

seeing by wireless



The Story of Baird Television
by Ray Herbert



SEEING BY WIRELESS.

Sir,—My attention has been drawn to a paragraph in your issue of the 26th ult, in which it is stated that I have invented a machine by which "I claim to see by wireless." This statement is both misleading and damaging.

May I point out that early in this year I demonstrated to the Press and also to a number of experts the actual transmission of moving outline images. Full accounts appeared in all the leading wireless journals and cinematograph journals and it is clearly described by Mr. Wm. Le Queux in "The Radio Times," 25th April (Television — A Fact!) Also by Mr. E. V. Robinson, Editor of "The Broadcaster," in the April issue ("Radio Television.") Both of these gentlemen were present at actual demonstrations.

The word "claims" is, therefore, entirely out of place, and gives the wrong impression. I shall be glad if you will publish this letter in correction.

J. L. BAIRD,

21, Linton-crescent,
Hastings.

Hastings and St Leonards Observer, 9th August 1924



At the end of 1929 members of the staff were invited to take part in a competition to design a company logo. The winning entry came from Margaret Leslie who received a prize of 2 guineas (£2.10). She was christened by Baird's father in November 1908, joined the Company on her 21st birthday and soon became John Baird's secretary. Her original design had to be modified for copyright reasons and the final result is shown above.

FOREWORD

It is nearly 50 years since the death of John Logie Baird, the Father of Television. In 1926 he was the first person anywhere in the world to demonstrate true television pictures as distinct from shadowgraphs having no detail. His other firsts make an impressive list. Video recording (1927), Transatlantic television (1928), the Derby televised (1931-32), the transmission of high definition colour pictures (1937), stereoscopic television in colour (1941) and the multi-gun colour television tube (1944), the forerunner of the type used in most homes today.

Many of the staff who built the equipment and took part in these historic activities carefully preserved their laboratory notebooks, photographs, press cuttings and diaries. This commemorative booklet has been compiled from the uniquely authentic material supplied by over 34 members of J.L. Baird's former staff and associates whose names are recorded elsewhere. Many of them were colleagues during my time with the Company and their assistance is gratefully acknowledged. My thanks also to D.F. McLean for permission to use the photograph of the Phonovision images which he retrieved by using special filtering and digital techniques.

John Baird's outstanding work on colour television has received scant recognition, possibly because the major achievements took place during the war years when newspapers had more important things to report. Also, the authors of books on early television tend to use the outbreak of the war as a convenient point at which to terminate their accounts.

The publication of this booklet has been made possible through the generosity of Quantel Ltd. of Newbury whose digital image manipulation systems are in use world-wide. My especial thanks to them for their interest and support.

RAY HERBERT

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(High definition in colour. Stereoscopic television in colour. The Telechrome tube.)

ACKNOWLEDGEMENTS

Most of the primary source information used in the preparation of the booklet has been supplied in the form of correspondence, laboratory notebooks, tape recordings, photographs and press cuttings by those whose names are given below.

| | |
|------------------|--|
| E.G.O. ANDERSON | Worked with J.L. Baird at his private laboratory on colour television 1936-45. |
| B.B. AUSTIN | Project leader of team developing airborne television 1936-9. |
| O. BARTLE | Glass technologist who produced the earliest large television tubes from 1936. |
| A.F. BIRCH | Technical assistant and studio manager at Long Acre 1928-9. |
| T.H. BRIDGEWATER | Baird studios and laboratories 1928-32, then BBC Television Service, becoming Chief Engineer in the post war period. |
| B. CLAPP | Baird's first technical assistant 1926, Chief Engineer 1927 - supervised transatlantic television trials 1928. |
| G. J. CRAIG | Developed the intermediate film system at the Crystal Palace studios 1934-6. |
| W.J.E. FORWARD | Worked on large screen television for cinemas 1936-9. |
| W.C. FOX | Press Association journalist and supporter of Baird from 1924. Company Information Officer 1928-30. |
| W. FRY | Company accountant 1928-39. |
| R.B. HEAD | Developed special phosphors for the screens of television projection tubes 1937-9. |
| R.M. HERBERT | Carried out airborne television transmissions from French Air Force bomber 1939. |
| P.T. HOBSON | Worked with J.L. Baird on Noctovision. Played the piano for early programmes 1928-30 |
| MRS. D. JACKSON | Secretary to J.L. Baird 1931-3 and W.C. Fox 1928-30. |
| T.M.C. LANCE | Head of research department 1933-9. |
| A. LAWSON | Camera man at Crystal Palace studios. |
| MISS M. LESLIE | Secretary to J.L. Baird 1929-31. |
| N. LOXDALE | Performed odd jobs in Hastings for J.L. Baird as a schoolboy in 1923-4. |
| E.D. McCONNELL | Worked on early telecine 1935. Member of airborne television team 1938-9. |
| V.R. MILLS | Provided voluntary assistance to J.L. Baird at Hastings 1923-4. |
| H.C. NICKELS | Long Acre laboratory from 1932. Telecine design at the Crystal Palace 1936. |
| D.W. PUGH | Transmitter department. Designed the Crystal Palace 10kW high power vision transmitter in 1934. |
| P.V. REVELEY | Project leader for large screen colour equipment designed at J.L. Baird's private laboratory 1933-8. |
| D.V. RIDGEWAY | Television receiver design 1936-9. |
| C.L. RICHARDS | Worked at the Baird television studios in Berlin 1929, Kingsbury Manor laboratories 1930. |
| F. ROSE | Sales department and stores 1928-39. |
| A.E. SAYERS | Member of J.L. Baird's private laboratory staff 1936-41 Long Acre from 1929. |
| W.B. SAYER | Telecine and intermediate film system construction 1935-9. |
| A.H. SOMMER | Designed special photocells for studio use and J.L. Baird's colour experiments 1935-9. |
| H.C. SPENCER | Telecine and Farnsworth camera work at the Crystal Palace 1936-7. |
| R.W. TAYLOR | Transmitter department. Magnetron work in 1936. |
| G.A.R. TOMES | Vacuum physicist. Developed television tubes, photocells, image converters and camera tubes 1935-9. |
| R. VINCE | Carried out television demonstrations from Germany in 1929. On J.L. Baird's personal technical staff later. |
| F. WHITWORTH | Involved in Coliseum Theatre lamp-screen demonstration in 1930. |

SEEING BY WIRELESS

The Story of Baird Television

THE RACE FOR TELEVISION.

It may seem surprising but in some ways television is conceptually older than radio. In 1884 Paul Nipkow invented the scanning disc, destined to play a vital role in the future development of television or 'Seeing by Wireless' as it was known in the 1920s. This discovery took place 11 years before Marconi succeeded in transmitting spark signals over a distance of a few feet. Radio developed rapidly and by 1901 morse transmissions had traversed the Atlantic.

