(No Model.) 3 Sheets—Sheet 1.

G. M. STEVENS.

FIRE ALARM TELEGRAPH REPEATER.

No. 463,340. Patented Nov. 17, 1891.

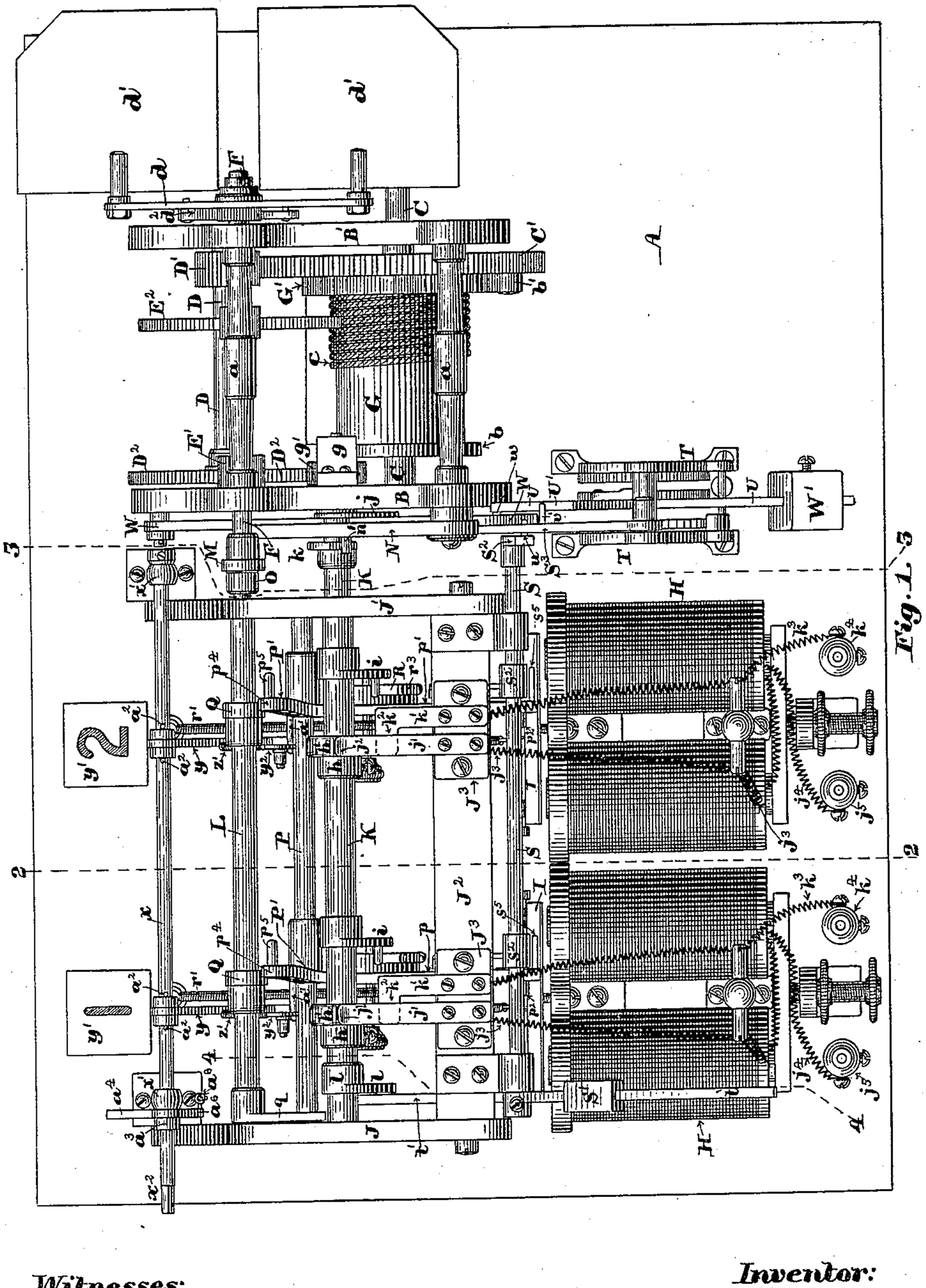

Fig. 1.

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Robert B. Edes.

Inventor:
George M. Stevens,
by W. E. Lombard
Attorney.

(No Model.) 3 Sheets—Sheet 2.

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FIRE ALARM TELEGRAPH REPEATER.

No. 463,340. Patented Nov. 17, 1891.

