CERN/TC/02 63-5.
30.10.1963

THE SWEEPER MAGNET IN THE O_2 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[(1)].

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_1 and I_2 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 $\pm \frac{I_{max}}{2}$ 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

PS/4097/dac

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 parallelto 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	∼ 2.8 mH
resistance	∼ 40 mΩ

Power supply and discharge circuit

The power supply and discharge circuit diagram is given in Fig. 3. The high voltage source givesa charging time up to 90 o/o of the max. voltage value of about 3 sec. The capacity of the condenser bank is 267 μF, 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 μ sec with a jittering of $\pm$ 0.1 μ 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

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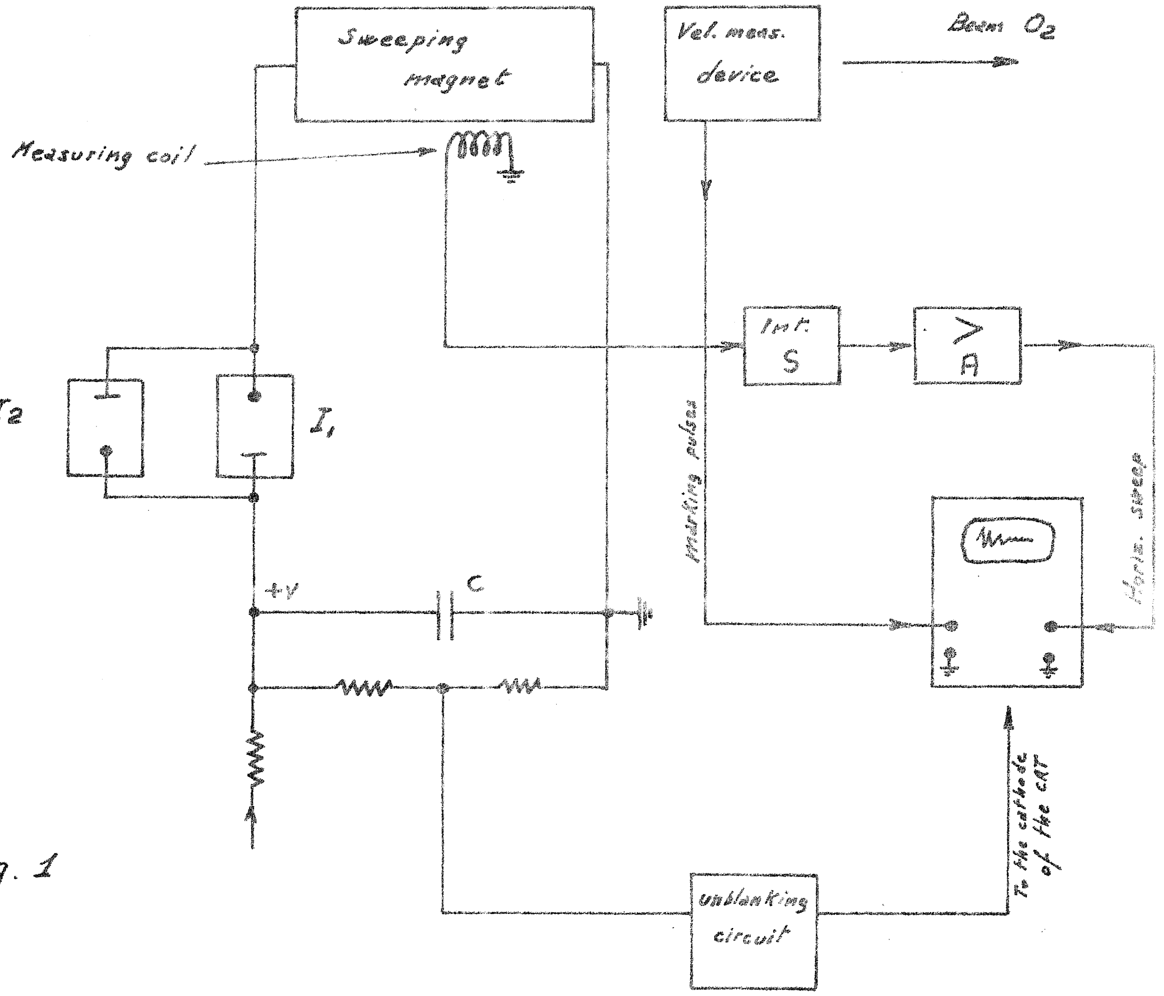
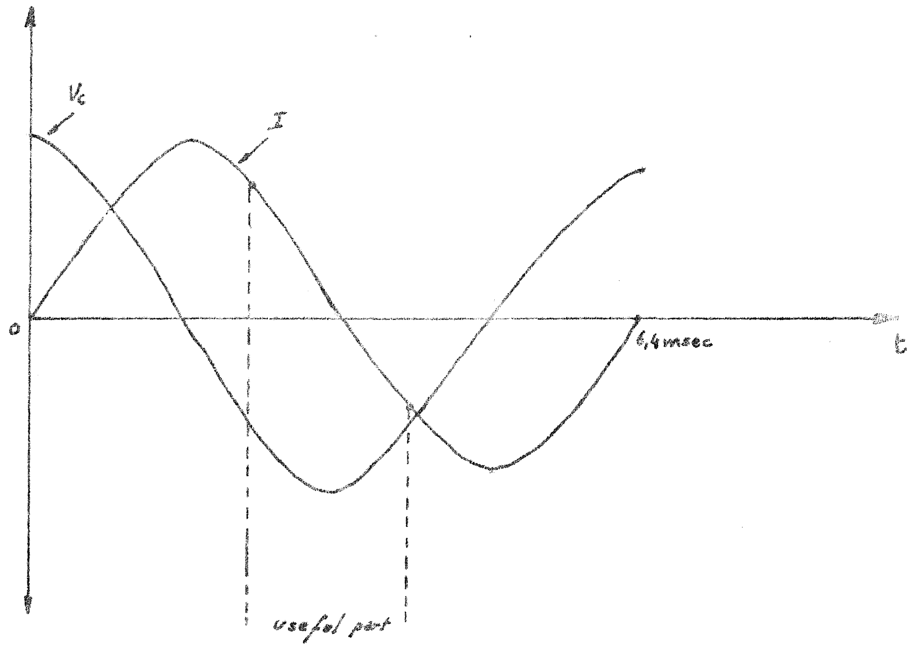


