GLINT NO. 325
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DECLINATION READOUT

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General. The layout of the gear train is shown schematically in Fig. 1. If it is at all possible to grind the "body filler" so that the radius is accurate to ±9 thousandths of an inch, then the readout will be accurate to ± ½ minute of arc in 90° of travel. The counter will read 10 minutes of arc for revolution. Each division of the counter unit wheel is divided into intervals of 0.2 minutes of arc. The pinion speed is $\frac{5 \times 927}{47} = 98.61$ minutes of arc per revolution. Each tooth of the pinion is thus $\frac{98.61}{18} = 5.48$ minutes of arc, hence backlash is very important. For the next gear of 103 teeth, each tooth corresponds to 0.957 minutes of arc so that a backlash of up to 1/10 of a tooth can be tolerated. Backlash in the rest of the train is unimportant.

At the other end, the synchro error is the determining factor. These synchros have a torque gradient of 0.47 inch oz/degree so that for a load of 2 inch ozs. there is an error of ± 4 degrees. Since the synchro reads 5 minutes of arc for revolution, the error due to this is only $\pm \frac{4}{360} \times 5 = \frac{1}{18}$ minutes of arc. This assumed torque is greater than is expected and therefore should not cause any difficulties. Because of the high step-up of the gearing the pinion load is high and was measured at 3 lb inches. This torque was required to turn the synchros with the readout synchro loaded by 2 oz inches.

It is intended that the counter should read 9000 at 90° north declination and decrease towards the south. No provision is made for easy resetting of the counter.

As well as the mechanical counter, an impulse counter is provided which has an electrical readout. This is used to find coincidence with the required declination number. This is preset for all five antennas on a thumbwheel switch. At coincidence the antennas will stop individually.

The impulses for this counter are derived from a 5 toothed wheel by an optical reader. The counter receives pulses at the rate of about 16 per second which is below its rated capacity of 25 per second.

