J. W. DARLEY, JR.

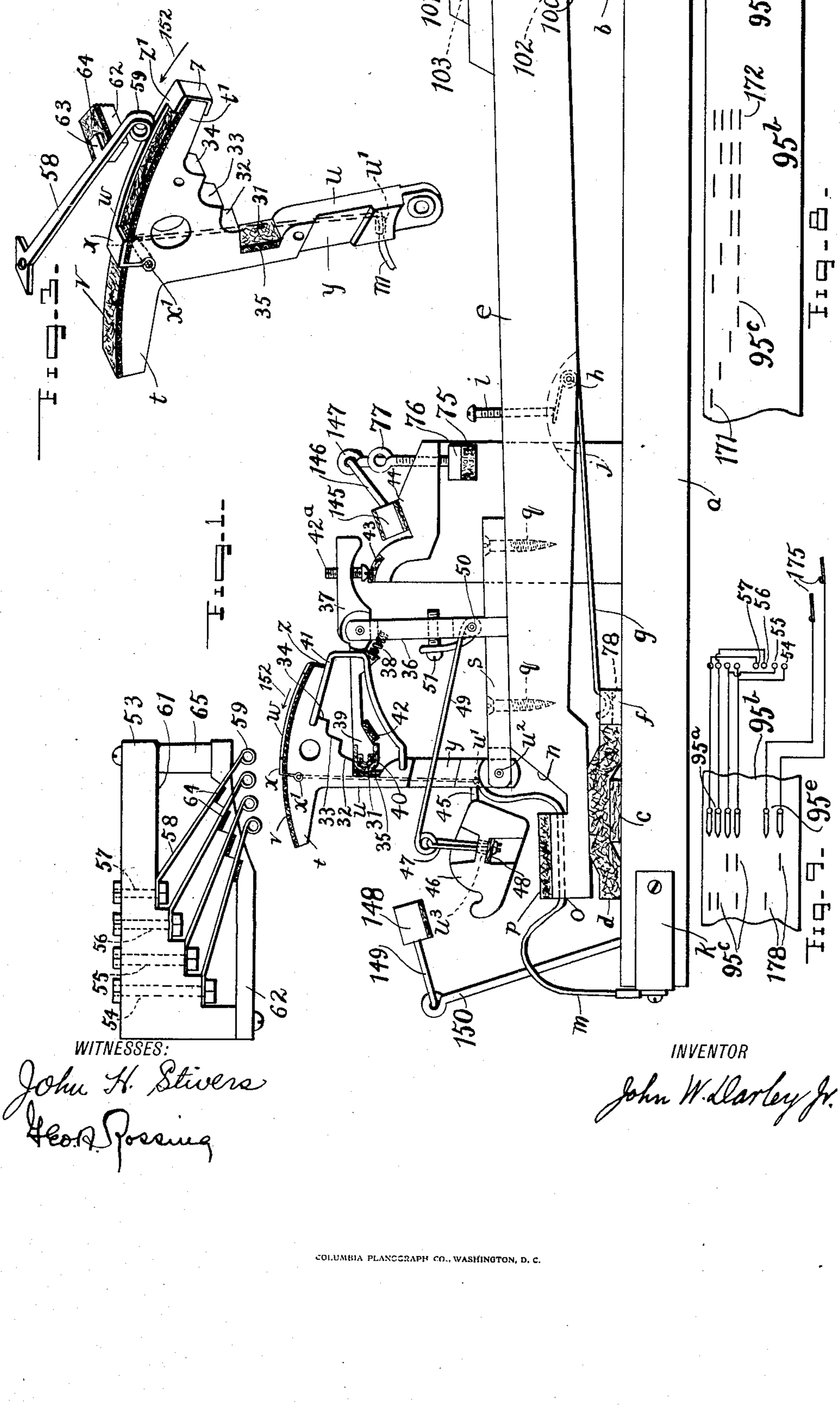
CIRCUIT CLOSER.

APPLICATION FILED DEC. 5, 1914.

1,155,302.

Patented Sept. 28, 1915.

2 SHEETS—SHEET 1.



WITNESSES:

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2 SHEETS—SHEET 2.

Fig. 2.

