PROVINCIAL STUDIO AND CONTROL EQUIPMENT

PART 6. POWER SUPPLY CIRCUITS

The power supplies required for operating the control room are as follows :—

High tension	300 volts	
Low tension	6 ,,	
Grid bias	30 ,,	(tapped at 2v., 12v. and 24v.)
Relays, lamps, buzzers	24 ,,	

All the supplies are obtained from batteries which are installed, together with the necessary charging plant, in duplicate. The normal arrangement is to charge the H.T., L.T., and 24-volt batteries from D.C. generators and the grid-bias batteries from rectifiers.

The three generators, together with their common exciter, are all coupled together and driven by a single motor which is designed to operate off the main supply available at the station. The motor starter is generally of the pillar type and stands in the machine room. The battery charging equipment is mounted upon a switchboard in the machine room and the battery discharge switchgear upon the rack in the control room.

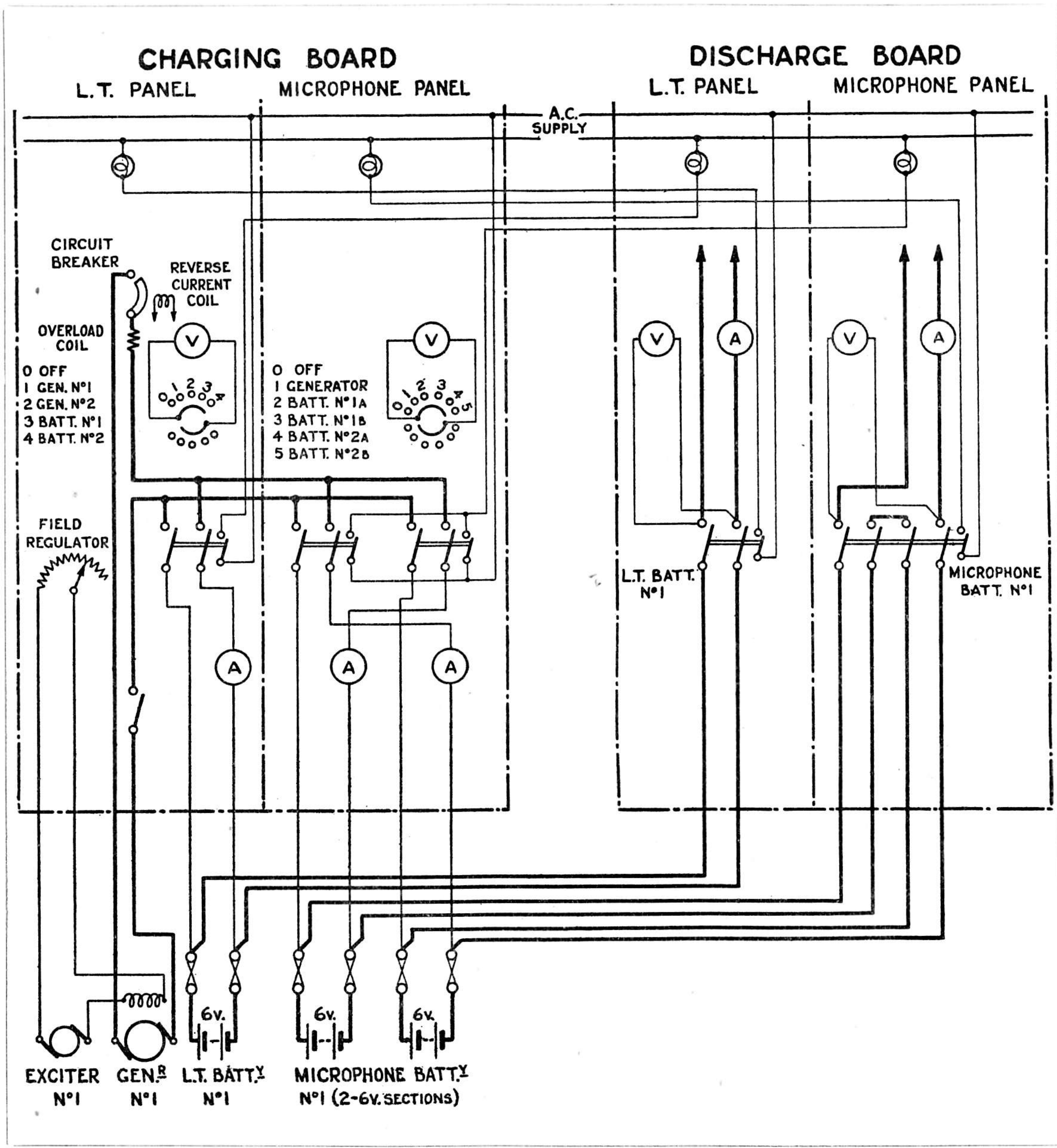
With the exception of Birmingham the mains supply at all stations is A.C. at 50 cycles, either single-phase or three-phase, but the voltages differ considerably.

