Aug. 14, 1928. 1,680,653

J. L. WALKER

RECORDING AND REPRODUCING OF SOUND WAVES

Filed Feb. 21, 1922 2 Sheets-Sheet 1

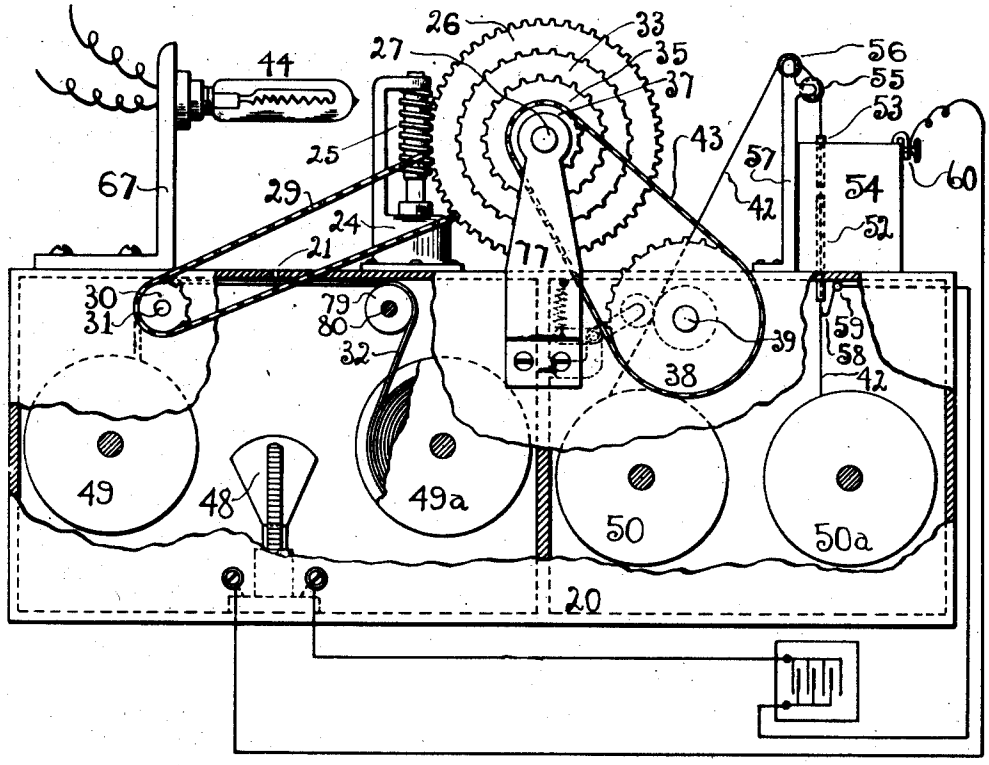

Fig. 1.

Jacob L. Walker

INVENTOR

Aug. 14, 1928. 1,680,653

J. L. WALKER

RECORDING AND REPRODUCING OF SOUND WAVES

Filed Feb. 21, 1922 2 Sheets-Sheet 2

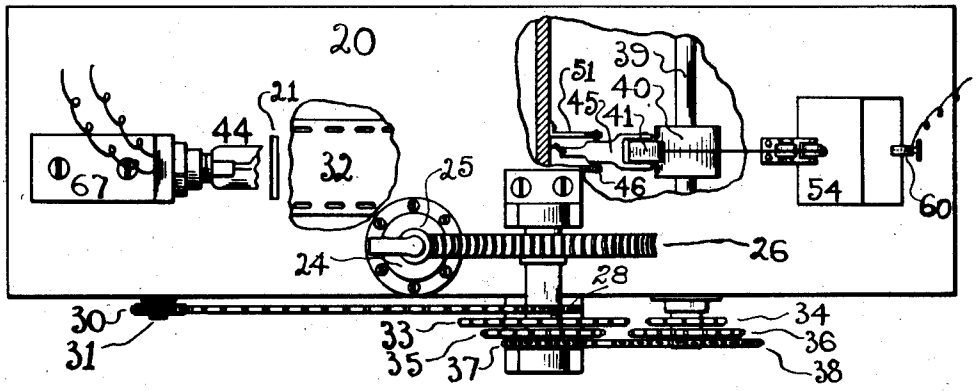

Fig. 2.

