No. 762,644. PATENTED JUNE 14, 1904.

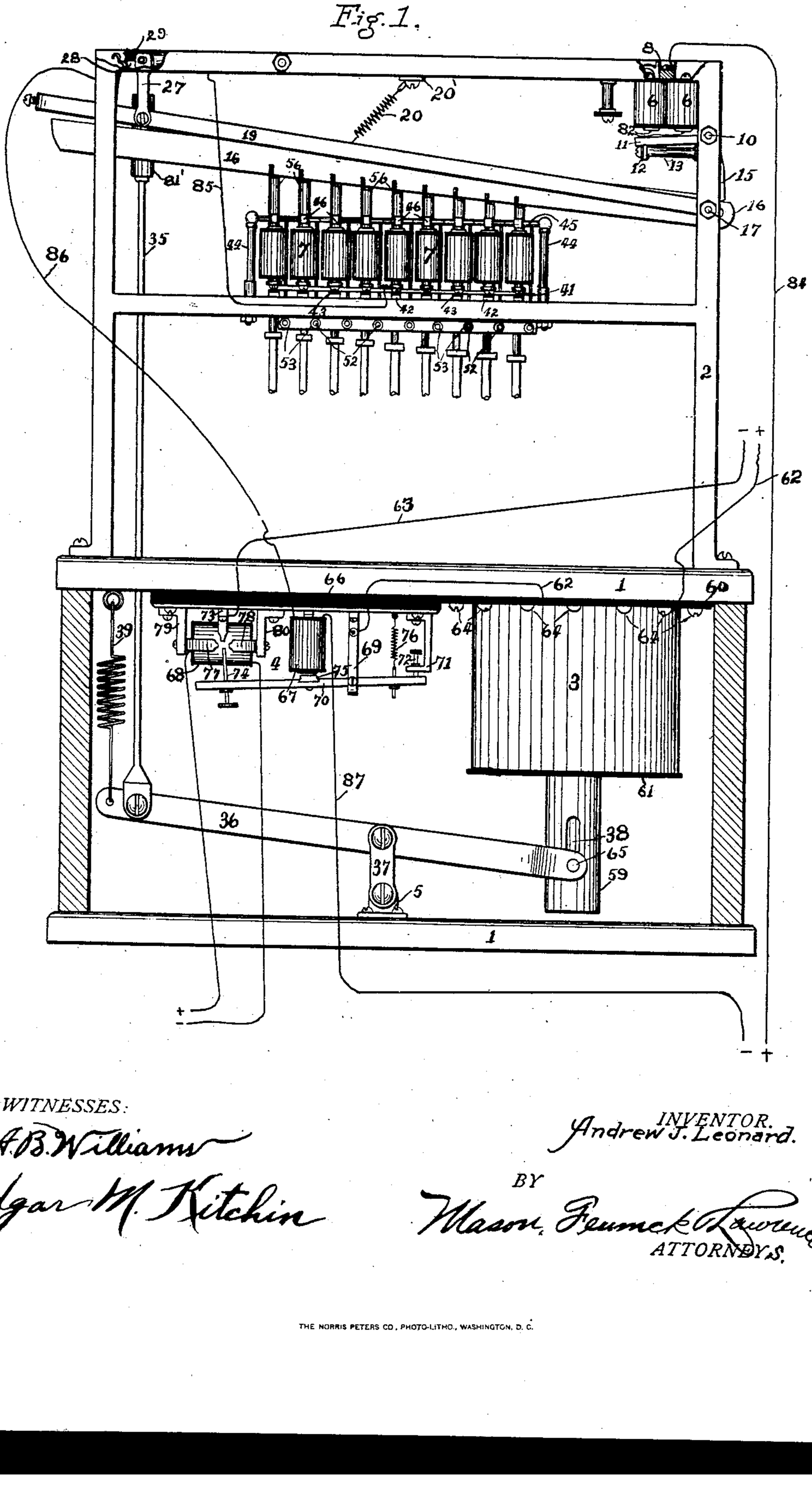
A. J. LEONARD.

ELECTRIC KEY SELECTING AND STRIKING MECHANISM.

APPLICATION FILED FEB. 21, 1902.

NO MODEL. 6 SHEETS—SHEET 1.

Fig. 1.



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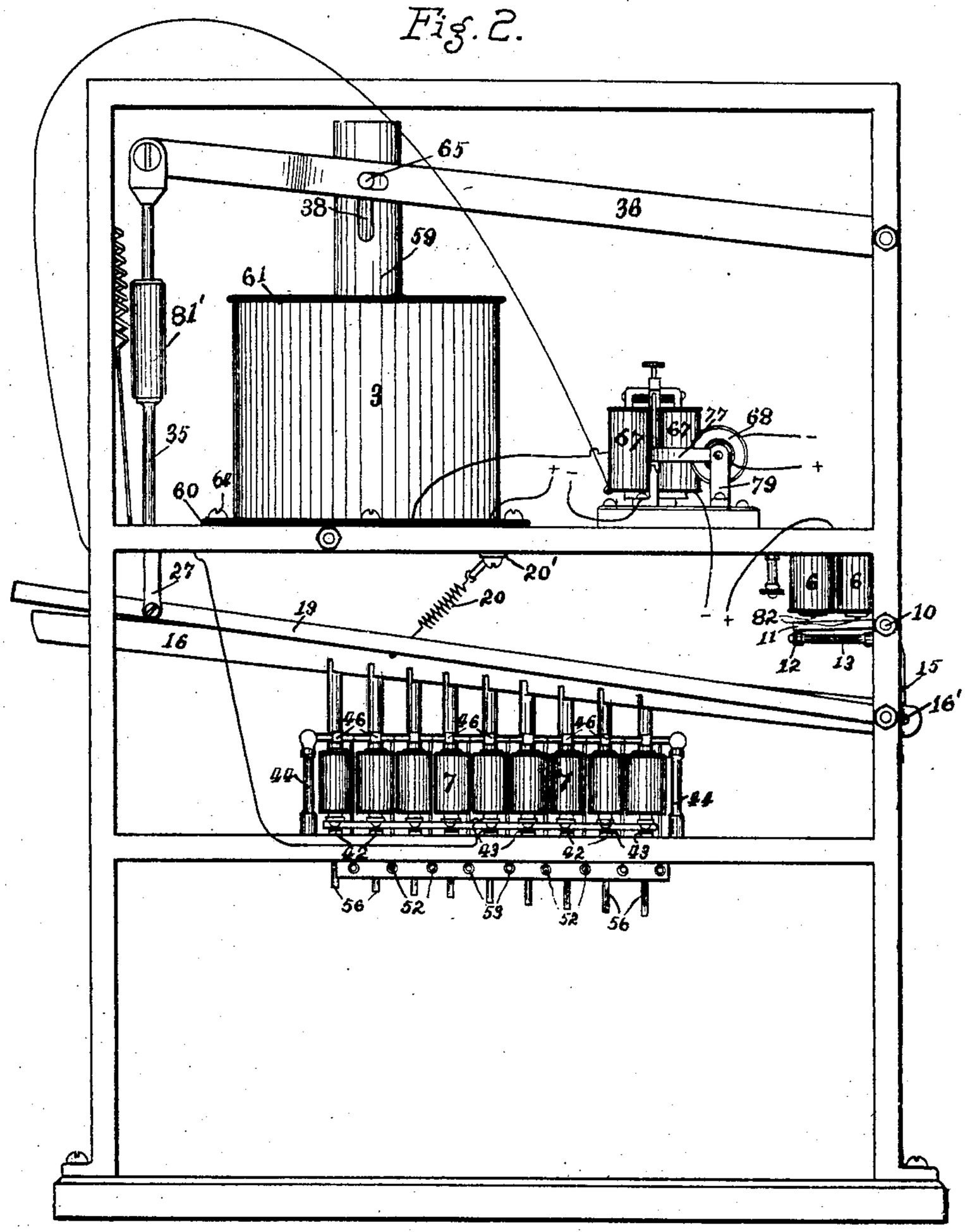
NO MODEL. 6 SHEETS—SHEET 2.

