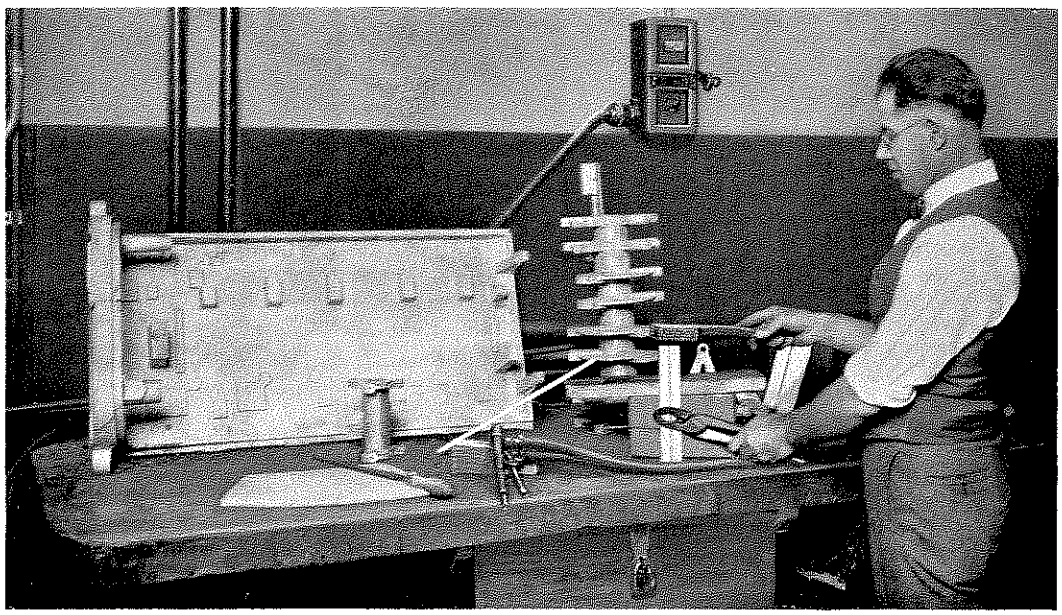
Soldering Aluminum Controller Cylinder Castings

The lugs on aluminum controller cylinder castings sometimes burn off or become broken, and it is often desirable to repair them by building up certain portions rather than making a replacement. These and similar castings are sometimes salvaged by means of welding. Procedure, in this case, is as follows: Fire clay is placed around the part and the lug is built up with $\frac{3}{16}$ in. diameter aluminum rods. This is usually done without removing the section. If necessary, the section may be removed to avoid burning the shaft insulation.



Rubbing in Aluminum Solder with a Wire Brush

Soldering is generally a more satisfactory and economical method of repairing such castings, except in certain cases where salt spray or excessive humidity render the climate particularly severe.

A joint, carefully made by the soldering method, will stand up quite well even under adverse climate conditions. Soldered joints will have a longer life if coated with paint or other protective substance which will exclude air and moisture.

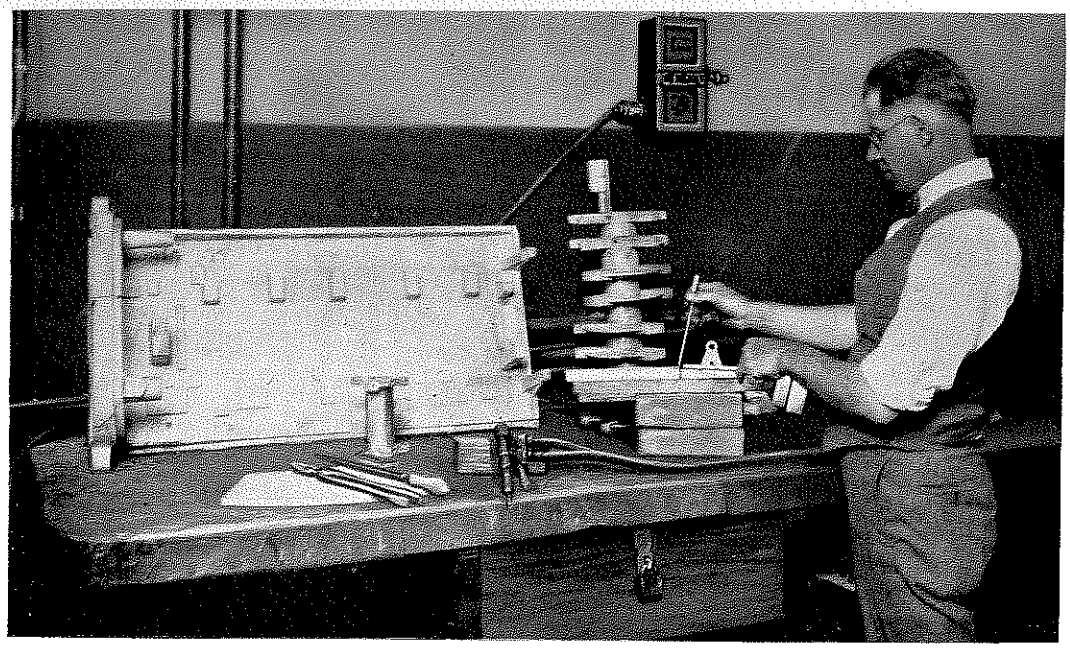
In soldering aluminum the following *general* rules should be observed:

1. The parts to be soldered should be preheated above the melting point of the solder. Aluminum conducts heat readily and if not preheated, chills the solder.
2. Aluminum oxidizes easily at soldering temperatures, forming a thin film of mineral character. This film is not easily fluxed, once it forms, but should be removed mechanically under the first layer of solder. The first "tinning" layer of solder, rubbed into the surface after the oxide has been scraped off, keeps the oxidizing atmosphere away from the aluminum and prevents further oxidation. The subsequent layers of solder serve as a binder between the tinned surfaces.
3. Oxidized solder should be removed from the joint. A dirty joint is always weak.
4. The melting point of aluminum or, to state more correctly, its point of thermal transformation, is not very far above the melting point of the solder. Therefore, care should be exercised so the aluminum will not "burn." However, the danger of "burning" is less than of soldering the joint too cold.

General Electric Company, Schenectady, N. Y.

SALES OFFICES IN ALL LARGE CITIES

November, 1924 64606



Skimming the Oxide from Aluminum Solder with an Iron Wire

DETAILED INSTRUCTIONS

Heat the parts to be soldered to the fusing temperature of the solder by means of a Bunsen burner or gas blow torch (the blow torch is recommended on account of its better temperature regulation). The temperature of fusing can be determined by applying the stick of solder to the metal. When the solder will flow freely on the surface, the temperature is about right.

Do not apply flame directly to the joint as the aluminum will oxidize especially heavily in the flame. Have the joint surfaces preferably horizontal. When properly heated, apply a little solder to the joint surface and *rub in vigorously* with a wire brush, file carding, or other sharp edged tool, which will serve to loosen the oxide under the solder and cause the solder to flow into the cleansed pores of the metal.

The wire brush rubs the solder into the surfaces, hence the solder must be in such a state that it will flow readily but not be hot enough to melt the upper fibers of the metal. There is a fairly definite temperature range for this work and any departure above or below this range will not secure the best results. After the first coating of solder has been rubbed *sufficiently* into the surface of the metal, more solder is added on both joint surfaces. This solder should melt and flow freely over the joint merging with the first layer. The solder will cover itself with a scum of oxide which should be skimmed off with a *preheated* iron knife or wire. A small wire, $\frac{1}{16}$ of an inch in diameter, pressed into a wood holder will give good results. Copper or brass wire should not be used as it might possibly contaminate the solder. Preheat this wire to above the melting point of the solder to avoid chilling the solder. Bring the two parts of the joint together in place and melt on enough additional solder to fill the joint. Pass the iron wire through the joint crack which procedure should effectively remove all the scale or scum, and allow to cool, holding the parts together if necessary. *Care must be taken to avoid an excess of solder on the joint planes before butting the parts together.*

Where not subjected to salt spray, alkali or humid climate, a solder containing five lb. tin, two lb. zinc, and four oz. of aluminum gives good satisfaction (70 per cent tin, 27 per cent zinc, 3 per cent aluminum).

Zinc-tin or zinc-tin-aluminum solders which are on the market may be used, such as 70 per cent tin, 30 per cent zinc or 54 per cent tin, 36 per cent zinc, 10 per cent aluminum. Aluminum in the higher percentages adds to the strength, but raises the melting point and makes the solder correspondingly sluggish.

Tin-zinc solders may be made by adding preheated tin to molten zinc. Tin-zinc-aluminum solders may be made by adding molten aluminum to the molten tin-zinc.

The strength of a butt-joint made carefully with these solders will show about the same strength as half and half solder and brass.

The melting point of these solders (except with aluminum above 3 per cent) is about 180 deg. to 200 deg. Centigrade.