June 9, 1936. E. E. COUPLEUX 2,043,828

ELECTRIC ORGAN

Filed Oct. 26, 1935 2 Sheets-Sheet 1

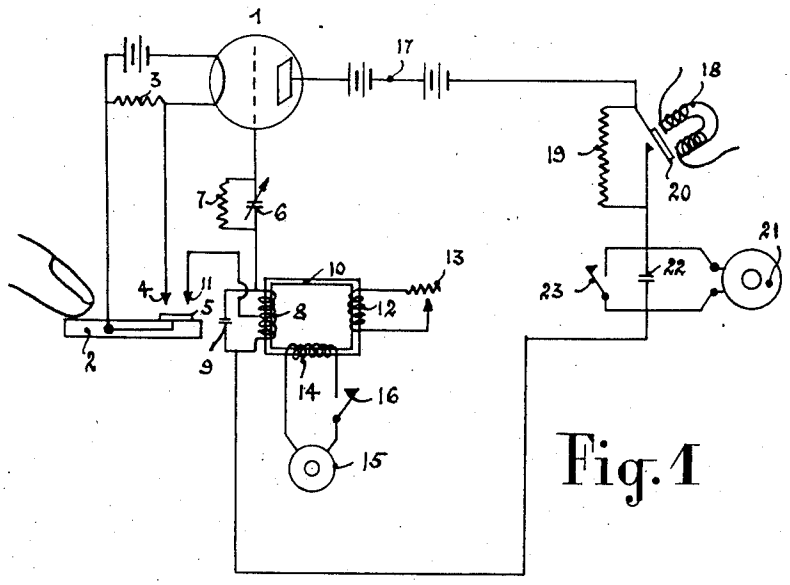


Fig. 1

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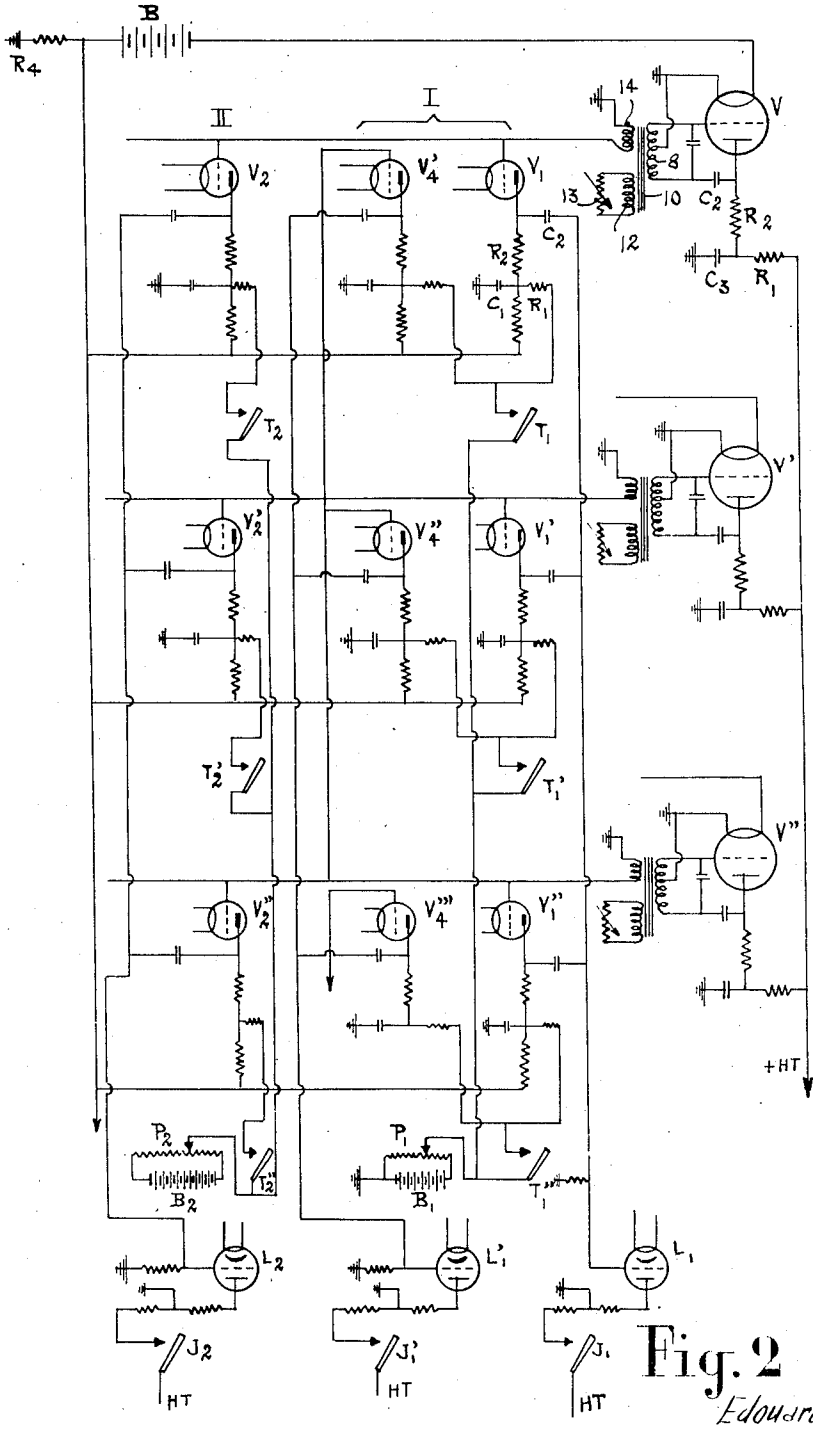


