F. PROCHASKA.

INTERDEPENDENT SIGNAL AND SWITCH APPARATUS FOR RAILWAYS.

APPLICATION FILED APR. 10, 1906.

928,004. Patented July 13, 1909.

4 SHEETS—SHEET 1.

Fig. 1

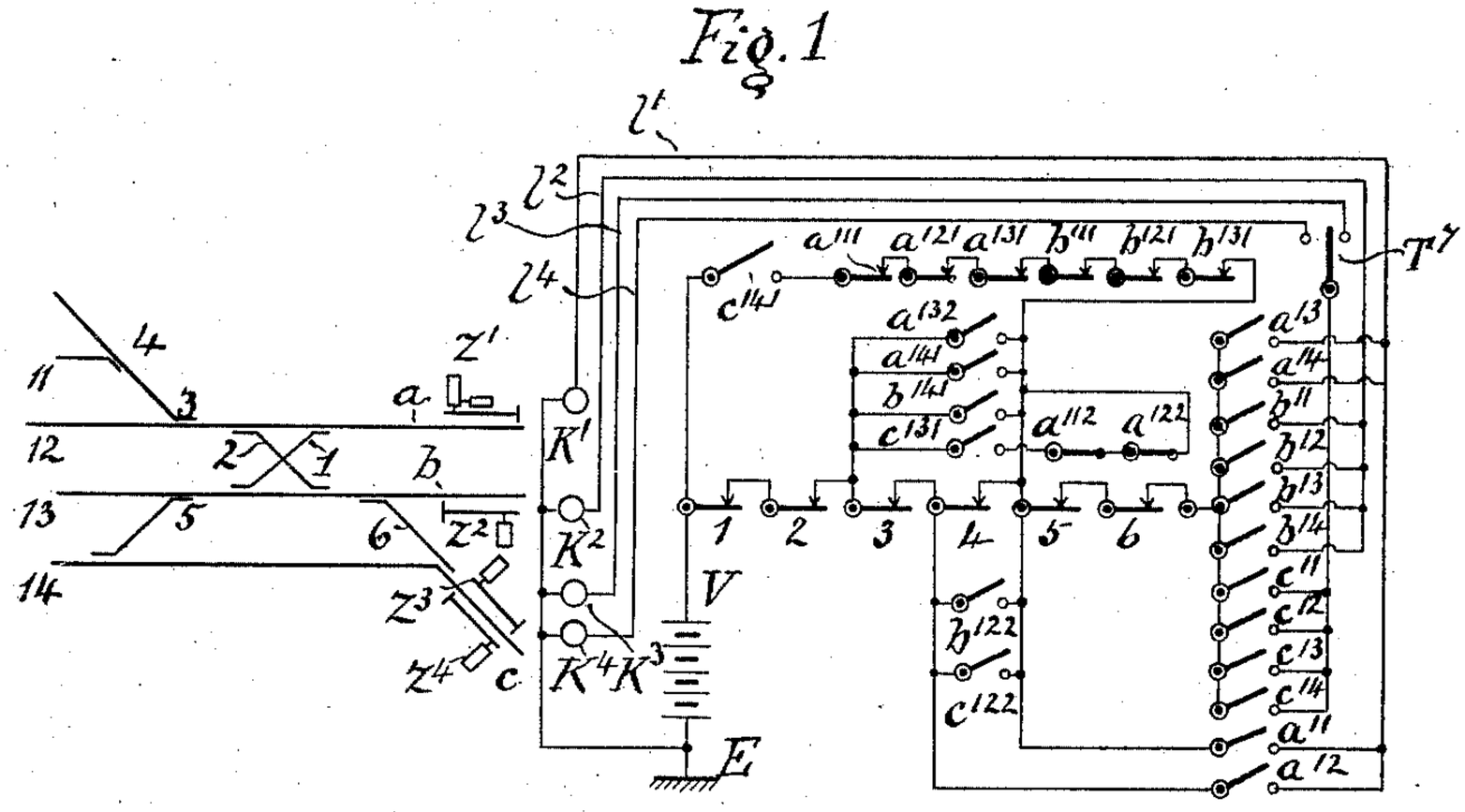

Fig. 2.