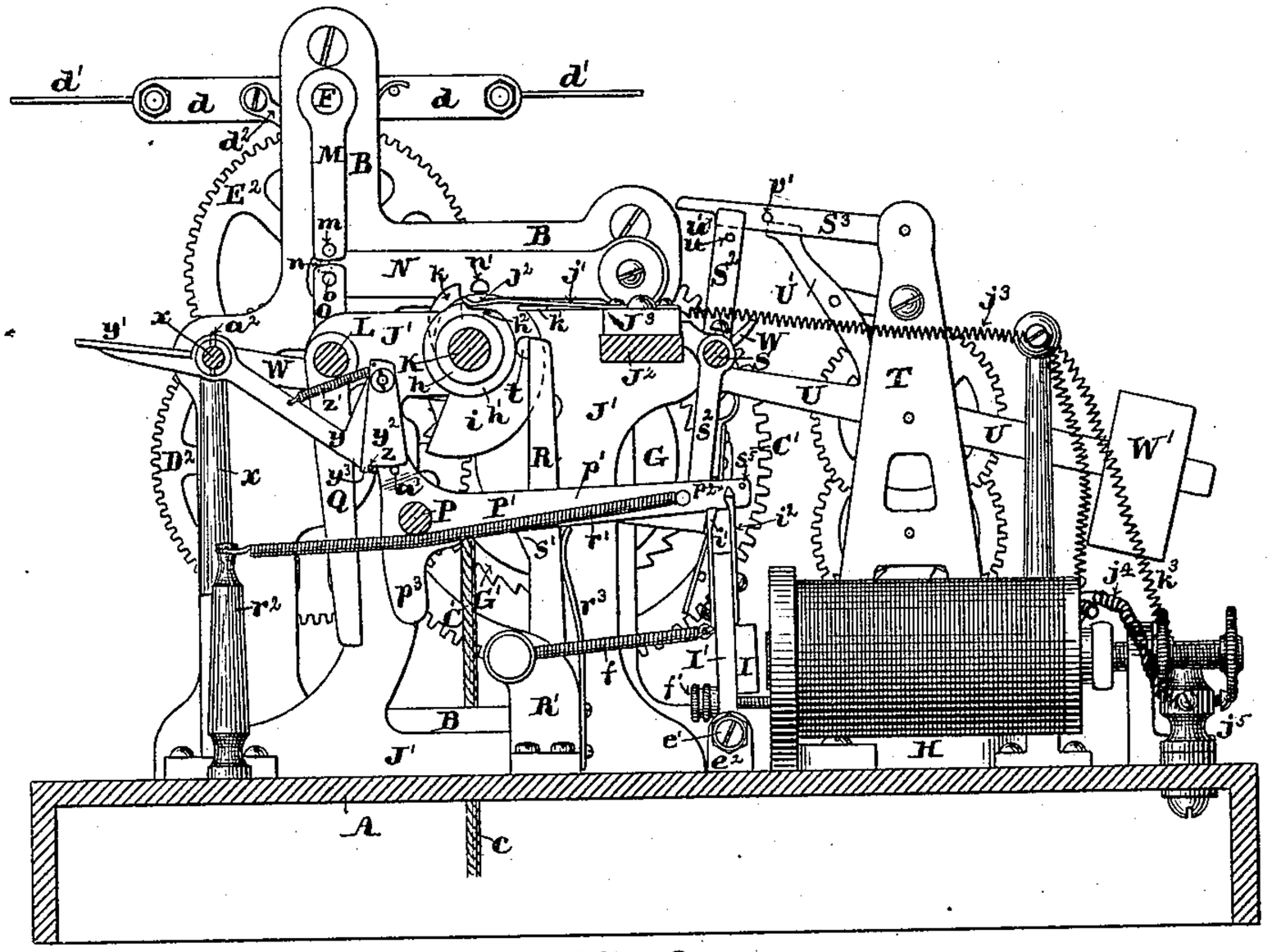

Fig. 2.

