(No Model.) 4 Sheets—Sheet 1.

E. M. CHASE.

ELECTRIC RAILWAY SIGNAL.

No. 367,598. Patented Aug. 2, 1887.

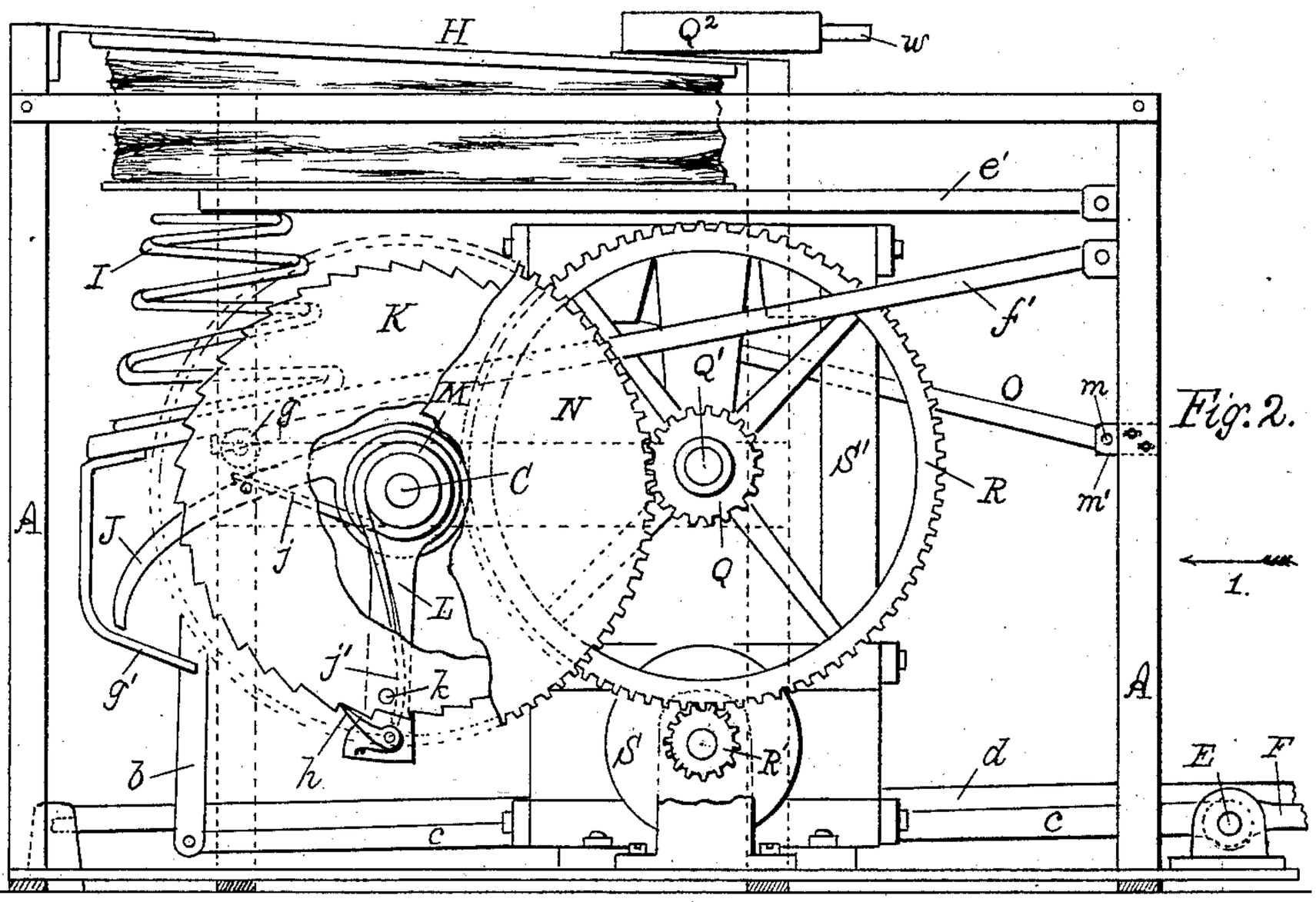
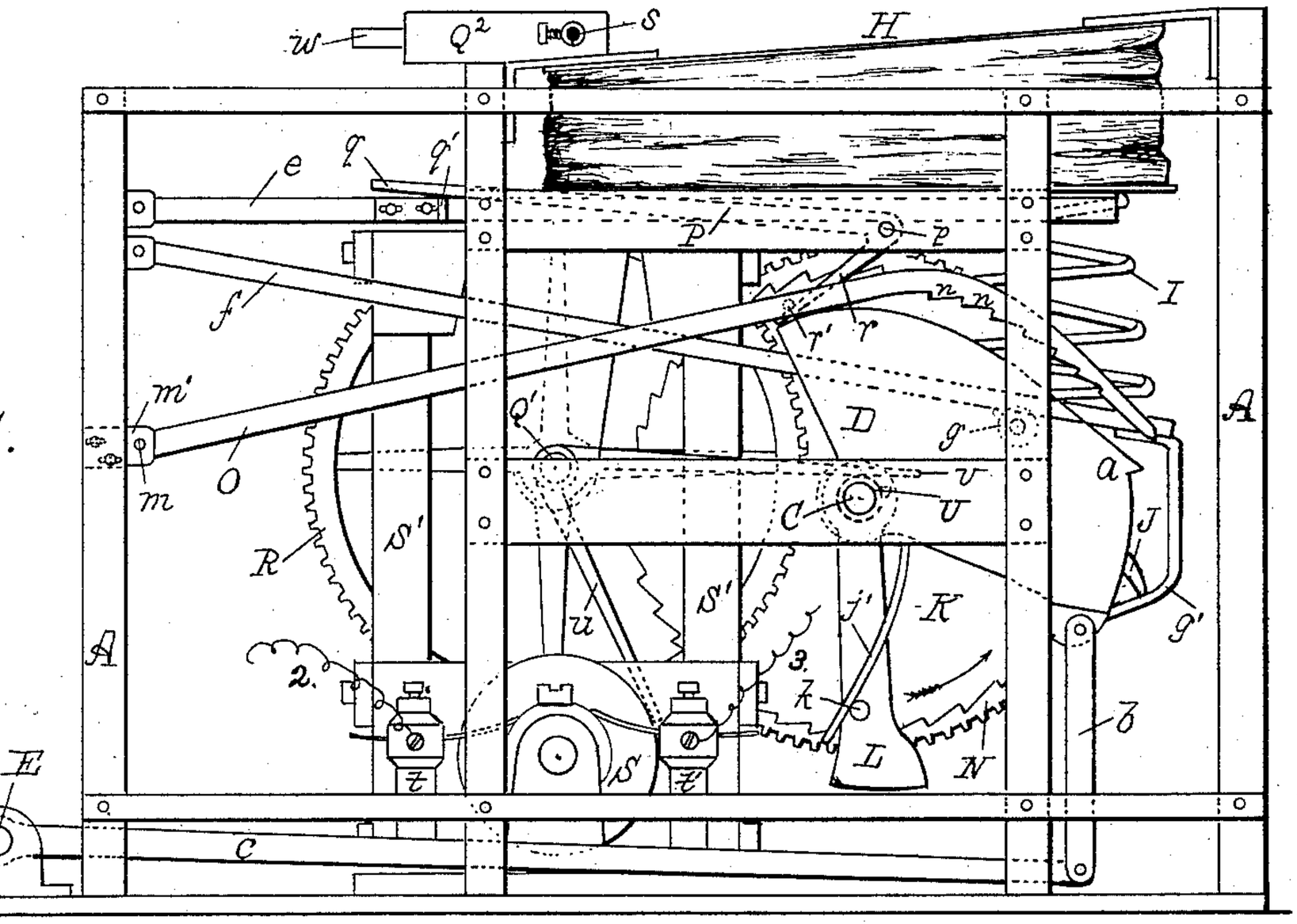


Fig. 2.

