HIGH POWER RADAR JAGDHAUS

Report prepared by

FIELD INFORMATION AGENCY, TECHNICAL
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BRITISH INTELLIGENCE OBJECTIVES SUB-COMMITTEE

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HIGH POWER RADAR JAGDHAUS

BY

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Joint Intelligence Objectives Agency

FIELD INFORMATION AGENCY, TECHNICAL

SECTION I

. for this report was secured from Dr. Schnabel
. Company who was employed on the construction of
installation in 1944, later, after being captured
ns he was compelled to assist in rebuilding the
tructing them in its operation and use. When
rebuilt the peak pulse modulator power was
750 k.w. The plant is now in Russian territory
me this data was secured was inaccessible.

ng to Dr. Schnabel this was the most powerful
station built by the Germans and although orders
o destroy it the German army did very little
age to it when the Zassen territory was evacuated.
ilar plants were built near Berlin by the Siemens
ed Jagdschloss with peak pulse power of 100 k.w.
Dr. Schnabel, Siemens built two Jagdschloss plants
paring to build more for some of the other large
the war ended and stopped the work.

it is located near the small village of Dergischow
e to the better known town called Zeesen in
the co-ordinate map of Germany.

on.

ose of the "Jagdhaus" plant was to act as a
range locator of approaching Allied aircraft and
their azimuth, height and approximate distance on
de ray tube screen. The maximum range during the
300 kms. The radar tower was rotated at the
evolutions per minute the same target being scanne
e every six seconds. In order to retain the
s length of time the cathode ray tube had a double
ront screen producing a brilliant spot, the back
en, retaining it throughout several rotations.

The co-ordination of the target with its position over Germany was easily noted since the "outer" screen had a circular map of an area of approximately 300 kms. radius surrounding Berlin superinposed on the glass. In addition concentric circles and radial azimuth lines gave the operator a ready means of quickly obtaining the allied planes position.

The superimposed map can be seen on the screen in Photograph #3.

Method of Operation

B) A transmitter (1) see drawing BVP-1819-5106, feeds a directive aerial (sector of a rotational parabaloid) with high frequency energy, pulse modulated. The antenna is rotated at a uniform rate of ten revolutions per minute. The antenna is designed to give as narrow a beam in the horizontal plane as practical while in the vertical plane the variation in the vector of the field intensity does not vary by more than 50% over the total angle of 0° to 60°. Due to imperfect reflection and focussing there were several angles at which the radiated power was very small. Slit radiators were used in the reflectors.

The signals, reflected from the target, are received on a second directional parabolic antenna located immediately above the transmitting antenna. The antennas are designed so that the secondary lobes of the transmitter and receiver units cancel out, sharpening the image and reducing the errors.

In addition to the parabolic antennas (2) and (5) the rotary frame carries the receiving set (4) and an additional directional transmitter and receiver (using a common antenna) directly above the large receiving parabola for the identification of the Luftwaffe planes. The identifying equipment was given the code names of "Kuh" and "Gemse" respectively and operated on a wavelength of 1.9 meters for the transmitter and 2.4 meters for the receiv r. The receivers on the Luftwaffe planes automatically keyed a transmitter which sent back a coded signal to the "Gemse" receiver. The signal from the plane was produced by a motor driven cam device with a changeable combination so that a different identification signal could be returned each time a flight was made. This was arranged to prevent allied flyers from using the code and thereby be

protected from the anti-aircraft batteries.

The main radar frame was on a circular steel track and is driven by a three phase synchronous motor which starts and runs as an induction motor until the frame has reached the correct rotational speed, (See Motor-Analage Jagkhaus). A low sinusoidal voltage of 1000 cycles is generated by generator (6). This controls the pulse rate and is fed through an amplifier 7 which in turn controls the keying pulse generatqr for the carrier modulation. The amplifier 7 also feeds a timing unit 9 and supplies the identifying transmitter "Kuh" as well. If the antennas are not rotating their functioning can be checked by a vacuum tube oscillator (1000 cycles) which is automatically switched on by the keying unit 11 which is connected by relays to the amplifier 7 and so takes the place of the generator 6 which is not in operation when the antenna frame is at rest. In this way the correct operation of the plant can be checked without rotating the heavy frame.

The received signals are taken from the receiver 4 to a demodulator and amplifier also the signals from the identifying receiver "Kuh" (16) and are fed to the modulator unit (10). (A knowledge of the signals from the friendly planes is supposed). The identifying equipment was not confined to the Jagdhaus plant but was generally made a part of all radar plants.

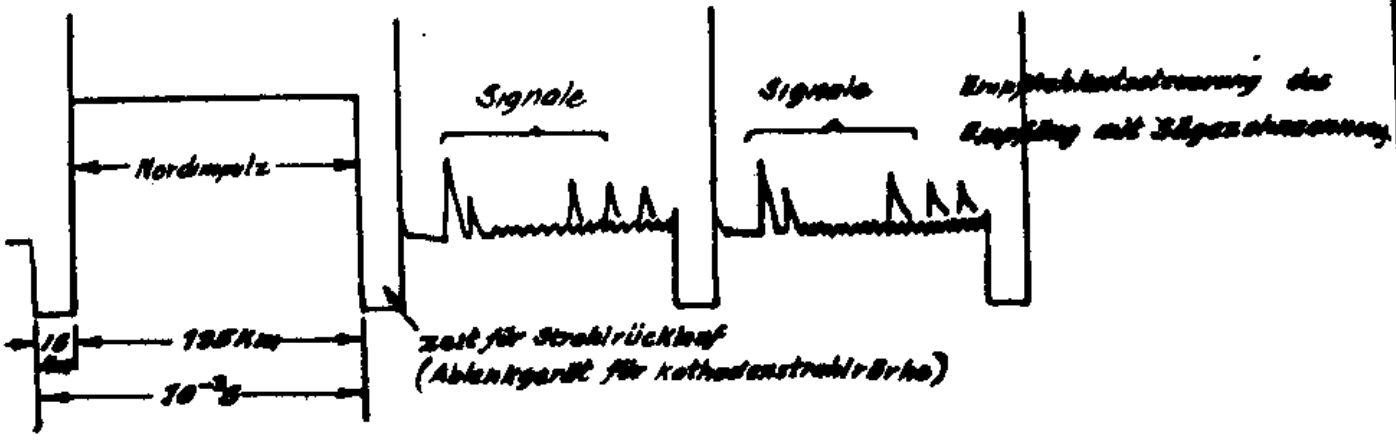
In the modulator the pulse and the identifying signals are used to modulate a new carrier which is controlled by the rectangular pulses from the synchronized timing generator through the amplifier 7.