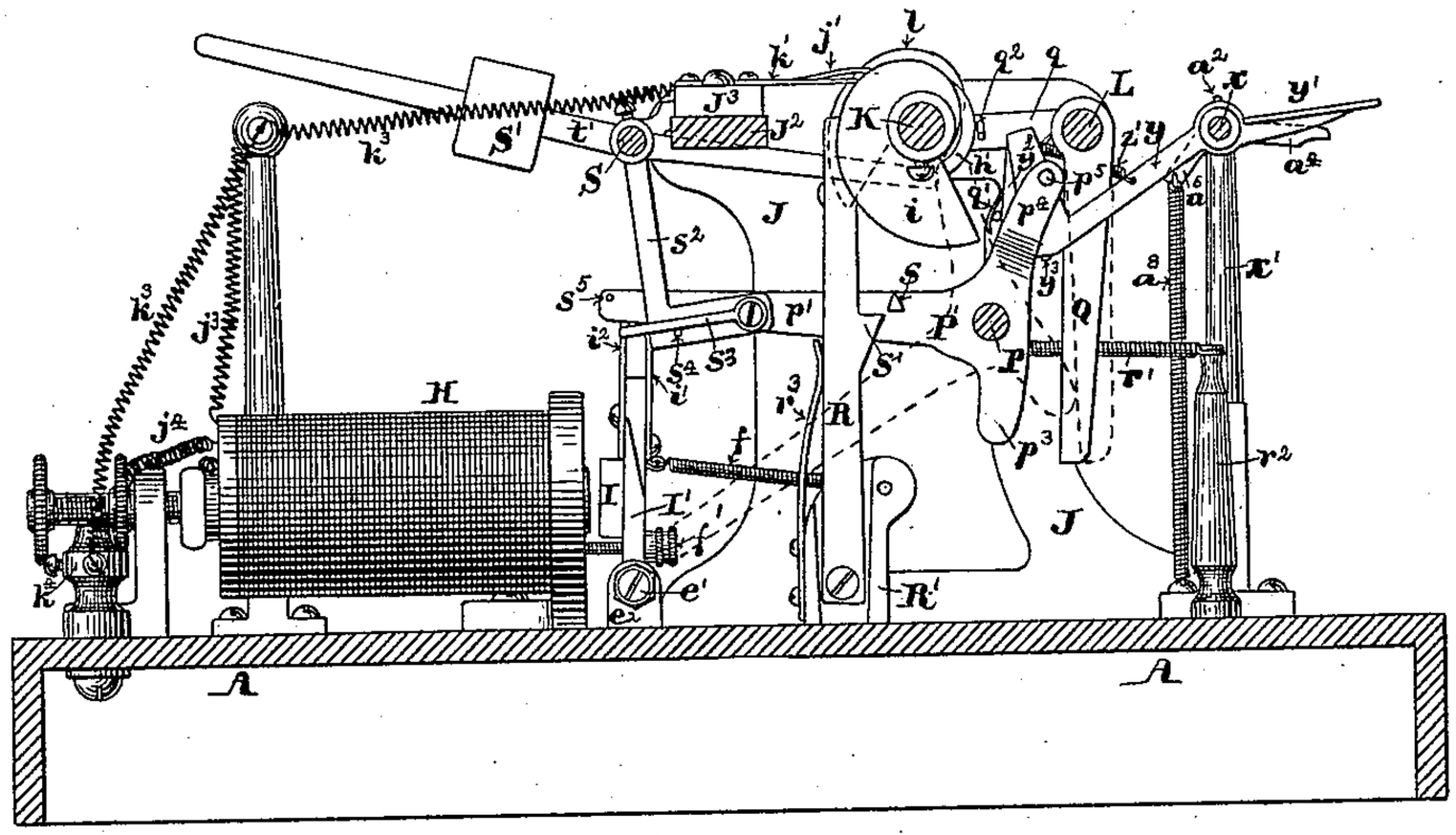

Fig. 3.

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(No Model.) 3 Sheets—Sheet 3.

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FIRE ALARM TELEGRAPH REPEATER.

No. 463,340. Patented Nov. 17, 1891.

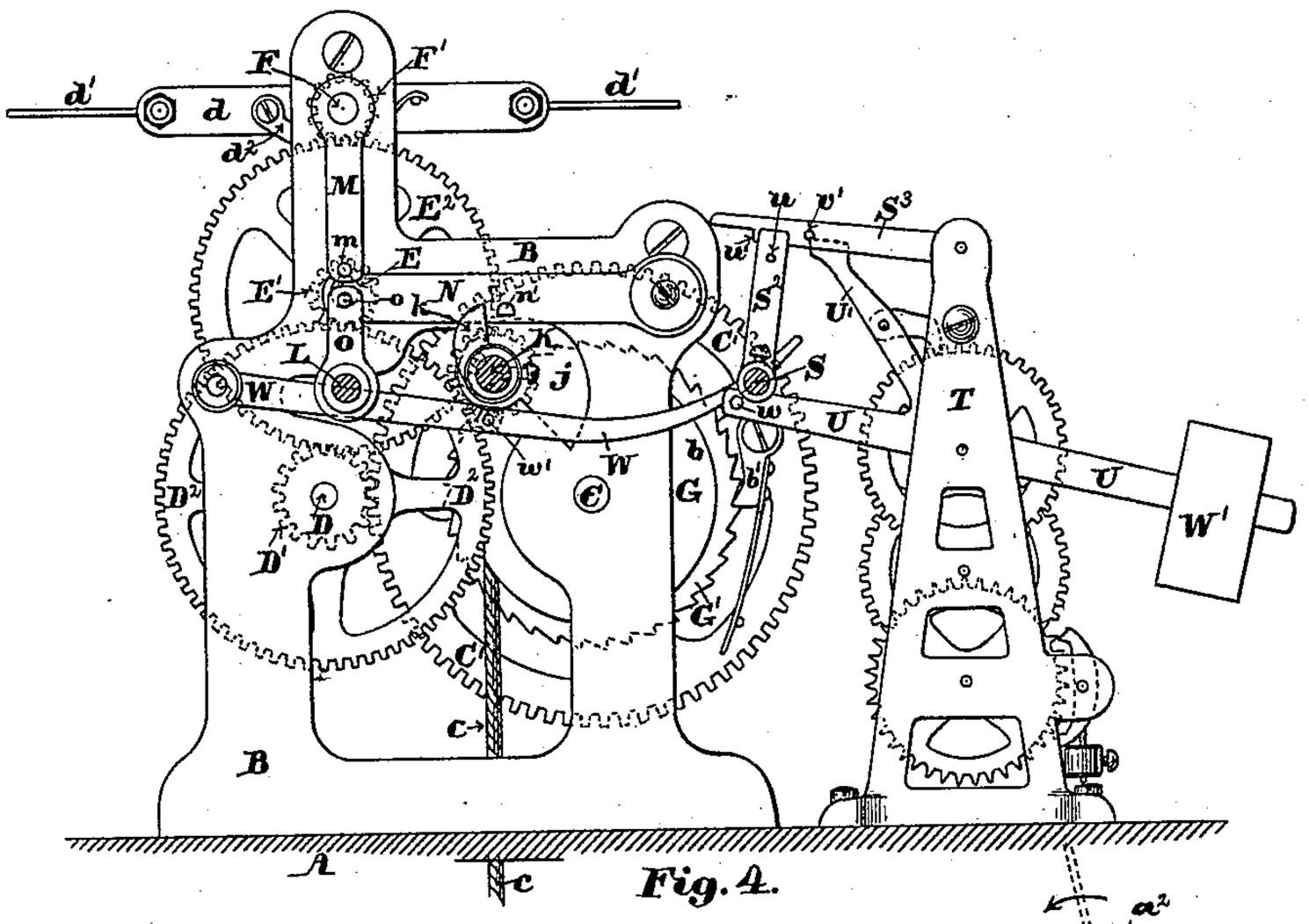

Fig. 4.