Fig. 1.



Witnesses.
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(No Model.) 4 Sheets—Sheet 2.

E. M. CHASE.

ELECTRIC RAILWAY SIGNAL.

No. 367,598. Patented Aug. 2, 1887.

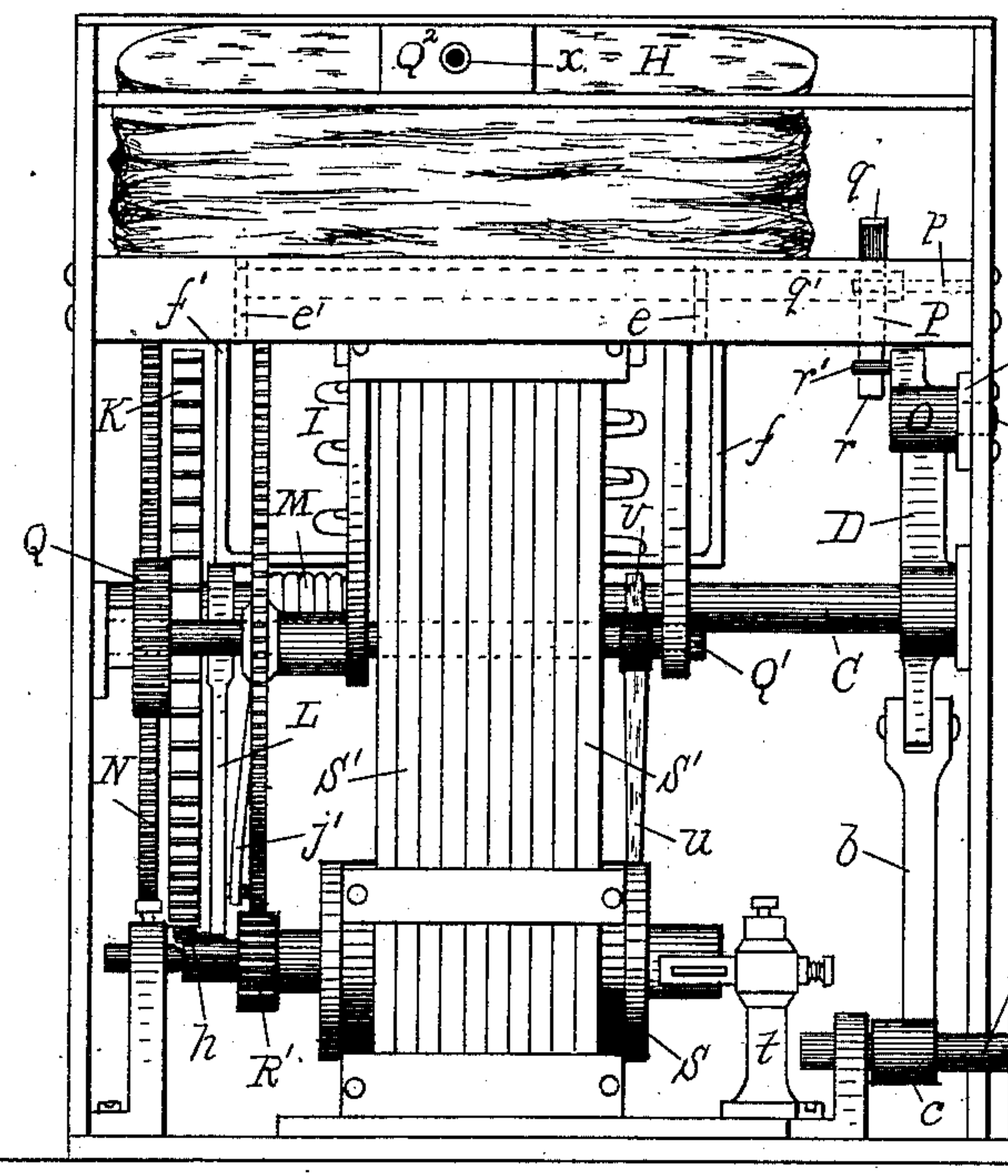
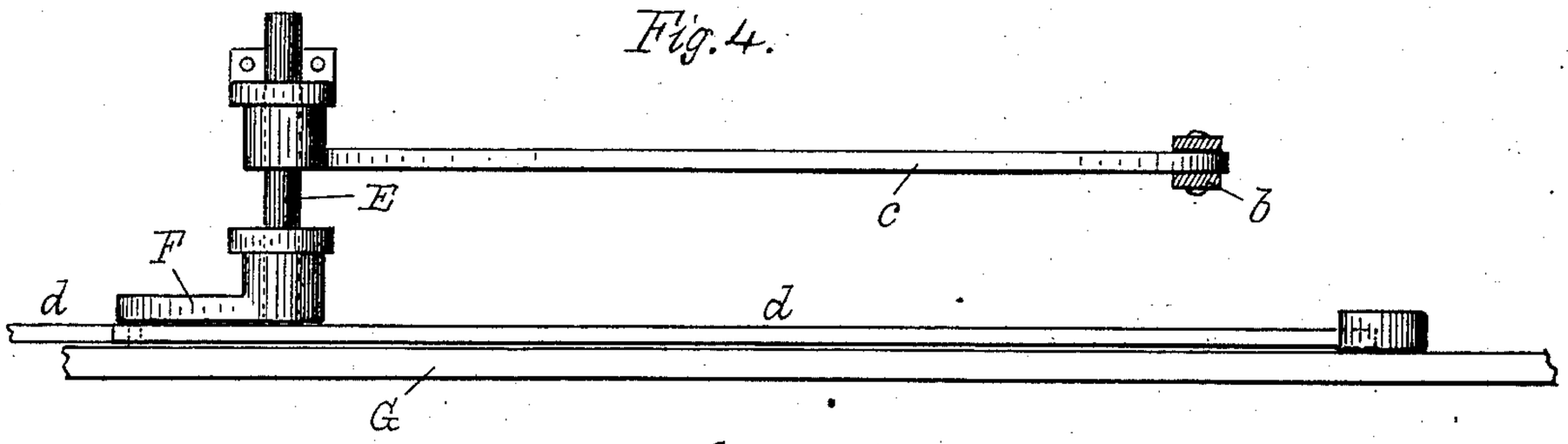


Fig. 3.

Fig. 4.



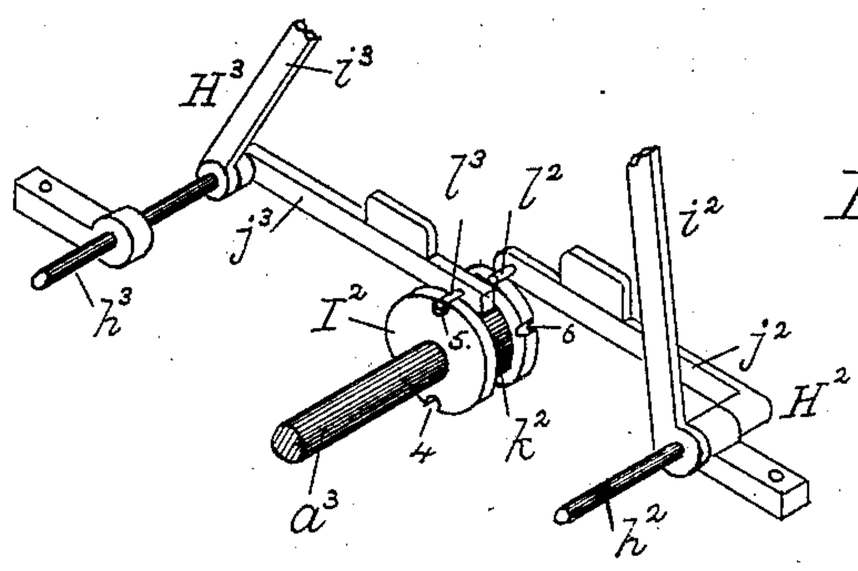


Fig. 12.

