

## A 78 Revolution

by David Evans

As most of us probably know, the disc gramophone was invented by Emile Berliner, a German immigrant living in America, in 1887-1889. Berliner visited his home country in 1889 and by 1890 the German toy manufacturers Kämmer and Reinhardt had secured the rights to manufacture a toy version of the machine. The machine was hand wound by a crank handle. By 1894 Berliner in America was producing a similar machine for domestic consumption. In 1897 Eldridge R Johnson of Camden, New Jersey, had developed a small but reliable clockwork motor for the gramophone, which transformed its performance. Also in 1897, William Barry Owen of the Berliner Gramophone Company arrived in England to promote sales of the new Johnson machine, and helped set up the Gramophone Company in 1898, with offices at 31 Maiden Lane, London. Meanwhile, after a bumpy legal ride, Johnson in America had incorporated the Victor Talking Machine Company on October 3<sup>rd</sup> 1901.

At this time of course all recordings were made acoustically. Basically, performers stood in front of a recording horn, the sounds mechanically vibrated a stylus that cut a modulated groove in a soft substrate to form the master recording. However, from 1919, J P Maxfield and H C Harrison of the Bell Laboratories (part of American Telegraph & Telephone (AT&T)) were experimenting with electrical methods of recording. They used capacitor<sup>1</sup> microphones, two-stage<sup>2</sup> amplifiers and balanced armature moving iron recording heads<sup>3</sup> to engrave the groove, using electrical power rather than acoustic to provide the recording. This gave a considerable improvement in frequency response – higher treble notes and lower bass notes.

The manufacturing arm of AT&T, Western Electric Company, became the licensed owner of the process. An offer was made to Victor Company in America to extend the licensing, but they rejected the offer, a decision they probably regretted later. The Columbia Phonograph Company, however, accepted and gained a Western Electric license to manufacture records using the new process.

Western Electric sent their first master waxes to the

Pathé factory in New York to be processed. Two Pathé executives decided to share news of the invention and some pressings with Louis Sterling, managing director of Columbia Graphophone Company in London. Sterling was so impressed that he immediately set sail for New York, where he purchased the American Columbia firm and thus acquired the Western Electric license to manufacture electrical recordings. At this point, Victor/Gramophone Company also acquired a license, so the industry giants now could produce the new records.

Columbia and HMV discs first appeared on the market in the summer of 1925. Early Columbia electrical recordings can be identified by a small letter W in a circle, impressed into the shellac.

Whilst HMV/Victor continued with the Western Electric system, Columbia moved to a new process developed by Alan Dower Blumlein in England in 1929, which overcame some of the technical issues, such as high sensitivity to background noise and some distortion.

So now the race was on to develop a means of playing back the new records electrically. The big gramophone manufacturers of course brought out new acoustic machines to play them, such as HMV's re-entrant series – Models 163, 192, 202 etc – and American Victor's similar Orthophonic range, but inevitably these were really a stop-gap.

One of the pioneers of electrical players was the Brunswick-Balke-Collender Company in Chicago. The firm was established in 1845 as a maker of fine furniture and were especially renowned for their pool tables. The firm became involved with record playing machines and records in 1916, when they issued their first vertical cut ('Hill and Dale') discs, but by 1920 they were issuing lateral-cut discs. They soon built up a great collection of international artists in classical and popular music and became one of the premier record labels in both North America and Britain. They also designed and manufactured record playing machines. The first group was of eight models of the Brunswick players. Some featured their specially designed Ultona

soundbox, that could be set to play Pathé vertical-cut records as well as lateral-cut. There was also a version known as 'All-Phonographs-in-One' that could play Edison Diamond Discs as well (Figures 1a, 1b & 1c). On March 1<sup>st</sup> 1924 Brunswick signed a deal with RCA to supply Radiola radio receivers



Fig 1a: Brunswick Ultona soundbox set up for needle-cut records. The tone arm is telescopic, to set the tracking.



Fig 1b (above): Set up for Pathe discs

Fig 1c (below): Set up for Edison Diamond discs



for incorporation in their range of machines.

At first Brunswick incorporated the Radiola IX<sup>4,A</sup> receivers into their acoustic machines for their 1924-25 season as well as supplying them to the after-market sales department. For the same season, Victor Talking Machine Company merely supplied some of their Victrolas with a blank panel so that a radio could be installed later. By September 1926, only a year after the introduction of electrical recordings to the market, Brunswick were advertising their latest machine, the Panatrope, which was about to go into production (Figure 2).