Fig. 2.



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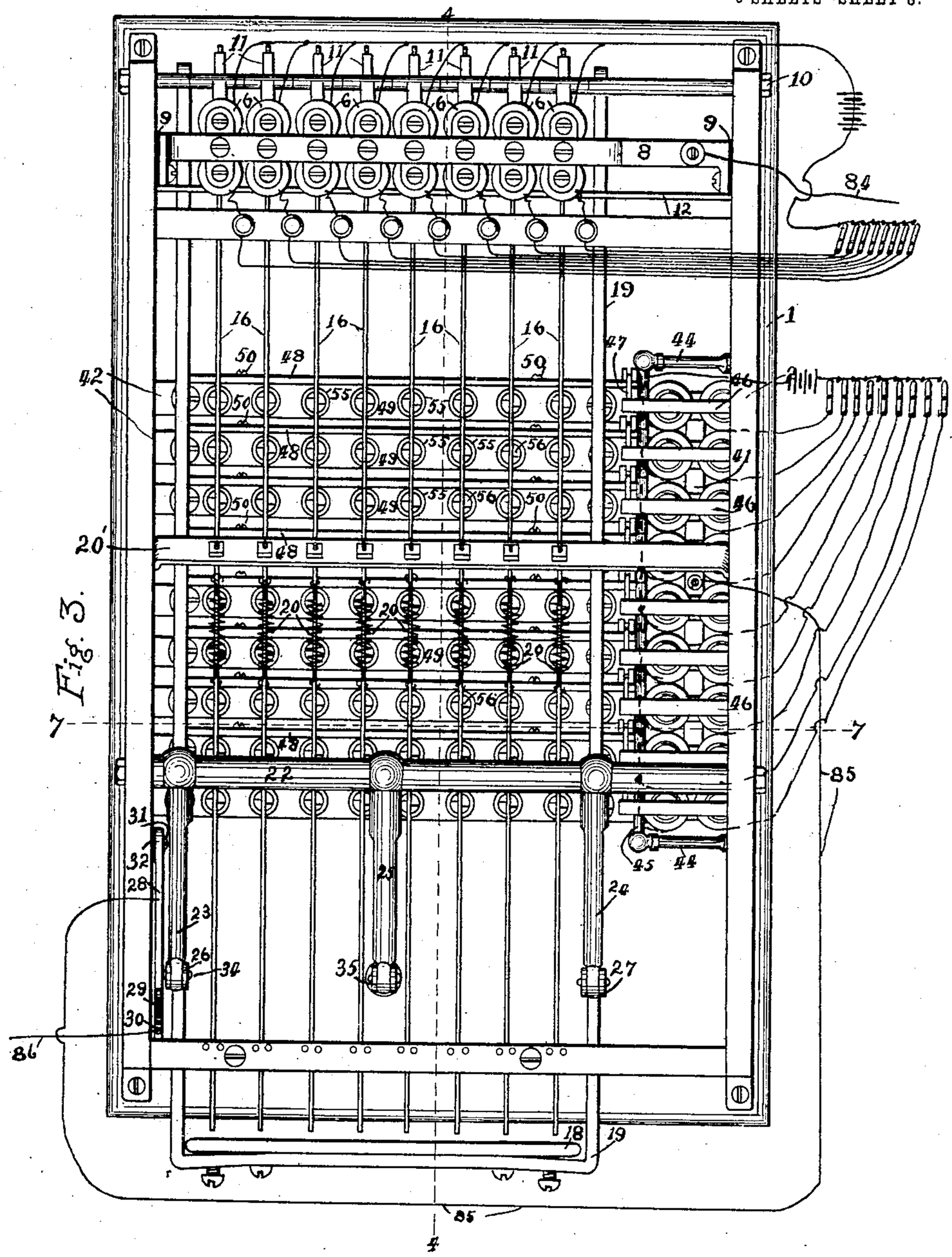

Fig. 3.

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NO MODEL. 6 SHEETS—SHEET 4.

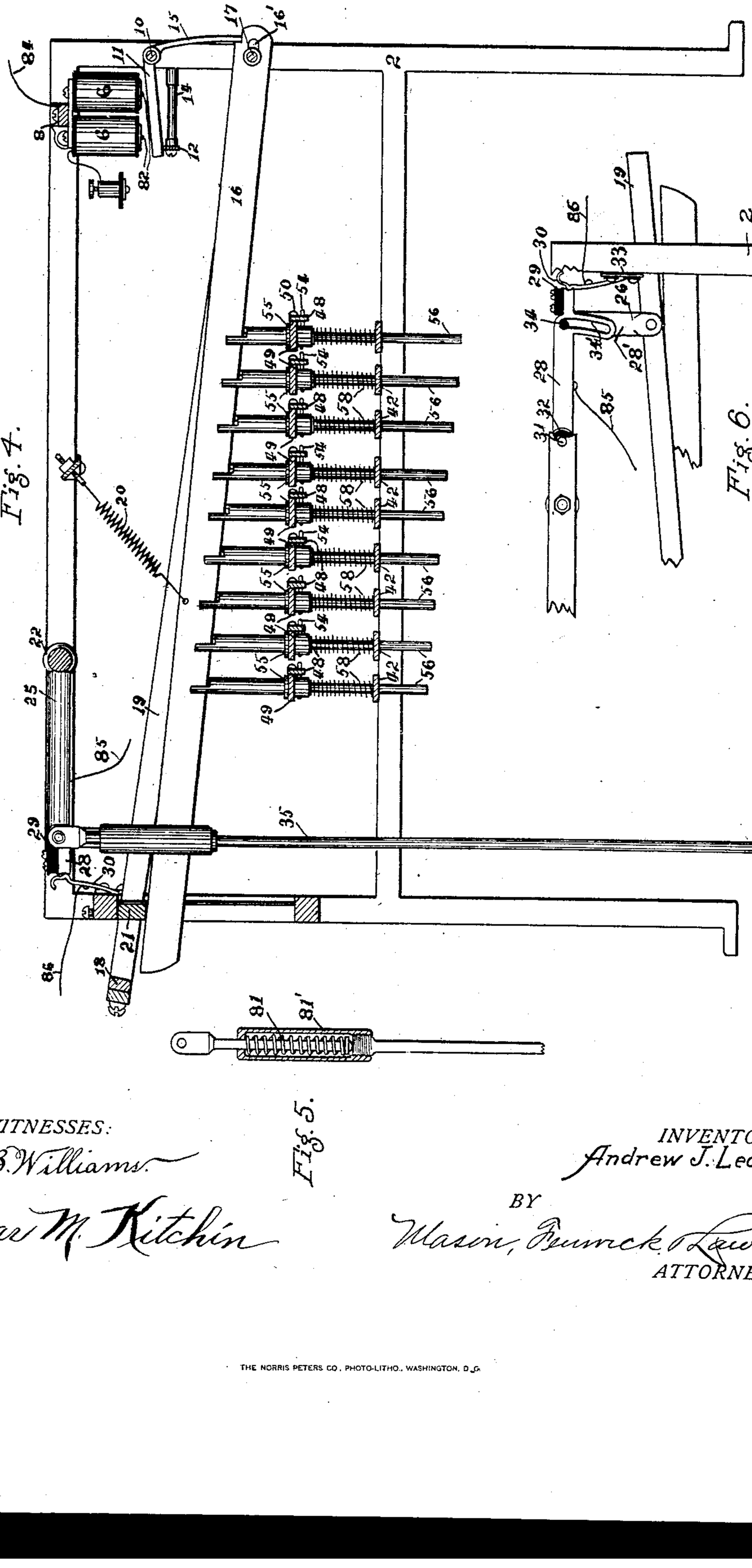

Fig. 4.

