(No Model.) 4 Sheets—Sheet 1.

H. BROCKLEHURST.

RAILWAY SIGNALING BY MEANS OF DETONATING OR EXPLOSIVE SIGNALS.

No. 525,584. Patented Sept. 4, 1894.

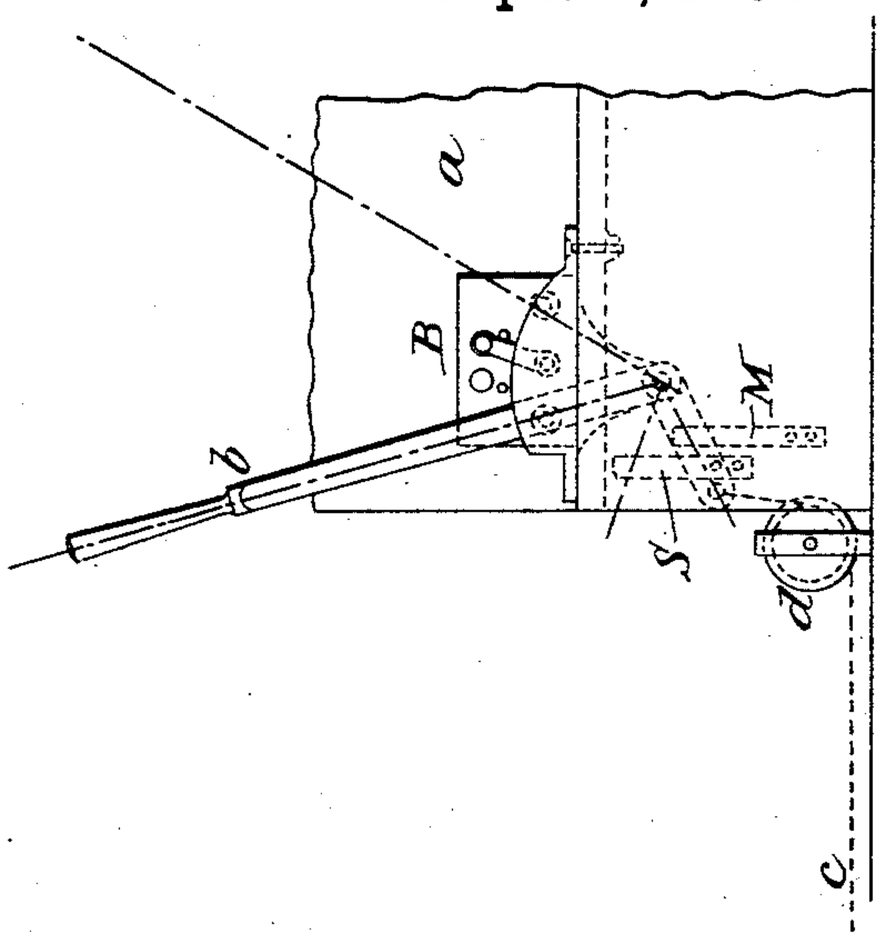

Fig. 1.

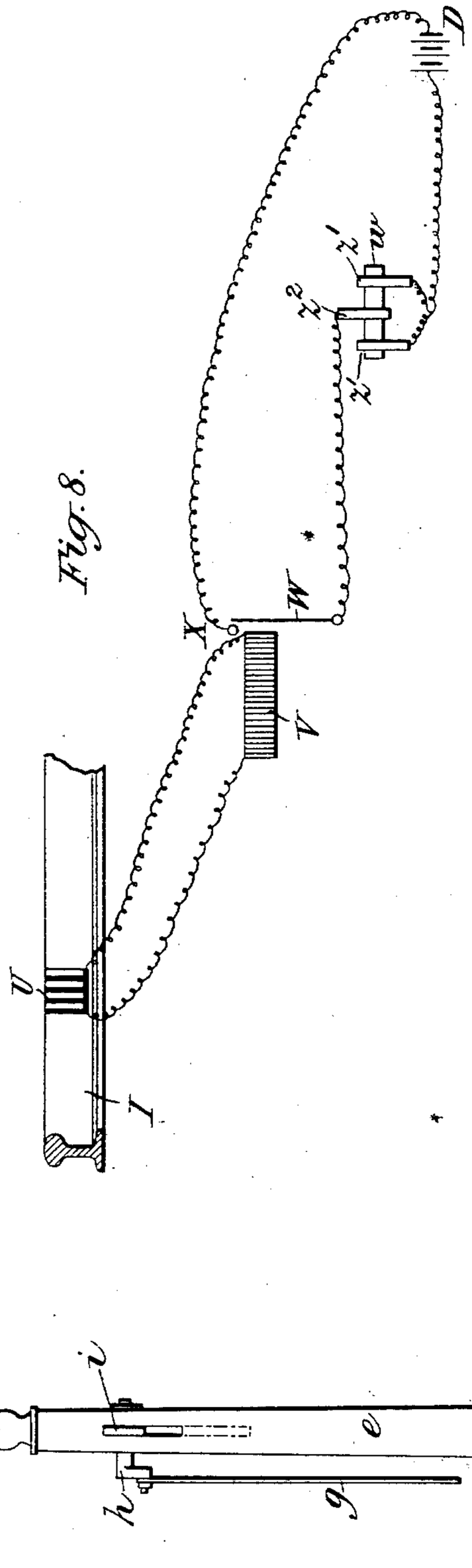

Fig. 8.

