M. DELANEY.

Electro Magnetic Piano Action.

No. 202,096. Patented April 9, 1878.

Figure 1.

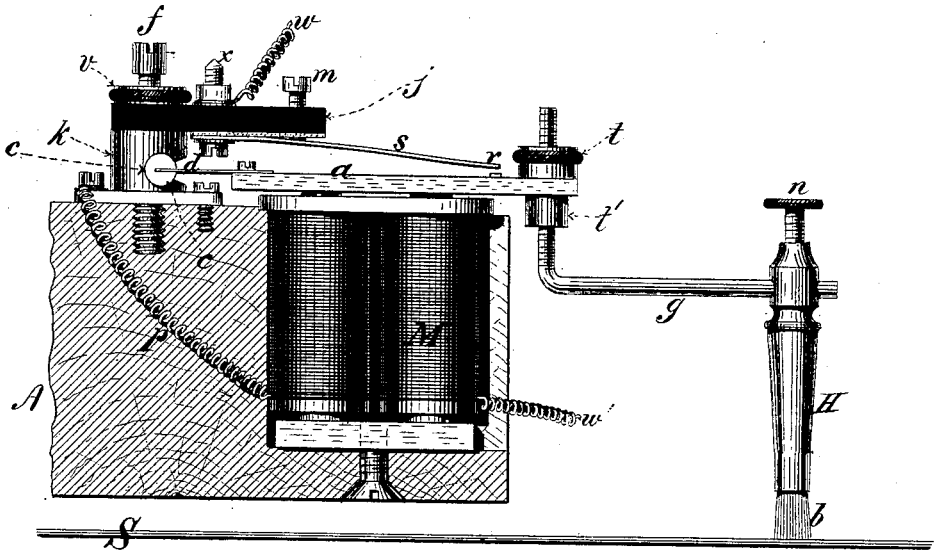
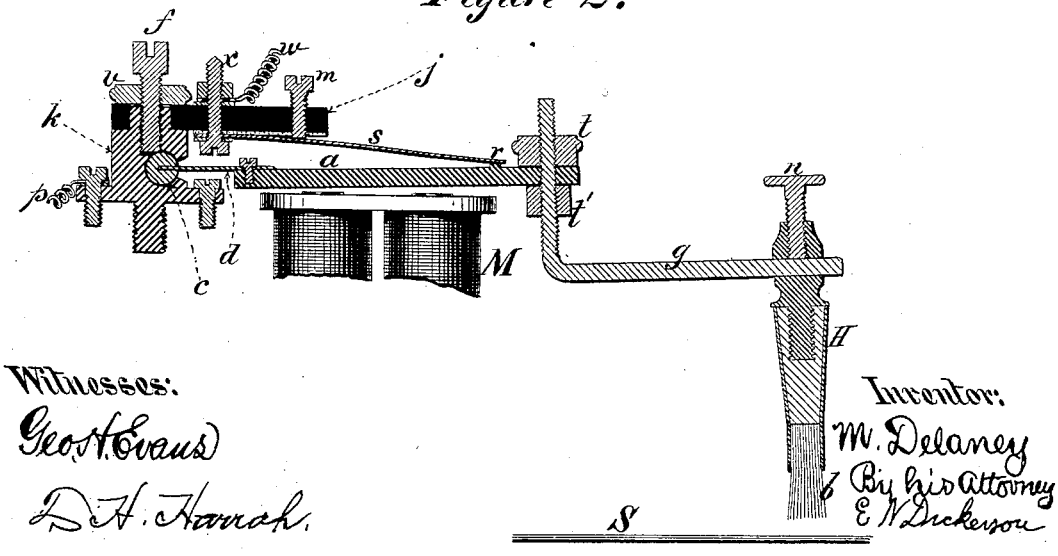


Figure 2.



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IMPROVEMENT IN ELECTRO-MAGNETIC PIANO-ACTIONS.

