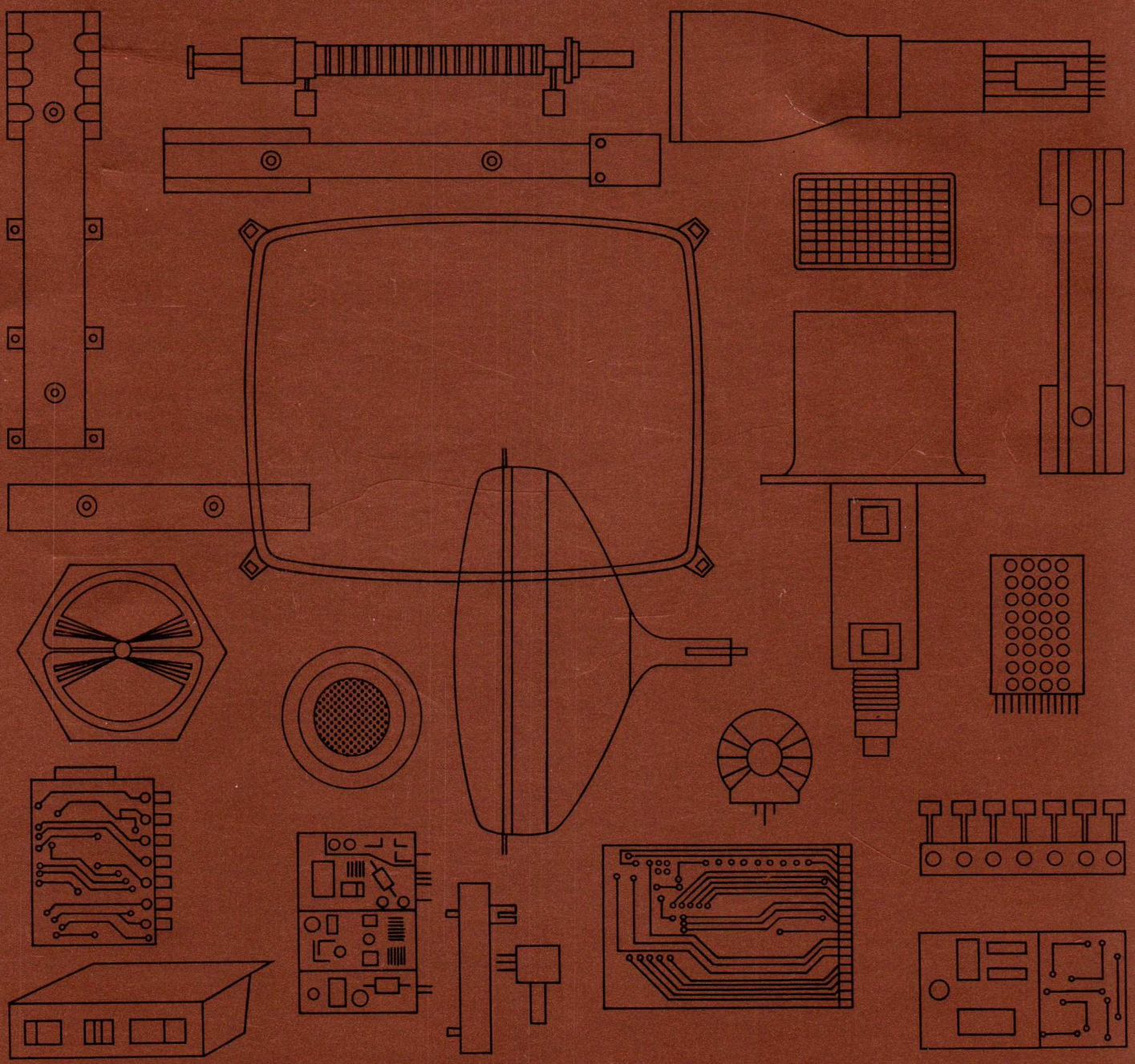
AEG-TELEFUNKEN

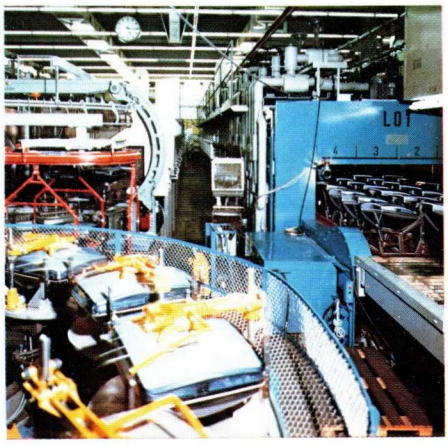
Introducing our Division

# Tubes and Sub-Assemblies



# At a Glance


The products of the Tubes and Sub-Assemblies Division of AEG-TELEFUNKEN are used directly or indirectly by numerous people every day. The Company's traveling-wave tubes, for example, are employed in radio relay stations and satellites for the worldwide transmission of messages and TV programmes, and the magnetrons are the principal components of the ATC radar systems. Cathode-ray tubes have found use in a wide range of applications. X-ray tubes are being used for the non-destructive testing of materials, and opto-electronic tubes in night viewing systems. Many more examples could be added. Moreover, numerous components are used in consumer electronics e. g. TV picture tubes, deflection units, tuners, and program memories.
On the following pages the line of products of the Tubes and Sub-Assemblies Division of AEG-TELEFUNKEN is indicated briefly, and an insight is given in the modern production facilities.

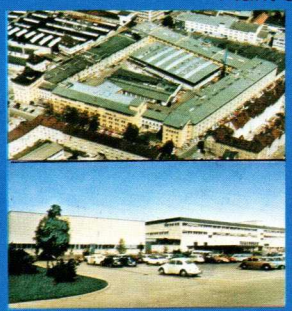


Plant at Berlin


Plant at Gräfenberg

Plant at Steyr/Austria

Plant at Sao Paulo
Brasil



Plants at Ulm

Plant at Ingolstadt

## Ingolstadt

The town looks back over a long and traditional past as a fortified town and garrison.
Industry has changed the picture of the town since 1945. Of the 91 000 inhabitants nowadays, 1500 are working at AEG-TELEFUNKEN.
Although the percentage is relatively small, it has none the less quite an economical significance because the Company employs female workers almost exclusively in contrast to other Companies in Ingolstadt.

## Ulm

Ulm was founded in 854 A. D. as a royal residence and developed quickly to a thriving trade centre favoured by its position on the then highly important north-south route.
The 30 Year's War left Ulm impoverished. The truth of the slogan „Ulm's money rules the world" was invalid for many centuries after the trade connections had been disrupted.
After the Second World War new prosperity came to Ulm and carried its name throughout the world again.
The Company is closely associated with this development.
With a small-scale production the Tube Factory of AEG-TELEFUNKEN started work in 1945. Today 4 000 workers are employed, not including the 5 000 staff of the Radio and Radar Systems Division. These figures show the extent of the reconstruction work by the Company and reflect the significance of AEG-TELEFUNKEN in the Ulm/Neu-Ulm region with its 120 000 inhabitants.

## Steyr

This romantic small town situated at the confluence of Ems and Steyr in the rolling landscape in front of the Alps.
Our production plant is the third largest company there, employing 400 people. In consequence it has special economic significance because mainly female staff is employed.

## Gräfenberg

Situated north of Nuremberg, Gräfenberg is the opening to the undulating countryside known for it's Franken wine. The town, with 2500 inhabitants nowadays, has never been of any real economic significance.
AEG-TELEFUNKEN is the only industrial company with a plant there and employs 450 workers. The economic significance of this production plant is therefore great for Gräfenberg.

## Sao Paulo

Even in a big city like Sao Paulo every job counts. We employ 1 200 workers in our production plant there.
Through the connections to the principals, technical know-how is available which is necessary to establish and extend a modern industry.

## Berlin

Wanting to characterise Berlin is like „carrying coals to Newcastle". The divided city and its problems are commonly known.
The original plant of the Tubes and Sub-Assemblies Division was in Sickingenstrasse, where nowadays the employees work principally on the production of X-ray tubes and deflection units.

# Colour TV Picture Tubes

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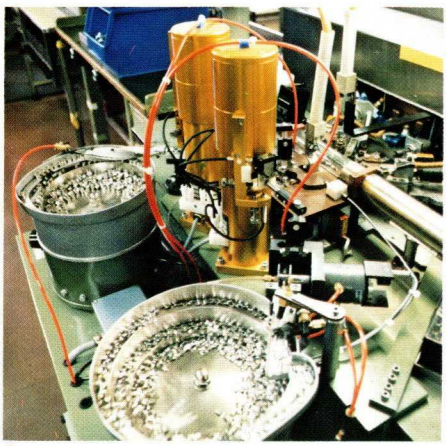

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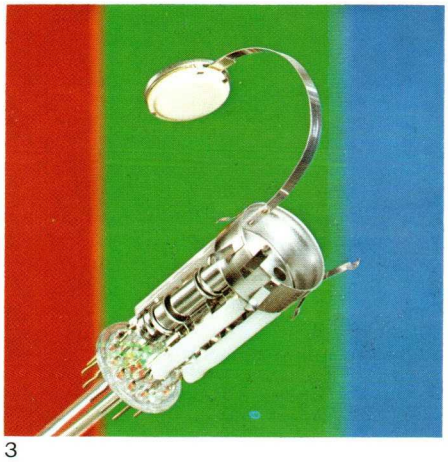

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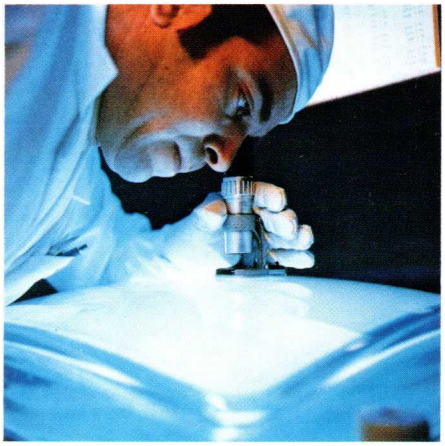

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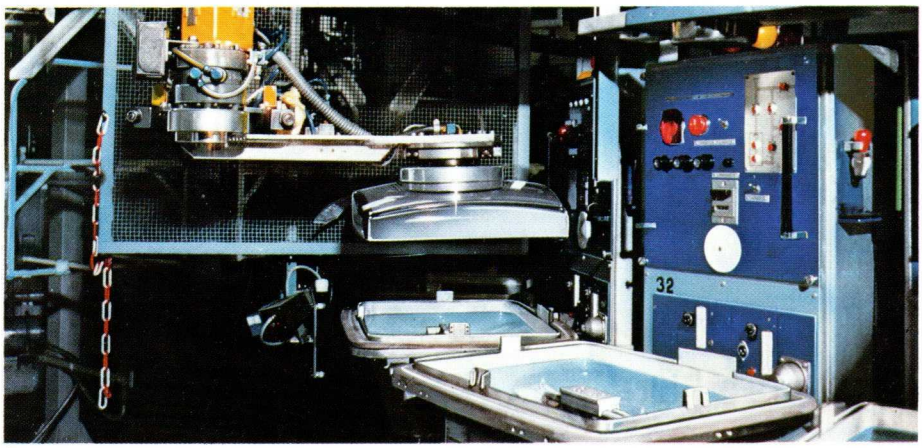
At the present time the colour TV tube is the most pretentious mass product in the world. We have supplied many millions of these tubes since 1967. Their exceptional brightness and defined picture reproduction are well known.