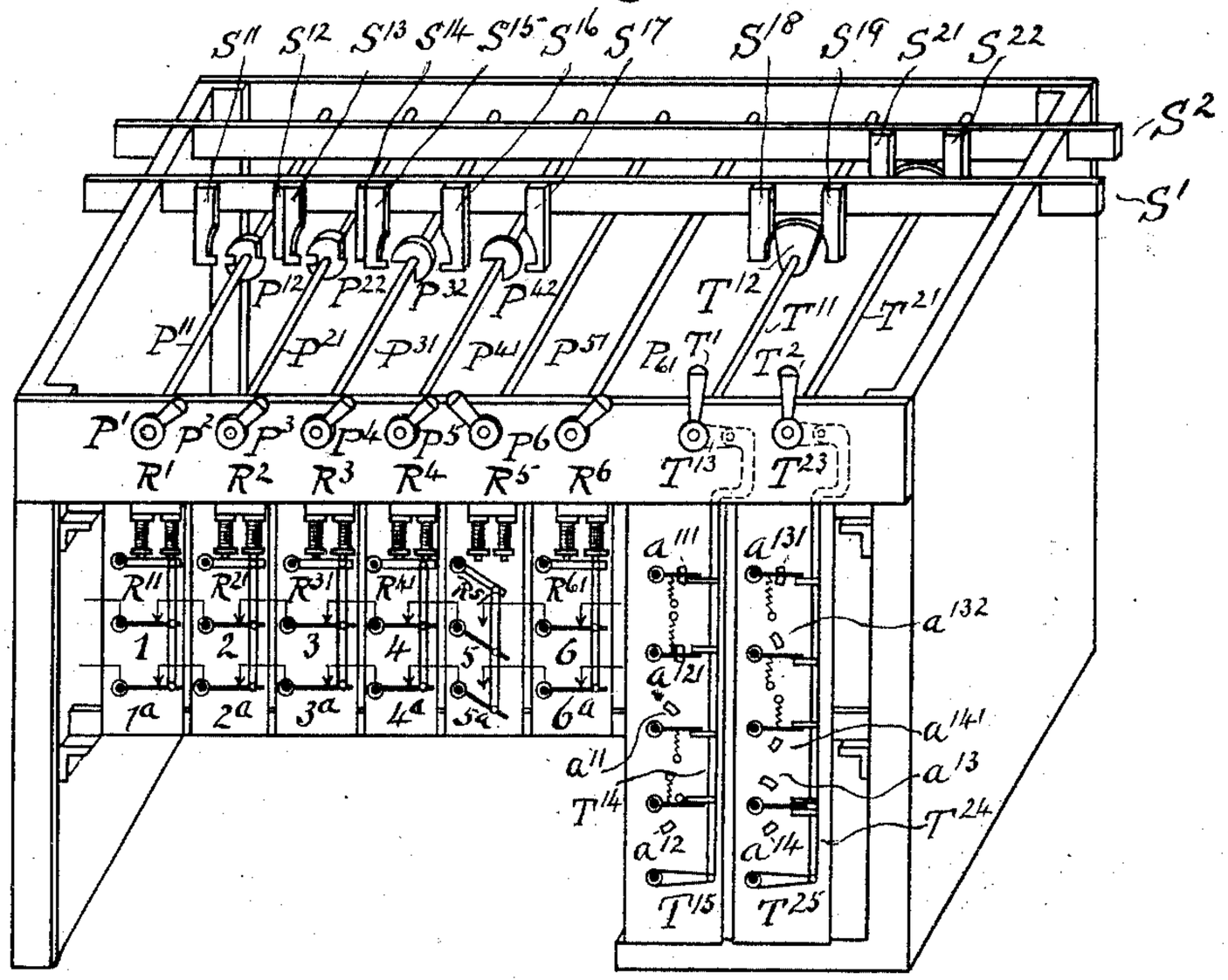

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Fig. 3.

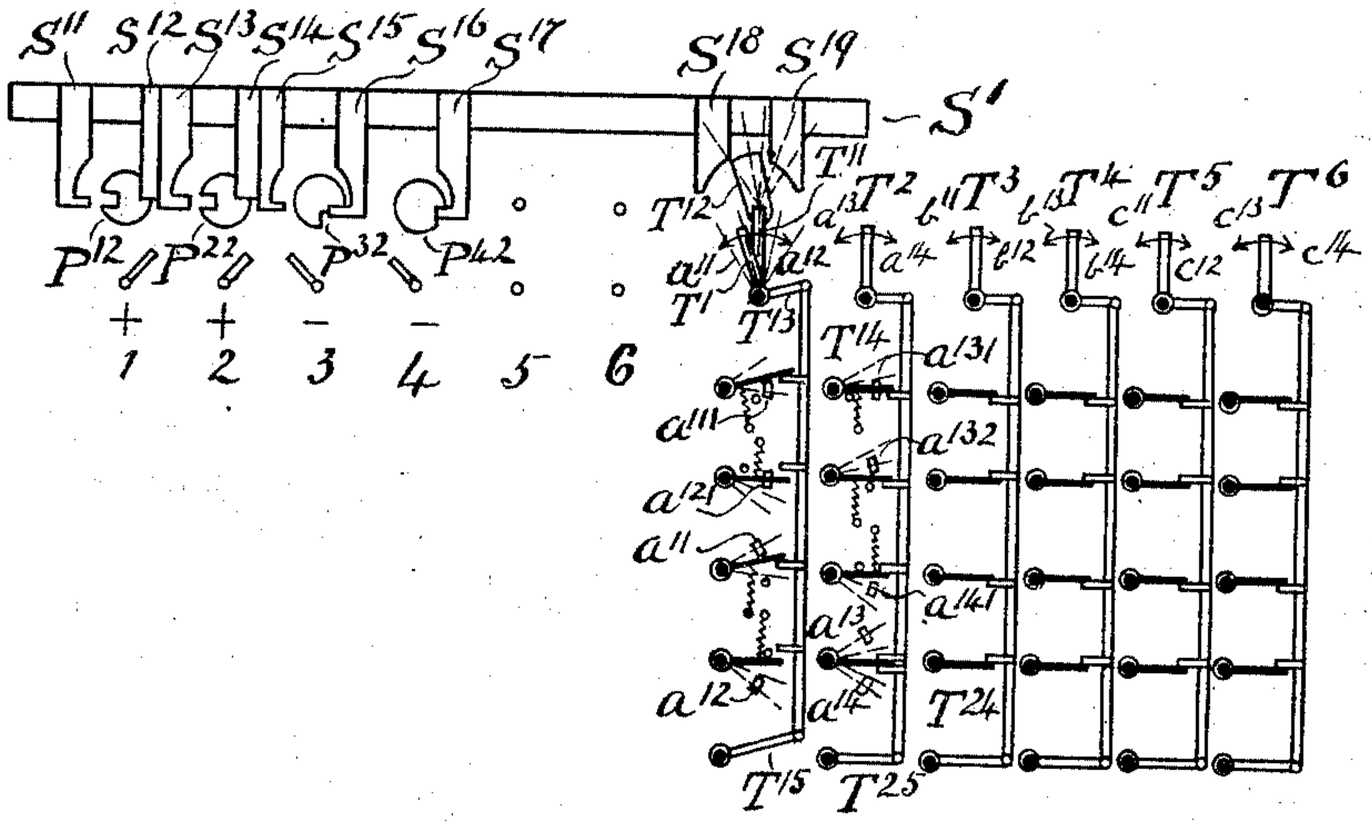
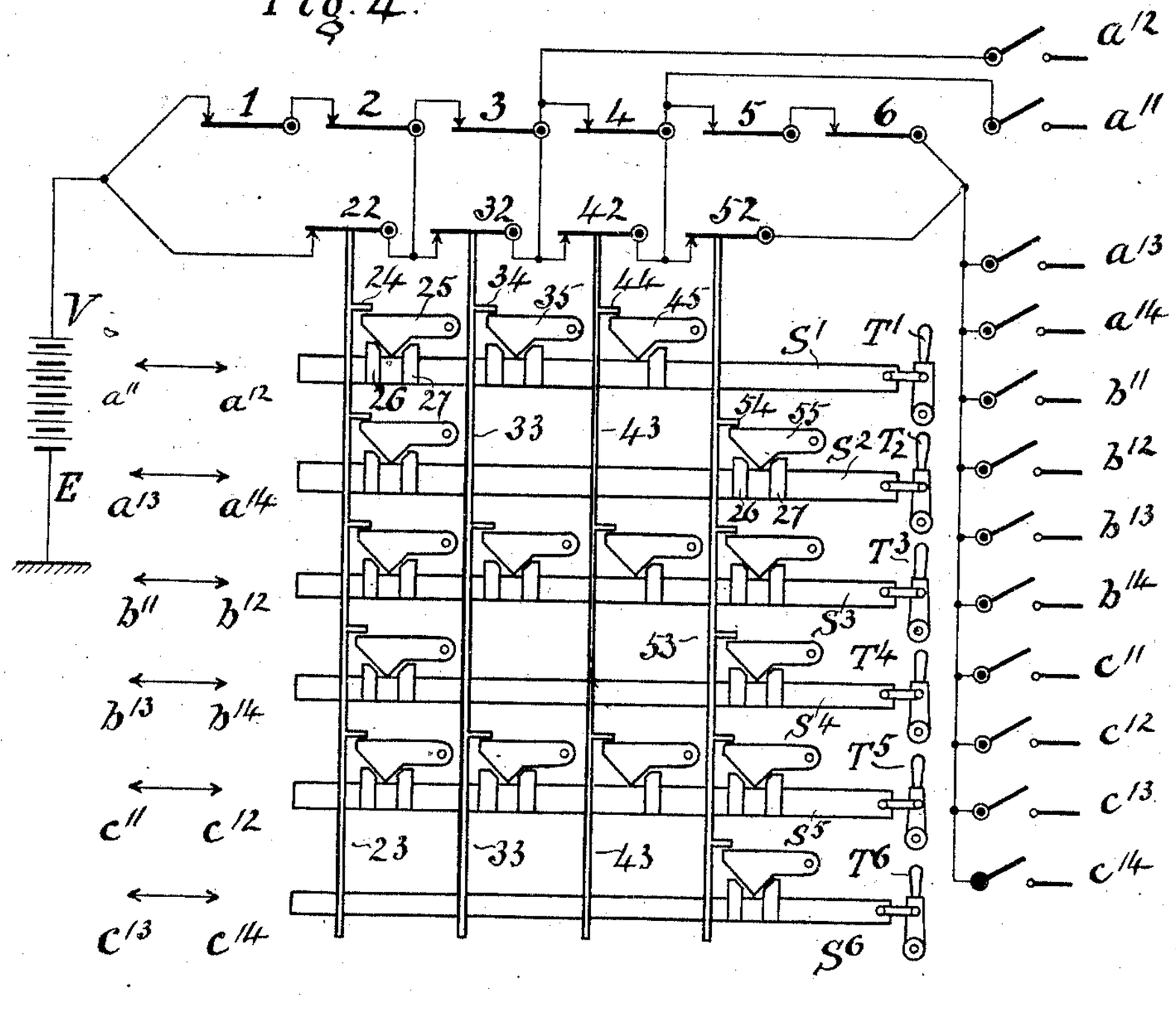


