No. 898,218. PATENTED SEPT. 8, 1908.

A. L. HART.

ELECTRICAL PIANO PLAYING INSTRUMENT.

APPLICATION FILED NOV. 29, 1902.

6 SHEETS—SHEET 1.

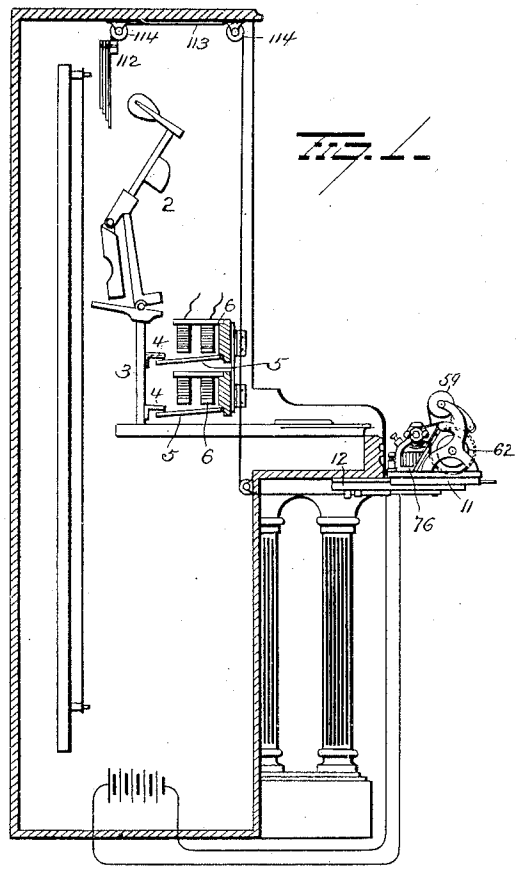

FIG. 1.

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6 SHEETS—SHEET 2.

Fig. 2.

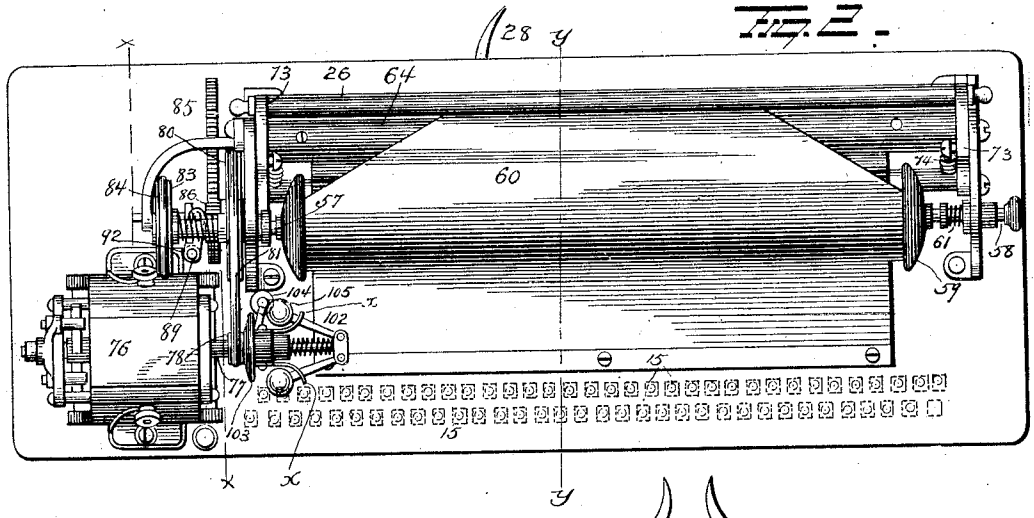


Fig. 5.

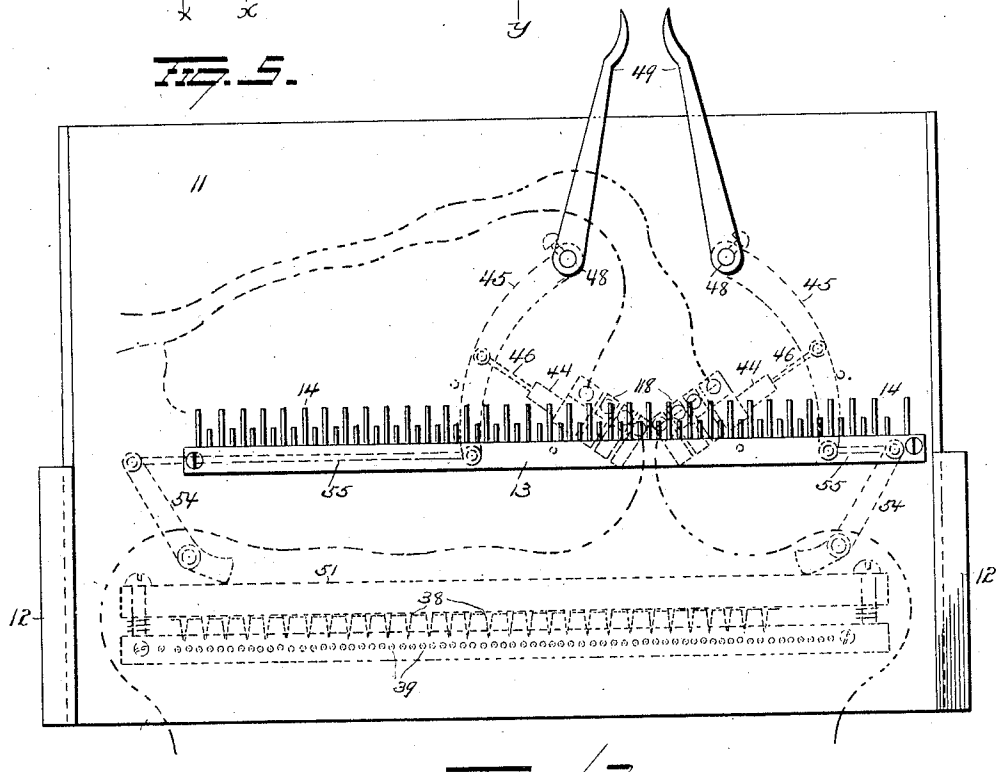
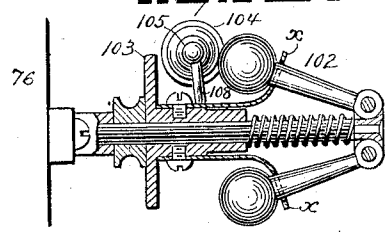


Fig. 12.



