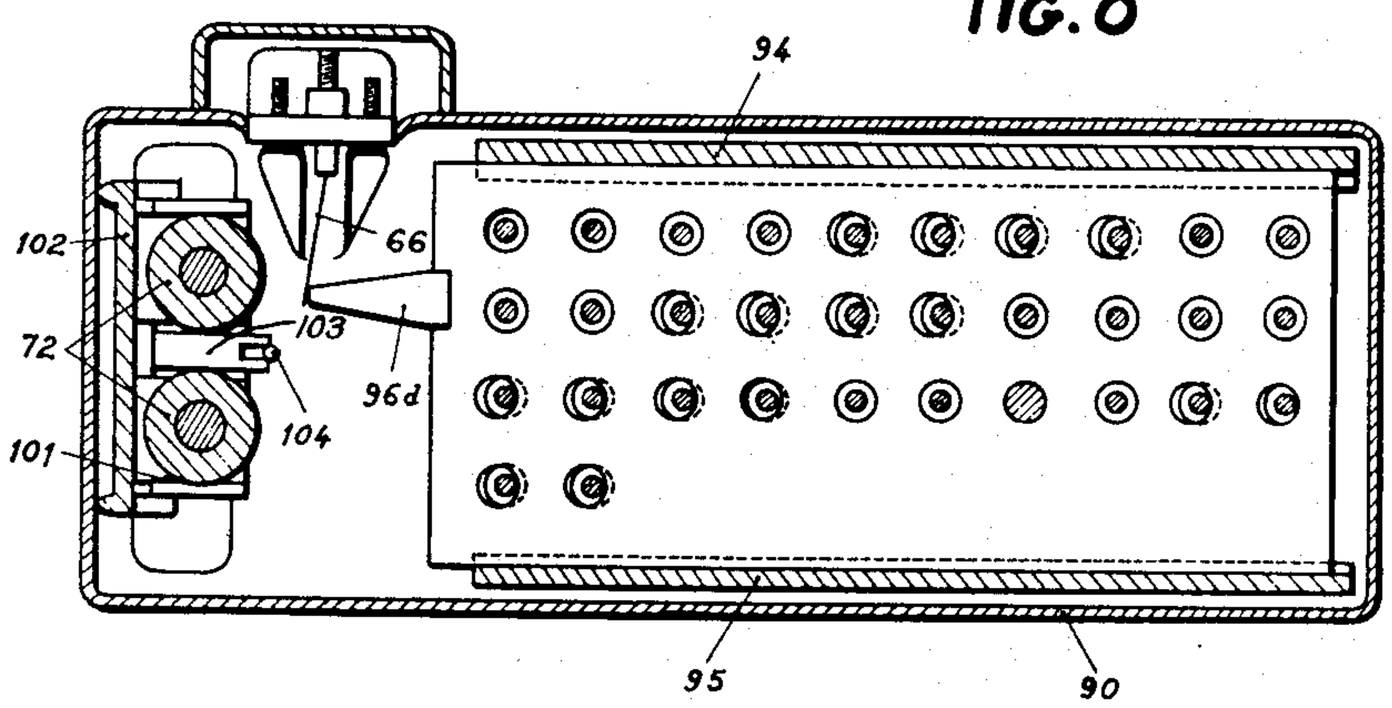
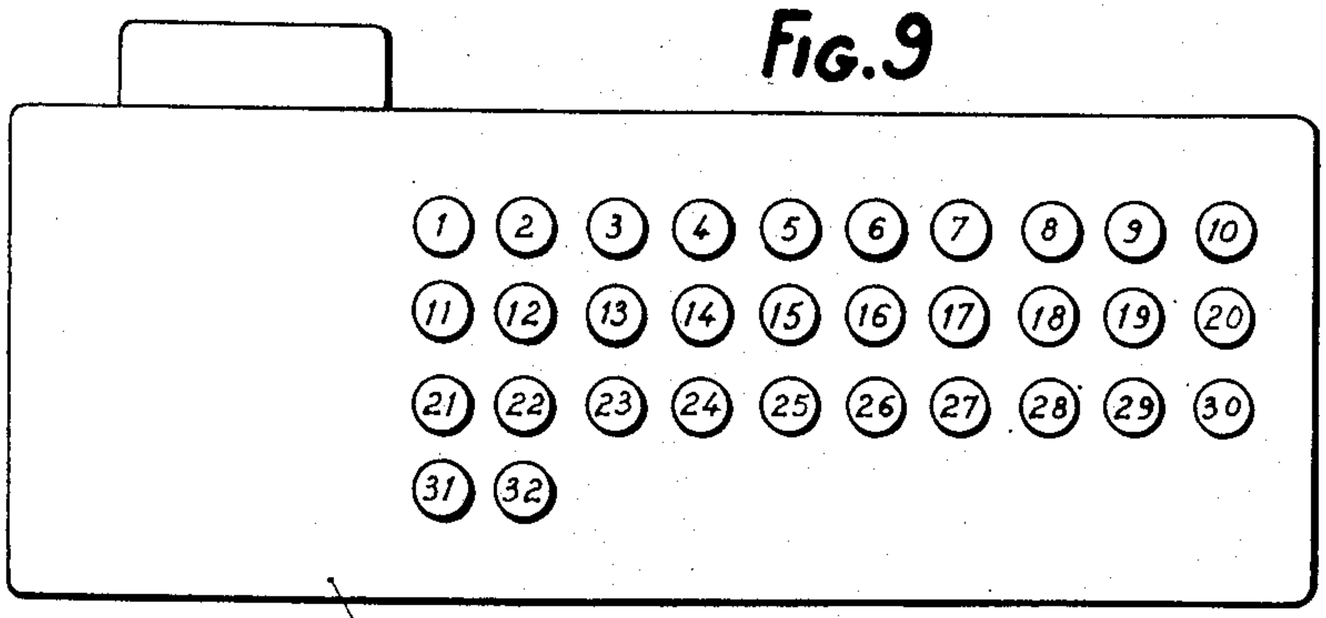


