3 Sheets—Sheet 1.

A. W. GRAY.

Fire-Alarm Telegraph-Repeater.

No. 221,229. **Patented Nov. 4, 1879.**

Fig. 1.

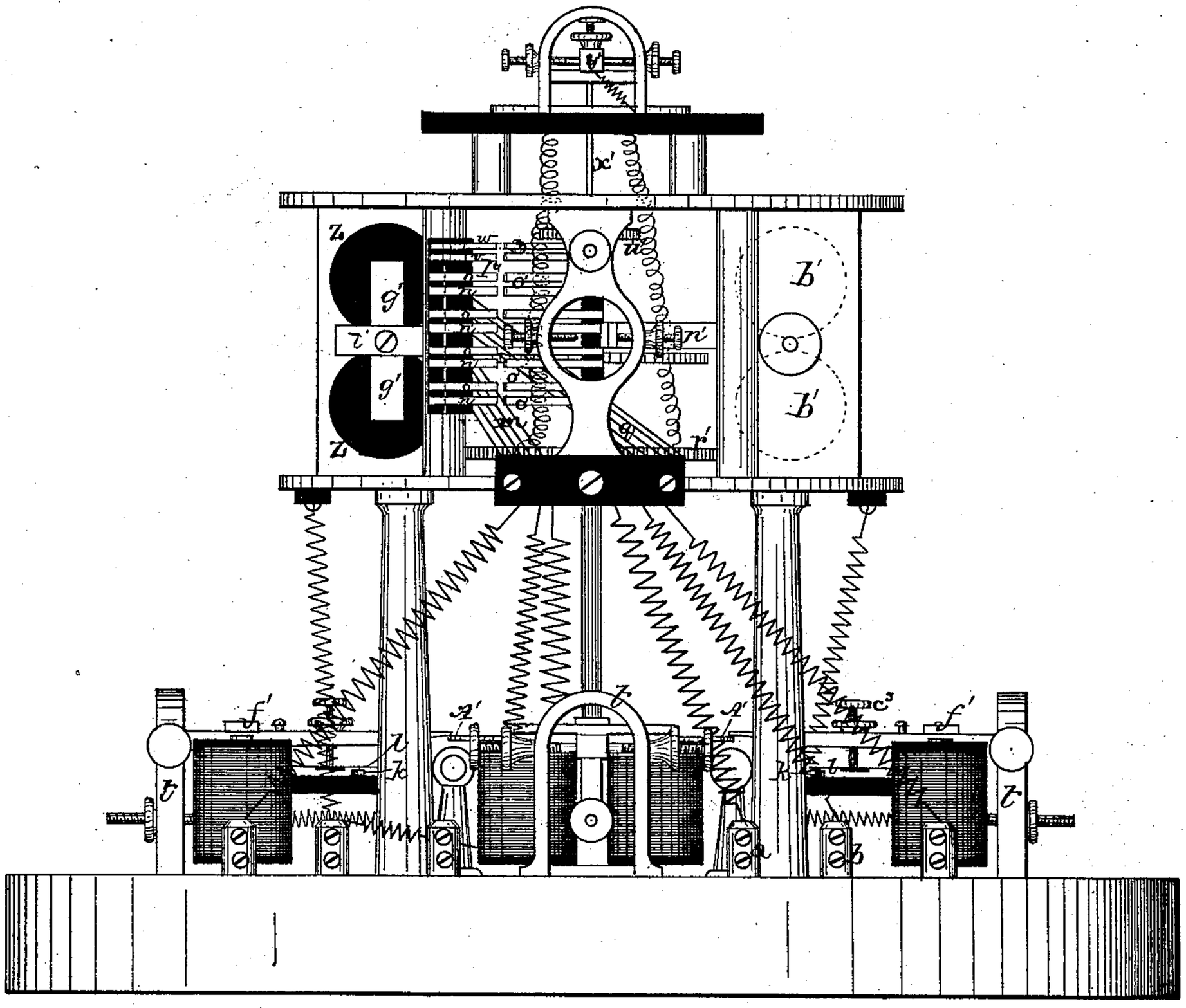
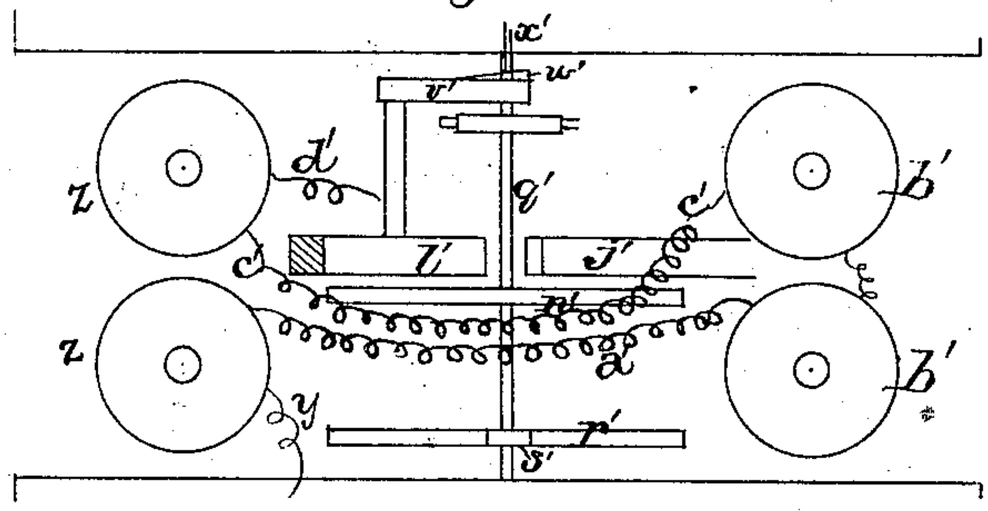