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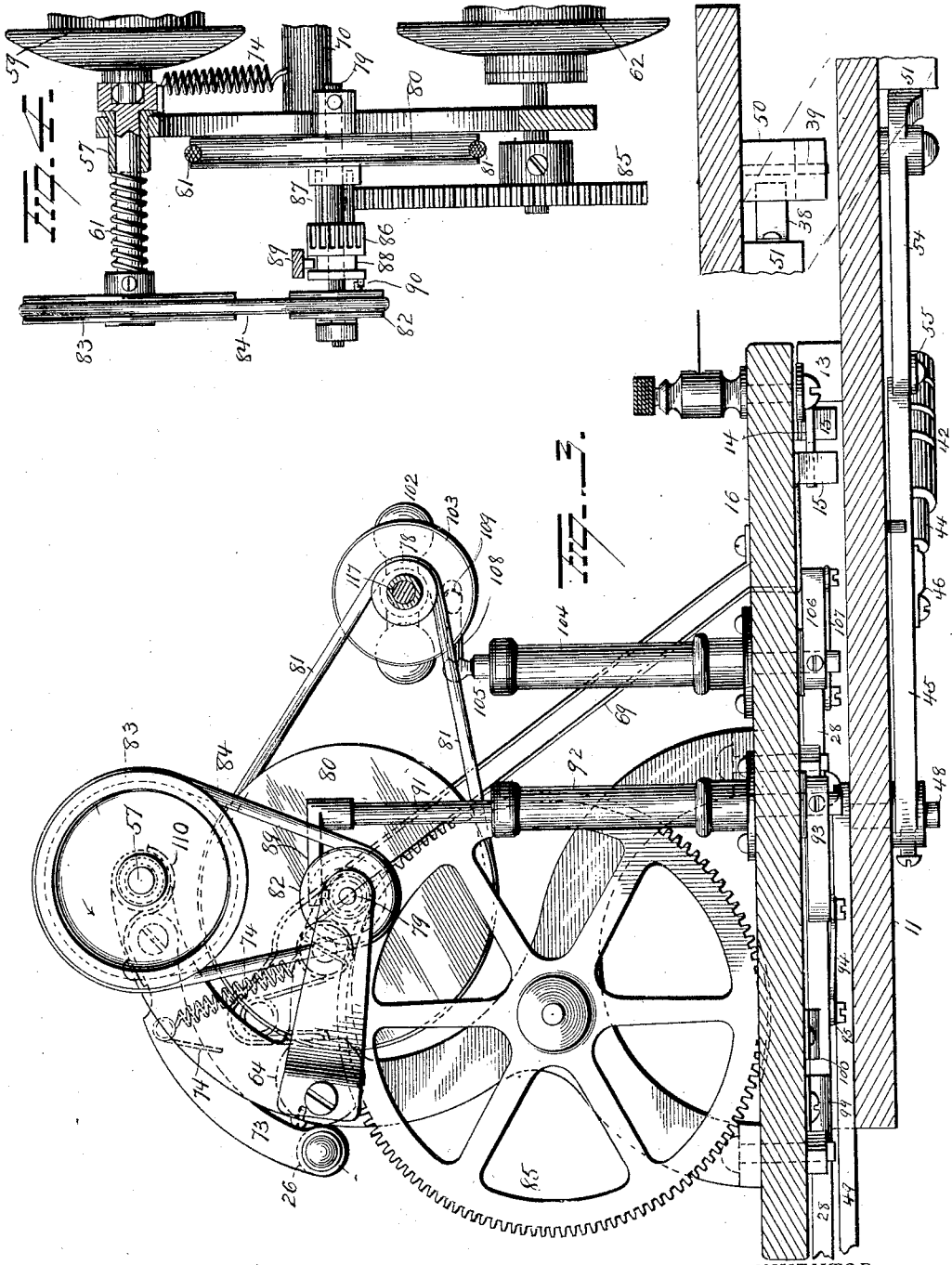
6 SHEETS—SHEET 3.



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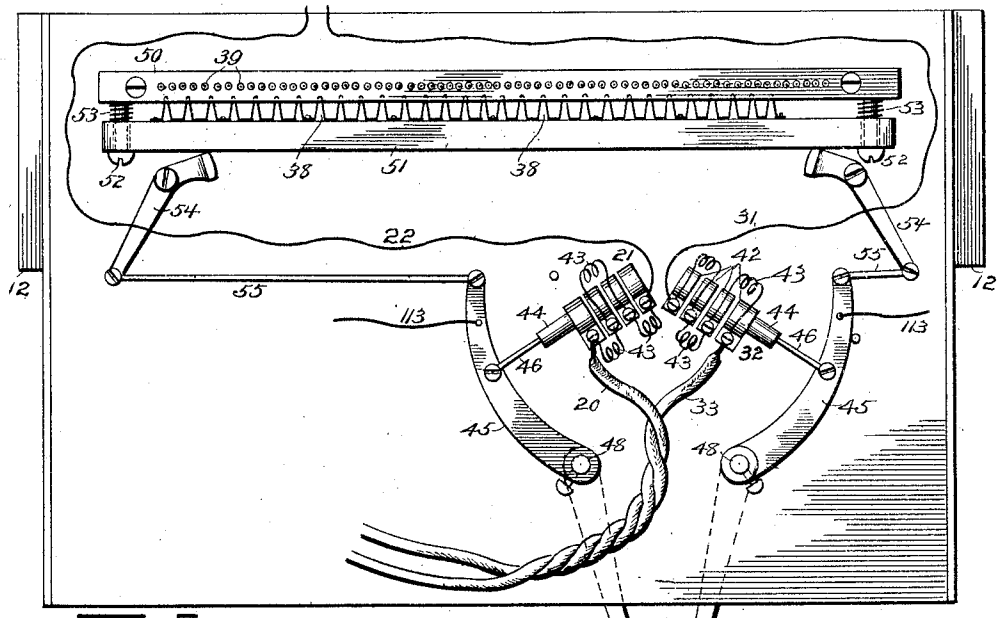


Fig. 6.