Fig. 4.



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4 SHEETS—SHEET 3.

Fig. 5.

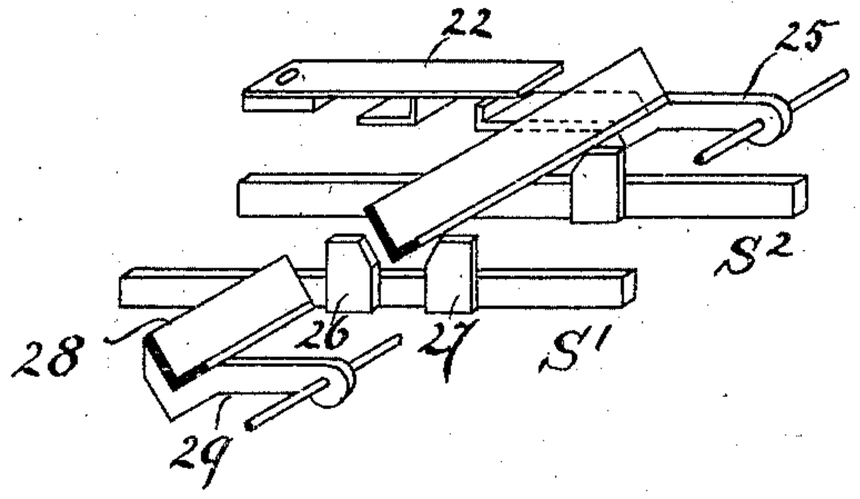

Fig. 6.

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4 SHEETS—SHEET 4.

Fig. 7.

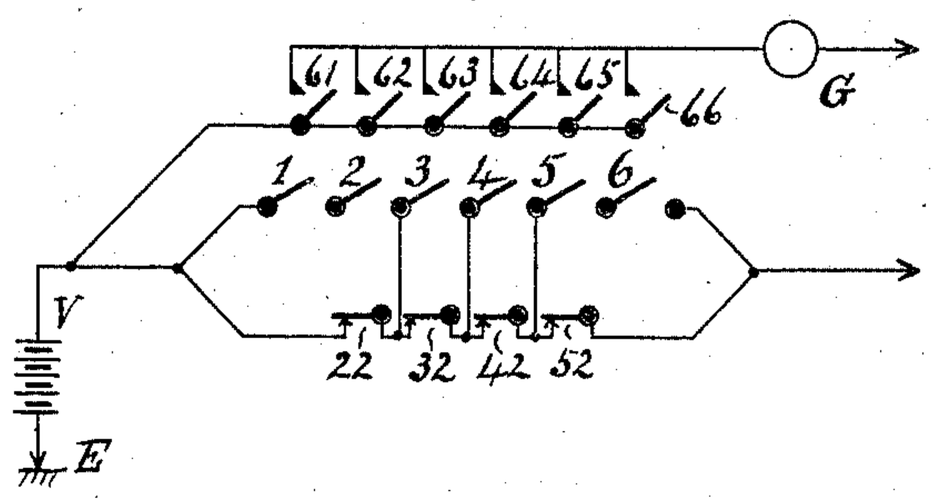


Fig. 8.

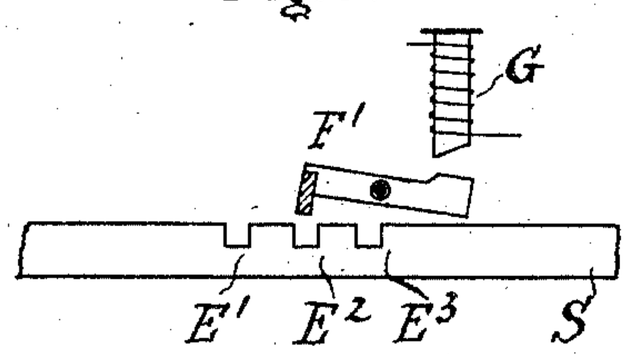


Fig. 9.

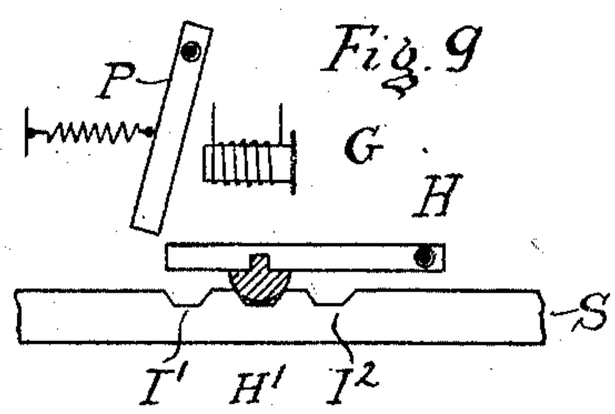


Fig. 10.