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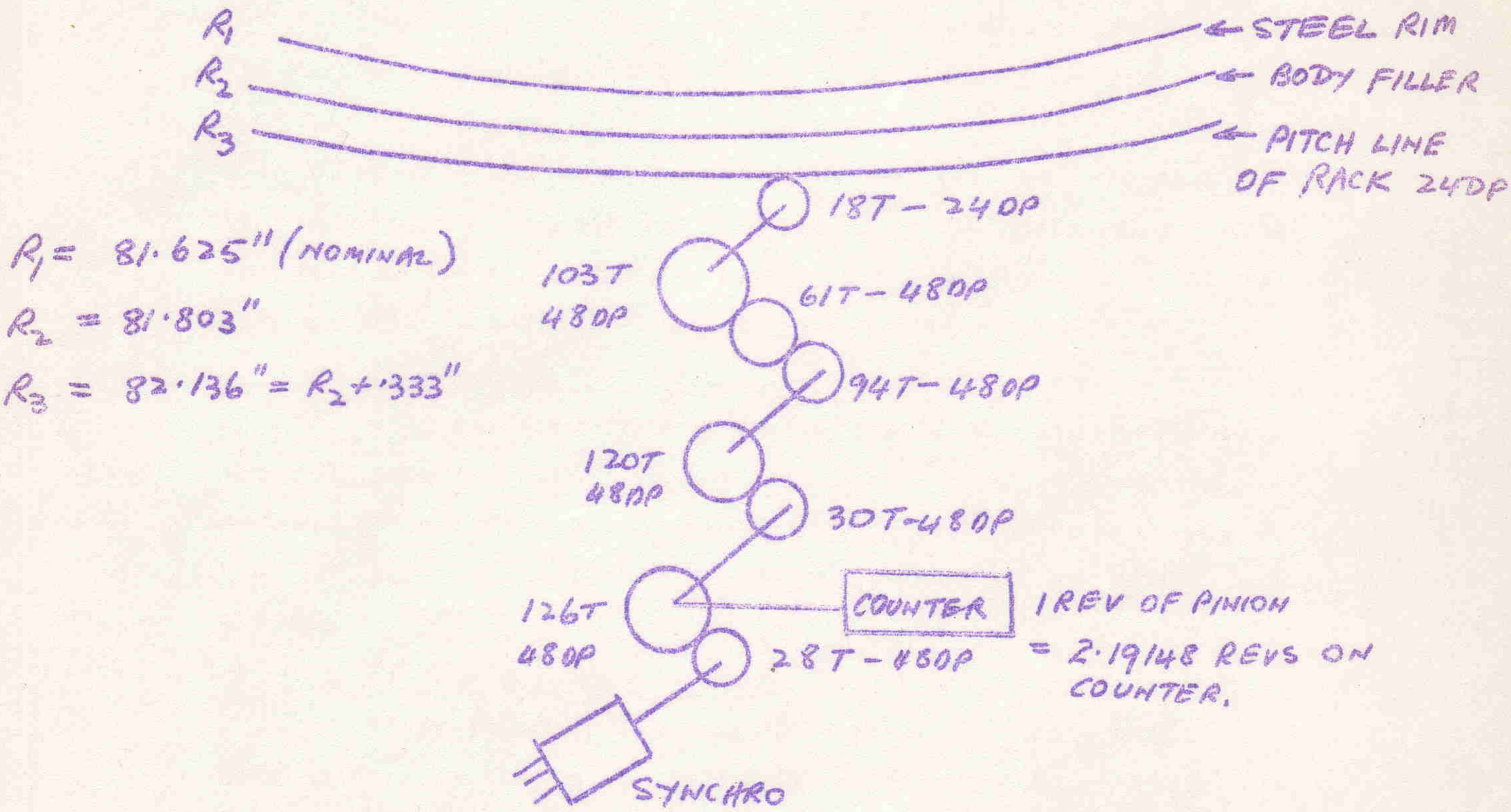
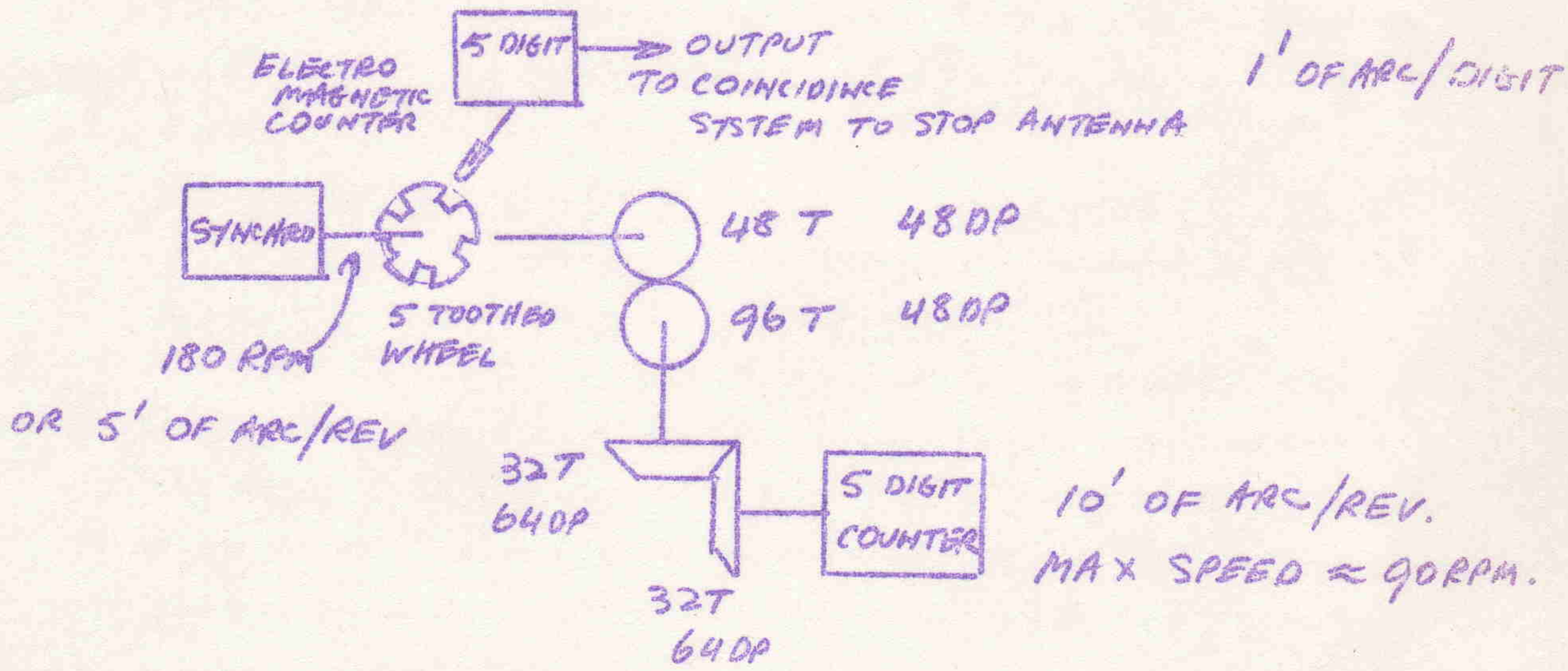


