(No Model.) 2 Sheets—Sheet 1.

P. EHRLICH.

MECHANICAL MUSICAL INSTRUMENT.

No. 566,150. Patented Aug. 18, 1896.

Fig. 1.

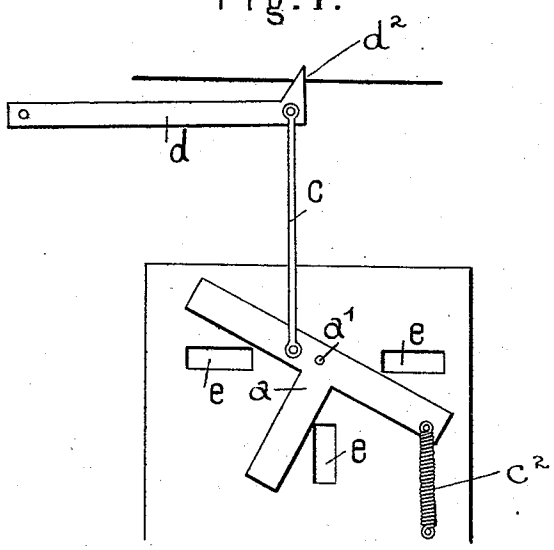


Fig. 2.

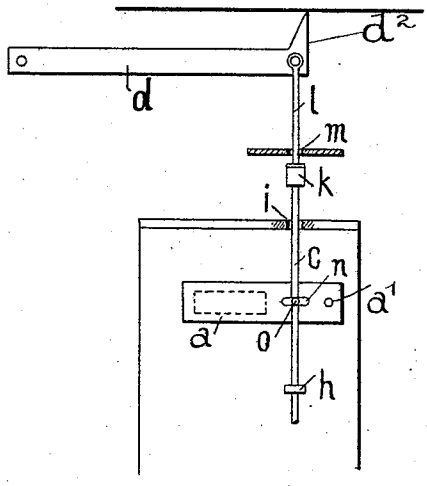


Fig. 3.

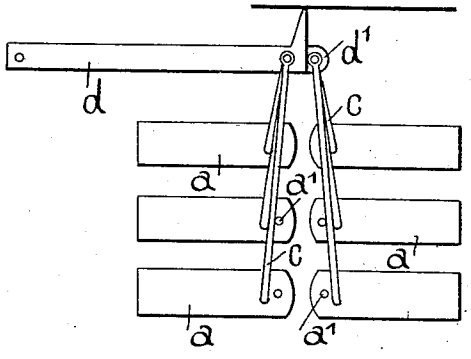
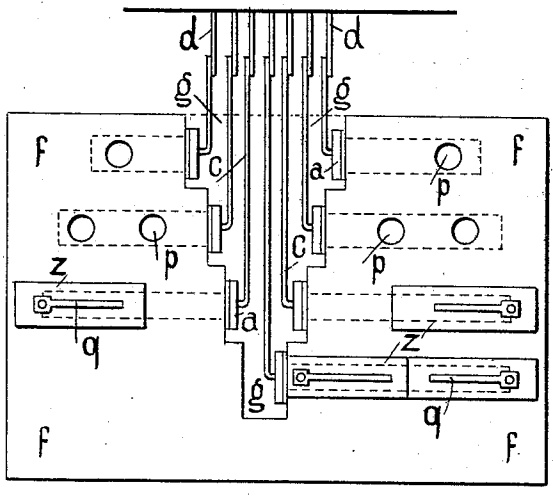


Fig. 4.



Witnesses

J. B. Keeler

E. W. Bond

Inventor

Paul Ehrlich

by Marcellus Bailey

his attorney

(No Model.) 2 Sheets—Sheet 2.

P. EHRLICH.

MECHANICAL MUSICAL INSTRUMENT.

No. 566,150. Patented Aug. 18, 1896.

Fig. 6.

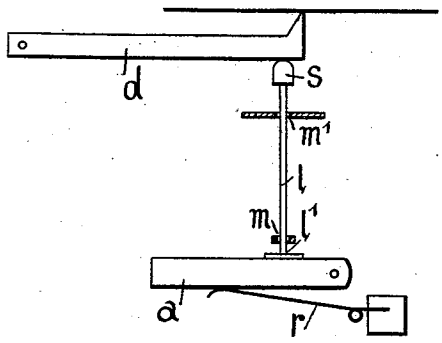


Fig. 9.