Specification forming part of Letters Patent No. **202,096,** dated April 9, 1878; application filed August 15, 1877.

To all whom it may concern:

Be it known that I, MATTHEW DELANEY, of New York city, New York, have invented a new and useful Improvement in Pianos, of which the following is a full, true, and exact description, reference being had to the accompanying drawings.

In the piano in ordinary use at the present time the duration of the note which can be produced by a single pressure of the key is determined by the length of time which the string forming such note will continue to vibrate after the impact. It is therefore impossible to obtain notes of long duration from a piano as at present constructed, and the only way in which a note can be continued is by rapid repeated blows upon the key.

My invention has in view two results—the first a note continuing as long as the key be depressed, the other an intermittent note, commonly known as a "tremolo note;" and my apparatus can be used for either purpose, depending only upon its adjustment. Another result which I obtain by my apparatus is the lessening of the force required to produce a note, while at the same time a note of any required degree of volume may be produced; also, by the employment of my apparatus, strings of greater length than formerly can be used, for the reason that the force necessary to put such strings in vibration is entirely under the control of the operator. By my apparatus, likewise, a number of notes may be produced by striking one key. The number of such notes is regulated at the pleasure of the operator by means of stops.

My invention consists in the use of electricity to put in vibration the strings of a piano or other similar instrument. This I do by the employment of the ordinary electro-magnet, having in front a vibrating armature, to which is attached the hammer producing the sound. This hammer is preferably of a peculiar construction, as I shall hereinafter describe. A current of electricity from any of the well-known forms of battery is used to actuate the magnet. The closing of a key closes a circuit through such magnet, and thereby attracts the armature with its attached hammer, which hammer, coming in contact with the string of the piano, produces the note.

My apparatus may be so arranged as to strike the string but once, or to continue to strike it so long as the note is depressed, and the rapidity of the strokes of the hammer will determine whether the note be a tremolo note or a continuous note, as I shall hereinafter describe.

By means of this contrivance an instrument may be played at any distance from the key-board, or several instruments may be played by means of the same key-board, which is sometimes desirable.

I will now describe my drawings.

Figure 1 represents a perspective view of one of my strikers arranged in part of the frame of the piano. Fig. 2 represents a cross-section of part of the same.

The same letters of reference indicate the same parts in both the drawings.

M represents an electro-magnet, through which a current of electricity may be passing by means of wires *w'* and *p*. Above this magnet is hung the armature *a* upon the spring *d*, and attached to the free end of this armature is the adjustable rod *g*, supporting the hammer H, held by means of the set-screw *n*. This hammer H strikes the string S, as is clearly shown in Fig. 1, while Fig. 2 represents the apparatus in its raised position. The distance between the hammer H and the string S may be regulated by means of the two opposing set-screws *t* and *t'*, while the hammer H can be slid on the rod *g* and set in any position by means of the screw *n*. The striking portion of the hammer H consists of a brush, *b*, which brush is made of any fibrous material, preferably of camels' hair or bristles. I find that the softer brush should be used for the bass notes, while the harder brush should be used for the treble notes; and I have experimented in vain upon many other materials before I succeeded in obtaining one which would give the desired tone. The tone produced by this kind of striker is a very peculiar one, differing from any which has ordinarily, so far as I know, been produced by a piano. The armature *a* is supported upon the

spring *d*, which spring is fast in the cylinder *c*, which is set in the supporting-post *k* by means of the screw *f*. This cylinder can be rotated in its socket in the supporting-post *k*, and thereby the upward tension of the spring *d* can be varied, which is a very important adjustment in all vibrating strikers of this description, and I consider this an important feature of my invention.