FIG. 9



Inventor
Lucien Joseph Armand LeGoff
by his attorneys
Howson and Howson

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2,628,572

UNITED STATES PATENT OFFICE

2,628,572

MAGNETIC CONTROL SYSTEM FOR RAILWAY TRAFFIC

Lucien Joseph Armand Le Goff, Clichy, France, assignor to Societe d'Electricite Mors, Clichy, France

Application March 13, 1947, Serial No. 734,513
In France April 7, 1939

19 Claims. (Cl. 104—88)

1

The present invention has for its object a device for facilitating and improving the conditions in which railways are operated. A principal objective is to provide each train with an indicating mark which is peculiar to given working conditions as to circulation and destination data.

Said indicating mark actuates, automatically, stationary receiving sets which intervene in turn either in indicative or imperative manner on devices such as devices usually arranged alongside the tracks.

According to the invention, magnetized zones are formed on wheel treads through magnetic inscribing members positioned in fixed places where the vehicles pass by; those magnetized zones then act by induction on stationary track members electrically connected with the devices which are to receive indications or controls.

In the first place the invention is applicable to the shunting or switching of cars. In this case, the wheels of each car are provided with inscriptions which are peculiar to this car; by acting on electromagnetic receivers said inscriptions control automatically the different points in order to enable the car concerned to reach the desired line.

The invention is also applicable to the signalling of trains at level crossings.

Level crossings must be closed before the trains come. If the time table is relied upon for this purpose, broad time limits have to be adopted, and the crossings are kept at a standstill for too long a period. If automatic devices located at a certain distance before the level crossing are relied upon, for signalling the on-coming train, and if those devices are positioned at points which are suitable for fast trains, they will signal too early in case of a slow running train.

With the help of the magnetic inscriptions according to the invention, it is possible to either signal each train or control the closing of the crossing at the desired moment so as to prevent the crossing from remaining closed too long.

The invention is shown by way of example only in the following drawing, in which:

Fig. 1 shows diagrammatically the tracks of the shunting yard.

Fig. 1*a* is an elevation view of a wheel showing diagrammatically different magnetic patterns thereon.

Figs. 2 and 3 are a vertical sectional view from II—II and a plan view of the magnetic inscribing apparatus, respectively.

Figs. 4 and 5 are a vertical sectional view from IV—IV and a plan view of an apparatus for the reception of magnetic signals, respectively.

2

Fig. 6 shows diagrammatically the head installations of a shunting area or group of points, said installations serving for inscribing the magnetic signals on the treads.

Figs. 7, 8 and 9 are a vertical sectional view, a horizontal sectional view from VIII—VIII and a plan view of the magnetic inscription controlling device, respectively.

Fig. 6*a* following Fig. 6 is a diagrammatic view of the controlling arrangements for a switch in a shunting yard.

Fig. 10 is a diagrammatic view of a train signalling apparatus for level crossings.

Referring to Fig. 1, a netwark of shunting tracks is shown here. The train of cars to be shunted is located on track **33** shown diagrammatically with a single line, the level of said track, especially on knoll F' being substantially higher than that of the receiving lines numbered from **1** to **32**, thus enabling the cars released on the knoll to reach the receiving yard through their own weight. Suitably positioned switches make possible a run from track **33** to any one of tracks **1** to **32**.

In the arrangement shown, track **33** is doubled at stage A, each line being doubled in turn on stage B toward switches B_1 and B_2, said lines being doubled in turn on stage C at C_1, C_2, C_3 and C_4, and so on, on stages D and E. With five subsequent stages, **32** tracks may be connected, which is generally a sufficient number; another stage would tie in a total of 64 tracks. Under these conditions, a vehicle starting from line **33** will meet with a switch at each stage A, B, C, D and E and its course is completely defined if the position of the switch of stage A, then of the switch of stage B, etc. are defined. For instance, a vehicle bound to track **27** passes over switch A on the right, switch B_2 of stage B on the right, switch C_4 of stage C on the left, switch D_7 of stage D on the right and switch E_{14} of stage E on the left.

