

(No Model.)

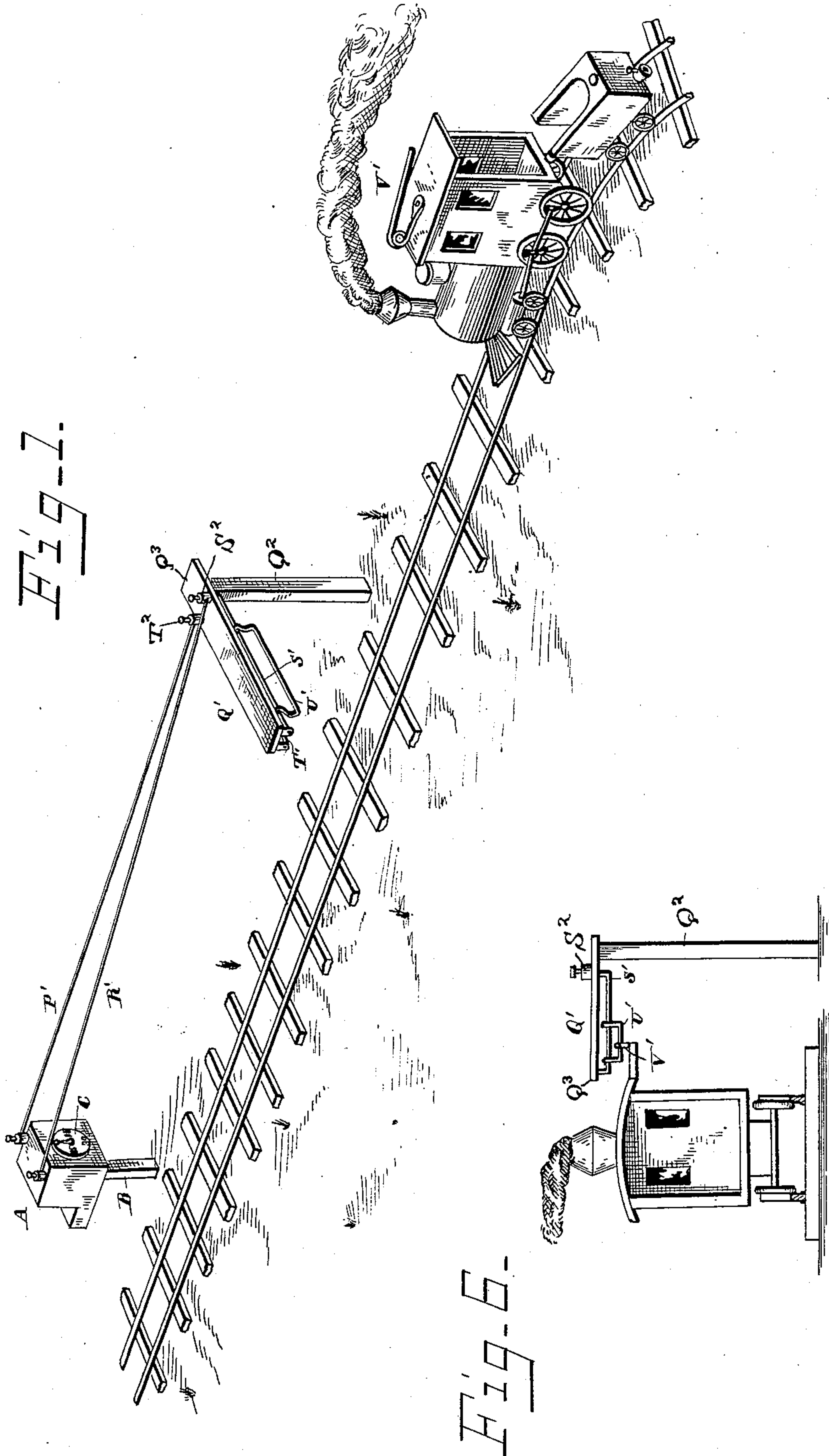
3 Sheets—Sheet 1.

M. TOULMIN.

ELECTRO MECHANICAL SIGNALING APPARATUS.

No. 308,533.

Patented Nov. 25, 1884.



WITNESSES

Edwin L. Jewell.  
Edwin L. Bradford

INVENTOR

Morton Toulmin,

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his Attorneys

(No Model.)

