The Phonographic Record

The Journal of The Vintage Phonograph Society of New Zealand

A Society formed for the preservation of Recorded Sound

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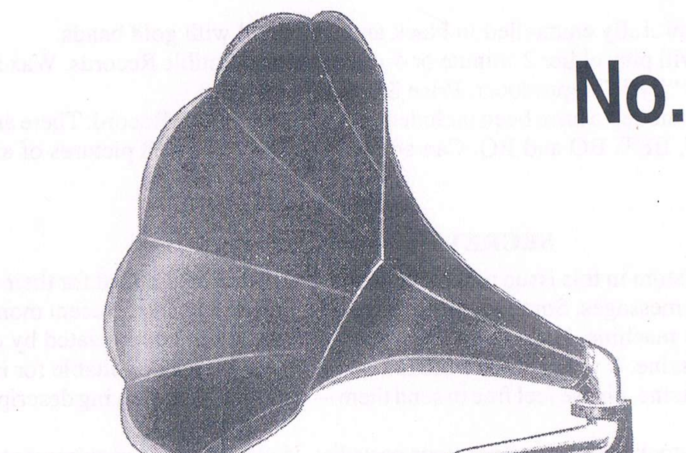
No. 36



Columbia BKT, No. 36

FOR YOUR INFORMATION

The start of another year and it appears to be one of the driest summers on record. A sad year 1998, the Society having lost two long-term members, namely Peter Mattison and Adair Otley.

Once again, members have come to our aid with photographs of their collections and this is always much appreciated by us and our many readers.

W. T. Norris, Editor

THE "NEW LEADER" COLUMBIA (CYLINDER) GRAPHOPHONE No. 36

(Front Cover)

Many of the principal advantages of the Columbia Disc Graphophone are embodied in this Cylinder Graphophone.

The "New Leader" is very compact, and in this respect is similar to the Columbia Disc Graphophones, the horn swinging over, and in any direction above the cabinet itself, and wholly dispensing with the awkward horn crane, horn stand, and rubber tube connection.

The motor has a double spring and plays three records at one winding. It is noiseless in operation and can be wound while running. The cabinet is beautifully designed, made of the finest selected oak and hand polished.

The floral horn is beautifully enamelled in black and decorated with gold bands.

The "New Leader " will play either 2-minute or 4-minute Indestructible Records. Wax records can be played only with our "Lyric" reproducer. Price $5.00.

This is the thirty sixth model to have been included in the Phonographic Record. There are only four more yet to come; BGT, BET, BO and BQ. Can anyone help us with good pictures of any of these models?

SECRETARY'S NOTES

As has become the custom in this issue of the magazine, members are thanked for their Christmas/ New Year greetings and messages. Some members have taken the trouble over recent months to send photos of their favourite machine, latest 'find' etc., and these are always appreciated by our readers when shown in the magazine. It you have a photo or two you think would be suitable for inclusion in a future issue of the magazine, please feel free to send them — a short accompanying description would be helpful too.

We have reasonable stocks of parts as per your parts list. If you have any requirements please let me know.

Lyndsey Drummond, Secretary

ILLUSTRATIONS

Columbia BKT - Deck and Motor:

Photographs taken by Bob Wright of Robert Sleeman's BKT, which is only the two minute model.

Lambert Typewriter:

The photographs were taken by Ron Corbett, and sent to us along with information about this machine which he owns. See article.

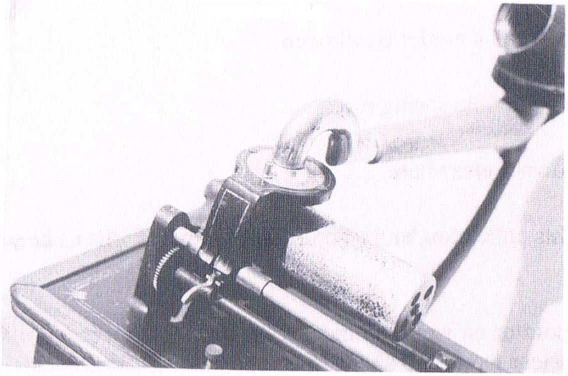
Adair Otley:

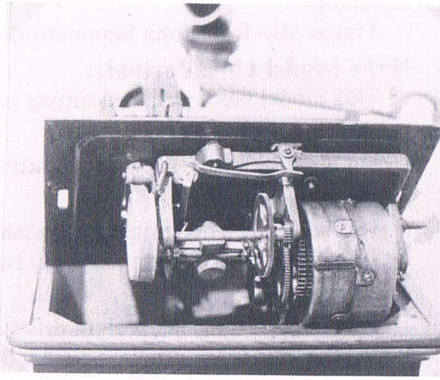
Nice photograph of Adair, kindly supplied to us by his wife, Hilde.

Semmens Collection:

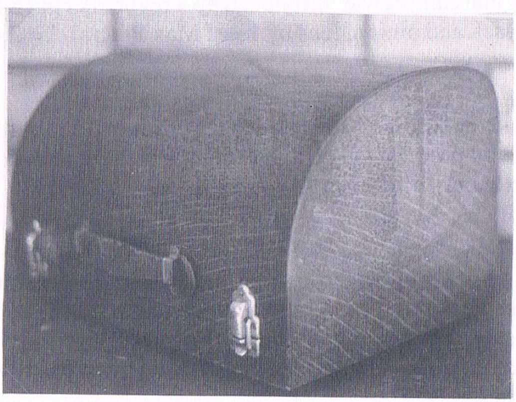
Pictures on this page all supplied by John and taken of his collection.

COLUMBIA BKT

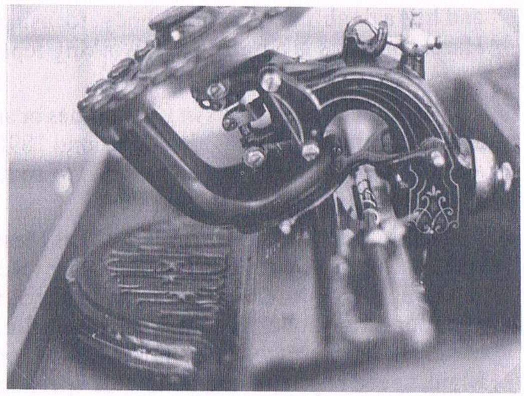




BKT Deck and Motor



Cover



Lambert Typewriter

Front View

Adair Otley

The Capehart Model 12B 1931:

Designed to play $33^1/_3$ and 78's.

Edisonic:

This is also from John Semmens collection, it is a model Beethoven.

HMV Model 114C Portable:

This model has a polished timber case and a double spring motor.

Puck:

Supplied by Mike Tucker. See article by owner elsewhere.

