(No Model.) 8 Sheets—Sheet 1.

J. G. SCHREUDER.

SWITCH AND SIGNAL APPARATUS.

No. 575,908. Patented Jan. 26, 1897.

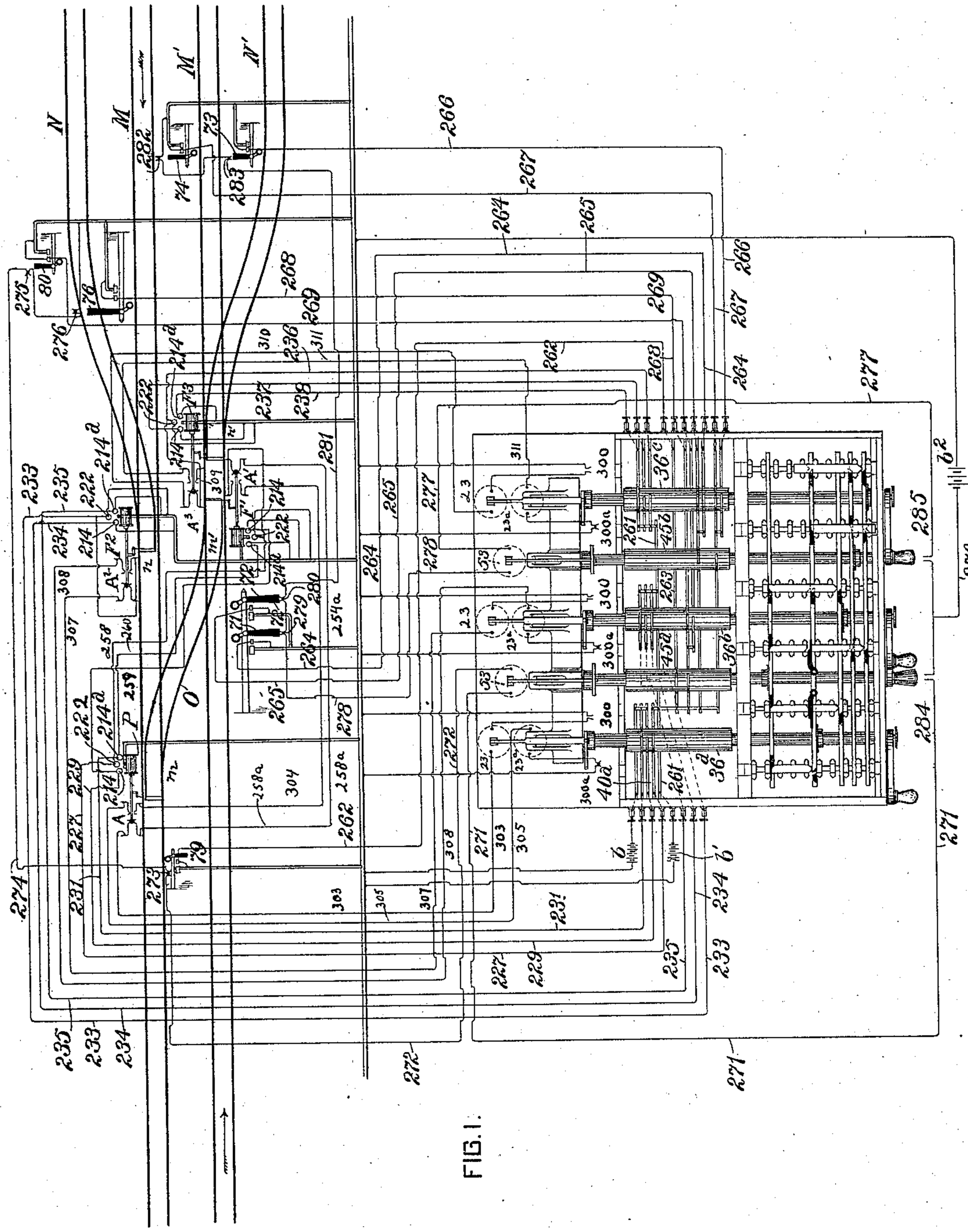

FIG. 1.

WITNESSES:

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F. E. Gaither

INVENTOR,

Jens G. Schreuder

by Dennis S. Wolcott Att'y.

(No Model.)

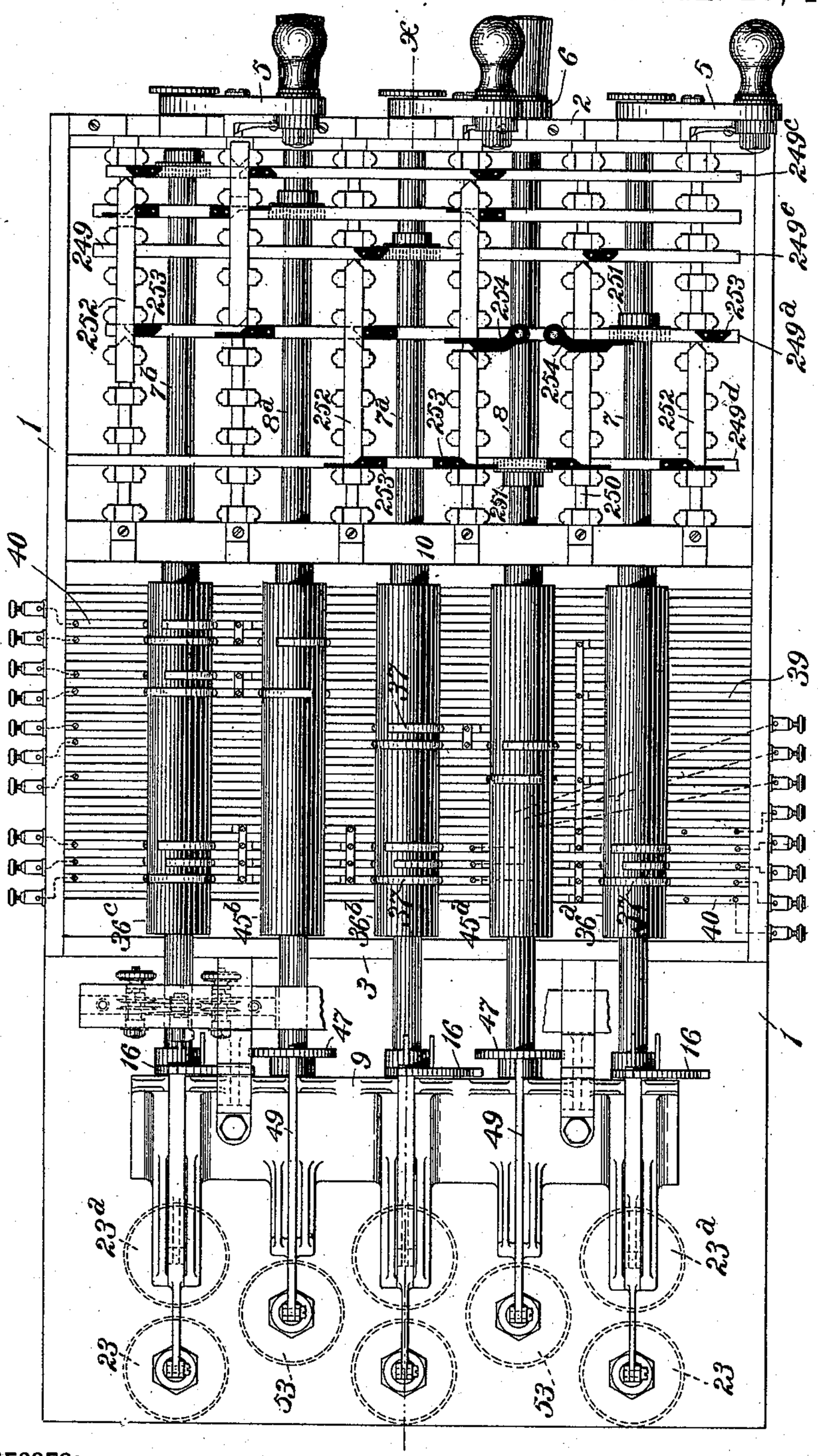
8 Sheets—Sheet 2.