Fig. 6.

Fig. 5.

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Fig. 7.

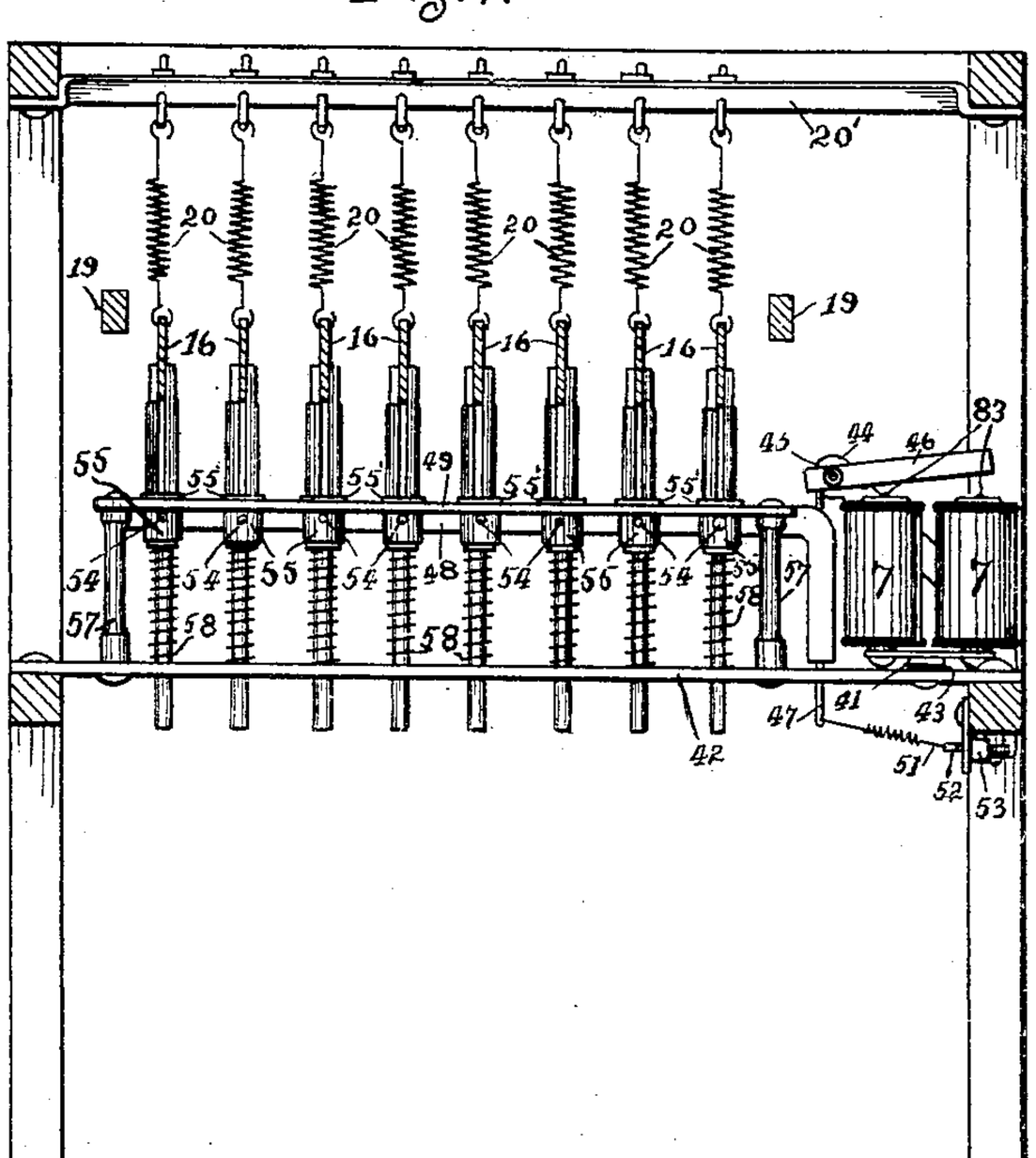

Fig. 8.

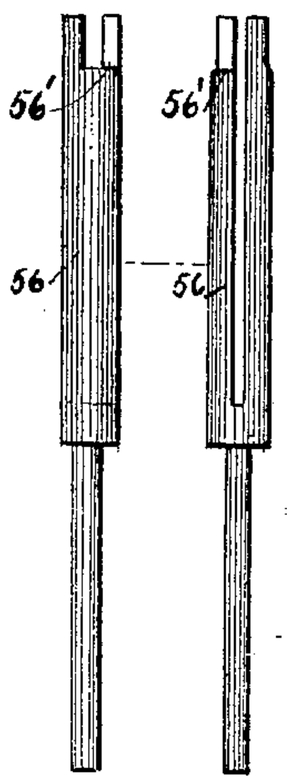

Fig. 8a.

Fig. 9.

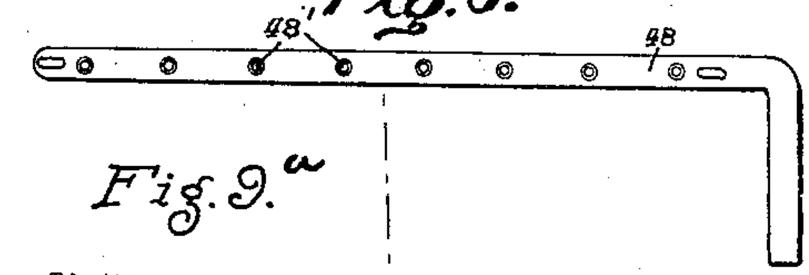

Fig. 9a.

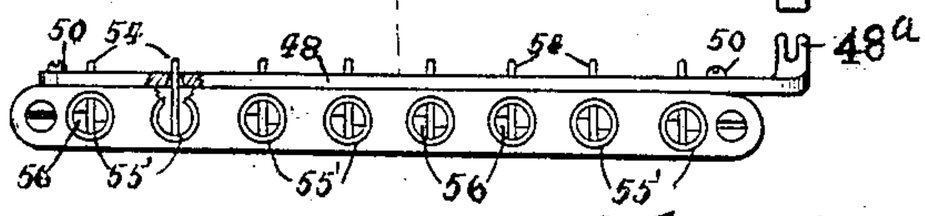

Fig. 10a.