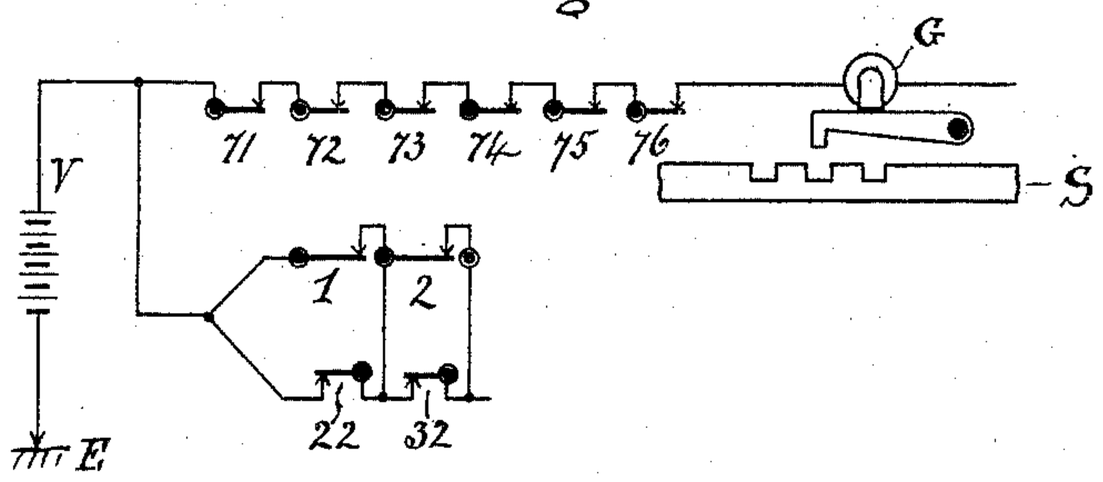
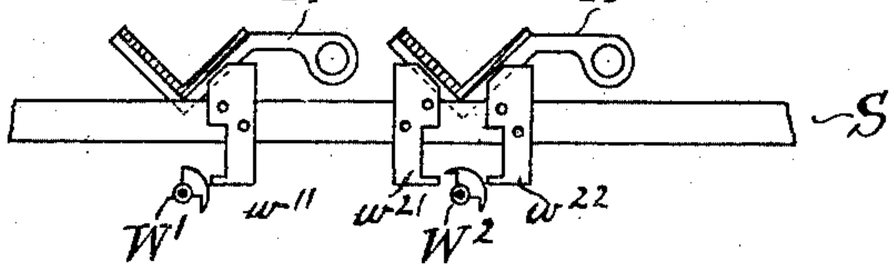


Fig. 11.



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UNITED STATES PATENT OFFICE.

FRIEDRICH PROCHASKA, OF BERLIN, GERMANY, ASSIGNOR TO SIEMENS & HALSKE A. G., OF BERLIN, GERMANY, A CORPORATION OF GERMANY.

INTERDEPENDENT SIGNAL AND SWITCH APPARATUS FOR RAILWAYS.

No. 928,004. Specification of Letters Patent. Patented July 13, 1909.

Application filed April 10, 1906. Serial No. 310,945.

To all whom it may concern:

Be it known that I, FRIEDRICH PROCHASKA, a subject of the Emperor of Austria-Hungary, and residing at Charlottenburg, Berlin, Germany, have invented new and useful Improvements in Interdependent Signal and Switch Apparatus for Railways, and in order that those skilled in the art may understand and practice my invention I give the following specification.

In signal operating apparatus the signal lever is generally made to be dependent upon certain track switch levers. Furthermore, there is frequently also a mechanical or electrical dependency of the signals upon the condition of track switches, turn tables, or the like, concerned therein. This dependency is generally produced by means of controlling or supervising devices (fluid pressure devices, electromagnets) which are connected with all the places to be supervised or controlled and operate supervising devices (valve or circuit closers) in the signal conductors. A supervising device of this character, for instance, is a contact 1, Fig. 2, which is closed by the armature R^{11} of the supervising electromagnet R^1 when the latter is excited by the supervising current, the circuit of which is closed so long as the supervised track or point is in proper condition, but which will be opened whenever this condition is disturbed (for instance by opening of the switch or the lock). Consequently, the supervising contact 1, shows whether the point is proper or not. It is well known to lead the current for operating or releasing or coupling the signal arm through such supervising contacts of all points and other elements, concerning to the route determined by the said signal, so that the signal can only be moved to "clear" position when the track switch is in proper locked condition; and further, if a disturbance of the track switch occur during the "clear" position of the signal, the signal thereupon drops to danger by the interruption of the coupling current. Since a signal is, as a rule, dependent upon a plurality of track switches, the coupling current must flow through a plurality or series of contacts which will be influenced in the manner before explained by the supervising magnets pertaining to the switches concerned. If, as is almost always the case, incoming trains from the same line are to be switched to different yard tracks or vice versa, then, as will appear in the following, the necessity will exist of uniting the supervising contacts (the supervising elements) of the switches in a particular sequence with one another.

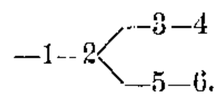
In Fig. 1 is shown a small district or switch yard consisting of four sidings, 11, 12, 13 and 14, six switches, 1 to 6, and four signals, Z^1, Z^2, Z^3, Z^4, for the incoming lines *a*, *b* and *c*, of which *a* and *b* are double tracked. For a train from *a* to yard track 11 the switches 1, 2, 3 and 4 must be locked; for a train from *a* to 13, switches 1, 2, 5, 6, etc. must be locked, as shown in the following chart or table of lockings, in which each track, secured for passing trains, which will be hereinafter designated by the expression "route", will be designated by the reference letter of the lines *a*, *b* or *c* and an index numeral designating the number of the yard track constituting a route. Thus, a^{11} indicates an arrival route from line *a* to yard track 11; c^{13}, arrival or departure route from or to the single track line *c* or from yard 13, etc.

The normal position of the switches is designated in the table in conventional manner by +; the opposite position by —. An inclosed sign as (+) or (—) signifies that the locking is not absolutely necessary, but permissible.

Route.	Track switch levers.					
	1	2	3	4	5	6
a^{11}	+	+	−	−		
a^{12}	+	+	+			
a^{13}	−	(+)			+	+
a^{14}	−	(+)			−	(+)
b^{11}	(+)	−	−	−	+	+
b^{12}	(+)	−	+		+	+
b^{13}	+	+			+	(+)
b^{14}	+	+			−	(−)
c^{11}	(+)	−	−	−	+	−
c^{12}	(+)	−	+		+	−
c^{13}	+	+			+	−
c^{14}					+	+

As appears from this table or chart of lockings, switches 1 and 2 are locked for all trains using line *a;* whereas switches 3 and 4 are locked only for certain train movements for which switches 5 and 6 remain free, and vice versa. From this results the sequence in which the supervising contacts or devices belonging to the switches 1 and 6, and indicated by the same reference numerals, must

be connected in circuit. First come contacts 1 and 2, then follows a branching over 3 (for route a^{12}), thence over 4 (for a^{11}); and after contact 2 the other branching over 5, 6 for routes a^{13} and a^{14}. The circuit or connection is thus



For train movements to b, however, another grouping is necessary: 1, 2, 5, 6, 3, 4, or also 5, 6, 1, 2, 3, 4. For train movements from and to c, the series 5, 6, 1, 2, 3, 4 is necessary.