Sweeping magnet
Vel. meas. device
Beam O_2
Measuring coil
I_2
I_1
Int. S
A
marking pulses
Horiz. sweep
+V
C
To the cathode of the CRT
unblanking circuit

Fig. 1



V_c
I
0
6,4 msec
t
useful part

Fig. 2

Power supply and discharge circuit

All contacts are represented in the "OFF" state

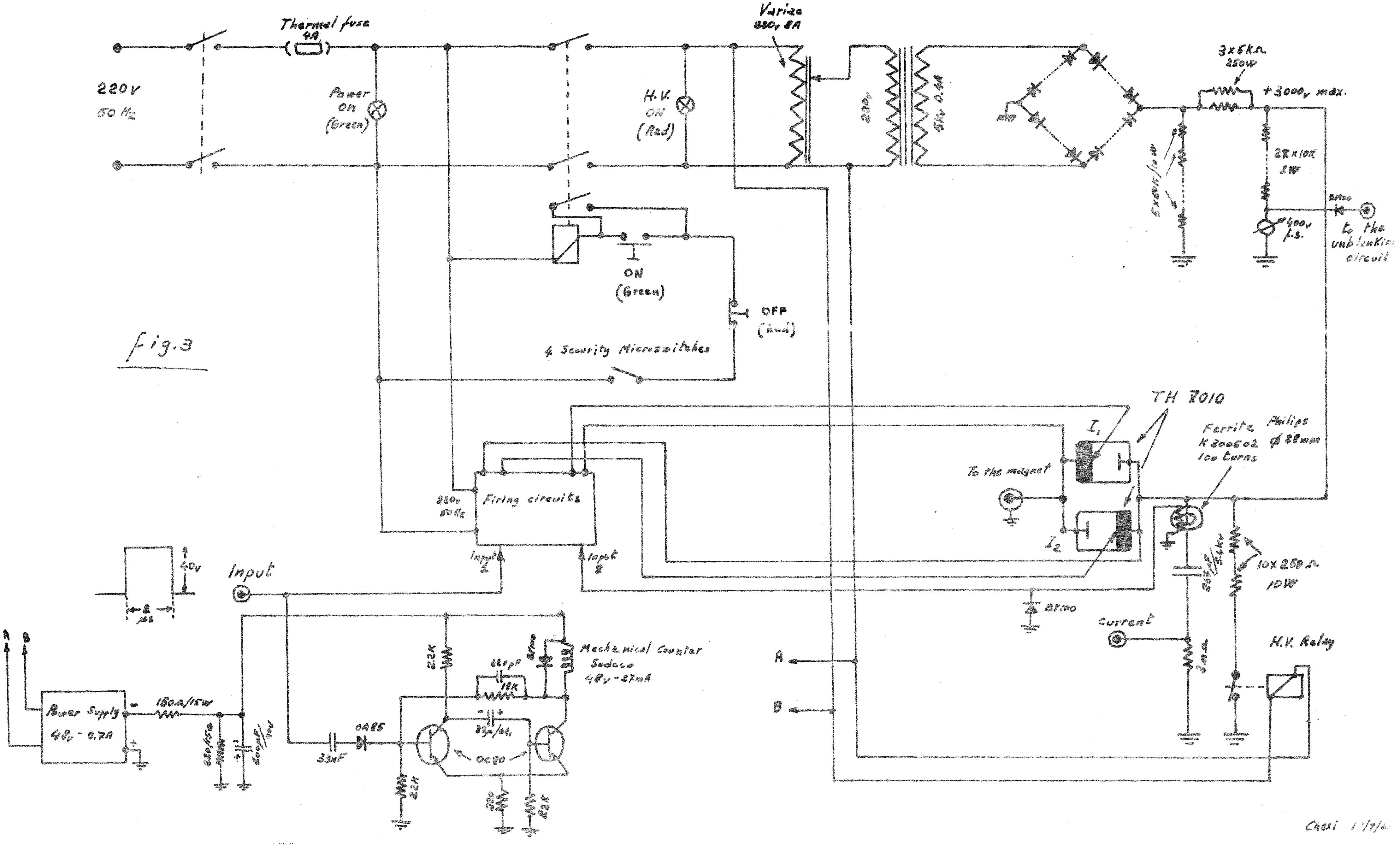


fig.3

Chesi 1/7/6

Amplifier circuit

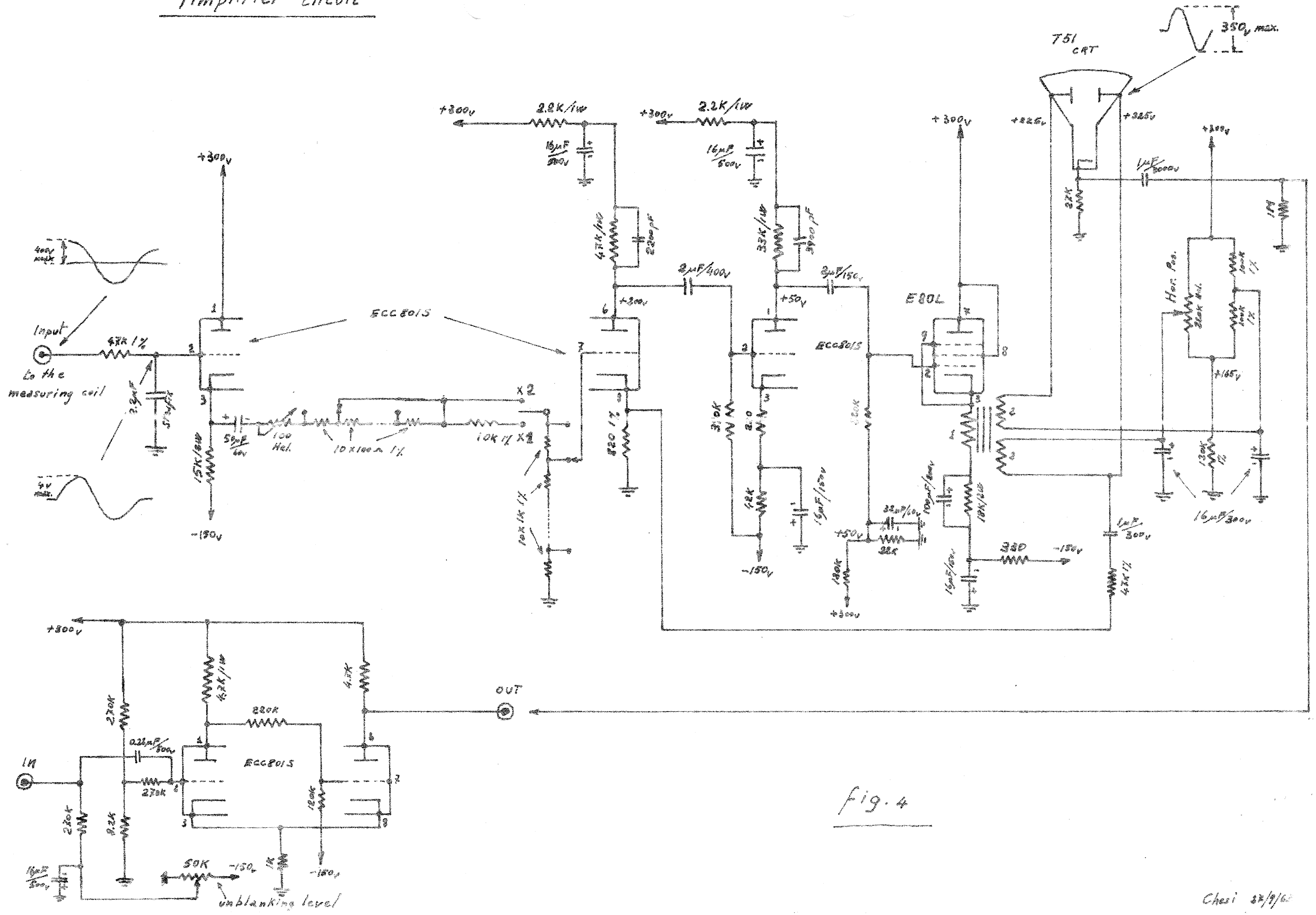


Fig. 4

Chesi 27/9/6?