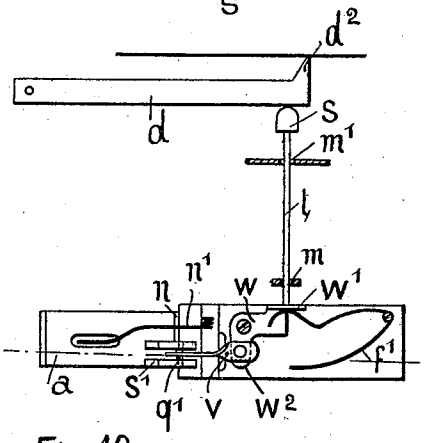


Fig. 10.

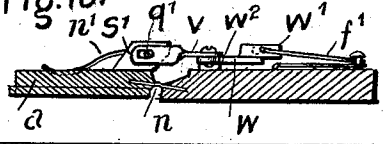


Fig. 7.

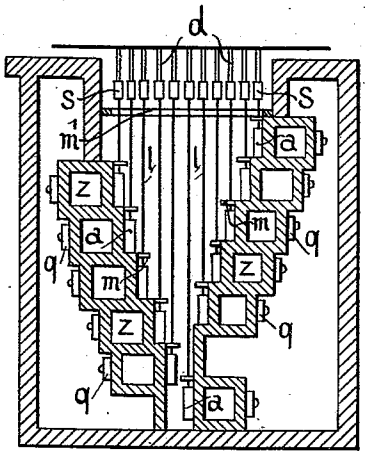
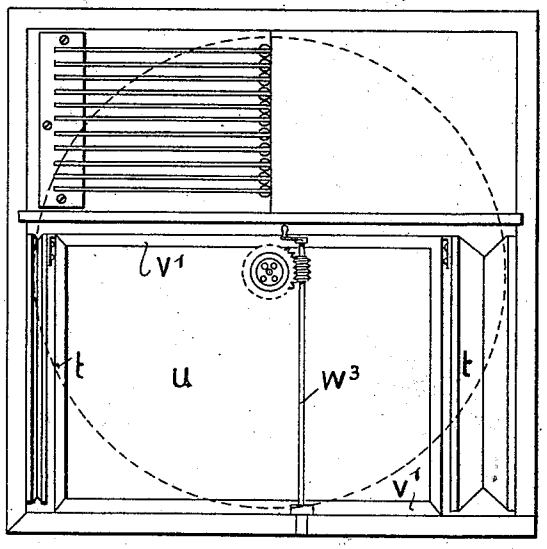


Fig. 8.



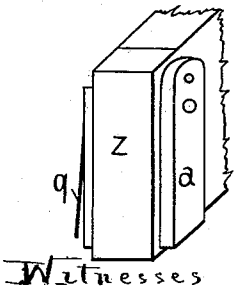


Fig. 5.

Witnesses

Inventor
Paul Ehrlich
by Marcellus Bailey
his attorney

UNITED STATES PATENT OFFICE.

PAUL EHRLICH, OF GOHLIS, GERMANY.

MECHANICAL MUSICAL INSTRUMENT.

SPECIFICATION forming part of Letters Patent No. 566,150, dated August 18, 1896.

Application filed September 18, 1895. Serial No. 562,844. (No model.) Patented in Germany June 21, 1893, No. 78,501; in England November 3, 1893, No. 20,889; in France March 1, 1894, No. 236,656; in Austria March 2, 1894, No. 58,758, and in Hungary March 2, 1894, No. 90,401.

To all whom it may concern:

Be it known that I, PAUL EHRLICH, a subject of the King of Saxony, residing at Gohlis, near Leipsic, in the Kingdom of Saxony, German Empire, have invented a new and useful Mechanical Musical Instrument, (for which I have obtained patents in Germany, No. 78,501, bearing date June 21, 1893; in Austria, No. 58,758, bearing date March 2, 1894; in Hungary, No. 90,401, bearing date March 2, 1894; in Great Britain, No. 20,889, bearing date November 3, 1893, and in France, No. 236,656, bearing date March 1, 1894,) of which the following is a specification.

This invention relates to that class of automatic musical instruments in which the sound is produced by the passage of a perforated music-sheet over levers which actuate valves controlling pipes or reeds; and it consists in a peculiar arrangement of the chambers and their valves and in the method of actuating the latter by means of the levers, as hereinafter described.

