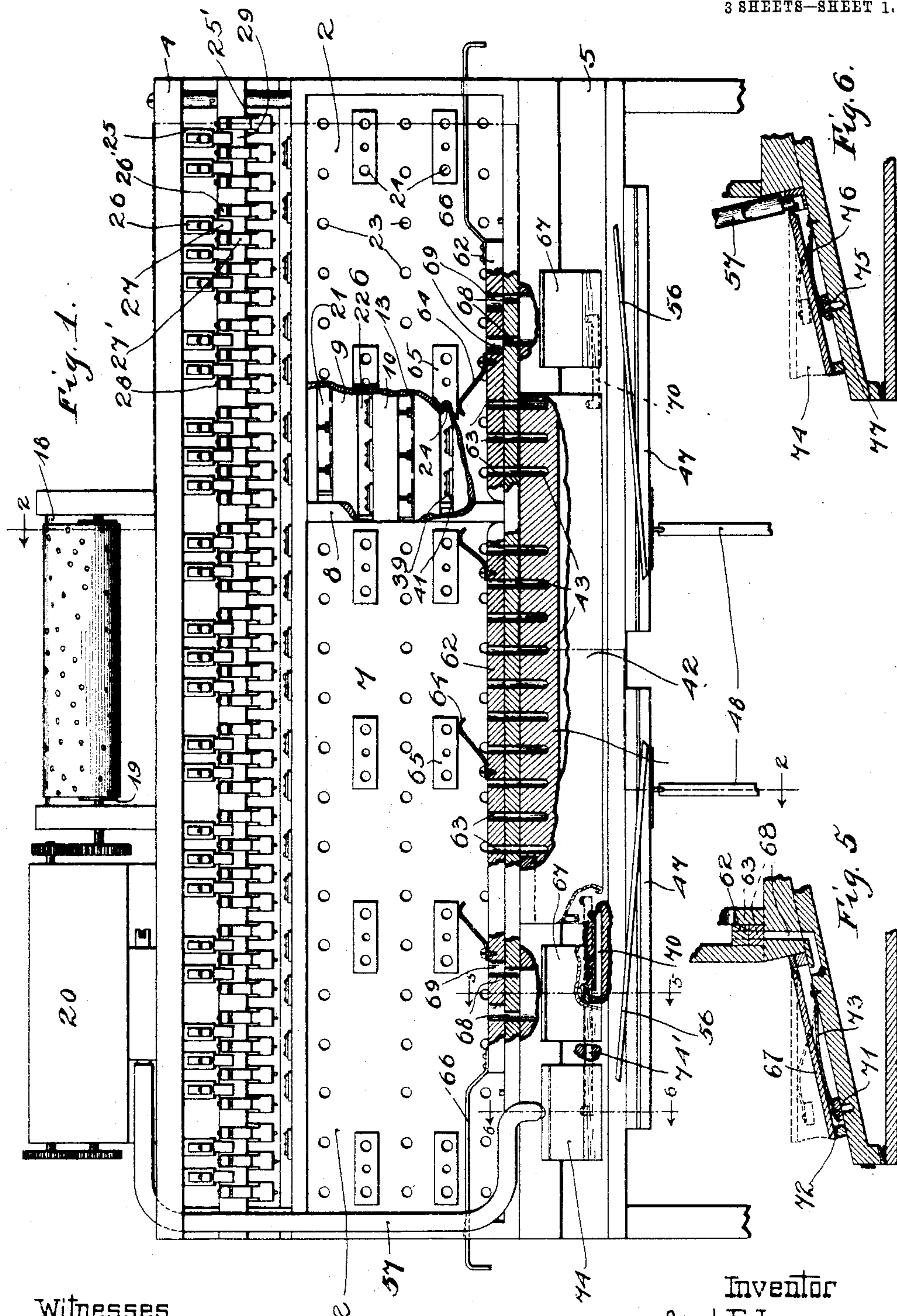


A. F. LARSON.
AUTOMATIC PIANO OR ORGAN PLAYER.

APPLICATION FILED SEPT. 30, 1903.

3 SHEETS—SHEET 1.



Witnesses

Leonard W. Novander.
Charles J. Schmidt.

