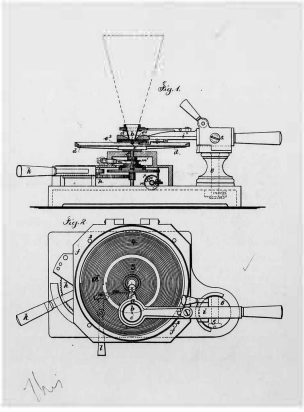
[New York,] May 29, 1878[1a]

Caveat: Phonograph



To all whom it may concern.

Be it known that I, Thomas Alva Edison of Menlo Park in the State of New Jersey United States of America Electrician, have invented, certain new and useful Improvements in means for Recording Sounds and in Reproducing such Sounds from such Record, and I do hereby declare that the following is a full clear and exact description of the same.

This invention consists in means for recording in permanent characters the sounds made by the human voice in speaking and singing, those made by musical instruments, birds animals or any sound whatever, and in means for reproducing those sounds at any desired time. The sound vibrations act upon a diaphragm or other body capable of motion; this diaphragm is at the back of a chamber provided with an opening or mouth-piece, and to this diaphragm an indenting point is secured. This instrument I term a "Phonograph." The phonograph is adjusted to position with its indenting point contiguous to a moving surface covered with a thin sheet of metal foil or other suitable material, or else the surface with the metal foil is stationary and the phonograph movable. The surface upon which the metal foil is secured is by preference grooved spirally and the indenting point indents the foil in the line of this groove as the diaphragm is moved back and forth by the sound vibrations, these indentations are a record of the sound waves and form the characters for reproducing the sounds. This indented sheet I term a "Phonogram."—

The instrument or portion of the instrument that reproduces the sound from the phonogram I term a "Phonet It is similar in construction to the phonograph, being provided with a diaphragm and point, but the mouthpiece is by preference funnel shaped to render the sound loud and distinct.—

The sounds are reproduced by the phonet being adjusted to place so that the point of its diaphragm is at the beginning of the spiral line of indentations and as the surface containing the indented foil is moved, the diaphragm of the phonet is vibrated by the point passing from one indentation to the next, hence the diaphragm receives the same movement from the indentations as when making those indentations, consequently the sounds made by the phonet will be the same as those that operated upon the diaphragm of the phonograph.

In the drawing Fig. 1 is a section of the phonograph and sectional elevation of the mechanism for presenting the surface to be indented, and Fig. 2 is a plan of the same.[2]

Fig.[b] 1.

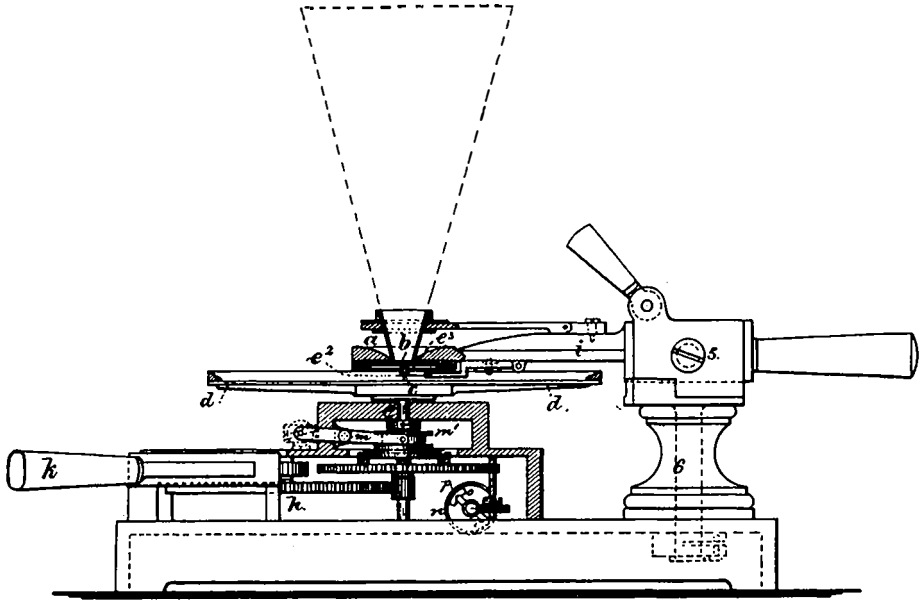
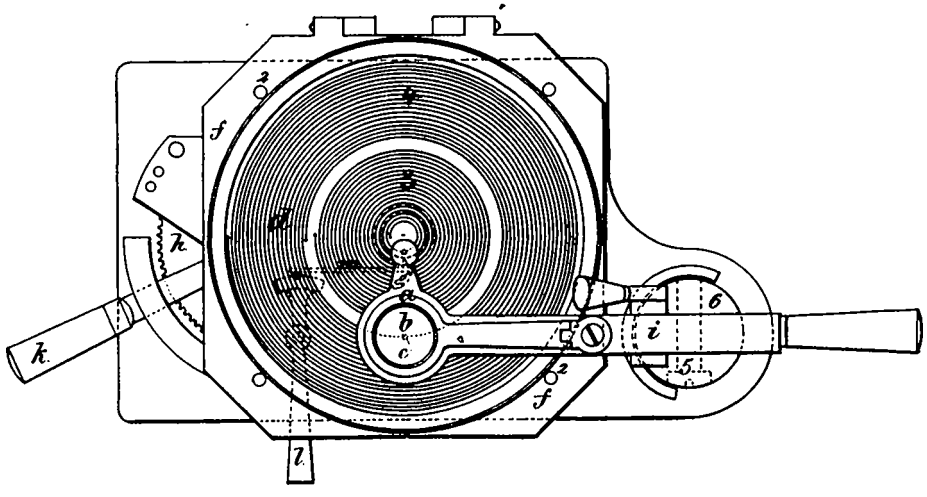


Fig. 2.



