

R. HOPE-JONES.  
ORGAN.

No. 514,146.

Patented Feb. 6, 1894.

FIG. 1.

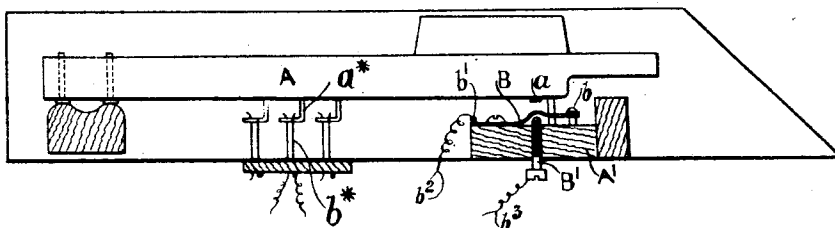
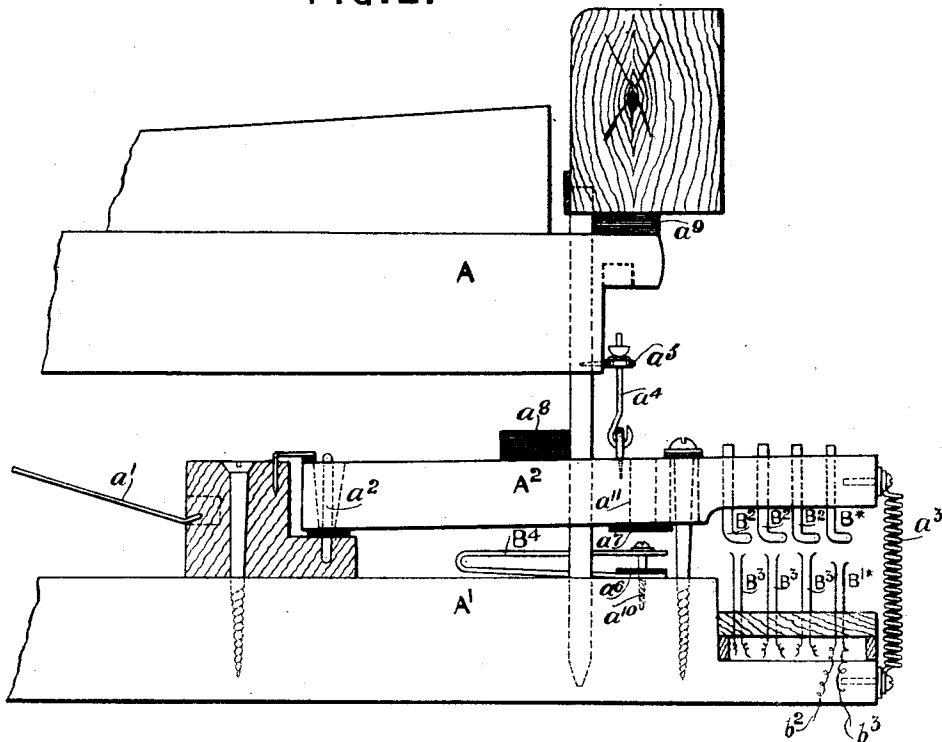


FIG. 2.



Witnesses

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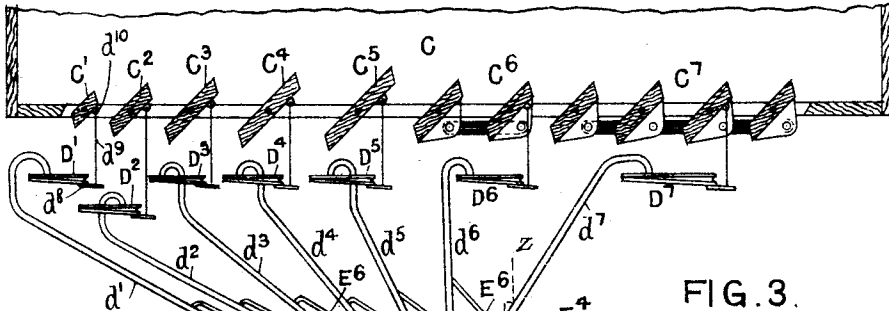


FIG. 3.

FIG. 4.

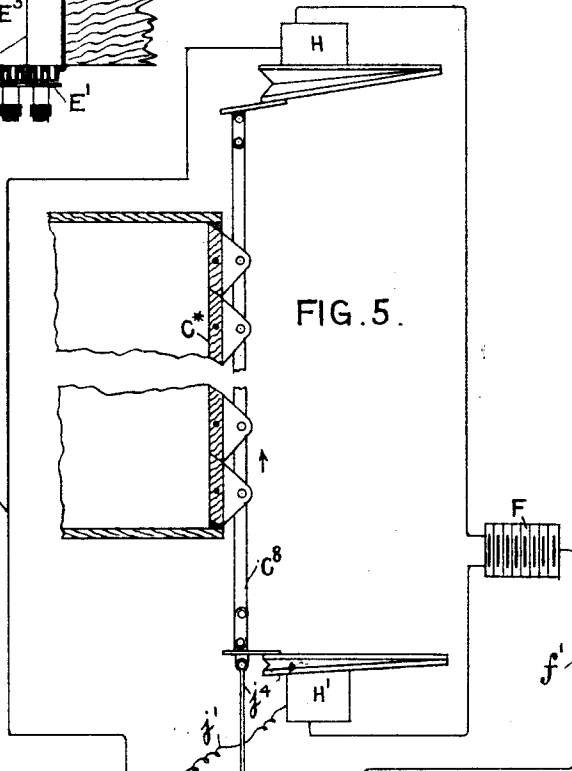
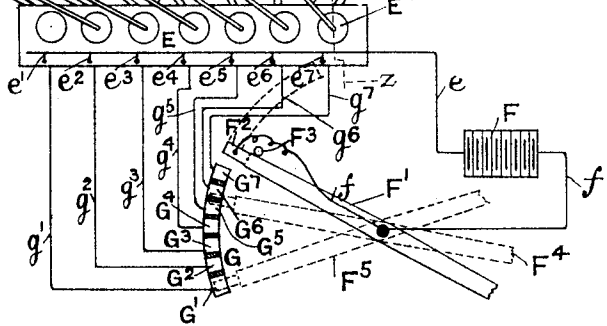
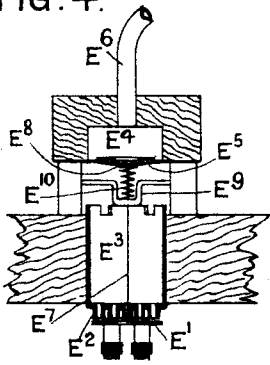
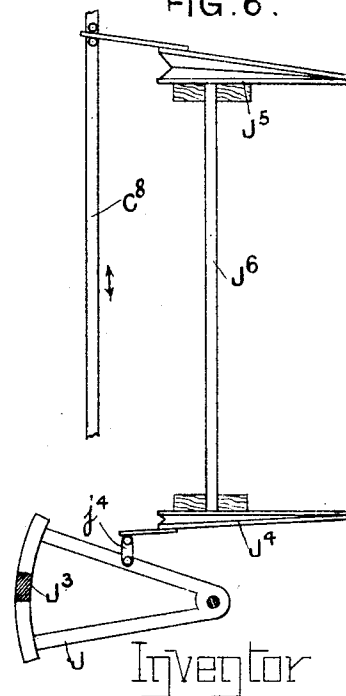