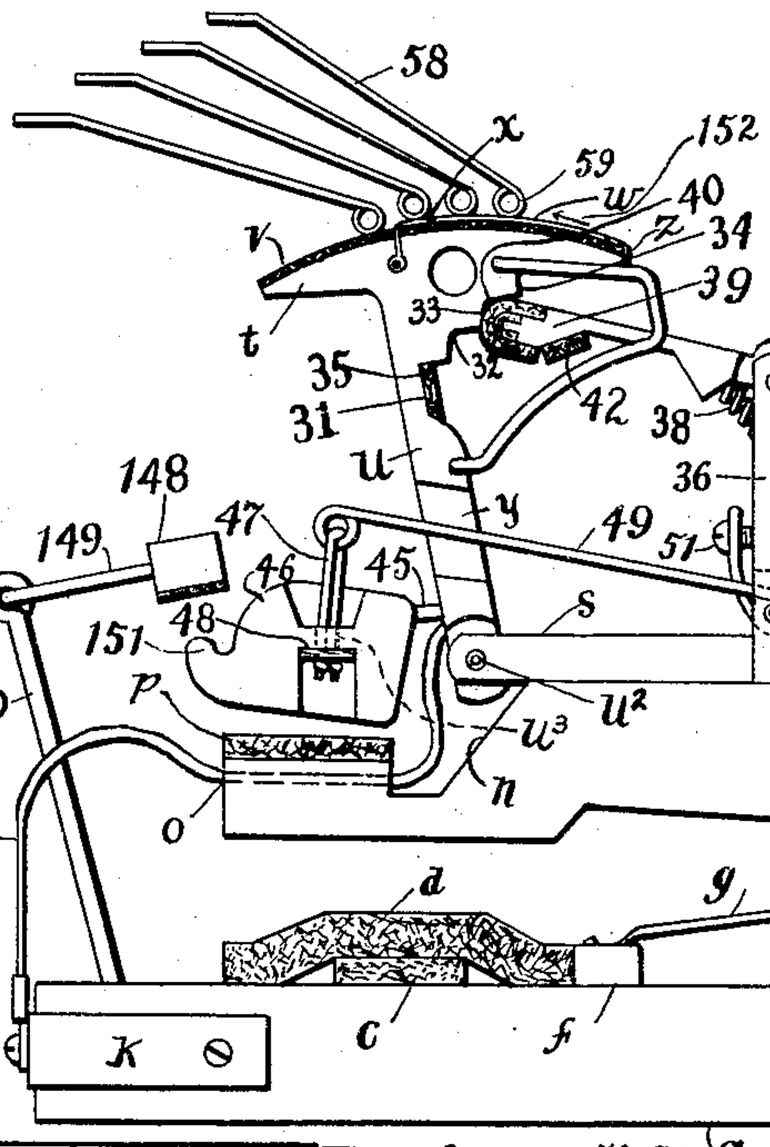
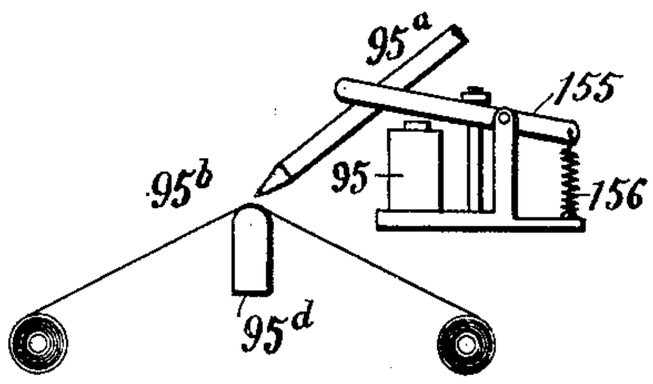


Fig. 5.



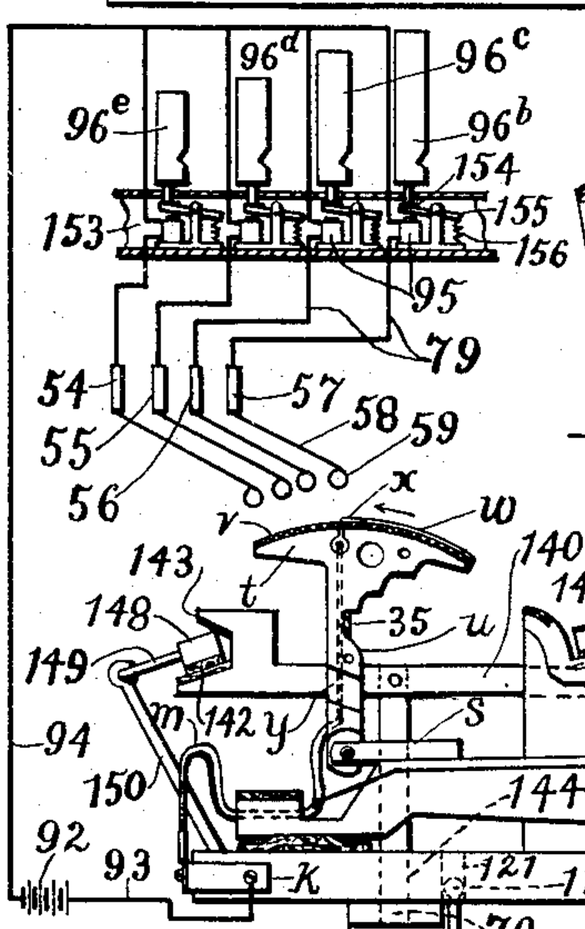


Fig. 6.