The phonograph is made of the body portion a diaphragm b and indenting point[3] c. The body portion a has a central opening forming the mouth-piece into which the person speaks or through which opening the sound vibrations pass to act upon the diaphragm and the diaphragm is secured at its edges to the body a leaving a space between the body and diaphragm in order that the diaphragm may vibrate freely.— The indenting point should be a diamond or other very hard substance The diaphragm is made of a thin sheet of iron or other material and it is preferable to place the indenting point

upon a delicate spring arm e[2] and to employ a short piece of rubber tubing e[3] between the spring and diaphragm, this rubber acts as a damper to prevent false vibrations of the diaphragm— The phonograph is upon a lever arm i pivoted at 5 to the vertical stud 6 so that the phonograph may be raised or lowered vertically or moved horizontally for a purpose hereafter explained—

It is now to be understood that if a person speaks with his mouth near the mouth-piece of the phonograph, the sound vibrations will act upon the diaphragm and vibrate it and communicate to the indenting point a similar movement, and that if a piece of metal foil or other material susceptible of being indented is placed beneath or behind the indenting point and caused to move regularly, or the indenting point moved over the material, that said material will be indented and form a perfect record of the sound vibrations I will now describe the means for sustaining the sheet to be indented and the mechanism for moving the same

d is a disk or plate secured to and turning with the shaft[4] e and hinged to this disk is a ring-frame f: this disk d has two spiral grooves 3 4 in its surface

There are pins 2 2 upon the surface of the disk and holes at corresponding places in the ring-frame; the sheet to be indented is of a size and shape to correspond with that of the disk d and frame f and said sheet has holes in it corresponding to the position of the pins 2 2 and these holes form register marks in placing or replacing the sheet upon the disk d and after the sheet is so placed, the ring-frame f is brought down upon the sheet and holds it firmly in place. There may be a central opening in the indented sheet of a size slightly larger than the space occupied by the spiral 3 and the outer edges of the sheet are stiffened by a ring of thick paper or paste-board caused to adhere by glue or other adhesive material. The surface of the disk d is made with two spiral grooves 3 and 4 as aforesaid, the groove 3 is a guide for a pin that is upon an arm[5] g on the phonograph and the groove 4 is for the indenting point c.

As the disk and sheet are revolved, the groove 3 causes the indenting point to occupy a position immediately over the line of the spiral 4 and the indentations will be made upon the sheet of foil in a line corresponding to that of the spiral 4 shown in fig. 2.

The indentations made in the foil are a complete record of the sound vibrations that acted upon the diaphragm b and

from this indented sheet which I term a "phonogram," the sounds are reproduced.

The phonograph is carried outwardly by the spiral 3 and in so doing the parts swing upon the vertical stud 6 By depressing the outer end of the lever i the phonograph is raised so that it can be swung aside from the disk d to allow of the ring-frame f being thrown back and the indented sheet or "phonogram" removed from the disk.

The shaft e is revolved by a weight or spring and gearing at h and the spring is wound up by moving the lever k back and forth which acts upon a ratchet and pawl of ordinary construction. l is a lever provided at its outer end with an inclined groove in which is a pin on the lever[6] m and the other end of this lever m is connected with the coupler m[1] by moving the lever l one way or the other, the shaft e will be connected to or disconnected from the gearing h and hence the disk d stopped or started at pleasure without interfering with the motor.

As it is necessary that the shaft e should be revolved with uniformity, I provide a governor at n to prevent the apparatus revolving too rapidly and this may be made as in figs 1 3 & 4 in which there are metal blocks o at the ends of spring arms from a crosshead on a shaft that is driven by the gearing h said blocks swinging radially and acting against the interior of a stationary cylinder p if the speed becomes too great, thereby checking the speed by the friction of the blocks against the cylinder.

Fig. 3.

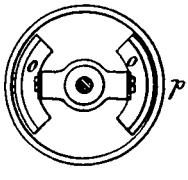


Fig. 4.

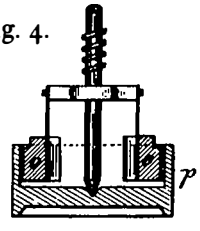
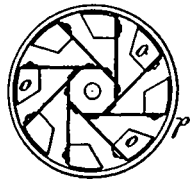


Fig. 5



These spring arms may be secured at one end to a prismatic block as shown in fig. 5. It is preferable to cover the surface of the blocks o next the cylinder p with felt or similar material that will slide upon the interior surface of the cylinder p but produce more or less friction according to the centrifugal action—

The guide spiral 3 may be dispensed with and either of the devices shown in figs 6 7 8 or 9 made use of

Fig. 6.

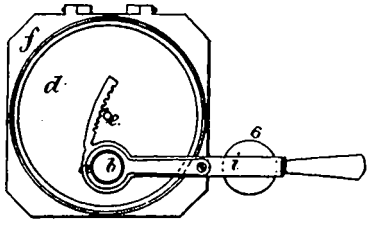
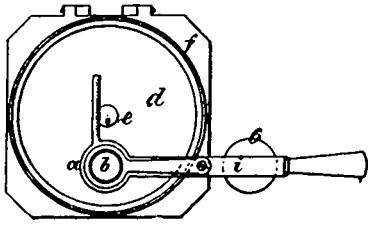
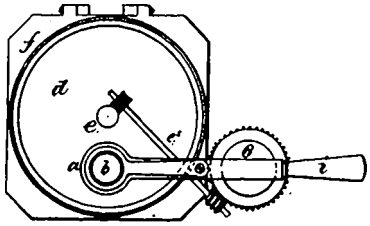


Fig. 7.



In figs. 6 and 7 the shaft e projets above the surface of the disk d and there is a tooth upon the shaft contiguous to a rack-bar extending from the phonograph, hence each revolution of the shaft the rack-bar and phonograph will be moved the space of one tooth, consequently the lines of indentations will be parallel and concentric to the shaft e excepting at the places when the tooth acts to move the rack-bar and phonograph outward or inward— In this case the spiral grooves are cut to correspond to the feed.

Fig 8.

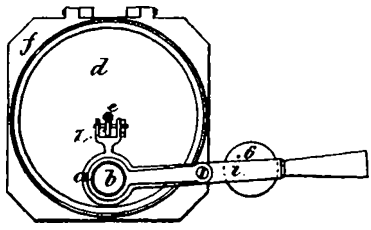


In fig. 8 a worm upon the shaft e acts upon a worm pinion to revolve the shaft e^5 and the worm at the other end of this shaft e^5 acts upon teeth around the base of the lever i on the stud 6: by this device the phonograph will be moved outward gradually and the line of indentations will be in a spiral corresponding to the continuous spiral groove in the plate d.