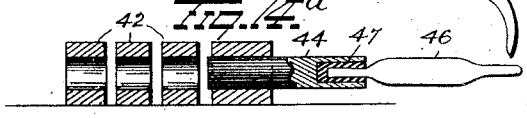
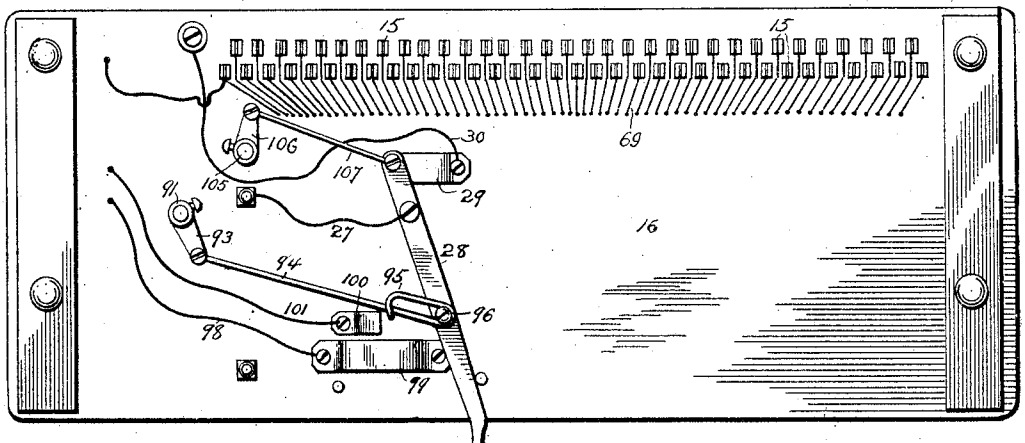


Fig. 14a.

Fig. 7.



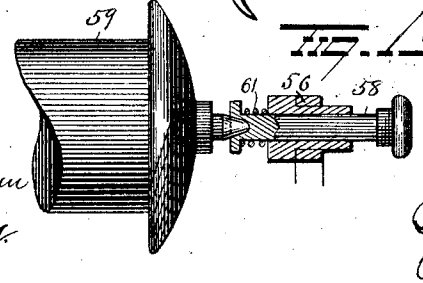


Fig. 13.

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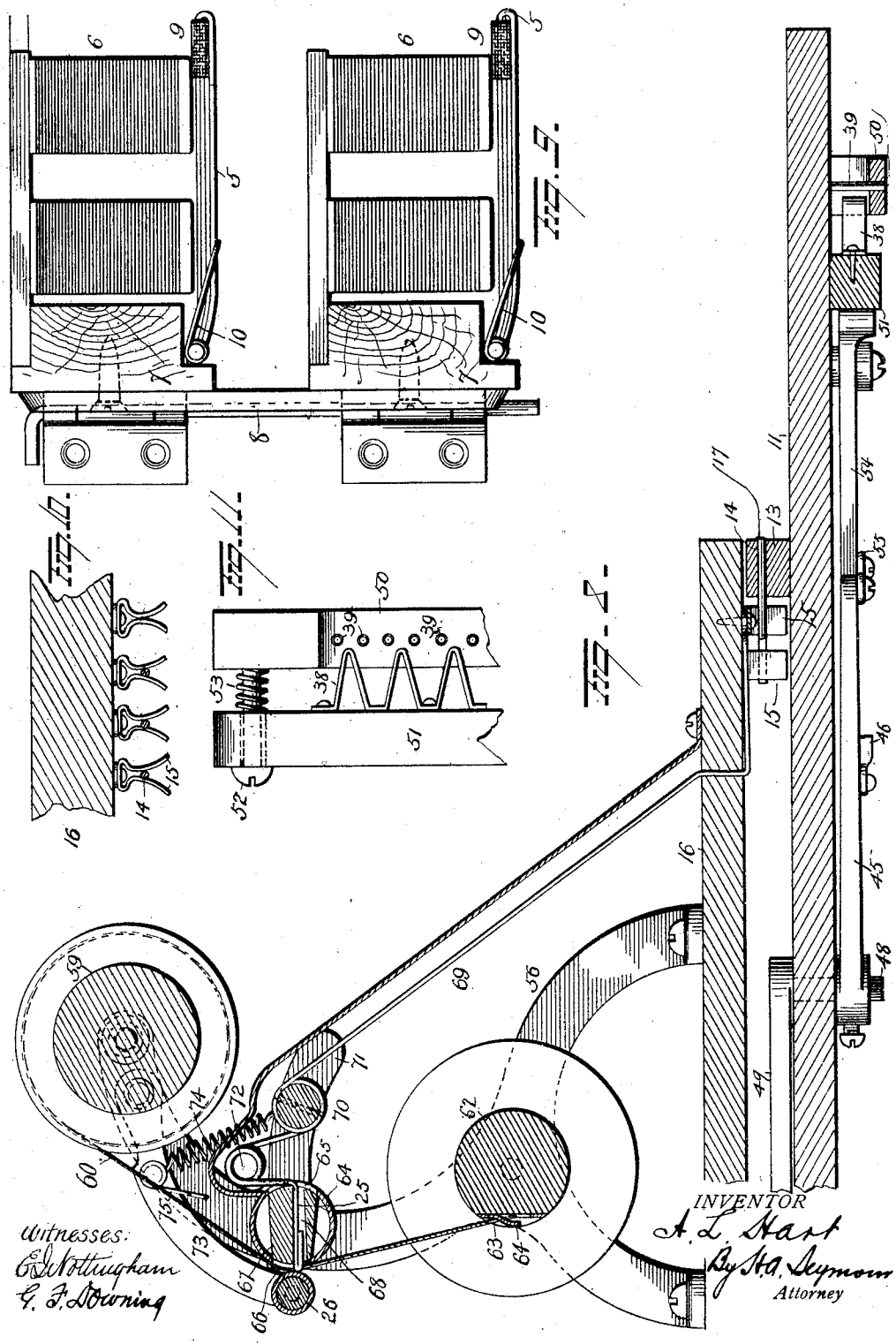
6 SHEETS—SHEET 5.



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6 SHEETS—SHEET 6.

