

(No Model.)

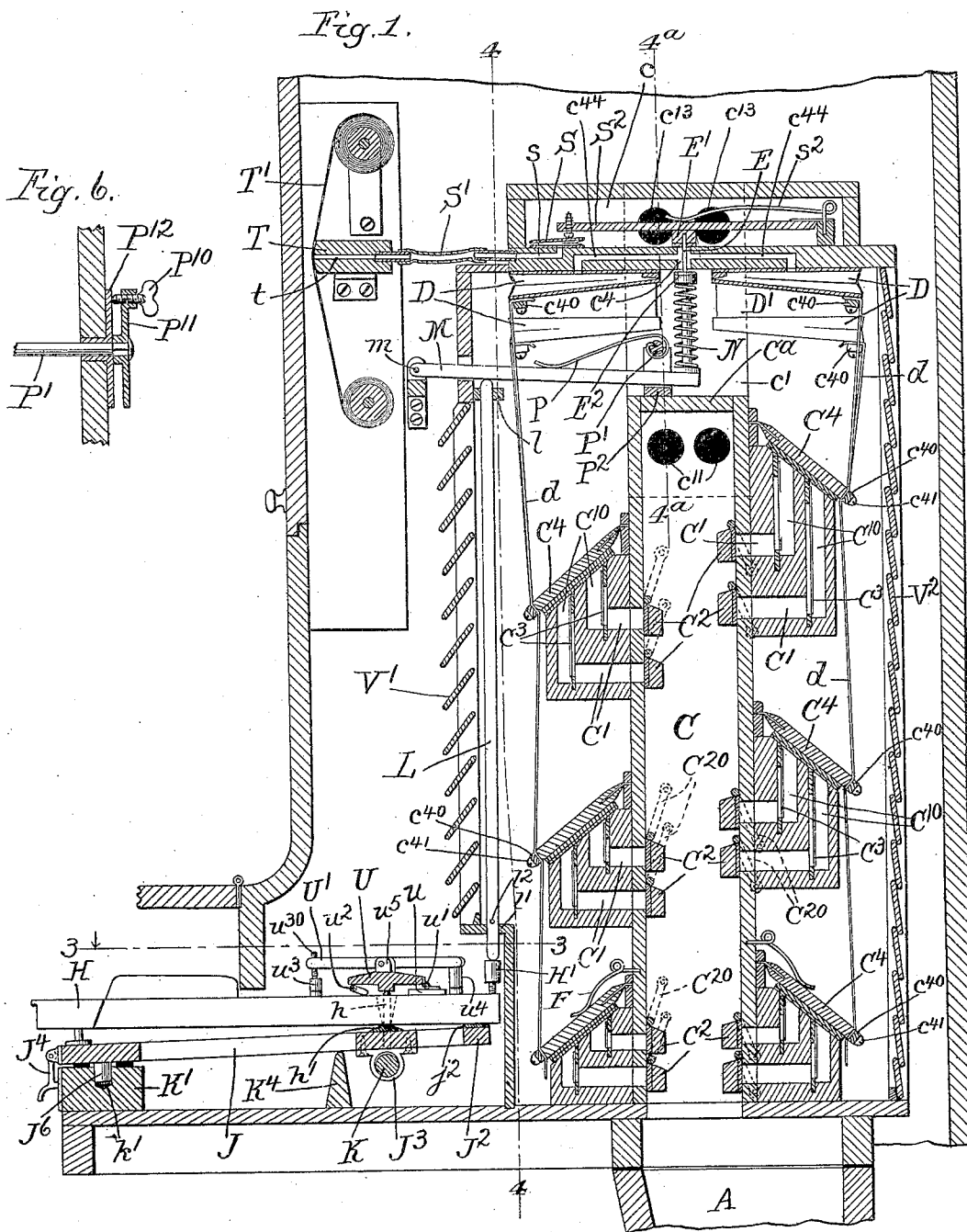
3 Sheets—Sheet 1.

M. CLARK.

PNEUMATICALLY OPERATED MUSICAL INSTRUMENT.

No. 576,030.

Patented Jan. 26, 1897.



Witnesses.

E. T. Wray.

John Elliott.

Inventor:
Melville Clark
by R. A. W. Dutton
his attys

(No Model.)

3 Sheets—Sheet 2.

M. CLARK.

PNEUMATICALLY OPERATED MUSICAL INSTRUMENT.

No. 576,030.

Patented Jan. 26, 1897.

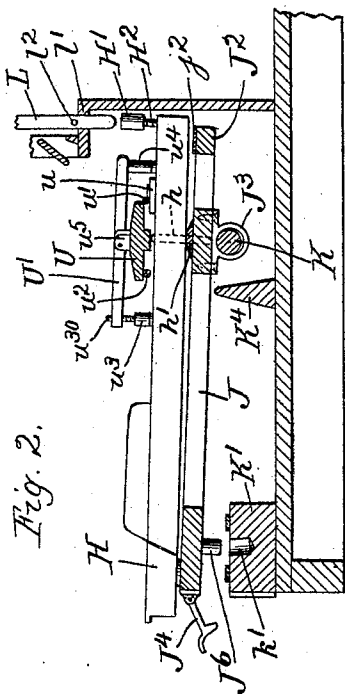


Fig. 2.