The object of the invention is to enable the holes or their equivalents in the music-sheet to be set closer together—that is to say, to effect a saving of space with regard to its width—and also to obtain a better utilization of its length—that is to say, to provide the greatest possible number of perforations or the like corresponding with the notes within a given area of surface.

The valves of a musical instrument of this description are preferably in the form of sliding pivoted valves, but hinged or flap valves may be employed, if preferred. The sliding valve is connected by a wire with the corresponding actuating-lever, or the latter may be arranged to act upon the valve by the aid of a disconnected wire or rod capable of transmitting to it the requisite movements. When the lever enters an opening or hole in the music-sheet, the valve is moved by the action of suitable intermediate parts or mechanism in such a manner as to open the passages through which the air from the bellows or other source has to pass in order to cause the instrument to produce the required sound.

The connecting-wire may act upon the valve at a point so near the center upon which it rotates or is hinged that a very small movement of the lever is sufficient to open the passage to produce the sound. Consequently the holes or the like in the interchangeable sheets are enabled to be correspondingly diminished in size, so that a larger number of them can be arranged within the limited length of the circular lines of a disk-shaped music-sheet, for example.

The chambers or tubes upon which the valves are placed or have their seats are arranged step-like, one above another, so as to enable the valves to be placed near together in a horizontal direction, whereby less space is required between the levers. A further saving of space is also obtained by arranging the chambers side by side in such a manner that levers of double or unequal length, for example, may be employed to work them, short levers being arranged to act upon the valves on one side and long levers to act upon the valves on the other side.

In order that my said invention may be fully understood, I shall now proceed more particularly to describe the same and for that purpose shall refer to the several figures on the annexed sheet of drawings, the same letters of reference indicating corresponding parts in all the figures.

Figure 1 shows in elevation an arrangement according to this invention for operating the sliding valves of automatic or mechanical musical instruments. Fig. 2 shows a modified arrangement of the valve-operating wires, and Fig. 3 shows a modification in the arrangement of the valve-operating levers and of the valves so as to economize space. Fig. 4 shows in elevation the step-like arrangement of the reed-boxes or tubes. Fig. 5 is a perspective view of one end of a reed-box. Figs. 6, 7, and 8 represent parts of a mechanical musical instrument constructed according to my invention to be operated by means of circular music or tune sheets, and Fig. 9 shows an arrangement for operating lifting-valves. Fig. 10 is a side elevation, with parts in section, of a part of the devices in Fig. 9, illustrative of the connection between the link *v* and valve *a*.

Referring to Fig. 1, *a* represents one of the

valves of a mechanical musical instrument, which valve in its normal position covers the three openings *e e e* in the wind-chamber of the instrument. This valve is pivoted at *a'*, and at as short distance as practicable from this pivot is connected by a rod *c* the valve-operating lever *d*, the point d^2 of which is shown as having entered a hole in the music-sheet *b*, and consequently under the action of a spring c^2 the valve *a* has been turned on its pivot *a'* so as to uncover the openings *e* and admit of air passing therethrough and so produce the required sound or note or notes governed by the said valve. By connecting the rod *c* with the valve close to the pivot *a'* the valve is fully opened by a very slight movement of the lever *d*, and consequently the fullest possible advantage is obtained from the rows of perforations in the music-sheet. The currents of air to produce the sounds on the reeds may be obtained either by pressure or suction by any known or convenient mechanism.

When the air-currents are obtained by suction, the connecting-wire *c* of each valve is preferably arranged, as shown in Fig. 2, to slide in guides *h* and *i*, the said rod or wire being connected by a knob or button *k* to a rod or wire *l*, sliding in a guide *m* and connected to the operating-lever *d*. On the wire *c* is a stud or projection *o*, which enters a slot *n* in the valve *a*, so that when the end d^2 of the lever *d* enters a hole in the music-sheet the wires or rods *c* and *l* will slide in their guides, and the stud *o*, by engaging with the slot *n* in the valve, will cause the said valve to turn on its pivot *a'*, so as to open the passage *e* for the air.