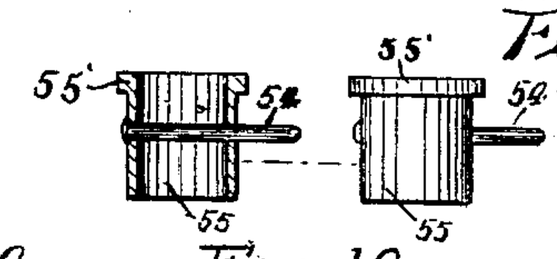

Fig. 10.

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NO MODEL. 6 SHEETS—SHEET 6.

Fig. 11.

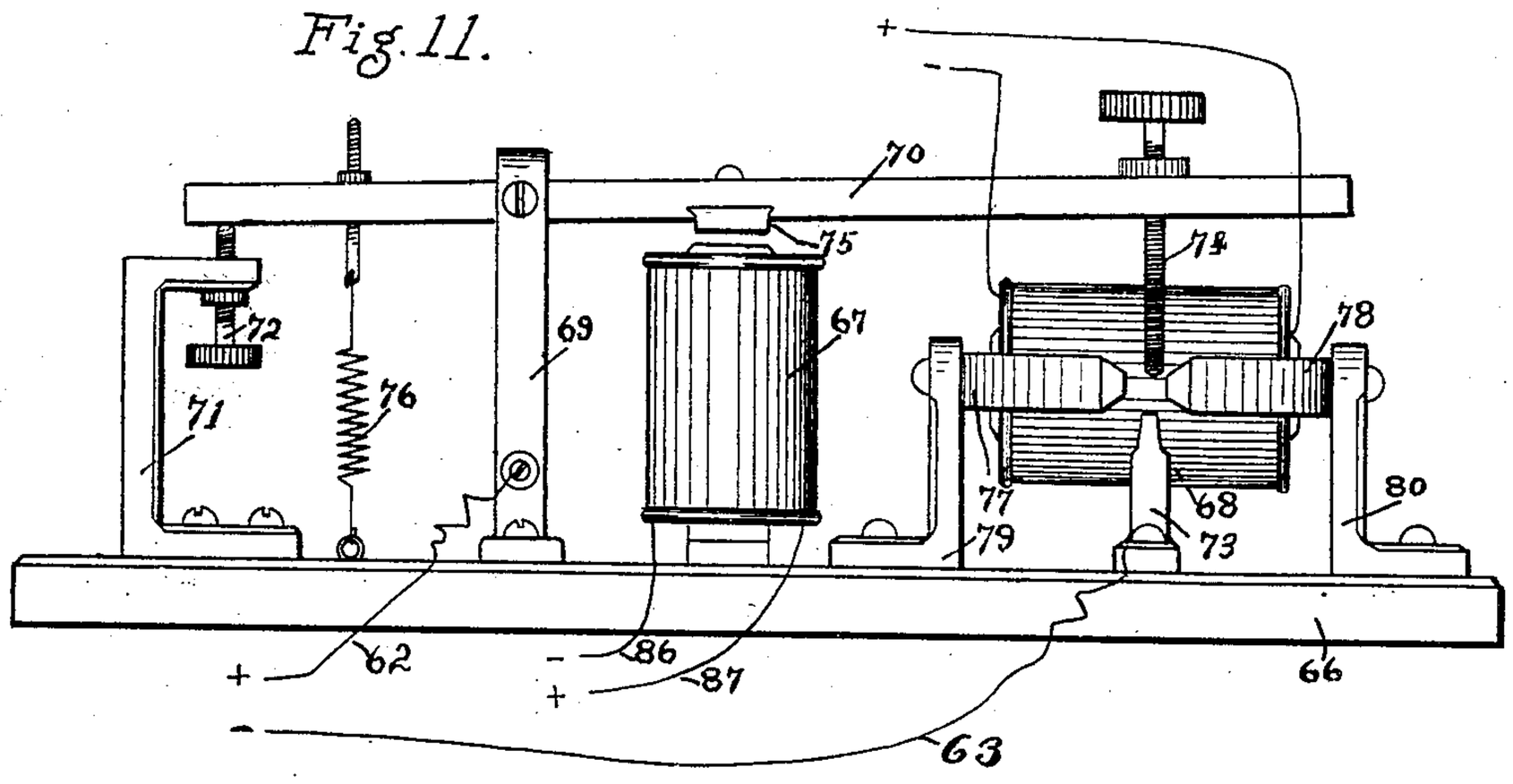
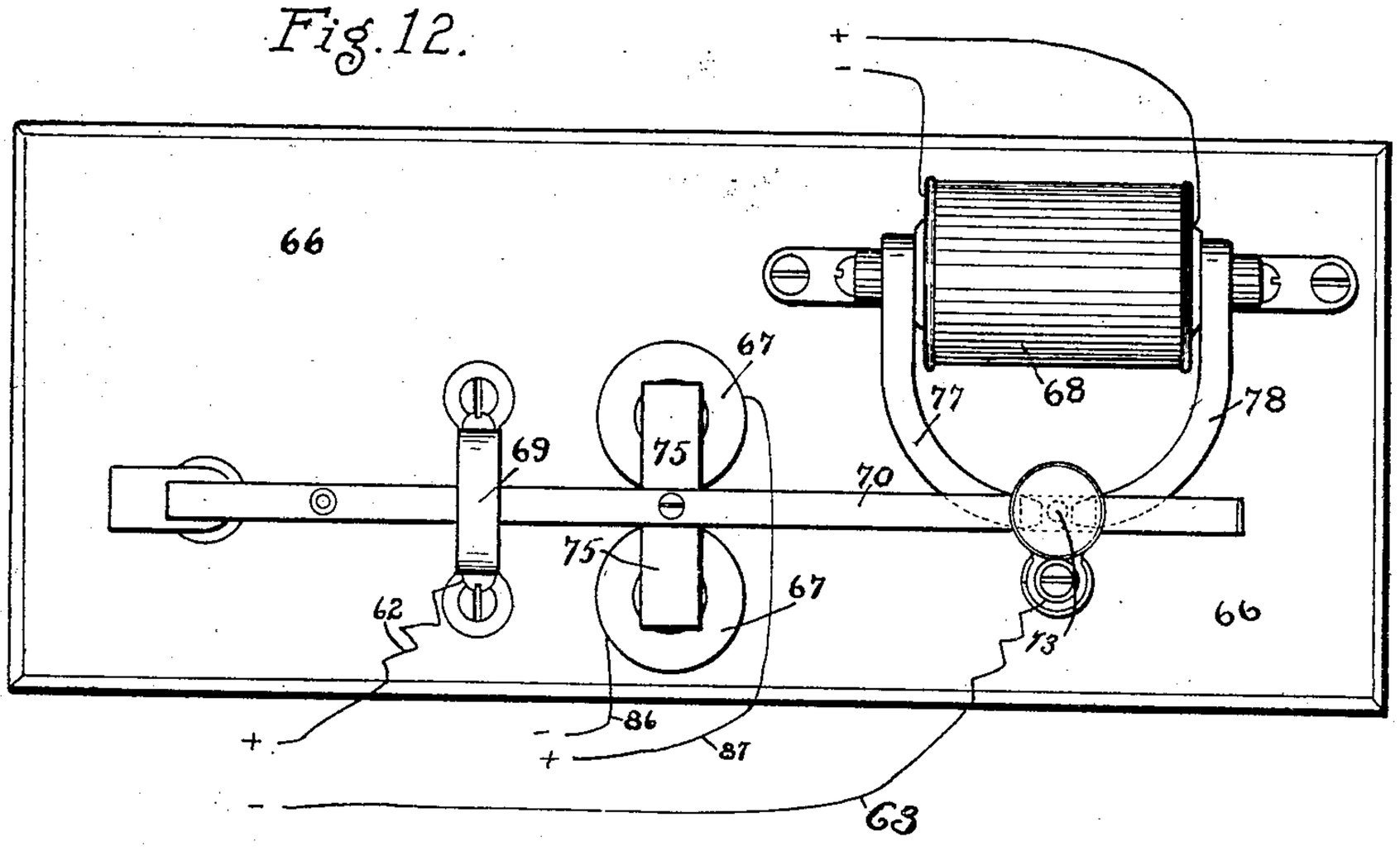


Fig. 12.