At **Birmingham,** the H.T. batteries are charged via resistances directly from the D.C. mains, an automatic cut-out being provided. The field excitation of the L.T. and relay generators is also obtained from the mains. At this station the grid-bias batteries are charged from the relay generator, but seeing that the voltages are not the same, the batteries cannot be paralleled for charging at the same time.

At **Edinburgh** the charging equipment is quite special and is described later.

A simplified schematic of the charging and discharge switchboards is shown in Figure 1. Only the L.T. and Microphone panels are shown for each switchboard and only one circuit in each case. In practice the equipment shown is duplicated, while the equipment of the H.T. and relay panels is similar to that of the L.T. panels shown. The microphone battery, of course, is not now used. The field circuits of the generators are all connected in parallel across the common exciter output.

In the case of the **Charging Switchboard** the No. 1 generator and the No. 1 battery are always associated together. The motor generator output circuit is completed on to the charging busbars via a single-pole knife switch and circuit breaker. The circuit breaker is fitted with overload and reverse coil releases and a limiting device is provided in series with the latter. The battery charging circuits are completed via double-pole single-throw knife switches, individual ammeters being equipped in each positive lead. A voltmeter is provided on each of the panels of the charging switchboard and a multi-point rotary switch enables it to



N.B.—The microphone battery is no longer used.

*Drawing S.*1033, *Sheet* 1.

Fig. 1. Typical Arrangement of Power Supply Switchboards at Provincial Stations.

be connected so as to read the output voltage of either generator and the voltage of either battery. In the case of the **Discharge Board** the output sides of the switches for the duplicate batteries are paralleled; the discharge ammeter and voltmeter are therefore common and are permanently connected in circuit.

When *placing a battery on charge*, the motor must first be started and the circuit breaker and single-pole knife switch closed. The battery voltage should be checked and the hand regulator adjusted to bring the generator output volts to a value slightly greater (say 5%) than that of the battery. The battery charging switch should then be closed and the field regulator again adjusted to obtain the normal charging current. The act of placing either of the alternative batteries on charge completes a circuit via an auxiliary contact on the switch, which lights the lamp above the associated discharge switch on the discharge switchboard. Similarly, when either of the discharge switches is closed in the control room, a lamp is lighted on the charging switchboard to indicate that the particular battery is in service.