From Harold Burtoft:

We have very good photographs taken of his collection, and a good one of him. He tells us he will be 79 in March — Congratulations, Harold.

The Japanese Stick Clock:

This is most unusual, weight driven and pointer on weight indicates the time. The procedure for telling the time is so complicated that the Japanese gave it up about 1870, and made European clocks.

Daguerreian Camera:

This camera is also something different. The original camera was introduced by Voigtlander in 1841 and had a double conical brass body, focusing by rack and pinion, lens by Josef Max Petgral, f = 3.6. Harold says his is a replica, but working replicas are very rare.

Dolls:

This collection of Dolls in glass domes or small show cases, all are automata. They move and at the same time music plays — date is around 1890. Please note the magic mirror in this picture, and also a Stroh 'Cello — Harold believes this to be the only one of these in Australasia.

HMV Upright Grand, Model 157:

This model is fitted with the latest "His Master's Voice" Patented EXPONENTIAL Tone Chamber, ball bearing tone arm, and No. 5A Sound Box, and is designed throughout in accordance with the scientific principle of Matched Impedance. Sunk needle bowls for used and new needles, together with clips for "Tungstyle" needle tins. Automatic lid stay operated by one hand. Two record (12 inch) motor, 12 inch turntable, Self-Releasing Automatic Brake Operated by Moving Tone Arm to Extreme Right, speed regulator and automatic speed indicator.

Height $36^1/_4$ inches; Width $18^1/_4$ inches; Depth 20 inches; Internal Fittings Nickel Plated and Enamelled. External Fittings Oxidised Brass.

Mahogany — Spring £23. Oak — Spring £20.

HMV "Bijou" Grand, Model 145:

This model is fitted with the latest "His Master's Voice" EXPONENTIAL Tone Chamber, ball bearing tone arm and No. 5A Sound Box, and is designed in accordance with the scientific principle of Matched Impedance. Sunk needle bowls for new and used needles, together with clips for "Tungstyle" needle tins. Automatic lid stay operated by one hand. Double Spring Motor, 12 inch Turntable, Self-Releasing Automatic Brake operated by moving tone arm to extreme right, speed regulator. Record Storage Compartment.

Height $34^1/_4$ inches; Width 18 inches; Depth 17 inches; Internal Fittings Nickel Plated and Enamelled. External Fittings Oxidised Brass.

Mahogany — £17. Oak — £15.

The Upright Grands are taken from a catalogue kindly sent to us by Hart of Australia.

Needle Tins:

The needle tins are from the Semmens Collection, the HMV is a 194.

Capehart Phonograph Combination

John Semmens Photos

Edisonic

H M V 114C Portable

Edison B80:

This is the early model diamond disc, has reproducer control on tone arm, and is belt driven underneath.

Atwater Kent:

Atwater Kent and electric speaker along with an early type of aerial, is a model 40 and is complete in every way with A.K. radio log card.

Sonora Model E40:

This is a large Sonora model E40, made around 1929 and designed to play $33^1/_3$ and 78's. A plate on the back of the unit proclaims it is fitted to play the new longer playing records. All these machines are from the John Semmens' Collection.

OBITUARY

ADAIR OTLEY

Foundation member, former President and former Patron Adair Otley died in Christchurch on 1st December 1998 at the age of 69. The end came suddenly and unexpectedly although he had suffered a severe decline in health in recent years.

Adair began collecting 78s as a small boy before the Second World War. By the early 1960s he had built up a large collection, concentrating on vintage dance bands, light orchestras, music hall, comedy and piano. He was one of that original 'network' of collectors who made contact through recorded music societies etc. and who were known to Walter Norris and Pam Rogers when the invitations went out to meet at Pam's home in September 1965 to found our society. Over the next 20 years and more Adair proved to be one of our most devoted and enthusiastic supporters. Looking back it seems he never missed a meeting and his keen interest and good humour made a major contribution to our operation.

Always ready to 'do his bit', Adair served on the Committee from the start and in a variety of positions. Never one to push himself forward, he quietly did his best wherever needed. Perhaps more than anything he enjoyed running the display in the church at Ferrymead, where he was able to potter about, play records and rig up speaker systems to his heart's content. His ingenuity often surprised us and we came to appreciate that behind Adair's conservative appearance was a quirky and original personality.

Throughout the years that we knew him Adair continued to collect records. He embraced LPs, CDs and video with gusto and carried on an extensive correspondence by tape and letter. He was an ardent fan of Billy Mayerl, possibly the greatest syncopated novelty pianist-composer of the 20s and 30s. I recall his delight when I asked if he could use a Parlophone of Dajos Bela and his orchestra playing "You're my Greta Garbo' ("You don't SAY! I've been looking for that for YEARS!").

Never a machine collector per se, he owned several good gramophones over the years, notably a handsome oak-horn Columbia disc machine which he often brought to meetings. In the early days Adair had an immaculate Edison 'suitcase' Home, now in the Dini collection.

Our sadness at Adair's passing is all the more acute since, after an absence of several years, he had been able to come to meetings again during the past year. His old friend and society member Derek Cockburn brought him and we all hoped that this arrangement would continue, frail though Adair had become. He enjoyed being back at meetings and was pleased at the interest we took in his impressive albums of newspaper cuttings and photos, covering the early years of the society and other subjects including the trams of Christchurch, another great interest of his.

To Hilde he was, as the death notice put it, "A gentle and kind husband, who loved his music." We will remember him as a good friend for over 30 years.

Gavin East

LAMBERT TYPEWRITER

Member Ronald Corbett, Australia writes as follows re his Lambert Typewriter, photos of which appear in the magazine. Ron says his machine is in going order.

"The Lambert is the typewriter of Gramophone and Typewriter Limited fame — apparently they were soon superseded and rather a failure. In 1898 Emile Berliner sent Fred Gaisberg to London from America to make the first European recordings and to set up the Gramophone company. It was thought that success of the fledgling gramophone was doubtful so the Lambert typewriter was taken on, hence G. & T. In 1908 the name was changed to 'The Gramophone Co.' at the same time that Nellie Melba laid the foundation stone at the new building.

My Lambert is Serial No. 2802 and is in mint condition as per the photo. To me, they are extremely rare. I acquired it in Melbourne."

Ron Corbett

1905

PUCK

A few months ago, member Mike Tucker from Australia visited the United Kingdom as part of an overseas trip, and has sent the Society photos of an acquisition there, namely a Puck machine. An extract from a recent letter reads as follows:—

"I purchased my Puck from a shop in Stratford on Avon and it was not cheap. However, I haven't seen one in Australia, so a nice addition to my collection.

From photographs and catalogues I have perused, the machine is almost certainly by Georges Carette & Co of Nuremburg, Germany and was probably made around 1908/1910.

