Paper given in 1977 to mark the 50th Anniversary Edition of The Royal Television Society Journal .

# BUSTIN' OUT ALL OVER. . .

## 1946-56: An 'Eruption' of Ideas and People

Leslie C. Jesty

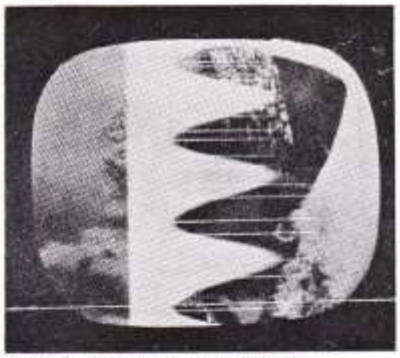
This is essentially a personal reminiscence. It may have errors and certainly omissions—memory fades—I hope that no one will sue!

At the end of the war, in fact well before the end, electronic engineers were bursting with ideas. The rush to return to television and similar peacetime activities was positively indecent. This was very understandable as the same thing had occurred in reverse with Radiolocation (Radar to the modern generation) immediately before the war. For example we were already working on special cathode ray tubes for this purpose in 1938, and by 1939 we had forgotten about television. To quote some examples: B. J. Edwards (Pye) read a paper to the IEE in January 1944 discussing the 'Problem of Post-War Television'; we had an elementary field-sequential colour TV system running in our lab (GEC) just before Christmas 1944 and some of the results obtained with this were presented at an IEE Discussion meeting in March 1945—*two months* before VE day. By the time VJ day had come and gone the heat was on and the procession of ideas in the decade under review seemed unending.

Some of these ideas which readily come to mind are: the Pye Videosonic TV system for transmitting sound on the synchronising pulses; flat screen displays; flat cathode ray tubes—Gabor and Aiken; efficient signal coding—Shannon (Bell Telephone); flying-spot telecine—Nuttal (Cintel); the Eidophor system of large screen projection—Prof. Fischer (Switzerland); theatre TV by CRT projection—McConnell (Cintel); bandwidth compression—Cherry (City & Guilds) and Gouriet (BBC); camera tubes—McGee (EMI), Rose and Law (RCA), Turk (EEV); the transistor—Shockley (Bell Telephone); industrial TV; videotape recording—Olson (RCA) and Axon (BBC); and of course picture quality/TV standards/405 v 625 lines—Everyone! The Independent Television service was opened towards the end of the period under review (September 1955). The IEE Radar Convention was held at the beginning (March 1946) and was quickly forgotten.

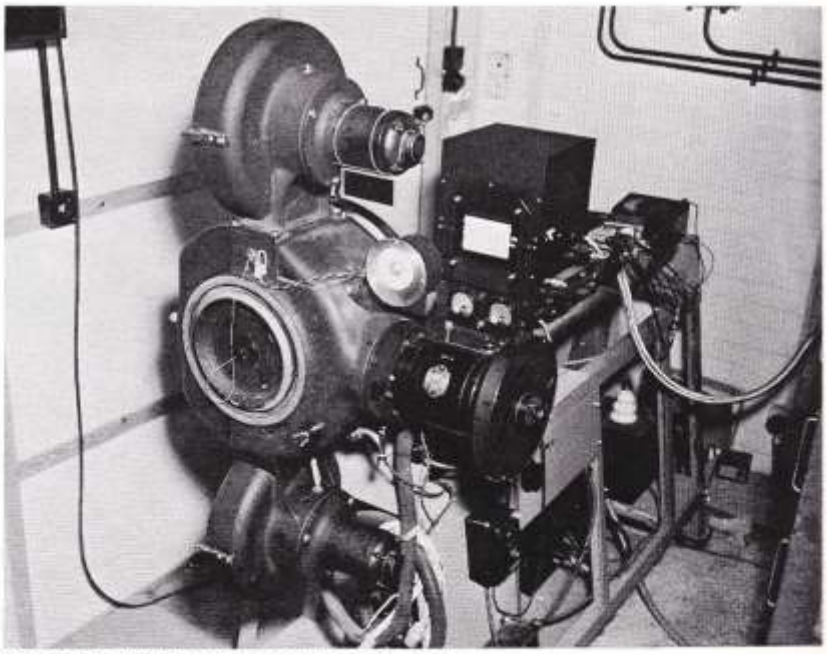
Two further items have been left for special consideration as I was actively involved in them myself which perhaps justifies my giving them more attention. These are television recording on film, and colour television. They involve a surfeit of ideas, the more important of which will be described and discussed.