Witnesses,

E. T. Wray.
Jean Elliott.

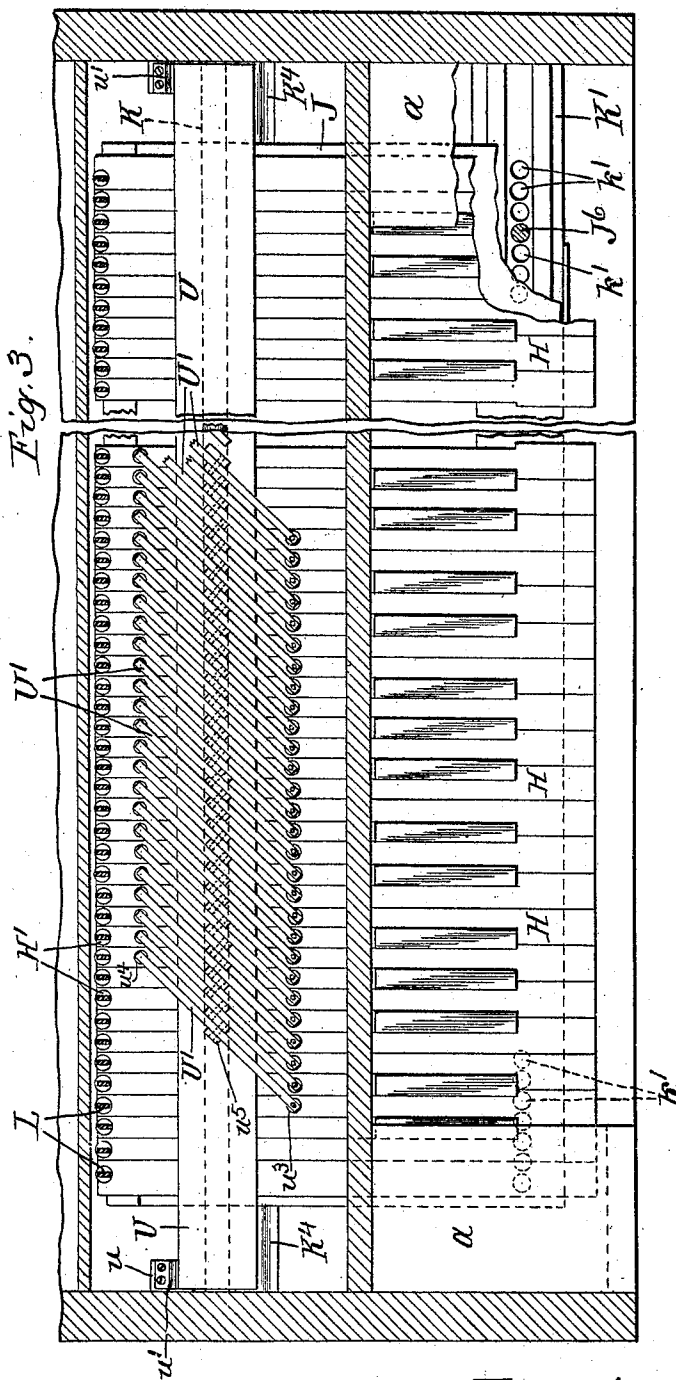


Fig. 3.

Inventor.
Melville Clark
by ^{Am} Burton & Burton
his attys.

M. CLARK.

PNEUMATICALLY OPERATED MUSICAL INSTRUMENT.

No. 576,030.

Patented Jan. 26, 1897.

