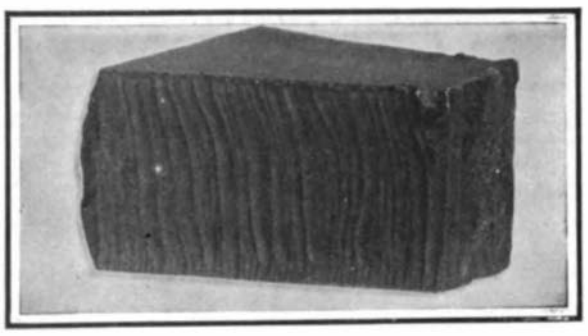
A "PUTTING-ON" TOOL.

It has long been a joke among engineers and mechanics that there were plenty of machines and tools for cutting off metal as and where required, and that all they wanted was a tool to "put a piece on" wherever wanted. The recent developments of so-called autogenous welding make it seem that the putting-on tool has at last arrived.

In the Scientific American of May 9th last year was described a method of cutting and welding metals by means of the oxyhydrogen blowpipe. The interest aroused by that article and the number of inquiries received led to investigation as to what America was doing in the same direction, the process above mentioned being a German one, and to the discovery of methods which merit further description, not merely because they have been successfully developed in this country by the Davis-Bournonville Company, but because they represent in several respects a considerable advance over those formerly described.

The German process was simply an application of the oxyhydrogen flame, which has been known for many years as the hottest obtainable, the combustion of a properly proportioned mixture of oxygen and hydrogen giving a temperature of about 4,000 degrees Fahrenheit; the method now under review uses a mixture of oxygen and acetylene, by means of which a much higher temperature is obtained; and as the value of either method is dependent upon the obtaining locally of an extremely high temperature, it is obvious that the latter has the greater possibilities. There are other more technical reasons, which cannot be adequately described within the compass of the present article, favoring the oxyacetylene method principally considerations affecting the efficiency of the burner upon which the operation depends.



Piece of 2-inch steel plate cut out with oxy-acetylene flame.

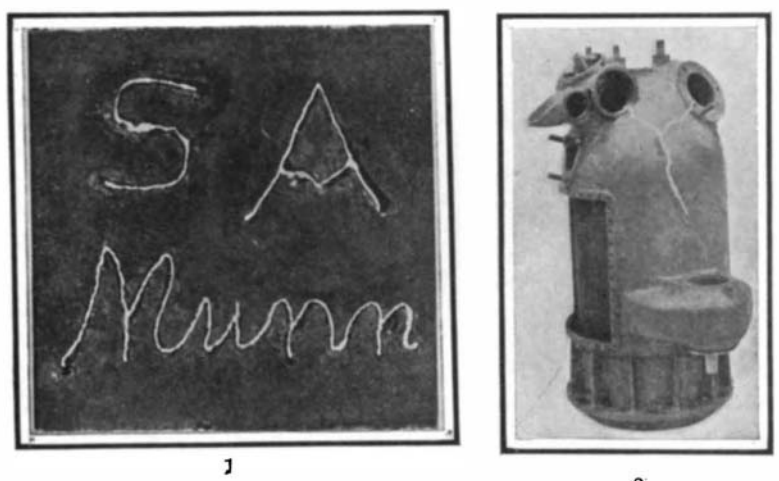
The "torch" of the Davis-Bournonville Company consists of an upper tube carrying oxygen at a pressure varying from 5 to 25 pounds as required, leading into a mixing chamber into which is introduced a lower pipe carrying acetylene at a pressure of one pound. Into the mixing chamber may be screwed a variety of different nozzles having a lengthwise hole, in its passage through which the jet of high-pressure oxygen draws in the acetylene through radial holes around the sides of the nozzle. The proportion of the area of the holes in the nozzle sufficiently regulates the proportionate mixture of the gases, but the latter may be further controlled by cocks upon either pipe. The acetylene pipe is also provided with an enlarged chamber filled with porous material, which prevents any danger of flash-back of the flame into the acetylene supply pipe, and also serves as a handle for the torch.