According to the invention, suitably selected zones of one or a plurality of wheel treads are magnetized so as to form an inscription carried by the vehicle and corresponding to its prescribed itinerary.

In the embodiment described, said inscription takes place on the treads of both wheels of a given axle (leading axle of the vehicle or train, for example). Magnetic indications are peripherically distributed so as to allow, for instance, placing eight of them on the wheel having the

smallest diameter, which corresponds to a given linear development. A first magnetic indications O (Fig. 1*a*) provided simultaneously on both left and right wheels will define the origin of the inscription; the indications are then placed either on the left or on the right side according to the direction of the control to be determined. In the example shown, the first magnetic indication O tells the source of the inscription, the second indication A placed either on the left or right side corresponds either to the left or right control of the firsth switch met (stage A); the third mark B arranged on the right or left side corresponds to the right or left side control direction of the second switch met (stage B), and so on. On the whole, there are six marks used to control the switches, and the two additional marks may be employed for automatic control of stationary brakes arranged in the shunting places so as to slow down fast running cars, space the cars regularly on the shunting area and moderate speed on receiving tracks, taking into account the load and wind-resisting characteristic of each car, etc. Such arrangements are not shown in the example given.

The magnetic inscription is obtained through electromagnets arranged alongside the assembly of tracks. This assembly of apparatus is located before the first switch, in a sloping zone of knoll F where the already fast running cars are clearly spaced from one another. This suitable arrangement is however, not indispensable and the unit may be placed at any point on the top of the knoll or adjacent thereto.

The assembly includes two units of six electromagnets each arranged face to face on the two rails of the track as partially shown in Figs. 2 and 3 on which 34 is the rolling rail; 35 a magnetic iron member having a low retentive characteristic, said iron member being secured on the rail web and carrying a core 36 with a pole extension 37 terminated by a narrow extension 38 level with the running surface or tread of the rail and at a certain distance therefrom. A winding 39 carried by a spool 40 is mounted on the core. Each apparatus is completed with a housing 41 and plugs 42. It will be readily understood that when current flows through the winding a magnetic field is created. When a wheel passes over, the magnetic flux path is closed by the wheel tread (shown at 43) and creates therein a magnetic condition in the zone adjacent to the contact point with the rail. In the absence of current, the passing wheel is not affected due to the low retentiveness of the metal of the electromagnet.

The distance from axis to axis of the electromagnet fixed on the same rail corresponds, as stated hereinabove, with a determined section of the periphery of the smallest wheel employed.

Ahead of each switch, under conditions to be detailed further on, each wheel comes in front of a fixed member, which may be influenced by the magnetic zones created on the wheel treads for the purpose of controlling the switch. For this purpose, each rail includes an apparatus such as shown in Figs. 4 and 5, comprising substantially a low retentive magnetic core 44 fixed on the rail web, carrying a winding 45 or a spool 46 and a pole extension 47. This extension is directed toward the head of the rail almost at the running surface thereof. a suitable gap being provided therebetween. It is desirable that this gap be variable, and so the extension 47 is conditioned to bend, the possible contact zone being protected

or not by a strip of suitable material, for instance of rubber, not shown.

During the running period, when a magnetized zone of the tread moves near the extension 47, a magnetic flux running through extension 47, core 44 and the rail, is created, increases and then decreases: the result thereof is a momentary electromotive force in winding 45 which will be used to control the switch as stated hereinafter; the number and arrangement of these subsequent voltage impulses determining the way the switch is to be thrown and being governed by the arrangement of the magnetized zones previously created on the wheel treads. The longitudinal dimension of extension 47 must secure a complete reception of the signal carried by the wheel; said dimension is somewhat lower than the total developments of a wheel having the maximum practical diameter and of a wheel having the minimum practical diameter of a car.

Non-magnetic supports 49 in suitable quantity are distributed along the apparatus.

In the zones where signalling, traction and undetermined wandering currents flow it may be desirable to form an extension 48 similar to extension 47 but directed towards the rail bearing plate or sole, so that the magnetic reluctance to the flux toward the head of the rail opposed by the extension 47 and toward the sole by extension 48 are equal. It may be readily seen that under these conditions the flux created by the currents in the rail and located in the head and the sole cancel each other in the core 44 and may not influence the winding.

Fig. 6 refers to the controlling and feeding devices of the inscribing electro magnets placed ahead of the group of points as at VI—VI. The train to be shunted moves on track 33 in the direction of arrow 50. During this movement, the wheel treads pass in front of the extensions of a demagnetizing device which is to cancel every previous magnetic condition of the treads. Such device, arranged in a manner analogous to that above described in connection with the reading of inscription adapted to the particular function, includes notably extensions adjacent to the running surface of the rail on a length corresponding to the development of the wheel having the maximum practical diameter. To each extension 51, 52, on each rail, corresponds an energizing winding 53, 54 fed with alternating current through wires 55.

The whole of the magnetic inscriping apparatuses are fed by a set of batteries 56 loaded by a transformer 57 and a rectifier 58.

