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No. 820,143. PATENTED MAY 8, 1906.

G. M. SCHREIBER.

RAILWAY SIGNALING AND SAFETY SYSTEM AND APPARATUS.

APPLICATION FILED NOV. 15, 1904.

13 SHEETS—SHEET 1.

Fig. 1.

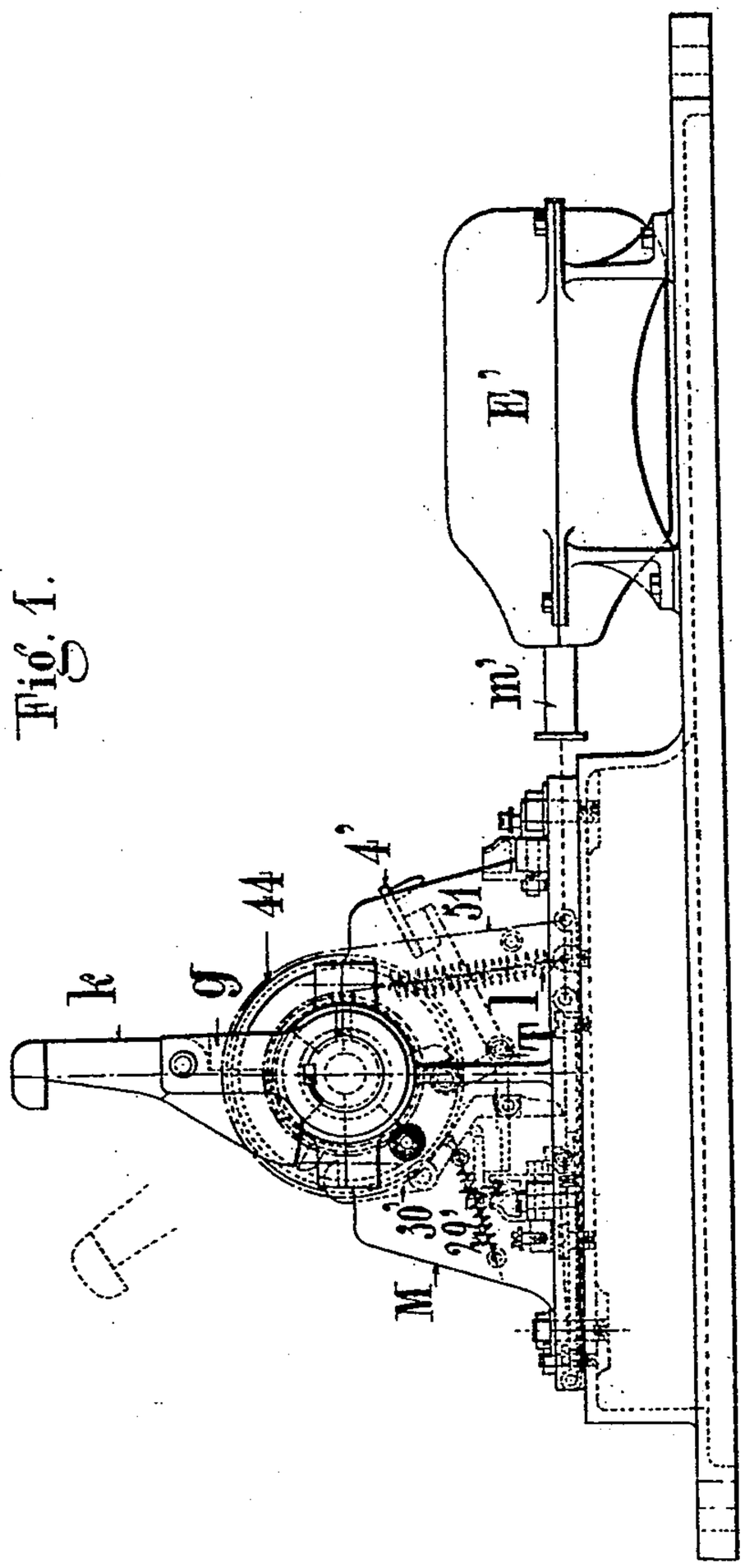
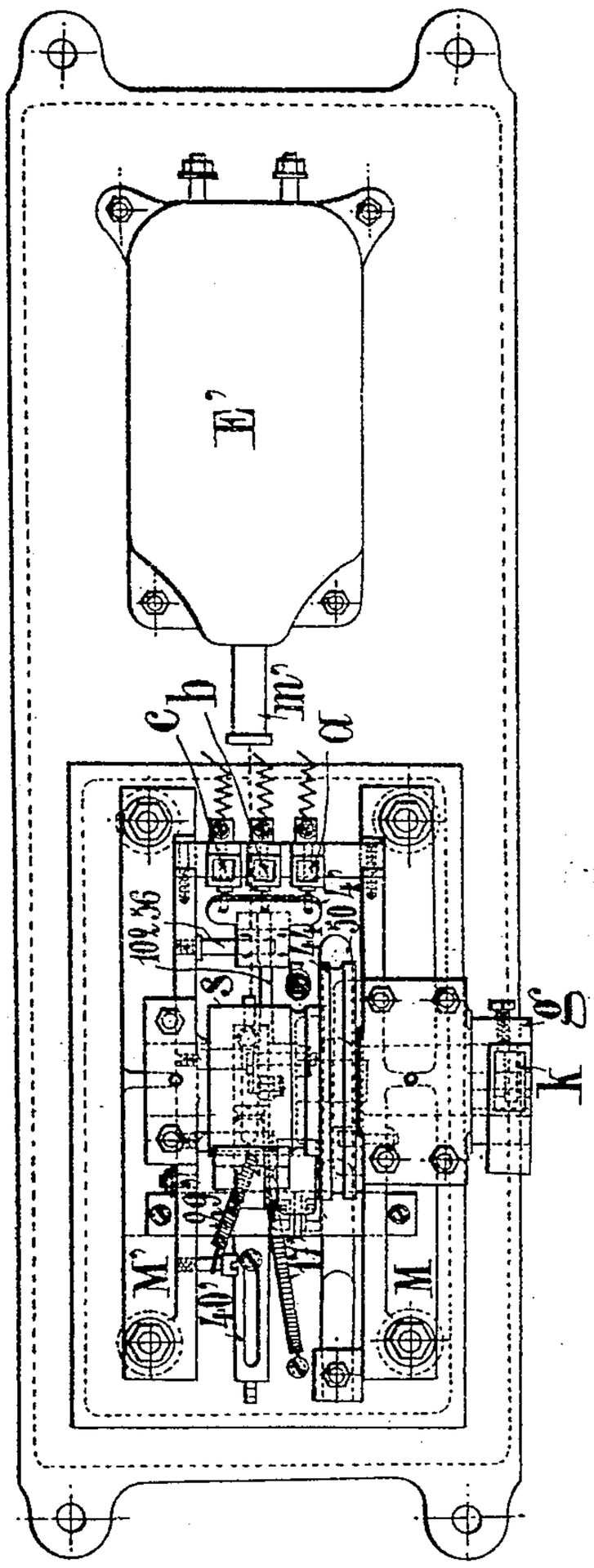


Fig. 2.



WITNESSES:

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W. E. Rockwell

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BY
Lemuel Wiles
ATTORNEYS.

ANDREW. B. GRAHAM CO., PHOTO-LITHOGRAPHERS, WASHINGTON, D. C.

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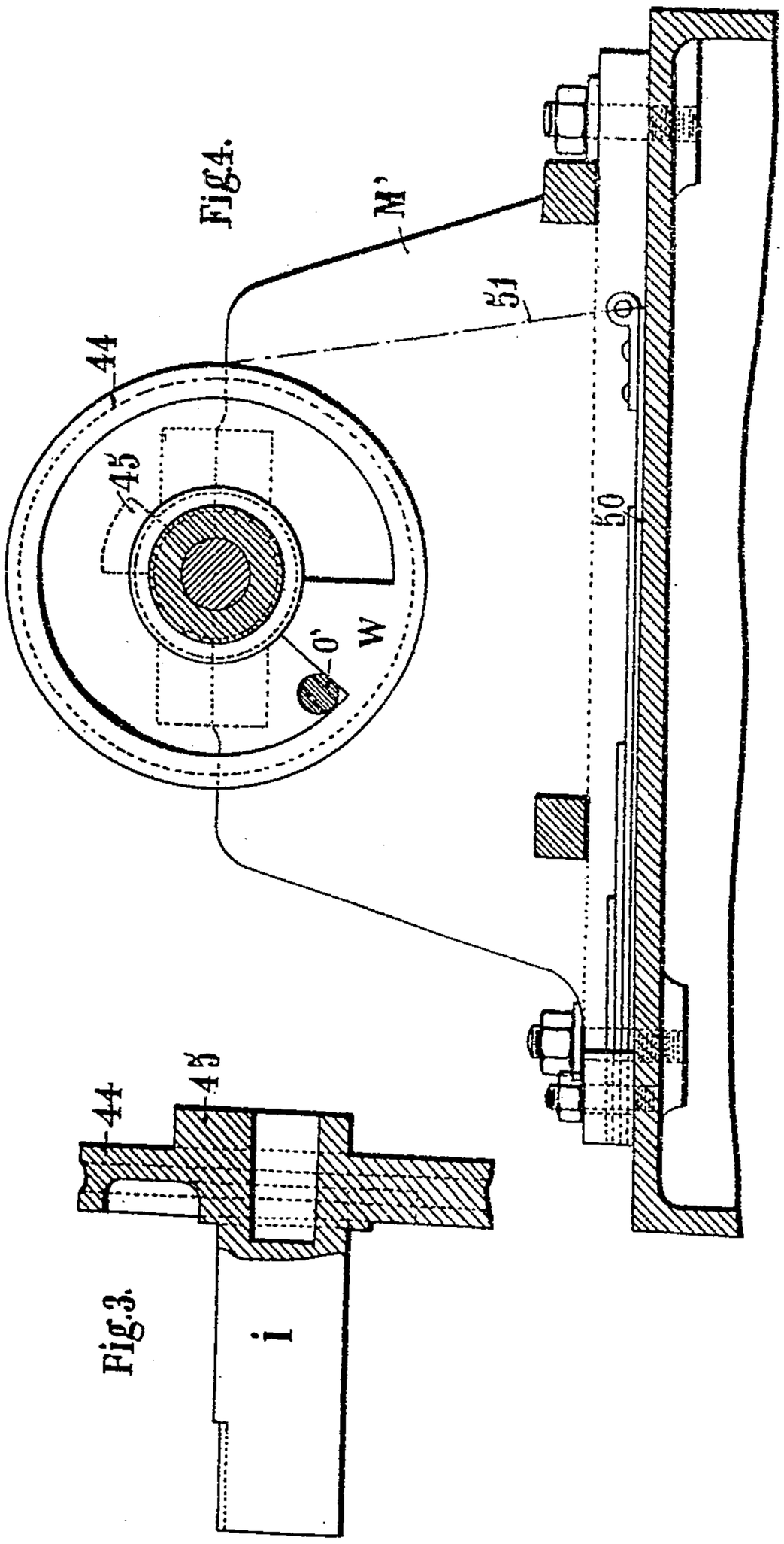

WITNESSES:

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246. RAILWAY SWITCHES & SIGNALS.