1 The precise arrangement of the phosphor strips in the frontplate is achieved in so-called light cabinets by photographic means.
2 Automatic machines help to eleviate tedious work and ensures consistent quality.
3 Inline electron gun
4 The base film for aluminisation is dried by infrared rays

8

5 Checking the phosphor strips under ultra-violet radiation
6 Cathode activating and RF annealing the systems parts
7 TELEFUNKEN colour TV-tubes provide bright pictures with high colour fidelity
8 Illustration of the Inline principle

9 A machine transfers the frontplate automatically from the aluminising automat to the rotary conveyor.
10 Extreme magnification of the phosphor strips on a control monitor
11 Checking the convergence
12 At the entrance to the soldering furnace the frontplate is carefully placed on the pasted bell
13 Visual inspection of the screen precedes a completely automatic check of all electrical functions
14 Checking the colour purity

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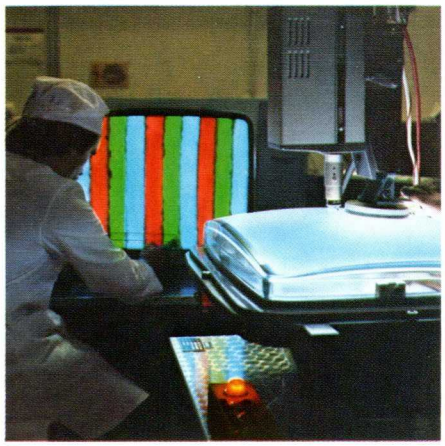

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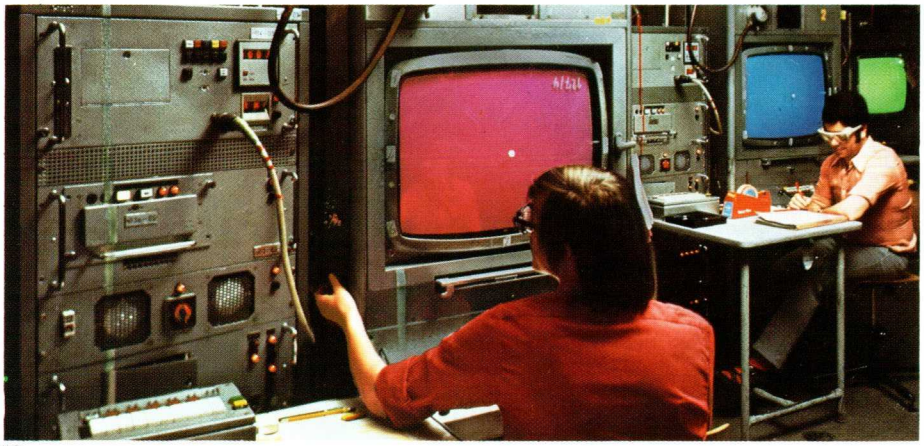

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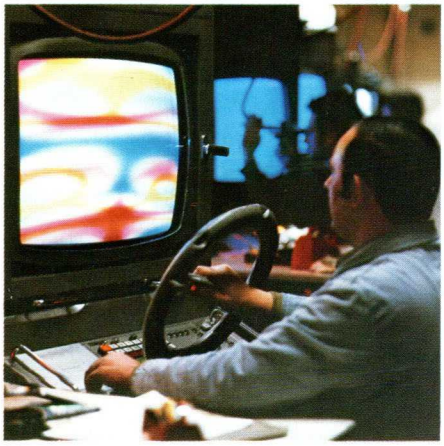

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# Deflection Units

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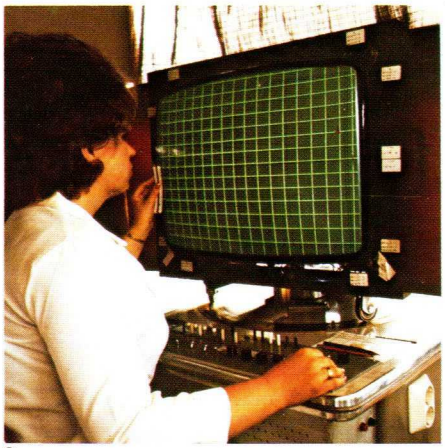

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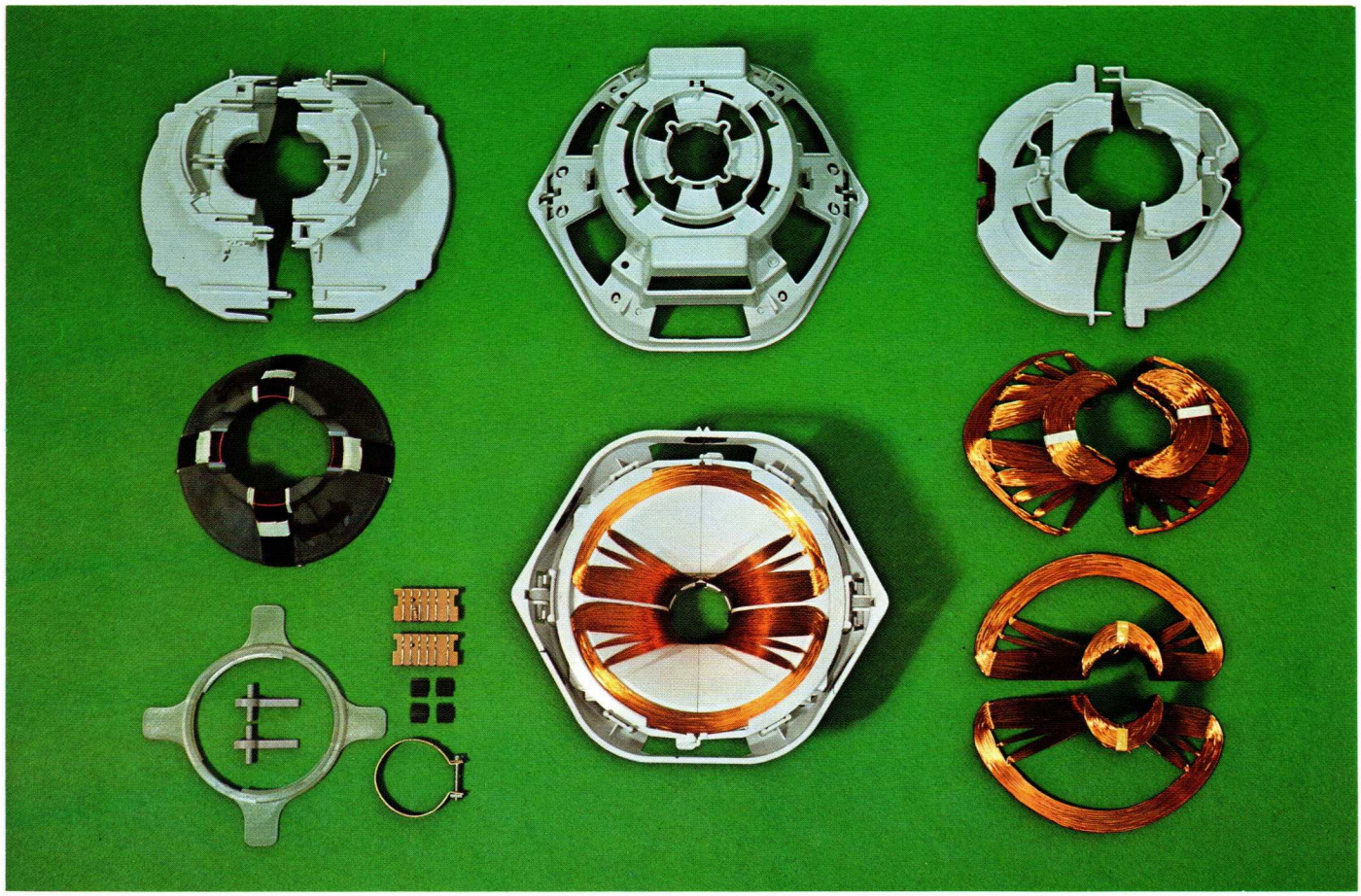
1 Deflection coils
2 Checking of deflection coils



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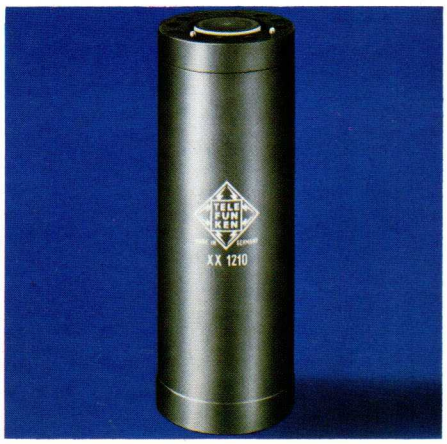
The production of a deflection unit appears simple in comparison to a colour TV-tube. However, we must bear in mind that this production procedure, too, calls for high technological knowledge and skill. In a colour TV-tube, namely, the three electron beams must be so deflected that a brilliant picture of high colour fidelity is produced. The adjustment, performed once, remains correct for many thousands of viewing hours.

4

3 The components of a deflection coil
4 Multi-pole unit

# Optoelectronic Tubes

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If while viewing at night with image converter tubes an invisible infrared light is in addition needed, „illumination" may be dispensed with image intensifier tubes. The residual light is sufficient for them. Light amplification of many thousands of times makes this possible, and in combination with a TV camera tube, black and white TV recordings may be made even under extremely poor light conditions.


