(No Model.)

G. M. HOPKINS.

Telegraph Relay.

No. 237,185. Patented Feb. 1, 1881.

fig. 1

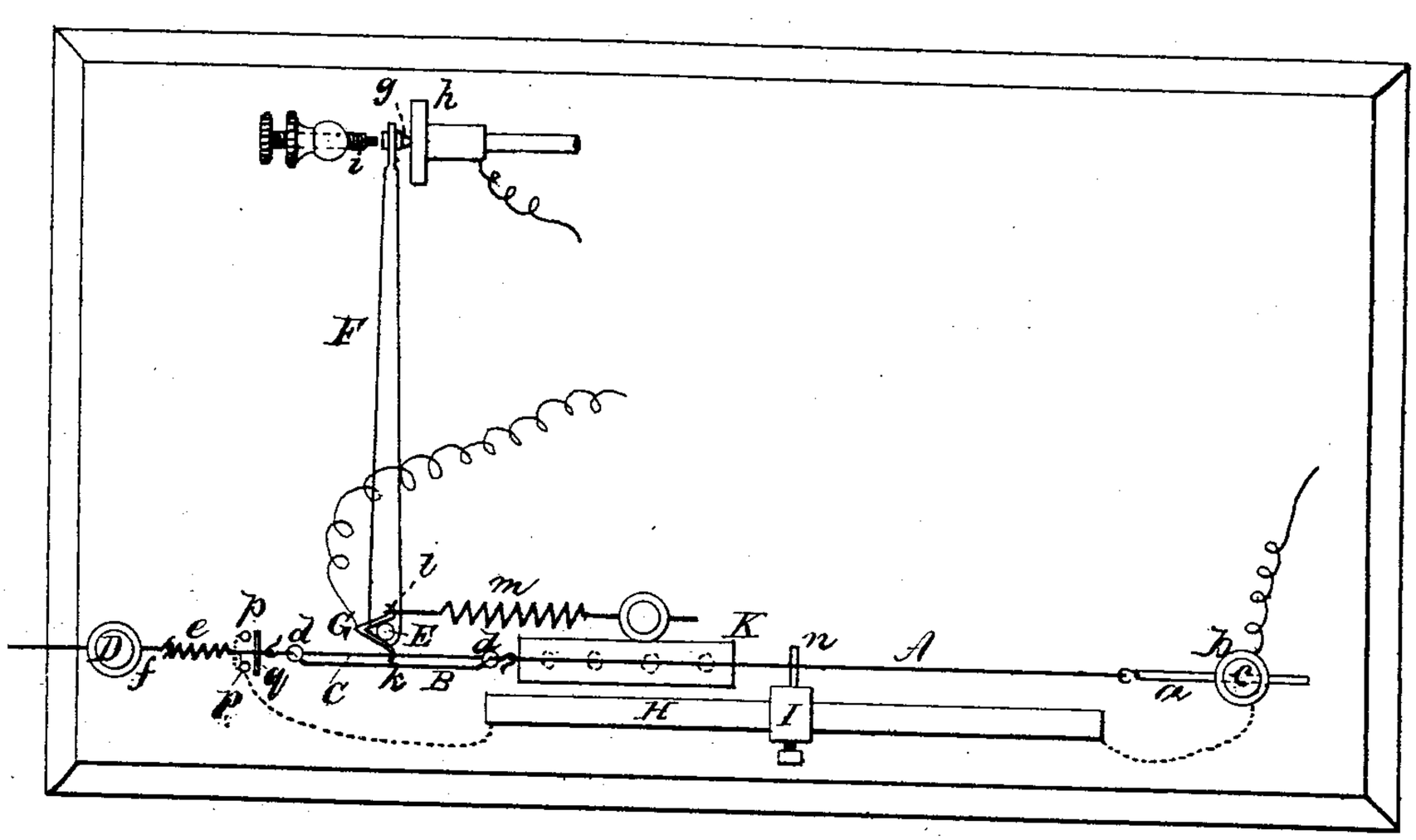


Fig. 2

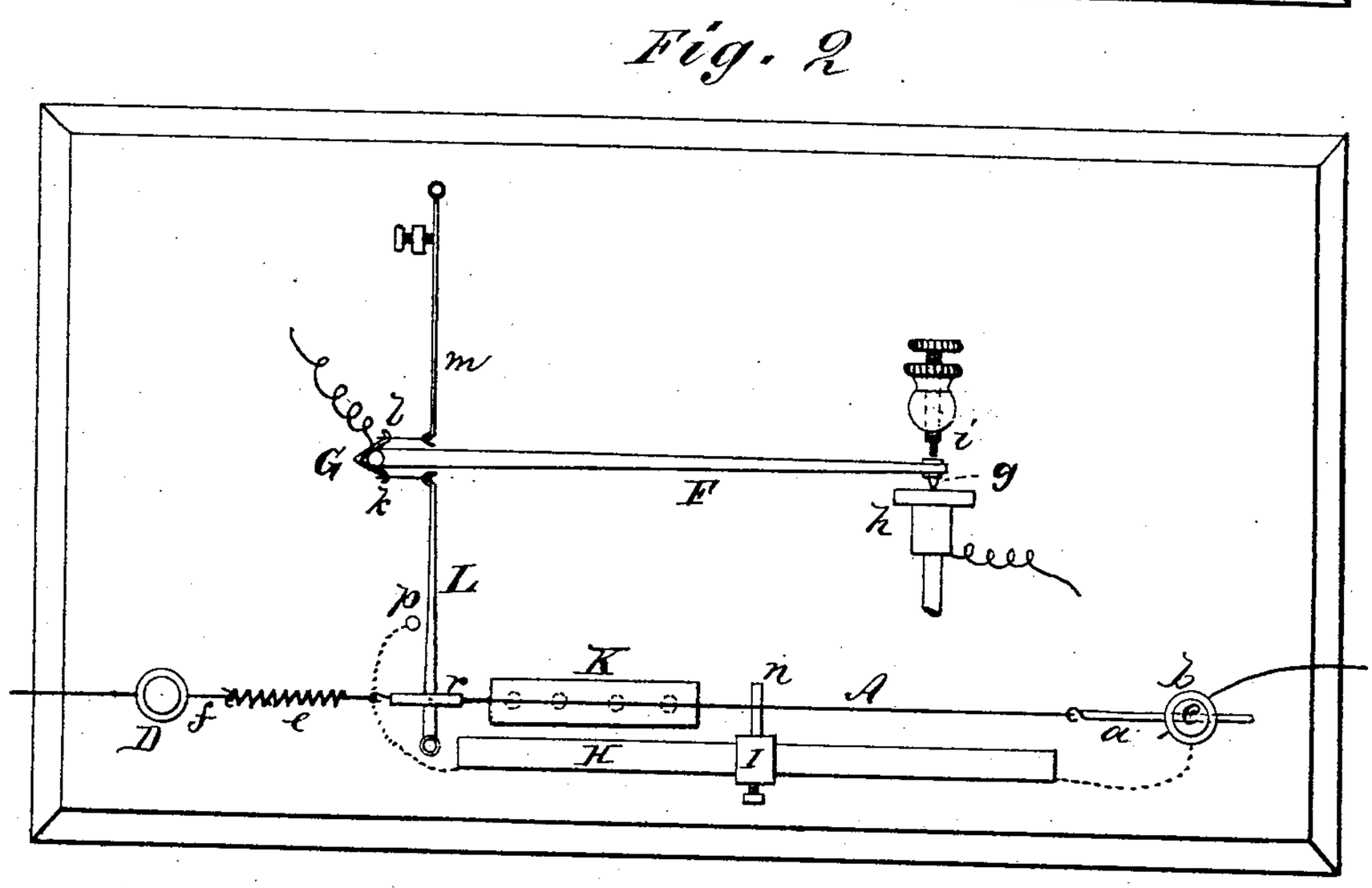


Fig. 3

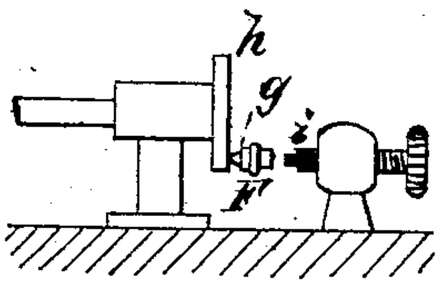
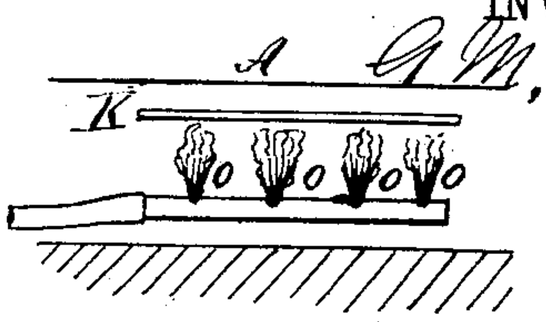


Fig. 4



WITNESSES:

C. Naeux

E. L. Topliff

INVENTOR:

A. G. M. Hopkins

UNITED STATES PATENT OFFICE.

GEORGE M. HOPKINS, OF BROOKLYN, NEW YORK.

TELEGRAPH-RELAY.

SPECIFICATION forming part of Letters Patent No. 237,185, dated February 1, 1881.

Application filed July 10, 1880. (No model.)

To all whom it may concern:

Be it known that I, GEORGE M. HOPKINS, of Brooklyn, in the county of Kings and State of New York, have invented a new and useful Improvement in Telegraph-Relays; and I do hereby declare that the following is a full, clear, and exact description of the same, reference being had to the annexed drawings, forming a part of this specification, in which—

Figures 1 and 2 represent different forms of my invention. Fig. 3 is a detail view of the movable contact-surface, and Fig. 4 is a detail view of the auxiliary heating apparatus.

My present invention is an improvement on a telegraph-relay on which Letters Patent No. 229,414 were granted to me June 29, 1880.

