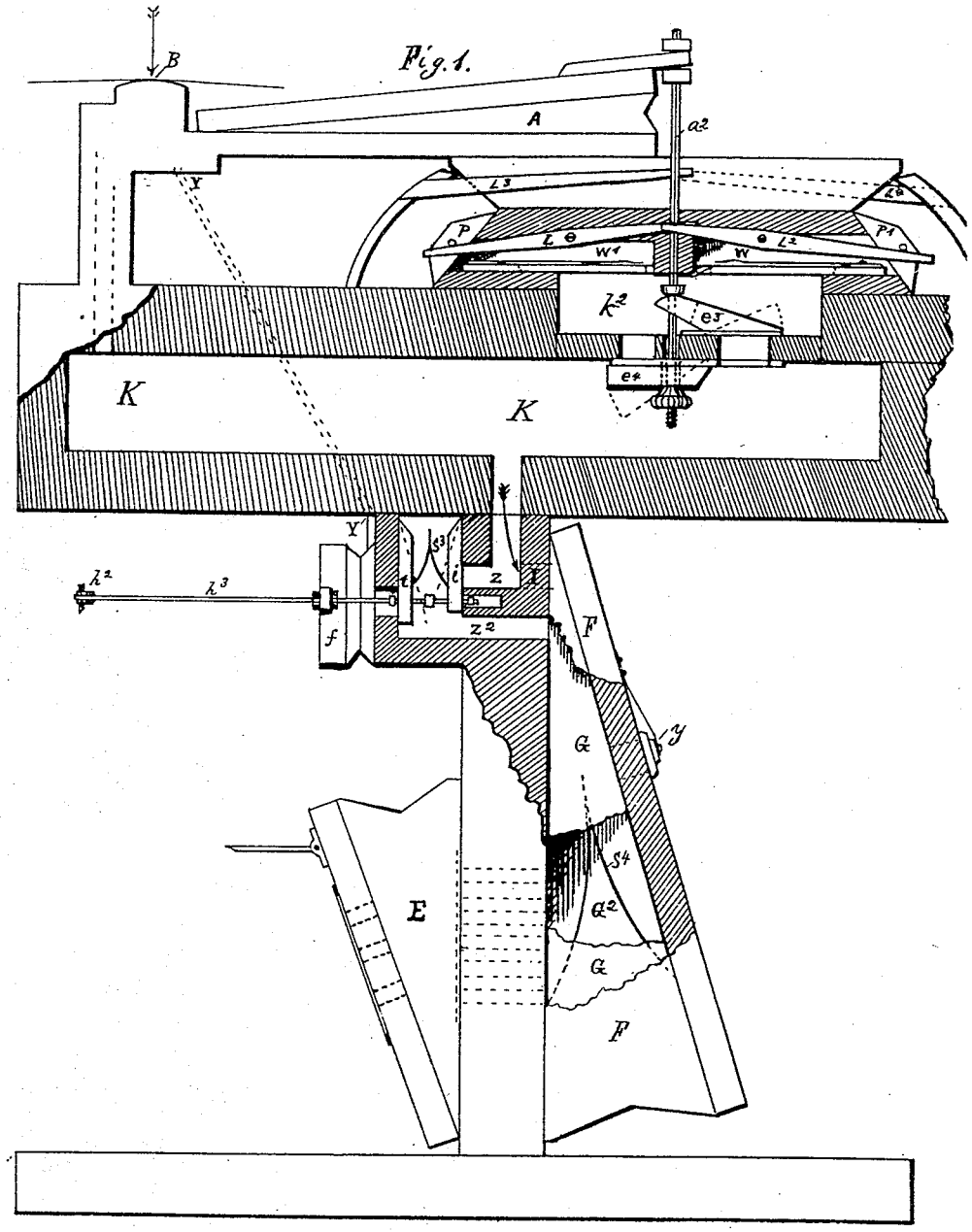
3 Sheets—Sheet 1

M. GALLY.

Mechanical Musical Instrument.

No. 214,121. Patented April 8, 1879.

Fig. 1.



WITNESSES.

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John P. Thomas

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3 Sheets—Sheet 2.

M. GALLY.

Mechanical Musical Instrument.

No. 214,121. Patented April 8, 1879.