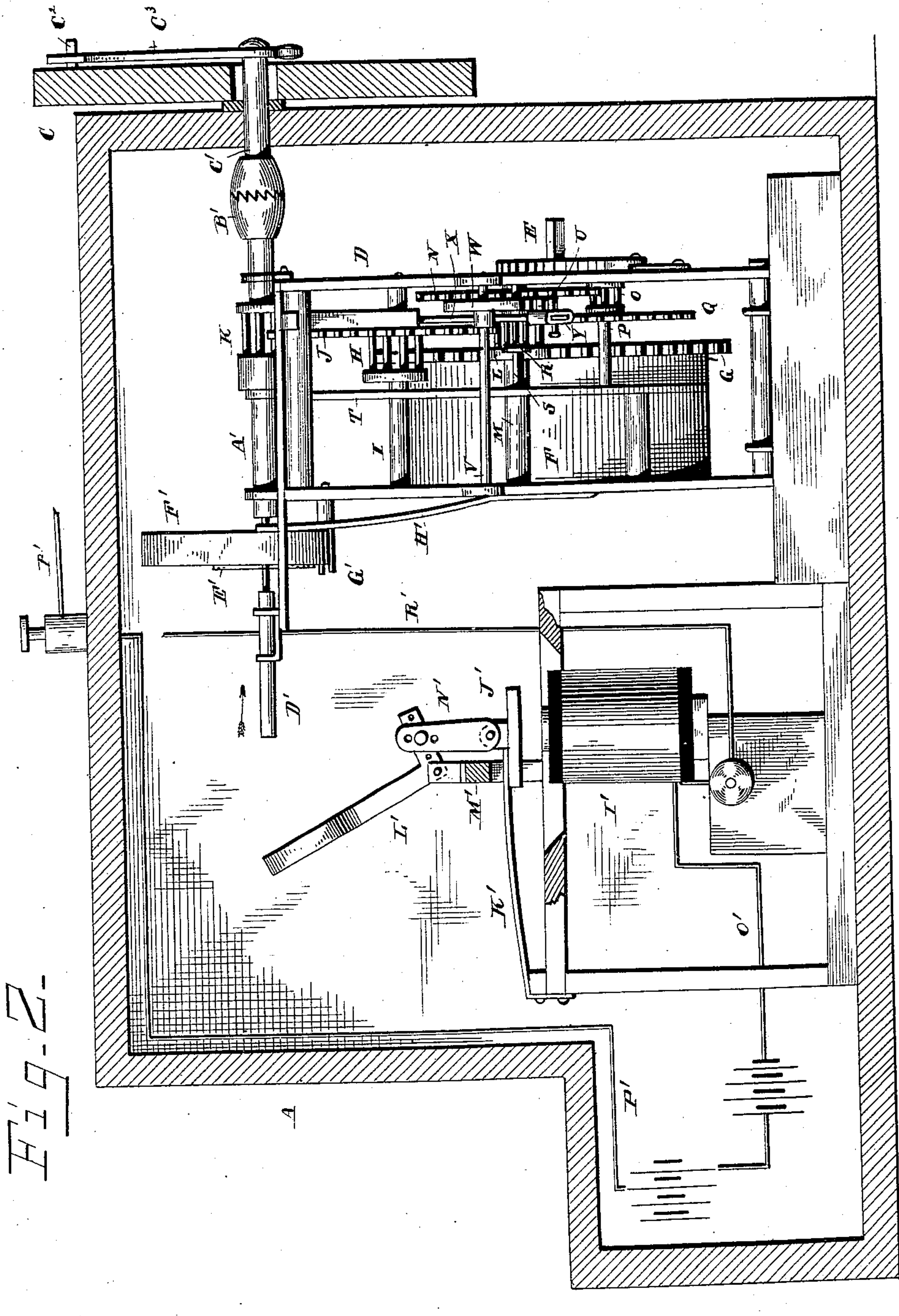
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ELECTRO MECHANICAL SIGNALING APPARATUS.

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WITNESSES

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(No Model.)