When the end d^2 of the lever is depressed by the unperforated portion of the music-sheet, the valve *a* will be moved in the reverse direction, so as to close the passage *e*. The wires *c* are connected to the valve *a* so close to the pivots *a'*, on which they turn, that the slightest movement of any one of the operating-levers *d* is sufficient to cause the corresponding valve to uncover its air-passage *e* to produce a sound. Consequently the perforations in the main sheet may be correspondingly reduced in size, whereby a greater number of notes than heretofore may be comprised in a sheet of a given size. A further reduction of space is obtained by arranging the reeds in juxtaposition, as indicated by the position of the valves *a* in Fig. 3. In this arrangement two sets of operating-levers of different length are employed, the set of short levers *d* being connected to the valves *a* on one side and the set of longer levers *d'* being connected to the valves on the other side. By thus employing levers of different length the said levers may be arranged closer together than is the case when the said levers are all the same length and the connecting-wires are situated between the levers.

As a further means of economizing space I arrange the reed-boxes *z*, one above another, or step-like, as shown in Figs. 4, 5, and 7, whereby the operating-levers *d* may be set very close together, the notes in the music-sheets being placed correspondingly close, and where pipes are employed for producing the notes or sounds they are placed over the apertures *p*, Fig. 4, the space *g* being tightly closed and receiving air under pressure, so that when the valves *a* are opened sounds are produced in the pipes.

Figs. 6, 7, and 8 represent a musical instrument constructed for use with circular music-sheets and in which the valves *a*, although operated by the levers *d*, are not connected thereto. The wires or rods *l*, interposed between the valve and the levers, are each provided with a head *s*, on which the levers *d* rest, (see Fig. 6,) while the valves are pressed against the opposite ends *l'* of the said rods or wires by springs *r*. These wires or rods *l* are guided in their movements in guides *m m'*.

Instead of employing sliding pivoted valves, as described, hinged or flap valves may be employed, as shown, for example, in Fig. 9, in which arrangement the rod or wire *l*, on which the lever *d* rests, acts at its opposite end on one arm, *w'*, of a bell-crank lever *w*, the other arm, w^2, of the said bell-crank being connected to a link or lever *v*, provided at its outer end with a pin or projection at *q'*, engaging in a slotted piece *s'* on the hinged flap-valve *a*. The valve *a*, which is hinged at *n*, is held in its closed position by a spring *n'*, but when the end d^2 of the lever *d* enters a perforation in the music-sheet a spring *f'*, acting on the arm *w'* of the bell-crank lever *w*, causes the said bell-crank to turn on its pivot and through the link *v* and pin-and-slot connection *q' s'* open the valve *a*.

By reason of the pin-and-slot connection of the link *v* with the valve *a* any inequality in the size of the note-perforations in the music-sheet cannot interfere with or injuriously affect the proper operation of the instrument.

As shown in Fig. 8, the bellows *t* for producing the necessary air-currents for playing and also a reservoir *u* for air are inclosed in the casing of the instrument, and motion is imparted to the mechanism from the main spindle w^3 by a crank and worm and worm-wheel in the usual manner.

By means of the improved arrangements hereinbefore described the divisions or lines in the music-sheet are enabled to be placed very near together and a much larger number of successive holes or the like are enabled to be placed within a given surface than has heretofore been possible. Consequently the instrument is enabled to continue playing for a longer time and to play a greater variety of airs. The advantages of this invention are especially conspicuous in the case of instruments with circular music-sheets.

What I claim, and desire to secure by Letters Patent of the United States, is—

1. In automatic or mechanical musical instruments in which sounds are produced by

the passage of a perforated music-sheet over levers which actuate valves governing the passage of air through pipes or reeds, the pipes or reed-boxes with the governing-valves arranged step-like one in advance of another so that the levers and rods or wires which operate the valves for controlling the passage of air to the pipes or reeds can be placed close together and permit of the perforations in the music-sheets being closer together than hitherto whereby a greater number of perforations or notes in a given area may be provided substantially as hereinbefore described.

2. In mechanical musical instruments of the kind hereinbefore referred to the combination with the operating-levers *d* and hinged valves *a* of rods or wires *l* operated by the said levers such rod or wire being caused to act on one arm of a bell-crank the other arm of which is connected to a valve *a* so as to open and close the valve substantially in the manner and for the purpose hereinbefore described.

In testimony whereof I have hereunto set my hand in the presence of two subscribing witnesses.

PAUL EHRLICH.

Witnesses:
RUDOLPH FRICKE,
OTTO DOEDERLEIN.