## MOST MARVELOUS MUSICAL INVENTION IN WORLD'S HISTORY

### The BRUNSWICK PANATROPE

utilizes newly discovered electrical processes to bring you music and radio of a beauty hitherto unknown

*The Brunswick Panatrope is the world's first purely electrical reproducing musical instrument. The new electrical method of recorded music reproduced on the Panatrope resembles the photographic process so closely that this amazing discovery is often called "music by photography."*

THE PANATROPE is the joint achievement of four of the most widely-known institutions in the fields of electricity and acoustics: Radio Corporation of America, General Electric Company, Westinghouse Electric & Manufacturing Company, and The Brunswick-Balke-Collender Company.

#### Amaze critics

Although perfected less than a year ago, this new reproducing musical instrument has been heard by more than four million persons. When first demonstrated, it was given front-page space by the great metropolitan newspapers as the most important musical development of the age. Critics were no less enthusiastic. Nothing in the whole world of music ever created such profound interest and attention.

The Brunswick Panatrope may be had either alone or in combination with the Radiola Super-heterodyne. Thus it puts at your finger-tips all recorded music and the programs of radio as well. Operates entirely from the light socket; no batteries or outside wires needed.

#### Another triumph

Brunswick has also developed another musical instrument, as yet unnamed, for bringing out the music of the new records. In tone quality and its ability to reproduce the entire musical scale, we believe this instrument represents a very great advance over anything in existence, save the Panatrope. It dispenses with the electrical mechanism of the Panatrope, and its prices are lower, ranging from only \$115 to \$300 (slightly higher west of the Rockies).

Certainly you must hear these wonder instruments. Your musical judgment will confirm the verdict of the critics that there is nothing in the field of musical reproduction equal to them. It is hardly necessary to suggest that before



*The Brunswick Panatrope, Model 10. Finished in highly figured walnut. Price \$650. (Slightly higher west of Rockies.)*

buying any musical instrument or radio, you hear the Brunswick Panatrope, the Brunswick Panatrope & Radiola and the new Brunswick musical instrument as yet unnamed.

Brunswick dealers will gladly demonstrate these instruments. If there is no Brunswick store near you, write us.

#### \*\$5,000 for a name

To find a suitable name for the new Brunswick instrument described above, we offer 3 prizes totaling \$5,000 for the best names submitted with slogan not exceeding 10 words describing its music. Write for free booklet giving all details. Address Dept. P-101.

**Brunswick**  
PANATROPE - RADIOLA - RECORDS

THE BRUNSWICK-BALKE-COLLENDER CO., General Offices: 623 S. Wabash Ave., Chicago

Fig 2: Brunswick advertisement from late 1926

This was billed as "The Most Marvellous Musical Invention in the World's History" and could reproduce the new records 'perfectly'. It was also fitted with an RCA radio, so qualifies as probably the world's first all-electric radio-gram. The electrical components were provided by the Radio Corporation of America (their Radiola radios – one of several models could be included in the package), the General Electric Company and Westinghouse



Electric and Manufacturing Company. A later advertisement, from winter 1927, states that "Last Christmas you could not buy the Panatrope". It also mentioned the \$5,000 available to competition entrants for a suitable name for the latest Brunswick acoustic machine. This was priced at 'only' \$115 to \$300, whereas the Panatrope in its various guises was priced between \$350 - \$1250 – this latter being equal to about \$50,000 (or about £30,000) in today's money.



*Figs 3a: Brunswick Panatrope, 1927*

The Panatrope illustrated in Figures 3a and 3b is Model PR-138-C with a Radiola 28 8-valve ('tube' in America) top-of-the-range radio and was introduced in 1926 at a price of \$1,100. Its performance is certainly amazing compared with HMV re-entrant machines. It was only a matter of time – actually a month or so – that Victor followed suit with an almost identical specification machine with units from the same manufacturers. Victor produced several models with battery-operated Radiolas that played through their Orthophonic horn, using a driver that could replace the soundbox on the tone arm of the acoustic gramophone. By 1925 they were advertising their competing machine with the Panatrope – the Victor Hyperion (Model 15-1), also with the Radiola 28 and at a similar price. In October 1929 RCA bought the assets of Victor.