Fig. 1.a

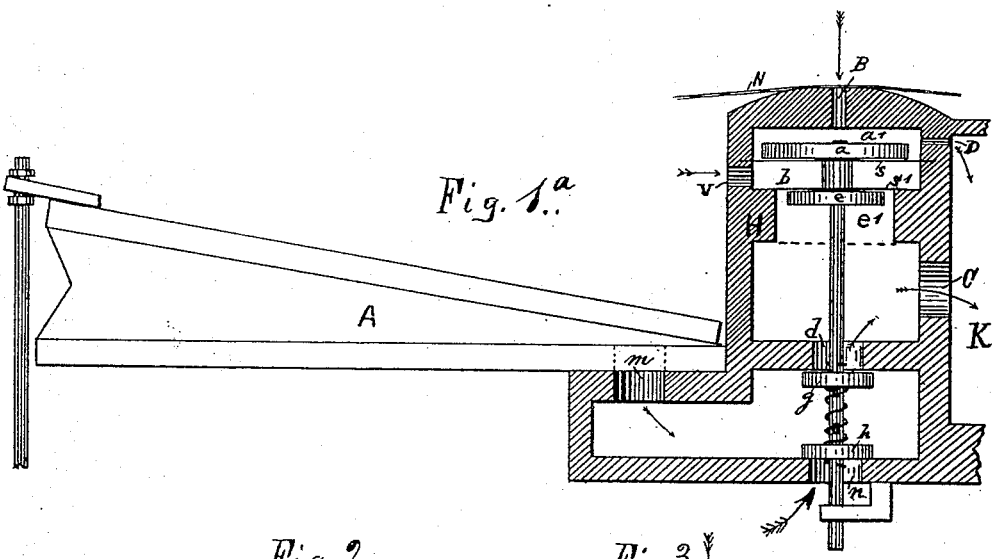


Fig. 2.

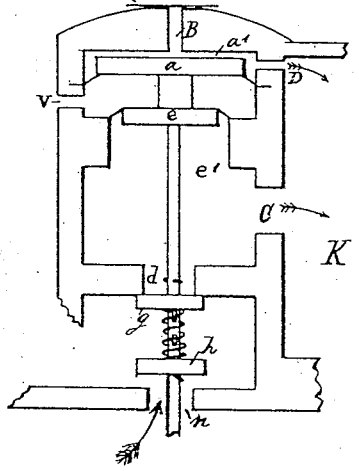


Fig. 3.

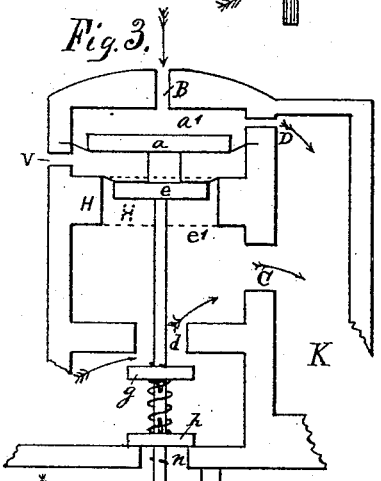


Fig. 4.

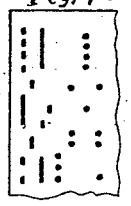
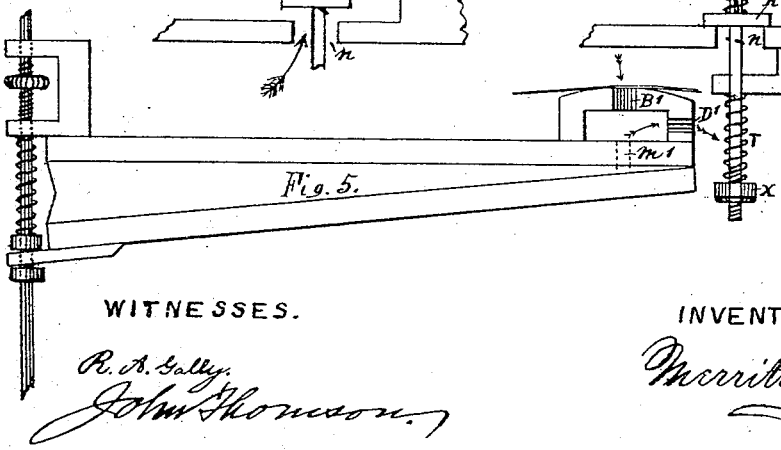


Fig. 5.



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3 Sheets—Sheet 3.

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Mechanical Musical Instrument.

No. 214,121. Patented April 8, 1879.

