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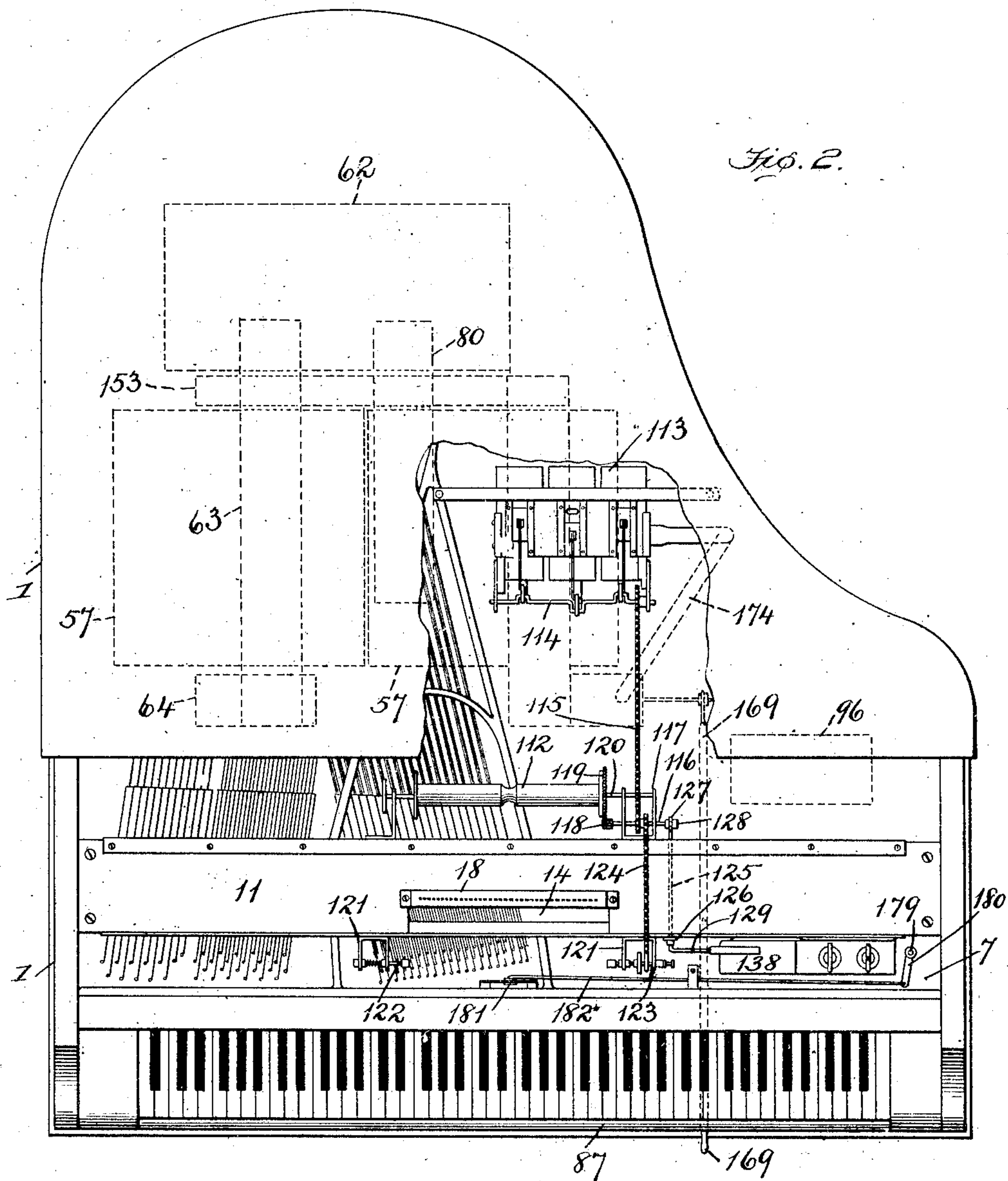
PLAYER PIANO.

APPLICATION FILED NOV. 27, 1909.

Patented June 20, 1911.

7 SHEETS—SHEET 2.

995,766.