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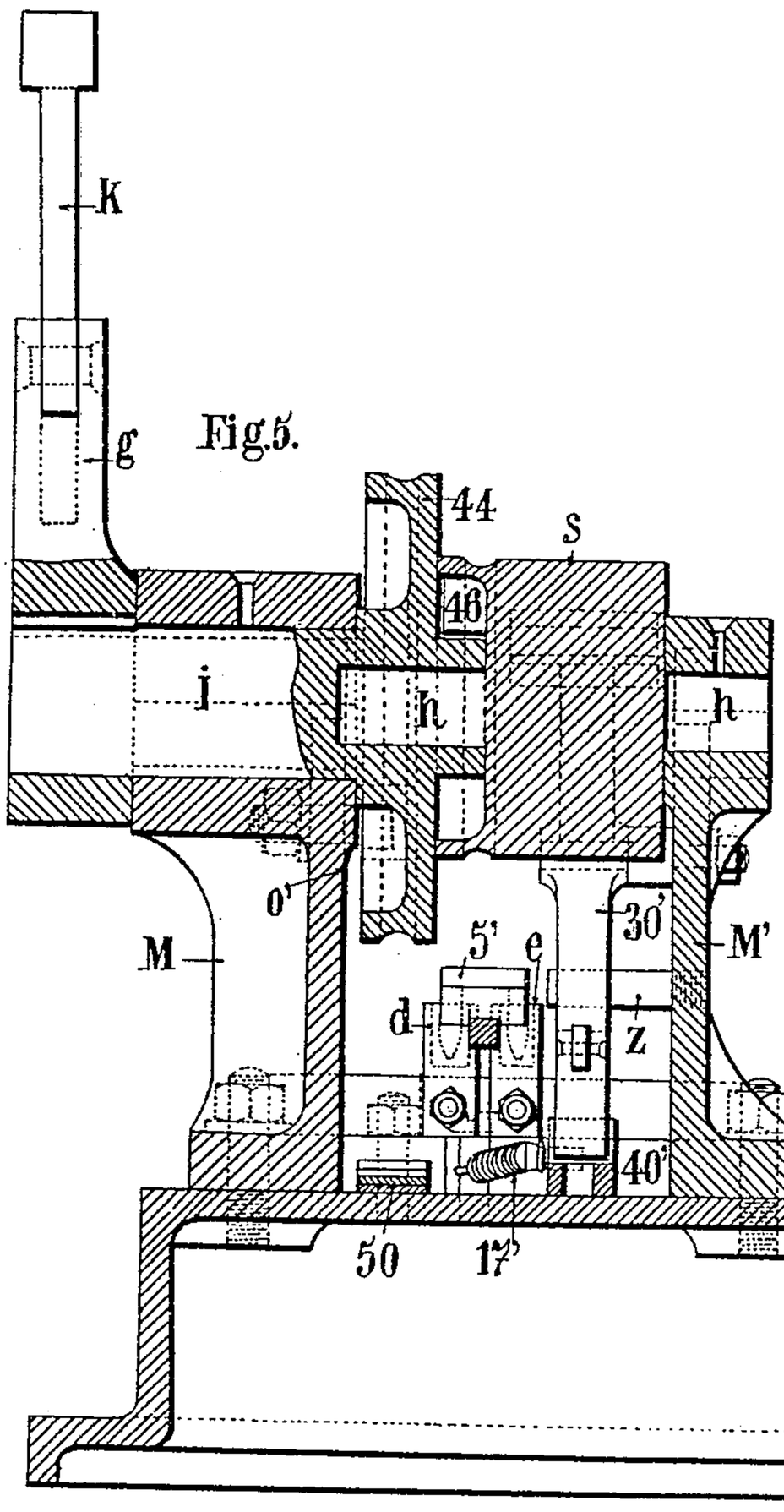

Fig. 5.

WITNESSES:

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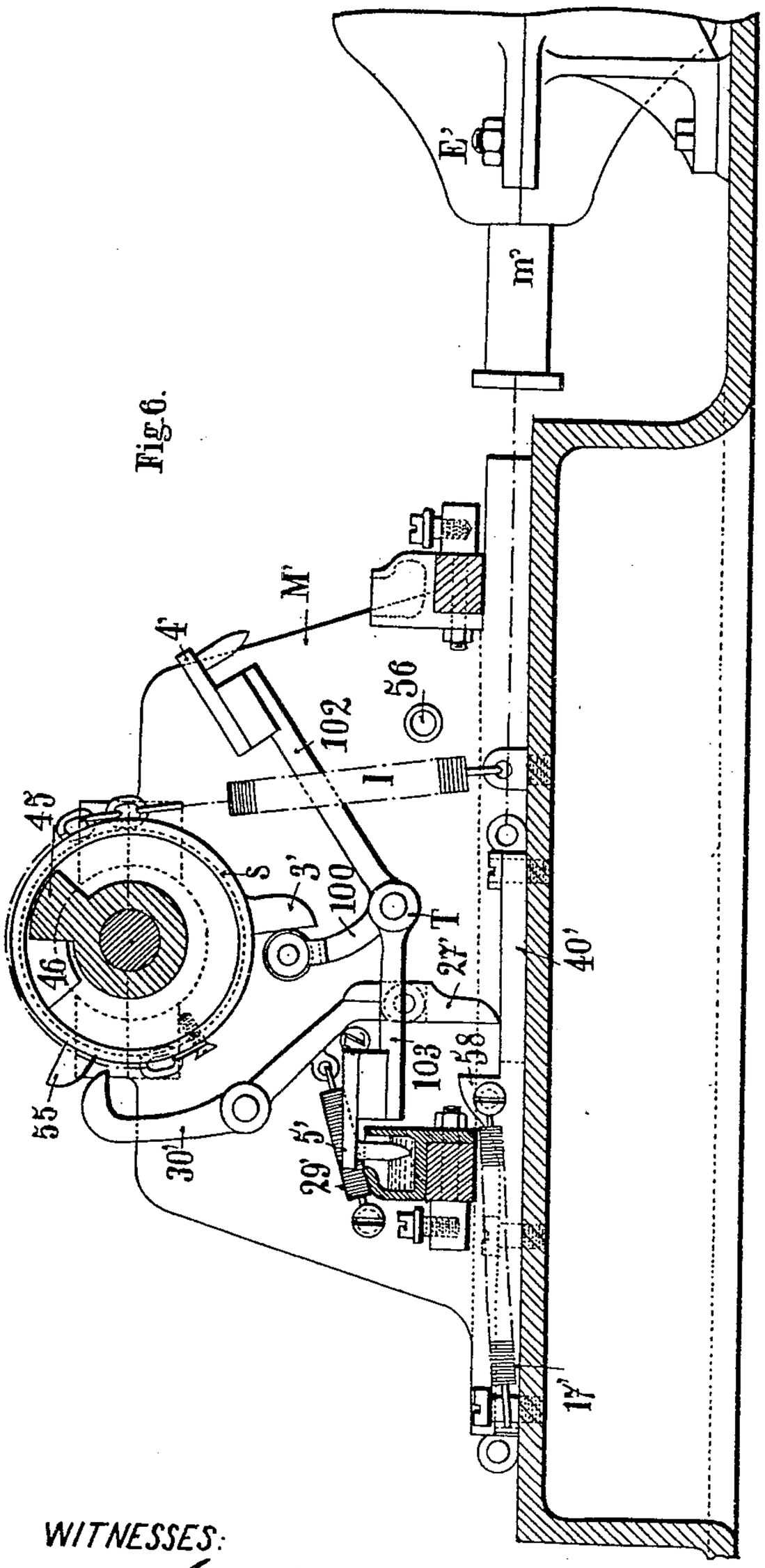
Fig. 6.