Fig. 6.

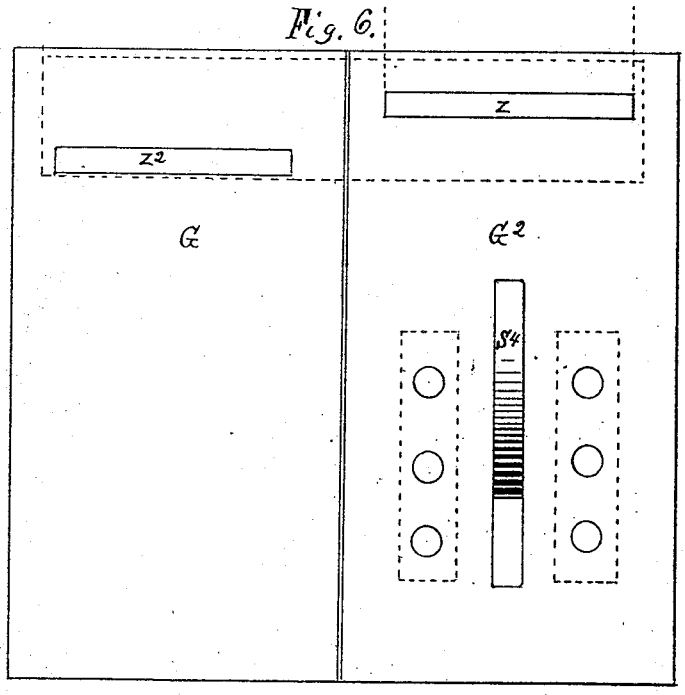
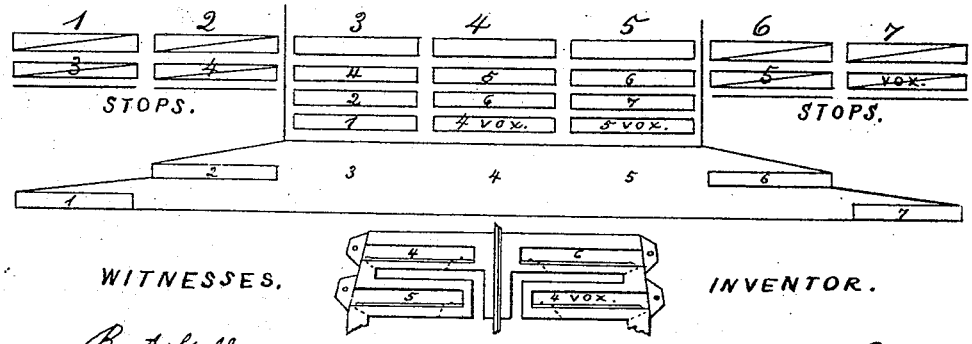


Fig. 7



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UNITED STATES PATENT OFFICE.

MERRITT GALLY, OF NEW YORK, N. Y.

IMPROVEMENT IN MECHANICAL MUSICAL INSTRUMENTS.

Specification forming part of Letters Patent No. **214,121**, dated April 8, 1879; application filed December 27, 1878.

To all whom it may concern:

Be it known that I, MERRITT GALLY, of the city, county, and State of New York, have invented certain new and useful Improvements in Musical Instruments, of which the following is a specification.

In the accompanying drawings, Figure 1 is a sectional elevation, showing the principal features of the invention. Fig. 1ª is a sectional view of the device for operating the ports of the ducts of the pneumatic key; Fig. 2, the same as Fig. 1ª, showing the position of the ports when an unperforated portion of the music-sheet covers the duct B; Fig. 3, the same as Fig. 1ª, showing the position of the ports when a perforation in the sheet opens duct B. Fig. 4 represents a piece of the music-sheet. Fig. 5 represents a modified arrangement of ducts B and D of Fig. 1ª in respect to the pneumatic key. Fig. 6 represents the position of the compartments of the receiving-chamber with spring and valves. Fig. 7 is a diagram representing the arrangement of a number of sets of reeds in groups, in such a manner as not only to be used for the ordinary "stops" of the instrument, but in combination with a suitable arrangement of the perforations in the music-sheet to produce music written in a wider range than represented by the number of octaves of lines of perforations in the sheet corresponding with the principal set of reeds.