FIG. 5.

FIG. 6.



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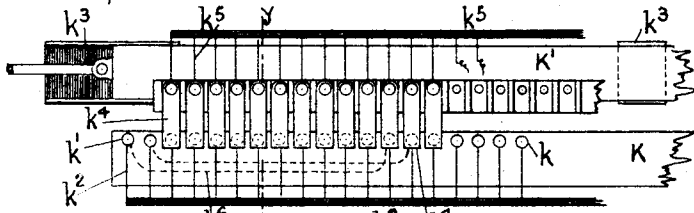


FIG. 7.

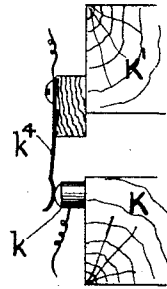


FIG. 8.

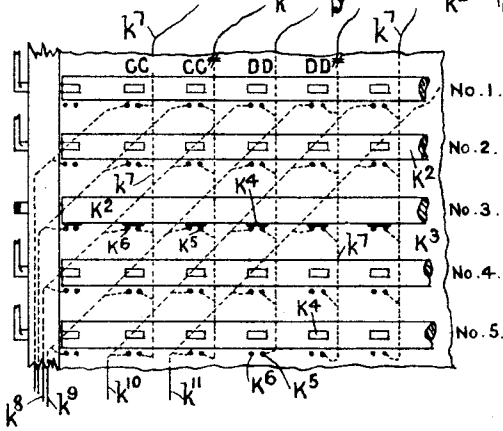


FIG. 9.

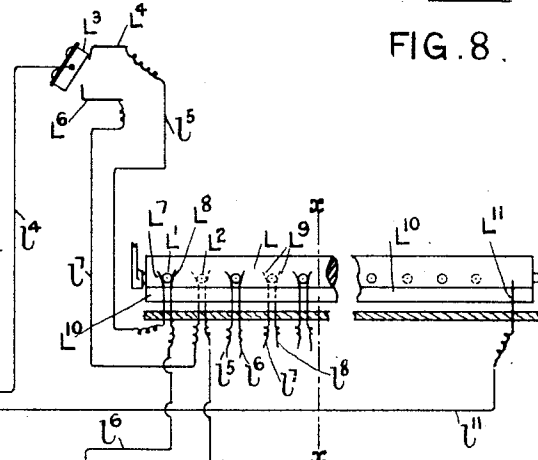


FIG. 10.

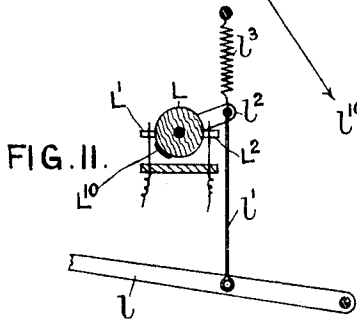


FIG. 11.

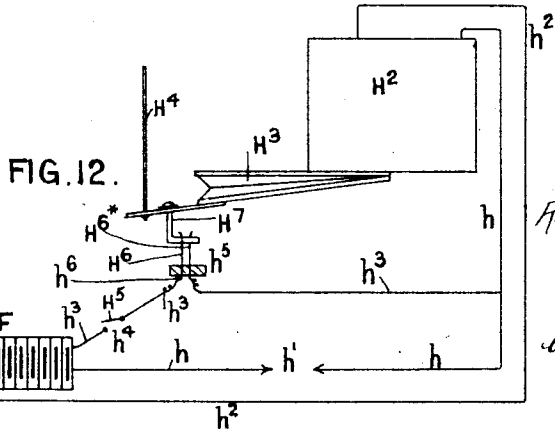


FIG. 12.

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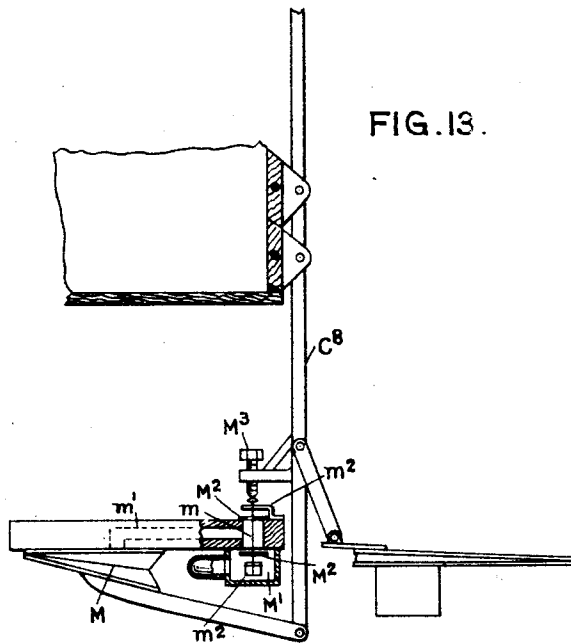
(No Model.)