Meanwhile, in England, a version of the Panatrope was also available, manufactured under licence by Electrocord of Water Lane, Leeds. This version was produced as a sound system for cinemas and was



*Figs 3b: Brunswick Panatrope, 1927*

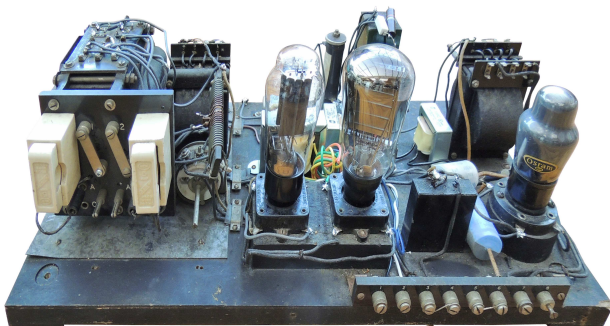
available from 1927. Stanley North, a prominent Bradford dance-band leader, recalled attending a demonstration of the Panatrope at the Mechanics' Institute in 1927. "The Panatrope was a means of reproducing records electrically from the mains." The immediate effect of the machine was to put cinema orchestras out of business. "The Panatrope was a big step forward technically. Usually about 25 Watts was ample output for the average cinema, but the ratio could be stepped up to 50 Watts if necessary, to fill one of the vast halls of that era with sound".<sup>5,D</sup>

HMV were also working on electrical reproduction, though independently of Victor. They did not advertise an electrical player until the Model 551 that appeared in their 1928 catalogue. This was a console record player only (Figure 4a) that had a jack socket so that you could plug in an external radio. It used a two-stage all-mains amplifier using the new (in 1927) Mullard output triode valve known as the type DO20 driving a moving-coil loudspeaker and using HMV's new No 7 electric soundbox on a conventional goose-neck arm. Compared with the American engineering, it was primitive.



*Fig 4a: HMV Model 551, serial number 63*

The components were mounted on a wood board ('Breadboard' was the term used for such construction) – see Figure 4b – and hand-wired on a point-to-point basis. Nevertheless, the major components, such as the induction disc motor, were of high quality and the reproduction perhaps a noticeable improvement over even the largest re-entrant models, though some may have disagreed. Figure 4b shows several modern transformers –



*Fig 4b: Model 551 Amplifier unit*

HMV has the reputation today for having such wound components often going open-circuit, so modern components have to be fitted to allow it to function. This amplifier is now ninety years old, so one has to make allowances!

HMV bought the Marconiphone Company in March 1929, with the encouragement of David Sarnoff of

RCA, thus acquiring some extra radio expertise. HMV's assessment of their purchase was not reassuring. On 6<sup>th</sup> March 1929 an HMV executive visited the Marconiphone works and reported that development of new models for 1929/30 had barely begun. The manager explained that "though their aim was to produce cheap sets, the output was too small to be competitive and that the company had been forced to reduce their cost by the use of shoddy methods and finishes". The Gramophone Company chairman, Alfred Clark, had been advised to keep the Marconiphone factory in Dagenham as a separate manufacturing unit for "the production of those lines where standards can be lower than those at Hayes"<sup>B</sup>. By the autumn of 1929 HMV were also discovering that there were problems with the Marconi-Osram Valve works of which they now shared ownership with GEC. The design of valves made there was some two years behind the latest methods used by Philips/Mullard, Mazda, Cossor etc, so the performance was badly affected. Since Marconiphone radios were designed around their own valves, the performance of the radios was also inferior to that of competitors. The M-OV valve works did redeem themselves to an extent by designing the triode output valve type PX4 used by a number of radiogram manufacturers after its introduction in late 1929.

In their 1930 catalogue, HMV still listed the Model 551, together with the Model 600 "Concert" for concert halls, comprised of separate units for



*Fig 5: HMV Model 520 radiogram*



flexibility, the Automatic Model 15 – very similar to the huge acoustic Automatic No. 1 but with similar electrical system to the 551, complete with a remote-wired pedestal for operating it. The catalogue also included Model 520 (Fig. 5), a radio-gramophone with medium and long wave tuning and No. 7A (Electric) soundbox.