It has the spun aluminium horn with brass ferrule, which is listed at an additional charge in the Carette catalogue, but is missing the small spirit level which is typical of these machines. There are two pins (original) in the holes where the level would have been located.

The case is unusual as it is not shown in the Carette catalogue nor have I seen a similar example elsewhere. The case is of the reversible type with cast carry handle. The catches work in the open and closed positions and are simple springs with a vertical slot opening through which a round knob protrudes. To open, the knob is in the vertical position and the clip can be pulled away. To close, the knob is in the horizontal position, which prevents it from pulling through the slot in the spring and which also exerts pressure to keep it in place.

The horn stand slides under the nickelled deck to enable the machine to be placed inside the case. The reproducer is a plain small Puck type with domed stylus support."

Mike Tucker

MEETING OF THE SOCIETY HELD AT THE HOME OF DICK HILLS ON 2/11/98

This Spring meeting was held in the cosy environment of Dick's lounge with eleven members in attendance. This was David Peterson's inaugural meeting as "Mr President", a job which he has successfully avoided for several years but a carefully managed "coup" resulted in his reluctant appointment! Needless to say he managed the position perfectly.

Following the financial report we had a lively discussion on how best we can use our healthy bank balance to further the objectives of the Society. Do any members have any ideas to contribute?

Discussion was held on the location of the Society's Seal. Gavin suggested it might have swum back to Antarctica!!!

Robert informed us that his collection should be reformed at his new address by Christmas, after three years in storage; something to look forward to.

Dick Hills amazed us all with the price he obtained at Christies for his Shackleton cylinder at the recent Antarctic Auction.

Ferrymead featured in a lively discussion on our involvement with some thought given to our options should we pull out.

Recent auction results varied considerably and the market seems very unstable re phonographs at the moment. An Amberola 30 fetched $1,100 N.Z. — expensive for here but an early Standard only $500 N.Z.

Robert Sleeman

PHONOGRAPHS

The phonograph is an instrument by which the mechanical effect of vibrations of sound can be imprinted on a moving surface of tinfoil or wax. By mechanical arrangements the sound can be reproduced from these imprints. The phonograph was invented by Thomas Edison in 1876, and the first design was patented in January 1877. Many attempts had been made by earlier experimenters to obtain tracings of the vibrations of bodies emitting sound, such as tuning-forks, membranes, and glass or metallic discs. In 1807 Thomas Young (Lectures, vol. i. p. 191) described a method of recording the vibrations of a tuning-fork on the surface of a drum; his method was fully carried out by Wertheim in 1842 (Recherches sur l'elasticite, 1$^{r.}$ mem.). Recording the vibrations of a membrane was first accomplished by Leon Scott by the invention of the phonautograph, which may be regarded as the precursor of the phonograph (Comptes Rendus, t. liii. p. 108). This instrument consisted of a thin membrane to which a delicate lever was attached. The membrane was stretched over the narrow end of an irregularly-shaped funnel or drum, while the end of the lever or marker was brought against the surface of a cylinder covered with paper on which soot had been deposited from a flame of turpentine or camphor. The cylinder was fixed on a fine screw moving horizontally when the cylinder was rotated. The marker thus described a spiral line on the blackened surface. When sounds were transmitted to the membrane and the cylinder was rotated, the oscillations of the marker were recorded. Thus tracings of vibrations were obtained. This instrument was much improved by the well-known physicist, König, of Paris, who also made with it many valuable observations. (For a figure of the improved instrument, see Nature, 26th December 1901, p. 184). The mechanism of the recording lever or marker was improved by Barlow, in 1874, in an instrument called by him the logograph (Trans. Roy. Soc., 1874). The next step was König's invention of manometric flames by which the oscillations of a thin membrane under sound-pressures acted on a small reservoir of gas connected with a flame, and the oscillations were viewed in a rotating rectangular mirror, according to a method devised by Wheatstone. Thus flame-pictures of the vibrations of sound were obtained (Pogg. Ann. cxxii. pp. 242, 660, 1864; see also Quelques Expériences d'Acoustique, Paris, 1882). Views of such flame-pictures may be seen in almost every text-book of physics. Clarence Blake in 1876 employed the drum-head of the human ear as a logograph, and thus obtained tracings similar to those made by artificial membranes and discs (Archiv. für Ophthalmol. vol. v. 1. 1876). In the same year Stein photographed the vibrations of tuning-forks, violin strings, &c. (Pogg. Ann., 1876, p. 142). Thus from Thomas Young downwards, successful efforts had been made to record graphically on moving surfaces the vibration of sounds, but the sounds so recorded could not be reproduced. This was accomplished by Edison. In the first phonograph a spiral groove was cut on a brass drum fixed on a horizontal screw, so that when the drum was rotated it moved from right to left. as in the phonautograph. The recorder consisted of a membrane of parchment of gold-beaters skin stretched over the end of a short brass cylinder about 2 inches in diameter. In the centre of the membrane there was a stout steel needle having a chisel-shaped edge, and a stiff bit of steel spring was soldered to the needle near its point, while the other end of the spring was clamped to the edge of the brass cylinder over which the membrane was stretched. The recorder was then so placed beside the large cylinder that the sharp edge of the needle ran in the middle of the spiral groove when the cylinder was rotated. The cylinder was covered with a sheet of soft tin-foil. During rotation of the cylinder and while the membrane was not vibrating the sharp edge of the marker indented the tin-foil into the spiral groove; and when the membrane was caused to vibrate by sounds being thrown into the short cylinder by a funnel-shaped opening, the variations of pressure corresponding to each vibration caused the marker to make indentations on the tin-foil in the bottom of the groove. These indentations corresponded to the sound-waves. To reproduce the sounds the recorder was drawn away from the cylinder, and the cylinder was rotated backwards until the recorder was brought to the point at which it started. The cylinder was then rotated forwards so that the point of the recorder ran over the elevations and depressions in the bottom of the groove. These elevations and depressions, corresponding to the variations of pressure of each sound-wave, acted backwards on the membrane through the medium of the marker. The membrane was thus caused to move in the same way as it did when it was made to vibrate by the sound-waves falling upon it, and consequently movements of the same general character but of smaller amplitude were produced, and these reproduced sound-waves. Consequently the sound first given to the phonograph was reproduced with considerable accuracy. Such was the first tinfoil phonograph. In 1878 Fleeming Jenkin and Ewing amplified the tracings made on this instrument by the sounds of vowels, and submitted the curves so obtained to harmonic analysis; that is to say, by the application of Fourier's theorem they were enabled to analyse the complex curves corresponding to the vibrations of vowel-tones into the simpler curves, in a harmonic series, of which they were composed (Trans. Roy Soc. Edin. vol. xxviii. p. 745). The marks on the tinfoil were also examined by Grützner, Mayer, Graham Bell, Preece, and Lahr (see The Telephone, the Microphone, and the Phonograph, by Count du Moncel, Lond. 1884; also The Speaking Telephone and Talking Phonograph, by G. B. Prescott, New York, 1878).