In my patent for improvement in musical instruments dated November 26, 1878, is described the combination, with the primary keys, of a pneumatic key-action of sub-pneumatic keys, for the purpose of increasing the power of the stroke of the primary keys, and also the operation of the valve of the air-duct of the sub-pneumatic, by means of the initial movement of the primary pneumatic.

The first part of my present invention consists in so constructing and combining the primary and secondary pneumatics as to use the movement of the primary for operating the ports of entry and exit of the air-duct of the secondary without necessarily connecting the primary pneumatic with the striking device, and by using the primary only for such purpose to be able to operate it by means of much smaller perforations in the music-sheet, and also to be able to use the perforated sheet in connection with the vent of the primary pneumatic instead of the exhaust or supply duct which leads to the air-chamber of the bellows.

In Fig. 1ª the pneumatic striking-key is represented by A. The remainder of the figure represents the primary pneumatic very much enlarged, in order to distinctly show its construction. The air-chamber a^1 and follower a might be constructed in the ordinary bellows shape, like the primary pneumatic of my patent of November 26, 1878, and does not materially differ from it in its action. It, however, differs in the construction of its air-ducts and the connection of the perforated sheet with the vent-duct instead of the duct of the air-chamber of the bellows. The perforated sheet N is drawn over the opening of the vent-duct B, and the air is exhausted from chamber a^1 through duct D, which leads to the bellows through chamber K.

The perforated music-sheet N, air-duct B, and air-duct D might be made to directly operate the pneumatic key A, if arranged as shown in the modification Fig. 5, by the use of an additional duct, m', the ducts B D being represented by B′ D′; but this, although operative, would require perforations in the music-sheet much larger than the duct m' and equal to B′, in order to prevent the exhaust of the chamber of the key, Fig. 5, while a perforation of the sheet opened the duct B′.

It is very desirable to have the perforations in the music-sheet as small as possible in order to have the sheet narrow. I therefore use the ducts B D in connection with a very small chamber, a^1, Fig. 1ª, which may be much smaller than that shown in the figure, while the duct C for exhausting the pneumatic may be made as large as desired to operate the key A through m, and fill it again very quickly by using the primary pneumatic a a^1 B D in connection with the music-sheet N simply for operating the valves of the air-ducts to and from key A.

The perforation in the music-sheet may now be made as much smaller than an opening large enough to exhaust properly the chamber of key A as chamber a^1 is smaller than A.

In the device of actual working size for a key much larger than A the duct B, and there-

fore the perforations in the sheet, do not require to be more than one-twentieth of an inch in diameter or width, as shown in Fig. 4, and the duct D requires to be not more than one-thirty-second of an inch in diameter, while the ducts C *m* can be the sizes shown.

When an unperforated part of the music sheet closes duct B follower *a* takes the position shown in Fig. 2, and valve *h* is open to fill key A with air. When a perforation opens duct B the follower *a* drops, and with it the rod of the valves, which closes valves *h* and opens valve *g*, as shown in Fig. 3. When the valves are closed they are held to their seats by a stop on the valve-rod for the purpose.

The valves slide on the rod, and a light spring with slight tension is placed between them, in order that one may open no sooner than the other is closed.

No further mechanism is necessary to make the device operative; but if the valve-rod is not sufficiently heavy to hold the valve *h* firmly to its seat, it is well to either add the spring T, or, what is much better, the follower *e*.

When the follower *e* is used the rod and valves may be very light, and the device be exceedingly sensitive and quick in its action, which is desirable.

The follower *e* is smaller than follower *a*, and has a flexible connection with the sides of the chamber in like manner to *a*. This forms the chamber e^1 under the chamber *b*.

The chamber *b* in both modes of construction is constantly filled with air from the external atmosphere through the opening V.

When the small follower is not used, the partition H is made to extend across the chamber from side to side, as shown by the dotted lines, an opening being left only sufficiently large for the rod to slide in, thus separating the chamber *b* from the chamber below the partition H.

When the device is constructed with the small follower *e*, the follower *a* representing a greater surface for air-pressure than follower *e*, the smaller one is carried upward with the larger, and held in such position until a perforation in the music-sheet renders the larger one inoperative, when the exhaust from below draws down the small follower with a quick movement, closing and holding firmly valve *h* to its seat until chamber a^1 is again exhausted.

The device thus constructed is exceedingly sensitive and quick in its action.

A single set of these primary pneumatics may be made to operate a number of sets of pneumatic keys, as the chamber in which the valves are placed may lead to any desired number of pneumatic keys, which may be arranged to act separately or in groups, as required.

