

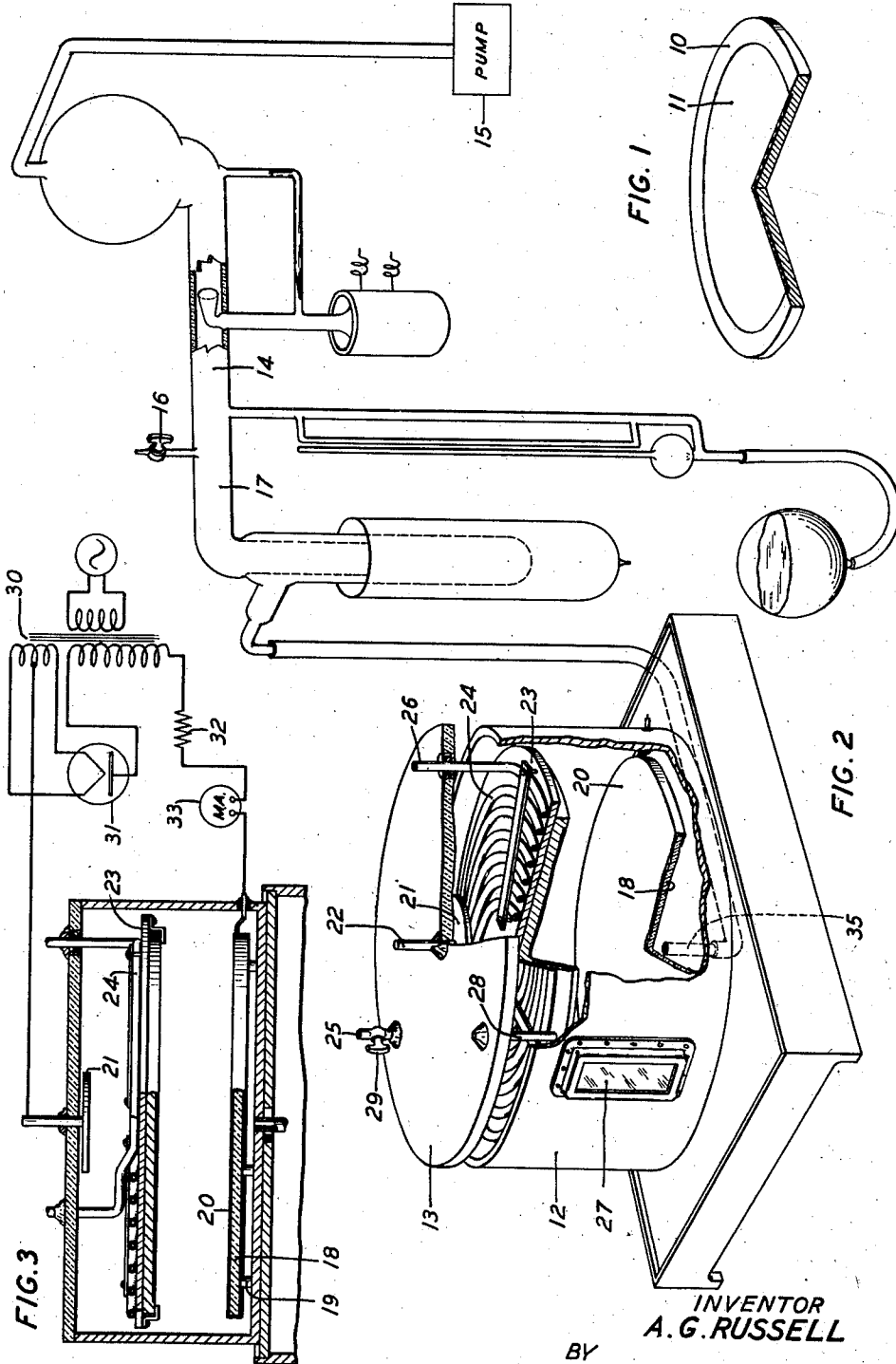
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A. G. RUSSELL

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APPARATUS FOR METALLICALLY COATING PHONOGRAPH RECORDS

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INVENTOR
A. G. RUSSELL

BY

J. M. Campbell
ATTORNEY

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APPARATUS FOR METALLICALLY COATING
PHONOGRAPH RECORDSAlexander G. Russell, Red Bank, N. J., assignor
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5 Claims. (Cl. 91—12.2)

This invention relates to apparatus for metal-
lically coating phonograph records and particu-
larly to such devices utilizing the sputtering effect
upon a cathode in a glow discharge chamber.

