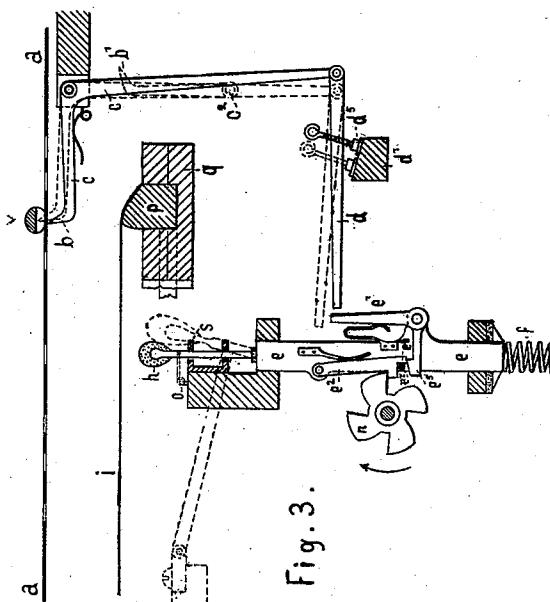
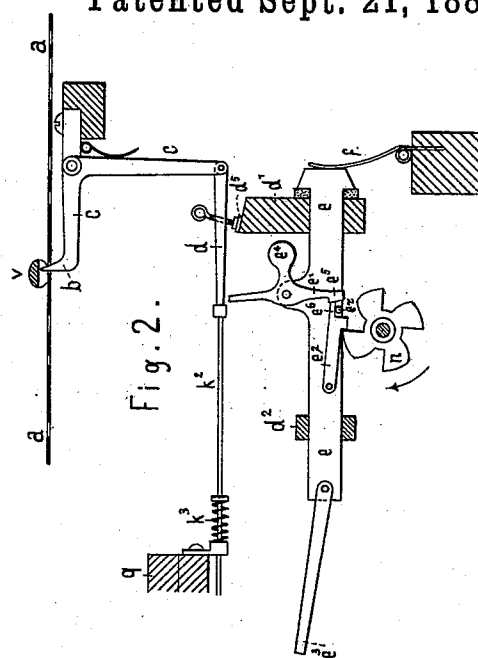
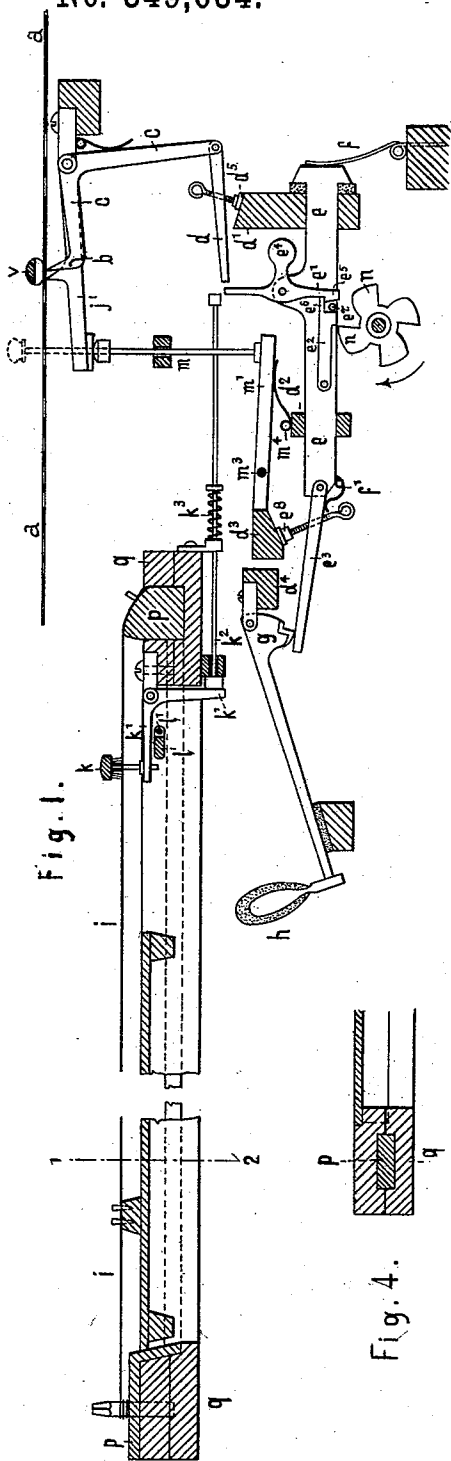


(No Model.)

F. E. P. EHRLICH.  
MECHANICAL MUSICAL INSTRUMENT.

No. 349,634.

Patented Sept. 21, 1886.



Witnesses:  
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# UNITED STATES PATENT OFFICE.

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## MECHANICAL MUSICAL INSTRUMENT.

SPECIFICATION forming part of Letters Patent No. 349,634, dated September 21, 1886.