Inventor
Axel F. Larson

By

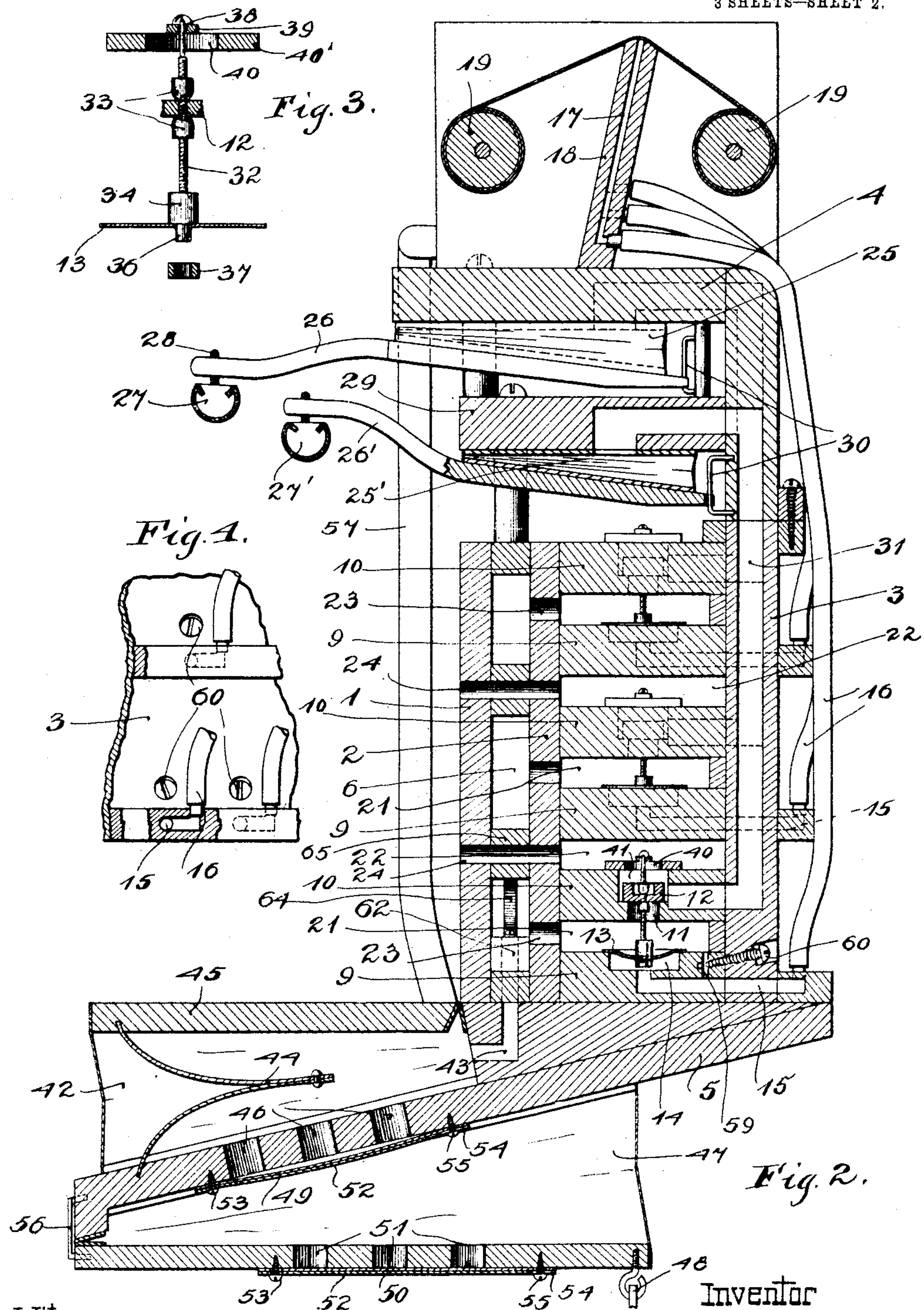
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3 SHEETS—SHEET 2.



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3 SHEETS—SHEET 3.

Fig. 8.