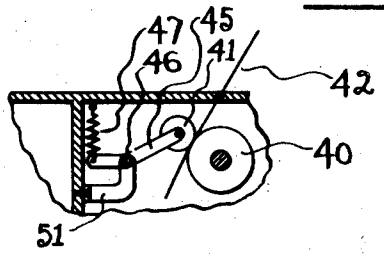

Fig. 3.

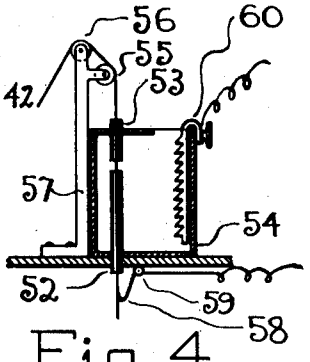

Fig. 4.

Fig. 5.

Jack L. Walker

INVENTOR

Patented Aug. 14, 1928. 1,680,653

UNITED STATES PATENT OFFICE.

JACK L. WALKER, OF DALLAS, TEXAS.

RECORDING AND REPRODUCING OF SOUND WAVES.

Application filed February 21, 1922. Serial No. 538,393.

This invention relates to new and useful improvements in recording and reproducing sound waves and electrical variations.

The invention has to do with that class of recording and reproducing devices which involve the use of chemistry and electricity, and in which the record is recorded upon a metallic substance by an electroplating process or an electro-chemical process.

The principal object of the invention is to record sound waves by an electroplating or electro-chemical process in a flexible manner so that the sound waves may be recorded at a speed which will allow sufficient time for the electroplating or electro-chemical action.

A further object is to produce a perfect record and one which is capable of being used upon the regular phonograph using a stylus attached to a diaphragm, and record sound waves without any loss of vibrations or distortion, by using a photographic record which has already been developed and fixed and which has had sound waves recorded upon it in an accurate manner and without distortion usually present in sound records as a controlling master record to control the production of variations upon a metallic substance by an electroplating or electro-chemical means.

A further object is to rerecord sound or electrical variations on a metallic substance by using a photographic sound record to control the re-recording and reducing the speed of the re-recording process so as to prevent distortion and to amplify the variations in the sound waves.

A further object is to amplify the variations in a sound wave record by amplifying tubes or audions and control the electroplating or electro-chemical action of an electrolyte acting upon a metallic substance.

A further object is to restrict the area of the metallic substance acted upon by the electro-chemical action at one time so as to prevent overlapping of the variations.

A further object is to record sound waves upon a metallic substance which have been previously recorded upon another record and cause the original record to control the recording upon second record and cause both original record and other record to travel at the same speed ratio and produce a record capable of being reproduced at a certain relative speed.

A further object is to provide means for varying the speed ratio between the original record and the subsequent record for varying the longitudinal space occupied by the sound waves variations and allow synchronism with a moving picture film when both are run at the same speed or the same speed ratio.

A further object of the invention is to either electroplate variations upon a metallic substance in accordance with the variations contained upon a sound record at a slow speed or to reverse the electroplating action or produce a chemical action which will change the diameter or thickness of a metallic substance in accordance with the variations in the sound wave record by reversing or controlling the direction of the flow of the electric current in the electrolyte.

A still further object is to produce a record from which a mold may be made for molding or stamping out other records or from which other records may be made by other suitable methods.

In carrying out the invention a beam of light is directed on a restricted opening through which the developed film record is exposed to the rays of light, said developed film record stopping or controlling the light in accordance with its light varying qualities at the portion exposed at the said opening, the light after passage through said film impinges upon a selenium cell or other light sensitive device capable of varying an electric current by a change in light rays impinging upon it. The selenium cell is acted upon by the variations in light rays controlled by the variations in the moving sound record film, moving past the aperture at a slow rate of speed, and causes the resistance of the said selenium cell to vary. The selenium cell is connected to a battery and controls the amount of current passing through a circuit which in turn controls the rate of electroplating in an electroplating device or controls the electro-chemical action of an electrolyte. A small copper wire or other metallic substance is carried through an electrolyte and is protected from the electro-chemical action of said electrolyte except at a small portion between two insulating tubes supported in the electrolyte. Thus the wire is only subjected to the action of the electrolyte at a small portion of it longitudinally of the wire and upon all sides. It is pointed out that various means might be used for shielding the wire at the portions

desired. The copper wire is carried through the electrolyte at a slow rate of travel which will allow ample time for the electroplating or chemical action in a substantial manner as well as amplify the recorded variations. Audions are also used to increase the amplification when desired or to hasten the electroplating action. The metallic wire is carried through the electrolyte at the same speed ratio of the developed film sound record and means are provided for changing the ratio between the two records. It is also pointed out that the metallic substance may be built up by the action of the electric current or it may be the reverse and the metallic substance might be etched or reduced by the electro-chemical action.

