

## THE SWEEPER MAGNET IN THE O<sub>2</sub> BEAM

### Purpose

This magnet has been designed in order to distribute the particles inside the useful region of the bubble chamber during the burst. In this way it will be possible by associating a signal proportional to the instantaneous bending power of the magnet with a velocity measuring device (e.g. Cerenkov) to individuate the particles in the bubble chamber<sup>(1)</sup>.

The magnet is placed 6.5 m in front of the chamber and is able to distribute a beam of 10 GeV inside an angle of 30 m rad in the vertical plane.

### Description

Fig. 1a) shows the principle diagram of the apparatus. The condensers bank C is discharged at the right time on the magnet coils through the ignitors I<sub>1</sub> and I<sub>2</sub> which are triggered so that the excitation current flows through the winding during the complete period of a sine wave. At the end of this period the current stops and the condensers bank is charged at nearly its full voltage. The used part of the sine wave, indicated on the oscillogram in Fig. 2., is the rather linear part between  $-\frac{I_{max}}{2}$  and allows thus a practical resolution all over the burst time.

The magnetic field induces a signal in a measuring coil mounted in the gap of the magnet. After integration and amplification this signal is transferred to the horizontal plates of an oscilloscope which is switched on during the used part of the sine wave by the "unblanking circuit". The signal produced by the "velocity measuring device" supplies the vertical deflection plates of the oscilloscope. The oscilloscope signals will be photographed by the bubble chamber camera and will so appear near the corresponding tracks.

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1)

A possible system for track labelling in bubble chambers by D.B. Miller and W.W. Neale

### The Magnet

The construction details are given by the attached drawings TC - AO-361, 369, 370, TC - AO-371. To reduce the energy to be stored in the condensers bank, the magnet has been installed in a vacuum tank.

The magnet yoke is made of oxidised laminated iron 0.3 mm thick. To improve the insulation mylar sheets have been inserted every 10 mm.

The winding consists of two double pancakes presently connected in series; they could, however, very easily be connected in parallel to double the resolution time.

The coil insulation has been tested at atmospheric pressure at 10 kv, 50 cycles. The gas pressure in the vacuum tank has to be kept, during operation, above 5 torr.

#### Magnet main data

gap 30 mm  
length 1000 mm  
pole width 80 mm  
current peak value 900 amp.  
max. bending power  
during the cycle +1 Wb/m  
-0.9 Wb/m

Total number  
of turns 28  
inductance  $\sim$  2.8 mH  
resistance  $\sim$  40 m $\Omega$

#### Power supply and discharge circuit

The power supply and discharge circuit diagram is given in Fig. 3. The high voltage source gives a charging time up to 90 o/o of the max. voltage value of about 3 sec. The capacity of the condenser bank is 267  $\mu$ F, and its nominal voltage 3000 volts.

The discharge circuit is composed of two ignitrons  $I_1$   $I_2$ , mounted reversed to each other. To trigger ignitron  $I_2$  after the accomplishment of the first half cycle, a ferrite ring is mounted in series with the discharge circuit.

When  $I_1$  current falls nearly to zero ( $8 \div 10A$ ), the ferrite comes out from saturation, so that a positive pulse will appear across the winding. In this way the  $I_2$  trigger is obtained at the right time independently from the oscillation frequency.

#### Amplifier circuit

The measuring coil signal, after integration, has to be amplified in order to supply the horizontal deflection plates of the C.R.T. The sensitivity of the tube used is about 32 volt/cm so that, for a deflection of 10 cm, a tension of  $\sim 320$  V peak to peak will be needed on the horizontal plates. Considering that the interesting part of the cycle is its nearly linear region (that is about half of the peak to peak value) the amplifier must be able to give an output tension of 600 to 700 V. To keep linearity and stability of the amplifier to values of  $1 \div 2$  o/o a feed-back loop is provided to reduce the gain from 900 to 55. The circuit diagram is shown in Fig. 4. The "unblanking circuit", shown on the same figure, switches on the CRT beam during the wanted part of the cycle.

#### Firing circuit

The firing circuit for the ignitrons is given in Fig. 5. It consists of two separated channels and a common power supply. Each channel consists mainly of two tyratrons in cascade and a transformer used to apply the right polarity on the ignitrons.

The time delay between the input pulse and the actual ignitron firing is about  $1.3 \mu$  sec with a jittering of  $\pm 0.1 \mu$  sec.

#### Acknowledgements

We wish to thank Mr. Regad who made the design of the magnet and Mr. Dozio who looked after the manufacturing and mounting.