Since train movements of group a and those of group b, also those of group a and of group c, require different sequences of contacts and a changing of the given sequence to suit the case by corresponding change of circuit connections is not permissible because train movements of group a might occur at the same time with train movements of group b or c, there has therefore been provided up to the present in such cases supervising magnets for the signal operating apparatus with more than one supervising contact each, and there has, thus, been obtained by their use different kinds of series of contact. For the present example two series would be required. For apparatus for larger switch districts and for a larger number of lines (a, b, c) a greater number of contact series is required, which results in a greater load for the supervising magnets and requires complicated connections and much space.

In accordance with the present invention, which has for its object a simplification of the apparatus, all necessary or required dependencies are obtained, even when more than two lines enter the switch district, by a single fixed series of supervising devices (series of contacts) connected in circuit. For doing this there is provided a selection apparatus by means of which only the supervising devices or contacts involved in a given route are made operative.

So far as the essentials of the invention are concerned, it is immaterial whether the apparatus employed is operated by pneumatic, hydraulic or electrical means. For the sake of simplicity, the employment of electrical apparatus has been taken as an example.

In the drawings I have illustrated (in most instances diagrammatically) as an example how my invention may be carried out in practice.

In these drawings Figure 1 shows diagrammatically a manner of carrying out the object of the invention. Figs. 2 and 3 show details, partly diagrammatically, of the general arrangement shown in Fig. 1. Fig. 4 shows diagrammatically a modification of the arrangement illustrated in Figs. 1 to 3. Fig. 5 is a modification of the detail structure for mechanically opening the short circuits shown in Fig. 4. Fig. 6 is an illustration, partly structurally, partly diagrammatically, of an additional safety device used in the supervising system to render it complete. Fig. 7 shows a modified manner of locking the route selective devices without an auxiliary series of contacts. Figs. 8 and 9 are two modifications showing in detail how the selective devices may be locked. Fig. 10 shows diagrammatically the electrical connection when the locking of the slides is made dependent upon a permanent current. Fig. 11 shows in detail how the locking elements for the selective devices may be used for operating the short circuiting devices.

Fig. 2 shows in perspective an electrical switch- and signal-operating apparatus with the parts necessary for explanation of the object of the invention. The apparatus corresponds in essential features to the train yard or switch district in Fig. 1, and contains the apparatus for setting and supervising the six track switches, such as levers P^1, P^2, . . . P^6, each of which is attached to a shaft P^{11}, P^{21}, . . . P^{61}, and serves for the operation of the switches (not shown) for controlling the switch motors. Below the switch levers are arranged the supervising magnets R^1, R^2, . . . R^6 pertaining to the same, the armatures R^{11}, R^{21}, . . . R^{61} of which move the supervising contacts or devices 1, 2 . . . 6 in the well known manner, as above explained, as well as the auxiliary contacts 1^a, 2^a, . . . 6^a. The magnet windings themselves may be made to be dependent upon and to correspond to the condition of the switches, by any suitable circuit connections, which in order not to overload the drawings have been omitted, as being well known in the art. Accordingly, contact 1 is, for example, closed only when switch 1 is in the proper condition. The contacts 1, 2, 3, 4, 5, 6 belong respectively to the similarly designated track switches. On the shafts P^{11}, P^{21}, etc. of the switch levers are secured locking elements P^{12}, P^{22}, etc., which are arranged to engage with locking dogs S^{11}, S^{17}, etc. of the so-called "route" slides S^1, S^2, etc. For the sake of clearness of illustration only, the locking devices which engage with slide S^1 are shown in the figure. This slide may be moved to the right or left by means of a route lever T^1 secured on the end of the shaft T^{11} outside the casing of the apparatus through the medium of a cam T^{12}, also secured to the shaft T^{11}, which cam engages between two jaws, S^{18} and S^{19} secured fast to the slide. Operatively connected to the same shaft by arm T^{13}, which is fast thereon, and having a guide link T^{15} at its lower end is a bar T^{14}, which by means of projections thereon will, when route lever T^1 is moved to the left, lift contact arms a^{111} and a^{11} and thereby open the contact a^{111} as shown in Fig. 3, which was theretofore closed. If lever T^1

be moved still farther,—beyond the position shown in Fig. 3 into the position indicated by broken line—the contact a^{11} will be closed. In the same manner contacts (not shown), which serve for operation of the signal motor, may be brought into operative position for setting the signal to "clear" by an extreme movement of the route lever. Movement of the lever T^1 to the right will correspondingly move downwardly the route contacts a^{121} and a^{12}, and thus contact a^{121} will be opened and contact a^{12} closed. The route lever T^1 and the parts operatively connected therewith (slide S^1, etc.) constitute route-selective devices. These route levers together form the selective apparatus.

Instead of route lever T^1 being employed for the setting of the signal by a further movement beyond the position indicated in Fig. 3, a special signal lever may be provided in the apparatus which would be made dependent upon the route lever. This lever would then have to operate the motor switches as well. Lever T^1 is further connected in well known manner with different locks (not shown in the figure) through the medium of the shaft T^{11} and the slide S^1; for example, with block apparatus or with electromagnetically releasable locks which make it possible to lock the same in the rest position (Fig. 2) or also in the shifted position (Fig. 3). Fig. 3 shows the condition of the contact switches and locks connected with slide S^1, which corresponds to the cleared condition for an arriving train from line a to siding 11, viz., the set route a^{11}. The corresponding positions of the track switch levers are P^1, P^2 &c. are here, for the sake of simplicity, indicated below the switch shafts, and by the signs + and — corresponding to the locking chart or table. The slide S^1, in this position, locks, as seen in Fig. 3, the operating levers of the switches 1, 2, 3 and 4. Shifting of the lever T^1 toward the right will in an analogous manner, set route a^{12}. Fig. 3 shows further all the levers T^1 to T^3, and the switches connected therewith, for the twelve routes which, for sake of simplicity, have mostly been omitted from Fig. 2.

In the circuits, as illustrated in Fig. 1, the supervising contacts 1 to 6 are shown, for example, connected one behind the other, in the same sequence in which they appear more spread out than in Fig. 2. All the other contacts in Fig. 1, except T^7 which is operated by a special lever, are represented by the same reference letters as the route contacts in Figs. 2 and 3. The connections are not designated in the latter figures because the circuits will be made clearer by putting the contacts in the sequence required for these circuits, as has been done in Fig. 1, regardless of the relative positions which they occupy in the apparatus. All contacts are represented in Fig. 1 in the rest position, thus some of the route contacts according to the upright position of levers T^1, T^2 . . . (Figs. 2 and 3) will be closed (a^{111}, a^{121} . . . b^{131}) others opened (a^{132}, a^{141} . . . c^{131}).