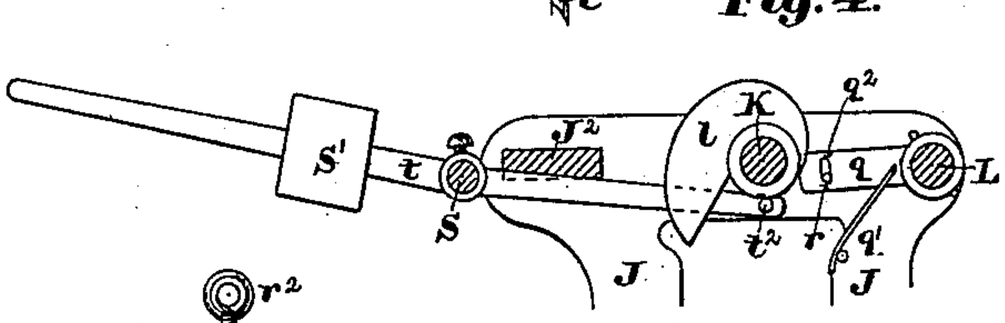

Fig. 6.

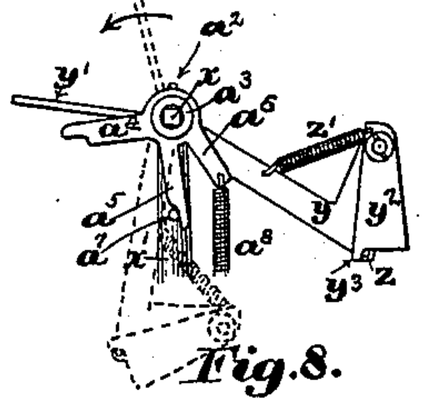

Fig. 8.

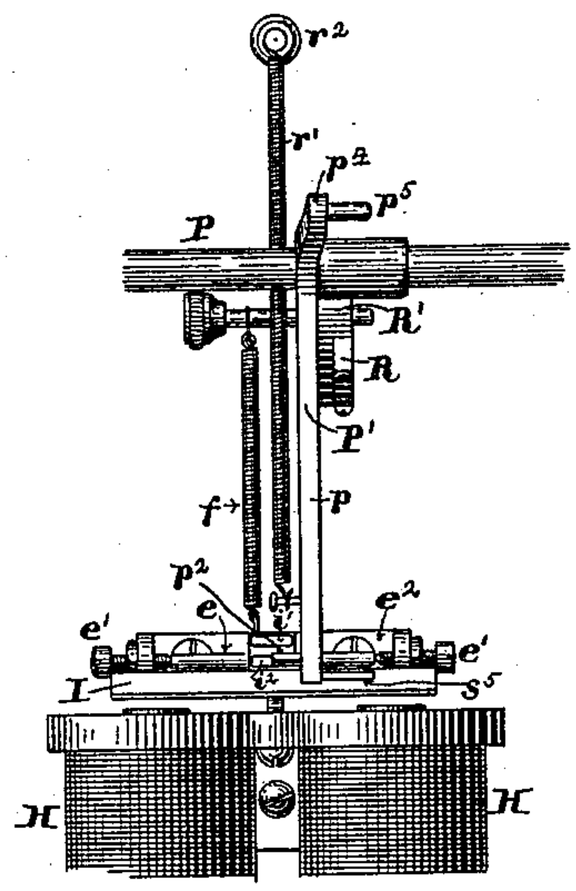

Fig. 7.

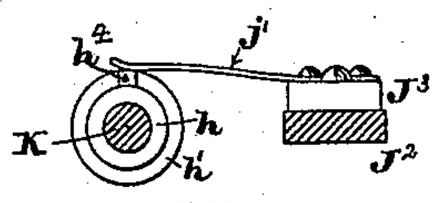

Fig. 10.

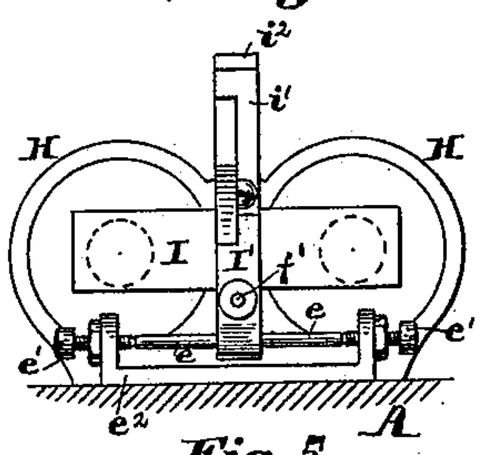

Fig. 5

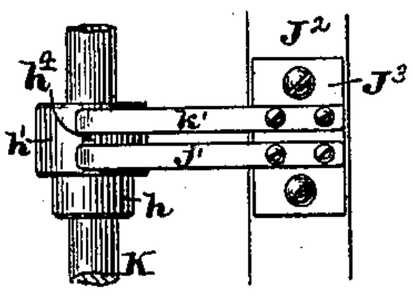

Fig. 9.

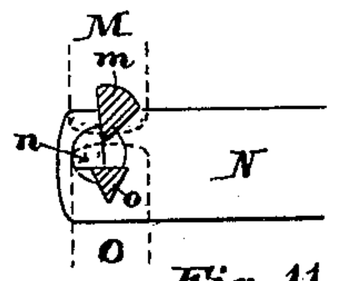

Fig. 11.

Witnesses:
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Inventor:
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UNITED STATES PATENT OFFICE.

GEORGE M. STEVENS, OF CAMBRIDGE, MASSACHUSETTS.

FIRE-ALARM-TELEGRAPH REPEATER.

SPECIFICATION forming part of Letters Patent No. 463,340, dated November 17, 1891.

Application filed April 30, 1891. Serial No. 391,129. (No model.)