E. Chesi  
G. Petrucci  
F. Wittgenstein

Distribution: open

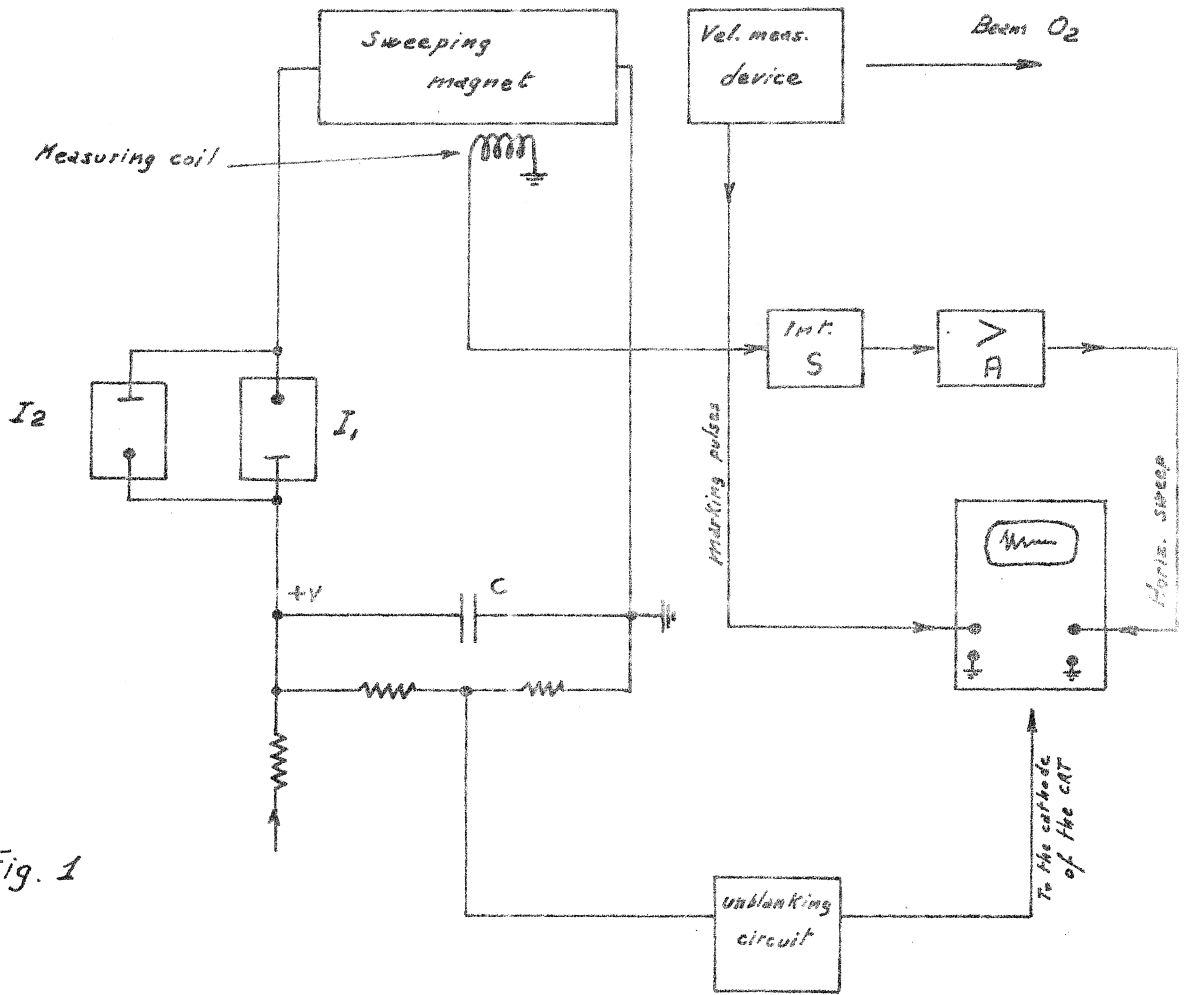


