

April 17, 1934.

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1,954,995

PROCESS FOR METAL COATING PHONOGRAPH RECORDS

Filed May 29, 1931

FIG. 1

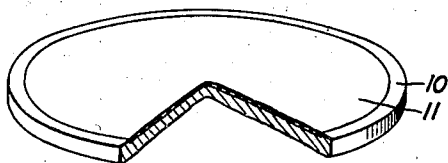


FIG. 2

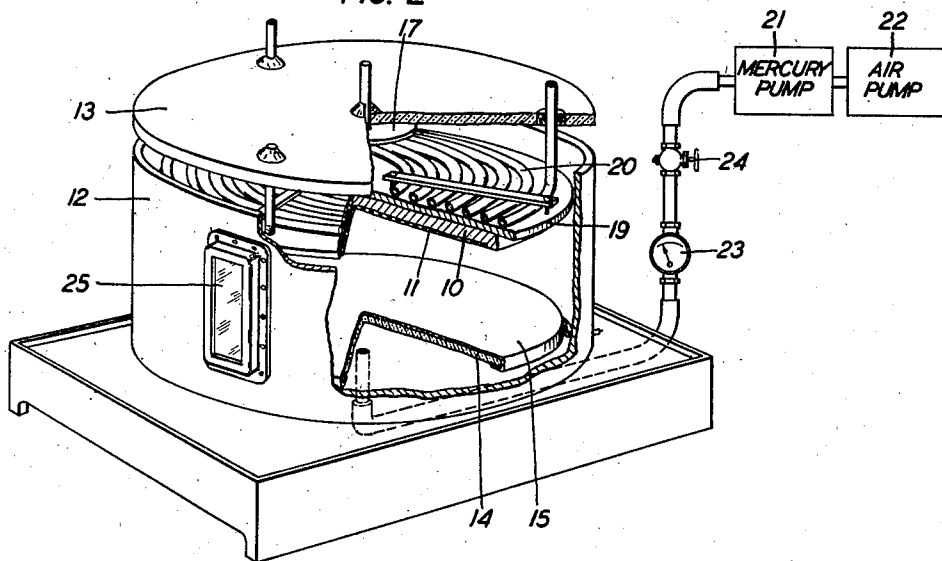
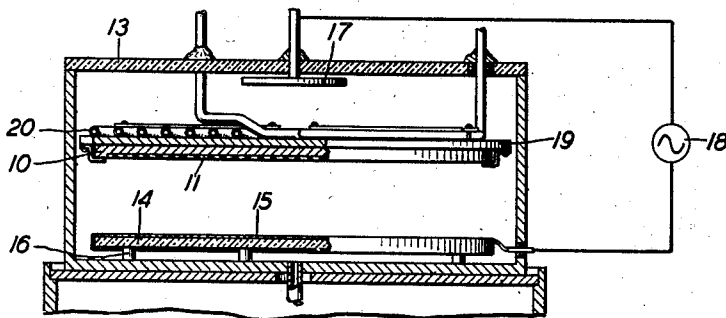


FIG. 3



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1,954,995

PROCESS FOR METAL-COATING PHONO-
GRAPH RECORDS

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Application May 29, 1931, Serial No. 540,867

2 Claims. (Cl. 91—68.2)

This invention relates to an art of metallically coating phonograph records, commonly known as "sputtering", and particularly to the adaptation of this art to the process of duplicating phonograph records.

It is well known in the sound recording art that the quality of a phonograph record from the standpoint of reduction in noise level is dependent to a large extent upon the condition of the surface of the original wax record before it is used in the electroplating bath to produce a metal master. It is also well known that the surface of the wax must be made conductive before any metal can be electro-deposited thereon. The problem has been to coat the surface in some manner so that the original noise level is not increased by the coating and yet a satisfactory conducting layer is provided for the electroplating process.

At present one of the best means for accomplishing this result is the sputtering process by which a metal such as gold is made the cathode in an electrical glow discharge apparatus and sputtered, the sputtered particles depositing in a film of the metal on the record and thereby rendering it conductive. Heretofore this process has been difficult to use satisfactorily because of the damage sustained by the wax record as a result of the excessive heat generated by the discharge. The wax discs commonly used have been of soft smooth cutting material and because of the low mechanical strength of such material the discs were made thick to permit handling. These thick discs were inherently poor in heat conductivity, high in thermal expansion and slightly volatile in a vacuum. In consequence, it had been necessary to sputter them very slowly to avoid raising their temperature beyond a point where the volatile materials, such as oils ordinarily required for smooth cutting, were evaporated and the shape of the groove thereby altered, or the temperature gradient within the wax became so great as to cause it to crack. The slowing down of the process naturally made it more expensive and difficult to carry out.