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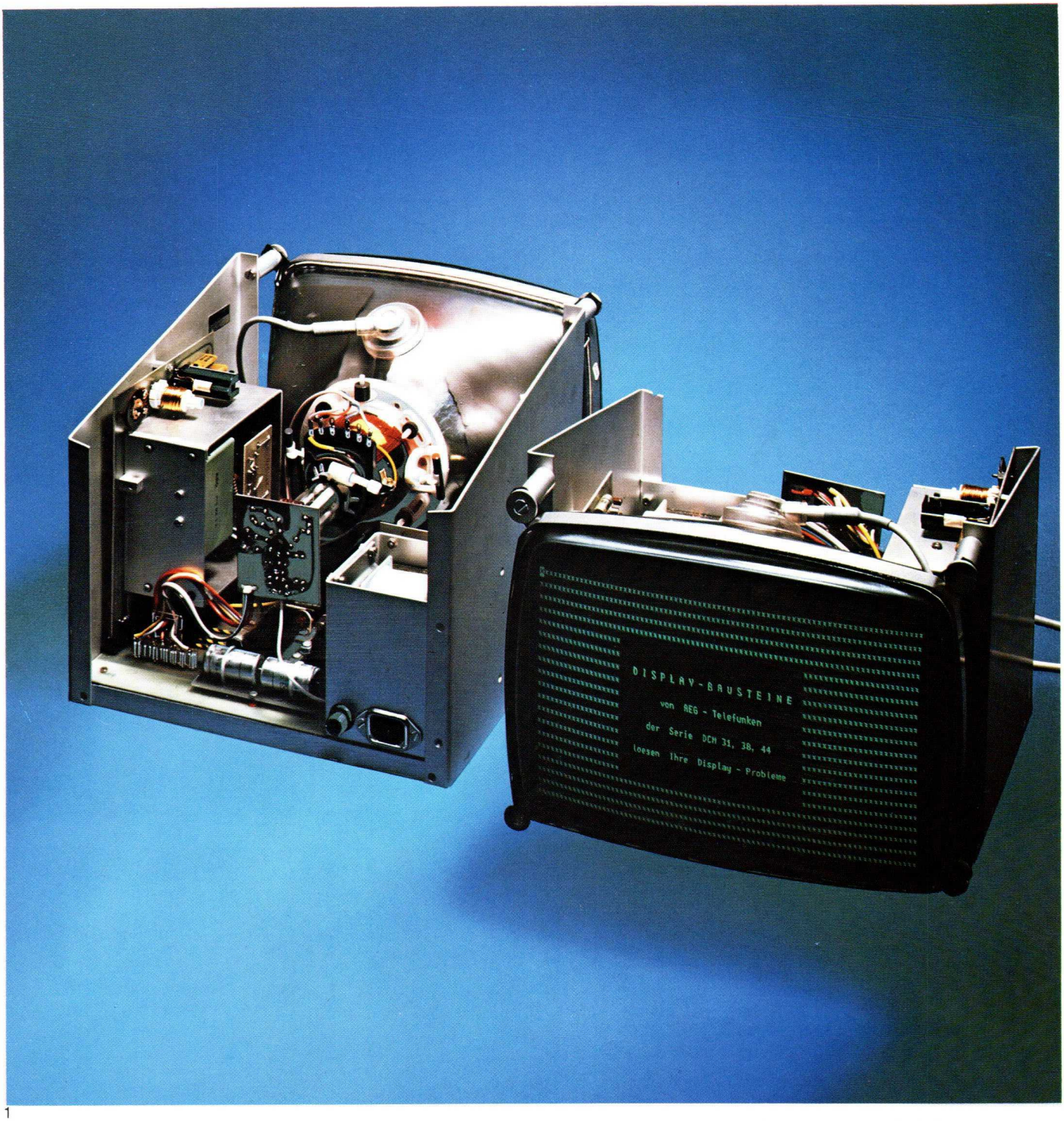
1 Three-stage image intensifier tube
2 Checking the fluorescent screen
3 Image intensifier tube in combination with a TV camera tube
4 Image converter tubes
5 Preparing image intensifier tubes for coupling

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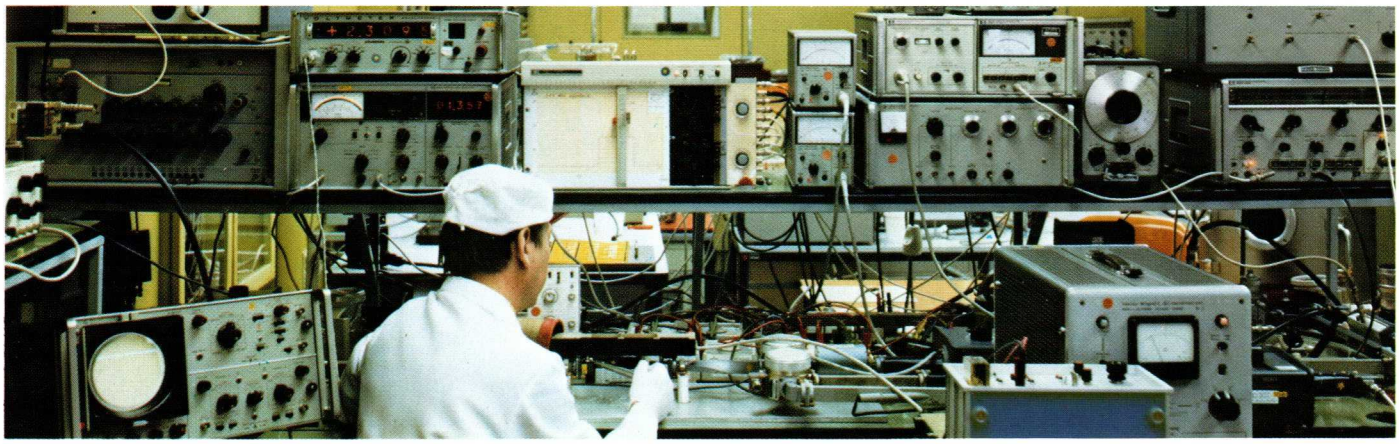
# Data Modules

Even the best monitor tube does not constitute an equally good data module. Extensive development work is needed to operate the tube in an optimum manner.
By using the AEG-TELEFUNKEN data modules this expenditure on development and time may be saved. In the factory all the components are matched to each other: tube, circuit and also the incorporated mains power supply. These data modules are thus serviceable units which may be driven by BAS-or TTL-video signals.

2

1 Data modules DCM 31
2 Data display in practical operation

# Microwave Tubes



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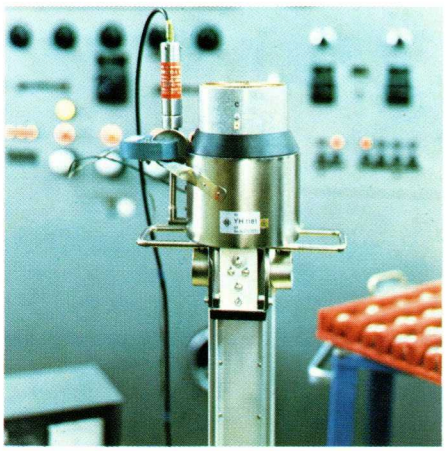

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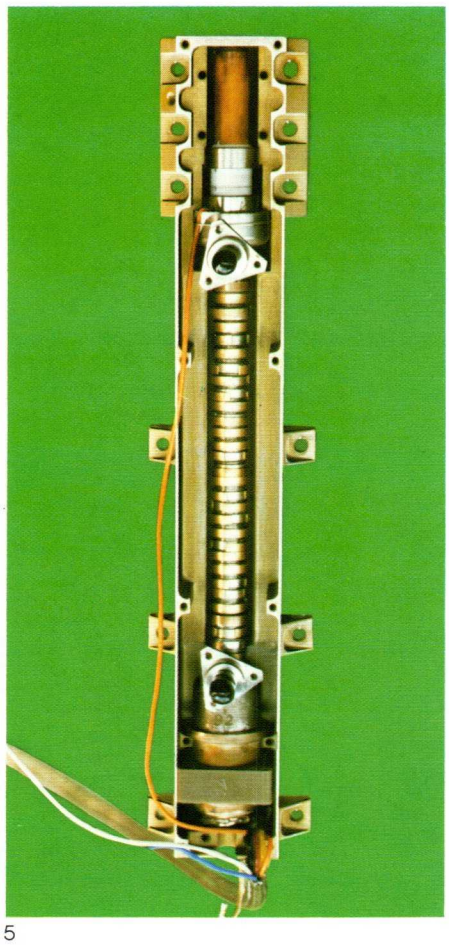

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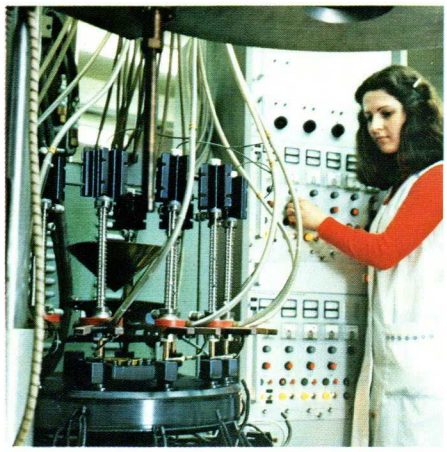

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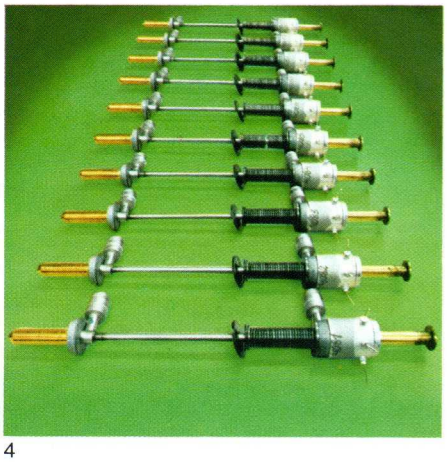

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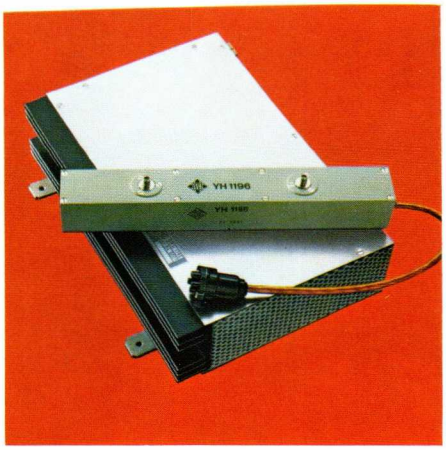
Microwave tubes make possible the live TV transmissions from „house to house", from Hamburg or from Tokio, allow subscriber through-dialling in telephone traffic to distant continents, control aircraft on take off and ensure safe landings and are indispensable in modern defence systems.



