

(No Model.)

2 Sheets—Sheet 1.

R. EISENMANN.
MUSICAL INSTRUMENT.

No. 496,402.

Patented May 2, 1893.

Fig:1.

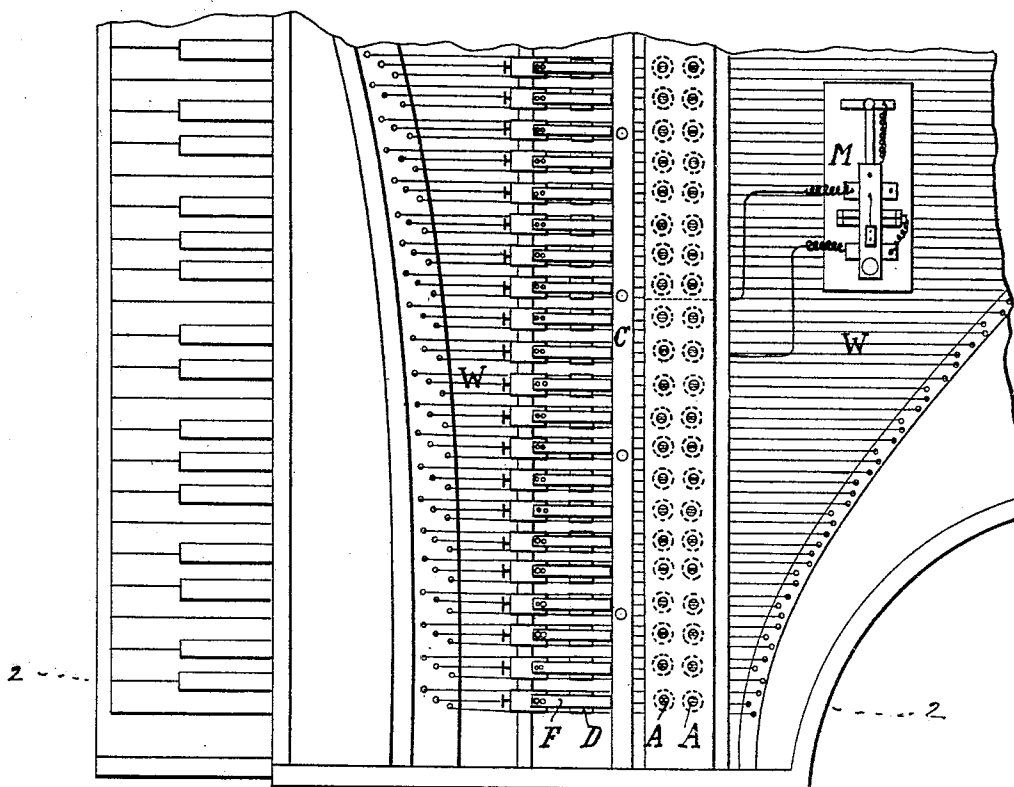
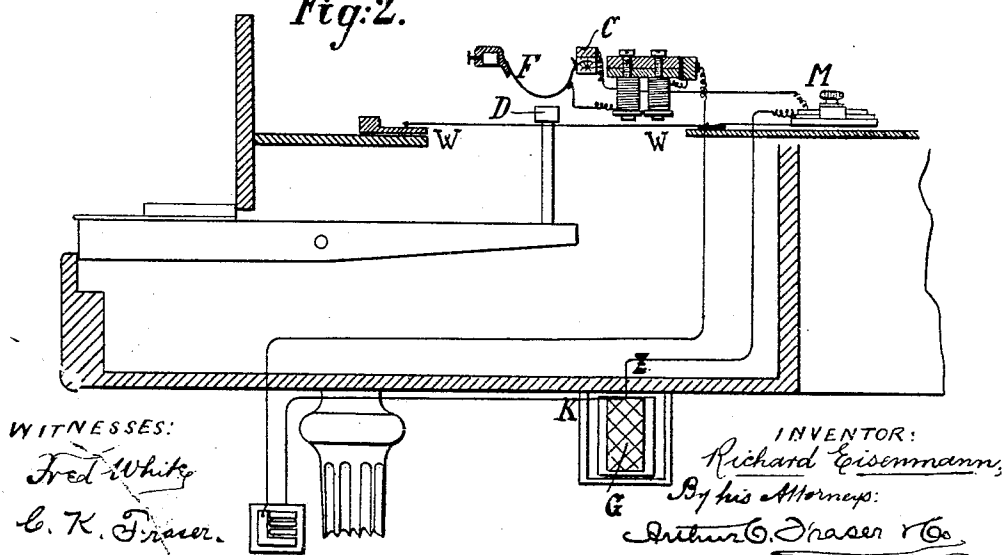


Fig:2.



(No Model.)

