

July 5, 1932.

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1,865,428

ELECTRIC PIANO HARP

Filed April 29, 1929

Fig. 1

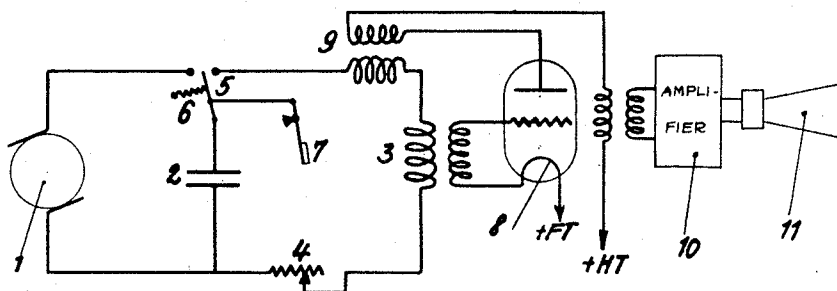


Fig. 2

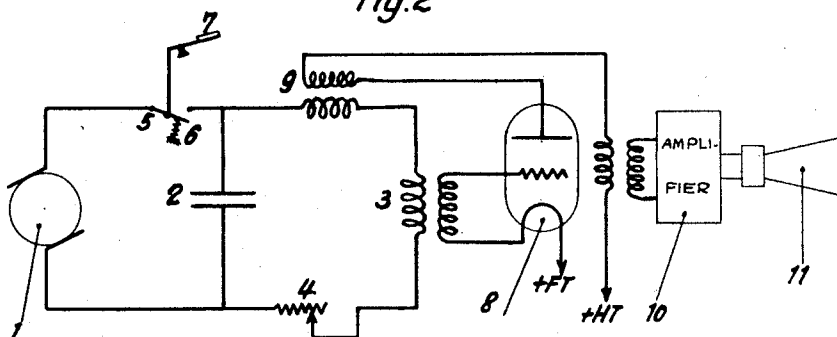
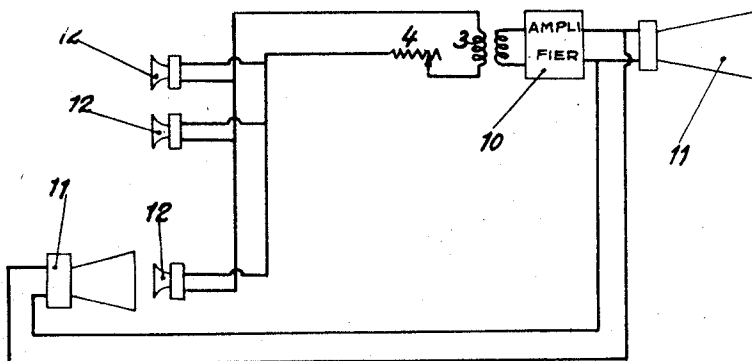


Fig. 3



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ELECTRIC PIANO HARP

Application filed April 29, 1929, Serial No. 359,137, and in France May 5, 1928.

My invention has for its object to provide an electric piano harp or analogous instrument and consists essentially in associating with one or a number of loud speaker telephonic receivers, oscillating circuits subjected to periodic charges or discharges of musical frequency by the intermediary of thermoelectronic amplifiers of suitable type. It is evident that my invention may have numerous modifications.

In this particular respect a condenser charged by a suitable local source may be discharged through a self-inductance coil, the discharge being obtained for example, by the pressure of the finger upon a simple switch maintained in charge position by means of a return spring. Use may be also made of the oscillations which are produced upon charging the condenser of an oscillating circuit. A self-inductance coil may be charged by a source of continuous current and use made of the damped oscillations produced on breaking the charging circuit of a condenser connected permanently across the terminals of the inductance coil. A rheostat, or equivalent device, enables the damping of the charge or the discharge to be controlled at will. Moreover the circuits may be combined with a negative resistance of known type, in such a manner as to reduce the damping within selected limits. Back couplings, that is electrical reaction, may produce an analogous effect. With respect to the oscillating circuits themselves, they may be of a complex nature and arranged in such manner as to obtain the desired tone, as a consequence of the simultaneous production of oscillations of various frequencies chosen in advance or regulated during actual working. By modifying, for example, the charging voltage the strength of the notes emitted may be selectively changed at will. Damping in the electrical system may be controlled by means of a "negative resistance" or a reaction effect, for the reproduction by a loud speaker fed through an amplifier, of musical sounds emitted very feebly before a microphone of any suitable type controlling the loud speaker or loud speakers. The diaphragm of the microphone may in itself form the resonant

organ subjected to impinging waves having a musical character. The well known Larsen effect may be utilized for prolonging at will the sound corresponding to the impinging waves, that is by acoustic feed back coupling between a loud speaker and a microphone whose vibrations are delivered to the same loud speaker. As many microphones are employed as there are notes to be produced. As regards initial musical sounds, they may be produced by any method such as a blow against an elastic body or vibration against a cord. The reproduction of the sounds may be systematically distorted for example by acting upon the amplifier circuits or upon the resonance frequency of the loud speakers.