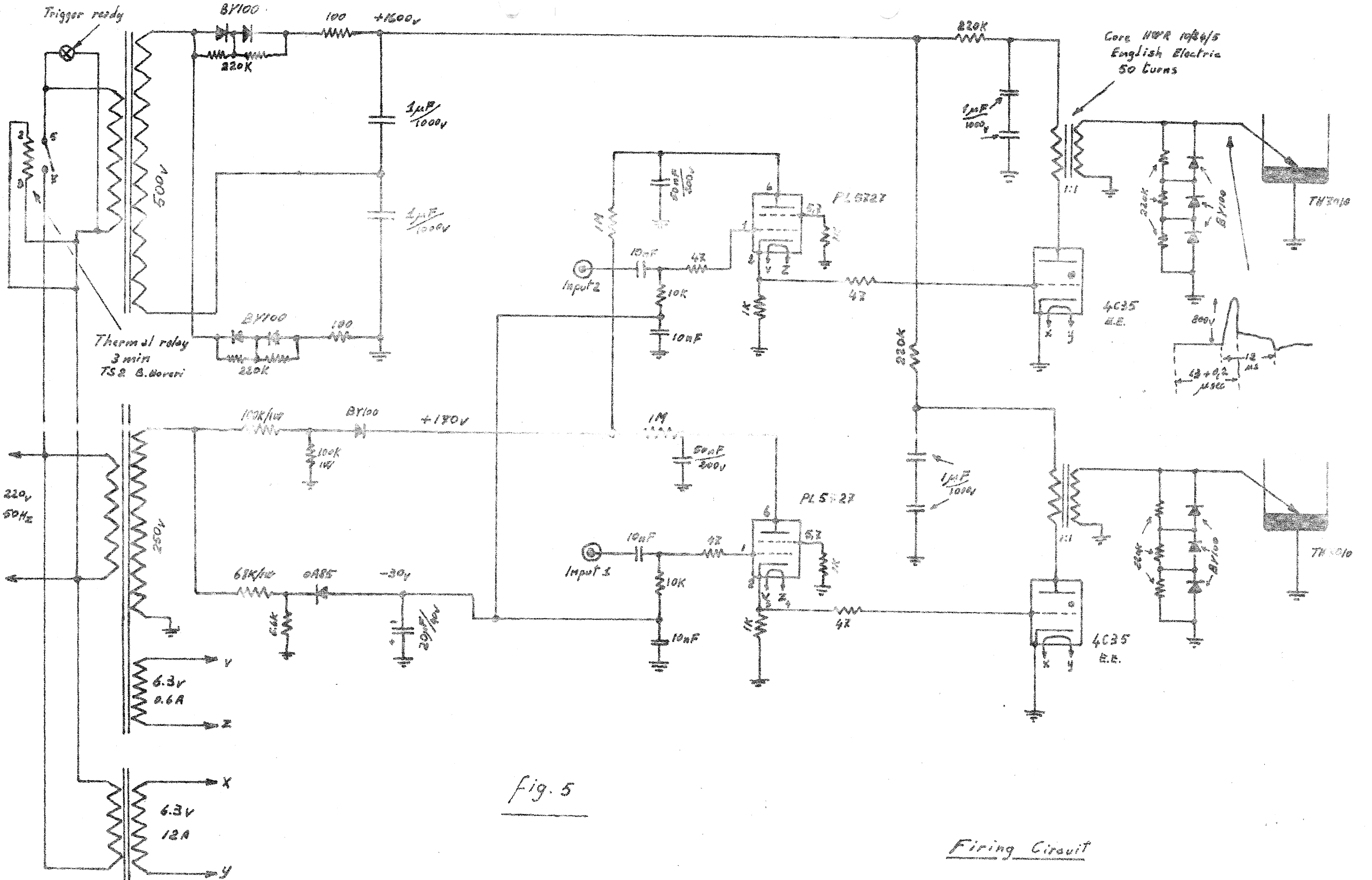