3 Sheets—Sheet 3.

M. TOULMIN.

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Fig-3-

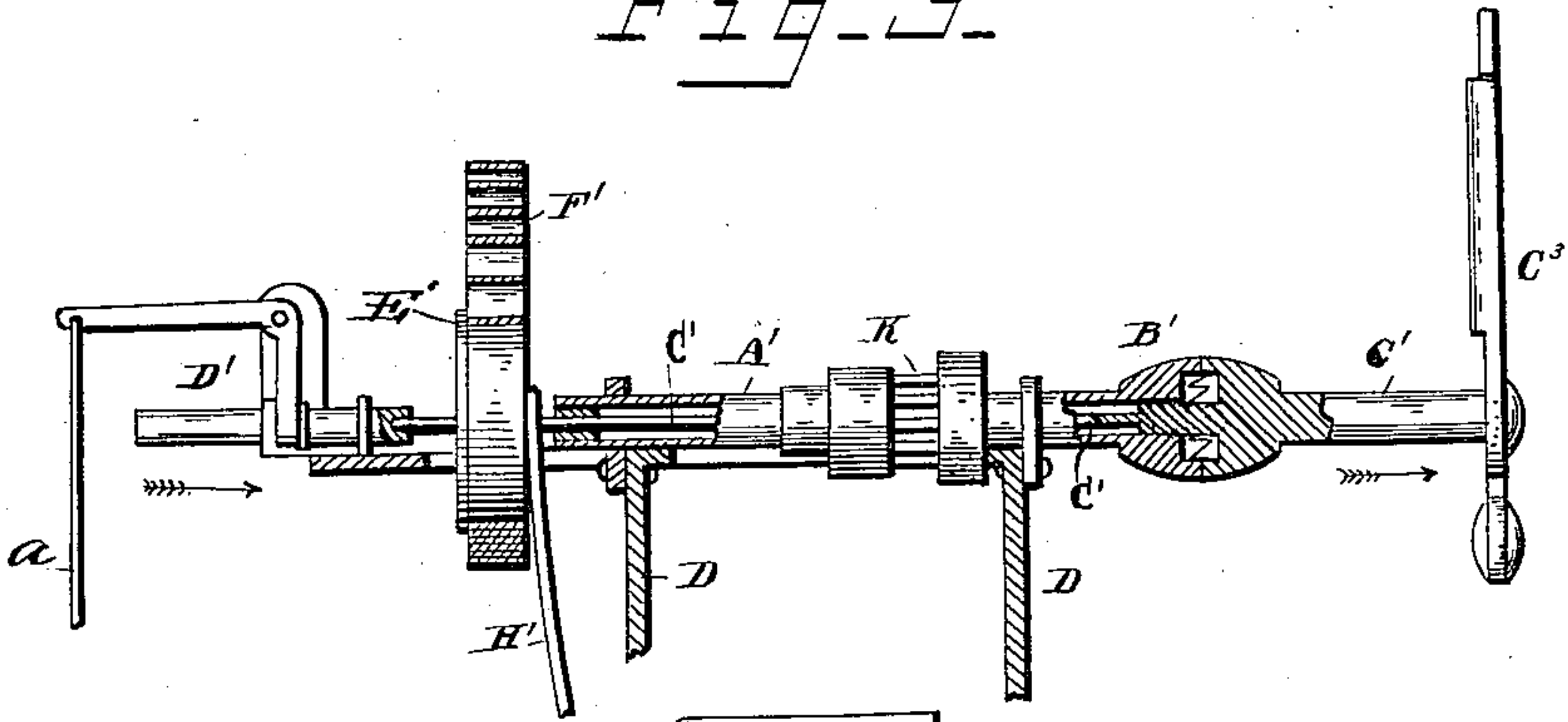


Fig-4-

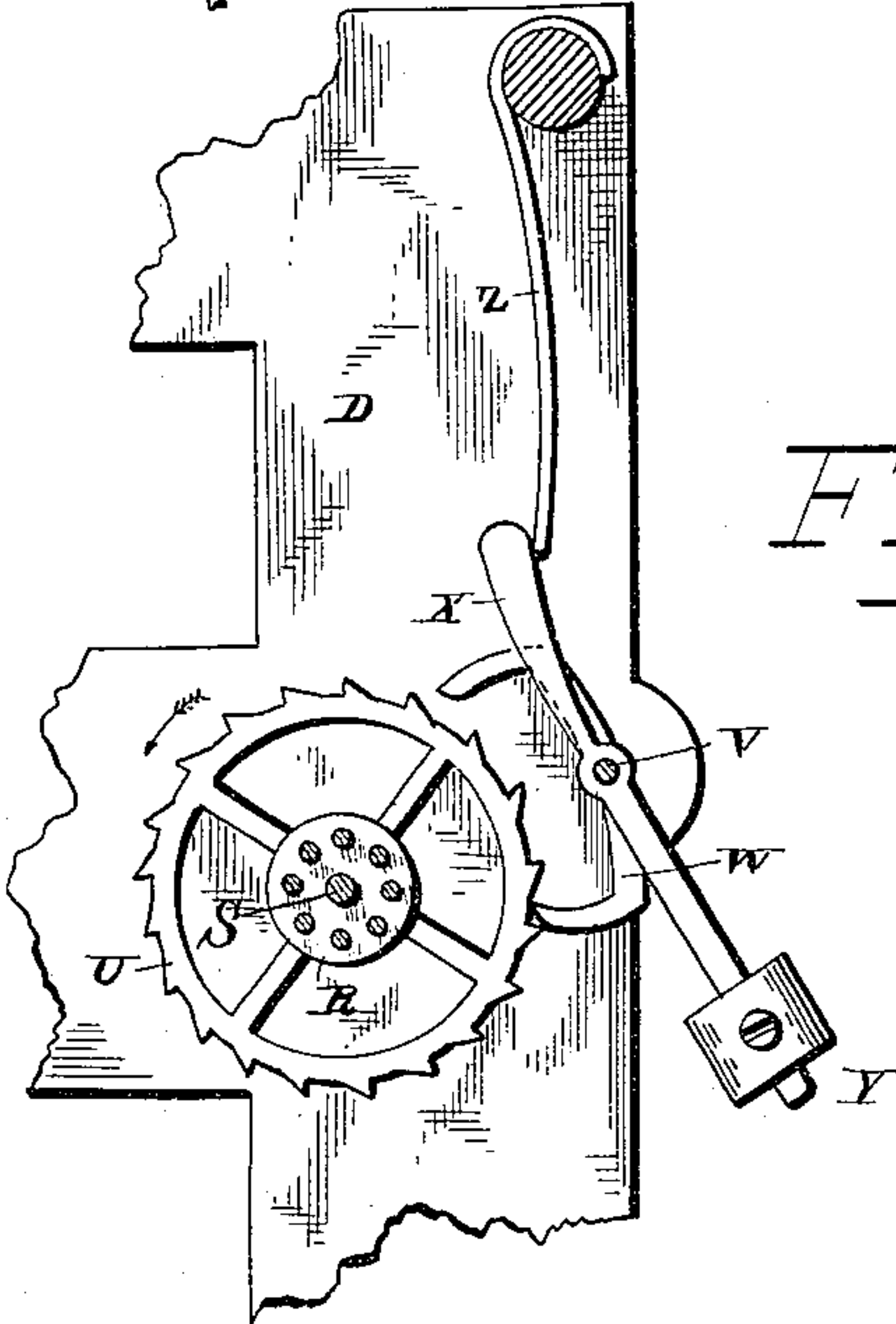


Fig-5-