Fig. 3.



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3 Sheets—Sheet 2.

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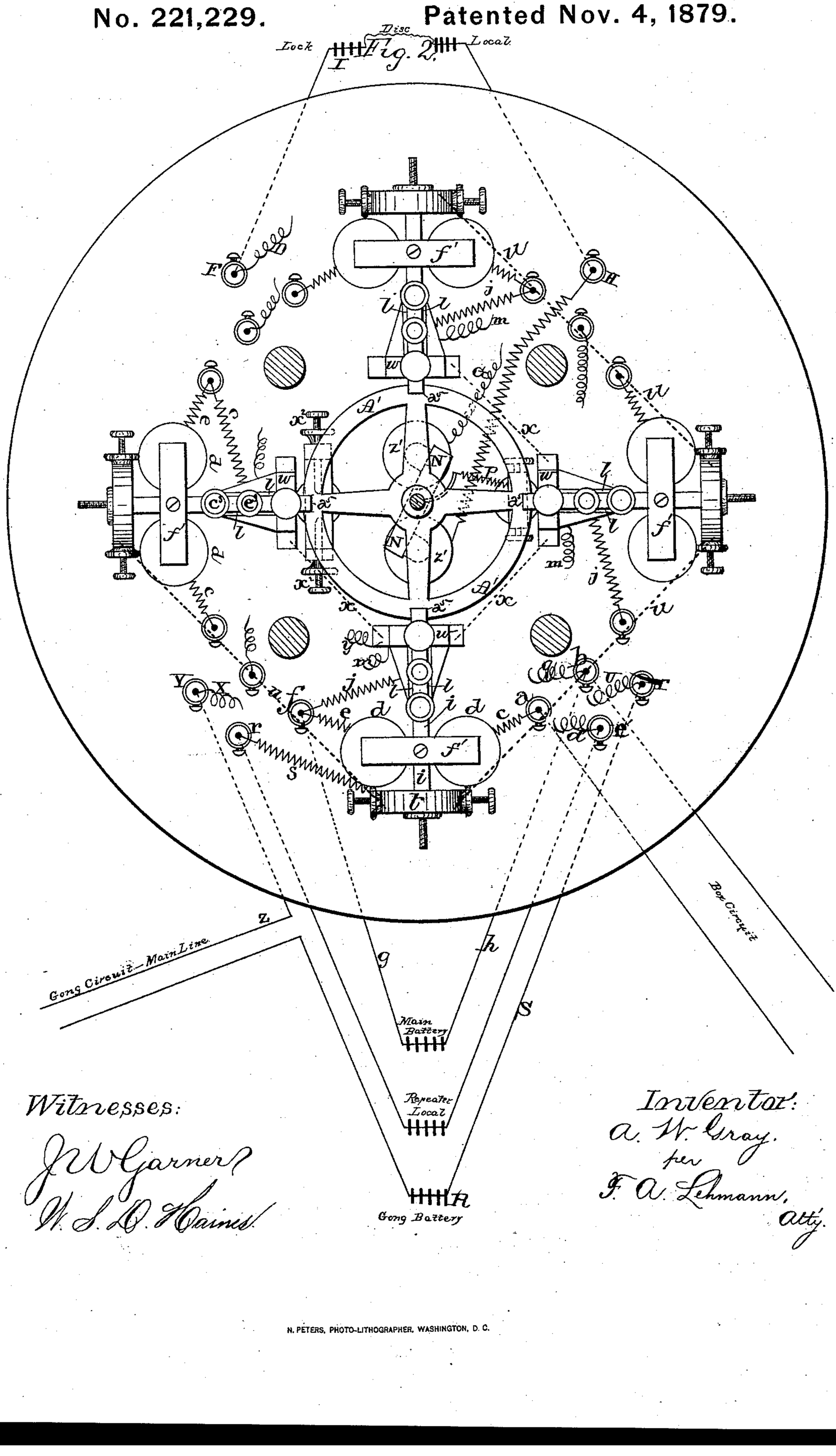
Fig. 2.



