(No Model.) 3 Sheets—Sheet 1.

F. W. HALE.

PIANO FORTE.

No. 474,827. Patented May 17, 1892.

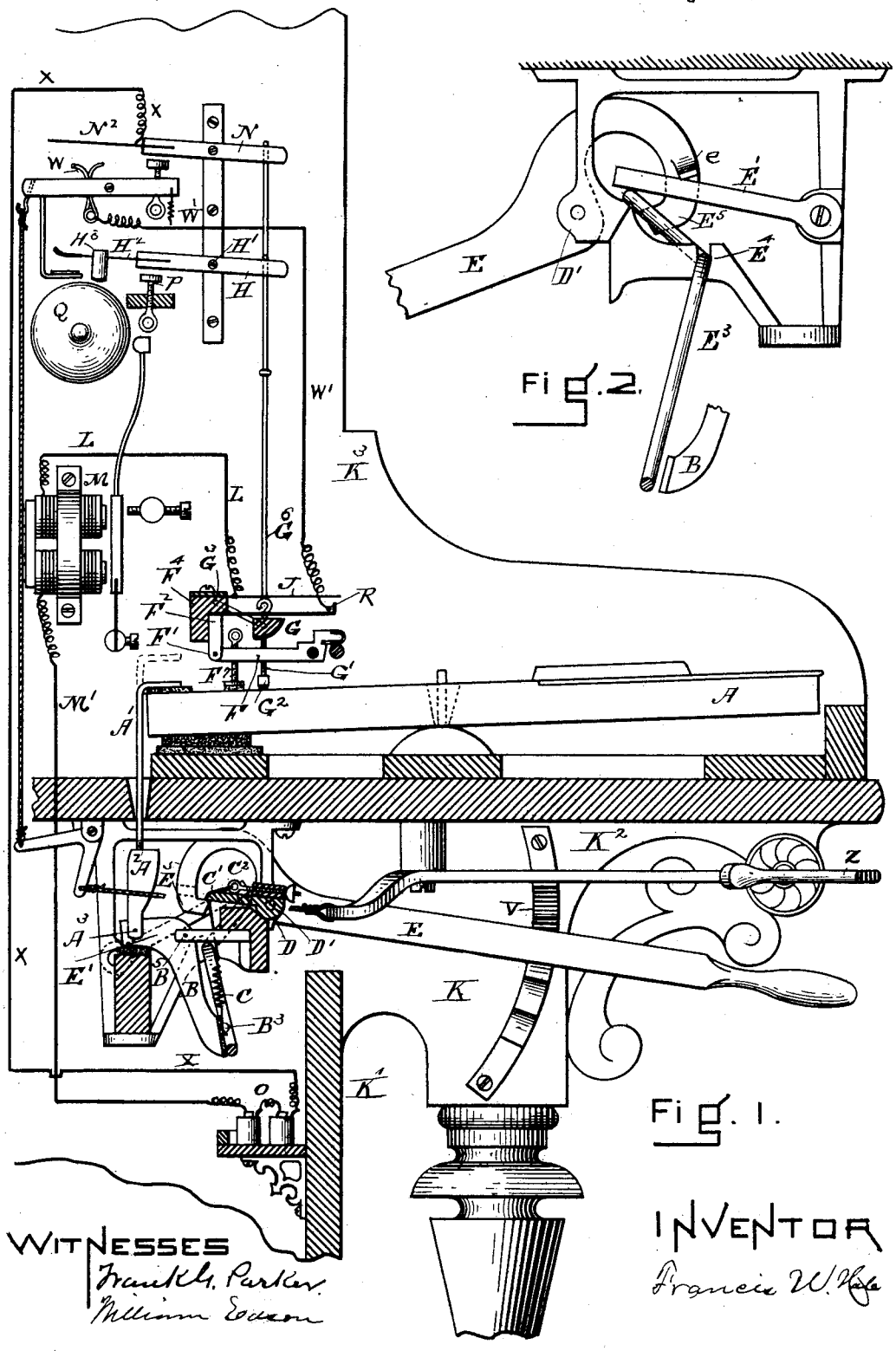

Fig. 1.

Fig. 2.

WITNESSES

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(No Model.) 3 Sheets—Sheet 2.