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UNITED STATES PATENT OFFICE.

ANDREW J. LEONARD, OF DENVER, COLORADO.

ELECTRIC KEY SELECTING AND STRIKING MECHANISM.

SPECIFICATION forming part of Letters Patent No. 762,644, dated June 14, 1904.

Application filed February 21, 1902. Serial No. 95,110. (No model.)

To all whom it may concern:

Be it known that I, ANDREW J. LEONARD, a citizen of the United States, residing at Denver, in the county of Arapahoe and State of Colorado, have invented certain new and useful Improvements in Electric Key Selecting and Striking Mechanism; 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.

The present invention relates to improvements in electrically-operated keyboard-machines, and has for its object the selection and striking of a particular key.

Another object is the attaining of the above result with a minimum number of magnets, the structure being such as to require only the effort of comparatively small magnets for the selecting operation and of but one large solenoid for accomplishing the striking of all the keys.

With these and other objects in view the invention consists in certain novel constructions, combinations, and arrangements of parts, as will be hereinafter fully described and claimed.

In the accompanying drawings, Figure 1 represents a view in side elevation of a device embodying the features of the present invention, the side wall of the solenoid-inclosing casing being cut away for better illustrating the parts. Fig. 2 represents a similar view of a slightly-modified form of the same. Fig. 3 represents a top plan view of the device as shown in Fig. 1. Fig. 4 represents a longitudinal vertical section through the key-choosing part of the invention on the plane of line 4 4 in Fig. 3. Fig. 5 represents an enlarged detail section through the connecting-rod, showing its cushioning-spring. Fig. 6 represents an enlarged detail fragmentary view of the auxiliary-circuit make and break. Fig. 7 represents a transverse vertical section on the plane of line 7 7 in Fig. 3. Fig. 8 represents an enlarged detail side elevation of one of the key-striking pins detached. Fig. 8ª represents an enlarged detail side elevation of one of the key-striking pins detached, showing the open slot. Fig. 9 represents a detail view in elevation of one of the cross-bars. Fig. 9ª represents a detail view, in top plan, of one of the cross-bars with its attachment for partially rotating a key-striking pin. Fig. 10 represents an enlarged detail sectional view of one of the striking-pin collars. Fig. 10ª represents a view in side elevation of one of the striking-pin collars. Figs. 11 and 12 represent, respectively, enlarged detail view, in side elevation, and a similar view, in top plan, of the solenoid-circuit make and break.

The accompanying drawings represent my improved key selecting and striking device as applied to an adding-machine—such, for instance, as is fully illustrated and described in Letters Patent No. 366,945; but it will readily appear that I may apply the same to any form of calculators, type-writers, linotypes, and similar keyboard-machines as desired.

Unless otherwise specified in the description which follows it will be understood that all parts of this machine are of metal, and consequently capable of carrying an electric current, and it will further be understood that parts not spoken of as being non-conductors or insulated from other parts to which they are attached or bear against are in metallic contact.

Mounted on top of the box-like base or inclosing casing 1, which is preferably of wood fiber or other non-conducting material, is the framework 2. On the under side of the top of this inclosing casing 1 is fixed the solenoid 3 and the make and break, spoken of generally as 4, of the solenoid-circuit.

At one end of the machine is a series of magnets 6, placed transversely, and at one side of the machine another series of magnets 7, placed longitudinally thereof. In the description which follows the magnets 6 at the end of the machine are referred to as "end" magnets, and those at the side of the machine are referred to as "side" magnets. The end magnets 6 and the side magnets 7 constitute the "key-choosing" or "key-selecting" magnets. It will be observed that the magnets are in pairs, commonly referred as "double" magnets. Hereinafter one pair will be spoken of as a "magnet."

As will be shown later, an electric current must be passing through one end magnet and one side magnet to complete the key selection. The current sent through an end magnet and

a side magnet may be from the same source of supply or may be separate currents.

In the series of end magnets 6 the number of magnets correspond to the rows of keys crosswise in the machine to which this improvement may be applied. The end magnets 6 are mounted beneath and secured to the bar 8, and this bar is insularly attached to the frame 2, it being insulated by the non-conducting strips 9.

On the shaft 10, which is secured transversely of the frame 2, are pivoted the armatures 11 for the end magnets 6, there being one armature for each magnet in the series. A strip 12, supported by the posts 13 and 14, holds the armatures 11 in their normal position. Each of the armatures 11 is provided with an arm 15, projecting downwardly therefrom and adapted to engage the notched end of one of the sliding levers 16, there being one sliding lever for each end magnet 6. These sliding levers 16 are slotted, as at 16′, so as to slide on the shaft 17, arranged parallel with shaft 10, beneath the same, whereby said levers 16 may be given a longitudinal thrust that will bring their free or movable ends into position to be engaged by a strip 18 at the end of the double arm 19, which I shall refer to as the "main" operating-arm, for it is through the medium of this arm that all the sliding levers 16 are moved laterally. The main operating-arm 19 is pivoted on the same shaft 17. Suitable springs 20, attached at their upper ends to a transversely-arranged bar 20′ and at their lower ends to the sliding levers 16, hold the same in their normal position, which is against the stop 21 and back from under the strip 18 on the main operating-arm 19.

Rotatably secured in the frame 2 is a transversely-arranged rock-shaft 22, provided with two side arms 23 and 24 and its middle arm 25, each rigidly secured thereto and extending longitudinally of the frame. The side arms 23 and 24 of the rock-shaft 22 are connected by the links 26 and 27, respectively, to the two sides of the main operating-arm 19. As will be apparent, downward movement of the free end of arm 25 will partially rotate rock-shaft 22, and the motion of the shaft 22 is transmitted through its side arms 23 and 24 to the links 26 and 27, thereby moving downwardly the two sides of the main operating-arm 19. This arrangement insures an equal travel of both sides of the main operating-arm, preventing binding, which is the chief purpose of the shaft 22, though another function of the said shaft is to operate the auxiliary-circuit make and break. Said make-and-break consists of arm 28, pivoted, as at 31, and formed with a laterally and downwardly projecting lug, as 28′, at its free end, formed with an arc-shaped slot, as 34′, therein, an insulator-piece 29, of hard rubber or wood fiber, and a contact-spring 30, fixedly attached to the frame 2, but insulated from the frame 2 by the non-conducting strip 33, as will be best seen by reference to Fig. 6. The arm 28 is insulated from the frame 2 at the point of its pivot 31 by a non-conducting washer 32. The insulator-piece 29 forms a portion of the bearing-surface designed to bear against the spring-contact 30 when the auxiliary circuit is broken between the arm 28 and the spring-contact 30.