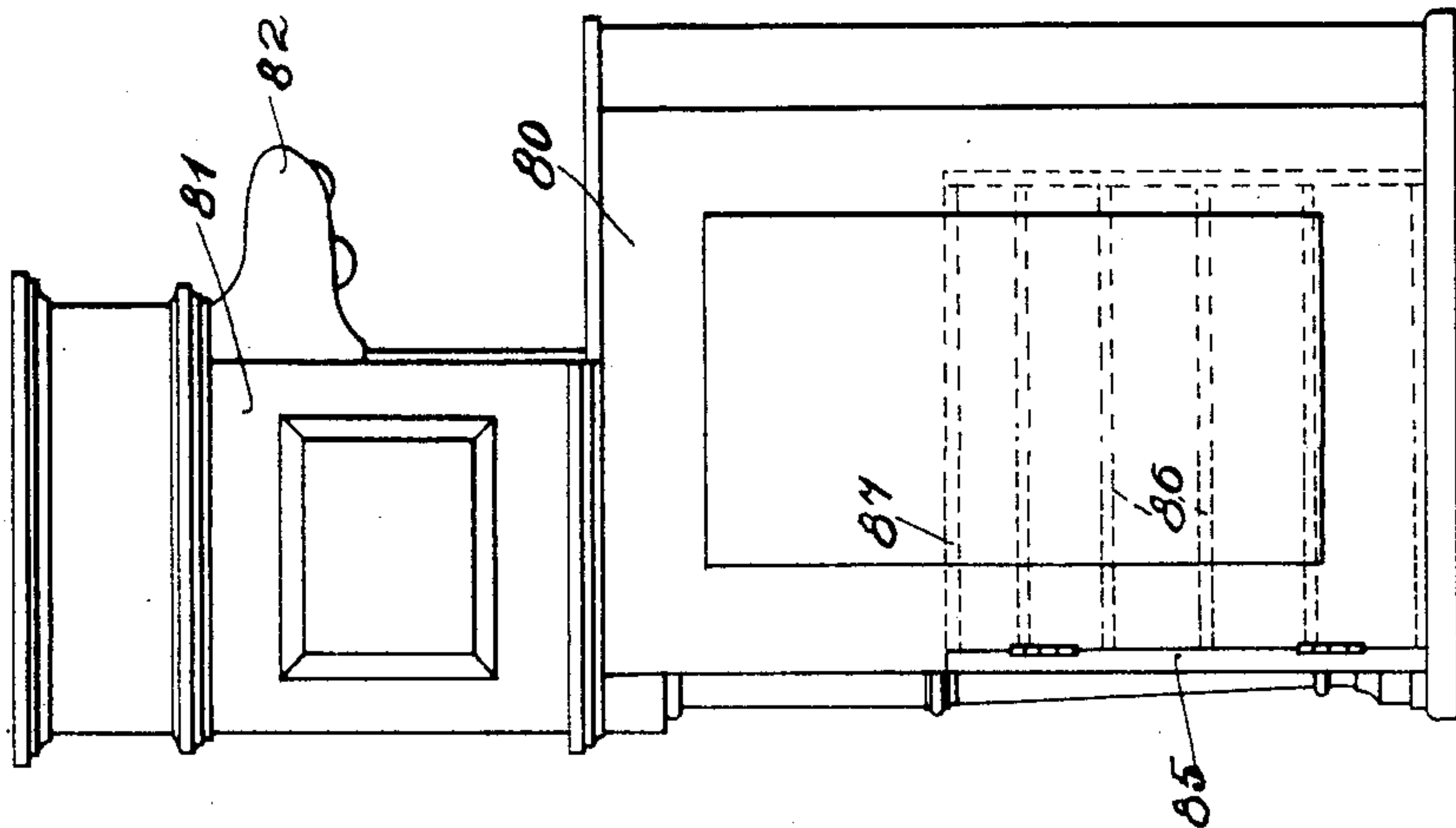
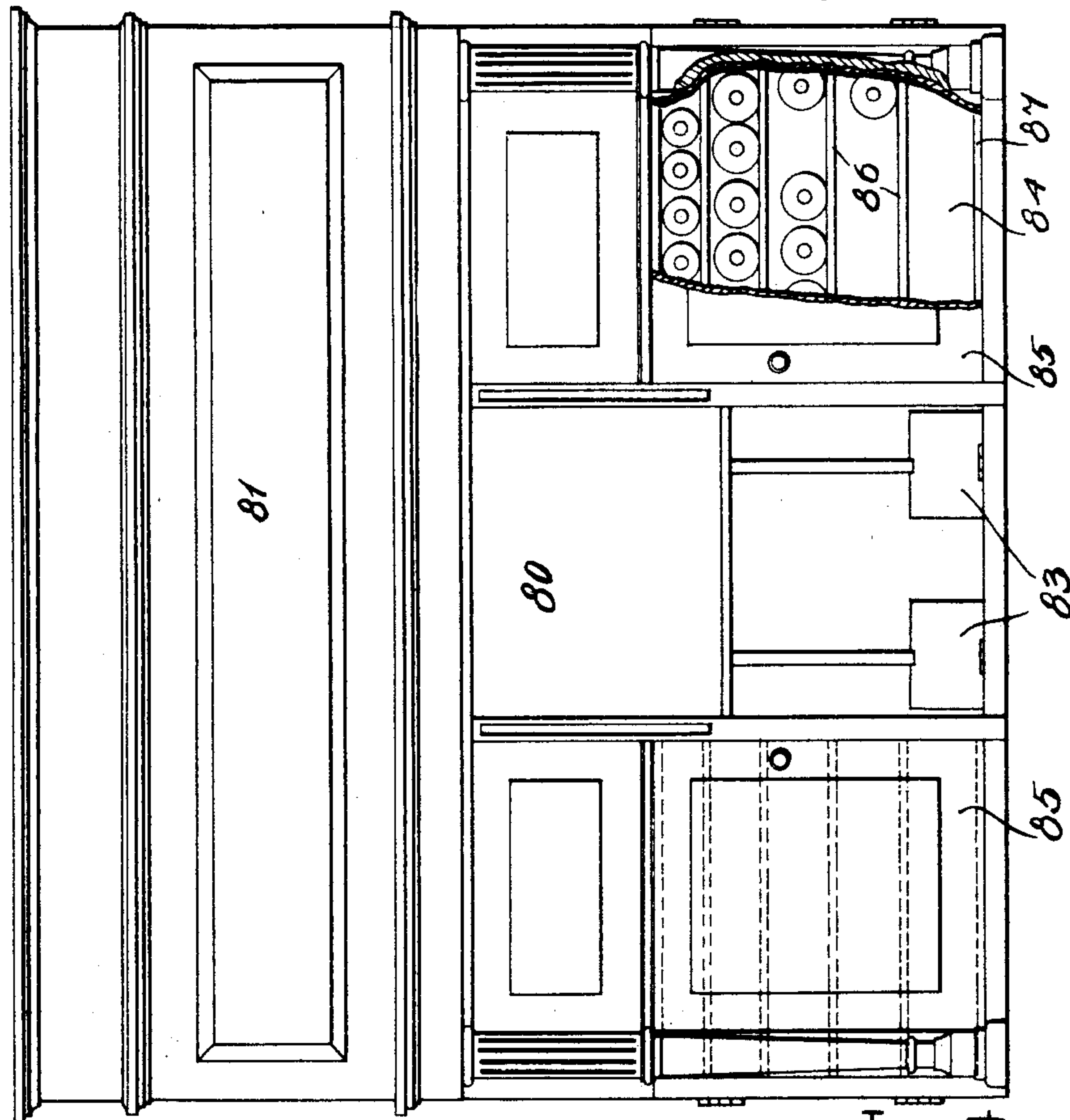