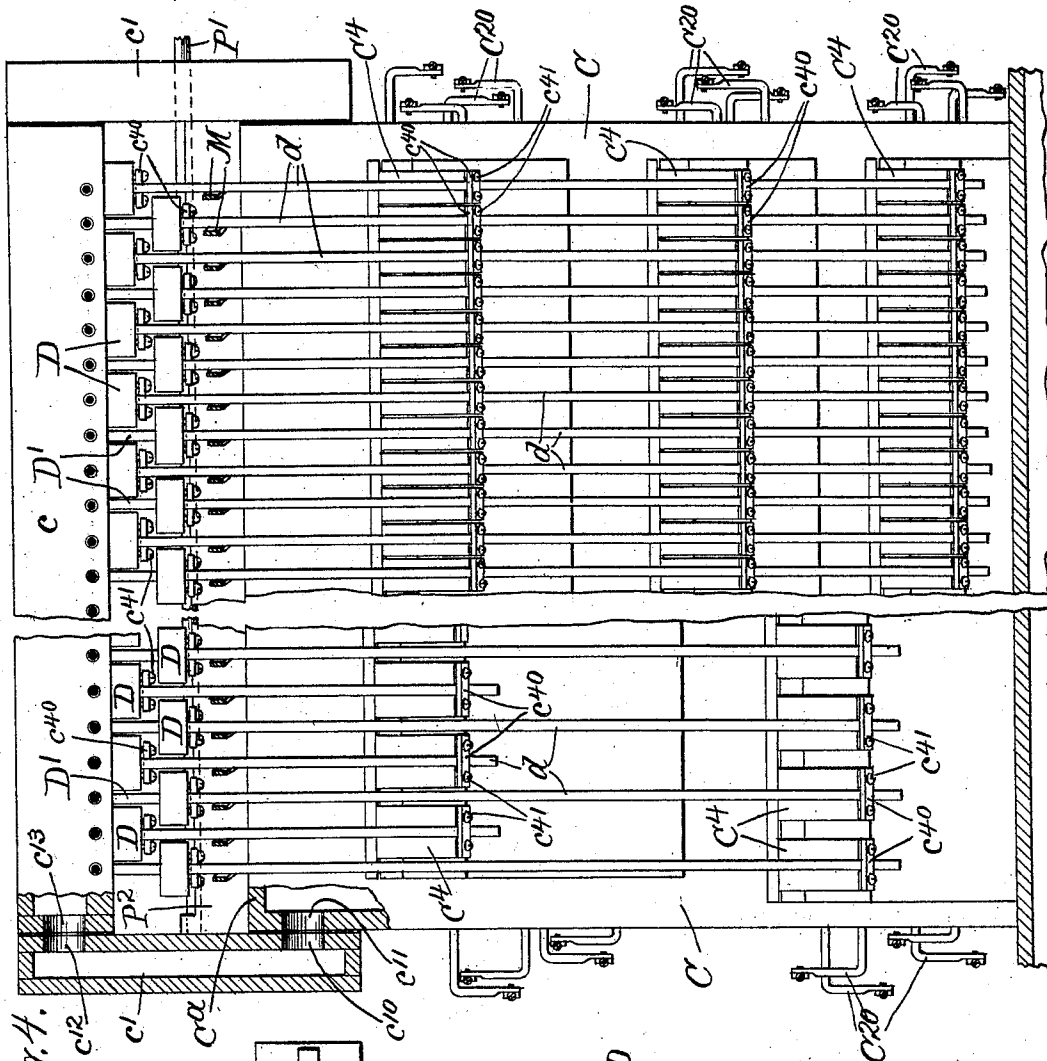


Fig. 4.

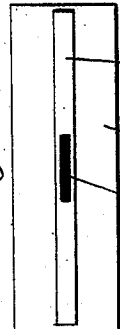


Fig. 5.

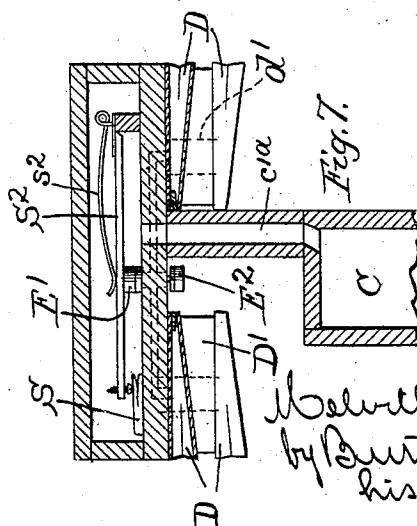


Fig. 7.

Witnesses,
E. T. Wray.
John Elliott

Inventor,
Melville Clark
by Burton B. Burton
his atty

UNITED STATES PATENT OFFICE.

MELVILLE CLARK, OF CHICAGO, ILLINOIS.

PNEUMATICALLY-OPERATED MUSICAL INSTRUMENT.

SPECIFICATION forming part of Letters Patent No. 576,030, dated January 26, 1897.

Application filed December 28, 1895. Serial No. 573,592. (No model.)

To all whom it may concern:

Be it known that I, MELVILLE CLARK, a citizen of the United States, residing at Chicago, county of Cook, and State of Illinois, have invented certain new and useful Improvements in Pneumatically-Actuated Musical Instruments, which are fully set forth in the following specification, reference being had to the accompanying drawings, forming a part thereof.

This invention embodies a novel adaptation of the pneumatic principle to a musical instrument having a key-manual and designed to be played by hand, meaning by the "pneumatic principle" the principle of operating the reed-valves by small bellows, commonly called "pneumatics," which communicate with the wind-chest or vacuum-chamber from or into which the air is forced or drawn to operate the reeds.

It consists in certain novel arrangements of the valves and the pneumatics by which they are operated, by which it is made possible to cause each pneumatic to operate a larger number of valves than have heretofore been possible, and in the combination, with valves and pneumatics so arranged, of mechanical connections from the manual-keys to the valves which control the communication of the motor-pneumatics with the wind-chest or vacuum-chamber, whereby the manual-keys are enabled to control and bring into operation a large number of sounding devices without increase of the pressure necessary to be exercised upon the manual-keys.

It consists, further, in details of structure and arrangement which are specified in the several claims.