A non-conducting pin 34, which forms the pivot connecting the link 26 and the side arm 23 of the shaft 22, projects into slot 34′, the length of said slot being such that when said shaft 22 is nearing the end of its downward stroke the pin 34 will engage the lower end of the slot, carrying the arm 28 down with it until metallic connection between the arm 28 and the contact-spring 30 is broken.

The middle arm 25 of the shaft 22 is pivoted to a connecting-rod 35, the lower end of which is pivoted to the lever 36, and the lever 36 is pivoted to the link 37 and to the armature 38 of the solenoid 3, said link 37 being pivoted to a suitable fulcrum 5.

From the foregoing it will be seen that any one of the series of sliding levers 16 in position to be engaged by the main operating-arm 19 would follow the movements of the main operating-arm 19 when it is actuated by the armature 38 of the solenoid 3 through connecting-rod 35. The main operating-arm 19 and the solenoid-armature 38 are returned to their normal position by the spring 39, attached at one end to lever 36 and at the other to the top of casing 1.

The series of side magnets 7 is made up of double magnets similar to the end magnets, and the number of magnets at the side of the machine correspond to the number of key-rows lengthwise in the machine which is to be operated. The side magnets 7 are mounted on the base-bar 41, which is insulated from the lower cross-pieces 42, supporting it by the non-conducting strips 43.

Two standards 44 support the shaft 45, on which is pivoted the series of armatures 46, there being one armature for each magnet in the series of side magnets. Each armature 46 is provided with an arm 47, projecting downwardly therefrom and adapted to engage in the fork 48ª of one of a series of sliding bars 48. The sliding bars 48 are slotted longitudinally and connected to the upper cross-bars 49 by the screws 50 passing through the slots. It will therefore be apparent that any movement of the armatures 46 will cause the sliding bars 48 to slide longitudinally on the screws 50. The series of sliding bars 48 and the armatures 46, adapted to operate them, are held in their normal position by the springs 51, the tension of which is controlled by the adjusting-screws 52 and the nuts 53.

The sliding bars 48 have a series of flaring apertures, as 48′, to receive suitable turning-pins 54. A number of collars, as 55, are ar-

ranged rotatably in apertures in each cross-bar 49, and each collar carries a vertically-slidable striking-pin 56, said pin being formed with an open slot in its upper end. The turning-pins 54 pass through the collars 55 and also through the open slot in the key-striking pins near the closed end thereof. There are as many of these key-striking pins 56 as there are keys in the machine to which this improvement may be applied. The collars 55 are provided with flanges 55′, which form a bearing on one side of the upper cross-bars 49, and the turning-pins 54 bear on the other side for retaining the collars against longitudinal movement. The upper cross-bars 49 are supported by suitable standards 57, which rest on the lower cross-bars 42.

The key-striking pins 56 are held in their normal position relative to levers 16 by the series of springs 51 acting through the arms 47, the sliding bars 48, the collars 55, and the turning-pins 54. When the key-striking pins 56 are in their normal position relative to levers 16, the two projections at their top serve as guides to keep their open slot in line with said levers. The key-striking pins 56 are held in their normal position vertically by the springs 58 pressing the closed end of their open slots against the turning-pins 54. It will be observed that the pins 56 are each cut away for one-quarter of each half, leaving diametrically opposite quarters projecting upwardly above shoulders, as 56′.

When the turning-pins 54 in any particular cross-row through the pull of the armature 46 actuating them give a partial turn to all the key-striking pins 56 in that cross-row, the shoulders 56′ on the key-striking pins 56 are brought under the sliding levers 16, which run lengthwise of the machine, so that any of the sliding levers 16 that may be given a downward pull will engage the shoulder of the key-striking pin 56 immediately under it.

The solenoid 3 consists of the spool formed by the tube 59, which may be of any non-magnetic metal or of wood fiber or hard rubber, fitted with non-conducting end pieces or insulators 60 and 61, this spool being wound with magnet-wire, as is well known, and having the terminals 62 and 63. The insulator 60 is set flush with one end of the tube 59 and has a larger diameter than the winding of wire on the spool, allowing space for the screws 64 with which the solenoid 3 is attached to the base 1. The tube 59 extends beyond the insulator 61, such extension serving as a guide for the armature 38. This extension is slotted to allow the pivot 65 to follow the movements of the solenoid-armature 38.

The electromotive force necessary to pass through the solenoid 3 to operate some of the machines to which my improvement may be applied makes when the circuit is broken a spark that will bridge across contact-points only slightly separated, preventing a complete stoppage of the current, and even if the current be stopped by making the distance between contact-points so great that the current will not jump there will be enough sparking to burn and injure the contact-points. The electric current would also cause a disagreeable shock to any one who might get a portion of their body in its circuit. For these reasons I provide an electrically-operated make-and-break for the solenoid-circuit, which obviates the necessity of making the machine a part of the circuit for the solenoid-current and admits the use of apparatus to blow out the electric spark.

The electrically-operated make-and-break, (best seen in Figs. 11 and 12) consists of the non-conducting base 66, on which are mounted magnets 67, a magnet 68, a U-shaped support 69, in which an armature-lever 70 is pivoted; a bracket 71 with an adjusting stop-screw 72 designed to limit the movement of armature-lever 70, and the contact-point 73, which being mounted on the non-conducting base 66 is normally out of contact with other metallic parts of the make-and-break. An adjusting-screw 74 is threaded through lever 70 and serves as a stop to the downward movement of the armature 75, as well as a means of electrical contact with the contact-point 73. The magnet 68 has its poles extended forming curved end pieces 77 and 78, approaching each other at a point near and above contact-point 73. In the description of connections to follow it will be made clear how an electric current passed through the magnets 67 pulls the lever 70 down until the adjusting-screw 74, passing between the ends of pieces 77 and 78, touches the contact-point 73, completing a circuit through the solenoid 3. When the current through the magnets 67 is broken, the lever 70 is returned by a spring 76 to its normal position and the magnetic flow between the curved end pieces 77 and 78 of the magnet 68 blows out the electric spark between the contact-points 73 and 74. The magnet 68 is preferably supported in position by non-magnetic standards 79 and 80, and said magnet may have an electric flux flowing through it constantly while the machine is in operation, or its electric flux may only be flowing while the current is flowing through the solenoid 3, for I find that if the current through the magnet 68 be broken at the same time that the solenoid-current is broken there remains enough magnetic flow between the end pieces 77 and 78 to effect a blowing out of the electric spark between the points 73 and 74, where the solenoid-circuit is made and broken. The circuit of this electrically-operated make-and-break is made through the machine, being completed by the armatures of both series of key-selecting magnets and broken by the auxiliary-circuit make and break through the movement of arm 28.

The solenoid-armature 38 in operation starts with a suddenness or jerk that is not desirable in a calculator. So to make the beginning of the stroke as transmitted to the calculator-keys less sudden or with less of a hammer-like blow the spring 81 is put in any suitable housing 81′ for connecting the two parts of the connecting-rod 35.

It having been shown that the series of sliding levers 16 may be engaged so as to be actuated by the armature 38 of the solenoid 3 and that the key-striking pins 56 may be put in position to be actuated by the sliding levers 16, I will now explain how the electrical circuit which operates to strike a key that has been selected is made by the key-selecting magnets through the armatures thereof when they have completed the selection of a key and also how the circuit is broken when the key has been struck.