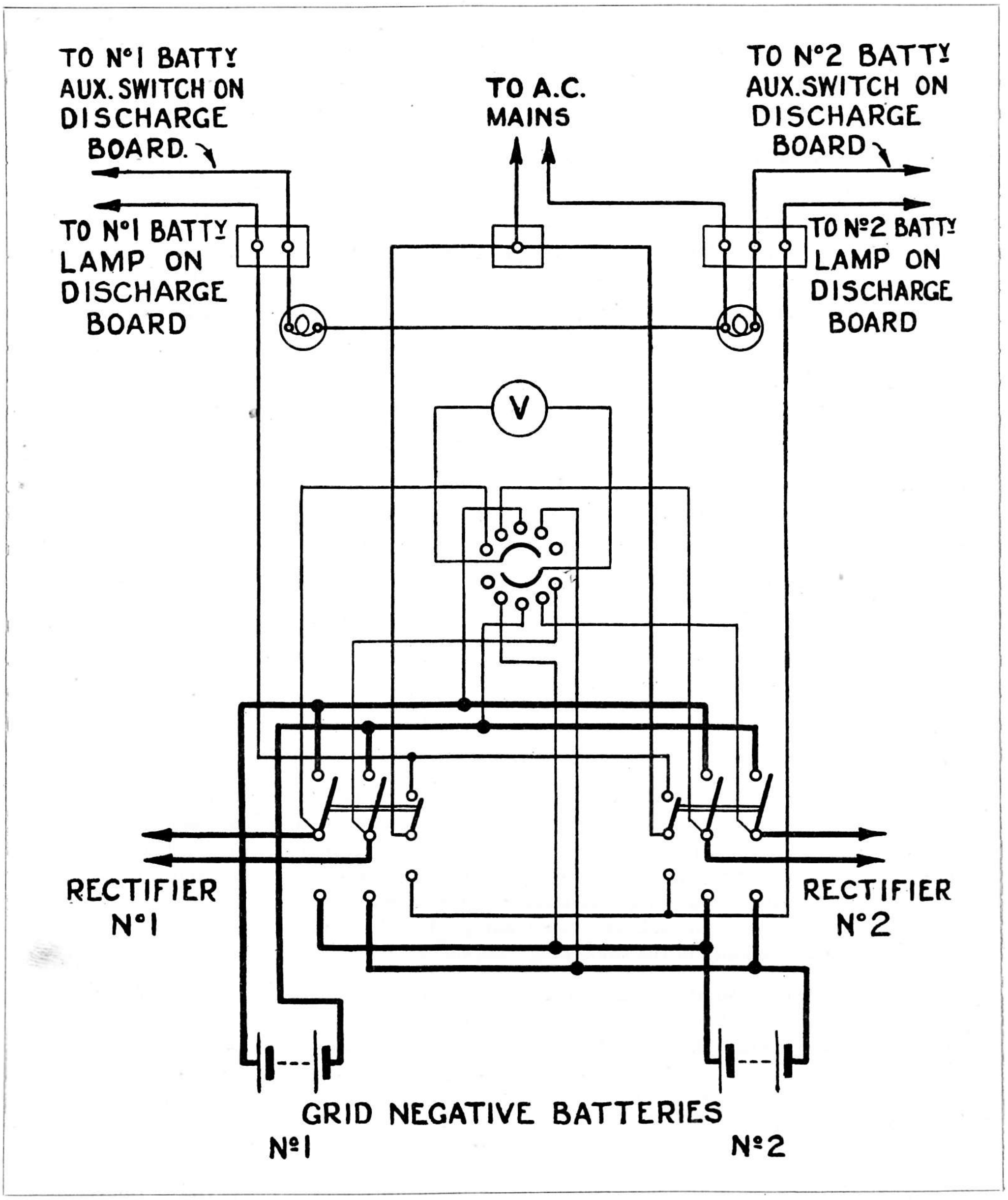
At certain stations, where there has been a considerable increase in the load since the plant was installed, the practice is to float the L.T. batteries instead of placing them alternately on charge and discharge. Pending the installation of automatic voltage regulators the charging rate is adjusted as required in order to maintain the voltage constant by manual operation of the generator field rheostat.

The arrangement of the **grid negative** switchboard is shown in Figure 2. Double-pole, double-throw switches enable either rectifier to be used for charging either battery. The voltmeter on the panel can be connected by means of its switch for measuring the voltages of both rectifiers and of both batteries. Warning lights, interlocked with the switches, are provided as for the switchboards already described.

At **Edinburgh**, rectifiers are used instead of machines for charging the batteries. Three-phase double-wave rectifiers, operating from the 400 volt, 3-phase, 50 c/s supply, are used for charging the L.T. batteries. Single-phase, double-wave rectifiers, operating from the 230 volt, single-phase, 50 c/s supply are used for charging the H.T. batteries and the relay and grid negative batteries, the two latter being charged at different times from the same rectifier. The three-phase system used for the principal load, has the advantage that the ripple in the rectified supply is at 300 c/s so that an economy in the smoothing equipment is secured.