The route contacts (a^{11}, a^{12}, a^{13}, a^{14} are connected at the right with the coupling apparatus K^1 for the signal blade of signal Z^1 over conductor l^1, the contacts b^{11}, b^{12}, b^{13}, b^{14} with K^2, and the contacts c^{11}, etc. are connected with l^3 and K^3 or with l^4 and K^4 by the lever T^7, which controls respectively departures and arrivals upon the line c, that is, releases signal Z^3 or Z^4, as required. For the setting of route a^{11}, previously selected as an example and illustrated in Fig. 3, the following circuit will accordingly exist, see Fig. 1: from the battery terminal V, supervising contacts 1, 2, 3, 4, route contact a^{11}, l^1, K^1 to battery terminal E. The coupling current (signal releasing current) must therefore flow through the supervising contacts belonging to the four locked switches. If route c^{14} is to be set, then the coupling current for signal Z^3 (or Z^4) must first flow through only the supervising contacts 5 and 6. This is for the reason that for this route track switches 1, 2, 3 and 4 are free to be moved, and any contacts corresponding to these switches could be opened at any time by a shifting of these track switches which would result in a setting of the signal of line c to danger unintentionally. To remedy this, a route contact c^{141} (Fig. 1) is so arranged that it affords a side path for the coupling current when route c^{14} is arranged, by which the current can flow from battery terminal V over the contacts a^{111}, a^{121}, a^{131}, b^{111}, b^{121}, b^{131} to contacts 5 and 6 without passing through the contacts 1, 2, 3, 4, from which point it can pass by means of c^{14} and T^7 to l^3 or l^4 (K^3 or K^4). By means of the contact c^{141} the supervising contacts 1, 2, 3 and 4 are thus first made to become inoperative, while 5 and 6 remain operative to supervise. In similar manner for the setting of route a^{13}, contact a^{132} makes contacts 3 and 4 inoperative to supervise. Similarly, for route c^{13}, contacts 3 and 4 will be put out of supervising action by contact c^{131} etc.

The route contacts, which are those with two-figure indexes 11, 12, 13, 14, which are open in the rest position of the route lever, thus, on the one hand, operate to connect the signal coupling with the supervising contacts in well-known manner, but, on the other hand, operate to remove the supervising operation of certain supervising contacts (open route contacts with three-figure indexes a^{132}, a^{141}, b^{141}, c^{131}, b^{122}, c^{122}, c^{141}). In certain cases, however, this interrupting action of the last named contacts must be counteracted, as will appear from the following: For this purpose route contacts a^{111}, a^{121}, &c. are provided, which are normally closed and which come into operation when

two routes requiring different series of supervising contacts are to be set at the same time. For example, supposing route c^{14} is to be set, and, during this condition, that is, before the complete entrance of the train, a route a^{11} is also to be set. For this latter, contacts 1, 2, 3, 4, made inoperative by c^{141}, must be again made operative to supervise. The contact a^{111} takes care of this. Now, it is true, that not only the coupling current for signal Z^1, but also that for signal Z^3 (or Z^4) must flow through the contacts 1, 2, 3, 4, though this condition is now immaterial, since the track switches 1, 2, 3 and 4 are also locked by the setting of route a^{11}, so that an interruption of the coupling current during the proper working conditions is no more to be feared. In similar manner also can routes c^{13} and a^{11} or a^{12} be provided for at the same time, in which cases c^{131} short circuits contacts 3, 4, but a^{112} or a^{122} opens this short circuit. Or, a^{13} and c^{14} may be set simultaneously, whereupon the following takes place: a^{132} closes short circuit 3 and 4; c^{141} short circuits 1, 2, 3 and 4. The latter short circuit will be opened by a^{131}. It is immaterial in which sequence simultaneously possible routes are set or unset. If, for example, routes a^{13} and c^{14} are to be set and a train coming from a has completely passed into the siding 13, while the other, from c, is still on its way, then the contact a^{131} will be again closed by setting back route lever T^2 (Fig. 3), and thereby the short circuit from battery terminal V to 5, produced by the closing of c^{141} (on account of the setting the track for route c^{14}) is again made effective, so that signal Z^4 is dependent once more only upon the closed switches (5, 6). In similar manner can all the other dependencies be produced without regard to the entering lines.

The apparatus may also be so adapted that the contacts 1 to 6 are not operative to supervise in the rest position of the route levers, and are only made operative as circumstances require by the setting of the routes. This manner of operation has the advantage over that above described, in that a change of supervising condition resulting from a setting of a route does not have to be restored when other routes are set. In Fig. 4 such a modification of the invention is represented. T^1, T^2, etc., S^1, S^2, etc., a^{11}, a^{12}, a^{13}, etc., indicate similar parts, as already described. For better illustration the slides are shown in one plane with the levers. The short circuits 22, 32, 42 and 52 lying in shunt to the supervising contacts 1, 2, or 3, 4 and 5, 6 may be opened by means of longitudinally movable rods pertaining thereto respectively, which lie crosswise over the slides S. Contacts 1, 2, 3, 4, 5, 6, in the rest position as shown are not operative to supervise, since, for example, a current from battery terminal V to one of the switches a^{13}, a^{14} etc. will not be interrupted even by the opening of one of the contacts 1, 2, 3, 4, 5, 6, so long as contacts 22, 32, 42, 52 are closed. If, however, a route is to be set, the corresponding cam levers 25, 35, 45, pivotally arranged beneath projections 24, 34, 44, 54 of the rods are lifted by means of the projections 26 and 27 on the slide, and the necessary interruptions are thereby produced by means of the rods at the contacts 22, 32, etc., whereby the supervising condition for the contacts of the series 1 to 6 required for the route will be produced. If, for example, route a^{13} is to be set, then S^2 is moved toward the left, thereby mechanically locking the operating levers of track switches 1, 2, 5, and 6, and pushing upward rods 23 and 53 by means of the cam levers 25 and 55 above the rod S^2, whereby contacts 22 and 52 will be opened, thus making contacts 1, 2, 5 and 6 operative to supervise. A current from the battery terminal V must therefore flow through the contacts 1, 2, 5 and 6, in order to proceed to the signal over a^{13}. If, besides route a^{13}, route c^{14} is also to be set, then the cam levers situated over slide S^6 will be lifted. The electrical condition will, however, not be changed thereby, since rod 53 without this had already been moved up by S^2. The operativeness of contacts 5 and 6 which is necessary for route c^{14} thus already exists before the setting of route c^{14}. A further modification by which the necessary dependencies are obtained in the same way by varying the supervising operation of the supervising contacts is shown in Fig. 5, in which 22 is a short circuiting device which is opened when lever 25 is raised. This lever is connected fast to the lever 29, rotatable about the same axis, by a channel cross bar 28 which covers all the route slides S^1, S^2, etc. By movement of a slide those cross bars will be lifted in front of which the slide carries a projection 26 and 27, and thereby the short circuiting device pertaining thereto will be opened.