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# UNITED STATES PATENT OFFICE.

ROBERT HOPE-JONES, OF BIRKENHEAD, ENGLAND.

## ORGAN.

**SPECIFICATION** forming part of Letters Patent No. 514,146, dated February 6, 1894.

Application filed August 8, 1892. Serial No. 442,472. (No model.) Patented in England November 20, 1890, No. 18,803; in France September 14, 1891, No. 216,104, and in Belgium September 14, 1891, No. 96,380.

*To all whom it may concern:*

Be it known that I, ROBERT HOPE-JONES, electrician, a subject of the Queen of Great Britain, residing at Birkenhead, in the county of Chester, in the Kingdom of England, have invented certain new and useful Improvements in Organs, (for which I have received Letters Patent in England, No. 18,803, dated November 20, 1890; in France, by patent of addition to original patent, No. 216,104, of September 14, 1891, and in Belgium, by patent of addition, No. 97,125, to original patent, No. 96,380, of September 14, 1891, filed November 10, 1891,) of which the following is a specification.

This invention relates to certain improvements in the construction of organs and similar musical instruments and in the means for controlling the same, whereby the power, pitch and quality of the tone emitted may be more readily governed, varied or sustained, at the will of the performer as hereinafter more fully described, the invention being chiefly applicable to organs having pneumatic or electro-pneumatic actions, some parts of it having reference to the invention set forth in my specification Serial No. 406,071.

The invention may be carried into effect as follows, reference being had to the accompanying drawings, in which—

Figure 1 is a section showing an arrangement whereby the volume of tone may be momentarily increased or a sforzando effect may be obtained. Fig. 2 shows a modification of the preceding arrangement depicted as applied to the pedals. Fig. 3 is a sectional plan, partly in the form of a diagram, showing an arrangement for operating the swell shutters, the pedal and its switch being, however, shown in elevation. Fig. 4 is a section on an enlarged scale of part of the apparatus shown in Fig. 3, the section being taken as on a line  $z z$  in said figure. Fig. 5 is an elevation, partly in section, of a modified device for operating the swell shutters. Fig. 6 is an elevation showing a modification of a part of the preceding device. Fig. 7 shows one form of transposing apparatus. Fig. 8 is a section, on an enlarged scale, on line  $y y$ , Fig. 7. Fig. 9 shows another form of transposing device. Fig. 10 illustrates, partly in diagram, an ar-

rangement whereby the quality and power of the tone may be instantly varied and a sforzando effect may be obtained with the whole organ or any predetermined portion thereof. Fig. 11 is a transverse section of a portion of the apparatus taken as on line  $x x$ , Fig. 10. Fig. 12 shows a device whereby the sound of the notes may be prolonged at will. Fig. 13 shows a brake apparatus for steadying the swell shutters and preventing rebound of the same.

When it is desired to momentarily increase the volume of tone or to produce a sforzando effect, additional contacts may be provided for the pedals or keys, such contacts playing the octaves of the pipes in use, or playing any pipes belonging to other ranks, or percussion instruments such as a drum or drums, the contacts being brought together by depressing the keys or pedals with more force than usual. An arrangement of this kind is depicted in Fig. 1, in which A is one of the manual keys provided (in an electric organ) with suitable contact devices (as  $a^* b^*$ ) for operating its own notes and the notes coupled to it.

A' is the pin rail.

B is a stiff insulated metallic spring mounted on the pin rail below the key and (if desired) prevented from rising beyond a certain fixed point by an insulated staple or headed screw  $b$ , which passes through the spring.

B' is an adjustable insulated contact screw mounted in the pin rail with its point in proximity to the lower side of the spring B. The springs B of each manual are all connected by a wire  $b'$  to the battery supply wire  $b^2$ , while the pins B' are each connected by a separate wire  $b^3$  to any suitable electrically controlled device or devices such as an electro-pneumatic lever or levers for operating the octave or octaves of the note in question or other pipe or instrument as before described.  $a$  is a piece of felt attached to each key above its contact spring B.

The circuit comprising the wire  $b'$  may (if desired) be controlled by a suitable switch located conveniently to the performer.

In operating the keys with the ordinary touch they are not depressed farther than will bring the felt  $a$  into contact with the spring B. When a sforzando effect is required or it

is desired to momentarily increase the volume of tone in connection with any particular key or keys, it or they are depressed with considerable force and bring the corresponding spring or springs B into contact with the adjacent pin or pins B', thus completing their respective circuits and instantly bringing into play the additional pipe or other sonorous device as described. On the key or keys being released, each depressed spring B returns to its elevated position against a felt washer below the head of the screw *b*.

In Fig. 2 there is shown a modified arrangement of the preceding device, shown as adapted to the pedals. A is the front end of a pedal key, A' the pin rail, and *a'* the ordinary key spring. A<sup>2</sup> is a short key or lever pivoted at *a*<sup>2</sup> below the key A and carrying two or more contact pieces B\* B<sup>2</sup> B<sup>3</sup>, each adapted, when the lever A<sup>2</sup> is sufficiently depressed, to engage a suitable contact device below it, as for instance, a pair of insulated flexible metallic pins B'\* or B<sup>3</sup>, which form terminals to the particular circuit to which they are connected. The contacts B<sup>2</sup> B<sup>3</sup> are for closing and opening the circuits of the key's own note and two other notes coupled thereto, as fully described in my specification above mentioned. The contacts B\* B'\* form terminals of the sforzando circuit *b*<sup>2</sup> *b*<sup>3</sup> before described. *a*<sup>3</sup> is a spring tending to depress the lever A<sup>2</sup>, and *a*<sup>4</sup> is a link connecting said lever with the pedal key A, the latter (under the influence of its spring *a'*) holding the lever A<sup>2</sup> and its contacts normally in their elevated position in defiance of the spring *a*<sup>3</sup>. The link *a*<sup>4</sup> is capable of a longitudinal movement through its connecting eye *a*<sup>5</sup> on the pedal key. B<sup>4</sup> is a stiff spring located below the lever A<sup>2</sup>. *a*<sup>6</sup>, *a*<sup>7</sup>, *a*<sup>8</sup>, *a*<sup>9</sup> are thumpers of felt. It will be noticed that the sforzando contact pins B'\* are considerably shorter than the pins B<sup>3</sup>. On depressing the pedal key with the usual touch, the lever A<sup>2</sup> is unsupported and the spring *a*<sup>3</sup> draws it down till the felt *a*<sup>7</sup> touches the spring B<sup>4</sup>, the key A being depressed until it bears upon the felt *a*<sup>8</sup>. This action closes the key contacts B<sup>2</sup> B<sup>3</sup>, the sforzando contacts B\* B'\* being still open. An additional pressure on the key A compresses the spring B<sup>4</sup> and closes the sforzando contacts. The upper end of the screw *a*<sup>10</sup> passes freely through the adjacent limb of the spring B<sup>4</sup> and enters, with the head of screw, into a hole *a*<sup>11</sup> in the key A<sup>2</sup>, when the latter is depressed beyond its normal amount, through which hole also the position of the screw may be readily adjusted. The circuits of each set of these sforzando contacts may (if desired) be controlled by one or more main switches within reach of the operator.

