RF Book

RF Note #49

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DA2 - PS FAST TRIP CIRCUITS

Gen. We have a power supply acquired from PPA rated at 3KV, 15 amps. This P.S. has two seriesed remote trip contactors, connected with resistors to provide step-start capability. This feature was included because of the large filter capacitor (200μF) in the output. In addition, there is a crowbar, 1/2 cycle vacuum relays, and current monitors for each of eight (8) outputs. Front panel switches can, under no load conditions, disconnect any of the outputs.

We propose to use this power supply to provide six (6) outputs: three for each of the drivers at 3 KV, 2 amps each, and three, using a circuitry addition as documented in RF note No 38, to supply screen power to the finals at 1500V, 1 amp each.

Fig. 1 is a simplified diagram of the power supply. We are fortunate indeed to have a drawing of the power supply: 5 RED-2L-G.

Crowbar

There is a FP & RP BNC for inputting a "crowbar fire" pulse. This requires a logic + gate to turn on a 2N1599 SCR. This in turn fires a 6279 hydrogen thyratron which, in turn, fires GL7171 ignition and crowbars the supply. There is a ferrite core which gives an output to two FP BNC's from a .5 Ω source impredance.

Interlockery

There is an interlock chain to give permissive control to K1 & K2. A Gaurdian overcurrent relay will turn the supply off and must be manually reset. There is provision for "local" and "remote" operation. If there is a crowbar then the Jennings vacuum switches automatically open and this in turn causes K1 & K2 to open. Remote control is achieved through AX22, 33 & 34. No doubt all will be obvious to W. Johnson.

Figure 2 shows the circuit contained in an auxilliary relay rack. It has the filter and the screen voltage generators. Fig. 3 shows how the six outputs are to be connected, specifying the number of turns through the current transductors. These transductors, feeding a 50 Ω terminated cable, give 0.1 volts per ampere turn and are flat from dc to 1 MHz. They saturate at 30 ampere turns, but are not destroyed by a 10,000 amp pulse.