The frequency of the pulses and the frequency of the generator 6 are so chosen that the time period from pulse to pulse is equal to the time for the signals to travel to and return from a target distant 150 kms. The received signals and the timing signals key the secondary carrier to its maximum value in the intervals when the transmitter are silent.

In the modulator, in addition to the operation described above, the secondary carrier is keyed at a rate which corresponds to the time interval required for a signal to travel 135 kms to a target and be reflected back again. This signal is repeated with the same frequency as the rotation of the antennas, i.e., 10 times per minute being keyed by a contact

qn the rotating antenna frame. This signal is used to give the "North" mark (13) for obtaining the azimuth angle to the target.

The carrier voltages so produced show up on the cathode ray screen as illustrated below:



This picture of the impulses is continually visible on the cathode ray screen of the control equipment of the main plant. Also from the modulator the signals are fed to the amplifier 14 from which three different circuits can be fed to auxiliary stations for remote minitoring or observation of the diagrams received.

(2) Auxiliary Station. (Nebenstelle)

See general overall circuit plan CV 1819-5109. At the auxiliary station in Berlin (near the Zoological gardens in Charlottenberg) the images were reproduced by transmitting them over a television cable with a high frequency carrier system. The image received at the central station gives the azimuth and distance exactly as seen from the "Jagdhaus" station.

At the auxiliary station the signals pass through a pre-amplifier 2 and then to a special receiver 2 where the synchronizing and the low frequency signals are separated by

appropriate filters. The synchronizing signals are put through a phase shifter and an alternating current amplifier 3 and then to a small synchronous motor in the observing equipment. This motor, through gearing, drives a cylindrical drum carrying a set of deflecting coils around the cathode ray tube. This motor keeps the ray rotating in synchronism with the rotation of the large antennas at Zassen. Only the relation between the phases of the signals remain to be determined. This relation can be quickly determined by means of the "North" pulse by switching off the synchronizing pulses and increasing or decreasing the output of the a.c. amplifier 3.

The deflecting coils drive the ray out radially the frequency of the deflections corresponding to the frequency of the impulses received. The intensity of the cathode ray is adjusted so that the line produced on deflection is just visible through the peaks of the signals from the receiver. Targets will appear as bright spots, their distance from the transmitter being proportional to their distance from the zero point. In a radial direction the sharpness of the signals is controlled by the width of the pulse from the transmitter and by the freezing band of the whole receiving equipment.

The operating power for the cathode ray tube 4 is supplied by the power pack 6 and is automatically switched on by the driving control unit 7 which regulates the high tension and prevents burning of the screen. When the auxiliary station is switched off the power to the cathode ray tube is automatically switched off by 7.

The cathode ray tube is equipped with two screens. The back or outside, screen retains the image from the target and is excited by the spot from the front or inner screen. This arrangement retains the image for a relatively long period without danger of burning the screen of the driving tube.

The signals produced by nearby targets will be disproportionately greater than those from a distant target. The reason for this is that the amplitude of the incoming signals vary with the fourth root of the transmitter output, that is, with constant transmitter output the intensity of pulse received by the target varies as the square root of the power- likewise the reflected image received at "Vagdhaus" varies as the square root of the power reflected from the target. The receiver may thus be overloaded, the signals unduly broadened

and may even block the receiver. To prevent this the sensitivity of the receiver is controlled during the time required for a signal to pass from the transmitter to the target and back. This is done by applying saw tooth regulating potentials to the grids of the input stage of the receiver. The frequency of these control pulses is synchronized by the pulse controller with the impulse frequency of the system. This driving effects the control image so that the receiver output increases according to the saw tooth function from zero to the maximum output of the equipment.

Normally therefore the amplification will be automatically adjusted so that the image will be visible to the eye only beyond a range of one-third or one-half kilometer from the transmitter. This arrangement effects a reduction of the amplitude of the reflected signal from the ground or targets near the transmitter and greatly improves the clarity of all targets near the plant.

C. Technical Data

1. Main plant, (Jagdhaus)

a) Antenna mechanism

Number of revolutions, 10 per minute
Power required, no wind, 25 kw.
Power required, wind strength 4 to 5, 60 kw.
Power of the driving motor 96 K.V.A., power factor $\phi = .9$.
Type of motor: Separately excited auto-synchrozing 220/380 volts with coupled exciter 22 volts.
Diameter of traveling platform 8 meters.
Diameter of the main frames across corners about 12 meters.
Diameter of the traveling rollers 900 mm.
Horizontal aperture of the antenna 5.5
Vertical aperture of the antenna 2
Height of the rotating part 12 meters.
Weight of rotating parts 48 tons.

b) Transmitter:

Self-excited, plate keyed, four tubes in parallel push-pull.
Power, impulse peak, 300 kw.
Impulse length 1.5 micro seconds.