By changing the valves *g h* to the opposite sides of their ports, the device may be operated by a pressure current of air instead of exhaust, if desirable; or the parts may be arranged to operate with a pressure current for the pneumatic key A and exhaust for the chamber a^1; or currents of different tensions may be used for the two chambers, thus necessitating the use of only the follower *a* with chamber a^1 on one side of it and chamber e^1 on the other side.

In my patent for improvement in musical instruments dated May 7, 1878, there was shown a balanced-valve for the reed-opening of an organ; but the same was reserved for a future specification. I now present a balanced valve in an improved form.

Fig. 1 the partition between the air-chest K and reed-chamber k^2 has two openings, closed by the two valves e^3 and e^4. These valves are both connected with the push-pin a^2, and operate in unison. The valve e^3 opens into reed-chamber k^2, and valve e^4 opens into air-chest K. The exhaust of the bellows tends to open valve e^4, but to close valve e^3. The air-surface pressure of valve e^3 is made to slightly exceed that of e^4, taking into account their difference of leverage, so that the valves are held closed by air-pressure, but are very easily opened. A slight spring may be added to secure their prompt closing, if desired.

The push-pin is provided with a screw and adjusting-nut, as shown, to adjust the valves so that they will strike their seats in unison. These valves thus constructed and arranged will operate with uniform touch, whatever the tension of the exhaust may be or under change of its tension, and are very useful in instruments provided with expression-bellows.

The third part of my invention consists in an improved expression-bellows. The receiving-chamber G G^2 has two or more compartments communicating with one another, and operated alike by air, either under pressure or exhaust. The chamber has a part cut away in Fig. 1 to show the two internal compartments, and Fig. 6 represents their positions. The compartment G does not necessarily require any spring, and in this respect differs materially from expression-bellows depending on springs of different tensions. When both compartments are operating in connection with the air-current, they communicate with each other, securing a constant equilibrium in the air of the air-chest K, with an easy transition from one air-tension to another, however sudden it may be, without the use of air-pads or regulating-springs, or any thing of the kind, and therefore the device differs in every respect from the use of an additional bellows, having no air-communication with the receiving-chamber proper. The pumps E operate only in connection with compartment G^2, and compartment G^2 takes the air from compartment G through an intervening passage, into which open the ports Z Z^2. Compartment G^2 opens into the duct leading to air-chest K through an opening represented by dotted lines at I.

In the passage leading from compartment G to G^2 are two valves, one to open and close the passage between the compartments, and

the other connecting the passage with the external atmosphere. The spring of the chamber is represented by S^4. When valve *i* is open and valve *t* closed, the entire receiving-chamber is operative, and the tension of the air is that of the spring, taking into account the area of the entire movable surface of the chamber. When valve *t* is open and valve *i* closed, compartment G is rendered inoperative, and the air-tension is that of the spring, taking into account only the movable surface of the remainder of the chamber. Thus, if the compartments were of equal size, and the entire movable surface of the chamber be three square feet, and the spring-pressure thirty pounds, the air-tension would be ten pounds to the foot when both compartments are operative, but twenty pounds to the foot when only one compartment is operative.

Any number of compartments may be used, so that a variety of air-tensions may be secured. The chamber thus constructed may be used either for exhaust or pressure, as the case may require. The valves may be operated by an attachment for knee or hand, in connection with rod h^3, at h^2, or by means of the music-sheet through the pneumatic *f*. The air-duct to this pneumatic is represented by dotted lines Y. The valves may be otherwise mechanically operated in connection with the music-sheet—for example, by means of levers connecting with depressions, elevations, or perforations in the sheet.

I use the tension-bellows for two distinct purposes: First, to operate the pneumatic key-action with different degrees of tension for different powers of stroke when required, the action being adapted to sounding devices other than reeds or pipes, such as strings, bells, and the like. It is also desirable to be able to vary the stroke of the keys when used with reeds or pipes. Secondly, I use the expression-bellows for different degrees of air tension on the reeds or pipes.

In Fig. 1 the air-chest K, in which the air-tension is changed by the expression-bellows, is shown connecting directly both with the pneumatic keys and the reed-chamber k^2.