J. G. SCHREUDER.

SWITCH AND SIGNAL APPARATUS.

No. 575,908. Patented Jan. 26, 1897.

FIG. 2.



WITNESSES:

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(No Model.) 8 Sheets—Sheet 3.

J. G. SCHREUDER.

SWITCH AND SIGNAL APPARATUS.

No. 575,908. Patented Jan. 26, 1897.

FIG. 3.

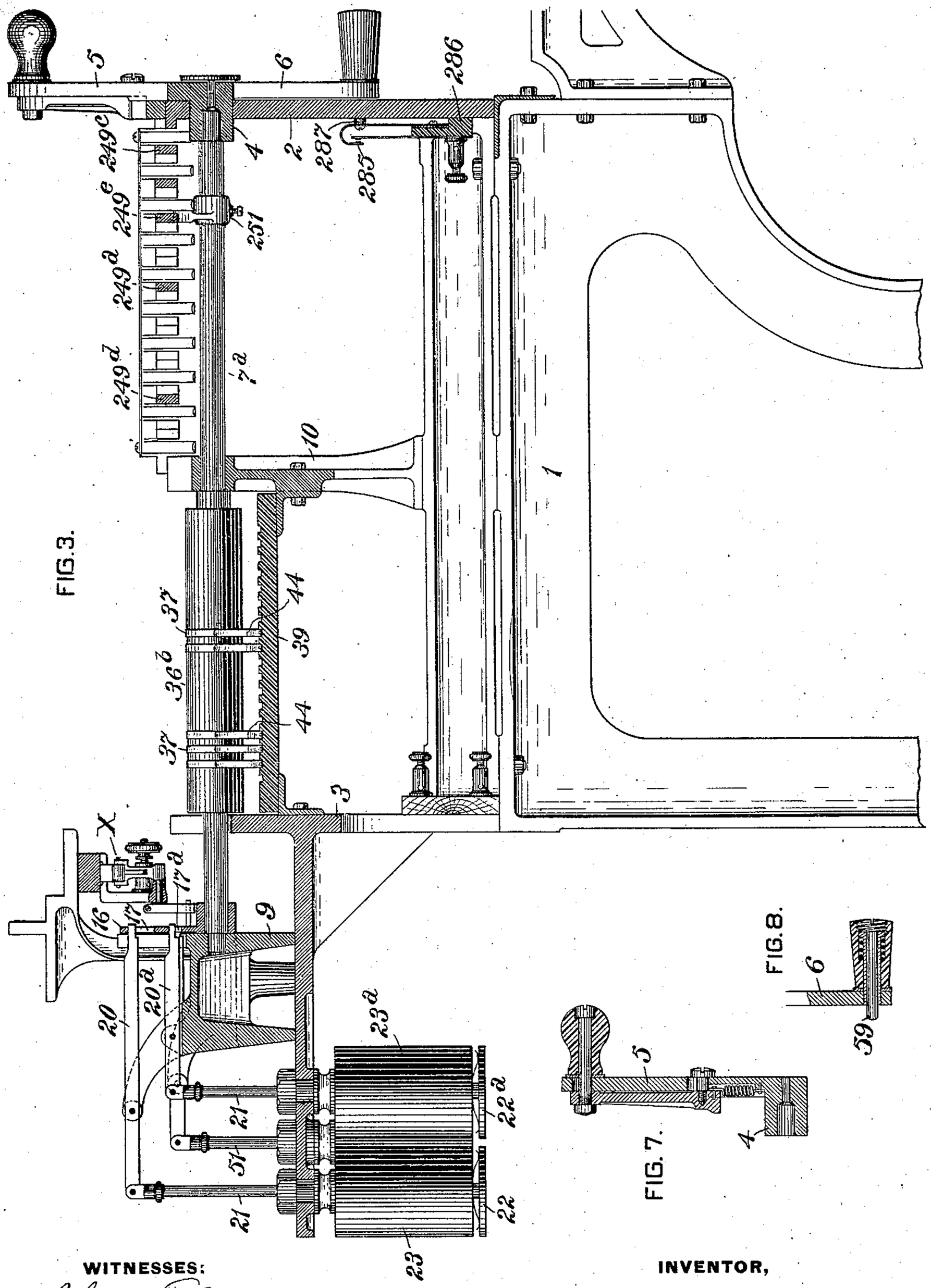

FIG. 7.

FIG. 8.

WITNESSES:

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by Dennis B. Wolcott

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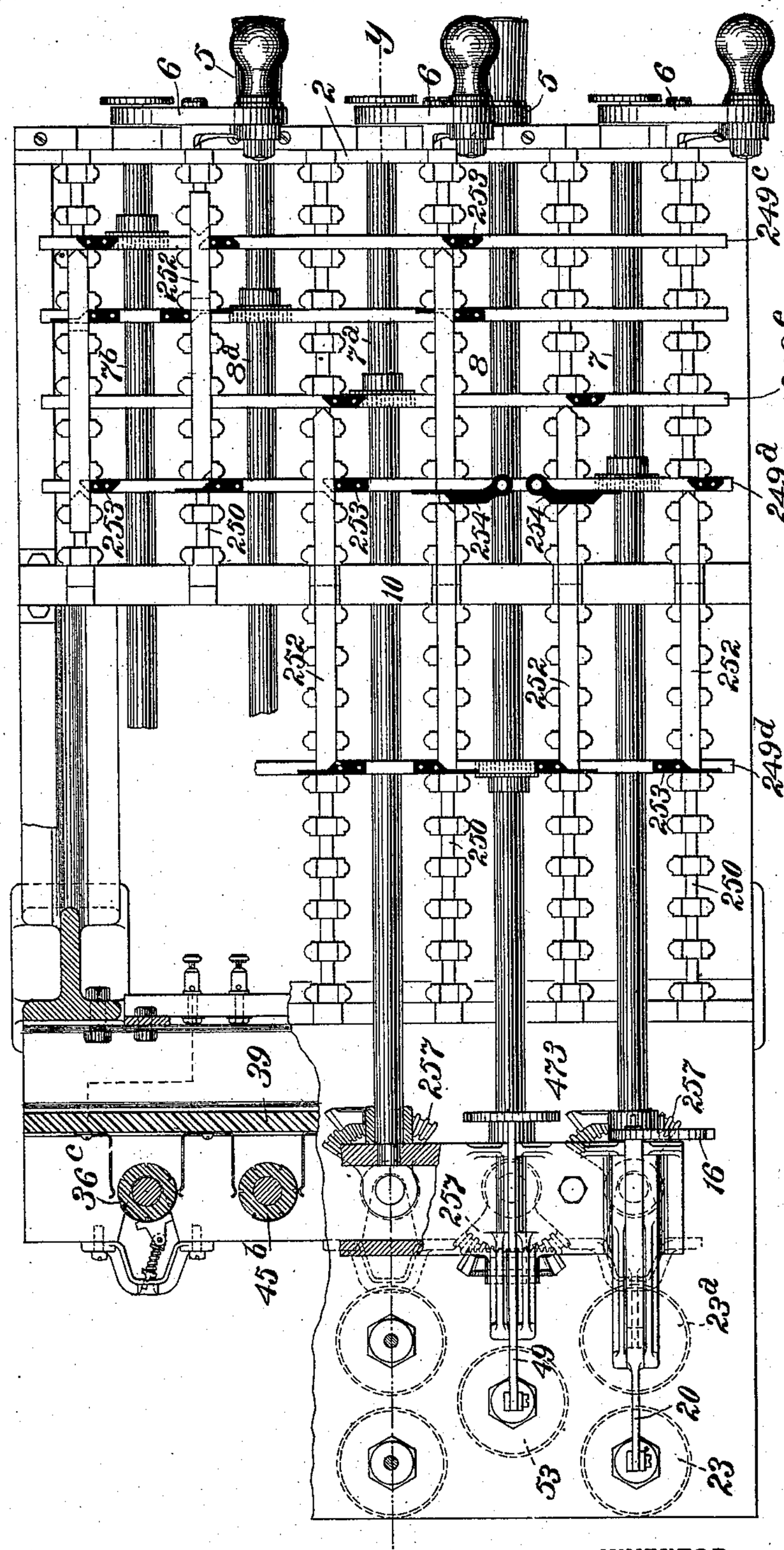
(No Model.) 8 Sheets—Sheet 4.