In January 1930 Harrods wrote to HMV expressing disappointment in their new radio gramophone (presumably Model 520), stating “I think it is general knowledge that the Marconi valve is not very successful, and this fact is proved by the selection of the Mullard valve (the DO20) for your electrical reproducer (Model 551) which is really splendid and worthy of HMV.” In 1931, Alfred Clark wrote to David Sarnoff of RCA “...there is evidence that the higher priced Electrical Gramophone being so much better than the higher priced Mechanical Gramophone, the public show hesitation in investing in lower-priced Mechanical Gramophones in the belief that they may eventually be able to buy lower-priced Electrical Gramophones and, unfortunately, it has not yet been possible to design good low-priced Electrical Gramophones.”

For 1931/32, the HMV catalogue shows that the instruments had gone from strength to strength:

The Model 532 Superhet Ten Autoradiogram (also known as Columbia 640 - as HMV and Columbia had merged by this time, they could market machines using both brand names) had a ten valve circuit using vari-mu<sup>6</sup> valves and push-pull<sup>7</sup> PX4s and a Type K autochanger. Price was 80 Gns. The Model 532 Superhet Ten Autoradiogram De Luxe (Still known as Columbia 640) was the same as the standard 532 but in a fancy Art Deco cabinet. Price 95 Gns. Another version, the Model 531 Superhet 10 Autoradiogram (Figure 6) was also similar to Model 532 except not using latest vari-mu valves and no tone control. Price 70 Gns. These all used the PX4 output valves.

Less expensive were Model 523 Superhet Radiogram Seven, the seven valve circuit with vari-mu valves and a single record player, priced at 48 Gns., and Model 501 Transportable Radiogram, a TRF<sup>8</sup> four valve circuit. Priced at 25 Gns. Finally there were Models 521 & 522 Radiograms, also known as Marconiphone 560. Model 521 had a single player, 522 had a type K autochanger and a TRF five valve circuit. Price – (521) 39 Gns, (522)



*Fig 6: HMV Model 531 Autoradiogram*

46 Gns. These were released by March 1931, no doubt designed by Marconiphone engineers after an infusion of funds from HMV.

Columbia merged with HMV on 20<sup>th</sup> April 1931 and the name of the conglomerate became Electrical and Musical Industries – EMI – consisting of the Gramophone Company (HMV, Zonophone Records), Columbia Graphophone Company Ltd (Columbia, Parlophone and Regal records), and the Marconiphone Co Ltd. This resulted in the world's largest recording organisation, controlling 50 factories in 19 countries and with assets of £6.5 million.

Prior to that, however, Columbia, too, decided in 1929 that they needed to get into radio. Louis Sterling, managing director of Columbia Graphophone, approached Allen Clark of the Plessey Company<sup>9</sup> to make suitable instruments. For Plessey it was a useful move, as they had lost

Marconiphone's business in 1926, when the firm set up its own manufacturing facility. Bill Heyne of Plessey had laboratory models drawn up, tooled and into production within six weeks, and when they were shown at the Olympia Radio Show, *Wireless World* magazine commented, "The entry of the Columbia Graphophone Co., Ltd., into the radio industry was an event of considerable importance, and the receivers exhibited at Olympia were the subject of much discussion and favourable comment. We have now had an opportunity of testing one of the No. 304 table models, and the results are fully in keeping with the efficient appearance of the layout. There can be no doubt that Columbia sets bear all the marks of the thoroughbred, and the 1930 models can definitely be placed among the best half-dozen makes at present on the market."<sup>10</sup> The No. 304 was a three-stage TRF receiver. One of the new Columbia range was the Electro-Graphophone No. 300 (figure 7) a console cabinet machine which also had a three-stage TRF radio plus a two-stage power amplifier using the latest PX4 valves in push-pull. The machine had a turntable belt-driven from a high-quality universal motor, so that the turntable speed could be easily adjusted. The performance was impressive and powerful. A treble tone control was incorporated.