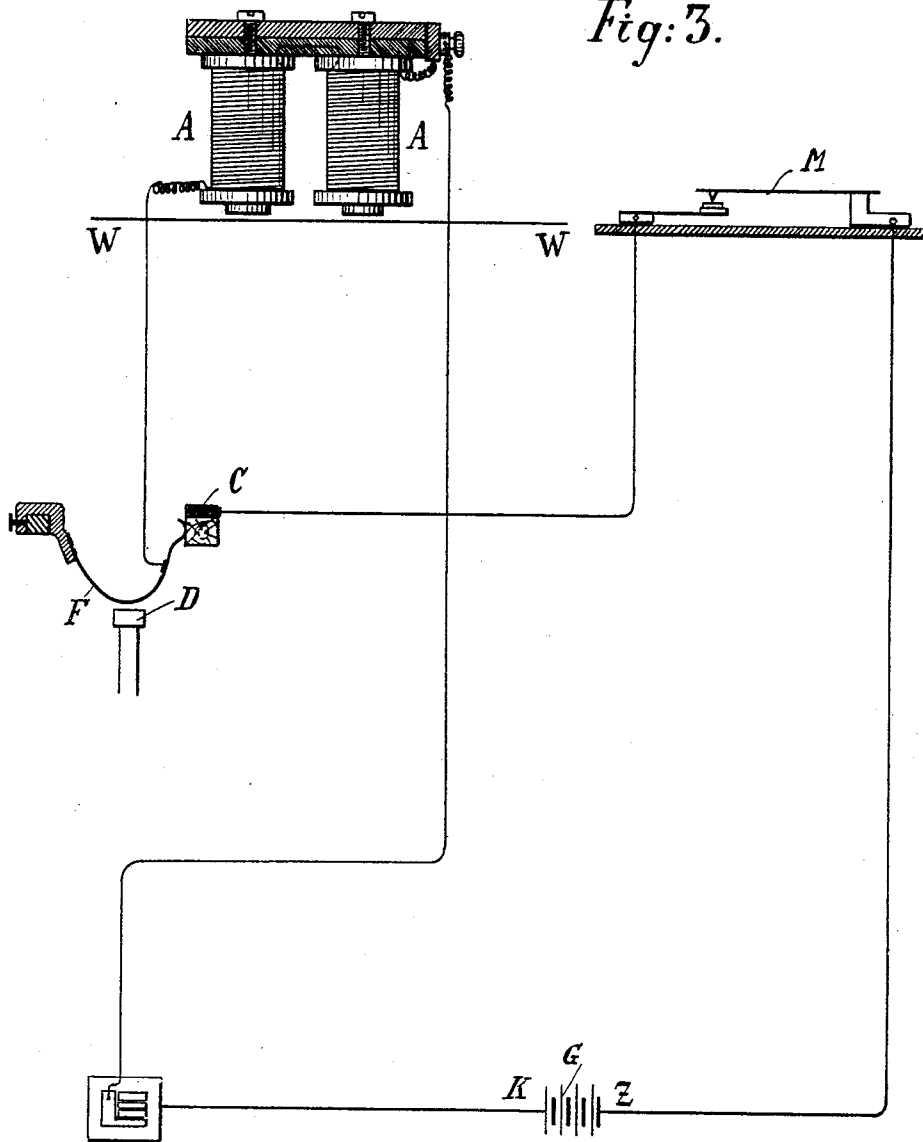
2 Sheets—Sheet 2.

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Fig: 3.



WITNESSES:

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UNITED STATES PATENT OFFICE.

RICHARD EISENMANN, OF BERLIN, GERMANY.

MUSICAL INSTRUMENT.

SPECIFICATION forming part of Letters Patent No. 496,402, dated May 2, 1893.

Application filed January 21, 1893. Serial No. 459,065. (No model.) Patented in Germany August 17, 1889, No. 51,668.

To all whom it may concern:

Be it known that I, RICHARD EISENMANN, a subject of the King of Prussia and the Emperor of Germany, and a resident of the city of Berlin, Germany, have invented certain new and useful Improvements in Musical Instruments, (which invention has been patented in Germany by Patent No. 51,668, dated August 17, 1889,) of which the following is a specification.

This invention relates to musical instruments, and particularly to pianos.

The object of the invention is to set the wires of a musical instrument in vibration, and to sustain these vibrations, by electro magnets which are actuated by means of intermittent currents passed through them and controlled by means of a microphone.

In the accompanying drawings, which illustrate one adaptation of my invention, Figure 1 represents a fragmentary plan view of a piano to which one execution of the invention is applied. Fig. 2 is a vertical fragmentary elevation thereof, partly in vertical section cut on the line 2—2 in Fig. 1, and Fig. 3 is a diagrammatic view representing the arrangement on a larger scale.