In the followinug movement of the vehicle, the treads of the first axle meet successively on each rail the six inscribing electro-magnets shown by means of their pole extensions and windings, 59*a*, 59*b*, 59*c*, 59*d*, 59*e*, 59*f*, 60*a*, 60*b*, 60*c*, 60*d*, 60*e* and 60*f* placed faced to face. The windings 59*a*, 60*a* for simultaneous inscriptions on the two treads of the original mark are fed in parallel between wire 61 and wire 62 connected to the terminals of battery 56 through contact 63 of relay 64. Windings 59*b* or 60*b* of the electromagnets of the following row are fed between wires 61 and 62; the circuit is closed on 59*b* or 60*b* through operation of a reversing contact 64 and completed by contact 63 of relay 64. In the same way, the action of contact 65 allows winding 59*c* or 60*c* to be fed, contact 66 operates the selection of the *d* row windings, contact 67 that of row *e* and contact 68 the selection of *f* row contacts.

In the same way as contact **63** of relay **64** allows the windings of rows *a*, *b*, *c*, to be fed, contact **69** of relay **70** enables the feeding of windings *d*, *e*, *f*. Selecting contacts **64**, **65**, **66**, **67**, **68** are controlled by a mechanical selector described hereinafter; the depression of a push button applied to a reception track of the selector determines, by setting the contacts, the energizing of the windings of the suitable left or right track. For instance, the operation of push button **27** sets contact **64** for feeding **60***b* (right rail); the setting of contact **65** energizes winding **60***c* (right rail); the setting of contact **66** energizes winding **59***d* (left rail); the setting of contact **67** energizes winding **60***e* (right rail), and the setting of contact **68** feeds winding **59***f* (left rail).

At the moment where a key or push button such as **27** (Fig. 7) is depressed, triggering plate **92** is caused to move under condition that locking device **71** is disengaged by winding **72**, which cannot take place unless contact **73** of relay **70** normally closed, is in fact closed. The triggering plate closes contacts **74** but for a brief interval and then is returned to the triggering position of the key by a spring **100** (Fig. 7). By closing of contacts **74**, a circuit is closed between conductors **61** and **62** by normally closed contacts **75** and **76** of relays **70** and **77** to cause operation of relay **78**. Contact **79** is substituted then for contacts **74** for maintaining relay **78** in an energized condition. Thus, contact **80** remains set (relay **78**).

Before coming up to the first inscribing electromagnet, the wheel engages a pedal **81** which closes the normally open circuit of relay **82** energized between conductors **61**—**62** by contact **83** of relay **70**. When relay **82** is energized, it closes its contacts **84**—**85**, and **84** closes the circuit of relay **64** which becomes thus energized; the circuit is completed by contact **80** of relay **78** set as stated above. Relay **64** being energized, its contact **86** proper is substituted for contact **84** of relay **82**, the latter being de-energized as soon as the wheel has passed over pedal **81**; the circuit of relay **64** is then closed by contact **86** and pedal contact **87** in its normal position. The short duration of the closing of contact **85** has allowed the simultaneous energizing of relays **70** and **77**, which circuit is completed by contact **80**, as stated above. The energizing of relays **70** and **77** opens normally closed contacts **73**, **75** and **76**. Feeding contacts **75** bis, **76** bis of relays **70** and **77** are substituted for back contacts **75** and **76** of same relays, thus securing an uninterrupted feeding circuit for relay **78**. The opening of contact **73** opens the energizing contact of winding **72**, and then the locking device **71** prevents triggering plaque **70** from moving thus impeding any further depression of another key until the very moment corresponding to the end of the magnetic inscription of the whole of the signal or indication referring to the reception track as will appear from the next part of this description, and the circuit of relays **70** and **77** is then kept closed by pedal contact **89** which is normally set.

As soon as the wheel has passed the third row of electro-magnets, it operates a pedal **87** which cuts its contact involving the opening of the circuit of relay **64** which is thus de-energized. This release is confirmed by the opening of contact **86** of the same circuit replacing the short duration cut of the pedal contact when the wheel passed over it. The de-energizing of relay **64** provokes the opening of contact **63** which suppresses the feeding of three rows of electro magnets having

ended their action on the treads. This arrangement enables putting under tension the first three electromagnets during exactly the time necessary and prevents their action on the wheel tread of the following axles at a short distance, such as the second axle of a bogie. The vehicle, following its movement, is influenced by the three last rows of electro-magnets, then the wheel engages pedal **89** which opens its contact, thus opening the circuit of relays **70**—**77**. Relay **70** is immediately de-energized, confirming through the release of contact **88** the short action of pedal contact **89** which closes as soon as the wheel passes on. The release of relay **70** results in the de-energizing of the three last rows of electromagnets, due to the opening of contact **69**.

Relay **77**, having a slow release characteristic, remains in an energized position for a short while after relay **70** has been released, then the circuit of relay **78** is opened by contact **75** bis of relay **70**. Relay **78** is de-energized, thus terminating a cycle of operation of the apparatus, every member of which being now in its initial position of rest. As soon as the last axle of the car or group of cars has passed over pedal **81** on its way, the depression of another key or push button will set the assembly in position for the new destination selected.