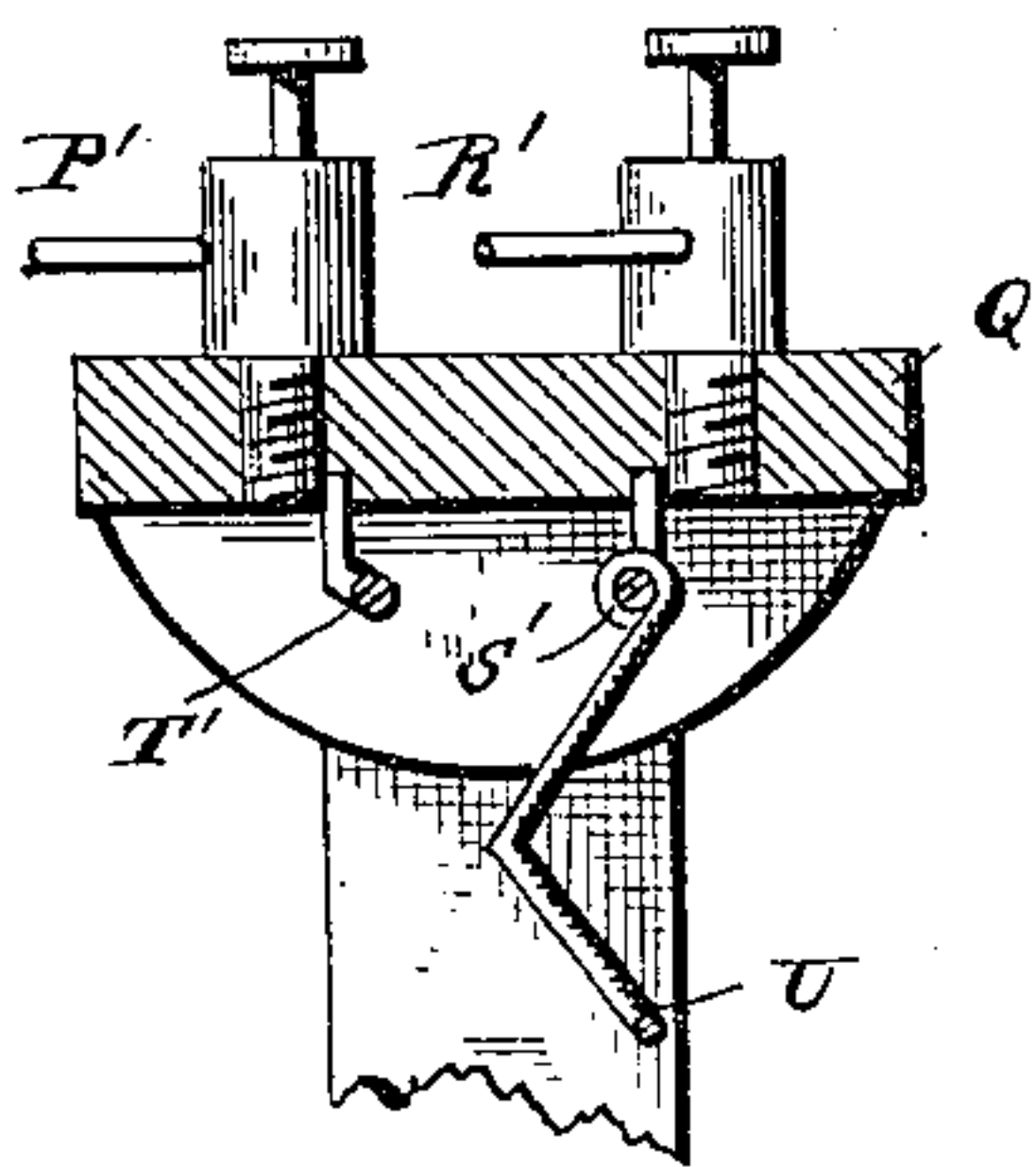
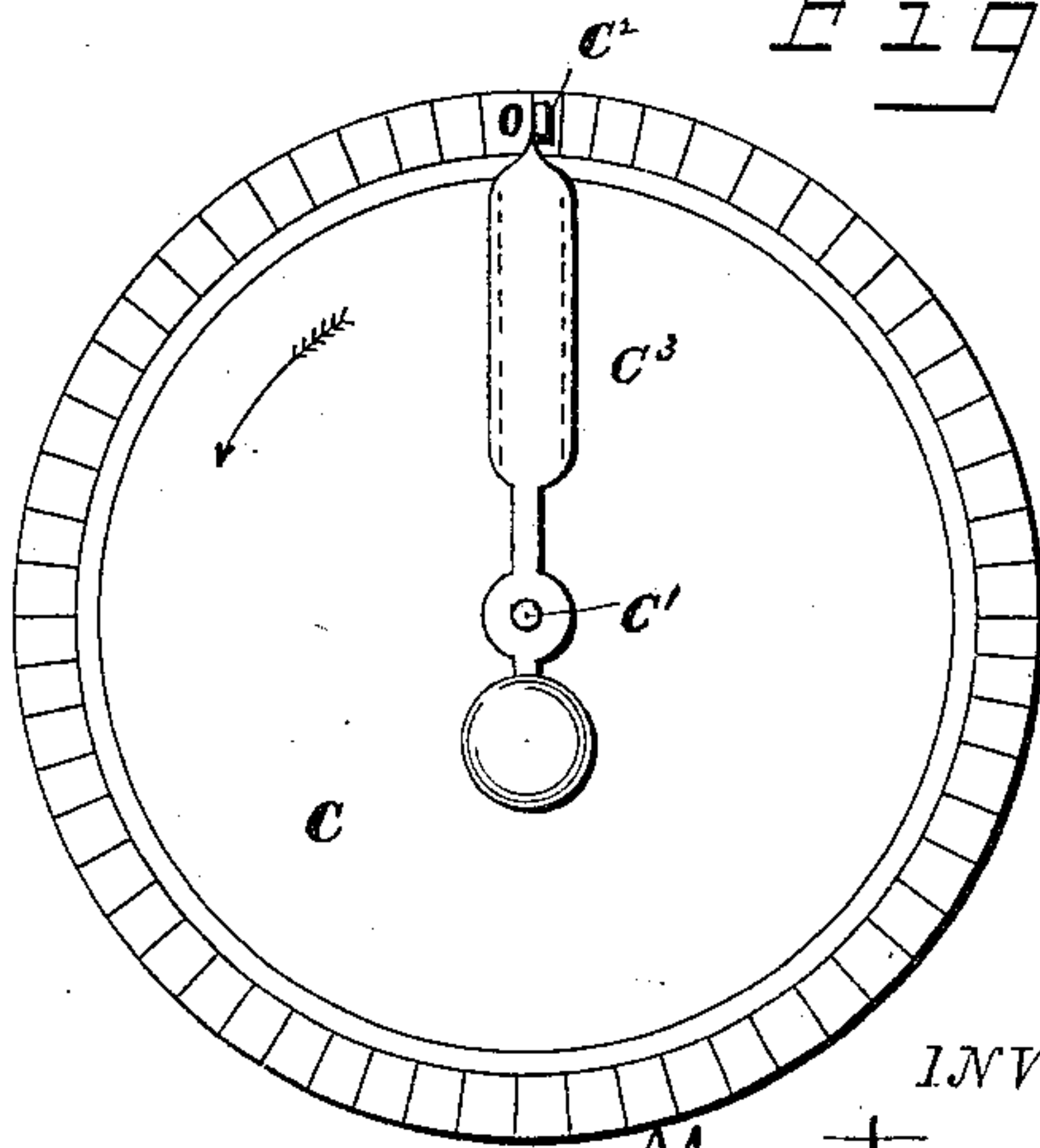


Fig-7-



WITNESSES

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# UNITED STATES PATENT OFFICE.

