May 3, 1932. J. DIEUX 1,856,910

PROCESS AND DEVICE FOR TRANSFORMATION OF ELECTRIC CURRENTS

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Fig. 1

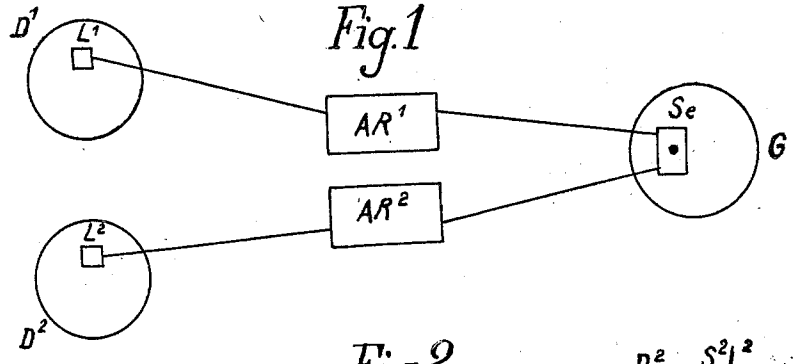

Fig. 2

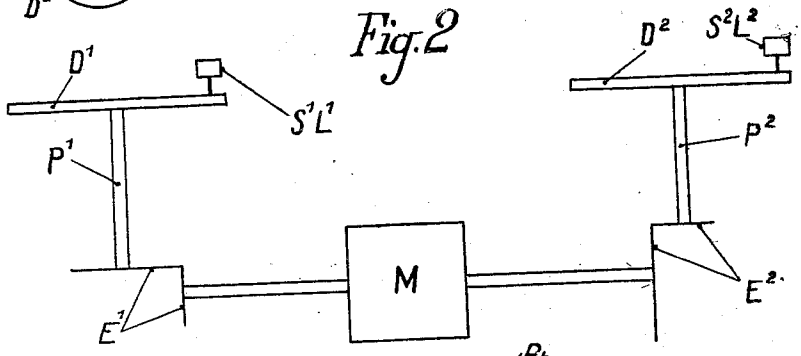

Fig. 3

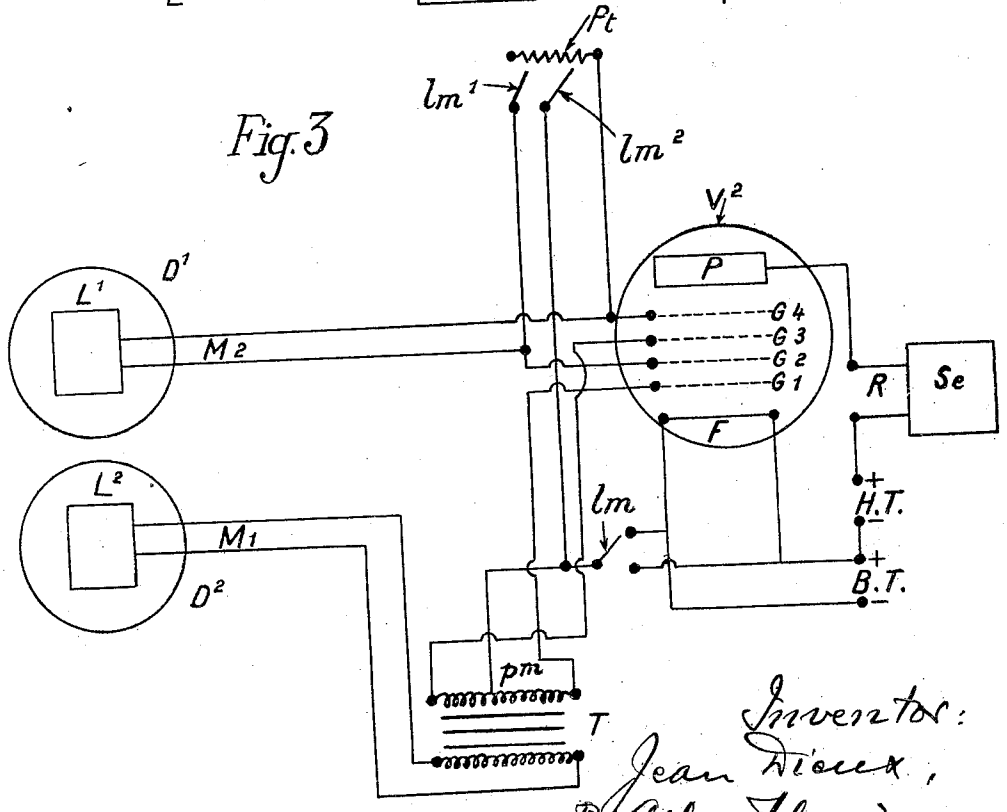

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Fig. 4

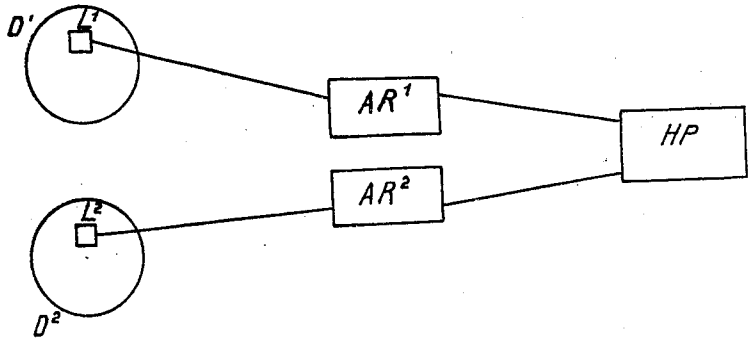


Fig. 5

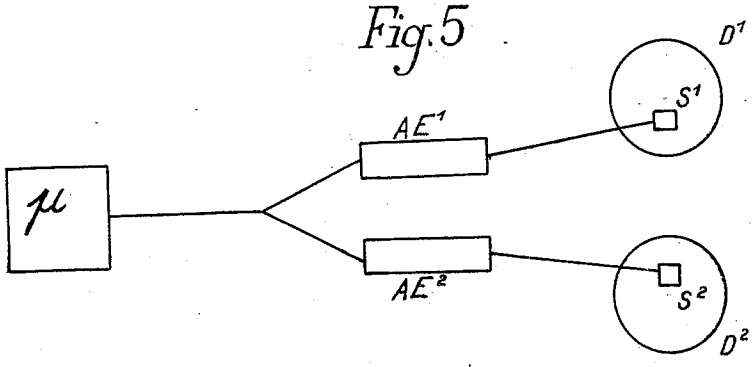
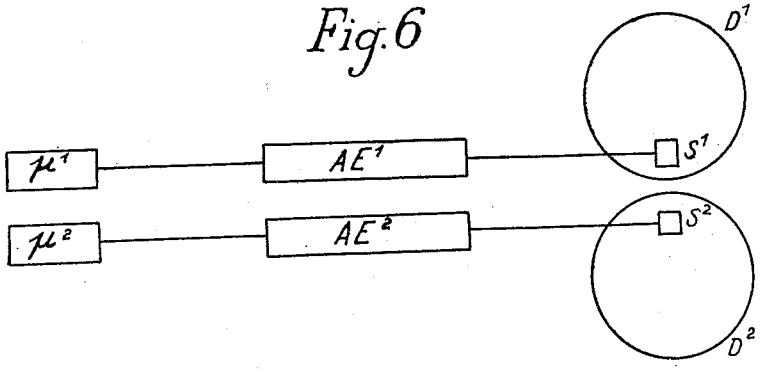


Fig. 6



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Patented May 3, 1932

1,856,910

UNITED STATES PATENT OFFICE

JEAN DIEUX, OF PARIS, FRANCE

PROCESS AND DEVICE FOR TRANSFORMATION OF ELECTRIC CURRENTS

Application filed January 8, 1930, Serial No. 419,255, and in France April 18, 1929.

The object of my invention is the recording of sounds on a surface such as that of a disk whilst imparting to the said surface a velocity considerably less than the speed usually attained by this surface for reproducing sounds. The speed thus reduced enables the engraving stylus to reproduce all the delicacies of the sounds to be recorded.

The invention also has for its object the construction of a matrix which in turn can be used to impress other disks so that needle scratch or surface noises are absent when said discs are used for reproduction.

The present invention relates to a special sound recording process which enables the attainment of the aforesaid objects. This process is an improvement made in the special processes and devices for analysis and synthesis of modulated or vibrated currents with polygrid and polyplate lamps.

The improved processes and devices of the invention consist essentially in the characteristic features given in the following description and particularly in the accompanying claims.

Arrangements, according to the invention, are shown by way of example, in the accompanying drawings; wherein:—

Fig. 1 is a diagrammatic general view of one arrangement according to the invention;

Fig. 2 is a diagram showing the method of working the disk holder plates fitted in this arrangement.

Fig. 3 is a diagram showing the electric connections of the arrangement, shown in Figs. 1 and 2.

Fig. 4 represents the arrangement of Figs. 1 and 2 wherein a loud speaker takes the place of the engraving stylus.

Figs. 5 and 6 are devices to analyze sounds and obtain surfaces D^1 D^2 which are utilized in the devices of Figs. 1, 2 and 3.