It may be remarked that in the arrangement thus described by way of example, the energizing of the inscription electromagnets takes place during the very short time of the passing of a single axle; such arrangement makes it possible to apply a considerable amount of electric power to each electro-magnet without any danger of heating and without an exaggerated consumption of electricity, while still obtaining powerful magnetic results on the wheel treads.

The separation of the unit into two groups of three electromagnets each on each rail may give satisfactory results, and said separation may be decreased or increased. In some particular embodiments of the invention, it would be possible, for instance, to have a pedal associated with each row of electromagnets, allowing an individual energizing thereof when the wheel passes over it. In this arrangement, the energizing of each electromagnet may be obtained through the discharge of a condenser thus enabling powerful results of very short duration to be obtained with a reasonable amount of energy.

Contacts **64**, **65**, **66**, **67**, **68** for selection of the inscribing electromagnet windings shown in the diagram of Fig. 6 are indicated with the same reference numbers in Figs. 7, 8, 9 showing the mechanical controlling selector. This apparatus S, enclosed in a housing **90**, has push buttons numbered from **1** to **32** extending from its upper portion in the example shown, corresponding each to a reception track of the shunting area. Their arrangement is made according to numbers by rows of ten. Each key is biased upward by a spring such as **91** bearing on the fixed bottom and acting on a flange provided on each stem.

The push buttons pass through a triggering plate **92** and five switch plates **93***b*, **93***c*, **93***d*, **93***e*, **93***f*. These plates move transversely to the push button axis in guiding portions of side supports **94**—**95**. The switch plates, due to action of push members **96***b*, to **96***f*, operate inversing contacts **64** to **68**. The push rods have a set of elements **97** and **98** with alternating large and small diameters, so that when the push button is depressed the large diameter elements are level with the switch plates. A tapered portion ensures a

proper junction of each larger diameter element with its next small diameter element above.

The push rods pass through the plates by means of holes the diameter of which corresponds to the larger elements of the rods. The clearance of said holes around the small diameter elements of the rods enables the plate to occupy indifferently a position on the right or on the left of its stroke. The depression of a push rod causes the tapered junctioning portions to act on the plates thus moving same toward the left or the right according to the position of the hole, the latter being centered on the large diameter portion of the push member at the end of its movement. For instance, the depression of push button **27** confirms or provokes the positioning of plate **93***b* to the right, **93***c* to the right, **93***d* to the left, **93***e* to the right, **93***f* to the left and causes contacts **64** and **68** to be closed in the suitable direction. A large diameter element lies above or under the triggering plate **92** according to whether the corresponding push rod is protruding or depressed. Said large diameter element is rounded off by two tapered portions with the small diameter elements on either side. At the moment the key is depressed, the tapered portion located under element **99** acts on the triggering plate and pushes it toward the right. At the right end of this stroke, the hole in the triggering plate is concentric with the operated push rod; the same applies to every other key, and notably a previously operated key is not hindered from getting back to its protruding position under the action of spring **91**. Following the operation of the selected key the large diameter element **99** passes under the plate, the latter returns, under the action of spring **100**, to its initial position and triggers or retains the key in its depressed position such as shown for push button **27**.

The operation of a push button is dependent upon the position of the triggering plate **92**. The latter is controlled by an electro magnetic locking device having a winding **72** carried by elements forming a magnetic circuit with pole extensions **101**—**102**. These elements may be pole extensions **101** which are connected by a transverse vertical member **102**. The member **102** pivotally supports one edge of an armature **103**, to whose opposite edge is pivotally connected a vertical link **104**. On the upper portion, the link **104** is guided by part **105'** of a fixed member **105** and has on its end a triggering member **71** or disc which fits in an opening in the triggering plate **92**. When the locking device is in its energized position the disc **71** is level with the opening of said trigger plate **92** thus allowing the triggering plate to be freely actuated. An insulating block **106** acts upon contact **74** operated by the triggering plate.

Each vehicle or group of vehicles the first axle of which has received magnetic inscriptions corresponding to its predetermined itinerary, as disclosed hereinabove, subsequently controls the switches it encounters. Both equipment and operation of a third row switch are described hereunder, switch C_4 for example. A device similar to that disclosed is provided for each point. As soon as the first axle has passed over the point of the previous switch, i. e. B_2, its wheel treads act through their magnetic marks on the extensions **47***g*, **47***d* (Fig. 6*a*), of a feeler or magnetic flux detecting apparatus. Voltages are inducted in the corresponding windings **45***g*, **45***d*. Each winding is connected with the entrance circuit of an amplifier **107***g*, **107***d* fed on the other hand with alternating current by a line **108**.

