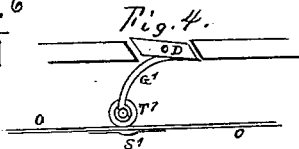
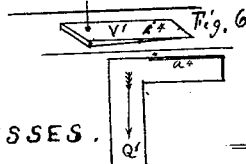
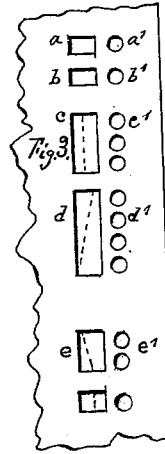
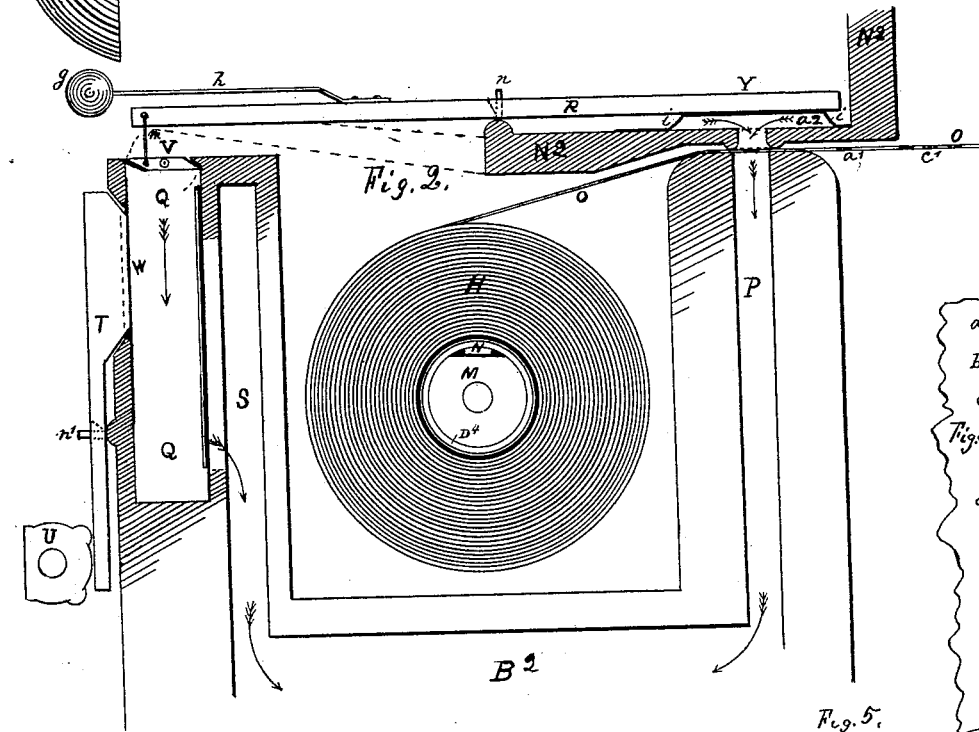
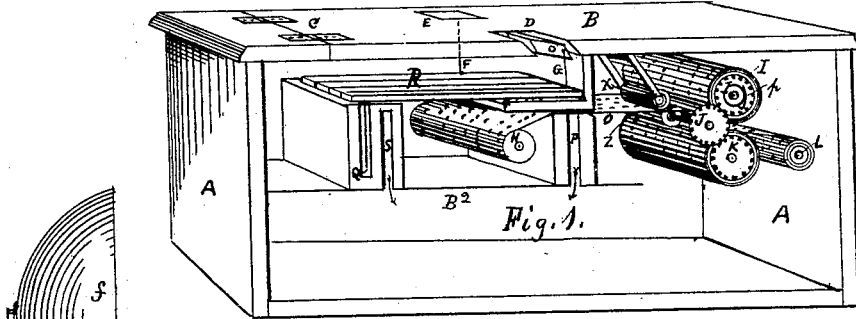


M. GALLY.  
Mechanical Musical-Instrument.

No. 203,257.

Patented May 7, 1878.