In carrying out the speed control the developed film sound record and the metallic substance are driven by a method capable of producing extremely slow speed an example of which is shown by the worm and gear method and both the film record and the metallic substance are driven by gearing or sprockets so as to travel at the same speed or the same speed ratio and are also variable in relation to each other.

The invention will be more readily understood from a reading of the following specifications and by reference to the accompanying drawings in which an example of the invention is shown and wherein:

Fig. 1 is an elevation of an apparatus constructed for carrying out my invention.

Fig. 2 is a top view of my invention showing, through cutaway portions the developed film sound record and the metallic sound record, also showing the feeding mechanism for feeding the metallic record.

Fig. 3 is a detail showing a side view through a cutaway portion, of the feeding mechanism.

Fig. 4 is a cross-section view showing the protecting tubes supported in the electrolyte and the electrode used for one terminal in the electrolyte.

Fig. 5 is a detail showing an example of a metallic record made with this device.

In the drawings numeral 20 designates a box constructed to exclude all light rays except at the exposing aperture 21 from selenium cell 48. Numeral 24 designates a motor and a worm 25 and gear 26 imparts slow movement to shaft 27 and sprocket 28 and transmits motion through chain 29 to sprocket 30 and shaft 31 which contains a film sprocket wheel for engaging the sprocket holes in a sound record film 32 without slipping. Shaft 27 has attached to its other sprocket wheels 33, 35 and 37 and are each connective to three other sprockets 34, 36 and 38 for changing the speed relation between the shaft 31 and shaft 39. Sprockets 34, 36 and 38 are attached to shaft 39. Shaft 39 has attached to it a drum 40 arranged with a pressure roll 41 supported by arm 45 pivoted at point 46. Pressure roll 41 is held against drum 40 by spring 47 and exerts pressure against wire 42 upon drum 40 for producing travel of wire 42. Arm 45 is supported by bracket 51. Numerals 50 and 50ª designate reels for containing wire 42. Wire 42 passes from reel 50ª through insulating tubes 52 and 53 in tank 54 containing an electrolyte or electroplating solution and passes thence over idler rollers 55 and 56 to drum 40 and take-up reel 50. Insulating tubes 52 and 53 in the electrolyte are slightly separated so as to expose wire 42 to the chemical action at a very small area. Idler rollers 55 and 56 are supported by bracket 57.

An illuminating device or source of light 44 is shown mounted upon a supporting bracket 67 for illuminating a portion of the developed film sound record 32 through aperture 21 and causes light rays passing through said film 32 to impinge upon a selenium cell or other light sensitive device 48 which changes its resistance in proportion to the amount or quality of light rays impinging upon it and is connected to a battery or other suitable source of electric current and is connected to wire 42 by wiper spring 58 supported on box 20 at point 59. Selenium cell 48 is also connected to electrode 60 in tank 54. The tank 54 contains an electroplating solution and the current controlled by selenium cell 48 controls the electroplating from electrode 60 to wire 42 exposed between tubes 52 and 53. Thus it will be seen that the strength of the electric current is controlled by the variations in the sound wave record and controls the action of the electrolyte upon wire 42 and records thereon variations in accordance with the variations in the sound wave record. While this is shown as a simple series electrical circuit other methods of wiring arrangements may be used to control the chemical action upon the metallic substance 42. Various kinds of electrolytes may be used and the wire 42 may be built up with an electroplate or the chemical action may etch or reduce the metallic wire 42 in accordance with the variations of the sound wave record. While no governor is shown in this device for producing slow speed it is understood that the same may be used in the place of the worm 25 and gear 26. It is necessary that the electroplating or electro-chemical action upon wire 42 be given the proper amount of time to record the variations in a substantial manner. It is pointed out that wire 42 may be the anode or the cathode in the electrolyte.