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Witnesses

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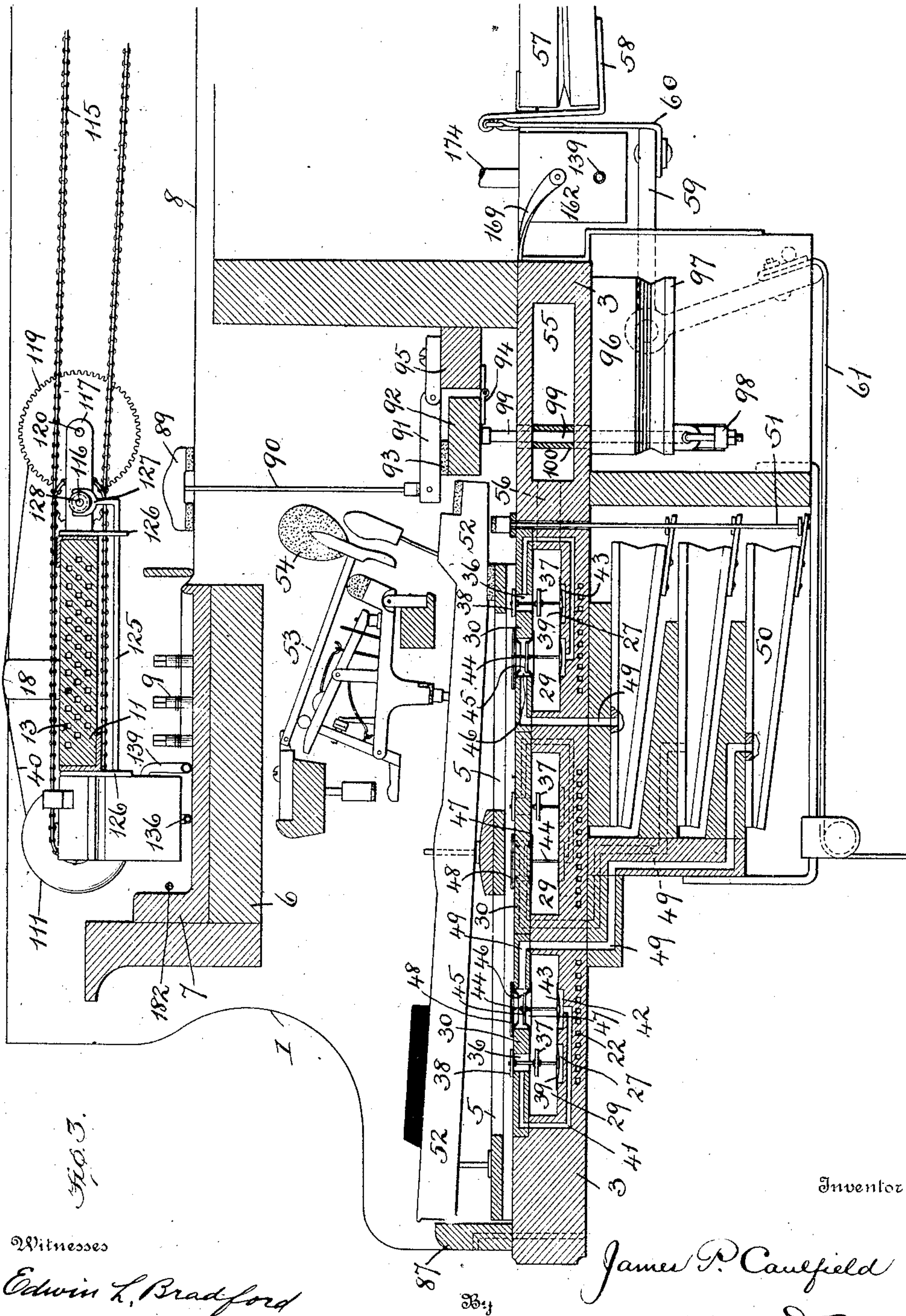
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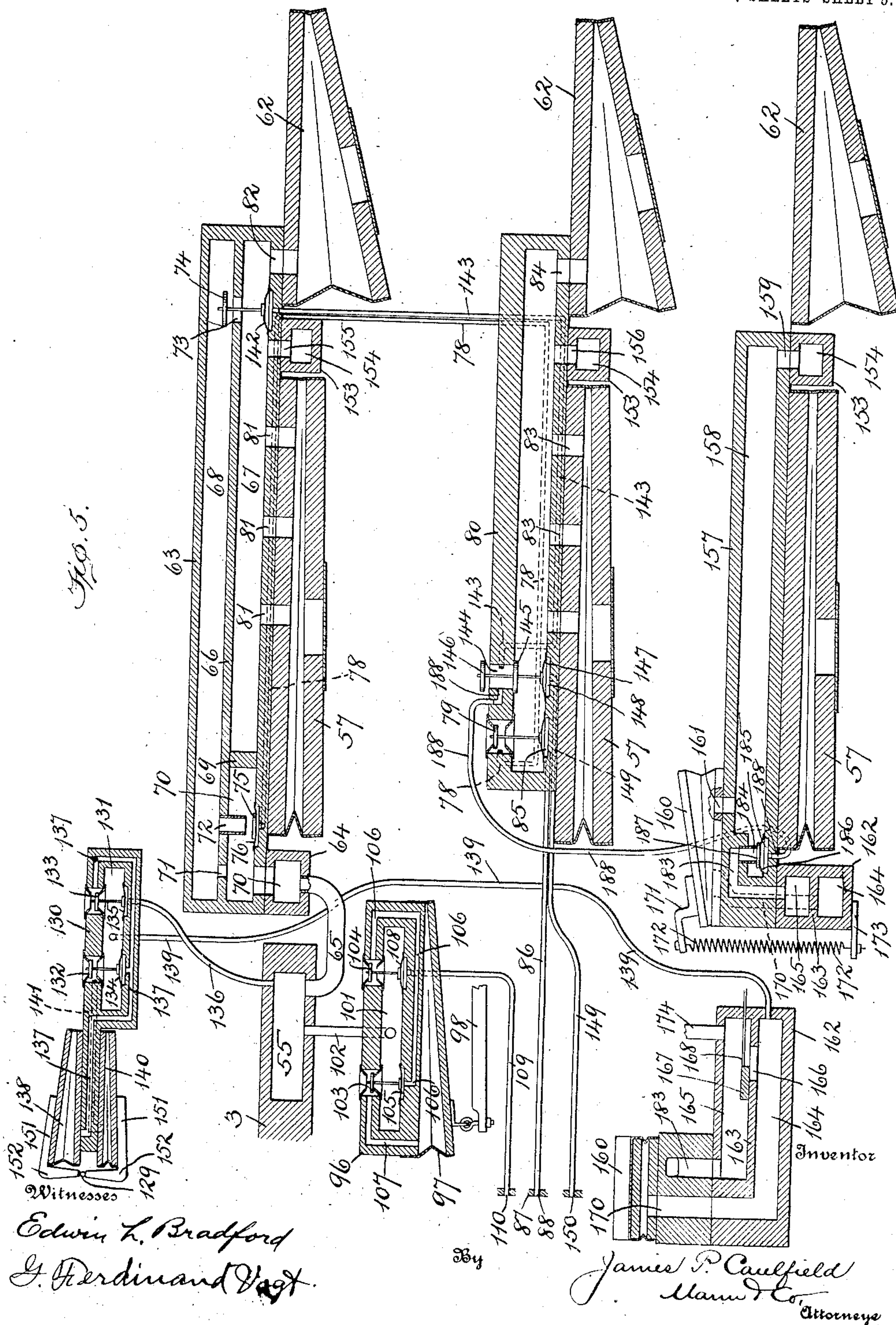




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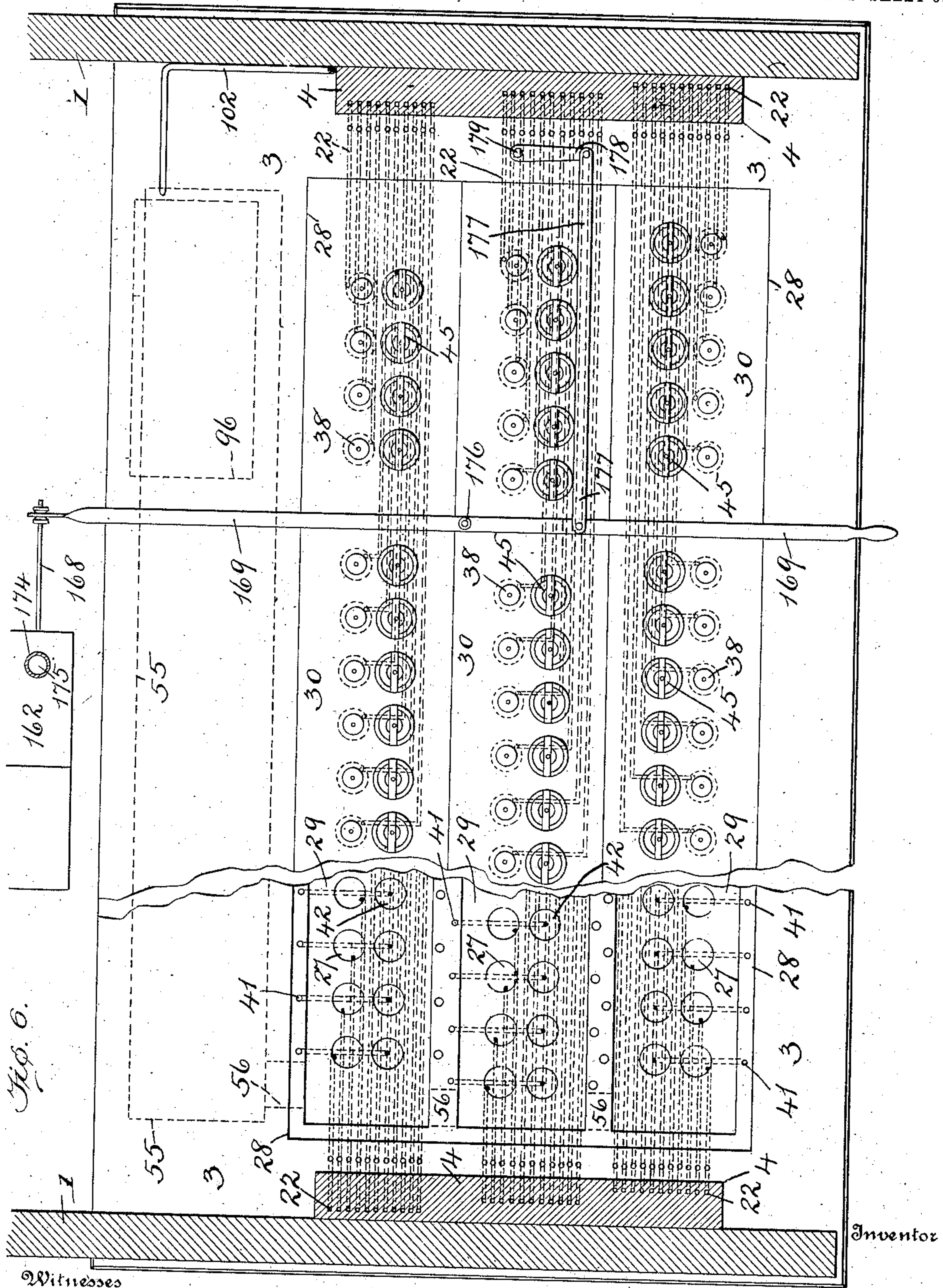