The tinfoil phonograph, however, was an imperfect instrument, both as regards the medium on which the imprints were taken (tinfoil) and the general mechanism of the instrument. From 1877 to 1888 Edison was engaged in working out the details of the wax-cylinder phonograph as we now have it, one of the most beautiful of instruments (see Fig. 1a and Fig. 1b). The improvements consisted chiefly (1) in substituting for tinfoil cylinders made of waxy substance on which permanent records are taken; (2) in substituting a thin glass plate for the parchment membrane; (3) in improving the mechanical action of the marker; and (4) in driving the drum carrying the was cylinder at a uniform and rapid speed by an electric motor placed below the instrument. In the first place, permanent records can be taken on the wax cylinder. The waxy material is brittle, but it readily takes the imprints made by the marker, which is now a tiny bit of sapphire. The maker, when used for recording, is shod with a chisel-shaped edge of sapphire; but the sapphire is rounded when the marker is used for reproducing the sound. The marker also, instead of being a stiff needle coming from the centre of the membrane or glass plate, is now a lever, heavily weighted so as to keep it in contact with the surface of the wax cylinder. A single vibration of a pure tone consists of an increase of pressure followed by a diminution of pressure. When the disc of glass is submitted to an increase of pressure, the action of the lever is such that, while the wax cylinder is rotating, the point of the marker is angled downwards, and thus cuts deeply into the wax; and when there is diminution of pressure, the point is angled upwards, so as to act less deeply. In reproducing the sound, the blunt end of the marker runs over all the elevations and depressions in the bottom of the groove cut in the wax cylinder. There is thus increased pressure transmitted upwards to the glass disc when the point runs over an elevation, and less pressure when

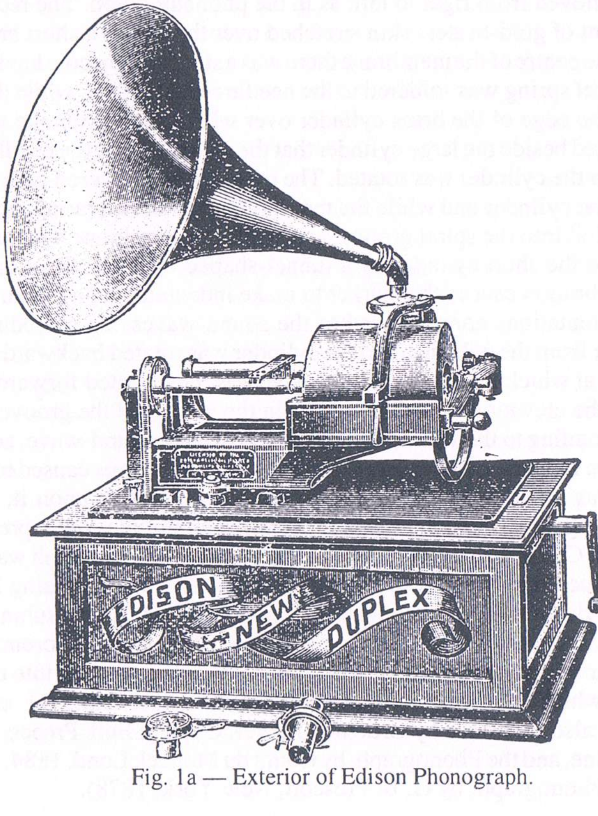


Fig. 1a — Exterior of Edison Phonograph.

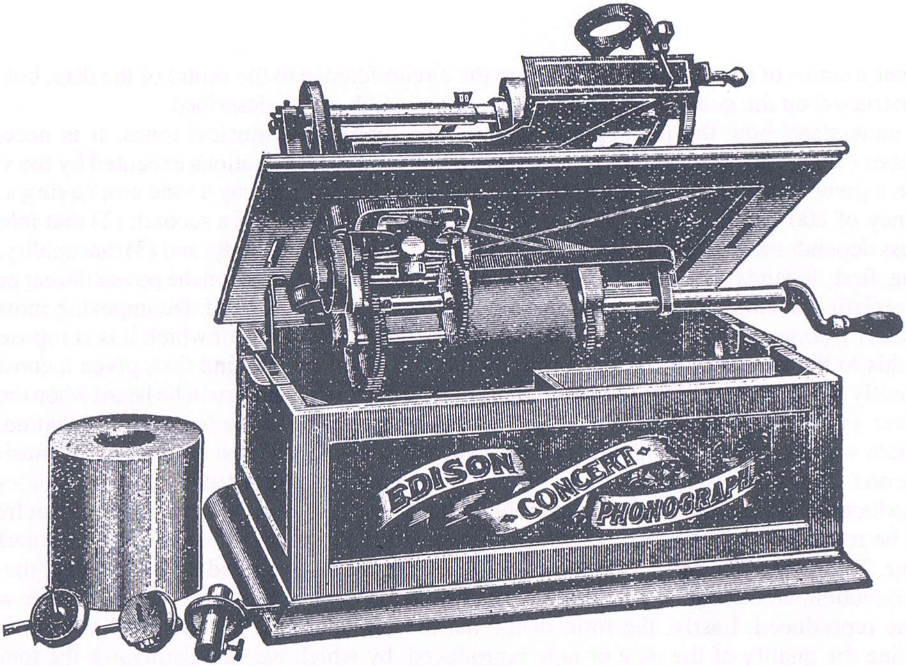


Fig. 1b — Mechanism of Edison Phonograph.

the point runs over a depression on the wax cylinder. The glass disc is thus, as it were, pulled inwards and thrust outwards with each vibration, but these pulls and thrusts follow each other so rapidly that the ear takes no cognizance of the difference of phase of the vibrations of the glass plate in imprinting and in reproducing. The variations of pressure are communicated to the glass plate, and these, by the medium of the air, are transmitted to the drum-head of the ear, and the sound is reproduced with remarkable fidelity. It is necessary for accurate reproduction that the point of the marker be in the centre of the groove. In the older phonographs this required accurate adjustment by a fine screw, but in newer forms a certain amount of lateral oscillation is allowed to the marker, by which it slips automatically into the groove. Recently two other improvements have been effected in the construction of the instrument. A powerful triple-spring motor has been substituted for the electric motor, and the circumference of the wax cylinder has been increased from $6^7/_8$ inches to 15 inches. The cylinders make about two revolutions per second, so that with the smaller cylinder the point of the marker runs over nearly 14 inches in one second, while with the larger it runs over about 30 inches. The marks corresponding to the individual vibrations of tones of high pitch are therefore less likely to be crowded together with the larger cylinder, and these higher tones, in particular, are more accurately reproduced. In a form of instrument called the 200-thread machine, motion of the drum bearing the cylinder was taken off a screw the thread of which was 50 to the inch, and by a system of gearing the grooves on the cylinder were 200 to the inch, or $^1/_{200}$ of an inch apart. It was somewhat difficult to keep the marker in the grooves when they were so close together; and the movement is now taken directly off a screw the thread of which is 100 to the inch, so that the grooves on the cylinder are $^1/_{100}$ of an inch apart. Thus with the large cylinder a spiral groove of over 300 yards may be described by the recorder, and with a speed of about two revolutions per second this distance is covered by the marker in about six minutes. By diminishing the speed of revolutions, which can be easily done, the time may be considerably lengthened. Other forms of phonographs, some termed gramophones, have been invented, in which the records are taken on a flattened disc rotating horizontally, and so arranged that the recorder describes a series of spirals diminishing from the circumference to the centre of the disc; but they are all constructed on the general principle of the phonograph above described.