J. G. SCHREUDER.

SWITCH AND SIGNAL APPARATUS.

No. 575,908. Patented Jan. 26, 1897.

FIG. 4.



WITNESSES:

Chas. F. Miller.

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(No Model.) 8 Sheets—Sheet 5.

J. G. SCHREUDER.

SWITCH AND SIGNAL APPARATUS.

No. 575,908. Patented Jan. 26, 1897.

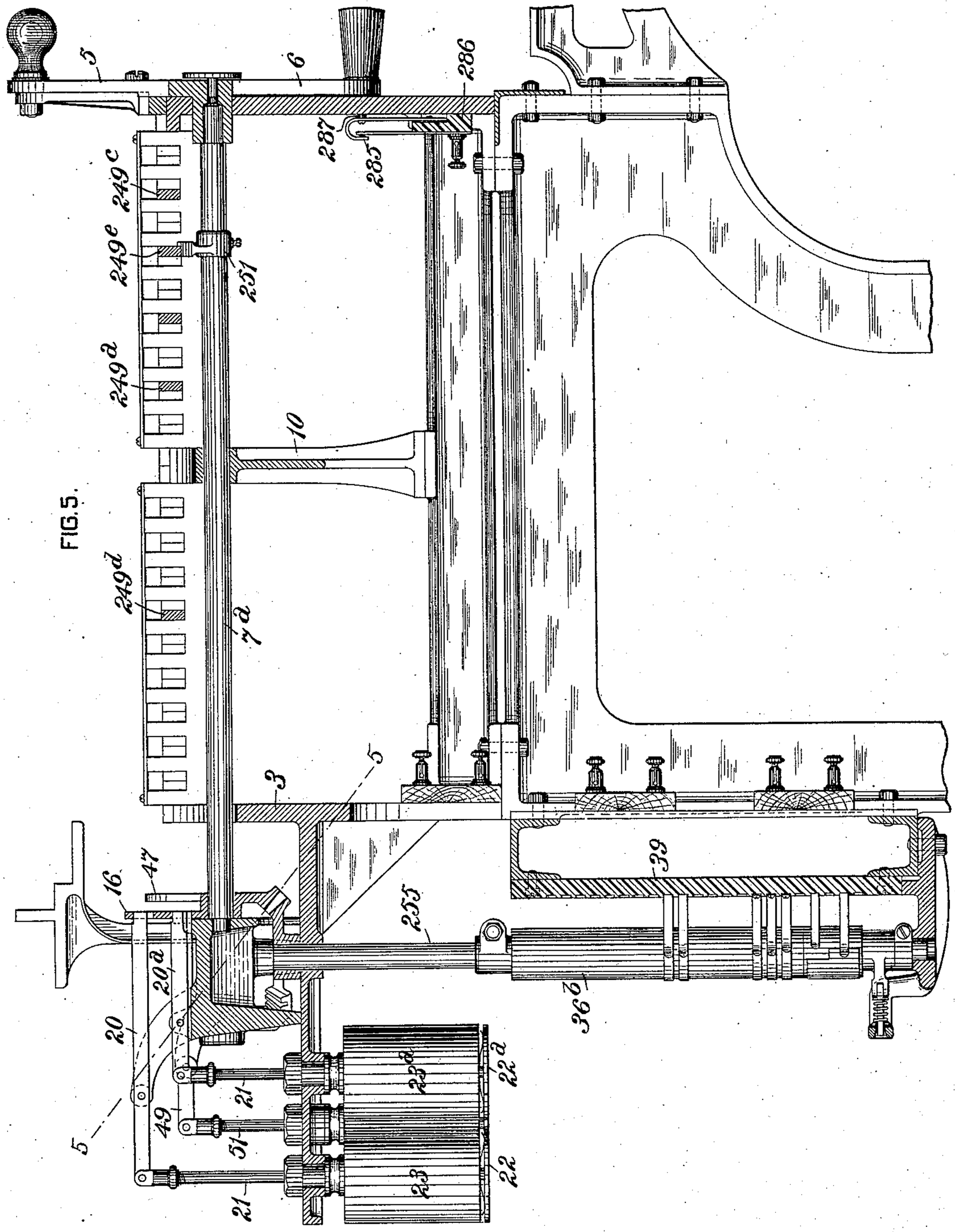

FIG. 5.

WITNESSES:

Chas. F. Miller.

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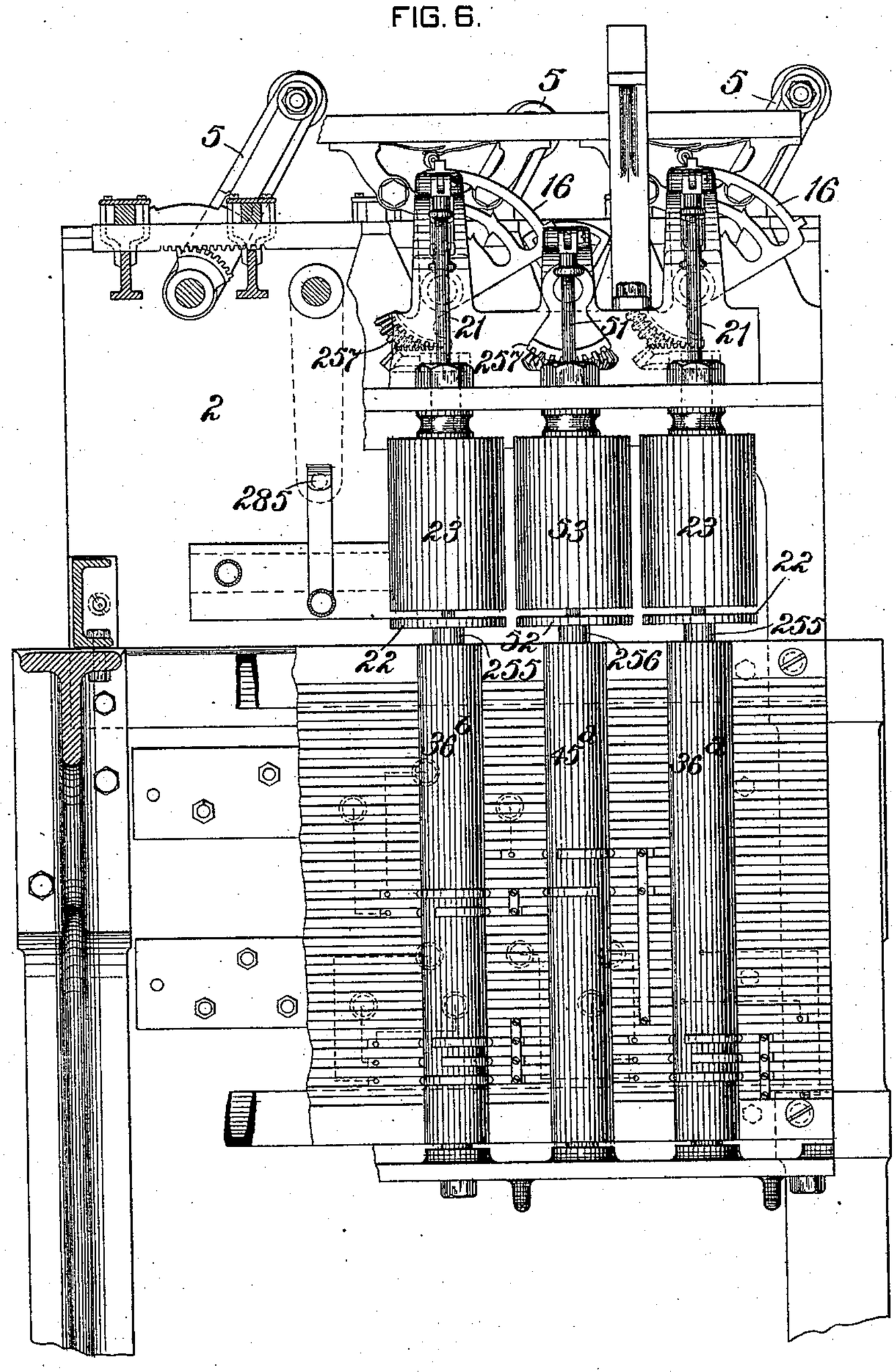
(No Model.) 8 Sheets—Sheet 6.

