INFORMATION REPORT INFORMATION REPORT

CENTRAL INTELLIGENCE AGENCY

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S E C R E T
NO FOREIGN DISSEM

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COUNTRY East Germany

REPORT

SUBJECT Development of Electronic Equipment in East Germany

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four reports describing the state of the art of electronics equipment in East Germany.

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Attachment 1:

The report describes the development of electronic measuring equipment and includes illustrations of the following devices treated in the text:

1. Ductilimeter (Technische Physikalische Werkstaetten Thalheim)
2. X-Ray gamma dosimeter (Vakutronik)
3. Device for adjustment and impedance measuring (Werk fuer Fernmeldewesen Berlin)
4. Precision decade generator (Werk fuer Fernmeldewesen Berlin)
5. Electronoptical device (Zeiss, Jena)
6. Ultrasonic material-testing device (Zeiss, Jena)
7. Light-electrical spectralcolorimeter (Zeiss, Jena)
8. Recorder regulator (Zeiss, Jena)

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(9 pages)

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GROUP 1
Excluded from automatic downgrading and declassification

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STATE	DIA	ARMY	NAVY	AIR	NSA		OSI EV
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(Note: Field distribution indicated by "#".)

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Attachment 2:

The report discusses and describes semiconductor components produced at the following installations:

Werk fuer Fernsehelektronik (semiconductor diodes)

Halbleiterwerk Frankfurt/Oder (Zener diodes, rectifiers and transistors)

Carl Zeiss, Jena (photodiodes)

Keramische Werke Hermsdorf (semiconductor resistors)

Peltier Kuehlelemente (pilot fabrication done at II. Physikalisches Institut of Martin Luther University, Halle/Saale)

The following illustrations are included in the descriptive text:

1. Silicon diodes OA 900 to 905
2. Prototype of a 200-A silicon element with cooling body (Institut fuer Halbleitertechnik Teltow)
3. Selenium rectifier (Gleichrichterwerk Grossraeschen)

(6 pages)

Attachment 3:

The report discusses the status of measuring devices techniques and new improved measuring devices. The following are illustrated in the descriptive text:

1. Counter frequency measuring device 3506; counter sum printer 3503; broad band generator 2016 (Funkwerk Erfurt)
2. Frequency spectrometer F Sp 10 a. (Funkwerk Koepenick)
3. Dualoscilloscope OG 2-10 (Funkwerk Koepenick)

Discussed are also new decimeter measuring transmitters (Mess-Sender) produced by Rafena-Werke Radeberg.

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Attachment 4:

The report offers information on the production of electronic tubes. It contains a list of tubes available for delivery and a list of new tube developments. The following tubes listed as "special tubes" are illustrated in the descriptive text:

1. Mx Noise diode GA 560 (Werk fuer Fernmeldewesen)
2. Rare gas thyratron S 1,3/30 dv
3. Relay tube with pure metal cathode Z 660 W for direct-current
4. Pure metal stabilizer tube St R 150/15
5. Electrometer tube Z 862 E
6. Decade counter tube Z 563 C
7. Signal indicator tube Z 561 M
8. Decade (decimeter) indicator tube Z 565 M
9. Transmitter tetrode SRS 456
10. Transmitter triode SRV 355
11. Reflex clystron HKR 902 (KR 90)
12. Continous-line magnetron (Dauerstrichmagnetron) HMD 241 (MD 3)
13. Impulse magnetron HMI 952 (2 J 55)
14. Traveling field tube HWE 402 (WE 3)
15. Traveling field tube HWL 412 (WL 21)
16. Coil focalizer for traveling field tube HWL 412
17. Traveling field tube HWL 221 (WL 1)
18. Superorthicon F 7,5 M2 for general use in studio and press cameras.

Distribution of Attachment:

50X1-HUM

OSI:
: Retention

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[redacted]

8 May 1964 50X1-HUM

EARLY 1963 STATUS OF DEVELOPMENT OF ELECTRONIC EQUIPMENT IN EAST GERMANY

[redacted] 50X1-HUM

[redacted]

(discussion of optical equip., Electrical quantity measuring equip., Nuclear physics Equip, semiconductor devices, rectifiers, & Electron tubes)

Attachment I

The scientific industrial enterprise, VEB Schwingungstechnik und Akustik, in Dresden produced 50X1-HUM a prototype of a new vibration-measuring set, called the SMD 6 The SMD 3 vibration-measuring set from the previous year, is 50X1-HUM now available for delivery.

The Technisch-Physikalische Werkstaetten Thalheim brought out the following new or improved developments: 50X1-HUM the EO1/77 U service-pulse-oscillograph designed especially for 50X1-HUM pulsed operation; a new EO 1/130 "Uniskop" single-beam oscillograph 50X1-HUM and a new "Duoskop" dual-beam oscillograph, the EO 2/131 A newly developed 3TG 1 transistorized power pack with 50X1-HUM a high voltage constant is also of interest. The output voltage (3 x 0.5 ... 15 volts AC) is adjustable in 8 stages. The new 4NG1 laboratory power pack is designed especially for providing tubes with 50X1-HUM current, and supplies three independent adjustable DC voltages between 30 and 300 volts, and one continuously adjustable AC filament voltage of 0 - 15 volts. The SO 86 F "Selektograf" oscillograph is also a new

development; it has a built-in wobbler and is primarily intended for use in television [redacted] 50X1-HUM

The final TPW (Technisch-Physikalische Werkstaetten) new development is a complete strain-gauge installation (Fig 1) for the determination of stress-strain distribution in structural parts and materials. The installation has very high sensitivity, provides direct-reading of strain values, and is very easily switched from one test piece to another. The 4 DU 3 switching device, [redacted] provides the means of determining the 50X1-HUM measurement results at 20 test sites or positions, one after the other, 50X1-HUM either automatically or manually. The D 3, or 4 D 3, strain gauges [redacted] which are used with the installation, were exhibited as prototypes 50X1-HUM last year.

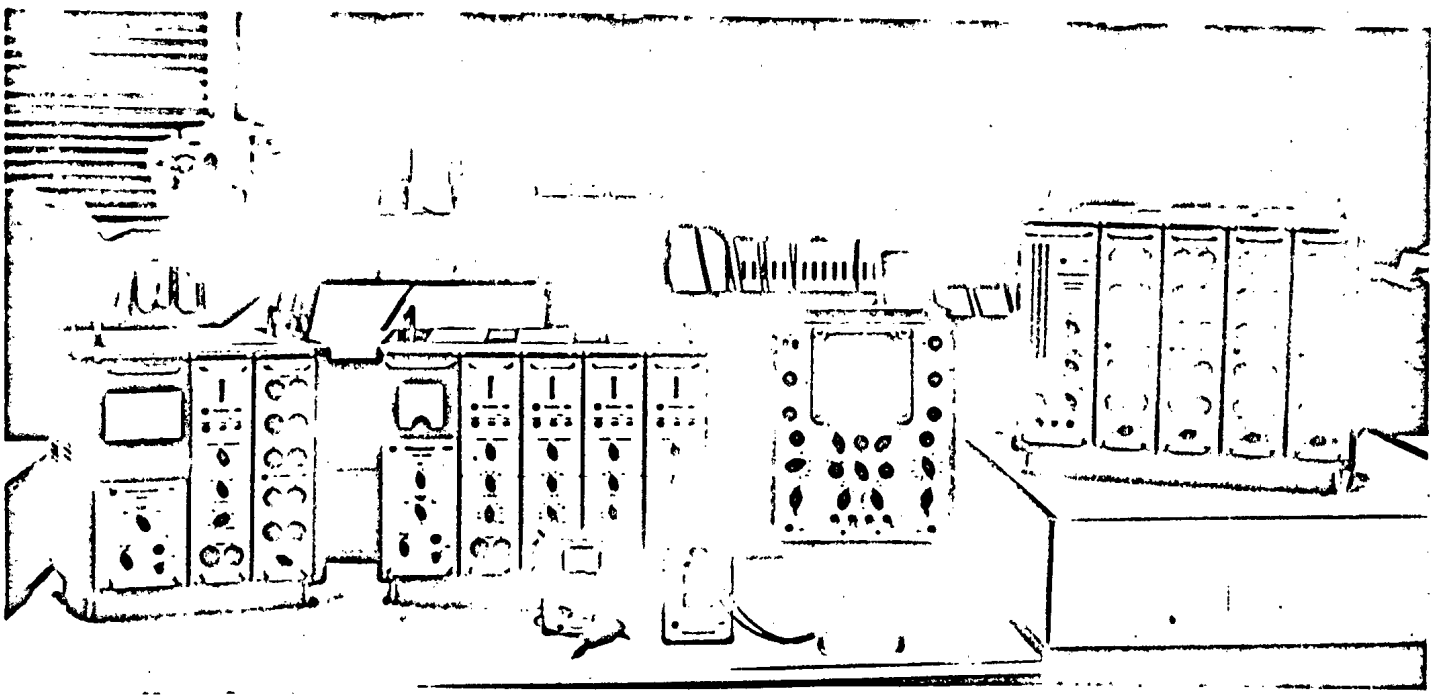


Fig 1. Complete Strain-Gauge Installation (TPW)
right: the 4 DU 3 switching device; left: the D 3 strain gauge

TFW has also developed the DE 1 strain-gauge balancing network, which is a strain-gauge resistance-balancing network which can produce a definite change of resistance. The instrument is required primarily when rather long lengths of cable are encountered, in which rather considerable losses of sensitivity occur. The balancing network can be reconnected to the resistance values of the measuring strips in use at the time; it is designed as a half-bridge circuit, and can be encorporated into a full bridge by adding one cable.

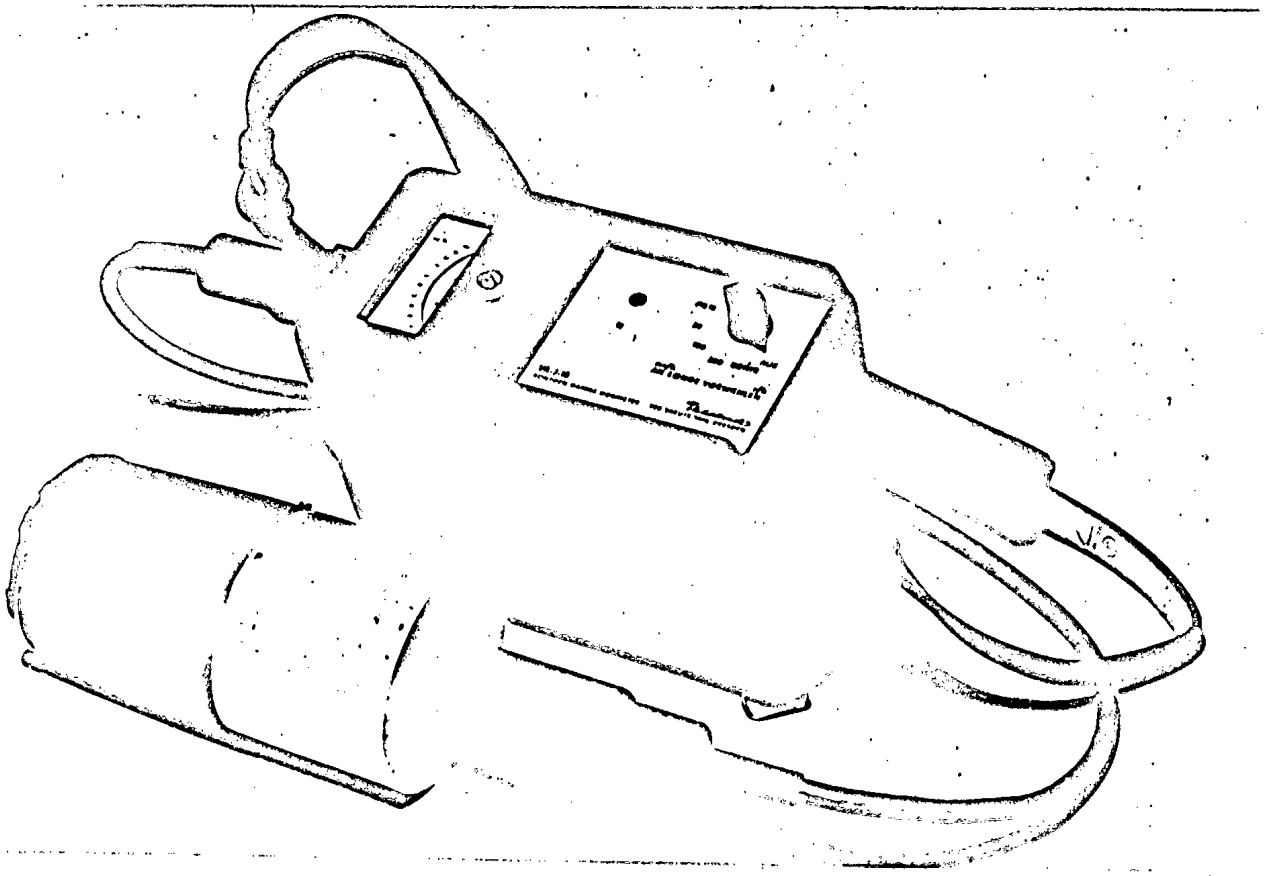


Fig 2.- Roentgen-Gamma Dosimeter VA-J-15 (made by Vakutronik)

The VAKUTRONIK outfit now occupies two plants, the old parent plant on Dornblueth Strasse in Dresden and the new factory in Pockau-Lengefeld,

which manufactures purely mechanical parts (such as plug-and-jack assemblies) 50X1-HUM

[redacted]

A parallel type of the VA-J-51 improved vibrating-capacitor electrometer [redacted] was designed, which differs only in the drift values: 50X1-HUM

zero displacement (at 10^{11} ohms input impedance and normal temperature): 0.5 mv/24 h;

zero displacement (at operating temperature changes, input impedance of 10^{11} ohms; max duration 48 hours): 0.12 mv/deg.