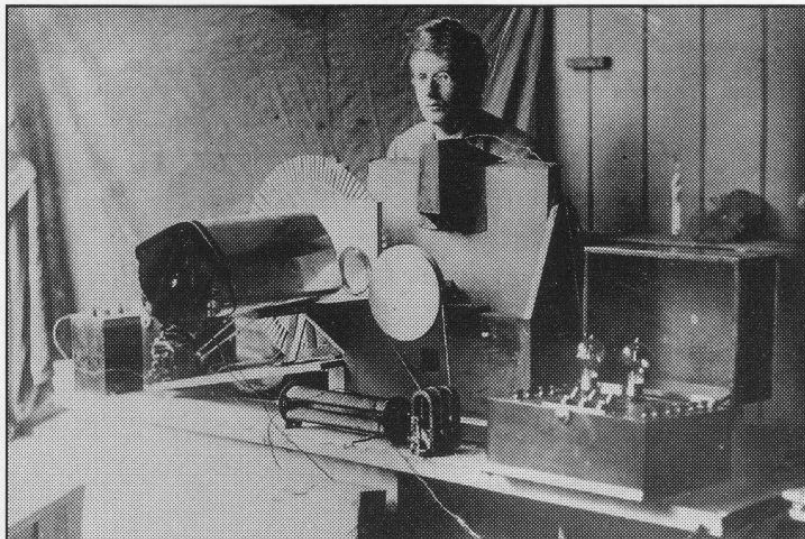
In spite of the combined efforts of a number of experimenters who were striving to win the race for television, 42 years were to elapse before the winner, John Logie Baird, demonstrated true television in the form of recognisable images with instantaneous movement and gradations in light and shade. Why the delay? The answer lies in the fact that the tiny electrical currents produced by the light sensitive cell could not be amplified to a usable level until the radio valve became generally available around 1922. Baird quickly realised that this represented the missing link and at the end of 1923 he produced the first crude television pictures but only as shadowgraphs. It is remarkable that the person to crack the problem was at the time without a job, recovering from an illness and lacked even the most basic workshop facilities. Although working alone in the sense that no staff were employed, he did receive enthusiastic assistance from several radio amateurs living in the Hastings area, the scene of his activities above a shop in the Queens Arcade. As a reciprocal gesture Baird gave his first lecture ever to members of the Hastings Radio Society on 28th April 1924.

The equipment demonstrated to a reporter from the Daily News in January 1924, could only be described as crude in the extreme. Tea chests from a Hastings grocer provided wood for the 2 feet diameter scanning disc comprising four groups of five holes set in a staggered formation around the circumference. The first receiver consisted of 20 torch bulbs arranged in a similar configuration to the scanning apertures and mounted on an even larger rotating disc. These lamps reproduced the outline of the object being televised. Later receivers used a neon lamp in a viewing tunnel.

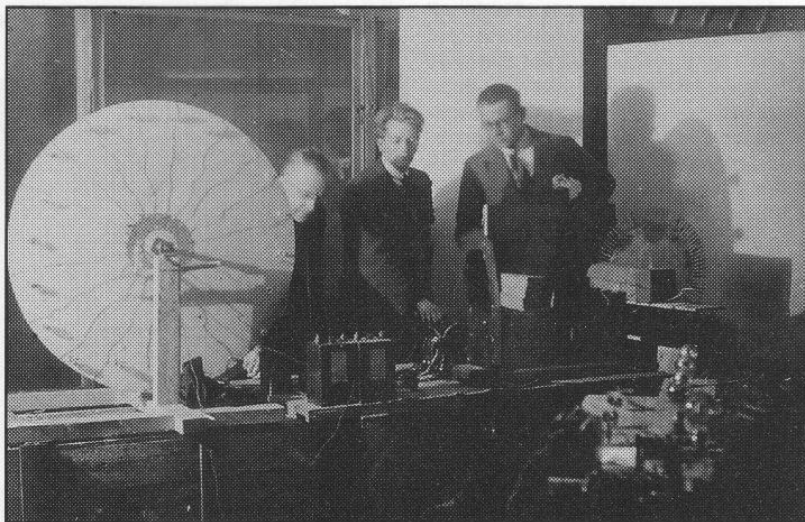
In order to obtain financial backing John Baird badly needed some publicity but after tramping the length of Fleet Street the only journalist who showed the slightest interest was Bill Fox, a wireless enthusiast who worked for the Press Association. He suggested that as a means of verification and to provide a story an attempt should be made to transmit a television signal which could be picked up at his home in Golders Green. Apparently Baird succeeded in connecting up his apparatus to a radio transmitter as several daily newspapers reported on 10th April 1924 "The tests were car-

ried out from a South Coast town and wireless amateurs listening to Paris Radiola may have heard the picture transmission..... With the necessary apparatus the signals could have been converted into a picture'. The identity of the amateur radio station involved remains a mystery. The person concerned probably kept quiet about it in case the authorities disapproved of television signals being transmitted instead of speech or morse code.

Baird moved to Frith Street, Soho, in August having sold a one third share in his enterprise to Wilfred L. Day, the owner of a radio shop at 19 Lisle Street, London.



J.L. Baird in his lodgings at Hastings (late 1923).



William Le Queux, President of the Hastings Radio Society, J.L. Baird and Claude Frowd in the Queens Arcade laboratory (early 1924).

HISTORIC DEMONSTRATIONS

In April 1925, Selfridge's store provided space in their electrical department for Baird's equipment to be seen in operation, the first public demonstration of television to be held anywhere. He provided technical details in a paper presented to the Radio Society of Great Britain in October 1926.

A large scanning disc 2 feet in diameter, had two groups of eight lenses set around the periphery in staggered formation as before, each casting a single strip of the televised image on to the light sensitive (selenium) cell. Images could now be reproduced using light reflected from the object, an improvement upon the Hastings arrangement where a bright light shone directly into the selenium cell, interposed geometric shapes providing the shadowgraphs.

Press reports commented upon the primitive nature of the equipment described in one magazine as an unimpressive erection of old sugar boxes, bicycle lamp lenses and a nightmare cobweb of electrical wiring. The editor of 'Discovery' thought it was an outstanding miracle that anything could be produced from the very indifferent material at his disposal.

The indifferent material was due to an acute shortage of cash. Baird received no grants from public funds and such supportive organisations as the National Research and Development Corporation did not exist. He received £60 for his three week stint at Selfridge's and that helped.

TRUE TELEVISION ACHIEVED.

Back at the Frith Street laboratory work continued in an attempt to produce better images which still had not progressed beyond an outline of the subject with no observable detail. The sensitivity of the light cell represented the all important factor and considerable mystery surrounds the nature of the device used in 1925-6. No photographs of it have ever been seen and when the original equipment was donated to the Science Museum in 1926 the cell had been removed. To compensate for the lack of sensitivity the maximum amount of light had to be obtained by using bigger lenses resulting in much larger scanning discs, now approaching 5 feet in diameter. The object to be televised needed to be illuminated by powerful floodlights placed a very short distance away and as human flesh could not withstand the heat for more than a few minutes Stooky Bill, a ventriloquist's dummy, had to be used for test purposes.

The receiver, or Televisor as Baird called it, consisted of an aluminium disc of between 15 and 20 inches diameter having a single spiral of tiny holes exactly matching in spacing and number those in the studio scanner. The disc rotated in front of a source of illumination which varied in sympathy with the brilliance of the scene being televised. For the earliest equipment the disc speed was around 300 rpm but later 750 rpm became the standard.

The quest for true television continued,

that is to say the reproduction of recognizable images with instantaneous movement and correct gradations of light and shade. On 2nd October 1925, Stooky Bill appeared on John Baird's screen not as a mere smudge of black and white but having detail with good tonal values. He was elated and dashed down to the floor below to find a living subject. The first person he encountered was William Taynton the office boy who reluctantly consented to sit before the scanner.

Returning to the receiving end in the next room Baird saw only a blank screen as William, disconcerted by the intense light and heat, had backed away. A half crown tip (12½p) persuaded him to stay put and this time his image came through clearly, the first human face to be seen by television.

William also became the first person to receive a fee for appearing on the box.