J. G. SCHREUDER.

SWITCH AND SIGNAL APPARATUS.

No. 575,908. Patented Jan. 26, 1897.

FIG. 6.



WITNESSES:

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(No Model.) 8 Sheets—Sheet 7.

J. G. SCHREUDER.

SWITCH AND SIGNAL APPARATUS.

No. 575,908. Patented Jan. 26, 1897.

FIG. 9.

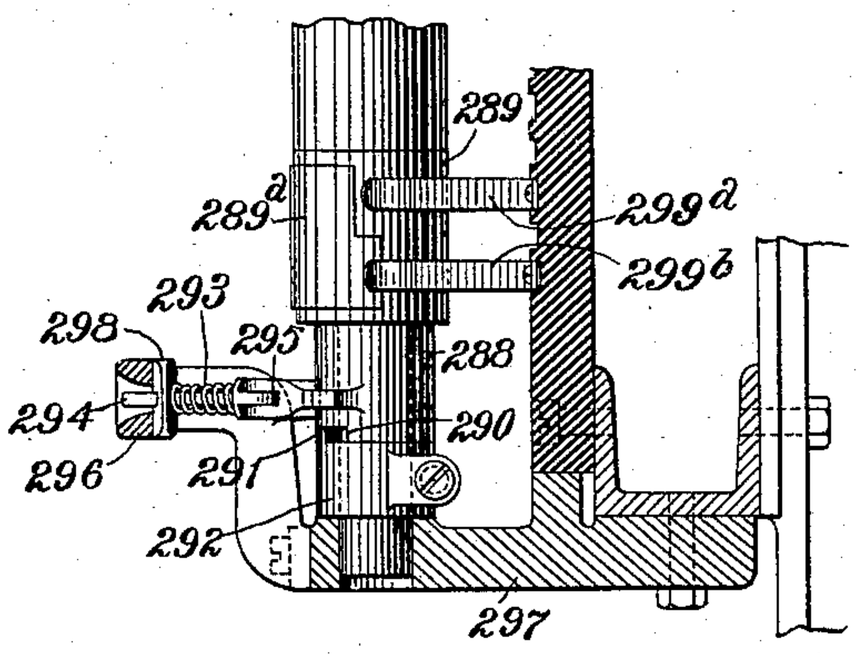


FIG. 10.

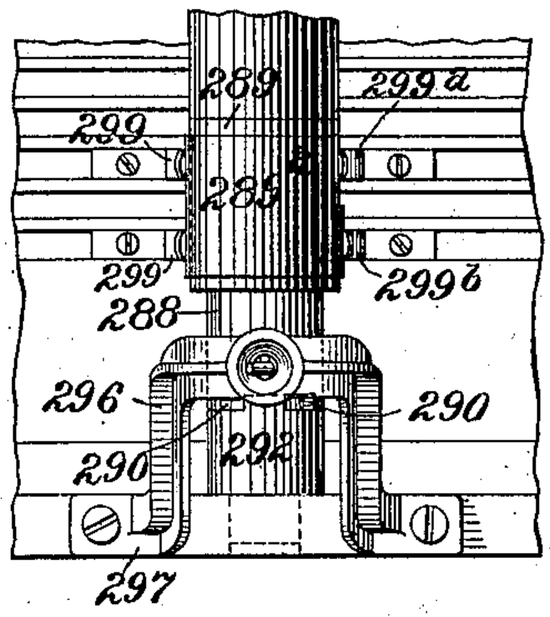


FIG. 11.

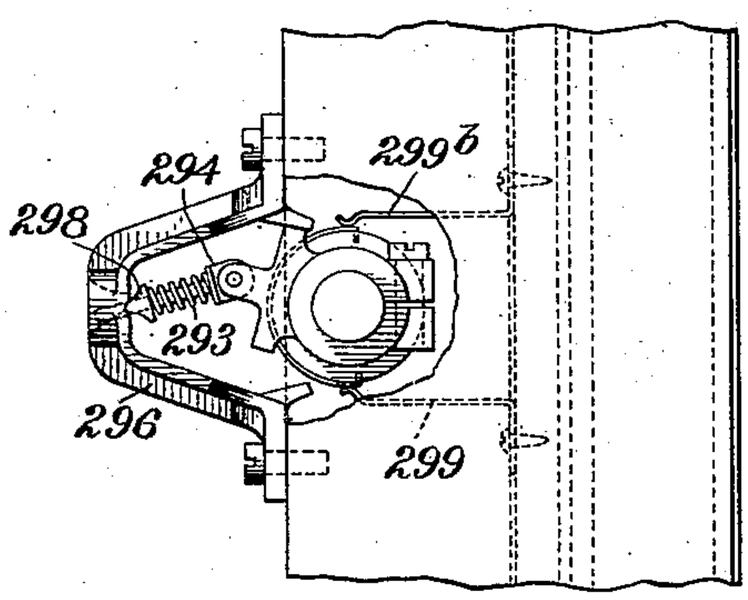


FIG. 12.

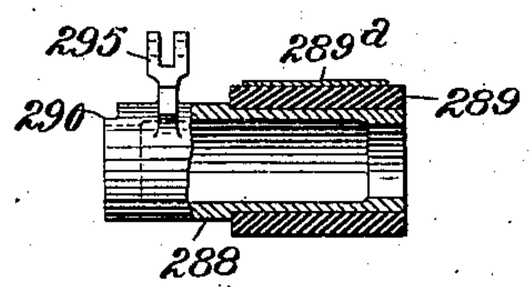
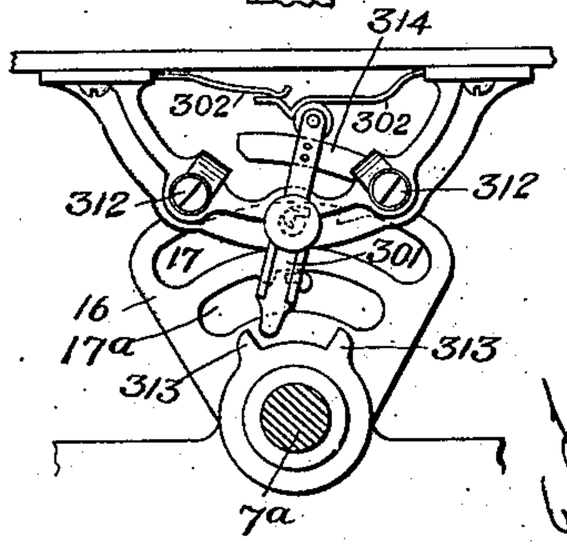


Fig. 14.



