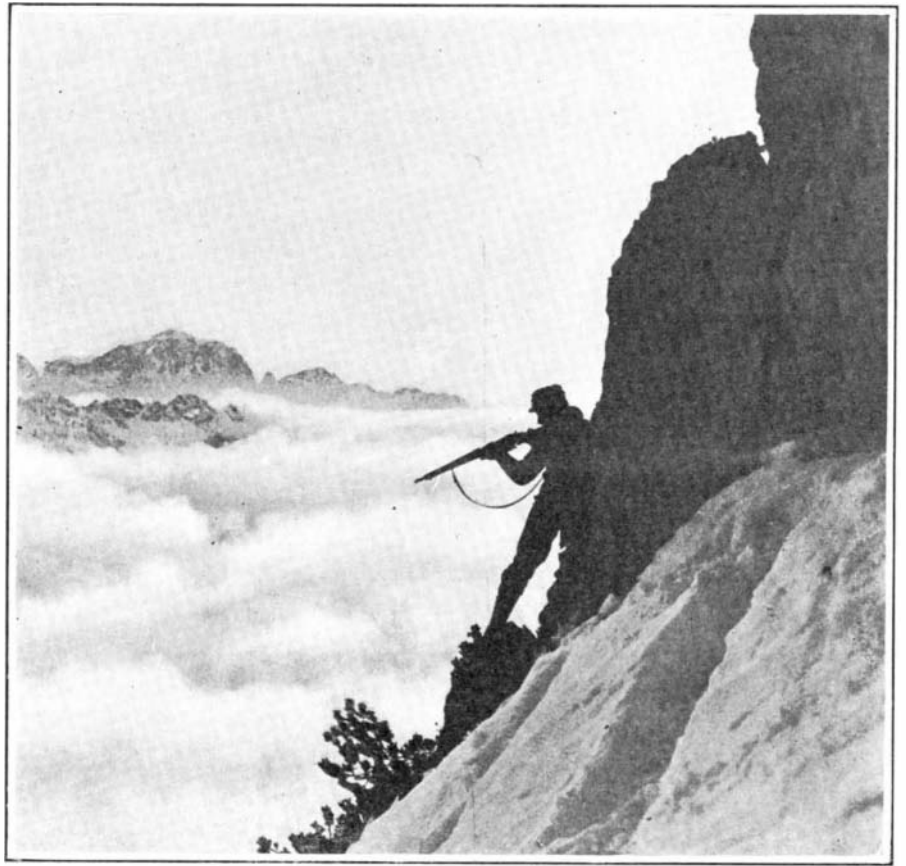




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Hungarian patrol signal station on a mountain crag.



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Fighting in the clouds on the Austro-Italian front.

### Fighting Above the Clouds

If public attention and interest had not been previously concentrated upon the military operations in Belgium, and in the East, and that interest stimulated by the magnitude of those operations, the campaign being conducted by Italy would be the marvel and the sensation of the world, for in difficulty and spectacular features it surpasses anything in the way of war maneuvers and military engineering that has ever been seen or dreamed of.

Owing to the extremely rugged nature of the territory involved the difficulties of the campaign have been tremendous, for in every direction there is practically a succession of high snow-clad mountains, interspersed by narrow winding valleys, which makes the concerted action of large bodies of troops impossible, and consequently, although there is an aggregate of nearly a million men engaged on each side, the number of men engaged in the various actions that have taken place has been comparatively small when compared with the immense numbers of men involved in the great battles fought in other regions.

These small engagements have, however, in many cases, been of a most desperate character, as naturally the most inaccessible cliffs are selected for defense, and the attacking party is obliged to scale the open mountain side in order to dislodge the enemy.