R_1 = 81·625" (NOMINAL)

R_2 = 81·803"

R_3 = 82·136" = R_2 + ·333"



FIG

GEAR TRAIN FOR DECLINATION READOUT.

The panel layout for declination control and readout is shown in Fig. 2. The top unit contains the normal operating controls and readout. The bottom contains the main power switch, emergency stow and danger zone controls.

To operate normally the mains are switched on, either slew, inch or stow control is selected and then appropriate buttons are pressed. (Because of the high starting current of the declination motors, it is desirable that they all be started at different times.)

a. <u>If antennas are stowed</u>

All that is necessary is to slew south. The solenoid to unlock the stow latch is connected across the south contactor and so will unlock automatically. Once outside the stow range a switch operates to remove power from the stow lock solenoid. (See diagrams RB-685 and RB-687 for wiring details.)

b. <u>If antennas have to be stowed</u>

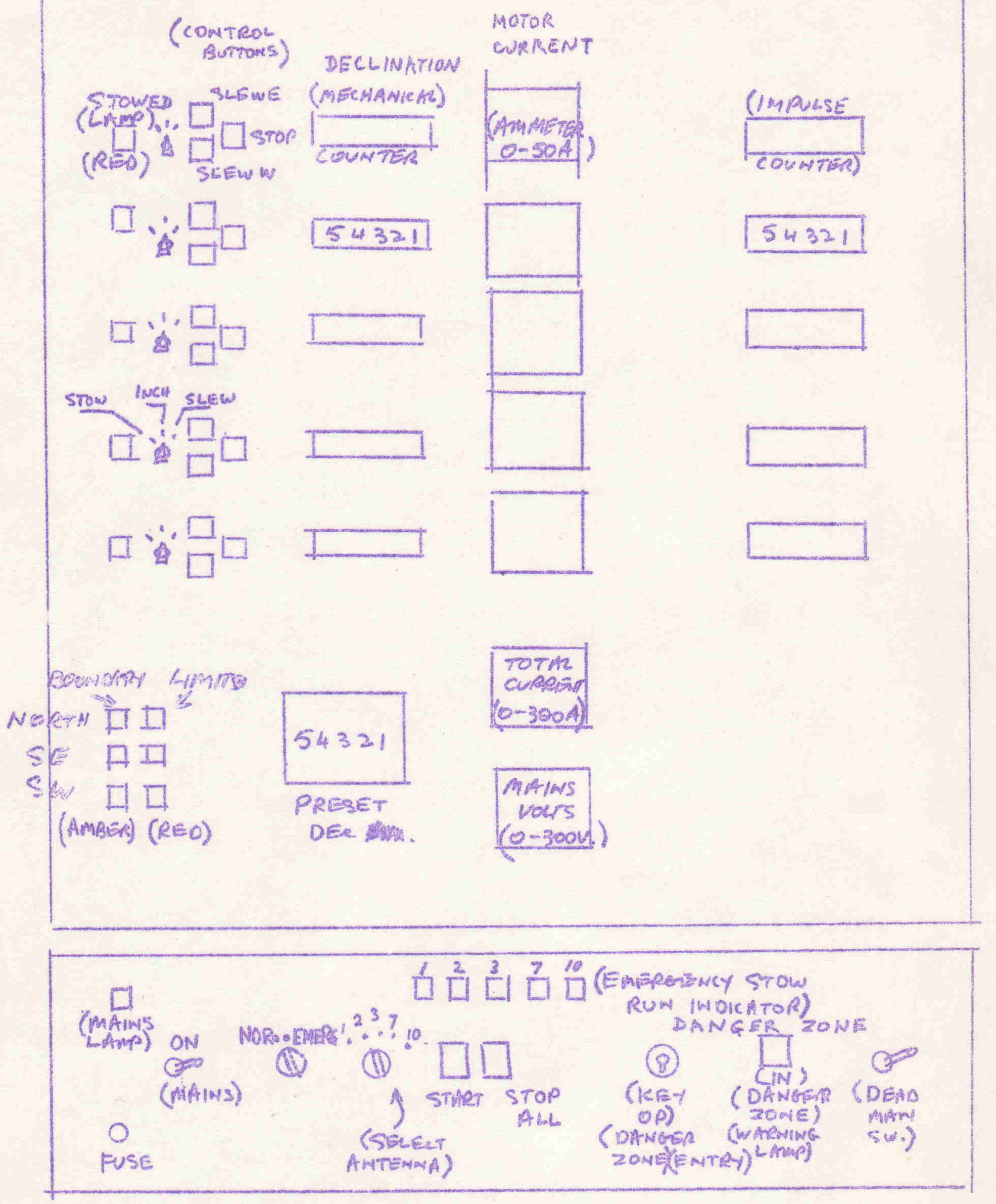
It is first of all necessary to set to the correct hour angle. This is done on the RA control panel with switch S4 in Meridian Set position. Once in this position the RA meridian switch overrides the north boundary and limit switches. Then when the stow position is chosen on the declination readout panel, pushing the slew north button will cause the antenna to stow. (The button must be manually depressed during this operation.) There are other limits which come into play to prevent accidental movement in δ hour angle and to switch off the north drive when stowed.