MORTON TOULMIN, OF WASHINGTON, DISTRICT OF COLUMBIA.

## ELECTRO-MECHANICAL SIGNALING APPARATUS.

SPECIFICATION forming part of Letters Patent No. 308,533, dated November 25, 1884.

Application filed March 1, 1884. (No model.)

*To all whom it may concern:*

Be it known that I, MORTON TOULMIN, a citizen of the United States, residing at Washington, in the District of Columbia, have invented certain new and useful Improvements in Electro-Mechanical Signaling Apparatus, of which the following is a specification, reference being had therein to the accompanying drawings.

10 This invention relates to certain new and useful improvements in electro-mechanical railway-signaling apparatus; and it has for its objects, first, to provide mechanism for automatically indicating to a locomotive-engineer, 15 a train-captain, or other person having charge of a railway-train what period of time has elapsed since the next preceding train passed the point of the line from which such observation is taken, and for making a record of the 20 time when said train passes and exhibiting it to the next succeeding train; second, to provide mechanism which by the passing of a railway-train will automatically indicate to the locomotive-engineer of the next succeeding 25 ing train what period of time has elapsed since that next preceding train passed the point of the line from which such observation is taken, with a hand or device which by the passing of such succeeding train will return to zero, 30 restart, and automatically indicate and exhibit to the next succeeding train after it the time when it passes such point, and so on *ad-infini-tum*, whereby the engineer of each succeeding train will be unerringly informed of what pe- 35 riod of time has elapsed since the last preceding train passed that point; third, to provide such mechanism with electrical connections and a circuit-closer adapted to be closed by a passing train, whereby mechanical devices are 40 set in motion to operate the time-indicating hand, and whereby after such hand has received its initial movement it is made by the passing of succeeding trains to start afresh from zero, and indicate and exhibit the time 45 of the passing of such succeeding trains, respectively; fourth, to so provide such hand or time-indicating device that it can be readily seen by the locomotive-engineers from the point of location of the circuit-closer; fifth, to 50 provide a device, adapted to be carried by the train, which will engage the circuit-closer with

a drawing and yielding contact, whereby the electric circuit is closed; sixth, to provide such mechanism with a stop, which shall act to arrest the operating devices when the time- 55 indicating hand approaches or reaches zero on the dial; and, seventh, to provide a speed-regulating device, whereby the speed of the mechanical device which operates the time-indicating hand may be relatively varied, and yet 60 which will exert no influence over the starting and stopping of such operating devices.

In carrying out the first object of my invention I employ an apparatus inclosed in a suitable housing, which is mounted upon a pedestal located near a railway-track, the same 65 consisting, essentially, of a train of gearing operated by a power-spring, so as to revolve a shaft carrying a time-indicating hand, which travels over a dial having a graduated face to 70 designate the fractions of time, the hand being put in motion by the passing of a train, and adapted to continue its travel around the dial after the train has passed.

In carrying out the second object of my invention I employ the apparatus above de- 75 scribed, and construct the revolving shaft in a hollow or sleeve-like form, the hand-shaft being of smaller diameter, and fitted within said sleeve, a clutch or similar device being 80 employed to rigidly but detachably unite the sleeve and shaft. This shaft is connected with the inner end of a convolute spring, and when a train passes it is given a longitudinal movement, which disengages the clutch, the spring 85 serving to return the hand to zero, when by the action of another spring the members of the clutch are re-engaged and the hand thereby caused to again revolve with the rotating sleeve. 9

In carrying out the third object of my invention I place an electro-magnet in close proximity to the apparatus, and station a circuit-closer near by the railway-track, the wires of the circuit-closer being connected one with 95 one pole of the battery, and the other with one end of the magnet-wire, and the other end of the magnet-wire with the other pole of the battery. This magnet, when the circuit is closed, acts to disengage the members of the 100 clutch which unite the hollow shaft and the hand-shaft, thereby putting the hand-shaft



under the control of the convolute spring until the members of the clutch re-engage, when the hand is made to revolve through the influence of the power-spring and intermediate gearing, this operation being repeated by each train that passes.

In carrying out the fourth object of my invention I place the face of the dial at about a right angle to the line of the track and widen the time-indicating hand between its point and its shaft, whereby it is made easily visible from a distance.

In carrying out the fifth object of my invention I connect with the locomotive-cab or other convenient part of the train an inclined yielding arm, which is adapted to engage the circuit-closer.

In carrying out the sixth object of my invention I provide a stop of a yielding or somewhat elastic nature, so located as to intercept the rotation of the time-indicating hand, whereby that hand is arrested at or near the zero-point.

In carrying out the seventh object of my invention I place an escapement-wheel in a train of gearing, and mount upon a rock-shaft fitted in bearings located near said wheel an arm having its ends bent so as to alternately engage with the escapement-wheel. This shaft I also provide with a lever, the upper end of which is engaged by a spring, and the lower end of which is provided with an adjustable weight. This regulator will maintain its normal position without being in contact with the escapement-wheel, and the action of the wheel is merely to throw the regulator out of such position.