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INVENTOR:

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(No Model.) 4 Sheets—Sheet 2.

H. BROCKLEHURST.

RAILWAY SIGNALING BY MEANS OF DETONATING OR EXPLOSIVE SIGNALS.

No. 525,584 Patented Sept. 4, 1894.

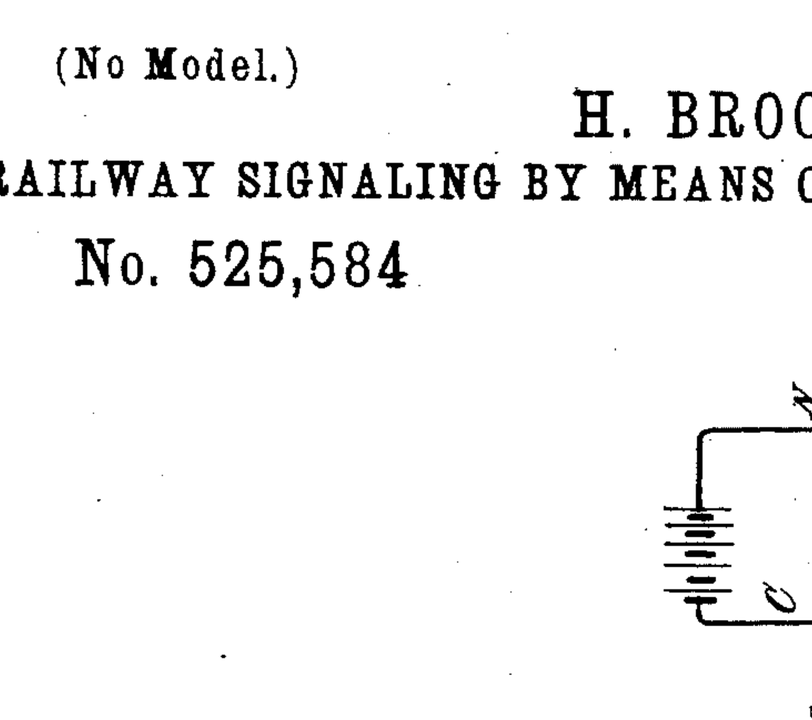

Fig. 2a.