WITNESSES.  
*C. S. Hayes*  
*Robert H. Gally*

INVENTOR,  
*Merritt Gally.*

# UNITED STATES PATENT OFFICE.

MERRITT GALLY, OF NEW YORK, N. Y.

## IMPROVEMENT IN MECHANICAL MUSICAL INSTRUMENTS.

Specification forming part of Letters Patent No. **203,257**, dated May 7, 1878; application filed January 16, 1878.

*To all whom it may concern:*

Be it known that I, MERRITT GALLY, of New York city and county, and State of New York, have invented certain new and useful Improvements in Musical Instruments; and I do hereby declare that the following is a full and exact description thereof, reference being had to the accompanying drawings and the letters of reference marked thereon.

Figure 1 is a perspective view of the interior of an instrument, showing the new and improved devices. Fig. 2 is a sectional view of the key-action, &c. Fig. 3 represents a piece of the perforated sheet-music, showing the improvement in perforations for expression in the music, and also the style of perforations constructed for securing the least width of material and the greatest amount of strength and durability to the sheet. Fig. 4 represents a modification of the expression-valve D, shown in Fig. 1. Fig. 5 represents a modification of the friction device for the wheel I, shown in Fig. 1. Fig. 6 represents a modification of the valve V of Fig. 2.

My invention relates, first, to that class of musical instruments, or attachments for performing automatically upon musical instruments, which are operated by means of a perforated sheet of paper or other material.

In using perforated music-sheets for automatic instruments, it is a custom to make the sheet in form of an endless belt, as the increasing size of a winding roll, when operated automatically, is liable to change the "time" of the piece being played.

The first part of my invention consists in such a construction of the mechanism which moves the sheet as to secure to it a regular movement, and to allow only a corresponding winding of the roll. The motor-shaft J may be turned by hand or any suitable motive power. On this shaft is a roller, Z, and above it another roller, X, between which the perforated sheet is drawn by the action of the motor. The motor-shaft J is connected, either by belt, tooth, or friction-gear, to the roller I, upon which roller the sheet is wound after passing between the small rollers X Z. The wheel of roller I turns loosely on the shaft, but is provided with a friction-clutch, which causes it to turn the roller with sufficient force

to wind the sheet upon the increasing roll. When the strain upon the sheet is more than sufficient to wind it upon the roll, the wheel I slips under the pressure friction-roll *p* and turns on the shaft. Thus the sheet is collected and wound on the roll I only as fast as it is allowed to pass between the motor-rollers X and Z.

The object of the second part of my invention is to provide for the rewinding of one or more rolls of music mechanically while music is being performed by the instrument.

After the sheet has been used and wound upon roller I it is necessary to rewind it before it can be used again, or the music would be reversed. In order that this can be done mechanically while another sheet is being rolled at I, the first roll collected at I is placed at L and rewound on roller K while the second sheet is being wound on roller I. Thus there is no interruption in the music from piece to piece, except the simple changing of the position of the rolls, and the several sheets are always mechanically rewound and ready for use.

The third part of my invention consists in a pneumatic-key action, which, in connection with the perforated sheet, can be used not only for operating wind musical instruments, but also those with strings, bells, drums, &c., or any instruments which may be operated by hand or mechanical action.

In Fig. 2 the perforated sheet-music is represented, by O O, passing from the roll H over the air-passage P. This air-duct is not provided with reeds, and does not produce directly any musical tone, but is used to exhaust the air from the air-chamber *a*<sup>2</sup> under the key R Y, the air being drawn through the perforations in the sheet O. The sides of the air-chamber *a*<sup>2</sup> are flexible, and allow movement of the key when pressed upon at Y.

If the key Y were placed over a chamber only equal in size to the perforations in the sheet, the action of the key would be very weak unless the perforations were very large, which would be impracticable; but by making the chamber *a*<sup>2</sup> much larger in area under the key than the perforation of the sheet, a strong action of the key is produced by the atmospheric pressure upon the entire area of the

key above the chamber. After the depression of the key it is returned to place as soon as a portion of the sheet without perforations cuts off the air-passage.