Fig. 9.

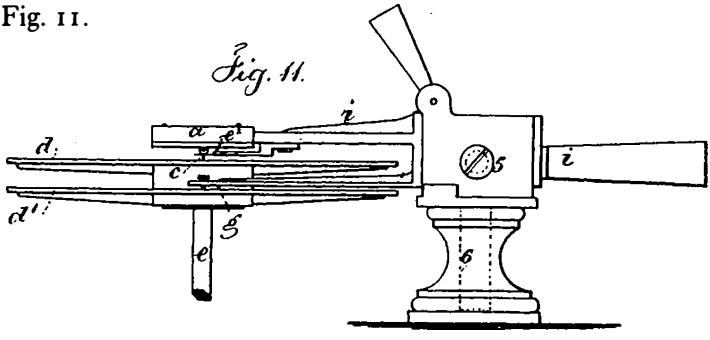
In fig. 9 the shaft e is made with a fusee at P^1 and one end of a swinging arm connected to the phonograph takes against the same; the spirals of the fusee gradually move outward the phonograph as the disk and shaft are revolved and the line of indentations will be spirally the same as that made by the spiral 3.

Fig. 10.



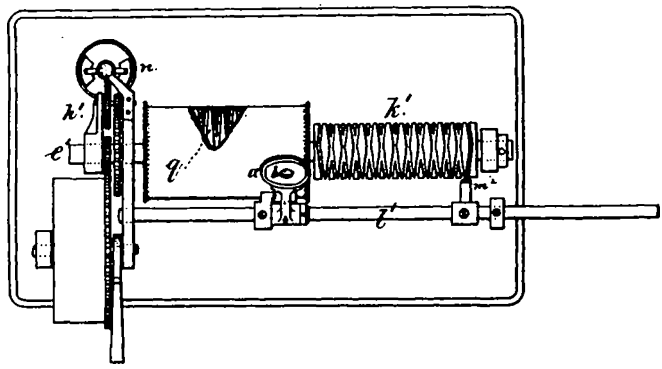
In fig 10 the shaft e is provided with a screw pinion meshing with teeth upon a cam-wheel 7; this gives the same movement to the phonograph as the spiral groove 3.

Fig. 11.



In fig. 11 the guide groove 3^7 for the arm and pin g is upon a disk d^1 upon the shaft e but the groove 3 occupies the same relative position upon the disk d^1 as the groove 4 upon the disk d so that the phonograph is moved outwardly by the groove of the disk d^1 swinging both the arms g and i upon the vertical pivot 6.

Fig. 12.[8]



Instead of the sheet of metal foil being upon the disk d it may be wrapped upon a cylinder q as in fig. 12. In this case the cylinder is upon a shaft e^1 revolved by the gearing at h^1

and upon said shaft there is a right and left hand screw at k^1 and there is a corresponding double spiral groove in the surface of the cylinder q.

The phonograph is secured to a sliding shaft l^1 and said shaft is moved endwise back and forth by the screw k^1 acting upon an arm m^2 that is secured to the said shaft l^1. As the phonograph is moved in one direction, the line of indentations is made spirally in the foil on the cylinder q and when the arm m^2 reaches the end of the screw it will be moved in the other direction by the reverse screw thread and the phonograph will make a second spiral line of indentations that will cross the first spiral line. This feature is especially available for a phonet where the surface of the cylinder q is formed of an electrotype or other copy of the phonogram, so that the words or sounds may be reproduced automatically and at intervals if desired—

Fig. 13.

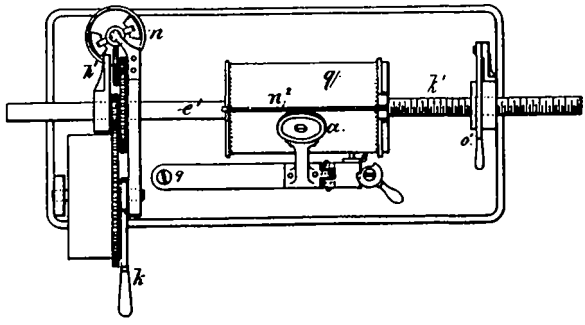
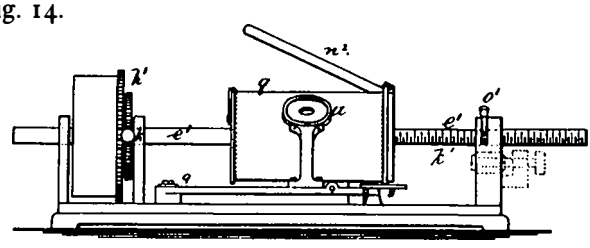


Fig. 14.

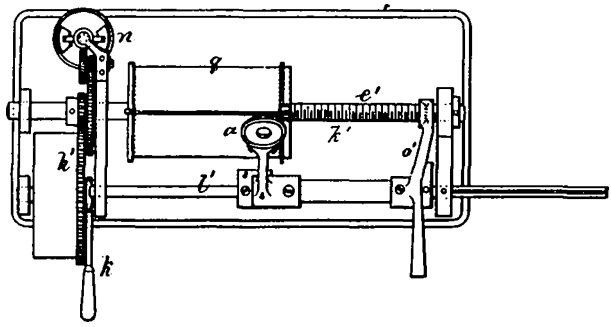


It is preferable to make use of a thin metal plate n^2 see figs. 13 and 14 pivoted at one end and fitting within a longitudinal groove in the surface of the cylinder q for securing the edges of the metal foil and holding it securely upon said cylinder— The top of the plate n^2 is flush with the surface of the cylinder and grooved to correspond with the grooves in the cylinder so as not to interfere with the indenting point A wire may replace this device such wire being secured by arms at each end of the cylinder and raised and lowered in and out of the

groove by a cam or otherwise— I find that an interruption of one eighth of an inch space where there is no recording is not detected by the ear.