Wavelength variable from 1.4 to 1.8 meters the latter adjustable by the control unit 12 through servomotors.
Type of tubes used, two A.S. 1010, air cooled.

c) Receiver:

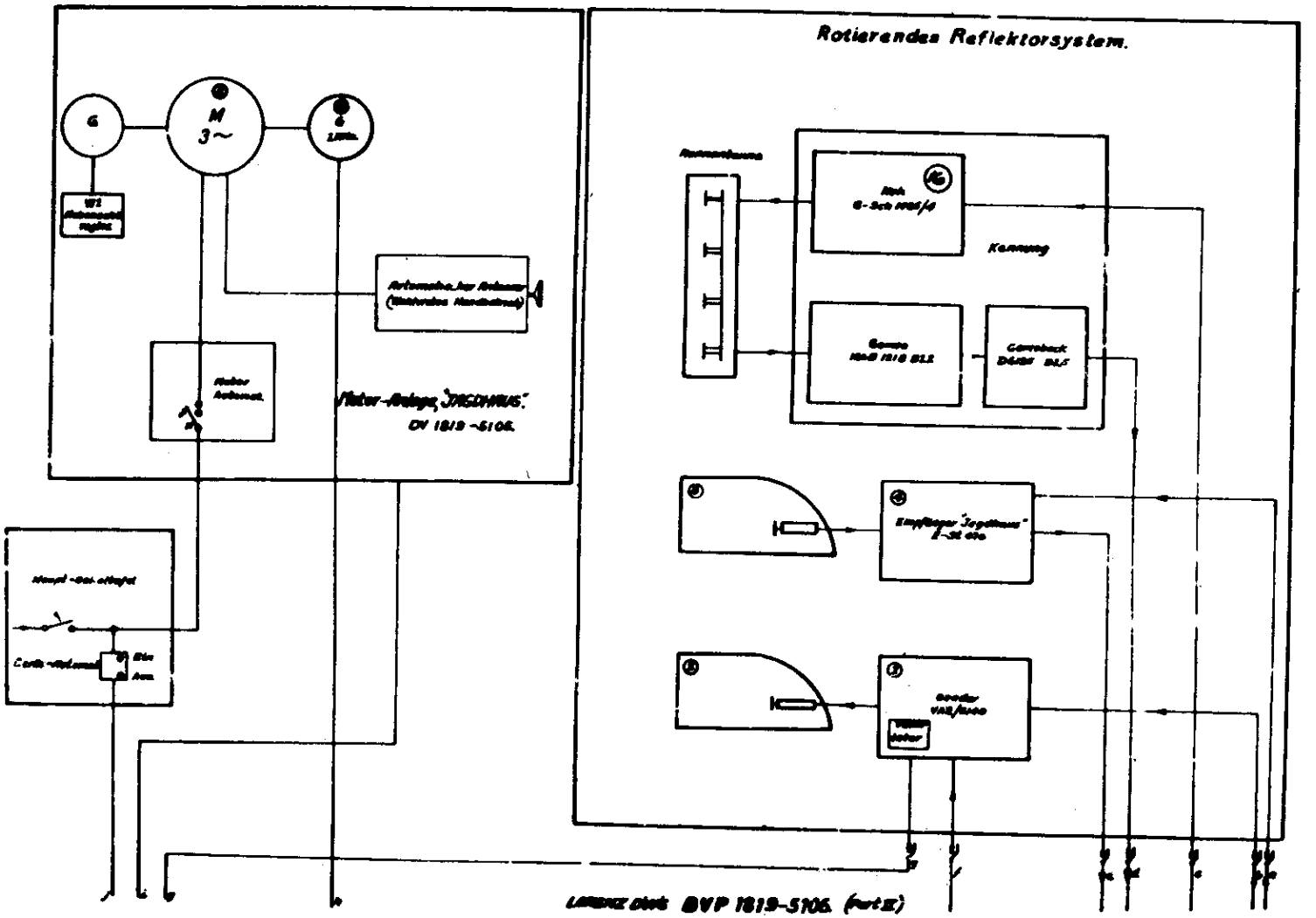
Superheterodyne with 2 preamplifier stages. Range 1.35 to 1.85 meters, tuned through a synchronized control apparatus.
Intermediate frequency 4.2 Mgcs, bandwith ± 1 Mgc.
Sensitivity 45 KT; Controlled by a saw toothed voltage and synchronized with the pulse equipment.

d) Identification Equipment:

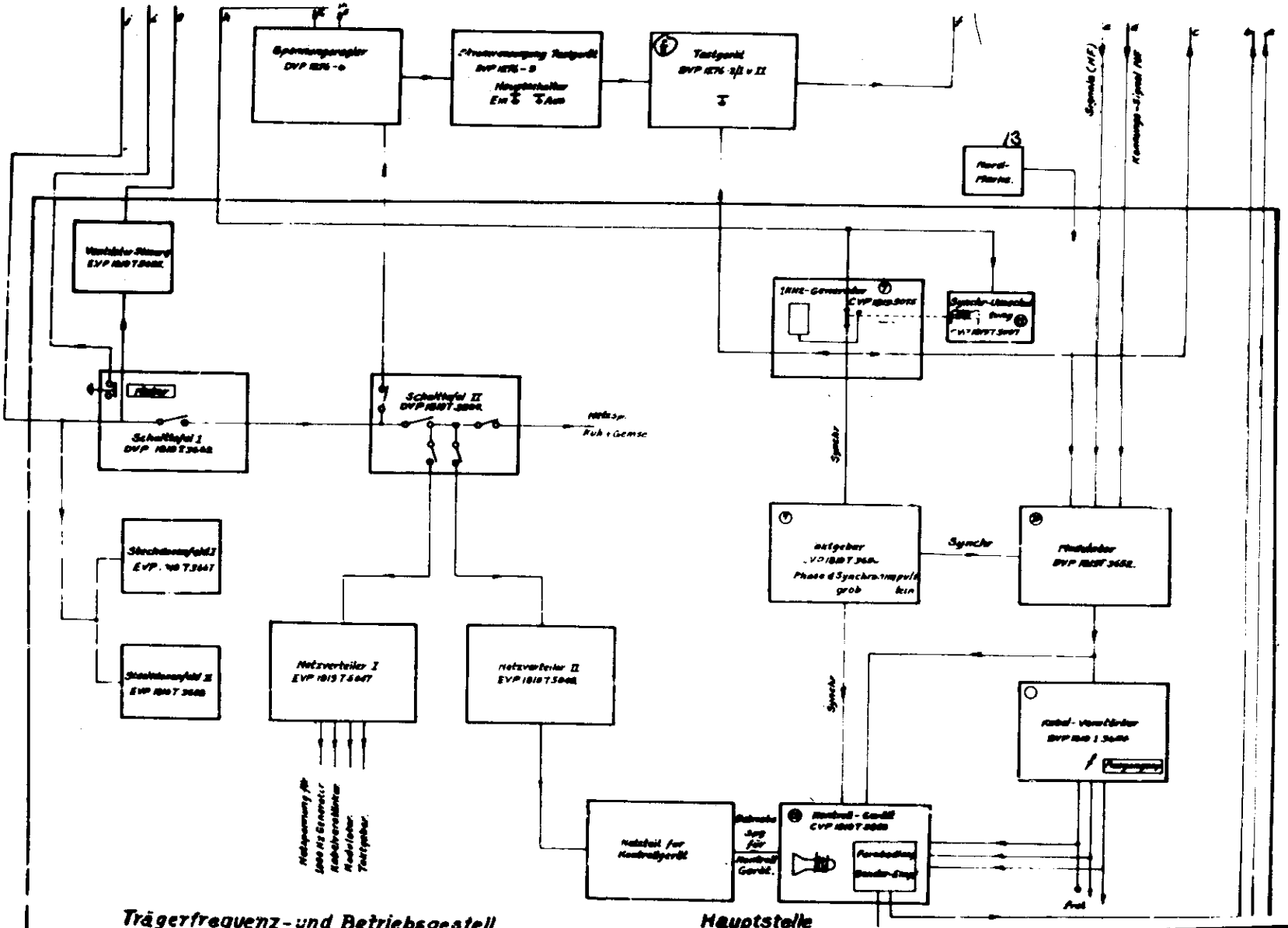
Identification transmitter, "Kuh" impulse modulated and synchronized with the impulse equipment.
Wavelength 1.9 meters.
Power in the pulses 2 KW peak.
Impulse length 1.5 microseconds.
Identification receiver, "Gemse", superheterodyne, frequency fixed at 2.4 meters ± 5%.