WITNESSES:

Chas. F. Miller.

A. E. Gaither

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Att'y

(No Model.) 8 Sheets—Sheet 8.

J. G. SCHREUDER.

SWITCH AND SIGNAL APPARATUS.

No. 575,908. Patented Jan. 26, 1897.

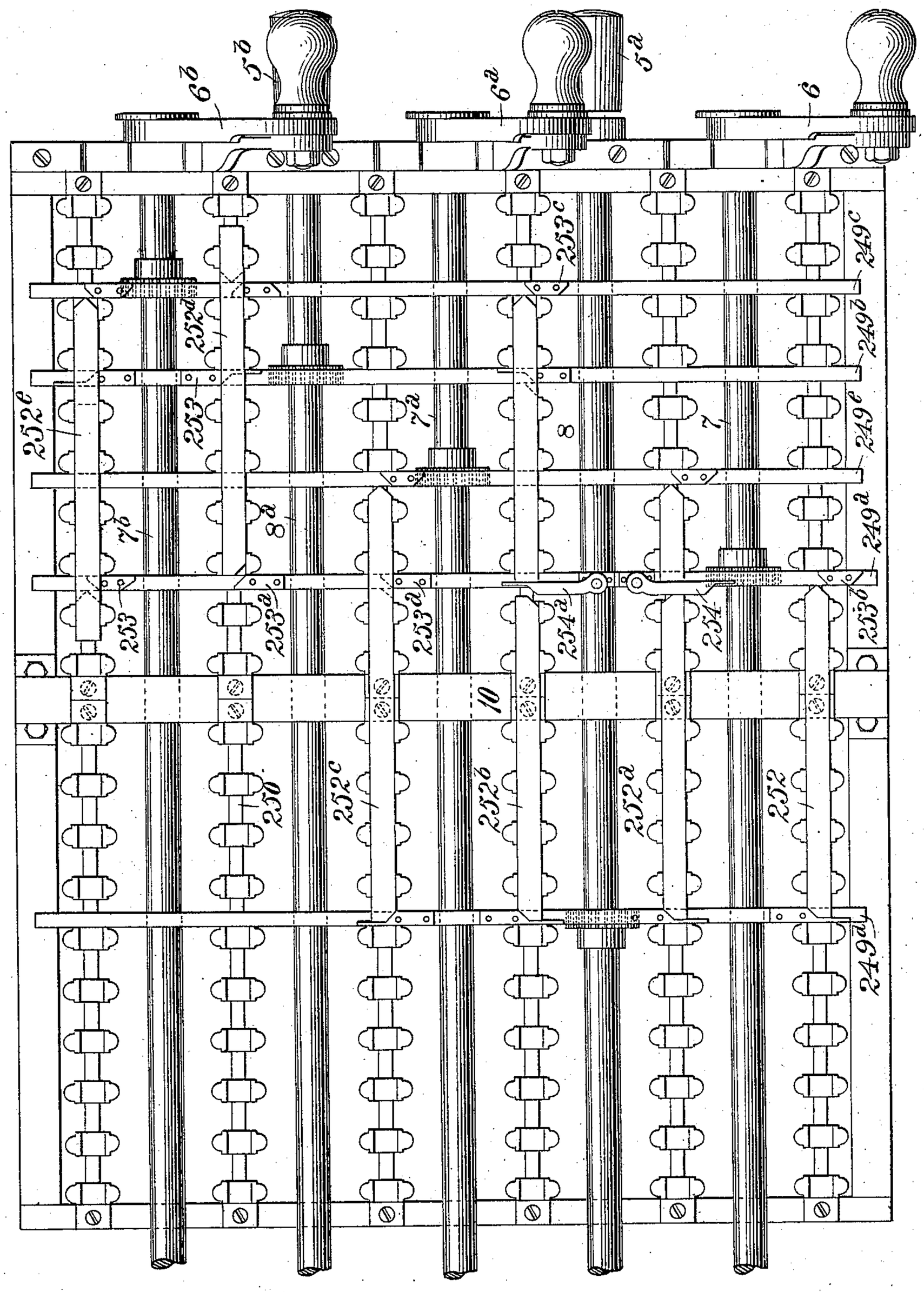

FIG. 13.

WITNESSES:

Chas. F. Miller.

F. E. Gaither

INVENTOR,

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by Dennis S. Wolcott

Att'y.

UNITED STATES PATENT OFFICE.

JENS G. SCHREUDER, OF EDGEWOOD PARK, PENNSYLVANIA, ASSIGNOR TO THE UNION SWITCH AND SIGNAL COMPANY, OF SWISSVALE, PENNSYLVANIA.

SWITCH AND SIGNAL APPARATUS.

SPECIFICATION forming part of Letters Patent No. 575,908, dated January 26, 1897.

Application filed September 21, 1895. Serial No. 563,230. (No model.)

To all whom it may concern:

Be it known that I, JENS G. SCHREUDER, a subject of the King of Sweden and Norway, residing at Edgewood Park, in the county of Allegheny and State of Pennsylvania, have invented or discovered certain new and useful Improvements in Switch and Signal Apparatus, of which the following is a specification.

The invention described herein relates to certain improvements in switch and signal apparatus of the class or kind known as the "electropneumatic," and shown and described in Letters Patent No. 357,109, dated February 1, 1887; No. 446,159, dated February 10, 1891, and No. 479,666, dated July 26, 1892.

The invention has for its object a construction and arrangement whereby the use of a large number of electric circuits and electrically-controlled interlocking devices is avoided and also more compact and accessible arrangement of the several parts is obtained.

In the accompanying drawings, forming a part of this specification, Figure 1 is a diagrammatic view illustrating a portion of a double-track railway having a crossover and siding and a machine for operating the switches and signals thereof through electric circuits controlling the switch and signal operating mechanisms. Fig. 2 is a top plan view of the machine. Fig. 3 is a sectional elevation of the machine, the plane of section being indicated by the line $x\ x$, Fig. 2. Fig. 4 is a top plan view of a modified form or construction of the machine, certain portions of the upper part of the machine being broken away. Fig. 5 is a sectional elevation of the modified form, the plane of section being indicated by the line $y\ y$, Fig. 4. Fig. 6 is a rear end elevation of the form of machine shown in Figs. 4 and 5, certain parts being shown in section. Figs. 7 and 8 are sectional detail views illustrating the handles or levers for operating the switch and signal rollers. Fig. 9 is a view, partly in side elevation and partly in section, of one of the switch-rollers, showing a modification of the make-and-break device in switch indication and lock circuits. Fig. 10 is an end elevation of the construction shown in Fig. 9. Fig. 11 is a top plan view of the same. Fig. 12 is a sectional elevation, the plane of section being indicated by the line $w\ w$, Fig. 11; and Fig. 13 is a top plan view, on an enlarged scale, of the mechanical interlocking mechanism. Fig. 14 is a detailed view of the circuit-changer controlled by the switch-rails.

The frame 1 of the machine is of any suitable form or construction and is provided with upwardly-projecting front and back plates 2 and 3. In the front plate are formed openings through which project the hubs 4 of the switch and signal levers 5 and 6. The hubs of the levers are provided with sockets for the reception of the ends of the shafts 7 7^a, &c., and 8 8^a, &c., which are mounted in suitable bearings in the back plate 3 and in a block 9, supported on a rearward extension from the back plate, as shown in Fig. 3. It is preferred to support these shafts intermediate of the front and back plates by a standard 10, having suitable bearings for the shafts. On these shafts 7 7^a, &c., and 8 8^a, &c., are placed rollers or cylinders 36^a 36^b and 45^a 45^b, &c., respectively formed of rubber or other suitable insulating material.