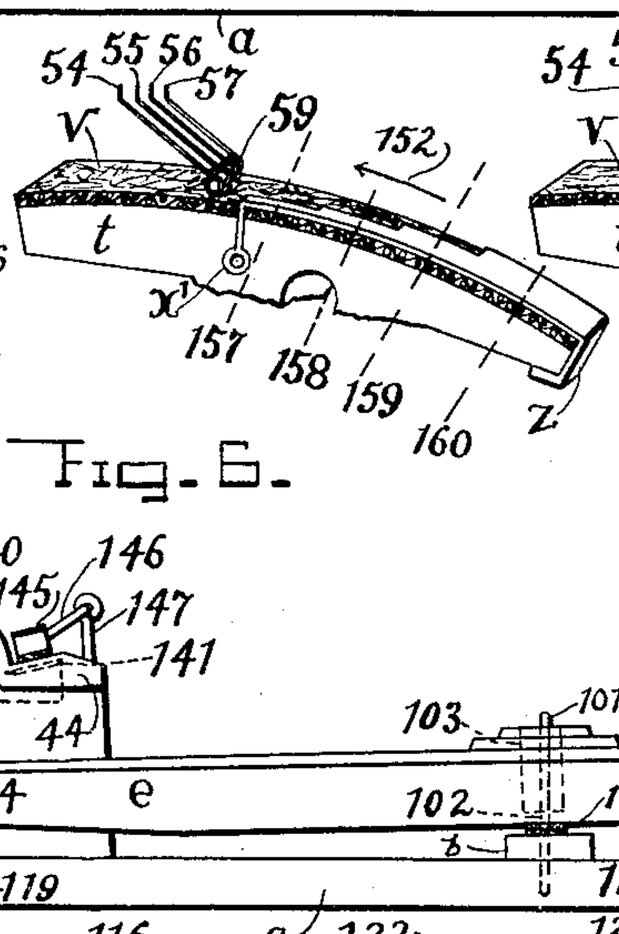


Fig. 7.

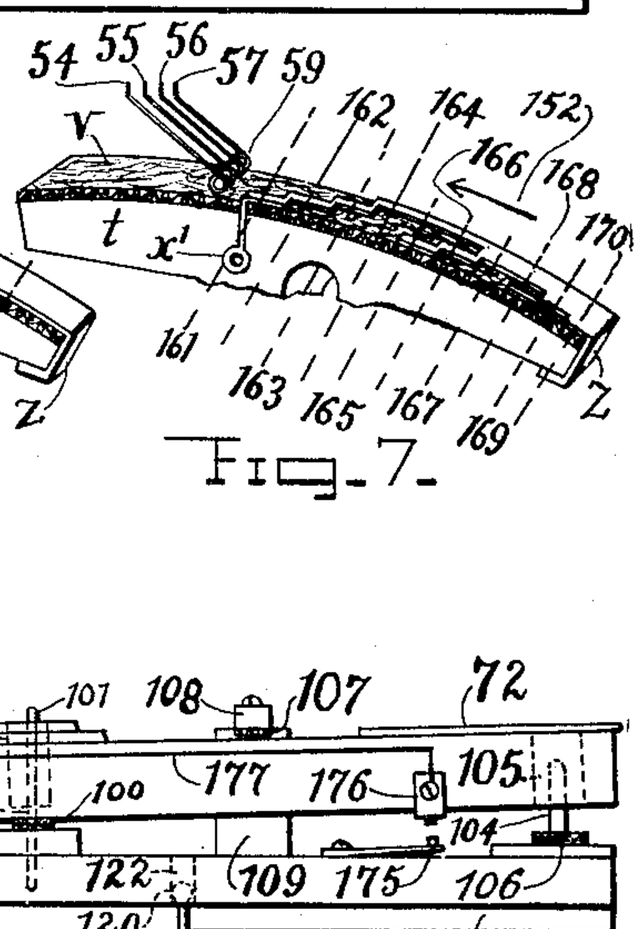
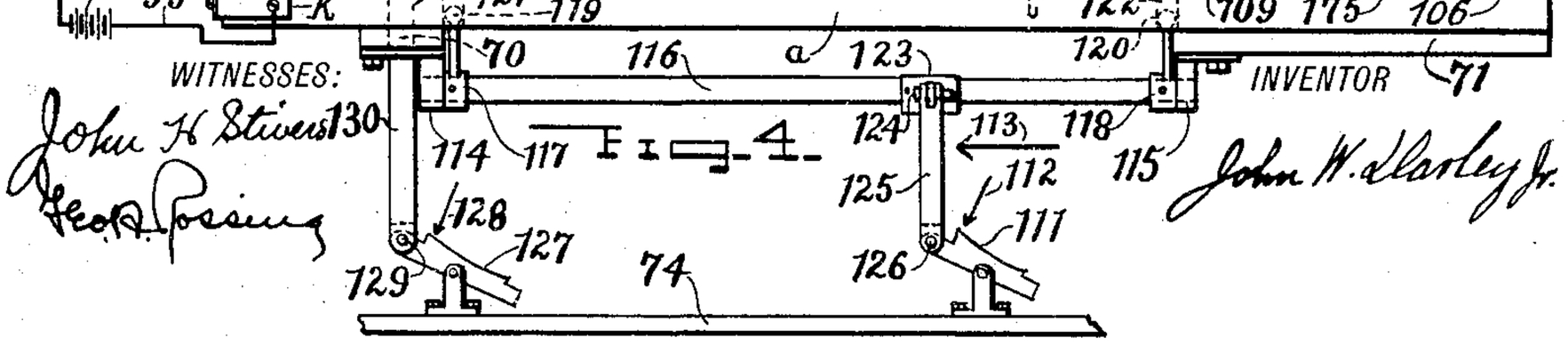


Fig. 4.