The apparatus shown in figs. 13 and 14 is similar to that shown in fig 12 except that the phonograph is stationary and the cylinder moves horizontally and the shaft e^1 is only provided with a screw thred in one direction, hence the cylinder will have to be moved back by hand to bring it to place if desired to reproduce the sounds from the phonogram, or to position the phonograph if a new sheet of foil is to be indented after the first one has been removed— This is readily accomplished by raising the arm o^1 and its tooth from the screw k^1 which leaves the shaft up and cylinder free to be moved back and forth.

Fig. 15.



In fig. 15 the phonograph is fitted to move horizontally instead of the cylinder q as in fig 12 but the shaft e^1 is provided with a screw thread in one direction only, hence the phonograph has to be positioned by hand after the arm o^1 has been raised from the screw k^1.

In figs. 12 and 15 the phonograph can swing upon the shaft l^1 to raise the indenting point from the cylinder q and allow for the removal or insertion of a sheet of foil, and there is a stop[9] at 8 for adjusting the position of the phonograph when brought down to indent the foil. In figs. 13 and 14 the phonograph is upon an arm pivoted at 9 so that it can be swung horizontally away from the cylinder q for the purpose aforesaid and the adjustable stop[10] 8 is also provided—

Thus far I have described the "phonograph" or instrument upon which the sound vibrations act, and which instrument acts to indent the sheet of foil and produce the "phonogram" or record of such sound vibrations; mechanism has also been described for presenting the sheet of foil to be indented by the

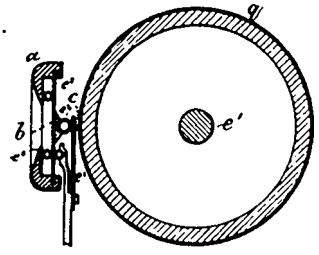
phonograph. I will now describe how the sounds are reproduced from the phonogram—

If it is desired to reproduce the sounds from the phonogram in the same instrument in which the phonogram was produced, it is only necessary that the indenting point c be made to traverse the line of indentations in the phonogram and that a funnel shaped mouth piece, shown by dotted lines in fig. 1 be added to the phonograph, to aid in increasing the loudness and distinctness of the sound. The instrument in this form I term a "Phonet"—

In the instrument shown in figs. 1 2 6 7 8 9 10 11 13 14 and 15 the phonet requires to be positioned by hand as before explained in order that the point c may be placed at the beginning of the spiral line of indentations. As the point c passes from one indentation to the next either by the foil being moved beneath said point as in figs. 1 2 6 7 8 9 10 11 13 and 14 or by the point moving over the foil as in figs. 12 and 15 the diaphragm b receives a movement corresponding to the depth of the indentations, and corresponding also with the same movement it received from the sound vibrations when making those indentations, hence air waves will be produced by the movement of the diaphragm that will make sounds by passing through the mouth-piece of the phonet that will be exactly the same as the sounds that acted upon the diaphragm of the phonograph. The material upon which the record is made may be metal foil such as tin, iron copper, lead zinc cadmium, or a foil made of composition of metals, paper or other materials may be used, the same being coated with parafine or other hydro-carbons, waxes, gums, or lacs, and the sheet so prepared may itself be indented, or the material, say paper may be made to pass through a bath of hot parafine and thence between scrapers; thin metal foil is now placed on the material and the sheet passed through rollers which give it a beautiful smooth surface. The indentations can now be made in the foil and the parafine or similar material and the indenting point does not become clogged with the parafine in consequence of the intervening foil. If the copper-foil or tin-foil with copper surface is used, and a matrix of iron or steel made by electrotype deposit or otherwise upon the phonogram, such matrix may be hardened and used for impressing a sheet or roller of metal as hereafter mentioned, thereby the original phonogram can be reproduced indefinitely in metal that may be hardened and used for any reasonable length of time to utter the sentence or words or sounds phonetically—

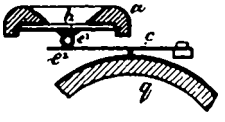
I will now briefly describe some modifications in the construction and operation of the Phonograph and Phonet.

Fig. 16.



In fig. 16 the indenting point c is upon a spring arm e^2 as in figs. 1 and 2 but there are short sections of rubber tube e^3 at each side of the diaphragm b to dampen the diaphragm and prevent false vibrations.

Fig. 17.



In fig. 17 the rubber of the diaphragm acts against the outer end of the arm e^2 to increase the leverage and lessen the depth of indentations in the foil and allow of the record being made in less yielding material than tin-foil.

Fig. 18.

Fig. 18 shows a modification of the last mentioned device the pressure being applied to the arm e^2 between the indenting point and the support for the arm so as to increase the depth of the indentations.

Fig. 19.

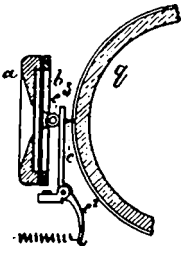


Fig. 19 shows the arm e^2 made as a lever with a spring

Fig. 20

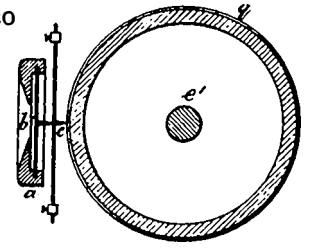


Fig. 20 shows the indenting point upon the center of a spring bar that is firmly held at each end; the bar is connected at its center to the diaphragm b by a string or otherwise.

Fig. 21.

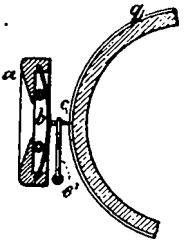


Fig. 21 represents the diaphragm b as of concave form instead of flat.

Fig. 22

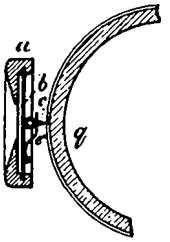


Fig. 22 shows the indenting point upon a spring secured to the diaphragm.

Fig. 23

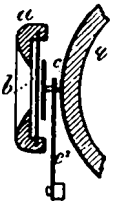


Fig. 23 shows a disk upon the spring e^2 of the indenting point; this disk is placed quite close to the diaphragm and is moved by the air as the diaphragm is vibrated, the disk being so close to the diaphragm that the two will vibrate together as

air cannot pass between or escape as rapidly as the vibrations take place.