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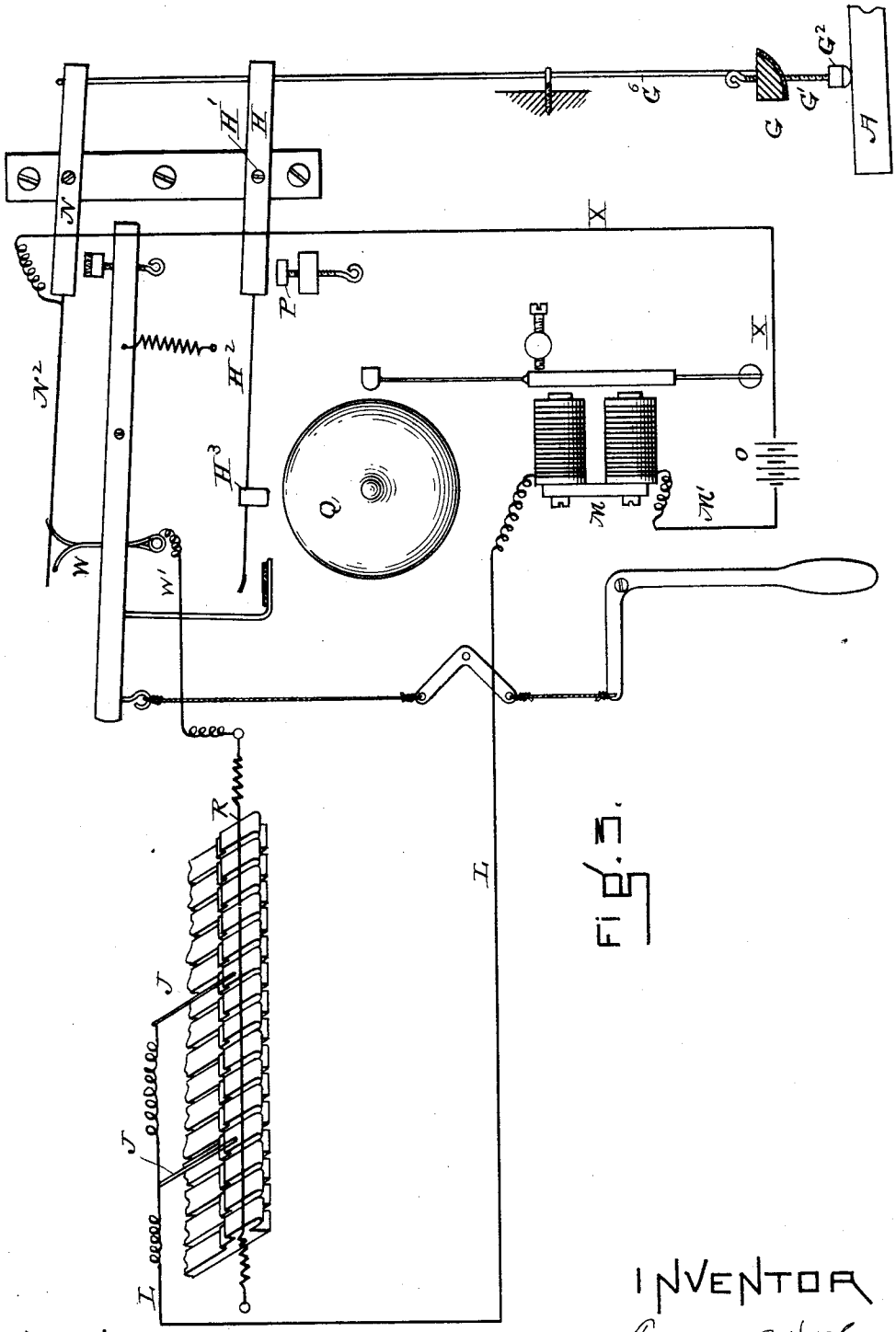

FIG. 1.