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(No Model.) 4 Sheets—Sheet 3.

E. M. CHASE.

ELECTRIC RAILWAY SIGNAL.

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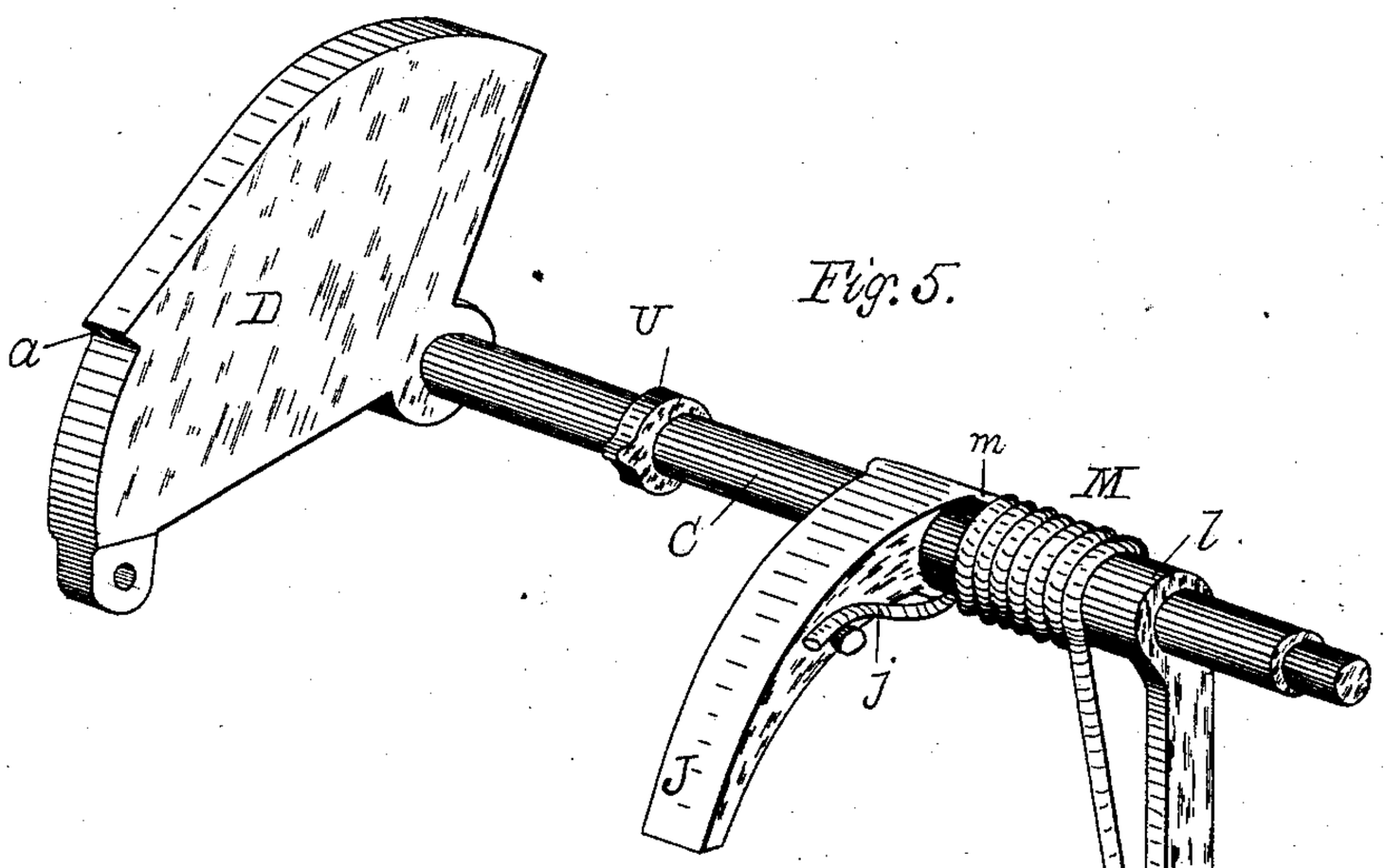
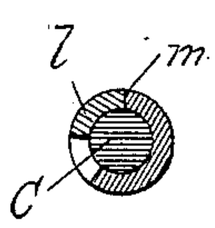


Fig. 5.

Fig. 7.



on line y.y.

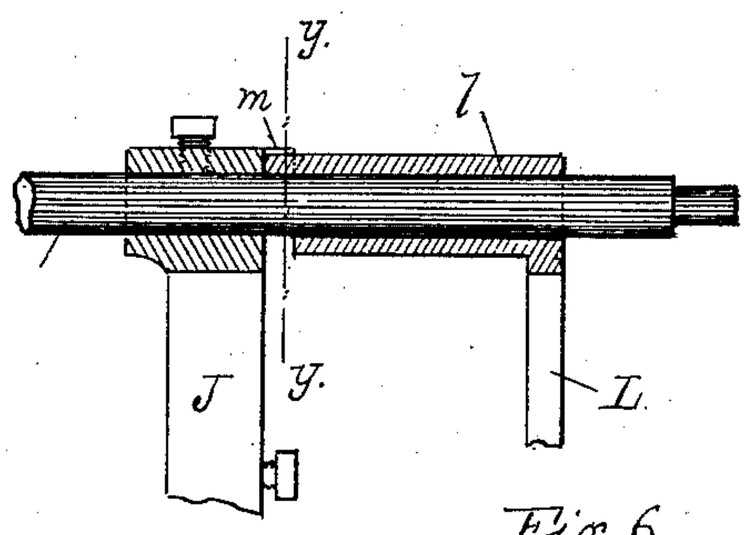
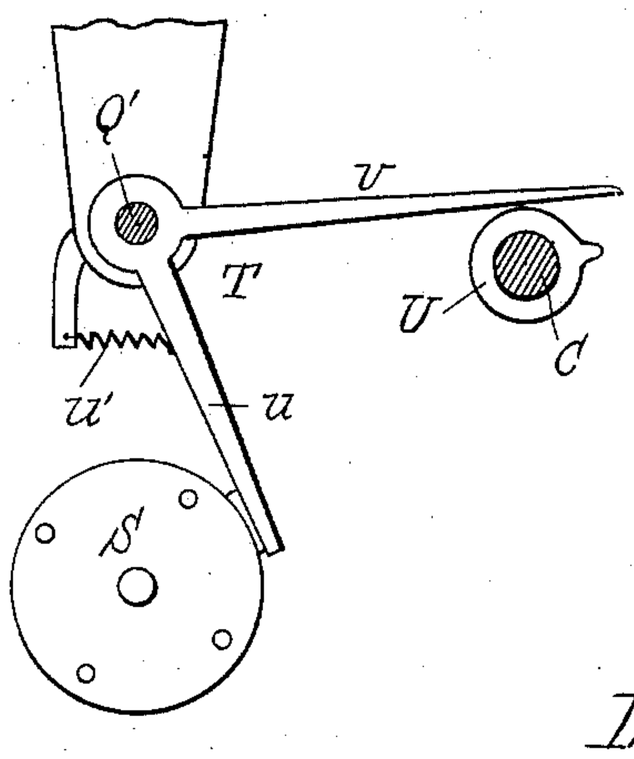


Fig. 6.

Fig. 8.



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ELECTRIC RAILWAY SIGNAL.

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Fig. 11.