Referring to the series of end magnets 6, in the center of the core ends of these magnets are small studs 82, of non-magnetic metal, preferably copper or brass. The purpose of these studs 82 is to keep the armatures 11 out of magnetic contact with the soft-iron magnet-cores, preventing "sticking," and also to make metallic contact with the base-bar 8, which, it will be recalled, is insulated from the frame 2. The object of making metallic contact between the magnet base-bar 8 and the frame 2 through the apertures will appear later.

The side-magnets 7 core ends are fitted with similar studs 83 for similar purposes—*i. e.*, to keep the armatures 46 out of magnetic contact with the magnet-cores and at the same time to establish metallic contact between the magnet base-bar 41 and the other parts of the machine.

It will now be apparent that when an end-magnet armature is in contact with the stud which acts as its stop the bar is in metallic contact with the framework of machine and the bar on which the side magnets are mounted is likewise put in metallic contact with the frame by one of the side-magnet armatures coming in contact with its stopping-stud.

The base-bar 8 of the end magnets 6 and the base-bar 41 of the side magnets 7 both being in metallic contact with the frame 2 are in metallic contact with each other, and consequently may form part of an electric circuit.

The end-magnet base-bar 8 is connected by the wire 84 to one side of an electric battery or other source of electric supply. The side-magnet base-bar 41 is connected by the wire 85 to the movable arm 28 of the auxiliary-circuit make and break. The spring-contact 30 of the auxiliary-circuit make and break is connected by the wire 86 to one side of magnet 67, the other side thereof being connected by the wire 87 to the side of the battery opposite that to which the wire 84 is connected.

An electric current passed through any one of the end magnets and a current passed through any one of the side magnets 7 will bring their respective armatures against the studs 82 and 83 and complete a circuit through magnet 67, the current passing from the source of supply through wire 84, bar 8, one of studs 82 and its core, the operated armature 11, through the framework, the operated armature 46, its corresponding stud 83 and core, through base-bar 41, wire 85, arm 28, spring 30, wire 86, magnetic coil 67, and wire 87 back to negative pole of the source of supply, thus closing the solenoid-circuit, causing the upward movement of the inner end of lever 36, thereby pulling down rod 35, rotating rock-shaft 22, causing strip 18 to engage the selected lever 16 for operating the particular pin 56, the arm 28 moving downwardly with pivot 34 until the contact between it and spring 30 is broken, whereby the magnet 67 will release armature-lever 70 and the solenoid-circuit will be broken, the springs 39, 20, and 51 causing the parts to automatically reassume their normal position.

It will be apparent that the side magnets will be provided with suitable wiring, such as is indicated in Fig. 1, and the end magnets similarly wired, as seen in Fig. 3, in each instance a common return-wire being employed. It will further be seen that any suitable switch-board may be employed for effecting the completion of a circuit through one of the end magnets and a circuit through a side magnet, and when these two circuits have been closed the remainder of the operation will be automatic, as above described.

In Fig. 2 I have illustrated a slight modification of the present improvement, the operating-solenoid being arranged above instead of below the key selecting and striking mechanism, and although I have specifically set forth one particular embodiment of the present invention, yet it will be understood that I contemplate making such alterations in the minor details of structure as are fully comprehended within the spirit and scope of the invention.

Having thus fully described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. In a mechanism of the class described, the combination with a suitable framework, of key-striking pins rotatably mounted and longitudinally movable therein, and electrical means for operating the same, substantially as described.

2. In a mechanism of the class described, the combination with a framework, of key-striking pins rotatably arranged therein and adapted to be moved out of their normal horizontal plane, electric means for selecting a pin to be operated, and means for operating said pin, substantially as described.

3. In a mechanism of the class described,

the combination with a framework, of rotatably-mounted and bodily longitudinally movable key-striking pins arranged therein, electric means for striking a pin to be operated by rotation of the same, and means for operating said pin, substantially as described.

4. In a mechanism of the class described, the combination with a framework, of key-striking pins arranged therein, a series of electromagnets arranged in said framework, selecting means for said pins controlled by said magnets, electric means for operating a pin selected, and means controlled by each of said magnets for closing the circuit of said controlling means through its core, substantially as described.

5. In a mechanism of the class described, the combination with a suitable framework, of longitudinally-movable key-striking pins rotatably mounted therein, electric means for rotating said pins for selecting one to be operated, and electrically-actuated means for shifting said pin longitudinally, substantially as described.

6. In a mechanism of the class described, the combination with a framework, of an electromagnet mounted therein, a series of axially and otherwise bodily movable key-striking pins arranged in said framework, a pivoted armature for said magnet, means controlled by said armature for moving said pins to an operative position, and means for operating one of said pins when in such position, substantially as described.

7. In a mechanism of the class described, the combination with a framework, of a series of electromagnets arranged therein, a second series of magnets also arranged therein, key-striking pins rotatably mounted in the framework, means controlled by said magnets for rotating said pins for selecting a particular pin to be operated, electrically-controlled means for operating said pin, and means for automatically closing the circuit of said electrically-controlled means, substantially as described.

8. In a mechanism of the class described, the combination with a suitable framework, of key-striking pins mounted therein, and provided with open longitudinal slots, levers pivotally supported and extending through the slots of the respective series, a portion of the upper end of each of said pins being broken away, whereby diametrically opposite shoulders are formed, means for rotating said pins for bringing their shoulders beneath their respective levers, and means for moving said levers for operating said pins, substantially as described.

9. In a mechanism of the class described, the combination with a suitable framework, of an electromagnet arranged therein, said magnet being provided with a pivoted armature, rotatably-mounted key-striking pins arranged in said framework, means for rotating a particular pin into position for operation, a lever designed to operate the pin so positioned, means for moving said lever for operating said pin when the lever is in a given position, and means carried by said armature for moving said lever into operative position, substantially as described.

10. In a mechanism of the class described, the combination with a suitable framework, of a series of pins arranged therein, laterally-arranged magnets, means controlled by said magnets for moving said pins into operative position, longitudinally-movable levers normally out of operative position, transversely-arranged magnets, means carried thereby for moving said levers into operative position relative to said key-striking pins, and means for operating said levers, substantially as described.

11. In a mechanism of the class described, the combination with a framework, of key-striking pins arranged therein, a series of electromagnets for selecting a particular pin to be operated, common operating means for all of said pins, a solenoid for actuating said operating means, an independent magnet, and means governed thereby for closing the solenoid-circuit, substantially as described.

12. In a mechanism of the class described, the combination with a suitable framework, of key-striking pins arranged in said framework, means for adjusting a particular pin into position for operation, a longitudinally-movable lever for operating said pins, electric means for shifting said lever longitudinally for bringing the same into operative position, and means for moving said lever for operating the pin selected, substantially as described.

13. In a mechanism of the class described, the combination with a suitable framework, of key-striking pins arranged therein, an operating-lever for said pins, means for positioning the pin into operative position relative to said lever, means for shifting said lever longitudinally into operative position and means for moving said lever into contact with said pin for actuating the same, substantially as described.

14. In a mechanism of the class described, the combination with a suitable framework, of key-striking pins arranged therein, pin-selecting means, means for operating the pin selected, a solenoid actuating said operating means, means controlled by said key-selecting means for closing the circuit of said solenoid, and means carried by said operating means for controlling the breaking of the said solenoid-circuit, substantially as described.