Fig. 2

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ELECTRIC ORGAN

Edouard Eloi Coupleux, Tourcoing, France

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In France October 27, 1934

11 Claims. (Cl. 84—1)

The object of the present invention is a particular connection of the tube oscillators of a radiophonic organ and a particular set or arrangement of coupling valves, connected to the said tube oscillators so as to facilitate the operation, to imitate the playing of a pipe organ and only to require one single row of tube oscillators, capable of producing the different stops, whatever may be the key-boards and the key-relationships.

Referring to the connection of a single tube oscillator such as shown in Fig. 1, the invention extends over the following features:

Like in the organ of this type, the valve 1 is controlled by the key 2, but in the occurrence, the heating circuit comprises a resistance 3, which is in closed circuit, when the key is not actuated. By depressing the key, the resistance is short-circuited by the contact of 4 with the blade 5, thus insuring the softness of starting of the pipe organ. In fact, when the resistance 3 is switched on, the heating voltage is lowered to about 3 or 3.5 volts. At the moment of switching in (short-circuiting of 3), a fraction of a second is required to enable the filament, put under 4 volts, to attain its heating norm. By regulating the resistance 3, the operator may obtain the normal repetition and the softness of starting the note.

According to another feature of the invention, use is made of a variable condenser 6, shunted by means of a resistance 7, which owing to its inaudible oscillations of relaxation, superposing those of the oscillating circuit, enables to vary the timbre in response to the values of the introduced capacity. Following the timbre or tonality of each valve, this capacity will be of the rang of 5/1000 to 1/10 microfarad, the resistance being of the rang of 100.000 ohms.

The oscillating circuit comprises the self-induction coil 8 and the condenser 9. This coil constitutes a winding of the transformer 10, the return circuit of the grid being insured by the contact 11 in such a manner that when the key is pressed down, this contact communicates with 4 and the oscillations of the tube may be produced and pass to the loud-speaker. When the key is not depressed, the return of the grid circuit is broken and thus the note is stopped. The secondary 14 of the transformer is connected to a loud-speaker 15 provided with an interrupter 16 (the filters and the amplifiers are not shown in the drawings).