Fig. 1

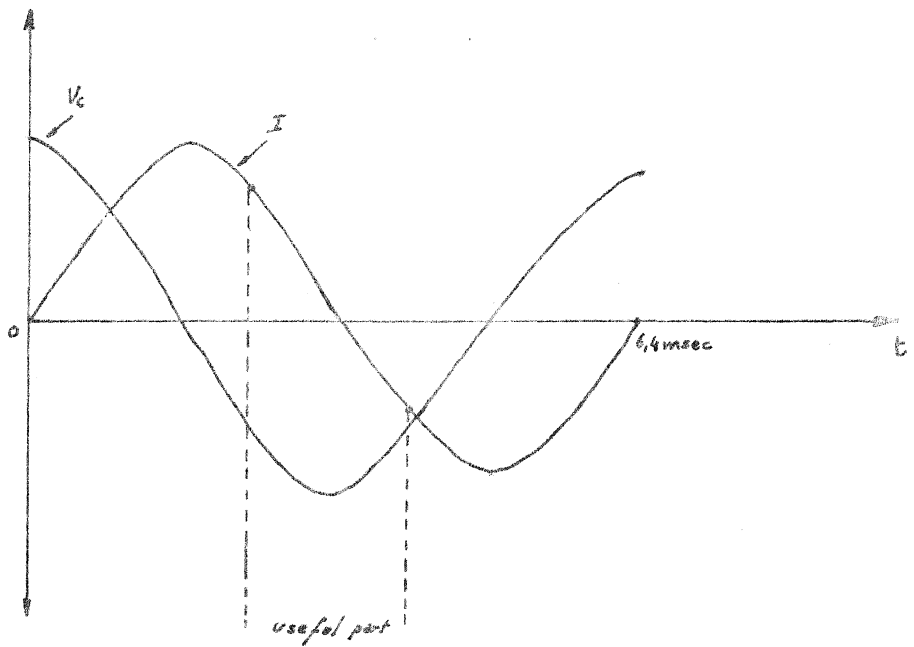
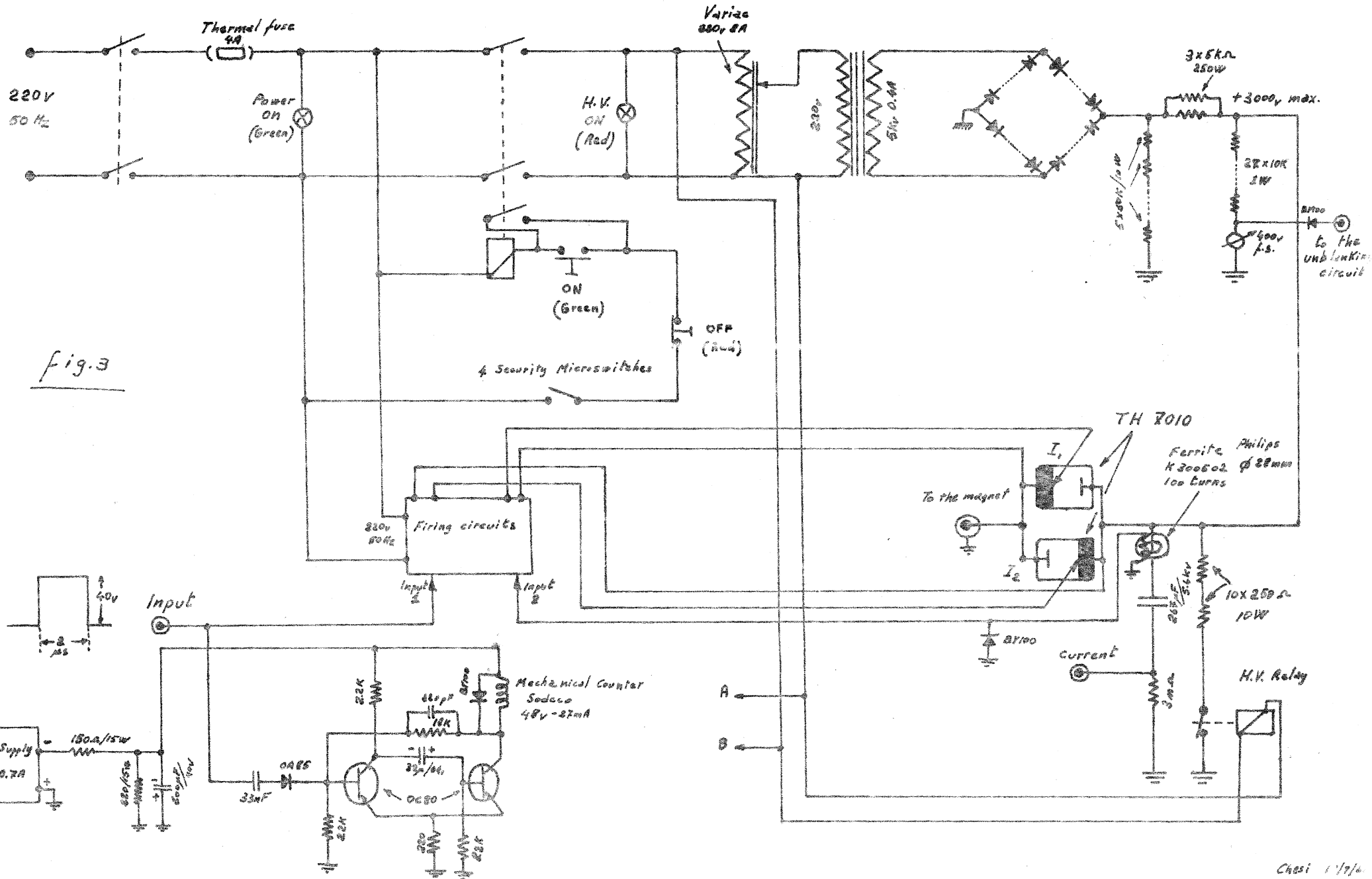