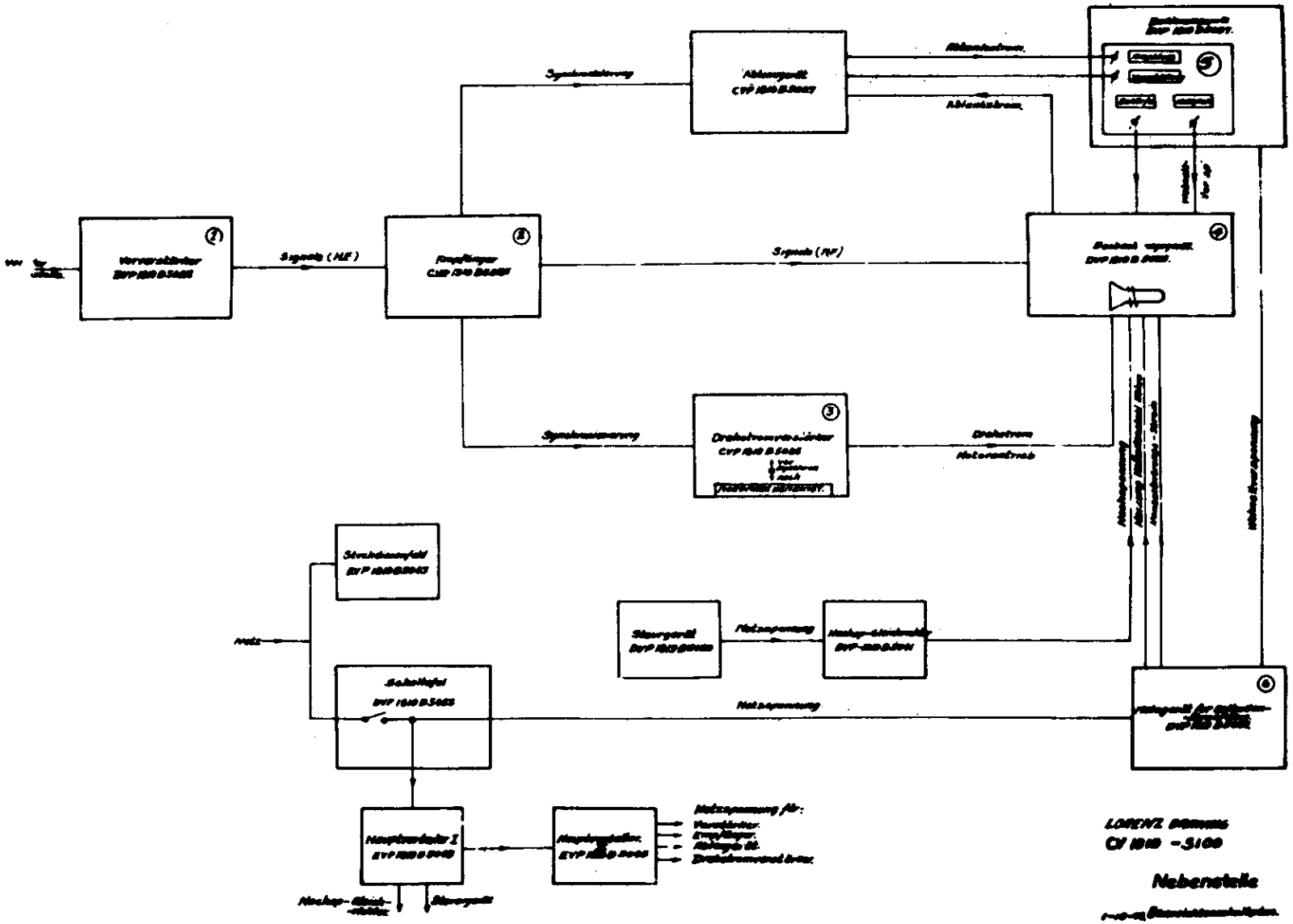
2. Auxiliary Plant (In Berlin)

a) Receiver frequency 4.2 Mgcs, bandwidth ± 1 Mgc input sensitivity 1 millivolt, output up to 150 volts.
Visual apparatus.
Cathode ray tube type LB 12 using 12,000 volts for the plate, peak impulse current 500 milliamperes, grid voltage, for zero plate current, 150 to 250 volts. Diameter of fluorescent screen, 25 cms.