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3 Sheets—Sheet 3.

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Fig. 4.

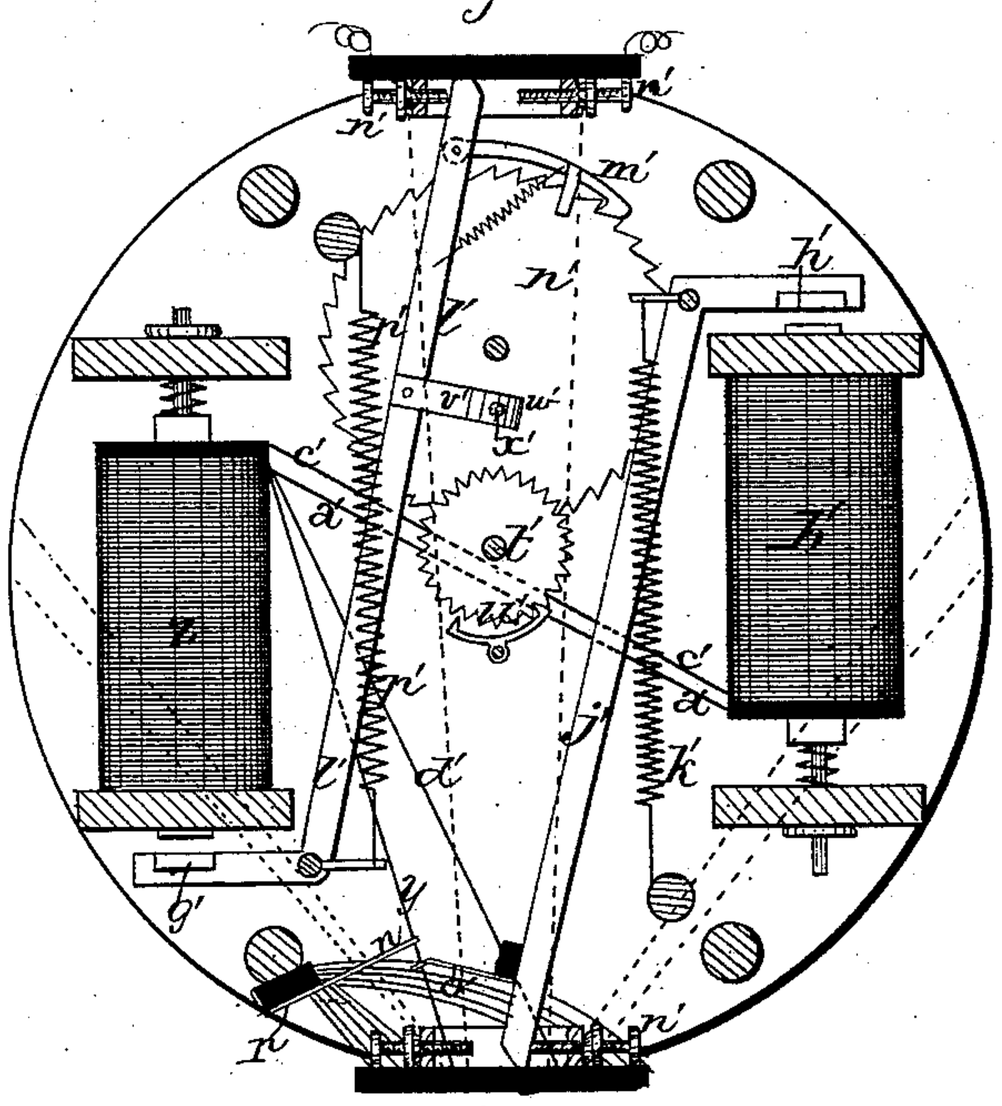


Fig. 5.

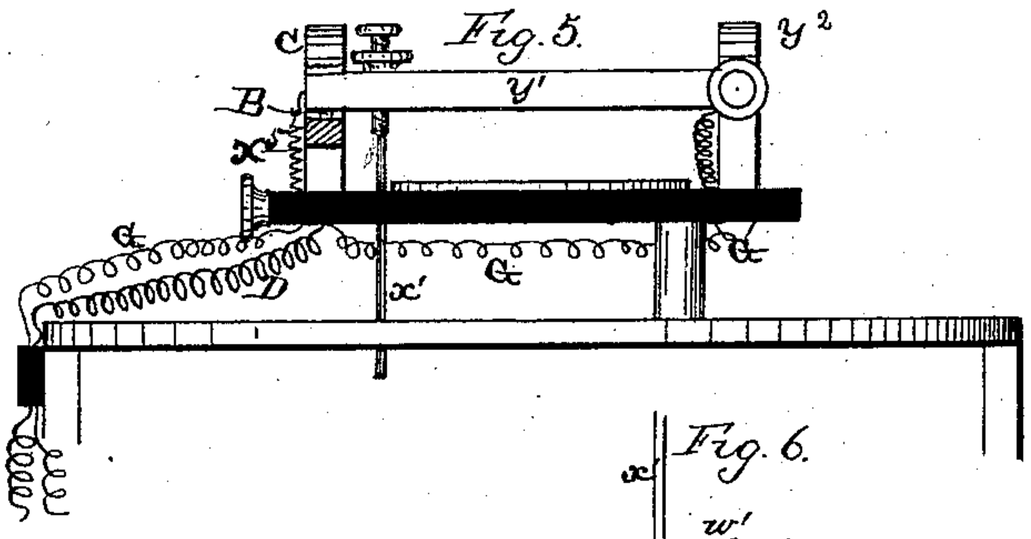
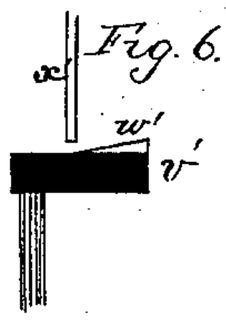


Fig. 6.