In the accompanying drawings, forming a part of this specification, and on which the same letters of reference indicate the same or corresponding features, Figure 1 represents a perspective view of my improved signaling apparatus and the circuit-closer located near a railway-track and a locomotive approaching the circuit-closer. Fig. 2 represents a vertical sectional view of the dial and of the housing in which the apparatus is contained, showing the apparatus itself and the electromagnet in side elevation. Fig. 3 represents a view, partly in side elevation and partly in longitudinal section, of the hollow shaft, the hand-shaft, and the several attached devices, as also a modified means of operating the hand-shaft through the magnet. Fig. 4 represents an enlarged detached view of the speed-regulating device and the escapement-wheel. Fig. 5 represents a cross-sectional view of the circuit-closer. Fig. 6 represents a rear elevation of a train and a side elevation of the circuit-closer, showing a modified manner of connecting the device with the train which actuates the circuit-closer; and Fig. 7 represents a face view in detail of the dial and the indicating-hand.

A designates a suitable housing or casing constructed of wood or metal, and mounted upon a pedestal, B. This pedestal is located

near the railway-track, and the dial C is placed toward the direction from which the train is approaching, and is suitably mounted or secured to the housing. The dial is provided on its face with lines indicating fractions of time, and projecting from it is a yielding or elastic stop, C<sup>2</sup>, the function of which will presently appear.

D indicates the frame of the apparatus, which is preferably constructed of metal, and in which is mounted the drive-shaft E, one end of which is squared to receive a winding-key. To this shaft the inner end of a convolute power-spring, F', is secured, the other end of the spring being preferably connected firmly with a suitable fixed part of the frame. On this shaft is also mounted the driving gear-wheel G, the usual ratchet and pawl being employed to connect the shaft and wheel so as to make them rotate together in one direction, and to allow the shaft to be turned in the opposite direction independently of the wheel, to wind up the spring. This driving-wheel G intergears with the pinion H, mounted on the shaft I, which has bearings in the frame, and which carries the gear J. This gear J intergears with the pinion K on the hollow shaft A', whereby that shaft is rotated. It also intergears with a pinion, L, mounted on a shaft, M, having its bearings also in the frame of the apparatus. This shaft M also carries a wheel, N, which intergears with the pinion O on the shaft P. The said shaft P further carries the gear-wheel Q, which intergears with a pinion, R, mounted on the shaft S, which has its bearings in one side of the frame, and in the strip T, which is secured to the frame proper. This shaft S carries the escapement-wheel U.

The letter V indicates a rock-shaft suitably mounted in the frame of the apparatus, and provided with a rigidly-attached arm, W, having its ends bent so as to engage with the escapement-wheel U, as seen in Fig. 4, the direction of the rotation of the escapement-wheel being indicated by the arrow. The points of the arm W are beveled, as indicated, so as to permit the teeth of the escapement-wheel to pass by and yet maintain engagement with the said ends, whereby the said arm is oscillated to and from its normal position; also, mounted on the rock-shaft V is a lever, X, the lower end of which is provided with an adjustable weight, Y, and the upper end of which is engaged by a spring, Z, fixed at one end to one of the cross-pieces of the frame. A stop of any yielding nature may be substituted for the spring Z, and the stop may be made capable of a slight adjustment toward the upper end of the lever X, thereby regulating the depth of the mesh between the escapement-wheel and the lower point of the arm W. It is further to be observed that the normal position of this speed-regulating device is governed by the adjustment of the spring Z, which in the present instance is done by slightly turning it on the cross-piece of the



frame, and the position of the weight Y on the lever X, so that the only effect of the escapement-wheel on the regulating device is to oscillate the latter a slight distance to and from its normal position, such arrangement accomplishing a retardation of the velocity of the escapement-wheel, thereby regulating the speed of rotation of the indicating-hand and governing the time it shall take to travel around the dial.

It is observable that any number of gear-wheels may be interposed between the driving-gear and the hollow shaft, and between that gear and the escapement-wheel, as the successful operation of the invention does not depend upon the particular number, nor indeed upon the arrangement shown in the drawings.

The hollow shaft A', before alluded to, is mounted in suitable bearings attached to the frame, and is provided near one end with one member of the clutch B', the other member of said clutch being formed with or mounted on the hand-shaft C'. Passing through this hollow shaft is the hand-shaft C', which fits snugly within the hollow shaft either its entire length or at intervals, as represented in Fig. 3 of the drawings. This hand-shaft is capable of longitudinal movement within and independent of the hollow shaft, and is provided at one end with the indicating-hand C<sup>3</sup>, while at the other it extends a short distance within a sliding spindle, D', mounted in bearings attached to the frame. This hand-shaft is further provided with a small drum, E', to which is connected one end of a convolute spring, F', the other end of that spring being connected with a fixed portion of the frame, as the stud G', in Fig. 2. This convolute spring is so disposed as to exert a rotary influence over the hand-shaft in the direction opposite to that in which it travels when rotating around the dial to indicate time. The engagement of the members of the clutch B' is maintained by the spring H', rigidly connected at one end to the frame and bearing at the other against the drum E'.

I' designates the electro-magnet, the same being suitably mounted and placed, by preference, in the housing A. The armature J' of this magnet is supported by a spring, K', which keeps it normally away from the magnet. A hammer, L', having an angle in its handle or arm, is pivotally connected to a standard, M', located near the electro-magnet, and the armature of the magnet is connected with this arm by a link, N'. Several apertures are made in this arm and several in the link, whereby the proper adjustment of the hammer relatively with the armature may be effected. The function of this hammer is, when actuated by the armature when under the influence of the magnet, to disengage the respective members of the clutch by striking a slight blow on the protruding end of the spindle D', whereby the hand-shaft is given a quick, short longitudinal movement in the direction of the arrow.