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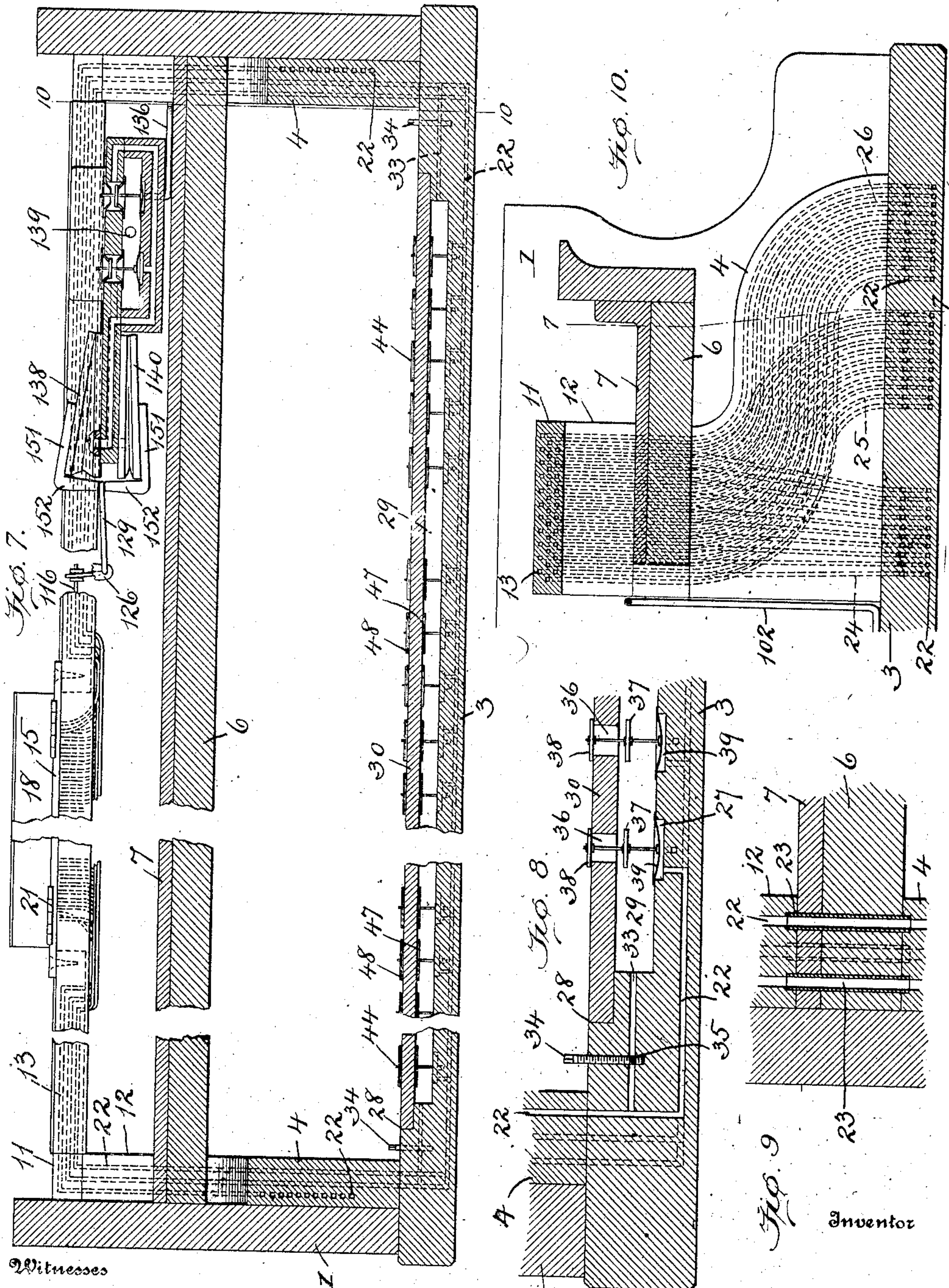


PLAYER PIANO.

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7 SHEETS--SHEET 7.

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# UNITED STATES PATENT OFFICE.

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PLAYER-PIANO.

995,766.

Specification of Letters Patent. Patented June 20, 1911.

Application filed November 27, 1909. Serial No. 530,124.

*To all whom it may concern:*

Be it known that I, JAMES P. CAULFIELD, a citizen of the United States, residing at Baltimore, in the State of Maryland, have  
5 invented certain new and useful Improvements in Player-Pianos, of which the following is a specification.

This invention relates to pneumatic player pianos in which the instruments are operated through the action of pneumatic pressures. The present invention however is more particularly designed for pianos of that class having horizontally disposed cases and known in the art as grand pianos, but  
15 features of the invention are also applicable to player pianos of the vertical or upright type.

One object of the invention is to provide an improved construction and arrangement of the pneumatic mechanism including the valves and passages, that the same may readily be installed in the cases as at present constructed and without increasing the dimensions thereof.

25 Another object is to simplify the construction of the pneumatic mechanisms and to render them more readily accessible for regulation and adjustment while in their operative positions.

30 A further object is to provide improved means for regulating the capacity of the bleeds and to insure greater responsiveness in playing rapid passages of music.

Another object is to provide an improved  
35 construction of sectional tracker that may be readily moved from one position to another to enable the case to be closed tight within the case lines.

With these and other objects in view, the  
40 invention is illustrated in the accompanying drawings, in which,—

Figure 1, is a side elevation of a grand piano to which my invention has been applied. Fig. 2, is a plan view of the same,—a  
45 portion of the cover having been broken away to illustrate the mechanism for driving the music roll. Fig. 3, is a vertical sectional view through the front portion of the piano and shows the relative positions of the tracker bar, conduit board, wrest plank; the connections of the conduits running from tracker bar through conduit board and of the same conduits in the key bottom at the under side of the diaphragms. Fig. 4, is a  
50 perspective view of the two exhaust feeders or bellows and the equalizer communicating

therewith and a sectional view of the air trunks connected therewith and also shows in a diagrammatic way the perforations adjacent the key board for controlling the  
60 loud, soft and rewind mechanism. Fig. 5, is a diagrammatic sectional view of the same. Fig. 6, is a sectional plan view through the key bottom showing the passages that connect the primary and second-  
65 ary valves and the passages connecting said valves with the tracker; and also shows the lever mechanism for operating the valve in the tempo-box and the indicator. Fig. 7, is a vertical section through the metal frame,  
70 the wrest plank, end conduit blocks and key-bottom and shows the pneumatics for shifting the rewind mechanism to return the music sheet to the original roll,—the section being taken on the line 7—7 of Fig. 10. Fig.  
75 8, is an enlarged vertical section through the key-bottom and shows the adjustable bleed pin in the exhaust channel. Fig. 9, is an enlarged sectional detail through the metal frame and wrest plank to show the  
80 tubular connections in the passages passing therethrough. Fig. 10, is a vertical cross-section through the conduit board, metal frame, wrest plank and key bottom to show the course of the passages leading from the  
85 conduit board to the key bottom,—the section being taken on the line 10—10 of Fig. 7. Fig. 11, is a detail of the pneumatic motor for operating the music sheet, and Fig. 12, is an enlarged detail of the sectional tracker  
90 pivoted so as to fold within the case lines.