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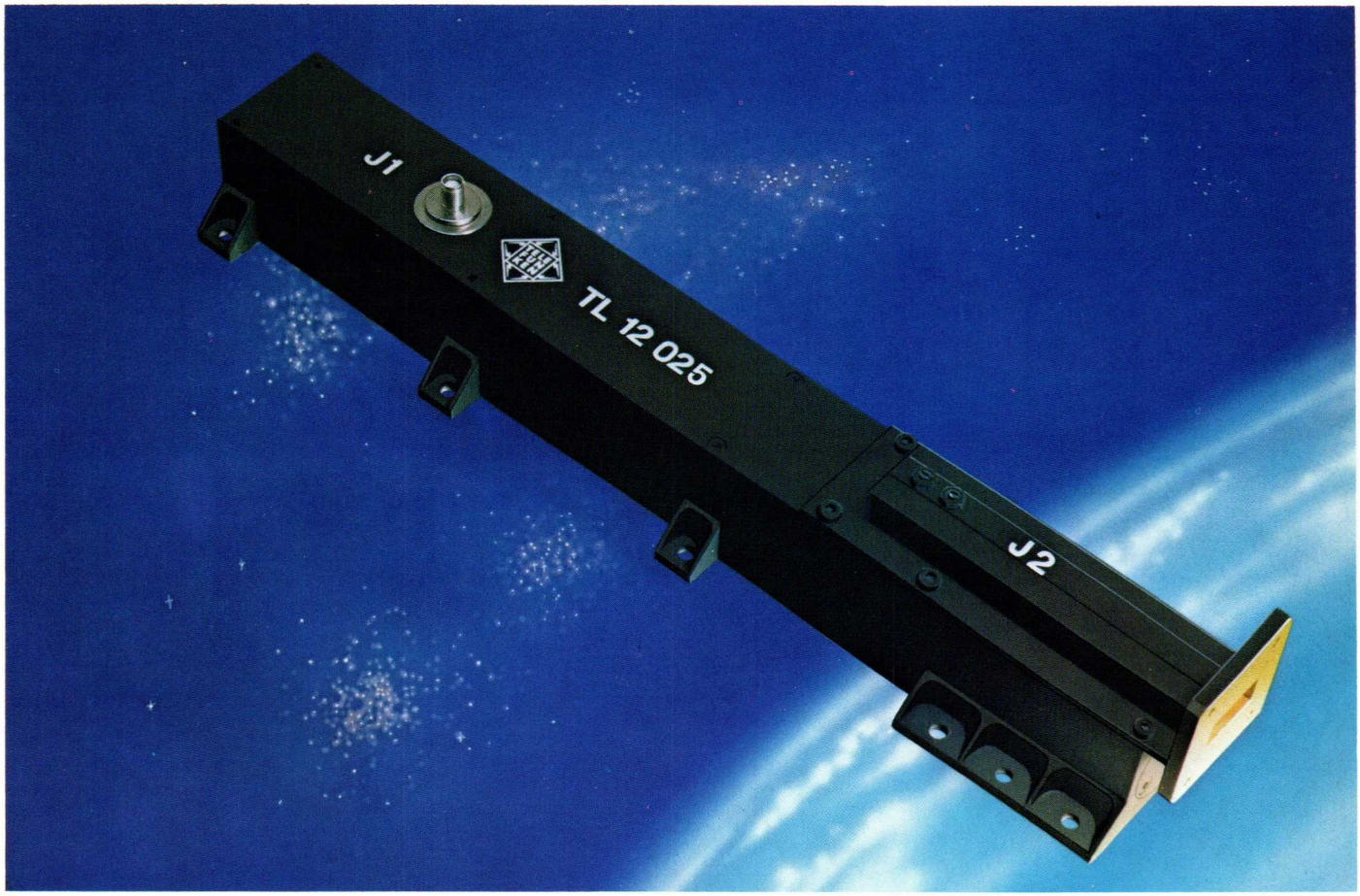
The development of the TELEFUNKEN tube TL 4003 pioneered the use of transmission links via satellites. The technology of these tubes offered, for the first time, the combination of minimum weight and dimensions with maximum reliability and life at high power ratings. We have consistently continued the development of this tube for other applications.

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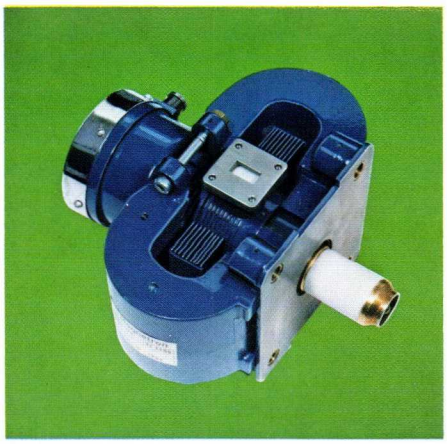
1 View of the test-shop for modern traveling-wave tubes
2 High power traveling-wave tubes on the test stand
3 Forming traveling-wave tubes at the pump station
4 The focussing magnets arranged round the tube are clearly visible
5 Vacuum section of a modern traveling-wave tube with focussing magnets
6 Assembly of a traveling-wave tube



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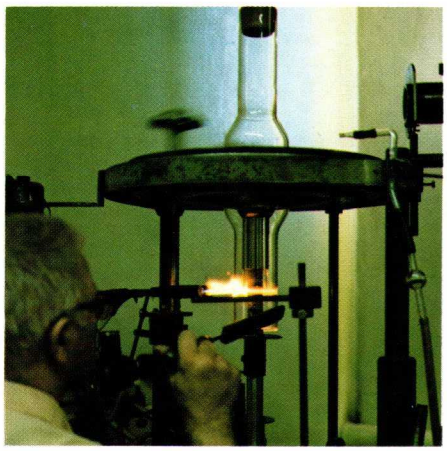
7 A modern traveling-wave tube with power supply
8 A satellite traveling-wave tube weighs only 650 grams. The focaliser of a conventional tube alone weighs 6 kg approximately
9 Modern magnetron for radars

# X-Ray Tubes

X-ray tubes must comply with the very highest requirements. In the non-destructive testing of materials. Voltages up to 400 kV are customary in addition to high power ratings.

In spectral analysis and examination with X-ray diffraction maximum spectral purity and high power are the premises. Our X-ray tubes comply with all requirements.



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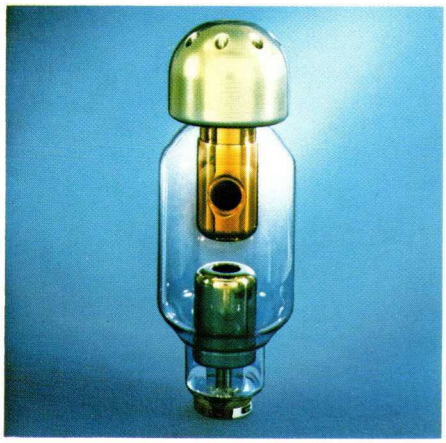

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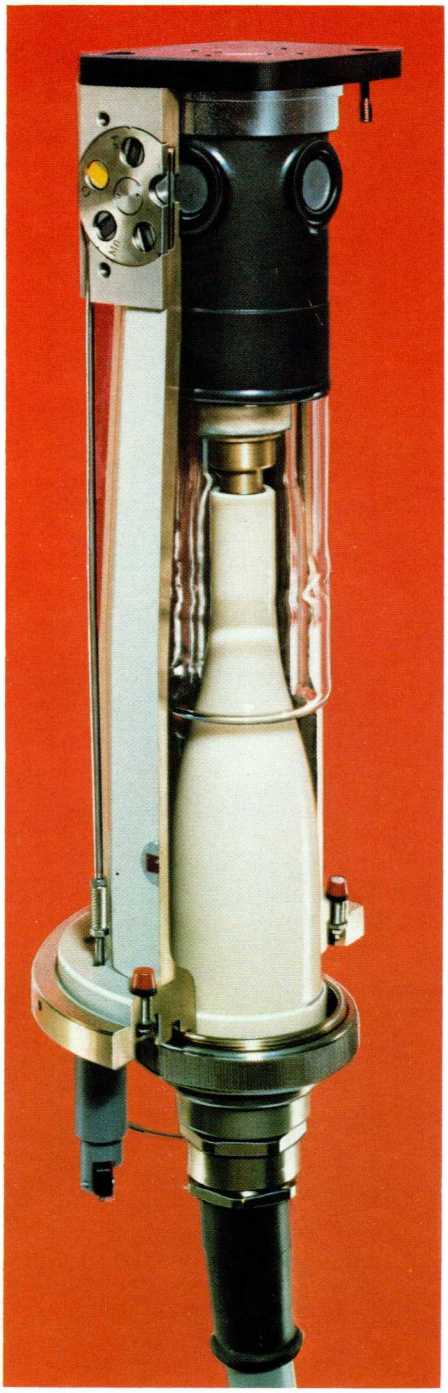

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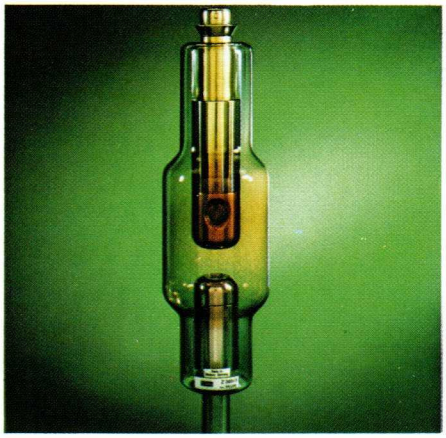

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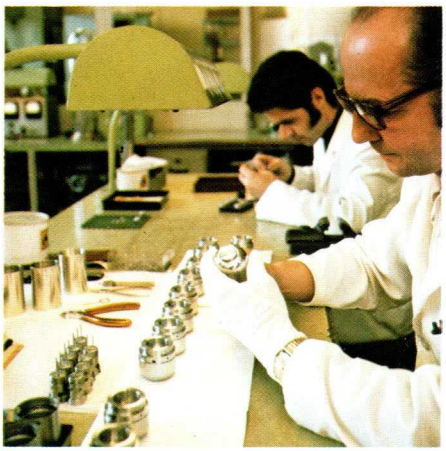

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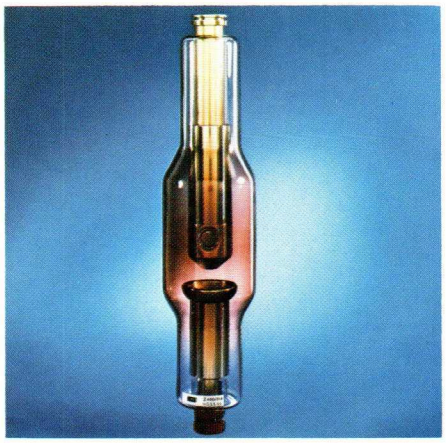


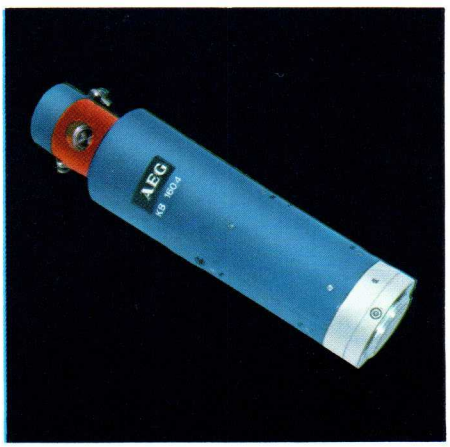
Dual focus tube for 400 kV DC voltage


Dual focus tube with beryllium window in metal-ceramic design

Tube with conical target for 200 kV AC voltage

7

1 Rectifier valve tube at the fusing position
2 This tube was developed for light portable units. Operation with AC voltage up to 300 kV
3 Tube in cut-away protective case with connected HT cable
4 Dual focus tube for continuous operation at 320 kV DC voltage
5 Cathode assembly

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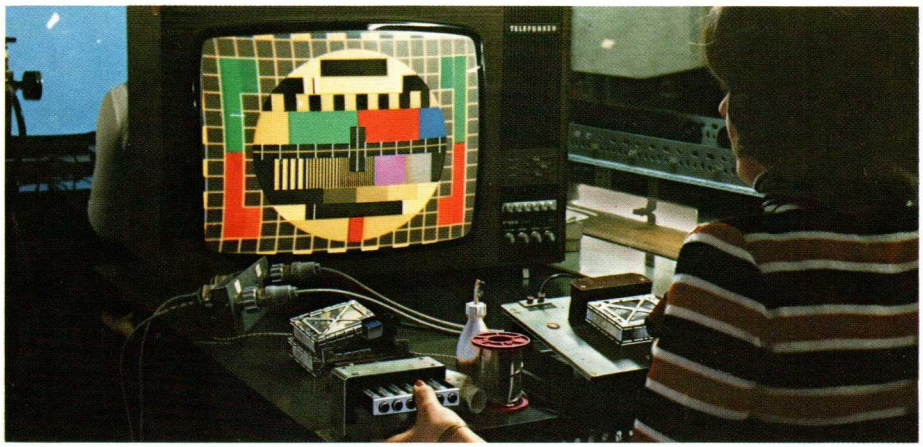
6 For checking welded joints on pipelines this tube is employed in transportable, gasinsulated equipment
7 The type series F 60 for diffraction work is characterised by high performance
8 Ceramic tube in protective case with integrated HT socket

# Tuners

In addition to the picture tube the tuner is one of the most important components in a TV set and determines to a great extent the reception quality of the set.