Fig. 4.



Witnesses

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UNITED STATES PATENT OFFICE.

AXEL F. LARSON, OF CHICAGO, ILLINOIS.

AUTOMATIC PIANO OR ORGAN PLAYER.

SPECIFICATION forming part of Letters Patent No. 792,054, dated June 13, 1905.

Application filed September 30, 1903. Serial No. 175,107.

To all whom it may concern:

Be it known that I, AXEL F. LARSON, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have
5 invented a certain new and useful Improvement in Automatic Piano or Organ Players, (Case No. 2,) of which the following is a full, clear, concise, and exact description, reference
10 being had to the accompanying drawings, forming a part of this specification.

My invention relates to automatic piano or organ players, and has for its object more improved, more efficient, and more simplified construction of the operative parts therefor,
15 particularly the mechanism for causing actuation of the keys.

The invention can be best understood by reference to the accompanying drawings, in which—

20 Figure 1 is a rear elevation view of the working mechanism, the rear wall thereof being removed to more clearly show the various mechanisms. Fig. 2 is a transverse section thereof, taken on line 2 2 of Fig. 1. Fig.
25 3 shows the valve mechanism employed. Fig. 4 shows the disposition of adjusting-screws relative to the air-conducting pipes. Fig. 5 is a detached sectional view taken on line 5 5 of Fig. 1. Fig. 6 is a detached sectional view
30 taken on line 6 6 of Fig. 1. Fig. 7 shows a front elevation of the cabinet within which the working mechanism is secured. Fig. 8 shows a side view of the cabinet.

Like characters of reference refer to like
35 parts throughout the various figures.

The framework of the working mechanism is built up of a plurality of walls and partitions and has a rear wall 1, an intermediate wall 2, a front wall 3, a top wall 4, and a
40 base 5.

Walls 1 and 2 inclose chambers 6 and 7, separated by a partition 8. Between the walls 2 and 3 are disposed a plurality of horizontal partition-walls 9 9 and horizontal partition-
45 walls 10 10, the walls 10 having port-openings 11 11 therethrough adapted to be closed and opened by valves 12 12. These valves are attached to and controlled by flexible diaphragms 13 13, which may be of leather
50 and which are disposed over chambers 14 14

in the partitions 9. Channels 15 15, through partitions 9, communicate with chambers 14 and with pipes 16 16, each pipe leading to a channel 17 in a tracker-board 18. A roller 19 is mounted at each side of the tracker-
55 board 18, and the perforated music-sheet, which passes over the tracker-board, may be wound up or unwound from either of these rollers, which may be carried into engage-
60 ment with a pneumatic motor 20, so that the music-sheet may be caused to travel in either direction. This motor 20 is of a construction as described in my copending application, Serial No. 165,349, filed July 13, 1903.

The chambers 21 21 are disposed below the
65 valve-containing partitions, and chambers 22 22 are disposed above said partitions, the chambers 21 communicating, through port-openings 23, with either chamber 6 or 7, and chambers 22 communicate with the atmos-
70 phere through channels 24 24. The upper wall 4 supports a plurality of cuckoo-bellows 25 25, to the under side of which are attached the actuating-arms 26 26, having at their ends adjustable buttons 27 27, which are connected
75 to the arms 26 by means of screws 28 28. The arms 26, with their buttons 27, are adapted for actuating the black keys of the keyboard. An intermediate horizontal wall 29 supports cuckoo-bellows 25', to the under side of which
80 are connected arms 26', terminating in actuating-buttons 27', adapted to strike the white keys of the keyboard. The arms 26 26 act as levers pivoted near their middle at the hing-
85 ing-point of the actuating-bellows. The ends of the arms 26 and 26' may be guided on ways 30 30 to prevent lateral displacement of the actuating-buttons. A channel 31 leads from each key-actuating bellows to one of the valve-
90 ports 11. The valve 12 has a U-shaped section, as best shown in Fig. 2, and is adjustably mounted on a threaded valve-spindle 32, between adjustable lock-nuts 33 33, which I preferably make of leather. A collar 34
95 screws over the bottom of the valve-spindle, being thus adjustable thereon, and the leather diaphragm 13 is provided with an opening in its center, which engages the neck 36 of said collar, being held against collar 34 by means
100 of a ring 37, which fits the neck 36. This ring

37 and the diaphragm may be glued into place. This diaphragm is stretched over chamber 14 in the partition 9, being glued at its periphery to the edges thereof. The top of the spindle
 5 passes through an opening 38 in a cross-piece 39, extending over the opening 40, through an annular piece 40', disposed at the top of a partition 10, this opening communicating with the valve-chamber 41. In its lowest position
 10 the valve 12 closes the port 11, while in its upper position it closes the opening 40.