The improvement consists, first, in novel mechanism for utilizing the variable expansion of an electrical conductor, forming a portion of the main telegraph-line; second, in a device for augmenting the expansion of the electrical conductor by the application of external heat; third, in a movable contact-surface operated by suitable power for preventing the sticking or welding of the local-circuit contact-surfaces; and, fourth, in a sliding contact for putting more or less of the expansible conductor under the influence of the current.

The expansion-wire A is attached at one end to an adjustable hook, *a*, supported in the binding-post *b*, and held in any desired position by a set-screw, *c*. The other end of the expansion-wire A is received by one end of a double connecting-hook, B, attached by insulators *d* to an apertured plate, C. The other end of the double hook is connected, by a short spiral spring, *e*, with an adjustable hook, *f*, in the binding-post D.

An arbor, E, supported by delicate pivots, carries an arm, F, which is preferably made of aluminum, that metal being very light, and at the same time a good conductor of electricity. The free end of the arm F is provided with a platinum point, *g*, which is capable of touching a rotative platinum-faced disk, *h*, above or below the center of the disk. This relative arrangement of parts secures a line of thrust at right angles with the axial line of the arbor E, and prevents bending the lever F when the platinum point *g* is pressed against the platinum-faced disk *h*. The object of employing a movable contact-surface, which, in the present case, is the rotative disk *h*, is to avoid the sticking or welding of the contact-surfaces together by the discharge of the extra current from the local-sounder magnet by constant movement of one of the surfaces at right angles to the plane of motion of the other contact-surface.

Fig. 3 is a side elevation, showing the relative positions of the centers of the contact-surfaces *g h*, and also of the insulated screw *i*, which arrests the retrograde movement of the lever F.

The disk *h* may be revolved by a small electric motor, by clock-work, or in any other convenient and desirable way. The power will be applied to its shaft. A slow speed will suffice.

On the arbor E is placed a V-shaped metallic friction-piece, G, having on its extremities hooks *k l*. The hook *k* enters an aperture in the plate C, and the hook *l* receives an adjustable spring, *m*, by which the friction-piece G is brought into light contact with the arbor E.

