2. The primary source of power for the HT and bias rectifiers and the heater transformers is the ~~12.6~~ 14 KVA, 48.5 c/s three-phase alternator.* The field of this alternator is fed from the exciter, whose field is in turn fed from the main through a metal rectifier and a series regulator.† The regulator consists of four 12E1 tetrodes in parallel; their grids are driven from a control amplifier, whose output depends on the three phases of the alternator output. The regulated supply is 'run up' by a motorised potentiometer, which supplies part of the input to the control amplifier while the heaters are warming up. The alternator output can be reduced to zero, without stopping the motor, by switching off the exciter field; this happens if a fan or bias alarm fuse blows or if one of the 'heater off' buttons is pressed.

3. Three-phase metal rectifiers are used for the bias and HT supplies. The bias voltages are held steady against fluctuations in load by the use of high-wattage bleeder resistors. There are basically three bias supplies, the -4V supply being obtained from a tapping on the -10V bleeder resistor. The HT supplies are stabilised by controlled shunt units consisting of ten 12E1 tetrodes in parallel; there are two of these units in parallel across each of the positive HT supplies, and one across the negative supply. Marginal-test facilities are provided by high-wattage rheostats mounted in bay 1 of the computing cabinet, which are short-circuited by a high-duty switch on the engineer's panel when not required.

4. The field current of the 145.5 c/s, 1 KVA, three-phase alternator, which drives the drum motor, is controlled by a series regulator unit similar to the unit used to regulate the exciter field. The grids of the valves (12E1) in this unit are fed from a discriminator circuit, which is constructed as a standard computer package, and in which the frequencies of the drum-clock-track output and the output of a packaged 1/3 Mc/s crystal oscillator are compared. The discriminator output controls the regulator unit, and hence the speed of the drum, to give a difference of about 250 c/s between the frequencies of these two signals.

## MOTOR-ALTERNATOR

5. The motor-alternator is switched on by a push button on the engineer's panel in the control desk, or by a push button on the star-delta starter. The switching circuits are fused and energised when the star-delta isolator is closed, as shown in fig. 2.1, the switching lines to the desk passing through suppressors in the power-supply cabinet and through a fourth pair of contacts on the main isolator. The motor starts off star-connected. When one of the 'start' buttons is pressed, the line contactor is energised, and the mains are connected to one end of the field windings. The initial position of the contacts on the timing relay is such that operating the 'start' button energises the star contactor, too, to connect together the remote ends of the field windings.

6. The timing relay, an Allen West component, type TR, incorporates an eddy-current delaying device. When it is energised, by pressing the 'start' button, the movement of the armature compresses a pair of springs; these, in attempting to expand, lift the main tripping stirrup. The movement of the stirrup, however, is coupled through a lever and gear train to an eddy-drag disc rotating between the poles of a permanent magnet, which constrains its rate of movement. After about ten seconds, during which