Canadian Railway and Marine World

January, 1918.

Oxy-Acetlyene and Electric Welding and Cutting Processes in Locomotive Shops.

By A. F. Dyer, General Foreman, Welding Department, Grand Trunk Railway, Montreal.

With the present prices of material, scarcity of labor, and difficulty of obtaining steel and iron, welding and cutting by both the above mentioned processes have proved a great boon and an almost indispensable factor in railway repair shops. Seven years ago we employed one man as an acetylene welder, and owing to failures, through his lack of experience, the process was nearly condemned, but as we gathered experience, both gas and electric welding developed, so that now instead of one man we employ 18 and have often to work them overtime.

The low pressure acetylene gas system is used, and the whole shops are piped for the acetylene, every other repair pit has a drop connection, in locomotive houses we use Prest-O-Lite dissolved acetylene in cylinders, which saves the expenses of a generator and piping where the process is only in use occasionally. There is a great difference in opinion as to the relative merits of high or positive pressure and low pressure gas, the manufacturers of pressure outfits contending that you save oxygen by using their type of generators and that you cannot get so near to a neutral flame with the low pressure gas as you can with the high. The makers of the low pressure outfits claim that by the use of an injector embodied in the torch or welding head, a neutral flame can easily be obtained. We find we can obtain a flame as nearly neutral as can be obtained, with the outfit we use, although with pressure gas you can obtain a much larger flame for the same sized head than with the low pressure. The principal factor, however, that made us decide on the low pressure outfit was the fact that our main supply pipes are carried overhead throughout the shops, and as nearly all, if not all, oil, steam and water pipes are overhead, we had to consider a very well known motto, viz., safety first, for if a man was working overhead and by mistake broke a joint of the gas pipe, his torch or candle might cause an explosion which might wreck the shop. Though we have been using acetylene gas for eight years, we have never had an explosion of any sort. Our low pressure generator went through a big fire two years ago, and we were enabled to repair it and use it for several weeks, till we received our new outfit.

There are many kinds of electric welding outfits on the market, and, of course, each one is claimed to be the best by its respective makers; each has its advantages and, whisper it, its disadvantages, and the old prejudice very often exists among operators that the machine they are using and are familiar with is the best, and they will stick to that opinion until they become accustomed to a new machine. A new equipment, using alternating current instead of the direct current, is now being put on the market, and only weighs 150 lb., and gives from 20 to 200 amperes, and is about 50% cheaper than any d.c. machine on the market. The electric welding outfit consists of two generators, each operating four welding circuits; the shops are wired and at convenient places connection boxes are placed, and only need a lead and ground wire connected to them and the work on which the welder is engaged. The outfit used has panel controls, which allow each man to control his amperes independent of the other welders.

The processes have proved themselves fit to be ranked amongst the greatest time and labor savers, and also we may safely say money savers, introduced for a long period. For instance, in the not very distant past, a locomotive with a broken frame had to stay several days in the shops before the men could strip down one side and remove the frame to the smith's shop, weld it and perhaps have it machined and then replaced. Now we drop the pair of wheels which may cover the break, cut out the crack with the cutting torch, to the shape of a double V, at an angle of 90°, clean off the oxide caused by cutting, and weld up with the metal electrode, using soft steel or Swedish iron, a frame 4 x 5 in. being cut and welded in under 14 hours, and it can be done in less time by having two operators on the frame at once, but the men do not like facing each other's arcs, as when they are changing their filling rods their eyes get sore.

Frames, when worn by brake gear and stays, are built up, and worn holes are plugged and welded, instead of reaming them out to a larger size and thereby weakening the frame. In rebuilding and superheating engines, the same boilers are seldom used on their original frames, and as in very few cases do the various holes in angle irons, furnace bearers, etc., come into alignment with frames or boilers, the holes are welded up and redrilled.

The present price of tool steel demands that none shall be wasted, therefore we use it down to the last inch, by welding it to tire steel. Twist drills, taps, and reamers, when broken near the socket end, are welded and put into use again. For this purpose we use either the electrode or gas, but in both cases we use vanadium steel filling rods, as we find this gives the best results. Spokes of driving wheels are welded, and flat spots on tires have been successfully welded up when it was necessary to do so.

We have not had much success on cast iron, with the iron electrode, although with the carbon you can make a fair job, but the gas is unquestionably the best for any of this material. We have successfully welded with the gas, steam shovel engine frames, slides and cylinders, by welding in patches of cast iron where worn or broken. When our contract for shells was completed and the lathes that were used for this purpose were being overhauled, it was found that most of the V slide beds were worn down by the tool carriers; these were built up with the gas, which saved machining these beds down in many cases ⅜ in.

Most of the boiler welding is done with the iron electrode, using a mild steel or Swedish iron as a filler. It is found that the electric process localizes the heat more than the gas does though it is the writer's opinion that gas makes a closer and neater weld, as all welds made by the electrode are more or less porous, unless hammered up. It pays better, whenever possible, to do so, to put quarter or half sides, in order to get out of the fire line, in preference to putting in a patch, for, as a rule, however well the patch is welded it generally gives out in from 12 to 18 months service, and the same applies to cracks, whereas the half or quarter side should last as long as the firebox.

When a nest of small cracks is found round the staybolts, the bolts are removed and the holes countersunk and welded up. This method has been found to be very successful. Corner patches are welded in by running the patch into the tube or back sheets, as the case may be, at the same time removing the flanges. If it is decided to do away with a number of tubes, plugs are welded in the holes, first countersinking the holes and having the plugs punched by a countersunk die which gives the proper bevel for welding.

A great deal of trouble was experienced in welding in the superheater flues and tubes when it was first started, but after a little experience much better success was arrived at. Some operators prefer the tubes belled, and others prefer them beaded; some prefer the water in the boiler and others do not. The operators I am connected with like the belled methods best and with the water in the boiler. This keeps the tube sheet from heating, especially round the smaller tubes. Tubes are set in with copper ferrules set back 1/32 in. and the flues are belled out 3/16 in. to 7/32 in. and the small tubes 3/16 in. The sheet is roughened all round the tubes and flues, and the oil is then burnt off with the oxy-acetylene flame and tubes, and flues welded in with electrode, using ⅛ in. mild steel or Swedish iron; the latter is preferred if caulking is needed.

A sample of an average day's work is as follows, for a gang of 12 men: 14 rivet holes in smokebox and 4 peg holes in foundation ring; 10 tubs holes in upper portion of firebox tube sheet; 2 air pipes which were worn through. In the tool room: 1 ratchet for jack (2 teeth replaced); 1 gear spindle built up; 1 chuck screw, key end built up; 1 boring shaft built up from 2½ to 2⅞ in.; 2 tool holders, rebuilt; 1 air hammer handle repaired; 6 teeth in lathe gear, built in; 1 cone, small end filled up solid; 2 1¼ in. holes in top rail of frame filled up; 4 cracks 18 in. long in right side sheet welded; 14 bottom tube holes built up for re-tapping in round head; cut out frame for welding and started welding same; welded bushes in pony truck stays; cut out 3 sets of boiler tubes; cut out one set of superheater flues; build up caulking edge of fire hole; heated corners of tube sheet for closing; welded broken superheater damper bracket; built up reversing lever where worn; built up 2 side rods where worn; cut out 48 flexible staybolts in firebox; welded 2 cracks in throat sheet. Air brake department: 1 broken flange of air brake cylinder. In addition to this list two men are engaged con-