In the drawings, Figure 1 is a vertical fore-and-aft section through an organ embodying my improvements, showing the reed-chambers, valves, pneumatics, and mechanical connections pertaining to a single key or manual. Fig. 2 is a detail section at the same point as Fig. 1, showing the manual-frame tilted to the position preparatory to shifting the same longitudinally for the purpose of transposition. Fig. 3 is a sectional plan, as at the plane indicated by the line 3 3 on Fig. 1, showing the arrangement of the coupling mechanism and having a portion of the manual broken away to show a detail pertaining to the devices for mechanical transposition. Fig. 4 is

a front elevation of the vertical pneumatic-chamber with the pneumatics and reed-chamber mounted thereon, as it would appear with the swell and manual action removed, the base which supports the manual-action being cut in vertical section, as at the line 4 4 in Fig. 1, a small portion at the left being shown in vertical section, as at the plane indicated by the line 4" on Fig. 1. Fig. 5 is a plan of a hanger such as are used to support alternate individuals of the motor-pneumatics. Fig. 6 is a detail section through the end of the case axial with respect to the shaft of a touch-regulating device which is shown in the same section. Fig. 7 is a detail section in a plane corresponding to Fig. 1, showing a modification of the throat or connecting passage between two parts of the pneumatic-chamber.

In the drawings, A represents the upper end of the exhaust-bellows, of which the wind-chest or vacuum-chamber C is substantially an extension. The wind-chest C is vertical and may extend to any convenient height. I have shown this wind-chest mainly above the level of the manual, but my invention is not limited to this arrangement, and the number of reed-chambers either above or below the level of the manual is determined only by preference as to the proportions of the instrument and the case which is to contain it. Blocks containing reed-chambers C¹⁰ C¹⁰ C¹⁰, &c., are mounted both on the front and rear walls of the vacuum-chamber C. I have shown two reed-chambers associated in each block and controlled by the same valve; and such blocks, having two reeds each, are arranged in vertical rows comprising any number of such blocks one above the other. The width of each reed-chamber, including the necessary partition-walls between laterally-adjacent chambers, is ordinarily equal to the lateral space apportioned to each key of the manual; but by the familiar expedient of offsetting the reed-chambers for consecutive keys double space can be obtained for each reed-chamber. This is necessary, if at all, only in the bass, and here so many sets of reeds are not usually required as in the higher parts, and the omitted sets will afford the space required for offsetting and lapping the reed-chambers, as seen in Fig. 4. Ports C', &c., lead from the

lower end of the vertical reed-chambers horizontally through the block in which the reed-chambers are formed and through the wall of the vacuum-chamber into the latter, the horizontal rows of such ports being controlled by the mutes C^2 , having crank-arms C^{30} outside the end walls of the vacuum-chamber, by which the mutes may be operated in a familiar manner. The blocks in which the reed-chambers C^{10} are formed are cut off obliquely at the upper end, through which the reed-chambers open, and through which the reeds C^8 are inserted, and the valves C^1 are adapted to seat upon the upper sloping ends of the blocks, covering the open ends of the reed-chambers, said valves being hinged at their upper ends proximate to the wall of the vacuum-chamber, being adapted to be lifted at their lower free ends and thereby adapted to be seated by gravity, the oblique seat being adapted only for the purpose of lengthening the valve and more nearly equalizing the opening afforded to each reed-chamber.

In the specific structure shown in Fig. 1, at a point above the uppermost reed-chamber mounted on the wind-chest C , the latter is closed by the wall C^a , but said vacuum-chamber is provided with a supplement or extension in the form of the flat or horizontally-extended chamber c , mounted above and at a little distance from the wall C^a and extending above the whole length of the principal vacuum-chamber C , being supported in this position by the hollow standards c' c' at each end of the principal vacuum-chamber C , said hollow standards having ports c^{10} c^{10} , which register with corresponding ports c^{11} c^{11} in the end walls of the chamber C , and having ports c^{12} c^{12} , which register with corresponding ports c^{13} c^{13} in the end walls of the supplemental chamber c , so that when said hollow standards are secured against the ends of the chambers C and c they constitute passages by which the chambers C and c communicate, so that a partial vacuum existing in the chamber C extends also in the chamber c .

Upon the under side of the supplement c of the wind-chest are mounted pneumatics D D , &c., in line with the vertical rows of reed-chambers and their valves C^1 C^1 , &c. These pneumatics therefore extend in two transverse rows corresponding to the reed-chambers and valves upon the front and rear sides, respectively, of the wind-chest C . The individuals of the upper row of the pneumatics D are mounted directly upon the under side of the supplement c of the wind-chest, and the individuals of the lower row are connected to the same wall by hangers as represented in Fig. 5, and consisting of a comparatively thin rib D' , whose upper edge is glued fast to the under side of the supplement c of the wind-chest, the lower edge being similarly secured to the upper side of the upper fixed wall of the pneumatic, the duct d' , which communicates between the pneumatic-chamber

and the supplemental chamber c , being a broad flat duct, as seen in Fig. 5, affording free communication, but requiring the minimum space laterally with respect to the entire instrument, its capacity being obtained by extent fore and aft. The pneumatics are hinged at their inner ends—that is, their ends toward the middle line of the supplemental chamber c —their oscillating ends being, respectively, at the front and at the rear for the front and rear sets of the reed-chamber valves. Through the lower wall of the supplemental chamber c , between each pair of pneumatics, front and rear, respectively, a port c^4 is formed, leading through said lower wall of the chamber c , and from such port ducts c^{41} c^{41} lead into the front and rear pneumatics, respectively. Through the port c^4 the valve-stem E extends, having the valve E^1 upon the inner side and the valve E^2 upon the outer side of said lower wall of the chamber c , adapted in the manner familiar in this art to control the communication of the pneumatics, so that they shall communicate either with the interior of the vacuum-chamber or with the exterior air, according as one valve or the other on the stem E is seated.