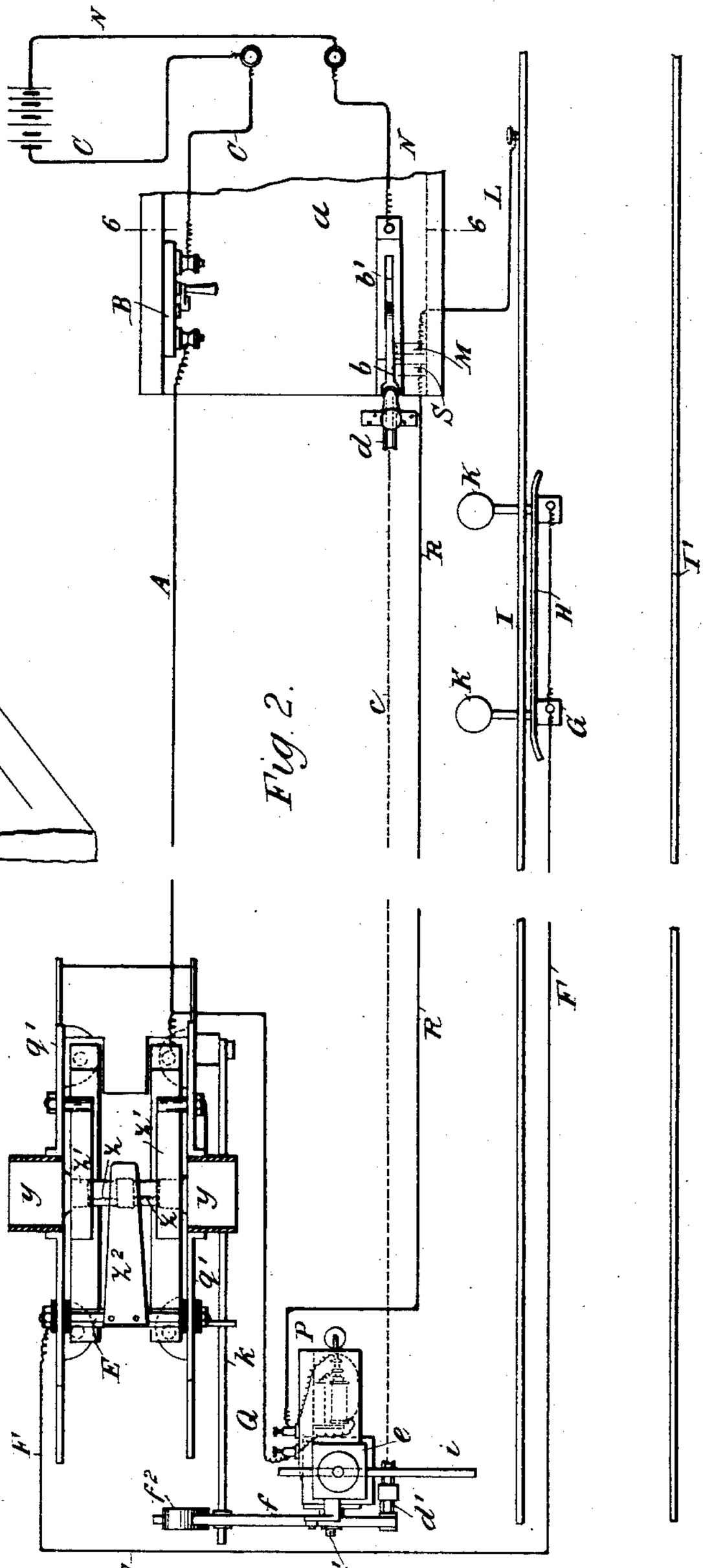

Fig. 2.

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(No Model.) 4 Sheets—Sheet 3.

H. BROCKLEHURST.