The immediate post-war eruption was not confined only to technology and engineering. There was also an eruption of personnel. A lot of new (mainly young) talent had come into the electronics business during the war, which was obviously looking for fresh fields to conquer. Some of us 'olduns' were feeling restless too. On the employment side many of the commercial firms were considering their positions carefully and the commercialisation of Radar for civil purposes was being actively developed. An important factor in the television



The Pye Videosonic tv system

The CPS Emitron from EMI



Cintel high-definition film recording equipment

field was the lapsing of the Marconi/EMI agreement. Marconi began looking for television engineers and EMI for transmitter people. This particular incident benefited me personally as will be seen later.

Recording television on film was an obvious requirement, accelerated by the advent of superb flying-spot film scanners, in which Cintel led the field (and still does). For Cinema Television the actual projection of such a recorded film in a theatre—either with or without rapid processing—was being considered. A further possibility was shooting a film with TV cameras in the film studio instead of Movie cameras and using electronic editing as in live TV production—popularly known as the 'ten minute take' at that time. Norman Collins and his 'High Definition Films' company were mainly concerned with this last project. Here, the operating standards of the TV equipment can be tailored exclusively to the film recording requirements and are not tied to existing broadcast standards. For example sequential scanning and higher definition were used.

At Cintel and later at Marconi's we examined all these possibilities. We took TV cameras into the Gate Studio at Elstree and demonstrated the making of a film and also the TV camera as a viewfinder on a movie camera (known as 'Cyclop'). It was here that I first met Paddy (Bill) Vinten. He was lighting camera at the studio. The highspot of these adventures was undoubtedly the recording of the Royal Wedding in November 1947 for the BBC. Philip Dorté of BBC Newsreel fame had heard of our experiments in this field and approached A. G. D. West, technical director of Cintel for a demonstration. He was impressed, and in consequence our equipment was installed in Alexandra Palace for the occasion. On the actual day the recording was OK but the weather was terrible, and so were the TV signals. To add insult to injury the rush print of the film had to be processed to give good sound and this certainly didn't help the picture quality. The film was broadcast in full the same evening—reported to be a 'world first'—and there were certainly no complaints from the customers.

Eventually a very high standard of picture quality was obtained. I recently saw our (Marconi) 35 mm recording of the Coronation optically projected and it was remarkably good. We recorded everything important 'for practice' in those days, including the famous cross-channel relay from Calais on 27 August 1950. Development work continued using the 4½in Image Orthicon and a sampled synchronous spot-wobble technique which allowed a higher definition picture to be recorded than that being broadcast.

Video-tape has now largely replaced film, but it still has many advantages, and I note that recording video-tapes on to film is still a profitable business.

### The challenge of colour

Colour television was undoubtedly the most captivating of the post-war TV possibilities. J. L. Baird had been developing his ideas on colour/stereo systems in his own private laboratory throughout the war, financed by Cable & Wireless. GEC and Baird were always friendly—this dated back to neon lamps and photocells in the 1920s. I was one of a GEC party that visited Baird in November 1944. He showed us colour/stereo pictures using field-sequential scanning with his two-gun, two-colour tube and also a projection system. His system was 'compatible' to the existing 405-line system, i.e. a black and white picture could be reproduced on existing monochrome receivers. His colour tube was an embryonic shadow-mask. At 50 fields/sec, colour flicker was intense. But as always with Baird, the basic ideas were there.