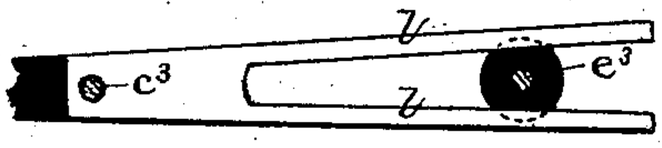
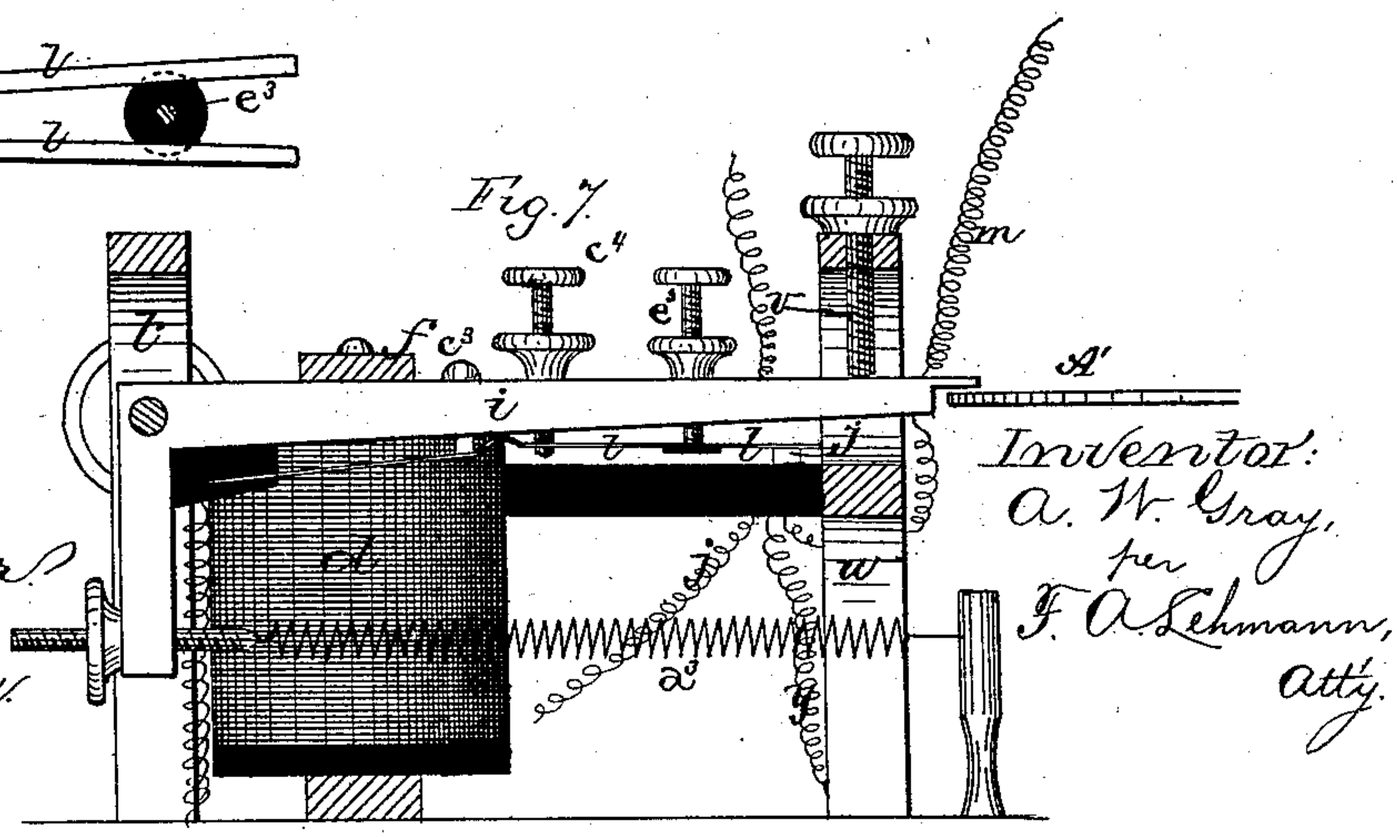


Fig. 7.



UNITED STATES PATENT OFFICE.

ADELBERT W. GRAY, OF CARDINGTON, OHIO.

IMPROVEMENT IN FIRE-ALARM-TELEGRAPH REPEATERS.

Specification forming part of Letters Patent No. **221,229,** dated November 4, 1879; application filed August 9, 1879.

To all whom it may concern:

Be it known that I, A. W. GRAY, of Cardington, in the county of Morrow and State of Ohio, have invented certain new and useful Improvements in Fire-Alarm-Telegraph Repeaters; 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 pertains to make and use it, reference being had to the accompanying drawings, which form part of this specification.

My invention relates to an improvement in fire-alarm-telegraph repeaters; and it consists in the arrangement and combination of parts, whereby the whole instrument is operated entirely by electricity, and all springs and mechanisms that have to be wound up are entirely dispensed with, the force of the battery lessened, and the care and attention usually bestowed upon such instruments also greatly decreased, all of which will be more fully described hereinafter.