RAILWAY SIGNALING BY MEANS OF DETONATING OR EXPLOSIVE SIGNALS.

No. 525,584. Patented Sept. 4, 1894.

Fig. 3.

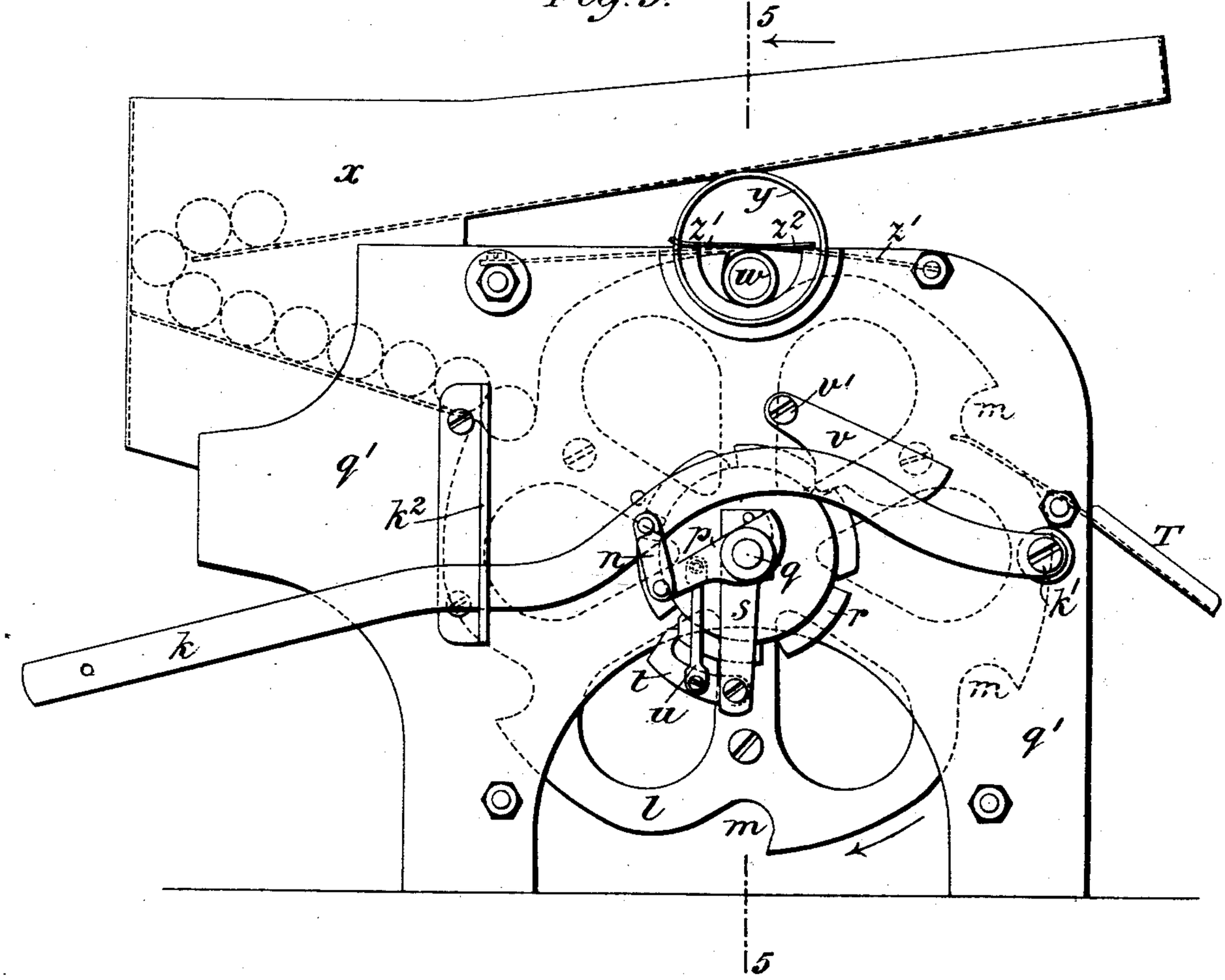
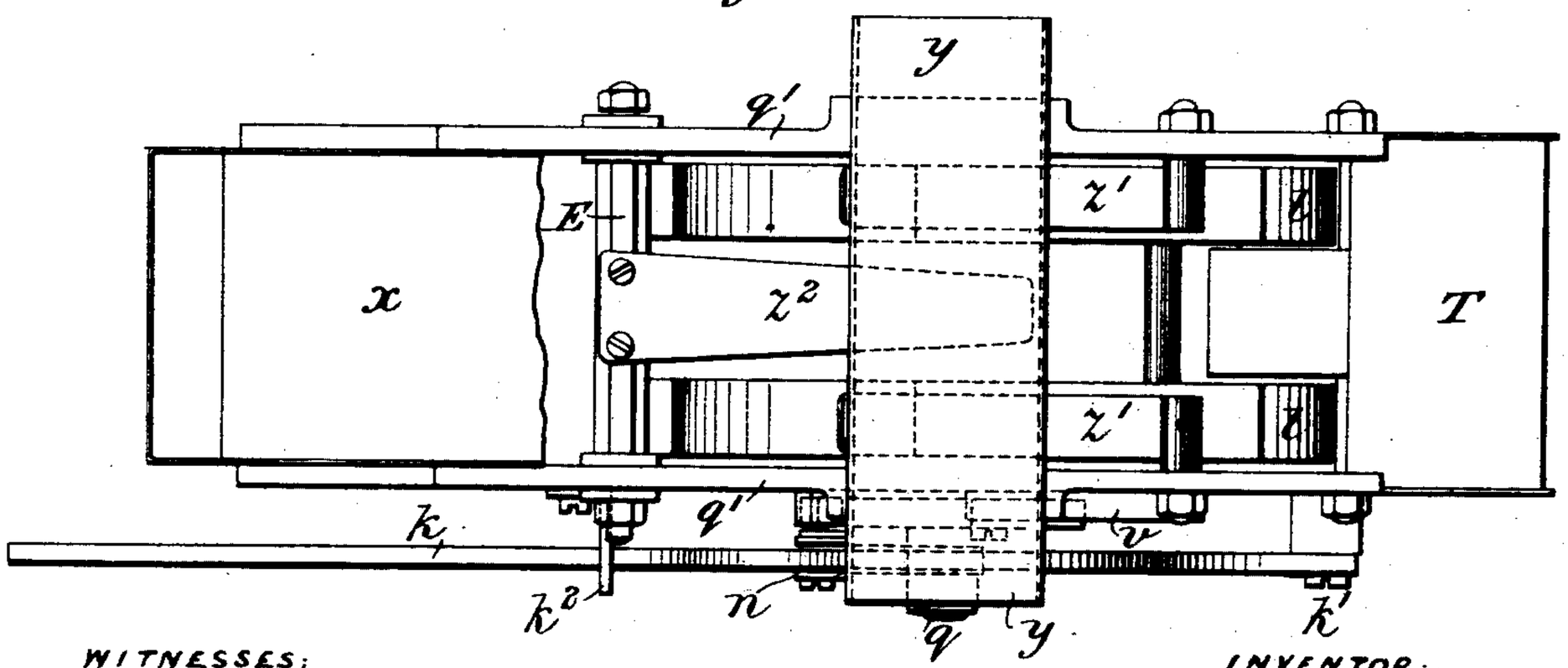