In organs in which the volume of the sound of certain of the pipes is controlled by inclosing said pipes within a swell-box having a series of adjustable openings or shutters through which the sound may escape in varying vol-

ume, I provide arrangements whereby these shutters, though more or less heavy in themselves, may be readily actuated and controlled by a very light pressure by the performer on a key, pedal, lever or other equivalent operating device. Two such arrangements may be described as follows: Referring first to Figs. 3 and 4—C is the swell box, and C'<sup>2</sup> C'<sup>3</sup> C'<sup>4</sup> C'<sup>5</sup> C'<sup>6</sup> C'<sup>7</sup> the swell shutters which, in this instance, are supposed to stand vertically for the purpose of readily balancing them. The shutters are, preferably, so arranged that each shutter, or set of shutters, shall control an opening of a different area from the others, and they are arranged to be opened successively according to their area, beginning with the smallest and ending with the largest. In the drawings, the first five shutters C' C'<sup>2</sup> C'<sup>3</sup> C'<sup>4</sup> C'<sup>5</sup> are shown as single pieces of a gradually increasing size, while the sixth and seventh shutters, instead of being single pieces, are formed of coupled sets of shutters C'<sup>6</sup> C'<sup>7</sup> containing respectively two and four single shutters of a suitable size. It is preferable to provide each single shutter and coupled set thereof with a spring or other counterbalancing device (not shown) adapted to normally hold it open, and to close each independently by means of an electro-pneumatic lever or levers, governed by a contact pedal or equivalent device under the control of the performer, the largest shutter being closed first. D' D'<sup>2</sup> D'<sup>3</sup> D'<sup>4</sup> D'<sup>5</sup> D'<sup>6</sup> D'<sup>7</sup> are the main bellows of a series of electro-pneumatic levers which are contained in a wind box E and are connected with their respective bellows D' D'<sup>2</sup> by tubes *d'* *d*<sup>2</sup> *d*<sup>3</sup> *d*<sup>4</sup> *d*<sup>5</sup> *d*<sup>6</sup> *d*<sup>7</sup>. The bellows D' D'<sup>2</sup>, &c., are connected with their respective shutters by tail-pieces *d*<sup>8</sup>, links *d*<sup>9</sup> and arms or lugs *d*<sup>10</sup>. F is the battery, F' is the swell pedal and F<sup>2</sup> an insulated contact piece which is mounted upon the rear end of the pedal, or on some part moving therewith, or with an equivalent operating device as described, the contact being connected by a wire *f* to the battery supply lead *f*<sup>1</sup>. G is a switch quadrant having a series of insulated contacts G' G<sup>2</sup> G<sup>3</sup> over which the contact F<sup>2</sup> works. The contacts G' G<sup>2</sup> G<sup>3</sup> are connected with their respective electro-pneumatic levers within the box E by wires *g*<sup>1</sup> *g*<sup>2</sup> *g*<sup>3</sup>. *e* *e*<sup>1</sup> *e*<sup>2</sup> *e*<sup>3</sup> are the return wires of the several electro-pneumatic levers. F<sup>3</sup> is a stop against which the swell pedal rests when fully depressed as shown. A spring (not shown) may return it to its normal position when the weight of the foot is removed. The pedal being fully depressed against the stop F<sup>3</sup>, all the shutters are fully opened by their respective springs and all the electro-pneumatic levers are inoperative by reason of the contact F<sup>2</sup> being removed from the contacts of the switch quadrant G. On permitting the pedal to move into contact with the section G<sup>7</sup> of the quadrant G, the circuit of No. 7 electro-pneumatic lever is closed, its bellows D'<sup>7</sup> operated and the set of shutters C'<sup>7</sup> closed. In a similar manner, the down-

ward movement of the contact  $F^2$  closes all the circuits in succession, causing their respective shutters  $C^6$   $C^5$   $C^4$  to be successively closed.

5 In the apparatus as thus far described, each shutter would re-open again under the influence of its counterbalancing spring as soon as the circuit of its electro-pneumatic lever had been broken by the movement of the contact  $F^2$  off the corresponding contact, as  $G^7$ , onto the contact  $G^6$  next below it. To prevent this re-opening of the shutters, the pedal contact  $F^2$  may be extended upward so that, as it moves downward over the quadrant, all the contacts  $G^7$   $G^6$   $G^5$  above its lower end are retained in circuit and their respective electro-pneumatic levers remain inoperative. Such an arrangement would, however, entail an undue expenditure of electric energy. To avoid such waste of power, I prefer to employ an arrangement, such for example, as the following, whereby the wind itself may be utilized to hold the larger shutters closed while the smaller ones are being operated. This arrangement may however be varied considerably, within the scope of the invention.

Each electro-pneumatic lever is provided with a device such as shown in Fig. 4.

30  $E^1$  is the primary valve of the electro-pneumatic lever, and  $E^2$  the perforated valve seat, whence, when the valve is depressed, the air may escape into the atmosphere through the tube  $E^3$ , and thus allow the lever to be operated, as is fully described in my specification Serial No. 406,071. Above each tube  $E^3$  there is mounted a small wind chamber  $E^4$  which is provided on its under side with a flexible diaphragm  $E^5$  and is furnished with a wind tube  $E^6$ .