A bellows 42 is disposed above the base-piece 5 and communicates, by means of channels 43 43, with the chambers 6 and 7. A
 15 strong spring 44, shaped as shown in Fig. 2, is disposed between the base-piece 5 and the hinged top piece 45 of the bellows and tends to keep the bellows distended. Valve-openings 46 46 open into other bellows 47 47, dis-
 20 posed below the base-frame 5, which bellows may be operated by a treadle suspended from hangers 48. The bellows 47 serve to exhaust the air from the bellows 42 to maintain a very low pressure therein. A leather clap-valve
 25 49 prevents entry of air into bellows 42 as bellows 47 collapse, and the clap-valve 50 allows the escape through ports 51 51 of the air drawn into bellows 47 from bellows 42 as bel-
 30 lows 47 collapse. To prevent the valves 49 and 50 from hanging too far from their seats, I provide a spring-support 52 therefor, which normally tends to press these valves against
 35 their seats. This spring may be of tin and rectangular in shape, large enough to entirely cover the valves, being secured at one end by means of screws 53 53 and provided at their
 40 other ends with slots 54 54, which pass under the heads of screws 55. These slots allow the necessary longitudinal motion of the springs as the valves move away from the port-open-
 ings. Collapse of the bellows 47 is caused by the action of torsional springs 56 56.

As the rollers 19 are now driven by the motor to carry the music-sheet over the top of
 45 the tracker-board, the openings in said music-sheet are successively and properly brought over the channels 17 in said tracker-board to control the operation of the key-actuating bel-
 lows, the manner of which operation I shall
 50 now explain and which is best seen in Fig. 2.

As an opening in the music-sheet is disposed over a channel 17, which is shown in Fig. 2, air under atmospheric pressure is allowed to enter through said channel and the pipe con-
 55 necting therewith through the channel 15 and to the chamber 14 below the leather diaphragm 13. As very low pressure exists in chamber 21, which communicates with the bellows 42, the diaphragm is immediately raised, due to
 60 the higher atmospheric pressure below it. The valve 12 consequently is raised from its seat to open the port 11 and to close the opening 40, leading to the chamber 22, which connects with the atmosphere. The air in the
 65 bellows 25', which normally is under atmos-

pheric pressure, now rushes from said bel-
 lows through the channel 31 and through the
 port-opening 11 into the chamber 21, in which
 the air is very much rarefied, owing to the low
 pressure in the bellows 42. The end of the
 70 arm 26' under the bellows is now suddenly raised to cause the button 27' to strike the white key over which it is placed. As the music-sheet now closes the opening into the
 channel 17 the pressure in the pipe 16, chan-
 75 nel 15, and chamber 14, and the pressure in chamber 21, become equalized through the small opening 59, extending between channel 15 and chamber 21, the suction now acting
 80 upon the under side of the diaphragm to assist gravity to quickly snap down the valve to close the port-opening 11, thereby opening the channel 31 and the bellows 25' to the at-
 85 mosphere which may enter through the channel 24, through chamber 22, and opening 40 to allow distension of the bellows. This valve feature is very important—as, for instance,
 when the same key is to be struck rapidly in
 succession it is imperative that the valve, and
 consequently the actuating-arm, act decisively
 90 and quickly. The key-actuating bellows may be provided with springs to distend them after collapse; but I prefer to cause this disten-
 tion by gravity, the arms 26 and 26' being
 heavy enough for this purpose at their end
 95 below the bellows. In order to cause all the actuating-bellows to respond with equal rapidity, I provide means for adjusting the rapidity with which the air-pressures equalize
 in channels 15 and chambers 21 after the chan-
 100 nel 17 is closed. I therefore provide means for varying the size of the opening 59, leading from channel 15 to chamber 21. By increasing or decreasing the size of the open-
 105 ings all valves can be caused to respond alike, and consequently the bellows controlled thereby cause equal response of the actuating-but-
 tons.

I provide means for gaging the size of the
 opening 59, which consists of a screw 60, the
 110 end of which may pass transversely through the opening 59 to close it to any degree. To provide ready access to these adjusting-screws 60, the pipes 16 are disposed between the
 screws so that a screw-driver may be readily
 115 interposed between them, as best shown in Fig. 4.