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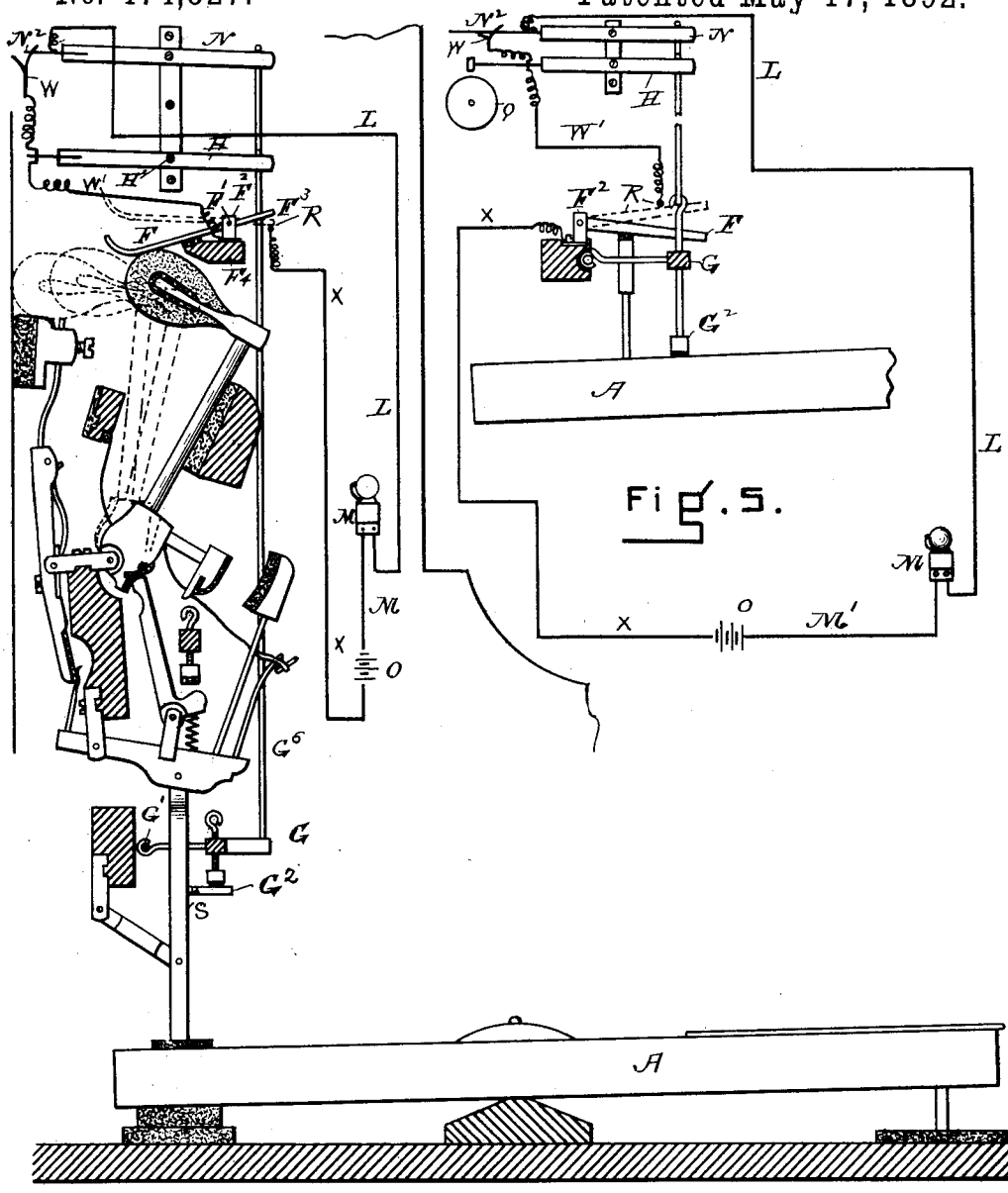

Fig. 5.

Fig. 4.

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UNITED STATES PATENT OFFICE.

FRANCIS W. HALE, OF BOSTON, MASSACHUSETTS.

PIANO-FORTE.

SPECIFICATION forming part of Letters Patent No. 474,827, dated May 17, 1892.

Application filed May 21, 1891. Serial No. 393,590. (No model.)

To all whom it may concern:

Be it known that I, FRANCIS W. HALE, of Boston, in the county of Suffolk and State of Massachusetts, have invented a new and useful Improvement in Piano-Fortes, of which the following, taken in connection with the accompanying drawings, is a specification.

My invention relates to devices to be attached to piano or organ keys, by means of which the "action" of the instrument may be made "easy," "medium," or "hard"—that is, the spring-resistance devices by which the keys are held up against the pressure of the fingers of the user are so made and connected to an adjustable mechanism that by a simple movement of a handle the amount of resistance to the downward movement of the keys may be varied at will, and also in connection with the same a device by means of which a signal is given in case there is an error made in the time or manner of depressing or lifting the keys.