Referring to the drawings by numerals, 1, designates the horizontal case of a grand piano having suitable legs, 2, by which it is supported and which contains the usual and  
95 well known elements entering into the make-up of pianos of this character. In the present instance I provide a key-bottom, 3, vertical conduit boards, 4, at opposite sides thereof which extend upwardly at each end  
100 of the key-frame, 5, and which have position beneath a horizontal wrest plank, 6, on which the usual metal frame, 7, is sustained. It will be understood that this metal frame, 7, carries the wires, 8, of the instrument and  
105 that the usual tuning pins, 9, are employed for regulating the tension on the wires in the usual manner. The case is provided with the usual cover, 10, which folds down flat and which may be constructed of one or  
110 more parts as desired. Below the plane of the cover and between the latter and wrest



plank, 6, I provide a conduit board, 11, which extends horizontally over the tuning pins, 9, and which extends from one side of the case to the other and is detachably connected at each end to a vertical conduit block, 12, as clearly shown in Figs. 7 and 10 of the drawings. These conduit blocks, 12, are supported by and rest upon the upper surface of the metal frame, 7, and are directly over the vertical conduit boards, 4, which extend from the key-bottom, 3, up to the under side of the wrest plank, 6. Ducts or passages, 13, extend horizontally through the conduit board, 11, from its opposite ends toward the center at which point said board is provided with a longitudinal slot, 14, as seen in Figs. 2 and 12. A horizontal plate, 15, extends over one side of the slot, 14, and has a plurality of vertical ports, 16, therein from which tubes, 17, lead to and connect with the respective horizontal ducts or passages, 13, in the said conduit board so that each port, 16, in said plate will be connected by a tube, 17, with one of the passages in the conduit board.

A tracker bar, 18, having a series of passages, 19, rests upon the plate, 15, during the operation of the instrument and when in this position the said passages will register with the ports, 16, in the plate. In order to economize in space and permit the cover, 10, to lie flat on the case I have hinged the tracker bar, 18, to one side of said plate, 15, and have provided a suitable packing, 20, between them to make a tight joint. By means of this construction it will be seen that the tracker bar may be turned over on the hinges, 21, and thus lowered with respect to the cover—the bar in its lowered position being shown in Fig. 12. It will thus be seen that the passages of the tracker are in communication with the horizontal ducts, 13, in the conduit board which latter ducts extend in opposite directions from the tracker and communicate with vertical ducts or passages, 22, in the conduit blocks, 12, as best seen in Figs. 7, 9 and 10. In order to make a tight joint between the passages in the conduit blocks, 12, and similar registering passages in the vertical conduit boards, 4, I provide short tubes, 23, which lead from the boards, 4, up through the wrest plank, 6, and through the metal frame, 7, into the blocks, 12, as clearly illustrated in Fig. 9 of the drawing. After entering the vertical conduit boards, 4, the passages or ducts, 22, extend downwardly therethrough in a plurality of groups, designated, 24, 25, and 26, respectively, and illustrated in Fig. 10, and at their lower ends these groups of ducts or passages communicate with similar passages which extend horizontally through the key-bottom, 3, as seen in Figs. 6, 7, 8 and 10 and terminate in the respective diaphragm cups, 27, in the key bottom beneath

the primary valves as will presently be described.

The upper side of the key-bottom, 3, is recessed on the lines designated, 28, so as to form parallel longitudinal chambers or air chests, 29. It has been found expedient to arrange these chests or chambers in the same horizontal plane in the key bottom because the primary and secondary valves are located in said bottom and as there is a large number of such valves, they can best be accommodated by arranging them in rows in the bottom and over the chests. Each air chest, 29, is closed on its upper side by a suitable plate or cover, 30, which carries the primary and secondary valves respectively—said valves having vertically extending stems that have position in the air chests, 29. Each air duct, 22, has a branch or exhaust passage, 33, which opens directly into one of the air chests and a regulating screw, 34, having a perforation, 35, passes down from the upper side of the key-bottom and crosses said exhaust passage so that by turning said screw the passage may be opened or closed more or less. The perforations, 35, in the regulating screws are sufficiently large to allow dust or particles of dirt that can pass through the passages of the tracker to be drawn on through the exhaust passages into the air chests. These exhaust ducts or passages may also be termed bleeds.

The plates or covers, 30, are provided with vertical passages, 36, in which a primary valve stem operates and each stem carries two spaced-apart disks or valves, one above the other. The lower valve, 37, controls the lower end of the passage at the air-chest side and the upper valve, 38, controls the upper end of the passage at the atmospheric side. The positions of these valves on the stem are such that a vertical movement of the stem will cause one valve to seat and the other to uncover the end of the passage it guards. Normally the upper valve, 38, will be seated because of the constant suction or exhaust in the air chest. The lower end of each primary valve stem is seated on a diaphragm, 39, that extends over the cups, 27, and it is into these cups and beneath the diaphragm that the tracker passages, 19, and ducts, 22, terminate, while there is a constant suction from the air chests through the exhaust passages, 33, from said passages, 19, and, 22. It will therefore be seen that when the music sheet, 40, which travels over the tracker presents a perforation to one of the tracker passages, 19, the exhaust tension in the passages, 19, and, 22, will be replaced by atmospheric pressure, and by admitting atmosphere at the tracker end of the said passages the suction on the lower side of the primary diaphragm, 39, will be broken and the said primary valves and stem will rise because of the air tension in the chest and in



rising will cause valve, 37, to close the lower end of passage, 36, and valve, 38, to uncover the atmospheric end of said passage and admit atmosphere into duct or passage, 41, which begins at the vertical passage, 36, of the primary valve and extends horizontally through the cover 30 then down through the key-bottom where it again turns and extends in a horizontal direction below the air-chest and communicates with a diaphragm cup, 42, below a diaphragm, 43, see Fig. 3. This diaphragm is at the lower end of a secondary valve stem, 44, which latter extends vertically through the air-chest, 29, and carries a circular or disk valve, 45, that has a slight vertical movement in a passage, 46, also in the chest cover, 30. This secondary valve, 45, has vertical movement between two seats, 47, and, 48, respectively,—the former being at the lower end of the passage, 46, and affords the communication between said passage and the air-chest while the latter seat, 48, is at the upper side of the valve and affords the admission of atmosphere to the said passage. It will therefore be understood that when the primary valve rises so as to seat valve, 37, at the lower end of the passage, 36, the valve, 38, will rise and admit atmosphere into said passage and thus break the suction in passage, 41, and beneath the diaphragm, 43, of the secondary whereupon said secondary valve-stem, 44, will rise, because of the suction in the chest on the upper side of the diaphragm, and seat the valve, 45, up against seat, 48. When in this position the valve, 45, will bring passage, 49, into communication with the suction or air chest, 29, and as this passage leads to the striking bellows pneumatic 50 the suction in the chest will collapse the said bellows, 50; throw rod, 51, up at the rear end of the key, 52; and thereby operate the latter. This upward movement of the rear end of the key actuates the action, 53, in the usual way and drives the hammer, 54, up against the string or wire, 8, to sound the note, all as clearly shown in Fig. 3 of the drawing. What has been said of the particular primary, secondary and passages connecting therewith is true of all like parts throughout the instrument.