Besides, another winding 12 is shunted on a variable resistance 13, which permits to modify the magnetic field and consequently the self-induction of the winding 8; the tonality is therefore adjusted very precisely with the aid of a transformer 10 and a self-induction coil 8, which are both of a smaller size than in the known arrangements.

In the plate circuit with its battery 17 is inserted a vibratory device comprising an electromagnet 18 and a vibrating blade 20, which connects alternately the resistance 19 so as to insure the vibrato with the desired characteristics.

Eventually, a loud-speaker 21 with its capacity 22 and its interrupter 23 may be inserted in the plate circuit so as to give a timbre, which is different from that of the loud-speaker 15.

Another feature of the invention is to utilize coupling valves on tubes, which oscillate in a permanent manner. When the key of a key-board is depressed, high voltage passes to the plate of the corresponding coupling valves. With one single row of oscillators, it is therefore possible to obtain different timbres or stops, for example an eight feet bourdon accompanying a four feet bagpipe stop and so on.

The resistances and the capacities of the coupling valves are chosen at such values that the constant of time may correspond to the constant of time of the start in the pipe organs.

Fig. 2 shows the connection of three valves of the organ with two key-boards. For the sake of greater clearness, only the said transformer, provided with three windings, is shown on each tube oscillator.

The first key-board I is arranged for eight feet with the coupling valves of the upper row and for four feet with the coupling valves of the row, which lies below the first one. The key-board II comprises coupling valves for eight feet. The oscillating tubes are shown at V, V', V'' ... Fig. 2 shows tubes oscillating each at the octave of the preceding tube. Thus, for example, V will be ut_2, V' will be ut_3, V'' will be ut_4 and so on. Of course, there are also intermediary oscillators giving the different notes which are comprised between all the octaves.

These tube oscillators are always in service and each attacks the grid of the coupling valves, associated with it in the different key-boards. In the present case, only two key-boards are utilized, but it is quite possible to increase their number.

The tube V controls the coupling valve V_1 of the first key-board and the valve V_2 of the second key-board, these valves being foreseen at eight feet or steps. In the same manner, V' affects V'_1 and V'_2, which are also provided at

eight feet or steps, but it controls at the same time the coupling valve V'_4 of four feet of the first key-board. This coupling valve will therefore produce the octave of V and it will be energized by the same key T_1 as the coupling valve V_1 of V.

All the coupling valves of four feet, viz: V'_4, V''_4, V'''_4 . . . will control the four foot stop, when the corresponding key of the first key-board is pressed down, as for example V_1.

The two valves V_1 of the eight foot stop and V'_4 of the four foot stop of the first key-board work simultaneously, but V_1 transmits the frequency f of the oscillator V and V'_4 the frequency $2f$ of V'. The outputs of the series of valves V_1, V'_1, V'_2 and those of the series of valves V'_4, V''_4, V'''_4 are separate and each of them affects the input valves L_1, L'_1 of the amplifiers of eight feet and of four feet respectively.

When the interrupters J_1 and J_2 are not closed, the plate of the input valves of the amplifiers has no current supply (these interrupters J_1 and J_2 correspond with the admission handles of the stops). If it is desired, for example, to give expression to an eight foot stop, the handle J_1 is to be extended; the plate of the input valve L_1 is connected to the high voltage and the following valves of the amplifier will be affected by the oscillations emanating from all the valves of the series V_1, V'_1, V''_1 . . ., and the amplified oscillations will be heard in the loud-speaker.

As to the second four foot stop on the first key-board responding to the valves V'_4, V''_4, V'''_4 . . ., use is made of the interrupter J'_1 in order to put in service the corresponding amplifier. As to the second key-board comprising the eight feet series with the valves V_2, V'_2, V''_2 . . ., use is made of the interrupter J_2, which controls the voltage on the first valve L_2 of the corresponding amplifier.