WITNESSES:

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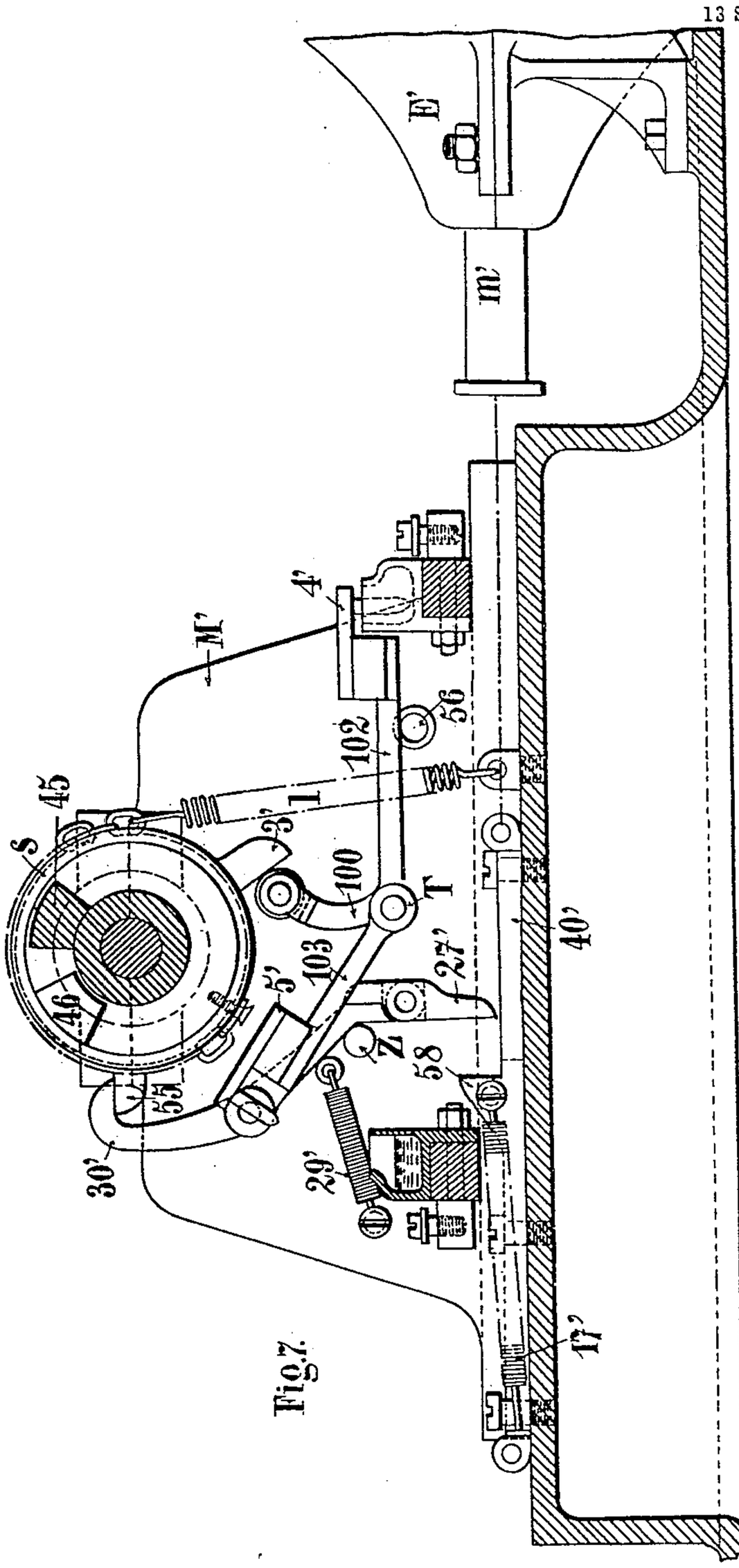

Fig. 7.

WITNESSES:

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ANDREW. B GRAHAM CO., PHOTO-LITHOGRAPHERS, WASHINGTON, D. C.

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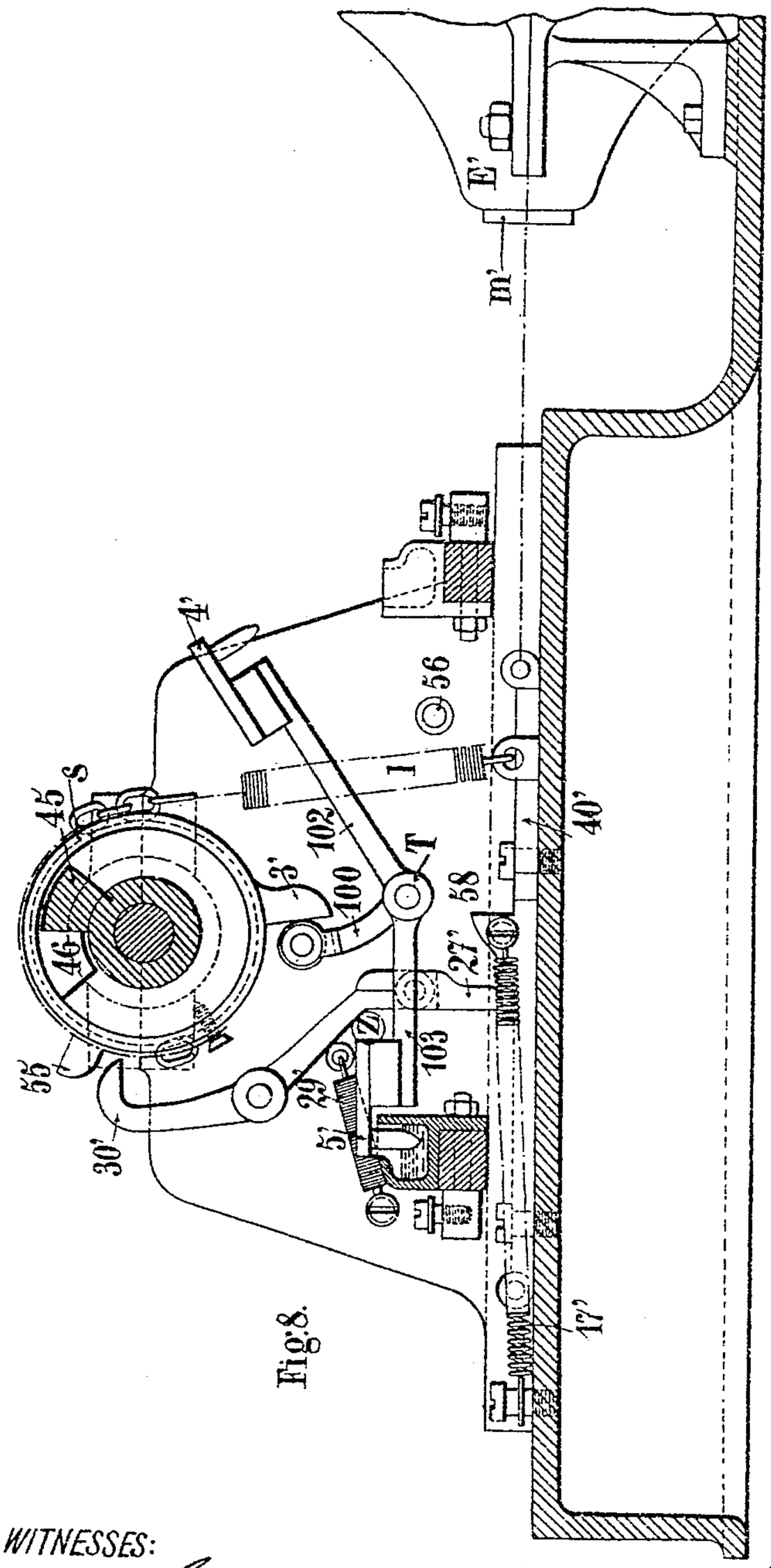

Fig. 8.

WITNESSES:

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Lowell Niles

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13 SHEETS—SHEET 7

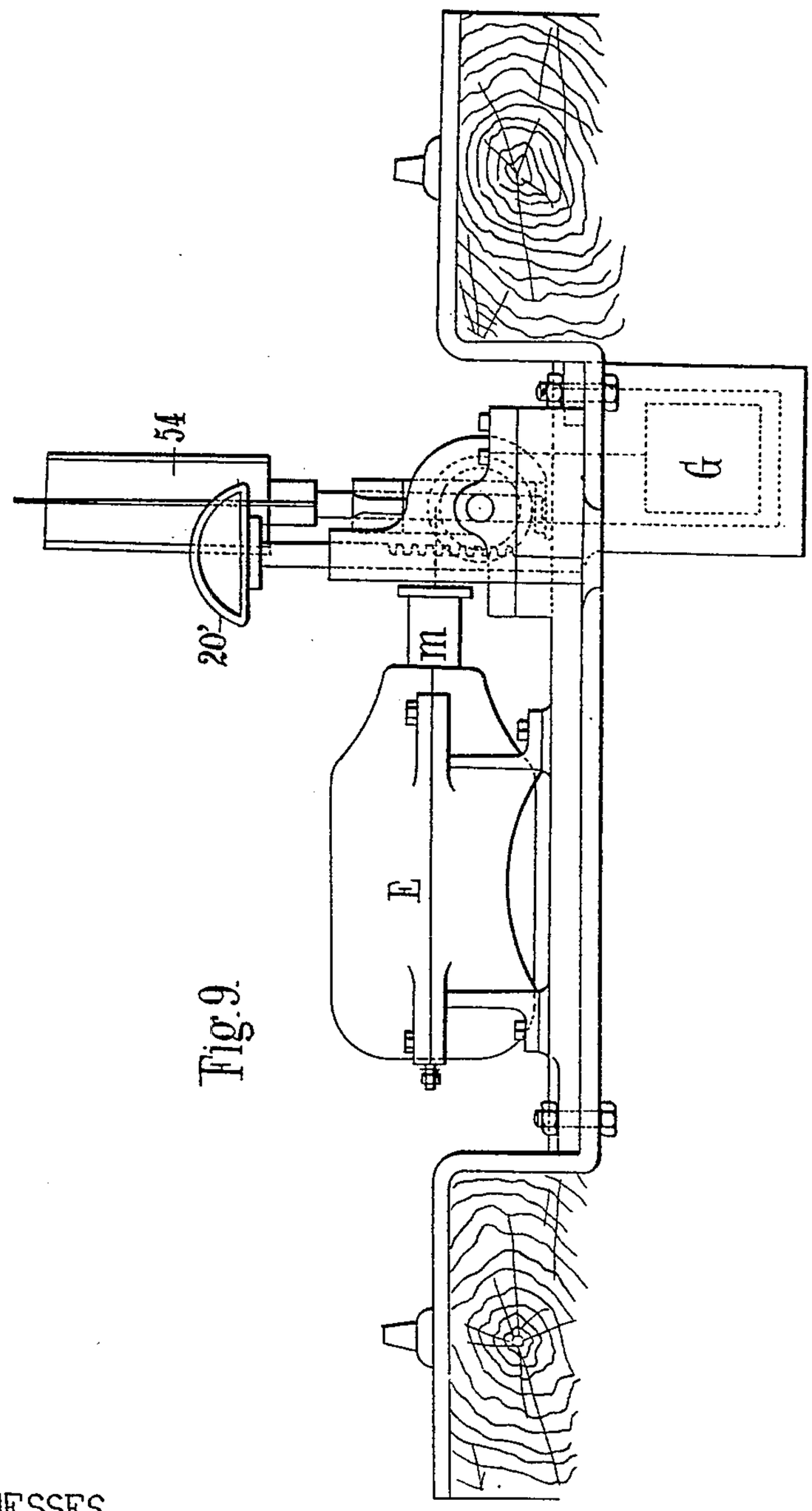

Fig. 9.