WITNESSES:

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UNITED STATES PATENT OFFICE.

JOHN W. DARLEY, JR., OF BALTIMORE, MARYLAND.

CIRCUIT-CLOSER.

1,155,302. Specification of Letters Patent. Patented Sept. 28, 1915.

Original application filed July 3, 1908, Serial No. 441,840. Divided and this application filed December 5, 1914. Serial No. 875,727.

To all whom it may concern:

Be it known that I, JOHN W. DARLEY, Jr., a citizen of the United States, residing at 1518 North Broadway, in the city of Baltimore and State of Maryland, have invented certain new and useful Improvements in Circuit-Closers; 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 appertains to make and use the same.

My invention relates to improvements in circuit closers, which circuit closers can be operated manually, pedally, by automatic means or in any approved manner. In the drawings I have shown my improved circuit closer as operated by a key which is to be moved by hand.

This application is a division from my pending application Serial No. 441840, filed July 3, 1908.

The object of my invention is to provide an inertia controlled means operated by a key, whereby a circuit, or circuits may be closed by a single movement of said key; the particular circuit that is closed, or the circuits that are closed being determined by the speed impressed upon the key by the operator.

My invention has special application to organs, harmoniums and similar instruments, to the recording of a performer's playing upon a musical instrument, and to any other application where the speed of the key is the determining factor in controlling various effects, or where it is desired to record the speed of movement of the key.

My invention as shown in the drawings is applied to an organ, in which the speed of movement of the key is caused to be the determining factor in selecting and closing electric circuits, the closing of which will cause the operation of reeds or pipes of the organ, as hereinafter described.

In the accompanying drawings, Figure 1 is a side view of a key and related parts, and the inertia controlled contact maker for closing and varying the electric circuits. Fig. 2 is a view similar to Fig. 1, but showing the key depressed, the inertia controlled contact maker being in its third position. Fig. 3 is a detail perspective view of the contact maker and one contact. Fig. 4 is a view showing a diagram of the connections with the contact maker, key and pedals; certain parts being omitted for the sake of clearness. Fig. 5 shows a device for recording a performer's playing which may be operated by my improved circuit closer. Fig. 6 shows a form of contact strip differing from that shown in Fig. 3. Fig. 7 shows still another form of contact strip. Figs. 8 and 9 show records of a performer's playing.

a represents the support for the key. The support *a* is mounted to slide transversely upon the cross pieces 70 and 71 which are supported upon the foundation 74 in any suitable manner so that the front 72 of the key *e* will be accessible to the operator.

The support *a* is provided with the usual balance pin 101 which passes freely through the hole 102 in the bottom of the key *e* and the slot 103 in the top of said key. A washer 100 of felt is introduced between the key and balance rail *b* for the key to rock upon. The pin 101 is rigidly secured in the rail *b*.

The support *a* is provided with the usual front pin 104 rigidly secured therein, which works freely in the slot 105 in the front end of the key. A felt washer 106 is placed around the pin 104 and serves as a stop for the key to limit its downward movement at the front end. The upward movement of the key at its front is limited by the pad 107 attached to the cross piece 108, which is mounted upon the support 109 the latter being secured to the support *a*. The downward movement of the rear end of the key is limited by the stop formed of the felt cushions *c* and *d* and the upward movement of said end is limited by the felt pad 75 secured to the button 76 which is mounted on the adjusting screw 77.

f is a cross piece secured to the support *a* and in this cross piece is a slot 78 in which one end of the spring *g* is supported. The body of the spring *g* is coiled around the pin *h* in the slot *j* formed in the under side of the key *e*. A screw *i*, mounted in the key *e* with its point projecting into the slot *j* against one end of the spring *g*, serves to regulate the tension of the said spring and thus reduce the effort required to depress the front end 72 of the key *e* to any required degree.

Mounted on the support *a* is a conducting strip *k*, and to said strip is fastened a flexible wire *m* which is passed through a hole in the rear end of the key *e*. The key is cut

away at its rear end as shown at n, leaving a projecting portion o, which is covered with the felt pad p. Secured to the top of the key e by means of the screws q is the piece s, on the rear end of which is pivotally mounted the inertia controlled contact maker, shown in perspective in Fig. 3.

The inertia controlled contact maker consists of an upright portion u and a portion t. The top of the portion t is covered by a layer of felt v and over this layer of felt is secured a contact strip z. The part u is cut away as shown at y, to allow clearance for the spring 49 and is provided with four notches, 31, 32, 33 and 34, the notch 31 having a felt lining 35.