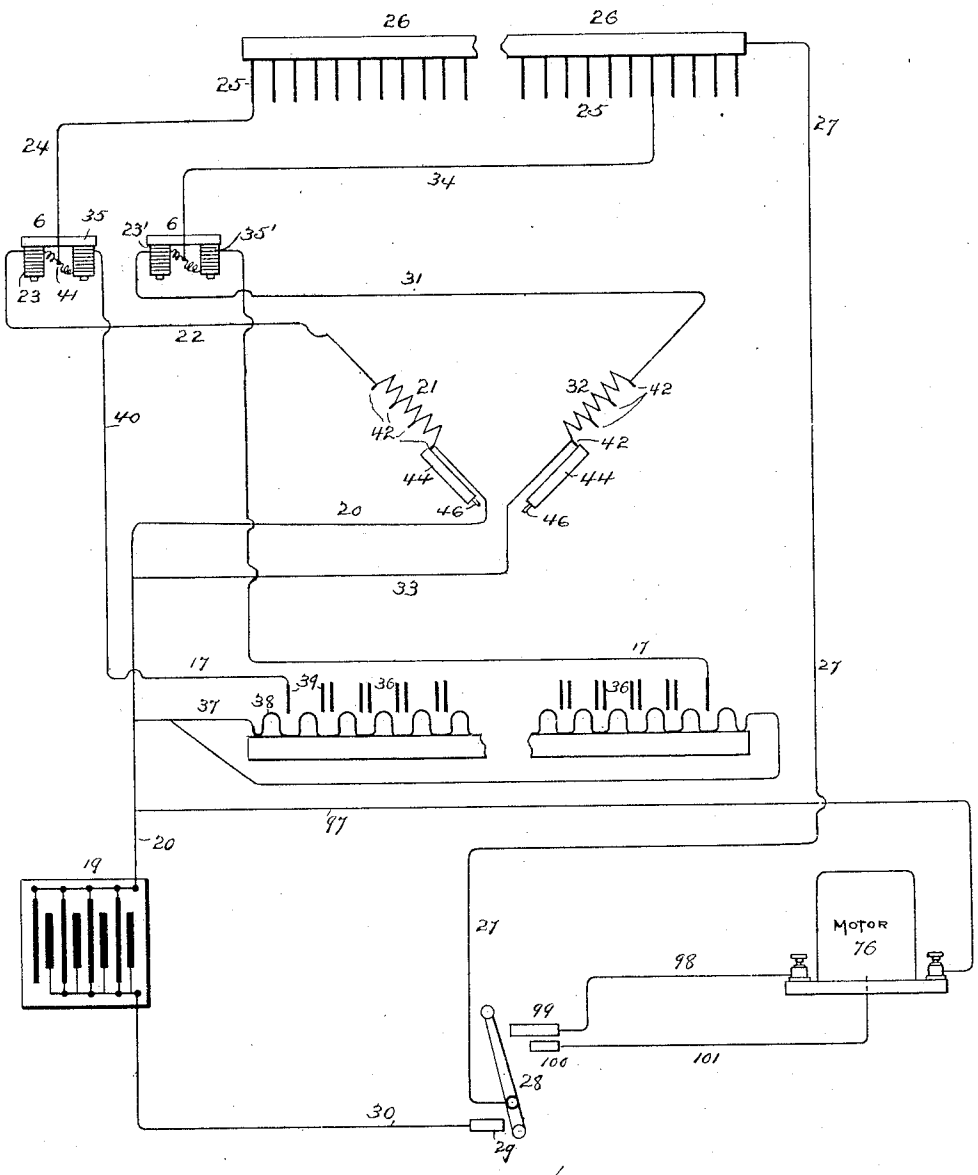

FIG. 4.

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UNITED STATES PATENT OFFICE.

ALVAN L. HART, OF BURLINGTON, IOWA.

ELECTRICAL PIANO-PLAYING INSTRUMENT.

No. 898,218. Specification of Letters Patent. Patented Sept. 8, 1908.

Application filed November 29, 1902. Serial No. 133,250.

To all whom it may concern:

Be it known that I, ALVAN L. HART, of Burlington, in the county of Des Moines and State of Iowa, have invented certain new and useful Improvements in Electrical Piano-Playing Instruments; 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 electrical piano playing instruments and more particularly to such as are actuated and controlled by means of electrical devices, and the invention consists in certain novel features of construction and combinations of parts as hereinafter set forth and pointed out in the claims.

In the accompanying drawings, Figure 1 is a view showing the application of my invention to a piano. Fig. 2 is a plan view of the controlling or make and break mechanism. Fig. 3 is an enlarged sectional view on the line *x*—*x* of Fig. 2. Fig. 4 is an enlarged detail view of portions of the gearing. Fig. 5 is a plan view of the shelf on which the apparatus shown in Fig. 2 is located, and showing portions of the connecting and controlling devices attached thereto. Fig. 6 is a bottom plan view of the shelf shown in Fig. 5 and devices attached thereto. Fig. 7 is a bottom plan view of the base of the apparatus shown in Fig. 2 and illustrating certain switch and connecting devices attached thereto. Fig. 8 is a sectional view on the line *y*—*y* of Fig. 2. Fig. 9 is a detail view showing the arrangement of magnetic devices which actuate the piano actions. Fig. 10 is a detail view illustrating the electrical connections between the terminals on the make and break controlling apparatus and the terminals on the shaft. Fig. 11 is an enlarged detail view of a switch device for closing circuits through certain of the magnets. Fig. 12 is a detail sectional view showing the speed governor. Fig. 13 is an enlarged detail view, partly in section of one of the supports for the roll on which the perforated music sheet is wound. Fig. 14 is a diagrammatical view illustrating the circuits. Fig. 14[a] is an enlarged sectional view through one part of the rheostat.

1 represents an upright piano casing and 2 one of the actions therein, the depending arm 3 of which has secured thereto a bracket 4 to be engaged by the armature lever 5 of an electro-magnet 6. The magnets 6 are arranged in two rows as shown in Figs. 1 and 9 to permit the placing of a suitable number within the casing of any upright piano, the number of magnets corresponding to the number of actions in the piano. The magnets of each row are secured to a strip 7, preferably of wood, and the two strips 7 are connected by bars 8. The bars 8 are hinged to the respective ends of the piano casing, the pin of the hinge at one end of the piano being removable to permit ready insertion of the magnets and their supporting strips into the piano casing. Each armature lever 5 is pivotally supported at one end and provided at its free end with a pad 9, which is held normally in contact with the under face of the bracket 4 on one of the piano actions by means of a spring 10. When the hammer of the action is in its position of rest as shown in Fig. 1, the arm 3 will be in its lowest position and will hold the armature lever depressed a short distance from the poles of the magnet, against the resistance offered by the spring 10, said spring acting to maintain the contact between the pay on the armature lever and the bracket 4 on the action constant. Each magnet comprises two cores and the helices are so wound that the corresponding ends of the two cores will be of opposite polarity.