Modern and economic production methods guarantee not only uniform quality and maximum reliability, but also allow us to adapt our tuners to customer specifications and the various TV standards.



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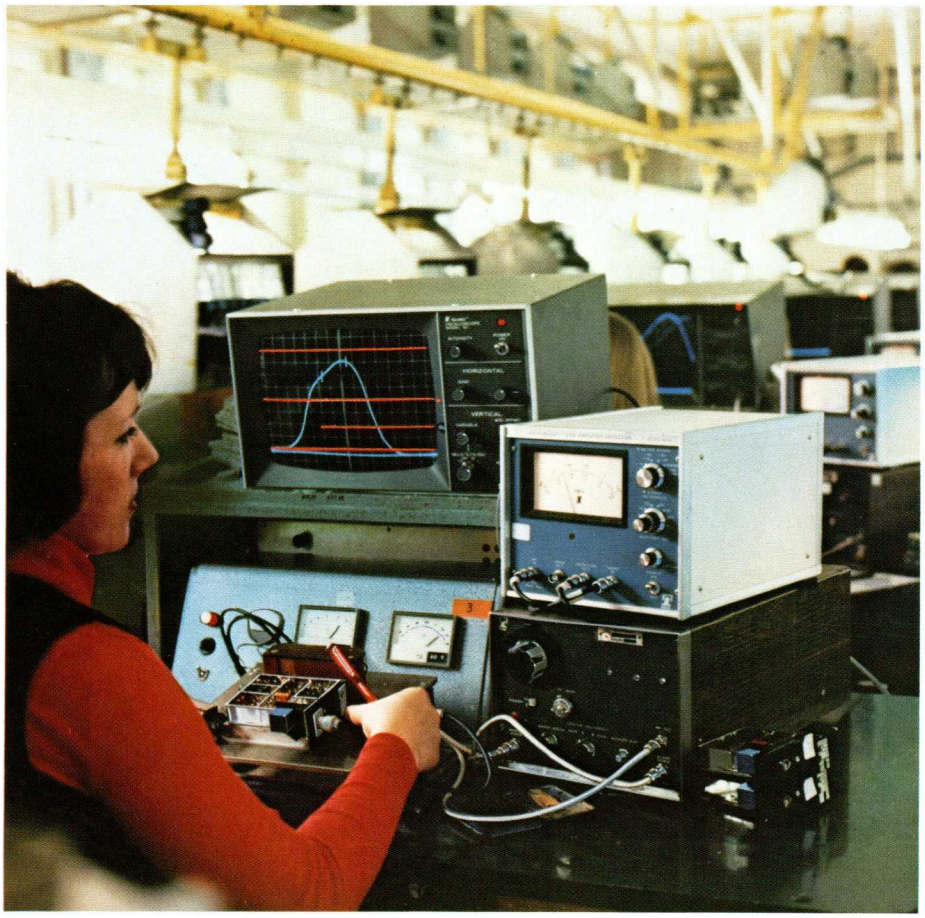
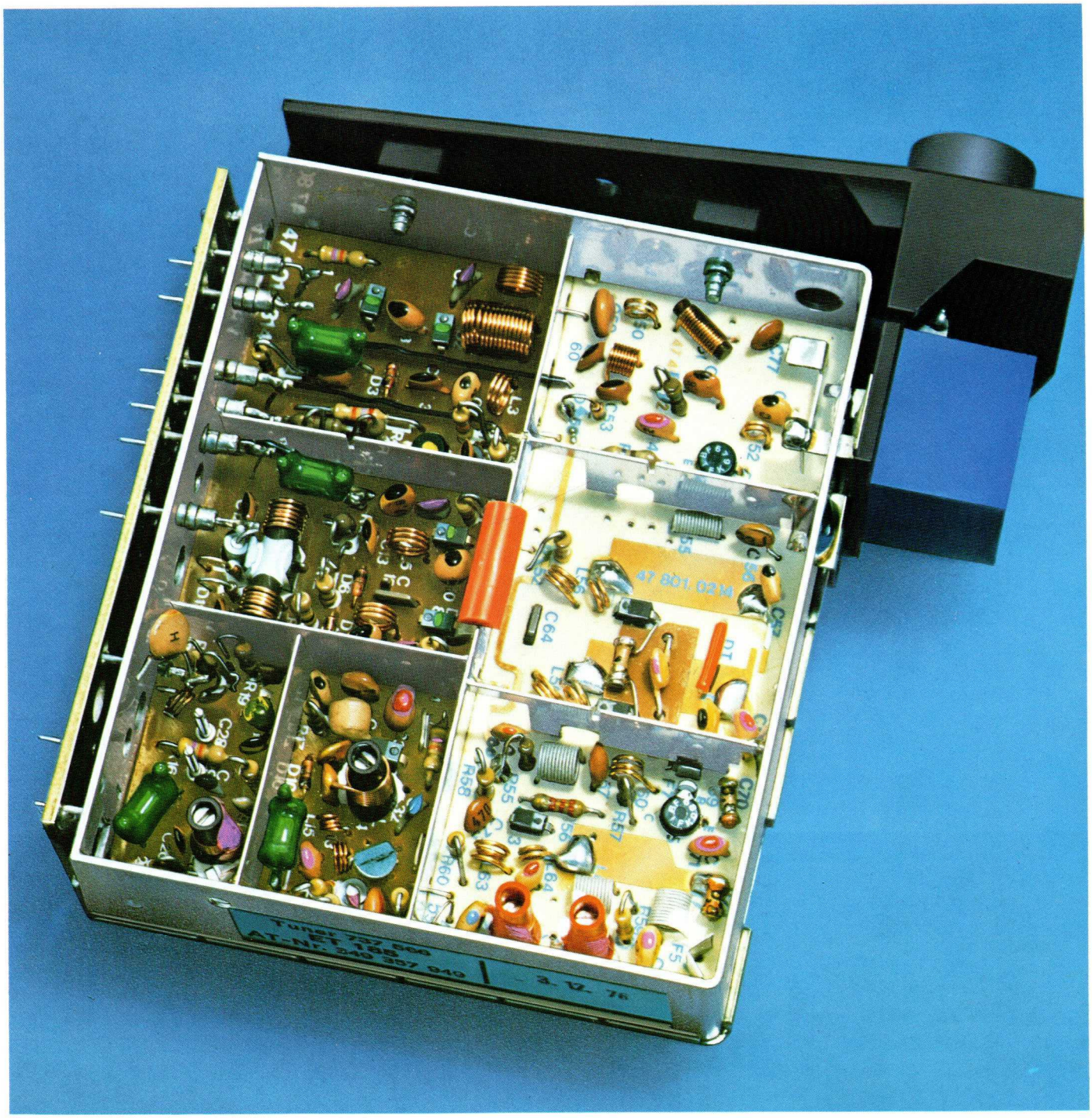
1 Tuner assembly
2 + 3 Careful alignment and precise final testing are only two reasons for the uniformly high quality standard of our tuners



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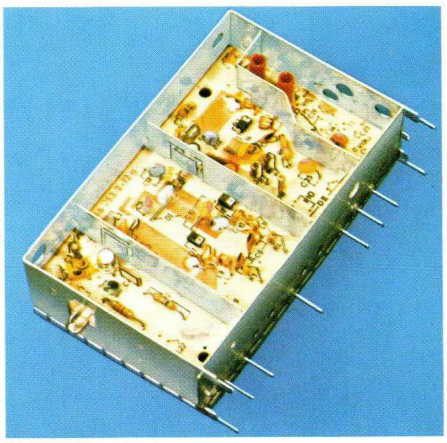
4 The view into an open UHF/VHF tuner illustrates the careful processing of all parts

5 UHF tuner

6 PLL tuner with digital program memory



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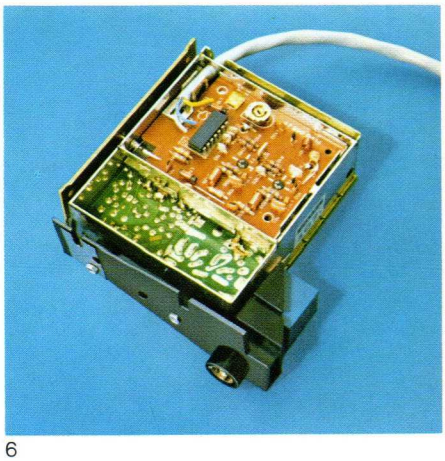

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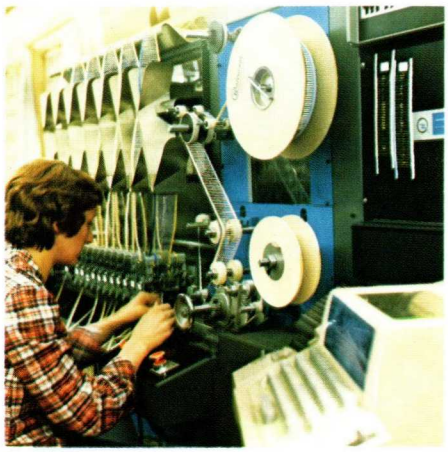
# Electronic Program Memories

The program memory is decisive for the convenience of control of all radio and TV sets. It is expected to perform diverse switching functions, feature maximum reliability and accurate repetition of all switching functions.