Figure 1 is a side elevation of my invention complete. Fig. 2 is a horizontal section of the same, showing the locking-disk. Fig. 3 is a detail view. Fig. 4 is also a horizontal section, taken on a higher plane than Fig. 2, and shows the mechanism for operating the lever that operates the circuit-closing and the repeating levers. Fig. 5 is a side elevation of the circuit-closing lever for operating the locking-disk. Fig. 6 is a detail view, showing how the circuit-closing lever is raised. Fig. 7 is a detail view of one of the relays which is operated by the main line.

The two wires of the main line are fastened to the lower ends of the two binding-posts *a b*. From the upper end of the post *a* the wire *c* passes to one helix of the relay-magnet *d*, of which relays there is one for each circuit. The wire *e* passes out of the other helix of the magnet to the top of the binding-post *f*, and from the bottom of this binding-post the wire *g* passes to one division of the main battery, and from this battery a wire, *h*, passes to the bottom of the binding-post *b*, to which the other wire of the main line is attached. When a signal is given from any box in the circuit just described, it is relayed by the back-stroke lever *i* upon the circuit which operates the repeating-lever and the lever for operating the lever which operates the locking-disk.

From the top of the binding-post *f* passes a wire, *j*, to an insulated contact-point, K, and from this point the current passes through the shunt *l*, which is insulated from, but operated by, the lever *i*, and from the second contact-point K or wire *m* passes to one of the spring or contact straps, *n*, of the four shunts *p*. From the other strap, *o*, of the shunt a wire, *q*, passes back to the top of the binding-post *b*. The straps *n o* are insulated from each other in any suitable manner.

The shunt *l* is here shown as having an adjusting-screw, c^3, which is fixed in lever *i*, and has an insulated point to force the shunt downward, while a second screw, e^3, passes down in between the ends of the shunt, and has an insulating-plate secured to its lower end to catch under the two prongs, and thus cause them to lift upward with the lever.

By the use of the screw c^3 the lever *i* can be adjusted so that the locking-disk will move just over its top while the lever is down, and when the lever is up the disk moves under its end and allows the lever a short stroke.

From a local battery there runs a wire to the bottom of the binding-post *r*, and from the top of this post there runs a wire, *s*, to the arch *t*, in which the lever *i* is pivoted. When the lever *i* is released a spring, a^3, at once draws it back to place. All of the arches *t* of the relays are connected together by a wire, *u*, so as to make a metallic connection, and thus connect that pole of the battery that is connected to the post *r* with all of the arches *t* of the relays. The current passes through the arch *t* and lever *i*, through the contact-point *v*, into the arch *w*. All of the arches *w* are connected together by a wire, *x*, the same as the ones *t*.

From a single one of these arches *w*, and not from all, there passes a wire, *y*, which connects to one helix of the magnet *z*, and from this helix there passes a wire, *a'*, across to one helix of the magnet *b'*. Only one of the arches *w* is connected to these magnets; but as the arches are all connected by the wire *x*, this single connection serves the same purpose as if the arches were all connected directly to the magnets by separate wires.

The current passes through the second helix of the magnet b', and then through a wire, c', back to the second helix of the magnet z, and from this helix a wire, d', passes down to the top of the binding-post e'. From the bottom of the post e' a wire passes to the other pole of one of the local batteries. As the back-stroke lever i is vibrated by means of the armature f' and magnet d and spring a^3, the circuit is opened and closed at contact-point v, for the purpose of operating the repeating-lever and the mechanism for operating the locking-disk.

Each time the lever i is thrown upward by means of spring a^3 the circuit described as running through the two magnets $z\,b'$ is closed, and the two armatures g' h' are attracted to the ends of the magnets. The armature h' is secured to the short end of the lever j', and to the long end of the lever are secured the fingers o', which correspond to the straps n o, already described. These straps and fingers form shunts for short-circuiting the main battery in such a manner as to cut the force of the main battery off from the main line. Each time that the main battery is thus cut the bells or non-interfering arrangements in the boxes may be operated. As soon as the armature h' is released by the breaking of the circuit a spring, k', draws it back, so that the fingers o' are drawn away from the straps n o. At the same time that the lever j is operated the armature g' operates the long lever l', which has a hooked dog, m', pivoted to its free end for engaging with the ratchet-wheel n'. The free ends of these levers j' l' are made to move back and forth between the set-screws w', for the purpose of limiting the length of their strokes. The lever l' is also provided with a spring, p, for drawing it back to position again after having been moved forward by magnetic force.