My invention is illustrated in the following drawings, in which—

Figure 1 is a view in vertical cross-section showing my improvements and also the parts of a piano to which they are attached or relate. Fig. 2 is an enlarged view in elevation of details. Fig. 3 is a diagrammatical illustration of some of the working parts of my apparatus. Figs. 4 and 5 are illustrations of a modification of my apparatus.

In the illustrations only such parts of a piano are shown as are required to illustrate the use of my invention, and, in fact, my device may be made wholly detachable from a piano, the only requirement being that it shall be so placed that the keys of a piano or other instrument to which it is applied shall have a connection with the hangers B and rail G, so that they may move in response to the movement of the keys of the piano, &c.

The frame to which I attach the several parts of my invention is represented by K K′ K^2 K^3.

The rear ends of the keys A, Fig. 1, are connected with the hangers B by an adjustable hooked rod A′ and block A^2. The upper end of the rod is bent at a right angle so as to rest upon the key A. The lower end of this rod is threaded and screwed into the block A^2, which block is pivoted at A^3 to the adjusting hanger B. There are as many hangers as keys to the instrument, and each hanger B is held under tension by a spring C, the end of which is connected by a cord C′ to a screw-eye C^2, and as the cords C′ pass over the hinged adjusting-plate D it will be understood that if said hinged plate D is turned upward on its pivot D′ (see Fig. 1) its rising edge will draw up the cords C′ and thus bring a tension onto the springs C and through them upon the hanging levers B. This tension, acting through block A^2 and rod A′, causes a pressure to be brought upon the key A of the instrument. Thus the pressure on the keys is regulated by the position of the adjusting-plate D—that is, when the plate is lying flat, as shown in full lines in Fig. 2, then but slight tension is brought to bear on the keys, but if the plate is turned upward then an increased tension is brought onto the springs and consequently upon the keys of the instrument. It will be observed that I pivot the hanging levers B, Fig. 1, and attach the spring C, so that the distance from the spring's point of attachment B^3 to the hanger's pivot B^5 is several times the distance from the pivot B^5 to the pivot A^3 of block A^2. By thus shortening the leverage of hanger B, I am able to make use of comparatively light springs and also give the key A a perfect piano-forte "touch."

By the above-described device I am enabled to have the action of the piano easy, medium, or hard.

My device for operating the tension-plate D is as follows: E, Figs. 1 and 2, is a lever pivoted at D′. The extreme rear end of this lever E is in the form of a hook, which engages the tension-plate D and forces it to rise when the front end of lever E is depressed. This movement of plate D, acting through the cords C′, increases the tension of the springs C, which, acting through hanger B and rod A′, adds resistance to movement of the keys.

When it is desired to separate the resistance action above described from the keys, I have the following-described device: If the rear end E^5 of the lever E is depressed, the projection *e* (see Fig. 2) will come in contact with the arm E′ and depress it, which, acting through the bent lever E^3, pivoted at E^4, will force the lower end of the hangers back, thus

raising the hooked rod A′ out of reach of key A, as shown by dotted lines in Fig. 1. The lever E may be locked in any position by a ratchet. (Shown at V, Fig. 1.)

The purposes for which I use the signal parts of my device are as follows: first, to indicate by means of a bell, sounder, or dial whether the successive movements of the keys of the instrument are made in a manner technically known among musicians as "legato," and, secondly, to further indicate by means of a sounder or dial whenever the performer, in his zeal to produce a perfect legato, carries the principles to excess and produces what may be called "overlapping"—that is, he does not permit one key to rise until after the following one is too far down.

This first or perfect legato-signal is accomplished in the following manner: G, Fig. 1, is a movable rail, which extends the whole length of keyboard and is hung (pivoted) at G^3. G′ is a screw-eye, which extends through rail G and to which is secured the button G^2. There are as many screw-eyes and buttons as keys. (One for each key.) The normal position of the rail G is such that each button G^2 rests upon its respective key. I may, however, attach button G′ to the key instead of to rail G, (one button for each key,) in which case the rail G will lie upon all the buttons when the keys are at rest. G^6, Fig. 1, is a cord, link, or lever, which connects rail G with lever H, which lever is pivoted at H′ and into which is screwed the hammer-stem H^2. P is a regulating-button, which controls the descent of bell-hammer H^3. The lever H is heaviest on the end of the bell-hammer, so that if raised and released will fall with sufficient force to sound the bell. The rail G, Fig. 1, is of sufficient weight to easily control (pull down) levers H and N, to which it is attached by link G^6.