Referring again to Fig. 3 it will be noted that the key-bottom or bed is also provided with an air chamber, 55, which also extends horizontally therein between the upper and lower surfaces and is parallel with and at the rear of the air-chests, 29, see also Fig. 6. This chamber is in communication with all of the air-chests, 29, through horizontal passages, 56, as can be seen in broken lines in Fig. 6.

Referring particularly to Figs. 1, 3, 4 and 5 it will be noted that at the rear of the key-bottom, 3, the instrument is provided with

two independently-operated power bellows or feeders, 57, the forward ends of which each carry a bracket, 58, which is connected to one end of a bell-crank lever, 59, by a strap, 60. A flexible band, 61, is connected to the other end of the bell-crank lever and extends forwardly therefrom and is attached to a treadle mechanism as will hereinafter be fully explained. At the rear of the two feeders, 57, I provide an equalizer, 62, by means of which the exhaust tension created by the feeders is equalized. Over one of the feeders I provide a horizontally-disposed air trunk, 63, the forward end of which is provided with a chamber or box, 64, which is connected by a tube, 65, with the air-chamber, 55, in the key-bottom, and it is through this tube that a constant suction is maintained in said air chamber, 55, and the air-chests, 29, where the primary and secondary valves are located. This air-trunk, 63, is provided with a horizontal partition 66, which forms therein two parallel horizontal chambers, 67, and, 68,—the former being below the latter and a vertical partition, 69, between the bottom of the air-trunk and partition, 66, forms another chamber, 70, at the forward end of the trunk into which the exhaust from the tube, 65, enters as clearly seen in Figs. 4 and 5 of the drawings. At the forward end the horizontal partition, 66, in the air trunk is provided with ports, 71, and, 72, respectively which establish communication between the chambers, 68, and, 70, and at the rear end said partition, 66, is provided with a port, 73, that provides a communication between said upper chamber, 68 and the lower chamber, 67. This latter port, 73, is provided with a valve, 74, which when closed will shut off all communication between the air chamber, 55, and chests, 29, and the equalizer, 62, and therefore, at such time there will be no suction from the said air-chest or chamber, but when it is open the suction will continue. The port, 72, is controlled by a valve, 75, which is secured upon a diaphragm, 76, that lies over a recess, 77, in the bottom of the trunk and a duct or passage, 78, leads from said recess beneath the diaphragm, to, and is controlled by a valve, 79, in a centrally-located case, 80, as shown in Fig. 4, which will presently be explained. The air trunk, 63, has position flat on top of the feeder, 57, and the equalizer, 62, and is provided with a plurality of ports, 81, through which the air in the chamber, 67, is exhausted by the feeder and additional ports, 82, that open into the equalizer. As there are two feeders,—one actuated by one foot of the operator and the other operated by the other foot, both feeders communicate with the equalizer so as to maintain a uniform tension in the instrument. The centrally-located case or chest, 80, is also flat on top of one of



the feeders and extends over onto the equalizer and is also provided with ports, 83, that communicate with the feeder and other ports, 84, that place the case or chest in communication with the equalizer, thus it will be seen that both the trunk, 63, and the case or chest, 80, are in communication with the equalizer, and that it is at the forward end of the chest, 80, that the valve, 79, which controls the valve, 75, and the port, 72, in the air trunk, 63, is located. This valve, 79, is carried on a stem the lower end of which is sustained by a diaphragm, 85, that extends over a recess in the bottom of the chest and from the under side of which a duct, 86, leads to the key slip, 87, where it opens to the atmosphere through a soft tone port, 88, which normally admits atmosphere to the bottom side of the diaphragm and allows the latter to rise, because of the suction in the chest, 80. By reference to Figs. 4 and 5 it will be seen that from the bottom side of the diaphragm, 76, in trunk, 63, the passage or duct, 78, extends to and normally opens below the valve, 79, in the chest, 80, but if said valve, 79, is lowered, as it is when the soft tone port, 88, is covered by the finger, the end of the duct, 78, will be exposed to the atmosphere and consequently the suction previously maintained through said duct, 78, will be broken and the diaphragm, 76, in trunk, 63, will raise valve, 75, which will cover the bottom side of port, 72, and thus shut off the larger of the two ports that establish communication between the air chests, 29, and the air trunk chamber, 68, and thereby reduce the exhaust in the air chests so as to operate the striking pneumatics with the decreased tension and produce a weak blow of the hammers on the strings. It will therefore be seen that instead of a soft pedal or lever mechanism to produce a soft tone the operator will simply cover port, 88, to get the soft tone effect.

The sostenuto or sustained effect of the instrument is also produced through the closing of a port in the key slip by the finger of the operator and without the use of unsightly levers or pedals and by reference to Figs. 1, 3 and 4 of the drawings the mechanism for producing this sustained effect will now be explained. By referring particularly to Fig. 3 it will be noted that dampers 89, extend crosswise of and normally lie upon or in contact with the string or wire, 8. Suitable rods, 90, depend from the dampers and are pivotally connected at their lower ends with horizontal levers, 91, which latter are sustained in any suitable or well known manner. A horizontal cross-bar, 92, extends crosswise of the instrument and immediately below the levers, 91, and the upper surface of this cross-bar has a cushion, 93, on which the free ends of said levers rest. At the

lower rear edge, the cross bar, 92, is connected by a hinge, 94, to a stationary or rigid bar, 95, so that said cross-bar may be tilted upward to a slight extent at its front edge. It is the raising or tilting of this cross bar that elevates the rods, 90, and consequently raises the dampers, 89, above the strings and when thus raised the strings will be free to vibrate without the restriction of the damper and thereby produce the sustained effect. While the dampers and the devices above described for operating the same are common I have devised a novel pneumatic mechanism for operating the said elements to which reference will now be made in connection with said Figs. 1, 3 and 5. Beneath the key-bottom, 3, and in the present instance at the rear of the striking pneumatics, I provide a box or case, 96, the under side of which carries a bellows, 97, and a lever, 98, has its forward end connected to the movable portion of said bellows and extends in substantially a horizontal direction below the same. The inner end of this lever is pivotally supported in any suitable manner so that the outer end thereof may rise and fall with the bellows. By reference to Figs. 3 and 5, an end and side view of the lever and bellows may be seen, and it will also be seen in said figures that a rod, 99, extends vertically over the lever and passes through a bushing, 100, in the chamber, 55, and its upper end has position directly below the cross-bar, 92. The lower end of the rod, 99, rests upon the upper side of said lever, 98, so that when the bellows is collapsed, as will presently be explained, the lever, 98, and rod, 99, will be raised and the upper end of said rod will tilt the cross-bar, 92, up thus raising the damper from the strings to produce the sustained effect when the hammers strike. By reference to the diagrammatic view shown in Fig. 5 it will be seen that the box or case, 96, is provided with an air-chamber, 101, and that a duct or tube, 102, connects the said chamber with the air-exhaust chamber, 55, so as to maintain a continuous suction in said chamber. Two valves, 103, and, 104, respectively, are provided in the said box or case, 96, and each valve has a vertical stem. The stem of valve, 103, is connected to a diaphragm, 105, and a duct or passage, 106, leads from the bottom side of said diaphragm and opens adjacent the valve, 104, where it communicates with the chamber, 101, as long as valve, 104, is raised so that the suction in said chamber will act on the bottom side of diaphragm, 105, and keep valve, 103, down and permit atmosphere to enter another duct or passage, 107, and pass into the bellows, 97, to keep the latter expanded. The stem of valve, 104, is also connected to diaphragm, 108, and a tube, 109, leads from the under side of this latter diaphragm and opens through a sus-