Fig. 24

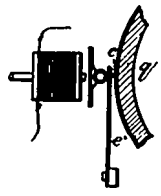


Fig. 24 shows the diaphragm vibrated by electro-magnetism In this case the diaphragm is to be of iron and the power of the electro-magnet will be varied by a rise and fall of electric current passing through the helix of the electro-magnet, this rise and fall of electro-tension is to be produced by the action of sound upon a diaphragm and connections in an electric circuit.

Fig. 25.

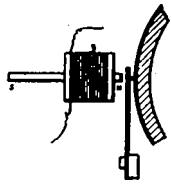


Fig. 25 shows the method of vibrating the indenting spring and point by the direct action of an electro-magnet without the use of a diaphragm, the electric tension in the helix being varied by sound vibrations upon a diaphragm.

Fig. 26.

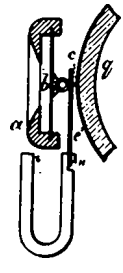


Fig. 26 shows the spring arm e^2 connected to one end of a permanent magnet so as to highly magnetize the reproducing point; the foil should be of iron;— when the point passes an indentation there will be less attraction than when passing no indentation; this will give good articulation free from the scraping noise of the point on the foil, for in this case it does not touch the foil but is worked by magnetic attraction.

Fig. 27.

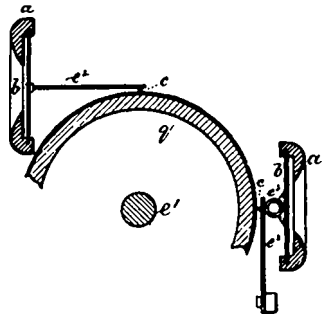


Fig 27 represents two instruments in connection with the cylinder q in this case the phonet and the phonograph are separate. The phonograph records in the usual manner but the phonet has its diaphragm set in motion by the rise and fall of the lever e^2. This reduces the scraping noise of the foil and acts by leverage and a slight tension to move the diaphragm as the phonogram is moved beneath the point c.

Fig. 28.

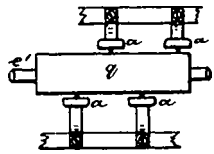


Fig. 28 shows an arrangement whereby four persons may speak simultaneously and have records made in separate parallel lines upon one cylinder and the phonogram will reproduce the sounds the same as though it contained the record of but one voice.

Fig. 29.

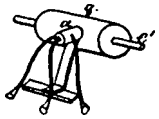
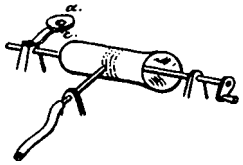


Fig. 29 shows a single phonograph adapted to receive the voices of three persons as in singing; the sounds made by the three voices are conveyed through flexible or other tubes to the diaphragm and will be recorded in a single line of indentations, but when reproduced by the phonet the sounds uttered will correspond to the three voices.

Fig. 30.



In fig. 30 the foil is sustained upon a hollow cylinder with a funnel shaped end. The record is made upon the foil in the usual manner by the phonograph excepting that holes are made entirely through the foil. A nozzle with a small opening is placed so that it will always be opposite the line of perforations as the cylinder is revolved. This nozzle is connected to a source of compressed air or other fluid, and every time a perforation comes opposite the nozzle, a puff of air passes into the cylinder and a sound is produced upon the principle of the siren— The nozzle may be placed on a spring to keep the end of the nozzle in contact with the line of perforations.

Fig. 31.

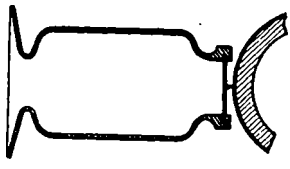


Fig. 31 shows the phonograph as made with a large chamber between the diaphragm and the mouth-piece this is especially useful in collecting sound when the person speaking or the sound to be recorded is made several feet from the instrument—

Fig. 32.

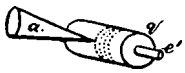


Fig. 32 shows a device whereby the indenting point may be dispensed with in the phonograph. The funnel forming the phonograph is made with a diaphragm at the larger end or mouthpiece, and a very small hole at the pointed end adjacent to the foil on the cylinder q; this foil should be very thin so that the indentations will be made by the direct action of the air waves as concentrated by the funnel without the interposition of the indenting point.—

Fig. 33.

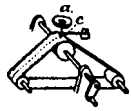


Fig. 33 shows a phonet in which the phonogram or sound record has been made upon an endless belt: this is a convenient arrangement for toys as the same may be made to imitate the bark of a dog or other noise made by an animal, and this belt may be of steel or other hard material that allows the same to be used for a long period of time.

Fig. 34.

Fig. 34 is a perspective view showing a double phonet there being a spiral line of indentations on each side of the revolving disk d one phonet coming into action as the other finishes: in this case the spirals should be in opposite directions so that the disk continuing to revolve in the same direction, moves one phonet from the center outwards and then the other phonet is connected and moved back towards the center: this may be used as a toy.—

Fig. 35

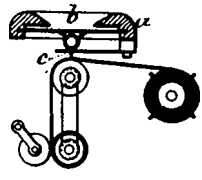


Fig. 35 represents a phonet in which the phonogram containing a sentence, speech, words, or other sound record is upon a belt or strip wound upon a reel; this belt is drawn along gradually and wound upon the second roller by any suitable mechanism, and as the phonogram is thus moved it actuates the phonet c b.

Fig. 36

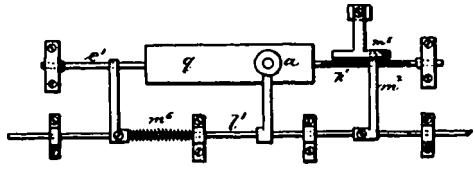


Fig. 36 shows a phonograph or phonet similar to that shown in fig. 12; the cylinder q is revolved but remains in one position and the phonograph or phonet is movable back and forth over the cylinder In this instance the arm m^2 is extended beyond the screw k^1 and passes beneath the inclined spring guide m^5 when the screw is carrying the arm and phonograph towards the right: as the arm m^2 passes from beneath the end of the guide m^5 it is no longer held to the screw and the arm m^2 and phonet are lifted by the guide m^2 as the spring m^6 draws the shaft, phonograph and arm along to the place of beginning, at which place the arm m^2 drops off the end of the inclined guide m^5 into the thread of the screw, and as this revolves it carries the arm along beneath the guide m^5 as before.