Particulars of the amplifying circuit are not shown, the latter being of a conventional type. Suitably amplified voltage impulses feed relays **109***d*, **109***g* after the waveform has been transformed and rectified through transformer rectifier units **110***d*, **110***g*. Thus, relays **109***d* and **109***g* are subjected to the rhythm of impulses corresponding to the magnetic marks carried by the wheels of the first axle. A D. C. supply **111**, fed through a transformer rectifier unit **112**, causes conductors **113**—**114** to be energized. The wheel approaches the feeler device in any way and the impulses received subsequently on the left or right rail cause either of relays **109***d*, **109***g* to beat without any further consequence.

When the magnetic mark, arranged to correspond on both wheels so as to serve as origin of the magnetic inscription, appears the two relays **109***d* and **109***g* are energized simultaneously. A circuit is then set from conductor **113** by contact **115***d* of relay **109***d*, contact **115***g* of relay **109***g*, the winding of relay **116**, parallel with winding **117** of the step by step rod switch **118** and back to conductor **114**. Relay **116** is energized and remains in this condition for a time, under the action of ring **116***a*, on its magnetic circuit. Another consequence of the energizing of relay **116** is that locking tooth **119** and operating teeth **120** are engaged on the ratchet wheel of the step by step switch due to arms **122** and rollers **123**, **124**. When winding **117** is energized armature **125** is attracted and operating tooth **121** is actuated thus moving the switch by half steps.

When winding **117** is de-energized, the action of tooth **120** moves the switch by another half step, thus engaging brushes **126***d* and **126***g* with the first row of stationary contacts **127***d* and **127***g* not connected elsewhere in this case. The following impulse is received either by relay **109***d*, or by relay **109***g*. A circuit is then established from conductor **113** either through contact **128***d* or contact **128***g*, then through contact **129** of relay **116**, and the current flows in parallel in the windings of relay **116** which is thus held energized and in winding **117** of the step by step switch which is thus moved another half step under the action of tooth **121**, cutting the contact between the brushes and the first row of fixed contacts.

When the winding **117** is de-energized, there takes place another motion of the switch under the action of tooth **120** and subsequent engagement of brushes **126***d*, **126***g* with the second row of stationary contacts **130***d*, **130***g*.

The following impulse (the second impulse after the double original impulse) operates in a similar way and brings the brushes in engagement with the third row of stationary contacts **131***d* and **131***g*. The next impulse (the third impulse after the double original impulse) corresponds to the control of the point or switch. In fact, a circuit utilizing contact **132** of relay **116** is closed either through contact **133***d* of relay **109***d*, brush **126***d*, stationary contact **131***d*, winding **134***d* and back to conductor **114**; or through contact **133***g* of relay **109***g*, brush **126***g*, contact **131***g*, winding **134***g* and back to conductor **114**. The operation of the step by step rod switch takes place as formerly and continues with the following impulses. Windings **134***d* and **134***g* belong to

a so-called tilter recorder relay having two positions and stabilized by a device not shown (magnetic or mechanical), so that the movable members of said relay are held in the last position set. The momentary feeding of either winding **134***d*, **134***g* as disclosed hereinabove, confirms the position of the tilter recorder **135** or causes same to tilt in the direction corresponding to the control of the switch. It has been seen that the recurrence of impulses caused the maintaining of relay **116** in an energized condition. When the last impulse of the characteristic signal has been received, a certain time elapses, then relay **116** is de-energized, thus causing:

1. Contact **129** to confirm the cutting of its circuit;

2. Contact **132** to cut the circuit of the tilter recorder;

3. The operation of arm **122** which disengages the retaining tooth **119** and operating teeth **120**, **121** under the action of rollers **123**, **124**.

As the step by step switch is no longer held, it is brought back due to the action of spring **136**.

A double switch **137** enables the point to be controlled on the spot through direct action by sending current directly through winding **134***d* or winding **134***g* of the tilter recorder.

The tracks controlled by switch C_4 are equipped like a conventional track circuit from a place located above the switch and along the branches to the gauge clearance, with feeding through a transformer **138** and a protecting resistance **139**. As soon as a vehicle is clear from the track circuit, track current reaches a two element relay **140** which becomes thus energized. A circuit is then set by contact **141** of relay **140**, either of contacts **142***d*, **142***g*, tilter recorder **135**, either of windings **143***d*, **143***g*, of a relay with two stabilized positions **149** called tilter breaker, and the circuit closes on conductor **114**. The operation of the tilter breaker is similar to that of the tilter recorder, but it comprises high intensity contacts **145***d*, **145***g*, **146***d*, **146***g* disposed on the circuit of the three phase motor **147** which controls the switch considered. Contacts **148***d*, **148***g*, **149***d*, **149***g* are end stroke contacts controlled by the motor itself.

Fig. 10 shows an example wherein the magnetic inscribing device is applied to a level crossing warning device.

A—B is a railway track level crossed at P by a roadway. The description relates to the case wherein the railway traffic takes place from left to right.