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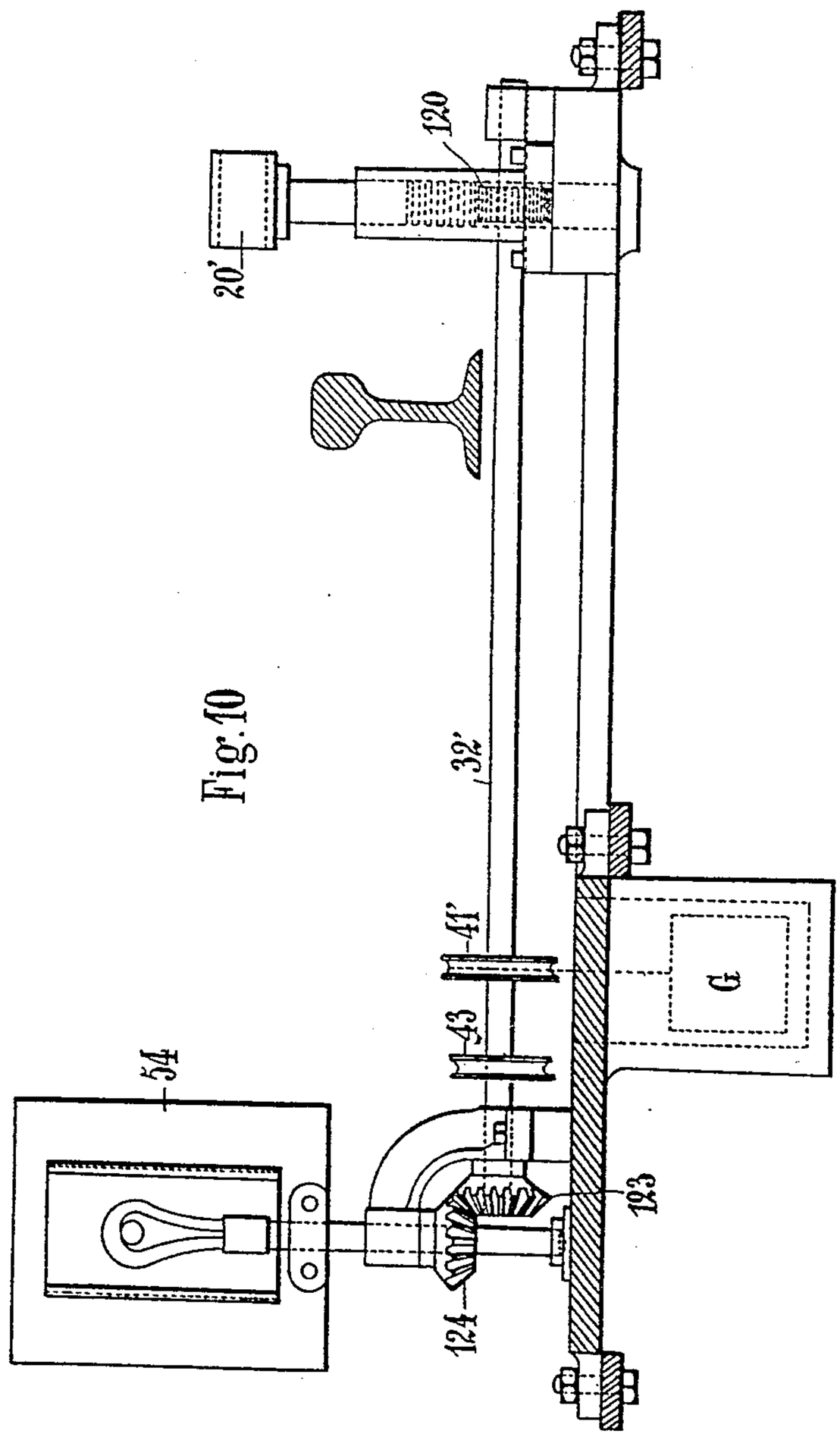

Fig. 10

WITNESSES

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13 SHEETS—SHEET 9.

Fig. 11

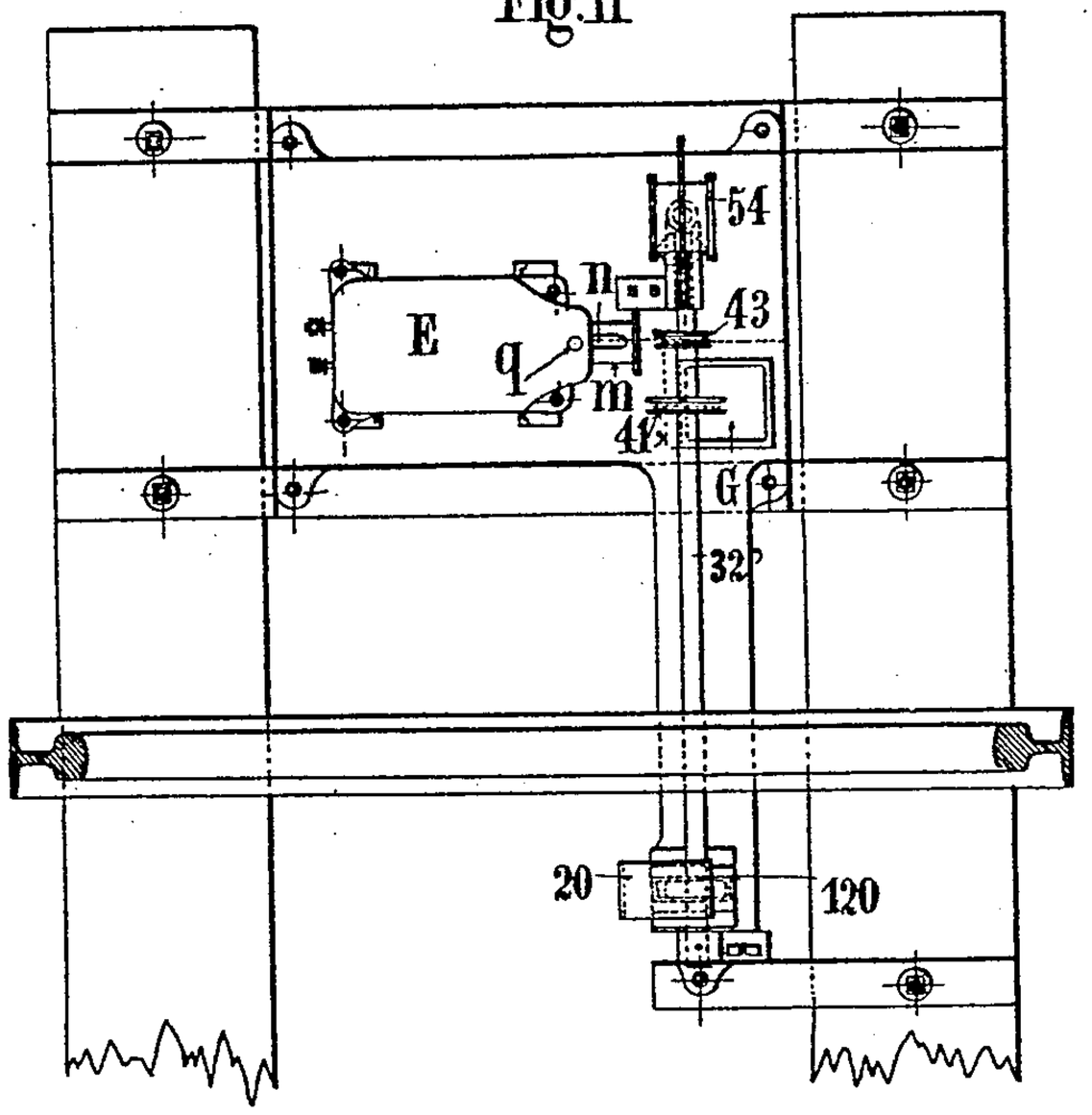
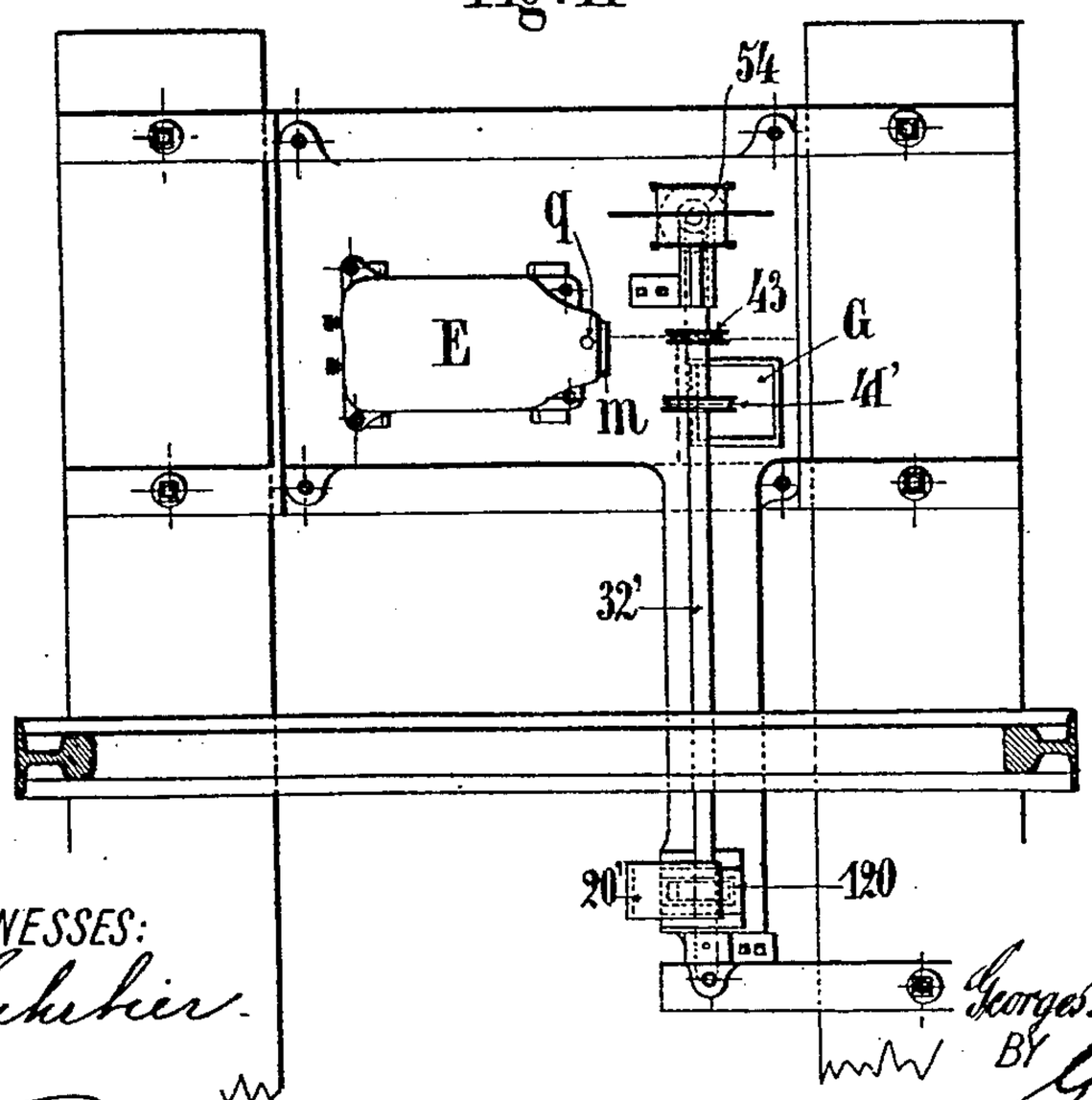