The purpose of the above mechanism I will now explain. The first key A, for example, Fig. 1, which is struck by performer, acting through its fulcrum and screw-button G^2, raises rail G and slackens cord or link G^6, which allows hammer-lever to descend until it reaches the regulating-button P. This movement sounds bell Q. The proportions and relations may be so regulated that lever H will reach regulating-button P at any point in the key's descent, though I prefer the two-thirds-of-the-way-down position. It is very evident that, as above explained, the first key struck sounds bell Q; but if it be held down until another is struck there will be no second stroke of bell Q, since the rail G is held up by first key and the lever H is at rest on button P, Fig. 1; but if the first key is raised more than one-half its ascent before the second key reaches that point the rail G will fall sufficiently, acting through cord G^6 and lever H to raise bell-hammer. If now the second key continues its motion, it will come in contact with rail G, cause it to return and sound bell, as above explained. It will now be seen that if a perfect legato is being performed—*i. e.*, the second key reaching the two-thirds position before the first returns to that point, no bell will be heard after the first stroke; but if the legato is broken a bell will be heard for every break. By changing position of bell—*i. e.*, placing it above hammer—I may sound it by return stroke of hammer, in which case the bell will be first heard when a break in the legato has occurred, and for every break afterward.

The technical error known as "overlapping"—*i. e.*, the first key held too long—is indicated by means of the following mechanism, Fig. 1: F is a swing, hung (pivoted) at F′ to flange F^2, which flange is fastened to rail F^4. Rail F^4 is held in position by standards. (Not shown.) Passing through swing F is a regulating screw and button F^7. The normal position of swing F is shown by full lines—viz., with its regulating-button resting on key A. There is one swing for each key of the instrument. A slow movement of the key will raise the front of the swing until it reaches the flexible wire R, as shown by dotted lines, Fig. 5. This wire R extends from end to end of keyboard and is attached at both ends to spiral springs, which hold it at a proper tension. Above the wire R, Figs. 1 and 3, at frequent intervals, are placed contact-springs J, the normal position of which is about one-eighth of an inch above the wire R. While a slow motion of the key A will cause swing F to rise only to wire R, a stroke sufficient to make a sound on a piano-forte will give sufficient impetus to swing F to cause it to ascend after key stops and force wire R into contact with contact-springs J, the swing instantly recoiling and returning to key. While the above movements are being performed, the key A also raises the rail G, (as before explained,) and which, acting through cord G^6, Fig. 1, allows the lever N to move until its metal stem N^2 reaches the contact-spring W. The parts are so adjusted that the metal stem N^2 does not reach the contact-spring W until the key is at or very near the bottom of its descent. The contact of stem N^2 with spring W closes the following circuit: Battery O, Fig. 1, line X X, coil *x*, stem N^2, contact-spring W, line W′, and wire R. The circuit will be broken here until swing F forces wire R into contact with contact-springs J. Assuming this is done, the remaining part of circuit is wire R, Figs. 1 and 3, contact-springs J, line L, magnet M, line M′, and battery O.

From the above it will be seen that there are two breaks or switch-points in the circuit, one at contact-spring W and the other between wire R and contact-spring J. A stroke upon key A will close both switch-points, since its motion causes swing F to force wire R until it reaches J, and it also raises rail G until lever N allows stem N^2 to reach contact-spring W. The movements, however, of the swing F and the stem N^2 are not alike as to speed, the

movement of swing F being far more rapid than that of stem N^2. The rapidity of movement of lever N is controlled by adding or reducing friction at pivot H'. I regulate the relative speed of each so that swing F has reached and recoiled from its extreme point of rise (which carries wire R up to J) before the metal stem N^2 has closed the circuit at contact-spring W. It follows, therefore, that the stroke of a single key cannot close circuit so as to sound bell. If, however, the first key be held down until the second or any number afterward are struck, the switch-point at W being closed by first key, each of its successors will carry the wire R into contact with J, close the bell-circuit, and sound the bell; but if the first key be raised sufficiently to break the circuit at W the second key will not be able to sound the bell, for reasons already explained. I may regulate the movement of the different parts so that the circuit will be broken at W if the first key returns any fraction of an inch before the second reaches that point in its descent. By combining both signals and resistance mechanism, as above explained, I am able to audibly indicate with the greatest accuracy every mechanical error in technical practice at any desired resistance of the key. It is, however, often desirable to indicate technical errors to the eye as well as to the ear, and to this end I place the lever N and contact W in such a position on the outer surface of the instrument-case that the eye may follow the movement of the lever N when the keys are depressed.