The arrangement of the electrical circuits through the helices of the magnet is such that the energy in the action of the magnet on the armature lever can be regulated to actuate the piano action with greater or less force as may be desired to bring out the expression of the music being played. The respective helices of each magnet are therefore arranged in parallel, the branch including one helix being closed when the perforated paper roll passing through the make and break apparatus hereinafter described, permits the closing of the circuit, and the helix in the other multiple arc branch being normally open, this branch to be closed by the manipulation of a switch device hereinafter described, when greater power is desired to throw the hammer with greater force for the purpose above stated.

The mechanism which controls the making and breaking of the action of the magnets through the medium of a perforated sheet and for moving said sheet through the make and break devices, is located upon a shelf 11 mounted to slide in guides 12 secured to the piano casing under the key board, at one end

of the latter. The said make and break actuating and controlling mechanism is built into a structure entirely separate from the piano casing and is also removable from the shelf 11, so that when not in use, it can be removed from said shelf and placed upon the top of the piano or in any other desired place. It is of course necessary to make electrical connections between the contact devices of the make and break mechanism, and the magnets, when the controlling mechanism is placed upon the shelf. I have provided means for making all of these electrical connections automatically when the controlling mechanism is placed on the shelf. To this end, a strip 13 preferably of wood, is secured upon the shelf 11 and serves as a support for two series of tubular pins 14, the pins of one series being shorter than and alternating with the pins of the other series. The tubular pins 14 extend transversely through the strip 13 and project laterally from one side thereof, in position to be engaged by contact springs 15 secured to the bottom of the base 16 on which the make-and-break mechanism is located. Each pair of contact springs 16 is electrically connected with one of the contact wires or fingers of the make and break mechanism and each tubular pin 14 is connected, by a wire 17 with a terminal of one of the magnet helices, the end of the wire 17 being inserted into one of the tubular pins to make the necessary electrical connection. Thus it will be seen that when the make-and-break controlling mechanism is placed upon the shelf 11 the electrical connections between the contact wires or fingers of said mechanism and the contact pins on the shaft will all be automatically made simultaneously. Each wire 17 connected with a pin 14 represents one terminal of one magnet helix of each pair, the other terminal of said helix being connected, through the resistance with one terminal of the battery 19. The piano actions may be considered as divided into two parts, viz. the treble and the bass and the electro-magnetic devices may be considered as divided in the same way. Thus, one half of the series of magnets, actuated one half of the actions and the other half of the series of magnets actuated the other half of the actions. The reason of such division is to enable a portion of the actions to be operated more energetically than other portions, in order to give expression to the music.

Referring to the diagram Fig. 14, the circuit may be traced through one magnet helix as follows: from one terminal of the battery 19, by conductor 20 to the rheostat 21; from the latter, by the conductor 22 to the magnet helix 23; from the other terminal of this helix, by wire 24 to a contact wire or finger 25 of the make and break mechanism; then to the bar 26 of said mechanism; from said bar, by a conductor 27 to a switch lever 28 pivoted to the under face of the base of said mechanism, then to contact plate 29 with which said switch lever engages, and then by wire 30 to the battery. One half of the series of helices 23 are connected with the wire 22. The other half of the series of said helices, 23′, are connected with a wire 31 which constitutes part of a parallel circuit, including the rheostat 32 and half of the contact fingers 25 of the make and break mechanism. This parallel circuit may be readily traced as follows:—by conductor 33 from conductor 20 to part 32 of the rheostat; then by conductor 31 to one terminal of the helix 23^1; from the other terminal of said helix to half of the contact fingers 25 of the make and break mechanisms, by the conductor 34, and then from the bar 26 through to the battery by the conductors 27—30 and the switch. It will be observed that the helices 23 are included in circuit with half the contact fingers 25 and one rheostat 21 and the helices 23^1 are included in circuit with the other half of contact fingers 27 and the other rheostat 32. Thus by operating one rheostat, the current which energizes the cores in one set of helices can be varied and these magnets made to act more or less energetically than the others to cause the piano actions which these magnets operate, to play louder or softer according to the adjustment of the rheostat. By these means therefore, the extent or degree of operation of the treble and bass actions can be regulated and controlled separately.

It has been hereinbefore stated that the respective helices of each magnet are arranged in parallel circuit, one branch of which includes a switch device which can be operated to close this branch and increase the energy of the magnet when more volume of sound is desired. Referring again to the diagram Fig. 14, it will be observed that the helix 35 shown at the extreme left of the diagram, is included in a circuit which is in parallel with the circuit which includes the helix 23. The parallel circuit which includes the helix 35 is maintained normally open by a switch device indicated at 36, and can be readily traced as follows: from the wire 20, by conductor 37 to contact finger 38 of the switch, to contact pin 39 of the switch and from said pin, to one terminal of the helix 35 by a conductor 40, and then from the other terminal 41 of said helix, to the make and break devices, by means of the conductor 24. It is clear that when the resistance of the rheostat is entirely removed from the circuit of helix 23 and the circuit of the helix 35 is closed by the switch 36, the magnet constituted by the two helices 23 and 35 and their cores, will be energized to the maximum extent and that its action on the armature lever will be such as to cause the operation of the piano action to be operated with maximum force, with resulting large volume of sound.

The helices 35 are divided between the treble and bass keys, the same as above described in connection with the helices 23; one half of the series of helices 35 being included in circuit with one half of the contact fingers of the make-and-break fingers and part of the switch device 36, and the other half of said series of helices, 35^1, being included in a parallel circuit including the said switch and the other half of the series of contact fingers. Thus the circuit of a portion of the helices 35, 35^1 can be closed without closing the others, when it is desired to increase the sound of certain notes without affecting the others.

With the devices thus far described, the greatest volume of sound will be had when the resistance of the rheostat has been all removed and the switch 36 is closed, and the softest tone will be had when the resistance is all in circuit and the switch 36 is open.