A contact **151** is actuated in a fixed apparatus called "pedal" by the tread or flange of the wheel of the first axle of any oncoming train on the track. The depression of said pedal opens a contact **151** and immediately de-energizes a relay **154** previously fed by a current supply **155** through its own contact **156**. The release of relay **154** which has been rendered definitive by cutting contact **156** causes both the lighting of a warning lamp **157** and the ringing of a bell **158** through contact **159**. This device, in the usual way, the immediate warning, and pedal **151** must be located bearing in mind that the AP portion, at full speed, takes a time period sufficient for road users to clear the level crossing area. The device described applies only in case of fast and highly accelerating vehicles.

Slow vehicles act through the wheels of their first axle firstly on pedal **151**, then also on the pole extension of a feeling device **152** similar to that described in connection with Figs. 2 and 3.

The impulses corresponding to the magnetic mark previously set on the wheel tread are suitably amplified, then rectified through amplifier **178** and rectifier **179** and eventually applied to the energizing winding of relay **160**. When the slow vehicle passes, relay **160** is energized and is held in this condition by a second winding fed by a local supply **161** through contacts **162** of relays **154** and **163** of relay **160**. The energizing of relay **160** controls through a contact **164** a warning light which signals the approach of a slow train.

This signal may be used directly by the railway personnel to delay the closing of the level crossing. A switch provided with contacts **166—167** or automatic devices (pedals, track circuits) is provided so as to enable the relays to return to their initial energized condition when the train is passed. The actuation of relays **154—160** may be added together with the intervention of slow relays or clockworks for obtaining automatically the immediate or delayed operation of the signalling devices according to the type of oncoming train.

Although the present specification only relates to two types of trains, it is clear that without departing from the frame of the invention, several classes of vehicles may be selected by means of different marks located on one or more wheels.

What I claim is:

1. A magnetic control system for railway vehicles comprising means for selectively forming magnetic patterns on the marginal portions of either of two of the vehicle wheels on the same axle, magnetic flux detecting members along the railway track selectively actuated by said magnetic patterns, and electric switching means operated by said magnetic flux detecting members.

2. A magnetic control system for railway vehicles moving on tracks comprising means for forming magnetic patterns on the marginal portions of the vehicle wheels, magnetic flux detecting devices selectively actuated by said magnetic patterns when said patterns pass adjacent to said devices, electric switching means operated by said flux detecting devices, and means connected with said switching means and said flux detecting devices for controlling selectively different track devices placed on the tracks.

3. A magnetic control system for railway vehicles comprising stationary magnetic inscribing means for forming magnetic patterns on the marginal portions of either of two of the vehicle wheels on the same axle, magnetic flux detecting devices selectively actuated by said magnetic patterns when said patterns pass adjacent to said devices, and electric switching means operated by said flux detecting devices.

4. A magnetic control system for railway vehicles moving on tracks comprising stationary magnetic inscribing members located alongside the railway tracks for forming magnetic patterns on the marginal portions of the vehicle wheels, magnetic flux detecting devices placed along the track and selectively operated by said magnetic patterns when said patterns pass adjacent to said flux detecting devices, and electric switching means actuated by said flux detecting devices.

5. A magnetic control system for railway vehicles moving on tracks comprising means for forming magnetic patterns on the marginal portions of the wheels of the vehicles, magnetic flux detecting devices selectively operated by said magnetic patterns when said patterns pass adjacent to said flux detecting devices, relay means operated by said devices, and electric switching

means actuated by said devices, said magnetic patterns including original zones for actuating certain of said relay means and zones for thereafter actuating certain other relay means selectively.

6. A magnetic control system for railway vehicles moving on tracks comprising means for forming magnetic patterns on the marginal portions of the vehicle wheels, magnetic flux detecting devices selectively operated by said magnetic patterns when said patterns pass adjacent to said flux detecting devices, relay means operated by said devices, and electric switching means actuated by said devices, said magnetic patterns comprising original zones for actuating certain of said relay means and zones for thereafter actuating certain other relay means selectively to actuate in the desired direction the railway switches to be encountered by the vehicle, said selecting zones being located on the side of the vehicle corresponding to the direction which must be imparted to a given switch.

7. A magnetic control system for railway vehicles moving on tracks comprising means for forming magnetic patterns on the marginal portions of the vehicle wheels, magnetic flux detecting devices placed on the track and selectively actuated by said magnetic patterns when said patterns pass adjacent to said flux detecting devices, electric switching means operated by said flux detecting devices, said flux detecting devices comprising coils in which electric currents are induced by the nearby passage of said magnetic patterns, and means for neutralizing the action of currents running in the tracks.

8. A magnetic control system for railway vehicles comprising means for inscribing magnetic patterns on the marginal portions of the wheels of the vehicles, magnetic flux detecting devices selectively operated by said magnetic patterns when said patterns pass adjacent to said flux detecting devices, electric switching means operated by said flux detecting devices, and means for selectively energizing said inscribing means, said inscribing means including a plurality of inscribing members, and said energizing means including a selecting device enabling the desired inscribing members to be selected.