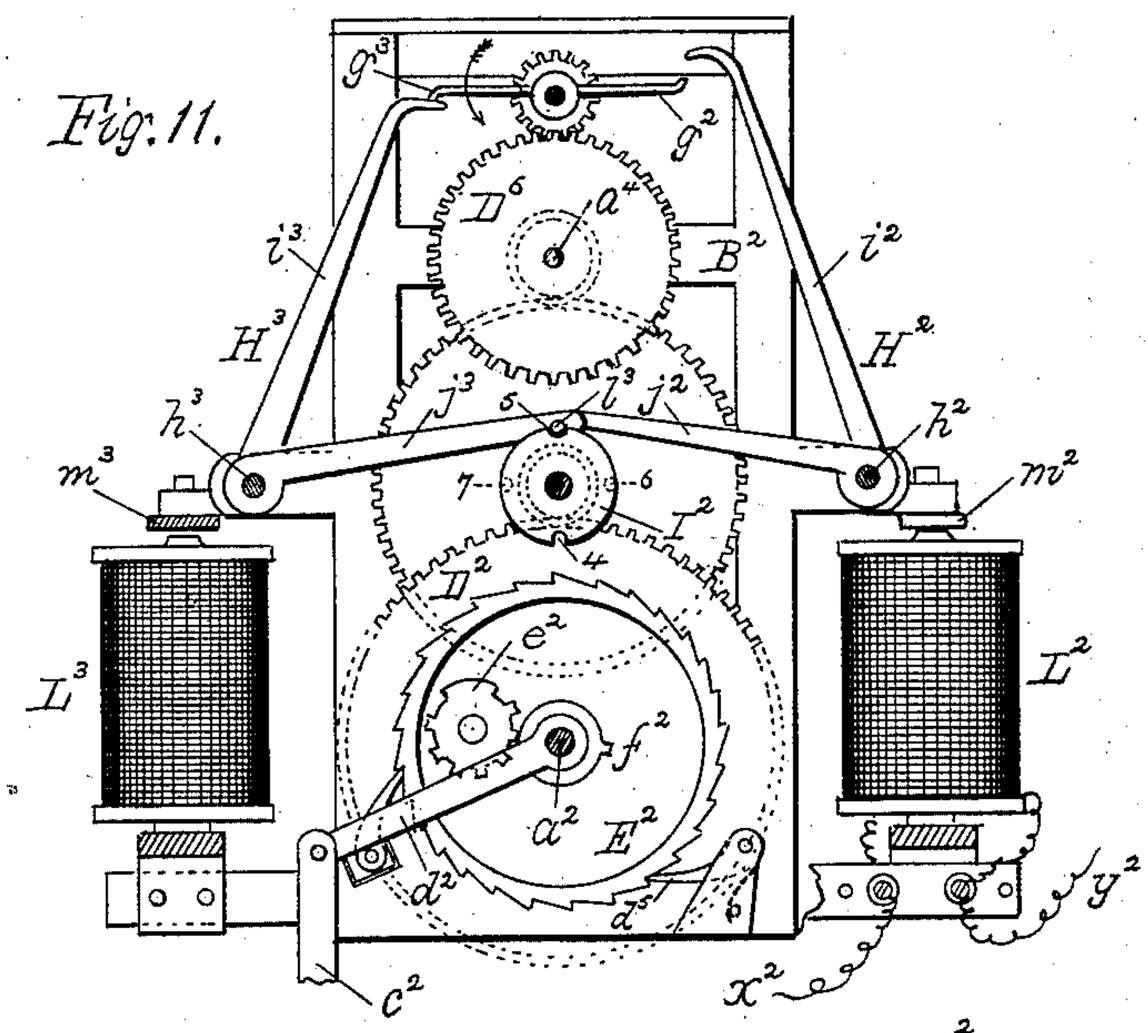


Fig. 10.

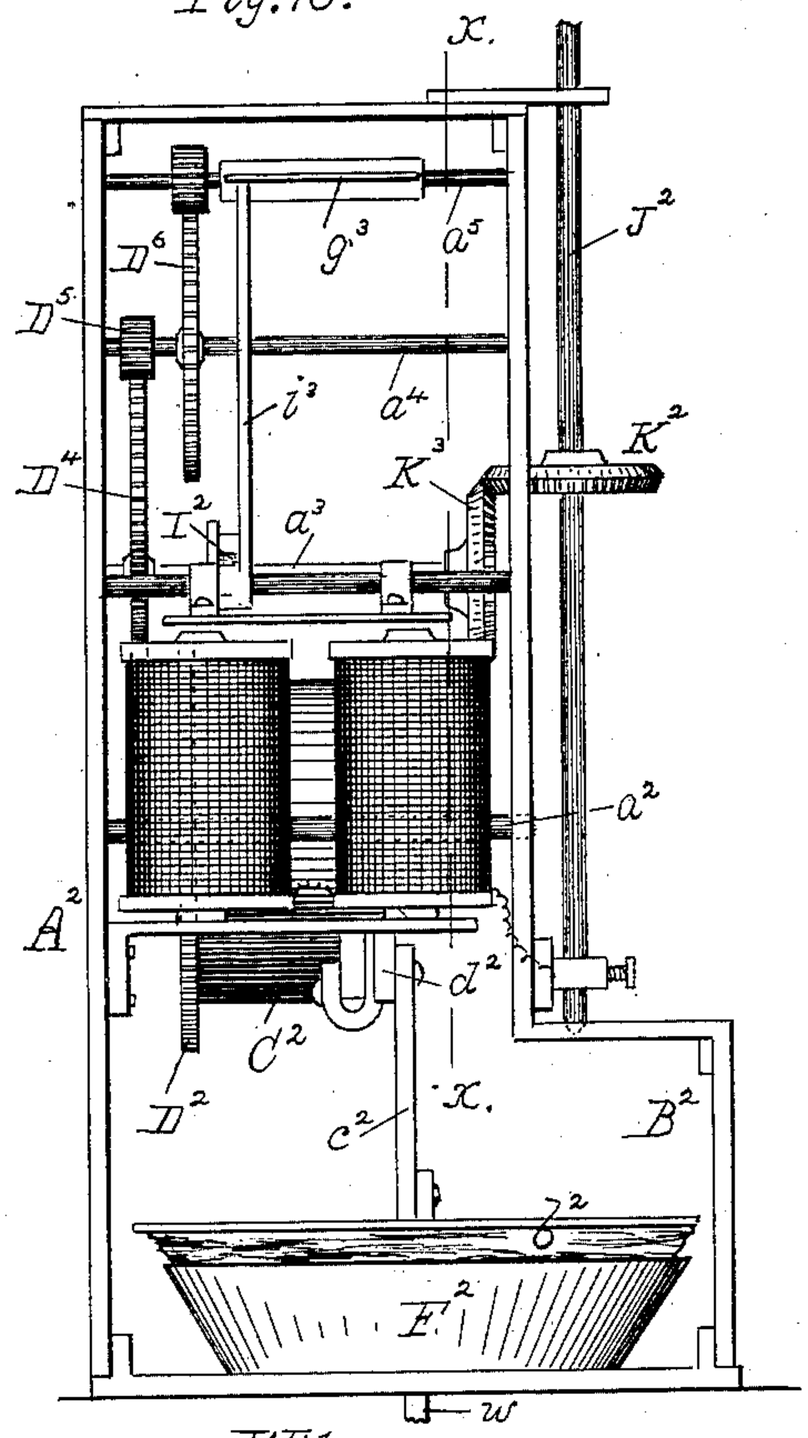
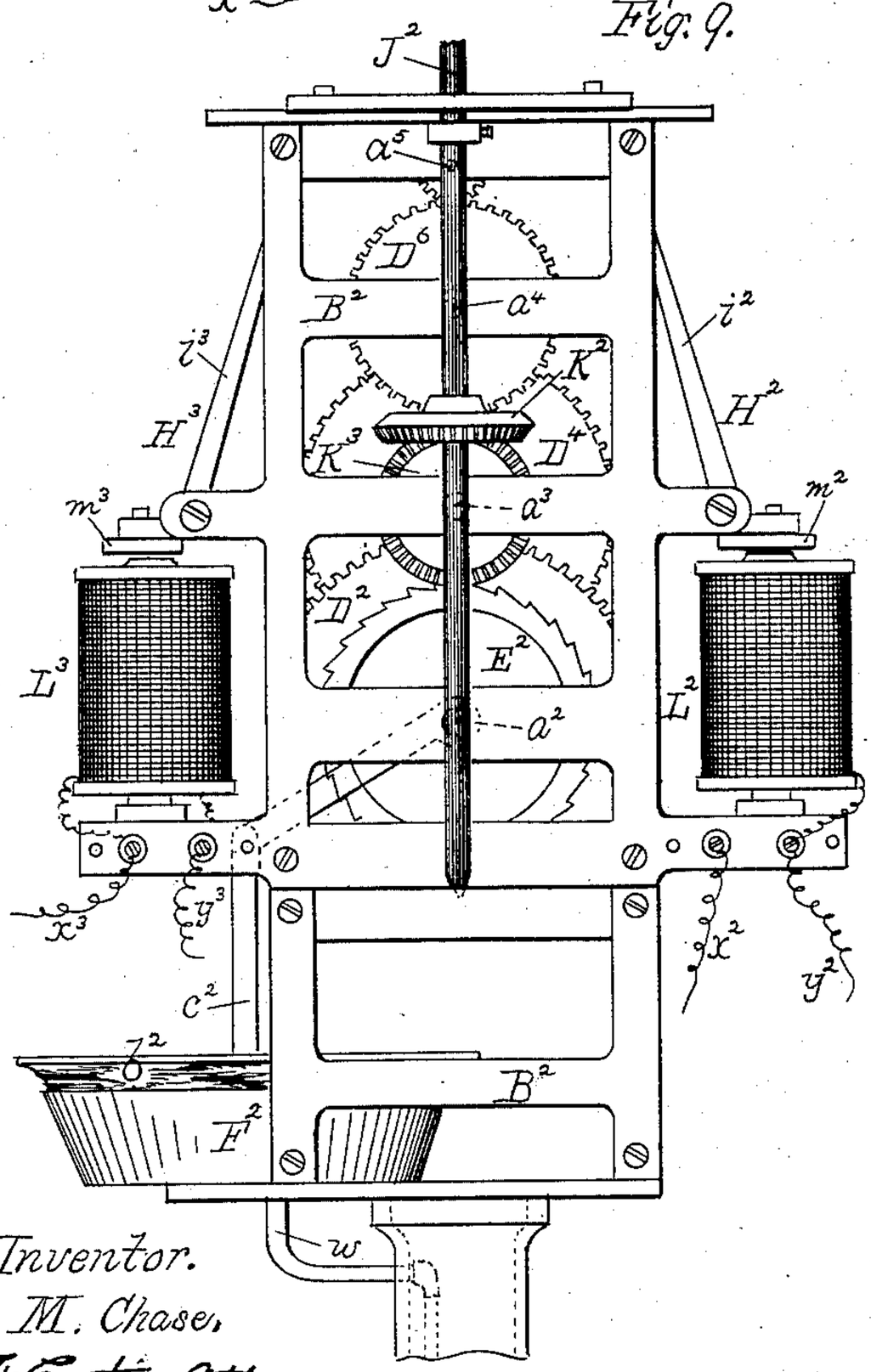


