How to Build a Serviceable A Battery Charger

Reliable Full-Wave Valve Rectification

By "Megohm"

THIS battery charger has been designed to meet the requirements of many readers for a reliable low-tension battery charger. It is quite possible to get a certain amount of success out of home-built chemical rectifiers, but such success is generally only of a fleeting character, and the day of reckoning usually arrives when alternating current is found to have been flowing through the battery for perhaps several hours, and the plates are ruined. Valve rectification has been proved to be the most reliable, and operates without the slightest anxiety to the owner, can be left running all night, and "delivers the goods" just in the right and proper way all the time. The expense of valve renewals is very slight, as the present type of rectifying valve sold for the purpose is made for long and efficient service.

This outfit is intended for use on alternating current supply of 230 volts, 50 cycles, which is the pressure most used in New Zealand. The chief components are a step-down transformer, full wave rectifying valve, and resistance lamp, which regulates the output to the required maximum.

THE STEP-DOWN TRANSFORMER.

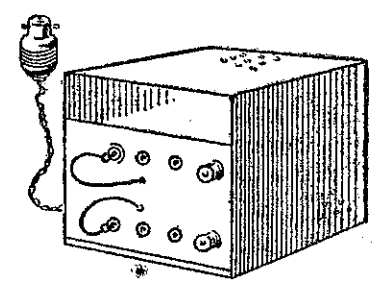
The step-down transformer is the main item, and in its construction the greater part of the total labour is involved. Upon the careful construction of the transformer depends the success of the charger, but if the instructions to be given are conscientiously followed, no trouble will be experienced.

The primary winding consists of 1100 turns of No. 26 s.w.g. enamelled wire, in nine layers. The secondary or low voltage windings consist of two separate windings each of 18's s.w.g. double cotton-covered wire, 126 turns in 3 layers, tapped to give variable voltages of 13½, 17 and 20 volts. Outside these windings is a filament winding of 12 turns, 18's d.c.c., tapped to give approximately 1.75 volts, a filament current of 3.5 amps being required.

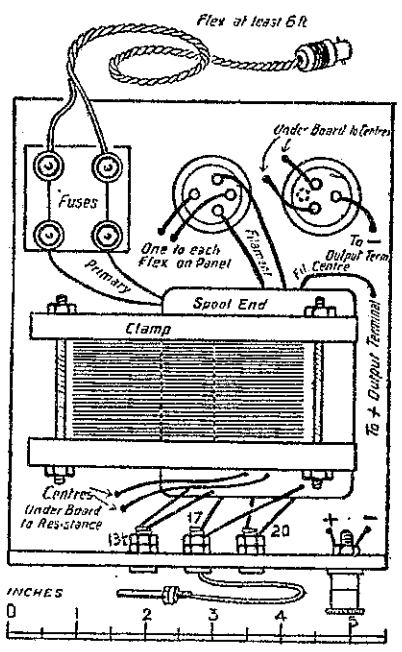
The core is built up of 1¼in. stalloy strips, and no attempt must be made to reduce the width of strips used. The core is a very vital part of a transformer, and any alteration of its dimensions has a great effect upon the output and general performance. The larger the amount of iron in a transformer core, the more efficient does the transformer become, the fewer the turns of wire required to produce a given voltage. This transformer is of the "core" type as distinguished from the "shell" type in which the outside iron divides and half comes around each side of the spool. The space actually occupied by the transformer is 4¾in. by 3in. and 5¾in. high.

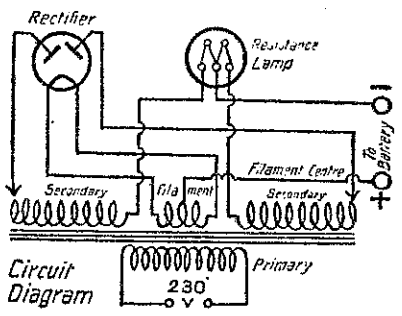
THE WINDING SPOOL.