tained tone port, 110, in the key slip, 87, so as to admit atmosphere to the under side of diaphragm, 108, and permit the latter and also the valve, 104, to be maintained in an elevated position as seen in said Fig. 5. When it is desired to produce a sustained tone effect the bellows, 97, must be collapsed to actuate the damper rail and this is effected simply by placing the finger over the port, 110, which shuts off the entrance of atmosphere to the bottom side of diaphragm, 108, it being understood that the diaphragm has the ordinary well known bleed and the suction in the chamber, 101, together with the weight of valve, 104, and its stem, will cause said latter valve to drop and thereby uncover passage, 106, so atmosphere can enter therein, whereupon valve, 103, will rise, because there is no longer a suction on the bottom side of diaphragm, 105, and passage or duct, 107, will be thrown into communication with the suction chamber, 101, and consequently bellows, 97, will be collapsed and will remain so as long as the port, 110, in the key slip is covered by the finger. The uncovering of said port will immediately restore the valves to their original normal position and a return to the normal tone will immediately follow.

In the operation of the instrument the music sheet, 40, is carried on a roll, 111, see Fig. 3, and is run from said roll onto another roll, 112, during operation, as can be better seen in Fig. 2. The particular form of mechanism for sustaining the latter roll while the sheet is drawn over the tracker while playing the instrument, may vary as may also the motor mechanism, 113, for operating said mechanism, but in the present instance the motor mechanism is of a well known form and operates a crank shaft, 114, which carries a sprocket wheel over which a sprocket chain, 115, travels. This chain also passes around another sprocket on a longitudinally movable shaft, 116, that is sustained in a bracket, 117, carried at the rear side of the conduit board and a pinion, 118, on said shaft meshes with a gear, 119, on the roll shaft, 120, on which the roll, 112, is mounted. Suitable hanger brackets, 121, are carried on the front face or edge of the conduit board, 11, and one of said brackets carries a stem or rod, 122, which is yieldingly pressed toward the other by means of a spring coiled thereon, as seen in Fig. 2. The other bracket carries a short shaft, 123, in which a sprocket wheel is mounted and a short sprocket chain, 124, travels over said wheel and also over a similar wheel on the shaft, 116. By this means the two shafts, 116, and, 123, are driven in the same direction from the motor while the roll shaft, 120, is normally revolved in a reverse direction to effect an unwinding of the music sheet from the roll, 111, that is supported between

the shafts, 122, and, 123, onto the roll, 112, during the rendering of the music. It will thus be seen that the horizontal conduit board, 11, sustains the roll-carrying brackets and driving mechanism immediately connected therewith, so that all of this mechanism may be removed simultaneously with the conduit board, as for example when it is desired to tune the instrument.

Another feature of the present invention is the novel rewinding mechanism whereby the music sheet may be returned from roll, 112, to roll, 111, without sounding the respective notes during such return and at the same time effect the return through pneumatically operated means as will now be described reference being made particularly to Figs. 2, 3, 4 and 5 of the drawings. In Figs. 2 and 3 it will be noted that a rod, 125, extends horizontally beneath the conduit board and is hung in suitable brackets, 126, so that it may be oscillated. The inner end of this rod extends upwardly and has a semi-circular support, 127, that engages a circular head, 128, on the outer end of the shaft, 116, so that when said rod, 125, is rocked in one direction the said shaft will be moved longitudinally and the pinion, 118, withdrawn laterally from engagement with the gear, 119, so as to cease driving the latter. The forward end, 129, of the rod, 125, turns laterally and parallel with the front edge of the conduit board and it is with this end of the rod that a pneumatic device engages to rock the bar one way or another to cause the music sheet to travel, and these devices will now be described. A case or box, 130, is secured to the front side of the conduit board, 11, and over the wrest plank, 6, and by reference to Fig. 5, which shows a longitudinal section through this box, it will be seen that the same has a chamber, 131, and two pneumatic valves, 132, and, 133, respectively extending vertically therein,—the same being carried on stems, the lower ends of which are attached to diaphragms, 134, and, 135. An air duct or passage, 136, extends from the under side of the diaphragm, 135, and communicates with the suction chamber, 55, and by this means the suction on the under side of said diaphragm keeps the valve, 133, seated so as to normally admit atmosphere through a duct or passage, 137, to the under side of diaphragm, 134, and also into a bellows, 138, thus permitting the said bellows to remain in an expanded condition. An air duct or tube, 139, also enters the case or box, 130, and a suction is continuously maintained through said duct and from the chamber, 131, so as to hold the valve, 132, raised and expose a rewind bellows, 140, to the exhaust in the chamber, 131, through a duct, 141, so that as long as a suction is maintained in both the duct, 136, and chamber, 131, the rewind bellows, 140, will



remain collapsed. By means of the constructions here employed a suction will always be maintained in the chamber, 135, through tube, 139, but during the rewinding operation there must be no suction or tension in the air chamber, 55, because if there were the return of the music sheet over the tracker would cause a reverse playing of the music which would be very objectionable, therefore as chamber, 55, is exhausted through tube or duct, 65, and chamber, 68, I have devised a construction whereby the valve, 74, will seat and remain seated during the rewinding operation and thus prevent any suction whatever in said chamber, 68, although the feeders, equalizer and motor continue to operate. By again referring to Figs. 4 and 5 it will be noted that valve, 74, is carried by a stem the lower end of which is connected to a diaphragm, 142, from the under side of which a duct or passage, 143, extends, and that said duct enters and extends along the bottom of the centrally-located case, 80, and terminates in a vertical passage, 144, in said case. This passage, 144, extends from the interior of the case to the atmosphere on the exterior and a valve stem extends through the passage and carries two valves, 145, and, 146,—one above the other. The valve, 146, controls the outer atmospheric end of the passage and the valve, 145, the inner end thereof and the duct, 143, enters the said passage between the said two valves so that when valve, 146, uncovers the passage, atmosphere can pass through duct, 143, and beneath the diaphragm, 142. The lower end of the stem that carries valves, 145, and, 146, is connected to a diaphragm, 147, which covers a recess, 148, and a duct, 149, communicates with said recess beneath the diaphragm and extends to the key slip, 87, where it opens through a rewind port, 150, to the atmosphere.

From the foregoing explanation it will be seen that normally atmosphere enters through the rewind port, 150, to the under side of diaphragm, 147; that the exhaust tension in the interior of case, 80, lifts said diaphragm and seats valve, 145, against the lower end of passage, 144; that atmosphere enters the upper end of passage, 144, and passes through duct, 143, to the lower side of diaphragm, 142, and consequently valve, 74, remains normally elevated. But suppose rewind port, 150, is covered by the finger of the operator and thus cuts off the atmosphere to the bottom side of diaphragm, 147; the usual bleed in the diaphragm will cause the tension in the case, 80, to deflate the diaphragm which will draw the valves, 145, and, 146, down thereby seating valve, 146, and throwing duct, 143, into communication with the exhaust tension in case, 80, whereupon said tension will immediately act on diaphragm, 142, and draw valve, 74, down

so as to cover port, 73, whereupon the exhaust in chambers, 68, and, 70, duct, 65, chamber, 55, and all the air chests, 29, will be broken and consequently all the primary and secondary valves will remain inactive so that the travel of the music sheet over the tracker can be reversed without sounding a note. The cutting off of atmosphere from entrance to rewind port, 150, and shutting off the exhaust in chamber, 55, will cause the bellows, 138, to collapse and the rewind bellows, 140, to expand and thus shift or rock rod, 125, to throw the pinion, 118, out of mesh with gear, 119, and shift the gearing then to drive shaft, 123, to effect a rewinding of the music sheet. The bellows, 138, and the rewind bellows, 140, are each provided with a bracket, 151, and each bracket has a vertical end, 152, which projects toward the end of the other bracket but leaving sufficient space between to receive the end, 129, of the rock rod, 125, so that when one bellows collapses and the other expands the rock bar will be moved toward the expanded bellows to effect a shifting of the shaft, 116.