Fig. 9.



Witnesses.
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UNITED STATES PATENT OFFICE.

EDWARD M. CHASE, OF BOSTON, MASSACHUSETTS.

ELECTRIC RAILWAY-SIGNAL.

SPECIFICATION forming part of Letters Patent No. 367,598, dated August 2, 1887.

Application filed November 9, 1886. Serial No. 218,431. (No model.)

To all whom it may concern:

Be it known that I, EDWARD M. CHASE, a citizen of the United States, residing at Boston, in the county of Suffolk and State of Massachusetts, have invented certain new and useful Improvements in Electric Railway-Signals; and I 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 appertains to make and use the same, reference being had to the accompanying drawings, and to letters or figures of reference marked thereon, which form a part of this specification.

This invention relates to that class of railway-operating signals in which a magneto-generator having mechanism interconnecting it with the rail-line is operated by the action of a passing train to create a current, and thereby excite electro-magnets with their co-operating parts and cause them to set to "danger" or restore to "safety" visual signals connected therewith, and thus in a double-track system protect the rear of the train in its travel along the track.

The primary object in my improvements is to enable the mechanism which constitutes the apparatus as an entirety to be rendered efficient and serviceably active by the impact of a single wheel of a passing train upon oppositely-disposed inclined lever-bars contiguous to the rail regardless of the speed of the train; secondly, my improvements consist in the arrangement of mechanism with a pair of time-bellows actively operated by the impact of the wheels, whereby the apparatus is maintained inactive after the first impact and during the passage of the train, or for a longer interval, if desired; thirdly, in the prevention of the rotation of the armature of the magneto-generator and its operating mechanism for a brief period after the impact is imparted by the train to the primary actuating mechanism of the apparatus, whereby energy is stored in the driving mechanism of the armature, and the generator is thus always rotated with speed sufficient to create an effective current; fourthly, in the combination, with a magneto-generator and its rotating armature and primary mechanism operated by a passing train, of interconnecting armature-impelling mechanism, which consists in a loosely-mounted ratchet-wheel and spur-gear and a pawl-bearing arm operated by a wiper-cam through a spring medium, whereby the direct thrusts or shocks from the wheel impact is obviated.

Furthermore, my improvements consist in combination with a magneto-generator operated by a passing train of apparatus controlled by electro-magnets excited by the generator, whereby visual signals arranged along the line may be set to "danger" or restored to "safety," and are automatically locked against accidental turning, while the winding of the actuating mechanism therefor is effected by an air-receiver and operating-diaphragm through the agency of an air impulse created by the time-bellows at the passing of each train, as more particularly hereinafter specified and described.

The drawings accompanying this specification represent, in Figure 1, an elevation, front side, and Fig. 2 a similar view of the rear side, of an apparatus for electrically operating railway-signals, and embodying in part my invention. Fig. 3 is an end elevation of the same apparatus, looking in the direction of arrow 1 in Fig. 2, while Fig. 4 is a plan of the intermediate mechanism, connecting the apparatus with the rail, and by means of which the impact from the passage of each train thereby is caused to operate visual signals. Fig. 5 is a perspective view, enlarged, of the shaft and its operative mechanism, which actuates the bellows and the magneto-generator. Fig. 6 is a longitudinal section of a portion of said shaft, showing the loose attachment of the pawl-carrying arm, and Fig. 7 is a transverse section thereof on line *y y* in Fig. 6. Fig. 8 is the brake mechanism by which the armature of the magneto-generator is held stationary until energy is stored sufficient to operate it, caused by the passage of a train. Figs. 9 and 10 represent, respectively, a side elevation and end view of the signal-operating mechanism, while Fig. 11 is a sectional elevation of the upper portion thereof on line *x x* in Fig. 10. Fig. 12 is an isometric view, enlarged, of the locking and releasing mechanism for the visual signals.

