(No Model.) 3 Sheets—Sheet 1.

G. KOENIG & S. H. STUPAKOFF.

INTERLOCKING APPARATUS FOR OPERATING SIGNALS.

No. 424,485. Patented Apr. 1, 1890.

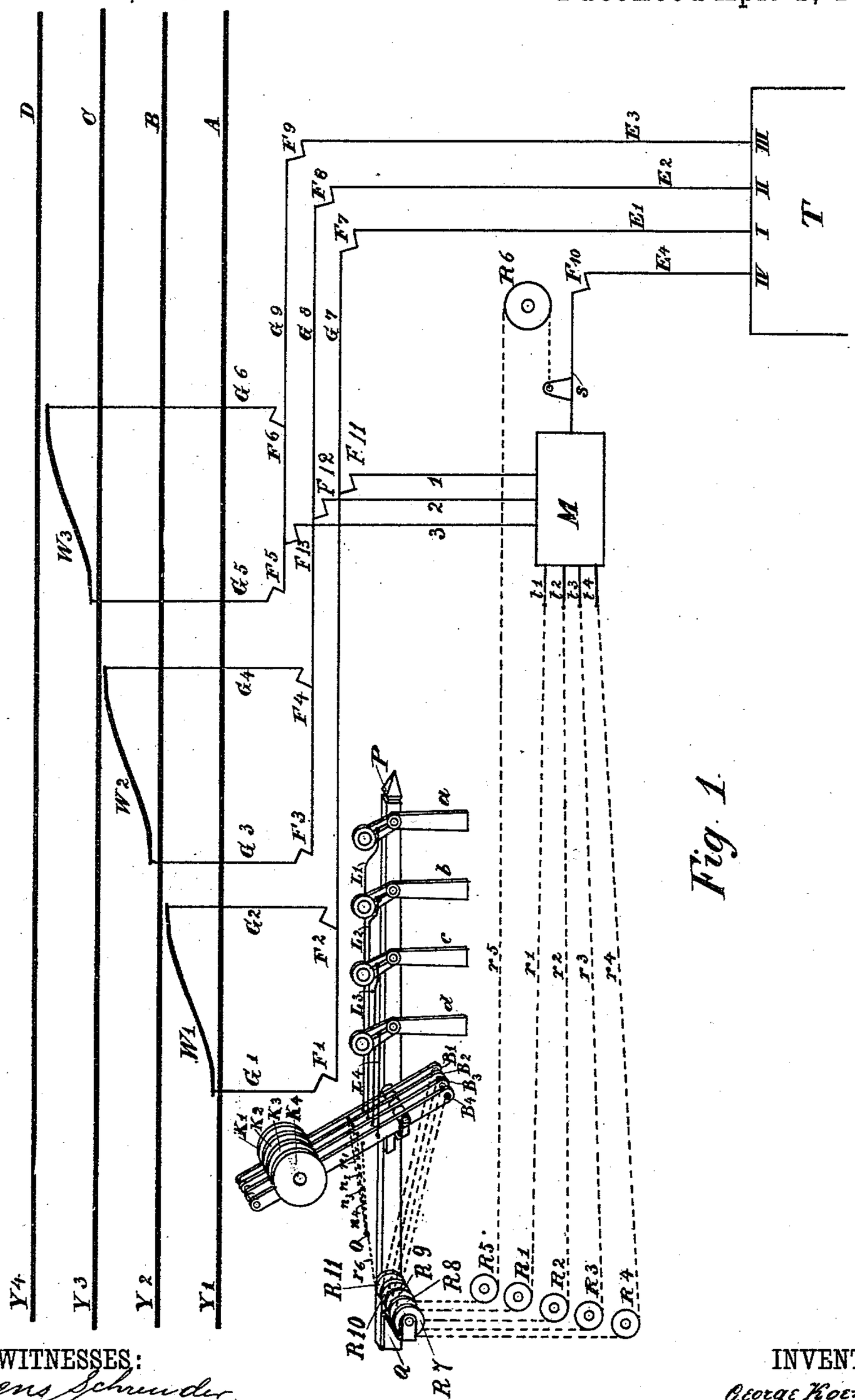

Fig. 1.