Fig. 2

# Power supply and discharge circuit

All contacts are represented in the "OFF" state



# Amplifier circuit

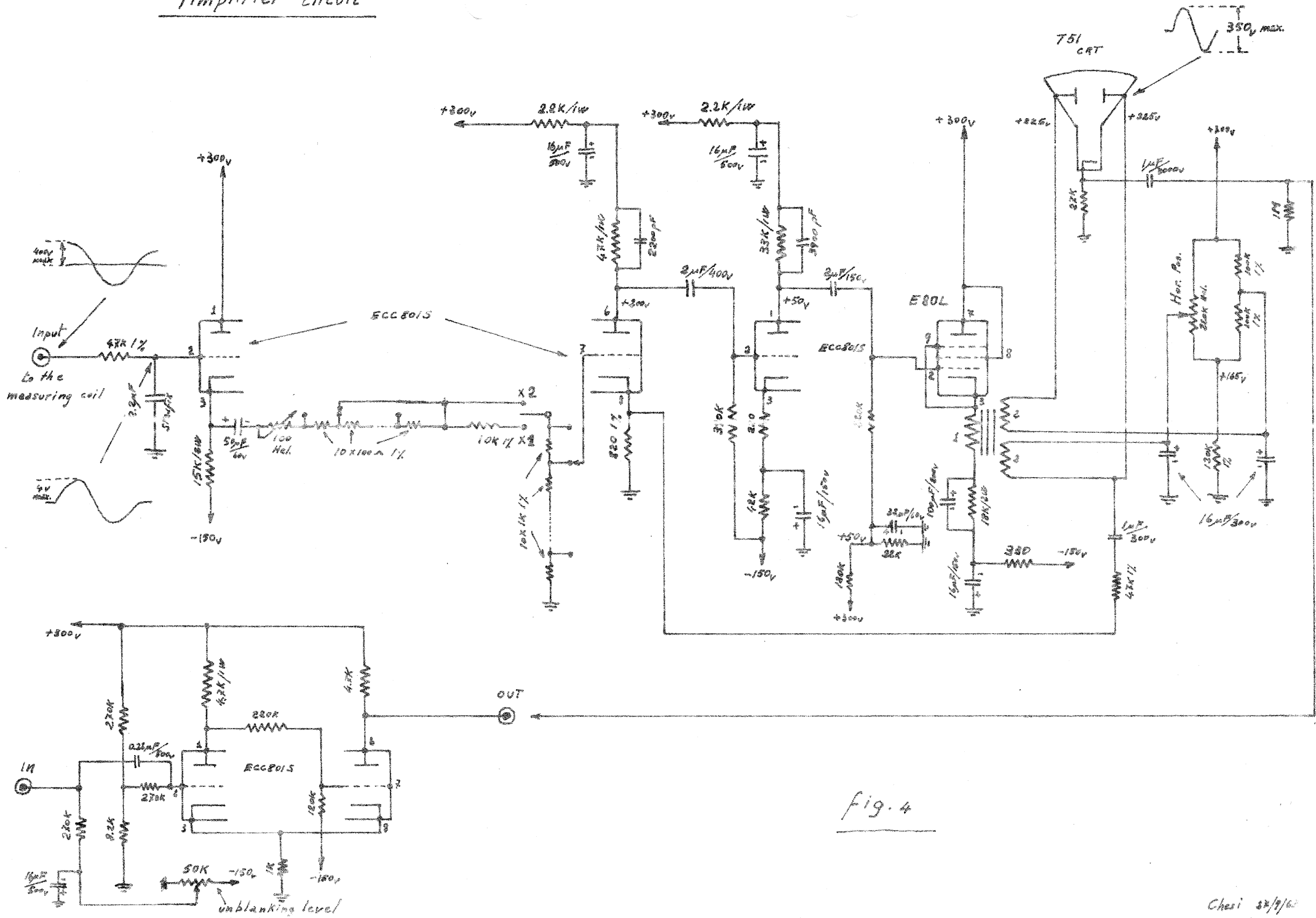


fig. 4

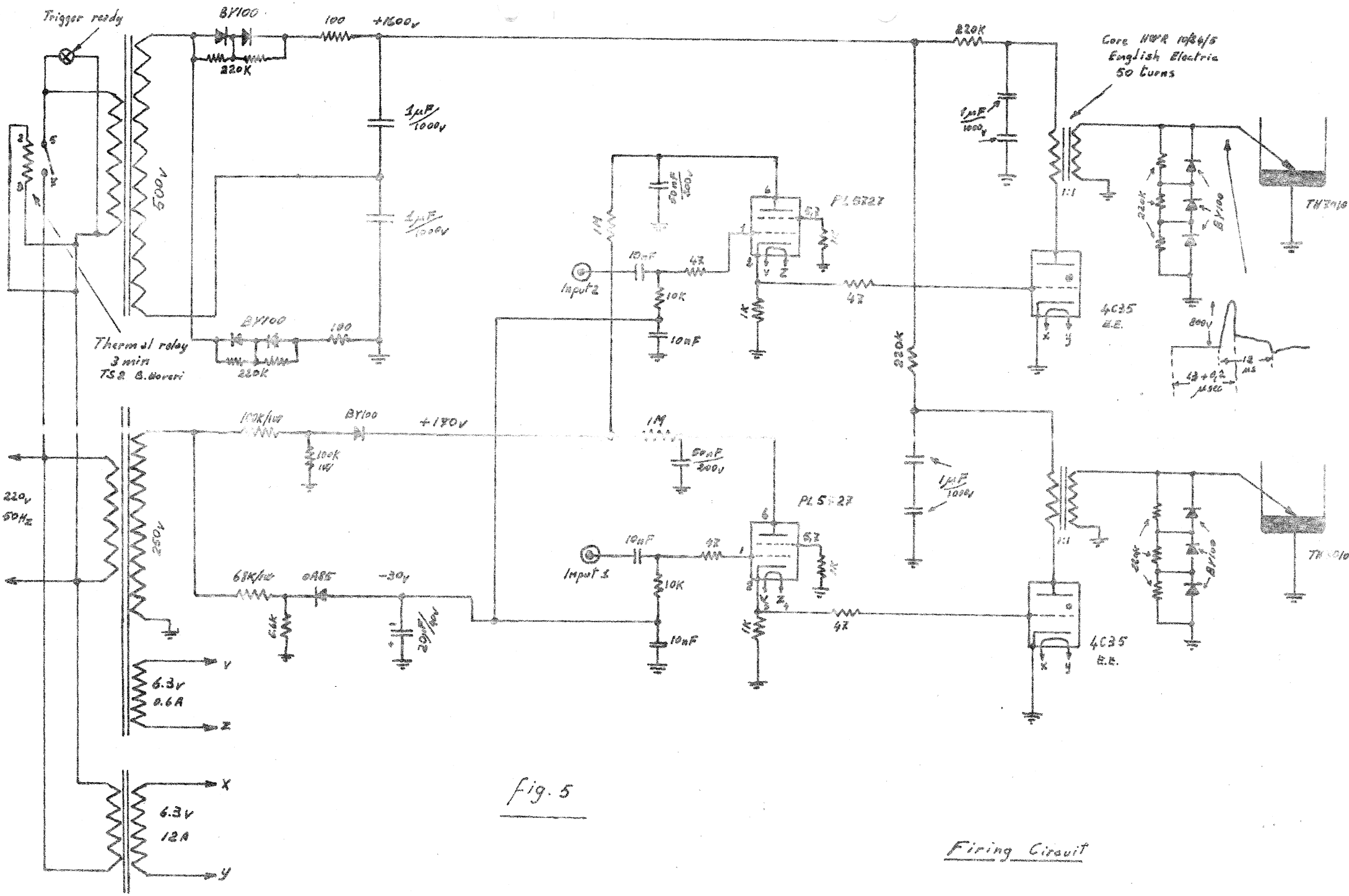
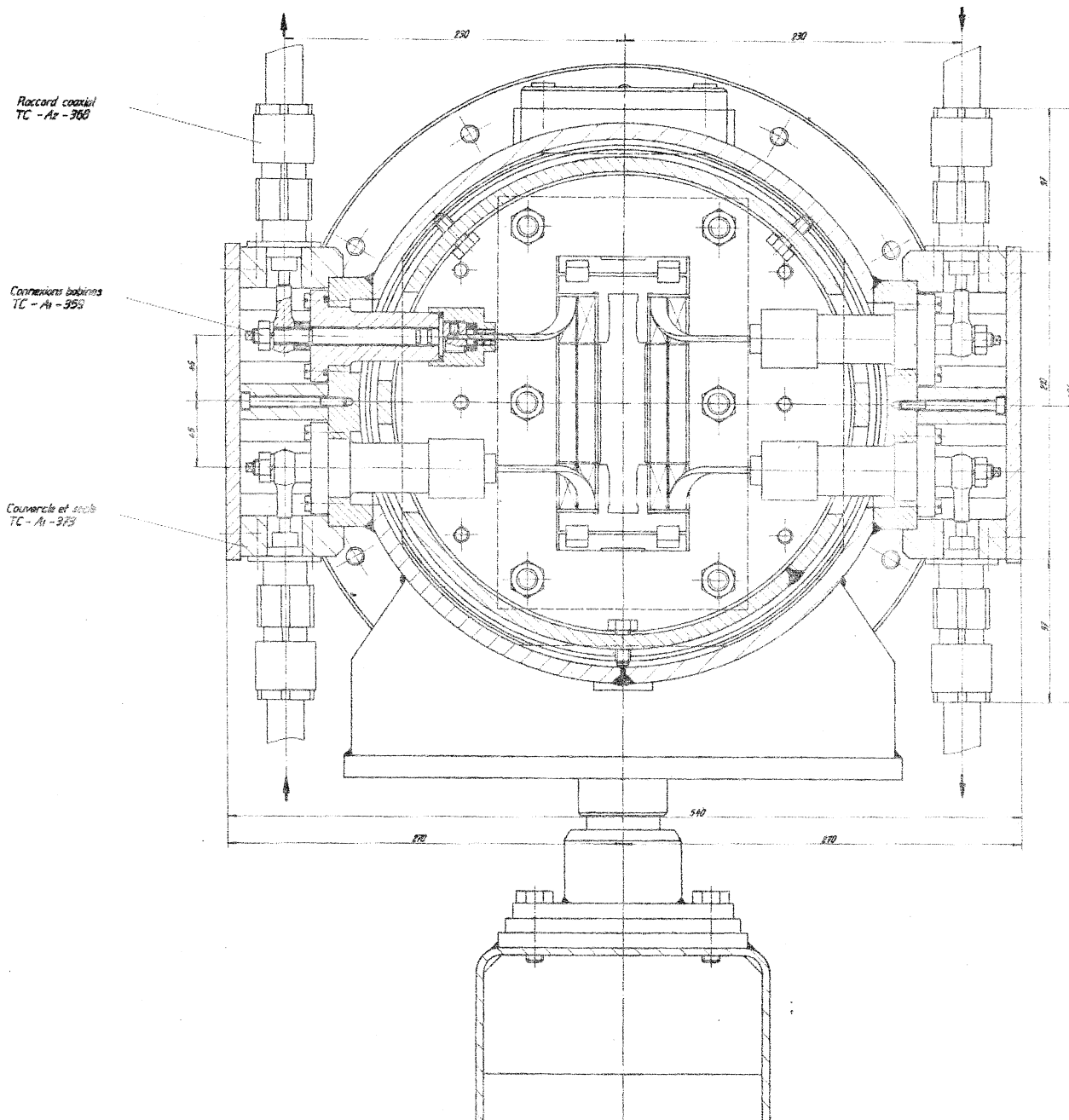