9. A magnetic control system for railway vehicles comprising means for inscribing magnetic patterns on the marginal portions of the wheels of the vehicles, magnetic flux detecting devices selectively operated by said magnetic patterns when said patterns pass adjacent to said flux detecting devices, electric switching means actuated by said flux detecting devices, and means for energizing said inscribing means, said inscribing means including a number of inscribing members, and said energizing means including a selecting device enabling the desired inscribing members to be selected, in combination with interlocking means for preventing a subsequent inscribing member from being operated until the previously activated inscribing member is restored to its original position.

10. A magnetic control system for railway vehicles moving on tracks comprising stationary inscribing devices placed symmetrically on either side of the two track rails for forming magnetic patterns on the marginal portions of the vehicle wheels, magnetic flux detecting devices located on the railway track and actuated by said magnetic patterns when said patterns pass adjacent to said flux detecting devices, and electric switching means operated by said flux detecting devices.

11. In a tracked railroad, a magnetic control system for railway vehicles comprising stationary inscribing devices located on the right and left rails for forming magnetic patterns on the marginal portions of the wheels of the vehicles, magnetic flux detecting devices located on the track and selectively actuated by said magnetic patterns when said patterns pass adjacent to said flux detecting devices, electric switching means operated by said flux detecting devices, and a selecting device for operating either the right or left inscribing device according to the position of the selector device.

12. A magnetic control system for railway vehicles moving on tracks, comprising stationary inscribing devices for forming magnetic patterns on the marginal portions of the vehicle wheels, magnetic flux detecting devices on the track and operated by said magnetic patterns when said patterns pass adjacent to said flux detecting devices, switching means actuated by said flux detecting devices, and means operated by passage of a wheel to make operable said inscribing devices.

13. A magnetic control system for railway vehicles comprising devices for inscribing magnetic patterns on the marginal portions of the wheels of the vehicles, magnetic flux detecting devices selectively operated by said magnetic patterns when said patterns pass adjacent to said flux detecting devices, switching means actuated by said flux detecting devices, means for energizing said inscribing devices including a selector whereby the desired inscribing devices are selected, said selector comprising a set of manually operated members, movable plates actuated by said members, and electric contacts operated by the movable plates.

14. A magnetic control system for railway vehicles having wheels comprising members for inscribing magnetic patterns on the marginal portions of the wheels of the vehicles, magnetic flux detecting devices selectively actuated by said magnetic patterns when said patterns pass adjacent to said flux detecting devices, electric switching means actuated by said flux detecting devices, means for energizing said inscribing devices including a selector whereby the desired inscribing members are selected, said selector comprising a set of manually operable members, movable plates operated by said members and electric contacts actuated by said movable plates, said members having tapered portions and said movable plates having apertures, said apertures cooperating with the tapered portion of said members to move said plates.

15. A magnetic control system for railway vehicles comprising means for forming magnetic patterns on the marginal portions of the wheels of the vehicles, magnetic flux detecting devices selectively operated by said magnetic patterns when said patterns pass adjacent to said flux detecting devices, electric switching means actuated by the flux detecting devices, each flux detecting member including a winding connected with a controlling circuit, a rotary switch which is movable stepwise under the action of said controlling circuit, and contacts provided in said switch in positions corresponding to the magnetization pattern of the wheels, and means energized by operation of said flux detecting members to rotate said switch, and means operated

by said switch for directing the movement of said vehicles.

16. A magnetic control system for railway vehicles comprising means for forming magnetic patterns on the marginal portions of the wheels of the vehicles, magnetic flux detecting devices operated by said magnetic patterns when said patterns pass adjacent to said flux detecting devices, and electric switching means actuated by said flux detecting devices, each of said flux detecting devices including a winding connected with a controlling circuit, a rotary switch which is movable stepwise under the action of said controlling circuit, contacts provided in said switch in positions corresponding to the magnetization pattern of the wheels and means for actuating a track switch from said rotary switch.

17. A magnetic control system for railway vehicles comprising means for forming magnetic patterns on the marginal portions of the wheels of the vehicles, magnetic flux detecting devices operated by said magnetic patterns when said patterns pass adjacent to said flux detecting devices, electric switching means actuated by said flux detecting devices, in combination with pedal operated switching means whereby fast trains having no magnetic inscriptions act only on said pedal operated signalling system, and slow trains bearing magnetic inscriptions act on the first signalling system.

18. A magnetic control system for railway vehicles for causing them to switch themselves onto the desired tracks along their courses, comprising means to apply magnetic inscriptions on the marginal portions of two wheels on the same

axle of a vehicle, magnetically responsive means to read the inscriptions, control means actuated by the reading means to control movement of the switch points in the desired position at the moment when the vehicle approaches them, means causing the magnetic inscription on the right wheel to switch the vehicle to the right and causing the inscription on the left wheel to switch the vehicle to the left, the reading means being disposed in two rows along two sides of the tracks in order to read on the one or the other wheel.

19. The system as claimed in claim 18 wherein the inscribing means are under control of a selector comprising as many selector manually operable members as there are switch points to control, and electric control contacts actuated by said manually operable members to cause actuation of the inscribing means.

LUCIEN JOSEPH ARMAND LE GOFF.

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