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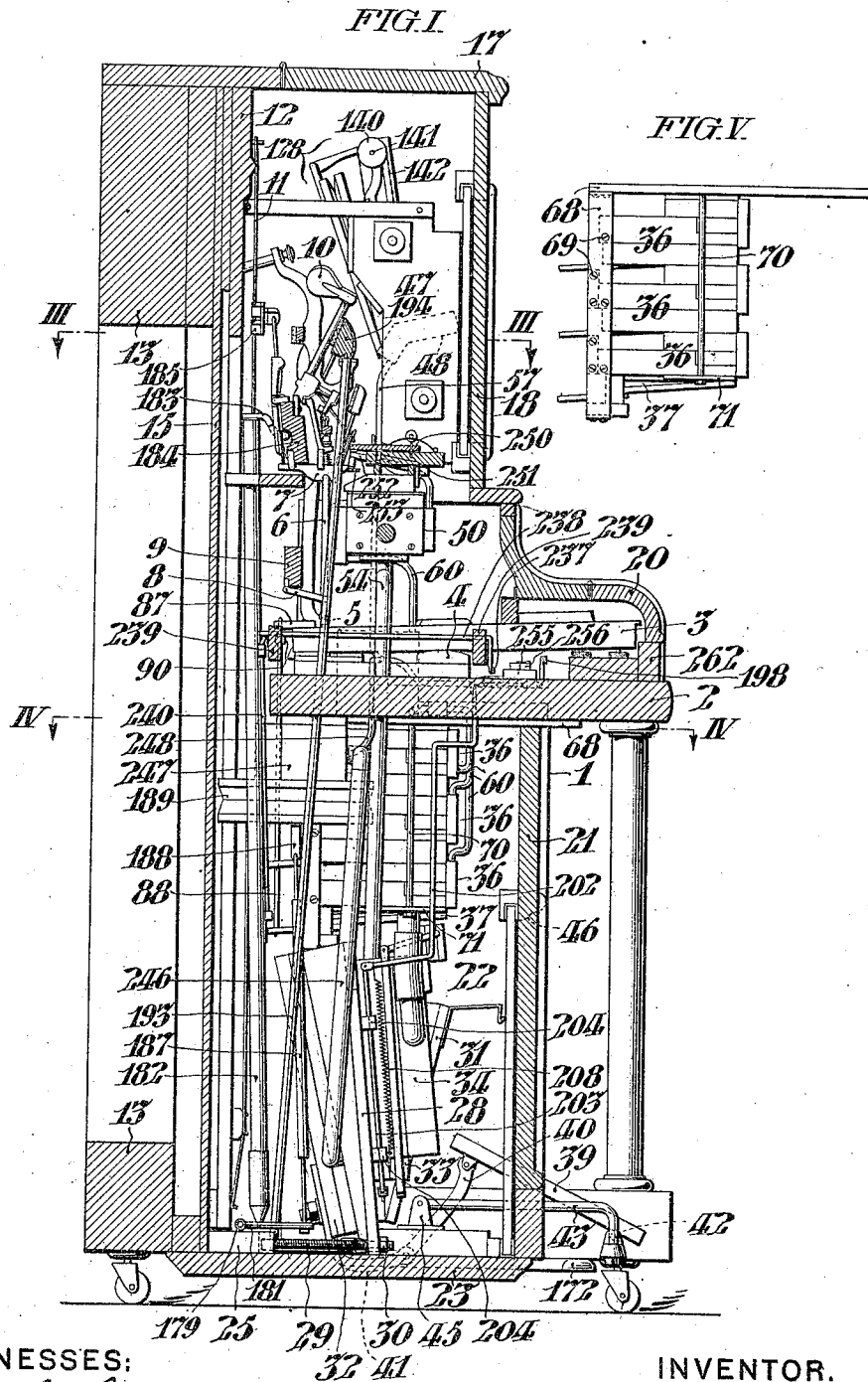
PATENTED JULY 16, 1907.

P. WUEST, JR.

AUTOMATIC PLAYING MECHANISM IN PIANOS.

APPLICATION FILED JUNE 30, 1905.

5 SHEETS—SHEET 1.



WITNESSES:

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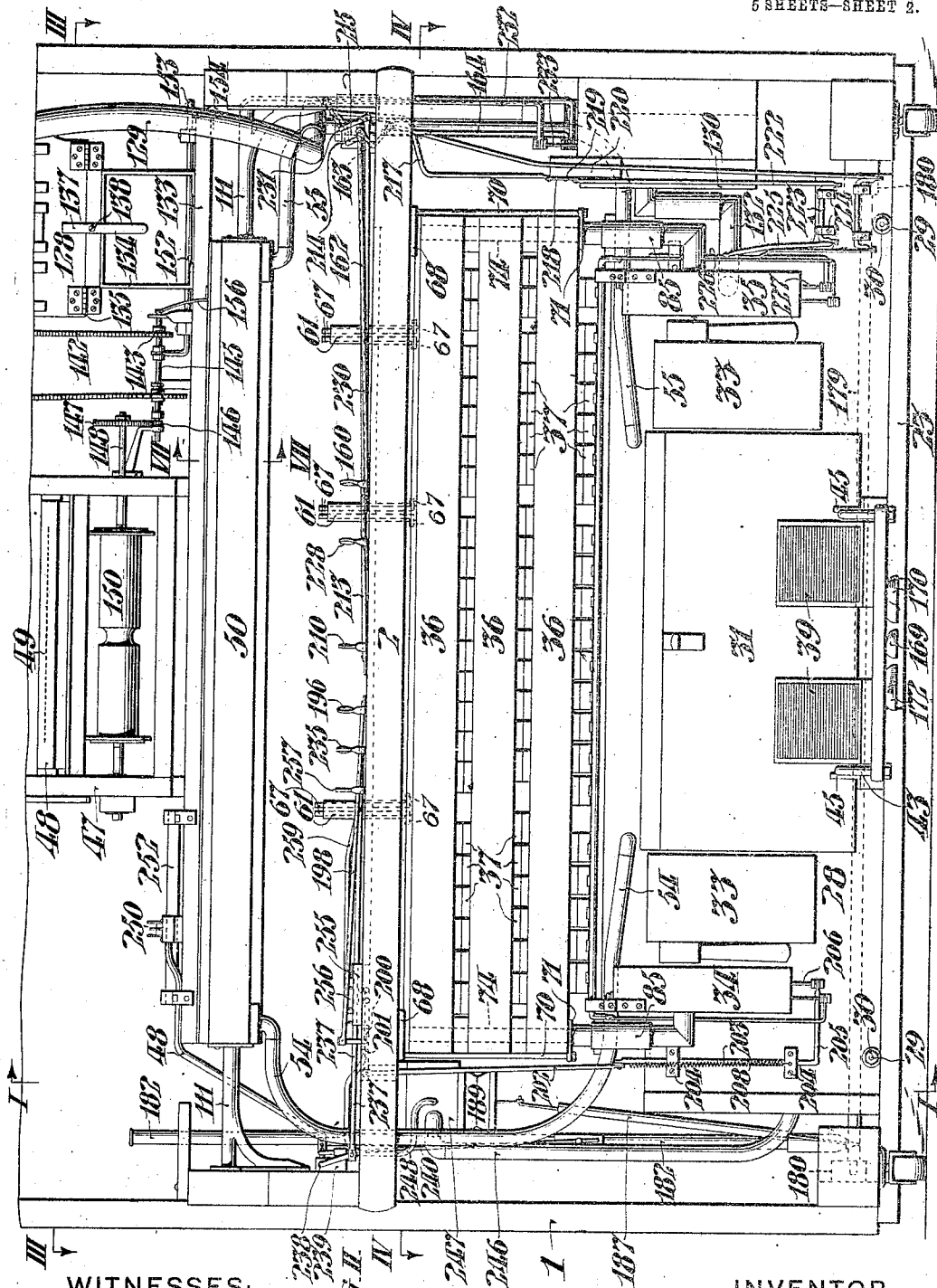
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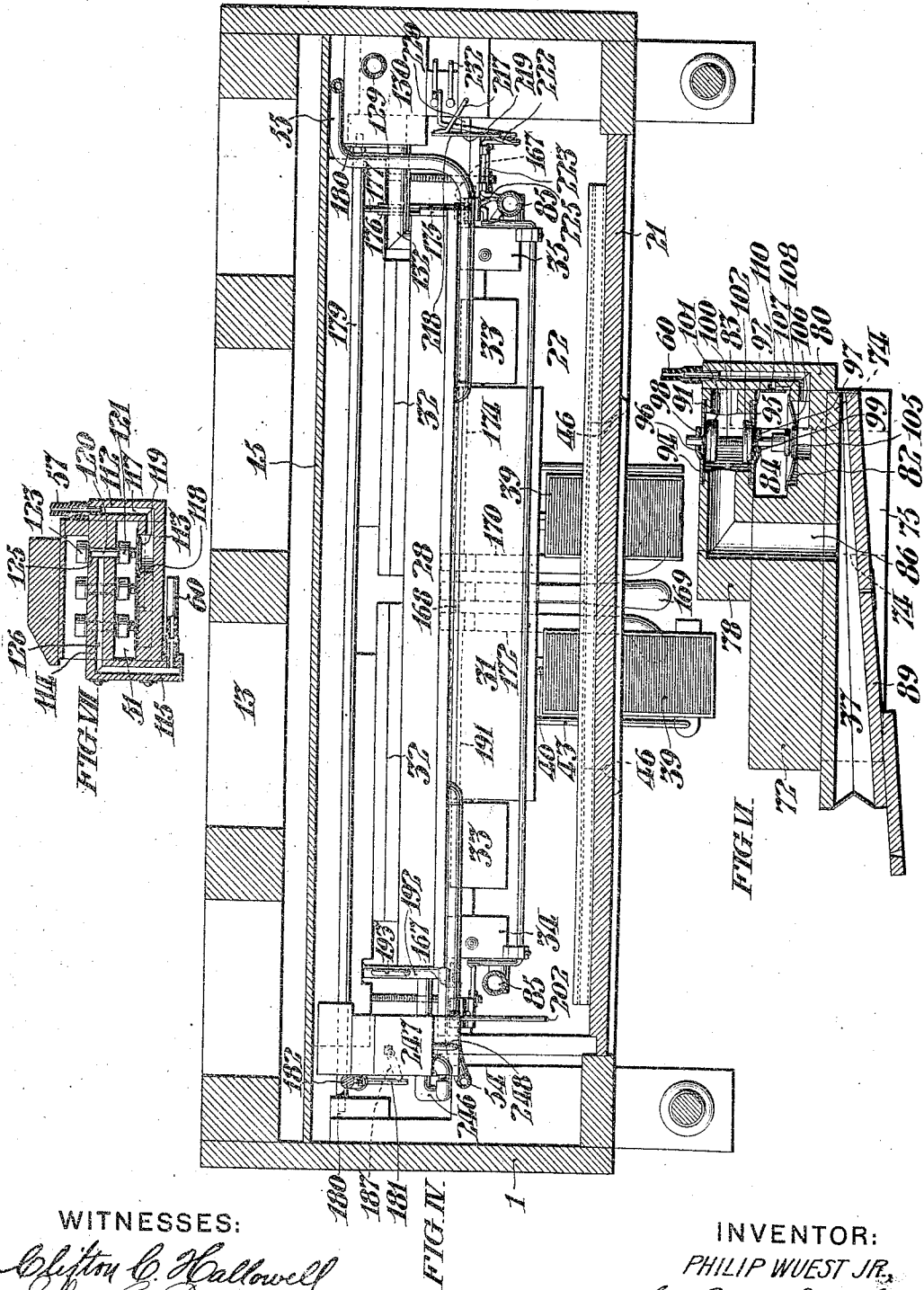
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5 SHEETS—SHEET 4.