15. In a mechanism of the class described, the combination with a suitable framework, of key-striking pins arranged therein, electromagnets mounted in said framework designed to select a particular key to be struck, means for operating the selected key, a solenoid for actuating said operating means, an electro-

magnet designed to close the solenoid-circuit, means for closing the circuit of said last-mentioned magnet through the cores of the key-selecting magnets, and means operated by said solenoid for breaking said last-mentioned circuit, whereby the solenoid-circuit will be broken, substantially as described.

16. In a mechanism of the class described, the combination with a suitable framework, of a cross-bar arranged therein, of collars mounted in said cross-bar, a pin carried by each of said collars projecting beyond said cross-bar, a sliding bar engaging said pins, a key-striking pin longitudinally movable through each of said collars, each of said collar-carried pins passing transversely through its respective key-striking pin, whereby rotation of each of said collars is designed to rotate its particular pin, electric means for moving said sliding bar for rotating said collars, whereby said key-striking pins will be rotated, levers designed to operate said key-striking pins when in a given position, and electric means for moving each of said levers into operative position, substantially as described.

17. In a mechanism of the class described, the combination with a suitable framework, of rotatably-mounted key-striking pins arranged therein, levers pivotally mounted above said pins, means for rotating one of said pins, means for shifting one of said levers into operative position relative to the rotated pin, and means for moving said last-mentioned lever for actuating said last-mentioned pin, substantially as described.

18. In a mechanism of the class described, the combination with a suitable framework, of key-striking pins arranged therein, longitudinally-movable levers arranged in said framework, designed to engage said pins when in a given position, means for moving said pins to such position, means for moving each of said levers longitudinally, means for operating said levers for actuating said key-striking pins when said levers are at the limit of their longitudinal movement in one direction, and means for returning the parts to their normal position after each operation, substantially as described.

19. In a mechanism of the class described, the combination with a suitable framework, of rotatably-mounted, longitudinally-movable key-striking pins arranged therein, a lever pivotally mounted above said pins, means for shifting one of said pins into operative position relative to the said lever, and means for moving said lever into contact with the end of said pin for operating the same, substantially as described.

20. In a mechanism of the class described, the combination with a suitable framework, of key-striking pins mounted therein, means for selecting a particular pin to be operated, a lever for operating the pin selected, arms for operating said lever, a rock-shaft mounted in said framework and pivotally connected with said operating-arms, and electric means for rotating said rock-shaft, substantially as described.

21. In a mechanism of the class described, the combination with a suitable framework, of key-striking pins mounted therein, means for selecting a particular key to be operated, levers designed to operate said pins, selecting means for said levers, pivotally-supported arms designed to operate the lever selected, a rock-shaft mounted in said framework, a plurality of arms projecting laterally therefrom and pivoted to said operating-arms, a solenoid, an arm carried by said rock-shaft, and connections between the solenoid and said last-mentioned arm, whereby operation of said solenoid is designed to rotate said rock-shaft, substantially as described.

22. In a mechanism of the class described, the combination with a suitable framework, of key-striking pins arranged therein, operating-levers arranged in said framework, means for moving said pins into operative position relative to said levers, means for actuating said levers for operating said pins when in a given position relative to each other, and electrically-operated means for shifting said levers into operative position, substantially as described.

23. In a mechanism of the class described, the combination with a suitable framework, of key-striking pins arranged therein, selecting means therefor, means for operating said pins, a rock-shaft mounted in said framework, electric means for rotating said rock-shaft, means for communicating motion from said rock-shaft to said key-operating means, and means controlled by said rock-shaft for making and breaking the circuit of said electric means, substantially as described.

24. In a mechanism of the class described, the combination with a framework, of key-striking pins arranged therein, a series of electromagnets for selecting a pin to be operated, operating means for said pins, a solenoid for actuating said operating means, an independent magnet, and an armature therefor designed to close the circuit of said solenoid when under the influence of the magnetic flux of the independent magnet, substantially as described.

25. In a mechanism of the class described, the combination with a suitable framework, of key-striking pins mounted therein, and provided with open longitudinal slots, levers pivotally supported and extending through the slots of the respective series, a portion of the upper end of each of said pins being broken away, whereby diametrically opposite shoulders are formed, electric means for rotating said pins for bringing their shoulders beneath their respective levers, and means for moving said levers for operating said pins, substantially as described.

26. In a mechanism of the class described, the combination with a framework, of key-striking pins rotatably mounted therein, electromagnets arranged in said framework for positioning a particular pin to be operated by rotation thereof, and mechanism for actuating said pin after such positioning, substantially as described.

27. In a mechanism of the class described, the combination with a suitable framework, of key-striking pins arranged therein, selecting means therefor, longitudinally-movable and pivotally-mounted levers arranged in said framework, means for moving said levers longitudinally, and means for swinging said levers upon their pivots for actuating the key-striking pins, substantially as described.

28. In a mechanism of the class described, the combination with a suitable framework, of key-striking pins arranged therein, means for adjusting a particular pin in position for operation, a lever designed to strike the same, a rock-shaft arranged in said framework, electric means for rotating said rock-shaft, means carried by said rock-shaft for operating said lever, and a make and break for the circuit of said rock-shaft-rotating means controlled by the rock-shaft, substantially as described.

29. In a mechanism of the class described, the combination with a suitable framework, of key-striking pins mounted therein, means for selecting a particular pin to be operated, devices for operating the pin selected, an arm for actuating said pin-operating devices, a rock-shaft mounted in said framework and carrying said arm, a solenoid, and connections between the solenoid and rock-shaft for effecting the rotation of the latter, substantially as described.

30. In a mechanism of the class described, the combination with a suitable framework, of key-striking pins mounted therein, selecting means therefor, slotted levers arranged in said framework, means pivotally supporting said levers and engaging the slots thereof for leaving the same free to move longitudinally, means for shifting said levers longitudinally for positioning the same in operative relation to said key-striking pins, and mechanism for swinging the said levers upon their pivots, substantially as described.

31. In a mechanism of the class described, the combination with a suitable framework, of key-striking pins arranged in said framework, pin-selecting means, a longitudinally-movable bar for operating the pins as they are selected, means for shifting said bar into operative position, and electric means for actuating said lever for moving the pin selected, substantially as described.

32. In a mechanism of the class described, the combination with a suitable framework, of an electromagnet therein, a series of rotatable and bodily-movable key-striking pins arranged in the framework, means controlled by said magnet for rotating said pins into operative position, and means for operating said pins when so positioned, substantially as described.

33. In a mechanism of the class described, the combination with a suitable framework, of an electromagnet mounted therein, rotatably-mounted, bodily-movable, key-striking pins arranged in said framework, means actuated by said magnet for moving said pins into operative position, and means for operating the pins when so positioned, substantially as described.

34. In a mechanism of the class described, the combination with a suitable framework, of axially-movable key-striking pins mounted therein, pin-selecting magnets in said framework, common operating means for all of said pins, and a solenoid for actuating said operating means, substantially as described.

35. In a mechanism of the class described, the combination with a framework, of axially-movable, vertically-arranged key-striking pins, and electric means for moving said pins longitudinally within the vertical plane thereof for effecting the striking operation, substantially as described.

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

ANDREW J. LEONARD.

Witnesses:

GEORGE S. CLASON,

W. B. BURTIS.