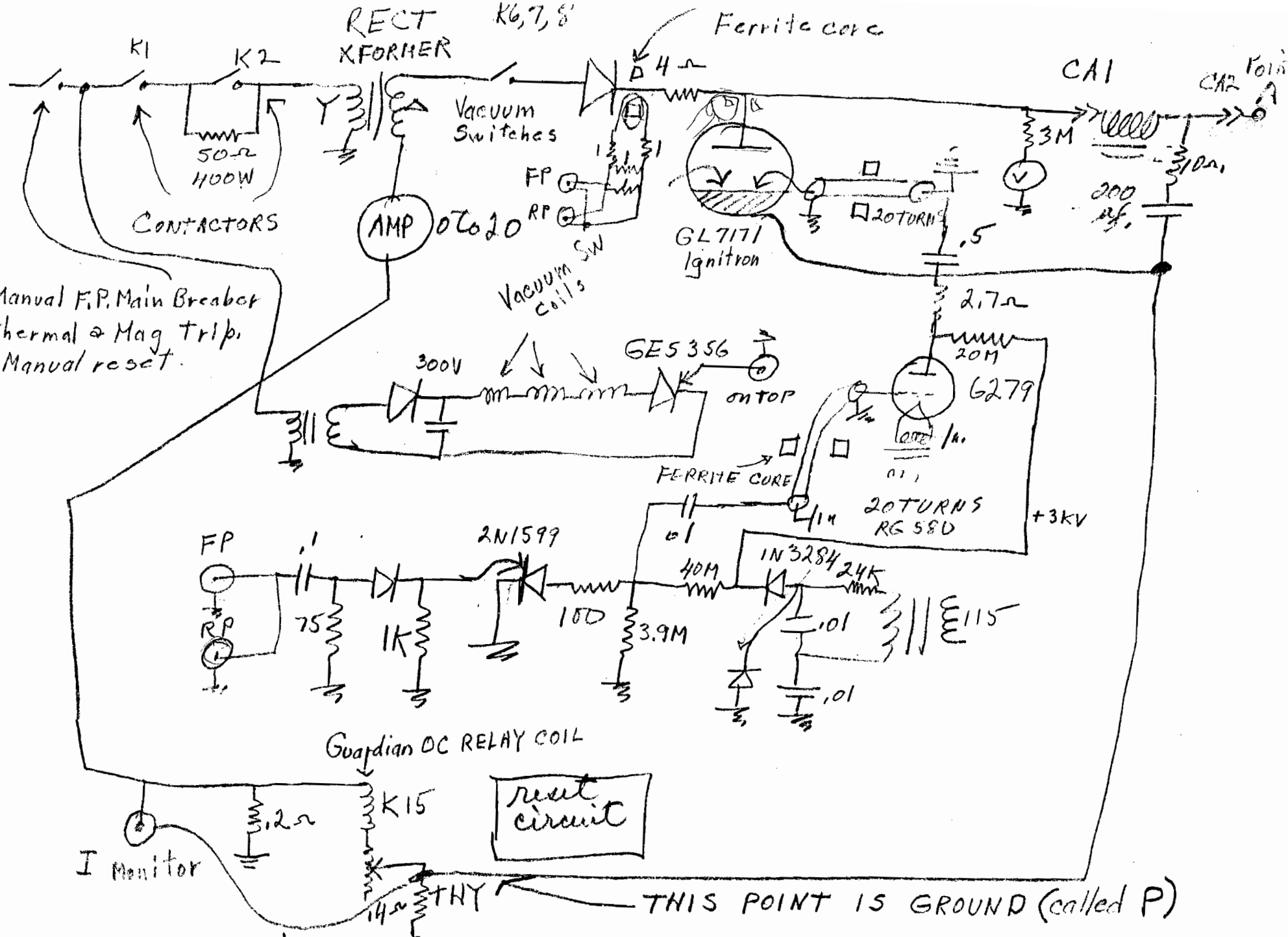

FIG. 1
SIMPLIFIED DWG. OF DA2 P.S.