The wire m after passing through the part o of the key, passes through a hole u' at one side of the part u and thence upwardly over the side of the contact maker and is soldered in the ring x' of the contact strip z. This ring is formed at the end of a downward extension from the portion x of the contact strip z. The portions x and z' are of the same width and are joined together by the narrow strip w. The portion z' has a downward hooked extension which fits around the portion t' of the contact maker. The ring x' and the downward extension of the portion x fit tightly in a hole and slot respectively provided in the contact maker.

To the part s is attached an upright standard 36, and in a slot in the top of this standard is pivotally mounted a lever 37. A spring 38 is located between said lever and the standard 36 and normally tends to press the rear end of said lever upward. This rear end is provided with an expanded head 39 adapted to engage in one of the recesses 31, 32, 33, and 34, and is provided with a felt strip 40.

41 represents a guiding wire, the ends of which are fixed in the parts t and u of the contact maker, and the front of the head 39 is provided with a felt cushion 42 adapted to engage with this guiding wire so as to guide the head 39 into one of the notches 31, 32, 33 and 34. It will be noted that the wire 41 is eccentric with reference to the center u^2, and is substantially parallel with the edges forming the outer extremities of the notches 31, 32, 33 and 34. Hence as the contact maker moves from the position shown in Fig. 1 to that shown in Fig. 2, if for any reason the head 39 should not be raised sufficiently fast by the spring 38, the wire 41 will strike the pad 42 and lift the head 39 to the position determined by the maximum movement of the contact maker, then as the spring 49 tends to return the contact maker toward the position shown in Fig. 1, the head 39 enters into the appropriate notch such as 33 in Fig. 2. Hence the head 39 is always set in the correct stopping position by the wire 41, and all that the spring 38 has to do is to prevent the head 39 from falling before the proper notch bears against it.

The front of the lever 37 is provided with an adjusting screw 42^a which is adapted to rest, when the parts are in the position shown in Fig. 1, upon the felt strip 43 of the rail 44, which is rigidly mounted on the support a in the position shown.

Rigidly attached to the rear of the contact maker by the pin 45 is a weight 46 preferably made of lead. This is hollowed out near the center and is provided with a loop 47 of flexible material, which passes down through a perforation u^3 and is attached to a leather head 48. The upper end of the loop 47 engages one end of a spring 49 which is coiled around a pin 50 in a slot provided in the standard 36, the free end of this spring engaging an adjusting screw 51 in said standard, whereby the tension of said spring may be regulated.

The contact maker and the parts carried thereby are so proportioned that the center of gravity of the entire mass, which is pivotally supported on the pin u^2 in a slot provided in the rear end of the piece s, is at, or near, the point of attachment u^3 of the loop 47 to the weight 46, the latter being shaped to produce this effect. The parts are so proportioned that a light blow upon the key will move the contact maker upwardly without disengaging the head 39 from the recess 31. When a swifter blow is struck, the rear end of the key moves upwardly so swiftly that the weight 46 cannot move bodily with the key, but lags behind. As a consequence, the contact maker turns as upon its center of gravity at or near u^3, thus moving angularly with reference to the key upon its pivot u^2 and releasing the head 39 from the notch 31. The said head 39 then enters the notch 32. A still swifter blow will cause the contact maker to move still farther with reference to the key, releasing the head 39 from the notch 32. The said head then enters the notch 33. So also, a blow more swift than the last will release the head 39 from the notch 33 and permit it to enter the notch 34. These effects are obtained because the inertia of the contact maker can be considered as acting at u^3, at the end of the lever arm from u^3 to u^2. When the key returns to its normal position, shown in Fig. 1, the screw 42^a strikes the pad 43, withdrawing the head 39 from the notch with which it was in engagement, and the spring 49 returns the contact maker to the normal position, shown in Fig. 1.

It is evident that if, after having been depressed, the front end of the key is allowed to rise slightly, then the circuits, which were made by the contact of the contact plate z with the rings 59 while the key was fully depressed, will be broken before the screw

42ª strikes the pad 43. If now, before the said screw strikes the said pad, the front end of the key be again depressed, then the contact plate *z* will again make contact with the same rings as before, and this repetition of contact of *z* with the same rings may be continued indefinitely, or until the front end of the key is allowed to rise sufficiently to cause the screw 42ª to strike the pad 43.

53 represents a rail rigidly mounted on the support *a*. Secured in the rail 53 are four wires 54, 55, 56 and 57; four wires are shown for each key, but a greater number can be used if desired, suitable changes being made in the rail 53, and a suitable number of notches, such as 31, 32, 33 and 34 being provided on the contact maker. To the end of each of said four wires is attached a spring contact strip 58 which terminates in a ring 59, and nuts on the ends of said wires secure said spring contact strips to the rail 53. The rings 59 are located to be engaged by the contact strip *z*.

To the bottom of the rail 53, which is cut away as shown at 61, is attached a support 62, the front of which on its upper side is dentated and on its lower side is curved. The spring contact strips 58 extend along the side of the support 62, and the projections 63 on said strips rest upon felt pads 64 secured to said dentations. As shown in Fig. 3 the felt 64 of only one dentation is shown, and only a small portion of the support 62 is shown. 65 represents a distance piece separating the front ends of the rail 53 and support 62.