By reference to Figs. 2, 4 and 5 it will be seen that a conduit box or case, 153, extends horizontally between the feeders, 57, and the equalizer, 62, and that the same is provided with a chamber, 154, that is in communication with the trunk, 63, by means of ports, 155, and with the central case, 80, by means of ports, 156, so that the exhaust maintained by the feeders and equalizer is also effective in the conduit chamber, 154, and it is through this conduit that the exhaust to operate the motor is conveyed. At one end of this conduit box or case, 153, I locate an exhaust box, 157, having a chamber, 158, which also extends over one of the feeders, 57, but has no direct communication therewith. There is however a port, 159, in the bottom and at the rear end of the said box which provides a constant communication with the conduit chamber, 154, and through the latter said chamber is exhausted by the feeders. At the front end of the exhaust box I provide an expansible receptacle, 160, which in the present instance has the form of a bellows and communication is established between the said receptacle and the exhaust-box chamber, 158, by a port, 161. Beneath the expansible receptacle and the front end of the exhaust box I provide a tempo box, 162, whose function, as its name implies, is to regulate the time or the speed at which the motor is to be operated. This box has a horizontal partition, 163, which serves to form a lower horizontal channel or chamber, 164, and an upper channel or chamber, 165, and a port, 166, is provided in said partition and may be opened more or less by means of a slide valve, 167, that has a stem, 168, which extends through the end



wall of the box and which is connected to a horizontal rod, 169, that extends over the key-bottom or bed, as clearly shown in Fig. 6 of the drawing. At one end the channel, 164, of the tempo box connects with a vertical passage, 170, that extends up through the front end of the exhaust box, 157, and whose upper end opens directly into the expansible receptacle or bellows, 160, as can be clearly seen in Fig. 4. The movable portion of the expansible receptacle or bellows, 160, carries a bracket, 171, at its hinged end and a spring, 172, is stretched between said bracket and a stationary bracket, 173, at the bottom of the tempo box, whereby the tension of the spring will serve to keep the receptacle or bellows yieldingly expanded but permit it to rise and fall if the exhaust tension in chamber, 158, should vary. A tube, 174, enters a port, 175, in the upper side of the tempo box and extends from the chamber, 165, thereof to the motor mechanism, 113, so that the air in the latter will be exhausted through said tube; across channel, 165, of the tempo box: through port, 166, and channel, 164, then by way of vertical passage, 170, to the expansible receptacle or bellows, 160, then through port, 161, to chamber, 158, of exhaust box and finally through port, 159, to conduit box or case and thence to feeders. In the normal operation of the instrument the slide valve, 167, in the tempo box will partly close the port, 166, but if it is desired to increase the time or speed either momentarily or for a greater period, the operator will shift the lever, 169,—the handle-end of which projects in front of the key slip, 87, see Figs. 2 and 6, and will move said slide valve so as to further uncover the said port, 166, whereupon the exhaust tension will be increased and the motor thus operated faster. On the other hand, a gradual closing of the slide valve over said port will reduce the speed of the motor and likewise the speed of the music sheet over the tracker. In connection with this tempo control, I have provided an ocular time indicator by means of which the slide valve in the tempo box may be accurately placed with respect to the port it controls and by reference to Figs. 2 and 6 the same will be briefly described. The horizontal rod, 169, that operates the tempo slide valve is pivoted at, 176, between its end to the key-bottom and a bar, 177, has one end pivoted to said rod and extends horizontally therefrom and its other end pivotally engages an arm, 178, that is carried on a vertical rock shaft, 179. This rock shaft extends vertically from the key-bottom and passes through the wrest plank, 6, and metal frame, 7, which latter serves as a bearing from its upper end and said latter projecting end also carries an arm, 180, which projects horizontally over the metal frame as

seen on Fig. 2. An indicator hand, 181, is pivoted adjacent to the metal frame and in the present instance in front of the tracker, and a rod, 182, connects said hand with the arm, 180, on the rock shaft. It will thus be seen that as the rod, 169, is moved to shift the slide valve, 167, the bar, 177, rock-shaft, 179, rod, 182, and hand, 181, will all shift correspondingly and thus by watching the hand the position of the slide valve may be determined.

During the rewinding of the music sheet to return it from roll, 112, to roll, 111, from which it was unwound while playing it is desirable that the rewinding be quickly accomplished, and that the striking pneumatics, 50; the primary valves, 38; and secondary valve, 45, also be held against operation. The latter feature has been explained in connection with the valve, 73, diaphragm, 142, duct, 143, and valves, 144, and, 145, which during the rewinding effect a closure of port, 74, by the seating of valve, 73 and thereby prevent further exhaust from that point to the air chests, 29. This additional exhaust tension that would otherwise be distributed through all the air chests, 29, and, 55, can be utilized in rapidly driving the motor mechanism and to aid in thus speeding up the motor while rewinding, I have provided the exhaust box, 157, with a passage, 183, which has one end opening into the chamber, 165, of the tempo box, 162, see Figs. 4 and 5, and the other end of said passage has a downwardly-extending tubular valve seat, 184, which projects into the chamber, 158. A recess, 185, is provided in the bottom of the exhaust box directly beneath valve seat, 184, and a diaphragm, 186, covers said recess and carries a disk valve, 187, on its upper side. In order to permit this disk valve and the diaphragm that carries it to be raised by the suction on the upper side I provide a duct, 188, that leads from the recess, 185, and enters the wall of the case or chest, 80, and opens in the vertical passage, 144, between the valves, 145, and, 146, which passage, as hereinbefore explained is open to the atmosphere as long as the rewind port, 150, at the key slip is uncovered. When port, 150, is covered for rewind as above explained valve, 146, will exclude atmosphere from duct, 188, and valve, 145, will drop and thus the suction in chest, 80, will draw valve, 187, and diaphragm, 186, down so as to uncover the tubular valve seat, 184. The uncovering of this seat, 184, will increase the suction in chamber, 165, of the tempo box which has direct communication through tube, 174, to the motor mechanism and as at this time the entire suction of the feeders is through chamber, 158, by way of conduit, 154 the motor mechanism will be operated very rapidly to rewind the music sheet. At this



same moment it will be seen that the suction in tempo chamber, 165, is drawing through tube 139, and the suction in chest, 55, is stopped, the bellows, 138, will be drawn down and the suction in bellows, 140, broken and atmosphere admitted thereto so that the roll driving chains will rewind the sheet of music.

The treadle mechanism comprises a seat or bench, 189, having a pivoted frame, 190, which extends forwardly therefrom and which rests upon the floor and the treadles, 191, are pivoted to the frame and incline upwardly therefrom. A link, 192, is carried or connected to the end of the flexible belt or strap, 61, and said link engages the forward end of the pedals whereby to support said end in an inclined position. By disconnecting the links from the pedals the latter may be folded together with the frame, 190, and turned back beneath the seat or bench.