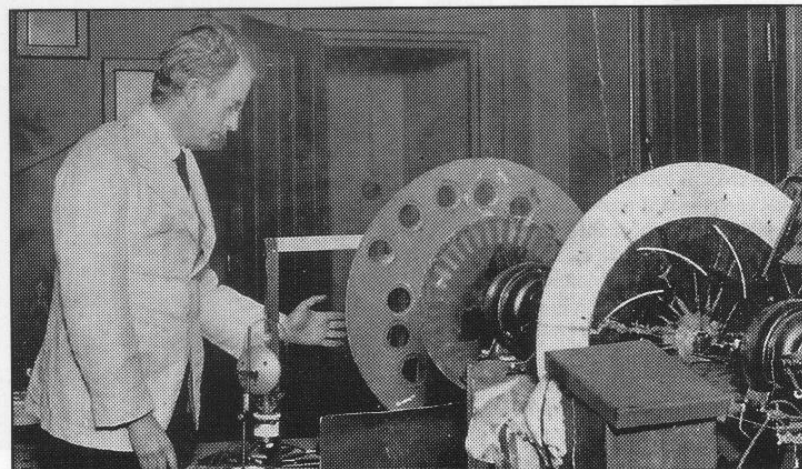
Just over three months later, on 26th January 1926, some 40 members of the Royal Institution visited Frith Street to witness a demonstration of real television using a definition of 32 lines. The Times newspaper sent an ob-

server and a reporter from The Daily Chronicle also attended. His account the following day commented "Looking down a dark tube on to a screen The Daily Chronicle representative was able to see a colleague smoking a pipe in another room". John Baird, still working single handed, had reached his goal with a handsome lead over the competition, for it was not until 7th April 1927, that the combined efforts of a large number of engineers at the Bell Laboratories of the American Telephone and Telegraph Company were able to produce comparable results. The New York Times reported "The international race for the perfection of television... has been won by Great Britain".

Sending pictures from one room to another had obvious limitations and in order to reach a wider audience television needed to be made available through the medium of wireless. As a means to this end Baird applied for a licence specifically for the transmission of television and received the singularly appropriate call sign G2TV on 5th August 1926.

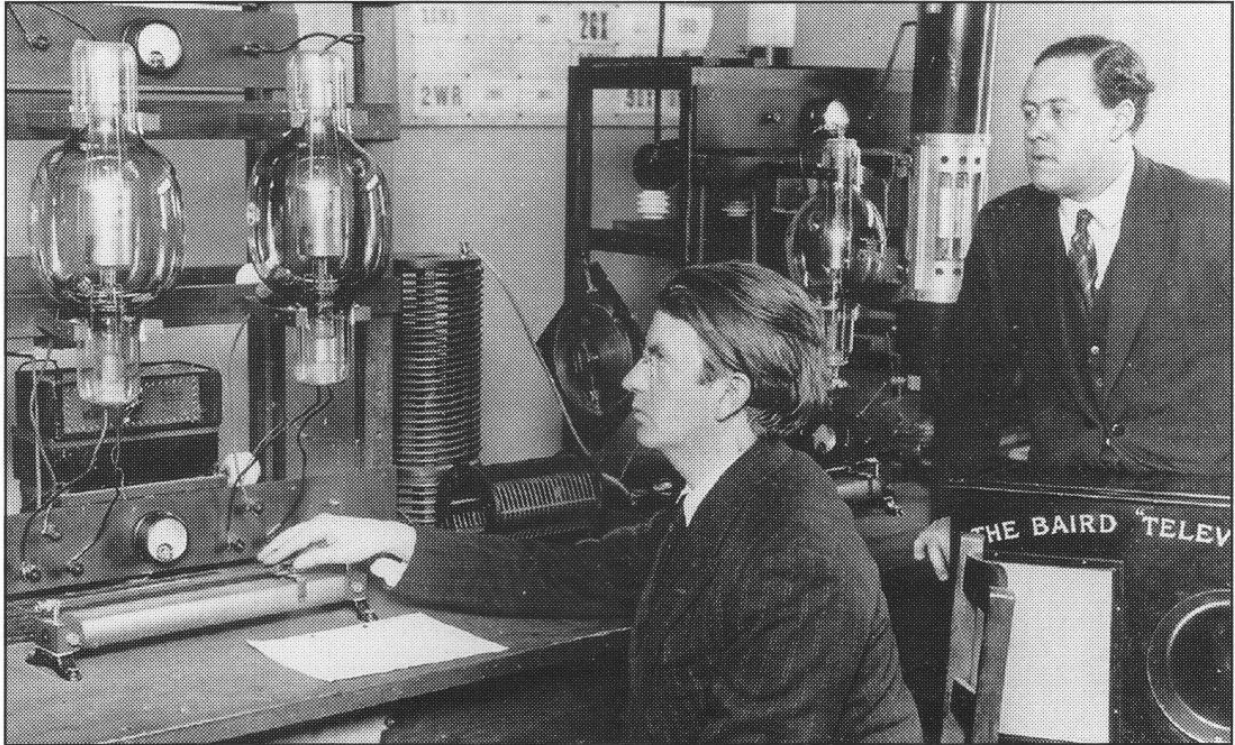


A famous trio. Oliver Hutchinson and John Baird, directors of Television Ltd., with Stooky Bill at Frith Street, Soho, January 1926.



The equipment used for the demonstration at Selfridge's store, April 1925.

FACES ACROSS THE SEA



J.L. Baird (sitting), with Ben Clapp at his amateur radio station G2KZ used to transmit television across the Atlantic, February 1928.

Ben Clapp joined the Company in November 1926, and became the only technical assistant. In 1925 he had obtained special permission from the Post Office to use the unusually high power of 1kW for trans-oceanic tests from his amateur radio station G2KZ at Coulsdon. There is little doubt regarding the role which John Baird envisaged for this privately owned wireless equipment. He was anxious to keep ahead in the television race and regarded the Atlantic as a challenge but getting any kind of television image over such a distance was infinitely more difficult than the three scratchy morse code dots which represented Marconi's similar feat by radio in 1901. With morse it is much easier, no matter how feeble the signal, if you can hear it, that's sufficient.

Press comment appeared well in advance of the actual event the Daily Telegraph and Daily Herald both choosing the headline "Faces Across the Sea" in their editions for 22nd April 1927.

The most favourable period for the reception of radio signals across the Atlantic was during the winter and Ben Clapp arrived in New York with a 30-line Televisor on 5th October 1927. He stayed with a fellow radio amateur Robert Hart, W2CVJ, of Hartsdale, New York, who had offered to assist by providing the receiver and maintaining a radio link back to London on 37 metres. Meanwhile, the transmitter at Coulsdon was operated by Len Luger from the Marconi wireless station at Croydon Aerodrome, Harold Smith and Frank Barford.

The true nature of these activities had to

be concealed from both the Post Office and other experimenters in the USA in case the latter should be spurred into launching a competitive venture. No mention could be made over the air of Baird, images or television and a simple letter substitution code disguised these words, Baird's name appearing throughout the messages as "IJKDR".

Tests took place three times a week. Vision signals sent by land line from the Baird Long Acre laboratory were transmitted when conditions were suitable, at other times gramophone records were used. An attempt was made to receive a video recording of Stooky Bill (Phonovision) made by Baird on 20th September 1927, but this proved to be unsuccessful due to the incompatibility of the synchronising arrangements. An entry in the station log book at 00.01 GMT on 7th October 1927, in telegraphese, reads "R ok. Pse stand bi for TV record", possibly the first time that this now universal abbreviation had been used. This 316 page log book makes fascinating reading as all outgoing and incoming messages were recorded verbatim. It reveals that some 58 transmissions were made from Coulsdon before the results were considered to be good enough for a press demonstration.