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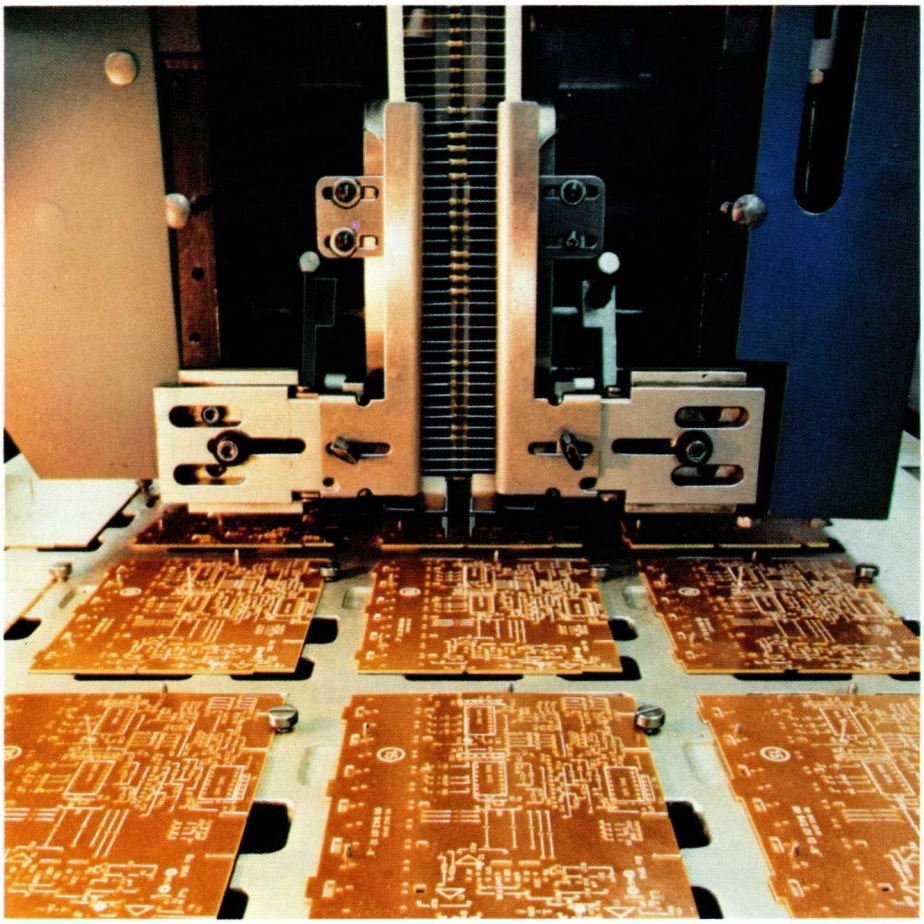

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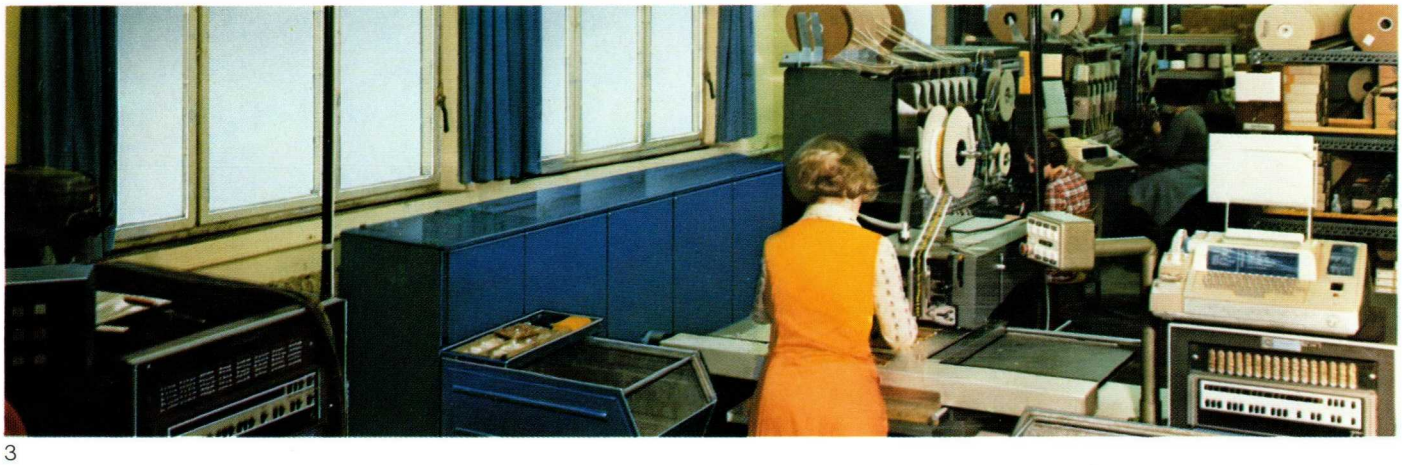

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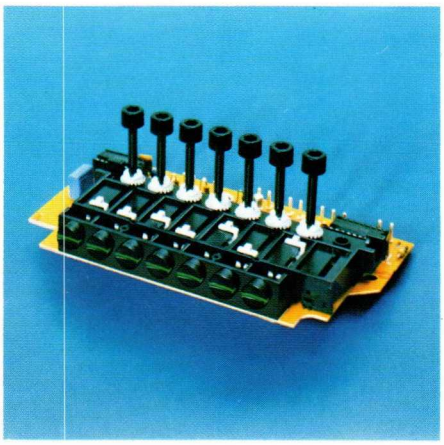
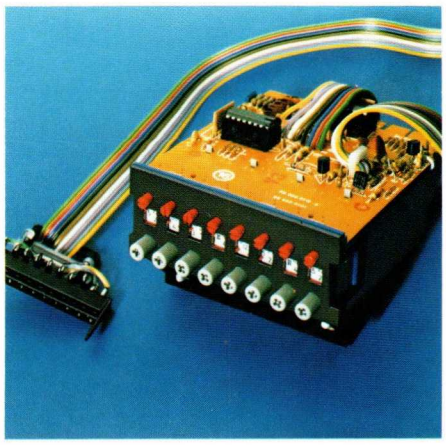
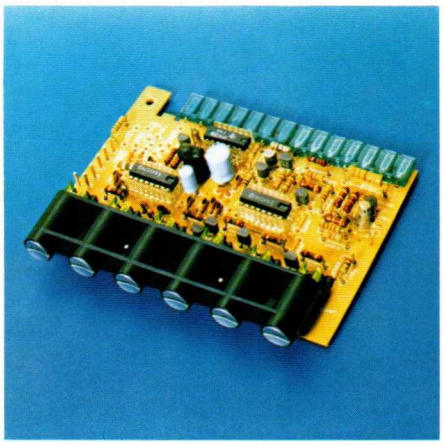


Electronic program memory for radio sets.



This electronic program memory is designed for 4, 8, 12 16 or 24 different TV programs



Electronic band tuner for radio sets with sensor buttons (top) Digital program memory for TV sets (bottom).

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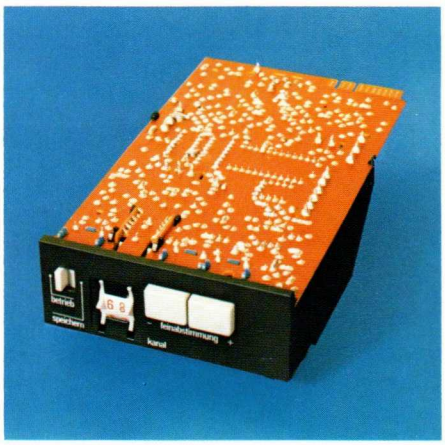

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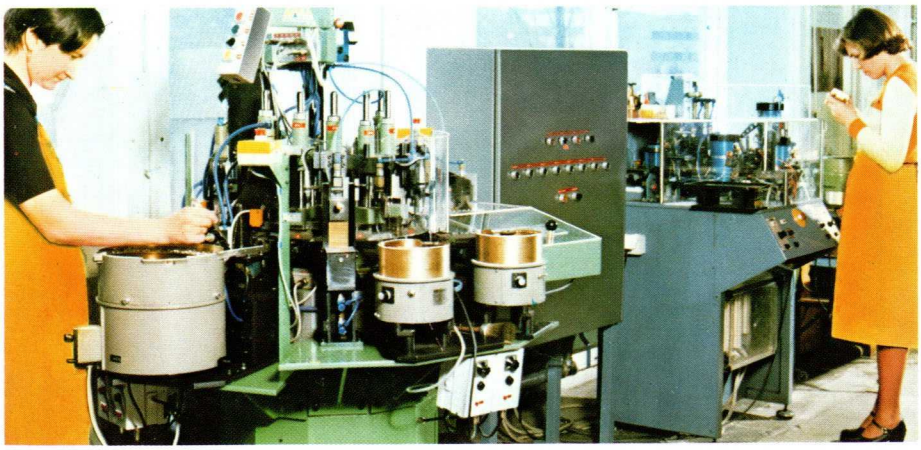
Computer-controlled automatic component mounting machines (Fig. 2) supplement work on the conveyor belt (Fig. 4). On the sequencer (Fig. 1) the components are sorted into the correct sequence for input into the automatic component mounting machine (Fig. 3).

Alignment (Fig. 5) and final testing are the last steps in the production procedure.

6

# Potentiometers and Switches

A process developed by AEG-TELEFUNKEN allows us to match the resistance characeristics of the conductive pattern to all customer requirements in the production of film potentiometers. We are just as flexible in the manufacture of the specified construction shape, in the combination of different types of potentiometers, including switches, to form a sub-assembly, in producing sub-assemblies with and without plug connector – all tailor-made to specifications.



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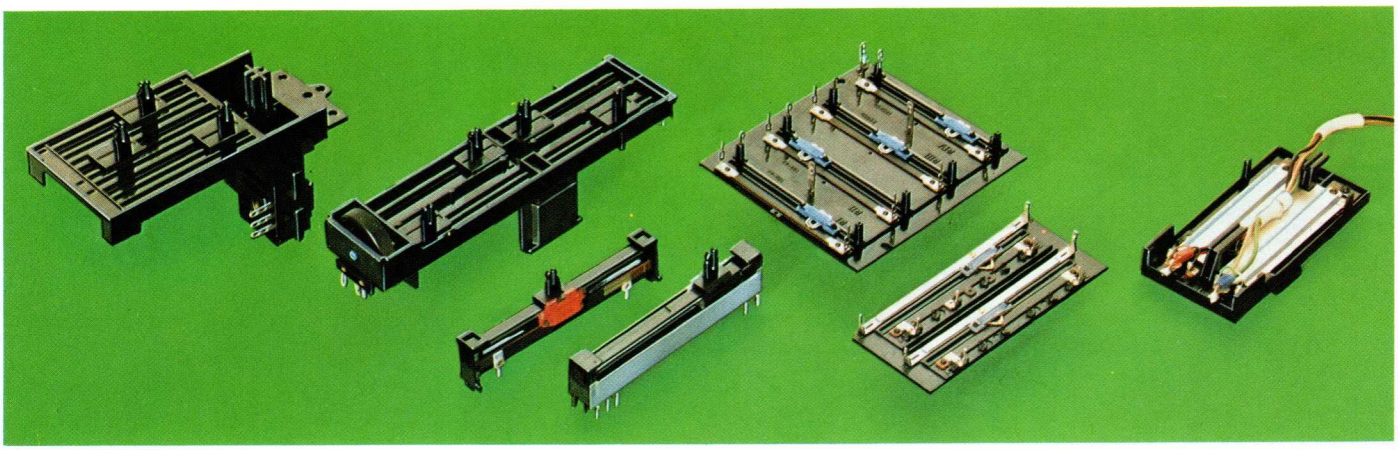

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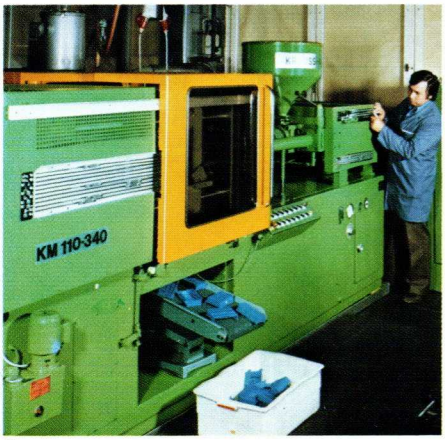