LORENZ blatt BVP 1819-5106. (Teil II)


Spannungsregler
Taktgerät
Schaltfeld I
Schaltfeld II
Netzverteiler I
Netzverteiler II
Synchr
Synchr
Synchr
Trägerfrequenz- und Betriebsgestell
Hauptstelle


Synchronisierung
Ablenkgerät
Ablenkströme
Signale (HF)
Signale (RF)
Synchronisierung
Drehstrom
Netzspannung
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LORENZ DEBEG
CV 1918 -3109
Nebenstelle

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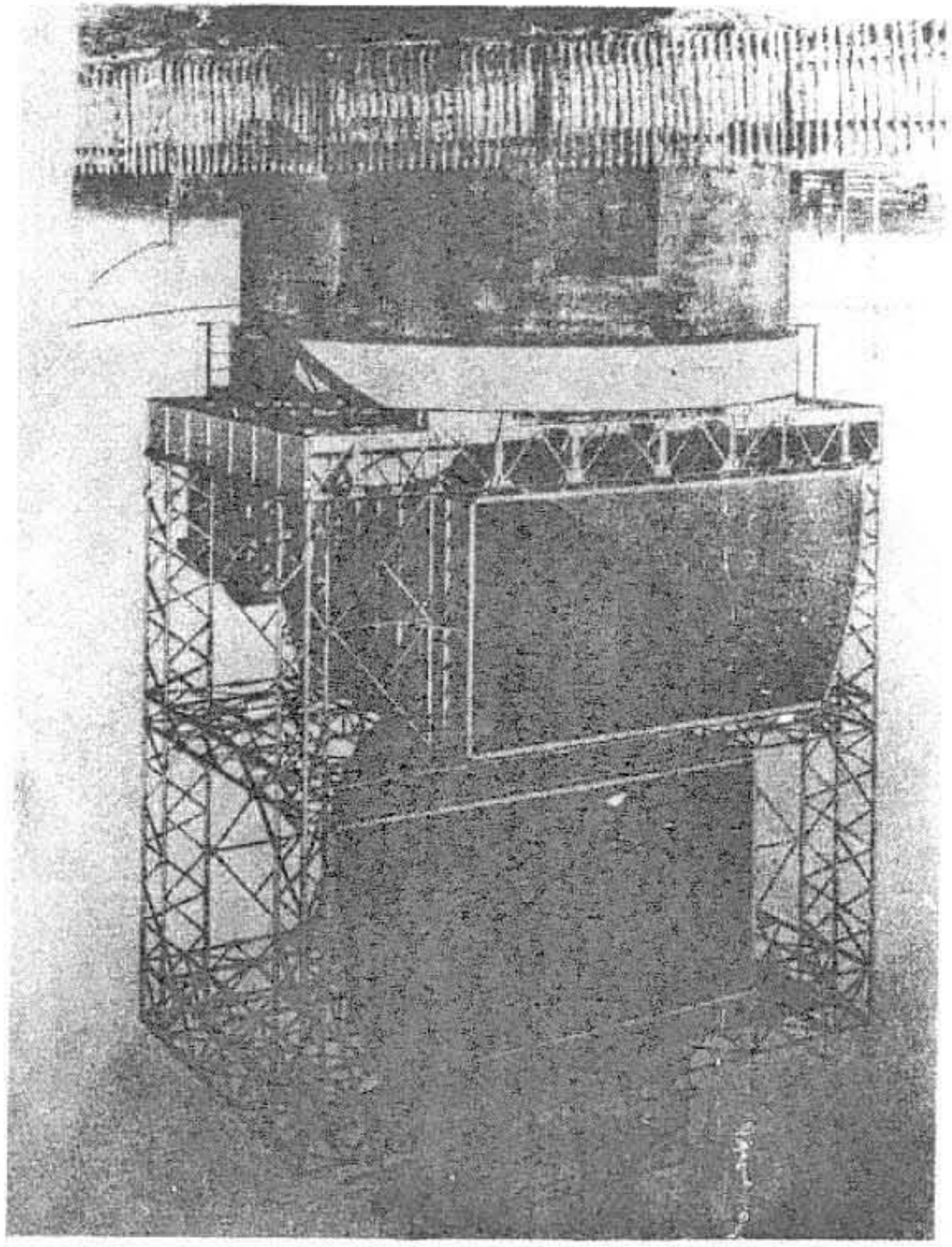
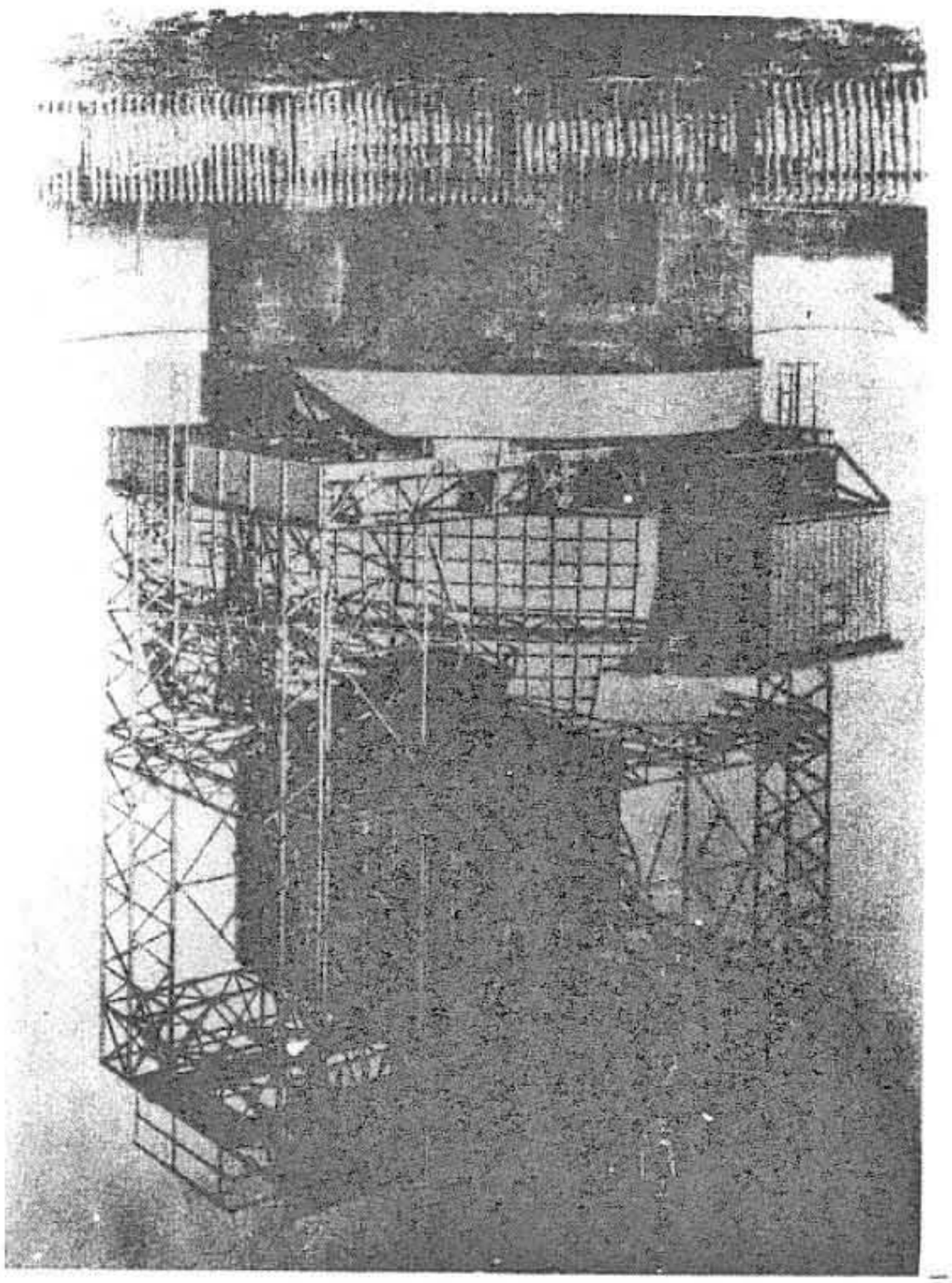
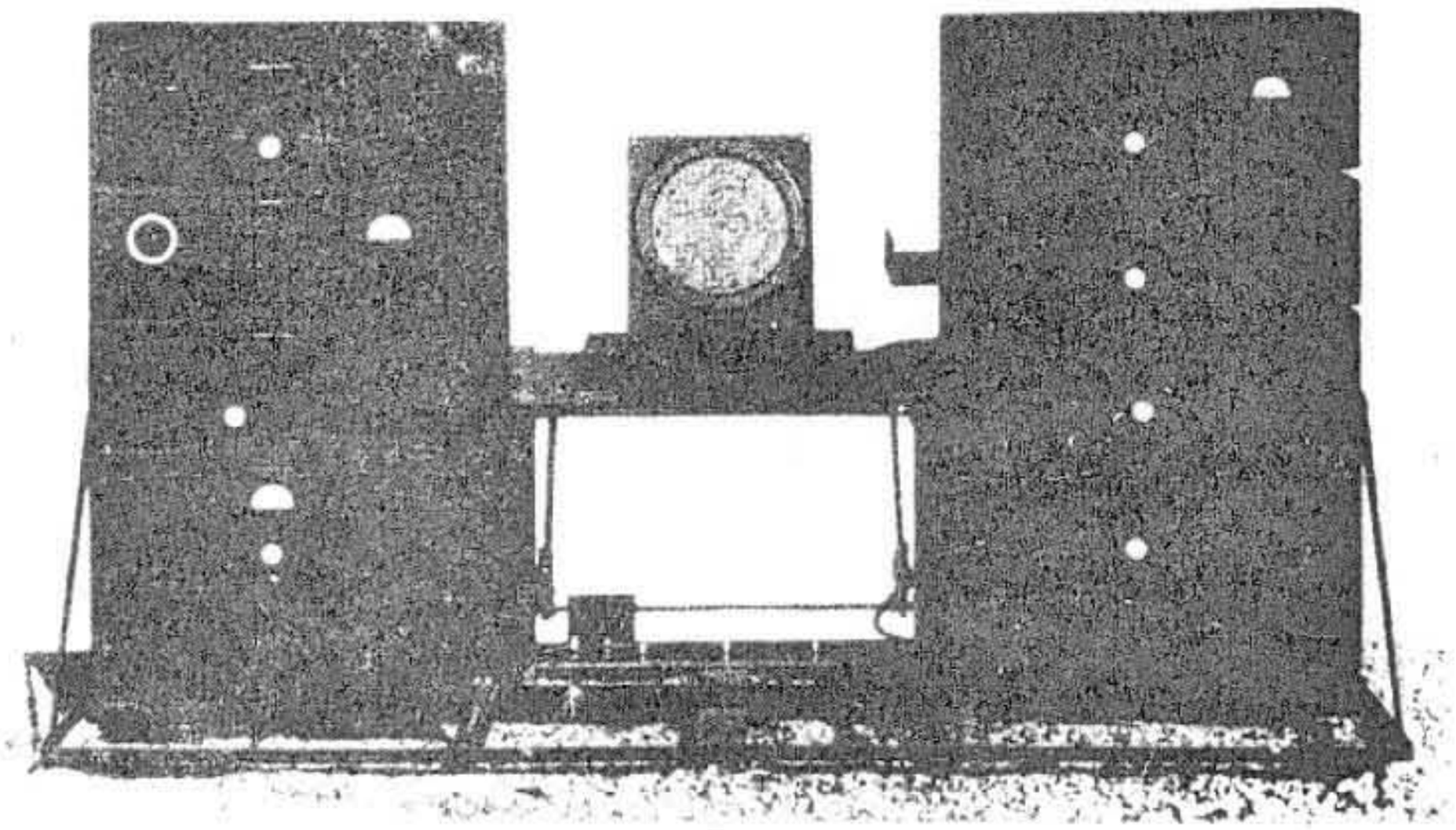