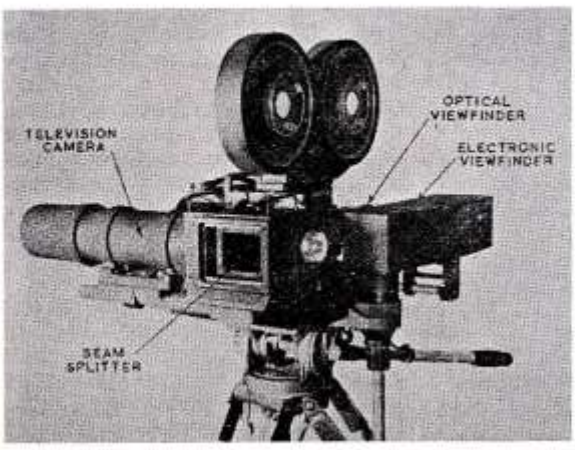
At GEC research we had a very short afterglow phosphor which was an offshoot of our Radar research. It was Ideal for a flying-spot scanner, and as already indicated we had rigged up such a 405-line TV system in late 1944. With a 16 mm film camera and a synchronised RGB colour filter wheel, we made three colour separation movies on Panchromatic film. We had a nice letter from Kodak's film processing lab saying that their service dept would rectify the fault in our camera! We learnt a lot, and were able to demonstrate the problems of colour break-up and colour fringing arising with field-sequential scanning at the IEE Discussion Meeting in March 1945. Two very important contributions were made at this meeting. Firstly, the basic idea of compatibility with a dot-sequential system of scanning was illustrated; but without solving the bandwidth problem of course. The credit for this must go to RCA. Secondly, a contribution from W. H. Stevens (Cossor's) who had invented a single-gun colour tube whilst on fire-watch during the war. His idea (BP No. 603080 1944) eventually proved to anticipate much of the index system developed initially by Philco around 1950. I, for one, did not realise the implications of his remarks at the IEE that evening.

At Cintel we went ahead with the development of a high definition field-sequential colour system for cinemas. Compatibility was not important and might in fact have been a disadvantage. The system, with a 3in Image Orthicon camera, was completed in 1949 and showed that the field-sequential approach was capable of giving very good colour with little difficulty. Cinema screen projection could be achieved with this system using the Eidophor System.

### Work stopped

Due to 'circumstances beyond our control', however, further developments of this field-sequential system were not possible. The Rank Organisation was running into financial problems and the 'new broom'—John Davies—swept out all the long-term developments—which meant us. Fortunately, Marconi's were looking for television engineers, and within three months practically all of our group at Cintel had transferred to their Baddow Research Laboratories. I now found myself with two bosses—L. H. Bedford, chief engineer Television, and R. J. Kemp, chief of Research. They say no man can serve two masters. However, with the help of Stephen Potter it was certainly an instructive and exciting exercise.

Marconi's were cross-licensed with RCA at this time and our attitude to colour was now therefore officially very 'Compatible'. RCA were developing the dot-sequential colour system in opposition to CBS's field-sequential. Shortly after I joined Marconi's, a new name appeared on the RCA colour TV campus—Geo. H. Brown, O/C colour TV. His appointment caused a flutter of interest at Marconi Labs. One comment (guess who from!) was, 'But he's a bloody aerial expert'. George, however, quickly donned his colour mantle and




**The experimental 'Cyclop' camera also used for film recording**

demonstrated that he knew what was what—and also what wasn't. Looking back now I wonder if RCA had it in mind that he was the man to solve those propagation problems so characteristic of the NTSC system.

In September 1950, Marconi sent me to the USA mainly to size up the colour television situation. CBS were applying to the FCC for recognition of their field-sequential system at this time and RCA were countering vigorously with their compatible dot-sequential system with copious demonstrations, including a full-scale broadcast for the FCC from the NBC transmitter in Washington. I was privileged to see most of these, including the rehearsal for the latter. Altogether I was in the USA for nearly three months and in the end had to insist against great opposition prompted by George Brown that I should return to spend Christmas with my family!

The Field-Sequential System was adopted by the FCC whilst I was in the USA and transmissions in colour commenced from CBS with great jubilation. I saw one of these received on an early experimental shadow-mask tube at RCA. It certainly worked, but the comment was, 'That's a hell of a way to get a colour picture!' As soon as a colour transmission started the existing monochrome receivers could receive nothing. Similarly, anyone buying an expensive new colour receiver could receive nothing except when colour transmissions were on the air. If the new colour service was to succeed, therefore, there was only one solution—scrap the whole of the existing monochrome service and start again. Obviously RCA weren't going to throw in the towel at that stage.