As has already been explained, the first key struck will raise rail G and allow lever N to fall until stem N^2 reaches the contact W, and, further, if another key is struck before the first is raised the stem N^2 will remain resting upon W, while if the first is raised before the second is full down the rail G will drop and, acting through link G^6, will raise stem N^2 from contact W. By watching the movement, therefore, of stem N^2 it is possible to observe the minutest error in the key's movement, and, further, since the contact of stem N^2 with W will produce a click if the surface of W be hard by noticing the presence or absence of these clicks the movement of key may also be positively determined. By means of a soft stop (not shown,) I may prevent or allow the click at will. By means of a switch I may use the above independently of the electric lines or in combination with them at will. By means of hand-lever *z*, not necessary to explain, I throw the whole action out of reach of keys, and also throw on or off either the staccato or overlapping lines.

A modification of Fig. 1 is shown at Fig. 5, where I dispense with the contact-spring of Fig. 1, and which is desirable where extreme sensitiveness is required by the performer. This is accomplished by making the swing F of metal and pivoting it in a metal fulcrum F^2, which is electrically connected with opposite pole of battery to that of wire R. The movement of the lever F and rail G in Fig. 5 are identical with Fig. 1. The circuit through swing F is as follows, Fig. 5: battery O, line X X, fulcrum F^2, swing F, wire R, line W', contact-spring W, stem N^2, line L, magnet M, line M', and battery O.

Fig. 4 shows a further modification. In pianos where the construction does not allow sufficient room to place the mechanism upon the key, as shown in Figs. 1 and 5, I may place the swinging rail G, by which it is pivoted at G', so as to rest upon supports G^2, fastened to the lifters S (strickers) of the piano-action, as shown at Fig. 4. The movement and purpose of the rail G in this position is identical to that of Fig. 1. I also place the swings in such a position that they receive their movement by a blow of the piano-hammer, as shown at F, Fig. 5. I prefer to use for this latter case the swing F of metal, pivoted to a metal fulcrum F^2, and dispense with contact-spings, as explained in the previous modification. The forward movement of hammer forces swings to assume the position shown by dotted line, which brings it into contact at F^3 with wire R and close electric circuit. I raise strikers out of working action by mechanism not shown.

The electric circuit of above modification is as follows: battery O, line X X, wire R, swing F, fulcrum F^2, line W', contact-spring W, stem N^2, line L, magnet M, line M', and battery O.

I claim—

1. In a piano-forte, the combination of the key A and the hooked rod A' A^2, with the hanger B, having a spring C, adapted to hold said hanger under tension, substantlally as and for the purpose set forth.

2. In a piano, the combination of the key A, the hooked rod A' A^2, hanger B, and spring C, adjustably connected to the tension-plate D, with the tension-plate D, substantially as and for the purpose set forth.

3. In a piano-forte, the combination of the hand-lever E with the tension-plate D and the ratchet V, substantially as and for the purpose set forth.

4. In a piano-forte, the combination of the lever E, having a projection *e*, adapted to act through intermediate mechanism upon the hanger B, with the hanger B, substantially as and for the purpose set forth.

5. The combination of the key A and the continuous rail G, whereby said rail is adapted to operate the levers N and H, with said levers N and H, substantially as and for the purpose set forth.

6. The combination of the key A, screw-button G', continuous rail G, link G^6, contact-lever N, and bell-lever H, adapted to operate as described, substantially as and for the purpose set forth.

7. The combination of the key A, swing F, line-wire R, contact-spring W, and lever N, having a metal stem N^2, with an electric circuit, connected sounder, and contact-spring

J, substantially as and for the purpose set forth.

8. The combination of the key A, rail G, link G^6, contact-lever N N^2, switch W, line-wire R, and swing F with electric circuit and bell, substantially as and for the purpose set forth.

9. The combination of the key A, rail G, link G^6, contact-lever N N^2, switch W, line-wire R, swing F, and contact-spring J with electric circuit and bell, substantially as and for the purpose set forth.

In testimony whereof I have signed my name to this specification, in the presence of two subscribing witnesses, on this 13th day of May, A. D. 1891.

FRANCIS W. HALE.

Witnesses:
FRANK G. PARKER,
WILLIAM EDSON.