In Fig. 1 I have shown the rear wall 1 removed to expose the interior of chambers 6
 and 7 and to show the disposition of the par-
 120 tition 8. This partition serves to entirely separate the bass part of the player from the treble side thereof, so that the air through each part may be separately controlled for expression, and so on. I provide a slide-valve
 125 62 in each of the chambers 6 and 7, said valves being provided with port-openings 63, normally adapted to register with the port-open-
 ings 43, leading to the bellows 42, the air
 coming through the channel 17 in the tracker-
 130

board through the valve-chambers into either chamber 6 or 7 and through these port-openings into said bellows. The valves may be held to their seats by means of springs 64, which are secured to the valves and bear against the under side of pieces 65, through which pass the channels 24, and handles 66 extend from said valves to the outside of the player and connect with suitable levers to be actuated by the operator. I provide means for softening the touch of the buttons with the keys by the interposition of expression-bellows 67 67 between the bellows 42 and each of the chambers 6 and 7, these bellows 67 communicating with these chambers through port-openings 68 68 and port-openings 69 69 in the valve 62. A channel 70 leads from the bellows 42 to each of the expression-bellows. The openings 71 of the channel into said bellows 67 are covered by a valve 72. These expression-bellows are normally kept distended by means of a leaf-spring 73, which is secured at one end to the base of the bellows and at its other end to the valve, which is carried thereby, the valve being normally out of engagement with the openings 71, leading to the bellows 42. When the valves 62 are in position as shown in Fig. 1—that is, when the port-openings 63 thereof are disposed above the openings 43 and the openings 69 are disposed above the openings 68—air entering through the channels 17 and 31 passes to the bellows 42 both through the ports 63 and the openings 69 through the expression-bellows. The expression-bellows collapse; but owing to the back pressure of the springs 73 the valves 72 allow some air to pass by them. To soften the touch of the buttons on the keys, the valves may be pulled out to shut off the passage of air through the openings 63 and cause all the air to pass through the expression-bellows, the valve 72 in which allows just enough air to pass to give the proper touch to the keys. The bellows 74, similar to the expression-bellows, is interposed between the pipe 57, leading to the motor 20, and the main bellows 42, a channel 74' connecting said bellows with the main bellows. This bellows 74 is also provided with a valve 75, carried by a spring 76, and when the music-sheet is to be driven in the forward or playing direction the bellows 74 is partly collapsed to lightly press the valve against the opening 77, leading to the bellows 42, allowing sufficient air to pass therethrough to give the required speed of rotation of the motor 20. If it is desired to rewind the music-sheet, the valves 62 are pulled out far enough to shut off both the openings 43 and the openings 68 to cause the entire air passing into bellows 42 to come through the motor and through bellows 74, whereby the speed of the motor is increased to reroll the music-sheet.

In Figs. 7 and 8 I have shown the cabinet which fits about the operating mechanisms

described in the other figures, this cabinet consisting of a body portion 80 and a top portion 81, having an overhanging part 82, in which are disposed the actuating arms and buttons, which when the player is in operation are disposed over their proper keys. The treadles 83 83 are disposed at the middle of the body portion of the cabinet, and the compartments 84 84 at the side thereof are provided with doors 85 85, the interiors of which compartments are provided with shelves 86 86, upon which may be kept the music-rolls. These shelves are preferably secured in a box 87, the box being bodily inserted into or removed from the compartments 84.

An improved feature is the manner in which all the parts are accessible or may be removed for inspection and repairs, the various walls and partitions being all held together by screws. For instance, by taking away the front wall 3 all the valve-chambers 21 and 22 are readily accessible, and the partitions themselves may be readily removed by withdrawing the screws holding them to the intermediate wall. All valves and joints are faced with leather to render them absolutely airtight.

As many changes may be made in the construction and disposition of the various parts, I do not wish to be limited to the exact construction herein shown; but

I claim as new and desire to secure by Letters Patent—

1. In an automatic player, the combination with a main bellows, of a plurality of key-actuating bellows, an air-passage leading from each of said actuating-bellows, a valve interposed in said passage to connect said actuating-bellows alternately with said main bellows and with the atmosphere, a stem for said valve, an adjustable collar on said stem, and a flexible diaphragm secured to said collar for supporting said valve, substantially as described.

2. In an automatic player, the combination with a main bellows, of a plurality of key-actuating bellows, a passage leading from each of said actuating-bellows, a valve interposed in said passage to connect said actuating-bellows alternately with said main bellows and with the atmosphere, a threaded valve-stem for said valve, a collar adjustably engaging the end of said threaded stem, a flexible diaphragm secured to said collar, and a chamber connecting with the atmosphere over which said diaphragm is stretched, substantially as described.

3. In an automatic player, the combination with a main bellows, of a plurality of key-actuating bellows, a passage leading from each of said actuating-bellows, a valve interposed in said passage adapted to alternately connect said actuating-bellows with said main bellows and with the atmosphere, a threaded valve-stem, leather adjusting-nuts on said stem between which said valve is clamped, a collar

adjustably engaging the lower end of said valve-stem, a neck portion on said collar, a leather flexible diaphragm fitting over said neck, and a ring adapted to engage said neck
5 portion to secure said diaphragm to said collar, substantially as described.