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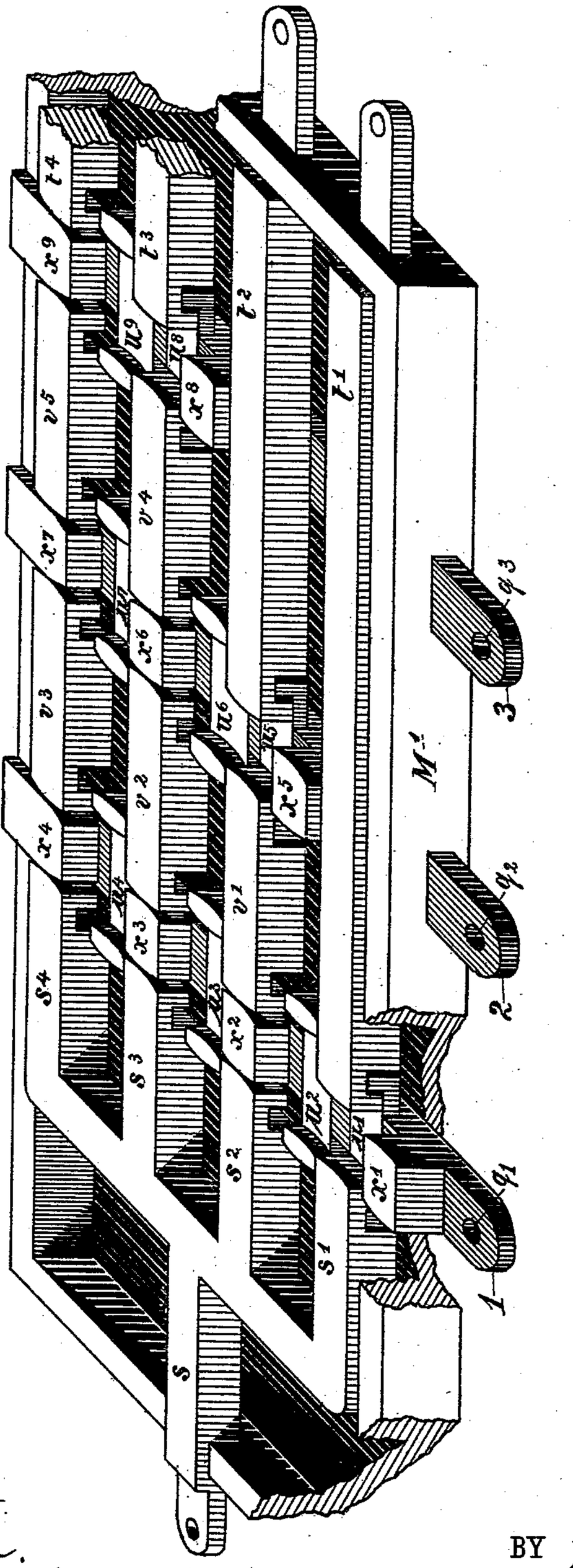
Fig. 2.