On the first of my many visits to RCA Labs at Princeton I met the famous Al Bedford, inventor of 'Mixed Highs'. As the name implies, all the high definition in the colour picture is transmitted with the colours mixed, i.e. in black and white. The colour was 'painted' over it at low definition. He told me that he got the idea from his childhood days when his mother used to send him to the store to buy a reel of sewing thread. In order to match the colour she always insisted that he took the whole reel and not just a piece of the thread. She had obviously found from experience that it was impossible to match colours in fine detail. Yet another example of human ability to do a thing without knowing the reason why!

George Brown took me to Hazeltine Labs. This was a memorable day. Hazeltine in their capacity as consultants to the American electronics industry were investigating the dot-sequential system initially off their own bat. I had already met Art Loughren (now VP Research at Hazeltine) in England before the war, and this was a happy reunion. I met for the first time Charlie Hirsch, then chief engineer. At Hazeltine they were able to investigate the dot-sequential system quietly without the terrific political and commercial pressure that the whole of the RCA colour television team were enduring. I was shown a closed circuit colour television system using an immaculate flying-spot transparency scanner to demonstrate combinations of luminance and chrominance of varying bandwidths. They had developed the 'Constant Luminance' concept whereby the colour signals ideally carried no brightness information thus reducing the visibility of dot-crawl. Some of these demonstrations were beautifully illustrated by colour pictures on the front cover of the December 1950 issue of *Electronics*, a copy of which I still treasure. The quality of the Hazeltine demonstrations was of such a high order that one felt assured that when suitable hardware was developed, compatible colour television should surely be commercially acceptable.

Already the radiation tests made with the dot-sequential colour system had shown its vulnerability to propagation (especially phase) errors. Hazeltine showed me in strict confidence their idea of changing the colour sequence, inverting it on alternate fields. They called this 'Colour Phase Alternation' (CPA). By this means phase errors were averaged out so that the hue of a colour remained the same but its saturation was slightly decreased. Unfortunately, the averaging had to be done by the human eye by persistence of vision. The idea worked beautifully but the task imposed on the eye was too onerous and this system eventually had to be abandoned. The basic idea is of course exactly the same as in the PAL system today. But the PAL system changes the colour sequence line by line and does the averaging by using a delay line.

Now we come to Philco. I had been in touch with Don Fink who had recently given up software editing in the form of *Electronics* magazine and taken up hardware bashing at Philco. Rumours had been rife regarding Philco's activities in the colour field. It was suspected and eventually confirmed that they were developing a single gun beam-index tube. This could obviously be very important because, although the compatible dot-sequential system was very promising, the terminal equipment currently demonstrated was not. A single gun tube with no registration problems could obviously allay a lot of fears. Don Fink, however, told me nothing and this secrecy at Philco was maintained for a long time, although of course there were leaks. When they finally demonstrated in the middle 50s they showed a secondary emission double beam index system. In their haste to get ahead of RCA they had chosen the worst of three alternatives. Their predicament reminds me of the story of Moses. When he reached the Promised Lane, if he had turned to the right instead of to the left he would have got the oil wells instead of the orange groves. If Philco had chosen photo-index instead of secondary emission index we might have had a single gun colour tube today.

Now I must make a brief detour from Colour to report an important visit—to Otto Schade, at the RCA-Victor Plant at Harrison NJ. He was a one-man research group, and during the time I knew him persistently resisted all inducements to get him to the Princeton Labs. Otto was doing remarkable work evaluating monochrome TV standards, and also assessing the performance of equipment—particularly camera tubes. He was well known for his publications (mostly in *RCA Review*), and it was these which had prompted my visit. His demonstrations, using an experimental 4½in Image Orthicon for pick-up, were superb. I was very anti image-orthicon at this time, due to the experience with them at Cintel. I was an instant convert in Otto's lab. My report mailed back to England read thus—'Never have I seen such a magnificent picture from a direct pick-up television camera.' Of course, it was a 4½in tube and not a 3in! George Partington, chief of TV Development at Marconi, arrived in the USA shortly after this visit, and I persuaded him to see Otto's demonstration. He too was most impressed, and eventually George and I together persuaded Marconi (English Electric Valve Co.) to manufacture this tube—actually in this instance ahead of RCA. As is well known, it was a great success, and won an EMMY award. Although I had left the Company by this time, they very thoughtfully invited me back to the celebration party.