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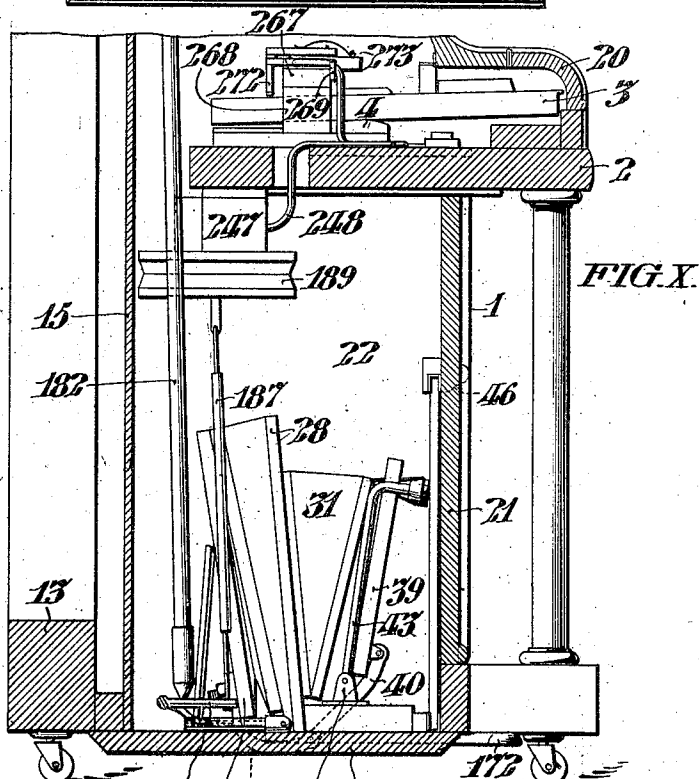
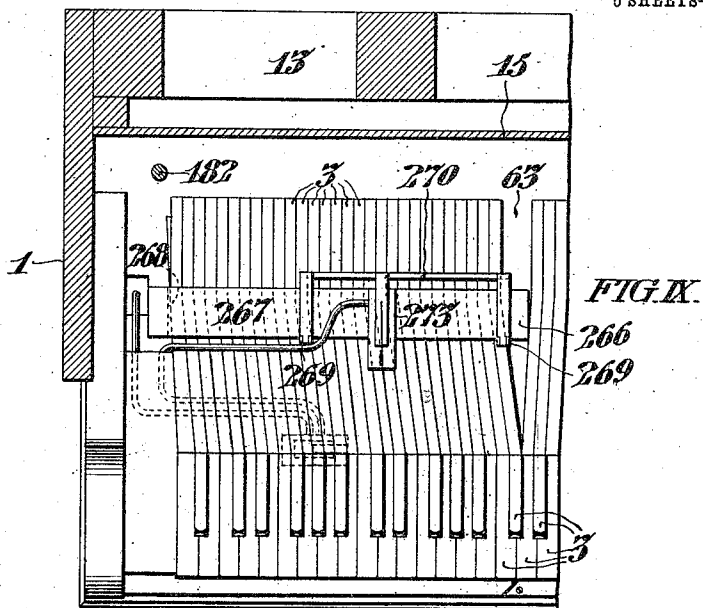
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5 SHEETS—SHEET 5.