Fig. 37

Fig. 37 represents the phonograph or phonet upon a pivoted arm so that it may swing across or at right angles to the line of movement of the indented material or phonogram. In this case the line of indentations may be lengthwise of the belt or across the same in the arc of a circle

Fig. 38

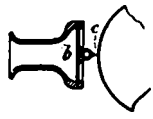


Fig. 38 shows a phonograph similar to that shown in fig. 31 except that the sound chamber is of a different shape

Fig. 39.

Fig. 39 shows a mouth-piece with an orifice of soft rubber to fit the mouth or the lips of the person speaking so that all sound waves will be confined to the chamber and diaphragm.

Fig. 40.

Fig 40 shows the mouth-piece of the phonograph made with cross slots with irregular edges.

Fig. 41.

Fig 41 shows the mouth-piece as perforated with numerous holes.

Fig. 42

Fig. 42 shows but one opening in the mouth-piece: the edges of this are irregular— These irregular edges reinforce the hissing sounds and cause a more perfect phonogram[c] to be produced.—

Fig. 43.

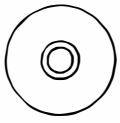


Fig. 43 represents a mouth piece of mica with a central opening protected at its edges by a wooden ring—

Fig. 44

In fig. 44 the diaphragm b is of wire gauze with a backing of paper connected to it by any suitable cement and there is a ring of stiff paper at the edges of the gauze disk to strengthen it.—

Fig. 45.

Fig. 45 represents a diaphragm b of parchment or similar material stretched tightly within the frame b^6 by cords and screws— The cords may be of different lengths and tension and respond to and reinforce certain sounds.

Fig. 46.

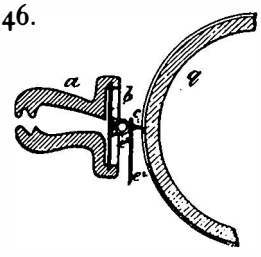


Fig. 46 shows a mouth-piece for the phonet made in imitation of the human mouth.

Fig. 47.

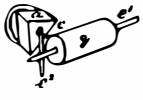


Fig. 47 represents the body portion of the phonograph or phonet made triangular and the diaphragm is of corresponding shape.

Fig. 48.

Fig. 48 represents three cylinders each provided with a phonograph or phonet; this is useful in recording and reproducing three part singing or music.

Fig. 49

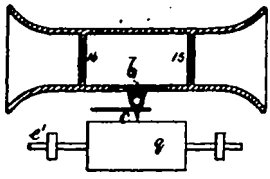


Fig. 49 represents a phonet made as a tube with flaring or trumpet shaped ends and with two diaphragms 15 16 placed cross-wise of the tube so as to form an air chamber— There is a third diaphragm b which is vibrated by the movement of the reproducing point c and said diaphragm gives motion to the air in the chamber and vibrates the diaphragms 15 16 which latter produce air waves and the sounds issuing from the two trumpet shaped ends will blend and increase the volume of sound.

Fig. 50.

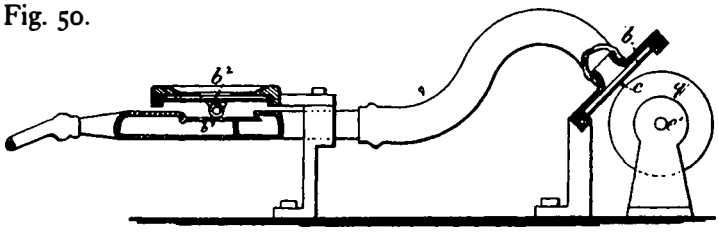


Fig. 50 represents a device whereby deep indentations are made in the metal foil— Two diaphragms are employed; the first:[11] b^2 is vibrated by the sound vibrations and controls a valve b^7 in a tube connected with a source of compressed air or other fluid; this valve b^7 allows more or less air to pass to the diaphragm b according to the vibration of the diaphragm b^2 hence the diaphragm b will vibrate in harmony with the diaphragm b^2 but it will be acted upon by greater force and consequently the indentations will be deeper in the foil than if the diaphragm b was acted upon simply by the sound vibrations of the voice.

Fig. 51.

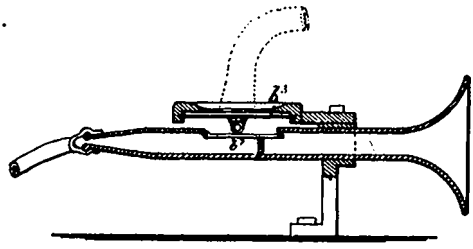
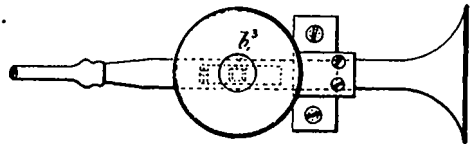


Fig. 52.



Figs 51 and 52 represent a device that may be used with a phonet to increase the loudness of the sounds reproduced. The sound vibrations from the phonet are conducted by a tube shown by dotted lines in fig. 51 to the diaphragm b^3 that controls a valve b^7 in a tube connected with a reservoir of air or other fluid under pressure, and the air as it escapes by the valves passes into the trumpet shaped end of the tube and produces sounds that are very loud and clear and are a reproduction of the sounds resulting from the use of one of the phonets before described.

This same apparatus may be used to reproduce with louder utterances a person's voice, the sound from the voice being used to vibrate the diaphragm b^3 and thereby regulate the air waves escaping from the valve b^7 into the trumpet.

Fig. 53

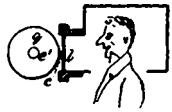


Fig. 53 shows the speaker's head within a box or case; in this instance nearly all the sound vibrations act upon the diaphragm.

Fig. 54.

Fig. 55.

Figs. 54 and 55 illustrate how the movements of the lips in speaking may be recorded and reproduced. In this instance a lever applied to the diaphragm carries the indenting point c

fig. 55 and the end of this lever is placed in the mouth of the speaker and the movement of the lips regulates the indentations in the foil. A similar apparatus shown in fig. 54 within a case is connected to the movable lips of a mask so that these lips open and close as in articulation at the same time that the sound vibrations are given by the phonogram to the phonet.