5 For a number of years attempts have been made
in the commercial production of phonograph rec-
ords to prepare the records for electroplating by
coating them with a conducting material such
as gold by means of the sputtering process. This
10 process consists essentially of placing the wax
master record between two electrodes in an evacu-
ated chamber and impressing a suitable poten-
tial difference across the electrodes such that a
glow discharge takes place. The surface of the
15 cathode is thus sputtered and the fine particles
loosened from the cathode deposited in a film of
metal on the wax master. The heat of the dis-
charge, however, has been found to cause the
wax master to become plastic if sputtered contin-
20 uously at a high rate, and to obviate this diffi-
culty the sputtering had to be done either inter-
mittently or at a greatly reduced rate to main-
tain its temperature at a safe level. These meth-
ods are unsatisfactory from the standpoint of
25 time consumed and quality of coating obtained.

The object of the present invention is to im-
prove the sputtering apparatus so that the time
required to deposit a suitable metallic coating
upon a phonograph record therewith will be ma-
30 terially reduced and the coating itself substan-
tially improved in quality.

In carrying out this object, a cooling means as
hereinafter described is provided within the sput-
tering device to maintain the temperature of the
35 phonograph record to be coated at a suitable level.
This makes possible at once a high speed contin-
uous sputtering apparatus to reduce the time re-
quired to deposit a coating, and a more homo-
geneous and, therefore, better quality coating.

40 To illustrate a preferred embodiment of my
invention reference is made to the accompany-
ing drawing wherein:

Fig. 1 is a wax record particularly adapted to
be cooled without danger of cracking and there-
fore well suited for use in a sputtering device.
45 It is comprised of a thermo-conductive disc 10
having one surface slightly recessed and covered
with a thin layer of recording wax 11;

Fig. 2 shows a wax record in place in the sput-
tering device together with the details of the
50 latter;

Fig. 3 is a sectioned side elevation of the device
showing a possible source of electrical energy.
This is comprised of a transformer 30 connected
55 across a 110 V—A. C. line and wound to furnish

3500 V across the secondary with a 2.5 V wind-
ing for the filament of a rectifier 31. A resist-
ance 32 of 8000 ohms is used in series to prevent
arcing, and a milliammeter 33 may be used to in-
dicate indirectly the state of the vacuum within
60 the device, since the current flowing between the
electrodes is dependent upon the amount of gas
remaining within.

Referring now to Figs. 2 and 3, the device is
comprised essentially of a cylindrical metal shell
65 12 open at the top, with the edge ground per-
fectly flat to make an air tight joint with a thick
glass cover 13. The side of the shell is slotted
and covered with a glass plate to form a window
27 through which the discharge may be observed.
70 A mercury vapor pump 14 and an oil pump 15
working in series are used to evacuate the cham-
ber, while a leak valve 16 in the line 17 leading
to the chamber serves to regulate the degree of
evacuation. The vacuum lead 35 is centrally lo-
75 cated to equalize the flow effects of the air as it
is being drawn out.

At the bottom of the shell is a horizontal glass
plate 18 supported by three rubber legs 19 and
covered with a thin sheet of gold 20, or other sput-
80 terable material, which constitutes the cathode of
the device. The anode is an aluminum disc 21
secured to the top, parallel to the cathode and as
far away from the latter as is expedient. The
rod 22 fastening the anode to the top extends
85 through the top and serves as a lead for an elec-
trical connection.

The thermo-conductive disc 10 is supported in
an inverted position over the cathode and secured
to the cooling plate 23 which, in the present de-
90 vice, is about 3" from the cathode. The inverted
position prevents any undesirable material sus-
pended in the air, or loosened from the top of the
shell, from falling on the wax layer 11 and intro-
ducing minute irregularities in the surface of the
95 coating to result later in the production of noise
in the finished record. The means used to fasten
the record to the cooling plate may be any suit-
able holding device such as a number of clamps
around the periphery of the metal back. The
100 spacing between the record and cathode should
be uniform to secure an even coating of the
fold. The relation between the degree of evacua-
tion, potential across the electrodes and spacing
of the electrodes and plate should be such that
105 the dark space accompanying the discharge is
located $\frac{2}{3}$ of the distance from the cathode to
the plate away from the cathode. It has been
found that the sputtering is most effective at
this position of the dark space.
110

The cooling plate 23 is a metal disc $\frac{1}{8}$ " thick to which is secured a flat coil of pipe 24 having an intake and outlet at 25 and 26 respectively. The pipe is made continuous so that there are no joints within the shell. This is desirable from a structural standpoint since the pressure within the shell is brought considerably below atmospheric and an internal pressure upon any joint within the shell might cause the joint to leak. At the pressure and temperature conditions found in the shell, water is instantly vaporized and an influx of vapor would greatly disturb the required vacuum and render the apparatus unsteady or even inoperative.