The lower fluctuating walls of the pneumatics D D are connected at their oscillating ends, which are their front and rear ends, respectively, with the oscillating ends of the valves C^1 C^1 , pertaining to the front and rear sets, respectively, of the reed-chambers, by suitable tapes d d , so that the collapsing of a pneumatic, lifting its lower wall, will lift all the valves in the vertical row below that pneumatic. In order to give promptness to the closing action of the valves, a spring F may be provided adapted to operate upon the lowermost valve of the vertical series, and thereby, through the medium of the tape d , to operate upon all of the valves, tending to seat them. In order that all the valves in each vertical series may be opened equally and simultaneously by the action of the pneumatic, the tape d should be without slack between the several points of attachment, and in order that it may be kept thus and may be readily adjusted from time to time to take up any slack I secure it to the edges of the valves by merely clamping it under a marginal block c^{10} by means of screws c^{11} , which, being slacked, permit the tape to be drawn through between the edge of the sleeve and the clamping-block, any slack thus taken up being passed on to the end and taken up at the last fastening, and in order that the slack may be taken up at either end I employ a similar mode of fastening the tape to the pneumatics and have used the same letters c^{10} and c^{11} to indicate the clamping-block and screws, respectively, by which it is held at the pneumatic.

From the construction thus far described it will be understood that the necessary partial vacuum being produced in the chamber C and supplement c any mechanism which operates the valve-stem to alternately seat

the valves E' and E^2 thereon will cause the pneumatics to be collapsed and distended with an amount of force dependent only upon the degree of vacuum; and the pneumatics being of sufficient area, so that a vacuum easily obtainable by the usual means of exhausting the vacuum-chamber—pumping-bellows or exhaust-fan—will afford sufficient power to lift the number of valves C^4 , attached to the pneumatic, all such valves will be opened at each opening of the valve E' and seating of the valve E^2 , by which communication is established between the wind-chest and the pneumatic, and the mutes being opened all the reeds controlled by said valves C^4 will seat in response to the action which opens the valve E' and seats E^2 .

It will be understood, upon consideration, that the supplemental chamber c is not necessarily disconnected from the principal wind-chest or vacuum-chamber C in such manner as to require the hollow standards c' for the purpose of effecting proper air connection between the two, the form of structure shown in Fig. 1 and represented in detail in Fig. 4 being adopted merely for the sake of compactness, because by that means the pneumatics and the valve E^2 in line with the pneumatics of each pair and between them may be grouped closely, as shown in Fig. 1. If it is preferred, however, to sacrifice this slight advantage, the chamber C may merge in the supplemental chamber c along its entire upper edge and throughout the entire length of the lower side of the supplemental chamber. Such structure is illustrated in Fig. 7, the principal chamber C being, however, reduced in thickness from front to rear at the neck C^a , thereby partly effecting the purpose aimed at in the other construction—viz., compact arrangement of the pneumatics and valves and the maximum possible size for the pneumatics. The force necessary to operate the valve-stem E and its valves E' and E^2 is very slight and bears no relation to the amount of work necessary to operate the valves C^4 , which are operated by the pneumatics as the result of the operation of the valves E' and E^2 . By providing, therefore, mechanical connection from the keys to the valve-stem E , by which the keys will operate the valves E' and E^2 , I am able to operate any desired number of valves C^4 and bring into action any desired number of reeds without making the action of the key any harder or stiffer by reason of the number of reed-valves operated, and, in fact, so light is the touch upon the key necessary, by any reasonably direct means, to operate the valves E' and E^2 that, but for springs interposed expressly to increase it, it would be almost imperceptible to the operator.

I will now describe the mechanical connection from the keys to the valves E' E^2 .

H H represent keys of the manual, the connections from one of which are illustrated. The entire manual is supported upon a man-