The support  $N^2$  for key R Y, which forms the base of the chamber  $a^2$ , is cut away underneath so as to have only a slight bearing around the perforation. This base  $N^2$  is allowed a slight spring, so that while a perforation is between the opening of the chamber  $a^2$  and an air-duct, P, the pressure of the base  $N^2$  on the sheet prevents leakage; but as soon as the air-duct is cut off by the sheet the reaction of the base instantly causes leakage to again fill chamber  $a^2$ , and the leverage of key R Y at  $h$  returns the key suddenly to place. If it is desirable to make the key very light, an ordinary spring, such as is commonly used for returning keys to position, may be used instead of gravity.

It would perhaps appear, on a cursory examination, that after the depression of the key the atmospheric pressure on follower Y would hold the base of the chamber down upon its seat, not allowing ingress of air for returning the key to place; but this is not practically the fact.

The aperture in the base being very small as compared with the area of the base, the external pressure of the air upward upon the under surface of the base causes a reaction the instant the exhaust is cut off, producing leakage, to allow the return of the key. Reaction also takes place in the air remaining in the chamber, a perfect vacuum not being caused by the exhaust. This aids materially in producing the necessary leakage.

The leakage may be increased, if desired, by closing one edge of the aperture for the exhaust, or an auxiliary aperture from the external air, by a flexible substance, which will be forced away by the internal reaction admitting the external air in an increased volume.

It may seem that the external atmospheric pressure would prevent the opening of such aperture; but the practical fact is that the internal reaction is for an instant sufficient to establish the entering current, which, having been established, is thereafter aided, instead of interrupted, by the outside pressure.

It will be seen that with a sufficient number of keys R Y any kind of musical instrument can be played, either forming part of the entire mechanism, or as an attachment to ordinary instruments, such as pianos, organs, dulcimers, drums, bells, &c.

In Fig. 2 the key R Y is represented as operating the valve of the reed of an organ, and at the same time striking a bell in accord. Strings, trumpets, &c., might be added, forming any desired combination of instruments; or the device may be used in connection with an instrument containing only one of the kinds mentioned.

In the drawing, Fig. 2, the wind-organ S is shown as operated by the same pumps as the

pneumatic keys, both having a common air-chamber, B<sup>2</sup>. They can, however, be separate, if desired.

In using the sheet O for operating the pneumatic keys R, the perforations corresponding to  $c$  and  $d$  are not required to be an elongated single opening to produce a long tone, but can be made as shown by  $c' d'$ —a number of small perforations near together. So long as they are near enough together for any part of one or the other to remain under the opening to chamber  $a^2$ , the key will remain depressed.

The perforations  $a' b'$  being separated sufficiently to produce a cut-off by the intervening material, two distinct movements of the key are produced corresponding to  $a b$ .

One of the advantages of the pneumatic-key action is that it will work perfectly and strongly with perforations in the sheet so small that, if used directly over the reeds, they would not produce any tone whatever. This also allows of a much narrower sheet being used, as a greater number of lines of openings can be made in the width of sheets commonly used; and by alternating the keys, or otherwise placing them in separate lines, the key-board may be comparatively short.

The fifth part of my invention consists in the peculiar construction of a voice-tremolo. The ordinary valve-tremolo produces a bubbling sound and deadens the tone, not imitating the tremolo of the human voice. The fan-tremolo is also defective in this respect. The tremolo of the human voice is produced by a rapid contraction and expansion alternating in the walls of the passage to the larynx; but the free and clear passage of the tone is not obstructed.

To imitate this tremolo, I make an opening in the side of the air-duct Q, Fig. 2, and cover this opening with a flexible wall, W.

To the outside of the wall I attach the vibrating motor T. When the vibrator is thrown to the dotted line the air in the duct is suddenly expanded, and again condensed on the return of the vibrator. The tremolo is thus produced without in the least obstructing the duct, and the tremolo of the voice is closely imitated in a clear, full tone.

The vibrator T may be operated by wind-wheel, or by any mechanical action that will produce a simple vibrating motion.