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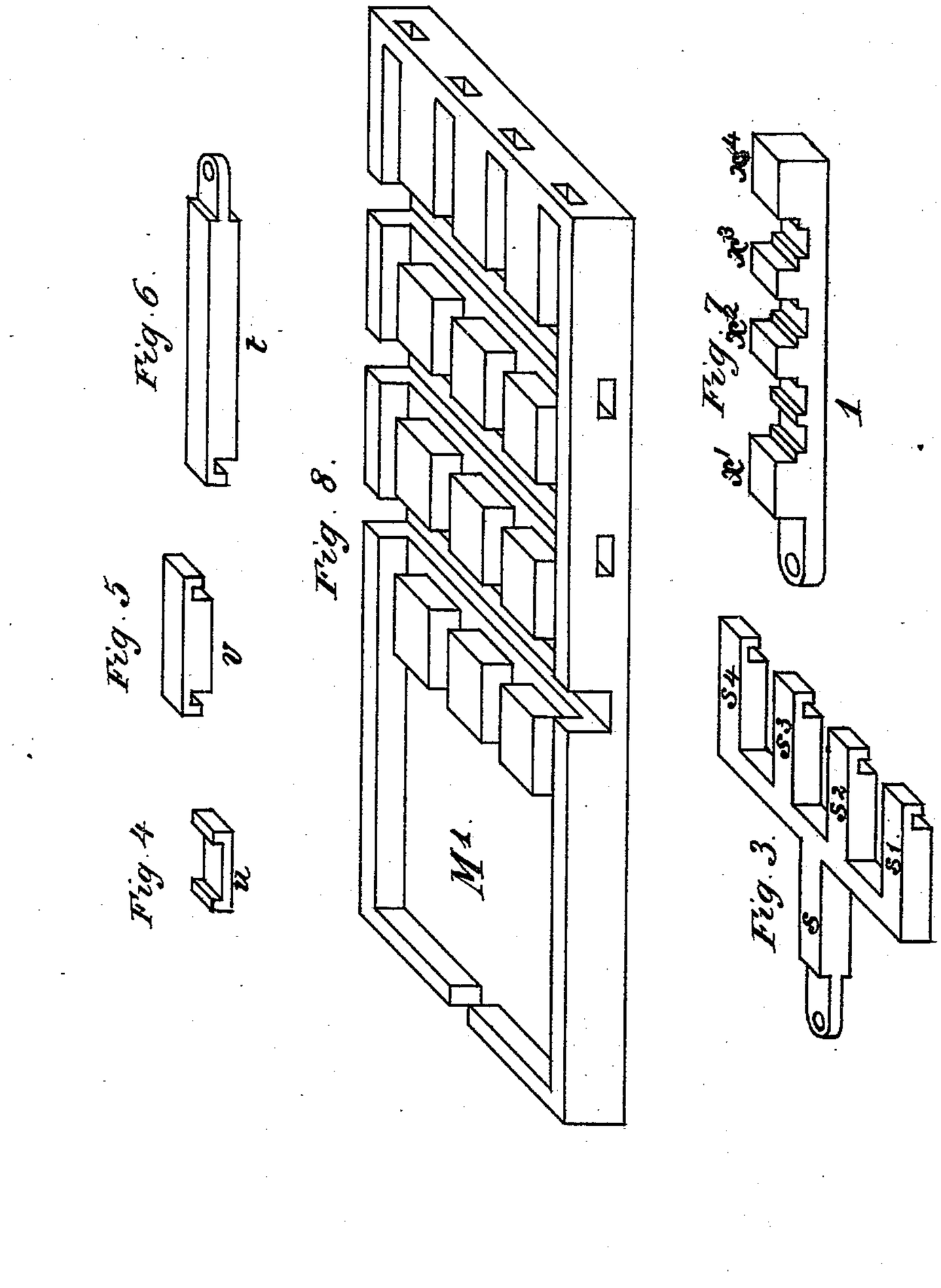

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GEORGE KOENIG AND SIMON HEINRICH STUPAKOFF, OF PITTSBURG, PENNSYLVANIA.

INTERLOCKING APPARATUS FOR OPERATING SIGNALS.

SPECIFICATION forming part of Letters Patent No. 424,485, dated April 1, 1890.

Application filed March 1, 1889. Renewed February 14, 1890. Serial No. 340,476. (No model.)

To all whom it may concern:

Be it known that we, GEORGE KOENIG and SIMON HEINRICH STUPAKOFF, both of the city of Pittsburg, county of Allegheny, and State of Pennsylvania, have invented certain new and useful Improvements in Interlocking Apparatuses for Operating Signals in Combination with Switches; and we do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it pertains to make and use the same, reference being had to the accompanying drawings, which form a part of this specification.

Our invention relates to a novel combination and construction of parts of such safety appliances for railroads as are known by the name of "selectors," and serves for the purpose of operating, by means of one single lever, two or more signals indicating the position of the switches pertaining to the same.

Our invention applies equally to railroad interlocking-machines which are used in signal-towers and in which the interlocking of the switch and signal levers is directly effected by suitable locking devices. Mechanical selectors heretofore applied for operating several signal-blades by means of one lever were absolutely safe only for two blades, while others, relying on gravity or springs, had grave objections in all cases.