40  $E^7$  is a light rod passing through one of the perforations in the valve seat and resting with its lower end against the valve  $E^1$ , its upper end being provided with a button  $E^8$  bearing on the diaphragm  $E^5$ .

45  $E^9$  is a guide for the rod  $E^7$  and  $E^{10}$  a spring serving to take the weight of the rod off the valve. Each tube  $E^6$  is connected at one end with the wind chamber  $E^4$  of one electro-pneumatic lever, and at the opposite end with the wind pipe  $d$  of the lever next below it in the series, as seen in Fig. 3. It will thus be seen that, as any given electro-pneumatic lever is operated by its circuit being closed (by the movement of the contact  $F^2$  over the quadrant  $G$ ) a small amount of wind from its pipe  $d$  will pass by a tube  $E^6$  into the chamber  $E^4$  of the lever next above it in the series, and, by depressing the diaphragm  $E^5$ , rod  $E^7$  and valve  $E^1$  will retain said latter lever in its operative position and hold its corresponding swell shutter closed. The contact  $F^2$  is so arranged that (as seen in dotted lines at  $F^4$ ) it touches the adjacent contact as  $G^3$  before it has quite moved off the contact  $G^6$  next above it. In this manner, wind is admitted successively into each electro-pneumatic lever, and thence

into the chamber  $E^4$  of the one next above it in the series, before the circuit of the latter lever has been broken. When the swell pedal is in its closed position, it rests, as shown at  $F^5$  in dotted lines, with its contact  $F^2$  bearing on the section  $G'$  of the switch quadrant  $G$ , the shutter  $C'$  being then held closed by the action of the electric current and the remainder of the shutters by the wind alone, or the apparatus may be arranged in a reverse manner, so that the shutters are normally held closed by a spring or other device and are opened successively by the action of the electro-pneumatic levers. Also the switch contact  $G$  instead of being fixed may be movable with the pedal and the contact  $F^2$  may be fixed, being connected as before with the battery supply lead, or the swell shutters may be operated by an arrangement such as shown in Fig. 5. The shutters  $C^*$  are connected together in the usual manner by a rod  $C^8$  operated in either direction by a pair of electro-pneumatic levers  $H$   $H'$ .

90  $J$  is a switch having two insulated contacts  $J'$   $J^2$  separated by a gap or insulation piece  $J^3$  and connected respectively by wires  $j'$   $j^2$  with the electro-pneumatic levers  $H$   $H'$ . The switch  $J$  is movable with the swell shutters, being to this end conveniently mounted on a pivot  $j^3$  and connected to the rod  $C^8$  by a link  $j^4$  or other light mechanical device.

95  $F^2$  is an insulated contact moving over the face of the switch and mounted upon the pedal  $F'$ , or other equivalent operating device as described, or upon a finger, pointer or other part movable therewith, the said contact being connected to the battery supply lead  $f'$  as before. The pedal  $F'$  and switch  $J$  may be conveniently mounted on the same pivot  $j^3$ , each moving however independently of the other. As the pedal is depressed or raised, the contact  $F^2$  is brought to bear upon the contact  $J'$  or  $J^2$ , the circuit of the electro-pneumatic lever  $H'$  or  $H$  is closed and the shutters  $C^*$  opened or closed. The shutters being connected to the switch  $J$  as aforesaid, the latter is moved with them until its gap or insulation piece  $J^3$  is brought opposite to the contact  $F^2$ , and, the circuit of the electro-pneumatic lever being thereby broken, the movement of the shutter ceases until the pedal is again operated in one or other direction.

100 If desired, the switch  $J$  could be connected to the shutters by a pneumatic device such as shown in Fig. 6, in which  $J^4$  is a bellows having its tail piece connected by a link  $j^4$  with the switch  $J$ .  $J^5$  is a second bellows communicating with the first by a tube  $J^6$  and having its tail piece movable with the shutter rod  $C^8$  as shown. The bellows are so arranged that, as the upper one is expanded by the movement of the rod  $C^8$ , the lower one is collapsed and vice versa. In cases where the pedal is located at a distance from the organ, the switch contact  $F^2$  may be operated from the pedal by any suitable light mechanical device, or by a pneumatic or electro-pneu-

matic device. If desired, the switch J could be movable with the pedal and the contact F<sup>2</sup> with the shutters.

When it is desired to alter the pitch of an organ in relation to its keyboard, this may be accomplished, where electricity is employed, by arranging a compound switch or test board in such manner that the order of the connections between the keys and the organ pipes may be readily changed. In Figs. 7, 8 and 9, two ways of carrying this into effect are depicted by way of illustration only.

K, Figs. 7 and 8, is a fixed test board provided with a series of terminals  $k k'$ . There are as many terminals  $k$  as there are keys in the organ, plus a few additional terminals  $k'$  at each end of the series. Each end of the sound board is also provided with a few additional pipes. Wires  $k^2$  connect the various terminals  $k k'$  with their respective electro-magnetic or electro-pneumatic actions within the organ. K' is a second but movable test board conveniently mounted in slides  $k^3$  and capable of being operated by the performer through any suitable mechanism. It carries a series of terminals  $k^4$  corresponding in number to the organ keys and connected to the key contacts by wires  $k^5$ . The terminals  $k^4$  are preferably in the form of spring fingers (see Fig. 8) adapted to bear upon the ends of the terminals  $k k'$ . By moving the board K' in one direction or the other for the distance of one or more terminals, the pitch of the organ may be raised or lowered one or more semi-tones. In cases where additional pipes are not provided at the upper and lower extremities of the organ, it is advisable to so arrange the aforesaid test board or switch, that, when the organ is transposed, the keys left without pipes shall play one of their octaves. This may be accomplished by connecting the additional terminals  $k'$  with the terminals  $k$  representing their upper or lower octaves as shown in dotted lines at  $k^6$ .