ual-frame J , which, for a special purpose hereinafter explained, is in turn supported upon the rod K , which extends from end to end of the organ-case and is supported on the latter, and the front sill or transposition-board K' , which is likewise rigidly supported upon the organ-case and extends from end to end. For the purpose of the action the manual-frame J may be considered as fixed in position. The keys H are fulcrumed in the customary manner at h , which represents a vertical pin rooted in the manual-frame, the key having the customary slot tapering from the lower surface to the upper, adapting it to rock about the point of support at the lower surface, h' being the customary felt cushion, on which the key rests at said lower surface. The rear bar J^2 of the manual-frame constitutes an evenner for the keys, a suitable felt cushion j^2 upon the upper surface of said bar making the contact with the lower surface of the keys of the manual at their rear ends. At the rear ends of the keys they have each a button H' , of felt or like substance, adjustable on the threaded pin H^2 , and a vertical rod L , having suitable fixed guideways at l and l' , and having a stop-pin l^2 above one of said guideways, rests at its lower end upon the button H' , and is adapted at its upper end to touch the under side of the lever M , which is fulcrumed on a fixed support at m , forward of the point of contact of the rod L and extending rearward underneath the supplemental chamber c and terminating under the valve E^2 . A spring N is interposed between the rear end of this lever and the valve E^2 , extending from the lever to the valve when the latter is off its seat and the rear end of the lever is at its lowest position—that is, the position from which it will be moved upward by the depression of the key. When, therefore, the key is depressed, the first downward movement lifts the valve-stem E , opening the valve E' and seating E^2 , and the further depression of the key compresses the spring N against the valve E^2 . I proportion the several levers and locate their fulcrums, respectively, so that the rear end of the lever M has approximately the same movement as the forward end of the key, and since a sixteenth-of-an-inch movement is sufficient to open the valve E' and seat the valve E^2 a sixteenth-of-an-inch depression of the key will effect such seating, the additional movement of the key serving merely to press the valve more closely on its seat, and since such additional pressure is scarcely required the additional movement is provided rather for the purpose of making the movement of the keys more nearly what is customary, so that the action shall be pleasant and not confusing to the operator.

The spring N will in any event be very light, and the resistance which it offers to the depression of the key, even at the maximum, will be only sufficient to be perceptible; but for the purpose of making the action harder, and also providing means for regulating the

same to the preference of the operator, I provide in the train of connections from each key II to its valve E' E^2 a spring, as P, such spring being most conveniently made to operate upon the levers M, because in that position it serves to hold all the working parts in positive contact and gives them a quickness of reaction which they would not have if the reaction were left dependent upon gravity alone. The springs P are secured to a shaft P' , which is supported upon a bracket P^2 , mounted upon the top of the wind-chest C, and slotted or notched vertically to afford guidance to the levers M. This shaft extends out through the organ-case and is provided with a handle P^{10} , screwed through the crank-arm P^{11} , by which the shaft P' may be rotated, said handle swinging over a plate P^{12} , against which the handle P^{10} may be screwed tightly to hold it at any desired point. The rotation of the shaft P' and securing it thus serves to tension the springs P to any desired degree, causing them to press lightly or heavily upon the levers M and make the action of the keys as light or hard as desired.

I have arranged the mechanism already described so that with it there may be associated devices for the use of perforated music-strips such as are common for the purpose of producing automatic action of organs. In the supplemental chamber c are located auxiliary pneumatics, of which one appears in Fig. 1, (indicated by the letter S.) From these auxiliary pneumatics ducts s lead outward from the chamber c and tubes S' connect them, respectively, with the air-ducts t in the tracker-range T, supported on the organ-case, extending horizontally from right to left and having the said ducts t extending through it from front to rear, T' being the perforated music-strip which travels over the forward edge of the crest of the tracker-range for the purpose of registering its apertures with the ducts t , according to the well-known principle of operation of such devices. Within the supplemental chamber c for each auxiliary pneumatic S there is a lever S^2 , fulcrumed at its end remote from the pneumatic and provided with a spring s^2 , tending to hold its oscillating end against the pneumatic, so that it shall be operated thereby when the pneumatic is inflated, and to this valve, intermediate its fulcrum and its point of bearing on the auxiliary pneumatic, the stem E of the valves E' E^2 is secured, so that the lever operates the valves, seating the valve E' normally by the action of the springs s^2 when the auxiliary pneumatic collapses and seating the valve E^2 when the auxiliary pneumatic is inflated, the power of the pneumatic being sufficient to overcome the tension of the spring when the proper degree of vacuum is produced in the chamber c . It will be noticed, therefore, that the mechanical connection from the manual and the connection from the perforated strip T' by way of the auxiliary pneumatic and its lever operate upon the

same valve-stem E and operate the same valves E' and E^2 to vent the motor-pneumatics which operate the reed-valves, thus producing precisely the same result, whether the action be produced by travel of the strip T' or by manipulation of the keys of the manual.

It will be noticed that the upright position of the wind-chest, affording opportunity for locating the reed-chambers and their respective valves which pertain to the keys of the manual, respectively, in vertical rows, and the construction of the wind-chest with the horizontally-extended cross-head or supplemental chamber c to accommodate pneumatics in line above the respective rows of reed-controlling valves C', (a,) gives to all the reeds equally opportunity to experience the effect of the air-tension in the wind-chest when their respective notes and valves are opened; (b) makes it possible to give all the valves C' the same mechanical action—*i. e.*, with or against gravity and to the same degree; (c) makes it possible to associate with each key of the manual an almost unlimited number of reed-chambers and their respective valves, all in the fore-and-aft plane of the key, and thus, (d,) to make direct connection from the one pneumatic at the head of each vertical row to all the valves in the row and cause them all to open simultaneously and without loss of power in transmission from the pneumatics, and (e) to control both the pneumatics which stand at the heads of corresponding front and rear rows by the same valve located between them, thereby insuring simultaneous action of the two pneumatics, and so of the reed-valves in the two rows. These advantages cannot all be attained except with a vertical wind-chest, and some of them are dependent upon the horizontally-extended cross-head.