Fig. 4.



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(No Model.) 4 Sheets—Sheet 4.

H. BROCKLEHURST.

RAILWAY SIGNALING BY MEANS OF DETONATING OR EXPLOSIVE SIGNALS.

No. 525,584. Patented Sept. 4, 1894.

Fig. 6.

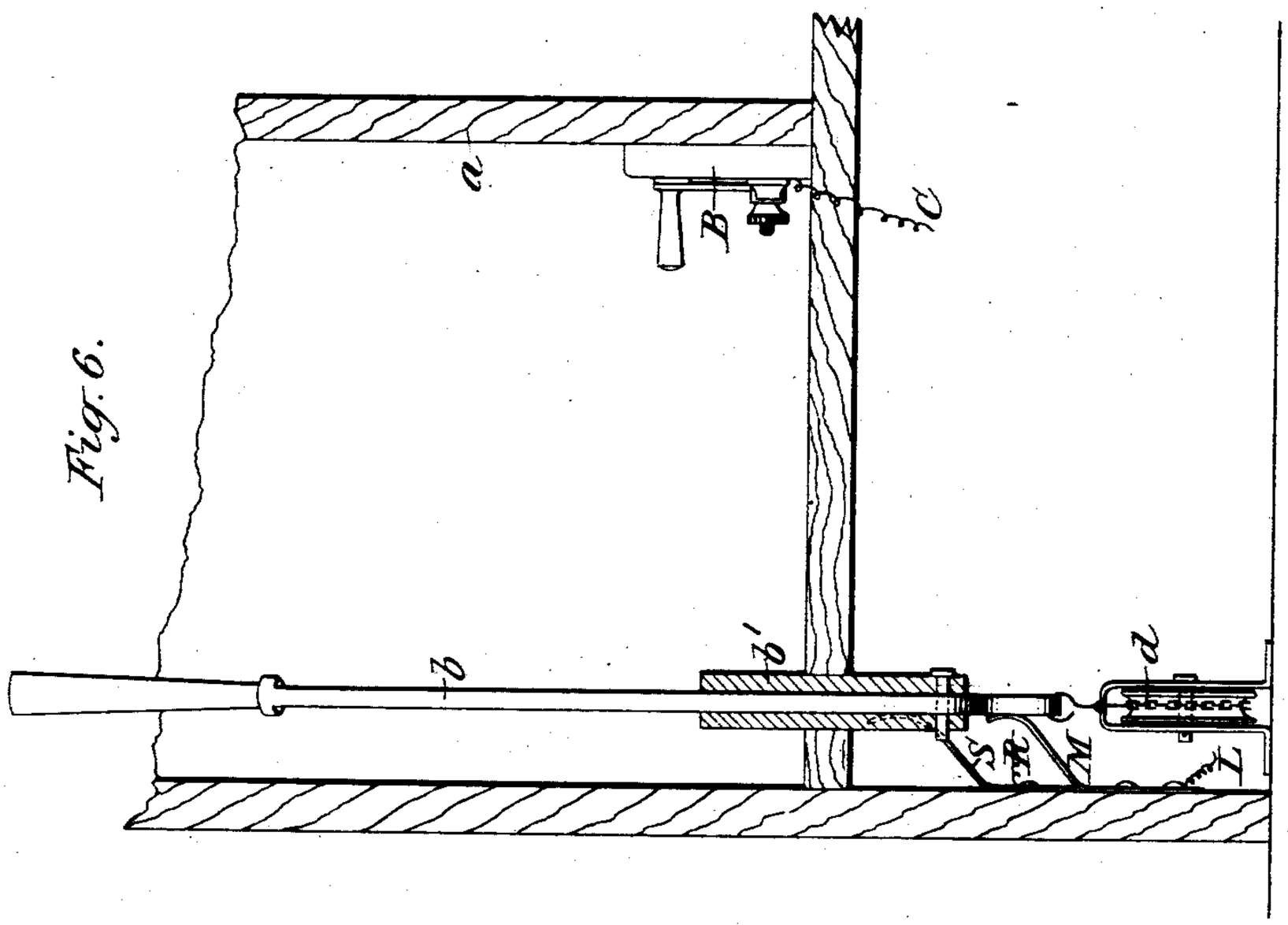


Fig. 7.

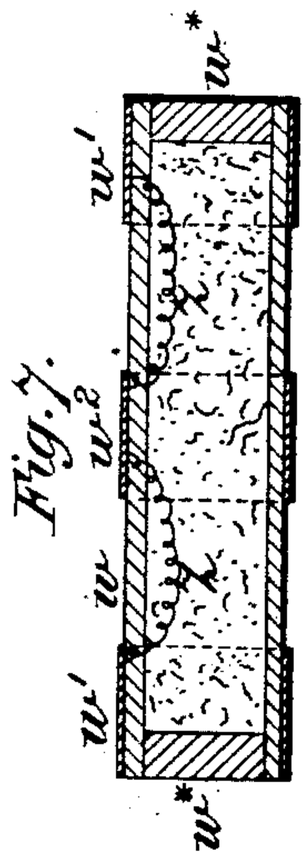
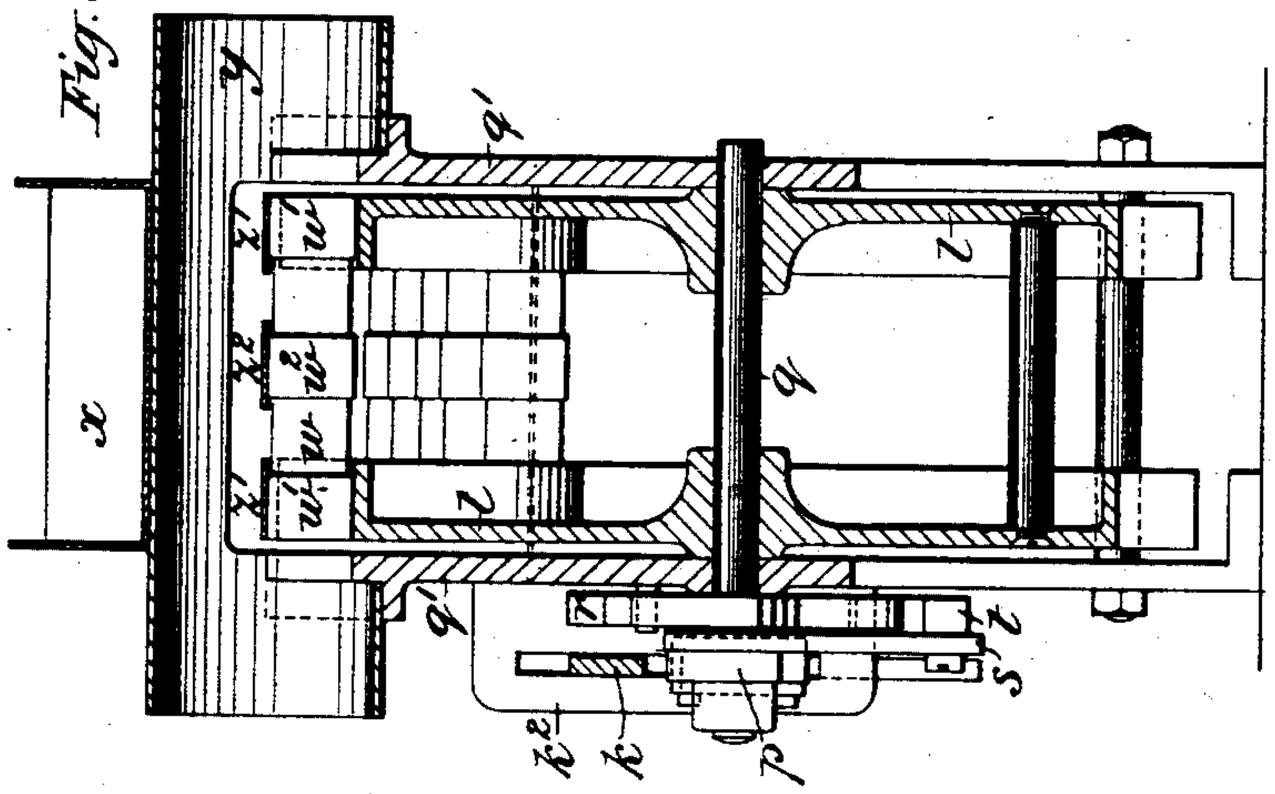