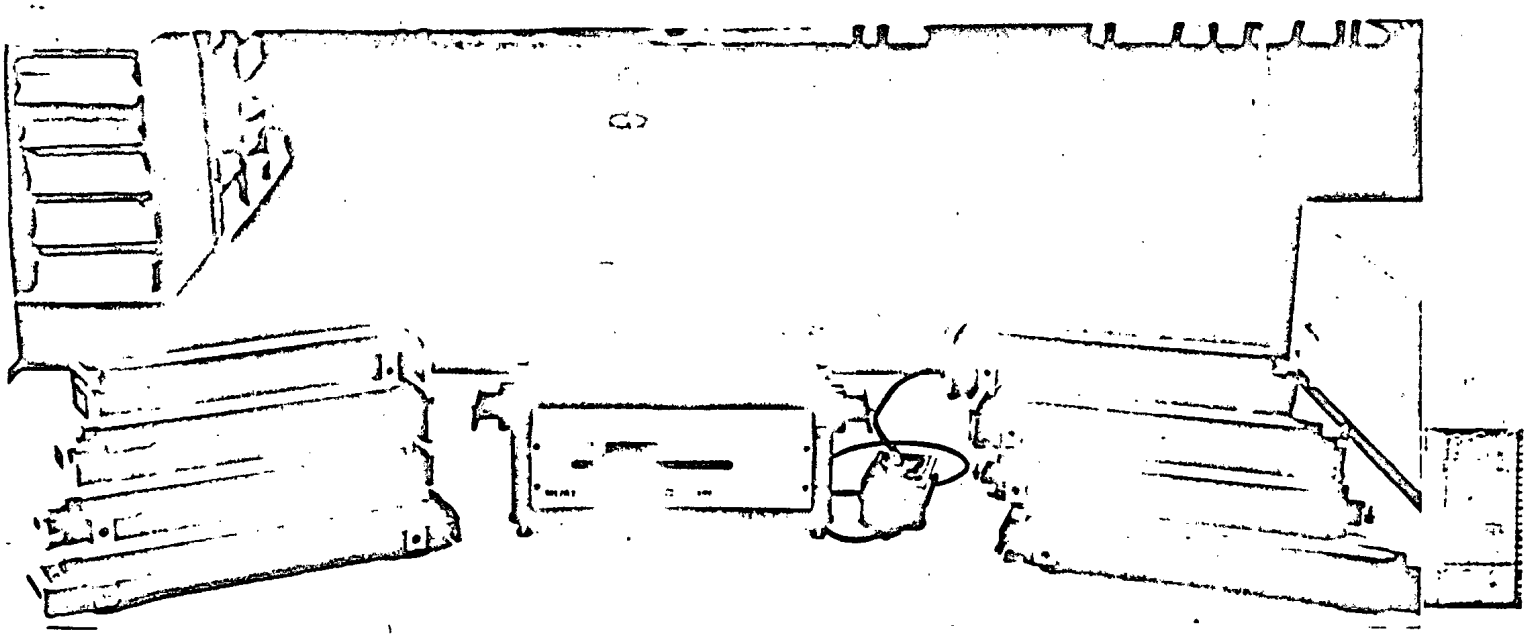


Fig-3. The ML/A2 Slotted Line for Matching and Impedance Measurements by Magnitude and Phase, Attenuation and Wavelength Measurements in the 3,200-12,400-megacycle Frequency Range. The slotted line can also be used for measuring the dielectric constants and loss angles of dielectrics (Werk fuer Fernmeldewesen Berlin-WF)

The Werk fuer Fernmeldewesen Berlin (WF) showed the RWG 4 square-wave test oscillator and the WG 3 wobbulator [redacted] in a new housing but very slight change in circuitry. 50X1-HUM

One new development is the PDG 1 test oscillator with stepped frequency adjustment, which went into production in February 1963. This is a test oscillator with high frequency constant and accuracy within the 100-cycle to 30-megacycle range, with adjustment in 100-cycle steps.

[redacted] 50X1-HUM

Another new item is the TP 13 low-pass filter for 0.1 - 30 Mc [redacted] as is the KF 1 combination filter [redacted] with a frequency range of 31.5 cycles to 31.5 kilocycles and a basic transmission loss of 50X1-HUM 50X1-HUM

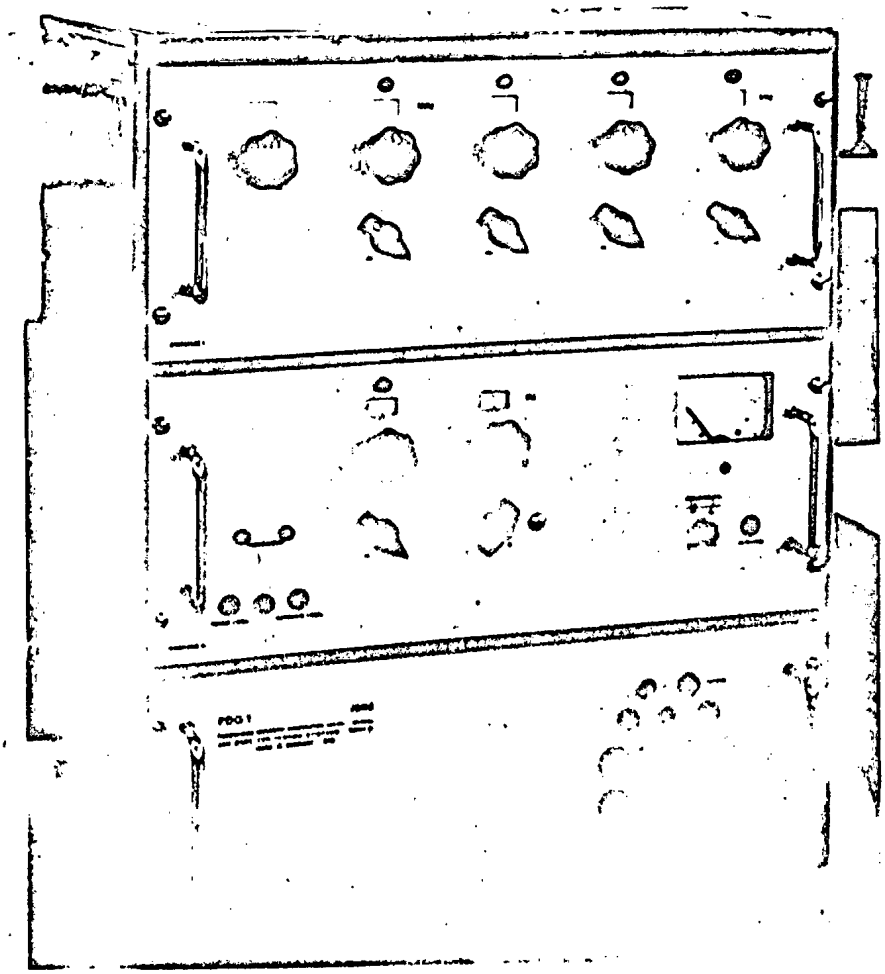


Fig 4. (WF)
PDG 1 Precision
Test Oscillator

0.6 - 0.8 neper in the passband, increasing up to 1.0 neper in the case of the fundamental frequencies.

Carl Zeiss, Jena showed the EF 4 "Electron-optical Device" (Fig 4) as its most important and most interesting new development. This device is designed primarily for the physical examination of objects in electron-optical enlargement up to 40,000x, resolution to 20 angstroms, and voltage

up to 65 kilovolts. Large objects can be imaged in 20-degree reflection as well as by emission. Various methods of electron diffraction are provided. [redacted] 50X1-HUM

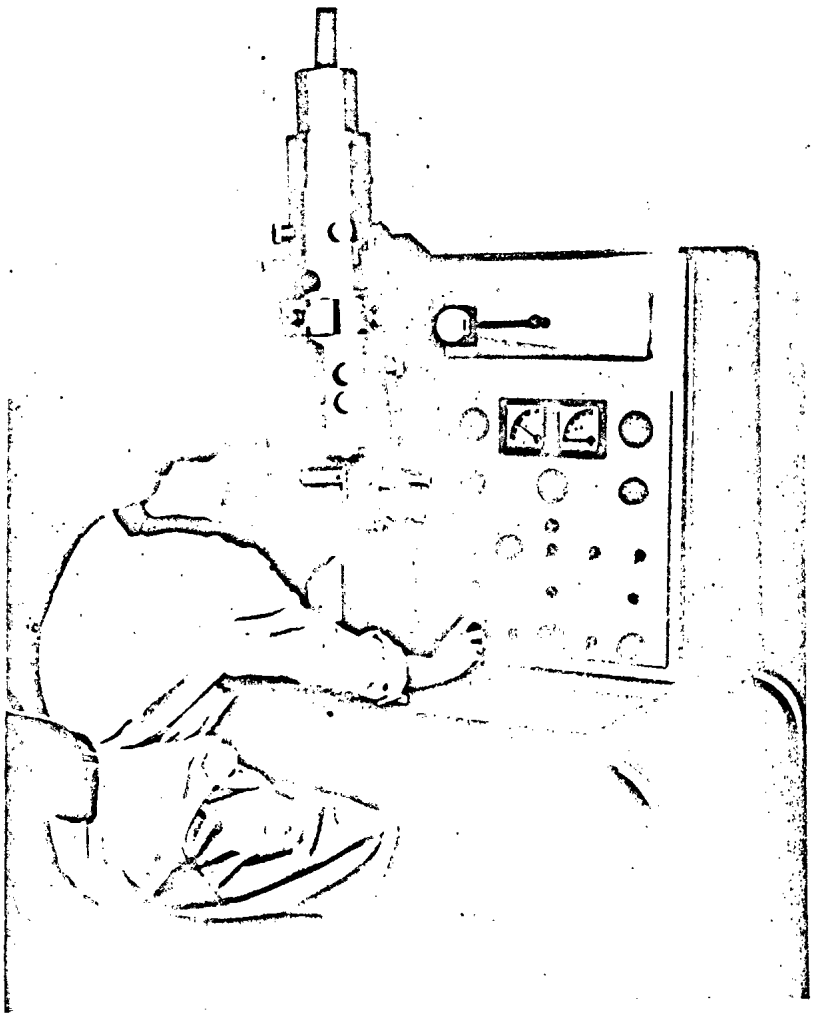


Fig 5. The EF 4 Electron-Optical Device (Zeiss)

The new "Usomat" ultrasonic materials tester (Fig 6) is a penetration-type instrument that operates continuously in the ultrasonic mode. Its main features are: 4-megacycle ultrasonic frequency,

two probe heads on universal stand, exchangeable probes, effective probe diameter 2-5 millimeters, probes extended pneumatically, triggering of probe movement by electric contact, ultrasonic connection with film of liquid or dry with plastic cap on probe. The test result is indicated by a pointer dial and signalled by relay. The probe heads are connected to the power supply by metal tubing; high-frequency generator, amplifier, indicator, compressed-air system and power pack all contained in the power supply unit.

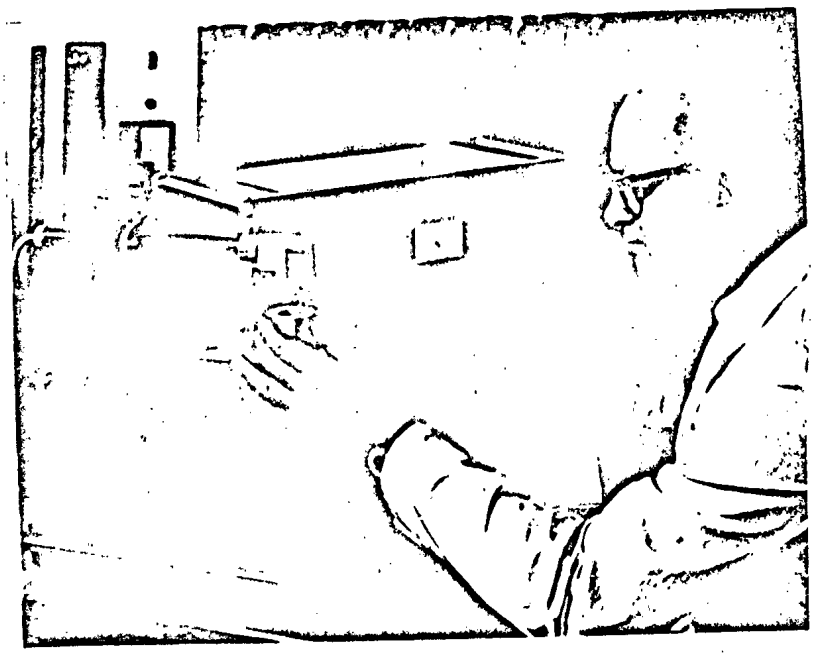


Fig 6.
Ultrasonic Materials Tester (Zeiss)

The Zeiss "Spekol" photoelectric spectral colorimeter (Fig 7) for routine laboratory investigations is also new. It is a single-beam instrument with meter indicating extinction (0-2) or transmission (0-100%) in the wavelength range of 365-750 nonano-meters, and uses a stabilized incandescent 6-volt, 30-watt lamp or a type HQE 40 mercury-vapor lamp.

