How the Socket Power has Helped Radio

A.C. v. D.C. Operation

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WHEN comparing present-day radio receiving sets with those of 15 years ago it is interesting to note that nowadays a set requires more sources of current. Though at first this may seem a retrogressive step in reality these conditions are due to the character of radio reception.

The energy received by an aerial is extraordinarily small even in the neighbourhood of a powerful transmitter. It is therefore remarkable that not only can a transmitter be successfully received over thousands of miles, but that such reception can be amplified to loudspeaker strength.

It is most difficult to measure the amount of energy which is induced in a receiving aerial, and what small energy there is can only be indicated by the most sensitive instruments.

The volume produced by the loudspeaker, which is sometimes so powerful that there is vibration, is not the direct result of the power in the receiving aerial, but is due to power derived from other sources, e.g., "B" battery or power unit.

For about 15 years, amplification was not possible, as the radio valve, as it is now known, had not been invented. In these times the received energy was the only source of power from which audible signals could be obtained, and therefore reception by telephones only was possible.

The reason why reception can now be amplified to any desired strength must not be attributed solely to the fact that transmission efficiency has improved, but to the development of receiving apparatus which enables a considerable amount of energy to be freed by the use of local sources of current supply.

These auxiliary sources supply the current for heating the valve filaments and also the voltage which is applied to the plate or anode of the valve. First dry cells or accumulators were used for both current supplies, i.e., one or more accumulators for the filament and dry cells for the plate.

These two sources supply energy for loudspeaker reproduction, and it goes without saying that the greater the amount of current used, and provided the valves are of the correct type, the greater may be the volume.

An accumulator, especially when only of one or two cells, provides an excellent and constant source of current if it is kept fully charged. Recharging, however, has one drawback. Some accumulators are very heavy, and are therefore difficult to transport to a charging station, and in addition there is the danger of leakage of acid. One way out of this is to charge the batteries where they are used, and to do this energy will be required. Provided electric mains are available the necessary current supply can be derived from them.

The first problem to be considered is that an accumulator must be charged with direct current. In most cases the mains supply is alternating current, which cannot be used for accumulator charging without its first being converted or rectified to direct current. Direct current is also necessary for other purposes in radio work.

Rectifiers, Mechanical and Otherwise.

THERE are various methods whereby alternating current can be converted into direct current. While we do not intend to discuss them all fully it is necessary to give a few details.

By mechanical rectifiers is meant apparatus which converts alternating current into direct current by means of moving parts. In the first place there are rotary convertors, small machines with a rotating armature which are fed with alternating current. The direction of the current is kept constant by means of brushes which make contact with the commutator. For charging accumulators as would be used in the usual type of receiving installation these machines are not used as they are too complicated, too expensive, and too heavy. Besides convertors, there are alternating current motors which are provided with interruptors by which the current can be rectified. These motors also have a rotating movement.

Finally, the current can also be rectified by a vibrating metal spring. If the vibration of the spring synchronises with the periodicity of the alternating current such current can be interrupted so that only one phase passes into circuit. As a matter of fact, there are rectifiers which work on this principle. A transformer (a safety device to prevent short-circuiting should the contact fail), a rheostat, and an ammeter are absolutely necessary.

It is of great importance that the ammeter be of the moving coil type, as otherwise the charging current cannot be tested correctly.

Vibrating rectifiers have various drawbacks which have resulted in this type almost disappearing from the market. Such a rectifier is not by any means silent in operation, and in addition adjustment is rather difficult, often requiring readjustment through alterations of frequency, heating, etc. Sudden alterations in alternating current frequency often occur when cables short circuit give rise to fusing or sparking of the contacts.

Chemical Rectifiers.

CHEMICAL rectifiers are based on the principle that certain elements only allow the current to pass in one direction when the electrodes are correctly selected. As an example we may mention a pointed aluminium electrode inserted into a solution of ammonium-phosphate. In this case a transformer is necessary to reduce the supply voltage and an ammeter and rheostat (or tap switch) cannot be dispensed with.

A rectifier of the electrolytic type is the so-called colloid rectifier, consisting of a colloidal silver deposit in concentrated sulphuric acid with a silver and nickel iron electrode. This rectifier has one advantage, viz., that in this electrolyte the losses are small. Less heat is developed, and a much smaller quantity is sufficient, while a higher output can still be obtained. A drawback is, however, the uncertain life of the cells and unreliable working.

The simplest types of rectifiers are those of the third class, such as Mercury vapour, and rectifiers with oxide coated filament. Both types are based on the principle that a glowing surface emits negative electrons which are attracted by a positive potential and cause a current of electrons (that is, an electric current) from the glowing surface to the point of positive potential. No current can possibly pass in the opposite direction.

The dry copper oxide rectifier has recently received some prominence. Its chemical action is not fully understood, but it may be taken as being electrolytic in character; the two rectifying surfaces being respectively a metal and an oxide of copper held in close contact by means of a bolt.

The resistance to the passage of current in one direction being considerably greater than in the other rectification can be made to take place.

The Mercury Arc.

WITH mercury arc rectifiers the glowing surface consists of a quantity of mercury on which a so-called cathode spot appears when a lighting arc is introduced between a higher electrode. Conditions of working are high vacuum and an excitation of the arc by a contact between electrode and mercury surface.

The difficulty is, however, that the drop in voltage in the arc between electrode and mercury is very large, viz., about 30 volts, and that a minimum current intensity of a few amperes is necessary to maintain the arc. Therefore, the mercury arc rectifier is not suitable for the charging of small accumulators.