It may be well at this point to describe the mechanical construction and operation of the rheostat and the switch 36. Both of these devices are attached to the under face of the shelf 11 and are controlled by the same operating levers. As before stated, the rheostat 18 comprises two parts 21 and 22 (see Fig. 14) but each part may be considered to be a separate rheostat as they are intended to control magnets in different, but parallel circuits. In constructing the rheostat, two sets of sleeves 42 are secured to the under face of the shelf 11, the sleeves of each set being arranged in line with each other and spaced a short distance apart. The sleeves of each set have connected therewith, the terminals of coils 43 of resistance wire. Contact bars 44 are arranged to pass through the respective sets of sleeves for cutting the coils successively into or out of circuit accordingly as the bars are moved in one direction or the other. The contact bars 44 are operated by pivoted levers 45, with which said contact bars are connected by means of spring arms 46, one end of each arm 46 being attached to one of said levers and the other end secured to one of the contact bars through the medium of an insulating plug 47 inserted into said bar. The pivotal support of each lever 45 consists of a short shaft or pintle 48 to which the lever is secured, said shafts or pintles passing loosely through the shelf 11 and provided at their upper ends with operating levers 49 disposed upon and projecting beyond the front edge of the shelf 11.

In constructing switch 36, I secure to the underside of the shelf 11, a strip 50 which carries the pins 39. These pins which are made tubular for the reception of the wires 40, extend through the bar 50 and project upwardly from said bar for the reception of the contact fingers 38 between them. The fingers 38 are made by bending a strip of sheet metal back and forth as best shown in Fig. 11 and the strip is secured at intervals to a wooden bar 51. The bar 51 is supported at its ends on headed screws or pins 52, 52, secured to and projecting laterally from the ends of bar 50, the holes in the bar 51 through which said pins pass loosely being of sufficient size to permit said bar to have a pivotal movement on either of said pins or screws when the opposite end of said bar 51 is moved toward the bar 50. The bar 51 is maintained normally a sufficient distance from the bar 50 to prevent engagement of the fingers 38 with the pins 39, by means of springs 53 located on the pins or screws 52 and bearing at their ends against the respective bars. A lever 54 is pivoted between its ends, to the shelf 11 in proximity to the respective ends of the bar 51. The short arm of each lever 54 is adapted to engage the bar 51 for moving the same to close the switch while the longer arm of each lever is connected with the free end of one of the levers 45 by means of a link 55. From this construction and arrangement of parts, it will be seen that when one of the operating levers 49 is moved from its normal position, one of the levers 45 will be moved and operate to cut out resistance and also to transmit motion to one of the levers 54 and cause the latter to press one end of the strip 51 toward the strip 50, thus moving certain of the contact fingers 38 into electrical contact with certain of the pins 39 and closing the branch circuits which include said pins, fingers and certain of the magnet helices, for the purpose hereinbefore explained. The bar 51, if moved but a slight distance by one of the operating levers will close the circuits through only a few of the helices 35, and if moved to the full extent of the throw of said lever, the circuits of about one half of said series of helices 35 will be closed, so that the circuits of any desired number of said helices to the extent of one half the whole number, can be closed according to the extent of movement of one of the operating levers. The other half of these helices (which may be at the bass side of the piano and designated in the diagram Fig. 14, as 35^1), will be under the control of the other operating lever and the devices connected therewith for operating the switch bar 51. Thus the circuits of a portion of the circuits of the helices 35, 35^1 or all of said circuits can be closed by manipulating one or both of the operating levers 49.

In addition to the devices hereinbefore described for softening the tone or reducing the volume of sound, I may employ two series of four sheets or curtains each, of varying lengths of soft material, suspended above the hammers of the actions. Each series of curtains are attached to a strip 112 and the latter is supported by cords 113 passing over suitable pulleys 114 and these cords are attached to the levers 45 which operate the

rheostat, so that when said levers are operated to throw in resistance, the curtains will be lowered, one after another in front of the hammers as said levers 45 are moved.

It now remains to describe the construction and operation of the make-and-break controlling mechanism. This mechanism is located upon a wooden base 16, having devices coöperating with other devices on the shelf 11 for making the necessary electrical connections, when the said make and break mechanism is placed upon said shelf, as has been already described in detail. Standards 56 are located upon the base 16. A short horizontal shaft 57 is mounted in the upper end of one of the standards and the upper end of the other standard carries a horizontal bar 58, said shaft and bar being provided at their inner ends with recesses for the reception of the journals of a roller 59 on which the perforated music sheet 60 is wound. The bar 58 is movable longitudinally to permit the insertion and removal of the roller 59, and the journals of the roller are maintained in proper engagement with the bar and horizontal shaft by means of a coiled spring 61. From the roller 59, the music sheet 60 passes through the make-and-break devices (presently to be described) and is wound on a receiving roller 62 mounted between the lower portions of the standards, the music sheet 60 being provided at its end with a loop 63 to engage a hook 64[a] on the roller 62.

A tube 64 extends from one standard to the other at a point between the music sheet delivery roller 59 and the receiving roller 62 and is provided with diametrically opposite elongated slots 65, 66 one slightly wider than the other. Within the tube 64, a bar 67 of wood or other insulating material is located, said bar being slightly wedge shaped transversely, to permit its ready insertion through the slot 65 in the tube and so that its forward edge will aline with the narrower slot 66 in said tube. The wooden bar 67 is provided with a number of transverse holes 68 through which the contact fingers 25 of the make-and-break mechanism project. The contact fingers 25 are made at the ends of wires 69. These wires are connected with the connecting devices under the base 16 as shown in Fig. 8 and the upper portion of each wire 69 is wound and passed through a bar 70 disposed between arms 71 of the framework. The portion of the wire beyond the bar 70 constitutes the contact finger; in constructing which, the wire is extended upward from the bar 70 and bent into a coil 72 and then extended downwardly to a point in line with one of the holes in the wooden bar 67, through which the finger projects. The end of the finger is bent upon itself as shown in Fig. 8 to give a smooth rounded surface to the extremity of said finger. Two arms 73 are pivoted at their upper ends to the standards near the upper ends of the latter and constitute a pivoted frame which carries the contact bar 26 and this frame is so proportioned that the contact bar will rest in front of the bar 67 and in such position that the contacting ends of the fingers 25 will engage said contact bar at a point slightly below the plane of the axis of said bar when such contact between the fingers 25 and bar 26 is permitted by the perforations in the music sheet which passes between said contact fingers and bar. The contact roller is pressed gently against the music sheet and contact fingers. The construction and arrangement of make-and-break devices above described are of considerable importance, because I am thereby enabled to avoid injury to the music sheet, which has heretofore been a source of annoyance on account of the contact fingers engaging the ends of the slots in the paper music sheet and thus tearing the latter. It will be observed that the extremity of a contact finger not only presses against the contact roller below the axis thereof, but said contact finger is permitted to yield rearwardly and also downwardly, the size of the hole through which it passes being ample to permit this. Thus, when the end of a slot in the paper sheet reaches a contact finger 25 said finger will be first depressed slightly against the resistance of the coil and its spring arms and as the paper rides over the end of the finger, the latter will also be pressed rearwardly against the gentle resistance of said spring. I have thus, in actual practice, been enabled to effectually prevent injury to the music sheet by the make-and-break devices. In order to protect the exposed portions of the contact fingers and the wires leading thereto, a sheet metal arm is employed. The contact roller 26 is pressed toward the paper music sheet passing in front of the bar 67 by means of springs 74 attached at one end to the arms 73 and at their other ends to a fixed part of the framework. When a music sheet is to be inserted into the machine, or when said sheet is to be wound from the receiving to the delivery roller the contact roller will be moved away from the bar 67 and will be retained in such removed position by means of spring catches 75 attached to the arms 73 and engaging the standards comprising the fixed frame.