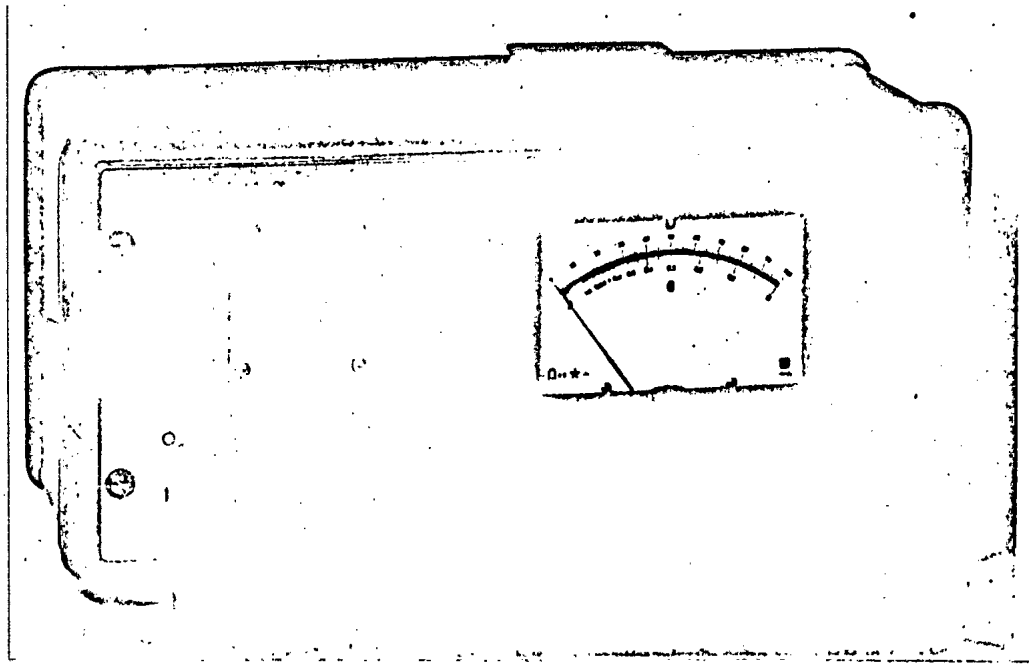


Fig 7. The Zeiss "Spekol" Photoelectric Spectral Colorimeter

The colorimeter contains one grating monochromator of high light intensity, which, with a fixed slit setting in the given spectral range, delivers monochromatic radiation of 14 nanometers half-value width. Exchangeable test attachments for two C-cells (layer thickness 0.1 - 1.0 cm) or test tube. The radiation receiver of the basic equipment is a photo-cell with transistor amplifier. Area of application of the instrument being expanded by attachments for turbidity-, fluorescence-, and re-emission-measurements, as well as for titrations with photometric end point determination.

The pH-recorder-controller (Fig 8) is also a new development with the following specific properties: self-compensator with about one-kilocycle chopper frequency ; input impedance 1,000 megohms when uncompensated, and

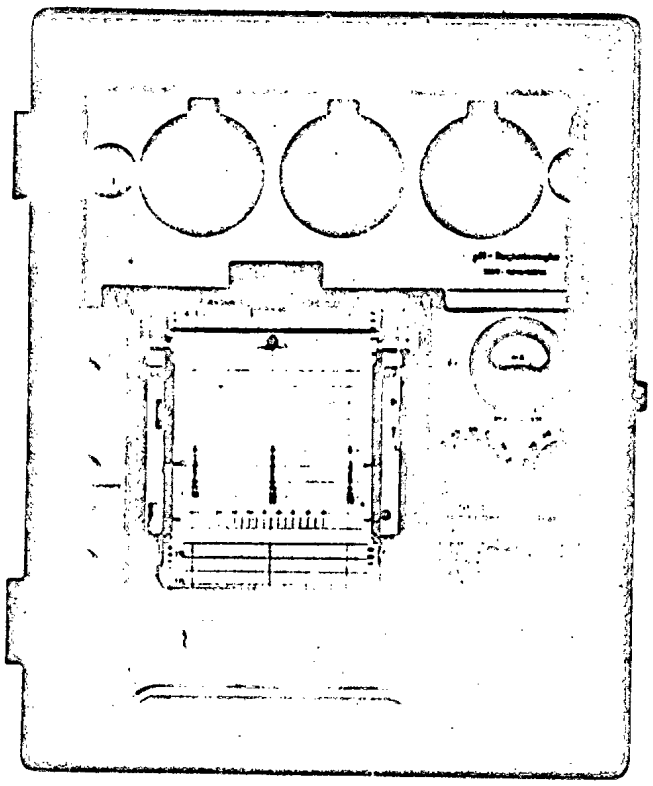


Fig 8.

The pH-Recorder-Controller (Zeiss)

higher when compensated; response sensitivity plus-minus one millivolt - 0.02 pH; indication accuracy one percent; adjustable for intersection of isothermal lines of the measuring circuit and for electrode transconductance; adjustable tolerance contact; double recording with 0-14 pH on 70-mm width and 0-14 pH, in steps of 2 pH, on a 100-mm width; pulse regulator has 20-ma current and 10-kilohm load impedance; pulse length proportional to the control deviation in range plus-minus 6 pH from nominal value with 2 sec/pH (adjustable); pulse spacing adjustable between 5 sec and 20 min, nominal value adjustable between 0 and 14 pH.

The Messgeraetewerk Zwoenitz (Zwönitz Test Instrument Factory) came to Leipzig with a newly developed 8-channel loop-oscillograph, the 8 SO-4.

This device records eight different processes on a 12-cm tape. Fifteen different types of measuring attachments are available for accomodation to a great number of measurement processes. It incorporates test loops for a high upper frequency limit, a coil vibrator with extremely high sensitivity but low upper frequency limit, and power testing loops which make possible a direct power recording. [redacted] 50X1-HUM

[redacted]

The piezoelectric tester PM-1 is, to be sure, not new, but has been improved and partially transistorized. [redacted] 50X1-HUM

[redacted]

Attachment 2

Semiconductors. (Transistors and Diodes)

The manufacture of semiconductor components in East Germany is distributed as follows among the various plants:

semiconductor diodes: WF (Werk fuer Fernsehelektronik), Berlin;
zener power diodes:
junction rectifiers: Halbleiterwiderstaende, Frankfurt (Oder);
transistors:
photodiodes: Carl Zeiss, Jena;
semiconductor resistors: Keramische Werke, Hermsdorf;
Peltier cooling elements: 2d Physics Institute, Martin Luther University, Halle (Saale)(pilot-production at present).

This section discusses only the diodes and transistors.

For the case of semiconductor diodes, and primarily for the case of transistors, it cannot be said with any certainty what types are actually new, what ones are in production, and which ones are in "permanent" development. Even a comparison of the type list for this year with last year's list does not reveal what types are actually being manufactured in East Germany. In Frankfurt there is no source of authentic information on the present manufacturing of semiconductors. Even the instrument designers are not completely clear about the actually available (not just offered for sale) types and numbers. Even the employees of the Frankfurt semiconductor factory know nothing about the schedule of types for delivery, since the entire production program is continuously subject to change, even complete reorganizations on short notice; the more one interrogates the "experts," the more contradictory are the statements on the production program. In the semiconductor field in East Germany the same mad confusion and contradiction prevails as in years gone bye! And this confusion is mirrored in the type lists.

Generally speaking, it can be said that neither the development nor the manufacture of semiconductors has advanced one step forward during the year.

It is useless to attempt to differentiate between new developments, laboratory production, prototypes and actual products in series production, as long as every laboratory model appears in the type list as a new development (but never goes into production), and as long as so many types

appear on the lists, year after year, again and again, with the note, "still in the development stage."

Only in the case of the series of germanium transistors for audio-frequency and switching applications , types OC 815 to OC 829, can it be said with some certainty that these are being manufactured in almost sufficient quantities and that some are available "off the shelf" or with only a short waiting period. But even with the power transistors rated above four watts, only sporatic deliveries in completely insufficient quantities can be expected. Conditions are even more unfavorable in the case of deliveries of the high-frequency germanium types OC 871, 872 and OC 880-883.

In the case of the majority of transistors there is the additional uncertainty involved in the extraordinarily wide discrepancy in the ratings and operational parameters. Types needed for more sensitive circuits and those with higher requirements must still be sorted out of a great number of transistors, a very expensive procedure that is out of the question for private concerns and possible for the VEB's only on a very limited scale.

Whereas, aside from microminiaturization, the trend in world-wide development of tranistors is more and more toward planar and epitaxial technologies, Frankfurt has not begun to follow this trend with any competence, but continues to stick with the simplest manufacturing methods. This means that the status of semiconductor development in East Germany is dropping farther and farther behind the world standard. It is extremely

doubtful that East Germany will ever be in a position to close the gap in transistor development, since progress in the Western World is so rapid. If East Germany intends to remain competetive to any extent on the world markets, she will never be able to supply her own transistor needs from her low-quality production, but will have to rely on imports.

The production situation is somewhat better at Werk fuer Fernsehelektronik (Television-Electronics Works), which, however, involves only germanium and silicon semiconductor diodes. The production of model 2 of the diode series OA 601-605 began (in large numbers) in December 1962, following completion of development work in the fall of 1962.

The silicon diode series OA 900-905 (Fig 1) is just now in the stage of transition into series production, whereas the 250-mw Silicon Zener diodes ZA 250/5 - 250/9 have been in continuous production since the first of this year.

Industrial Semiconductor-Rectifiers

As a development of the Teltow Institute for Semiconductor Engineering,(IHT), an incomplete series of heavy-current silicon rectifier cells, the largest being a 200-A cell (Fig 2) intended for later use in electrolysis plants and in locomotives, was exhibited at Leipzig. Series production, however, is not yet in the forseeable future; East Germany is still importing such heavy-current silicon rectifiers from Czechoslovakia.