On the lower part of the shaft q', on which the ratchet is secured, is a large gear-wheel, r', which meshes with a pinion, s', on the shaft t'. On the upper part of this shaft t' is an escapement, u', for the purpose of regulating the speed at which the lever l' shall move the ratchet after the armature has been released. This retarding mechanism prevents the spring p' from drawing the lever back too quickly between strokes. Upon the top of this lever l' is placed a small standard, on the top of which standard is an insulating-block, v', and on this block is a wedge, w', which raises the adjusting-screw x', that passes up through the lever y', for breaking the circuit that passes through the magnet z', that operates the lock-disk A'.

When a signal is given, and the lever l' is moved forward at its free end, the dog m' engages with the ratchet n', and as this ratchet allows the lever l' to move backward very slowly it has not time to return back to its place in between the strokes of its armature. Being thus retarded in its movements, the lever y' is not raised upward from the contact-point B on the arch C until after the alarm is completed. From this insulated arch C runs a wire, D, down to the top of the binding-post F, and thence to the local battery I, for operating the locking-disk A.

From the pivoted end of the lever y', that is fastened in the insulated arch y^2, runs another wire, G, down to the magnet z', that operates the lock-disk A, having a notch, a^5, in its outer edge for each circuit, and from this magnet out through the binding-post H to the battery I. As soon as the lever l' is moved from under the screw x', the lever y' is drawn downward by its spring x^5 upon the contact-point B, completing the circuit through magnet z', when the current from the battery I at once magnetizes the cores of the magnet z', so as to attract the armature N, which is placed at any suitable angle, as shown in Fig. 2. As this armature is secured to the locking-disk A, when it is attracted by the cores the armature at once draws the locking-disk A around, so as not to catch over the top of all of the levers i, except the one that is relaying the signal, which is locked above the lock-disk, but to hold them down out of contact with the points v, while all of the shunts l, excepting the one attached to the lever i that is relaying the signal, are forced down upon the contact-point K.

Each time the levers i are thus locked down and the shunts l closed downward on the contact-point K, the lever j' is operated so as to close the circuit by bringing the fingers o' against the straps n o, and thus the main battery on the circuit, except the one that is operating, is short-circuited from binding-post f to binding-post b, instead of passing out through the box-circuits.

As soon as a signal comes in on one of the relays the locking-disk instantly locks all of the other levers i down except the one that is giving the signal, and this one alone is left above the disk, so as to come in contact with the point v. As soon as the signal is finished and the lock-disk circuit is broken the spring P instantly draws the disk A back, so as to release all of the levers i, when the signaling-lever drops down, when a signal can come in through any of the box-circuits.

The stroke movement of the disk is controlled by set-screws x^2. By this construction and arrangement of parts the circuits are made absolute non-interfering at all times, and while the levers i are locked down the shunts l are held down upon the contact-points K.

From the gong-battery R there runs a wire, S, to the binding-post T, and from this post the wire U runs to the strap V, and from the other strap, W, a wire, X, runs down to the binding-post Y, to which one wire, Z, of the main line of gong-circuit is attached. The other wire of the gong-circuit returns to the battery.

The two magnets $z\,b'$ are provided with suitable adjustments for adjusting them in relation to the two armatures g' h' in case of variation in the force of the battery. This ad-

justment is also necessary so as to cause the lever l' to move more quickly than the lever j' at the first stroke of the signal, in order to lock the levers i, not giving the signal under the locking-disk before the fingers o' are brought in contact with the straps n o.

The magnet z is wound with silk-insulated wire, while the magnet b' is wound with cotton-insulated wire, for the reason that much more silk than cotton insulated wire can be wound in the same space, hence bringing many more convolutions of silk wire near the core of the magnet than can be done with cotton wire. The result is, that the core of the silk magnet z becomes fully charged in a shorter space of time than the magnet b', inasmuch as cotton-insulated wire is thicker than the silk wire, and hence not so great length of wire can be wound in the same space. The cotton-wound magnet is therefore not so strong and does not act as quickly as the silk-wound magnet, and hence the lever p' is moved more quickly than the one j', as is necessary in this case.