The lever system of Fig. 5 consisting of the channel bar 28 and the levers 25 and 29 is actually nothing more than a combination of the cam levers 25 as shown in Fig. 4 arranged one over the other, coöperating with a common rod 23. The contact 22 in Fig. 5 corresponds with the contact 22 of Fig. 4.

With the selective apparatus described, it may now happen that a signal for one of the routes may be placed at danger by a hasty setting of a route. For example, if, after route c^{14} (Fig. 4) is set and made dependent upon the switches 5 and 6, the route a^{11} which is dependent upon switches 1 to 4, should also be set, then, in case track switch 4 has still to be shifted, supervising contact 4 will be opened during the shifting the switch. If, now, the operator sets quickly

the slide S^1 for the route a^{11} before the shifting and locking of the switch points is properly completed, then the supervising operation of contact 4 will be prematurely produced, that is to say, so long as it is still open. Therefore, the current holding the signal for route c^{14} at "clear" will be interrupted at contact 4 and the signal will drop to "danger". In order that such interruptions may be prevented and a setting of a route be possible only when the switches are in proper condition, the selective apparatus, as described, is supplemented by a retarding apparatus (Fig. 6) which consists of a locking of the route selective devices by means of a particular series of auxiliary contacts. This device is used in combination with the main controlling system, such as is, for instance, illustrated in Fig. 4, but for the sake of clearness it has been omitted in that figure and has been illustrated separately in Fig. 6.

In Fig. 6 route levers U^1, U^2, U^3 are movable according to the manner described in Figs. 2 and 3, but for purposes of illustration, are shown movable only in one direction from the rest position. Route lever U^1 is shown in the rest position, while lever U^2 is represented in an intermediate position and lever U^3 is represented in the full shifted position (signal at "clear"). Their connection with the other parts of the apparatus is analogous to that of the levers T^1, T^2, etc. in Fig. 2, but, according to the modification shown in Fig. 6, for each route one lever and one slide is required. K^1, K^2, K^3 are, as before, signal couplings, or in general, devices which, when excited or conducting current, cause or make possible the movement of the signals to "clear". N^1, N^2, N^3 are lever locks operated by magnets M^1, M^2, M^3. 1, 2, 3, . . . 6 have the same signification as in Fig. 2. 1^a, 2^a, 3^a . . . 6^a are the simultaneously acting auxiliary contacts. Their connection with the supervising magnets is the same as appears in Fig. 2. The series of contacts A and B contain as before short circuiting devices A^{22}, A^{32}, A^{42}, A^{52}, B^{22}, B^{32}, B^{42}, B^{52}, which, in regard to the electrical connections and manner of working, correspond to the short circuiting devices 22, 32, 42, 52 of Fig. 4, with the difference, however, that the short circuit devices of series A are selectively interrupted, in well known manner, when lever U^2 is in the position represented in Fig. 6; while the short circuit devices B^{22} . . . B^{52} in this position of the lever still remain unaffected and will be interrupted only after lever U^3 reaches the full shifted position shown in accordance with the chart of lockings. This difference of operation can, for example, be obtained by an apparatus of slightly different form from that shown in Fig. 5. For this purpose the channel bar 28, Fig. 5, has the cross-section shown in Fig. 6 at D, D^1, D^2. Lever C of Fig. 6 corresponds to the lever 25 of Fig. 5, but carries, at its free end two insulated contact buttons, which, in the rest position of lever C, occupy different relative positions unequally distant from the lower pair of contact levers of groups A and B, of which here merely A^{22} and B^{22} and A^{52} and B^{52} are indicated.

Lever C is shown in three positions, each of which coresponds to the equivalent positions of the route levers U^1, U^2, U^3, by which it is controlled through the medium of one of the slides S^1, S^2, S^3. Thus, accordingly, for the lever position U^2, in which the slide projections 27 engage lever C at the middle step D^1 of the channel bar D, the short circuit device A^{22} is opened, B^{22} closed; for U^3 both (here indicated with B^{52} and A^{52}) opened, for U^1 both closed. Thus, if a route lever be shifted out of position U^1 into position U^2, then the auxiliary contacts corresponding to the route (the upper series Fig. 6) will be made able to supervise by the removal of their short circuits, and there occurs a circuit for the current from battery terminal V over the auxiliary contacts A (1^a, 2^a, etc.) over the route contacts 201, 203, magnet M^2, to the grounded battery terminal E. The magnet M^2 now operative removes the lever lock N^2. Now, lever U^2 can be completely thrown over and thereby a new signal-operating circuit will be closed from V, contact series B, contact 201, 204, signal coupling K^2, battery terminal E. A similar circuit may also result by means of lever U^3 of which the releasing magnet M^3, as distinguished from M^1 and M^2, is so connected, for example, that it also supervises the condition of the coupling current circuit during the clear position of the signal and by means of a color disk or an indicator moved by the armature can indicate the same.

The operation of the apparatus will be explained by the following example: Lever U^2 may correspond to route a^{12} previously mentioned, lever U^3 to route c^{14} which can be set simultaneously. The levers are in the position indicated in Fig. 6: U^3 is shifted over. The signal belonging thereto, which must be dependent upon the contacts 5 and 6 according to the locking chart, stands at clear, the short circuiting devices A^{52} and B^{52} are open, but at the same time the short circuiting devices A^{22} and A^{32} are also opened by S^2, since the contacts which belong to track switches 1, 2 and 3 must be supervised for the route a^{12}. If, for example, track switch 2 at this time is not in proper condition, then the releasing circuit previously described for magnet M^2 is not possible, on account of the interruption at contact 2^a, and lever U^2 could not be further moved. At the same time, it also results that the disturbance at track switch 2 can