An electric motor 76 is located on the base 16 and to the armature shaft 77 of this motor a pulley 78 is secured. A stub 79 is supported by one of the uprights and on this stub, a large pulley 80 is mounted and over the pulley 80, a belt 81 passes. A small pulley 82 is mounted on the stub 79 and a larger pulley 83 secured to the short shaft 57. A belt 84 passes over the pulleys 82—83 to transmit motion to the music sheet delivery.

To one journal of the music sheet receiv-

ing roller 62, large gear wheel 85 is secured and motion is transmitted to this gear wheel from a pinion 86 mounted on the stub 79. The pinion 86 is mounted to slide on the stub 79 and carries pins 87 to engage sockets in the hub of the pulley 80 by which it is driven. Motion is thus transmitted to the music sheet receiving roller in the same direction as the direction of the delivery roller. The pinion 86 is provided with a grooved portion 88 for the reception of pins on a shifter arm 89 for moving said pinion out of engagement with the hub of pulley 80 and into locked engagement with the pulley 82 through the medium of pins 90 as shown in Fig. 4 for a purpose which will be hereinafter explained. The shifter arm 89 is carried by a vertical shaft 91 mounted in a tubular post 92 and extending through the base 16. An arm 93 (see Fig. 7) is secured to the lower end of the shaft 91 and has pivoted thereto, one end of a rod 94. The other end of this rod is made with an elongated loop 95 which receives a pin 96 on the switch lever 28, whereby, when said lever has been moved a certain distance, the pinion 82 will be shifted to the position shown in Fig. 4 and the rotation of the music sheet delivery roller reversed.

The electric motor is included in a circuit which may be traced on the diagram Fig. 14, as follows:—from the conductor 20, by conductor 97 to one terminal of the motor; from the other terminal of the motor by conductor 98 to a contact plate 99; then to switch lever 28; then to contact plate 29 and then by conductor 30 to the other terminal of the battery. Another contact plate 100 is arranged to be engaged by the switch lever and is connected by conductor 101 with an intermediate portion of the field winding of the motor for the purpose of cutting out a portion of said winding to increase the speed of the motor after the gearing has been reversed to rewind the music sheet.

A speed governor 102 is located on the armature shaft of the motor and the weighted arms of this governor are connected, by means of spring arms x with a disk 103 mounted to rotate with, but slide on the armature shaft. The arms 102 are preferably made tapering and pass freely through holes in the arms x, so that when said weighted arms 102 are thrown outwardly by centrifugal action, they will operate, through the medium of the arms x, to move the disk longitudinally on the armature shaft. A tubular post 104 is located on the base 16 near the governor and in this post a vertical shaft 105 is mounted, and made to extend through the base 16. The lower end of this shaft is provided with an arm 106, which is connected, by a rod 107 with one end of the switch lever 28. The upper end of the shaft 105 is provided with a horizontal arm 108 provided at its free end with a head 109 adapted to have frictional contact with the disk 103 for the purpose of retarding the action of the motor when said disk is brought into engagement with the head 109 by the action of the weighted arms of the governor. The purpose of the governor is to regulate and control the speed of the motor and gearing so as to insure the steady and regular passage of the perforated music sheet through the apparatus. Such movement of the music sheet may be further insured by offering a slight resistance to the rotation of the delivery roller. This can be accomplished by a spring arm 110 fixed at one end to one of the arms which carry the contact bar 26 and curved at its free end to have frictional contact with the short horizontal shaft which drives the delivery roller. When the contact bar is raised to permit the rewinding of the music sheet from the receiving roller to the delivery roller, the pressure of the spring 110 against the shaft will be relieved so as to permit said shaft and the delivery roller which it drives to rotate freely.

To start the operation of the apparatus, the operator will move the switch lever 28 to connect the contact plates 99 and 29. This will close the motor circuit and bring the circuits of the magnet helices 23—23^1 into action when said circuits are closed by the make-and break devices as the perforated music sheet passes through the latter. The same movement of the switch lever will operate to open the friction brake device to release the motor, said brake device (comprising head 109 on arm 108 and disk 103) being afterwards controlled by the action of the governor as hereinbefore explained. When the playing of a piece of music shall have been concluded and it is desired to rewind the music sheet from the receiving to the delivery roller, the operator will (after having raised the contact bar 26) move the switch lever 28 toward and into contact with the plate 100 and thus cut out a portion of the field coils of the motor to increase the speed of the latter. At the same time, the pin on the switch lever will engage the end of the loop in the rod and transmit motion to the vertical shaft and result in shifting the pinion 82 and the consequent reversal of operation of the gearing. The motor and gearing will now operate to rapidly rewind the music sheet from the receiving roller to the delivery roller, after which, the apparatus can be stopped by reversing the switch lever. The roll carrying the music sheet can now be removed and another substituted therefor if desired.

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

1. In a piano playing instrument, the combination of an electro-magnet comprising two helices, an armature lever, means

for transmitting motion from said armature lever to a piano action, make- and break devices, an electric circuit including said make-and break devices and one of said helices and a normally open electric circuit including the make and break devices the other helix, and a switch.

2. In a piano playing instrument, the combination with a series of electro-magnets, each comprising two helices, and an armature lever to be actuated by each magnet for operating a piano action, of make-and-break devices, electric circuits normally including said make-and-break devices and one helix of each magnet, normally open circuits including the make and break devices the other helices of said magnets, and a switch common to said normally open circuits for closing them.