Application filed June 2, 1886. Serial No. 203,949. (No model.)

*To all whom it may concern:*

Be it known that I, FRIEDRICH ERNST PAUL EHRLICH, a subject of the King of Saxony, and residing at Gohlis, near Leipsic, Kingdom of Saxony, German Empire, have invented new and useful Improvements in Mechanical Musical Instruments, of which the following is a specification.

My invention relates to mechanical musical instruments in which the notes are produced by the impact of hammers against tuned strings, the said hammers being actuated by mechanism the operation whereof is so controlled by a surface provided with perforations or depressions, in combination with movable pins or fingers and intermediate parts, that the hammers will produce a melody.

The improvements consist in the particular construction of the said mechanism and of the parts whereby the same is caused to actuate the required hammer or hammers; in the means for operating the dampers of the instrument and for varying the loudness of the notes, and in the construction of the frame to which the strings are attached.

In the accompanying sheet of drawings an instrument comprising my invention is shown in two different arrangements.

Figure 1 shows the first arrangement in a sectional side elevation, and Fig. 2 a portion thereof with several parts in different position. Fig. 3 represents the second arrangement in a like view with some of the parts in two different positions. Fig. 4 is a section on line 1 2 of Fig. 1.

On Fig. 1, *i* is the string for one of the notes; *h*, the hammer, designed to sound the same; *a*, a music-sheet, supposed to be provided with perforations, and constituting the aforesaid controlling-surface; *c*, a lever having the finger *b* adapted to engage with the said perforations, and which is pressed against the sheet by a spring. The said lever *c* has a vertical arm, to which is jointed the jack *d*, having an adjustable knob, *d'*, forming a shoulder that bears against the inclined upper surface of the bar *d''*. In suitable slits of this bar and of another bar, *d''*, is mounted a sliding bar, *e*, pressed toward the hammer *h* by a spring, *f*, and arranged to operate against the foot *g* of the hammer by means of a jack, *e'*, pressed up-

ward by the spring *f'*, and having the adjustable knob or shoulder *e''*, which bears against an inclined surface of the bar *d''*. To the bar *e* are pivoted a latch, *e''*, upon which an offset is formed adapted to be acted upon by rotating cams *n*, and a pawl, *e'*, having three arms, the lower one of these arms being provided with a hook arranged to engage with a projection, *e''*, of the latch *e''*, the middle or horizontal one with a weight, *e'*, pressing the lower arm against the said projection *e''*, and the upper one extending into the path of the jack *d*. Fig. 1 shows these parts in the position they occupy when the horizontal arm of the lever *c* is pressed down by an unperforated portion of the music-sheet acting against the finger *b*, and the latch *e''* raised and in engagement with the hook of the pawl *e'*. The cams *n*, though they be rotated, will, under these conditions, not operate upon the latch *e''*; but when a hole of the music-sheet has come opposite to the finger *b* the lever *c* is brought by its spring into the position of Fig. 2, and during the motion of the lever the jack *d* strikes against the upper arm of the pawl *e'* and causes the lower arm thereof to release the latch *e''*, which consequently drops with its offset into the path of the cams *n*. (The latch is, however, prevented from dropping beyond a certain limit by a pin, *e'*, inserted into the bar *e*.) One of the said cams then, in acting against the latch, pushes the sliding bar *e*, together with the jack *e'*, backward against the force of the spring *f*. The jack *e'*, sliding with its shoulder *e''* on the inclined surface of the bar *d''*, is at the same time pressed upward by the spring *f'*, so that at the end of the retrograde motion of the bar *e* it will have engaged with the foot *g* of the hammer. As soon as the cam *n* slips away under the offset of the latch *e''* and releases the latch, the spring *f* pushes the bar *e* forward and causes the jack to impel the hammer against the string, the jack immediately becoming free from the hammer-foot, as in ordinary piano-actions. During the forward motion of the bar *e* the latch *e''* slides with its downwardly-projecting portion on the outer convex surface of cam, made sufficiently long for the purpose, and is thereby raised and returned to the position of Fig. 1, in which it is caught and retained by the pawl *e'* up to a renewed action of the jack *d*. The

said jack  $d$  is also made use of for operating the damper  $k$ . For this purpose the damper is arranged to be lifted by an elbow-lever,  $k'$ , and a rod,  $k^2$ , placed in a line with the jack  $d$  when in raised position. When the jack  $d$ , operating against the pawl  $e'$ , as described, slips past the upper arm of  $e'$ , it strikes against a knob on the end of the rod  $k^2$ , pushes the rod forward, and thereby causes the lever  $k'$  to raise the damper and to keep it raised as long as the finger  $b$  is in the perforation of the sheet that had caused the parts to operate. Subsequently the rod  $k^2$  is returned to its normal position by the spring  $k^3$ . By means of a bar,  $l$ , fixed to an axle,  $l'$ , and arranged to be turned by hand, all the dampers may be raised simultaneously.

