these diaphragm cabs are equipped, is out of order, which is sometimes the case from their freezing up.

The old entrance through the rear of the cab is replaced by a door opening in the side of the cab near the rear end, as shown in fig. 2. Inset steps, built into the sides of the cab walls, which are continued down below the cab floor an amount sufficient to embody the steps, lead into the cab through this side entrance, replacing the former offset steps at the rear end of the cab.

A number of passenger locomotives have so far been equipped with this new diaphragm cab, most of those now in service being on the three runs of the Montreal-Toronto line. Their introduction has met with great favor from all concerned with their operation.

The Oxy-Acetylene Process in the Railway Shop.

By Frederick H. Moody, B. A. Sc.

The technical press has been devoting considerable space during the last few years to the uses of the oxy-acetylene process in the railway shop, more particularly on locomotive repair work where work must be produced expeditiously so that the earning power of a locomotive on the road might not be lost during the period that would be required to make the customary repairs. Most of these articles describing the advance of the subject, and its all round usefulness, have dealt with the practice followed in the United States, the instances cited coming for the most part from the same place. While the practice on both sides of the line is identically the same, the progress made in Canada concurrently with that in the United States, ought to be described in order to emphasize the fact that equally extensive repair and general work is being undertaken on this side of the line, and that the process where installed has been developed to an equal degree.

Modern conditions of keen competition involving the introduction of more efficient, and in some cases scientific, management, require that the methods of doing work must be constantly being improved in order that the quality of the work may be raised, and at the same time have the cost of production decreased—improvements in both directions. Oxy-acetylene would seem to be doing all this, with a saving of time, less waste, increased output and greater efficiency. This is emphasized by the speed with which a crippled locomotive may be taken into the repair shop and be completely repaired in a remarkably short time as compared to former methods. In addition, there is the factor of making many complicated repairs that would not be considered possible by the older methods, or, if considered possible, would not be deemed worth while from the poor quality of job that would result.

The term "welding," as applied to the oxy-acetylene process, is somewhat a misnomer, as dictionaries define it as "to press or beat into intimate and permanent union," neither of these actions entering into the process, it being purely autogenous, more metal building up the fractured place, heat alone entering into the operating mediums, with no pressure involved.

A fusion of the metals subjected to the oxy-acetylene flame causes the molten portions of the parts to commingle to form the union. This flame is said to have a temperature in excess of 6,000 degs. Fahr., formed by the mixing in the proper proportions of oxygen and acetylene gas at the tip of a torch. This very high temperature is the result of the fact that acetylene gas has more weight per given volume than any other combustible gas, and is the closest approach to gaseous carbon known to chemistry. In consequence, the temperature of combustion is very high and intense heat is generated.

Two systems of operation are employed on this continent—the high and the low pressure. It is the former of these two that is in most general use, the acetylene gas being led to the nozzle of the torch under an appreciable pressure instead of the oxygen, which is under pressure in both systems, drawing the very low pressure acetylene along with it to the point where it ignites. The Academy of Science in France determined that the proper proportions for the two gases to give the best results was one of acetylene to a little more than one and a quarter of oxygen.

Impurities in either of the gases tend to produce inferior work, and the intensity of the flame is decreased so out of proportion to the amount of the impurities that the cost of the work increases very rapidly. This makes good gas a prime requisite. Impurities in the acetylene are largely due to the heat evolved in the acetylene generator after it has been in operation for some time. This internal heat produces other hydrocarbons in the gas, giving the resulting flame a carbonizing effect that will harden the weld and make it brittle.

There are two classes of welds. The first, for very thin plate, requires the addition of no extra material at the weld, the edges being brought into intimate contact and fused together. The second class, for heavier plates, requires that the contact edges be chamfered, and the groove thus formed is filled with the same metal under the torch.

The general consensus of opinion among the users of the oxy-acetylene process seems to be that a long period of trials and tribulations is almost invariably experienced before satisfactory results can be obtained. The earlier experiences often lead to a desire to reject the process in favor of the older methods of repair, so discouraging are the results obtained in the earlier stages. In most instances, where the operator perseveres, very satisfactory results are the outcome, and the oldest users are for the most part the most enthusiastic advocates.