2

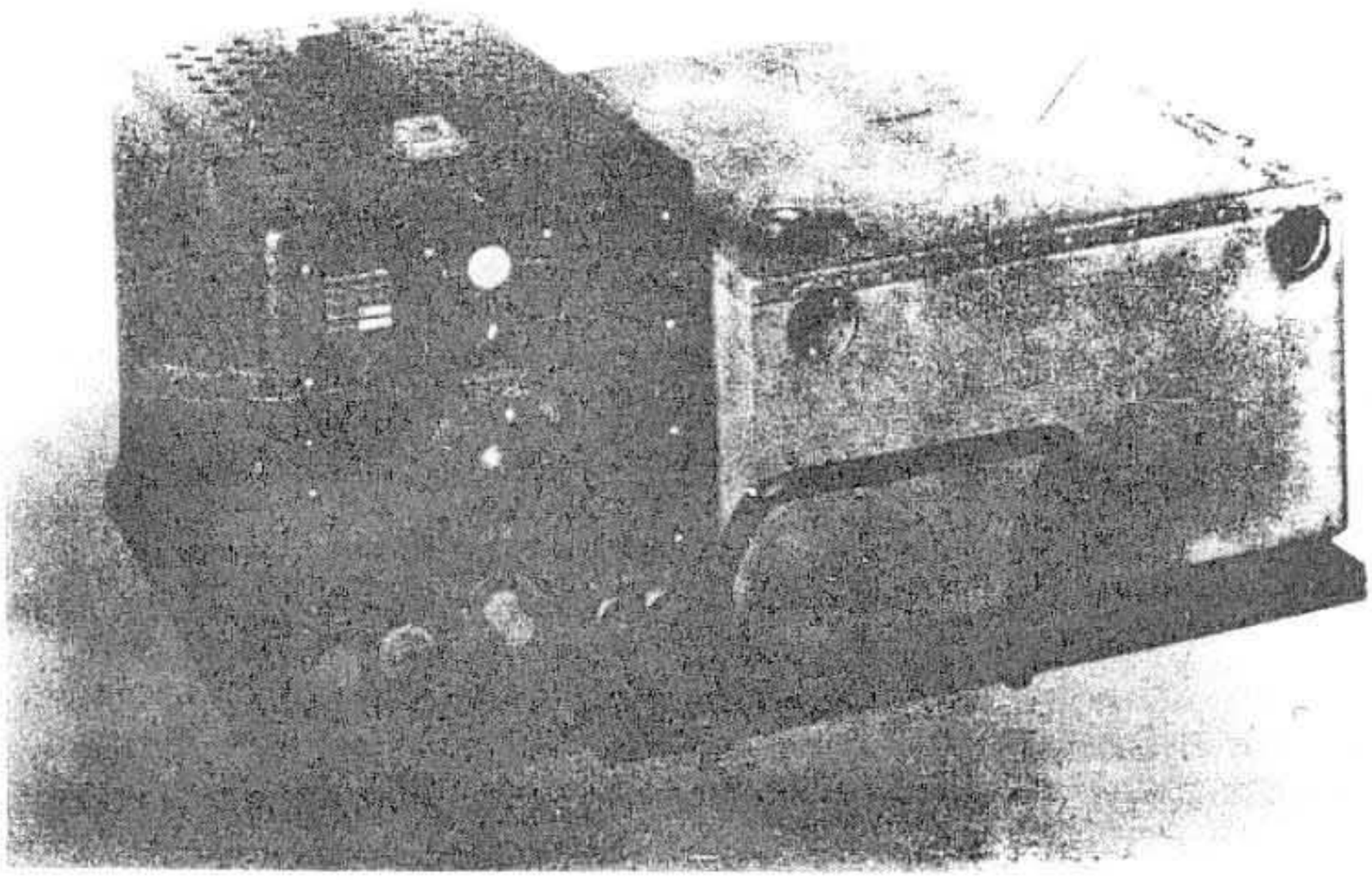




#3

Power

HF-LF unit



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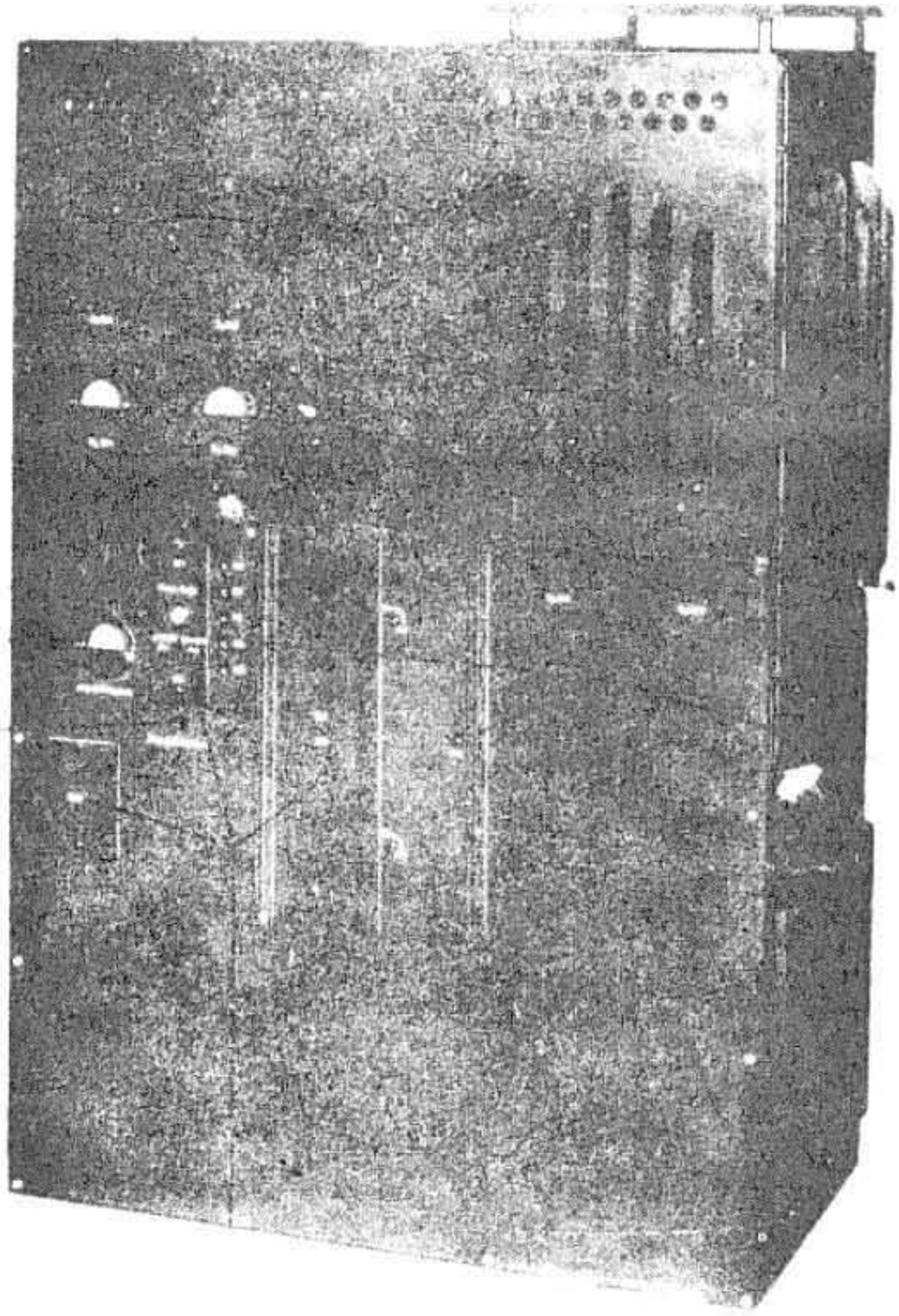