The rectifiers are installed at the back of the charging switchboard which consists of five bays. Bay No. 2 carries the L.T. battery charging circuits, and the switchgear required for controlling the rectifier equipments. Bays Nos. 3 and 4 carry the grid negative and relay battery charging circuits respectively, and bay No. 4 the switchgear for the common rectifier equipments. Bay No. 5 carries the H.T. battery charging circuits and the switchgear for controlling the H.T. rectifier equipments. Mains fuses and watt-hour meters are provided for each of the incoming mains supply circuits and these are carried on the lower panel of bay No. 1.

The voltage input to each rectifier is regulated by means of a tapped choke coil in the rectifier input on the mains side of the transformer, and the supply is connected to the rectifiers via single-pole knife switches and fuses of the triple-pole or double-pole type, as required. The rectifier outputs are connected to the busbars via single-throw double-pole knife switches. The charging circuits are equipped with double-pole single-throw knife switches and ammeters, four circuits being provided on bay No. 1 to cater for the four 6-volt sections into which the two 12 volt microphone batteries are divided for charging purposes.

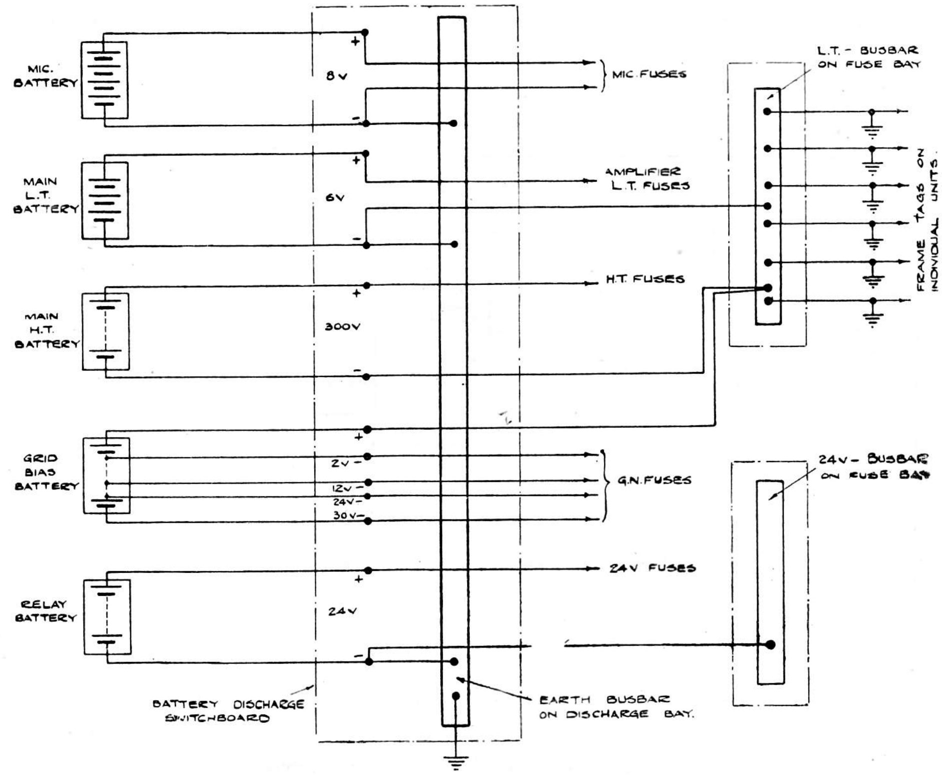


Drawing S.1033, Sheet 2.

Fig. 2. Connections of Grid-Negative Battery Charging Board.

A voltmeter with fuses and a switch is provided on each bay to enable the battery, busbar and rectifier output voltages to be read as required.

As at other stations a system of lights, operated by means of auxiliary contacts on the charging and discharge switches, is equipped for giving a warning on the charging switchboard in the rectifier room when a battery is placed on discharge and on the discharge switchboard in the Control room when a battery is placed on charge.