The effects now to be noted are obtained when the pedal 111 is in the position shown in Fig. 4, in which case the key *e* is in such a position that the offset portion of the part *x* of the contact strip *z* can make contact with only one of the rings 59 at a time, the one with which contact is made depending upon the speed impressed upon the key. When the pedal 111 is in said position, the contact maker is sufficiently to the right of the position shown in Fig. 3, for the rings 59 to clear the portion *w* of the contact strip *z*. The parts are so proportioned and located that when a light blow is struck upon the key the contact maker will be moved upward and only the front ring will make contact with the offset portion of the part *x* of the contact strip *z*. If a heavier blow is struck the second of said rings will be brought into contact with said portion, a still heavier blow will bring the third ring into contact with said portion, and a still heavier blow will bring the fourth ring into contact with said portion, but in each case only one ring 59 will make contact with the offset portion of the part *x* of the contact strip *z*. If, however, the toe of the pedal 111 is moved in the direction of the arrow 112, another form of operation of my improved circuit closer will result through the action of the following instrumentalities: Secured to the cross pieces 70 and 71 are bearings 114 and 115 supporting the ends of the shaft 116, on which are rigidly secured levers 117 and 118 which extend upwardly and terminate in balls 119 and 120, which work freely in holes 121 and 122 provided in the support *a*. Another lever 123 is rigidly secured to the shaft 116, and extends toward the left when observed in the direction of the arrow 113, and is connected by a pin 124 to a rod 125 which is connected to the pedal 111 by the pin 126. Hence it is evident that when the toe of the pedal 111 is moved in the direction of the arrow 112, the support *a* will be moved toward the left, when observed in the direction of the arrow 113. This movement will bring the contact maker into such a position that the strip *w* will make contact with the rings 59, as shown in Figs. 2 and 3. When the pedal 111 has been moved as just described, and a light blow is struck upon the key, the contact maker will be moved upward and only the front ring will make contact with the contact strip *z*. If a heavier blow is struck the second of said rings will be brought into contact also with said strip, and a still heavier blow will bring the third ring into contact also with said strip; this being the condition shown in Fig. 3. A still heavier blow will bring the fourth ring also into contact with said strip. Hence in this form of operation the contact strip *z* makes contact with one or more of the rings 59, the number depending upon the speed impressed upon the key.

To shift the contact maker after the front end of the key is depressed the following instrumentalities are provided: The pedal 127 is connected by the pin 129 with the rod 130 which slides in a hole 144 provided in the cross piece 70. A head piece 140 is rigidly secured to the top of the rod 130 and is provided on its front end with a cushion 141 which extends under the bar 145, and on its front end it is provided with a fork having the cushions 142 and 143 which embrace the bar 148. The bars 145 and 148 are rigidly secured to arms 146 and 149 respectively, which have bent ends revolubly mounted in the supports 147 and 150. The supports 147 and 150 are rigidly secured in the rail 44 and the support *a* respectively. When the pedal 127 is in the position shown in Fig. 4, the bars 145 and 148 will be in the position shown in the Figs. 1, 2, and 6. If, when the key *e* is in the position shown in Fig. 2, the toe of the pedal 127 be moved in the direction of the arrow 128, then the bar 148 will be moved to press against the nose 151 of the weight 46 and thus move the contact maker in the direction of the arrow 152. If the pedal 127 be moved in the op-

posite direction, the bar 145 will be moved to press against the nose 153 of the lever 37. This will move the head 39 out of the notch 33 and then the spring 49 will move the contact maker in a direction opposite to that of the arrow 152. These effects are obtained by the movement of the pedal 127 whether the pedal 111 has its toe depressed or not.

The means for controlling the pipes will next be described, reference being had especially to Fig. 4.

The strip *k* is connected with the battery 92 by the wire 93, and a wire 94 leads from the battery to one terminal of the winding of each of the magnets 95, the other terminal of the winding of each magnet is connected by a wire such as 79 to one of the vertical wires such as 57. Each one of the magnets controls one of the pipes. The magnets 95 are mounted in the wind chest 153 shown in section, and each armature such as 155 is provided with a valve 154 normally kept against and closing the opening to a pipe, such as 96^b, by the spring 156 and pressure of the air in the wind chest 153. When an electric current flows through the winding of a magnet, its armature is attracted and the valve 154 moves from the opening of the pipe, and then the compressed air in said wind chest sounds said pipe. When the pedals 111 and 127 are in the positions shown in Fig. 4, it is evident from the foregoing, that the pipe 96^b will be sounded when a light blow is struck on the front of the key. The pipe 96^c will be sounded when the depression of the key is made with sufficient speed to bring the lever 37 into the notch 32, thus bringing the portion *x* of the contact strip *z* into contact with the second of the rings 59, and so on for the other pipes, notches and rings. Thus each pipe sounds only when the corresponding speed is impressed upon the key, and only one pipe sounds at a time. If the front end of the key be held down and the pedal 127 moved, the sounding of either of the pipes can be stopped and that of another started.