In Fig. 9, K<sup>2</sup> are a series of roller switches mounted on a board K<sup>3</sup> and each adapted to be operated independently of the others by any suitable device under the control of the performer. Each roller is provided with a series of insulated contact pieces K<sup>4</sup>, each located in proximity to a pair of insulated pins K<sup>5</sup> K<sup>6</sup> with which it is adapted to be placed in contact when the roller is turned. The corresponding pins K<sup>5</sup> of all the rollers are connected by wires  $k^7$  to their respective key contacts. Each pin K<sup>6</sup> of any given roller K<sup>2</sup> is connected by a wire, as  $k^8 k^9 k^{10} k^{11}$ , with that pin K<sup>6</sup> on the roller next above or below it, which represents the note a semi-tone higher or lower, as the case may be. The wires from the pins K<sup>6</sup> of the last roller are led away to their respective electro-magnetic or electro-pneumatic actions within the organ. Assuming No. 3 roller to be the "C" or "normal" roller, then, when this roller is turned as in Fig. 9, the organ is of normal pitch. If it be desired to raise the pitch of the organ a semi-tone, the roller No.

3 is turned out of action and the roller No. 4 is so turned as to bring its contact pieces K<sup>4</sup> in touch with the adjacent pins K<sup>5</sup> K<sup>6</sup>. The various key contacts are now connected in circuit with the electro-pneumatic levers of those pipes which are a semi-tone higher in pitch than the pipes to which they were previously respectively connected. For example, the wire  $k^7$  from the key "D D" was previously connected by the roller No. 3 to the wire  $k^{10}$  leading to the electro-pneumatic lever of the pipe "D D," but, on transposing, as before described, the wire  $k^7$  of the key "D D" is connected by the roller No. 4 with the wire  $k^{11}$ , which forms part of the circuit of the electro-pneumatic lever of the pipe "D D."

As in the construction previously described, additional pipes may be provided at each end of the sound board, or, failing this, the keys, which are left without pipes when the organ is transposed, may be so connected as to play one of their octaves as before described.

Forms or arrangements of compound switches other than those described with reference to Figs. 7, 8 and 9 may be employed with the object of altering the relative connections between the keys and the organ.

In order to vary the quality and power of tone, one or more adjustable keys, touches or pedals may be provided and so arranged and connected that the speech of the various ranks of pipes may be controlled with but slight effort on the part of the performer, and, when desirable, without moving the stop or coupler keys or draw stops. An arrangement of this kind is depicted in Figs. 10 and 11. L is a roller capable of being operated by the performer by any suitable device, as for example, by a pedal  $l$ , link  $l'$  and arm  $l''$ .  $l^3$  is a spring adapted to return the roller to its normal position when the pedal is released. The roller is provided on two opposite sides respectively with two rows of insulated metallic pins L<sup>1</sup> L<sup>2</sup>. L<sup>3</sup> is one of the stop or coupler keys, shown in its "on" position. F is the battery supplying current to the stop key by wire  $l^4$ . L<sup>4</sup> is the "on" contact and  $l^5 l^6$  the wires leading therefrom to the console test board L<sup>5</sup>. L<sup>6</sup> is the "off" contact and  $l^7 l^8$  the wires leading from it to the board L<sup>5</sup>.  $l^9$  is the cable connecting the test board L<sup>5</sup> with the battery F and comprising in its circuit (as at  $l^{10}$ ) the various electro-pneumatic levers and other electrical devices within the organ. Each of the pins L<sup>1</sup> aforesaid works between and in contact with a pair of flexible insulated metallic pins L<sup>7</sup> L<sup>8</sup> connected in circuit with the "on" wires  $l^5 l^6$ , while the pins L<sup>2</sup> work in a similar manner between flexible insulated pins L<sup>9</sup> connected in circuit with the "off" wires  $l^7 l^8$ . The turning of the roller in either direction thus closes or opens all the "off" and "on" circuits at the pins L<sup>7</sup> L<sup>8</sup> L<sup>9</sup>. L<sup>10</sup> is an insulated contact strip running along the roller in proximity to the pins L<sup>7</sup> L<sup>8</sup> and adapted, when the pedal  $l$  is depressed and the roller is turned, to break the "on" and "off"

circuits as aforesaid, to bear against all the pins  $L^7 L^8$ . When the roller is thus turned, the strip  $L^{10}$  is also brought into contact with an insulated pin  $L^{11}$  connected with a supply wire  $L^{11}$  from the battery, so that a current is sent through the wire  $L^{11}$ , pin  $L^{11}$ , strip  $L^{10}$ , pins  $L^8$ , "on" wires  $l^6$ , and so on, through all the electro-pneumatic levers connected therewith, back to battery. The whole of the corresponding stops are thus instantly brought into operation, and that quite independently of the positions of the various stop and coupler keys  $L^2$ . On releasing the pedal  $l$ , the roller resumes its normal position and all the stops are silenced except those the stop keys of which happen to be in the speaking position.

A separate roller and pedal, or its equivalent, may be provided for each manual and for the pedals, or one roller and pedal may operate the stops of the entire organ, or any predetermined portion thereof. By the use of an arrangement such as just described, a sforzando effect may be instantaneously obtained at will.

When it is desired to obtain a prolongation of the sound resulting from the depression of one or more of the keys or pedals, electrical contacts may be arranged within the organ or console, two or more of said contacts being brought together whenever a note is sounded, and the whole or a given number of them being rendered electrically effective or ineffective by the movement of a key, pedal, lever or the like, situated within reach of the performer.