On the rollers are placed bands 37, extending partially around the rollers and adapted in certain positions of the rollers to be in contact with springs 44, which in turn are electrically connected to metallic strips 40^a on the bed-plate 39, formed of insulating material and arranged under the rollers. The metallic bands 37 form a bridge between the sections of the metallic strips 40^a, said strips being provided at the ends adjacent to the rollers with springs 44, adapted to bear against the rollers and in certain predetermined positions of the latter to form electrical connections with the bands.

The construction and arrangement of the bands 37, springs 44, and strips 40 form parts of electric circuits extending to the mechanism operating signals 79, 71, 72, 73, 74, 76, and 80, and the switch-motors F, F′, F^2, and F^3, respectively. The arrangement of these circuits is fully described in the Letters Patent hereinbefore referred to.

On the rear ends of the shafts 7^a 7^b, &c., are secured quadrants 16, provided with slots 17 17^a, into which project latches 20 20^a.

These latches are pivotally mounted on suitable supports on the block or bracket 9 and have their rear ends connected by rods 21 to the armatures 22 22ª of the magnets 23 23ª. As described in the patents referred to, the latches engage projections in the slots 17 17ª and control the movements of the switch-levers from normal to reverse and from reverse to normal, respectively.

The movement of the latches 20 and 20ª are controlled through magnets 23 and 23ª by make-and-break mechanisms A′, A², and A³, operated by the motors F F′, &c., or the movable switch-rails, and by make-and-break mechanisms 300 and 300ª, operated by the shafts 7ª and 7ᵇ, &c., as shown and described in Letters Patent granted December 24, 1895, to J. P. Coleman.

The make-and-break mechanisms 300, &c., consist of contact-plates 312 on opposite sides of but above the shafts 7ª 7ᵇ, &c., and a pivoted arm 301, carrying a contact-plate 314, having a preliminary movement imparted by projections 313 on the shafts, and the final or complete movement being imparted by a spring 312. (Shown in Figs. 2, 3, 8, and 14.)

It is characteristic of the apparatus described and shown in the patents referred to that the switch-operating levers were locked mechanically by the signal-operating mechanisms, but the signal-operating levers were not interlocked mechanically with each other or with the switch-levers, nor were the latter mechanically interlocked with each other. Protection as against the setting of wrong signals or switches was obtained in said apparatus by make-and-break mechanisms in the circuits controlling the switch and signal operating mechanisms. In order to avoid the multiplicity of circuits necessary in the systems heretofore used, a complete mechanical interlocking mechanism is employed.

While any suitable construction of interlocking mechanism may be used, it is preferred to employ the construction described and claimed in Letters Patent No. 406,212, dated July 2, 1889, which consists of a series of bars 249, arranged in suitably-grooved frames 250 above the shafts 7ª 7ᵇ and 8ª 8ᵇ and at right angles thereto. The number of bars employed is dependent upon the number of switch and signal levers in the machine. Each of the shafts 7ª 7ᵇ, &c., has fixed thereon a toothed sector 251, adapted to engage a tooth portion on the under side of each of the bars 249, so that by the rotation of the shafts the bars may be shifted longitudinally. The frames 250 are provided with transverse notches which serve as guides for the locking-blocks 252, said blocks being adapted to slide over the bars 249. These blocks are shifted longitudinally by means of bevel-ended dogs 253 and fingers 254, the former secured on the bars and the latter pivotally mounted thereon. The bars, with their dogs and pivoted fingers and the locking-blocks, are so arranged that when the switch and signal levers forming a combination have been shifted the switch and signal levers of any opposing route or combination are locked and cannot be shifted until the first switch and signal levers are returned to normal position.

In the form of apparatus shown in Figs. 1, 2, and 3 the mechanical interlocking mechanism and the rollers 36ª, &c., and 45ª, &c., forming a part of the make-and-break mechanisms of the switch and signal circuits are arranged in approximately the same level one behind the other. This arrangement permits of easy access to either part of the apparatus for inspection and repair. When it is not possible to provide a tower of sufficient width to permit of such an arrangement of the mechanisms, the insulating-rollers are placed on vertical counter-shafts 255 and 256, mounted in suitable bearings on the rear side of the frame 1, as shown in Figs. 4 to 6, inclusive. The shafts 255 and 256 are driven by the shafts 7 and 8 through the medium of bevel-gearing 257. This arrangement is more compact than that shown in Figs. 2 and 3 and is nearly as accessible for inspection and repairs.

The switch-operating motors F F′, &c., are constructed as described and shown in Letters Patent No. 393,596, dated November 27, 1888, and No. 479,666, dated July 26, 1892, and consist, generally stated, of a cylinder and piston, a valve controlling the flow of fluid-pressure to and from the cylinder, auxiliary cylinders, and pistons for operating the main valve, valves controlled by magnets 214 and 214ª, regulating the flow of fluid-pressure to and from the auxiliary cylinders, and a lock for the main valve operated or controlled by the magnet 222. As the switches *m m′* of the crossover O are operated together the several magnets of the motors F and F′ are in the same circuits which are controlled by the switch-roller 36ª. The circuit for the locking-magnets 222 of the motors F and F′, starting from the battery *b′*, one of whose poles is grounded by connection with the pipes conducting fluid-pressure to the several motors, consists of the binding-post on the machine, one of the connected strips 261 on the table of the machine, a band on the rollers 36ª, wire 227, locking-magnet 222 of motor F, wire 258, locking-magnet 222 of motor F′, to ground.

The circuit of operating-magnet 214 starts from battery *b*, and consists of binding-post on machine, one of the connecting-strips 40ª, and a band on roller 36ª, and from thence is formed by wire 229, magnet 214 of motor F, wire 259, magnet 214 of motor F′, to ground. The battery *b* and the connection to roller 36ª is also common to the circuit of operating-magnets 214ª, the remaining portion of which consists of a separate band on roller 36ª, wire 231, magnet 214ª of motor F, wire 260, magnet 214ª of motor F′, to ground.

The motors F² and F³ are controlled by circuits from the battery *b′*, one pole of which is grounded in the same manner as described

in connection with battery *b*. The other pole of the battery *b'* is connected to metallic strip 261, extending along the bed of the machine and connected by transverse pieces to short strips adjacent to the rollers 36[b] and 36[c], which have transverse bands adapted in certain predetermined positions of the rollers to form electrical connection with other metallic strips on the opposite sides of said rollers, in a manner fully set forth in Letters Patent hereinbefore referred to.

The circuits of the locking-magnet 222 and operating-magnets 214 and 214[a] of motor F[2] outside of the machine are formed by the wires 233, 234, and 235, respectively, the opposite poles of said magnets being grounded.

The circuits of the magnets 222, 214, and 214[a] of the switch-motor F[3] are formed by the wires 236, 237, and 238, respectively.

The circuit of the magnet 23, controlling the locking-latch 20 of roller 36[a], is the same as that of the locking-magnets 222 of motors F and F' to the locking-magnet of the latter motor, from which point it is formed by a continuation of wire 258, make-and-break mechanism A' of switch M', wire 258[a], make-and-break mechanism A of switch M, wire 303, magnet 23, controlling latch 20, make-and-break mechanism 300, controlled by roller 45[a]. The circuit of magnet 23[a], controlling latch 20[a] of roller 36[a], is the same as that of magnet 23 up to make-and-break mechanism A', where the wire 258 connects with both sets of contact-springs. The circuit under consideration starts from the second set of springs and is formed by wire 304, the second set of contact-springs of make-and-break mechanism A, wire 305, magnet 23[a], make-and-break mechanism 300[a], to ground. As stated in the Coleman patent, the latch 20[a] is normally held so as to permit of such a rotation of roller 36[a] as will complete the circuits through the locking-magnets and one of the valve-operating magnets of motors F and F', thereby causing the operation of said motors, with the consequent shifting of the movable member of make-and-break mechanisms A A', so as to close the circuit through magnet 23[a], the make-and-break mechanism 300[a] being closed by the movement of roller 36[a] to reverse position, as shown in Fig. 1. The closing of the circuit through magnet 23[a] so shifts the latch 20[a] as to permit of a full movement of the roller 36[a] to reverse, whereby the circuits through locking-magnet 222 of motors F F' are broken and said motors locked. The complete movement of roller 36[a] to reverse shifts the movable arm or circuit-changer 301 to close the make-and-break mechanism 300[a], breaking make-and-break mechanism 300, thus preparing circuit of magnet 23 for a movement of roller 36[a] from reverse to normal.