The upper end of the post *k* supports the insulator *j*, which insulator is held against the post by means of the set-screw *v*, turning on the thread cut on the set-screw *f*. The insulator *j* has attached to it a spring, *s*, by means of the screw *x*. This spring *s* comes in contact with the armature *a* by means of a platinum point when the said armature is in its upward position, as is represented in Fig. 2, but is separated from it when the armature is depressed, as is shown in Fig. 1. The position and tension of this spring *s* can be regulated by means of the adjusting-screw *m*, bearing against the upper portion of it. The course of the electricity may now be seen. Coming from the key and battery, it passes through the wire *w'*, through the magnet M; thence, by means of the wire *p*, to the post *k;* thence to the armature *a;* thence, when the armature is raised, to the spring *s;* thence to its supporting-screw; and then, by means of the wire *w*, it returns to the battery.

It is now evident that, if a connection be made by the piano-key through the battery and wires *w* and *w'*, the armature *a* will be attracted, and thereby the hammer H will impinge against the string S and produce a note. The downward movement of the armature *a* has broken the contact of the spring *s* at the point *r*, and therefore the adjustable spring *d* will raise the armature *a* until it again comes in contact with the spring *s*, when the operation will be repeated, and the rapidity of the blows of the hammer at H will depend upon the distance which it is situated from the supporting-pivot *c*, or, in other words, upon the length of the pendulum, so that as rapid vibration as may be desired can be obtained, and this vibration will continue as long as the connecting-key be depressed.

By altering the point of impact between the hammer and the string the effect of this vibration on the note can also be altered. If it be struck near the bridge, the rapid vibration of the hammer will produce a continuous note. If, on the contrary, it be struck at one-eighth the distance between the supports—which is the usual place for striking a note—the note will be more of the tremolo character.

By means of the adjustment of the distance of the hammer from the string, which is accomplished by means of the set-screws *t* and *t'*, and by varying the strength of the current and the position of the connecting-spring *s*, which is done by means of the set-screw *m*, and by the adjustment of the retractile force of the spring *d*, the rapidity of the strokes or vibrations of the hammer can be readily varied to meet the requirements of the tone.

I find it advantageous to arrange my strikers alternately with reference to the string—that is, I put each striker on the opposite side of the string from the preceding one, whereby I obtain more room, and am enabled to employ larger magnets.

By means of suitable stops I increase or decrease the strength of the battery, and thereby the force of the impact; and by means of other stops I can connect together as many of the notes as I desire, so that the pressure of one key of the key-board will affect all the strikers in unison with it, or so many as may be desired.

I sometimes use batteries of different strengths for different notes, but find that a single battery is sufficient to operate all the notes which are usually struck at once on the piano.

When it is desired to strike but a single blow from one closure of the key, the spring *s* is maintained in contact with the armature when the armature is depressed, so that the attraction of the armature to the magnet does not break the electric circuit, nor allow the armature to fall back until the key is raised.

I claim—

1. The combination, with a vibrating string, of an electrical striker, which automatically strikes repeated blows during the passage of the current, substantially as described.

2. The combination of the armature *a* with the adjustable supporting retractile spring *d*, substantially as described.

3. The combination of the armature *a*, supporting retractile spring *d*, and adjustable cylinder *c*, substantially as described.

4. A piano-striker, which consists of a hammer formed of a bundle of fibers laid longitudinally, when the blow between the string and the striker is struck by the ends of said fibers, substantially as described.

5. The combination of an electric hammer and a piano-striker, which consists of a hammer formed of a bundle of fibers laid longitudinally, when the blow between the string and the striker is struck by the ends of said fibers, substantially as described.

6. The combination of a piano-string, struck by an electric hammer, with the magnet which actuates it, and with apparatus, substantially as described, whereby the length of the stroke of the hammer may be varied.

7. The combination of the electric striker, the magnet which operates it, and apparatus, substantially as described, whereby the distance between the hammer and its support may be varied.

8. The combination of an electric striker with the magnet which operates it and apparatus, substantially as described, whereby the length of stroke and the distance between the hammer and its support may be varied.

9. An electric striker, combined with an adjustable retractile supporting-spring and an adjustable contact-spring, substantially as described.

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