WITNESSES:

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181 41 43 23  
32

INVENTOR:

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*Attys.*

# UNITED STATES PATENT OFFICE.

PHILIP WUEST, JR., OF CHELTENHAM, PENNSYLVANIA, ASSIGNOR TO THE AUTO-MANUAL PIANO ACTION COMPANY, OF PHILADELPHIA, PENNSYLVANIA, A CORPORATION OF NEW JERSEY.

## AUTOMATIC PLAYING MECHANISM IN PIANOS.

No. 860,618.

Specification of Letters Patent.

Patented July 16, 1907.

Application filed June 30, 1905. Serial No. 267,706.

*To all whom it may concern:*

Be it known that I, PHILIP WUEST, JR., of Cheltenham, in the State of Pennsylvania, have invented certain new and useful Improvements in Automatic Playing Mechanism in Pianos, whereof the following is a specification, reference being had to the accompanying drawings.

My invention relates to pianos, organs and similar instruments comprising automatic playing mechanism permanently adjusted in operative relation with their sounding devices; for instance, mechanism of the kind comprising a series of pneumatic motors, or "strike pneumatics" respectively in operative relation to the individual sounding devices, and, having individual valve mechanisms controlled by a web of perforated paper which is progressed with respect to a pneumatic tracker bar provided with a series of apertures corresponding with a series of sounding devices in the instrument.

One object of my invention is to provide means for automatically operating the pedals of the instrument in proper accord with the music being played and without the interposition of the operator.

Where the automatic playing mechanism is embodied in a separate organization, external to the instrument itself, and operated by simulating manual playing upon the digitals, the necessary movements of the pedals can be derived from the striking levers, without occasioning serious interference with their action. This however, is not the case in the class of instruments to which my invention relates, where the automatic playing mechanism is self-contained and is permanently in operative relation with the sounding devices. In these instruments the conditions are such that the pedal operating devices cannot be directly combined with the efficient elements of the playing mechanism, without the risk of serious disturbance. The digitals however, although incidentally moved during the action of the automatic playing devices, are not in themselves active elements, and I have found that by reason of this fact they can be utilized for deriving the necessary movements of the pedals, without interfering with the proper action of the playing mechanism. Hence this feature of my invention consists in combining, with selected digitals, means whereby the pedal operating mechanism may be controlled.

My invention relates to the method of grouping the conduits by means of which communication is established between the main divisions of the automatic mechanism. Such conduits being necessarily numerous, their passage through the region of the key frame has been found to seriously affect the strength and stability of the adjacent parts and also to interfere with

ready access thereto. Hence, instead of leading the conduits through this region in dispersed relation, so as to pass through or between all the digital levers, my invention consists in definitely grouping the conduits and concentrating the passage region of each group, so as to conduct its members through the plane of the keyboard with a minimum of interference with individual digital levers. This arrangement is peculiarly advantageous in that it takes advantage of certain natural divisions of the keyboard ordinarily found in instruments of this class, which afford, without serious modifications of the normal arrangement, proper locations for the passage of the several groups.

In the accompanying drawings; Figure I, is a vertical sectional view of a piano embodying my improvements, taken on the line I, I, in Fig. II. Fig. II, is a front elevation of the piano shown in Fig. I; the front of the casing being removed. Fig. III, is a plan sectional view, taken on the line III, III, in Figs. I, and II, certain portions of the mechanism being removed, or shown as broken away, in order to exhibit the region of the keyboard. Fig. IV, is a plan sectional view, taken on the line IV, IV, in Figs. I, and II. Fig. V, is an elevation of the left hand end of the separable group of valve shelves, shown in the piano in Fig. II. Fig. VI, is a transverse sectional view of one of said valve shelves taken through a strike pneumatic motor and its controlling valve. Fig. VII, is a transverse sectional view of the pneumatic chest shown above the keyboard in Figs. I, and II, section being taken through one set of pneumatic conduits, on the line VII, VII, in Fig. II. Fig. VIII, is a fragmentary sectional view of the front of the key frame, showing one of the controlling levers of the automatic playing mechanism. Fig. IX, is a fragmentary plan sectional view, similar to Fig. III, but showing a modified form of my invention. Fig. X, is a fragmentary sectional view, similar to Fig. I, but showing the modified form of my invention indicated in Fig. IX.