The circuits of magnets 23 and 23[a], controlling latches 20 and 20[a] of roller 36[b], are formed by the wire 233 as far as motor F[2]. From thence the circuit of magnet 23 is formed by wire 306, one set of contact-springs of make-and-break mechanism A[2], wire 307, magnet 23, make-and-break mechanism 300, controlled by roller 36[b] to ground. The circuit of magnet 23[a] is formed by wire 306, the second set of springs of make-and-break mechanism A, wire 308, magnet 23[a], and make-and-break mechanism 300[a] to ground.

The circuits of magnets 23 23[a], controlling latches 20 20[a] of roller 36[c], are formed by wire 236 as far as motor F[3], from thence to the two sets of contact-springs of make-and-break mechanism A by wire 309. The circuit of magnet 23 is continued from one set of springs by wire 310, magnet 23, make-and-break mechanism 300 on one side of roller 36[c] to ground. The circuit of magnet 23[a] is continued from the other set of springs of make-and-break mechanism A[3] by wire 311, magnet 23[a], make-and-break mechanism 300 on opposite sides of roller 36[b] to ground.

The signal 79 controls movements of trains from the main track M over the crossover O to the track M', and its operating mechanism is controlled by roller 45[a] through a circuit consisting of the wire 262, metallic strip 263 on bed of machine, a band on roller 45[a], and metallic strips connected to battery *b'*.

The signals 71 and 72 control train movements along the main track M', and from the latter to the branch line N'. The operating mechanism of the signals 71 and 72 are controlled by roller 45[b], operating for signal 71 through circuit consisting of the wire 264, and for signal 72 through circuit consisting of wire 265. These circuits are continued by independent strips on bed of machine, bands on switch-roller 36[c], a common strip, a common band on roller 45[b], and a common strip connected to battery *b'*. The roller 36[c], controlling switch-motor F[3] of switch *n'*, operates as a selector for these signals, as the bands which form parts of the circuits of signals 71 and 72 are so arranged on the roller 36[c] that when the latter is in normal position the circuit for signal 71 is closed and that for signal 72 is opened, so far as said circuits are controlled by the roller 36[c]. The final closing of these circuits is effected by shifting the signal-roller 45[b]. It follows from this construction that when roller 36[c] and its switch *n'* are in normal position the shifting of roller 45[b] will close the circuit of signal 71, and when the roller 36[c] and its switch *n'* are reversed only the circuit for signal 72 can be closed by reversing roller 45[b].

The signals 73 and 74 control train movements from tracks M' and N' over the crossover O to track M, and are provided with suitable motors controlled by signal-roller 45[b] through circuits formed by wires 266 and 267. These circuits are continued in the machine by independent strips and bands on the bed and switch-roller 36[c] and a common strip and a common band on roller 45[b], the common strip being connected to battery *b'*. As in the case of signals 71 and 72, the po-

sition of switch-roller 36^c determines which signal shall be operated by signal-roller 45^b.

Signals 76 and 80 control train movements along the main track M and branch track N and are provided with suitable operating mechanisms controlled by signal-roller 45^a through outside circuits formed by wires 268 and 269, continued in the machine by independent strips and bands on the bed and the switch-roller 36^b, common strip on the bed, and a common band on signal-roller 45^a, the common strip being connected to battery b'.

As described and shown in Letters Patent No. 446,159, the shafts of the signal-rollers 45^a and 45^b have secured thereto slotted quadrants 47, provided with studs projecting into the slots for engagement with the forward ends of latches 49, which are pivoted on suitable brackets on the frame of the machine. The rear ends of the latches are connected by rods 51 to the armatures 52 of electromagnets 53. The circuit of the magnet 53, controlling signal-roller 45^a, consists, starting from battery b^2, having one of its poles grounded, of the wires 270 and 271, magnet 53, wire 272, make-and-break mechanism 273, controlled by signals 79, wire 274, make-and-break mechanisms 275 and 276, controlled by signals 76 and 80, respectively, to ground. The circuit of magnet 53, controlling signal-roller 45^b, consists of wires 270 and 277, magnet 53, wire 278, make-and-break mechanisms 279 and 280, controlled by signals 71 and 72, respectively, wire 281, make-and-break mechanisms 282 and 283, controlled by signals 73 and 74, respectively, to ground. In order to save battery, make-and-break mechanisms 284 and 285 are included in the foregoing circuits. These make-and-break mechanisms consist, as shown in Figs. 3 and 5, of two springs so attached to an insulating-block 286 on the front plate of the machine that when free to move they will spring into contact, completing the circuits. One of these springs is provided with a stud 287, projecting into a hole in the front plate for the reception of the spring-actuated pin 59 (see Fig. 8) in the handle of the signal-lever. The hole is so located that the pin 59 will enter it and bear against the stud 287 to separate the springs of the make-and-break devices only when the signal-lever is in normal or middle position. As the pin must be withdrawn before the signal-lever can be shifted the locking or indication circuits of the signals will be closed, provided all signals on a circuit are at normal or "danger," thereby exciting magnet 53 and so shifting the locking-latch 49 as to permit the signal-lever, with its roller, to be shifted.

It will be observed that each signal-indication circuit includes all signals controlling opposing routes and operated by same roller in the machine, so that when one signal is cleared it breaks the indication-circuit, thereby so locking the signal-lever as to prevent the setting of signals for opposing routes. As, for example, when signal 79 is cleared for the passage of a train over the cross-over, its make-and-break mechanism is opened, thereby preventing the shifting of roller 45^b in a reverse direction to clear opposing signals 76 and 80.

Where signals controlling opposing routes are operated by different rolls, the shifting of one of the rollers to set a signal at "safety" so shifts the mechanical locking as to prevent a rotation of the roller-controlling signals of opposing routes, and also the rotation of rollers controlling all switches which on being shifted after a certain route has been given will give an opposing route.

The indication or locking circuits for the switch-levers are arranged as described in Coleman's patent, heretofore referred to, and the switch-lever-locking mechanism controlled by said circuits is constructed and operated as described in Patent No. 446,159.