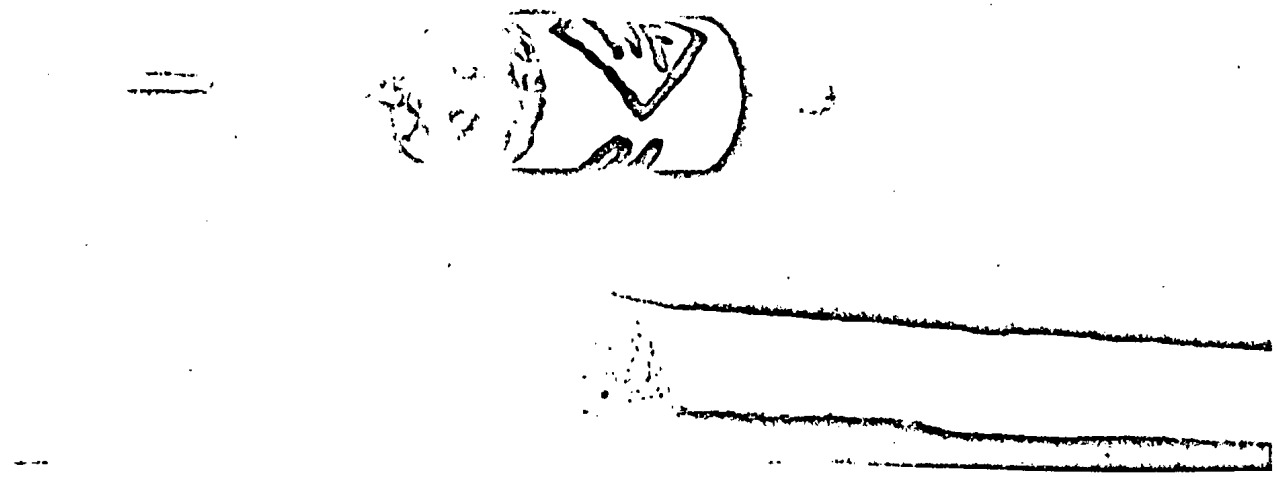


Fig 1. Silicon Diode of the Series OA 900-905

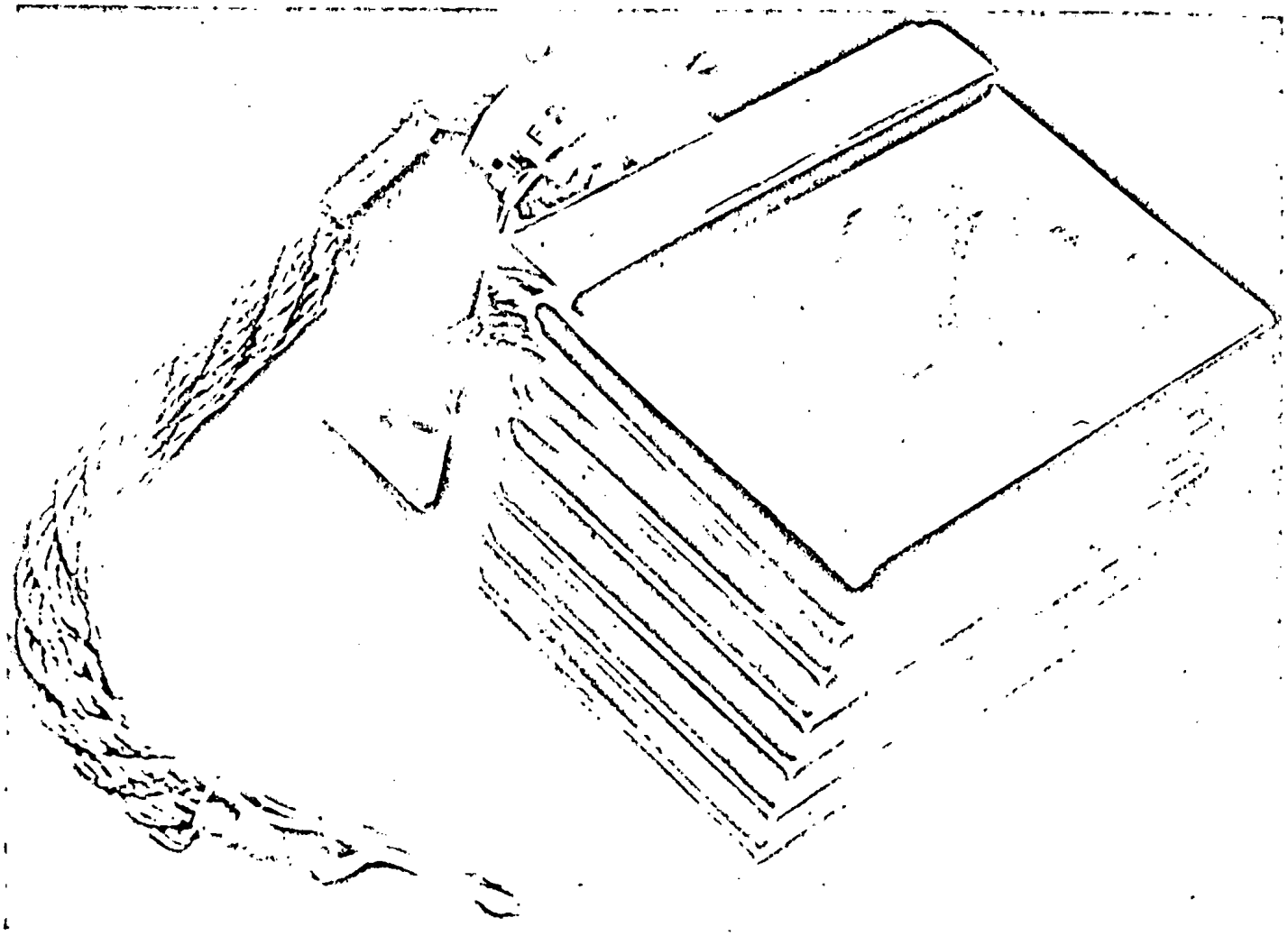


Fig 2. Prototype of a 200-A Silicon Cell With Cooling Element (IHT)

Controlled silicon rectifier cells, the so-called "thyristors," the development of which can be considered complete in the West, are not yet even in the beginning stages of development in East Germany.

The Grossraeschen Rectifier Works, East Germany's special plant for selenium rectifiers, exhibited as a new development two types of high-voltage rectifier tubes for 500 and 1,000 volts and 0.25 milliamp rated current, and a 14 x 15 x 4 mm hearing-aid rectifier KG 60 in cast resin. The new type GF junction rectifiers, for 250 $volts_{eff}$ and 40-120 milliamps -- are likewise in cast resin, and the new miniature high-voltage selenium rectifier is in a cast resin housing 32 x 12 x 12 mm, and designed for 1,000 v_{eff}, 400 volts DC and 15 ma (Fig 3).

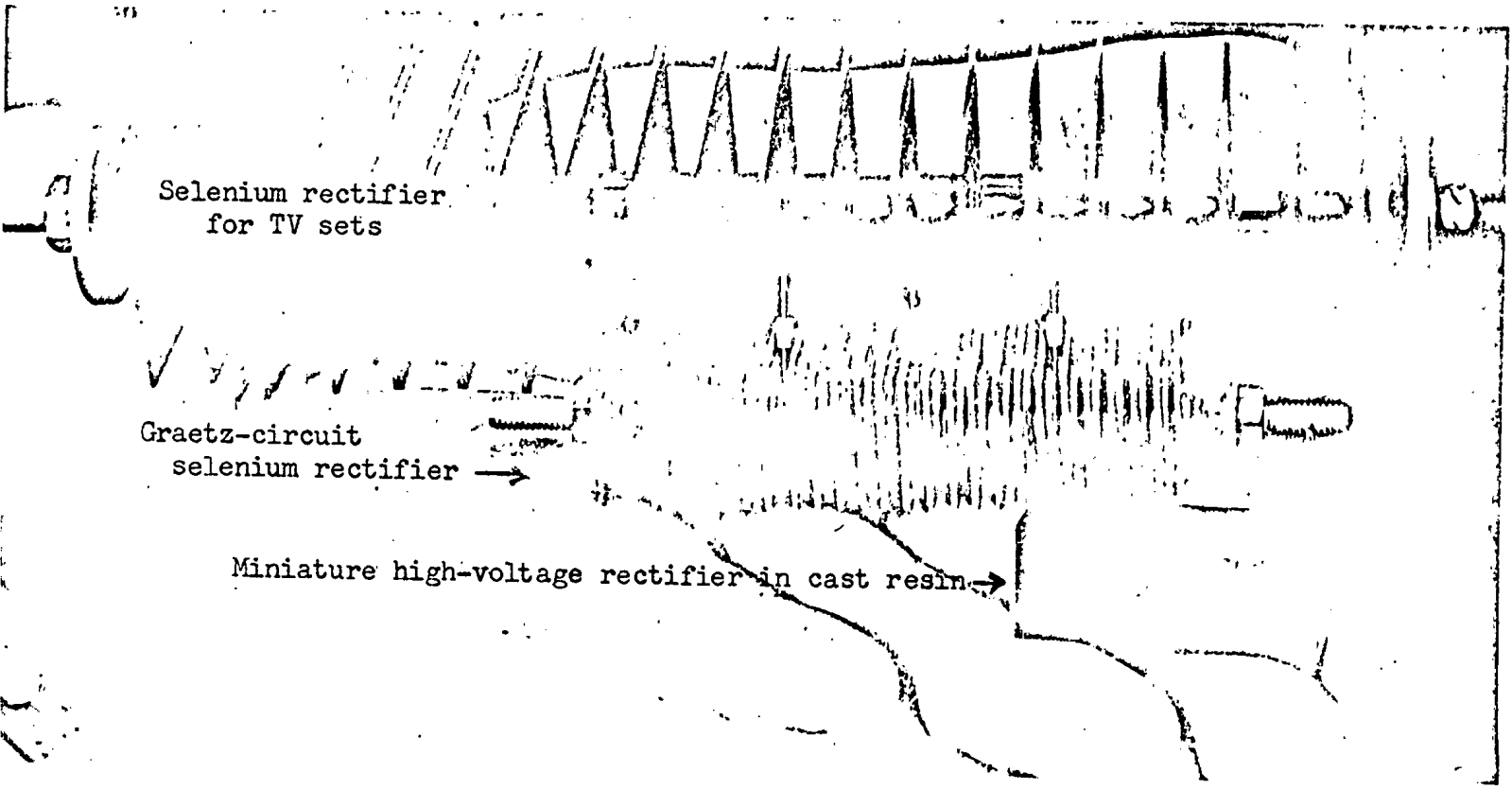


Fig 3. Selenium Rectifiers

Attachment 3

Electronic Measuring Instruments

1. Status of East Germany

In conventional test instruments East Germany is up to the West, but as soon as special instruments become involved, the gap between East Germany and West Germany widens, and often an outright copy of a Western design of a special instrument is encountered, which, however, generally lacks the final technological finesse of the original. The development of digital measurement techniques, concentrated mostly at Funkwerk Erfurt, has progressed considerably since the spring of 1962, and good results have been obtained. However, the technique in East German involves primarily only relatively simple measurement problems; for example, digital voltmeters and ohmmeters have not yet been fully developed, and instruments with digital indicator tubes are still lacking. Another thing completely lacking in East Germany is the completely automatic testing or measuring assembly for incorportation into production lines and for checking finished products.

Transistorization of test instruments is progressing, but is limited generally to circuits for low-and intermediate-frequency ranges. High-frequency circuits must, for the most part, rely on vacuum tubes (made in East Germany) or, if transistorization is absolutely necessary, on imported high-frequency transistors [redacted] 50X1-HUM

Printed circuits are in general use in test instruments, the basic materials being, for the most part, laminates, rarely epoxy resins or glass fiber materials. Some of the high-quality instruments have components

incorporating ceramic boards with silver conductors.

In the arrangement of components and subassemblies, more and more attention is being paid to easy accessibility on all sides. Most of the connections are soldered; the use of plug boards is very rare.

The electrical and mechanical properties of the test instruments are very good. All important components are over-designed with respect to loads and ruggedness, so that the instruments are stable, reliable, and last a long time.

The weak point in East German test instrument activities is still the matter of delivery. Only a very few types are available "off the shelf," most types being produced in very limited series, or even individually, with very long waiting times for delivery.

The prices on the export lists are about on a level with those of the West, but in most cases the prices are reduced, sometimes drastically, in order to make the sales.

Besides the VEB's, some half-nationalized companies and production cooperatives are engaged in the manufacture of electrical and electronic measuring instruments. The responsibility for the development and production of test instruments is centered in the VVB "Nachrichten- und Messtechnik" (Communications- and Test Engineering); coordination of development and manufacture is handled by the Technical Group for Test Engineering (Fachgruppe Messtechnik) within the above VVB, and by the Central Working Group C 56 for "Electrical Measurement- and Test-Engineering."

2. New and Improved Test Instruments

Funkwerk Dresden exhibited a new frequency indicator, the FZ 201. It provides frequency measurements in the 50-1,650-kilocycle range, thereby extending the range of direct-indicating frequency meters into the carrier-frequency range. The instrument operates on the frequency-conversion principle. By conversion of individual auxiliary frequencies, the modulation product is shifted together with the tested frequency in the 50-150-kilocycle range and directly indicated by means of a frequency meter which operates on the principle of capacitor charging. A control rectifier is hooked up in front of the test circuit in order to provide a high input impedance and high sensitivity. The auxiliary frequencies are derived from the frequency of a 100-kilocycle quartz oscillator, which also serves as a reference frequency for calibrating the instrument.

Funkwerk Erfurt has developed several new test instruments including the MS-10-s-2 calibration-mark oscillator, which is used to produce nine quartz-stabilized pulse trains, two of which can, at any time, be removed from the instrument at the same time and with adjustable frequency ratio. Both pulse trains can be adjusted independently in stages and have the same insertion point with respect to time. The instrument can be used as a trigger oscillator and calibration oscillator at the same time.

The 2039 AM-FM-VM test oscillator (4.5 - 300 megacycles) and the 3014 absorption-frequency meter (succeeding type 182) are new developments. The 1023 Q-meter and the 2016 and 2020 wide-band oscillators are improved designs. Type 2016 is a table model (Fig 1) and the 2020 is designed as a slide-in subassembly for the video tester manufactured by Funkwerk Koepenick.

In the digital counter series the new instruments are the 3504 direct counter with preset and the 0102 10-megacycle decade counter. The latter is used as an input decade for very fast counters (up to 10,000,000 events per second), is designed as a double decade and contains the one-megacycle decade in addition to the 10-megacycle decade; indication is by 2 x 10 numbered lamps.

The 8131 one-megacycle pulse shaper is the final newly developed instrument at Funkwerk Erfurt.