In the above-mentioned drawings, A represents a rectangular skeleton frame-work of

iron, arranged in close proximity to and alongside the track, and adapted to be exteriorly sheathed or covered, to contain the operative parts of the electric generating apparatus, (shown as an entirety at B,) and protect the mechanism of the latter from atmospheric influences. Since in my invention the visual danger or block signals of a railway are to be operated electrically, my primary object is to arrange an apparatus which is to be actuated only by a single blow from a locomotive or car wheel, which latter then renders it inoperative during the further passage of the train.

Furthermore, energy at the same time must be stored to generate an electric current and control signals along the line, either at the home station or at ones in the rear of the then passing train. To successfully attain this result, I have mounted a shaft, C, transversely of the frame A, and affixed upon its front end a sectoral plate, D, provided with a single tooth, *a*. To this plate is pivoted a link, *b*, united to the connecting-lever rod *c* upon the rock-shaft E, which latter is actuated by the lever F, due to the impulse of the wheels of a passing train upon one of two oppositely-disposed inclined lever-bars, *d d*.

Each bar is pivoted at its free upraised end to the lever F, while its opposite extremity is secured in a chair, and is arranged in parallelism with and in close proximity to one of the rails G of a railway system. To maintain this inclined bar *d* below the rail and render it inoperative after receiving an impact from the wheel of a passing train, and to release the same after said passage has occurred, I have secured to the frame A the upper part of a pair of bellows, H, which is stationary. The lower expansible part thereof is attached to a pair of arms, *e e'*, pivotally arranged upon the frame. A second pair of similar arms, *f f'*, are pivoted below, while between the two sets of arms, and attached to them, is located a coiled spring, I. Furthermore, to actuate the bellows a roller, *g*, and hook *g'* are attached to the free end of the arms *f f'*, and engage a wiper-cam, J, upon the shaft C. Thus semi-rotation of the latter, induced by the sectoral plate D, brings the cam against the roller to contract the spring and compress the bellows, while upon a reverse movement the wiper-cam engages the hook *g'*, and the several parts are returned to their normal inactive positions. In the operation of this electric generating apparatus B, it is very necessary that no positive sudden thrust, caused by the wheels of a passing train, should be permitted to affect the actuating parts of the apparatus, especially the mechanism composed of the ratchet-wheel K and its pawl *h*, employed to drive the rotary armature of the magneto-generator. This driving mechanism is effected actively by a semi-rotary movement of the shaft C, induced by the inclined lever *d* and its interconnecting rocker-shafts and levers, and consists of a ratchet-wheel, K, loosely turning upon said shaft, and to be rotated by the pawl *h*, pivoted to the arm L, which is also loosely mounted upon the shaft C and spring-impelled by the spring M, coiled about the sleeve-hub *l* of the said arm L. One end, *j*, of this spring bears upon a stud in the wiper-cam J, while the other end, *j'*, oppositely disposed, rests against the laterally-projecting pin *k* in the free end of the pawl-carrying arm L, for purposes more fully hereinafter explained. The two ends of the spring M are normally under strong tension, and thus serve to maintain the cam J and arm L interlocked when inactive. Furthermore, upon reference to Figs. 6 and 7, it will be observed that a portion of the sleeve hub *l* is removed, while the end adjacent to the hub of the wiper-cam J engages a lateral shoulder, *m*, thereon. Thus upon an upward thrust of the link *b*, semi-rotation of the shaft C, and oscillation of the wiper-cam J, the shoulder *m* is disengaged from the sleeve-hub *l*, against the tension of the spring M. Simultaneously therewith the tension of the spring M is increased by the movement of the end *j*, and the loose pawl-carrying arm L is now free to rotate upon its shaft, impelled by the tension of the spring M through its end *j'*. Thus the pawl *h* actuates the ratchet-wheel K and forces it to advance, and thereby also rotates a spur-gear, N, attached to and forming an integral part of it. Thus the positive sudden thrust exerted by a passing train upon the sectoral plate and its operating mechanism, which would be detrimental, is overcome and obviated, while the pawl and ratchet-wheel are operated by an efficient but powerful and yielding agency; hence no shock or jar is transmitted to these particular parts, and the latter are not liable to be impaired or broken. Upon the passage of a train and the sudden impact arising therefrom the inclined bar *d* is depressed and a corresponding upward movement of the rod *c* and link *b* occurs, while rocking of the sectoral plate and shaft C is effected. This semi-rotation of the latter wipes the cam J against the roller *g*, and rapidly swings the pivoted arms *f f'* upward, compressing the spring I, located between them and the frame *e e'* of the bellows. This action is due to resistance offered by the sudden compression of the air contained within the time-bellows H, which can escape but slowly. Now, when the inclined bar *d* has been actuated and depressed, as above premised, by the wheel of a passing train, it is necessary to thus maintain it against the pressure of the bellows and prevent further action of the wheels; hence when the sectoral plate has been rocked it must be locked in order to retain the inclined bar *d* inactive until passage of the train past the apparatus is completed. This result is attained by the aid of a toothed arm, O, loosely pivoted at *m*. Said arm is in vertical alignment with the sectoral plate, and its free end extends over and is adapted to engage with said plate. This is accomplished by bending said end in the arc of a circle coincident with that described by the tooth *a*, the center of this circle, however, being slightly

eccentric from the center of rotation of the sectoral plate D, and, furthermore, in constructing upon the under side of this curved end and contiguous to said plate a series of teeth, *n n*, &c.

In the event of removal of the various parts of the mechanism above described for repairs or otherwise, and to facilitate the ready adjustment of and eccentricity of the teeth *n n* on the arm O with respect to the tooth *a* on the sectoral plate D, I have secured the pivot of said arm, as shown at *m*, to a bracket, *m'*, adjustably bolted to the frame A. Thus the arm O is adapted to move endwise, and its teeth can readily be accurately arranged with respect to the sectoral plate and its peripheral tooth *a*.

Since the speed of passing trains is continually varying, the travel or throw of the sectoral plate will be more or less, according to said speed, and hence, to render the relative position of each tooth *n n* the same with respect to the throw-off mechanism for all positions of the plate D and bellows, I have arranged said teeth slightly eccentric to the path of travel of the tooth *a*, as above fully described. When the sectoral plate has engaged the toothed arm O, said plate D is to be held locked for a certain interval of time, when it is released, and this is effected as follows: By the swinging up of the arms *f f'* against spring I and frame *e e'* of the bellows, sudden compression of air in the latter creates resistance against the spring I, which is compressed, and during the gradual expulsion of the air and collapse of the bellows this spring exerts a downward force upon the wiper-cam J, which, together with its shaft C and sectoral plate D, are now held rigid by interlocking of the tooth *a* on the latter with the toothed arm O. These parts are thus held until a gradual collapse of the bellows effects their release and an uprising of the inclined lever-bars *d d* by means of a lever, P which is loosely pivoted to a stud, *p*, projecting inwardly from the side of the frame A. This lever is composed of the arms *q r*. The end of the latter rests beneath the pin *r'*, set in the toothed arm O, while the free end of arm *q* lies above and on the adjustable strut *q'*, affixed laterally to the arm *e* near its pivot end.

The strut *q'* is rendered adjustable upon the frame A in order to regulate the release of the sectoral plate, caused by the collapse of the bellows. Thus it will be seen that the nearer said strut is placed toward the pivotal stud *p* of the throw-off lever P, the more quickly will it engage the free arm *q* of said lever, and correspondingly less movement of the bellows is required, while the sectoral plate is released much sooner than if said strut were placed more toward the free end *q* of the throw-off lever; hence the time of release effected by the bellows may be adjusted in this way as well as by permitting the air under pressure in said bellows to escape more or less freely, as may be desired. Thus it will be perceived that while the spring I acts to compress the bellows and discharge the air therefrom, the free end *q* of the lever P is raised as the bellows collapse, and simultaneously actuates the arm *r*, which wipes beneath the stud *r'* and disengages the arm O from the sectoral plate, which now returns to its previous position, again inflating the bellows. The time during which the inclined lever-bars *d d* are maintained inactive is regulated by the rapidity with which the air suddenly compressed within the bellows is permitted to escape, and to this end I have inserted a discharge-valve, *s*, in the metallic box Q, connecting with the bellows.