In addition to the electrical safeguards complete mechanical interlocking is provided, which will operate to lock up all opposing switches and signals after the switch and signal for a desired route has been given. As, for example, if it be desired to send a train from M to N', the switch-lever operating the roller 36^a is shifted to the right, thereby completing the circuits through the magnets of motors F and F' in due sequence to permit of the operation of the motors and the consequent shifting of the switches m and m'. The movements of this switch-lever 6 will shift the bar 249^a toward the top of the sheet, as shown in Figs. 4 and 13. By this movement of switch-lever 6 from normal position, as shown in Fig. 13, and the consequent movement of the locking-bar 249^a, the dogs 253^a on the bar 249^a will be shifted into line with the locking-blocks 252^c and 252^d, and the dog 253 to the opposite side of the path of movement of the block 252^e, the fingers 254^a will be shifted in between the sections of the locking-block 252^b, and the body portion of finger 254 will be shifted out from between the sections of locking-block 252^a, and the dog 253^b will be shifted by this movement of the bar 249^a to the opposite side of the path of movement of the locking-block 252. The lever 6^b for operating the switch-roller 36^c is next shifted from normal position, thereby opening the switch n' to branch line N', and also shifting the locking-bar 249^c toward the top of the sheet in Figs. 4 and 13. This movement of bar 249^c shifts the dogs on said bar to the opposite sides of the paths of movement of blocks 252^b, 252^d, and 252^e, but without imparting any movement to said blocks. The signal 79 is then cleared by shifting the lever 5^a of roller 45^a from normal position, thereby closing the circuits of signal 79 and also shifting locking-bar 249^d toward the bottom of the sheet. By the movement of signal-lever 5^a from normal position, as shown in Fig. 13, and the consequent movement of the bar 249^d, the block 252 will be shifted into

the path of movement of the dog 253^b on the bar 249^a, and the sections of block 252^b will be moved to the right, the right-hand section of said block being shifted into the path of return movement of the dog 253^c on the bar 249^c. By these several movements the bar 249^a will be held as against return to normal position by the block 252, thereby locking switch-lever 6, and the bar 249^c will be locked by the right-hand section of the block 252^b, moving transverse of the path of movement of the dog 253^c, as against movement toward the top of the sheet, thereby locking switch-lever 6^b. By the movement of the right-hand section of block 252^b to the right, as above stated, the bar 249^b will be locked as against movement from normal position, thereby locking signal-lever 5^b. These several movements lock the levers 6^b as against movement, and the movement of the locking-bar 249^a will prevent such movement of the levers 5^a and 5^b of rollers 45^a and 45^b, whereby signals 72, 73, 74, and 76, controlling an opposing route, would be cleared. In addition to protection afforded by the mechanical locking, the signals controlling opposing routes are held at "danger," as their circuits were broken when roller 36^c was shifted to set switch n' to branch line.

It will be observed that in the foregoing operation the preliminary steps of the locking described were effected by the movement of switch-levers 6 and 6^b from normal position, and that the locking was completed by the moving of signal-lever 5^a from normal position. Hence to unlock the machine the above-described movements must be reversed, the signal-lever being first returned to normal position, thereby permitting the return of switch-lever 6 to its normal position.

The construction of make-and-break mechanism shown in Figs. 9, 10, 11, and 12 may be used in lieu of the form of make-and-break mechanisms X shown in Figs. 2 and 3 and forming part of the subject-matter of the patent of Coleman heretofore cited, and which are arranged in the switch-indication circuit and operated by the switch-roller for preventing a return movement of the switch-roller until the switch-rails have been shifted and a complete movement of the roller effected. This form of make-and-break mechanism consists of a metal sleeve 288, loosely mounted on the shaft of the switch-roller at one end of the latter and provided with a collar 289, formed of insulating material and having a metallic band 289^a extending partially around it. The end of the sleeve is provided with shoulders 290, preferably formed by cutting away a portion of the end of the sleeve. Between these shoulders projects a lug 291, formed on the collar 292, which is secured on the shaft of the switch-roller. This driver, consisting of the collar and lug, imparts a preliminary rotation to the sleeve, the movement of the latter being completed by a spring 293. This spring is arranged around a pin 294, which is pivotally connected to a radial lug 295 on the sleeve and projects up through a guide-opening in bridge-piece 296, secured on posts or pillars 297 in the frame of the machine. The spring 293 bears at one end against a shoulder on the pin and at the opposite end against a follower 298, fitting loosely on the pin and in turn bearing against the bridge-piece. By reference to Fig. 11 it will be seen that when the sleeve has been shifted by the driver to move the point of junction of the pin 294 and lug 295 beyond the plane passing through the axis of the sleeve and the point of bearing of the follower upon the bridge-piece the spring will operate to shift the sleeve on the shaft independent of the driver, whose lug 291 has a width less than the distance between the shoulders 290. As shown in Fig. 10, metal springs 299, 299^a, and 299^b are so arranged on the insulating-bed of the machine that in all positions of the sleeve the spring 299, which is connected to ground, will bear upon the band 289^a. In the normal position of the sleeve the spring 299^a, which is connected to the normal indication-magnet 23, will bear upon the band 289^a, and when the sleeve is in reverse position the spring 299^b will bear upon the band 289^a, said spring being connected to or in circuit with the reverse indication-magnet 23^a.

It will be observed in this construction, as in that shown and described in the Coleman application, the movement of the switch-roller beyond middle position, at which time the switch is shifted, so shifts the sleeve 289^a as to close a circuit through one of the indication-magnets, which, operating through the locking-latches, will compel a complete movement of the switch-roller before it can be returned.

By reference to Fig. 3 it will be seen that the general plane of the mechanical interlocking mechanism is at an angle to a plane passing at an angle to the axes of the rollers, such plane being indicated by dotted lines 3 3, and the same is true of the construction or arrangement shown in Fig. 5, the reference-plane being indicated by dotted lines 5 5. In other words, it is characteristic of this improved machine that the interlocking mechanism and the rollers are arranged on opposite sides of a plane passing at an angle through the axes of the rollers, so that the mechanical interlocking mechanism is at all times readily accessible for adjustment or repairs.

I claim herein as my invention—

1. In a switch and signal apparatus, the combination of a series of electrically-controlled motors for operating a series of switches and signals, or other appliances connected with a track, a series of make-and-break mechanisms controlling the circuits leading to the motors, and mechanical interlocking mechanisms arranged to interlock the switch and signal make-and-break mechanisms, substantially as set forth.

2. In a switch and signal apparatus, the combination of a series of electrically-controlled motors for operating a series of switches and signals, or other appliances connected with a track, a series of make-and-break mechanisms controlling the circuits leading to the motors, and mechanical interlocking mechanisms arranged to interlock the switch and signal make-and-break mechanisms of any given route, and also with the corresponding mechanisms of any opposing route, substantially as set forth.

3. In a switch and signal apparatus, the combination of a series of shafts having rollers formed of insulating material secured thereon, and provided with metallic bands, a bed of insulating material arranged under the rollers and provided with metallic strips, a mechanical interlocking mechanism controlling the operation of said rollers, the interlocking mechanism and rollers being arranged on opposite sides of a plane passing through the axes of the rollers, thereby permitting access to the mechanical interlocking mechanism without disturbing the rollers and bed, substantially as set forth.

4. In a switch and signal mechanism, the combination of a series of shafts having secured thereon rollers formed of insulating material, and provided with metallic bands, a bed formed of insulating material arranged adjacent to and parallel with the axes of said rollers, and provided with metallic strips, a second series of shafts arranged at an angle to those of the first series and operatively connected thereto by suitable gearing, and an interlocking mechanism operated by the second series of shafts, substantially as set forth.

5. In a switch and signal apparatus, the combination of a revoluble shaft, a sleeve provided with a collar of insulating material loosely mounted on the shaft, a driver secured to the shaft and adapted to impart an initial rotary movement to the sleeve, a spring arranged to complete the movement of the sleeve, a metallic band partially surrounding the insulating-collar, springs arranged on opposite sides of the shaft and adapted to be brought into contact with the band by the rotation of the sleeve, substantially as set forth.

6. In a switch and signal apparatus, the combination of a series of two or more signals, electrically-controlled mechanisms for operating the signals, make-and-break mechanisms in the circuits of the operating mechanisms, electrically-controlled locks for said make-and-break mechanisms in the operating-circuits, a series of make-and-break mechanisms in the lock-circuits controlled by the signals, and a make-and-break mechanism also in the lock-circuit and controlled by the make-and-break mechanisms in the signal-operating circuit, whereby the lock-circuit is held open while the signal-operating mechanisms are in normal position, substantially as set forth.

In testimony whereof I have hereunto set my hand.

JENS G. SCHREUDER.

Witnesses:

DARWIN S. WOLCOTT,

F. E. GAITHER.