An arrangement for carrying the above into effect is seen in Fig. 12.  $H^2$  is a wind box containing a series of electro-pneumatic levers for operating the pallets of a corresponding number of pipes by means of bellows  $H^3$  and rods or pull-downs  $H^4$ .  $h$  is a wire leading from the battery  $F$  through the contacts of one key (supposed to be situated at  $h'$ ) to its electro-pneumatic lever within the box  $H^2$ .  $h^2$  is the return wire to the battery.  $h^3$  is a second supply wire from the battery to the electro-pneumatic lever. The circuit of this latter wire is broken at  $h^4$  and at  $h^5$ . At  $h^4$  a switch  $H^5$  is provided, by means of which the circuit may be opened or closed at will by the performer, the switch being operated by a pedal or other suitable device at the console. At  $h^5$  the separated ends of the wire  $h^3$  terminate in flexible insulated metallic pins  $H^6 H^{6*}$ .  $H^7$  is an insulated contact mounted upon the tailpiece of the bellows  $H^3$  and adapted to establish an electrical connection between the pins  $H^6 H^{6*}$  at each operation of said bellows. Any suitable form of contact device may be employed in lieu of the above. When the circuit is closed at  $h'$  by the depression of its key by the performer, the corresponding electro-pneumatic lever is operated, the bellows  $H^3$  expanded and the note sounded. If the switch  $H^5$  be open, the circuit  $h^3 h H^2 h^2 F$  remains broken when con-

tact is made at  $h^5$ , and, on the release of the key and the consequent breaking of the circuit  $h H^2 h^2 F$  at  $h'$ , the electro-pneumatic lever becomes inoperative, the contact at  $h^5$  is broken and the pipe silenced. When, however, the switch  $H^5$  is closed by the operator and the key also depressed, both the circuits aforesaid are closed and the note sounded. On releasing the key, the circuit  $h H^2 h^2 F$  is broken, but the circuit  $h^3 h H^2 h^2 F$  remains closed, as the electro-pneumatic lever, which is included in the latter circuit, operates to maintain the contacts  $H^6 H^{6*} H^7$  closed. The note is thus prolonged as long as the switch at  $h^4$  remains closed.

It will be understood that one switch  $H^5$  only is provided for each department of the organ or otherwise for each predetermined series of contacts  $H^6$ , each contact  $H^6$  of the series being connected to a common wire  $h^6$  in electric connection with the supply lead  $h^3$ .

In some cases, I employ a pneumatic or electro-pneumatic brake for the purpose of steadying the shutters at the moment of closing and thus preventing rebound of the same. An arrangement of this kind is shown in Fig. 13.  $C^8$  is the shutter rod and  $H^8$  the bellows whereby the shutters are opened.  $M$  is a second bellows of smaller area than the bellows  $H^8$ .  $M'$  is a wind box communicating by the passages  $m m'$  with the bellows  $M$ .  $M^2$  is a small double valve adapted to close either end of the passage  $m$ , one end of which communicates with the wind box  $M'$ , and the other with the atmosphere.  $m^2$  are guides for the valve spindle.  $M^3$  is an adjustable abutment carried by shutter rod, or by some part moving therewith, and adapted to strike the end of the valve spindle a moment before the shutters are fully closed.

In the normal position of the parts, that is, when the shutters are open or partly open, the valve  $M^2$  is so operated by the pressure of the wind in the box  $M^2$  that the passage  $m$  is closed to the wind box and open to the atmosphere. The bellows  $M$  is thus free to move with the shutter rod and offers no impediment to the movement of the rod. When the shutters are closed, however, the abutment  $M^3$  strikes the valve spindle and closes the passage  $m$  to the atmosphere, opening it at the same time to the wind box. The bellows  $M$  is instantly filled with wind and the shutters are held firmly closed against any tendency to rebound. The bellows  $M$  being of smaller area than the shutter operating bellows  $H^8$ , the latter, when operated, is able to move the shutter rod in defiance of the bellows  $M$ , to sufficient distance to release the valve  $M^2$  and permit the bellows  $M$  to exhaust.

In some cases I may mount the abutment  $M^3$  upon the shutter rod in such manner that it may have a slight longitudinal play thereon, and, in this case, I connect the shutter closing bellows to the sliding piece supporting the abutment. The object of this is to permit the abutment to act upon the valve a lit-

tle in advance of the movement of the shutter rod, that is, before the shutters are actually closed. The inflation of the bellows M then acts to firmly close the shutters and hold them closed.

It will be obvious that, in place of the abutment striking a pneumatic valve as described, the abutment may carry or move an electric contact or may otherwise so act as to close an electric circuit which operates through an electro-pneumatic device to inflate the bellows M.

No claim is made by me in this application to such features of my pending application Serial No. 406,071, as may be incidentally herein shown and described.

I declare that what I claim is—

1. In an organ, the combination, with the key A, of a stiff insulated spring B below the key and serving to limit the depression of the same under normal touch, the insulated contact pin B' below the spring and serving as a stop for it and the key when depressed under a more forcible touch, and the wires  $b^2$   $b^3$  connected respectively with the spring B and pin B' and forming parts of the circuit of one or more electrically operated actions as described, substantially as set forth.

2. In an organ, the combination, with a series of keys A, of a corresponding series of contact springs B below the same, a series of contact pins B' below the springs, a wire  $b'$  connecting said springs through a common supply wire  $b^2$  with the like terminals of a corresponding series of electrically operated actions as described, a series of wires  $b^3$  connecting the pins B' respectively with the opposite terminals of said actions, and a switch inserted in the wire  $b^2$ , substantially as described.

3. In combination with the swell-box of an organ, a series of swell shutters, each of a different area, and mechanism under the control of the performer whereby said shutters are successively opened or closed in the order of their respective areas, substantially as described.

4. In an organ, the combination, with the swell-box C, of a series of counterbalanced swell shutters  $C'$   $C^2$   $C^3$   $C^4$   $C^5$  and sets of coupled shutters  $C^6$   $C^7$ , having their areas increasing from one end of the series to the other, and mechanism whereby said shutters may be successively operated in one direction, substantially as described.

5. In an organ, the combination, with a series of counterbalanced swell shutters, of a series of electrically operated actions for successively actuating said shutters in one direction, and a switch under the control of the performer, whereby the circuits of said actions may be successively made and broken, substantially as described.

6. In an organ, the combination of the series of counterbalanced swell shutters  $C'$   $C^2$ , series of electro-pneumatic actions E D' D<sup>2</sup> and

operating their respective shutters in one direction, contacts  $G'$   $G^2$  connected to their respective actions each to one terminal thereof, contact  $F^2$  connected to all the opposite terminals of said actions and adapted to cover one or all of the contacts  $G'$   $G^2$ , and means whereby the operator may place the contact  $F^2$  in contact successively with the series of contacts  $G'$   $G^2$ , substantially as described.