The object of our invention is to provide such an improvement upon the construction of selectors as in a simple device will combine cheapness with durability and absolute safety for all and any number of train movements which are dependent upon a correct position of the signal-blades and the relative position of the switches and cross-overs pertaining to the same. This we accomplish by the division of the rods which lead to the various signal-blades into a certain number of parts corresponding to the arrangement and the requirements of the switches and cross-overs, effecting thereby the possibility of moving one end of such rods independently of the other, and by the interposition of coupling pieces or clutches at such points of interruption, which, being guided and regulated in their relative position to the rods operating the signals by rods standing in connection with the switches, will effect a coupling or uncoupling of the continuation of the connecting-rod common to all signals and its branch or branches leading to the respective signal-blades pertaining to the same, and by interposing locking-blocks between the switch-rods by means of the signal-rods, or, vice versa, between the signal-rods by means of the switch-rods, as the requirements may prescribe.

In the accompanying drawings, Figure 1 represents the general arrangement of a portion of a railroad-plant. Fig. 2 is a perspective view of the selector in its normal position, the top plate being removed. Fig. 3 is a perspective view of the common connecting-rod with its prongs. Fig. 4 is a perspective view of the coupling-piece. Fig. 5 is a perspective view of the intermediate signal-bar. Fig. 6 is a perspective view of a single signal-bar. Fig. 7 is a perspective view of a locking or switch bar, and Fig. 8 is a perspective view of the base of the selector from which all working and moving parts have been removed.

Like letters and figures denote like parts in all the drawings.

Referring to Fig. 1, A, B, C, and D indicate four parallel tracks, which are provided with three cross-over switches W' W^2 W^3. The switches are connected by the rods G', G^2, G^3, G^4, G^5, and G^6 to the bell-cranks F', F^2, F^3, F^4, F^5, and F^6, respectively, and a further connection between these and the bell-cranks F^7, F^8, and F^9 is effected by the rods G^7, G^8, and G^9, respectively, while E', E^2, and E^3 represent rods coupling those bell-cranks to the levers I, II, and III of the interlocking machine placed in the tower T. The lever IV of the interlocking machine is connected with the selector M by means of the rod E^4, bell-crank F^{10}, and the sliding bar *s*. This sliding bar *s* enters the selector, and continuing through the same and through the mechanism within leaves it in the shape of four separate sliding bars, which are indicated by the letters t', t^2, t^3, and t^4. Four wires (indicated in the drawings by dotted lines and the letters r', r^2, r^3, and r^4) are fastened to the ends of these sliding bars and continue over the pulleys or wire sheaves R', R^2, R^3, and R^4 to the four

balance-levers B′, B², B³, and B⁴ of the signal-post P. This signal-post P is also provided with four signal-blades *a*, *b*, *c*, and *d*, five wire sheaves R¹¹, R⁷, R⁸, R⁹, R¹⁰, and one bracket Q for the reception of such wire sheaves. A connection between the balance-levers and the signal-blades is effected by the rods L′, L², L³, and L⁴. The balance-levers are provided with the counter-weights K′, K², K³, and K⁴ and the wires *n*′, *n*², *n*³, and *n*⁴, which latter are jointed at the point O to the back wire *r*⁶, which returns over the wire sheave R⁵, as wire *r*⁵ over the wire sheave R⁶ to the sliding bar *s* of the selector M. The locking-bars 1, 2, and 3 stand in connection with the rods G⁷, G⁸, and G⁹ by the interposed bell-cranks F¹¹, F¹², and F¹³.