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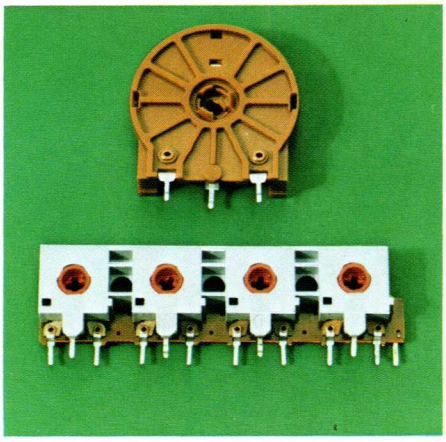
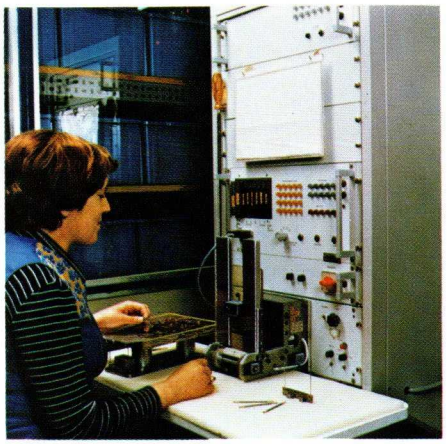


4

1 Contacting the conductive patterns in automatic machines
2 Different constructional types of potentiometers
3 Manufacture of injection moulded parts
4 Focussing control potentiometers



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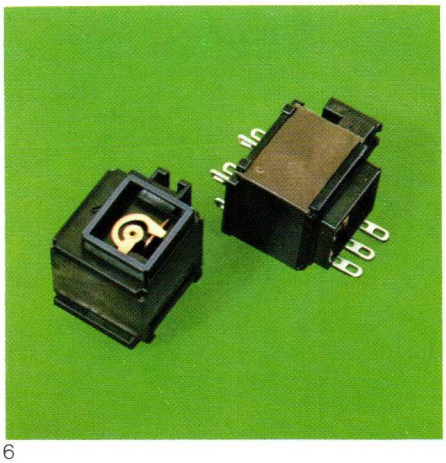
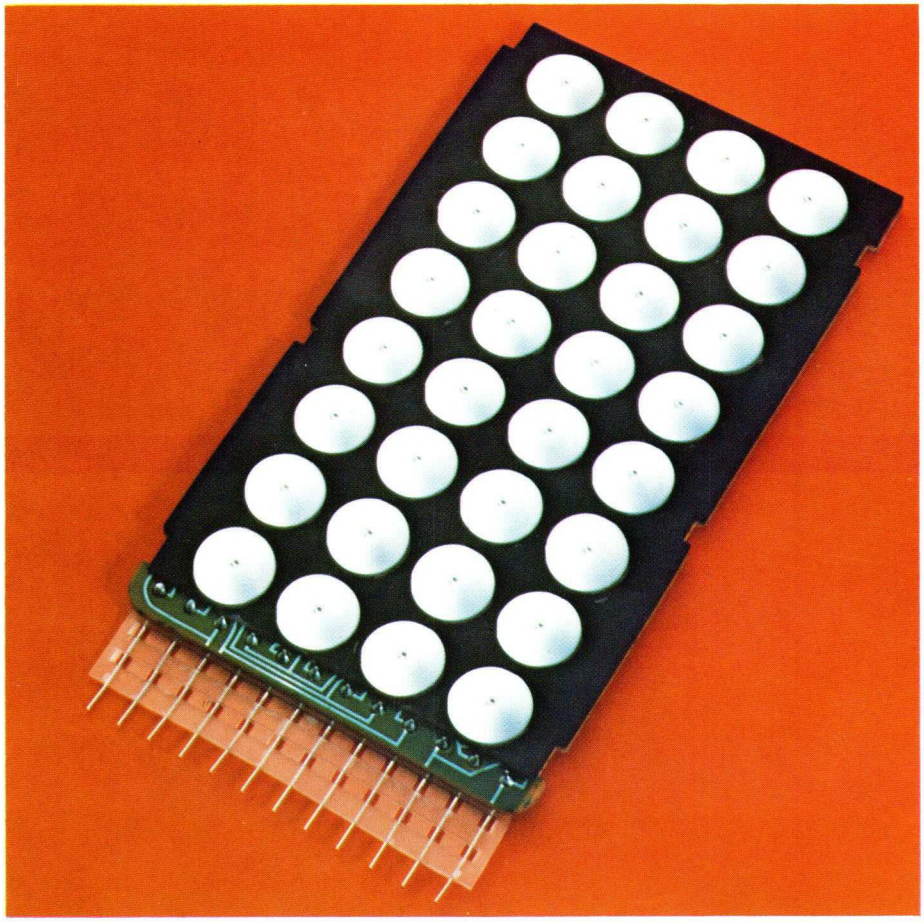
5 Checking the conductive patterns



6

6 Mains switch



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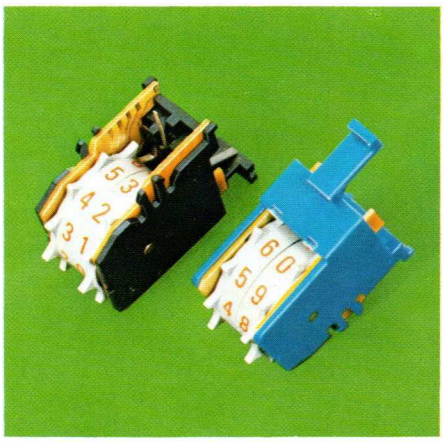
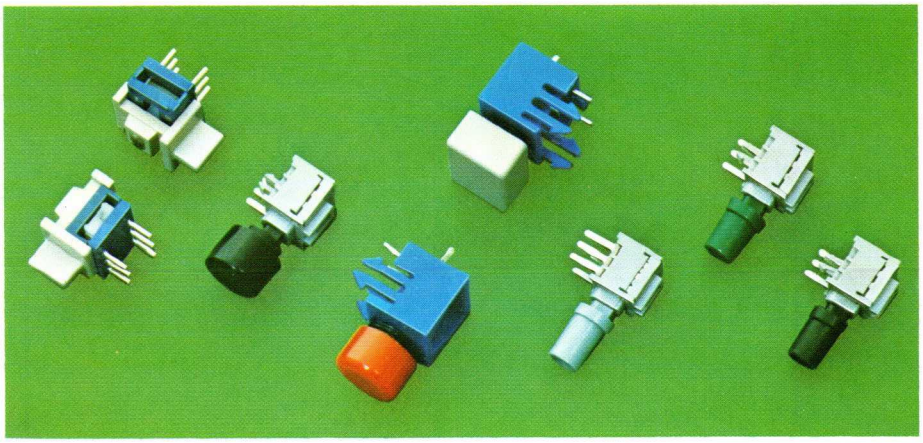


7

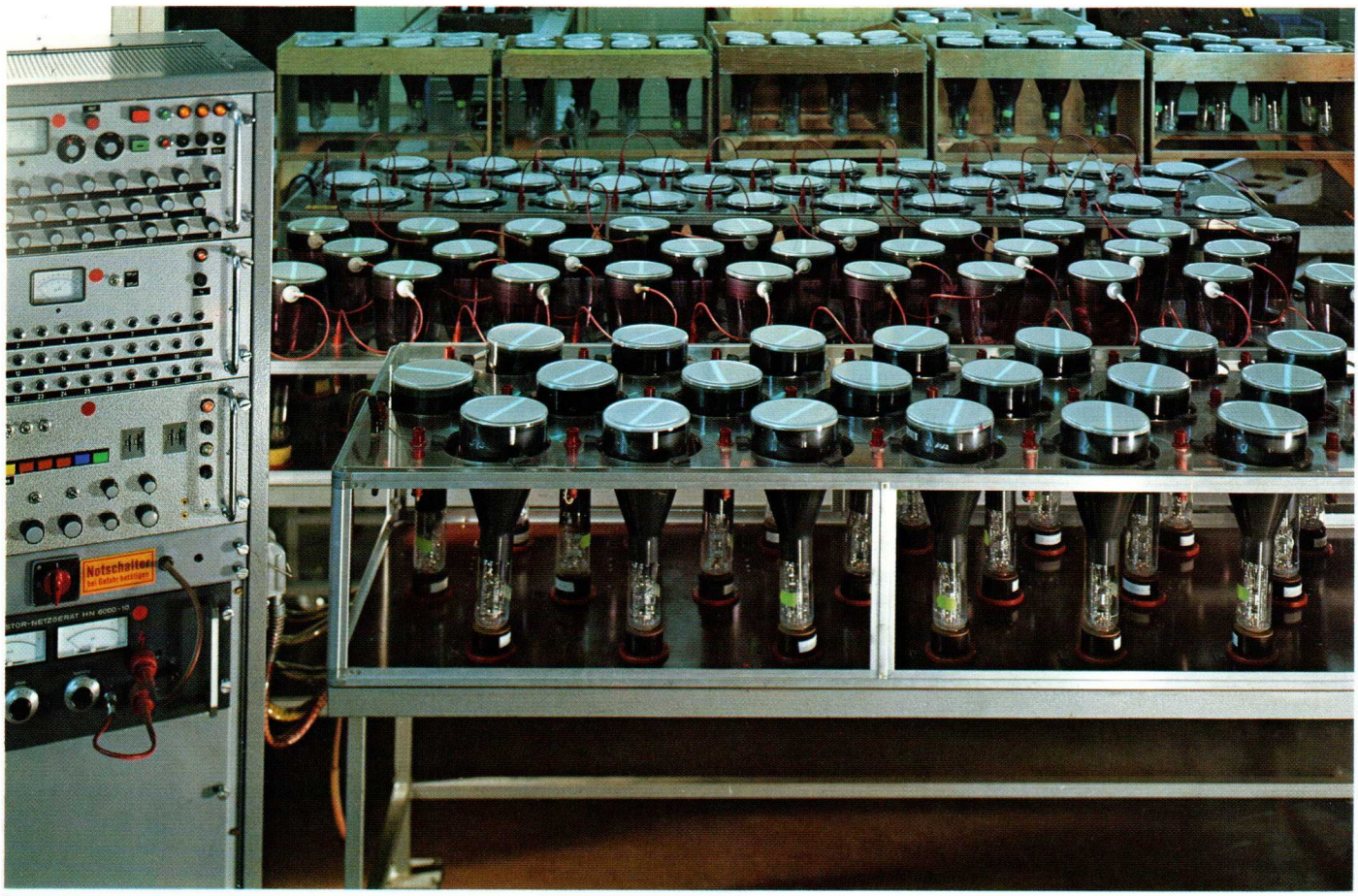
7 Coding switches
8 Switch base plate



9

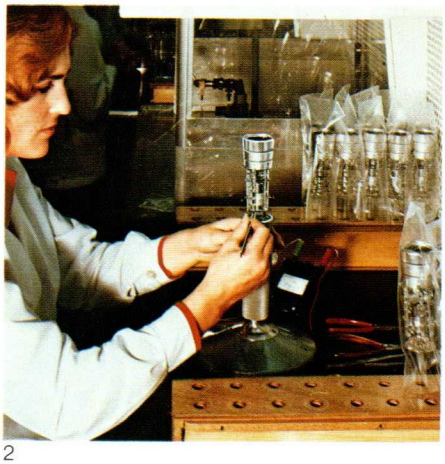
9 Various pulse buttons and switches

# Cathode-Ray Tubes




1

In 1887 Prof. Braun developed the cathode-ray tube, the ancestor of the modern TV picture tube.
But for what fields of applications has the cathode-ray tube been used in the meanwhile! The premise, however, was intense and ingenious development work by engineers and scientists.