The spool ends are 3in. by 2¾in., cut out of red fibre, pressboard, or other non-inflammable substance not



The Charger Complete





Circuit Diagram

exceeding 1/8-in. in thickness. To make the spool a former of wood is first required, and this must measure a full 1¼in. by 1¾in. by 3in. long, and is best built up of strips of wood as shown. The 1¼in. dimension must really be a shade over to give an easy fit to the stalloy strips. Two strips of wood from which the former is made should be 3/8-in. thick by just over 1¼in. wide, separated by two narrow strips to make up to 1¼in. If it is necessary to increase the size, glue on a piece of thin card. The former is put together with brads near the centre, and should be made about 4in. long, and sawn to length by trimming the necessary amount off each end when made up. For insulation between the primary layers we require a few strips of good but thin paper 2¾in. wide by 13 or 14 inches long. It is a good plan to get these strips cut by a printer from waste that is generally on hand. The strips may be a fraction over the measurement, but must on no account be any less, or the requisite number of turns will not be accommodated in each layer. A couple of dozen strips will suffice. These strips are to be used as a gauge to determine the width apart of the spool ends, so that when used to separate the layers there will be no space at the ends. From the width of these strips plus two thicknesses of spool ends, we get the total outside length of the spool which should not exceed 3 1-16in. The wooden former is now cut to the requisite length and covered with one thickness of good quality thin cord or two thicknesses of "folder" manilla, the exact length of the former, glued at the overlapping joint, taking care that no glue is allowed to cause it to adhere to the former. In each spool end is now to be cut a square hole that will fit closely over the end of the spool centre. One of the spool ends is then fastened in place with seccotine or strong glue, a number of the paper strips curled round the square centre, and the other spool end also fixed in place, pressed against the edges of the paper strips. See that all is square, and put away to set under a weight. When set, remove the paper strips and run a fillet of glue or seccotine round the inside of the spool ends to add extra strength, and again leave to set. The spool will now look like No. 2, and should be quite flat and flush outside both ends. The inside must now be shellaced. Now cut two pieces of heavy cardboard or millboard 2¾in. by 1¼in. In the exact centre of each make a hole to fit the spindle, usually a dowel-stick, to be used on the winding jig. Nail one of these on each end of the spool, putting brads into the former at AA, with the round hole in the centre of the square hole in the former. These will support the ends during winding. A thin nail through a hole drilled in the dowel can be used to prevent the spool working loose on the spindle. There must be no end-play on the spindle, or even winding will be difficult.

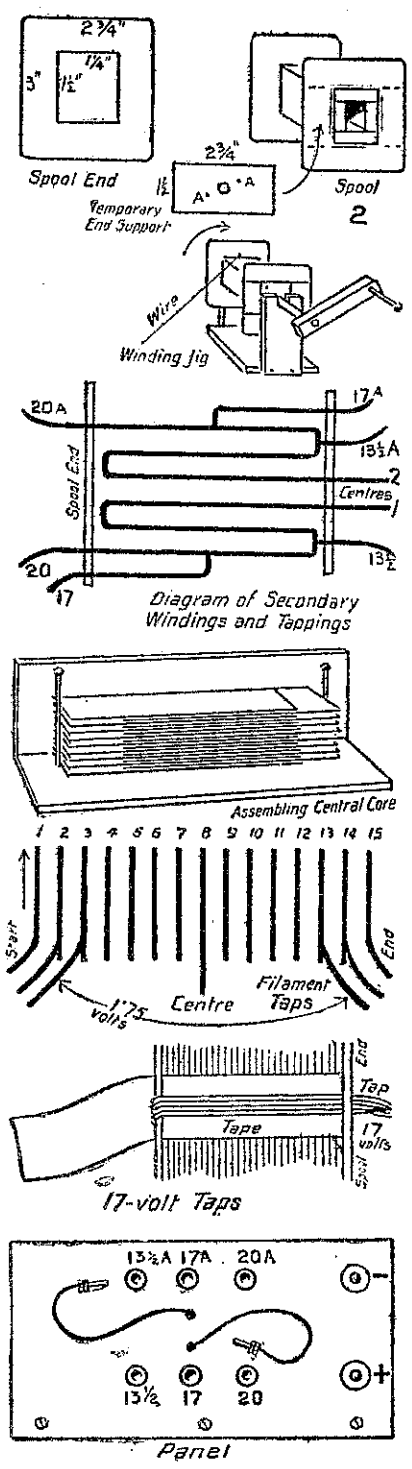
PUTTING ON THE PRIMARY.

Before commencing winding, put one layer of paper round the spool centre, securing with seccotine. Pass the end of the 26's wire out through the hole in proper position, commencing winding at the left, turning in the direction shown by the arrow. The wire should pass through a small piece of linen held in the hand to keep taut during winding. Each turn must be put on evenly, and close up against the previous turn. The number of turns on every layer should be counted and written down. The number of turns on each layer, leaving at least 1/16in. blank at each end, will vary slightly, but should never be less than 122, and on some layers, especially the first, there should be 126. At this rate 9 layers will give a few over 1100 turns, 1106 in the writer's case, but if there is room for a few more, put them on to complete the ninth layer, and bring the end out through a hole at the opposite end of the spool to the start. It must be understood that where the extra strips of millboard are nailed over the ends, shows where the laminations come, and no wires may come through the spool ends at those parts.