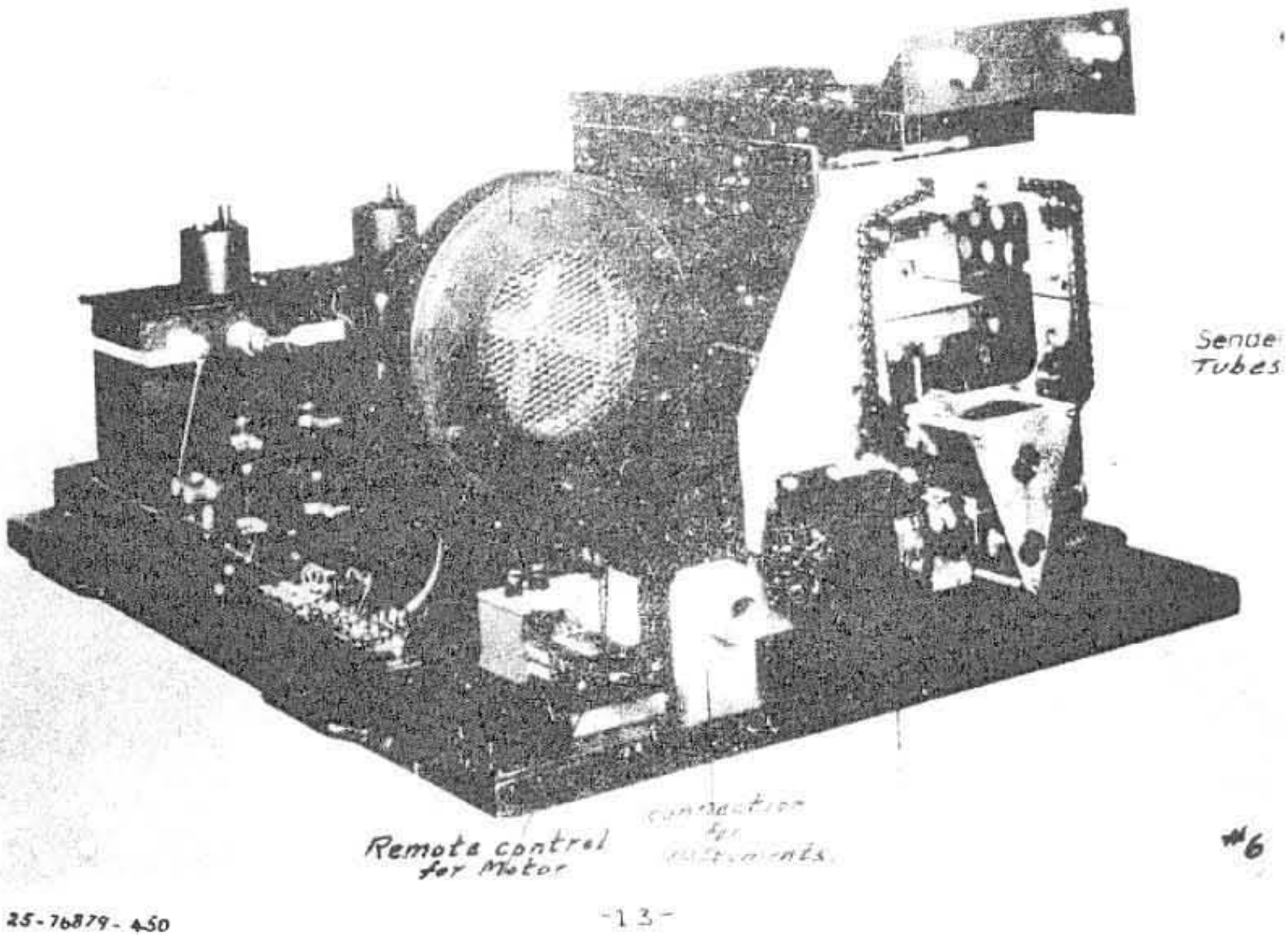


#5

Peak Limiting Tubes



Sense Tubes

Remote control for Motor

connector for instruments

#6