On 8th February 1928, (9th February in London) a small group gathered around the Televisor in the cellar of Hart's home. Capt O.G. Hutchinson (Joint Managing Director of the Baird Company), Ben Clapp and a reporter from Associated Press watched the flickering, orange-pink screen resolve in to a smudgy image of Stooky Bill. John Baird came over next

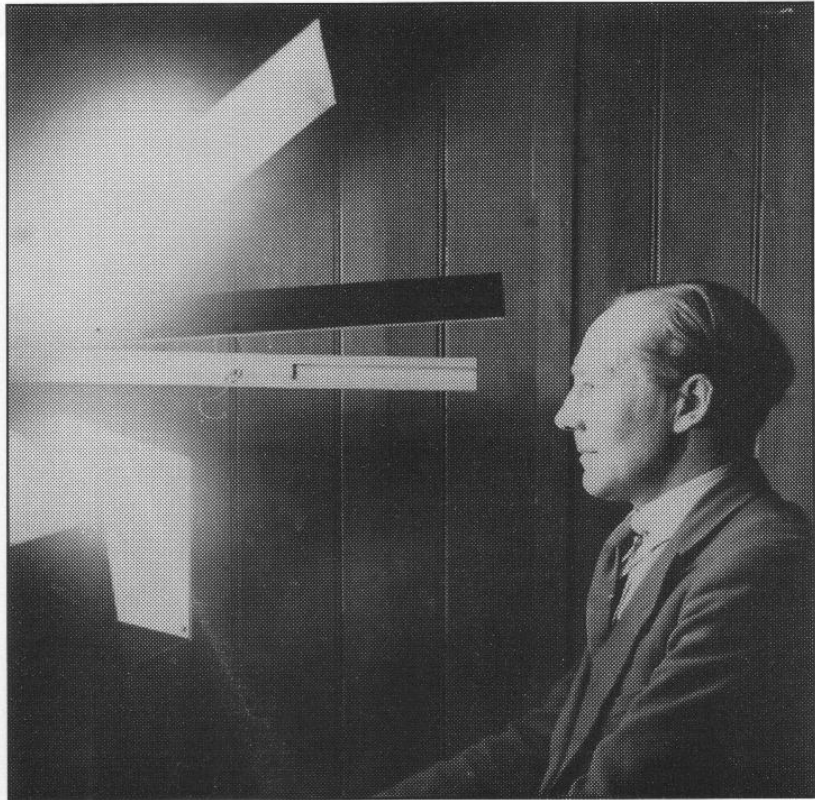
at 01.35 GMT, followed by Bill Fox a Press Association journalist. Mia Howe, the wife of the AP representative in London was televised last. History having been made that night Harold Smith entered in the log book for 9th February 1928, "Station closed 04.38".

The results were admittedly crude but little better could be expected bearing in mind the equipment available and the inevitable degradation of the signal due to fading, phase distortion and interference. Television had bridged the Atlantic less than six years after the start of broadcasting and 34 years before the Telstar satellite.

Capt. Hutchinson and Ben Clapp travelled back to the UK on the SS Berengaria. Arrangements were made to attempt the reception of television pictures in mid-Atlantic and on the evening of 6th March the vacant grin of Stooky Bill appeared. Unknown to those on the ship Baird had asked Dora Selvey, the fiancée of the Chief Radio Operator, to be present in the Long Acre studio and he was able to recognise her without difficulty. "Radio operator recognises his betrothed on screen" proclaimed The Evening World the following day. Two radio amateurs in New York, Boyd Phelps W2EB and Werne Olpe W2BUO successfully recorded the vision signals of Miss Selvey on a 78 rpm phonograph disc which they sent to the Baird Company as proof of reception.

These remarkable transatlantic achievements provided a much needed boost to the fortune of the Company, the shares rising sharply afterwards. As a result the staff was increased from six in 1928 to about 35 in 1929.

Bill Fox being televised across the Atlantic from the Baird Studios in 1928.



HOME
EDITION

The Winnipeg Evening Tribune

THE WEATHER
Forecast: Fair and mild, 77
Temperature: 40. 20 days' mean,
40. Maximum, 70. Minimum, 20.
Wind: S.W. 10 to 15. 10 days' mean,
10. Maximum, 20. Minimum, 0.
Bar: 30.00. 10 days' mean, 30.00.
Sun: 7:30 a.m. to 5:30 p.m.
Moon: 11:30 a.m. to 11:30 p.m.

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No. 34

TELEVISION TRAVERSES ATLANTIC

Sitting In Dark Cellar In New York, Group See Man And Woman In London

Hartsdale, N. Y., Feb. 8.—(AP)—A man and a woman sat before an electric eye in a London laboratory tonight and a group of people in a darkened cellar in this village outside New York watched them turn their heads and move from side to side.

The images were crude, imperfect, broken, but they were images none the less. Man's vision had spanned the ocean; transatlantic television was a demonstrated reality and one more great dream of science was on the way to eventual complete realization.

The demonstration was made by the Baird Television Development Company, of London, using short wave radio sets for transmission of the "vision sound" and the telvisor invented by John L. Baird.

The transformed vision of the man and woman in the London laboratory came through the ether in the form of a bumblebee's hum, a musical buzz of irregular cadence representing in sound the lights and shadows of their faces—all that was transmitted in the test.

When the telvisor, a black box compact enough to be carried around in a taxi, had done its work with this rhythmic rumble from across the sea the visions gradually built themselves up of tiny oblongs of light suspended in a whirling rectangle of brilliance in the machine's gaping mouth. These oblongs shifted and swirled, scarcely for a moment holding their places.

NEW YORK SEES PEOPLE 'SENT' FROM LONDON

British Laboratory to Cellar
in N.Y. Village in Science's
Latest Conquest

DISTINGUISH HEADS TURN, MOVE FROM SIDE TO SIDE

Images Are Crude, Imperfect
and Broken But Images
None the Less

HARTSDALE, N.Y., Feb. 8
—A man and a woman sat before an electric eye in a London laboratory last night and a group of people in a darkened cellar in this village outside New York watched them turn their heads and move from side to side.
The images were crude, imperfect, broken, but they were images none the less. Man's vision had spanned the ocean; transatlantic television was a demonstrated reality and one more great dream of science was on the way to eventual complete realization.
The demonstration was made by the Baird television development company of London, using short wave radio sets for transmission of the "vision sound" and the "tel-

The Evening World

Y.

NEW YORK, WEDNESDAY, MARCH 7, 1928.

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10 York World 1928

Voyagers in Mid-Ocean, By Television, Watch Londoners Move About

Passengers on Berengaria
See Persons Moving
in British Studio

Radio Operator Recognizes
His Betrothed
on Screen

S. S. BERENGARIA, March 7 (A. P.)—A ship has been linked to shore for the first time by television.

Spectators aboard the Cunard liner, Berengaria, in the mid-Atlantic last night, saw persons appear before the transmitting apparatus in a London studio. They saw the subjects move and in one case the image that came across the Atlantic was recognized.

The test lasted for two hours and 44 times the vision from London was stated to be remarkably clear. The receiving apparatus of the television aboard the Berengaria was in operation.

Ben Clapp at the window of his radio room.



New York Times, 14th March 1928.

RADIO AMATEURS HERE CATCH LONDON PICTURE

Image Being Sent to Liner Is Recorded on Phonograph Disc With Extra Parts Costing \$15.

A record of the photograph of Miss Dora Selvy, sent by television from the Baird Laboratory in London to the steamship Berengaria in mid-ocean on March 6, was picked up by two amateur radio operators in Jamaica, Queens, during the transmission, it was learned last night at the home of Boyd Phelps, operator of radio station 2 EB at 8,505 167th Street, Jamaica.