My final report, covering my three months in America nominated the following memorable impressions: Firstly the Hazeltine demonstrations of compatible constant luminance colour tv; secondly Otto Schade's remarkable achievement with the 4½in Image Orthicon; and finally RCA's GUTS!

On my return to Baddow, it was decided that Marconi should press on with compatible dot-sequential constant-luminance ideas, and gain experience. RCA and Philips were very helpful and supplied special components which enabled us to build a complete system.

Meanwhile, the television industry in the UK was organising itself to cater for colour. A BREMA Colour Committee was formed, under the chairmanship of Peter Wethey. It was rumoured that the main purpose of

the committee was to make sure that colour TV did not come to the UK 'yet'. Miraculously Charlie Hirsch appeared in London. Officially, he was on a Hazeltine military electronic assignment. Of course we suspected this was a blind to get him here to make sure we adopted the American (NTSC) system. BREMA did a mental ju-jitsu and wisely invited Charlie to join their committee. He gladly accepted and we profited greatly from his help and advice—but I don't think he was rewarded in quite the manner hoped.

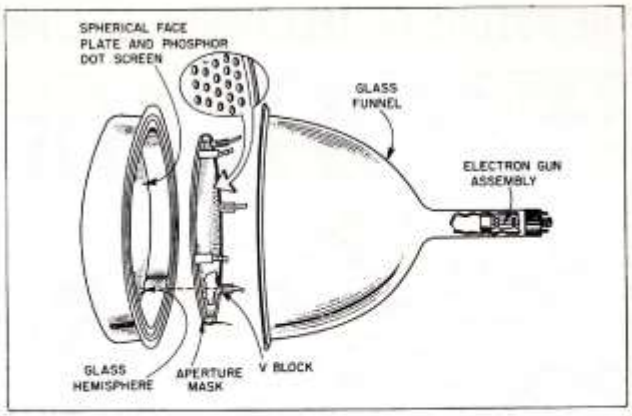
### NTSC standards adopted

In December 1953, the NTSC colour standards were adopted by the FCC, and the first compatible colour television service in the world became operational. CBS eventually achieved some reward from their efforts, however, as the first colour camera on the moon was field-sequential. And in 1954, their subsidiary, CBS-Hytron, unveiled the first shadow-mask tube with the phosphor-dot screen printed on the faceplate of the bulb.

In the spring of 1954 Marconi were ready to demonstrate. The equipment was transferred from Baddow Labs to Marconi House with cloak and dagger secrecy. A premature leak to the press was feared, as Marconi House in the Strand was vulnerable from Fleet Street. We had one 100% Marconi development to unveil—a two-tube colour camera. One tube produced the luminance signal, and the other, with assistance from trick optics, produced two chrominance signals. Three-inch Image Orthicons were used, and the picture was 'somewhat noisy', but quite acceptable and exciting at the time.

In the course of rehearsals for the demonstrations, we met a very important television personality: Leslie Mitchell had been engaged to produce and announce a 10-minute show from our little studio. To say that I was scared of Leslie was putting it mildly! I was afraid that he would concentrate on showing the art and beauty of colour in relation to television, and ignore all the wonderful technical achievements we were so anxious to demonstrate. I need not have worried. He had grown up with television from the beginning, and he knew about engineers. In the early days of course the engineer was top-dog and Art had to come to heel. Nowadays, engineers just twiddle knobs in order that artists can do their thing. Leslie cottoned-on to our objective, and not only showed off our technology but also enhanced it.

Some 15 years later I again had the pleasure of working with Leslie Mitchell, when he was a 'Visiting Academic' at Chelsea College. By a curious coincidence, we also bought a two-tube colour camera at the College—made in Japan of course.




**'Exploded' view of the CBS-Colortron showing its internal components**

Demonstrations of three different colour systems began in May and were given three times a day for about three weeks. We were very lucky and had no breakdowns. In fact, we staggered everyone by staging a deliberate failure of the colour—faces went green—and then putting up a caption saying 'Normal colour will be restored as soon as possible.' Demonstrations were given to the Television Advisory Committee, the Post Office, the BBC, the Radio Industry Council, the Television Society, BREMA, visitors from overseas and most important—two whole days of press. The latter were very enthusiastic and complimentary. But the lady from *The Economist* rumbled us. She reported, 'Marconi are out to show that whatever colour system is adopted, they can do it.'