Referring now to the disposition of the coupling elements, it will be seen from the diagram that the valves V_1, V'_1, V''_1, the valves V_2, V'_2, V''_2 and also the valves V'_4, V''_4, V'''_4 form resistance amplifiers. The examination of the connections on one of the valves, for example V_1, leads to the statement that the plate circuit comprises the resistance R_2 producing the difference of alternating potential. This circuit comprises also a discoupling resistance R_1 through which takes place the discharge of the condenser C_1. The values of R_1 and C_1 are chosen in such a manner that the constant of time of the system may correspond to the constant of time of the start in the pipe organs.

The resistance R_1 is directly connected to the high voltage source B_1 by the key of the key-board T_1 with a potentiometer for adjusting. Use may also be made of a relay (not shown). When a key, such as T_1, is lifted, the condensers do not discharge through the space between the filament and the grid, which would require one or several seconds, but through the resistance R_3, connected to the negative of the heating source B. This source has a voltage, which is superior to that of the filament for some volts, on account of the presence of resistance R_4. Thus, when the key T_1 is lifted, the plate of the coupling valve V_1 takes a potential, which is inferior for some volts to that of all the points of the filament, which permits to avoid any background noise caused by the persistence of slight electronic currents.

The adjustment of the expression is effected by the variation of the plate voltage just with the aid of the potentiometer P_1, which will give expression to the swell for example, as represented in the diagram, while the potentiometer P_2, mounted on the battery B_2 which responds to the valves V_2, V'_2, V''_2 of the second keyboard, will give expression for example to the big organ.

Thus, the organist, depressing a key of the first key-board, will be able to call up independently an eight foot stop or a four foot stop by depressing a special key of one of the stops, and there may also be provided a very great diversity of combinations of this kind, the number of coupling valves not being limited to that shown in the diagram.

As the stop of harmonics has a power depending upon the important high voltage, as explained before, it is possible to graduate this power by means of the interposition of resistances (not shown) either for each octave or for each note so as to harmonize the harmonic notes at will. This interposition of resistances is effected either on one single wire (case of a special row of amplifiers) or on the wires coming from the key-board to each harmonic note, which permits of avoiding the too great importance of the shrill notes and giving the predominance in intensity to the tonal note.

The device of static tremolo (not shown) is based upon the utilization of the discharge of a condenser through a voltage limiting device (for example a valve containing rarified gas). Advantageously, use is made of voltage limiting devices with heated cathode.

I claim:

1. A radiophonic organ comprising a valve with an oscillating circuit for each note, with a condenser, a self-induction coil, a small sized transformer with a primary, constituted by the self-induction coil of the oscillating circuit, a secondary, mounted on the transformer and connected to the sound-reproducer, a third winding on the transformer, a variable resistance, branched on this winding in closed circuit.

2. A radiophonic organ comprising a valve with an oscillating circuit for each note, with a condenser variably shunted on the grid circuit, a self-induction coil, a small sized transformer with a primary, constituted by the self-induction coil of the oscillating circuit, a secondary, mounted on the transformer and connected to the sound-reproducer, a third winding on the transformer, a variable resistance, branched on this winding in closed circuit.

3. A radiophonic organ comprising a valve with an oscillating circuit for each note, with a condenser, a self-induction coil, a small sized transformer with a primary, constituted by the self-induction coil of the oscillating circuit, a secondary, mounted on the transformer, a variable resistance, branched on this winding in closed circuit, a resistance in the circuit of heating of the filament, a key with contacts for short-circuiting this resistance, when the key is depressed.

4. A radiophonic organ comprising a valve with an oscillating circuit for each note, with a condenser, a self-induction coil, a small sized transformer with a primary, constituted by the self-induction coil of the oscillating circuit, a secondary, mounted on the transformer and connected to the sound-reproducer, a third winding on the transformer, a variable resistance, branched on this winding in closed circuit, with a resistance in the high voltage circuit, a vibrator with a

blade and contacts for alternately switching in or removal of the said resistance.