A metallic bar, H, arranged parallel to the expansion-wire A, supports a slide, I, carrying a platinum finger, *n*, over which the wire A is stretched. The bar H is electrically connected with the post *b*, so that when the expansion-wire A is thrown into the main line, by connecting the posts *b* D with the main-line wires, the greater portion of the current will pass from the post *b*, through the bar H, slide I, and finger *n*, before passing over the working portion of the wire A, so that by moving the slide I more or less of the expansion-wire A may be thrown into the circuit, thus adapting the length of the expansion-wire to the strength of the current passing over the line. When very feeble currents are employed to work the relay the sensitiveness of the expansion-wire is increased by using artificial heat. The manner in which this is done is clearly shown in Fig. 4.

A plate, K, of copper or other suitable metal, is supported a short distance below the expansion-wire, and below the plate are placed two or three very small gas-jets, *o*, which heat the plate K, and the latter supplies the initial

heat to the wire A, increases the electrical resistance of the wire A, and renders it more sensitive to slight currents.

When an electrical impulse is sent through a telegraph-line of which the expansion-wire A forms a part, the wire is expanded more or less, according to the strength of the current, and the pressure on the hook *k* of the friction-piece G being relieved, the latter is drawn around by the spring *m*. The friction between the piece G and the arbor E is sufficient to cause the arbor to turn with the friction-piece carrying the lever F until the contact-point *g* strikes the disk *h*. If the wire A continues to expand after the contact of the point *g* with the disk *h*, the friction-piece G moves forward on the arbor E without producing any effect. When the main-line circuit is opened the wire A immediately contracts, and, by pulling the hook *l*, first turns the arbor E, moving the lever F, until the contact between the point *g* and disk *h* is broken and the back of the lever F touches the screw *i*. Should the wire contract still further the only effect produced is to move the friction-piece G around on the arbor E.

The wires of the local circuit are connected with the bearings of the disk *h* and pivots of the arbor E, so that the local-battery current passes through the arbor E, lever F, platinum point *g*, disk *h* and its bearings, and the sounder.

The wire used in the relay should be of platinum of about $\frac{3}{1000}$ to $\frac{4}{1000}$ of an inch in diameter. As wire as fine as this is liable to accidental breakage, I have added to the instrument already described a device for completing the main-line circuit automatically in case of the breakage of the expansion-wire A. This device consists of two platinum pins, *p p*, placed on opposite sides of the hook B and connected electrically with the bar H. A cross-piece, *q*, also of platinum, is secured to the hook B a short distance from the pins *p p*, so that should the expansion-wire A break, the spring *e* will carry the bar *q* against the pins *p p* and complete the main-line circuit.

Fig. 2 shows a method of compounding levers so as to increase the motion of the lever F. In this figure parts that are found in Fig. 1 will be indicated by the same letters of reference. In this case an auxiliary lever, L, is pivoted in the same frame with the lever F, and is connected at its free end with the friction-piece G by a link. The expansion-wire A is connected with the lever L by a link, *r*, and is kept under tension by the spring *e* on the opposite side of the lever. Every motion of the expansion-wire is multiplied by the lever L, and again by the lever F. The platinum pin *p*, which is connected electrically with the bar H, is touched by the lever L, completing the main-line circuit, in case of the breakage or disconnection of the expansion-wire.

Having thus described my invention, I claim—

1. In a telegraph-relay, the combination of the expansion-wire A, friction-piece G, spring *m*, and arbor E, as shown and described.

2. The method of augmenting the expansion of an electrical conducting-wire by the application of external heat, as herein specified.

3. In a telegraph-relay, the combination of a heater with an expansion-wire, as specified.

4. In a telegraph-relay, a rotative contact-surface, in combination with a vibratory contact-surface, substantially as specified.

5. In a telegraph-relay, a movable electrical conductor, in combination with the expansion-wire, for putting more or less of the expansion-wire into circuit, as specified.

6. In a telegraph-relay, the contact-pins *p*, electrically connected with the main line, and the movable contact-bar *q*, connected with the main line, in combination with the expansion-wire A and spring *e*, as herein specified.

GEO. M. HOPKINS.

Witnesses:
C. SEDGWICK,
C. L. TOPLIFF.