Fig. 5

Firing Circuit

Coupe A-A

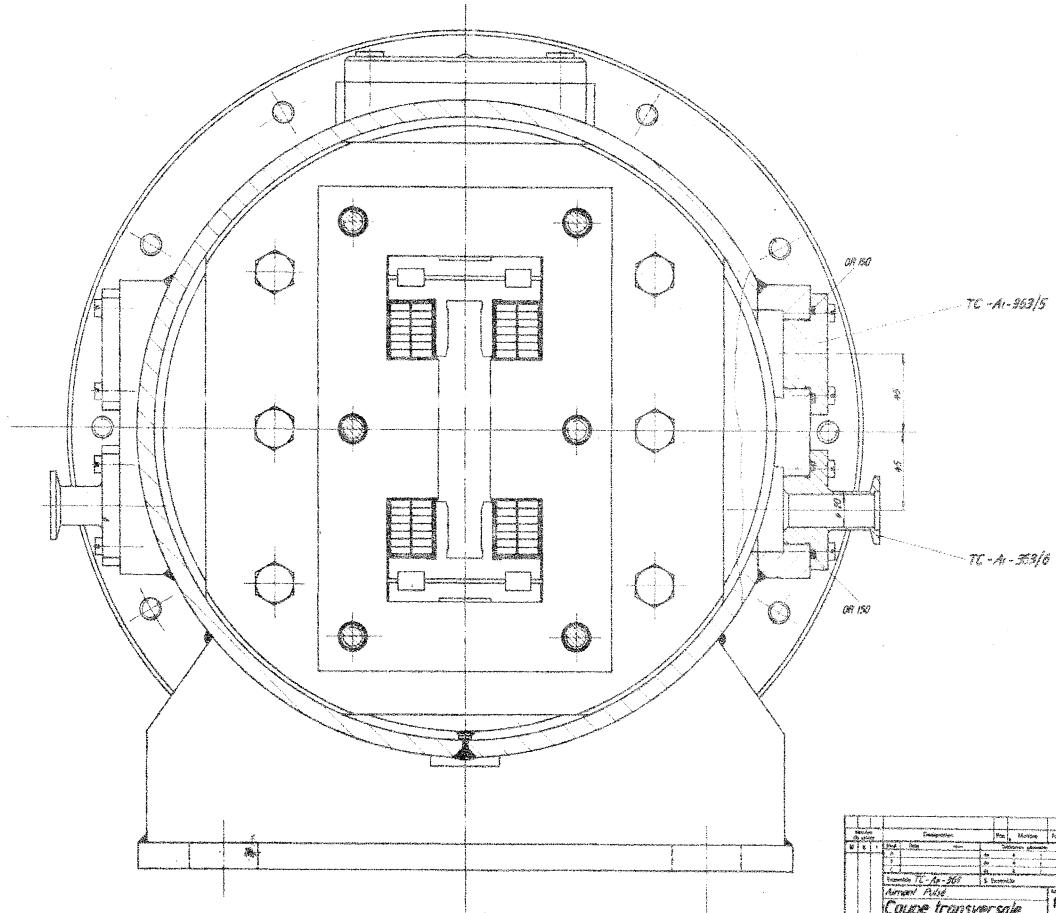


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Coupe transversale  