5. A radiophonic organ comprising a valve with an oscillating circuit for each note, with a condenser, a self-induction coil, a small sized transformer with a primary, constituted by the self-induction coil of the oscillating circuit, a secondary, mounted on the transformer and connected to the sound-reproducer, a third winding on the transformer, a variable resistance, branched on this winding in closed circuit, with a loud-speaker, provided with an interrupter, placed on the secondary of the transformer and a second loud-speaker, placed into the plate circuit.

6. A radiophonic organ, comprising a valve with an oscillating circuit for each note, with a condenser, a self-induction coil, a small sized transformer with a primary, constituted by the self-induction coil of the oscillating circuit, a secondary, mounted on the transformer and connected to the sound-reproducer, a third winding on the transformer, a variable resistance, branched on this winding in closed circuit, means for producing continuous oscillation of the oscillator tubes, coupling valves at the ratio of one for each stop in the key-board, a set of amplifiers surmounting each row of valves, an interrupter for supplying high voltage to the plate of the first valve.

7. A radiophonic organ, comprising a valve with an oscillating circuit for each note, with a condenser, a self-induction coil, a small sized transformer with a primary, constituted by the self-induction coil of the oscillating circuit, a secondary, mounted on the transformer and connected to the sound-reproducer, a third winding on the transformer, a variable resistance, branched on this winding in closed circuit, means for producing continuous oscillation of the oscillator tubes, coupling valves at the ratio of one for each stop in the key-board, a set of amplifiers surmounting each row of valves, an interrupter for supplying high voltage to the plate of the first valve, with a discoupling resistance, a capacity connected to this resistance, values of the resistance and of the capacity furnishing a determined constant of time, means for adjusting the resistance and the capacity.

8. A radiophonic organ, comprising a valve with an oscillating circuit for each note, with a condenser, a self-induction coil, a small sized transformer with a primary, constituted by the self-induction coil of the oscillating circuit, a secondary, mounted on the transformer and connected to the sound-reproducer, a third winding on the transformer, a variable resistance, branched on this winding in closed circuit, means for producing continuous oscillation of the oscillator tubes, coupling valves at the ratio of one for each stop in the key-board, a set of amplifiers surmounting each row of valves, an interrupter for supplying high voltage to the plate of the first valve, the valves of one coupling series being connected to the tube oscillators with a forward displacement of an octave.

9. A radiophonic organ, comprising a valve with an oscillating circuit for each note, with a condenser, a self-induction coil, a small sized transformer with a primary, constituted by the self-induction coil of the oscillating circuit, a secondary, mounted on the transformer and connected to the sound-reproducer, a third winding on the transformer, a variable resistance, branched on this winding in closed circuit, means for producing continuous oscillation of the oscillator tubes, coupling valves at the ratio of one for each stop in the key-board, a set of amplifiers surmounting each row of valves, an interrupter for supplying high voltage to the plate of the first valve, with a potentiometer, placed on the high voltage battery.

10. A radiophonic organ, comprising a valve with an oscillating circuit for each note, with a condenser, a self-induction coil, a small sized transformer with a primary, constituted by the self-induction coil of the oscillating circuit, a secondary, mounted on the transformer and connected to the sound-reproducer, a third winding on the transformer, a variable resistance, branched on this winding in closed circuit, means for producing continuous oscillation of the oscillator tubes, coupling valves at the ratio of one for each stop in the key-board, a set of amplifiers surmounting each row of valves, an interrupter for supplying high voltage to the plate of the first valve, with adjustable resistances on the high voltage supply.

11. A radiophonic organ, comprising a valve with an oscillating circuit for each note, with a condenser, a self-induction coil, a small sized transformer with a primary, constituted by the self-induction coil of the oscillating circuit, a secondary, mounted on the transformer and connected to the sound-reproducer, a third winding on the transformer, a variable resistance, branched on this winding in closed circuit, means for producing continuous oscillation of the oscillator tubes, coupling valves at the ratio of one for each stop in the key-board, a set of amplifiers surmounting each row of valves, an interrupter for supplying high voltage to the plate of the first valve, with a condenser, a voltage limiting device with heated cathode, placed on this condenser.

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