The object of the fourth part of my invention is to be able to use the additional sets of reeds which are required for the stops of a reed-instrument, to perform music by means of the pneumatic keys beyond the range of octaves given to the width of the music-sheet—for example, a sheet with three octaves of perforations and the stops to perform music written on five or more octaves of notes. The levers $L\ L^2$ may be operated by means of the pneumatic key-action as rapidly as the reed-valves. The levers $L\ L^2$ operate the shutters P P', which are the ordinary stops of the organ. All the stops of a reed-organ, except what are called the "fancy" stops, simply open to sets of reeds in octaves ranging above or below the principal set. The violina being the principal set, the piccolo would be the same an octave above, and the trumpet the same an octave below. If, then, a manual performer were able to manipulate his stops as rapidly as his keys, and manipulate both in unison, he would be able to perform music beyond the range of his key-board. This is what I accomplish with the pneumatic keys and the groups of sets of reeds of Fig. 7. The music-sheet is only wide enough to operate three octaves of pneumatic keys and seven stops. By arranging the sets of reeds for the principal set, and those for the stops in groups, as shown, to be operated upon by the three octaves of keys for the notes, and having seven shutters, one for each stop-pneumatic, such combinations may be made by means of the perforations in the sheet as not only to produce the ordinary effect of stops, but to perform music written on five, six, or even seven octaves. Each note-key opens all the valves of its letter in all the sets of reeds of its group; but only the letter of such set is sounded in the group as may be opened by a corresponding action of its shutter-key. If a letter-key be operated in the third group, for example, and the stop-keys be operated for six and seven, the letter would be in the sixth octave with violina and piccolo stops.

Many pieces on even seven octaves can be rendered properly with the effect of the stops perforated in sheets for three octaves in width. All solo passages can thus be rendered in seven octaves. A greater or less number of sets of reeds may make up each group, according to the desired limit of the range of the instrument.

It is unnecessary to enter into a long explanation as to the method of combining the different sets for different results, as it is a fact well known that a great many combinations are possible from a very few numbers.

The ducts B, Fig. 1, converge, requiring only a narrow sheet.

The devices of my invention are applicable not only to reed-organs, but to musical instruments provided with strings, bells, or other sounding devices. They are also adaptable either to complete instruments or to attachments for playing on musical instruments. Many of the devices are also applicable either to mechanical musical instruments or to those manually operated, or to those which are adapted to be operated manually or mechanically at will. I do not therefore wish to limit myself in their application to musical instruments of any particular description.

What I claim as my invention, and desire to secure by Letters Patent, is—

1. The combination, with the valves *g h*, of follower *a*, air-chamber a^1, follower *e*, and air-chamber e^1, substantially as and for the purpose specified.

2. The combination, with follower *a*, and its air-chamber, follower *e*, and its air-chamber, of valves *g h*, the followers differing in area, for the purpose specified.

3. The combination, with follower *a* and air-chamber a^1, of the perforated music-sheet N.

air-duct B, and air-duct D, the duct B being larger than duct D, in order that the air passing through the music-sheet may be in excess of that passing through duct D, to secure the proper action of follower *a*.

4. The combination, with air-chamber a^1 and follower *a*, of valve *h*, substantially as and for the purpose specified.

5. In a pneumatic key-action for musical instruments, the air-ducts B, D, and C, differing in size, when arranged to operate substantially as and for the purpose specified.

6. The combination, with the pneumatic key-action of a musical instrument, of bellows constructed to produce different degrees of air-tension for giving different degrees of power to the movement of the keys, substantially as specified.

7. The expression-bellows having two or more connecting compartments, and having a valve for establishing or cutting off such communication at will.

8. The expression-bellows having two or more compartments, and a valve for establishing or cutting off their communication, one compartment having a spring, the others with or without springs, constructed to operate substantially as specified.

9. The combination, with the expression-bellows, of the perforated music-sheet, whereby the different degrees of air-tension of the bellows are controlled, substantially as specified.

10. The expression-bellows and its valves *t i*, in combination with the pneumatic *f*, substantially as specified.

11. The combination, with a perforated music-sheet and stops operated thereby, of a group or groups of reeds, each group containing more than one octave of notes, operated by a single octave of perforations in the music-sheet.

12. The combination, with the push-pin a^2, of the valves e^3 e^4 for the reed or pipe of a musical instrument, constructed and arranged to operate substantially as specified.

13. The combination, with a mechanical musical instrument, of an expression-bellows, substantially as and for the purposes specified.

MERRITT GALLY.

Witnesses:
JOSEPH MOSSMAN,
C. P. BLISS.