Fig. 5.



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UNITED STATES PATENT OFFICE.

HERBERT BROCKLEHURST, OF LONDON, ENGLAND, ASSIGNOR OF ONE-HALF TO HENRY CONSTIEN, OF SAME PLACE.

RAILWAY SIGNALING BY MEANS OF DETONATING OR EXPLOSIVE SIGNALS.

SPECIFICATION forming part of Letters Patent No. 525,584, dated September 4, 1894.

Application filed November 3, 1893. Serial No. 489,957. (No model.)

To all whom it may concern:

Be it known that I, HERBERT BROCKLEHURST, of London, England, have invented certain new and useful Improvements in Apparatus for Signaling on Railroads by Means of Detonating or Explosive Signals, of which the following is a specification.

Hitherto detonating or explosive signals used on railroads for signaling during fogs have most commonly been laid upon or in close contiguity to the rail so as to be exploded by direct contact with the wheel or other part of the train itself when the train reaches the signal. The laying of these signals if done manually is dangerous to the men employed while no satisfactory means have as yet been introduced to lay them mechanically.

Now the object of this invention is to provide improved means adapted to explode detonating or explosive signals by causing the train or a suitable device actuated by the train when it reaches a given part of the track to close or complete an electric circuit which includes platinum or other wires within a cartridge or detonating signal whereby the electric current explodes the said cartridge or signal.

The accompanying drawings represent an electric detonating signaling apparatus constructed and working in accordance with this invention in its preferred form.

Figure 1 is a side elevation of the apparatus. Fig. 2 is a plan, showing also the electrical connections. Fig. 2^a is a fragmentary perspective of the operating lever and its contact springs. Fig. 3 is a side elevation. Fig. 4 is a plan (with part of the cartridge reservoir broken away); and Fig. 5 a section on the line 5—5 of Fig. 3 of the part of the apparatus which effects the successive feed or supply of the cartridges. Fig. 6 is a section on the line 6—6 of Fig. 2. Fig. 7 is a longitudinal section of one of the cartridges and illustrating the preferred construction. Fig. 8 is a diagram illustrating a modification in which a thermo-electric pile is used. Figs. 3 to 6 are on a larger scale than Figs. 1 and 2 and Fig. 7 is on a still larger scale.

a represents the signal cabin, *b* the lever for working the ordinary visual signal and *c* a chain or other connector leading from the tail of the lever *b* round a pulley *d*, a pulley *d'* at the signal post and any intermediate pulleys that may be necessary.

e is the signal post.