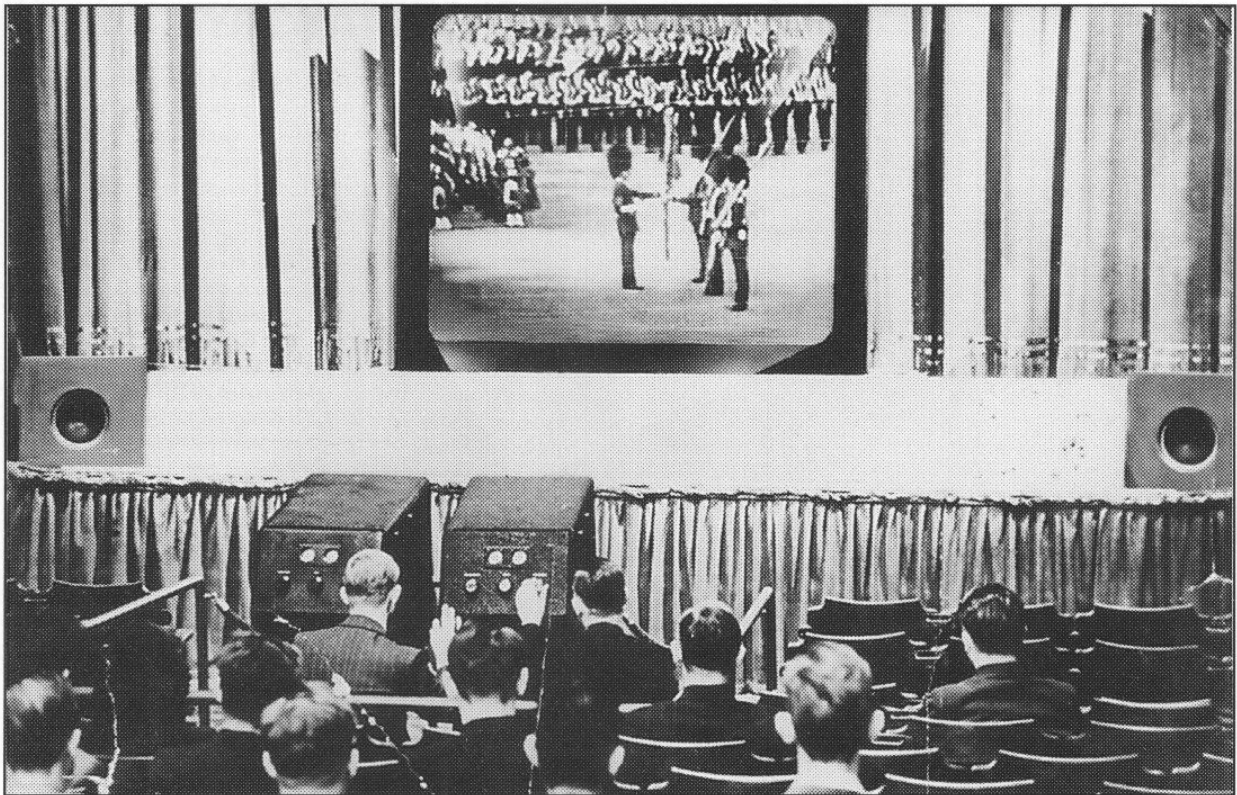
The picture of Miss Selvy was recorded on an ordinary phonograph disc by Phelps and Werner H. Olpe, operator of radio station 2 BUO, 14 Brooklyn Avenue, Jamaica, with the aid of an ordinary receiving set, to which parts worth approximately \$15 were added for the test. Boyd said he was mailing a copy of the photograph to the Baird Laboratories to prove his claim that he picked up the picture in transmission.

Phelps and Olpe had been on the lookout for signals, but until the night of March 6 they had been unsuccessful. When Boyd detected the signals he sent for Olpe and for a professional piano tuner.

In a written statement given out last night Phelps said the picture was "heard" about 9 P. M., and the transmission lasted more than an hour.

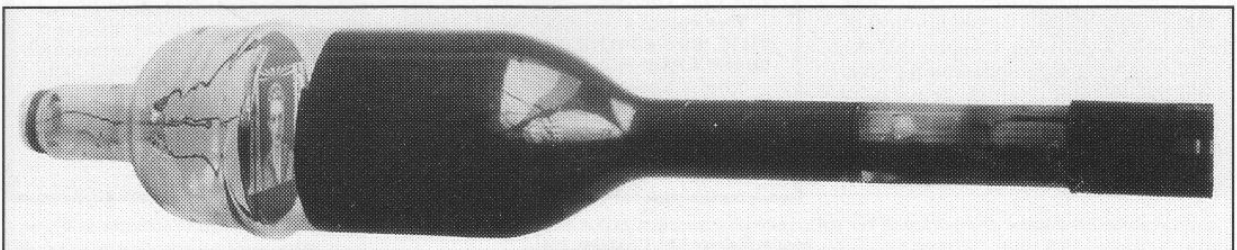


The Televisor on the S.S. Berengaria for receiving pictures in mid-Atlantic.



Cinema television. Baird projection receivers at the Tatler Theatre, London, in 1938.

This still picture tube (below) enabled captions to be transmitted without using a camera. The circular nickel plate (right) was scanned by a cathode-ray beam from a conventional electrode assembly, releasing secondary electrons. Madeleine Carroll in the film 'I Was a Spy' is shown on the plate.



J.L. BAIRD'S PRIVATE LABORATORY

This booklet would not be complete without reference to the outstanding colour television demonstrations carried out by John Baird.

From 1933 he had worked at a private laboratory in a converted stable adjoining his rambling Georgian house at 3 Crescent Wood Road, Sydenham. Although operating entirely independently with his own staff he could always call upon various Company services, for example workshop facilities, stores and assistance from the main research department.

Following the successful demonstration of interlaced, 120 line monochrome television pictures on a 8 feet by 6½ feet screen at the Dominion Theatre, Tottenham Court Road, London, in December 1936, Baird ambitiously set out to establish yet another first, a public demonstration of colour television on an even larger screen. After a press pre-view in December 1937, on 4th February 1938, at the same theatre colour pictures were displayed on a 12 feet by 9 feet screen and introduced as a surprise item to an audience of 3000 people at the evening performance.

The vision signals were transmitted to the theatre on a wavelength of 8 metres from the Crystal Palace South Tower. Baird had to use a small studio at the bottom of the spiral staircase because it proved impossible to put the higher definition pictures down the telephone lines from his main studio in Crescent Wood Road.

For these experiments he had reverted to the floodlight system and this made possible the transmission of outdoor scenes. The mechanical colour scanner (camera) mounted on a four wheeled dolly could be trundled through a convenient gate near the studio for televising the red trolley buses in Anerley Hill.

The scanner consisted of a drum carrying 20 small mirrors around the periphery each inclined successively at slightly differing angles. It rotated at 6000 rpm reflecting sections of the scene to be televised upon a revolving disc having 12 slots fitted alternately with blue-green and red colour filters. The vertical slices comprising the televised images were then directed to a multiplier photocell with a rubidium cathode. This arrangement provided a two colour 120 line picture.

At the theatre the projection receiving equipment utilised the same combination of mirror drum and slotted disc. A water cooled 150 amp arc lamp was used in the projector, differing levels of light and shade being provided by a Kerr cell interposed in the light path.

In case it should be thought that John Baird was pursuing outmoded mechanical techniques it must be mentioned that the vast resources of the National Broadcasting Company and the Columbia Broadcasting System in the USA could do no better. Even in 1940-41 they were still using mechanical components in the form of rotating colour filters.

HIGH DEFINITION IN COLOUR

Shortly after the outbreak of war, his connection with the Company now severed, Baird was without a job. In his autobiography written in 1941 and published many years later by the Royal Television Society, he outlined the prevailing situation "I was in the middle of some extremely interesting and I believe important work on colour television... I also sent my name in to the authorities and expected to be approached with some form of Government work but no such offer materialised". Throughout the war years the colour experiments were financed out of his savings supplemented by a consultancy fee from Cable & Wireless. With the armed forces having priority on demands for electronic components and other resources, the circumstances were altogether unfavourable for embarking upon a colour television development programme in competition with the USA heavyweights.

Baird set his sights on a much higher definition of 600 lines accepting that this would mean abandoning any form of mechanical scanning. It was back to the flying spot method but this time using a large projection tube similar to those employed at the Marble Arch Pavilion for the big screen demonstrations.