Fig. 14



WITNESSES:

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13 SHEETS—SHEET 10.

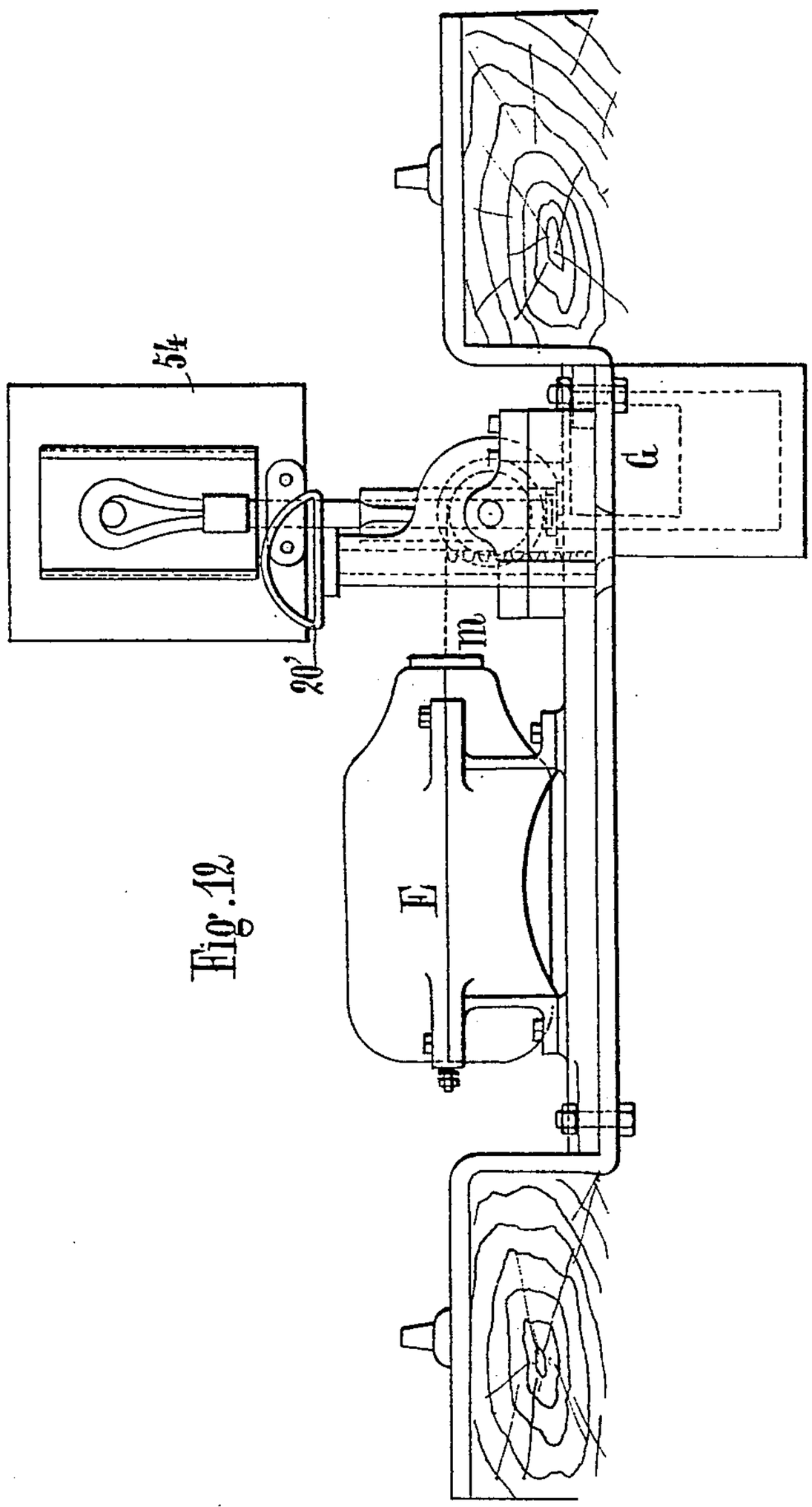

Fig. 12.

WITNESSES:

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246. RAILWAY SWITCHES & SIGNALS.

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RAILWAY SIGNALING AND SAFETY SYSTEM AND APPARATUS.

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13 SHEETS—SHEET 11.

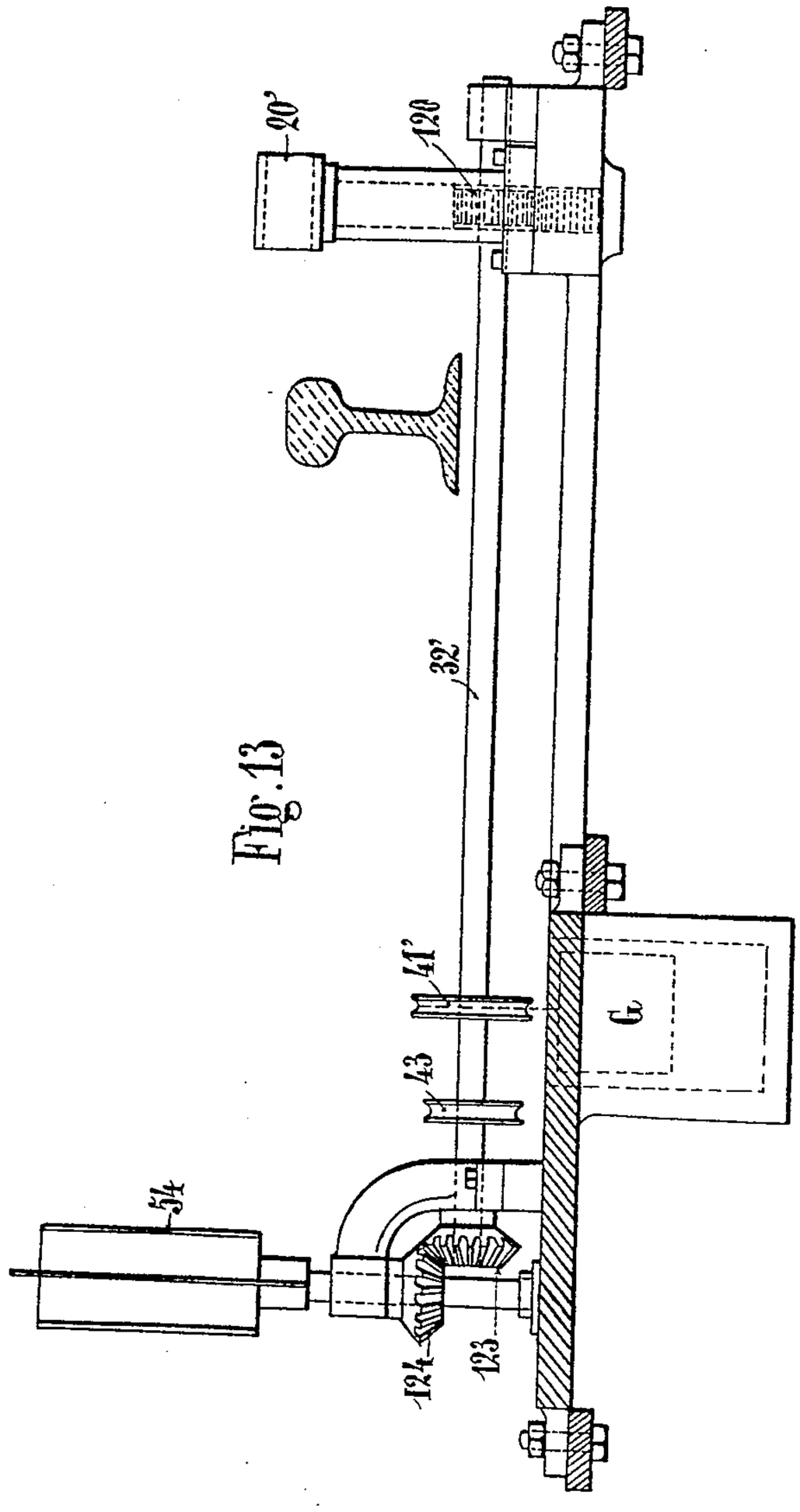

Fig. 13

WITNESSES:

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G. M. SCHREIBER.