From the foregoing description it will be noted that the conduit board 11 extends horizontally over the wrest plank and above the tuning pins, and that it carries the tracker bar, music rolls and immediate mechanism for reversing the motion of the rolls. As this conduit board is detachably secured to end blocks or equivalent supports having vertical passages that register with the passages in the said board, it may readily be lifted out together with the devices it carries to permit access to the tuning pins and as readily replaced, thus avoiding the necessity of dismantling or separately removing all those parts.

Another very desirable feature is the arrangement in the key-bottom of air chests and valves in parallel rows in different vertical planes but all in the same horizontal plane because this permits immediate access to all of those valves, or any one of them without the necessity of dismantling or the removal of numerous parts.

It is to be understood that the horizontal and side-by-side arrangement of air chests and the location of the valves in the key-bottom is just as applicable to upright as to pianos of the grand type.

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

1. In a grand player piano the combination with the horizontally disposed case, of a horizontal key-bottom having a plurality of ducts and air-chests therein; striking pneumatics; valves also in the key-bottom for controlling the operation of the striking pneumatics; a tracker bar having a plurality of ports; a horizontal conduit board between the tracker and the key-bottom said board having a plurality of horizontal ducts therein between its upper and lower surfaces that communicate with the tracker ports,

and means at opposite ends of the horizontal conduit board and the ducts therein and extending downwardly to the horizontal key-bottom for establishing communication between the ducts in said board and the ducts in said key-bottom.

2. In a grand player piano the combination with the horizontally disposed case, of a horizontal key-bottom having ducts and air chests therein; striking pneumatics; valves also in the key-bottom for controlling the striking pneumatics; a perforated tracker bar; a horizontal conduit board having ducts extending horizontally therein that communicate with the tracker perforations and conduit boards extending upwardly from opposite sides of the key-bottom,—said latter boards also having ducts that communicate with the ducts in the key-bottom and also communicate with the ducts in the horizontal conduit board.

3. In a grand player piano the combination with the horizontally disposed case, of a horizontal key-bottom having ducts and air-chests therein; striking pneumatics; valves also in the key-bottom for controlling the striking pneumatics; a perforated tracker bar; a horizontal conduit board beneath the tracker and having a plurality of ducts formed therein and extending therethrough from its opposite ends toward the tracker and connected with the perforations of the latter; a wrest plank between the key bottom and the conduit board and vertical conduit boards extending upwardly from the key-bottom and sustaining the wrest plank,—said vertical boards having ducts that connect the ducts of the horizontal conduit board above the wrest plank with the ducts in the key-bottom below the wrest plank.

4. In a player piano the combination with the key-bottom having a horizontal air chest therein, of a removable cover on the upper side of the said chest; a plurality of valves sustained by said cover and accessible from the upper side of the key-bottom and striking pneumatics controlled by said valves.

5. In a player piano the combination with the key-bottom having a horizontal air-chest and a plurality of air ducts therein, of a removable cover at the upper side of said air chest and having rows of ports therein and also having ducts extending laterally in the cover from said ports which communicate with the air ducts in the key bottom; valves in the ports of said cover and accessible from the upper side of the key bottom, and striking pneumatics controlled by said valves.

6. In a player piano the combination with the key-bottom having a plurality of horizontal air chests arranged side-by-side in different vertical planes and also having a



plurality of horizontal ducts between the lower surface of the bottom and said air chests; of a removable cover over said air chests and having a plurality of ports therein; valves in the key-bottom chests for controlling said ports in the cover, and striking pneumatics also controlled by said valves.

7. In a player piano the combination with the horizontal case, of a tracker; a horizontal key-bottom; air chests in said key-bottom; valves in said chests and exposed at the upper side of the key-bottom; ducts leading from the tracker downwardly and then horizontally through the key-bottom and adjacent the chest valves; bleed ducts branching from the tracker ducts and opening into the chests in the key-bottom; adjusting stems extending across said bleed ducts and exposed at the upper side of the key-bottom for regulation; striking pneumatics; sounding devices and means operating between said striking pneumatics and sounding devices.

8. In a player piano the combination with the key action, of a plurality of air chests side-by-side and in the same horizontal plane but below the key-action; valves in said chests; a tracker bar above the key action and connections between the tracker above the action and the air-chests below the action.

9. In a player piano the combination with the key action, of a plurality of air chests in the same horizontal plane and side-by-side and below the key action; valves in said chests; a tracker bar; striking pneumatics; sounding devices; means operating between the striking pneumatics and at the rear end of the key action for operating the sounding devices and connections between the tracker bar above the action and the chests below the key action.

10. In a player piano the combination with the key action, of a plurality of air chests arranged side-by-side in a single horizontal plane and below the key action,—said chests containing a plurality of horizontal passages; valves in said chests above the passages therein, a tracker bar above the action and connections between the said bar above the action and the passages in the chests below the action.

11. In a player piano the combination with the key-action, of a plurality of parallel air chests in the same horizontal plane below the key action; valves arranged in parallel rows and in the same horizontal plane as the chests; a tracker bar above the action; striking pneumatics; sounding devices; means at the rear of the action and operating between the sounding devices and the striking pneumatics and connections between the tracker above the action and the parallel chests below the action.

12. In a player piano the combination

with the key-action, of a plurality of air chests; valves in said chests; a conduit board above the action and having a plurality of passages therein,—said board and its passages being detachably secured; a tracker bar; connections between the tracker bar and the passages in the detachable conduit board and connections between the conduit board and the chests.

13. In a player piano the combination with the keys, of a plurality of parallel air chests in different vertical planes and said chests being arranged in a single horizontal plane; valves in each of said chests and also arranged in different vertical planes but in the same horizontal plane; striking pneumatics beneath the inner ends of the keys; a channeled board beneath the chests and having channels that connect the chests with the striking pneumatics; sounding devices; and means coacting between the inner ends of the keys and the striking pneumatics whereby to raise the said inner key-ends and operate the sounding devices.

14. In a player piano the combination with the key action, of a plurality of air chests below the said action; valves in said chests; a horizontal board over the key action and supported at its opposite ends,—said board having a plurality of passages extending horizontally therein between its upper and lower surfaces; a tracker carried by said board and having passages that communicate with the passages in the board and means at opposite ends of the board for establishing communication between the passages therein and the valves below the action.

15. In a player piano the combination with the key action, of air chests below the action; valves in said chests; a horizontal conduit board above the key action and having passages extending horizontally toward opposite ends thereof and communicating with short lateral passages adjacent the end of the board which open at the bottom side of the board; means connecting the short lateral passages at the end of the board with the valves below the action; a tracker above the board; connections between the tracker and board passages and means for securing the board in place to hold the passage openings in register with the means that connects said passages with the valves below the action.

16. In a player piano the combination with a key-bottom having a continuous flat upper surface and a plurality of vertical passages therein between said upper surface and the lower surface thereof, of a key-frame sustained on top of the flat upper surface of the key-bottom; keys mounted on said frame; striking pneumatics for actuating the keys and pneumatic means located in the key-bottom between the upper



and lower surfaces thereof for controlling the striking pneumatics.

17. In a player piano the combination with the key action, of a key bottom below  
5 the action and having a plurality of air chests therein, said chests being side-by-side and in the same horizontal plane,—valves in said key-bottom chests; a tracker, and connections between the tracker and the said

side-by-side horizontal air chests in the key 10 bottom.

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

JAMES P. CAULFIELD.

Witnesses:

G. FERDINAND VOGT,  
CHARLES B. MANN, Jr.