The acetylene being under pressure, however, the flame is not dependent upon injection for its acetylene supply, and the torch as above described is all that is required for welding. The two pieces of metal to be welded, with no flux or special preparation whatsoever, are simply laid with the edges to be welded together, the jet of flame from the torch is passed along the joint, and the intensely high local temperature generated causes the metals to flow together, and the weld is complete. In most cases it is advisable to add a little of the same metal from a wire or stick carried in the other hand, and introduced momentarily into the flame, as required when it drips off, just as one drops sealing wax onto an envelope.

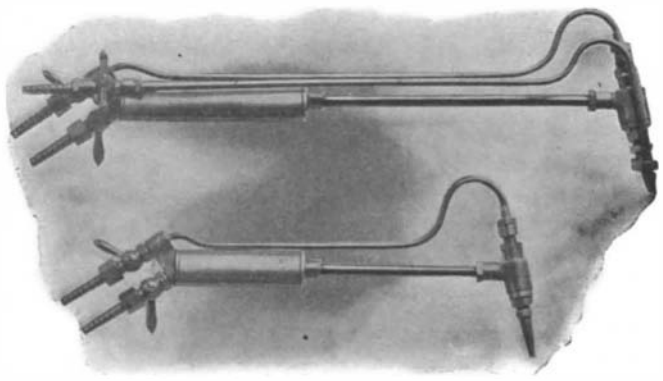
In this way cast iron may be welded to cast iron, wrought iron, steel, brass, copper, aluminium even, and other metals, or any of them to another piece of the same or to each other.

For cutting metals a third pipe is attached to the side of the torch, carrying oxygen at a higher pressure and provided with a separate cock and jet nozzle. After the metal to be cut has been sufficiently heated with the welding flame, the side jet of oxygen is turned on, and the added oxygen completely burns up the metal, the force of the blast carrying the disintegrated metal before it; but so local is the application of the intense heat, that in cutting metal 2 inches thick, the cut is less than ⅛ inch wide, its sides are smooth, and the adjacent metal is not perceptibly injured by oxidation.

For use in portable form the oxy-acetylene process has the great advantage over the oxyhydrogen, that the acetylene has about five times the heating power in proportion to its volume, so that the quantity required to be carried is smaller. For permanent plant the Davis generator, which is approved by the engineers of the National Board of Fire Underwriters, generates acetylene up to 15 pounds pressure by the direct use of lump carbide, from which 5 to 15 per cent more gas is obtained than from the finely-crushed material.



1. Monogram of the Scientific American and an attempt to "forge" the publisher's signature in half-inch boiler plate. 2. Aluminium automobile cylinder with crack repaired by oxy-acetylene welding.

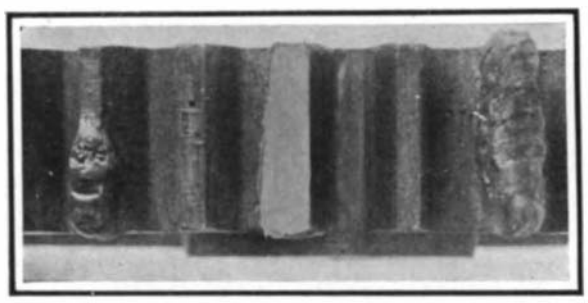


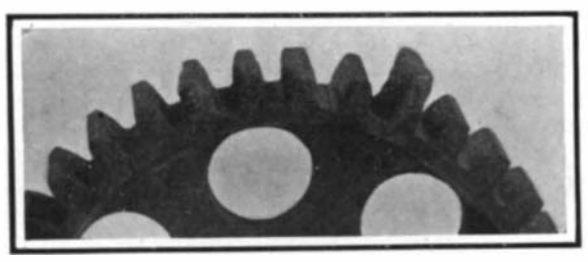
1. Small welding torch. 2. Larger torch with oxygen tube added for cutting.

To illustrate the simplicity of the operation, the Scientific American representative, with no previous practice or experience, made a serviceable weld between the longer edge of two pieces of wrought iron, 1½ inch by 3 inches and ⅛ inch thick, with much less trouble than he has ever had in soldering a similar joint in thin tin plate. The united pieces were then held in a vise by one edge, and the upper edge bent over nearly double with a hammer, no crack in the weld appearing, nor could any evidence of the joint be shown by file or hacksaw. Similar welds were made between two pieces of cast iron and between cast iron and steel, the united pieces being broken by a blow, and breaking always in the original casting and not at the weld.