The leads 25 and 26 together with the brace 28 comprise the means for suspending the coil from the top. The suspension should be rigid to insure air tight joints between the support and top. The intake is connected to a source of water supply through a valve 29 while the outlet 26 may be disposed of in any convenient manner.

Having described the various elements of my invention, its operation will now be outlined.

The glass top is removed from the shell and supported in a suitable manner so that access may be had to the cooling plate. Hinges (not shown) may be provided for the top to facilitate this procedure. Next, a wax record to be coated is placed on the plate and secured to it. The record must be thoroughly cleaned before it is put in place to insure the absence of wax cuttings and other loose material. This if left in the grooves forms minute hollows in the deposited master and corresponding excrescences in the record which produce objectionable "clicks" in the sound reproduced therefrom. After the record is secure, the cover is replaced and water sent through the cooling coils. The cooling is done very slowly to avoid a sudden change of temperature within the wax. The temperature may be as low as desired, but it must be evenly distributed to prevent cracking of the record.

The oil and mercury pumps are started and the chamber is evacuated to a pressure of about 0.001 millimeters of mercury. At this point the potential is impressed across the electrodes and a glow discharge effected. The evacuation is continued until the pressure is such that the dark space is about 1" from the cathode which, in the present machine, corresponds to $\frac{2}{3}$ of the distance from the cathode to the plate. The pressure is then maintained at this level throughout the sputtering by the leak valve.

The sputtering is continued for about ten minutes which has been found to be sufficient for plating purposes. At the end of ten minutes air is admitted into the chamber, the cooling water is shut off and the wax is brought slowly to room temperature. The top is then removed and the record taken from the cooling plate ready for plating in the copper plating bath.

It is understood that various changes can be made in the structure shown without departing from the spirit of the invention and the scope of the invention, therefore, is not to be limited by

the foregoing illustrative description but is to be determined by the appended claims.

What is claimed is:

1. Apparatus for sputtering phonograph records comprising an evacuated hollow cylinder and a removable top therefor, means for maintaining the evacuation at a predetermined state, a gold cathode at the bottom of the cylinder, an anode near the removable top and secured to it, a source of electrical energy for the cathode and anode, means for suspending a record from the removable top in an inverted position and parallel to the cathode, said means comprising a metal platen secured to a coil of pipe integral with the top and containing a cold fluid for conducting away the excess heat in the record generated by the sputtering process.

2. Apparatus for sputtering phonograph records comprising an evacuated hollow metal cylinder and a removable top therefor, a mercury vapor pump and an oil pump to maintain the state of evacuation, an air lead centrally located to equalize the flow effects of the air, a gold cathode at the bottom of the cylinder, an anode near the removable top and secured to it, a source of electrical energy for the cathode and anode, means for suspending a record from the removable top in an inverted position and parallel to the cathode, said means comprising a metal platen secured to a coil of pipe integral with the top and containing a controllable stream of cold water for conducting away the excess heat generated by the sputtering process.

3. Apparatus for sputtering thermo-critical articles comprising an evacuated apertured container, a removable cover for the aperture, means for maintaining the evacuation at a predetermined state, a cathode of sputterable metal within the chamber, an anode secured to the cover, a source of electrical energy connecting the anode and cathode, a removable cooling system within the chamber, and means on the cooling system for supporting the thermocritical articles whereby the heat in said articles is conducted away and the articles thereby maintained at a safe working temperature.

4. In a continuous sputtering apparatus for a thermo-critical structurally weak phonograph record, a stiff thermo-conductive support for the record, said record being secured to said support, a cooling system within the apparatus co-extensive with the surface of the record, and means for securing said thermo-conductive support to the cooling system whereby heat is conducted rapidly from the record to maintain it at a safe working temperature.

5. In a continuous sputtering apparatus for a thin wax phonograph record, a cooling plate within the apparatus for the thin wax record, a stiff thermo-conductive support for the record adjacent the cooling plate, and means for detachably mounting said support on said plate whereby the thin record can be safely placed in and removed from the apparatus.

ALEXANDER G. RUSSELL.