c. <u>Antenna is against a boundary</u>

All that is required is to drive in the opposite direction.

d. <u>Antenna has to go to preset declination</u>

First of all it is necessary to set in the required declination on the preset switch, then drive the antenna in the required direction with the selector in the slew position. If the preset number is the same as the antenna then it will not run so the number would have to be changed. Once the preset number is reached the antenna cannot be started again until the selector switch is turned to inch or stow. Momentarily switching from slew to inch and back to slew will reset the auto stop relay (RB 689).



( ) means omit from panel

DECLINATION READOUT AND CONTROL PANEL.

FIG. 2

Emergency Procedure. If the switch on the lower panel is turned to emergency stow, then the antennas can be driven with maximum power in the northerly direction only. They can only be started one at a time by the one start button and have to be selected by the rotary switch - once selected they will continue to run until the stop button is pressed or they reach a limit. The stop button controls all antennas. When the emergency stow switch is closed, it will be impossible to operate the antenna using the normal push buttons.

Note: Current meters are provided which should be watched carefully during this operation. They are also used to make the decision to use emergency stow.

Entering Danger Zone. To drive the antenna beyond the boundary switches, the key operated switch is closed. Then by holding down the spring loaded "dead man" switch, the antenna may be driven in the manner of above. If the "dead man" switch is released the antenna will stop. Using this provision, the antennas can be driven individually into the limits. Only authorised personnel should be allowed to use this facility.

Remote Operation. Provision is made to operate the slew and inch controls at the antenna by using the control room -- or local selector switch in the connector box at the antenna.

However no provision is made to operate the emergency stow, or the preset declination, or the danger zone entry switch at the antenna station.

List of Drawings

Circuit Diagram

RB-685 Antenna limit switches

RB-687 Declination Motor Control

RB-690 Optical pulse generator to drive impulse counter

RB-689 Coincidence circuit for preset declination

Mechanical

Synchro Gear Box

RD-681

RD-682 same for R.A.

RD-683

Readout Unit

RC-676 Dec. Readout details

RC-668 Main Frame

RC-679 Front Panel layout

RC-678 Front Panel drilling details

RD-675 Readout layout

RC-680 Readout Gear Train

RC-677 Back Plate detail

Jobs to be Done.

1. A mounting bracket will have to be designed to be welded to the declination sprocket box to carry the synchro gear box. It was intended that the rack be mounted on the western edge of the rim which means the gear box has to be mounted on the northwest corner of the sprocket box.

2. To complete the other 4 readouts nearly all the components will have to be ordered.

The only item of which there are 5 is the electromagnetic counter.