For the purpose of controlling and modulating the tone, as is commonly done by devices called "swells," I provide the slat-shutters V' and V², between which the wind-chest and reed-chambers and valves mounted thereon are inclosed at the front and rear, respectively. These slat-shutters are operated by familiar mechanical expedients, by which they may be opened to any degree or closed entirely to modulate the tone produced by the instrument. The mechanical expedients for operating them are not shown, the intention being to employ any familiar means.

The space above the rear portion of the manual-keys II, being entirely clear, may be conveniently utilized for the purpose of coupling mechanism over such part of the manual as it is desired to provide with such devices. For this purpose the coupler-board U, extending entirely across the manual from right to left, is hinged at its rear edge on any support fixed with respect to the organ-case, as upon the blocks u , by means of the hinges u' . At the forward edge it is stopped by a cranked shaft u^2 , journaled at its ends in supports fixed with respect to the organ-case, and may be operated by the coupling-stop for the pur-

pose hereinafter explained. This coupler-board is located directly over the pivot-pins of the manual-keys H and serves as a retaining device to keep the keys on the pins. The 5 coupler-levers U' U', &c., are all of equal length and pivoted at their middle points above the board U, which is provided with a vertical rib u^3 , extending longitudinally and adapted to afford pivotal support for the 10 coupling-levers, which cross it at such oblique angle that the forward end of each lever overhangs a manual-key one octave below the key which is overhung by the rear end of the same lever. The levers being, as stated, fulcrumed 15 at their middle points, and this middle point being, as will be noticed, directly above the manual-keys themselves, the points of the manual-keys, overhung by the opposite ends of each lever, are equally distant upon opposite sides of the fulcrums of the keys, respectively.

The overhanging ends of the coupling-levers are provided with contact-buttons u^3 and u^4 at the forward and rear ends, respectively, 25 such buttons being made of or covered with felt or similar substance, one of them being provided with a threaded stem u^{30} , by which adjustment may be made to cause the buttons to properly come into contact with the 30 keys, respectively. It will be understood that when the coupler-board U is tilted down at its forward edge to the position shown in Fig. 1 the contact-buttons on the opposite ends of the coupling-levers are brought into contact 35 with their respective keys, so that the depression of the forward end of any key, throwing up its rear end against the button at the rear end of the coupler resting on such key and depressing the forward end of such coupler, causes the button on said forward end to 40 depress the key upon which it rests, being the octave below the key of the manual operated, the depression being precisely equal to that given the key operated. To throw 45 the coupler out of action, the forward end of the coupler-board is tilted up by rocking the cranked shaft u^2 by means of a stop device adapted for that purpose in a manner which is well understood and which is not 50 illustrated. The manual-frame J, as already stated, is pivotally supported on the rod K, which extends transversely—that is, right and left—from end to end of the organ-case, in which it is supported at its ends. The 55 pivotal attachment of the manual-frame to this rod is made by means of brackets $J^3 J^3$, secured to the frame and having suitable eyes adapted to pass onto the shaft K and to operate easily thereon. In position for action the frame J is at its forward end drawn 60 down closely onto the sill K' rigid with the organ-frame and there secured by the hooks $J^4 J^4$. In being drawn down to this position it comes in contact at a point a little forward 65 of its fulcrum on the rod K' with the upper edge of a rib K⁴, which may extend along the whole length of the frame J underneath the

latter, being supported on the organ-case rigidly and having its upper edge, with which the frame J comes in contact, high enough 70 so that when the forward edge of the frame is locked down snugly upon the sill K' the eyes J^3 are drawn up tightly against the under side of the rod K, and the frame J is thereby held very rigidly in position. As 75 soon, however, as the hooks J^4 are released for the purpose of throwing up the forward edge of the frame J the eyes J^3 are unbound from the rod K and tend to rock easily and permit the frame to tilt and slide easily over 80 the rod. When the frame J is thus released and tilted up at the forward end far enough so that pins $J^6 J^6$, one near each end, are lifted wholly out of the sockets $k' k'$, which are made in the upper side of the sill K' to receive said 85 pins, the frame J first comes into contact with the under side of the keys H at their forward ends, the evener-bar J^2 of said frame moving down out of contact with the rear ends of said keys; and then, as the frame moves up a little 90 farther at the front, the keys tilt with the frame over the fulcrum K, the buttons H' being thereby carried down out of contact with the pitmen or push-rods L. The frame J may now be moved longitudinally on the rod K, 95 carrying with it the entire manual. The sill K' is provided with a plurality of holes k' for the pins J^6 , the distance between said holes corresponding to the distance between the central points of consecutive keys—that is to 100 say, to the distance between adjacent pitmen L. I make as many holes as I desire to provide transpositions of the manual. Twelve holes would be necessary for all possible 105 transpositions, but seven holes permit transposition to the extent ordinarily desired. The normal position of the frame J being such that the keys of the manual at their rear ends project under and are in position to operate the pitmen pertaining to the train of connections 110 for operating the reeds corresponding to said keys, respectively, the pins J^6 are at this normal position lodged in the fourth hole from either end of the row of holes k' . By moving the frame up—that is, to the right—one hole 115 the key "middle C," for example, will be brought under the pitman pertaining to "C sharp," all other keys being similarly advanced one step, thereby effecting a transposition mechanically, so that the operator play- 120 ing—that is, manipulating the keys—according to the indications of music written in "C natural" will produce the music one-half tone higher than it is written. Successive adjustments to the right, setting the pin J^6 successively into the second and into the first hole, 125 will effect transpositions successively, so that the music will be produced two or three half-tones higher than it is written. Adjusting the frame at the left to normal position will 130 cause the music to be produced lower than it is written—a half-tone for each hole or step in the adjustment.