The great variety of the applications of such a method is immediately obvious. Locomotive and other boiler tube sheets may be repaired when cracked without removal of the tubes; broken locomotive and car frames may be repaired without the stripping in the shops which causes delay so costly to transportation companies, and the same applies to exterior and other repairs to steamships.

Cracked cylinders and water jackets of automobile and other engines, reparable in no other way, may be made as good as new, saving costly replacement. Tool steel of any desired quality or alloy may be added to common steel or wrought iron exactly where required in the manufacture of special tools or machine parts.

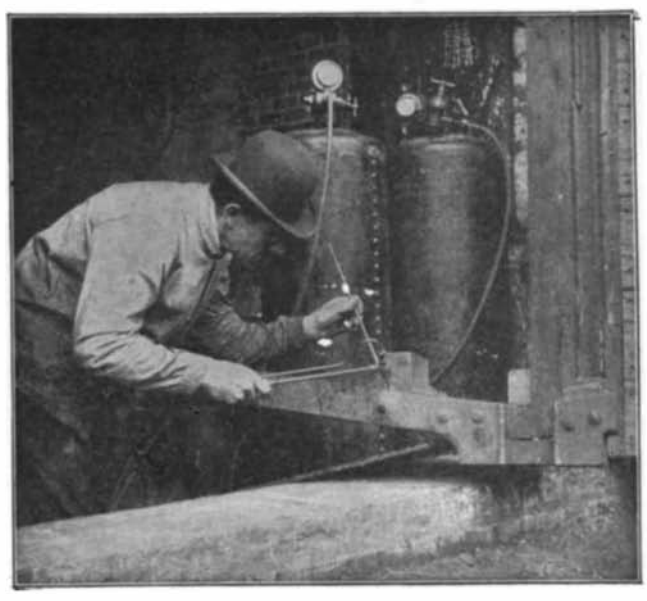




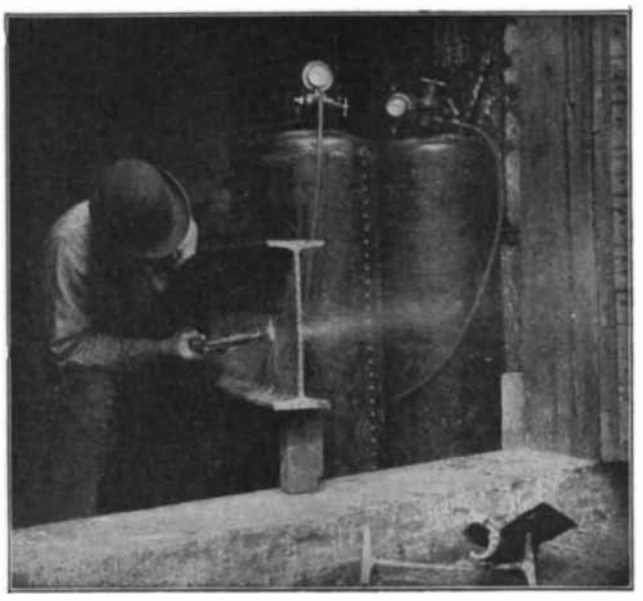
Top and side view of gear-wheel with broken teeth built up.

Perhaps the most striking use of the oxyacetylene torch, however, is that which suggests the title of this article. Worn parts of machinery, broken teeth of gear wheels, or any missing piece of metal object may be *built up* of any metal required, and the making of "wasters" avoided in foundry practice by the filling of blowholes and other defects in castings, not with a makeshift and often deceptive substitute, but with metal identical and homogeneous with the rest. The writer saw repaired in a very short time an aluminium gear case, which arrived with a flange broken off and missing. This belonged to an imported automobile, and could be duplicated only in France at a cost of several hundred dollars and a delay of two or three weeks, much more expensive to the owner. The missing part was built up of aluminium, neither joint nor addition being weaker or in any way different from the body of the case, the added part machined as required, and the car in use with the repaired part in place after a lapse of only six days from the time of the breakage, including a journey across country by express of the broken part occupying forty-eight hours each way.

In the gear wheel illustrated above the rebuilt teeth require only machining to be as good as ever. Superfluous metal has been added for effect in one case, but the middle tooth, filed down to the former level, shows no trace of a joint.



Repairing a cracked truck bolster, similar metal being fed from a rod.



Cutting a 20-inch I-beam, the fine spray of burnt metal distinctly visible.

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