N.B.—The microphone battery is no longer used.

Drawing A.2412, *Issue* 3.

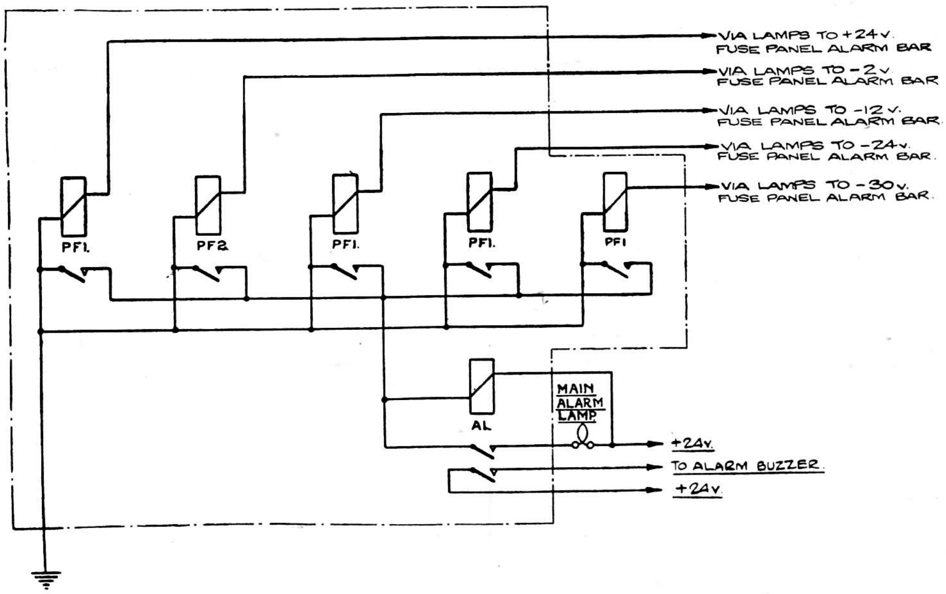
Fig. 3. Battery Earthing Arrangements.

The Battery Earthing arrangements are shown in Figure 3.

The fuses are mounted on the fuse bays on strips each carrying a number of fuses of the same type. Individual *H.T. fuses* are provided for each of the amplifiers. These are of the 'Siemens' glass type rated at 0.3A. The filament circuit to each amplifier and the microphone polarising and L.T. supply to each studio is separately fused. The filament connections are made via *filament decoupling units* FD/1 which comprises a series choke of 0.0125 or 0.03 H. and a 2,000μF. electrolytic condenser connected across the filament relay contacts. The *L.T. fuses,* in each case, are of the P.O. 20/5 cartridge type rated at 5A.

Failure of an H.T. or L.T. fuse is covered, in common with other causes of H.T. failure, by the amplifier alarm circuits, indication being given by the individual amplifier alarm lamps in the amplifier bay jackfields, and by the sounding of the common amplifier alarm buzzer. A blown fuse can be readily found on account of the discoloration of the holder which results.

Individual fuses are equipped in each of the *grid bias* leads to each amplifier and are of the P.O. 31/1 alarm type rated at ½ A. Alarm type fuses, P.O. 31/2 rated at 1 A, are also used in the case of the *relay battery* leads. The relays and indicating lamps are not all separately fused but those grouped for supply purposes on any particular fuse are in general all associated with the same operating circuit. The *fuse alarm circuit* is shown in Figure 4.



Drawing A.1661, *Issue* 4.

Fig. 4. Fuse Alarm Relay Circuit.

When a fuse blows, a spring normally held in position by the fuse flies upwards and makes contact with the fuse panel alarm busbar associated with the particular row of fuses, thereby providing battery for the alarm lamp mounted at the end of the row of fuses and for the associated **PF** relay connected in series with it. The **PF** relay upon operation completes the circuit for the operation of the common **AL** relay, which in turn completes the circuit of the fuse alarm buzzer and of the main alarm lamp where fitted. Attention is thus directed to the fuse panel, on which the particular fuse which has blown can be readily found by the fact that its coloured indicator is projecting.