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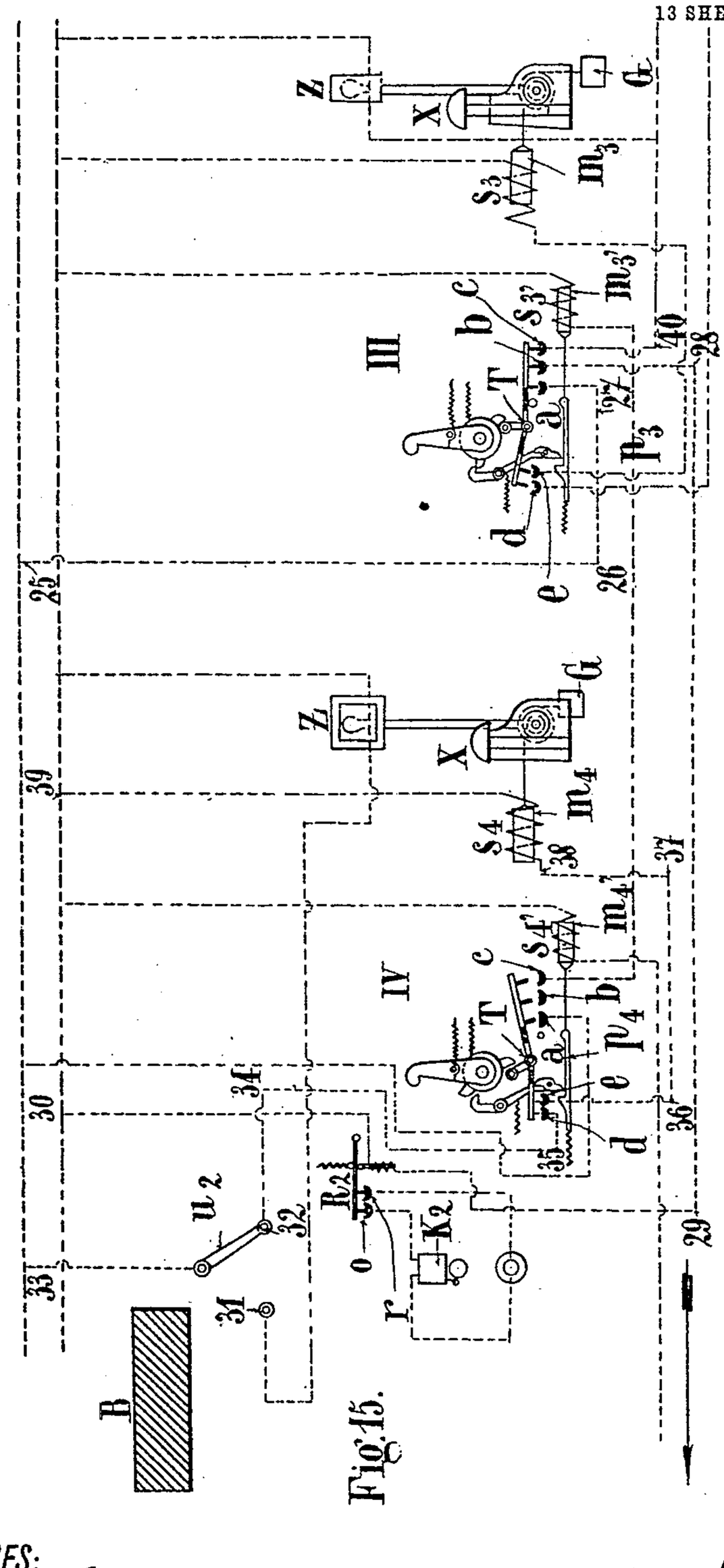

Fig. 15.

WITNESSES:

Henry J. Sukelier.

[illegible]

INVENTOR

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BY

Lemuel Wiles

ATTORNEYS.

ANDREW. B. GRAHAM CO., PHOTO-LITHOGRAPHERS, WASHINGTON, D. C.

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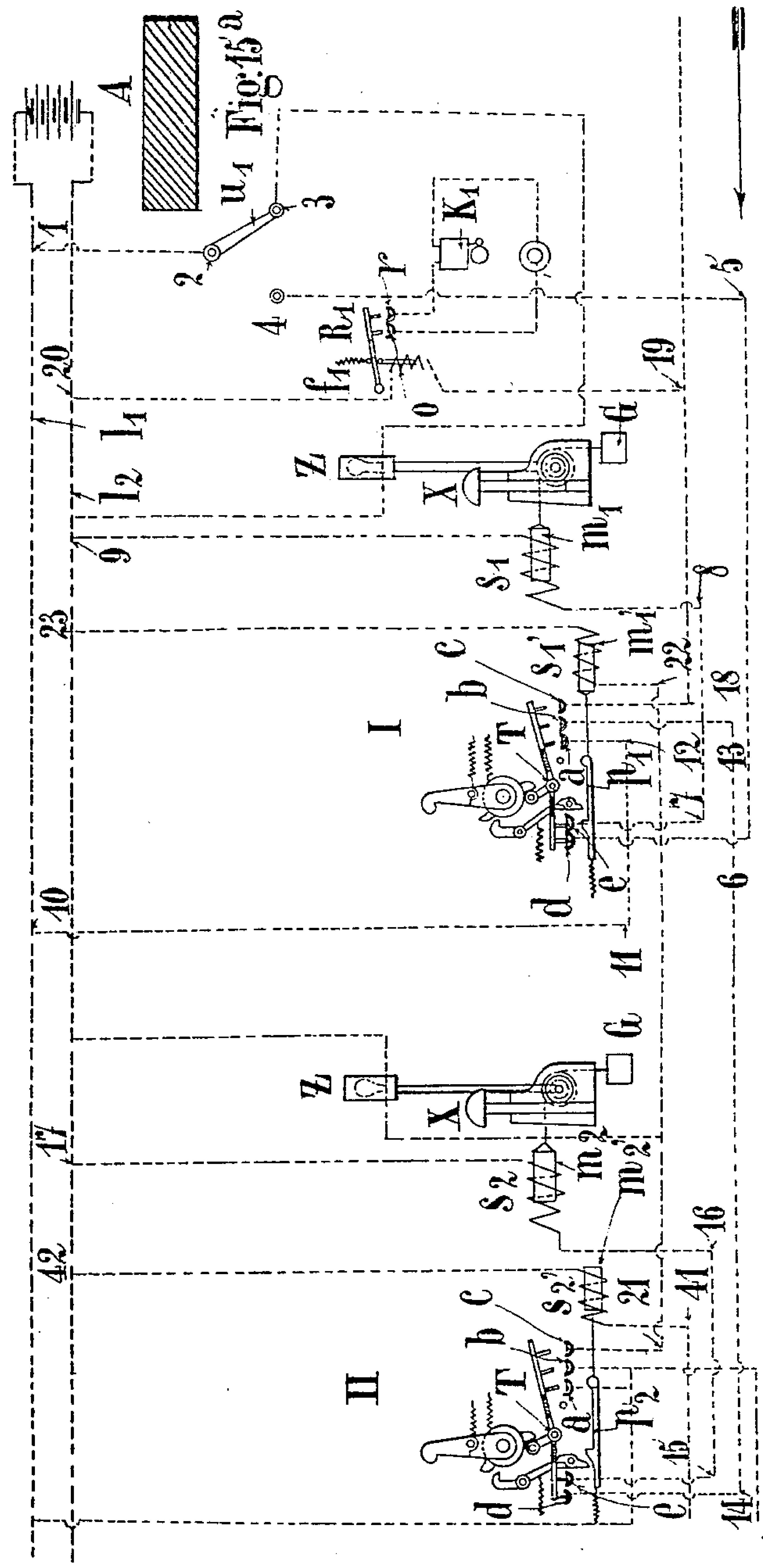

WITNESSES:

Henry J. Suhrbier.

[signature]

INVENTOR

Georges Michel Schreiber

BY Goepel & Niles

ATTORNEYS.

UNITED STATES PATENT OFFICE.

GEORGES MICHEL SCHREIBER, OF ROUBAIX, FRANCE.

RAILWAY SIGNALING AND SAFETY SYSTEM AND APPARATUS.

No. 820,143. Specification of Letters Patent. Patented May 8, 1906.

Application filed November 15, 1904. Serial No. 232,821.

To all whom it may concern:

Be it known that I, GEORGES MICHEL SCHREIBER, a citizen of the Republic of France, and a resident of Roubaix, France, have invented new and useful Improvements in or Relating to Railway Signaling and Safety Systems and Apparatus, which improvements are fully set forth in the following specification.

This invention relates to improvements in the electric signaling system for railways set forth in Letters Patent No. 658,806, which were granted to me on October 2, 1900.

The characteristic features of this invention will appear from the following description.

The improved apparatus, as has already been explained in the said previous patent, has for its object to prevent automatically collisions which might take place between trains traveling in all directions on railway-lines. To that end the line is divided between the stations into several sections by means of contact apparatus communicating with each other with their protective stops. These stops, arranged between the rails, are connected to optical signals, such as lamps, in which an incandescent lamp is placed behind a red glass. In danger position the stop is raised, and the disk showing a red light faces the direction from which the trains arrive, whereas when in the safety position the stop is lowered and the lamp extinguished and turned in the direction parallel to the line. When a train passes over one of the contact apparatus, it sets the signals in front at "safety," so as to clear a passage for itself, at the same time automatically blocking the line behind by means of the stop and lamp which it has passed. This protective device cannot be set at "safety" by another train until after the first train has left that section. If, for any reason, the driver of a train arriving at a blocked section passes over the stop without noticing the stopping-signal, the stop acts by means of suitable mechanism on the whistle of the engine, and thus gives an alarm and at the same time it acts on the brake so as to stop the train.

In the arrangement according to this invention automatic signaling has been preserved, but under the control of the station-masters. Moreover, this system is arranged so that it can be adopted while retaining the ordinary signals employed.