To understand how the phonograph records and reproduces musical tones, it is necessary to remember (1) that pitch or frequency depends on the number of vibrations executed by the vibrating body in a given period of time, or on the duration of each vibration, say a tone arm having a pitch or frequency of 200 vibrations per second, each vibration lasting $^1/_{200}$ of a second; (2) that intensity or loudness depends on the amplitude of the movement of the vibrating body; and (3) that quality, timbre, or clang, first, depends on the form of the individual vibrations, or rather on the power the ear possesses of appreciating a simple pendular vibration producing a pure tone, or of decomposing more or less completely a compound vibration into the simple pendular vibrations of which it is composed. If we apply this to the record of the phonograph on the wax cylinder, we find that, given a constant and sufficiently rapid velocity of the cylinder, a note or tone of a certain pitch will be heard when the marker runs over a number of elevations and depressions corresponding to the frequency of that note. Thus if the note was produced by 200 vibrations per second, and suppose that it lasted in the music for $^1/_{10}$ of a second, 20 marks, each made in $^1/_{200}$ of a second, would be imprinted on the wax. Consequently, in reproduction, the marker would run over the 20 marks in $^1/_{10}$ of a second, and a tone of that frequency would be reproduced. The loudness would correspond to the depth of each individual mark on the cylinder. The greater the depth of a series of successive marks produced by a loud tone, the greater, in reproduction, would be the amplitude of the excursions of the glass disc and the louder would be the tone reproduced. Lastly, the form of the marks corresponding to individual vibrations would determine the quality of the tone or note reproduced, by which we can distinguish the tone of one instrument from another, or the sensation produced by a tone of pure and simple quality, like that from a well-bowed tuning-fork or an open organ pipe, and that given by a trumpet or an orchestra, in which the sounds of many instruments are blended together. When the phonograph records the sound of an orchestra it does not record the tones of each instrument, but it imprints on the wax cylinder the form of impression corresponding to the very complex sound-wave formed by all the instruments combined. This particular form, infinitely varied, will reproduce backwards, as has been explained, by acting on the glass plate, the particular form of sound-wave corresponding to the sound of the orchestra. This is one of the wonderful feats of the phonograph. Numerous instruments blend their tones to make one wave-form, and when one instrument predominates, or if a human voice is singing to the accompaniment of the orchestra, another from of sound-wave, or rather a complex series of sound-waves, is imprinted on the wax cylinder. When reproduced, the wave-forms again exist in the air as very complex variations of pressure, these act on the drum-head of the human ear, there is transmission to the brain, and there an analysis of the complex sensation takes place, and we distinguish the trombone from the oboe, or the human voice from the violin obbligato. The phonograph reduces all to mechanical simplicity; complexity arises when we have to deal with the effects on the human ear and brain.

Many efforts have been made to obtain graphic tracings of wave-forms imprinted on the wax cylinder of the phonograph. Thus the writer has taken (1) celloidin casts of the surface, and (2) micro-photographs of a small portion of the cylinder (Journ. of Anat. and Phys., July 1895). He also devised a phonograph recorder by which the curves were much amplified (Trans. Roy. Soc. Edin. vol. xxxviii; Proc. Roy. Soc. Edin. 1896-97, Opening Address; Sound and Speech Waves as revealed by the Phonograph, Lond. 1897; and Schafer's Physiol. vol. ii., Vocal Sounds, p. 1229). As already mentioned, so long ago as 1878 Fleeming Jenkin and Ewing had examined the marks on the tinfoil phonograph. Professor Hermann, of Königsberg, took up the subject about 1890, using the wax cylinder phonograph. He obtained photographs of the curves on the wax cylinder, a beam of light reflected from a small mirror attached to the vibrating disc of the phonograph being allowed to fall on a sensitive plate while the phonograph was slowly travelling. (For references to Hermann's important papers, see Schafer's Physiology, vol. ii. p. 1222). Boeke, of Alkmaar, has devised an ingenious and

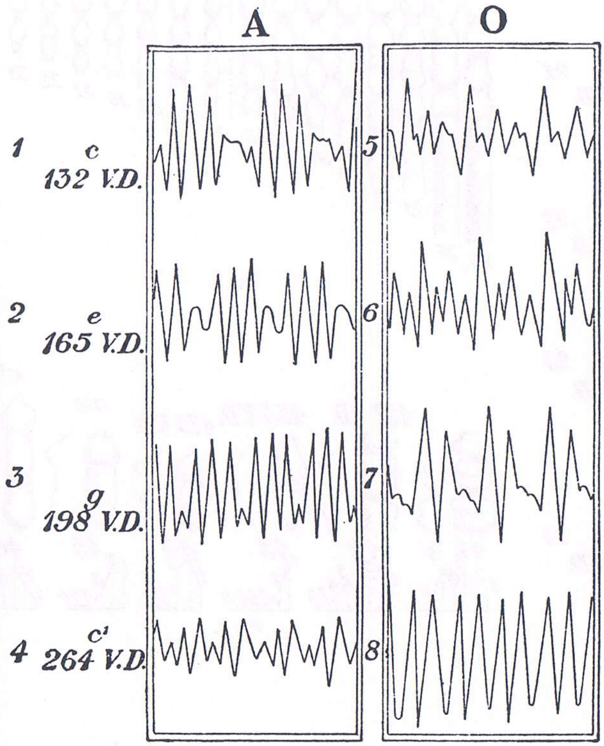


Fig. 2.