In order that the adjustments described

may be possible without preventing the use of the manual to the limit at both ends of the keyboard, as many extra keys are provided as there are holes for adjustment, and the case is extended at each end beyond the space necessary to accommodate the action, in other respects far enough to accommodate the extra number of keys, so that the adjustment of the manual from the middle point in each direction may be made as described, and panels *aa* at each end, adjacent to the ends of the case, respectively, serve to screen or cover the space into which the extra keys may be moved in the extreme adjustments in each direction and to cover the keys, when so adjusted, out of use.

I claim—

1. In an organ in combination with a vertical wind-chest; reed-chambers mounted upon the vertical sides of the wind-chest in vertical rows, exterior valves for said reed-chambers respectively; pneumatic-motors located exterior to the wind-chest in line with the vertical rows respectively of reed-chamber valves provided with connections to the several valves in their respective rows; said pneumatic-motors communicating with the wind-chest; valves which control said communications respectively, and suitable means for operating said valves.

2. In an organ in combination with the manual; reed-chambers mounted upon the vertical sides of the wind-chest in vertical rows, exterior valves for said reed-chambers respectively; pneumatic-motors located exterior to the wind-chest in line with the vertical rows respectively of reed-chamber valves provided with connections to the several valves, said pneumatic-motors communicating with the wind-chest; valves which control said communications respectively, and mechanical connections from said valves to the keys respectively of the manual.

3. In an organ in combination with reed-chambers mounted upon the vertical sides of the wind-chest in vertical rows, exterior valves for said reed-chambers respectively; pneumatic-motors located exterior to the wind-chest in line with the vertical rows respectively of reed-chamber valves and above the same and provided with connections downward to the several valves in the rows beneath them respectively, said pneumatic-motors communicating with the wind-chest, and valves which control said communications respectively.

4. In an organ in combination with the wind-chest erected vertically; reed-chambers mounted upon the sides thereof in vertical rows; and downwardly-seating valves for said reed-chambers respectively; pneumatics mounted exteriorly on said wind-chest in line with the said vertical rows respectively and above the same; connections from the pneumatic of each row to the uppermost valve of

the row and from each valve successively to the one below it whereby the pneumatic actuates all the valves in the row and a spring acting upon the lowest valve tending to seat the same.

5. In an organ in combination with the manual; a wind-chest erected vertically at the rear of the manual; reed-chambers mounted upon the vertical sides of the wind-chest in vertical rows exterior valves for said reed-chambers respectively; pneumatic-motors located exterior to the wind-chest in line with the vertical rows respectively of reed-chamber valves and above the same and provided with connections downward to the several valves in the rows beneath them respectively; said pneumatic-motors communicating with the wind-chest; valves which control said communications respectively, and mechanic connections from said valves to the keys respectively of the manual.

6. In an organ in combination with the manual, a wind-chest erected vertically at the rear thereof and having at its upper side a horizontal extension front and rear; reed-chambers mounted upon the front and rear sides of the wind-chest underneath said front and rear horizontal extension; pneumatic-motors mounted upon the under side of said horizontal extension above the reed-chambers respectively; downwardly-seating valves for said reed-chambers, and direct connections therefrom to said pneumatics above them respectively; said pneumatics communicating with the wind-chest and valves which control their respective communications and suitable means for operating said valves.

7. In an organ in combination with the manual, a wind-chest erected vertically at the rear of the manual and having at its upper end a supplemental portion extended horizontally fore and aft beyond the front and rear planes of the main vertical portion; reed-controlling valves mounted upon the front and rear sides of said vertical portion; and pneumatic-motors arranged in pairs, the individuals of which are located above the front and rear reed-controlling valves, respectively, and mounted on the horizontally-extended supplemental portion of the wind-chest and communicating therewith; a valve for each pair of pneumatics controlling the communication of both individuals of the pair with the wind-chest and mechanical connections from the keys of the manual to said valves respectively.

In testimony whereof I have hereunto set my hand, in the presence of two witnesses, at Chicago, Illinois, this 19th day of December, 1895.

MELVILLE CLARK.

Witnesses:

CHAS. S. BURTON,
JEAN ELLIOTT.