f is a lever having its fulcrum on the signal post at *f'*; the chain *c* is connected to one end of the lever *f* and the other end of the lever has a counter-balance weight f^2. The lever *f* is connected by a rod *g* and cranked arm *h* to the semaphore or signal arm *i*. The parts above enumerated are all of ordinary construction. The lever *f* is attached near its weighted end by means of a link *j* which is preferably a spring as shown, to one end of a lever *k* the opposite end of which is pivoted at *k'*. The lever *k* is therefore lifted when the lever *f* is lifted and it descends when the lever *f* descends; it moves in a slotted guide k^2. Every time the lever *k* rises it causes a wheel or cylinder *l* to turn on its axis to an extent equal to the distance between two of the recesses *m m* in the periphery of the wheel *l*; when on the other hand the lever *k* descends it does not cause the wheel *l* to turn. The wheel *l* receives its movement from the lever *k* as follows: The lever *k* is connected by a link *n* to the outer end of an arm *p* the inner end of which is loosely pivoted on the shaft *q* of a sort of ratchet wheel *r*. The ratchet wheel *r* and the wheel *l* are both fixed to the shaft *q*. From the same shaft *q* (which turns in bearings in the fixed frame *q'*) an arm *s* loosely hangs and to the lower end of this arm is attached a pawl or catch *t* for engaging with the teeth or notches of the wheel *r*; the pawl *t* is also connected by a link or rod *u* to the arm *p*. *v* is a stop catch to the wheel *r* pivoted at a fixed point *v'*. The drawings show the above parts in their normal position, that is to say when the semaphore *i* is up or at "danger" and the lever *k* is down. When the lever *k* rises (to the position indicated by the dotted line k^x Fig. 1) simultaneously with the fall of the semaphore *i* to the "line clear" position the pawl *t* through the action of the lever *k*, link *n*, arm *p*, arm *s* and link *u* is caused first to enter fully into that notch of the ratchet wheel *r* which is immediately above it and then to travel upward so as by means of the said notch to cause the ratchet wheel to turn on its axis to an ex-

tent equal to the distance between two of its notches. The wheel *l* being fixed on the same shaft as the wheel *r* turns to the same extent, that is to say an extent equal to the distance between two of its recesses *m m*. In this turning movement the stop catch *v* is pushed by the wheel *r* itself out of the notch in which it was engaged and then at the end of the movement drops into the next notch so as to hold the wheel in its new position.

On the descent of the lever *k* when the semaphore *i* is raised to the "danger" position, the pawl *t* through the action of the lever *k*, link *n*, arms *p* and *s* and link *u* is first withdrawn from the notch in which it is engaged and then travels downward without moving the wheel *r*, finally stopping in the position seen in the drawings, that is opposite the notch below. The length of the link *u* and its points of connection with the pawl *t* and arm *p* are preferably such that the pawl at the end of this movement is drawn somewhat into the notch of the wheel *r* as shown, so that its engagement with this notch in the next turning movement is insured.

As the wheel *l* is partially and intermittently turned as above explained its recesses *m m* are each supplied in succession with a cartridge *w* from a hopper or reservoir *x* and brought to the exploding position, which in the apparatus illustrated is the highest position, in line with an open ended tube *y*. The cartridge case is made weakest at the ends in order that the force of the explosion may chiefly be expended endwise and with this object the body of the case is preferably made of strong paper or other suitable material and the ends are closed by wads $w^{\times}$ $w^{\times}$ as seen in Fig. 7.

Around the cartridge case at the ends are circumferential metallic bands *w' w'* and around the middle is a circumferential metallic band w^2. The bands *w' w'* are connected to the band w^2 within the cartridge by fine platinum or other wires *z z*. When the cartridge is in the exploding position the two end bands *w' w'* are in contact with two metallic springs *z' z'* and the middle band w^2 is in contact with a metallic spring z^2, this connection being made in any rotative position of the cartridge. One of the springs *z'* is connected with a wire A (see Fig. 2) which leads to a switch B and from the switch B another wire C leads to one pole of a battery D; the wire A may be connected to both of the springs *z'* but connection with one of them is sufficient because the two springs *z'* are metallically connected through the metal of the apparatus.

The spring z^2 which is in metallic connection with the springs *z' z'* by means of the metal bands *w' w'*, wires *z z* and metal band w^2 is connected to an insulated bar E from which a wire F leads to one of the metallic supports G of a short rail H placed alongside but not in contact with one of the rails I of the railway; this rail H has counterweights K K to return it to its normal position after having been acted upon by a passing train as hereinafter described. From the rail I a wire L leads to a spring contact M in the signal box, and when the signal lever *b* is in the normal or "danger" position (as seen in the drawings) the tail of the lever is in contact with the spring contact M. From the metallic frame *b'* of the lever a wire N goes to the other pole of the battery D. It will thus be seen that when the lever *b* is in the normal position and the switch B is closed there is an electric circuit partly formed by the wires *z z* in the cartridge and complete except between the short rail H and the ordinary rail I. It will therefore be understood that when the first wheel of a train reaches the rail H between which and the rail I the wheel flange passes metallic connection is made by the train between the rails H and I and the electric circuit is thus closed. The current which then passes heats the wires *z z* and explodes the detonating or explosive material that the cartridge case contains, thus signaling to the driver that he is to stop.

In order that the driver may subsequently receive an audible signal that he may proceed, an electric bell P is employed which is sounded when the semaphore *i* is lowered. With this object a wire Q connected with the wire A is led to the electric bell and another wire R from the bell to a spring contact S in the signal cabin in such position that the tail of the signal lever *b* when moved into the "line clear" position comes in contact with the contact S; consequently the circuit of the bell and the battery D is closed and the bell rings, the other circuit, that is to say the cartridge circuit, being at the same time broken between the spring contact M and the tail of the lever *b*. As the lever *b* is moved over to the "line clear" position the wheel *l* makes a partial turn; the last exploded cartridge falls down the shoot T and a fresh cartridge is brought into the exploding position.