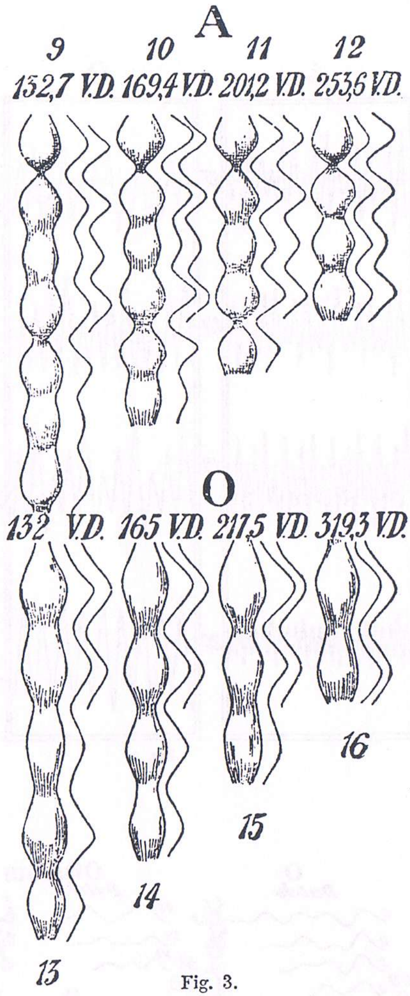


Fig. 3.

accurate method of obtaining curves from the wax cylinder. He measures by means of a microscope the transverse diameter of the impressions on the surface of the cylinder, on different (generally equidistant) parts of the period, and he infers from these measurements the depth of the impressions on the same spot, or, in other words, he derives from these measurements the curve of the vibrations of the tone which produced the impression (Archiv. f. d. ges. Physiol. Bonn, Bd. 1, S. 297; also Proc. Roy. Soc. Edin., 1898).

From a communication to the Dutch Otorhinolaryngological Society Dr Boeke has permitted the author to select the accompanying illustrations, which will give the reader a fair conception of the nature of the marks on the wax cylinder produced by various tones. Fig. 2 shows portions of the curves obtained by Hermann, and enlarged by Boeke one and a half times. The numbers 1 to 4 refer to periods of the vowel A (as in "hard"), sung by Hermann on the notes c e g c'. Numbers 5 to 8 show the curves of the vowel o (as in "go") sung to the same notes. The number of vibrations is also noted. Boeke measured the marks for the same vowels by his method, from the same cylinder, and constructing the curves, found the relative lengths to be the same. In Fig. 3 we see the indentions produced by the same

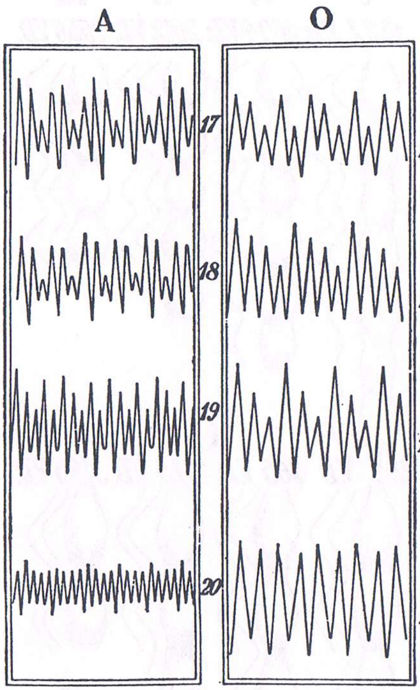


Fig. 4.

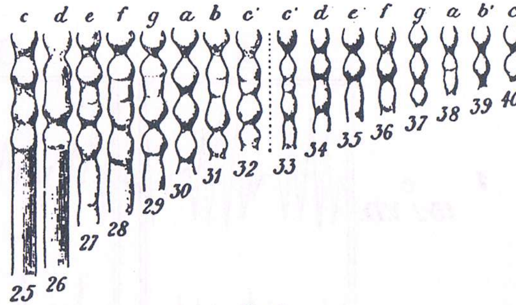


Fig. 5.

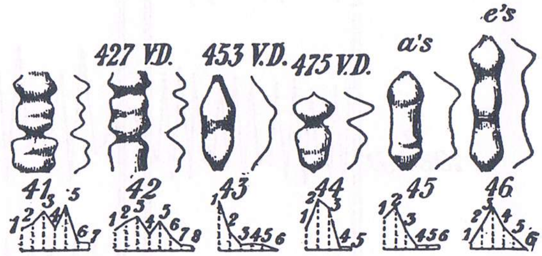


Fig. 6.

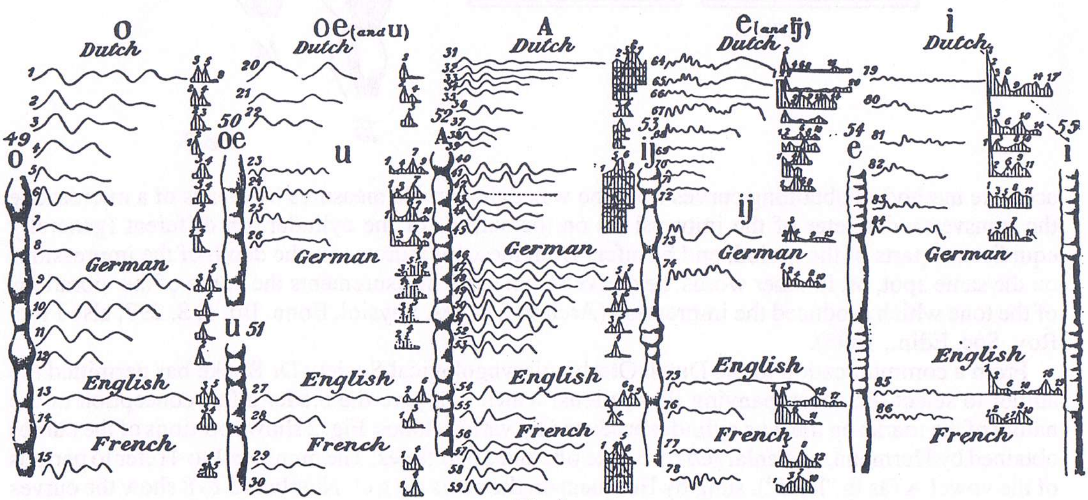


Fig. 7.