Fig 7a: Columbia Electro-Graphophone Model 300

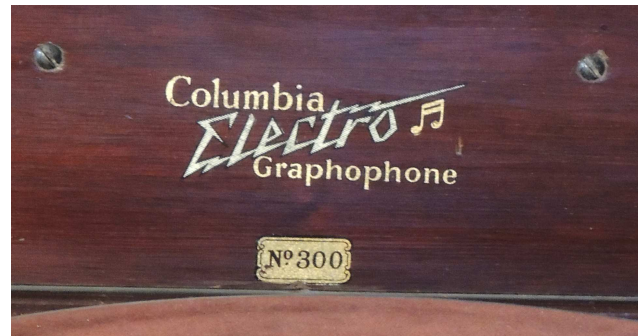


Fig 7b: Columbia logo

It was not, however, just the big companies that ventured into making radiograms. In 1929 the Gambrell Brothers<sup>11</sup> in London also entered the market with their Gam-Brell Radio-Novogram, a radiogram (figure 8) with a two-stage TRF radio receiver plus a two-stage audio amplifier and fitted with their patented Novotone device – basically a bass and treble boost network placed between the pickup and the amplifier.

*Wireless World* magazine commented on it on November 13th 1929:

"...the effect of introducing the Novotone is most striking. On orchestral records it is like switching on the double basses, while the pedal and bass notes of the organ and piano are reproduced with a richness and volume closely approximating to the original.



Fig 8: The Gam-Brell Radio-Novogram



**The Gam-brell  
1930-1931  
Range includes  
ALL - ELECTRIC**

2 Valve ..... D.C.  
2 Valve ..... A.C.  
3 Valve ..... D.C.  
3 Valve ..... A.C.  
4 Valve ..... D.C.  
4 Valve ..... A.C.  
(Peetral Model)  
4 Valve ..... A.C.  
4 Valve ..... D.C.  
(Table Model)  
4 Valve ..... A.C.  
(Table Model)

and the GAM BRELL  
RADIO-NOVOGRAM  
FOR D.C. AND A.C.

All supplied in Oak or  
Mahogany Cabinets

**Stand 106 Olympia**  
Demonstration Room 'R'

**The GAM-BRELL RANGE of  
ALL-ELECTRIC RECEIVERS  
is the most complete obtainable.**

A truly wonderful range, and every instru-  
ment has many excellent selling points.

ALL - ELECTRIC AND TROUBLE FREE.

VARIO-SELECTIVITY CIRCUITS GIVING HAIR-LINE  
TO BROAD TUNING AT WILL.

NUMEROUS STATIONS TO CHOOSE FROM, MANY  
RECEIVED WITHOUT AERIAL.

HIGHEST STANDARD OF REPRODUCTION.

HANDSOME OAK AND MAHOGANY CABINETS OF  
NEAT DESIGN.

**STOCKS WILL BE READY BY SEPT. 15th**

*Supplies of Illustrated Literature and "Sales-aids" on application.*

**GAMBRELL RADIO LTD.**  
6, BUCKINGHAM STREET, STRAND, LONDON, W.C.2

Fig 9: Gambrell Advertisement in Wireless & Gramophone Trader of September 1930.

The effect of the scratch filter and the special output circuit for modifying the low note amplification are also clearly demonstrated.

There can be no doubt that anyone who has heard the Novotone demonstrated in this way would from that time onwards cease to be satisfied with gramophone reproduction by ordinary methods."

Like HMV, Gambrell Brothers opted for the Mullard DO20 power valve as their choice to drive the loudspeaker. The turntable, with universal electric motor, was bought in from Garrard and the radio and amplifier components from a variety of trade suppliers. Gambrells were renowned for their



Fig 10: RCA Victor Radio Electrola Model RE-57. Its microphone can be seen in the left compartment next to the record player.

ingenious radio tuning coils, so no doubt made those themselves. Their advertisement for the forthcoming Radiolympia trade show appeared in 'The Wireless and Gramophone Trader' magazine of September 6<sup>th</sup> 1930 (Figure 9).

In America, RCA Victor were not to be outdone. For 1930 they fielded a considerable range of machines<sup>C</sup>, including the Model RE-57 (figure 10), which not only had a fine sound but also enabled you to record programmes from its radio or from a microphone – but only for a few minutes – on a special soft wax disc and using its magnetic pickup head as a disc cutter! Shades of Thomas Edison's phonograph – be sure your phonograph will make its own records!

There were of course by now dozens of manufacturers vying for the public's attention, most of them outside the scope of this article. We may look at one or two more in the future.