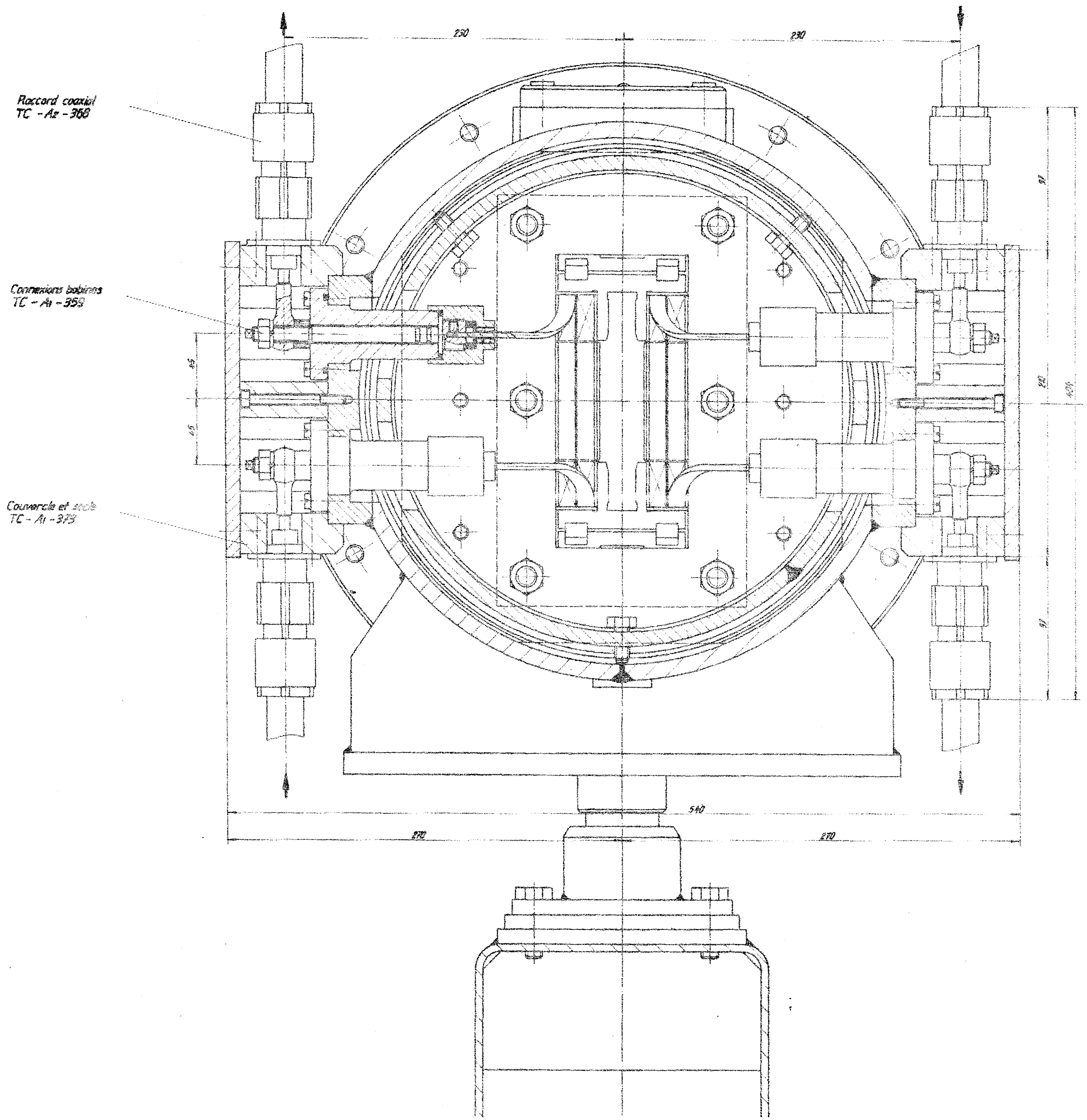