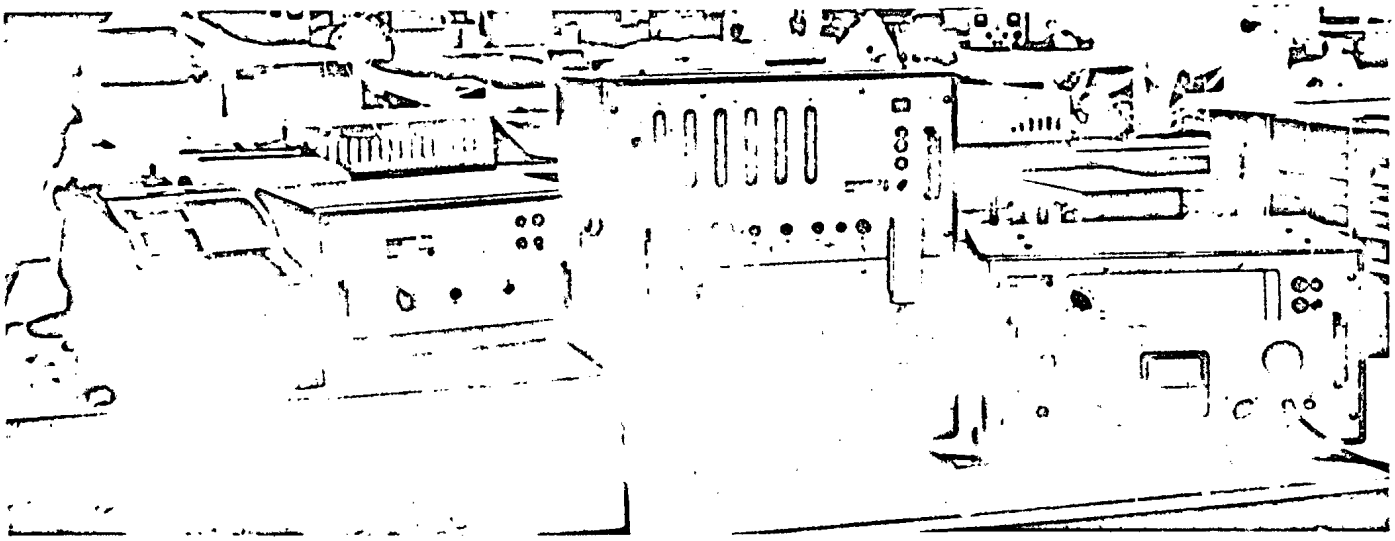


Fig 1. 3503 scaler-printer with electronic converter (left); digital frequency meter 3506 (center); and 2016 wide-band oscillator (right) (Funkwerk Erfurt)

The F Sp 10 a frequency spectrometer (Fig 2), an improved version of the F Sp 10, was developed by Funkwerk Koepenick and is to be built later by Werk fuer Fernmeldewesen Berlin; it is used to analyze mixed frequencies in the audio range. Depending on the cabinet rack used, the mixed frequency is fed to 24 or 36 parallel-connected individual filters, the outputs of which are swept by a motor switch, and the frequency spectrum is indicated by an oscilloscope. The frequency range is 4cps to 2 kc or 40 cps to 20 kc (depending on the cabinet rack used), with four filters per octave. The instrument operates on the principle of multi-channel filtering; the analysis takes about 50 milliseconds.

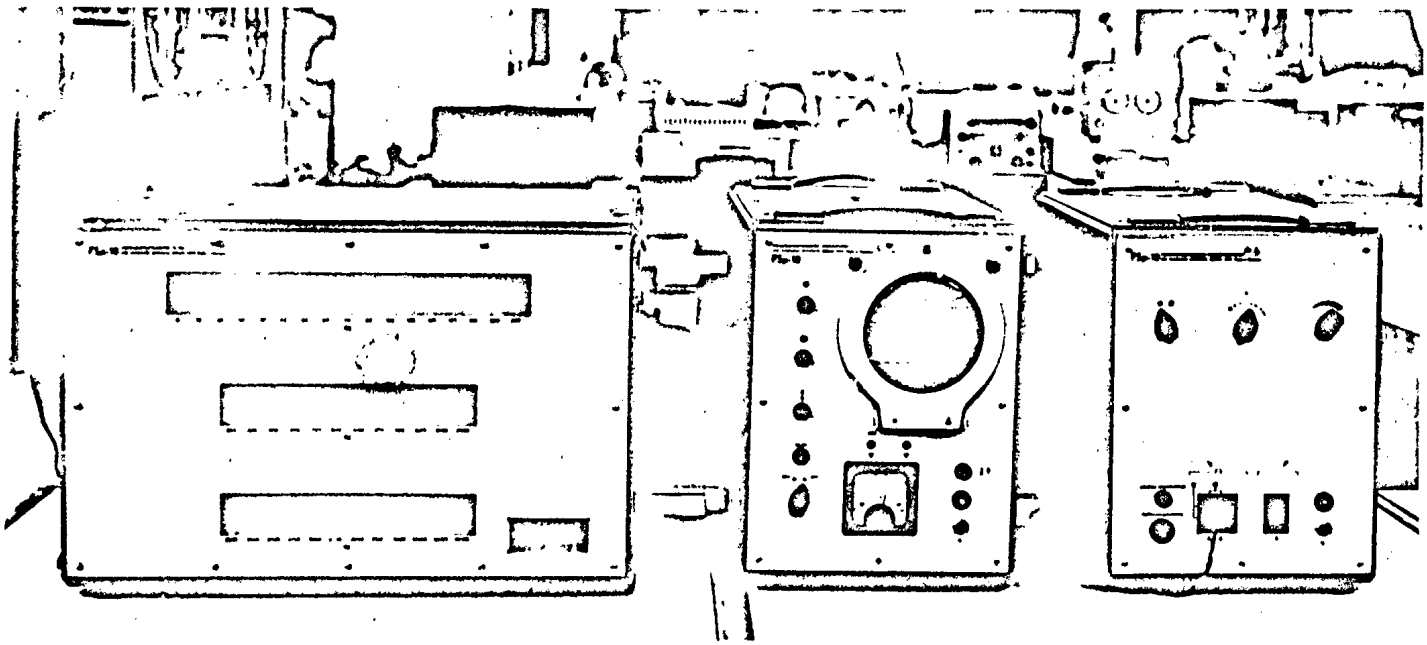


Fig 2. F Sp 10a Frequency Spectrometer. (left: filter assembly; center: indicator oscilloscope; right: motor switch) (Funkwerk Koepenick)

The OG 2-10 dual oscilloscope was developed by Funkwerk Koepenick and is now being manufactured by Werk fuer Fernmeldewesen Berlin. It is a two-channel pulse oscilloscope with a two-channel electron switch and can be used for several purposes through the choice of several plug-in attachments. Two different square-wave oscillators, one marker oscillator and one delay oscillator can also be plugged-in (Fig 3).

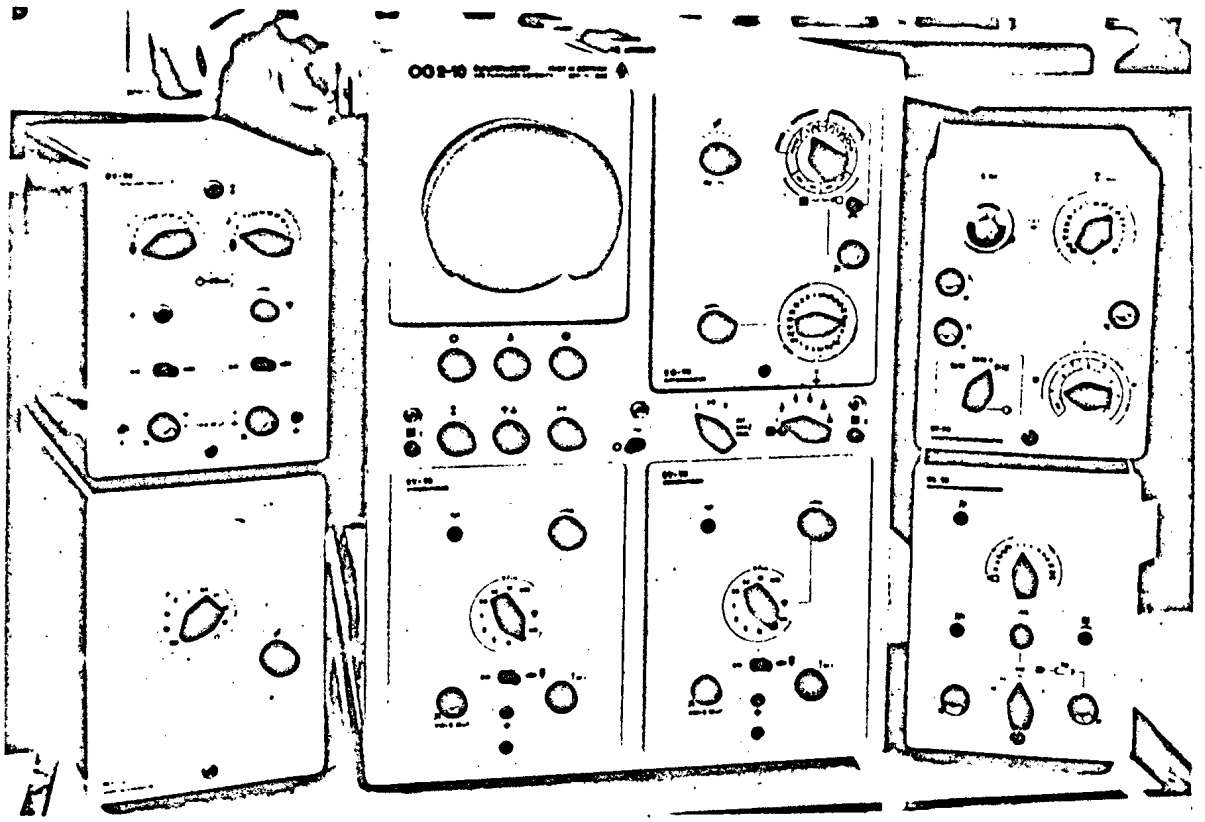


Fig 3. OG 2-10 Oscilloscope. At right and left are 4 additional plug-in attachments (Funkwerk Koepenick)

The oscilloscope operates in the 2 x 0-30 megacycle range and has a 10-cm tube which is controlled by an x-axis amplifier and sweep generator in the

horizontal direction and in the vertical direction by a y-axis amplifier, which is switched from one preamplifier to the other by an electronic switch periodically, so that both test signals are displayed on the screen. The bandwidth is 0-30 megacycles, the deflection factor 50 millivolts per centimeter.

The Rafena-Werke Radeberg exhibited two new test oscillators and one new test receiver for the decimeter-wave range. The DMS 524 test transmitter is used for the 1,540 - 2,720-megacycle range as a power- and sensitivity-testing oscillator for impedance and impedance-matching measurements in vhf components, lines and antennas, for attenuation measurements in filters with sharp cutoff, for Q-measurements in resonant circuits, and for sensitivity measurements in receivers. Both continuous and pulse (1,000-cps square-pulse) operation are possible. A voltage meter, a waveguide voltage divider with digital indication in volts and decibels, as well as a temperature-compensated frequency meter with digital thousands-indications and a fine scale with built-in projection lens are all included in the transmitter. The output voltage is from 2.5 microvolts to 2.5 volts at 60 ohms; modulation is 1,000 cps/square.

The DMS 542 B decimeter test oscillator (transmitter) has the same electrical properties and data, but is designed for a frequency range of 860 - 1,620 megacycles.

The,likewise new, DME 492 A decimeter test receiver uses a frequency

range of 1,470 - 2,750 megacycles and has a sensitivity limit of 50 kT_o.

Attachment 4

T U B E S

Receiver tubes. The current program for series produced tubes from the East German tube factories is given in the new handbook, Empfaengerroehren (Receiver Tubes), 1963 edition. Tubes for replacement only are now being produced in small series only as special manufacturing series that take up to a year for delivery ! For example, these include the following:

DC 760	DF 668	EF 761	DM 70	EM 83.
DC 762	DF 669		DM 71	

The following types are new developments:

available in large numbers off the shelf:
E 88 CC
EA 766
ECC 88
ECC 813
EC 865
EF 183
EF 184
EF 806 S
EYY 13
PC 88
PCC 88

development completed, but available only as laboratory models in small numbers with long waiting period for delivery:

EA 960	EH 960
EA 961	EL 862
EA 962	ECC 863

development not yet completed: EC 866

As far as quality is concerned, the tubes are completely satisfactory; their rates of failure are only a little higher than comparable Western types. As far as the status of development is concerned, however, the entire East German tube program lags the West by about a year and a half. In the opinion of East German tube specialists, this gap might well increase in the future, because the time between the completion of development and initiation of series production is much too long — up to two years and more in some cases. The development of tubes in the West, however, is so rapid and requires such a short period of lag time up to series production, which will never be equalled in East Germany because of the required preplanning (otherwise no material is available).

Special Tubes

In this area there are a very few actual new developments, thus the lack of a new edition of "Special Tubes" (handbook) this year. The remarks made previously concerning quality and rate of development apply here also, indeed for all tubes. East Germany is falling behind the world standard particularly in the case of microwave tubes. Even though the East German tube factories showed quite some progress during the past year, this progress was in the areas of manufacturing tubes in greater numbers, reducing the deviations of rated values of individual types, and improving the operational stability of tubes, but did not involve any progress toward higher frequency ranges.