A very important advantage gained by recording sound waves in this manner is that the delicate sound waves which are too feeble to record or impress themselves even upon

the softest wax are perfectly recorded without loss or distortion. No friction or inertia is encountered in the recording process, therefore the variations are recorded in an accurate manner.

It is obvious that various means of accomplishing the desired results might be carried out and the machine might be made of different materials and in different designs and it is the principle involved which I desire to protect rather than any mechanical skill by which it might be carried out. The example shown is for the purpose of making the theory clear rather than exact mechanical details being shown.

While only one electrode is shown acting upon one side of the wire 42, it is advisible to use more than one electrode so as to reinforce the plating action from all sides and a metal tube surrounding insulating tubes 52 and 53 is preferable to the one electrode acting from only one side.

In Fig. 1 a cutaway portion is shown exposing the reels to view containing the metallic substance upon which the sound waves are to be transferred and also reels 49 and 49^a which contain the developed film sound record. A cutaway portion of reel 49^a shows the convolutions of film 32 upon reel 49^a. The film 32 is carried over idler roll 79 arranged to turn on shaft 80 and thence to sprocket wheel upon shaft 31 (not shown) where it engages sprocket teeth and is positively fed by rotation of shaft 31 and is taken up on reel 49 by slip belt or other take-up means.

What I claim is:

1. The method of recording sound waves which consists in controlling an electric current by variations in a sound record film and controlling the electroplating upon a copper wire in accordance with the variations recorded upon said sound record film and producing longitudinal travel of both said copper wire and said sound record film at an extremely slow rate of speed for increasing the amount of metal deposited by said electroplating on said copper wire and restricting the area of exposure of said sound record film and said copper wire for transferring a portion of a sound variation at a time.

2. The method of recording sound waves which consists in electroplating upon a copper wire or other metallic substances, a film or coating of metal and varying the thickness of said coating of metal in accordance with the variations in a sound record film and controlling the electroplating by said sound record film and amplifying the rate of deposit of said coating of metal by producing extremely slow continuous longitudinal travel of said sound wave record and said copper wire.

3. The method of recording sound waves which consists in electroplating upon a metallic wire, variations in thickness of an electroplate in accordance with the variations in opacity of a developed sound record film and producing extremely slow continuous travel longitudinally of said sound record film and said metallic wire at the same rate of speed or a certain relative ratio of speed.

4. The method of recording sound waves which consists in controlling the rate of deposit of an electroplate upon a copper wire in accordance with the variations upon a developed film sound record varying in opacity and producing extremely slow travel of said sound record and said copper wire and varying the speed of said metallic wire and said sound record and controlling the relative ratio of speed and amplifying said electroplating by said extremely slow travel and controlling the space occupied by said sound variations upon said copper wire by said relative ratio of speed.

5. The method of recording sound waves which consists in transferring sound variations from one record to another and using the original sound record to control the rate of deposit of an electroplate upon a metallic substance which is to contain the transferred record and maintaining extremely slow travel of both said records at the same speed or a certain ratio of speed and amplifying the electroplated variations by said extremely slow travel.

6. The method of recording sound waves which consists in using a steady source of light rays impinging upon a selenium cell and varying the light rays by intercepting part of them by a portion of a developed film sound record varying in opacity and travelling past an aperture which restricts all light rays excepting at a small portion of said sound record and controlling by said selenium cell the current from a steady source of electricity connected to an electroplating device and a copper wire travelling through said electroplating device to be electroplated and restricting the area of said copper wire that is exposed to the action of said electroplating device and electroplating upon said copper wire variations in accordance with the variations in the said sound wave record and amplifying the plating action by causing said sound wave record and said copper wire to travel at a very slow rate of speed.

7. The method of recording sound waves upon a copper wire which consists in utilizing a developed film sound record, varying in opacity, coacting with a beam of light impinging upon a selenium cell, and travelling at a very slow rate of speed past an aperture and varying said beam of light in accordance with the variations in opacity recorded thereon and consequently varying the

resistance of said selenium cell and varying the current allowed to pass through said selenium cell and co-acting with an electroplating device with said copper wire travelling therethrough at a very slow rate of speed, and gearing said sound wave record and said copper wire to the same driving power and producing the same speed of said copper wire and said sound wave record or a certain relative ratio of speed and restricting the area of space on said copper wire acted upon by said electroplating device longitudinally at one time and thereby controlling the amount of space occupied by said sound waves.

JACK L. WALKER.