By December 1940, with only three staff remaining, an improved colour system had been designed using 600 lines. The projection tube in conjunction with rotating colour filters provided a brilliant picture on a 2½ feet by 2 feet screen.

The results were recorded on Dufaycolor film and a colour plate of Paddy Naismith, one of the visitors to the press demonstration, subsequently appeared in the April 1941, issue of Electronics and Television (Reproduced on the back cover). Wireless World, not given to effusive reporting, commented "The demonstration can only be described as a very considerable success. The colour picture was of more than adequate brilliance, being also both pleasing and restful to watch. The various tone values were produced with a degree of truth comparable with the Technicolour films which we are now used to seeing at the cinema. A notable point in connection with viewing the colour pictures is an apparent stereoscopic effect which make the picture stand out to a remarkable degree. The effect was quite apparent when still pictures were used as the subject, but became even more so when their place was taken by a girl with red hair, the tones and screen of which were reproduced perfectly."

Colour Television Shown On World's Largest Screen

TELEVISION in colour, newest wonder of science as the "Sunday Referee" revealed last week, was demonstrated for the first time during the week.

With Mr. J. L. Baird, the inventor, a small group of people at the Dominion Theatre, Tottenham Court-road, London, watched this new miracle of "looking-in."

They saw a full-colour programme on a 12-foot screen, the largest television screen in the world.

The programme had been relayed from the Baird research station at Crystal Palace, over seven miles away. But the audience saw it perfectly from the back of the dress circle in the vast theatre.

The colours on the screen were vivid, and sharply defined—each shade distinct.

The audience hailed the demonstration as a tremendous advance on coloured films—for no artificial colour is used.

It was the actual colour of life

that they saw, glowing and unchanged, before them. They were seeing real people.

A man moved and postured on the screen, displayed gay Hungarian and other national costumes, all of which appeared with a vivid "actualness" impossible in the most perfect film.

There was a show of fashion plates, a gay array of national flags, with every colour pure and true.

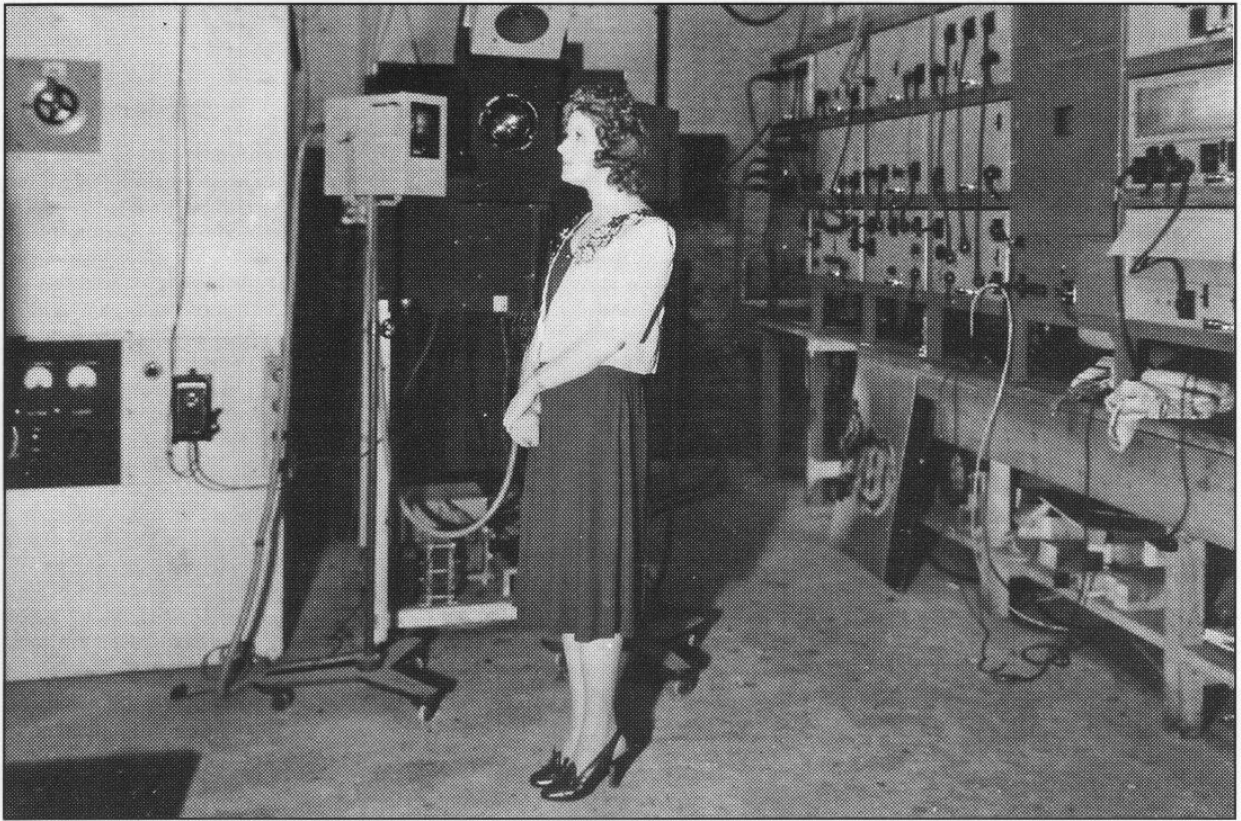
The demonstration was a triumph.

Another demonstration of Baird colour television, on an even more elaborate scale, will be given in London this week, probably on Thursday, before a number of Mr. Baird's business associates.

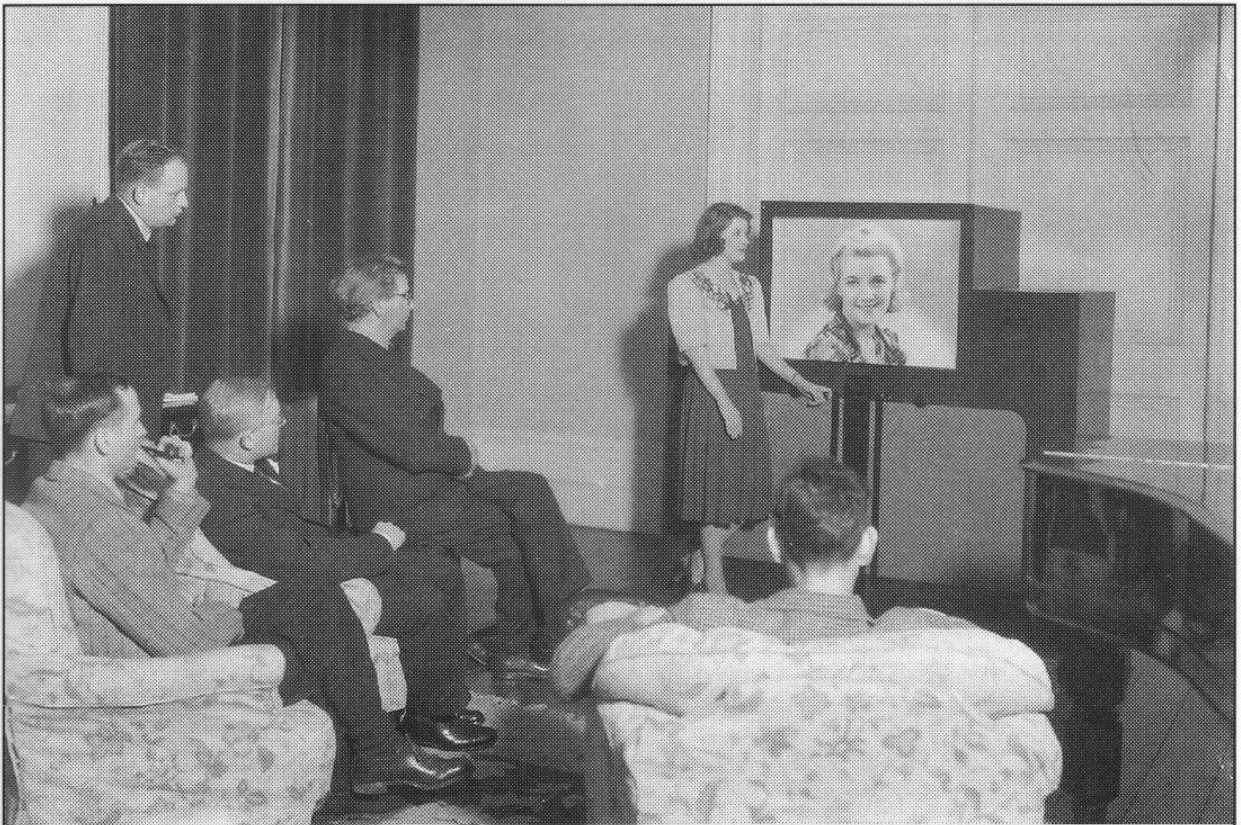
Mr. Baird, forty-nine-years-old Scottish "son of the manse" and former Glasgow engineer, told a "Sunday Referee" reporter yesterday:

"We are now working on final developments of the process. Soon colour television will be available to the public."

Sunday Referee 12th December 1937.



Paddy Naismith in the Crescent Wood Road colour television studio.



A press demonstration of high definition colour television in December 1940. E.G.O. Anderson is standing at left and Paddy Naismith is beside the colour receiver. The picture on the screen is a photograph.

STEREOSCOPIC TELEVISION IN COLOUR

When John Baird first demonstrated stereoscopic television in 1928 it was an interesting digression from the 30-line activities but of little commercial potential. No further experiments were carried out here or abroad until 1941 when Baird successfully ventured into high definition stereoscopic television in colour.

Several different approaches were considered including the use of polarised light, also the anaglyphic principle which required displaced images of differing colours and the use of tinted glasses for viewing. These alternatives were discarded for various reasons and Baird decided upon an adaptation of his 1928 system but with the added benefit that the viewer would not need to use either a prismatic stereoscope or coloured spectacles. Colour television cameras had not yet arrived and in the studio Baird used once more the flying spot system. As the spot of light traversed the scene panchromatic photocells recorded the level of reflected light and they also had to discriminate between the colours. This could be achieved by placing in the scanning beam a segmented disc containing red, blue and green filters which revolved at 1500 rpm.

In order to obtain the correct stereoscopic effect the subject had to be scanned from slightly different positions, the displacement being equal to the average separation of the eyes. This was accomplished by splitting the beam using pairs of mirrors, a revolving shutter ensuring that the differing optical paths were transmitted alternately. To reduce flicker, which

would result from an abrupt changeover of the scanning position, the shutter was specially shaped so that as one beam was gradually obscured, the other opened up.

The television projection equipment employed at the Marble Arch Pavilion cinema during 1939 and no longer usable for its original purpose, provided Baird with a ready-made electronic flying spot scanner. The intensely bright spot of light emanated from a teapot projection tube, so called because of its appearance. Cylindrically shaped, the neck entered at an angle, the fluorescent screen being deposited on an aluminium disc instead of the tube itself. Scanning had to be carried out obliquely and this required keystone correction. The light beam was front-projected through the optically flat tube face. This projection tube needed a high tension supply of 40,000 volts and the power unit also came from the redundant cinema installation.

A definition of 500 lines (100 lines interlaced five times) had been chosen for the stereoscopic demonstration with a repetition rate of 150 frames per second, successive 100 line frames being coloured red, green and blue.

At the receiving end another teapot tube provided the basic monochrome picture, colour being added by the rotating colour filter disc which had to be synchronised with the studio equipment. A shutter provided right and left eye perspectives in rapid sequence producing on the image forming lens a stereoscopic picture in full colour. Although coloured spectacles were not required this arrangement suf-

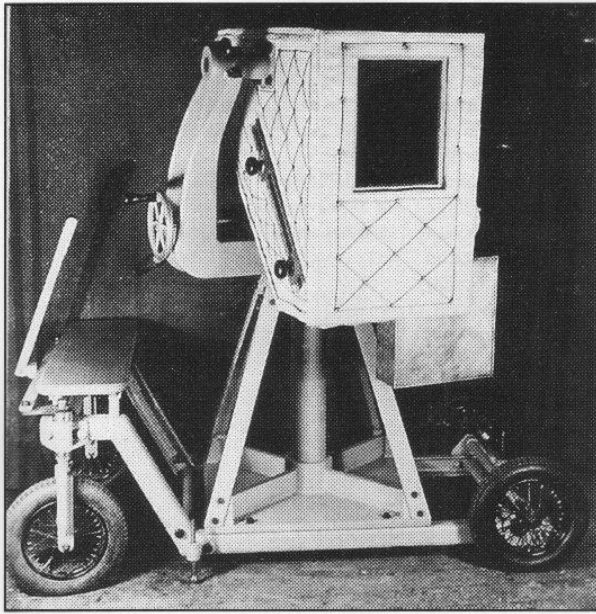
fered the disadvantage that the viewer had to be in a fixed position otherwise the stereoscopic effect was lost.

On the afternoon of 18th December 1941, the press assembled in the laboratory at Crescent Wood Road. These wartime demonstrations were relaxed affairs with John Baird handing out ham sandwiches and a press release which he had typed himself. On occasions one of his voluntary helpers, an accomplished pianist, would provide an impromptu recital on Margaret Baird's Steinway grand piano while final adjustments were made to the equipment.

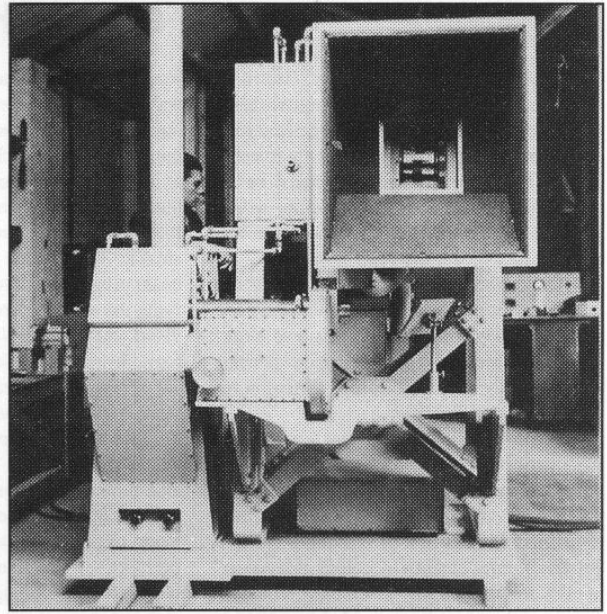
The journalists sat before the image forming lens and witnessed the first stereoscopic television pictures in colour to be seen anywhere in the world. Whatever may have been their thoughts regarding the electro-optical lash-up, they were impressed by the results. *Wireless World* reported "If the colour reproduction lacked the ability in this early experiment to differentiate the subtler shades, it dealt faithfully with the bolder colours. The stereoscopic effects were an unqualified success and when the person being televised reached towards the 'camera' his arm at the receiving end seemed to project out of the lens towards the viewer". Fortunately the enterprising editor of *Electronic Engineering* arranged for a colour photograph to be taken direct from the screen of Baird's receiver, thus preserving for posterity the result of this important contribution to television progress. (Reproduced on the back cover).