In Fig. 2, M represents the casing for the selector mechanism. *s* is a sliding bar terminating in the four prongs *s*′, *s*², *s*³, and *s*⁴. *t*′, *t*², *t*³, and *t*⁴ are sliding bars fitted loosely and independently from but in line with the prongs *s*′, *s*², *s*³, and *s*⁴ to the base of the selector. 1, 2, and 3 are sliding bars placed at an angle to the sliding bars *t*′, *t*², *t*³, and *t*⁴. *u*′, *u*², *u*³, *u*⁴, *u*⁵, *u*⁶, *u*⁷, *u*⁸, and *u*⁹ are coupling-pieces loosely fitted to and guided by the bars 1, 2, and 3, and made in such a way that they may slide freely with these or in the direction from *s* to *t*, or vice versa, with the set of interrupted sliding bars, as their relative position to either of them will permit. *v*′, *v*², *v*³, *v*⁴, and *v*⁵ are intermediate bars placed in line with and between the sliding bars *t*′ *t*² *t*³ *t*⁴ and the prongs *s*′, *s*², *s*³, and *s*⁴ of the sliding bar *s*, and *x*′, *x*², *x*³, *x*⁴, *x*⁵, *x*⁶, *x*⁷, *x*⁸, and *x*⁹ are extensions of the sliding bars 1, 2, and 3, protruding within reach of the sliding bars *t*′ *t*² *t*³ *t*⁴, the intermediate bars *v*′ to *v*⁵, and the prongs *s*′ to *s*⁴, respectively.

Before entering into a detailed description of our device we deem it advisable to explain some of the requirements of a perfect railroad plant and the relation which exists between the various semaphore-blades mounted on one signal-post and the right of way for moving trains on tracks which are governed by said signal-blades. To this effect we refer to the accompanying drawings on Sheet 1, in which a part of a railroad plant is illustrated.

The usual way adopted for indicating the position of the switches in regard to the tracks is that the upper blade of the signal indicated by the letter *a* has always and only reference to trains moving from Y′ to A. The second blade *b* refers in the same way to trains moving from Y′ to B, the third for trains from Y′ to C, and the fourth *d* for trains from Y′ to D, and so on, if more tracks should be provided for. Under normal position of the cross-over switches it is understood that trains moving from Y′ have right of way to A, trains from Y² to B, from Y³ to C, and from Y⁴ to D, and no other one. The normal position of all signal-blades is the horizontal or "danger" position. Therefore it should be evident that if a train is given the right of way from Y′ to A by a "safety" or downward position of the signal *a* the switch W′ should be locked in its normal position in order to prevent a train from B coming in collision with the same, and the switch W′ in its normal position should prevent from giving any other signal but that for the straight route from Y′ to A; but at the same time it should not prevent from moving or reversing the switches W² and W³, as in this case there is nothing in the way to interfere with trains moving from Y² to C or D and from Y³ to D, or vice versa in the opposite direction. If, however, a train approaching from Y′ is given the right of way over the cross-over switches W′ to B, then it will be necessary that the cross-over switches W′, should be locked in the reversed position, while the cross-over switches W² should be locked in their normal positions, and the cross-over switches W³ should be free to occupy either their normal or their reversed positions. Furthermore, should the signal *b* occupy the reversed or the "safety" position, the signals *a*, *c*, and *d* should be locked in their normal or "danger" positions. In a third case, when a train has the right of way from Y′ to C, the cross-over switches W′ and W² must be reversed and the cross-over switches W³ must occupy their normal positions. The signals *a*, *b*, and *d* must be locked in their normal positions, while the reversing of signal-blade *c* to the "safety" position should thus lock the switches. Finally, it is necessary that if a train has the right of way from Y′ over the cross-over switches W′, W², and W³ to D, all switches must occupy a reversed position, the signal-blades *a*, *b*, and *c* must be locked in their normal or "danger" position, and a moving of the signal-blade *d* must effect a locking of all the switches in their reversed position.

The main principle upon which the whole system of interlocking is based consists therein that a "safety" signal should not be given before the switches pertaining to the same have been placed in their proper position, and therefore the unlocking of the signal from the "danger" position should not be possible before the reversing of the switches actually has taken place. Moreover, a throwing back of the switches should not be possible unless the "signal" pertaining to them occupies its "danger" position, and therefore the unlocking of the switches should not be performed before the signals have fully completed their stroke and stand at their "danger" position, while the locking of such signals as would indicate in their "safety" positions different routes than the one opened and determined by the switch or switches within its direction should take place at the beginning of the movement of such switch or switches; and, finally, the switches should be locked in their relative positions at the beginning of the movement of the signals.