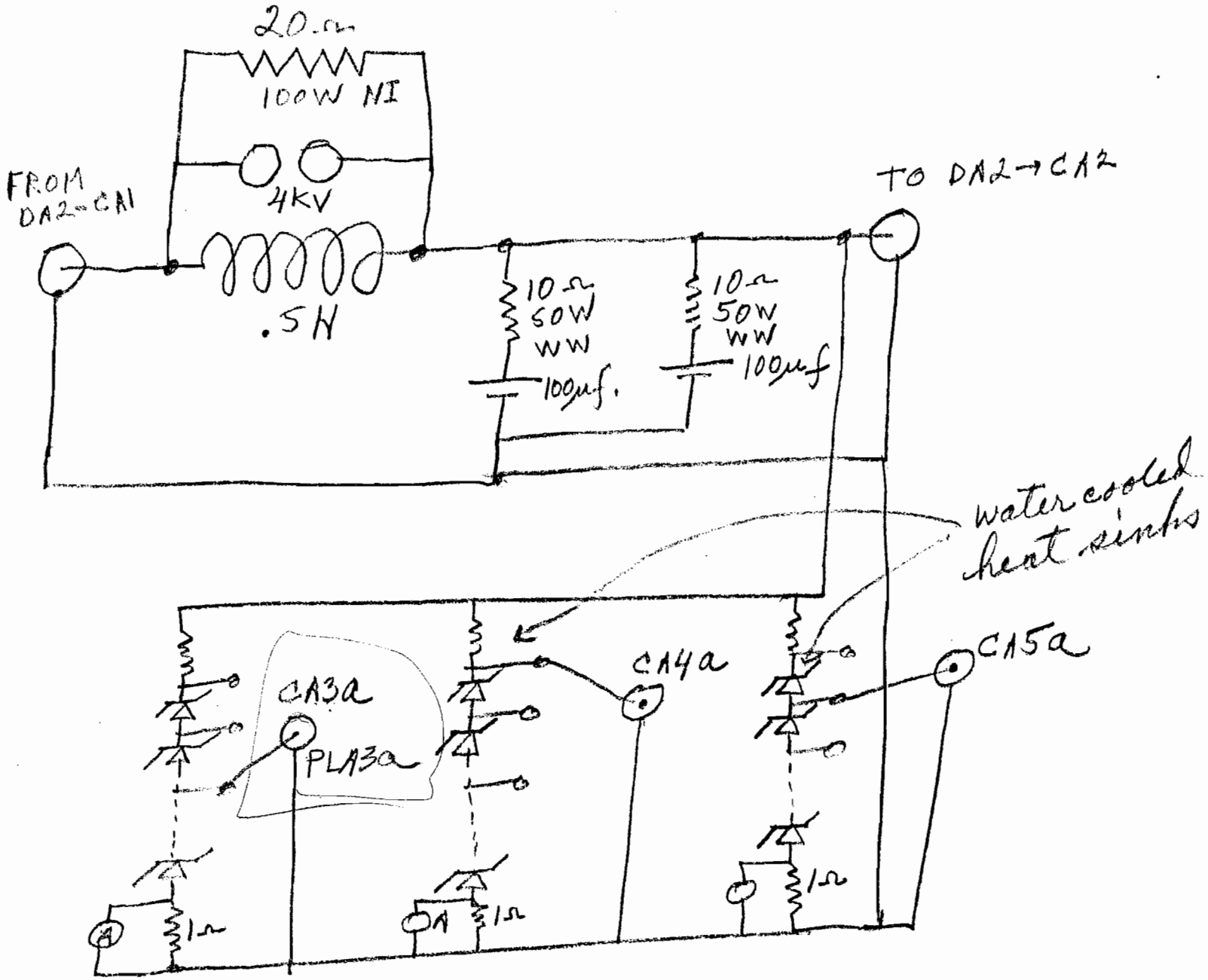

FIG 2 → DA2 FILTER

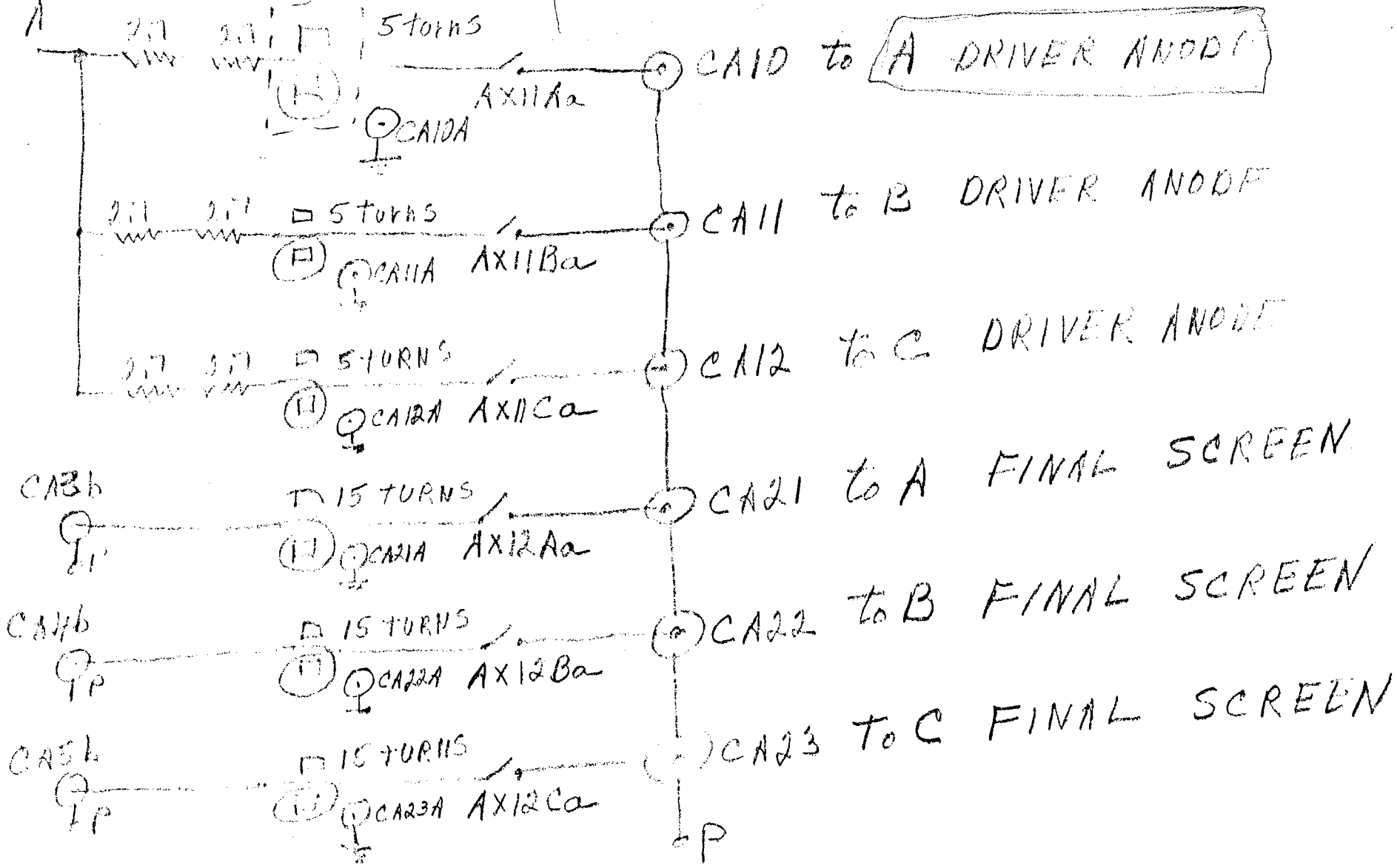

FIG 3

OUTPUTS OF DA2

So for our purposes, for each driver, whose maximum current requirements will be less than 3 amps, we will use 5 turns, and for the screens, 15 turns, of the guts of RG 58μ, or equivalent.

Now we have disposed of the P.S. The essential features are that it self crowbars, is self protecting, has an input for external crowbarring, for external on-off (via K1 & K2), will trip on overcurrent, and delivers six outputs and six output current monitors.

FAST TRIP CIRCUITS

A. Purpose

The purpose of these circuits is to first, protect the driver plates and final screens from damage; second, to provide signals to the amplitude regulators to avoid trips due to overcurrents without damage; third to provide monitoring and memory for display.

B. Method

The six current monitor signals from CA10A etc will first go to a buffer amplifier (Opamp) with a gain from 2 to 5 such that the outputs are at a suitable level to be fed into logic circuits. These buffered signals will be fed to output BNC's or test points for oscilloscope monitoring, and to front panel meter relays. Excessive current on any of these relays will shut DA2 and the driver screen supplies off, with memory indication left to ascertain which one was responsible. This is the final back-up for tube protection, and shouldn't ever have to be used unless all else fails. A manual reset is in order.

The buffered signals then go into level 1 discriminators (adjustable via screw driver). Whenever a current exceeds level 1, a logic gate will be outputted to the station amplitude regulator, and a light will come on, and stay on until reset. For the driver plates this level 1 is 2 amps, and for the final screens, 0.9 amps.

These buffered signals then go to level 2 discriminators. These levels (settable via screw driver) are about 50% higher than level 1 settings and will fire the crowbar, provide 1st event memory indication, and be manually resettable.

Figure 4 shows the circuits for each of the 6 circuits; of course there is only one first event detector.