In said drawings, the piano casing 1, comprises the key frame 2, on which the digitals or keys 3, are supported by the balance rail 4. Each of said digitals 3, is provided with an adjustable stud 5, in operative relation with an extension rod 6, depending from the jack whip 7, and pivoted to an extension lever 8, fulcrumed on the small action rail 9, in connection with a hammer 10, arranged to strike the string 11, on the metallic string frame 12; which latter is provided with the usual wooden back supports 13, and sounding board 15. Said casing 1, also comprises the usual upper lid 17, the removable front panel 18, inclosing the action; the hinged cover 20, for the manual comprising the digitals 3, and, the removable front panel 21, inclosing the chamber 22, below the key frame 2.

Said chamber 22, is provided with the floor 23, having the beam 25, at its rear side, arranged to support the removable chest 28, by the bolts 29, having nuts 30. Said chest 28, supports all of the exhausting mechanism, so that it can be conveniently removed with said chest for adjustment or repairs. Said chest 28, supports the main bellows 31, the two pump bellows or exhausters 32, the two auxiliary bellows 33, and the two valve boxes 34, and 35, which latter are provided with valves which respectively control the area of the ports through which communication is established between the exhaust bellows and the bass and treble exhaust chambers in the respectively opposite ends of the three separable valve casings or shelves 36. Said shelves contain the secondary valve mechanisms which control the strike pneumatic motors 37, as hereinafter described.

As shown in Fig. I, the exhausters 32, are arranged to be operated by the pumping pedals 39, with which they are connected by the links 40, and brackets 41. Said pedals are supported by pivots 42, on the frame 43, which is pivoted on the brackets 45, secured to the casing floor 23, so that said frame and pedals may be upturned within said casing through the doorway indicated by the dotted line 46, in Figs. I, and IV, which may be closed by suitable sliding or folding doors.

Referring to Figs. I, and II, the music box 47, provided with the tracker bar 48, having the series of apertures 49, is supported by the pneumatic chest 50, containing the primary valve mechanisms having an exhaust chamber 51, connected with the main exhaust bellows 31, by the flexible pneumatic conduits 54, and 55, shown in Fig. II. Each of said primary valve mechanisms in the chest 50, is connected by an individual conduit 57, with a corresponding aperture 49, in said tracker bar 48, and, each of said valve mechanisms is also connected by an individual conduit 60, with a corresponding secondary valve mechanism in one of the three valve casings or shelves 36. In order to minimize the interference of said conduits 60, with the movable members of the mechanism, I dispose the digitals 3, in four groups, so as to afford three spaces 63, between them in which I secure the three duct blocks 61, in rigid relation with the key frame 2. Each of said conduits 60, makes connection above and below the key frame 2, and digitals 3, through its individual duct 66, in one of said duct blocks, each duct being provided at top and bottom with a projecting metallic nipple 67, to engage the end of the conduit.

It will be noticed that the locations selected for the duct blocks are in a natural relation to normal subdivisions of the digital elements, and therefore do not call for any substantial rearrangement thereof. Furthermore, inasmuch as the conduits relating to each block are readily removable both above and below the keyboard by detaching them from their respective metallic nipples, complete access at the regions of the groups themselves can be afforded by such detachment, when necessary, the intervening portions of the interior being at all times readily accessible by reason of the definitely localized arrangement of the conduits at the region of passage through the key frame and adjacent parts.

The valve casings or shelves 36, are conveniently

supported, in separable relation, in the two brackets 68, which depend from the lower side of the key frame 2, to which they are secured. As shown in Fig. V, said shelves are attached to said brackets at their rear ends by the screws 69, and are upheld at their front edges by the bolts 70, and plates 71. Said bolts 70, may be unscrewed from said brackets 68, when it is desired to remove any one of said shelves.

Each valve casing or shelf 36, is constructed as shown in Fig. VI, and comprises a bottom board 72, having a wind port 74, and a spacing block 75, fixed to said board 72, a removable top cover board 78, and a removable front cover board 80. It is to be understood that each of said shelves comprises a series of individual secondary valve mechanisms, only one of which is shown in Fig. VI, and that each mechanism is provided with a diaphragm seat 82, in said bottom board 72, in registry with a valve chamber 83, in the top cover board 78, and that the vacuum chamber 84, is common to all of said diaphragm seats 82, in communication through the wind ports 74, conduits 85, valve boxes 34, and 35, and chest 28, with the exhaust bellows 31, so as to maintain a partial vacuum in said chamber 84.

Each valve mechanism aforesaid controls an individual strike pneumatic motor 37, which is removably secured upon the bottom of said board 72, in connection with the duct 86, extending through said board 72, and top cover board 78, into the valve chamber 83, and the free leaf 89, of said bellows motor 37, is provided with the vertical rod 88, whose upper end extends through the bracket 87, on the corresponding digital 3, and is provided below said bracket with the collar 90, adapted to strike said bracket when said motor is collapsed, and thereby operate said digital.