fig. 5

Firing Circuit

Clessi 12/9/65

Coupe A-A



Ensemble TC - A1 - 369

Armand Pulzé

Coupe transversale
Ensemble (A - A)

Echelle 1:1

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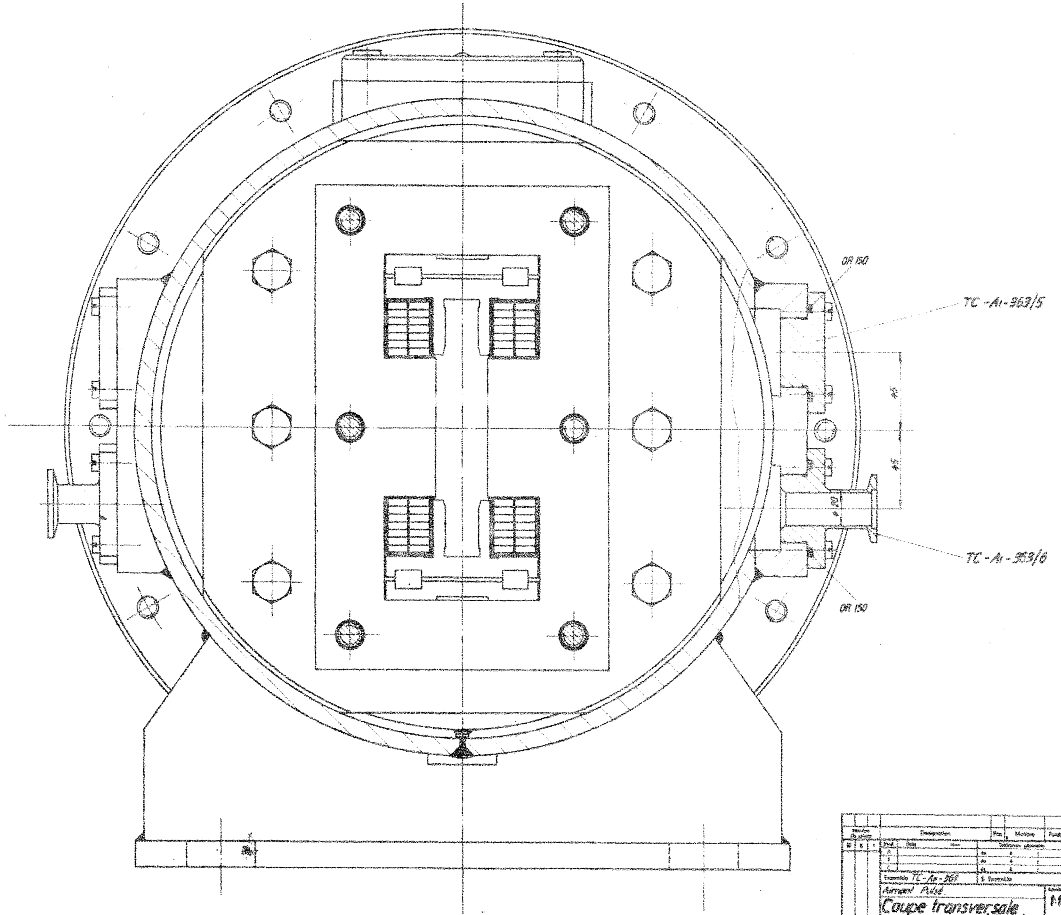
TC - A0 - 370