The purpose of our invention is to effect the interlocking of switches and signals strictly

after this principle and in a way like or similar to the one just described, which is only a single instance of the many cases which may occur; to operate two or more signal-blades with one single lever, and to interlock signals and switches mechanically by means of a safety device, which may be placed at any point between the interlocking machine, the signals, and the switches, and either in close proximity to the operating-lever, the track, the signals, or the switches, or at any distance from the same, as the requirements or convenience may prescribe. To the best of our knowledge this has heretofore never been accomplished for more than two signals at a time.

The operation of our selector is as follows: In the normal position, as shown in Fig. 2, the rod *s*, with its four prongs s', s^2, s^3, and s^4, occupies a position which will enable a motion of the same in an outward direction to the left. The sliding bars 1, 2, and 3, whose relative position is directly dependent upon the position of the switches, and which, in consequence thereof, we shall call the "switch-bars" of the selector, are drawn out and occupy a position which permits an inward motion of the same—that is, a motion in the direction from their eyes q', q^2, and q^3 toward the selector. The position of the coupling-pieces, which is in the first line determined by the position of the switch-bars, is in this case as follows: u' couples s' to t'. The couplings u^2, u^3, and u^4, which need to occupy a position between the prongs s^2 s^3 s^4 and the intermediate bars v', v^2, and v^3, respectively, in order to effect a combination of the rod *s* with the sliding bars t^2, t^3, and t^4, are entirely withdrawn from the corresponding clutches of the prongs s^2 s^3 s^4 and those of the intermediate bars v', v^2, and v^3. The connection between the operating-rod *s* and the signal-bars t^2, t^3, and t^4 is therefore interrupted, and a movement of the connecting-rod *s* in consequence thereof will affect only the signal-bar t', while the bars t^2, t^3, and t^4 are securely locked (that is, prevented from moving) by the upwardly-extending locking-blocks x^2 x^3 x^4 of the switch-bar 1 in one direction and by the offsets in the bars lying against the rim of the box in the other direction. A slight movement of the connecting-rod *s*, with the signal-bar t' thus secured to the same, locks, therefore, at once the switch-bar 1 in one way by the clutch u^2 with the signal-bar t', and by the locking-block x' with the signal-bar t' in the other way, while the switch-bars 2 and 3 are in no way prevented from changing their position. It will be noticed that before another combination of interlocking can be obtained it is absolutely necessary to return the signal-bar t', with the clutch u' and the operating-rod *s*, to the normal position.

The second combination will take place after the switch-bar 1 has been moved, or after it occupies a position which is reversed from the normal one. A reversing of this bar carries along the clutches u' u^2 u^3 u^4 in the same direction toward which it is moved and effects a combination between the prongs s^2 s^3 s^4 and the intermediate bars v', v^2, and v^3, respectively. The locking-block x' will now occupy a position between the prong s' and the signal-bar t', while the locking-blocks x^2, x^3, and x^4, on account of their removal from the signal-bar passages, will allow the intermediate bars v', v^2, and v^3 to be moved. The clutch u^5 being placed at the normal position of the switch-bar 2, in line with signal-bar t^2, will complete in this case the connection from s^2 to t^2 by way of the intermediate bar v', while the connections between t' t^3 t^4 and s', s^3, and s^4 are interrupted at x', x^6, and x^7, respectively, which locking-blocks as parts of the switch-bars prevent the signal-bars t', t^3, and t^4 in this position from being moved in the direction toward the connecting-rod *s*. On withdrawal of the rod *s* from the selector, and with it the movement of the signal-bar t^2, the clutches u^2 u^3 u^4 u^5 and the intermediate bars v' v^2 v^3 will effect at once a locking of the switch-bar 1 at x^2, x^3, and x^4 in the reversed and of the switch-bar 2 at x^5 in the normal position. The switch-bar 3, however, is not locked and free to be moved in either the normal or the reversed position.