4. In an automatic player, the combination with a main bellows, of a plurality of key-actuating bellows adapted for connection there-
10 with, actuating-arms secured to the under side of said actuating-bellows and extending rearwardly therefrom, actuating-buttons secured directly to the rear end of said arms, actua-
15 tion of said bellows causing said arms to engage said actuating-buttons with the finger-surface of the keys, the part of said arms below said actuating-bellows being heavy enough to cause distention of the bellows after col-
20 lapse thereof to remove said buttons from said keys.

5. In an automatic player, the combination with a main bellows, of a plurality of key-actuating bellows adapted for connection there-
25 with, actuating-arms secured to the under side of said actuating-bellows and extending rearwardly therefrom, adjustable actuating-buttons secured directly to the rear end of said arms, actuation of said bellows causing said arms to engage said buttons with the finger-
30 surface of the keys, and guideways engaging the front end of said arms to prevent lateral displacement of said buttons, the part of said arms below said actuating-bellows being heavy enough to cause distention of the bellows after
35 collapse thereof to remove said buttons from said keys.

6. In an automatic player, the combination with a main bellows, of two low-pressure compartments separated by a partition, air-chan-
40 nels leading from said compartments directly to said bellows, an expression-bellows for each of said compartments communicating with the compartment and said main bellows, and valves for shutting off either the communica-
45 tion of the compartments with the main bellows through the direct channels or for entirely shutting off communication of the compartments both through the direct channels and the expression-bellows, substantially as
50 described.

7. In an automatic player, the combination with a main bellows, of two low-pressure compartments separated by a partition, an air-path from said compartments directly to said main
55 bellows, an additional path from said compartments to said main bellows, an expression-bellows interposed in said path, and a spring-valve for said bellows for limiting the amount of air passing therethrough, substantially as
60 described.

8. In an automatic player, the combination with a main bellows, of two low-pressure compartments separated by a partition, channels leading from each of said compartments di-
65 rectly to said main bellows, an expression-

bellows for each compartment connected with the compartments and said main bellows, and a spring-valve for said expression-bellows serving, when said bellows is collapsed upon passage of air therethrough, to engage the
70 openings leading to the main bellows to limit the passage of air therethrough, substantially as described.

9. In an automatic player, the combination with a main bellows, of a low-pressure com-
75 partment, channels leading from said compartment directly to said main bellows, an expression-bellows connecting with said compartment and said main bellows, a main valve adapted to entirely cut off both the passage
80 of air through said direct channels and said expression-bellows, a pneumatic motor, a controlling-bellows connecting with said motor and said main bellows, and a spring-valve for said bellows for limiting the passage of air
85 from said main bellows to said motor and for allowing more air to pass therethrough to increase the speed of the motor as the communication of said main bellows with said com-
90 partment is entirely cut off by means of said main valve, substantially as described.

10. In an automatic player, the combination of a front wall, an intermediate wall, a rear wall, a horizontal top wall, a horizontal in-
95 termediate wall, a base-wall, horizontal valve-partitions extending between said first-named intermediate and front walls valve-controlled openings through said partitions, a low-pres-
100 sure bellows supported by said base-wall, low-pressure compartments between said rear and intermediate walls, low-pressure chambers between said valve-partitions communi-
105 cating with said low-pressure compartments by means of port-openings, actuating-bellows supported underneath said horizontal top and intermediate walls key-actuating arms se-
110 cured at their front end to the under side of said actuating-bellows, passages from said actuating-bellows, said passages leading through said horizontal top and intermediate walls,
115 said front wall, and said valve-partitions, valves for connecting said passages with said low-pressure chambers, tracker-board mechanism disposed above said top horizontal wall, an outer casing for all the above parts
120 consisting of a body portion and a top portion, compartments at the sides of said body portion, and shelves disposed in said compartments, substantially as described.

11. In an automatic player, the combination
120 of a front wall, an intermediate wall, a rear wall, a horizontal top wall, a horizontal intermediate wall, a base-wall, horizontal valve-partitions extending between said first-named intermediate and front walls, valve-controlled
125 openings through said partitions, a low-pressure bellows supported by said base-wall, low-pressure compartments between said rear and intermediate walls, low-pressure chambers between said valve-partitions communicating
130

with said low-pressure compartments by means of port-openings, actuating-bellows supported underneath said horizontal top and intermediate walls key-actuating arms secured at their front end to the under side of said actuating-bellows, passages from said actuating-bellows, said passages leading through said horizontal top and intermediate walls, said front wall, and said valve-partitions, valves for connecting said passages with said low-pressure chambers, tracker-board mechanism disposed above said top horizontal wall, an outer casing for all the above parts consisting of a body portion and a top portion, compartments at the sides of said body portion, and a box provided with shelves adapted for bodily insertion into or withdrawal from said compartments, substantially as described.