On 19 May 1954, our two-tube colour camera received Royal Patronage. On that day the Queen and the Duke of Edinburgh drove to the City to be received by the Lord Mayor following the Commonwealth Tour. The route of the procession was down the Strand right past Marconi House. We obtained permission from the police at Bow Street to put the colour camera out on the pavement and televise it to the demonstration room. It was a beautiful sunny day, and as Marconi House faced south we had some trouble with the light. They rode in an open carriage and despite the light the results were very acceptable. History was made. I doubt if Her Majesty knew then—or does now—that she appeared on colour television so early in her reign.

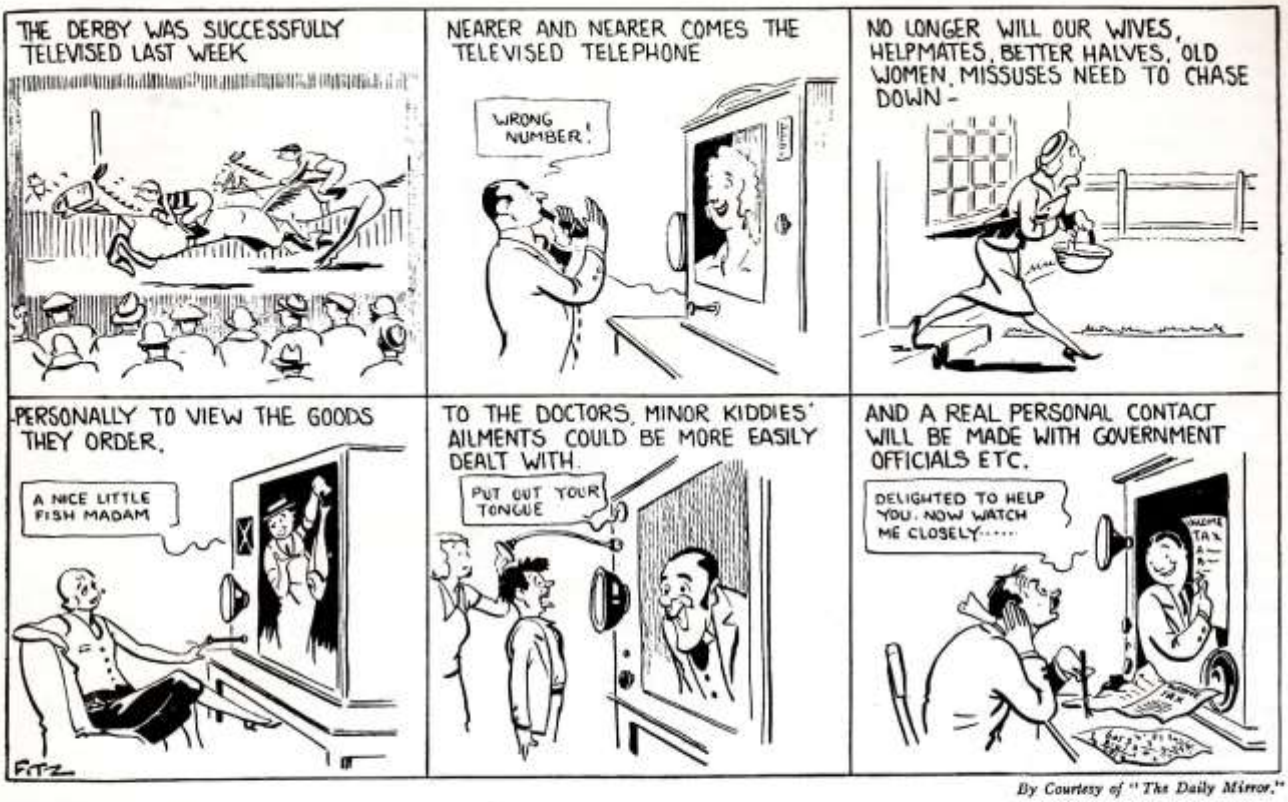
### BBC interest

The BBC were very interested in the Marconi demonstration, and it was agreed to lend them the essential equipment for a more thorough appraisal. In July it was moved to BBC Designs Dept, and installed in Neville Watson's television group. He and his colleagues soon had the various combinations of colour signal rushing madly up and down the TV links to Kirk-o'-Shotts and back. Then at dead-o'-midnight 405-line colour TV was broadcast—but Fleet Street were awake, and with a camera too. The results of the link tests were conclusive—a synchronous sub-carrier modulated in quadrature was much more robust than two separate sub-carriers.