In the accompanying drawings, Figure 1 is an elevation of the contact apparatus. Fig. 2 is a plan view of the same. Fig. 3 is a detail view of the disk employed in said apparatus. Fig. 4 is a vertical transverse section through the contact device. Fig. 5 is a vertical longitudinal section thereof. Figs. 6, 7, and 8 are vertical transverse sections showing the parts in different positions. Fig. 9 is a side elevation of the stop device and signal. Fig. 10 is a front elevation of the same. Fig. 11 is a plan view. Figs. 12 and 13 are views similar to Figs. 9 and 10, the parts being shown in different positions. Fig. 14 is a view similar to Fig. 11, but showing the parts in different positions. Figs. 15 and 15^a show diagrammatically the arrangement of the protection mechanism along a line between two stations A and B, between which the trains travel in the direction of the arrow.

The whole comprises a departure signal-station, (station A,) an arrival signal-station, (station B,) and two intermediate signal-stations. Normally the lamps of the signal-stations are set against the trains with the stops raised; but the intermediate signal-stations are not necessary for every installation.

In the station A the station-master wishing to give the signal for the departure of a train moves the switch u_1, which was on the contact 3, and places it on the contact 4. If the line is clear, electric current supplied by an outside source—say, by a storage battery—will pass through the coil s_1, whereupon the core of the electromagnet s_1 is attracted and the balance-weight G raised, the stop X lowered and the disk Z set at "safety" or "line clear." The current from the battery passes then through the points 1, 2, u_1, 4, 5, 6, d, e, 7, 8, s_1, and 9. The departure-signal having been given, the train enters the first section-switch, ing in by the passage of the engine the contact apparatus I. This is the first automatic operation. As soon as the mercury-contact has been closed by this switching in, the current passes into the electromagnet s_2, its core m_2 is attracted, and the first intermediate signal-station is set at "safety." At the same time the contact between the mercury-cups d and e of the commutator having been interrupted the current which held the departure signal-station locked is cut off, and this signal-station is automatically set at "danger" by the action of the balance-weight G. The lamp is therefore turned transversely of the line and the stop raised. By this operation

the train has blocked the line behind it and opened for itself a passage in front. At the same time the current passes through a relay R_1 at the station-master's end, and by the contact taking place at the commutator a bell K_1 is caused to ring and notifies the station-master that the train to which he gave the signal of departure has already passed the departure-signal and that the apparatus I has been switched in. He must then replace the switch or lever u' on the contact 4, whereupon the bell stops ringing. Any operation of the said lever for the purpose of giving passage to a new train would remain unsuccessful as long as the bell rings. Moreover, the station-master would not be able to set the departure-signal at "safety" as long as the train has not passed the contact apparatus II. At that moment, owing to the movement of the lever T of the mercury-commutator of the apparatus II, the electromagnet s'_1 is operated, its core m^1_1 attracts the slide-block p_1, which releases the switching-in lever, the lever T swings about its pivot, and the apparatus I is switched out and returns to the position of rest. The first intermediate signal is set at "danger," owing to the current in the electromagnet s_2 being cut off and the balance-weight G becoming operative. Finally, the current would act to set the second intermediate signal at "safety," which would be effected if no train occupied the portion of the line in front of the contact apparatus III. In Figs. 15 and 15[a] it is, however, assumed that the said apparatus III is still locked. Owing to this arrangement no current can pass, the circuit of the electromagnet s^3 being open on account of the position of the lever T of the commutator of the contact apparatus III, and the second intermediate signal remains at "danger." On approaching the engine-driver finds, therefore, the line blocked and must stop, otherwise the train will be automatically stopped by the stop X, which is raised and which on coming in contact with a slide-block of the locomotive operates the whistle and opens the air-outlet valve of the Westinghouse brake on the engine. The train is stopped as long as the preceding train has not passed the departure apparatus IV, and so on. By the switching in of the apparatus III the second intermediate signal is set at "danger," while current is sent into the relay R^2 of the station B, and owing to the contact thus produced between the cups *o* and *r* of this relay the bell K^2 is caused to ring, thus notifying the station-master that a train is approaching to be admitted into the station B. He then turns the handle u^2 onto the contact 32 and thus sets at "safety" the arrival-signal of the station B. The engine passes this signal and turns down the lever of the contact apparatus IV, which switches out the apparatus III, the bell K^2 stops ringing, and the station-master turns the handle u^2 back to the contact 31. This contact apparatus (shown in Figs. 1 to 8 mounted on a cast-iron plate) is fixed direct to the sleepers without any other foundation. Its mechanism arranged between two brackets M and M′ comprises a disk 44 in one piece with a spindle I, to the end of which is secured a lever *k g*. This disk 44 is provided on one side with a sector 45, which fits into a drum or block *s*, and on the other side with a tappet *w*, adapted to strike a projection *o′*, as shown in Fig. 4. A flat spring 50, Figs. 2, 4, and 5, connected to a chain 51, holds the said disk 44, with the lever *k g*, in vertical position, Fig. 1. The drum *s*, the spindle *h* of which engages on one side in the partly tubular shaft I and on the other side in a bearing in the bracket M′, is held in its normal position by the action of its spring 1, Figs, 1, 6, 7, and 8, and of its sector 46, resting against the sector 45 of the disk 44. To the drum *s* are secured projections or fingers 55 and 3′. The finger 55, with the hook 30′, constitutes switching-in gear for the apparatus. This hook 30′ is maintained in one position by the action of its spring 29′ and of its stop *z*. The finger 3′ in its movement operates the pivoted contact lever or commutator T by acting on the short arm 100 thereof. This commutator T carries at the ends of its arms 102 and 103 insulated plates 4′ 5′, provided with copper points or pins, by means of which it establishes contact, according to its position either between the mercury-cups *a b c*, Fig. 2, or *d e*, Fig. 5, which are all insulated from each other.

As soon as an engine passing by a contact apparatus causes its operating-bar to slide over the head of the lever *k g* it gradually turns down the said lever, which in its movement turns the disk 44. The sector 45 moves, and in coöperation with the sector 46 turns the drum *s*, which assumes the position shown in Fig. 7. The finger or lug 55 has become engaged under the hook 30′ and is held thus under the action of the springs *l* and 29′. The finger or lug 3′ having also moved the arm 102 of the lever T has been turned, thus bringing the copper pins of the plate 4′ into the mercury-cups *a b c*. The cup *a* being connected to the source of electricity, circuits starting from the cups *b* and *c* are then closed at that moment. At the same time as the arm 102 of the lever T sinks the arm 103, with its plate 5′, rises and interrupts electric communication between the cups *d* and *e*. After the switching in of the contact apparatus the lever *k g* under the action of the spring 50, connected to the disk 44 by the chain 51, resumes its vertical position as soon as the operating-bar of the engine has released it.

The contact apparatus after having once been switched in cannot be switched out except by the passage of the train to a second apparatus. If by any chance a train had to

go back to a switched-in apparatus by backing, its operating-bar would merely turn the pivoted part *k* of the double lever *k g*, which would not in any way affect the mechanism of the apparatus, and that part *k* would at once resume its vertical position under the action of its tail end provided with a balance-weight. It will thus be seen from Fig. 7 that a train once having thrown the apparatus into gear can move on the line in both directions, its protected sections remaining blocked all the time. It will also be seen from Figs. 7 and 8 how the armature *m'* of the electromagnet E' is connected, by means of a chain, with a switching-out block 40' and how the armature and the slide-block are held in their initial position by the action of the spring 17'.

The releasing of the apparatus is effected by the passage of the train to the next apparatus or section. At that moment the circuit of the electromagnet E' of the first apparatus is closed and the armature *m'* attracted. The slide-block 40', with its projection 58, moves under the pivoted tail 27' of the hook 30', and the latter swings and releases the finger 55 of the drum *s*, which returns to its original position under the action of its spring *l*. The finger 3', following the movement of the drum *s*, acts on the short arm 100 and turns the lever T, which thus resumes its original position. The contact between the mercury-cups *a b c* is thus interrupted and the contact between the cups *d* and *e* reëstablished, Fig. 8. The slide-block 40' and the armature *m'* of the electromagnet E' resume their original positions under the action of the spring 17' as soon as the current in the electromagnet E' is interrupted by the passage of the train to the third apparatus which disengages the second.

As already stated, the line is protected by two different mechanisms, which, however, work together, an optical signal and a stop, the effects of which on the engine are already known. Figs. 9 to 14 show these two protective mechanisms, but without their protective metal casings. The same applies to the protective tube for the spindle 32', which controls the disk and the stop, and to the sheath protecting the rack of the stop 20' against snow and dust. For setting at "safety" these protective mechanisms which normally are set at danger and switched out only for the passage of trains an electromagnet E, using a current of 0.80 amperes at a pressure of one hundred and ten volts, serves as a motor.

Figs. 9, 10, and 11 show in elevation and in plan the whole of a protective mechanism set at "danger." The stop 20' and the disk-lamp 54 are arranged with their electromagnet E on a cast-iron plate, which is bolted to the sleepers. These two parts are operated by a spindle 32', passing under the rail. This spindle 32', connected to the armature *m* of the electromagnet E by a chain secured to a grooved pulley 43 on the spindle, operates, on the one hand, by means of a pinion 120, the vertical toothed rack of the stop 20', and, on the other hand, by means of bevel-pinions 123 and 124, the vertical spindle of the disk 54. Moreover, a second grooved pulley 41' is keyed to the spindle 32' and carries a balance-weight G. The travel of the armature *m* of the electromagnet is five centimeters and is limited by a stop *q*, which slides in the groove *n*, as shown in Fig. 11. By the action of the balance-weight G the disk 54 and the stop 20' are maintained at the danger positions. The disk is turned with its red face at right angles to the line and the stop 20' between the rails is held raised to the extent of five centimeters.

Figs. 12, 13, and 14 show in elevation and in plan a protective mechanism set at "safety." The passage of a train to the respective contact apparatus which had been switched in, closes the circuit of the electromagnet E. The armature *m* is then attracted and turns the spindle 32', to which it is connected. The balance-weight G is raised, the stop 20' lowered, and the disk 54 turned parallel to the line. Every protective mechanism remains then in that position until the train has completely passed it and reached the next contact apparatus. The latter by being switched in cuts off the current from the electromagnet E, and under the influence of the balance-weight G the whole protective mechanism is brought back to the position of "danger."