It is well known that steel or iron wires or plates may be brought into sound producing vibrations by the attraction of electro magnets actuated by intermittent currents. A Mr. Helmholtz at first put tuning forks into vibration by the attraction of an electro-magnet, the actuating current of which was interrupted by another tuning fork or a string. To move this latter tuning fork or string a separate electro-magnet was required. In this manner we have one electro-magnet which puts the wire or plate into vibration, and another electro-magnet which, by reason of the interrupted current actuating it, attracts the tuning fork or the wire to be vibrated and the sound of which we wish to hear. There is a second condition to fulfill if the wires or tuning forks or plates are to be put into regular and musical vibration. It is not sufficient that the wires or equivalent devices be intermittently attracted by their electro-magnets, but the attractions must in addition be exactly synchronic with the vibrations of the wires against which they act. We know for

instance that to get the note "a" the wire must vibrate four hundred and forty times back and forth in a second, and we know that a wire which, when struck by a hammer, gives the note "a" vibrates four hundred and forty times in a second. Now, if this wire is put into vibration by the intermittent attraction of an electro-magnet, it is apparent that this attraction must be synchronic with the vibration of the wire, that is to say: if the wire vibrates upward it must be then attracted by the electro-magnet, and when it vibrates downward it must not be attracted. If the attraction is not synchronic with the vibrations of the wire attracted then it must result that the electro-magnet would attract the wire upward just at the moment in which the wire should go downward by its own elasticity. Then we would have two opposed forces, each of which would destroy the effect of the other, and the wire would immediately come to rest. Thus we see that we are compelled to take, if we use rheotomes, as many rheotomes as we have different pitches, on a piano for instance at least twelve, and we see that the rheotomes must be moved by separate electro-magnets, and that, notwithstanding this, since the wires change their pitch while the tuning forks do not—there is still danger that the attraction will not be synchronic. If we use the wires themselves as rheotomes we have in the first place as many rheotomes as we have wires, and secondly it is impossible to make any musical use of the wires themselves because they must be touched as often as they have to break the current, and if a wire is touched at all it gives no true musical sound, but instead it gives an impaired sound. In this manner I proceeded in my prior invention as covered in my German Patent No. 38,814, and in the same manner Mr. Dickman proceeded. Subsequently I discovered several different difficulties. To avoid these, and to get all notes, single or combined, into accord, a synchronic interruption by one single rheotome, which is independent of its own vibrations but dependent only from the sound of the wires, I now employ instead of a rheotome a microphone.

It is known that a microphone reproduces exactly all sounds which are produced in its neighborhood. It reproduces a whole opera,

the voices of the singers and the sounds of each instrument. All this a rheotome, which is a circuit breaker, cannot do. A rheotome cannot bring an electric current into undulations, but a microphone does this. That which the microphone does in a telephone, *i. e.*, to put the plate into sound producing vibrations, it effects in my apparatus.

Referring to the drawings I will now describe the particular adaptation of my invention therein illustrated. In Fig. 3, which shows the essential features diagrammatically, W W are the wires or plates of a musical instrument, A A are the electro-magnets which act to set these wires or plates in vibration, and G is a battery, or other source of electricity, in the circuit leading from which the magnets are installed. One end of the wire of each of the electro-magnets is connected to the pole K of the battery G. The other wire of each of the magnets is connected to a circuit closer C of any suitable form. From this circuit closer a connection extends to a microphone M, and from there to the other pole Z of the battery G. Thus when the circuit-closer C is closed there is a complete electric circuit through the wires, magnets, circuit-closer and microphone, which circuit is dependent upon the vibrations of the microphone, and when the circuit-closer C is open this circuit is broken.

In Figs. 1 and 2 a piano is shown to which the invention is applied. In this the damper D of each key of the piano rises when its key is struck and closes the circuit at C, shifting the spring F to which one of the wires from the electro-magnet A is connected upward into contact with the circuit closer C. As soon as this is done the electro-magnet A attracts the wire W, and the microphone M begins to work, being put in vibration by the vibration of the wire and vice versa, without touching the wire and without being moved by a separate electro-magnet. In this way the wire is sounded, and the sound sustained as long as the circuit is closed.

One microphone is sufficient for all the elec-

tro-magnets and for one key or all the keys at the time touched. Notwithstanding this, it is preferable to take more than one microphone and to connect them in derivation, since in this manner the resistance is less and the current proportionately stronger.

I am aware that rheotomes are used with electrically sounded musical instruments, but that is not the object of my present invention, and is not herein claimed.

What I claim is, in musical instruments, the following-defined novel features and combinations, substantially as hereinbefore set forth, namely:

1. In a musical instrument having vibrating wires or plates, an electro-magnetic sound generating and sustaining device comprising an electro-magnet acting to vibrate said wires, an electric circuit for supplying an electric current to said magnet, and a microphone installed in said circuit for controlling the current traversing said magnet, whereby the vibrations of said microphone cause undulations in the current actuating said magnet and thereby the action of the latter is controlled, substantially as shown and described and in the manner set forth.

2. In a musical instrument, the wires W, in combination with electro-magnets A for vibrating said wires, an electric circuit in which said magnets are connected, a circuit breaker C in said circuit, and a microphone M installed in said circuit and making or breaking the latter during its vibration, whereby the action of the magnets will be controlled by the microphone, the vibrations of which correspond with those of the wires, and thereby a synchronic attraction of the wires by the magnet is obtained.

In witness whereof I have hereunto signed my name in the presence of two subscribing witnesses.

RICHARD EISENMANN.

Witnesses:

CHAPMAN COLEMAN,
EARL T. BIERCHARD.