Coupe B - B



Ensemble TC - A1 - 360

Aimant Pulsé

Coupe transversale (B - B)

Ensemble

Échelle 1:1

Dessiné 11.5.61

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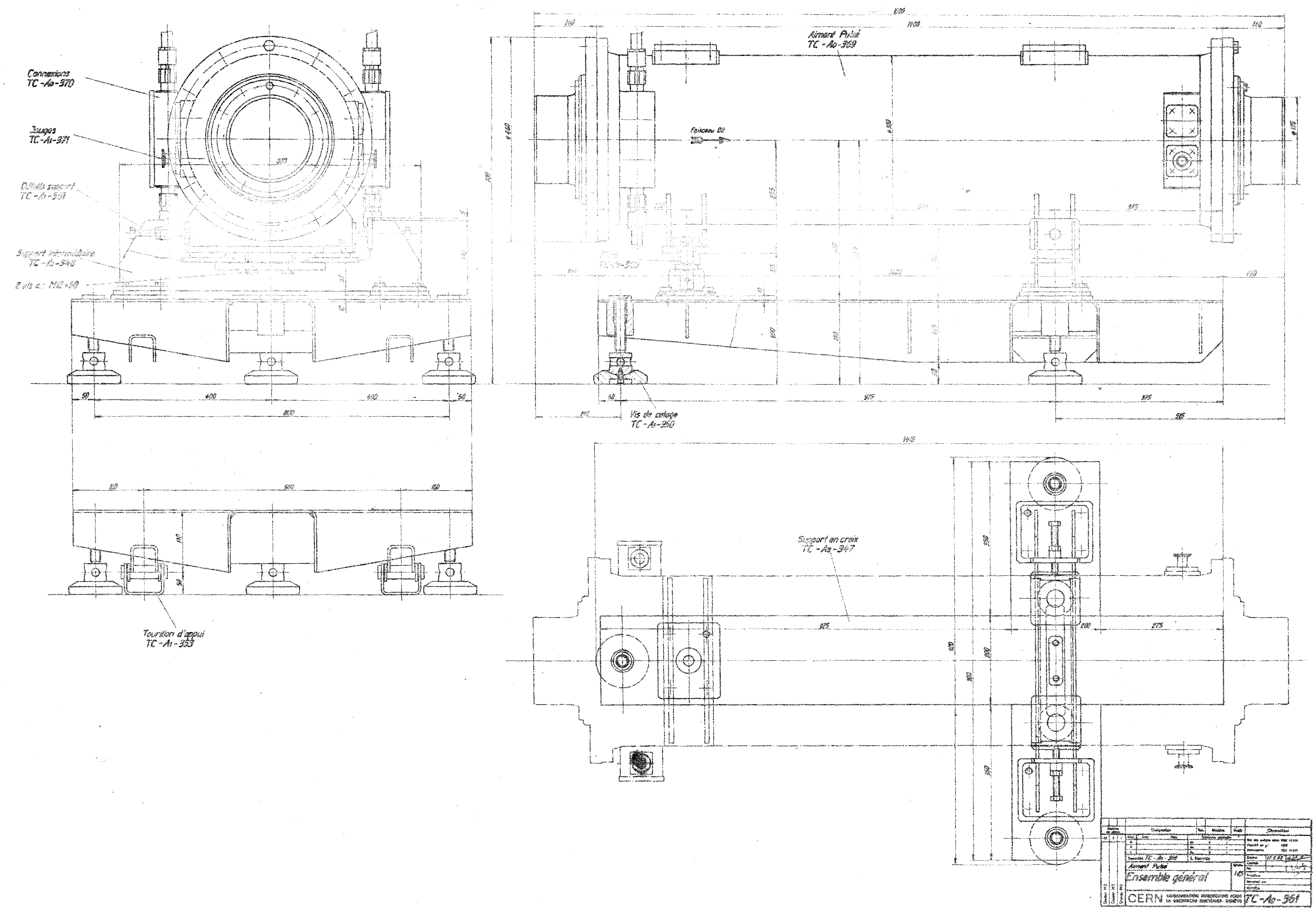
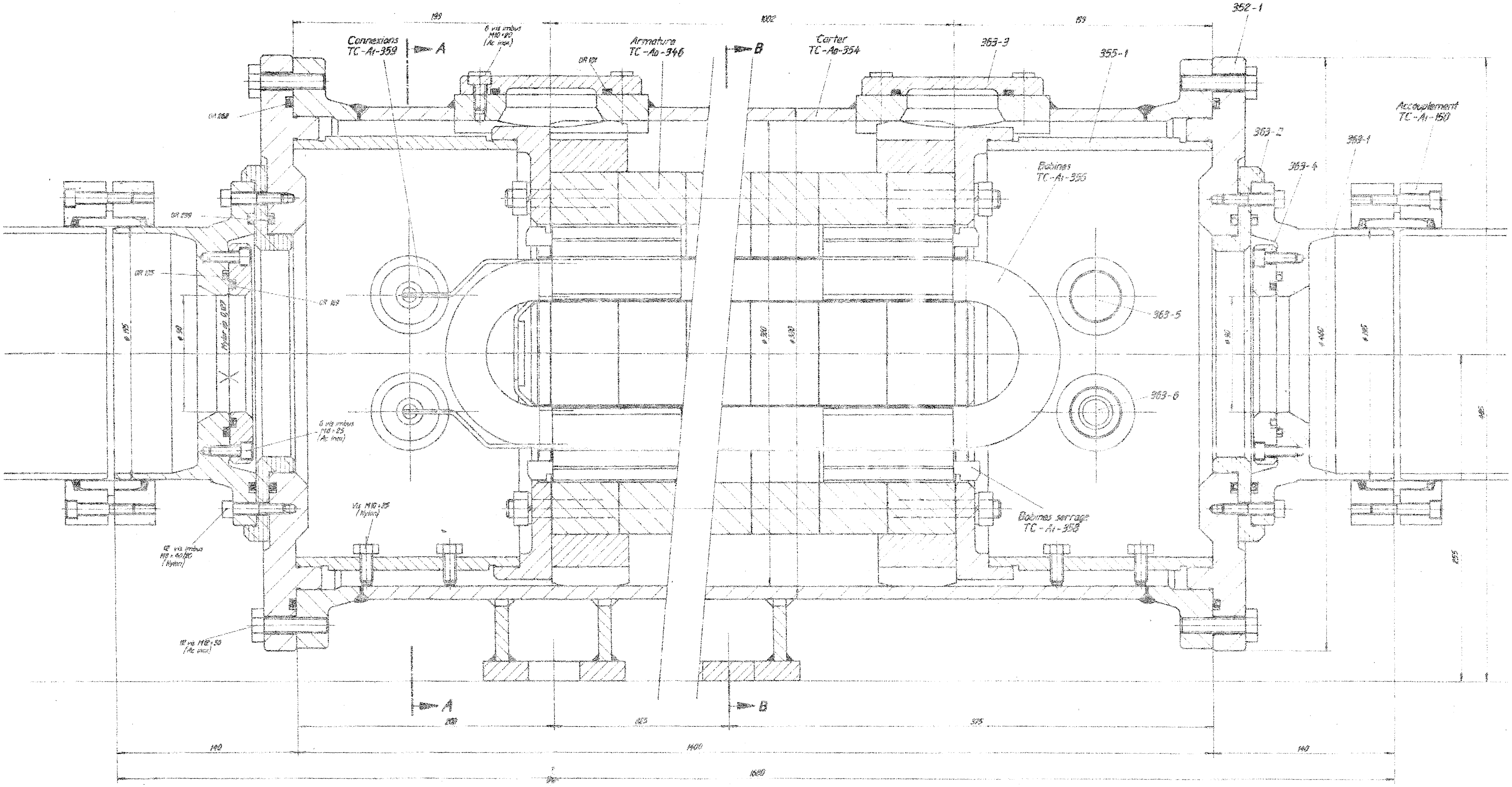
TC - A1 - 371



Connexions
TC-Ao-370
Jauges
TC-Ai-371
Détails support
TC-Ai-351
Support intermédiaire
TC-Ai-348
2 vis ac. M12×50
Tourillon d'appui
TC-Ai-353
Aimant Pulsé
TC-Ao-369
Faisceau 02
Vis de calage
TC-Ai-350
Support en croix
TC-Ao-347
Ensemble TC-Ao-368
Aimant Pulsé
Ensemble général
1:5
CERN
TC-Ao-361



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

Ensemble TC-A0-365

Aimant Pulsé

Coupe longitudinale

Ensemble

Échelle 1:1

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TC-A0-369