Fig. 56.

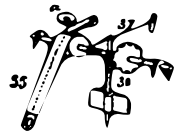
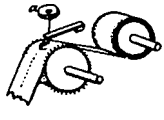


Fig. 56 represents a toy phonet in which the phonogram strip 35 is secured at one end to a cylinder upon which it is wound— By pulling upon the strip it is unwound and a rubber cord 37 is wound upon the shaft of the cylinder— When the hand is removed from the indented strip the rubber cord rotates the shaft and winds up the phonogram upon the cylinder and the sounds are reproduced in the phonet by the phonogram acting upon a point and diaphragm a. The movement of the shaft is regulated by the fan, worm and pinion 38.

Fig. 57



In fig 57 the cylinder for moving the phonogram-strip is shown as provided with pins that enter holes in the edges of the strip; this causes the strip to be fed along very regular.

Fig. 58.

In fig. 58 the cylinder with pins is shown as made with heads to act as guides for the strip

Fig. 59.

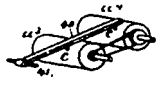
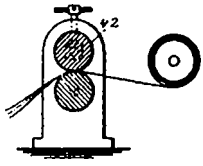


Fig. 59 shows a re-indenting device for amplifying or increasing the size of the indentations— There are two rollers one of which a^4 travels faster than the other a^3 and there is a lever 40 pivoted at 41 and provided with a point c for each cylinder. One point follows the indentations in the cylinder a^3 and the other rests upon a^4 and as this travels the fastest, the

indentations made therein will be longer and also deeper by the point being at the outer end of the lever.

Fig. 60



In fig. 60 one roller 42 of the pair is made of hardened metal with the sound record in relief. This is obtained by electrotype or other process from an iron foil or other metal phonogram and this roller is used to indent strips or sheets of foil or rollers to produce copies that can be used with the phonet.

Fig. 61.

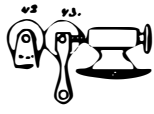
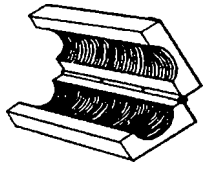


Fig. 61 represents a roller 42 of hardened metal with the record in relief and arranged so as to knurl or indent the phonogram in a roller 43 of soft metal that is to be pressed against the roller 42 by a screw or other suitable means.

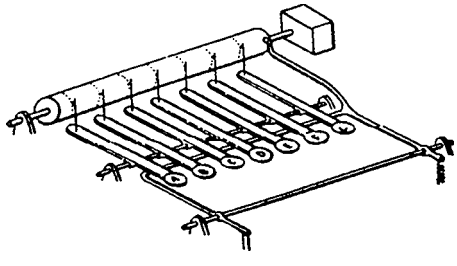
Fig. 62



The cylinder having a spiral groove in its surface may be made by placing the mould shown in fig 62 around a cylinder or shaft and filling the space between the cylinder and mold with plaster of paris or other suitable material— The mold is of metal with a screw or spiral rib projecting therefrom and it is made in two parts and hinged so that it can easily be removed when the plaster of paris is dry

For amusement or instruction the phonograph is capable of extended use.

Fig. 63



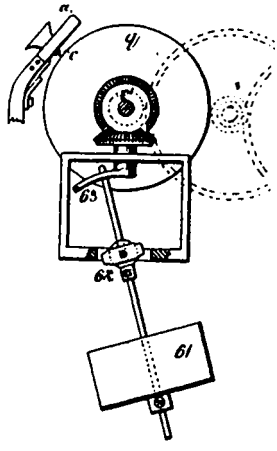
For instance, a revolving cylinder, see fig. 63 containing rows of indentations representing the letters of the alphabet and provided with keys containing corresponding letters, can be used in teaching the alphabet, and sentences, speeches, and other matter can be spoken by the phonet and repeated by the learner without the eyesight being called into use.

Clocks may be provided with phonogram cylinders or wheels to call off the hours, to give alarms &c.

The phonogram may be upon a strip, sheet, belt, or roller, and it can be of a dog's bark a rooster's crow, a bird's song, a horse's neigh, and these can be used in toy animals with a simple phonet for reproducing the sound.

In copying phonograms or making duplicates, an original phonogram may receive a deposit of copper, or iron in a plating bath, and if of iron may be carbonized to convert it into steel and hardened and then the same should be backed up with type metal and used for impressing strips or pieces of metal A bed of gutta percha or similar material may be used to sustain the sheet metal while being pressed; numerous copies of the original phonogram can thus be reproduced— A plaster cast can be used for producing a copy by pressure.

Fig. 64.



The governor to regulate the speed of the instrument may be made of a pendulum weight 61 see fig. 64[d] hung at the lower end of a rod that is provided with a universal joint at 62 and the upper end of the rod is moved around by a crank 63 that is revolved by the train of gearing— As the speed increases the weight will describe a circle of larger diameter and thereby increase the resistance—

The universal joint may be displaced by a spring wire fig. 65 that allows of the movement—

Fig. 65.

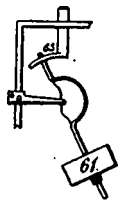
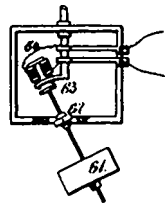
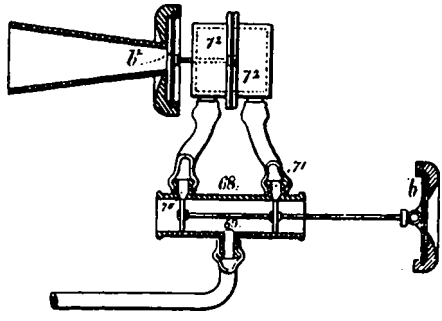


Fig. 66



A magnet 64 upon the crank-arm 63 fig. 66 may be used to revolve the pendulum by attracting an armature at the upper end of the pendulum rod and thereby avoid the friction resulting from the contact of the surfaces of the pendulum rod with the crank.

Fig. 67.