To all whom it may concern:

Be it known that I, GEORGE M. STEVENS, of Cambridge, in the county of Middlesex and State of Massachusetts, have invented certain new and useful Improvements in Fire-Alarm-Telegraph Repeaters, of which the following, taken in connection with the accompanying drawings, is a specification.

This invention relates to that class of apparatus which is employed in fire-alarm telegraphs and known as an "automatic non-interfering repeater," by the use of which a signal transmitted over one of several independent circuits is automatically repeated on each of the other of said circuits, and while a signal is thus being transmitted on one circuit and repeated on the other circuits such signal cannot be interfered with by an attempt to transmit another signal on either of said circuits.

This invention consists in certain novel features of construction, arrangement, and combination of parts, which will be readily understood by reference to the description of the drawings and to the claims hereinafter given, and in which the invention is clearly pointed out.

Figure 1 is a plan of a machine illustrating this invention. Fig. 2 is a transverse sectional elevation looking toward the right of Fig. 1, the cutting plane being on line 2 2 on Fig. 1. Fig. 3 is a similar sectional elevation looking toward the left of Fig. 1, the cutting-plane being on the same line as Fig. 2. Fig. 4 is a sectional elevation looking toward the right of Fig. 1, the cutting plane being on line 3 3 on Fig. 1. Fig. 5 is an elevation of one of the electro-magnets and its armature detached. Fig. 6 is a partial sectional elevation, the cutting plane being on line 4 4 on Fig. 1 and looking toward the left of said figure. Fig. 7 is a plan of one of the levers P′, its shaft, a portion of one of the magnets, and its armature. Figs. 8, 9, and 10 are detail views to be hereinafter referred to. Fig. 11 is a diagram view illustrating the devices for locking the main motive-power mechanism.

In the drawings, A is the bed of the machine, having erected thereon the frames B B′, connected together by the tie-rods *a a*, and having mounted in suitable bearings therein the shafts C, D, E, and F, as shown.

The shaft C has loosely mounted thereon the spur gear-wheel C′, the teeth of which engage with the teeth of the pinion D′ on the shaft D to impart motion thereto, and the shaft D also has secured thereon the gear-wheel D^2, the teeth of which engage with the teeth of the pinion E′ on the shaft E, which also has secured thereon the gear-wheel E^2, the teeth of which engage with the teeth of the pinion F′ on the shaft F.

The shaft C has firmly secured thereon the drum G, provided with the flanges *b* and G′, the latter having formed in its periphery a series of ratchet-teeth, with which the toe of the pawl *b′*, pivoted to the side of the wheel C′, engages, so as to compel said gear C′ to revolve with said drum when said drum is revolved by the descent of a weight (not shown) attached to the cord *c*, wound on said drum, as shown in Fig. 1.

The shaft F has loosely mounted thereon outside of the frame B′ the arm *d*, carrying at each end a regulator-fan plate *d′*, and near its shaft the spring-pressed pawl d^2, which engages with the teeth of a ratchet-wheel firmly secured upon said shaft F.

The mechanism above described is the motive-power machine which operates the armature-controlling mechanisms for the different circuits and is of well-known construction.

A plurality of electro-magnets H H are secured in position on the bed A, and each magnet is provided with an armature I, secured to a lever I′, mounted on the short shaft *e*, supported by screw-centers *e′ e′*, set in the stand e^2, secured upon said bed, as shown in Figs. 1, 2, 3, 5, and 7. The armatures I are retracted when the circuits are broken by the springs *f*. (See Figs. 2, 3, and 7.) The bed A also has erected thereon the frames J and J′, which are connected at their upper ends by the tie-girt J^2, and have mounted in bearings formed therein the shafts K and L. The shaft K also has a bearing in the stand *g*, secured to the inner face of the frame B, and has secured thereon the pinion *g′*, with which the gear-wheel D^2 engages to impart to said shaft K a rotary motion. The shaft K also has mounted thereon, so as to revolve therewith, a plurality of circuit-breaking wheels, each comprising a hub *h* and an insulating-ring *h′*, each provided with a depression h^2

in its periphery, the number of said hubs and insulating-rings corresponding to the number of magnets H, which of course correspond to the number of circuits in the fire-alarm system. Said shaft K also has secured thereon a plurality of cams *i i*, corresponding to the number of magnets H, and also the cams *j*, *k*, and *l*, the offices of which will be explained later.

Upon the tie-girt J^2 are secured as many insulating-blocks J^3 as there are magnets H, and each of said blocks has secured thereon the two spring-plates *j'* and *k'*, (see Fig. 1,) the former being provided with a curved bend or downward projection j^2 at or near its free end, adapted to be acted upon by the insulating cam-ring *h'* and to drop into the depression h^2 thereon, while the latter is provided at its free end with a lateral offset or expansion *k'*, which extends beneath the spring *j'*, with which it is in contact when the bend or projection j^2 falls into the depression h^2, as shown in Figs. 2 and 3. Each of the spring-plates *j'* is connected by the wire j^3 to one end of the coil of a magnet H, the other end of which is connected by the wire j^4 to a screw-cup j^5, which is connected by a suitable wire to one pole of a battery, (not shown,) and each of the plates *k'* is connected by the wire k^3 to a screw-cup k^4, which in like manner is connected to the opposite pole of the battery.