My invention will be more fully understood by reference to the following specification by reference to the accompanying drawing, in which:

Figure 1 represents a diagrammatic circuit arrangement embodying a preferred form of my invention; Fig. 2 represents a modification of the circuit of my invention; and Fig. 3 illustrates diagrammatically a further modified circuit embodying my invention wherein the source of vibrations is furnished by a microphone in front of which very weak sounds are produced.

The same reference characters designate the same elements in the drawing.

Referring to Fig. 1 in more detail, the numeral 1 designates a source of continuous current charging the condenser 2 when the switch 5 closes the charge circuit under the action of key 7. Upon completing the discharge circuit by throwing switch 5 to the right the condenser 2 discharges across the coil 3 at musical frequency. The damping of the oscillating circuit is controlled by means of the rheostat 4. The oscillations of this circuit are amplified by tube system 8. An amplifying tube system 8 is provided having a feed back coupling 9 with the oscillating circuit, which may be considered the equivalent of introducing a "negative resistance" in this circuit, to use an expression familiar in the art. The amplification continues in the successive stages of the amplifier 10, and the os-

cillations are transformed into sound in the loud speaker 11.

In the modification of the circuit arrangement illustrated in Fig. 2, the condenser 2 is mounted permanently at the terminals of the coil 3, and the oscillations are initiated by the charging of the condenser 2 when the switch 5 is closed by means of the key 7.

In Fig. 3 the microphones 12, in front of which very weak sounds are produced, serve as a source of damped oscillations delivered through the coil 3, the damping of the circuit being controlled as before by the rheostat 4. The oscillations as in the other diagrams are amplified and reproduced by the loud speakers 11. One of these loud speakers is placed in the proximity of a microphone, creating an acoustic coupling or feed back (Larsen effect) which sustains the vibrations of the diaphragm of the microphone or the object reproducing the sounds. This feed back action may be considered equivalent to the introduction of a "negative resistance" in the oscillating circuit.

In lieu of the set of microphones 12 I may employ a set of resonant diaphragms each corresponding to a definite note and vibratable within the field of electromagnetic windings connected in the input circuit to coil 3. The energy generated in a selected winding is thus rendered effective upon the input system of coil 3.

What I claim as new and desire to secure by Letters Patent of the United States is as follows:

1. In an electric system for producing damped acoustic vibrations, a source of direct current potential, an oscillating circuit comprising a condenser, inductance, a variable resistance, and a switch, said switch being connected to open said oscillating circuit and connect said condenser to said source of potential when in one position and to close said oscillating circuit and open the circuit connecting said condenser to said source of direct current potential when in another position, a thermionic tube, input and output circuits therefor, said input circuit and said output circuit each being coupled to said oscillating circuit, and an electric sound reproducer in electrical relation with said output circuit.

2. In an electrical system for producing damped acoustic vibrations, a thermionic tube, input and output circuits therefor, said input circuit being coupled to said output circuit in feed back relation, an oscillating circuit comprising inductance, a variable resistance, a condenser and a switch, said oscillating circuit being coupled to said input circuit, a source of direct current, said switch being connected to open said oscillating circuit and connect said condenser to said source of potential when in one position and to close said oscillating circuit and open the circuit

connecting said condenser to said source of direct current potential when in another position, an electric reproducer in electrical relation with said output circuit, whereby sustained notes of varying damping characteristics may be produced by adjusting said variable resistor.

3. In an electrical system for producing damped acoustic vibrations, a thermionic tube, input and output circuits therefor, an electrical sound reproducer in electrical relation with said output circuit, an oscillating circuit adapted to pass free damped oscillations of musical frequency, said oscillating circuit being coupled to said input and output circuits, means for initiating a train of oscillations in said oscillating circuit, and means in said oscillating circuit for variably damping said oscillations.

4. In an electrical system for producing damped acoustic vibrations, a thermionic tube, input and output circuits therefor, an electrical sound reproducer in electrical relation with said output circuit, said input and output circuits being coupled together in feed back relation, a closed oscillating circuit coupled to said input circuit and comprising reactance elements and a variable resistance, and means for intermittently as desired applying potential to certain of said reactance elements, said oscillating circuit being adapted to generate a train of free damped oscillations of musical frequency under the intermittent application of potential by said means.

5. Apparatus for producing musical sounds resembling those of a piano, comprising an oscillating circuit of audible natural frequency, means for generating in said oscillating circuit trains of free damped oscillations, means for controlling the damping of said oscillating circuit, and means for transforming the electric oscillations in said oscillating circuit into sound.

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