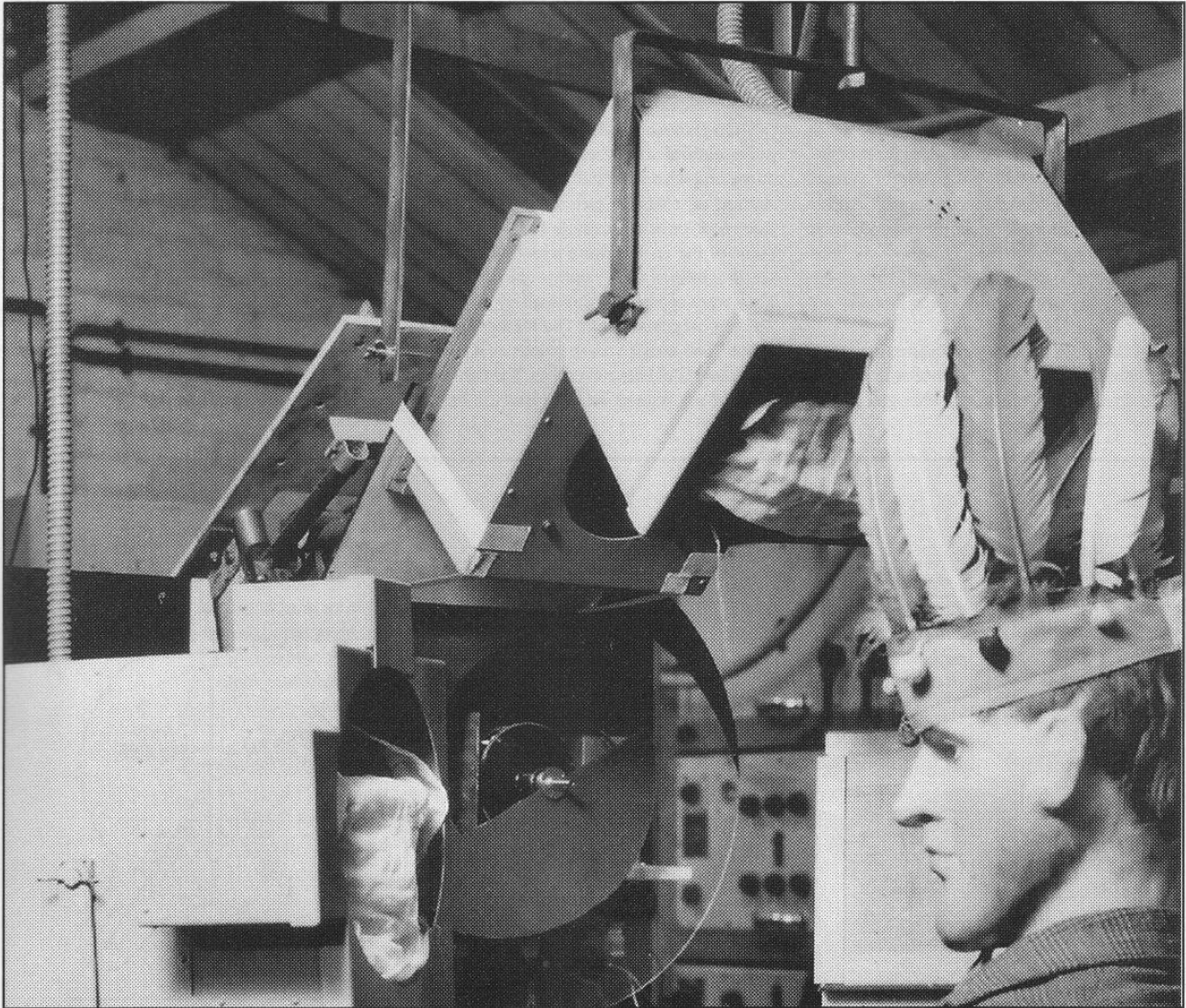
This equipment provided stereoscopic television pictures in colour. The image forming lens is in the box in front of J.L. Baird.



Mirror drum colour camera. Quilted material was used to reduce the mechanical noise. (1937).



The Dominion Theatre colour television projector.



Eustace, the tailor's dummy, in front of the stereoscopic television scanner. Note the specially shaped shutter for producing left and right eye perspectives alternately.

THE TELECHROME TUBE

Any suggestion that the first electronic colour television tube to employ multiple cathode-ray beams (similar to the arrangement used today) was designed, built and demonstrated by John Baird, for so long considered to be the champion of 'mechanical' television, would probably be met with disbelief. However, it is true and he called it the Telechrome.

Undeterred by worsening health, bomb damage to his premises and now with only one assistant, Andy Anderson, he strove to eliminate the few remaining mechanical components so that a fully electronic colour television receiver would be feasible.

Baird visualised that if two teapot tubes were mounted back to back using a common envelope and a transparent screen with suitable colour coatings, a two-colour tube could be produced. This line of reasoning led to a patent "Improvements in colour television" applied for on 25th July 1942, and granted almost exactly a year later on 23rd July 1943.

The next step was to provide a convincing demonstration of his system. This posed many problems; in particular he had to obtain a large, specially shaped glass envelope capable of withstanding the considerable pressure of the atmosphere when under vacuum. His ingenious solution was to modify a mercury arc rectifier bulb to his needs. These large glass bulbs were used widely in industry for producing considerable quantities of direct current from the alternating current supply. Arthur Johnson, a retired glass technologist undertook the conversion work. He had previously been employed by Baird Television and Hackbridge Hewittic, the manufacturer of the mercury arc bulb.

The offset cathode-ray beams impinged on opposite faces of a 10 inch diameter clear mica screen one side having a blue-green fluo-

rescent coating and the other orange-red. In this way the superimposed images formed a colour picture. Baird had considered a three colour arrangement which required a ridged screen to provide an extra surface for the third colour but it is not clear if demonstrations along these lines were ever carried out. He had produced a smaller Telechrome tube with one electron beam perpendicular to the screen, thus simplifying the scanning arrangement. This has survived and is at the National Museum of Photography, Film and Television.

The system operated at a definition of 600 lines, triple interlaced, so it took six scans to produce a complete colour picture.

The two-colour Telechrome tube could also produce good monochrome stereoscopic pictures after suitable modifications had been made to the studio scanner so that different perspectives were transmitted for each eye. The blue-green and orange-red images formed a stereoscopic pair and were viewed through colour spectacles.

In the studio Eustace, a tailor's dummy resplendent in hunting pink, blue trousers and a sheik's headdress, provided an inanimate but colourful tuning signal, a pipe protruding from his mouth gave a good illustration of the stereoscopic effect.

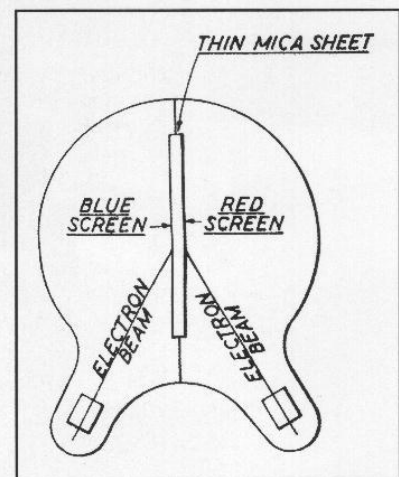
On 16th August 1944, a group of journalists assembled at the Crescent Wood Road laboratory and witnessed the world's first demonstration of a wholly electronic colour television receiver using a single cathode-ray tube. Some of the visitors were televised and could see themselves on a nearby colour receiver. They were apparently surprised by the results. The representative from The News Chronicle wrote "The image was in colour as natural as any colour film I have ever seen. The light wood grain of my pipe stood out clearly, a bead of

perspiration on my forehead was highlighted and the book in my hand was pictured so plainly that the coloured title could easily be read".

John Baird died in 1946 at the early age of 58 leaving his colour work unfinished and, as it has turned out, largely unknown.



J.L. Baird with his Telechrome, the world's first multi-gun colour television tube. August 1944.



The sketch above is taken from the original 1944 press release.