The magnet z attracting its lever more quickly than the one b', the lever l' moves forward on the first stroke of the alarm, so as to move the disk A and lock the lever i that relays the signal above the disk before the lever j' operates the shunts, and thus locks the levers i not giving the signal below the disk.

By my arrangement of the circuits the main-circuit lines are given ample time to discharge, and thus more accurately operate the non-interfering and gong arrangements in the boxes, and also gives the gong-circuit lines ample time to become fully charged, and thus more reliably operate the heavy electro-mechanical arrangements controlled by that circuit.

Still another advantage gained is in having the long lever l' drawn toward the magnet during the spaces between the strokes of the alarm, and drawn away only at the time that the main circuit is closed, as by so doing the lock-disk circuit is broken, thus allowing any relay to work within four or five seconds after the signal is completed, instead of keeping them disabled for twenty or twenty-five seconds after the signal is completed.

Having thus described my invention, I claim—

1. In a fire-alarm-telegraph repeater, the combination of a series of arches, t, metallically connected together, and a series of arches, w, connected together, and a relay-lever and a magnet for each of the arches t w, substantially as shown.

2. In a fire-alarm telegraph, a series of relays that are connected together so that when a signal is given upon any one of them the repeater local circuit is relayed through the magnets z b', substantially as described.

3. In a fire-alarm telegraph, a series of relays whose contacts are connected together in the same local circuit, in combination with a locking mechanism for locking all of the relay-levers out of contact with the exception of the one that is relaying the repeater local circuit through the magnets z b', substantially as set forth.

4. In a fire-alarm telegraph, the combination of the relay-lever i with an insulated shunt around the relay-magnet, which is connected to and operated by the relay-lever, as specified.

5. In a fire-alarm telegraph, the combination of a series of shunts that are connected to and operated by the relay-levers, insulated contact-points K, connecting-wires, and a series of shunts that are operated by a magnet, whereby all the main circuits are short-circuited, so as to cut out the box-circuits, except the one through which the signal is being given, substantially as shown.

6. The shunt l, in combination with the relay-lever, and the adjusting-screw e^3, provided with a plate for catching under the shunt, and a screw, c^3, substantially as described.

7. The combination of a series of relays that are electrically connected together with a locking device, A, having a notch in its edge for each relay-lever, and which device, whenever a signal is received, is given a movement by a magnet operated by a local circuit or circuits controlled by the relays, so as to lock all of the relay-levers down except the one relaying the circuit, substantially as set forth.

8. The combination of the two magnets z b', through which the repeater local circuit is relayed, with the two levers j' l', the lever l' being made to operate before lever j', so as to lock down the relay-levers before the main circuits are short-circuited, substantially as specified.

9. The combination, in the same circuit, of two magnets, the helix of one being wrapped with silk-insulated wire, and the other with cotton-insulated wire, whereby one magnet is made to operate its armature more quickly than the other, substantially as shown.

10. The combination of the magnet b' and lever j', having the spring-strap shunts o' secured to its free end, with the shunts p, substantially as described.

11. The combination of the magnet z, lever l', provided with a dog, m', and a retarding mechanism, whereby the lever is prevented from moving backward to break the circuit that passes through the magnet that operates the lock-disk between the strokes of the alarm, substantially as set forth.

12. The combination of the magnet z, lever l', and a retarding mechanism, the lever being provided with means for raising the lever y' as it moves back into position after having been moved forward by the magnet z, whereby the circuit which passes through the magnet that operates the lock-disk is broken and the relay-levers released, substantially as specified.

13. A fire-alarm-telegraph repeater consisting of a series of relays that are connected together, shunts that are operated by the relay-levers, shunts for short-circuiting the main

battery, and a lever for operating the lever that opens and closes the circuit for operating the locking mechanism, the whole being automatically operated by electricity, substantially as shown.

14. In a fire-alarm-telegraph repeater, the combination of a main-battery circuit for each relay, a repeater local circuit, a gong-circuit, and a circuit for operating the locking mechanism, substantially as described.

In testimony that I claim the foregoing I have hereunto set my hand this 9th day of August, 1879.

A. W. GRAY.

Witnesses:
F. A. LEHMANN,
W. S. D. HAINES.