A few examples of the use of the process and the results obtained, as they have come under the notice of the writer, will undoubtedly prove of interest. In the C.P.R. shops at West Toronto, the process has been carried to as fine a stage of development as is generally to be found in the railway repair shop. Here, the locomotive shop has been piped throughout with acetylene, with connections at convenient points, these connections being painted red for identification purposes to prevent confusion with the air piping.

In these shops, a great variety of work is handled, though the principal work is that of patching up boilers, for which the oxy-acetylene process is peculiarly adapted. The accompanying illustrations show two instances where heavy repairs were made unnecessary. In fig. 1, the front end of the inside sheet at the bottom of the water leg near the mud ring had been so reduced in thickness, from the attacks of acid water accumulating in the interior at that point, that the plate was considered dangerous. Under former conditions, this would have required a patch to cover this part of the firebox, a construction that in itself is objectionable from the fact that it makes a double thickness wall through which the heat has more difficulty in penetrating, and, in consequence, that part of the inside sheet is particularly liable to further damage from burning. The oxy-acetylene process solved the difficulty. The original piece that had been corroded was first of all cut out by the oxy-acetylene flame, removing the whole area that was affected. The oxy-acetylene flame in removing the injured piece cuts it out perfectly clean, the flame penetrating a small incision made at one end, cutting along at a rapid rate with a narrow cut. The holding staybolts are drilled out and the damaged portion removed. Another piece of good plate is then cut to the shape of the removed portion, and the staybolt holes laid out and drilled or punched to make it in every way a counterpart of the removed piece. The joining edge of this plate, as well as the good edge of the side sheet, are chamfered, and the new piece bolted in place

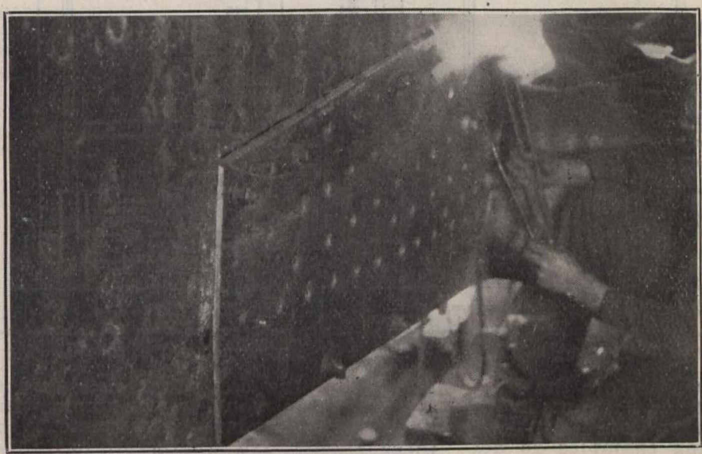

Fig. 1—Patching the Inside Sheet of the Firebox by the Oxy-Acetylene Process.

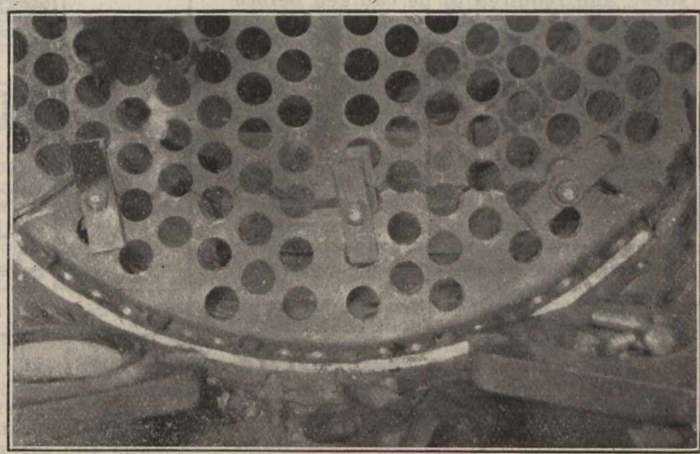

Fig. 2—Repairing the Front Tube Sheet by the Oxy-Acetylene Process.