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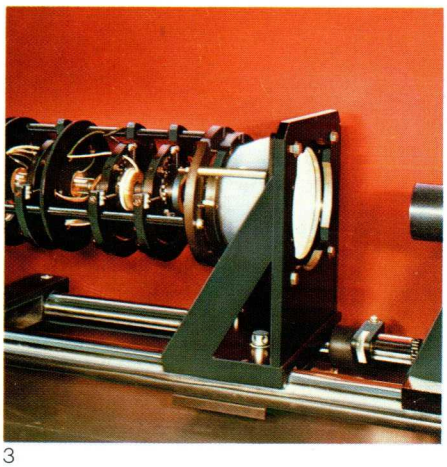


3

Nowadays we find this tube in electro-medical equipment, in electronic photo-composers, in servicing oscilloscopes, in the non-destructive testing of materials, in aviation technology and also in radar systems. Thus the cathode-ray tube was, and still is, one of the premises for many achievements in modern times.

1 Multiple test assembly for cathode-ray tubes
2 Checking a system with mesh electrode
3 Flying spot tube on the test bench

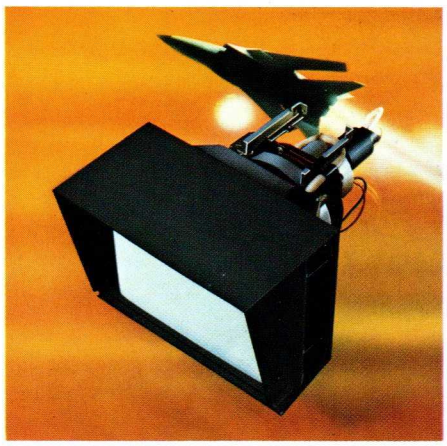
4

4 Radar display tube
5, 7 and 9 Display tubes for aviation equipment

6 Monitor tube
8 Tube for compact sets for non-destructive testing of materials
10 Tube for inexpensive servicing oscilloscopes

5

6



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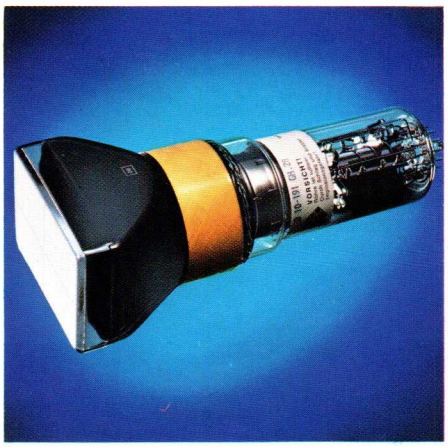

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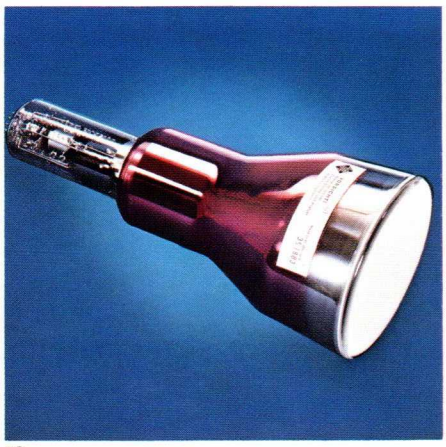


10

Thanks not only to their dimensions but specially because of power consumption, our miniature TV tubes are sure of a wide field of applications. A power consumption of 35 mW is about 20 times less than needed by a conventional tube and thus allows use in pocket-size units using commercial-type 1.5 V dry batteries.

Some applications worth mentioning are pocket-size TV sets, electro-cardioscopes for emergencies and home visites by the doctor, and servicing oscilloscopes for immediate repairs.

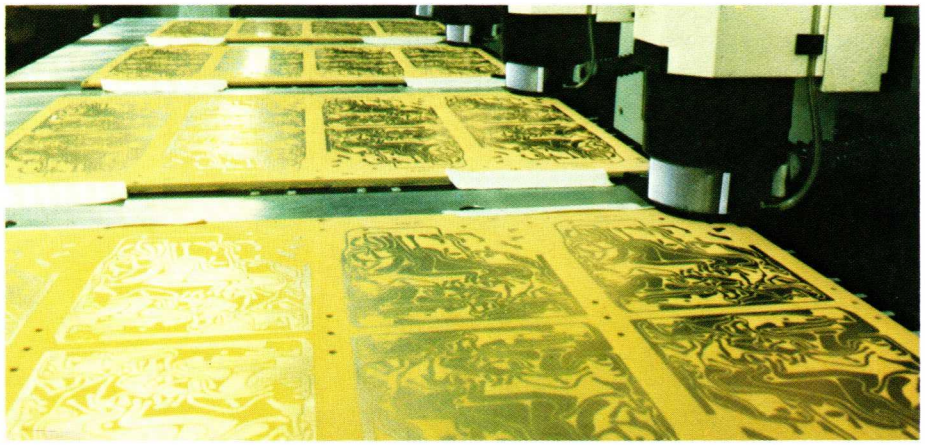
# Printed Circuit Boards

Item for item we have referred to the aspects which may be important for your particular applications. For commercial, professional and applications calling for maximum requirements we supply prototypes, small and large batches in the following designs: plated-through holes, metallised with burnished tin, lead tin, silver, nickel-gold and multilayer.

1 The circuit boards are drilled by computer control and with maximum precision

2 Magnification of a section of a plated-through circuit board

3 +4 Frequent checks ensure uniform quality



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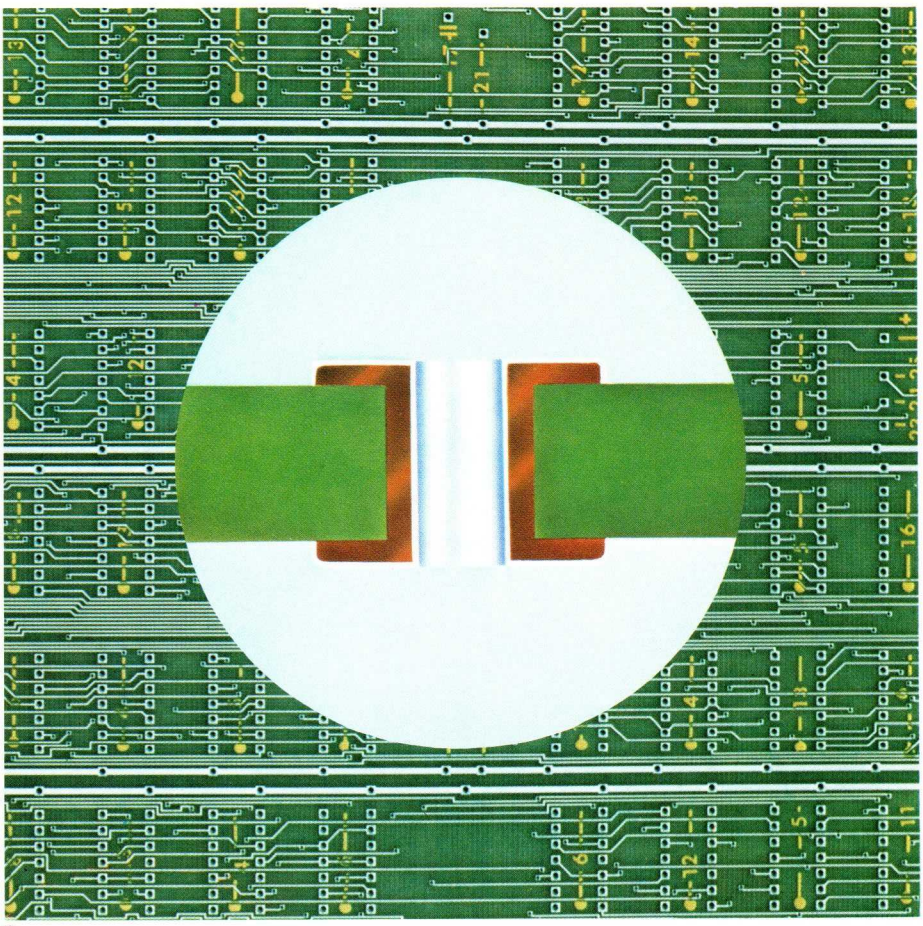

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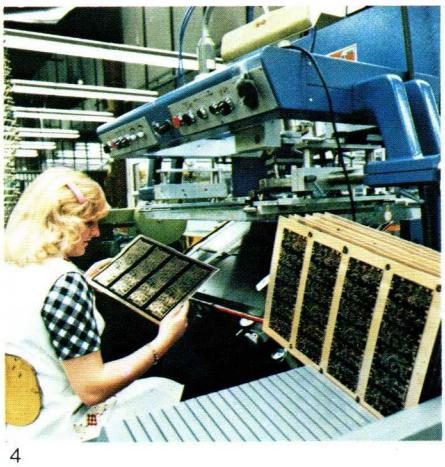

4

Line of products of the Tubes and Sub-Assemblies Division

Colour TV tubes
Deflection units
Multi-pole units
Convergence segments
Blue lateral units
Correction coils for deflection circuits
Line transformers
Picture tubes for miniature sets

Cathode-ray tubes for:
Servicing and test oscilloscopes
Storage oscilloscopes
Industrial and medical display units
General display purposes
Electronic photo-composers
Aviation technology
Radars
Data monitors

Display modules

Microwave components:
Traveling-wave tube for terrestrial and satellite applications
Pulse magnetrons
Reflex klystrons
Lighthouse tubes
Microwave semiconductor diodes

VARISYMBOL display elements

Opto-electronic tubes for:
Active and passive night-viewing units
TV cameras

X-ray tubes for:
Materials testing
Spectrometry
Diffractometry

Transmitting tubes

Special-purpose amplifying tubes

Sub-assemblies:
Tuners for VHF and UHF
Digital program memories
Electronic program memories for radio and TV
Potentiometer sub-assemblies for transmitter and band selection

Potentiometers:
Single and tandem types
Rotary and slide potentiometer combinations
Focussing control potentiometers
Printed resistors and resistor combinations
Potentiometers for special purposes

Switches:
Mains switch (VDE, SEMCO, SEV)
Mains switch in incorporated units
Coding switches (BCD)
Pulse buttons and switches
Switch base plates
Switching elements in special designs

Printed circuit boards:
by the silk screen printing or photographic methods with circuit pattern on one or both sides in special technologies (multil-layer, semi-additive, etc.)

AEG-TELEFUNKEN
Serienprodukte

Geschäftsbereich
Röhren und Baugruppen

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7900 Ulm/Donau
Telefon (07 31) 191 1
Telex 712 601

Printed in Western Germany

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