Instead of arranging that the cartridge circuit shall be closed by the train wheels acting upon a short rail such as H as hereinbefore described any other suitable arrangement by which the train will close the circuit can be adopted. For example the wire F instead of being led to a rail such as H may be led to the other ordinary rail I' so that the electric circuit may be completed through the first pair of wheels and axle of the train; in this case the rails I and I' must be insulated from the adjoining rails. Or any suitable known arrangement used in ordinary electrical railroad signaling apparatus whereby the train on reaching a given point completes an electric circuit such for example as a metallic brush or rubber on the engine contacting with a metallic projection on the rail I, or as a plunger which the train depresses so as to cause it to close an electric circuit, may be adopted as will be well understood. Or the circuit can

be completed or closed by causing the train to bring into action a thermo-electric pile or battery placed sufficiently near to the rails. This is illustrated diagrammatically in Fig. 8 in which I represents the rail, U a thermo-electric pile composed of any suitable different metals such as bismuth and antimony or selenium. The heat caused by the friction of the wheels of the train heats one of the junctions or series of junctions of the pile and thereby causes a current of electricity to flow from one junction to another. This current is caused to flow to a relay V and to attract an armature W which when thus attracted closes at X the circuit of a battery D which is the battery of the cartridge circuit. *w* indicates the cartridge in position, *z' z'* the two springs connected with one pole of the battery and z^2 the other spring which is connected with the armature W. Instead of a thermo-electric pile a very sensitive heat indicator such as those employed as fire alarms and which complete an electric circuit when the heat reaches a prescribed limit may be employed.

It is obvious that various other arrangements than those shown in the drawings can be employed for giving the cartridge carrying wheel *l* a partial rotation at every movement of the lever *b* in the one direction so as to bring a fresh cartridge into the exploding position, and that other devices than the cartridge carrying wheel can be used to bring the cartridges successively into the exploding position, but the arrangement shown has been specially designed for the purpose.

At ordinary times, that is to say when there is no fog the detonating signaling apparatus may be disconnected from the ordinary signaling apparatus; this can be effected by disconnecting the lever *k* from the lever *f* or otherwise.

As this invention enables the detonating signals to be worked by the ordinary signalmen when doing their ordinary duty in the signal cabins, it is unnecessary to have special fog signalmen for the dangerous work of laying detonating signals upon the rails. If, however, it be thought desirable to still work the detonating signals by special men, the apparatus can readily be arranged to be worked by such men from safe positions by means of levers or other appliances connected with the cartridge carrying wheel *l* as will be readily understood.

What I claim, and desire to secure by Letters Patent, is—

1. For signaling on railroads by means of detonating or explosive signals, two metallic pieces contacting respectively with separate metallic parts of the signal to be exploded, the one of said pieces being normally connected with one pole of a battery the other pole of which is normally connected through the lever that works the ordinary visual signal with one of the rails of the railroad and the other of said metallic pieces being normally connected with a device between which and the said rail the train on reaching a given part of the track makes metallic connection and closes the electric circuit as described.

2. For signaling on railroads by means of detonating or explosive signals, two metallic pieces contacting respectively with separate metallic parts of the signal to be exploded, the one of said pieces being normally connected with one pole of a battery the other pole of which is normally connected through the lever that works the ordinary visual signal with one of the rails of the railroad and the other of said metallic pieces being normally connected with a device between which and the said rail the train on reaching a given part of the track makes metallic connection and closes the electric circuit as described, in combination with a wire connecting part of said circuit with an electric bell and another wire leading from said bell to a metallic piece with which the visual signal lever contacts when in the "line clear" position, the said signal lever at same time breaking or opening the circuit through the rail, whereby the bell circuit is closed and the bell caused to ring, substantially as set forth.

3. For signaling on railroads by means of detonating or explosive signals, the combination of an operating lever, an electric circuit having contact-springs at an exploding position for making connection with the detonating signals, a mechanism for moving such signals successively to such exploding position, consisting of a wheel having recesses in its periphery to receive the signals to be exploded, means whereby said wheel receives step by step rotation in accordance with the movements of said lever and thereby brings the signals successively into the exploding position, and a reservoir adapted to automatically supply the signals to the recesses of said wheel as it rotates, substantially as set forth.

4. The combination with the lever *k* moved in accordance with the movements of a lever which is worked in connection with an ordinary visual railroad signal, of the link *n*, arm *p*, shaft *q*, ratchet wheel *r*, arm *s*, pawl *t*, link *u*, stop catch *v*, wheel *l*, recesses *m m* in said wheel *l*, and reservoir *x* substantially as and for the purpose hereinbefore described.

In witness whereof I have hereunto signed my name in the presence of two subscribing witnesses.

HERBERT BROCKLEHURST.

Witnesses:
JOHN C. MEWBURN,
GEORGE C. BACON.