A layer of paper is put round between every layer of wire, and great care must be taken to prevent a turn slipping down the edge of the paper to the layer below, and for that reason it is wise not to wind close up to the spool end, but leave a space about equal to two turns. Cover the primary with a layer of paper and a layer of empire cloth.

THE SECONDARY WINDINGS.

This winding is done by hand with end as the finish of the primary, but in the centre of the opposite side as the spool on the knee, the spindle having been removed. The 18's wire commences on the same spool shown. It is most convenient to wind from left to right, turning the spool in the opposite direction, guiding the wire on with the right hand. There must be carefully done, and the turns



laid absolutely straight and close together, or the necessary 42 turns will not be got in each layer. Each few turns must be pressed up to the preceding ones where necessary, as any spaces will prevent the full number going in. Leaving a few inches outside, winding is proceeded with, until 21 turns, or half a layer has been put on. Here a tap is required for the 17 volt point. In order not to be bulky, the tap should consist of three 22's or four 24's enamelled wire soldered side by side and kept in flat formation until through the spool end. A piece of adhesive tape is laid under these to butt against the spool end, passes under the tap join, and over the top of the wires, finishing flush at inside of spool end. Mark this 17 volts. Winding proceeds, until the layer is complete, and here a piece 18's d.c.c. wire is soldered on as shown and brought out through the end, marking 13½ volts. Then the layer is well shellaced and allowed to dry. When dry, and not before, a covering of empire cloth is put on, and no more tape are required, the wire end being brought out at the end of the third layer, which is the finish of 126 turns, and marked Centre 1.

Now a quarter of an inch from where the last turn goes through the spool end, another hole is drilled and the wire passed out from the beginning of the next winding (Centre 2), which must proceed in the same direction as if there had been no break, but of course a layer of empire cloth must be put on after the shellac is dry, and the turns of this winding must be prevented from coming into contact with turns of the previous winding. Two layers are put on without taps, until the end of the second layer, where an 18's wire tap is brought out and marked 13½A, then 21 turns of the next, the last layer, bring out a 3-wire tap over the turns already wound (17A), protect as before with adhesive tape, and put on remaining 21 turns, bring out end and mark 20A. All taps must be made on the same surface of the windings, but may come out at the nearest end. Now after shellac and a layer of empire cloth, comes—

THE FILAMENT WINDING.

This is a short winding of 15 turns placed outside in order to provide a filmaent supply of 1.75 volts, 3.5 amps. This winding has a centre tap that forms the positive side of the charging output, conveying from the rectifying valve the rectified charging current, which in the valve always flows from the plates to the filament. Ten turns should give the necessary 1.75 volts as is the case in the original, but it is wise to place a couple of extra tapped turns on each side to provide for any lessened voltage that is possible. Then an extra turn can be included from one or both sides to make up the required voltage. This provision is wise because, owing to slight differences in construction, the "turns per volt" may not work out just as in the original.

When winding is completed, the whole should be covered with bookbinders' cloth or similar material as a protection.

THE STALLOY STRIPS.

The stalloy should not be cut until the winding is completed, so that there will be no need to cut the strips any longer than necessary. The long pieces should be 4¾ins. long and the short pieces 2.1ins. long, but if the winding projects outside the spool, this latter will have to be increased. About 185 of each size will be required. The cutting will be done with ordinary snips, failing access to a suitable machine for cutting accurately. Cutting with the snips, a gauge must be cut of the correct length and all others cut by holding this on the strip and cutting as squarely as possible with the snips against the end. The slight curve put in by the cutting must be tapped out by hammering lightly a few taps, on an iron surface. Unless this is done well, there will be too much air space in the core, and it will be inclined to hum. When all the flattening is complete, the strips must all be coated thinly on one side with shellac dissolved in methylated spirits and applied with a brush. There are two good reasons for the shellac, firstly, electrical insulation of each lamination, and secondly, cutting out any tendency to mechanical hum by the deadening effect of the coating. The best side to shellac is the dark or oxided side.

ASSEMBLING THE CORE.

Carried out in the wrong way, the assembling of stalloy strips can be quite an irritating process, but if the following procedure is carried out, no trouble whatever need be experienced. A pile of the long

(Continued on Page 11.)