3. In a piano playing instrument, the combination with a series of electro-magnets and armature levers therefor, each of said electro-magnets comprising two helices, make-and-break devices, electric circuits including said make-and-break devices and one helix of each magnet, a series of contact pins, a pivoted bar, contact fingers carried by said pivoted bar and electric circuits including the make and break devices the other helices of said magnets, and said contact pins and fingers.

4. In a music playing instrument, the combination with a series of electro-magnets, each comprising two helices, and an armature lever for each magnet, of make-and-break devices, electric circuits including said make-and-break devices and one helix of each magnet, a fixed bar, contact pins secured thereto, a strip adjacent to said bar and having a pivotal support at each end, contact fingers carried by said strip, means for moving either or both of its supports, and circuits including the make and break devices the other helices of said magnets, and said contact pins and fingers.

5. In a piano playing instrument, the combination with a series of electro-magnets, each comprising two helices, and an armature lever for each magnet, of make-and-break devices, electric circuits including said make-and-break devices and one helix of each magnet, a bar, a series of contact pins secured to said bar, pins or screws projecting laterally from the ends of said bar, a strip mounted loosely on said pins or screws, contact fingers secured to said strip, springs between the strip and bar, means at respective ends of the strip for moving it toward the bar, and electric circuits including the make and break devices the other helices of said magnets, and said contact pins and fingers.

6. In a piano playing instrument, the combination with a magnet comprising two helices, and make-and-break devices, of a rheostat, an electric circuit including said rheostat, make-and-break devices and one of said helices, a switch, an electric circuit including the make and break devices the other helix, and said switch, and means for operating said rheostat and switch simultaneously.

7. In a piano playing instrument the combination with a magnet comprising two helices, and an armature lever for said magnet, and make-and-break devices, of a rheostat, a switch, an electric circuit including one of said helices, the rheostat and said make-and-break devices, an electric circuit including the make and break devices the other helix, and said switch, a lever for operating the rheostat, a lever for operating the switch, a rod connecting said levers and means for manually operating the first mentioned lever.

8. In a piano playing instrument, the combination with two sets of electro-magnets and armature levers therefor, and make-and-break devices included in circuit with said magnets, of rheostats one included in circuit with each set of magnets and means for independently controlling said rheostats.

9. In a piano playing instrument, the combination with two sets of electro-magnets, armature levers therefor and a make-and-break mechanism included in circuit with said magnets, of two rheostats, one of said rheostats included in circuit with one set of magnets, and a parallel circuit including the other rheostat and the other set of magnets, and means for separately controlling said rheostats.

10. In a piano playing instrument, the combination with two sets of magnets, each magnet comprising two helices, armature levers for said magnets, and make and break mechanism included in circuit with said helices, of two rheostats, one of said rheostats included in circuit with one helix of each magnet in one set, an electric circuit including the other rheostat and the corresponding helices of the other set of magnets, a switch, and electric circuits including said switch and the other helices of the two sets of magnets.

11. In a piano playing instrument, the combination with electro-magnetic devices for actuating the piano actions, of a perforated bar of insulating material, a contact bar in front of said perforated bar, a series of contact fingers, each comprising a wire coiled between its ends and projecting through a hole of the perforated bar, and means for passing a perforated music sheet between the contact bar and the terminals of said contact fingers.

12. The combination with electro-magnetic devices for actuating piano actions, of a contact bar, a series of contact fingers to engage said contact bar, each of said contact fingers comprising a wire coiled between its ends, arms projecting from said coil and the

end of the wire bent substantially at right angles to one of said arms and disposed to engage the contact roller, and means for passing a music sheet between said contact roller and contact fingers.

13. In a piano playing instrument, the combination with electro-magnetic devices for actuating the piano actions, a contact bar, a series of contact fingers, each having a coil behind its free end, the free ends of said fingers disposed to engage the contact bar below the axis of the latter, and means for passing a perforated music sheet between said contact bar and the terminals of said contact fingers.

14. In a piano playing instrument, the combination with electro-magnetic devices for actuating the piano actions, of a fixed frame, a slotted tube supported by said frame, a perforated bar of insulating material in said tube, contact fingers supported by the frame and projecting through the perforations of said bar, a contact bar in front of the terminals of said fingers and means for passing a perforated music sheet between said contact bar and contact fingers.

15. In a piano playing instrument, the combination with electro-magnetic devices for actuating the piano actions, of a fixed frame, a bar of insulating material supported by the fixed frame and having a series of horizontal perforations therein, a pivoted frame, a contact bar carried by said frame and disposed in front of said perforated bar, a series of contact fingers projecting through and freely movable longitudinally and vertically in the horizontal perforations of the perforated bar and disposed to engage the contact bar below the axis of the latter, and means for passing a perforated music sheet between the contact bar and contact fingers.

16. In a piano playing instrument, the combination with electro-magnetic devices for actuating the piano actions and make-and-break mechanism electrically connected therewith, of gearing for moving a perforated music sheet through the make-and-break mechanism, an electric motor for driving said gearing a switch and devices coöperating with said switch for reversing the gearing and simultaneously increasing the speed of the motor to rewind the perforated music sheet.

17. In a piano playing instrument, the combination with electro-magnetic devices for actuating the piano actions, and make-and-break mechanism electrically connected therewith, of music sheet delivery rollers, gearing for operating said rollers to move a music sheet from the delivery to the receiving roller and through the make-and-break devices, reversing means for the gearing, an electric motor for driving the gearing, a switch in the motor circuit, mechanical devices connecting a movable part of said switch with the reversing means, and means operated by said switch for cutting out a part of the field windings of the motor to increase the speed of the latter.

18. In a piano playing instrument, the combination with electro-magnetic devices for actuating the actions of the piano, of a fixed frame, contact fingers carried by the frame, a pivoted frame a contact bar carried by the frame and coöperating with said contact fingers, mechanism for feeding a perforated music sheet between said contact bar and contact fingers, and a spring attached to said pivoted frame and bearing against a rotating part of the music sheet feeding mechanism to retard the operation of the latter.

19. In a piano playing instrument, the combination with electro-magnetic devices for actuating the actions and make-and-break mechanism electrically connected with the electro-magnetic devices, of a rheostat in circuit with said electro-magnetic devices, a lever for operating said rheostat, a series of sheets of soft fabric to be disposed in front of the hammers of the actions, and devices connecting said sheets with the lever which operates the rheostat.

In testimony whereof, I have signed this specification in the presence of two subscribing witnesses.

ALVAN L. HART.

Witnesses:
M. E. DINCK,
K. L. MCPARTLAND.