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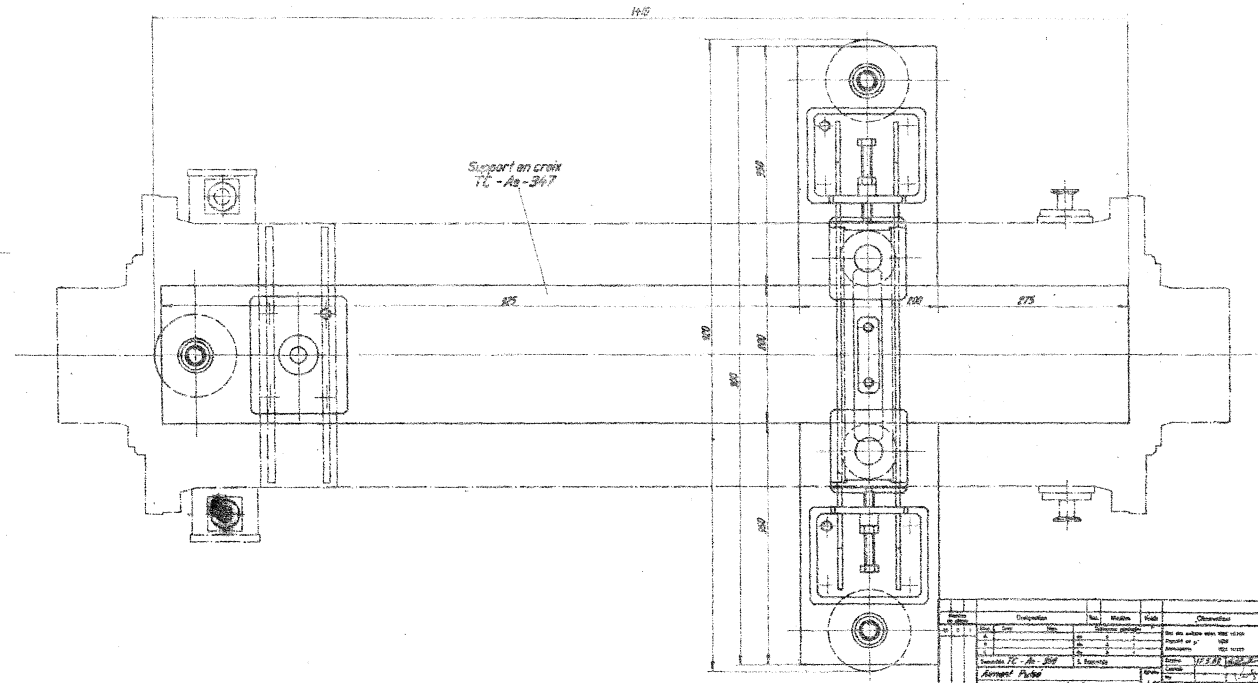
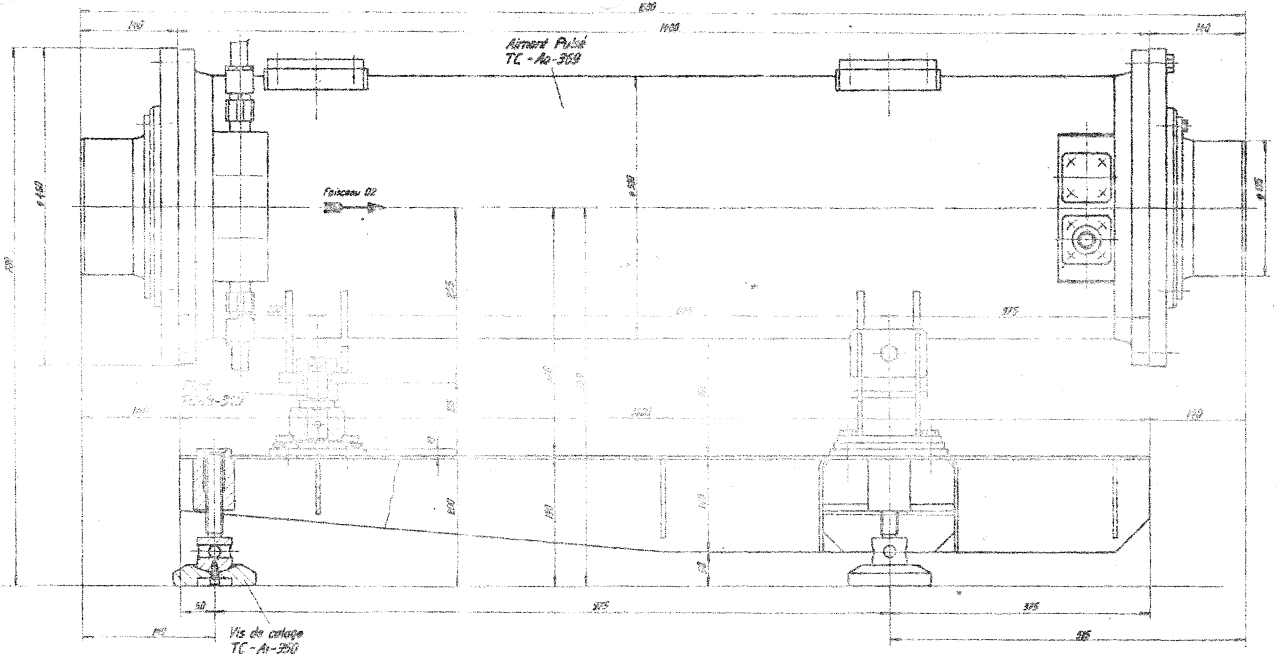
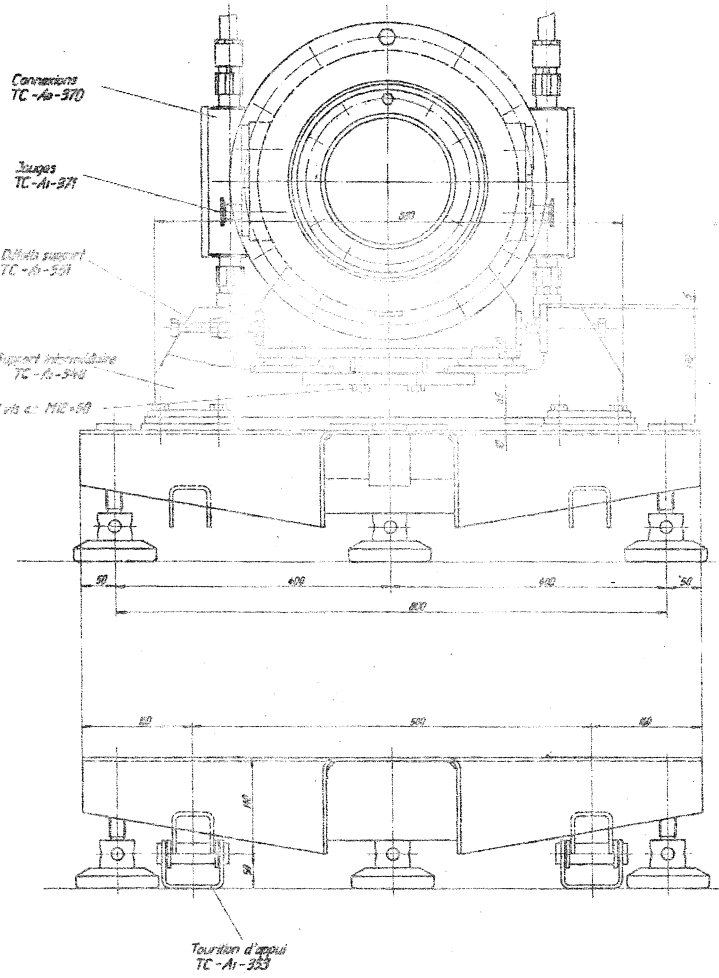