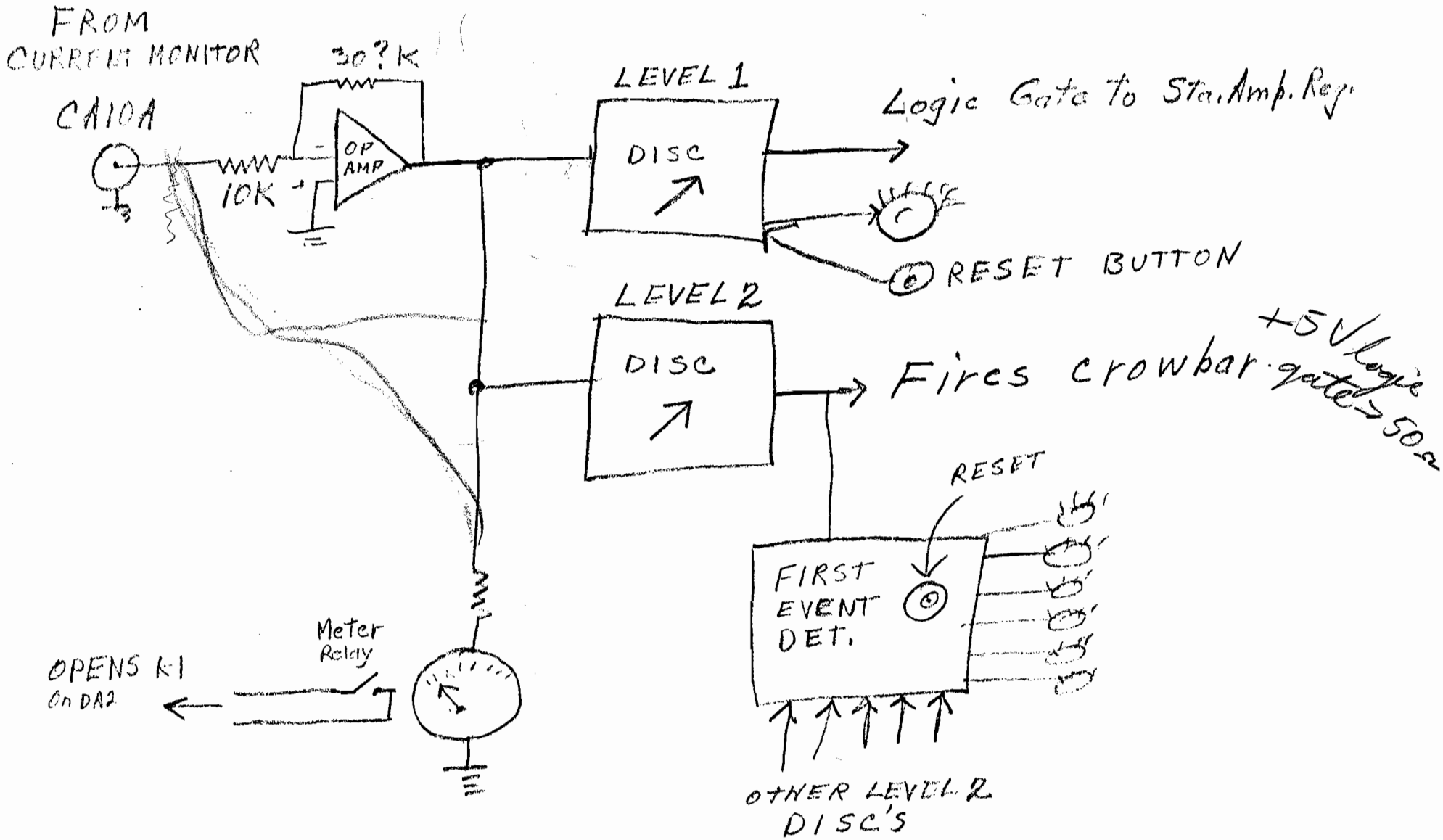

FIG 4

One Fast Trip Circuit.

Other

Now DA2 will normally be turned on and off via the Modicon associated with the control and display circuitry of the station or master control panels. However, if DA2 trips off either for overcurrent or crowbar the operator must go to the DA2 trip circuit panel to reset it so that he is forced to see why. In the normal course of events this will seldom happen. Another thing: if the final anode PS crowbars, then DA2 must also crowbar and appropriate displays should show that DA2 tripped because the final crowbarred. In this event, the reset for the final should also reset DA2. The controls engineer can have a happy field day here, and I wish him success.

Packaging

The controls engineer gets to choose the method of packaging! Since there are seven panel meters (I forgot to mention the necessity of also having a voltmeter on the panel), perhaps a 3 or 4 unit wide NIM module with thin meters would be satisfactory. On the other hand, a standard chassis with a full 19" wide panel is not out of order. Ah! what an opportunity for someone to exercise his artistic skills!

Afterthought

Another circuit in the fast trip circuit should monitor that B^+ exists at the anodes of the thyratron and ignitron of the crowbar circuit and prevent PA2 from turning on if these are absent. Another circuit should monitor and display the fact that the crowbar did fire, and a veeder counter should keep track of the number of such crowbars.

/pcp