The sounds emitted by the source of sound are collected by the microphone U (Fig. 5) and transformed into vibrated or modulated currents; the said currents being amplified in two amplifiers AE^1 and AE^2 or in an amplifier like that of the previous application, comprising a single grid surface connected with the microphone and two plate circuits each connected with an engraving stylus S^1 S^2, each of the said styli separately making an imprint on plate D^1 or D^2. Plates D^1, D^2, are driven at low rates of speed V^1 V^2 respectively, different to each other and remaining constant in a known ratio

$$K=\frac{V^1}{V^2}.$$

Fig. 6 is a modified form of this arrangement wherein two microphones U^1 and U^2 are utilized instead of one and two separate amplifiers AE^1, AE^2, working two engraving styli S^1, S^2. The two combinations U^1, AE^1, S^1, D^1 and U^2 AE^2, S^2, D^2, only depend upon each other by the condition that the speeds V^1 V^2, of plates D^1, D^2, remain constant and in a known ratio

$$K=\frac{V^1}{V^2}.$$

The plates D^1, D^2 obtained by this process will be different one from the other as they will have been recorded at different rates of speed. It will not be possible to utilize them on an ordinary machine as it would be necessary to make them rotate at a very slow speed and besides each plate taken separately cannot, even when running at its recording speed, reproduce the original sound, as it only reproduces an analytic part of the said sound.

These plates D^1 D^2 will then be utilized in the arrangement shown in Figs. 1 and 2 which is the object of the invention.

These plates D^1, D^2, are placed on two supporting tables P^1, P^2 (Fig. 2) and driven by a motor M at speeds V'^1, V'^2, very nearly the same as the recording speeds V^1, V^2 but strictly constant and remaining in the same ratio

$$K=\frac{V^1}{V^2}.$$

Rotation at speeds V'^1, V'^2 such that

$$\frac{V'^1}{V'^2}=K$$

can be obtained from a single motor M by means of suitable speed reducing gear (bevel gearing for example) indicated by E^1 and E^2

and each having a perfectly controllable reducing ratio.

The styli S^1 S^2 placed on the disks D^1, D^2 record separately the analytized musical compositions; the vibrated or modulated currents produced in the reproducers L^1, L^2, carrying the styli S^1, S^2 being impressed on the grid circuits of an amplifying valve V^2 (Fig. 3) of the type described in the aforesaid application.

The valve has several grids G^1, G^2, G^3, G^4, a single filament F and a single plate P. The circuit of the reproducer L^1 is connected with grids G^2 G^4, whereas the circuit of the reproducer L^2 is connected with the grids G^1, G^3 through a transformer T. The filament circuit is provided with a switch *lm* by means of which one or other of the poles of the filament can be connected with a movable point *pm* on the secondary circuit of the transformer T and also with a potentiometer P*t* also connected with the grids G^2, G^4 of the amplifying valve V^2. The amplified synthetic currents produced in the single plate circuit of the amplifying lamp are received in an ordinary recording apparatus comprising an engraving stylus *Se* connected at R with the plate circuit of the amplifying valve V^2. This engraving stylus will give an imprint on a final disk G, revolving with a speed V^3 also reduced.

As the speeds V'^1, V'^2 can differ slightly from V^1 V^2 it will be necessary to control slightly the speed V^3 of disc G for recording on the disk to be regular with the speed of reproduction.

Instead of two intermediary surfaces D^1, D^2 and an amplifier with two plates for the analysis and four grids for synthesis, it is possible to have three or four intermediary surfaces and amplifying valves comprising a double number of grids or the same number of plates.

The chief advantages of this improved process are as follows:—

(*a*) The recording surfaces D^1 D^2 in the recording room move with a much smaller linear speed than usual. The engravings in the groove, produced by the engraving stylus, will be less close together and it will be possible to record very complex variations of sound, viz., to obtain much greater precision and fidelity in reproduction of the sounds on the disks D^1, D^2.

(*b*) The surfaces D^1, D^2 being driven at different but constant speeds, each of which has its quality and influence on the sound frequencies, it is easy to make corrections, rectifications, artificial echo productions and all modifications of the sounds in question, by acting on the intermediary electric amplifying circuits for recording, whether primary or secondary. Employment of similar and synchronized speeds would give much poorer results.

(*c*) Disks D^1 D^2 placed on the tables P^1, P^2, of the synthesis apparatus will be endowed with movements of rotation at low rates of speed and all the recorded vibrations will be transmitted to the synthesis amplifier and as the final disk G also rotates at a reduced speed, all the delicacies will be integrally recorded on this said plate. The physical, chemical or luminous work of engraving will thus have great precision.

