of the castings, and then be heated up slowly in a charcoal fire to a red heat, and as soon as the welding is done the article should be buried in ashes till it has cooled right down. We find this to be the only way to make a reliable job.

Three years ago the water chamber of a hydraulic pump (steel casting), subjected to a pressure of 3,000 lb. a sq. in., opened up pores, and part of the valve face was cracked. It was successfully welded, and has been in constant use ever since.

Whenever possible all heavy parts to be welded should be pre-heated, as it saves time and gas, and makes a more homogeneous joint.

In boiler work, all sorts of patches and cracks, also half and side sheets, are successfully welded, and metal built upon wasted foundation rings, dry pipe joints, etc., all patches, cracks, and side sheets being chamfered to a 45° V.

Cutting by the oxy-acetylene process on steel or wrought iron saves many hours of labor. For example, a fire box side sheet can be cut across and down the centre in twenty minutes, and a fire hole patch measuring nine feet can be cut in the same time.

G.T.R. Shops, Battle Creek, Mich.—J. C. Garden, Master Machanic, writes: We have used Thermit for a number of years, with very good results. When we first got the machine our welds were not satisfactory, although we followed closely the instructions issued by the Thermit repre-sentative. The material at the weld was hard and brittle, and, with very few ex-ceptions, the welds broke before they had been any length of time in service. I ex-plained this to one of their representaplained this to one of their representa-tives who called on me, and he asked to be allowed to watch us make a weld, which I permitted him to do. Before we got well started he said that it would be impossible for us to make a proper weld under the conditions we were using; that the material with which we were lining our crucibles would destroy any weld, the crucible being lined with carborundum and silicate of soda, the metal passing through this carborundum would pick up sufficient carbon to make it as hard as glass. We asked him what was required, and he told us to line the crucible with a special preparation of tar. He also ad-vised that the Thermit mixture we were using was not suitable, as it was put up in a big can and the matter separated, the light lighter portion coming to the top so that the mixture would not be correct. He advised that we should not be correct. If the whole body of this mixture every time we used it, but recommended that we procure the mixture in small cans, which should be freely shaken before being used. We followed his instructions and our Thermit welds afterwards were perfectly satisfactory, the metal being soft enough to machine or cut with a hammer and chisel, and since adopting this system we have never had a weld break.

We are also getting very good results with electric welding, especially on locomotive frames, but the success of this welding also depends on using the proper material. If the proper grade of iron is not used it will be hard and break. We use the Thermit machine for very little except locomotive frames, but on one or two occasions we welded cast steel wheels which were broken in the spokes, to save in both cases are equally satisfactory.

With the electric welder we weld broken cylinders, if they are broken in the cavity, which takes only exhaust steam, but we have not been able to weld satis-

factory on the high pressure cavities. We weld frames and all iron and steel parts on locomotives, cracked bridges in tube sheets, patch in fireboxes, and fill staybolt holes, which have been worn large, for retapping. We have also been very successful in repairing high speed milling cutters—in fact, the number of purposes for which this machine can be used is unlimited.

Canadian Northern Railway, Winnipeg Shops.—L. Wedge, General Locomotive Foreman, writes as follows: Four men are continuously employed by us on oxy-acetylene welding, which we find very satisfactory, two men doing the boiler work and two doing machine work. With this greater saving was made in material than if the cylinder had pieces broken out of the front 12 in. long and 16 in. wide, U shape.

Welding flat spots on driving tires is a practice which is also a great saving in both time and material, as it is not necessary to lift the locomotive off the wheels or to turn the tires, which necessarily shortens their life by some 12 months or more, depending on the size of the socket.

The above are only a few of the socket. The above are only a few of the important jobs done by welding in this shop, but the fact that we keep four men continuously on this work will give an idea of how much we accomplish by this process of welding.



Long Arm Grinder

process of welding we effect a great saving in time and material. A breakdown occurred in our pumping station a short time ago which was very serious. Two of the water cylinders were broken, and it would have taken considerable time to make patterns and have castings made from them and machined. Instead, the broken cylinders were welded by acetylene, and were in working order again in three or four days, which was a saving of at least ten days against having new castings made and machined.

A great saving is also effected by welding lugs on air pumps which have been broken off; also by welding split pipes. An equally great saving is effected in our superheater work, welding headers and welding in 'side sheets, cracks in fire boxes, side fire boxes where worn by driving wheel rubbing same, and welding broken cylinders on locomotives. Two locomotives which were just out of

Two locomotives which were just out of the shop had their cylinders badly broken. These, of course, could be patched, but by welding they were made as good as new. They were repaired by acetylene welding in a shorter time, and a

## Long Arm Grinder on Grand Trunk Pacific Railway.

A useful attachment for motion and general grinding is shown by the accom-panying illustration. The saddle block is formed to suit the tool post opening in carriage on lathe, to which are attached two hollow spindles, one operating in babbit lined bearings and saddle block and fitted with drum, which is belt connected to an operating shaft above the tool car-The main spindle carries a 34 in. riage. arbor for an emery wheel, and is locked firmly by the extension spindle, which is screwed into place as shown, being further held by a long rod carrying small outer wheel on right hand end and ter-minating at left hand face of saddle block. The device has been found of great convenience for roundhouse work in grinding taper pins and holes, piston rings, joint rings, etc. It is in operation at the Grand Trunk Pacific shop, at Wainwright, Sask., and we are indebted to W. W. Yeager, formerly Locomotive Foreman there and now at Biggar, Sask., for the above data.