If the toe of the pedal 111 be moved in the direction of the arrow 112 and the pedal 127 be left in the position shown in Fig. 4, then the pipe 96^b will be sounded when a light blow is struck on the front of the key. The pipe 96^c will be sounded with the pipe 96^b when the depression of the key is made with sufficient speed to bring the lever 37 into the notch 32, thus bringing the portion *x* of the contact strip *z* into contact with the second of the rings 59 and the portion *w* into contact with the first of said rings, and so on for the other pipes, notches and rings. Thus, as before, each pipe sounds only when the corresponding speed is impressed upon the key, but the number of pipes that sound depends upon said speed, since all the pipes up to and including the pipe that corresponds to said speed are sounded for each depression of said key. The toe of the pedal 111 remaining depressed as just described and the front end of the key being held down, a movement of the pedal 127 will vary the number of pipes that are sounding.

It is evident that if the pedal 127 be moved so as to bring the bar 148 into the path of the nose 151 of the weight 46 before the front end of the key is depressed, then when said key is depressed, even though slowly, the bar 148 pressing against the nose 151 will bring the contact maker into any one of the three positions other than the first position, depending upon the position into which the bar 148 had been moved. The first and third positions of the contact maker are shown in Figs. 1 and 2 respectively; the second and fourth positions are they in which the head 39 enters the notches 32 and 34 respectively. The form of operation just described may be used whether or not the pedal 111 is depressed.

The pedals and the parts operated thereby may be omitted.

The rings 59 shown in Figs. 1 to 4 are in a row disposed in the plane of movement of the contact maker, but in Figs. 6 and 7 the rings 59 are in a row at right angles to said plane.

It is evident that with the form of contact strip *z* shown in Fig. 6, when the contact maker moves to bring the lines 157, 158, 159 or 160 under the rings 59, then one, two, three or four pipes, respectively, will sound.

It is evident that with the form of contact strip *z* shown in Fig. 7, when the contact maker moves to bring the lines 161 to 170 consecutively under the rings 59 then the pipes will sound in the following combinations respectively—one; two; three; four; one and four; two and four; three and four; one, three and four; two, three and four; and one, two, three and four; making ten combinations in all.

Pipes one to four in the above list are considered to be the pipes whose controlling magnets 95 have their windings connected to the wires 54 to 57 respectively.

When using the form of contact strip shown in Fig. 7, it will be necessary to provide ten notches in the contact maker instead of the four 31 to 34 shown in Fig. 1.

It is evident that the armature 155 of the magnet 95 could move a pencil or stylus such as 95^a, shown in Figs. 5, 8, and 9 which could mark a line upon a web of paper 95^b or press a hole or slot therein when the paper is drawn across the support 95^d; or the support 95^d could be of metal and connected to the wire 94, shown in Fig. 4, and 95^a be of metal and connected to one of the wires 54

to 57. In this case the paper 95[b] would be impregnated with chemicals that would change color when a current of electricity was passed through said paper.

In each of the above cases a record 95[c], as shown in Fig. 8, would be made upon the paper 95[b] if the contact strip *z*, shown in Fig. 7, were used.

In Fig. 8 the four styli 95[a] are for a single key, and the record 95[c] shows that ten blows have been struck on the key, increasing from a strength equal to unity at 171 to a strength equal to ten at 172, the spring 49 being so adjusted that the movement of the contact maker will be approximately proportional to the strength of blow upon the key. Instead of having four styli to record the speed impressed upon each key, I can use four styli for a number of keys.

In Fig. 9 are shown four styli, as 95[a], each connected to two similar wires of two rows of wires 54 to 57, each row of wires belonging to one key, and there may be as many as desired rows of wires so connected. Hence these four styli will record the speed impressed upon either key.

Two additional styli 95[e] will record the key that is depressed as shown at 178 in Fig. 9. Each of these styli is connected to a contact spring, such as 175 in Fig. 4, which is touched by the contact plate 176 when the key is depressed. The contact plate 176 is connected to the wire *m* by the wire 177.

To generalize, for each key there is a contact maker, a row of spring contact strips such as 58, and notches such as 31 to 34 in the contact maker equal in number to the combinations intended to be provided for.

It is evident that the various contacts need not actually touch. They can be arranged to merely approach each other and electricity of high tension be employed to jump the gap.

It is evident that the wire 57 need not be connected to any circuit, hence no effect will be produced until the speed impressed upon the key is sufficient to cause the contact plate *x* to touch the ring connected to the next wire 56, and so for any other wire that is disconnected. If the spring contact strip connected to 57 is omitted the same effect is obtained.

It is evident that all the spring contact strips 58 may be omitted excepting one so located as to permit the closing of the circuit therethrough when a predetermined speed is impressed upon the key.

It is evident that many changes may be made without departing from the spirit of my invention.