Experience with the Marconi equipment encouraged the BBC to equip themselves, and the following year (1955) they were radiating regular late night test transmissions. By this time also, there were several colour receivers available in the various industry laboratories etc. The transmissions—mainly colour slides—were watched by a variety of viewers who were persuaded to fill in and

**Leslie Mitchell, *centre*, with the team that did the Marconi 1954 demonstrations**

# THE FUTURE OF TELEVISION . . . . . How the cartoonists saw it in the 'thirties




*By Courtesy of "The Daily Mirror."*

This peep into the future was drawn by FITZ for the *Daily Mirror* in June 1932. 'Will it prove to be a help or hindrance to life?' he asked.

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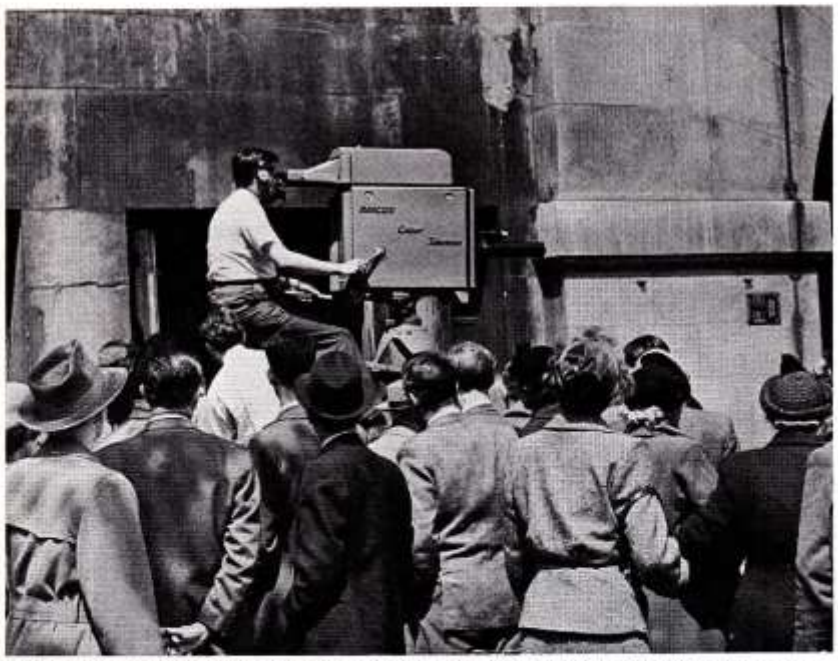
## • Bustin' out all over. . . *continued*

return questionnaires to assess compatibility, picture quality etc.

Before closing I must mention one further item—'CCIR', the Consultative Committee International Radio which held three important meetings in the period under review—1950 in London, 1955 Brussels and in 1956 a 'World Tour' of all countries willing to show their developments in colour TV to the international delegates. Descriptions of these deliberations, whilst relevant and of great interest, are far beyond my present brief. Summarising the last meeting, however (1956), which visited the USA, France, UK and the Netherlands, I think everyone was left with the feeling that the NTSC system was an acceptable solution for broadcasting BUT . . . ! and secondly, that an alternative to the shadow mask tube was badly needed.

What of television after 50 years? I often think of the idea suggested to me by an engineer in the NBC Television Studio in New York in 1950 (repeat 1950). He said, 'If I ever buy a television receiver, I shall ask my best friend, who lives on the opposite side of town, to have it for me. Then—when I want to see a programme—I shall have to get out the car and go over to his house to see it.' Good thinking!



**Marconi engineers televising in colour the Queen's Procession to the Mansion House on 19 May 1954. The pictures were received at Marconi House, in the Strand, and recorded for experimental purposes**

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• *Leslie C. Jesty: 1946–9—head of Advanced Development Dept. Cintel. 1949–56—chief of Television Research, Marconi.*