vowels, sung by Hermann on the notes c e g c', on the same phonograph cylinder, but delineated by Boeke after his method. The curves are also shown in linear fashion beside each group of indentations. From these measurements the curves were calculated and reproduced, as in Fig. 4. Thus the curves of the same vowel sounds on the same cylinder are shown by two methods, that of Hermann and that of Boeke. In Fig. 5 we see the indentations on the vowel a, sung by Dr Boeke, aged 55, on the notes c d e f g a b c', and near the frequencies of 128, 144, 160, 170-6, 192, 213-3, 240, and 256. The numbers 33 to 40 show the marks produced by the same vowel, sung by his son, aged 13. It will be seen that the boy sang the notes exactly an octave higher. Fig. 6 shows the marks produced by some musical sounds. Each shows on the right-hand side the curve deduced from the marks, and under it a graphical representation of the results of its harmonic analysis after the theorem of Fourier, in which the ordinates represent the amplitude of the subsequent harmonic constituents. No. 41 is the period of the sound of a pitch-pipe giving a' (425 double vibrations per second), No. 42 the period of a Dutch pitch-pipe, also sounding a' (424-64 double vibrations per second). No. 43 is a record of the period of a sound produced by blowing between two strips of indiarubber to imitate the vocal chords, with a frequency of 453 double vibrations per second. No. 44 is that of a telephone pipe used by Hermann (503 double vibrations per second). Nos. 45 and 46 show the marks of a cornet sounding the notes a of ±400 double vibrations per second, and e of 300 double vibrations per second. In Fig. 7 are shown a number of vowel curves for the vowels o, oe, a, e and i. Each curve has on the right-hand side a graphical representation of its harmonic analysis. The curves are in five vertical columns, having on the left-hand side of each drawings, by Boeke's method, of two periods of the marks of the vowel. The marks are shown for the Dutch, German, English, and French languages. The sounds of the vowels are o, like o in "go"; oe, like oo in "too"; u, like the German ü in "Führer"; a, like a in "hard"; e, like a in "take"; ij not in English words, but somewhat like e in "bell"; and i, like ee in "beer". The first section contains only Dutch vowel sounds, either sung or spoken by Boeke or members of his family. The second section contains curves from the voice of Professor Hermann, the third from the voice of the author from a cylinder sent by him to Dr Boeke, and the fourth from the voice of Mons. H. Marichelle, professor de l'Institut des Sourds-Muets, also forwarded by him to Dr Boeke. Thus curves and marks of the same vowel are shown from the voices of men of four nationalities.

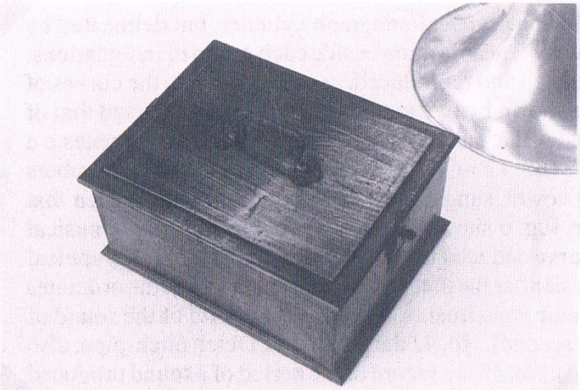
Apart altogether from the use of the phonograph in business and for the reproduction of music, it will be seen that it is an instrument of great value in the investigation of problems in acoustics, and that it illustrates these as no other instrument can so (see "Experimental Phonetics," by the author, Nature, 26th December 1901).

Supplied by Geoff Johnston, Hàstings
Taken fron Encyclopaedia Britannica, 1901

EDISON BATTERY OIL

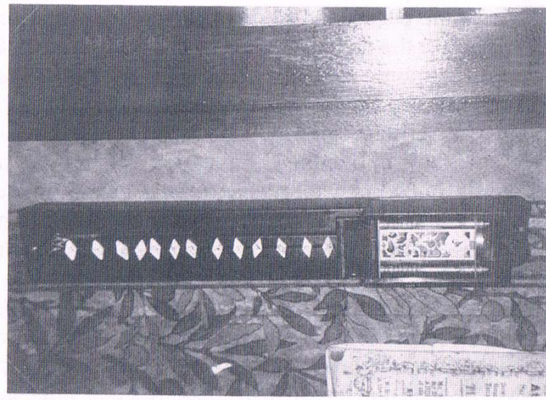
There always seems to be a query on the purpose of the oil in small bottles, usually labelled Edison Battery Oil. I have previously written on this and also read the explanation in a previous issue of the magazine. It is true the oil was placed on the surface of the electrolyte in the battery but it was not to prevent evaporation!

Edison was a perverse inventor and tried to do something that no other people had done. There were many types of batteries (or we should say cells when dealing with a single unit) invented in the 19th and early 20th centuries. Most of them used acidic electrolytes. Edison set out to produce cells with alkaline electrolytes. He was eventually successful in this and invented the nickel-iron secondary cell (able to be recharged) and the Edison primary cell. The nickel-iron secondary cell has evolved to the rechargeable nicad cells in common use today. The Edison primary cell has ceased to exist.

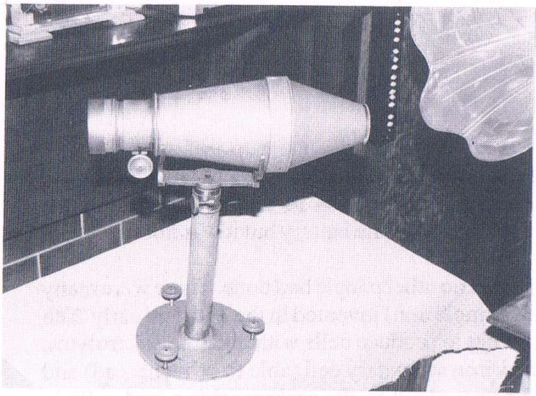


closed — Puck — open

Harold Burtoft

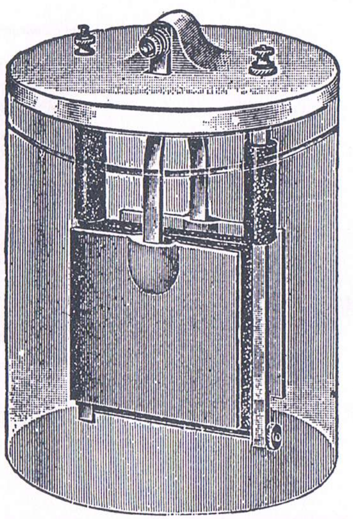


Stick Clock



Dagverreian Camera

Burtofts Collection



48.—Edison cell, type R R. The electrolyte used is caustic soda, the positive element zinc, and the negative element copper oxide. The Edison cell is suitable for large stationary gas engine ignition, railroad crossing signals, electroplating, fire alarms, telephone circuits, etc.

In its day it was an excellent cell as it could deliver a reasonably high current for its size. It only had a voltage per cell of 0.7 volt but three in series (as a battery) could produce a good 2.1 volts. The cell was used extensively for railway signal lights (among other uses) as it was long lasting and reliable.