7. In an organ, the combination, with a series of counterbalanced swell shutters, of a series of electrically operated actions for successively actuating the same in one direction, a switch whereby the performer may successively make and break the circuits of said actions, and a pneumatic device whereby the shutters are automatically held opened or closed in defiance of their counterbalancing devices by the agency of the wind pressure alone after the breaking of the circuits of their respective actions, substantially as and for the purpose described.

8. In an organ, the combination, with a series of counterbalanced swell shutters, of a series of electro-pneumatic actions for successively actuating the same in one direction, a switch for successively making and breaking the circuits of said actions, and a pneumatic device whereby the one or more electro-pneumatic actions last in operation are automatically retained in their operative condition after the breaking of their circuits, substantially as described.

9. In an organ, the combination, with a series of counterbalanced swell shutters, of a series of electro-pneumatic actions for successively actuating the same in one direction, a switch for successively making and breaking the circuits of said actions, and a series of by-pass devices, whereby the wind pressure from that electro-pneumatic action at any time in operation retains the previously operated action or actions in an operative condition after the breaking of the circuit or circuits thereof, substantially as described.

10. In an organ, the combination of the series of counterbalanced swell shutters  $C'$   $C^2$ , series of electro-pneumatic actions E D' D<sup>2</sup> successively operating the same, switch  $F^2$  G for placing the actions successively in and out of operation, and a by-pass device for each action in the series except the first, each by-pass being adapted to convey the wind pressure from the operative action next below it in the series to its own action and to apply it to the primary valve thereof in such manner as to retain the latter in its operative position, substantially as described.

11. The combination of the series of swell shutters  $C'$   $C^2$ , series of electro-pneumatic actions E D' D<sup>2</sup> therefor, action controlling switch  $F^2$  G, chambers  $E^4$  applied one to each action in the series except the first and having their flexible sides  $E^5$  connected as described with the primary valves of their respective actions, and wind passages  $E^6$  each

connecting its respective chamber  $E^4$  with the wind space of the action next below it in the series, substantially as described.

12. The combination of a series of electric actions controlling respectively the pipes of an organ, a series of keys controlling respectively the circuits of said actions, a compound or multiple switch through the separate contact devices of which said circuits pass respectively, and means for operating said switch in such a manner that the relative connections of the circuit wires entering the opposite sides of the switch are simultaneously altered, whereby the entire organ or a given part thereof, may be transposed at will, substantially as described.

13. The combination, with the electrical connections of the key board, of a compound switch board, whereby the connections with the key board can be changed one or more half notes.

14. The combination, with the electrical connections of an organ key board, of a compound switch board capable of moving the connections forward or backward one or more keys, and one or more additional pipes and additional terminals, whereby, if the pitch is altered, each key shall still operate a pipe.

15. In combination with a series of stop slides and a series of electric actions for respectively operating said slides in one or both directions, a series of stop keys  $L^3$  controlling the circuits of said actions respectively, and a switch  $L$  adapted to simultaneously disconnect all the stop keys from their circuits and to close all the circuits of those electric actions which open in the said stop slides, whereby its sforzando effect may be produced at will.

16. The combination of the spring roller  $L$ , pins  $L' L^2$ , stop keys  $L^3$ , test board  $L^5$ , battery  $F$ , and wires connecting the same, substantially as and for the purposes described.

17. The combination of the roller  $L$ , wires  $L^5 L^6$ , &c., pins  $L' L^2$ , projecting contact strip  $L^{10}$  and contact piece  $L^{11}$ , whereby, by means of the pins  $L' L^2$ , all the "off" or "on" wires are brought into requisition that are connected by keys  $L^3$  and by felt  $L^{10}$  all the "off" or "on" wires are operated whether connected by keys  $L^3$  or not.

18. A series of stop slides, a series of electric actions for respectively opening and closing the said slides, a series of stop keys  $L^3$  controlling the circuits of both "off" and "on" electric actions and a switch  $L$  adapted to simultaneously break the action of both stop keys with both "off" and "on" circuits and to close all the "on" circuits, whereby all the stop slides are immediately opened irrespective of the positions of their respective

stop keys, substantially as and for the purpose described.

19. The combination, with a series of stop slides and electric actions for opening and closing said slides, of the switch  $L L^{10}$ , insulated pin  $L^{11}$ , line to battery  $L^{11}$  and "on" connections  $L^5$  and  $L^6$ , whereby all the corresponding actions are immediately brought into action.

20. A series of electric actions  $h'$  controlling respectively a series of pipes, a series of keys controlling the circuits of their respective actions, a series of contact devices  $H^6$  and  $H^7$  each closed on the operation of its respective action and each connected in circuit with said action by a branch circuit  $h^3$  and a switch  $H^5$  controlling said branch circuits and adapted to simultaneously render them effective, whereby the prolongation of the notes may be obtained after the release of their keys.

21. The combination of circuit  $h h^2$  having in it electric action  $h'$  and operating electro-pneumatic lever in box  $H^2$ , pull down  $H^4$ , bellows  $H^3$ , contacts  $H^7$  and  $h^6$ , shunt  $h^3$  and switch  $h^5$  operated by a stop at the will of organist.

22. In combination with a swell shutter operating device, a pneumatic brake operated by the swell shutter closing mechanism near the termination of its stroke, whereby a rapidly accelerating resistance is brought to bear upon the movement of the closing rod, but a resistance so regulated that, at its maximum, it shall be less than the force used in closing the shutters.

23. In combination with the swell shutters of an organ, a bellows opened by the closing movement of the shutters and adapted, when inflated, to hold the shutters closed, an air controlling device admitting air to the bellows and an abutment moving with the shutters and adapted to operate said air controlling device as the shutters close or are on the point of closing, whereby the shutters are held firmly closed and rebound of the same when closed is prevented, substantially as described.

24. The combination of rod  $C^8$ , abutment  $M^3$  thereon, operating mechanism  $H^8$ , bellows  $M$ , passages  $m'$  and  $m$ , valve  $M^2$  and valve box  $M'$ , substantially as and for the purposes described.

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

ROBT. HOPE-JONES.

Witnesses:

GEO. C. DYMOND,  
L. C. JOHNSON.