not influence the signal controlled by lever U^3, since the signal coupling K^3 lies in a circuit with the lower series of contacts B in which only B^{32} is interrupted, so that only contacts 5 and 6 are operative to supervise. After removal of the disturbance at the track switch, that is, when the auxiliary contact 1^a, 2^a, etc., is closed, lever U^2 may now also be shifted, and B^{22}, B^{32} opened, and then, this interruption effects no disturbance of the signal circuit since the contacts 1 and 2 of the lower series must also now be closed. The locking of the route selective devices may also be obtained for all selective devices at the same time, and without an auxiliary series of contacts, as shown in Fig. 7, wherein 1 to 6, as also 22, 32, 42 and 52 have the same significance as in Fig. 4. 61 to 66 are contacts which are provided for the connecting of alarm apparatus. They are controlled by the supervising devices and are opened when the track switches are in proper condition. If this condition be changed, thus closing one of these contacts, then magnet G is excited and the selective devices will be locked. An apparatus for such common locking for all slides is represented in Fig. 8. Every slide S is provided with notches E^1, E^2, E^3 which are in position to be engaged by locking element F^1 which is situated above all the slides and is moved into locking position by means of an electro magnet G. This locking may also be effected with deënergized magnets. In Fig. 9, P is a light, pivotally mounted armature by which any suitable element such as H^1, which is moved by each slide S, is locked. H^1 is, for example, a bar provided with sloping engaging surfaces which engage in suitable notches I^1 I^2 of the slides S. One could also make the bars H^1 sharp cornered like F^1 in Fig. 8, and allow them to drop into sharp cornered notches (like E in Fig. 8) of the slide S. In this case, lever H, Fig. 9, must be provided with a handle by which the locking may be removed, which, of course, is only possible if armature P has fallen away. If the locking of the slide is to be made dependent upon a permanent current, then the releasing magnet G (Fig. 10) will be arranged behind the series of contacts 71, 72, etc. which are controlled by the supervising devices. This kind of locking also requires no special series of contacts, since contacts 71, 72, etc. usually provided for the alarm apparatus may be used.

In certain cases it is necessary to give the operator the ability to release the selective devices independently of the condition of the supervising contacts. This may, for example, be done by placing under the control of the operator a key which closes or opens the circuit of electromagnet G or a lever which operates directly on the lever F or H. Since a mechanical dependency always exists between the operating lever of a track switch and the selective element which makes the supervising contact belonging to this track switch able to supervise, the locking element which produces this dependency can be used according to this invention for operating the short circuit devices 22, 32, etc. In Fig. 11, for example, are two shafts shown, W^1, W^2 connected with track switch levers, which are dependent upon locking elements w^{11}, w^{21}, w^{22}. On movement of slide S to the left A and A^2 are raised. On movement to the right, only A^2 is raised. Similary, by movement to the left both shafts are locked, and in movement to the right only shaft W^2 is locked. By this arrangement an absolutely reliable agreement of the electrical with the mechanical dependencies is obtained.

Having thus described my invention, the following is what I claim as new therein and desire to secure by Letters Patent:

1. In a switch and signal setting and controlling apparatus, the combination of a single series of supervising devices dependent upon the condition of the switches, selective devices for the routes, and means operated by the selective devices for making only the supervising devices belonging to the selected route operative.

2. Apparatus for causing a dependent operation of switches and signals, said apparatus comprising a single series of supervising devices respectively corresponding to and dependent upon the switches, said devices connected in sequence in the signal controlling circuit, side paths or shunts connected with said series for certain of the said supervising devices, and selective devices corresponding to routes for opening and closing said side paths.

3. Interdependent switch and signal apparatus for switch yards and entering lines, said apparatus comprising the combination of a single series of supervising devices for and desired number of entering lines, said supervising devices dependent upon the condition of the switches and arranged in fixed order of sequence in the signal circuit, route selective devices for setting the required train routes to and from the entering lines, and means controlled by said selective devices for rendering operative only supervising devices of said series desired for the switches to be set for the selected route.

4. Interdependent switch and signal apparatus for switch yards and entering lines, said apparatus comprising the combination of a single series of supervising devices for any desired number of entering lines, said supervising devices dependent upon the condition of the switches and arranged in fixed order of sequence in the signal circuit, short circuits for cutting out one or more of said supervising contacts, route selective devices for setting the required train routes to and

from the entering lines, and means controlled by said selective devices for controlling said short circuits for rendering operative only supervising devices of said series desired for the switches to be set for the selected route.

5. Interdependent switch and signal apparatus for switch yards and entering lines, said apparatus comprising the combination of a single series of supervising devices for any desired number of entering lines, said supervising devices dependent upon the condition of the switches and arranged in fixed order of sequence in the signal circuit, said supervising devices normally inoperative, route selective devices for setting the required train routes to and from the entering lines, and means controlled by said selective devices for making operative the supervising devices pertaining to the switches involved in the selected route.

6. Interdependent switch and signal apparatus for switch yards and entering lines, said apparatus comprising the combination of a single series of supervising devices for any desired number of entering lines, said supervising devices dependent upon the condition of the switches and arranged in fixed order of sequence in the signal circuit, route selective devices for setting the required train routes to and from the entering lines, means controlled by said selective devices for rendering operative only supervising devices of said series desired for the switches to be set for the selected route, switch controlling devices and selective interlocking means between the selective devices and the switch-controlling devices for locking the controlling devices of those switches which are involved in the selected route.

7. Interdependent switch and signal apparatus for switch yards and entering lines, said apparatus comprising the combination of a single series of supervising devices for any desired number of entering lines, said supervising devices dependent upon the condition of the switches and arranged in fixed order of sequence in the signal circuit, said supervising devices inoperative in their normal or rest position, route selective devices for setting the required train routes to and from the entering lines, and means controlled by said selective devices for making operative those supervising devices which belong to the switches involved in the selected route.

8. Interdependent switch and signal apparatus for switch yards and entering lines, said apparatus comprising the combination of a single series of supervising devices for any desired number of entering lines, said supervising devices dependent upon the condition of the switches and arranged in fixed order of sequence in the signal circuit, normal closed shunt circuits around said series of said supervising devices, route selective devices for setting the required train routes to and from the entering lines, and means controlled by said selective devices for selectively opening said shunt circuits, whereby the supervising devices belonging to the selected route are made operative.

9. Interdependent switch and signal apparatus for switch yards and entering lines, said apparatus comprising the combination of a single series of supervising devices for any desired number of entering lines, said supervising devices dependent upon the condition of the switches and arranged in a fixed order of sequence in the signal controlling circuit, normally closed shunt circuits around said supervising devices, a series of auxiliary circuit controlling devices also in shunt to the supervising devices and corresponding respectively thereto, route selective devices for setting the required train routes to and from the entering lines, means controlled by said selective devices for selectively opening the shunt circuits around the supervising devices pertaining to the switches involved in the selected route, lock devices for said selective devices, said lock devices dependent upon the auxiliary circuit controlling devices, whereby premature supervising action of the supervising devices is obviated.

10. Interdependent switch and signal apparatus for switch yards and entering lines, said apparatus comprising the combination of a single series of supervising devices for any desired number of entering lines, said supervising devices dependent upon the condition of the switches and arranged in fixed order of sequence in the signal circuit, route selective devices for setting the required train routes to and from the entering lines, means controlled by said selective devices for rendering operative only supervising devices of said series desired for the switches to be set for the selected route and common locking means for the selective devices, a circuit for operating said locking means, circuit closers in said circuit corresponding respectively to the supervising devices and dependent respectively thereon, whereby disturbances of a track switch involved in the selected route will operate through its supervising device to control the corresponding circuit closer and operate said locking means.

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Witnesses:

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