The GA 560 noise diode (Fig 1) developed for measurements of receiver sensitivity in the range of 0-75 kT_o-units has the following ratings:

heater voltage: 2.2 - 2.8 volts
diode current: not over 2.15 amp
diode/cathode insulation current: not over 10 microamp.

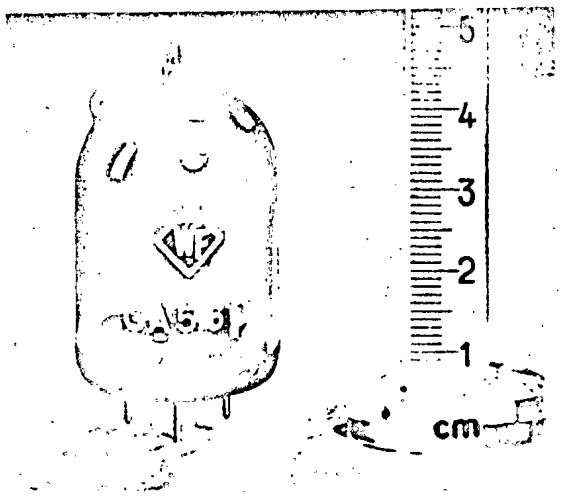


Fig 1. GA 560 noise diode (WF)

The new inert-gas thyratron S 1.3/30 dV (Fig 2) is intended primarily for igniting ignitron tubes and for continuous rpm-control of electrical machines; it has the following ratings:

heater voltage:	2.5 volts
heater current:	9 amp
plate ignition voltage (at zero grid-bias volts):	60 volts
plate blocking voltage: (peak)	1,300 volts
max controlled plate voltage:	1,000 volts
max cathode current (peak):	30 amp

All other new tubes are cold-cathode tubes. These include the pure-metal relay tube with inert-gas filling Z 660 W (Fig 3) for DC operation, with the following ratings:

plate ignition voltage:		320 volts
starter ignition	" :	140 volts
plate operating	" :	115 volts
plate current:		5 milliamp

Fig 3. Relay tube with pure-metal cathode (Z 660 W) for DC-voltage operation

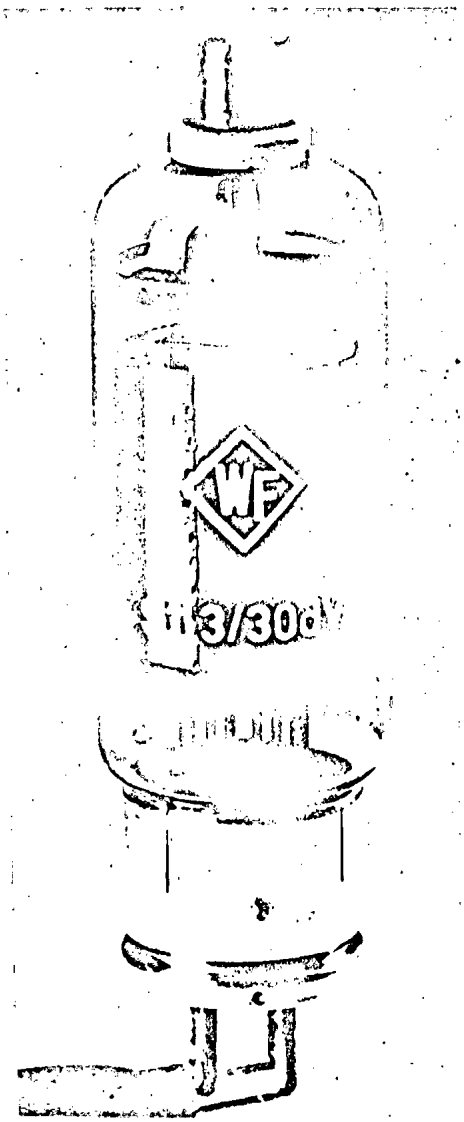


Fig. 2. The S 1.3/30 dV inert-gas thyratron

The StR 150/15 /single-section/ stabilizer tube (Fig 4) is also new and has the following ratings:

operating voltage:	150	volts
ignition voltage: not over	180	volts
shunt current:	15	milliamp (max)
shunt current:	5	" (min)

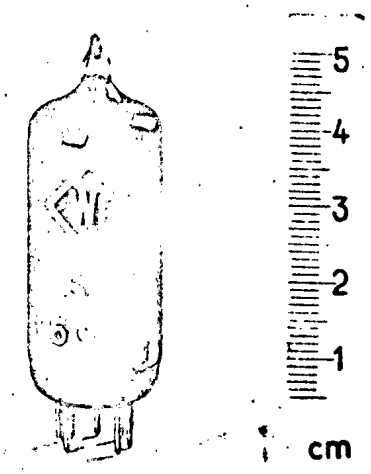


Fig 4. StR 150/15
pure-metal stabilizer tube

The Z 862 E (Fig 5) electrometer tube for DC-voltage operation is likewise new and has the following ratings:

plate ignition voltage: (U_{st} = 30 volts)	310 volts
starter ignition voltage: (U_a = 0 volts)	140 volts
available voltage:	220 volts
operating voltage:	108 volts
plate current:	10 - 15 milliamp

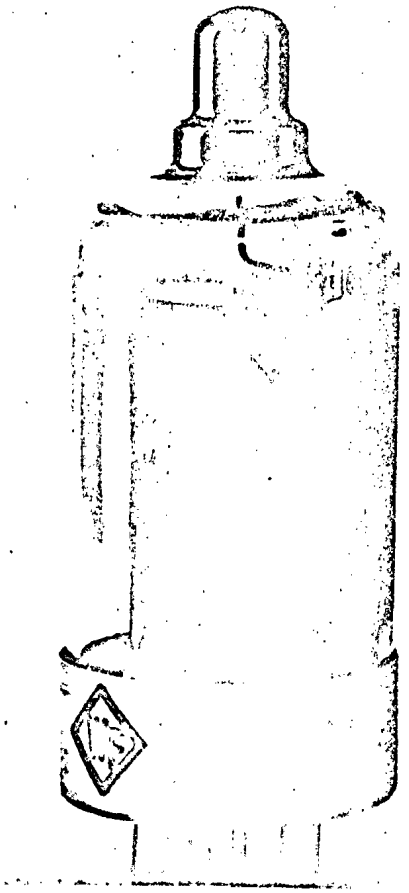


Fig 5.

Z 862 E Electrometer Tube

In digital test and control engineering, which is gaining more and more ground in East Germany, there are some cold-cathode tubes available. The Werk fuer Fernsehelektronik (WF) exhibited an inert-gas-filled decade counter tube, the Z 563 C (Fig 6), which is being produced at present only in small series. It is a reversible counter tube and has the following ratings:

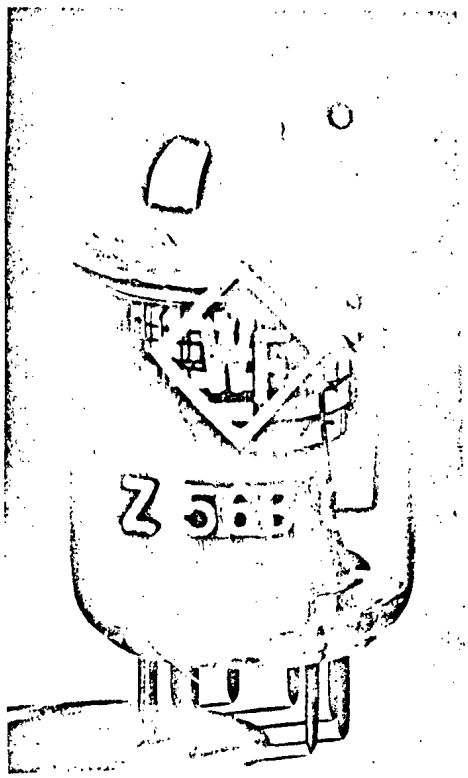


Fig 6. Z 563 C Decade Counter Tube

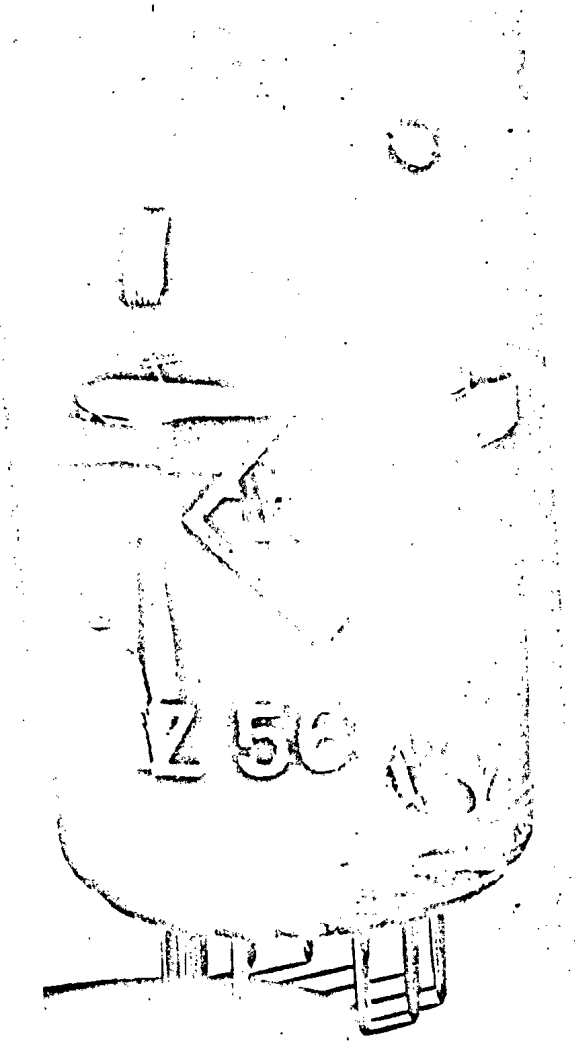
ignition voltage:	300 volts
operating voltage: (I_k = 300 microamps)	190 volts
max interelectrode voltage: (or line voltage)	450 volts
plate current:	350 microamps
max counting rate:	4 kilocycles

Pressler (Deutsche Glimmlampen-Gesellschaft, Leipzig) likewise appeared with two new decade counter tubes (still without designation of type) with similar ratings and circular indication. In one type all ten cathode leads were brought out separately, whereas the second type has outside leads for the fifth and tenth pulses only. A third Pressler (DGG) counter tube being built is a miniature counter tube for front read-off, with only one anode, one cathode and one starter(ignition) anode. The characteristics of this interesting tube are:

ignition voltage:	150-200 volts	ignition current:	2 microamps
plate voltage, max:	225 volts	reactive current, max, (continuous operation:)	5 milliamps
optimum operating range:	150-200 volts	reactive current, max, (pulse operation):	15 milliamps
length:	40 mm		
diameter:	10 mm		

WF showed two inert-gas-filled cold-cathode signal-indicator tubes, the Z 561 M (Fig 7) and the Z 565 M (Fig 8), both of which have pure-metal cathodes and are designed for front read-off. The most important data for these tubes are:

Fig 8. Z 565 M ...cade Counter Tube ⟶



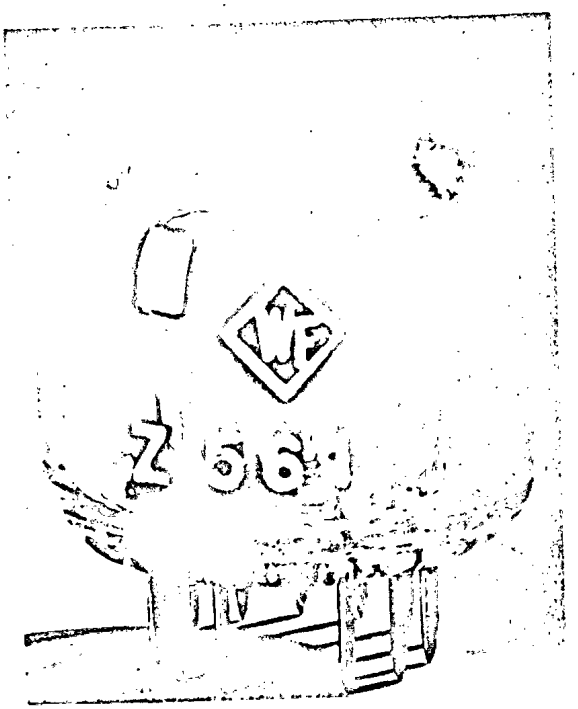


Fig 7. Z 561 M Signal-Indicator Tube

	Z 561 M	Z 565 M
plate ignition voltage:	140 volts	140 volts
operating voltage:	125 volts	
extinction voltage:		min 100 volts
cathode current:	2 milliamps	0.1 milliamp

3. Transmitter Tubes

Some of the transmitter-tube types propagandized this year as new items were exhibited last year as prototypes or laboratory models. However, all of the types described below are supposed to go into series production (in small numbers, to be sure) this year. In the case of tubes for microwave frequencies, particularly in the case of traveling-wave tubes, the expected service life is still much too short, particularly in pulsed operation in which about 80 percent of the tubes have a service life of only 30-40 hours.