In fig 67 the diaphragm b is represented as connected to a pair of delicate piston valves within a tube 68 that has three parts, one 69 is connected to a reservoir of compressed air; the others 70 and 71 are connected to a chamber 72 at opposite sides of a diaphragm so as to vibrate the same in harmony with the diaphragm b but there will be greater amplitude given to the same by the pressure of the air and by a connection to the phonet diaphragm b^2 the sound produced will be greatly increased.

I shall probably[c] claim as my Invention,

~~First. A phonograph apparatus consisting in the combination with a diaphragm or body vibrated by sound, of a point and a surface upon which a record is made by indentations to produce a phonogram, substantially as specified.~~

~~Second. The combination with a phonogram of a phonet to reproduce the original sound, substantially as set forth.~~

~~Third. The method of reproducing speech and other sounds consisting in recording the same by the atmospheric vibrations and reproducing corresponding vibrations by the record or phonogram giving motion to a diaphragm or similar movable body.~~

1[f] The combination with the diaphragm and point of a

flat receiving surface and means for revolving the receiving surface and causing the point to follow a volute or spiral line, substantially as represented in figs. 1 2 6 7 8 9 10 and 34

2 The combination with the phonograph or phonet of a propelling weight or spring and a governor to regulate the speed and ensure uniformity of movement substantially as set forth.

3 A revolving disk provided with a clamping frame to secure the foil or other material in combination with the swinging arm diaphragm and point substantially as specified.

4 The combination with a revolving grooved cylinder of a diaphragm and point and a screw or other mechanism for causing the point to correspond in position with the groove so as to indent the foil or other material wrapped around the cylinder substantially as set forth and shown in figs. 12 13 14 15 16 17 & 18.

5 In a phonograph or phonèt, a spring introduced between the diaphragm and the point substantially as set forth and shown in figs. 16 17 18 19 22 and 26.

6 In a phonograph or phonet, a rubber spring or similar device to dampen the vibration of the diaphragm and prevent false vibrations as set forth and shown in figs. 16 and 21.

7—The combination with the diaphragm in a phonograph or phonet apparatus of a lever to modify the relative action of the diaphragm and point substantially as described and shown in figs. 17 18 27.

8 The combination with the diaphragm and point, of a permanent or electro-magnet, substantially as described and represented in figs. 24 25 26.

9 The method of recording and reproducing two or more sounds or speeches simultaneously substantially as described and as illustrated by figs. 28 29 and 48.

10 A phonet composed of a perforated sirene and a jet tube substantially as described and represented in fig. 30.

11 The mechanism for producing a phonogram and employing the same in a phonet substantially as described and illustrated in figs. 32 33 35 36 and 37.

12 The combination with the phonograph diaphragm and point of a sound chamber substantially as described and illustrated in figs. 31 38 39 and 53.

13 The diaphragm and mouth-pieces for a speaking phonograph substantially as described and as illustrated in figs. 41 42 43 44 45 and 46.

14 The combination with a diaphragm and its point of

two diaphragms for the purposes and substantially as shown in fig. 49.

15 In combination with a diaphragm and valve actuated by sound vibrations, a source of compressed fluid and a trumpet as in figs. 51 52 ~~on~~ or[c] a phonograph, as in fig. 50 substantially as set forth.

16 The combination of two diaphragms with a valve and a source of compressed fluid as represented in fig. 67 for increasing the volume of the voice or other sound as set forth.

17 The combination with two or more phonograms, of phonet keys for selecting letters or utterances as described and illustrated in fig. 63.

18 The means for duplicating or reproducing phonograms from an original phonogram substantially as set forth.

19 The combination with the phonograph or phonet of the revolving crank and pendulum governor substantially as described and shown in figs. 64 65 66.

20 The combination with the phonograph of a lever moved by the lips and of a lever and phonet to move the lips of a mask, substantially as described and illustrated by figs. 55 and 54.

21 The combination with a phonogram of a clock movement or toy and a phonet for reproducing sounds for clocks or toys substantially as set forth.

D (transcript), NjWOE, DF (*TAEM* 18:669). In an unknown hand. Periods used to demarcate figure references have not been reproduced. [a]Date from file wrapper. [b]All figures are on eight separate sheets. [c]Interlined above. [d]"see fig. 64" interlined above. [e]"shall probably" interlined above. [f]This and all subsequent claim numbers in a different hand.

1. Edison executed this caveat (Caveat 80) on this day and filed it at the Patent Office on 3 June (it is not in the existing National Archives file of Edison caveats; neither is Caveat 81 or 82). He had begun sketching designs for it on 5 March, and had drawn more on 28 March (NS-78-007, Lab. [*TAEM* 7:871–72]). At the same time, Lemuel Serrell was assembling materials for Edison's foreign phonograph patent applications. Serrell wrote Edison on 2 May that drawings and specifications for those applications awaited his approval for photolithographing (DF [*TAEM* 18:659]). Edison used those drawings as the basis for this caveat, which is why it includes material from his earlier phonograph caveat (Doc. 1227) and the drawings from his aerophone patent (U.S. Pat. 201,760), which had issued on 26 March. He did not include drawings from 30 April and later, even though some were labeled "Caveat 80" or "Caveat Phonograph" (Doc. 1310; NS-78-007, Lab. [*TAEM* 7:873]).

2. Edison's September patent application for the disk phonograph (Case 155) included figures 1–11 from this caveat (see Serrell to TAE, 8 July 1878, DF [*TAEM* 18:724]).

3. Located beneath "b" in figure 1, with an arrow pointing from "c" to the indenting point.

4. Located below and to the left of "c" in figure 1.

5. Located above "a" in figure 2.

6. Located to the left of "m1" in figure 1; to the left of "g" in figure 2.

7. Not shown in figure 11; see figure 2.

8. Edison's second September phonograph patent application (Case 154) covered much of the remaining material in this caveat along with the modifications to the clockwork cylinder phonograph of Doc. 1310. See Serrell to TAE, 8 July 1878, DF (*TAEM* 18:724).

9. Located to the right of "l1" in figure 15; similarly placed in figure 12 ("8" is illegibly small in both).

10. At right end of arm in figures 13 and 14.

11. Located at the top left; b7 is beneath b2.