We will now return all parts to their normal position, in order to procure a third combination. To effect this, we shall reverse the switch-bars 1 and 2 and leave the switch-bar 3 in its normal position. As before, the switch-bar 1 will carry along with it the clutches u', u^2, u^3, and u^4, and will place its locking-block x' between s' and t', while the switch-bar 2 will shift the clutches u^5, u^6, and u^7, disconnecting thereby v' and t^2 and connecting v^2 and v^4 and v^3 and v^5, respectively, unlocking at the same time the signal-bars t^3 and t^4, but locking the signal-bar t^2 on account of the different positions which the locking-blocks x^6, x^7, and x^5 occupy after this movement has taken place. The switch-bar 3, being in its normal position, will hold t^4 also in its normal position, locked with the locking-block x^9, while with the clutch u^8 the connection of s^3 with t^3 is completed by the aid of v^4, u^6, v^2, and u^3. A pulling of the connecting-rod *s* will therefore affect the position of the signal-bar t^3, and in doing this it locks the switch-bar 3, while the signal-bars t', t^2, and t^4 are in no way affected, but locked in their normal positions by the interposed locking-blocks x', x^5, and x^9, respectively. At the same time a locking of switch-bars 1 and 2 will take place by means of the intermediate bars v', v^2, v^3, v^4, and v^5, which have been moved in front of the locking-blocks x^2, x^3, x^4, x^6, and x^7, respectively. Again, we will presume that everything in our selector occupies its normal position, and we shall proceed to complete the fourth and last combination, which we are able to obtain with the identical apparatus shown in the drawings. We now reverse the switch-bars 1, 2, and 3. In addition to the shifting of the clutches and

locking-blocks dependent from and proper to the switch-bars 1 and 2, as before mentioned, we shift in this case by means of the switch-bar 3 also the clutches u^8 and u^9 and the locking-blocks x^8 and x^9, thereby unlocking the signal-bar t^4 and coupling the same to the operating-rod s by the aid of u^9, v^5, u^7, v^3, and u^4 and uncoupling and locking signal-bar t^3. A pulling of the rod s will now affect signal-bar t^4, while it will not affect signal-bars t', t^2, and t^3, and it will lock all the switch-bars in their reversed position.

Now it is evident that in the same way and by the same means like results may be obtained if it should be required to operate more or less switches and signals by interlocking with each other. As in the first case, it only will be necessary to add one or more signal or switch bars with the proper number of clutches or couplings and intermediate bars, while in the second case a corresponding number of bars, clutches, intermediate pieces, and locking-blocks have to be omitted, and also any number of combinations may be obtained by merely interchanging the working parts of the mechanism. Therefore we do not limit ourselves to a mechanism in which an interlocking of the different parts should take place in exactly the same way and order as in the example given in this specification; neither do we limit ourselves to the construction and to the arrangement of the operating parts, as such will readily suggest themselves to any one acquainted with the art to which this device pertains, and though we do not claim, broadly, a selector in which, by means of one operating-rod, one of several signal-blades is operated,

We do claim as our invention—

1. In an interlocking apparatus for switch and signal movements, the combination of the clutches with the longitudinal signal-bars formed in sections and the transverse interlocking bars, substantially as and for the purpose set forth.

2. In a switch and signal interlocking apparatus, the combination, with a switch or switches controlling two or more railway-tracks, of one actuating-rod for working all said signals, a series of signal-bars, one for each signal, formed in sections and having prongs or hooks at either end of said sections, a series of transverse switch-bars, one for each switch, having loosely mounted thereon a number of clutches, said switch-bars when reciprocated laterally being adapted to control the engagement and connection of either of said signal-bars with the actuating-rod by means of said clutches or coupling-pieces and the disengagement of all others, substantially as and for the purpose set forth.

3. In a switch and signal interlocking apparatus, the combination, with a switch or switches controlling two or more railway-tracks, of an actuating-rod provided with prongs or hooks for working all said signals, a series of signal-bars, one for each signal and formed in sections, a series of transverse switch-bars, one for each switch, having loosely mounted thereon a number of clutches or coupling-pieces, said switch-bars being also provided with a number of locking blocks or extensions, whereby when said bars are reciprocated laterally the engagement and connection of either said longitudinal bars with the actuating-rod is effected and the disengagement and locking of all others, substantially as herein set forth.

In testimony that we claim the foregoing we hereunto affix our signatures this 27th day of February, A. D. 1889.

GEORGE KOENIG. [L. S.]
SIMON HEINRICH STUPAKOFF. [L. S.]

In presence of—
JAMES BRYAR,
WILLIAM J. SIMPSON.