Countersunk recesses 91, and 92, are respectively provided at the top and bottom of said boards 72, and 78, respectively in registry with said chamber 83, to receive the valve seat plates 94, and 95, which are secured therein. Said plates are respectively provided with central valve ports 96, and 97, and offset bearing lugs, 98, and 99, in which lugs the opposite ends of the valve stem 100, are arranged to reciprocate. Said valve stem 100, carries two valves 101, and 102, respectively in operative relation to said ports 96, and 97, and arranged to alternately seat against the annular plane portions of said plates 94, and 95, surrounding said ports, and the lower end of said valve stem 100, is opposed to the disk 105, upon the diaphragm 106, which latter is mounted over the seat 82, in operative relation to said valve stem. Said diaphragm seat 82, is in communication with the conduit 60, through the duct 107, and the latter is provided with the branch 108, terminating in a small aperture 110, opening into the vacuum chamber 84. Said conduit 60, being directly controlled by the corresponding primary pneumatic valve in the chest 50, the secondary valve mechanism aforesaid may be operated in the usual manner to cause the strike pneumatic bellows 37, to be collapsed to operate the sounding devices, through the connections above described, when the corresponding tracker bar aperture 49, is opened, and to permit inflation of said strike pneumatic bellows 37, under atmospheric pressure, when said tracker bar aperture is closed. Said pneumatic chest 50, inclosing the vacuum chamber 51, provided with the flexible pneu-

matic conduits 54, and 55, which lead to the main chest 28, below the key frame, as above described, is conveniently mounted to tilt outwardly on the brackets 111, projecting from the respectively opposite ends of the casing 1, above the digitals 3, and, conveniently comprises primary valve mechanisms, corresponding with the respective apertures 49, in the tracker bar 48, and with the individual secondary valve mechanisms which control the individual strike pneumatics 37, as above described.

As shown in Fig. VII, said valve chest 50, comprises the front board 112, bottom board 113, top board 114, and back board 115, and, the pneumatic conduits 57, which lead from the tracker bar 48, connect with the conduits 117, extending through said front board 112, and bottom board 113, to the seats 118, for the diaphragms 119. Each diaphragm 119, is in operative relation with a valve stem 120, having valves 121, and 123, at its opposite ends controlling the port 125, which extends from the vacuum chamber 51, through said top board 114, to the outer atmosphere, and has the branch conduit 126, extending through said top board 114, and back board 115, in communication with the flexible conduit 60, leading to the secondary valve mechanisms above described. Said chest 50, supports the wind motor 128, which is provided with a suitable flexible pneumatic conduit 129, leading to the main chest 28, through the wind trunk 130, and conduit 132, as shown in Fig. IV. Said motor is connected with the base board 133, on said chest 50, by the standard 134, to which it is hinged at 135. Said motor is normally maintained in the position shown in Fig. I, by the latch 137, which is pivoted at 138, but upon turning said latch said motor may be folded downwardly and outwardly to afford access to the strings 11, and tuning pins which extend behind it.

The wheel 140, on the crank shaft 141, of said motor is connected by the band 142, with the wheel 143, on the reciprocatory shaft 145, carrying the pinion 146, which latter according to the position of said shaft is adapted to engage or disengage the gear wheel 147, upon the shaft 148, of the takeup roller 150, which latter is mounted to rotate in the music box 47. The position of said reciprocatory shaft 145, is determined by the slide rod 152, whose end 153, is in operative relation with the vertical reciprocatory wedge 154, which when lifted shifts said rod toward the right in Fig. II, against the tension of the spring 156, which serves to return said shaft 145, to the normal position shown in Fig. II, when said wedge is lowered. Said wedge 154, is operatively connected with the manual lever 160, pivoted at 161, on the key frame 2, by the rod 162, rock shaft 163, and link 164; said rock shaft being supported in horizontal position in the suitable bearings 165, on the key frame 2, as shown in Fig. III. Said main chest 28, is provided with brackets 167, at its opposite extremities through which extends the rod 168, provided intermediate of its length with the foot pedal 169, between the loud pedal 170, and the soft pedal 172, projecting at the front of the casing, as shown in Fig. IV. Said loud pedal 170, is provided with a tubular shaft 174, having the lever arm 175, whose free rearwardly extending end is provided with the groove 176, to receive the lever 177, projecting from the rock shaft 179, whose opposite ends are mount-

ed in bearing blocks 180, on said floor-28. Said rock shaft 179, is provided at its left hand end with the lever 181, shown in Fig. IV, connected by the pitman 182, having the laterally projecting head 183, which connects in the usual manner with the damper rail 186, so that when said loud pedal 170, is depressed at the front of the piano casing said pitman 182, is uplifted, said damper rail 186, is tilted, and the damper heads 185, mounted on the action rail are separated from the strings 11, to permit the latter to vibrate freely and produce a louder tone. Said lever 181, is provided at its free extremity with the flexible connector 187, (which conveniently consists of a spiral spring covered with a leather sleeve to deaden its vibration), connected at its upper end with the bracket 188, on the pedal motor bellows 189.

The soft pedal 172, is provided with the tubular shaft 191, having the lever arm 192, connected by the pitman 193, with the spring rail or hammer rest 194, which is supported in the usual manner so that when said pedal 172, is depressed at the front of the casing, said hammer rest is upraised by the pitman 193, to bring the hammers 10, nearer to the strings 11, and cause them to strike a less effective blow.