12. In an automatic player, the combination with a main bellows, of a plurality of key-actuating bellows, an air-passage leading from each of said bellows, a valve interposed in said passage-way to connect said actuating-bellows alternately with said main bellows and with the atmosphere, a stem for said valve substantially threaded its entire length, a collar engaging the threads of said stem to be longitudinally adjustable thereon, a neck portion and a shoulder on said collar, a flexible diaphragm fitting over said neck portion and against said shoulder, and a ring engaging said neck portion, said ring and said diaphragm being glued in place on said collar, substantially as described.

13. In an automatic player, the combination with a main bellows, of a plurality of key-actuating bellows, a passage leading from each of said actuating-bellows, a valve interposed in said passage-way adapted to alternately connect said actuating-bellows with said main bellows and with the atmosphere, a threaded valve-stem, leather adjusting-nuts on said stem between which said valve is clamped in any adjusted position on said stem, the collar engaging at the lower end of said threaded stem and longitudinally adjustable thereon, a neck portion and a shoulder on said collar, a flexible diaphragm fitting over said neck portion and against said shoulder, and a ring engaging said neck portion, said diaphragm and ring being glued in position on said collar, substantially as described.

14. In an automatic player, the combination with a low-pressure main bellows, of a low-pressure chamber communicating therewith, a plurality of key-actuating bellows, an air-passage leading from each of said bellows, a valve-chamber interposed in said passage, a valve adapted to move in said valve-chamber to alternately connect said air-passage with said low-pressure chamber and with the atmosphere, a valve-stem upon which said valve is longitudinally adjustable, a flexible diaphragm at the lower end of said valve-stem and longitudinally adjustable thereon, a cham-

ber below said diaphragm over which said diaphragm is stretched, a channel leading from said chamber below said diaphragm, means for admitting the atmosphere through said channel and to the chamber below said diaphragm whereby said diaphragm is raised with said stem to actuate said valve to connect said actuating-bellows with said low-pressure chamber whereby said bellows is actuated, means for again closing said channel from the atmosphere, and a narrow passage-way leading from said low-pressure chamber to said chamber below the diaphragm whereby upon closure of said channel from the atmosphere air will be exhausted from said chamber below the diaphragm, whereby said diaphragm is suddenly snapped downwardly to close communication from said main bellows to said actuating-bellows, substantially as described.

15. In an automatic player, the combination with a low-pressure main bellows, of a low-pressure chamber communicating therewith, a plurality of key-actuating bellows, an air-passage leading from each of said bellows, a valve-chamber interposed in said passage-way, a valve adapted to move in said valve-chamber to alternately connect said air-passage with said low-pressure chamber and with the atmosphere, a valve-stem upon which said valve is longitudinally adjustable, a flexible diaphragm at the lower end of said valve-stem and longitudinally adjustable thereon, a chamber below said diaphragm over which said diaphragm is stretched, a channel leading from said chamber below said diaphragm, means for admitting the atmosphere through said channel and to the chamber below said diaphragm whereby said diaphragm is raised with said stem to actuate said valve to connect said actuating-bellows with said low-pressure chamber whereby said bellows is actuated, means for again closing said channel from the atmosphere, a narrow passage-way leading from said low-pressure chamber to said chamber below the diaphragm whereby upon closure of said channel from the atmosphere air will be exhausted from said chamber below the diaphragm, whereby said diaphragm is suddenly snapped downwardly to close communication from said main bellows to said actuating-bellows, and a screw extending transversely across the interior of said narrow passage-way, whereby the size thereof may be gaged, substantially as described.

16. In an automatic player, the combination with a low-pressure main bellows, of a low-pressure chamber communicating therewith, a plurality of key-actuating bellows, actuating-arms secured at their front end directly to the under side of said actuating-bellows, an air-passage leading from each of said bellows, a valve-chamber interposed in said passage, a valve adapted to move in said valve-chamber to alternately connect said air-passage with said low-pressure chamber and with

the atmosphere, a valve-stem upon which said valve is longitudinally adjustable, a flexible diaphragm at the lower end of said valve-stem and longitudinally adjustable thereon, a
5 chamber below said diaphragm over which said diaphragm is stretched, a channel leading from said chamber below said diaphragm, means for admitting the atmosphere through said channel and to the chamber below said
10 diaphragm whereby said diaphragm is raised with said stem to actuate said valve to connect said actuating-bellows with said low-pressure chamber whereby said actuating-arms are actuated, means for again closing
15 said channel from the atmosphere, and a nar-

row passage-way leading from said low-pressure chamber to said chamber below the diaphragm whereby upon closure of said channel from the atmosphere air will be exhausted from said chamber below the diaphragm, 20 whereby said diaphragm is suddenly snapped downwardly to close communication from said main bellows to said actuating-bellows, substantially as described.

In witness whereof I hereunto subscribe my 25 name this 25th day of September, A. D. 1903.

AXEL F. LARSON.

Witnesses:

CHARLES J. SCHMIDT,
HARVEY L. HANSON.