The shaft F has secured upon its left-hand end outside of the frame B the pendent lever M, having set in its lower end the inwardly-projecting triangular pin *m*, which engages with a similarly-shaped pin *n*, set in and projecting outward from the free end of the lever N, pivoted to said frame B, to lock the motive-power mechanism when the circuits are all closed, said lever N being supported in position to lock said mechanism by the pin *o*, set in the free end of the lever O, secured upon the end of the shaft L, said pin *o* being moved from beneath the pin *n*, so that the free end of the lever N may drop and release the pin *m* and allow the motive-power mechanism to operate whenever one of the circuits is broken outside of the repeater mechanism. The lever N has set in its side, at a point over the shaft K, the pin *n'* in position to be acted upon by the cam *k* to raise said lever into position for the pin *n* to intercept the pin *m* and again lock the motive-power mechanism. The frames J J' also have mounted therein a non-revolving shaft P, upon which are mounted, so as to be movable about said shaft, a plurality of three-armed levers P', corresponding in number to the number of circuits in the system and which serve to control the movements of the motor mechanism. The long arm *p'* of each lever P' has set in its free end a triangular pin p^2, which, when the circuit is closed, rests upon the upper end of the spring *i'*, secured to the rear or outer face of the upper end of the armature-lever I', so as to maintain said lever P with its long arm in a nearly horizontal position; but when the circuit is broken and the armature is retracted by the spring *f* the spring-plate *i'* is withdrawn from beneath the pin p^2, thus permitting the free end of the long arm *p'* to fall, when the pendent short arm p^3 of said lever P strikes one of a plurality of pendent arms Q Q, secured upon the shaft L, and causes a slight movement of said shaft about its axis sufficient to withdraw the pin *o* from beneath the pin *n* and permit the lever N to drop, so as to remove the pin *n* from the path of the pin *m* and allow the motive-power mechanism to operate long enough to impart to the shaft K one complete revolution. As the shaft F, that carries the lever M, is arranged to make five revolutions to one of the shaft K, it follows that the cam *k* must be so shaped that the pin *n* will not be raised into the path of the pin *m* until the shaft F has completed four revolutions after being set in motion. The upwardly-projecting arm p^4 of the lever P' has set in its free end a pin p^5, which is acted upon by the cam *i* to raise the free end of the long arm *p'* until the pin p^2 rests upon the upper end of the spring i^2, secured to the inner face of the upper end of the armature-lever I', as shown in the drawings, said spring i^2 being somewhat longer than the spring *i'*, as shown in Fig. 2. When the long arm of the lever P' is raised, the shaft L is moved about its axis by the spring *q'* acting upon the lever *q*, secured on said shaft, so as to move the pin *o* into position to support the end of the lever N, said spring permitting the pin *o* to move slightly to allow the pin *n* to pass above it when said lever is raised. The lever *q* has formed in its movable end a slot q^2, which extends transversely of said lever, into which projects the pin *r*, which serves as a stop to limit the movements of the shaft L about its axis in either direction.

The lever P' has connected thereto one end of a spring *r'*, the other end of which is connected to some fixed part of the machine, as the post r^2, and serves to insure the rapid dropping of the long arm of said lever when released by the movements of the armature.

Each of the levers P' has set in its long arm, a short distance from the shaft on which it is mounted, the pin *s*, Fig. 3, arranged to engage with the shoulder *s'*, formed on the side of the upright lever R, fulcrumed on the stand R', and having its upper end pressed toward the shaft K by the spring r^3 and arranged to be moved against the tension of said spring by the pin *t*, Fig. 2, set in the side of the cam *i*.

In order to prevent interference with the signal at any time being rung in on one circuit by an attempt to ring in a signal on either or all of the other circuits, a rocker-shaft S is mounted in bearings formed in or secured to the frames J and J', upon which are secured as many pendent L-shaped levers s^2, Fig. 2, as there are circuits in the system, to the free ends of the horizontal portions of

which are pivoted the stop-bars s^3, the front ends of which, when in their normal positions, rest upon the pins s^4, set in the levers s^2, as shown in Fig. 3.

The shaft S has secured thereon at the left hand of Fig. 1 the two-armed levers t', the front arm of which has adjustably secured thereon the weight S', and the other arm has set therein the pin t^2, Fig. 6, which is acted upon by the cam l to depress the rear arm of said lever t' and move the free ends of the L-shaped levers s^2, with the stop-bars s^3, toward the front of the machine, so that the front ends of the stop-bars s^3 will project beneath the pins s^5, set in the free ends of the long arms of the levers P', so that neither of said levers can fall, so as to permit a signal to be given, except the one that is connected with the circuit upon which the signal is first given.

The shaft S has secured upon its right-hand end the upwardly-projecting arm S^2, having set in its free end the pin u, with which the shoulder u', Fig. 4, on the under side of the arm S^3 engages to lock the arm S^2 in its rearward position and prevent the withdrawal of the stop-bars s^3 from beneath the pins s^5.

An independent clock-power mechanism consisting of a train of gearing with suitable shafts and an escapement, all mounted in the frame-work T, with the two-armed weighted lever U and the radius-arm U' and the pawl v, is secured in position on the bed A, so that the free end of the radius-arm U' will act upon a pin v', set in the locking-arm S^3, to lift said arm to release the pin u and permit the weight S' to descend and retract the stop-bars s^3 from beneath the pins s^5.