The communication between the bass pneumatic valve mechanisms and the exhausters is controlled by the lever 196, shown in Fig. III, pivoted at 197, and extending horizontally beneath the digitals 3. Said lever 196, is provided intermediate of its length with the link 198, connected with the rock shaft 200, supported by the bearings 201, at the left hand end of the key frame as shown in Figs. II, and III. Said rock shaft 200, is connected by the vertically pendant link 202, with the slide rod 203, journaled in the bearings 204, on the chest 28, and having the arm 205, operatively connected with the stem 206, of the valve arranged to regulate the area of the opening leading to the pipe 85. Said slide rod 203, is normally maintained in the position shown in Fig. II, by the spring 208, whose lower end is secured to the lower bearing bracket 204, and whose upper end is connected with said link 202.

Communication between the treble pneumatic valve mechanisms and the exhausters is controlled by the lever 210, shown in Fig. III, pivoted at 211, and extending horizontally beneath the digitals 3. Said lever is provided intermediate of its length with the link 213, connected with the rock shaft 214, supported by the bearings 215, at the right hand end of the key frame 2, as shown in Figs. II, and III. Said rock shaft 214, is connected by the vertically pendant link 217, with the bell crank lever 218, fulcrumed at 219, on the bearing block 220, and having its opposite end connected by the link 222, with the rock shaft 223, journaled in the bearings 224, on the main chest 28. Said rock shaft 223, is connected by the link 225, with the slide rod 226, whose lower end is operatively connected to the stem 227, of the valve arranged to regulate the area of the opening leading to the pipe 85.

The tempo is controlled by the lever 228, shown in Fig. III, pivoted at 229, and extending horizontally beneath the digitals 3, said lever is provided intermediate of its length with the link 230, connected with the rock shaft 231, supported by the bearings 215, at the right hand end of the key frame 2, as shown in



Figs. II. and III, said rock shaft 231, is connected by the vertically pendant link 232, with the stem 233, of the valve arranged to regulate the area of the opening through which communication is established between the conduits 132, and 129, which, by way of the trunk 130, connect the main exhaust chest 28, with the motor 128.

The above described movement of the damper rail 186, effected by the depression of the loud pedal 170, may also be manually effected by the lever 235, shown in Fig. III, pivoted at 236, and extending horizontally beneath the digitals 3. Said lever is provided intermediate of its length with the link 237, connected with the rock shaft 238, supported by the bearings 239, at the left hand end of the casing 1, as shown in Figs. II, and III. Said rock shaft 238, is connected by the vertically pendant link 240, with the pitman 182, arranged to operate said damper rail 186, as above described, the arrangement being such that by movement of said lever 235, toward the right hand side of Fig. III, said pitman 182, is uplifted and the strings 11, freed from the damping devices 185.

During the manipulation of the damper rail 186, by either the loud pedal 170, or the manually operative lever 235, as above described, the pedal motor bellows 189, is idly distended or collapsed in accordance with the position of the pitman 182. However, said pitman may be positively actuated by said motor bellows 189, when the latter is pneumatically collapsed by the establishment of communication between its interior and the main exhaust chest 28, through the conduit 246, which, as indicated at the left hand side of Fig. II, extends from the valve box 247, of said motor 189, to the end of said chest.

It is to be understood that said pedal motor bellows 189, is arranged to be controlled by valve mechanism similar to that which controls the strike pneumatics 37, as shown in Fig. VI. That is to say the valve box 247, contains an exhaust chamber equivalent to the exhaust chamber 84, shown in Fig. VI, and in communication with the main exhaust chest through the conduit 246. Said motor bellows 189, is normally excluded from communication with said exhaust chamber and in communication with the outer atmosphere by a double valve similar to that shown in Fig. VI, and controlled by a diaphragm similar to the diaphragm 106, in a seat to which air may be admitted through the conduit 248, and when air is thus admitted beneath said diaphragm, the latter is shifted to operate the valve to establish communication from the exhaust conduit 246, to the interior of the bellows 189, and contemporaneously close the vent from said bellows to the atmosphere, so as to effect the collapse of said bellows.

Air may be admitted to said conduit 248, automatically at such times to effect the operation of the loud pedal 170, in proper accord with the music being played, and without the interposition of the operator, by a device of the kind claimed in Letters Patent of the United States #744,990, granted to me under date of November 24th, 1903, and which comprises the oscillatory valve 250, shown in Figs. I, and III, which normally closes the port 251, at the termination of the conduit 248, but which is uplifted by the bail lever 252, when the latter is operated by any one of the series of digitals whose respective jack whips 7, common to said bail

lever 252, have pins 253, extending in operative engagement therewith, as shown in Fig. I.

During the automatic control of said motor 189, as last above described, communication between the opposite ends of said conduit 248, is established through the valve block 255, provided with the slide valve 256, but when it is desired to free said motor 189, from such automatic control, said slide valve is shifted, such movement of the slide valve being conveniently effected by the lever 257, shown in Fig. III, pivoted at 258, and extending horizontally beneath the digitals 3; said lever being provided intermediate of its length with the link 259, connected with said slide valve 256.