The sixth part of my invention consists in a mechanism operated by perforations in the music-sheet to produce expression of tone, as very soft, soft, loud, very loud, &c. The reeds, cords, bells, or other musical devices are inclosed to shut in the sound, as shown in Fig. 1, and valve-doors E D (more or less in number, as desired) are connected with operating-keys, so that the valve-doors are opened or closed, as indicated, by perforations for such keys in the music-sheet representing the expression required.

A modification of this device is shown in Fig. 4, in which the valve-door is operated by a lever, the end of which rides upon the sur-

face of the sheet, except as it meets with perforations, depressions, or elevations indicating the changes of expression.

The seventh part of my invention consists in attaching to the end of the music-sheet a tube,  $D^4$ , or in forming a tube of the end of the sheet rolled upon itself and made fast in form of a tube, and in providing a stop to prevent the turning of the tube on the roller of the instrument. This tube answers two important purposes: first, of a roller, on which the sheet-music is rolled when not in the instrument, and, second, of an easy method of preparing the sheet for inserting or removing it from the instrument. The tube is made slightly larger than the roller of the instrument, so that the roller may be easily thrust into it. A small recess is cut into one end of the roller, and a small block,  $N$ , is fastened to the inner surface of the end of the tube. This block enters the recess of the roller, and prevents turning of the tube on the roller, and secures a positive winding of the sheet as the roller turns. The rollers are made movable from their journal-bearings, so that they can be readily removed from the instrument to receive the rolls and be replaced at will.

The pneumatic-key action may be otherwise than mechanically operated, or it may be used for general purposes, aside from musical instruments, for producing mechanical movements or operating certain parts of instruments, or for machines, such as looms, &c., according to arranged plans or intervals. I however reserve this matter for another specification; also the construction of the valve  $V$  of Fig. 2, and its modification in Fig. 6; also the shape of the perforation  $c d e$ . (Shown by the dotted line in Fig. 3.)

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

1. The combination, with the perforated music-sheet and mechanism for moving the same, of the roller  $I$ , provided with slipping gear, to cause the winding of the roll to correspond with the proper movement of the sheet, substantially as specified.

2. The combination, with a musical instrument and perforated or other music-sheet, of a rewinding mechanism, which is operative while music is being performed by the instrument, substantially as specified.

3. The combination of follower  $Y$ , air-chamber  $a^2$ , and air-duct  $P$  with sheet  $O$  or other cut-off, substantially as specified.

4. The pneumatic-key action, consisting, essentially, of follower  $Y$ , air-chamber  $a^2$ , and air-duct  $P$ , with sheet  $O$  or other cut-off, in combination with reeds, strings, bells, stops, pipes, or other devices for producing or effecting musical tones.

5. The pneumatic-key action, consisting, essentially, of follower  $Y$ , air-chamber  $a^2$ , and air-duct  $P$ , with sheet  $O$  or other cut-off, having an inlet to the air-chamber adapted to be closed, or a loose joint between the air-chamber and air-duct, adapted to be held closed by atmospheric pressure during the continuance of the exhaust, but which is thrown open by the momentary counteraction of such pressure by the recoil of the air in the partially-exhausted chamber  $a^2$  when the exhaust is suddenly cut off, substantially as and for the purpose specified.

6. The combination, with an air-passage of a musical instrument, of a perforated music-sheet, in which perforations for the passage of air through the sheet, arranged in a single group, represents a single continuous tone, substantially as specified.

7. In a musical instrument, the tremolo, consisting of a flexible wall of the air-duct to or from the reed or pipe of a wind musical instrument, and a vibrator for vibrating the flexible wall, substantially as specified.

8. The valve door or doors  $D E$ , operated directly or indirectly by the music-sheet, substantially as and for the purpose specified.

9. The valve-doors, (one or more,) in combination with the pneumatic key or keys  $Y$ , substantially as specified.

10. The tube  $D^4$ , attached to or formed of a portion of the music-sheet, substantially as and for the purpose specified.

11. The tube  $D^4$ , attached to or formed of a portion of the music-sheet, in combination with the recessed roller and stop  $N$ , substantially as specified.

MERRITT GALLY.

Witnesses:

C. G. HAYES,  
ROBERT A. GALLY.