A curved lever W, Fig. 4, is pivoted at one end to the frame B and rests near its other end upon a pin w, set in the rear arm of the weighted lever U, and has set in its inner side near the middle of its length the pin w', (shown in dotted lines in Fig. 4,) upon which the cam j acts to depress said lever and the rear arm of the lever U and raise the front or weighted end of said lever, and thus set in motion the independent clock-power mechanism. A shaft x is mounted in bearings in the upper ends of the posts x' x', so that it may be partially rotated therein. The shaft x has loosely mounted thereon a plurality of two-armed levers y, corresponding in number to the number of circuits, each of which has formed upon or secured to one of its arms a plate y', upon which is placed a numeral corresponding to the number of a circuit or district, as 1, 2, 3, &c., while the other arm of said lever, which is made L-shaped, has pivoted thereto the pendent stop-plate y^2, Figs. 2 and 3, the lower end of which is curved concentric to its pivotal axis and is provided at its rear lower corner with the shoulder y^3, which is pressed against the pin z, set in said lever y, by the tension of the spring z', Fig. 8, one end of which is connected to said lever y and the other to the plate y^2 above its pivot, all so arranged that when the plate y' is in a horizontal position and the long arm of the lever P' is in a horizontal position the curved lower end of the plate y^2 will rest upon the pin a', set in said lever P', to maintain said numbered plate y' in a horizontal or nearly horizontal position until the end of the long arm of said lever P' falls from its support upon the upper end of the spring i', when, the pin a' being withdrawn from beneath the plate y^2, the L-shaped arm of the lever y falls by the action of the force of gravity until the plate y' assumes a nearly-perpendicular position and indicates the district from which the signal is given.

The levers y y are prevented from being moved lengthwise of the shaft x by the pins a^2 a^2, set in said shaft, one at each end of the hub of each of said levers, said pins projecting upward sufficiently far to serve as stops to limit the movement of the levers y around said shaft, when the heavier ends of said levers drop by the inner edges of the plate y' coming in contact therewith, as indicated in dotted lines in Fig. 8. The left-hand end of the shaft x has firmly secured thereto a hub a^3, from which radiate three arms a^4, a^5, and a^6, the arms a^4 and a^5 serving, in connection with the pin a^7, set in the post x', to limit the movement of the shaft x about its axis in either direction. The normal position of said arms is, as shown in Fig. 8, with the arm a^5 in contact with said pin a^7, where it is held by the tension of the spring a^8, one end of which is connected to the arm a^6 and the other to the base of the column x', as shown in Fig. 3.

The end of the shaft x is squared at x^2 to receive a key by which said shaft may be partially rotated in the direction indicated by the arrow on Fig. 8 to turn the indicator-plates down to a horizontal position after they have been thrown up.

In Figs. 9 and 10 is iilustrated a modified form of the circuit-breaking wheels and the spring-plates j' and k', in which the spring-plates j' and k' are made of equal length and uniform shape and separated from each other, as shown in Fig. 9, and the ring h', instead of being provided with the depression h^2, has set in its periphery a piece of metal h^4, which extends longitudinally of said ring h', so that both springs j' and k' will make contact therewith and thus complete the circuit, as shown in said Figs. 9 and 10.

The operation of this invention is as follows: The parts being in the positions shown in the drawings, without being in connection with the battery or other source of electric force, if such connection be made the several armatures will be moved into contact with the pole ends of the magnet-cores, thereby withdrawing the springs i^2 from beneath the pins p^2 and allowing said pins to drop upon the upper end of the spring i' without affecting any other parts of the machine, such being the normal condition of the machine when

ready for operation. Suppose now that a signal is given from a box in district 1, and the circuit through the left-hand magnet is broken. The armature of said magnet is retracted by the tension of its spring *f*, the spring *i'* is withdrawn from beneath the pin p^2 of the left-hand lever P', and the long arm of said lever drops to the position indicated by dotted lines in Fig. 3, the pin p^2 passing downward between the springs *i'* and i^2, and the backward movement of the armature I being limited by the adjustable stop *f'*.

The falling of the long arm *p'* of the lever P' causes the arm p^3 of said lever to strike the lever Q and move it into the position indicated by dotted lines in Fig. 3, thereby moving the shaft L about its axis and moving the upper end of the lever O toward the front of the machine a sufficient distance to remove the pin *o* from beneath the pin *n*, when the freed end of the lever N will fall, thereby releasing the main motive-power mechanism, which is set in motion by the descent of its weight (not shown) and continues to operate until the shaft K has made one complete revolution, when the motor mechanism will be again locked by the levers N, O, P, and Q assuming the positions shown in full lines in Figs. 2 and 3 and in part in Fig. 11. The first effect produced by the rotation of the shaft K is the passage of the pins *t* in the cams *i* above the upper ends of the levers R, thus releasing them, so that their upper ends are moved toward the rear of the machine by the tensions of the springs i^3 until the shoulders *s'* on said levers are beneath the pins *s* of all the levers P' except the one that was dropped before the commencement of the movement of said shaft, thereby rendering it impossible for said levers to drop so as to interfere with the signal being given from district 1. The next result of the movement of said shaft K is the action of the circuit-breaking wheels upon the spring-arms *j'* to raise them from contact with the springs *k'*, so as to break all the circuits not before broken and cause the signal being given in district to be repeated on all the other circuits. The continued movement of the shaft K causes the cam *l* to act upon the pin l^2 to raise the weight S' and move the shaft S about its axis, thereby moving the lower ends of the levers s^2 and the stop-bars s^3 toward the front of the machine till the forward ends of all of the stop-bars s^3 are advanced beyond the path of the pins s^5, so as to prevent the levers P' belonging to the other circuits dropping, even after the shoulders *s'* are removed from beneath the pins *s*, which is done by the action of the pins *t* in the cams *i* upon the upper ends of the levers R during the last part of the revolution of the shaft K. At the same time that the cam *l* is acting to raise the weight S' the cam *j* is acting, through the lever W and its pin *w'*, to depress the pin *w* in the lever U and raise the weighted end of said lever, thereby allowing the arm S^3 to drop and engage by its shoulder *u'* the pin *u* in the upper end of the lever S^2 to lock said shaft in the position to which it was moved by the raising of the weight S', so that neither of the levers P' can drop until the independent clock-power mechanism has completed its operation by its weight W' running down and the arm U' comes in contact with the pin *p'* and raises the latch-lever S^3. The latter part of the revolution of shaft K causes the cam *i* to act upon the pin p^5 to raise the long arm *p'* of the lever P' to the position shown in full lines in Figs. 2 and 3; but the very last part of said revolution causes metal contact to be completed between the springs *j'* and *k'*, and the armature is again attracted into contact with the poles of the magnet and the pin p^2 is transferred from the spring i^2 to the top of the spring *i'*, when the parts are in condition to repeat the operations. Whenever one of the levers P' drops it releases the L-shaped arm *y*, which drops of its own weight into the position indicated by dotted lines in Fig. 8, thus indicating the number of the district from which the signal comes.