## Notes

1. A capacitor (or condenser) microphone basically has a fixed metal plate and a second similar attached to a diaphragm which is vibrated by sound waves. When a battery is connected across the plates (through a high-value resistance) no current flows, as they are insulated from each other, but an electrical charge exists between them. The charge is fixed and cannot change, but if one plate vibrates, the voltage across the plates does change, producing an electrical signal that varies in sympathy with the vibrations.
2. A two-stage amplifier has two valves (tubes), one after the other, so that the amplification of each stage is multiplied together.
3. A small coil of wire is suspended between the poles of a magnet. A small piece of iron is also suspended there, so that an alternating voltage applied to the coil varies the magnetic strength, which causes the iron piece to move in sympathy. The record cutter is attached to this iron piece.
4. The Radiola IX was specially designed for the after-sales department. It was based on a square of polished mahogany and only 3 ½" thick in total. The idea was that it could be mounted inside the lid of the gramophone. It had a transducer that could be attached to the tone arm so that the radio played through the gramophone internal horn.
5. At that time, the cinema version of the Panatrope would have been in several units - record player, amplifier, speakers etc. The

author's uncle, the late John Mansfield, a keen musical box collector and friend of several of the more senior members of AMBC, was in the electrical business until his retirement. They owned a Brunswick Panatrope, which they rented out to various venues. He recalled that, in his youth, it was one of his jobs to deliver and set up the machine and described it as a 'beastly thing', as it kept giving him electric shocks!

6. Hitherto radio valves had a fixed amplification factor (known by the Greek letter  $\mu$  – phonetically 'mu'). Around 1930, valve designers had produced a range in which the  $\mu$  could be varied by altering the bias voltage. The big advantage in radio design was that the amplification of the receiver could be automatically reduced if a powerful signal was received. In earlier designs the result was distortion in such circumstances.
7. The use of two output valves in 'push-pull' for driving the loudspeaker was found to effectively cancel even-order harmonic distortion compared with a single output valve.
8. TRF, or Tuned Radio Frequency, was a simple type of receiver in which all signals received were amplified by several stages all tuned to the signal's frequency. A much more effective and efficient design was the Supersonic Heterodyne ('Superhet') in which all incoming signals were converted to a single fixed frequency (the Intermediate Frequency, or IF) which could be amplified easily without retuning for every received station. The disadvantage was that it needed more valves and components, so the cost was higher than the TRF.
9. At the outbreak of the First World War a young man called W O Heyne, born in Germany, was interned, even though he had lived in Britain since childhood. He eventually became a good business man and a brilliant production engineer. The war made it difficult for him to get a job but he finally obtained work with a business in Lisson Grove, Marylebone (London) - the Coutsam Piano Action Company. It was in financial difficulties and was bought by a Thomas E Hurst-Hodgson, who soon realised that he must liquidate the company but that Heyne was one of the major assets. He formed a new company to take over Coutsam's machine shop. That company was The Plessey Company Limited, registered with limited liability on 11th December 1917. The shareholders were Heyne, Hurst-Hodgson and two brothers, Raymond and Plessey Parker. In 1921 B G Clark, an American, persuaded

Plessey to manufacture tags and eyelets for his shoe-making business. He was sufficiently impressed to buy shares in the company and arrange for his son, Allen Clark, aged 22, to join it. As it turned out, Allen and Bill Heyne made an ideal partnership. In 1922 Clark Senior learned that Marconi were looking for a firm to manufacture radio sets under contract. Plessey obtained the contract and received an order from Marconi for 500 'Junior' crystal sets, 5,000 'A' crystal sets and 5,000 V2 receivers, a total of just over £30,000 worth, which started Plessey in the radio business.

10. Wireless World magazine, November 27<sup>th</sup> 1929.
11. In 1894, Gambrell began with the production of scientific equipment for schools and laboratories, such as resistance banks, galvanometers, volt and ampere meters, at the address 17, Giltspur Street, London. In the 1920s Gambrell began making crystal receivers, reception units for radio amateurs and wireless constructors, radios, wavelength meters and components, such as coils. In 1921, the brothers Thomas Edward and Charles Thomas Gambrell were registered in the Manual of Electrical Undertakings and Directory of Officials, as manufacturers of and dealers in electrical instruments and appliances. The address was 76, Victoria Street, London, S.W.1. The factory was at Merton Road, Southfields, London, S.W.18. Later, the company moved to 6 Buckingham Street, London W.C.2. Radios were made from about 1922 to the early 30s. The company introduced the first ever British all-AC mains receiver, the "Baby Grand" in 1926. Gambrell Radio Ltd. was liquidated in 1939. Gambrell continued the production of scientific instruments until after the Second World War.

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