One end of the magnet-wire is connected with one pole of the battery by a wire, O'. The other pole of the battery is connected by a wire, P', with one wire of the circuit-closer Q', suitable binding-posts being employed to effect these connections. The other end of the magnet-wire is connected by a wire, R', with the other wire of the circuit-closer, suitable connecting-posts being also employed for this purpose. This circuit-closer consists of a post, Q<sup>2</sup>, located near the railway-track, provided with a strip or beam, Q<sup>3</sup>, extending partly over the rails, above the highest part (the smoke-stack) of a railway-train; or it may extend nearly to the track. On the under side of this strip are run the wires S' and T', one end of each of which is connected with binding-posts S<sup>2</sup> and T<sup>2</sup>. From the wire S' a contact-link, U', is flexibly hung, and by preference provided with an angular bend, whereby when swung in the arc of a circle toward the wire T' it will engage therewith and effect an electrical connection between the respective wires of the circuit-closer.

Secured to the locomotive-cab, and adapted to extend slightly above the smoke-stack or other highest point on the train, is a yielding inclined arm, V', the function of which, as will presently appear, is to engage the link U' as the train passes under the circuit-closer. From the inclined position and the yielding nature of this arm it is obvious that its contact with the link U' will be of a yielding and drawing or sweeping nature, thereby maintaining contact between the link and the other wire of the circuit-closer sufficiently long to insure a perfect electrical contact.

As represented in Fig. 6, the strip which carries the circuit-closer wires extends near the track, but not over it, and the yielding inclined arm carried by the train is designed to be set out on a beam or timber projecting from the train a short distance, but not far enough to interfere with stationary objects.

I contemplate constructing the indicating-hand of thin sheet metal, with angles formed at the edges, so as to stiffen it, and with a counterbalance-weight and a broad face, so as to be easily visible at a considerable distance, its end being somewhat pointed, so as to register accurately with the indicating-lines on the dial. I also contemplate painting the dial-face and the hand with strongly-contrasting colors, the dial, in practice, to range from two or three feet in diameter upward.

The operation of my invention will be readily understood when taken in connection with the above and is as follows: The indicating-hand normally stands opposite zero on the dial-plate, and the circuit stands normally open. When a train passes, the local circuit-closer, through the medium of the inclined yielding arm, actuates a contact-link in the arc of a circle, thereby placing it in electrical contact with the opposite wire of the circuit-closer. When the circuit is closed, the armature, under the magnetic influence of the elec-



tro-magnet, is made through the hammer to give the sliding spindle a slight blow in the direction of the arrow. This movement of the spindle moves the hand-shaft longitudinally against the spring which maintains the clutch-connection, thereby disengaging the respective members of the clutch. This done, the convolute spring attached to the hand-shaft causes the hand to instantly fly around the dial in the direction of the arrow in Fig. 7 until it strikes the yielding stop on the dial-plate. When the hand is arrested, the spring which keeps the clutch members engaged then exerts itself and draws the hand-shaft back, engaging the said clutch members. As soon as this engagement is effected the rotation of the hollow shaft, which rotation commenced as soon as the clutch-connection was broken by the hammer, is transferred to the hand-shaft, thereby making the hand revolve slowly around the dial. The length of time which the hand shall consume in effecting its circuit around the dial is governed by the speed-indicating device, and may be from one minute or less upward, according to the requirements of the particular road. When the next succeeding train comes along and finds the indicating-hand at zero, the engineer knows that the last train which passed the signal passed there as many minutes or fractions thereof as it requires for the hand to make a complete revolution, and, knowing the speed at which the trains on his road generally travel, he can at once ascertain how far ahead such train is from the one he is running.

Should the hand be at any point on the dial other than at zero when such succeeding train reaches the signal, the engineer is likewise informed of how far ahead the last preceding train is. When such second train passes the signal and closes the circuit in the manner above described, the hand, if at zero, flies back to the opposite side of the stop and recommences to travel around the dial, thereby leaving its record for the next succeeding train. If, when such second train (or any subsequent train) reaches the signal, the hand is at any intermediate point on the dial, it returns to zero in the same manner, and again recommences its travel around the dial. As the stop acts to arrest the hand after it has made a revolution around the dial, and as the hand, through its shaft and the clutch, is connected with the hollow shaft, and the hollow shaft, through the intermediate gearing, is connected with the power-spring, this arrest of the hand stops the rotation of the gearing, and thereby prevents the power of the spring from being expended. The circuit-closer is located some distance ahead of the dial—say nearly as far as the engineer can well see the position of the hand—so that the engineer can see the position of the hand before changing such position by closing the circuit. This distance between the circuit-closer and the dial is also useful in that it enables the engineer of each train to see whether the apparatus is working perfectly after he

has closed the circuit and before passing the dial, thus notifying him of any possible derangement of the apparatus should any such unlikely event happen, as by reason of a severe storm. The strip which supports the circuit-closer wires is designed to be of such width, and otherwise so constructed, as to effectually shed off rain or snow, which may possibly effect the making of electrical connections. The position of the dial relatively with the rails being at a slight angle, the rays of light from the head-light of the engine will be intercepted at right angles, thereby making the hand perfectly visible, avoiding the necessity of lighting the apparatus at night.

In some instances I contemplate substituting for the hammer which actuates the sliding spindle a bell-crank lever, as seen in Fig. 3, one end of which is bifurcated, so as to straddle the said spindle and fit against a collar, the other end being flexibly connected by a wire, *a*, with the armature.

It is designed to place these apparatus along the line of a railway at intervals to suit the natural conditions of the country through which the road is built—as, before curves, at tunnels, bridges, &c.—and, as the engineer as he passes each successive signal is enabled to ascertain at once whether he is gaining or losing time as compared with the last preceding train, the danger of one train overtaking another is effectually avoided.