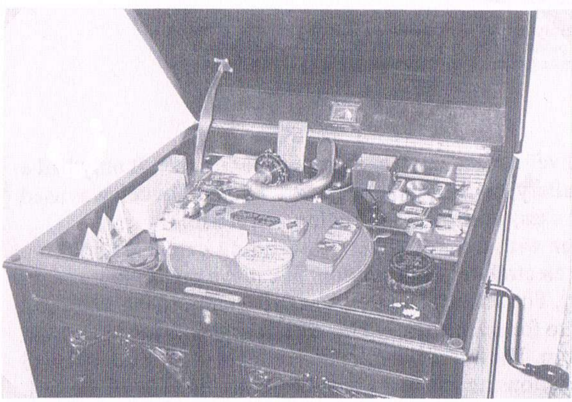
Each cell consisted of a straight sides glass jar with a hard rubber close-fitting cap. This held the electrodes which were zinc and copper oxide. The electrolyte was a solution of caustic potash (potassium hydroxide) commonly called lye in the 19th century. The action of the cell was to decompose the water and the oxygen, thus liberated, combined with the zinc to form zinc oxide. This then reacts with the potassium hydroxide to from a double salt of zinc and potassium. The hydrogen liberated reduces the copper oxide to pure copper. Because of these strange chemical reactions no gas was given off during the life of the cell. Eventually the cell wore out and the electrodes and electrolyte were replaced. Again the cell was ready for years of use again.

Now, where does the oil come in? Well potassium hydroxide reacts strongly with carbon dioxide, forming potassium carbonate and water. Because there is always a small amount of carbon dioxide in the air, in time the cell electrolyte would be contaminated and useless. Usually a cell would only give a quarter of its life unless this was prevented from happening. Edison's solution was to supply oil to place on the surface of the electrolyte to prevent any contact with the atmosphere. The new cells were always shipped dry and the customers mixed their own electrolyte. Always included with the dry cell was a bottle of 'Edison Battery Oil'. This was poured over the surface of the electrolyte as soon as it was put into the cell. One small bottle of oil being sufficient for one call. As the cells could be renewed by replacing the electrodes, new electrodes also came with a bottle of oil.

The oil was a heavy paraffin type oil which is derived from mineral oil. The standard bottle of oil would allow an oil depth of about $^1/_4$" (6mm) on top of the potassium hydroxide electrolyte. The oil was useless for lubrication and that is why the wording *battery oil* is on the bottle.

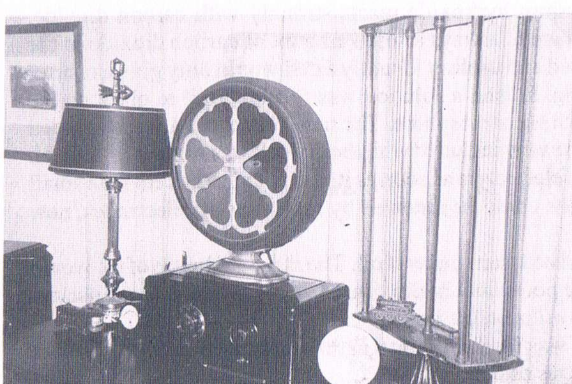
It is not known by many that Edison, at his death, was the richest man in the world. At present day values he would have been worth many hundreds of millions of dollars.

James Lowe, N.S.W., Australia.

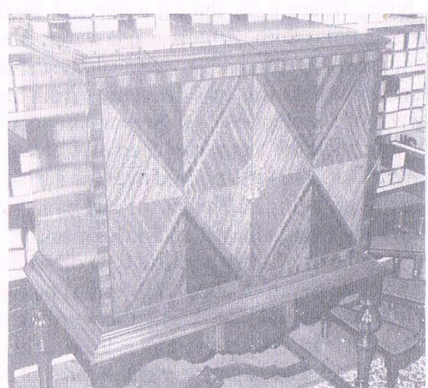


Needle Tins

Edison B 80



Atwater Kent



Sonora Model E 40

NEW LIGHT ON EDISON'S LIGHT

(Part 4) **By Robert Friedel**

All of this was comforting to Edison, and for several weeks the workers at Menlo Park went about constructing models of the new lamp, testing generators to power the system, and preparing patent applications. Only one problem clouded the picture — the light didn't work. Dozens of regulators were made, using several approaches, all designed to cut off current to the platinum wires or strips as they exceeded safe temperatures. The platinum was formed into a variety of shapes, with the intent of conserving the heat energy put into the lamp while allowing the maximum amount of light to be emitted. In every case the lamp flickered intolerably, the burner melted or broke, or the light was too faint. At this point Edison had made little effort to systematically investigate prior work on incandescent lights or to work out the various elements of the generation and distribution system that he would need. By late fall it was apparent that what he didn't know about electric lighting was at least as important as what he did.

Unfortunately for the inventor's giant ego, this was as clear to some of his financial backers as it was to Edison. In November, therefore, Edison was prevailed upon to hire a young Princeton-trained physicist, Francis Upton, recently returned from graduate training in Germany. In later years some claimed that Upton, with his advanced knowledge of mathematics and physics, was the key member of the Menlo Park team, and this claim has become part of the image of Edison's laboratory as a modern scientific establishment. Upton was unquestionably valuable, for he was sharp, eager, and ambitious. But the electric light did not depend on the latest knowledge of physics. Upton's hiring was more important for what it said about Edison and his new line of attack in late 1878 than for the advanced learning it brought to the project. Edison now resolved to find out all he could about every aspect of lighting systems. He and his workers studied old patents, analyzed the work of current rivals, subscribed to the gas-light journals, and set about to begin all over again, still confident but now driven by both the challenges before them and the promises behind them.

At just this point, as the year was ending and the work in the laboratory began to take on the rhythm of a long, hard slog, a technical discovery was made that would set Edison's system apart from all others and provide a key to long-term success. In looking at some rival efforts, Edison and his associates noticed that the amount of electrical current required to operate the systems was quite large. Since Edison was determined to make a lamp that could be used with all the convenience of gaslight and, in particular, could be turned on and off without affecting other lamps, he realized that the lamps would have to be on a "parallel" circuit. In such a circuit, as opposed to a "series" circuit, electric current would be delivered independently to each lamp from the main wires of the circuit. This much was generally known, but the team at Menlo Park observed something else. If a circuit had many lamps on it (and Edison always felt that would be the only economical approach), the delivery of sufficient energy to light each lamp would require either a high voltage or a large current (energy equals voltage times current). Large currents, which everyone else's system relied on, could be carried only by large conductors — resulting in enormously expensive use of copper. A combination of smaller currents and large voltages would require that each lamp have a high resistance, (voltage equals current times resistance). Edison thus decided that his lamp would have to have a high-resistance burner.

(To be Continued), Taken from "Great Inventions"

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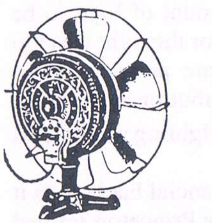

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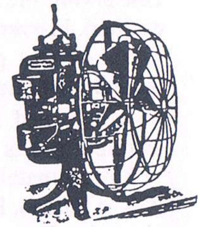

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