Briefly, the operation of this portion of the electric generating apparatus and the co-operating instrumentalities above described are as follows: Upon passage of a train thereby and impact upon the inclined bar *d* the latter is depressed and by aid of the interconnecting shafts and lever-rods rocks the sectoral plate D, the tooth *a* of which engages one of the teeth *n*, dependent upon the speed of the then passing train, and the parts are locked and held fixed for the time being. Coincident with this movement of the plate D the wiper-cam J impinges against the roller *g* and compresses the spring I, as before premised. Owing to the now rigid position of the bars *f f'*, the spring I is free to expand upwardly as the air compressed within the bellows is gradually expelled, carrying and lifting the frame *e e'*, which supports the lower portion of the bellows, and likewise the strut *q'*. This strut now lifts the end *q* of the lever P with the aid of arm *r'* and stud *r*, when the toothed arm O is disengaged from the sectoral plate, and this occurs when the bellows are in a collapsed condition. The tension of the spring I is now exerted oppositely, and the cam J now engages the hook *g'* and returns the frame *e e'* and arms *f f'* downward, again refilling the bellows. Coincident with the semi-rotation of the shaft C and the rocking of the wiper-cam J the shoulder *m* of the latter is advanced away from the loose sleeve *l* of the pawl-bearing arm L. The latter is now free to advance and actuate the ratchet-wheel K and spur-gear N, which latter meshes with a pinion, Q, upon the shaft Q', also carrying the wheel R. This wheel cooperates with a second pinion, R', affixed upon the armature-shaft of a magneto-generator. Upon reverse downward movement of the sectoral plate D, rock-shaft C, and wiper-cam J the pawl *h* and arm L are swung backward by means of the sleeve *l*. The latter is now in contact with and abuts against the shoulder *m* upon the wiper-cam, which latter compels its return inactively over the teeth of the ratchet-wheel, in readiness for a repetition of an active advance stroke.

The magneto-generator is of any ordinary construction, and is composed of a rotary armature, S, revolving in a field of fixed magnets, S' S'. The current generated is circuited through posts *t t'* and wires 2 3, thence by branch wires to the signal-operating appara-

tus, which is to be located at suitable distances along the track. In the event of a train stopping upon the inclined bars *d d*, or passing very slowly over them, the movement of the ratchet-wheel and its intercommunicating train of gears might not actuate the armature S with sufficient rapidity to generate the necessary current to operate the signals. To obviate this difficulty, I have provided mechanism by which the armature is held stationary until the movement and travel of the sectoral plate due to the then passing train is almost completed, when said armature is released, and the energy stored within the spring M is permitted to quickly and rapidly actuate the ratchet-wheel K and spur-gear N, which transmits high speed to the armature. Upon reference to Figs. 1 and 8, a loosely-mounted bifurcated lever, T, is shown upon the shaft Q′. One end, *u*, of this lever is forcibly drawn against the head of the armature as a brake-lever by means of the spring *u′*. The other arm, *v*, extends above the shaft C, and co-operates at suitable intervals of time with a cam, U, rigid upon and actuated by said shaft. Now, it is evident that semi-rotation of the shaft C and rocking of the plate D and wiper-cam J would ordinarily rotate the armature S of the magneto-generator at once; but the brake-lever T now firmly holds said armature. Likewise the ratchet-wheel K and pawl-bearing arm L, loose on the shaft C, are also held fast by the intermediary train of gears, N Q R R′. The resultant action is as follows: The shaft C is gradually moved by the slowly-passing train, while the tension of the spring M is likewise increased, due to the advance of the free end *j* with the wiper-cam J, (it being understood that the end *j* is now held fixed by estoppage of the armature,) until sufficient energy is stored in said spring M. This is effected almost at the completion of the active rocking movement of the sectoral plate and shaft C. The latter has now carried the cam U to a position in which it impinges against and lifts the arm *v* of the lever T, and thereby removes the brake-lever *u*, when the armature S revolves rapidly and efficiently. During the time the sectoral plate D is held locked the brake-lever is kept clear from the armature by the cam U, and said armature is free to rotate to the extent of the energy stored within the spring, or until the latter has rotated the sleeve *l* of the pawl-arm L again into contact with the shoulder *m* upon the wiper-cam J.

The purpose of the above-described combination of mechanism, termed the "electric generating apparatus" B, as before premised, is to create a current by means of which electro-magnets controlling visual block or other signals are actively operated. This signal-operating mechanism or apparatus is arranged as an entirety, A^2, in close proximity to the generating apparatus B, and mounted upon a post above the latter. Supported upon said post and bolted thereto is a rectangular open frame, B^2, adapted to receive and within which the operating parts are located and protected from the weather. The primary features of this apparatus consists in a coiled spring contained within a drum, C^2, constructed with a ratchet-wheel, E^2, and loosely mounted upon the shaft a^2, journaled in the frame B^2. To the rear of the drum C^2, and affixed to the same shaft, is a spur-gear, D^2, which is operated by the tension of the spring within the drum after the manner of clock mechanism. In vertical alignment with the shaft a^2 are disposed a series of counter-shafts, a^3 a^4 a^5, with a train of gears mounted upon them. Activity of this train of gears is effected by the coiled spring before mentioned, which is wound in part by the action of each passing train upon the generating apparatus B through the bellows H, air being conveyed therefrom by a pipe, *w*, attached to the box Q^2 at *x*, to a circular receiver, F^2, closed at the top by a flexible diaphragm, b^2. A vertical rod, c^2, unites this latter with a pawl-carrying arm, d^2, secured upon the shaft a^2. Thus upon compression of the bellows H, due to the passage of a train, air is expelled forcibly into the receiver F^2, expands the diaphragm, which lifts the rod c^2, and actuates the pawl upon the arm d^2, causing the ratchet-wheel to rotate, and winds the spring which is locked and held by the pawl d^5.

Excessive winding of the spring is prevented by the epicycloidal wheel G^2, constructed with a convex portion, e^2, adapted to abut against the tooth f^2 rotating with and secured to the ratchet-wheel E^2. When the spring (not shown) is wound, or partly so, the train of gears are in a condition to rapidly rotate a regulator, R^2, with fans g^2 g^3, whenever the interlocking latches H^2 H^3 are removed. These gravity-latches are attached to rocker-shafts h^2 h^3, placed in struts projecting oppositely from the frame B^2, and are composed in part of vertical arms i^2 i^3, which alternately engage at intervals of time the fans g^2 g^3, and in part of the horizontally-disposed arms j^2 j^3, which enter a locking-pallet, I^2, and alternately serve to hold the visual signal in the position desired and maintain it against any accidental movement or partial rotation arising from the wind or other causes.

By reference to Fig. 12 the relative positions of the pallet and its co-operating mechanism will be readily understood. This pallet is located upon the shaft a^3, and is annularly recessed at k^2 to receive the arm j^3, and is further provided with four peripheral slots, 4 5 6 7, arranged in quadrature. Lateral studs l^2 l^3 are disposed in the ends of the arms j^2 j^3, and alternately engage the said slots. 4 5 co-operate with the stud l^3, while 6 7 engage the stud l^2. Each arm in turn becomes active upon release of the opposite arm and return of the latter to a state of inactivity. As shown, the tension of the coiled spring within the drum C^2 is now operating to turn the shaft a^3, and when the stud is lifted from the slot 5 the arm i^3 is disengaged from the fan g^2 and the regulator revolves, while the pallet carried by the

shaft is free to turn ninety degrees and operate the signal. At this time the stud l^2 drops into the slot 6, while the arm i^2 is moved inwardly in unison and engages one of the regulator-fans, and the operating train of gears is stopped and the signal is locked.