It is the object of this invention to provide a method for rapidly sputtering phonograph records while maintaining their quality. An important feature of the invention is conducting heat away from the record during the sputtering process so that the process may be carried on continuously without overheating the record.

The preferred procedure in carrying out this invention is to make the record on a material the temperature of which may be readily con-

trolled during the sputtering operation. The record accordingly may take the form of a thin coating of recording material such as wax applied to a stiff metallic plate which may be placed in contact with a suitable cooling medium within the discharge chamber of the sputtering apparatus. The removal of excess heat results in constant wax surface temperature and dimensions and low evaporation with a corresponding smooth metal deposit. The entire process thus becomes rapid and relatively inexpensive.

To illustrate one form of the invention reference is made to the accompanying drawing in which:

Fig. 1 is a thin wax record backed by a metal disc in accordance with a feature of this invention;

Fig. 2 is a perspective of the sputtering device partly cut away to show the cooling plate and record mounted thereon; and

Fig. 3 is a sectioned side elevation of the device.

In Fig. 1, 10 is a stiff thermo-conductive disc of a slightly larger diameter than the desired sized record, and 11 is a thin layer of wax flowed on to the disc to form the recording surface. This surface is obtained by carefully heating the disc to a temperature slightly above the melting point of the wax and flowing the wax on the disc at this temperature until an even layer of it is formed. The disc is cooled slowly to room temperature and sound then recorded on the wax surface in the usual manner. The method of preparing the disc is described more fully in a copending application of E. M. Patterson, Serial No. 524,471, filed March 23, 1931.

The sputtering device in Figs. 2 and 3 is comprised of a hollow metal cylinder 12 with a glass top 13 placed over its open face and an air-tight joint formed between the two. At the bottom of the cylinder is a glass disc 14 covered with a sheet of gold 15 and supported by three rubber legs 16. Attached to the top 13 is an aluminum disc 17 which comprises the anode of the sputtering device, while the gold sheet forms the cathode. Taps are brought out from the electrodes and electrical connections made with a source of potential 18. A window 25 is provided so that the discharge can be observed.

The record to be coated is placed above the cathode and secured to a circular plate 19 which is rigidly suspended from the top at a predetermined distance from the cathode. The function of the plate is to maintain the record at a safe working temperature throughout the process. This is accomplished by providing the plate with a conduit

20 through which may be pumped a cooling fluid such as water at a sufficient rate to remove the excessive heat of the plate. Thus any desired temperature can be maintained simply by regulating the rate of flow of the fluid.

To establish a glow discharge the chamber is evacuated to a pressure of about .001 millimeter of mercury. A mercury vapor pump 21 assisted by an oil pump 22 may be used for this purpose. A pressure gage 23 serves to indicate that the proper degree of evacuation has been reached, and a leak valve 24 can be used to prevent the pressure from becoming too low.

The procedure used in sputtering a phonograph record is as follows:

The wax record is thoroughly cleaned to remove all dirt and cuttings and is secured to the cooling plate. Next, the joint-forming edge of the chamber is cleaned and greased and the top placed over it. The leads from the conduit are connected to a source of water supply, water is pumped through the conduit and the plate cooled very slowly so that the wax does not crack. When the temperature of the wax becomes constant, the pumps are started and the chamber is evacuated to the aforementioned pressure of .001 millimeter of mercury. At this point a potential of about 3000 volts is impressed across the electrodes and a glow discharge effected accompanied by the appearance of the well known Crooke's dark space. The evacuation is continued until the dark space is two-thirds of the distance from the cathode to the record away from the cathode. The sputtering has been found to be most effective at this position of the dark space. If the pressure becomes too low the leak valve may be opened and outside air allowed to enter the pumps.

The sputtering is continued for about ten minutes after which the electrical energy is switched off, atmospheric pressure restored to the chamber and the cooling water shut off. The record is brought slowly to room temperature and then removed from the cooling plate, ready for the electroplating process.

Thus throughout the sputtering the wax is maintained at a safe temperature without appreciable damage to the recorded sound thereon, and the gold is sputtered on to the wax in a more homogeneous layer than has heretofore been possible.

The invention has been described with reference to a specific embodiment for purposes of illustration, but its scope is to be limited only by the appended claims.

What is claimed is:

1. The method of obtaining a rapidly sputtered wax surface which consists in combining a thin layer of wax with a layer of thermoconductive material, placing the combined layers adjacent a cooling system in a sputtering apparatus and sputtering the surface of the wax for a predetermined length of time.
2. The method of obtaining a rapidly sputtered wax phonograph record which consists in combining a thin layer of wax with a layer of thermoconductive material, inscribing a record into the wax layer, placing the combined layers in a sputtering apparatus, applying a cooling medium to the layer of thermoconductive material and sputtering the wax record for a predetermined length of time.

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