I claim as new:—

1. In a circuit closer, the combination of a key, contacts, a contact maker moved by said key, pedally controlled means for moving said contact maker to make contact with any number of said contacts when said contact maker is moved by said key, the number depending upon the extent of movement of said key and said pedally controlled means.

2. In a circuit closer, the combination of a key, contacts, a contact maker moved by said key, and inertia controlled means for moving said contact maker to make contact with any number of said contacts when said key is depressed, the movement of said contact maker and the number depending upon the speed impressed upon the key.

3. In a circuit closer, the combination of a key, contacts, a contact maker moved by said key, means for moving said contact maker to make contact with any number of said contacts when said key is depressed, and means for varying said number while said key is depressed.

4. In a circuit closer, the combination of a key, contacts, a contact maker moved by said key, means for moving said contact maker to make contact with any one of said contacts when said key is depressed, and means for shifting said contact maker to make contact with another contact while said key is depressed.

5. In a circuit closer, the combination of a key, contacts, a contact maker moved by said key, means for moving said contact maker to make contact with any number or with any one of said contacts, and means for changing from the first mode of making contact to the second.

6. In a circuit closer, the combination of a key, contacts, a contact maker moved by said key, means for moving said contact maker to make contact with any number of said contacts, and means for supporting said contact maker in the contact making position.

7. In a circuit closer, the combination of a key, contacts, a contact maker moved by said key, means for moving said contact maker to make contact with any number of said contacts, and means for supporting said contact maker in the contact making position, so that while supported it can be moved by said key.

8. In a circuit closer, the combination of a key, contacts, a contact maker moved by said key, means for moving said contact maker to make contact with any one of said contacts, and means for supporting said contact maker in the contact making position, so that while supported it can be moved by said key to break and make said contact.

9. In a circuit closer, the combination of a key, contacts, a contact maker mounted upon said key, and means for causing said contact maker to make contact with one of said contacts, the one depending upon the speed impressed upon said key.

10. In a circuit closer, the combination of

a key, contacts, a contact maker moved by said key, means for causing said contact maker to make contact with one of said contacts, the one depending upon the speed impressed upon said key, and means for supporting said contact maker in the contact making position, so that while supported it can be moved by said key to break and make said circuit.

11. In a circuit closer, the combination of a key, contacts, a contact maker moved by said key, and means for causing said contact maker to make contact with any number of said contacts, the number depending upon the speed impressed upon said key.

12. In a circuit closer, the combination of a key, a contact, a contact maker moved by said key a distance varying with the speed of said key and adapted to make contact with said contact, and a detent for supporting said contact maker near the limit of its movement until said key is almost returned to its normal position, said detent being so arranged that said contact maker can be moved by short strokes of said key to break and make said contact in succession.

13. In a circuit closer, the combination of a key, contacts, a contact maker moved by said key, and means for causing said contact maker to make contact with any combination of said contacts, the combination depending upon the speed impressed upon said key.

14. In circuit closers, the combination of keys, a row of contacts for each key, similar contacts in different rows being connected together, a contact maker moved by each key and adapted to make contact with the contacts in said row of contacts, an additional contact maker moved by each key, and a contact for each key adapted to be touched by said additional contact.

15. In a circuit closer, the combination of a key, contacts, a contact maker carried by said key, an inertia controlled means acting on said contact maker to shift said contact maker to make contact with any one of said contacts, the one depending only upon the speed impressed upon said key.

16. In a circuit closer, the combination of a key, contacts, a contact maker moved by said key, and inertia controlled means acting upon said contact maker to shift said contact maker to make contact with any number of said contacts, the number depending only upon the speed impressed upon said key.

17. In a circuit closer, the combination of a key, a plurality of contacts, a single lever carried by said key and provided with a contact maker, adapted to make contact with a plurality of said contacts, means for moving said lever relatively to said key, whereby said contact maker makes contact with a variable number of said contacts, the number depending upon the extent of movement of said lever with reference to said key.

18. In a circuit closer, the combination of a key, contacts, a contact maker carried by said key and capable of moving relatively to said key to make contact with any one, or any number of said contacts, the one, or the number depending upon the speed impressed upon the key.

19. In a circuit closer, the combination of a key, a contact, a contact maker moved by said key a distance varying with the speed of said key, and adapted to make contact with said contact, and a detent, detached from said contact maker, for supporting said contact maker near the limit of its movement.

20. In a circuit closer, the combination of a key, a contact, a contact maker moved by said key a distance varying with the speed of said key, and adapted to make contact with said contact, a detent, detached from said contact maker, for supporting said contact maker near the limit of its movement, and a spring normally tending to move said detent to support said contact maker.

21. In a circuit closer, the combination of a key, a contact, a contact maker moved by said key a distance varying with the speed of said key, and adapted to make contact with said contact, a detent, detached from said contact maker, for supporting said contact maker near the limit of its movement, a spring normally tending to move said detent to support said contact maker and means for releasing said detent from supporting said contact maker.

In testimony whereof I affix my signature in presence of two witnesses.

JOHN W. DARLEY, JR.

Witnesses:
JOHN H. STIVERS,
GEO. A. ROSSING.