Movement of the visual signal (not shown) which surmounts the signal-shaft J^2 is obtained by and through a pair of miter-gears, K^2 K^3, respectively, upon the shafts J^2 a^3. Alternating movements of the latches H^2 H^3 are effected by exciting the electro-magnets L^2 L^3, which attract the armatures m^2 m^3 upon the rocker-shafts h^2 h^3 to actuate the latter. Moreover, as shown in Figs. 11 and 12, the latch H^3 is rendered active by its tilting inward, consequent upon the engagement of the stud l^3 in the slot 5. On the other hand, the latch H^2 is rendered inactive, since it is thrown outwardly and held so by the stud l^2, resting upon the periphery of the pallet.

Presuming the generating and signal-operating apparatus B B^2 are located at the same place upon a block railway system, the positive wire 2 from the magneto-generator connects with branch wire x^2, and upon the passing of a train the electro-magnet L^2 is excited and actuates the armature m^2, rocks the latch H^2, and releases the fan-regulator to set the signal to "danger." This latter has just been operated, and its shaft J^2 is represented in Fig. 11 as locked by the opposite and corresponding latch, H^3. The current through the magnet L^2 returns by branch wire y^2 to negative wire 3, connected with the magneto-generator. To return this signal to "safety," similar generating apparatus is located at the next station beyond, and upon the passage of this train thereby two wires, corresponding to wires 2 and 3, (shown,) respectively connect with the branch wires x^3 y^3 and convey and return the current generated through the electro-magnet L^3, the armature m^3 is attracted, the latch H^3 rocked, and the pallet I^2 and fan-regulator released, while the signal rotates ninety degrees, and is then locked by the tilting of the latch H^2, due to the engagement of the stud l^3 with the slot 6.

I claim—

1. The primary double-inclined levers actuated by the impact from a passing train, the time-bellows operating to retain said levers inactive, in combination with the magneto-generator and its driving mechanism, as herein described, likewise actuated by the same impact to excite electro-magnets controlling visual signals along the line, substantially as stated.

2. The time-bellows H, the swinging frame e e', to which it is attached, and arms f f', having a spring, I, therebetween, in combination with the wiper-cam J, its actuating-shaft C, rocked by the impact from a passing train, the sectoral plate D, having tooth a, and the toothed arm O, adapted to be released by the bellows, substantially as described.

3. In combination, the wiper-cam J, its actuating-shaft C, rocked by the link b and lever c, caused by the passing of a train, the sectoral plate D, the toothed arm O, engaging the latter, the pivoted releasing-lever P, and the spring-actuated bellows operating the latter in their collapse, substantially as and for the purposes stated.

4. In combination, the double-inclined levers operated by a passing train, the spring-impelled time-bellows, the actuating sectoral plate, the toothed pivoted locking-arm, its stud r', the adjustable strut q', carried by the frame e e', and the releasing-lever P, with its arms q r, operating to release the locking-arm upon collapse of the bellows, as herein set forth and described.

5. The combination, in an electric railway-signal, of the magneto-generator, its rotary armature, and the intermediary gear-train impelled by a rocker-shaft having a pawl-bearing arm loosely mounted thereon and connected with it by a spring medium uniting said pawl-arm and a wiper-cam, the latter affixed upon said shaft, which is rocked by impact caused by a passing train, substantially as stated.

6. The sectoral plate D and its shaft C, actuated by a passing train, the wiper-cam affixed thereon, and the ratchet-wheel K and pawl-bearing arm L, both loose upon said shaft, in combination with the spring M, disposed upon the sleeve l, and with its ends j j' secured, respectively, to said arm L and cam J, whereby rocking movement of the shaft increases tension in the spring M and compels the ratchet to rotate, all for purposes herein specified.

7. The rocker-shaft C, and the wiper-cam J, affixed thereon and provided with the shoulder m, in combination with the driving mechanism of the armature, consisting of the ratchet-wheel K, loose upon said shaft, the pawl h, attached to the arm L, with its sleeve l also loose upon the shaft C, and the spring M, normally under tension, interconnecting cam J with arm L, all co-operating as herein set forth, whereby partial rotation of the shaft energizes the spring and compels the ratchet to rotate, substantially for the purposes set forth.

8. In electric railway-signals, the combination, with the double-inclined levers d d, the sectoral plate D, and rock-shaft C, with its armature-driving mechanism, as described, and the gears N Q R R′, of the magneto-generator and its armature S, held fixed by the lever T, spring-actuated at u', substantially as herein specified and stated.

9. In electric railway-signals, the combination, with the double-inclined levers d d, the sectoral plate toothed at a, rock-shaft C, and the armature-driving mechanism thereon, as described, which impels the intermediary gear-train N Q R R′, of the magneto-generator and its armature S, released by the arm v wiping the cam U, affixed upon the rocker-shaft at proper intervals, as herein described.

10. A railway-signal adapted to rotate in

one direction intermittently through arcs of ninety degrees, in combination with double-inclined levers and time-bellows, an air-receiver operated by said bellows to actuate the winding mechanism, as described, which rotates the signal-shaft, the two-armed gravity-latches to stop and start the shaft, and which co-operate with electro-magnets excited by a magneto-generator actively induced at each passage of a train, substantially as stated.

11. In electric railway-signals, the pallet I^2, provided with the slots 4 5 6 7, the shafts a^3 J^2, carrying the gears K^3 K^2, respectively, and operated by clock-work mechanism, in combination with two-armed gravity-latches H^2 H^3, having the studs l^2 l^3 and armatures m^2 m^3, alternately attracted by electro-magnets L^2 L^3 to start and stop the fan-regulator R^2, and controlled by electric currents from a magneto-generator actuated by the passage of a train, all co-operating substantially as herein described.

12. The combination, with a magneto-generator, its armature S, rotated by its driving mechanism, as herein described, by the passing of a train, the circuit-wires 2 3 therefrom, wires x^2 y^2 x^3 y^3, interconnecting the electric magnets L^2 L^3, of the gravity-latches H^2 H^3, rocking upon the shafts h^2 h^3, which latter carry the armatures m^2 m^3, the arms i^2 i^3, engaging alternately the fan-regulator to stop the signal, and the arms j^2 j^3, successively engaging the pallet I^2 to lock said signal, substantially as herein set forth.

13. In electric railway-signals, a magneto-generator operated by the passage of a train to induce a current, and the electro-magnets which control the signal, in combination with rotating mechanism actuated by a receiver and expanding diaphragm by means of air-impulses created in bellows and due to the passage of a train, substantially as stated.

14. In combination with primary levers d d, the sectoral plate D, connected therewith, and the spring-actuated bellows H, operated by the passage of a train, the pivotal toothed arm O, adjustable with respect to the periphery of said plate, and co-operating with the latter to hold the primary levers inactive, as and for purposes set forth.

15. The combination, with the double-inclined levers d d, the sectoral plate D, connected therewith, the toothed pivotal locking-arm O, and the rock-shaft C, with its wiper-cam J, of the bellows H, the bellows-frame e e', and the adjustable strut q' upon the latter, to operate the throw-off lever P upon collapse of the bellows, substantially as herein described.

16. In combination with the primary inclined bars, the connecting-levers and the sectoral plate with the spring-actuated time-bellows actuated thereby, the toothed arm adapted to engage said plate, and its releasing mechanism co-operating substantially as and for purposes described.

In testimony whereof I affix my siguature in presence of two witnesses.

EDWARD M. CHASE.

Witnesses:

H. E. LODGE,

RICHARD SMITH.