The SRS 456 (Fig 9) transmitter tetrode with thoriated tungsten cathode is a genuine new development. The tube produces an output power of some 850 watts at 110 megacycles and is designed for oscillators and radio-frequency and audio-frequency amplifier stages.

The SRV 355 (Fig 10) transmitter triode was completely developed as early as the spring of 1961, but was not available in large numbers until the beginning of 1963. This triode is designed especially for short-wave transmitters and industrial oscillators and produces a net power of 75 kilowatts

at an operating frequency of 30 megacycles and an anode voltage of 10 kilovolts.

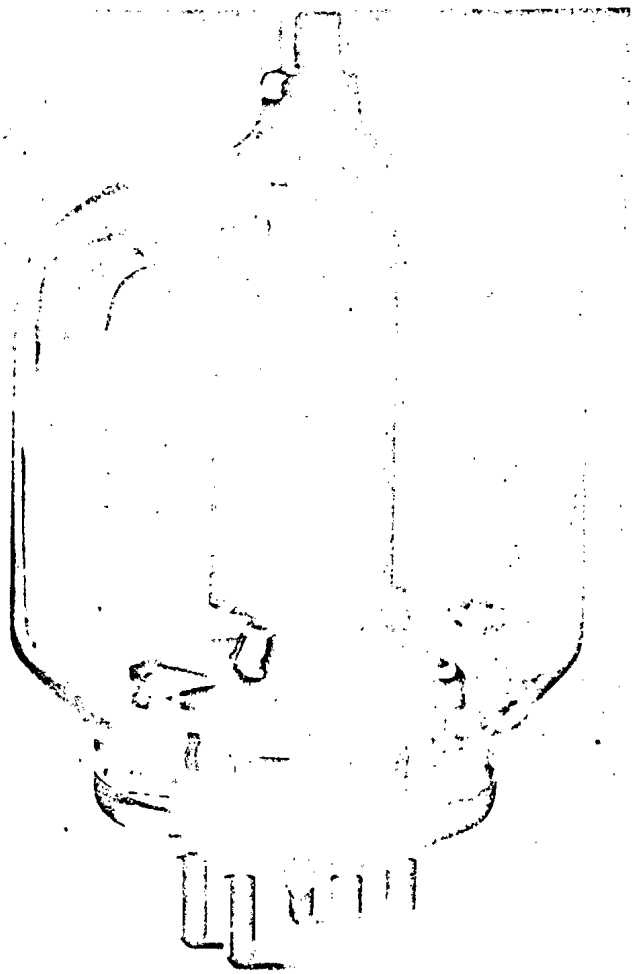


Fig 9. SRS 456 Transmitter Tetrode

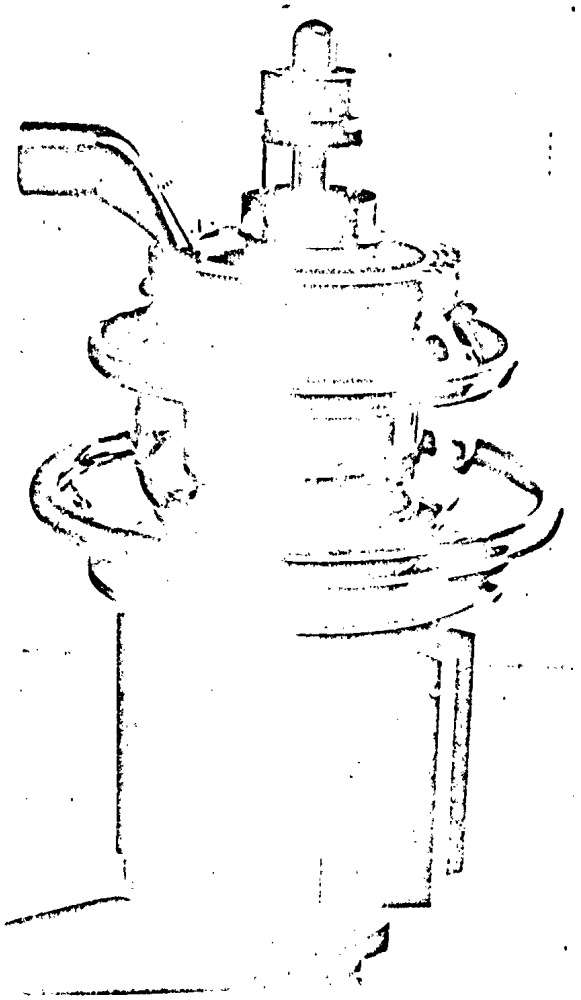


Fig 10. SRV 355 Transmitter Triode

The HKR 902 (KR 90) reflex klystron (Fig 11) was also announced in 1962; it is intended for transmitter-, receiver-, and test oscillators with average output power of 65 milliwatts and operates in the 8,500 - 9,600-megacycle range.

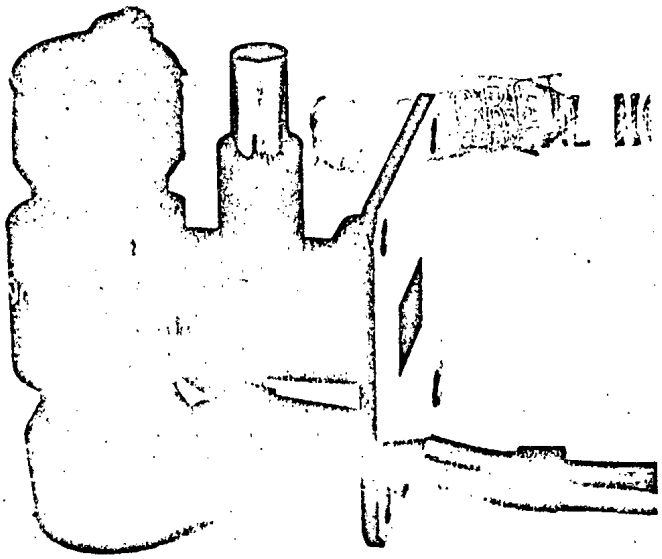


Fig 11. HKR 902 (KR 90) Reflex Klystron

The two new magnetron types are the result of a development which has now lasted three years. The HMD 241 (MD 3) continuous-wave magnetron (Fig 12) is designed for dielectric heating devices and has an average output power of two kilowatts at 2,400 megacycles. The HMI 952 (2 J 55) pulse magnetron (Fig 13) a metal, multichamber type, is designed as an oscillator tube in radar sets and is about to be manufactured in small series on a laboratory scale. Data given so far include:

fixed frequency in the range:	9,345 - 9,405 megacycles
pulse duration:	1 microsec
pulse repetition rate:	1 kilocycle
pulse output power:	45 kilowatts

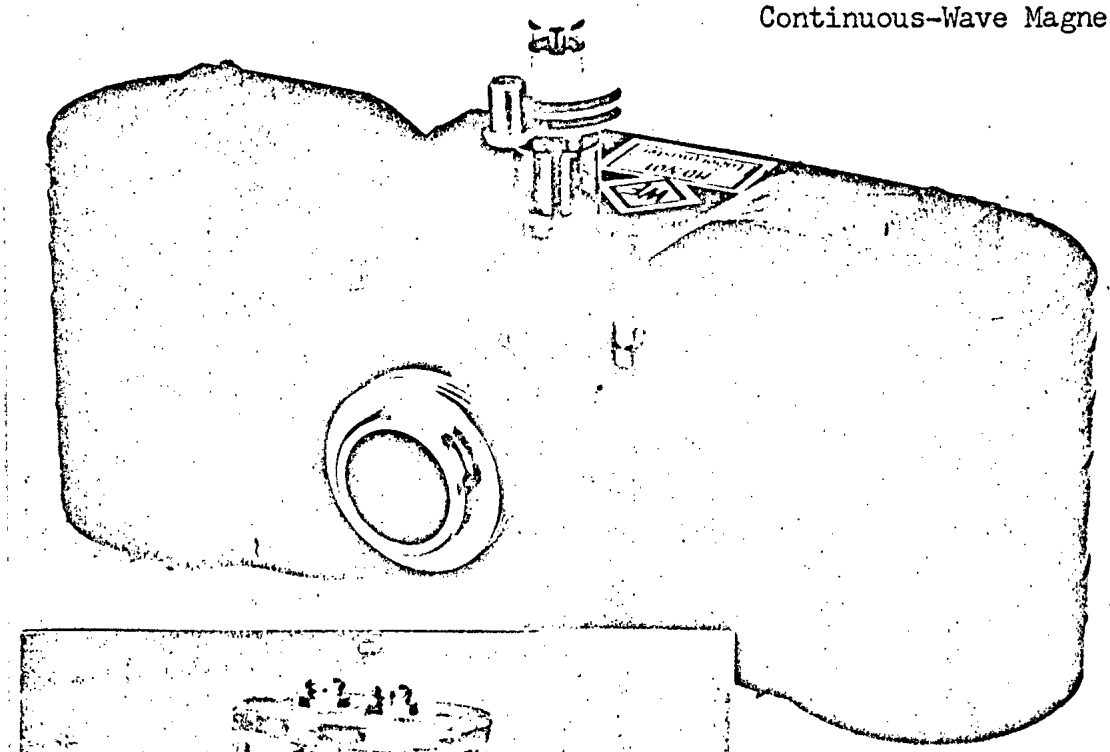


Fig 12. HMD 241 (MD 3)
Continuous-Wave Magnetron

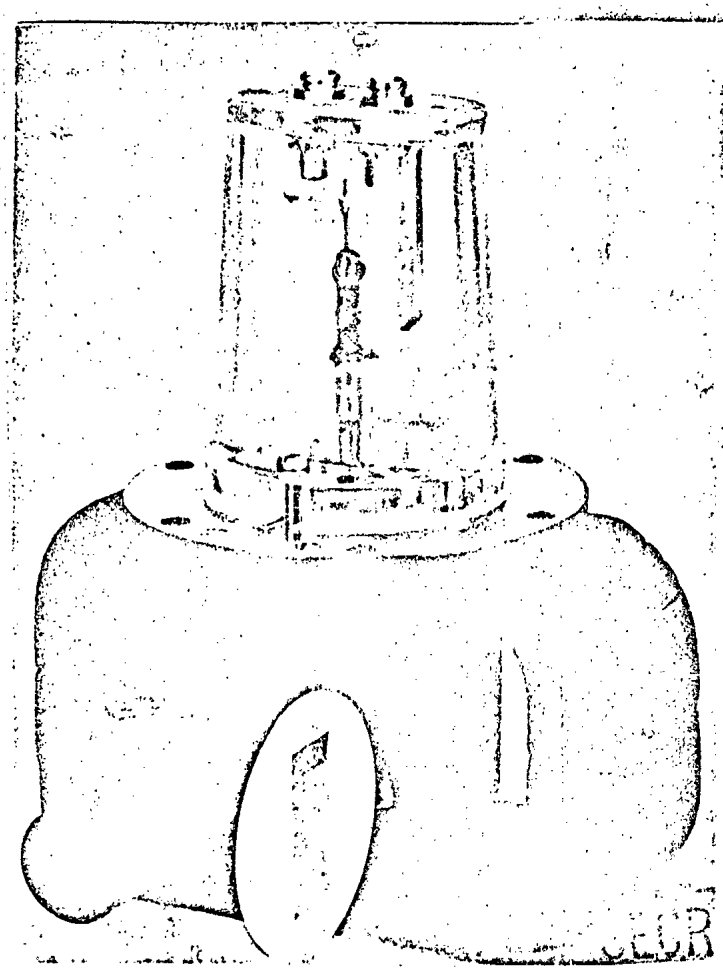


Fig 13. HMI 952 (2 J 55)
Pulse Magnetron

The following three traveling-wave tubes are also, at present, being manufactured only on a laboratory scale in small series, which means as special manufacture with very long waiting time for delivery. The HWE 402 (WE 3) type (Fig 14) is designed for use as an amplifier tube for frequency conversion through phase modulation. The tube operates in the 3,300 ± 4,200 megacycle range, achieves an amplification of about > 45 decibels and an average output power of approximately 200 milliwatts.