(*d*) As the engraving stylus *Se* works with practically inaudible frequencies, the particular frequency of the engraving tool has no influence on the final sound and this advantage will be had both for engraving the auxiliary disks D^1, D^2, and for the engraving of the final disk G. On the other hand, it is known that parasitic recording noises constitute in the actual noise known as "surface noise" a much greater fraction than the friction of the reproducing apparatus on the sound generating surface, a friction, the vibration period of which can be removed from the audible scale by a suitable choice of the material acting as a support for recording. The final surfaces thus obtained are free from congenital surface noise, and good results only depend on the reproducing apparatus.

I claim.

1. The process of recording and reproducing sounds consisting in collecting the audible vibrations of a source of sound, transforming these audible vibrations into modulated vibrated currents, analyzing these currents, amplifying the analytic currents, fixing them by engraving on two surfaces moving with different speeds but remaining at a constant ratio, synthetizing the vibrated modulated currents reproduced by said surfaces, and transforming the vibrated modulated current of the synthesis into mechanical vibrations.

2. In an arrangement for carrying out the process as specified in claim 1 for recording sounds by an intermediary surface, two auxiliary disks moving at different speeds (V', V^2) but remaining at a constant ratio

$$\left(K=\frac{V'^1}{V'^2}\right),$$

electric reproducers cooperating with said auxiliary disks, a multigrid and monoplate amplifier, an engraving stylus, a disk to be engraved by said stylus, electric means connecting each reproducer to a grid circuit of said amplifier, and electric means connecting the plate circuit of said amplifier to said engraving stylus.

3. In an arrangement for carrying out the process for recording sounds by an intermediary surface, as specified in claim 1, two auxiliary disks, means for imparting to said disks different speeds, electric reproducers cooperating with said disks, a multigrid and

monoplate amplifier, an engraving stylus, a disk to be engraved by said stylus, electric means connecting each of said reproducers to a grid circuit of said amplifier, and electric means connecting the plate circuit of said amplifier to said engraving stylus.

4. In an arrangement for carrying out the process of recording sounds by an intermediary surface, as specified in claim 1, a disk to be engraved, auxiliary disks moving at different speeds, (V'^1 V'^2), but remaining at a definite constant ratio

$$\left(K=\frac{V'^1}{V'^2}\right),$$

a multigrid and monoplate amplifier, an engraving stylus for making an imprint on said disk to be engraved, electric reproducers cooperating with said auxiliary disks, electric means connecting each of said reproducers to a grid circuit of said amplifier, and electric means connecting the plate circuit of said amplifier to said engraving stylus.

5. In an arrangement for carrying out the process for recording sounds on an intermediary surface as specified in claim 1, a disk to be engraved, auxiliary disks, means imparting to said auxiliary disks different speeds (V'^1, V'^2) but remaining at a definite constant ratio

$$\left(K=\frac{V'^1}{V'^2}\right),$$

a multigrid and monoplate amplifier, an engraving stylus for making an imprint on said disk to be engraved, electric reproducers cooperating with said auxiliary disks, electric means connecting each of said reproducers to a grid circuit of said amplifier, and electric means connecting the plate circuit of said amplifier to said engraving stylus.

6. In an arrangement for carrying out the process for the recording of sounds on an intermediary surface, a microphone, a monogrid and polyplate amplifier, intermediary engraving styli, intermediary disks imprinted by said engraving styli, means for imparting movement to said disks at different speeds (V'^1, V'^2) remaining at a constant definite ratio

$$\left(K=\frac{V'^1}{V'^2}\right),$$

electric means connecting said microphone to the grid circuit of said polyplate amplifier, and electric means connecting each plate circuit of said polyplate amplifier to an intermediary engraving stylus.

7. In an arrangement for carrying out the process for recording sounds on intermediary surfaces, as specified in claim 1, a microphone, a monogrid and polyplate amplifier, intermediary engraving styli, auxiliary disks imprinted by said styli, means imparting to said auxiliary disks movement at different speeds (V'^1, V'^2) remaining at a definite constant ratio

$$\left(K=\frac{V'^1}{V'^2}\right),$$

electric means connecting said microphone to the grid circuit of said polyplate amplifier, electric means connecting each plate circuit of said polyplate amplifier to an intermediary engraving stylus, electric reproducers cooperating with said auxiliary disks a multigrid and monoplate amplifier, an engraving stylus, a disk adapted to be imprinted by said last mentioned stylus, electric means connecting each of said electric reproducers to a grid circuit of said last mentioned amplifier, and electric means connecting the plate circuit of said last mentioned amplifier to said last mentioned stylus.

In testimony whereof I have signed this specification.

JEAN DIEUX.