As the power of the spring is only consumed during the short time that the hand is traveling, and as the consumption of the battery will be very slow, the necessity to wind up the spring and replenish the battery will be deferred to periods of time of considerable lengths, and these duties may be assigned to the employes now known as "track-walkers."

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

1. In an electro-mechanical signaling apparatus, the combination, with the time-indicating hand detachably connected with the power mechanism, of an electro-magnet adapted to break said connection, and means to operate the hand in a reverse direction, and means to re-establish said connection when the hand reaches zero, whereby it is put under the influence of power mechanism and moved to indicate time.

2. In an electro-mechanical signaling apparatus, the combination, with a time-indicating hand and a power mechanism detachably connected therewith, of an electro-magnet and electrical generator, a circuit, and a circuit-closer carried by a passing train, and means to operate the hand in a reverse direction, and means to re-establish said connection when it reaches zero, whereby it is put under the influence of the power mechanism and moved to indicate time.

3. In an electro-mechanical signaling apparatus, the combination, with the time-indicating hand, means to move its shaft longi-



itudinally, a spring to move the hand in the reverse direction to that in which it travels when indicating time, and a stop to arrest such movement, of an electro-magnet, the magnet being adapted to move the shaft longitudinally and put it under the influence of said spring.

4. In an electro-mechanical signaling apparatus, the combination, with the time-indicating hand, means to move its shaft longitudinally, a spring to move the hand in a reverse direction to that in which it travels when indicating time, a power-spring, a train of gearing to operate the hand to indicate time, and a stop to arrest such operation, of an electro-magnet and a circuit-closer.

5. In an electro-mechanical signaling apparatus, the combination, with the time-indicating hand and its shaft, a rotating shaft detachably connected therewith, a spring to operate one of said shafts in one direction, a stop to arrest it, and a spring to operate both of said shafts in the opposite direction, of an electro-magnet and a circuit-closer.

6. In an electro mechanical signaling apparatus, the combination, with the time-indicating hand, its shaft, a hollow rotating shaft within which the hand-shaft fits, a clutch for connecting said shafts together, a spring to rotate the hand in one direction, a yielding stop to arrest the same, and a spring to rotate both shafts in the opposite direction, of an electro-magnet and a circuit-closer.

7. In an electro-mechanical signaling apparatus, the combination, with a dial having time-indicating lines and a stop, a time-indicating hand, its longitudinally-movable shaft, a hollow rotating shaft within which the hand-shaft fits, the clutch for connecting them together, a spring to maintain the engagement of the clutch, a spring for operating the hand-shaft in one direction or from the stop, and a power-spring and a gearing to operate both shafts simultaneously in the opposite direction, of an electro-magnet and a circuit-closer, the said magnet being adapted to give the hand-shaft a longitudinal movement, whereby it is free to rotate and return the hand toward the stop.

8. In an electro-mechanical signaling apparatus, the combination with a dial, a stop, a time-indicating hand, its shaft, a rotating shaft detachably connected therewith, and means to operate the hand-shaft in one direction and both shafts in the opposite direction, of an electro-magnet, a circuit-closer, and a contact-arm carried by a train, the said arm being adapted to actuate the circuit-closer by the passing of a train.

9. In an electro-mechanical signaling apparatus, the combination, with a time-indicating hand, its shaft, and a stop, of a rotating shaft detachably connected therewith, means to operate the former in one direction and both in the opposite direction, a sliding stud, a ham-

mer, and an electro-magnet adapted to actuate the same, whereby the stud is caused to move the hand-shaft longitudinally, and the latter put under the influence of the spring, which operates it in one direction.

10. In an electro-mechanical signaling apparatus, the combination, with the longitudinal movable time-indicating hand, its shaft, and a stop, of a hollow rotating shaft within which the hand-shaft fits and with which it is detachably connected, a spring to operate the hand-shaft in one direction, and a train of gearing and a spring to operate both shafts in the opposite direction, a sliding stud, an electro-magnet having a yieldingly-supported armature, and a pivoted hammer.

11. In an electro-mechanical signaling apparatus, the combination, with a train of operating-gearing, of a speed-regulator constructed so as to permit the starting of said train from the driving-wheel without first actuating said regulator.

12. In an electro-mechanical signaling apparatus, the combination, with a train of operating-gearing, of a speed-regulator adapted to engage an escapement-wheel, and provided with a yielding and adjustable stop to adjust it relatively with said wheel, and an adjustable weight, the whole being so constructed as to permit of the starting of said train of gearing from the driving-wheel.

13. In an electro-mechanical signaling apparatus, the combination, with an escapement-wheel, of a rock-shaft having an arm whose ends engage said wheel and a lever mounted thereon, and provided at its lower end with an adjustable weight, and a yielding stop which engages the upper end of said lever, whereby a speed-regulator is constituted and arranged so as to permit of the starting of said train of gearing from the driving-wheel.

14. In an electro-mechanical signaling apparatus, the combination, with the time-indicating device consisting, essentially, of a dial, a rotating hand capable of flying back to the commencing-point, and means to operate the said hand, of an electro-magnet, a circuit-closer located somewhat in advance of the time-indicating device, and an arm carried by the train and adapted to effect a sweeping contact with the circuit-closer, whereby the engineer of an approaching train can see the indicating-hand and dial before and after closing the circuit.

15. In an electro-mechanical signaling apparatus, the combination, with an electro-magnet and a circuit-closer, of a longitudinally-movable hand-shaft, a sliding stud, and a hammer adapted to be actuated by the magnet.

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

MORTON TOULMIN.

Witnesses:

EDWIN L. BRADFORD,  
M. P. CALLAN.