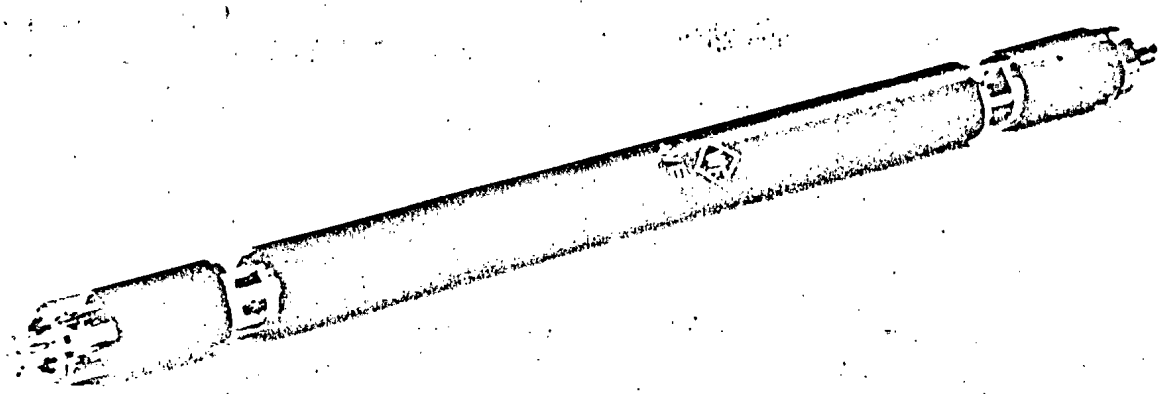


Fig 14. HWE 402 (WE 3) Traveling-Wave Tube

The HWL 412 (WL 21) output-amplifier traveling-wave tube has an output power of about 10 watts at an amplification of > 45 decibels in the frequency range of 3,300 - 4,200 megacycles. It is shown in Figure 15.

The SF 21 focussing coil developed for it, for producing a steady magnetic field, is shown in Figure 16. The HWL 221 (WL 1) is also a power amplifier and produces 15 watts at a 40-decible amplification in the frequency range of 1,500 - 2,500 megacyles.

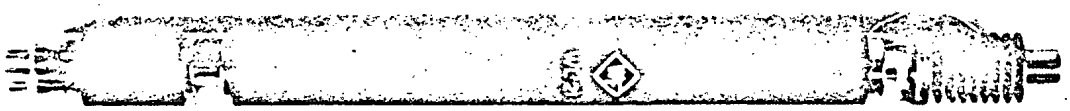


Fig 15. HWL 412 (WL 12) Traveling-Wave Tube

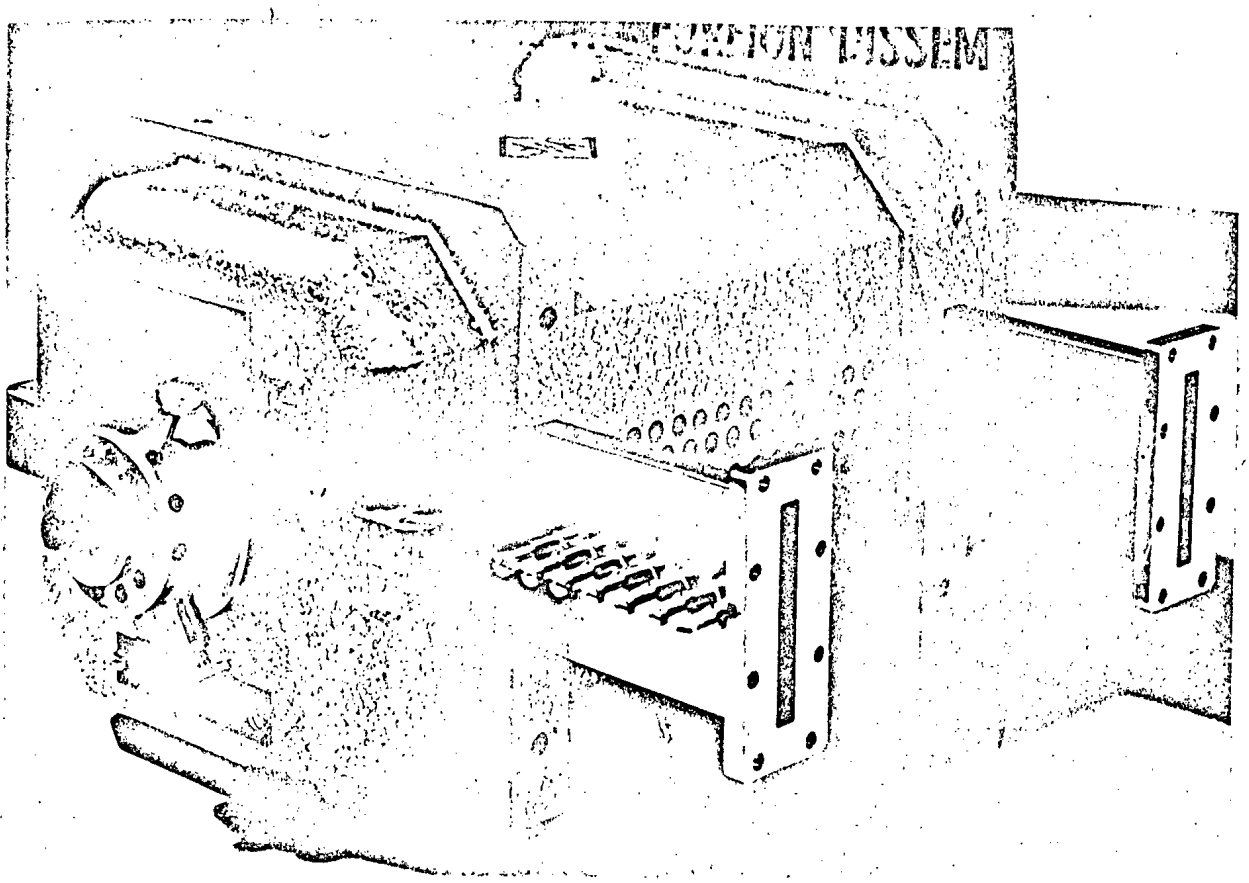


Fig 16. Focussing Coil for the HWL 412 Traveling-Wave Tube

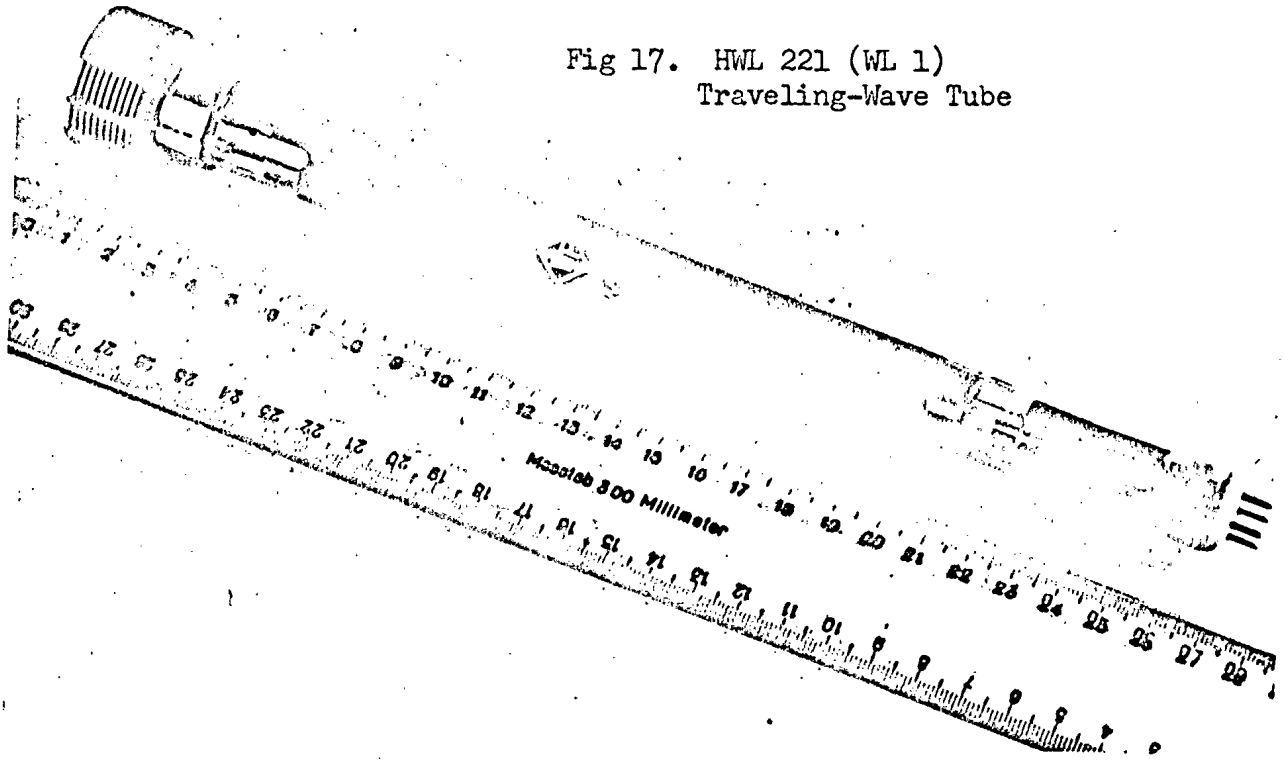


Fig 17. HWL 221 (WL 1)
Traveling-Wave Tube

All the above transmitter tubes are being built at Werk fuer Fernsehtechnik where they were also developed.

The Roehrenwerk Rudolstadt is offering two new miniature transmitter tubes with radiation cooling; they are an indirectly heated 200-W-tetrode (SRS 461) for a 30-megacycle limiting frequency and a 300-W-triode (SRS 361) with direct-heated, thoriated tungsten cathode for a 200-megacycle limit. The first of the two represents a genuine new development; the SRS 361 triode appeared last year as a prototype. The tetrode was designed primarily for use in small ship transmitters, and the triode for welding and electromedical equipment.

4. Oscilloscope Tubes and Image Tubes

In the area of cathode-ray tubes, development in the SBZ (East Germany) seems to be stagnated. Even the urgently needed radar display tubes announced more than two years ago have not yet appeared. In the oscilloscope tube program, three supplementary types have appeared as products of Funkwerk Erfurt. These are the single-beam tube (B 7 S 3) with a 78-mm flat scope, and the B 13 S 7 wide-band type with metal-backed 133-mm flat scope.

No new developments have been forthcoming in TV picture tubes. One AW 59-90 is said to be in the last stage of development, but its series production is not yet in sight. The Bildroehrenwerk Oberschoeneweide is still having technological difficulties in producing 43- and 53-cm picture tubes. The production rejects are still way above average.

Only in individual isolated cases were complaints of poor quality of picture tubes encountered; on the other hand, all consumers spontaneously complained of sporatic deliveries. The picture-tube production at Oberschoeneweide is just about enough to satisfy the needs for the TV-set production on a day-to-day basis, but there are no picture tubes available as replacements.

5. X-ray and Rectifier Tubes

No new tubes of these types have appeared. The manufacturing program of Roehrenfabrik Rudolstadt is continuing without change.

6. Photoelectric Tubes

WF has developed a superorthicon (F 7.5 M2)(Fig 18) with magnetic focussing, magnetic deflection and magnetic beam shifting. With a voltage of 1,550 - 1,650 volts applied to the SEV-anode, a resolution of 600 lines in the center of the image and 400 lines on the fringe is attained at 35°C.

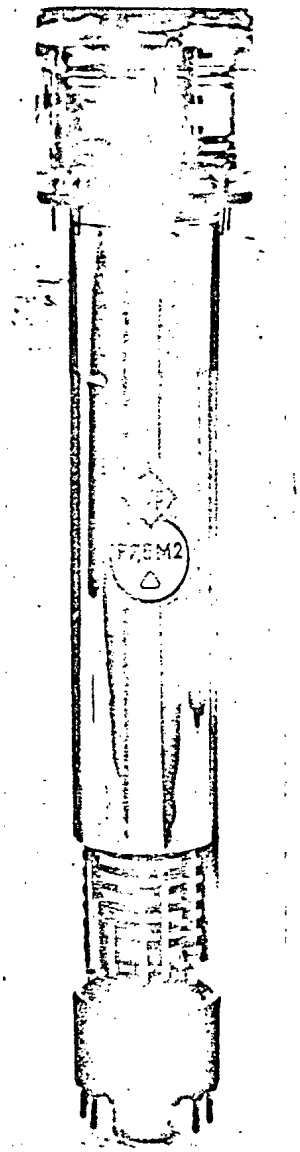


Fig 18. F 7.5 M2 Superorthicon for universal use in studio and reportage cameras

Carl Zeiss, Jena exhibited several new photoelectric multiplier tubes, which are described below.

The M 10 FS 25 miniature photomultiplier is designed for photometry and scintillation techniques, contains a front and side window and has a cathode diameter of 25 millimeters, and 10 multiplier stages. The sensitivity lies between 335 and 700 nanometers.

The K 14 FS 50 multiplier is a special type for scintillation and high-speed measurements, has a 50-millimeter cathode diameter and 14 multiplier stages; sensitivity likewise 335 - 700 nanometers.

The following five types of photomultipliers were developed for the international standard sonde. They differ in cathode diameter, which is indicated

by the last number in the designation (in millimeters), and by the guaranteed maximum amplitude deviation for gamma radiation 661 kev in NaI, namely, less than 8% in the S 12 FS 35, less than 9% in the S 12 FS 50, less than 9% in the S 12 FS 60, less than 10% in the S 12 FS 100 photomultiplier, and less than 11 % in the M 12 FS 50.

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