Coupe B-B



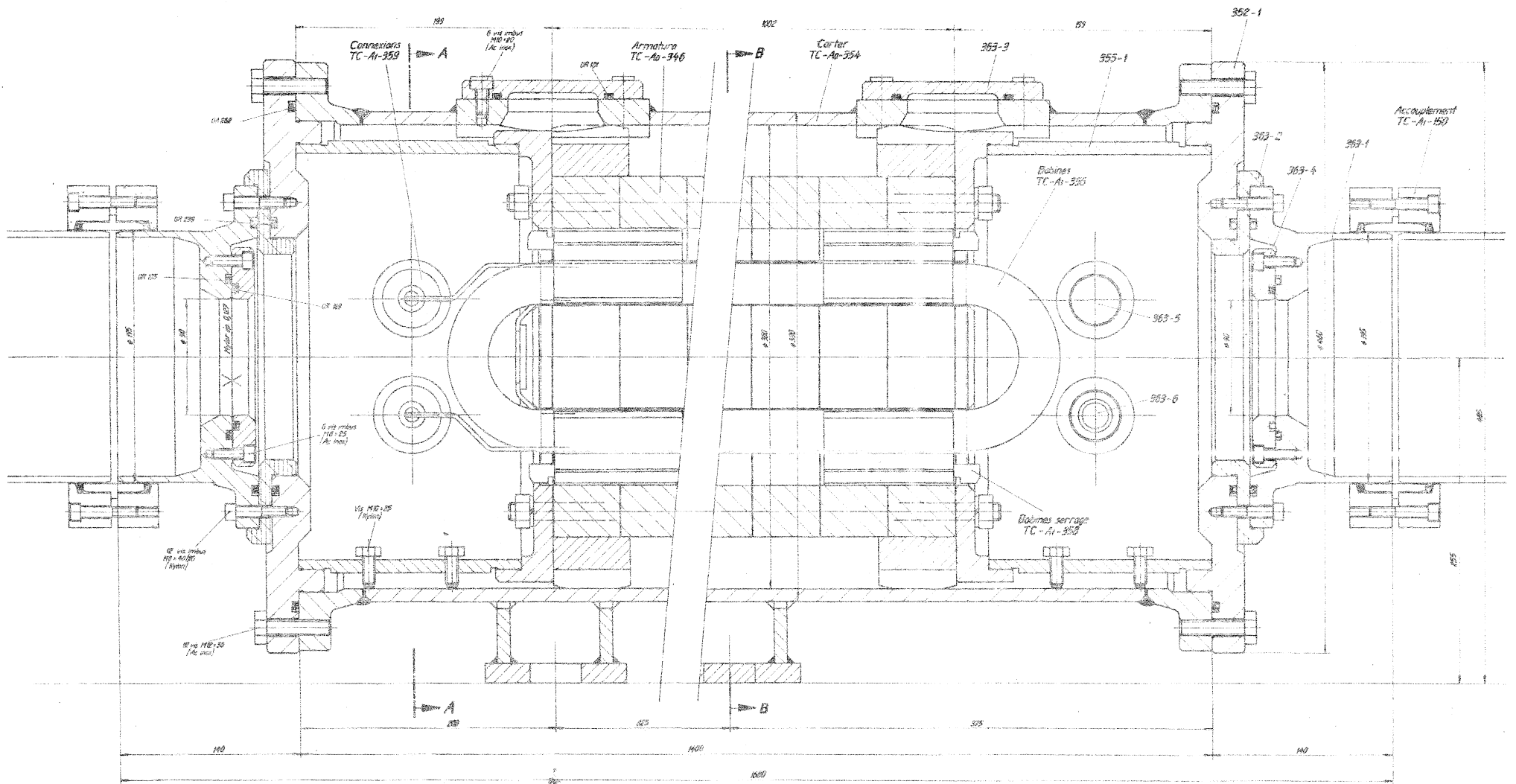
Rev.	Description	By	Checked	Date	Observation
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2	TC-A1-963				
3	TC-A1-359/6				
4	TC-A1-963/5				
5	Coupe transversale (B-B)				
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Designation	N°	Matériau	État	Quantité
Aimant Polar	TC-AI-359	Aluminium	1	1
Faisceau D2	TC-AI-370	Aluminium	1	1
Support en crain	TC-AI-347	Aluminium	1	1
Support intermédiaire	TC-AI-373	Aluminium	1	1
Connexions	TC-AI-370	Aluminium	1	1
Supports	TC-AI-371	Aluminium	1	1
Différentiel support	TC-AI-372	Aluminium	1	1
Tourillon d'appui	TC-AI-374	Aluminium	1	1
Vis de serrage	TC-AI-350	Aluminium	1	1
Vis de M12x60		Aluminium	2	2

Ensemble général  
 CERN  
 TC-AI-361



Coupe A-A voir : TC-A0-370  
 " B-B " : TC-A1-371

Rev.	Designation	Etat	Modif.	Etat	Observations
1	TC-A1-369	01			100% de fabrication
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Coupe longitudinale  
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