For varying the loudness of the notes produced, the bar  $d^3$ , on which slides the shoulder  $e^3$  of the jack  $e^3$ , is made movable in vertical direction by being fixed to two levers, such as  $m'$ , pivoted at  $m^1$  and operated by a rod,  $m$ , a lever,  $j$ , having a finger registering with holes in the music-sheet, and a spring,  $m^4$ . When one of these holes comes opposite to the said finger, the lever  $j$  and the tail ends of the levers  $m'$  are raised by the spring  $m^4$ , and the bar  $d^3$  is depressed. In consequence hereof the jack  $e^3$  will slip off sooner from the foot of the hammer and impart to the hammer a reduced impulse, so as to cause the same to strike the string more gently. If preferred, the lever  $j$  may be omitted and the rod lengthened, as shown by dotted lines, and arranged to pass by the side of the music-sheet and to be operated by hand. The spring  $m^4$  will then keep the bar  $d^3$  in the position required for producing soft notes, while a pressure exercised by hand on the rod  $m$  causes the bar to be raised and the hammer to strike more forcibly.

The frame of the instrument to which the strings are attached is made of a metal part,  $p$ , and a wooden part,  $q$ , the latter inclosing the former, except upon the portions to which the strings are fixed. With this construction of frame the sound of the instrument is more sonorous than with frames made of metal only.

In the modified arrangement of the instrument shown by Fig. 3 the sliding bar  $e$  is placed in vertical position relatively to the strings, and it acts without any intermediate part on a hammer,  $h$ , moving in a straight line in guides  $s$ . The same arrangement may, however, also be applied to an oscillating hammer, such as shown by dotted lines. For insuring proper action of the latch  $e^2$ , the same is pressed toward the cams  $n$  by a spring. Moreover, the weight  $e^4$  of Figs. 1 and 2 is replaced by a spring. If this arrangement is to be used in

an instrument having vertical strings, the hammer has to be provided with a spring,  $o$ , for returning it to its position of rest, and if in such case it is, moreover, desired that the music-sheet be placed horizontally, the lever  $e$  is centered at  $e^2$  and formed with a finger,  $b'$ .

I claim as my invention—

1. The combination, with the hammer  $h$ , controlling surface  $a$ , provided with perforations or their equivalents, and lever  $e$ , having the finger  $b$ , of the sliding bar  $e$ , spring  $f$ , moving cams  $n$ , latch  $e^2$ , and pawl  $e'$ , both pivoted to the bar  $e$ , jack  $d$ , pivoted to lever  $e$  and having the shoulder  $d^3$ , and bar  $d'$ , having an inclined surface for the said shoulder to slide on, substantially as and for the purpose specified.

2. The combination, with the hammer  $h$ , controlling-surface  $a$ , lever  $e$ , having the finger  $b$ , sliding bar  $e$ , spring  $f$ , cams  $n$ , latch  $e^2$ , pawl  $e'$ , jack  $d$ , with shoulder  $d^3$ , and bar  $d'$ , of the jack  $e^3$ , pivoted to the bar  $e$  and having the shoulder  $e^3$ , and bar  $d^3$ , having an inclined surface, against which the shoulder  $e^3$  bears, substantially as and for the purpose described.

3. The combination, with the hammer  $h$ , controlling-surface  $a$ , lever  $e$ , having the finger  $b$ , sliding bar  $e$ , spring  $f$ , cams  $n$ , latch  $e^2$ , pawl  $e'$ , jack  $d$ , with shoulder  $d^3$ , and bar  $d'$ , of the damper  $k$ , lever  $k'$ , and rod  $k^2$ , substantially as hereinbefore set forth.

4. The combination, with the hammer  $h$ , sliding bar  $e$ , spring  $f$ , and jack  $e^3$ , having the shoulder  $e^3$ , of the bar  $d^3$  and means for raising and lowering the said bar  $d^3$ , as and for the purpose set forth.

5. The combination, with the hammer  $h$ , controlling-surface  $a$ , sliding bar  $e$ , spring  $f$ , and jack  $e^3$ , having the shoulder  $e^3$ , of the bar  $d^3$ , having arms  $m'$ , pivoted at  $m^1$ , lever  $j$ , having a beak adapted to engage with the controlling-surface, and means for transmitting motion from the lever  $j$  to an arm,  $m'$ , substantially as and for the purpose described.

6. In a mechanical musical instrument in which the notes are produced by the impact of hammers against tuned strings, the frame to which the strings are attached, consisting of an inner part,  $p$ , made of metal, and an outer part,  $q$ , consisting of wood, the latter inclosing the former, except upon the portions to which the strings are fixed, as and for the purpose specified.

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

FRIEDRICH ERNST PAUL EHRLICH.

Witnesses:

JOHANN HEINR. BECK,  
C. BORNGRAEBER.