Figs. 15 and 15[a] show diagrammatically the method of protecting a line between two stations. The trains travel on the line in the direction of the arrow from the station A to the station B. Beside the departure-signal at the station A and the arrival-signal at the station B there are also two intermediate signal-stations. As already stated, all the signal-stations are normally set at "danger," and the train itself operates the intermediate signal-stations, while for the switching out the arrival or departure signals at the stations the staff of the station is obliged to act, and to that end there are provided in the stations handles which are operated by the staff only. In the station A there is the handle u_1 for the departure-signal and at the station B the handle u_2 for the arrival-station. As regards motive power for operating the whole system, each station must be provided with a source of electricity, which for the station A is shown in the shape of a storage battery connected to the line-wires *l'* and l^2, arranged along the line on telegraph-poles, the contact apparatus and the protective mechanisms being arranged in shunt-circuit on the said line-wires. It may be taken that the consumption of electricity for the working of such installation will amount to two amperes at one

hundred and twenty volts, and electric energy will be expended only when a train is situated in the protection-section between the two stations. If a train has to leave the station A in order to go to the station B, the station-master will move the handle u_1 from the contact 3 to the contact 4. At that moment (provided there is no other train in the first section) an electric current will pass in shunt-circuit through the coil s_1 of the departure-signal in the following manner: Coming from the battery it passes through line l' 1 2 u_1 4 5 6 into the mercury-cups d and e of the contact apparatus I, thence through the line 7 and 8 into the coil s_1, and returns to the battery through 9 and l_2. This current causes the armature m_1 of the electromagnet s_1 to be attracted. The balance-weight G is raised, the stop X lowered, and the disk Z set at "safety"—that is to say, parallel to the line. The train can therefore enter at that moment the first protection section which has become free and travel the distance, passing to the apparatus I, which it switches in.

As soon as the lever T of the commutator is in the contact position III two circuits are closed, starting from the cups b and c in the following manner:

(*a*) Starting from the line l_1 at 10 the current passes through 11 12, the cups a b of the switched-in apparatus I, line 13 14 and the two cups d and e of the contact apparatus II, line 15 16 into the coil s_2 of the first intermediate signal-station and returns through 17 to the wire l_2. The armature is attracted, as has been described for the departure-signal, and the first intermediate signal set at "safety."

(*b*) Starting also from 10 on the wire l_1 the current passes through 11 and 12, cups a and c, line 18 19, through the coil of relay R_1, and returns thence to 20 on the return-wire l_2. The armature of this relay is attracted, and the contact-points establish contact between the mercury-cups o and r. In this way the battery-circuit of the bell K_1, arranged in the office of the station, is closed. The bell rings and notifies the station-master that the train to which he has given passage has passed beyond the departure-signal and switched in the apparatus I and that he must replace the handle u_1 from the contact 4 to the contact 3.

Owing to the switching in of the contact apparatus I the contact between the cups d and e of that apparatus is interrupted and that between the cups a b c established. At that moment, the current no longer arriving at the coil s_1, the departure-signal, under the influence of its balance-weight G, returns to the danger position, thus protecting the train in the first protection-section.

By reference to the diagram in Figs. 15 and 15[a] it will be readily understood that after the train has passed the contact apparatus II of the first intermediate signal-station, the second intermediate signal will have been set at "safety," while, owing to the interruption of the contact between the cups d and e of the apparatus II, the first intermediate-signal will be returned to "danger." Moreover, the current passing through the cup c of the apparatus II will pass through 21 22 into the coil s'_1 of the electromagnet connected with the slide-block p_1, returning to the wire l_2 through the line 23. The armature is attracted, and with it the slide-block p_1, which, as already stated, switches out this apparatus I. The electric current passing through the cups a b c is cut off, so that the electromagnet of the relay R_1 becomes inoperative. The relay R_1, under the action of its spring f_1, resumes its normal position, and the bell K_1 ceases to ring. The station-master is thus notified that the train has entered the second protective-section. At that moment the station-master could therefore allow a second train to follow by moving again the handle u, so as to set at "safety" the departure-signal, which was impossible as long as the first train had not passed beyond the contact apparatus I of the first intermediate signal-station, since the contact apparatus I, being switched in, the circuit of the electromagnet s_1 was interrupted at the cups d and e.

Figs. 15 and 15[a] clearly show the position of the whole series of signal-stations and contact apparatus due to the passage of a train which started from the station A and passed the contact apparatus III. This apparatus III is switched in. Its lever T has established contact between the cups a, b, and c and interrupted the contact between the cups d and e. Owing to this the current passing through the coil s_3 is also interrupted and the second intermediate signal remains at "danger." Current arriving through the branch 25 of the wire l_1 through 26 27 a b 28 29 passes through the coil of the relay R_2 and returns through 30 to the wire l_2. The contact in the relay R_2 is established, and the circuit of the bell K_2 of the station B is closed. This bell K_2, which begins to ring at that moment, notifies the station-master that a train is approaching the arrival-signal. Provided there is no other train in the station, which is the case shown in the diagram, since the contact apparatus IV is shown in its normal position, the station-master in order to set at "safety" the arrival-signal will move his handle u^2 from the contact 31 to the contact 32. The current will then pass from 33 through u_2, 32, 34, 35, d, and e of the contact apparatus IV and through 36, 37, 38, into the coil s_4 of the arrival-signal and return through 39 to the line-wire l_2. The armature m_4 of the electromagnet is attracted and sets the signal at "safety." From the branch 25 of the line-wire l_1 the current passes through 26 27 a c 40 41 into the coil s'_2 of the apparatus II, and passes

through 42 to the wire l_2. The armature m'_2, which is then attracted, and the releasing or switching-out block p_2 then cause the engagement-hook of the apparatus II to swing and to come into its initial position. If, on the contrary, a train had preceded that just mentioned and was still in the station, the arrival-signal could not be set at "safety," even if by an error the station-master moved the handle u_2 from 31 to 32. In that case the contact apparatus IV, switched in by the first train having interrupted the contact between the cups d and e, the current would be unable to pass to the coil s_4 of the arrival-signal, which therefore will remain at "danger." On continuing to travel, the train switches in the contact apparatus IV, whereby the contact apparatus III is switched out, and the arrival-signal at the station brought back to "danger." The bell K_2 ceases to ring and the armature m'_2, as well as the block p_2 of the contact apparatus II, come into their original position under the influence of the spring. The contact apparatus IV is switched out by the contact apparatus of the departure-block, as at the station B or, in the event of the train going into a siding, by a contact apparatus placed for that purpose at the said siding. The preceding description shows, therefore, that at no moment and by no false maneuver could two trains arrive in the same protection-section. A collision between two trains is therefore quite impossible, even if one or the other of the wires should break or if for any reason the supply of current should suddenly fail. The only result would be a delay in the passage of trains, but never a collision. It will also be seen from Figs. 15 and 15[a] that the incandescent lamps of the disks of the arrival and departure signals can be lighted by means of the handles u_1 and u_2, as well as by the trains, and the intermediate signal-stations are lighted by the switching in of the apparatus during the whole time that a train remains in the section in which it is blocked.

The described safety apparatus for railway-lines can have many applications and is specially important for crossings and stations with large traffic and for sidings, for the system can be arranged so that blocking and unblocking can be effected automatically by the trains without the assistance of any attendant on the train or on the line.

Having thus described my invention, I claim as new and desire to secure by Letters Patent—

1. In an electric signaling system for railways, a track divided between stations into a number of blocks by signals which are normally maintained in position to indicate danger, electrical devices for shifting said signals to safety position, a train-operated contact device in each block, the contact device of the block in which the station is included being normally included in the circuit of the signal-shifting device of that block but cut off when said contact device is operated by the train, and a switch in the station also included in the circuit of said signal-shifting device.

2. In an electric signaling system for railways, a line divided into a number of blocks and having a signal in each block, said signals being normally maintained in position to indicate danger, electrical devices for shifting said signals to safety position, a train-operated contact device in each block and normally included in the circuit of the signal in the same block, but opening said circuit and thereby permitting the signal to shift back to danger when said contact device is operated by a train, a relay device in the station the circuit of which is closed by the contact device in the station-block in being so operated, and a station-signal actuated by said relay.

3. In an electric signaling system for railways, a line divided into blocks by a plurality of signals normally set to indicate danger, electrically-operated means to shift each signal to a position to indicate safety, a contact device in each block and each embodying: an intermediately-pivoted lever adapted to be rocked by the train, three contacts carried at one end of said lever and in electrical connection with each other, two contacts carried at the opposite end of said lever and in electrical connection with each other, but not with said first-mentioned contacts, fixed contacts to coöperate with all of said movable contacts, and means for normally maintaining said two movable contacts in engagement with their corresponding fixed contacts; electrical means for returning said lever to normal position after actuation by the train, a main circuit, an electrical connection between one of said three fixed contacts and said circuit, a connection between another of said set of three contacts in the same contact device and one of the fixed contacts of the contact device in the block in advance, an electrical connection between the third of said three contacts and the electrical returning means of the contact device at the immediate rear and also with said main circuit, an electrical connection between one of said two fixed contacts in each contact device with the signal-operating device in the same block and also with the main circuit, and an electrical connection between the second of said two fixed contacts in each contact device with one of the set of three contacts of the contact device in the preceding block.

4. In an electric signaling apparatus for railways, a plurality of signals arranged along the track and normally set to indicate danger, electrically-operated means to shift each signal to a position to indicate safety, a train-operated contact device in each block, the contact device of the station-block being nor-

mally included in a circuit openable and closable by the station-master and serving when actuated by the train to open said circuit so that the same cannot be closed from the station, a relay device in said station included in a circuit which is closed when said contact device in the station-block is actuated, a station-signal in the circuit of said relay, and electrical connections between said contact devices whereby when one is actuated the signal in the block in advance is switched in and moved to indicate safety.

In testimony whereof I have signed this specification in the presence of two subscribing witnesses

GEORGES MICHEL SCHREIBER.

Witnesses:
EMILE LEDRET,
ARCHIBALD R. BAKER.