I claim—

1. In a fire-alarm-telegraph repeater, the combination of a circuit-breaking wheel, an electro-magnet and its armature, a pivoted lever carrying said armature, a pivoted motor-controlling lever constructed and arranged to have its main or long arm supported in a horizontal or nearly horizontal position by said armature-lever and to be moved about its pivotal axis by the force of gravity when said armature is moved away from its magnet, a motor mechanism constructed and arranged to be operated by a weight, a locking mechanism for arresting the operation of said motor mechanism, constructed and arranged to be tripped by the falling of said motor-controlling lever, and a cam for raising said lever to its normal position, mounted upon and revolving with the circuit-breaker shaft.

2. In a fire-alarm-telegraph repeater, the combination of a plurality of circuit-breakers, an equal number of electro-magnets connected with as many independent circuits and each provided with an armature carried by a pivoted lever, a motor mechanism for operating the circuit-breakers, a lever mounted upon and revoluble with one of the shafts of said motor mechanism, a movable stop for intercepting said lever and locking the motor mechanism, a rocker-shaft carrying a radius-arm for supporting said movable stop in locking position, a plurality of arms secured upon said rocker-shaft corresponding in number to the number of magnets and armatures, a like number of pivoted motor-controlling levers supported in their normal positions by said armature-levers, (and each constructed and arranged to automatically move about its pivotal axis when the circuit to which it belongs is broken outside of the repeater and by such movement release the motor mechanism,) and a cam to act upon and raise each of said mo-

tor-controlling levers to their normal positions before the completion of a revolution of the circuit-breaker shaft.

3. The combination, with an electro-magnet, an armature carried by a pivoted lever, a circuit-breaking wheel, and a motor mechanism for operating said circuit-breaker, of a motor-locking mechanism comprising the levers M, N, and O and the pins *m*, *n*, and *o*, the rocker-shaft L, an arm Q, secured on shaft L, the three-armed lever P′, provided with pins or shoulders p^2, p^5, and *s*, the lever R, provided with a shoulder *s*′, the spring r^3, the cam *i*, and the pin *t*, all constructed, arranged, and adapted to operate substantially as described.

4. In a fire-alarm-telegraph repeater, the combination, with a plurality of electro-magnets and armatures connected in as many independent circuits, an equal number of circuit-breaking wheels on a common shaft, a motor mechanism for operating said circuit-breaking shaft, and a movable locking device for arresting and releasing said motor mechanism, of a plurality of pivoted motor-controlling levers constructed and arranged to be supported in their normal positions by the armature-levers and to drop from said normal position when the circuit is broken outside of the repeater unless arrested by the non-interfering devices, an equal number of movable stops constructed and arranged to prevent said motor-controlling levers falling when the circuit is broken by the circuit-breaking wheel, cams and springs for moving said stops, a rocker-shaft, a radius-arm and a two-armed lever secured to said shaft, a weight on one of said arms, a cam to raise said weighted arm and rock said shaft, an auxiliary motor mechanism provided with an escapement and a weighted lever, a cam for raising the weighted end of said lever, a latch-lever for locking said rocking shaft with its weighted lever-arm in raised position and to be tripped by the weighted lever of the auxiliary motor, and a plurality of stop-bars carried by said rocker-shaft and arranged in position to prevent the falling of the motor-controlling levers after the first-mentioned movable stops are withdrawn and until the latch-lever is raised by the running down of the auxiliary motor mechanism.

5. As a means of preventing interference between a plurality of fire-alarm circuits, the combination, with an intermittently-revoluble circuit-breaker shaft and a plurality of circuit-breaker wheels thereon, of a plurality of drop-levers P′, one for each circuit, for controlling the rotations of said circuit-breaker shaft, the rocker-shaft S, constructed and arranged to be moved about its axis by the revolutions of the circuit-breaker shaft, a plurality of movable stops, one for each circuit, carried by said rocker-shaft and movable thereby into positions to prevent the dropping of all the levers P′ except the one first released by the breaking of the circuit outside of the repeater, a locking-arm arranged to maintain said stops in such intercepting position, and a clock-motor mechanism constructed and arranged to release said locking device at the expiration of a certain interval of time after the completion of the last revolution of the circuit-breaker shaft.

In testimony whereof I have signed my name to this specification, in the presence of two subscribing witnesses, on this 27th day of April, A. D. 1891.

GEORGE M. STEVENS.

Witnesses:
N. C. LOMBARD,
WALTER E. LOMBARD.