The five levers by which the automatic playing mechanism may be controlled as above described, project in front of the digitals 3, as shown in Fig. III, in the recess 261, in the key slip 262, and are supported to oscillate in the angle bearing plates 263, secured on the key frame 2, as shown in Figs. III and VIII.

Although in the form of my invention shown in Figs. I, III, etc., the automatic pedal controlling device 252, etc., is operatively connected with the piano hammer action, it is to be understood that it may be directly connected with the digitals. For instance, in the modified form of my invention shown in Figs. IX, and X, the left hand space 63, between the adjoining groups of digitals 3, is utilized to admit the supporting block 266, for the bridge 267, whose opposite end is supported by the block 268, resting on the key frame 2, which bridge is provided with brackets 269, in which the pedal operating bail lever 270, is mounted to oscillate. Said lever 270, has the member 272, extending in operative relation with the ends of the digitals 3, at the rear of the balance rail 4, and is in operative relation with the valve 273, which is constructed and operated like the valve 250, shown in Figs. I, II, and III.

It is to be understood that I do not desire to limit myself to the precise details of construction and arrangement herein set forth, as various modifications may be made therein without departing from the essential features of my invention.

#### I claim:—

1. In a mechanical instrument, the combination with a casing; of sounding devices in said casing; a key frame; digitals or keys supported on said key frame, adapted to operate said sounding devices; automatic playing mechanism in said casing in operative relation with said sounding devices, comprising strike pneumatic motors and valves controlling the same; a tracker bar in operative relation with said valve mechanism; a forte device arranged to vary the effect of the playing mechanism upon said sounding device; and means within said casing, operatively connecting said forte device with a selected digital or key above mentioned.
2. In a musical instrument, the combination with a casing; of sounding devices in said casing; a key frame; digitals or keys supported on said key frame, adapted to operate said sounding devices; automatic playing mechanism in said casing in operative relation with said sounding devices, comprising strike pneumatic motors and valves controlling the same; a tracker bar in operative relation with said valve mechanism; a forte device arranged to vary the effect of said playing mechanism on said sounding devices; a pneumatic motor arranged to operate said forte device; and means connecting said forte device motor in operative relation with said digitals or keys.
3. In a musical instrument, the combination with a casing; of sounding devices in said casing; a key frame; digitals supported on said key frame in operative relation with said sounding devices; automatic playing mechanism

- in said casing in operative relation with said sounding devices; pneumatic conduits for controlling said automatic playing mechanism; a connection block extending between adjoining members of said series of digitals, comprising a plurality of ducts; and, a plurality of pneumatic conduits connected with said playing mechanism through the ducts in said connection blocks, substantially as set forth.
- 5 4. In a musical instrument, the combination with a casing; of sounding devices in said casing; a key frame; digitals supported on said key frame in operative relation with said sounding devices; automatic playing mechanism in said casing in operative relation with said sounding devices, comprising strike pneumatic motors and valves controlling the same; a tracker bar in operative relation with said valve mechanisms; conduits connecting said motors and valves; and, a connection block extending between adjoining members of the series of digitals and comprising ducts in communication with said conduits, substantially as set forth.
- 10 5. In a musical instrument, the combination with a casing; of sounding devices in said casing; a key frame; digitals supported on said key frame in operative relation with said sounding devices; automatic playing mechanism in said casing in operative relation with said sounding devices, comprising strike pneumatic motors, and valves controlling the same; conduits connecting said motors and valves; and, a connection block secured between adjoining members of the series of digitals, in stationary relation with and supported by said key frame, comprising a plu-
- 15 rality of parallel vertically extending ducts communicating with said conduits above and below said block, substantially as set forth.
- 30 6. In a musical instrument, the combination with a casing; of sounding devices in said casing; a key frame; digitals supported by said key frame, comprising adjoining groups disposed in divergent positions in operative relation with said sounding devices; automatic playing mechanism, in said casing, in operative relation with said sounding devices; pneumatic conduits for controlling said automatic playing mechanism; a connection block secured between adjoining members of said digitals in stationary relation with the key frame comprising a plurality of ducts; and, a plurality of pneumatic conduits connected with said playing mechanism through the ducts in said connection blocks, substantially as set forth.
- 35 40 45 7. In an automatic musical instrument, the combination of a plurality of flexible pneumatic conduits; a key frame; a connection block mounted upon the key frame, said block having a plurality of ducts having nipples above and below the block, and adapted to removably connect with the ends of the conduits when arranged in definitely organized groups, substantially as set forth.
- 50 In testimony whereof, I have hereunto signed my name, at Philadelphia, Pennsylvania, this 28th day of June 1905.
- PHILIP WUEST, JR.
- Witnesses:
- CLIFTON C. HALLOWELL,  
ARTHUR E. PAIGE.