To establish these points of defense breastworks of stone are piled up, or, as has in some cases been necessary, trenches have been hewn out of the solid rock. Of course, it is not always difficult for troops of riflemen to establish themselves among the crags, but where artillery is also required on some high cliff it is entirely a different question, and remarkable feats of engineering have been frequently accomplished in such cases. One of the illustrations shows how a heavy field gun is being slung across a narrow mountain gorge on a cable way that has been established for the purpose, and the same means has often been employed for removing the wounded in places where it was found impossible to convey them down the steep and rugged sides of the mountains.

Much of the success in these regions has been the result of the hardiness and daring of the combatants, for a trench on a mountain face is often made untenable by a flanking fire from across the valley, or from a more elevated position on some neighboring mountain, so that, in many cases, in order to make an advance, the uttermost heights of mountains eight and ten thousand feet high must be won and held in succession.

Mining operations have been a feature of the fighting in these mountains, the same as elsewhere, and on two occasions, once by each side, tunnels were driven under a fortified mountain, and the entire top blown off by an immense charge of explosives. The fact that much of the work of the troops was done amid snow and ice, and even above the clouds, added much to the fantastic and sensational character of the campaign, and it is to be regretted that more complete reports of the military operations in these regions have not been published.

### Effect of Water Upon Carbon

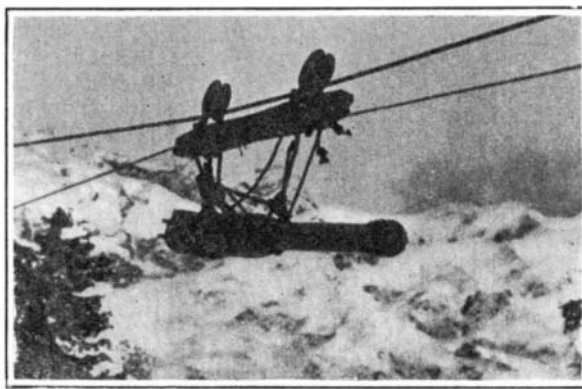
By Glenn Warren

OWING to the numerous claims for devices upon the market designed to remove carbon or prevent its formation by the injection of water or steam into the combustion chamber of an oil or gas engine, the writer determined to make an investigation. Experiments were made under conditions approximating those existing in the cylinders of an internal-combustion engine, and at the same time the apparatus was so arranged that the action could be easily observed.

For this purpose a thin-walled steel tube, about 1 1/4 inch diameter and about 12 inches long was supported so that steam from a small boiler could be forced in at one end and under the last 3 inches from the other end a couple of blow-torches were placed.

It is a well-known fact that incandescent carbon at a temperature of about 1,800 to 2,500 deg. Fahr. will decompose steam into hydrogen and carbon monoxide according to the equation  $H_2O + C = CO + H_2$ .

To note the effect of this upon a deposit of carbon,



From the Illustrated War News.

Transporting an Italian field gun to a firing position high up on a mountain, by a cradle that travels on a wire cable.

cylinder oil was placed in the steel tube and boiled until it no longer gave off inflammable vapors, and in this way a thin layer of carbon similar to the deposit on the inside of a cylinder was obtained. Upon passing steam for a short time through the tube, a small portion of which was heated to a bright-red heat with a blow-torch (about 1,800 deg. Fahr.), the carbon upon the inside of the hottest part of the tube was found to have been entirely consumed, but that on the tube that did not reach a red heat was apparently unaffected.

Upon throwing water in the liquid condition upon the heated carbon on the inside of the tube and allowing it to boil vigorously, a much larger portion of the carbon appeared to be removed or loosened to such an extent that the least breath of air would blow it away.

To verify this observation a small amount of cylinder oil was distilled to dryness upon a sheet-iron plate without access to the air and as nearly as possible realizing the conditions in the cylinder where the oil

is heated in an atmosphere containing a large percentage of inert gases such as carbon dioxide and nitrogen. This sheet iron coated with carbon was then heated not quite to redness and treated with water. After the water had evaporated the carbon was in every case loosened from the plate so that it could easily be blown away with the breath.

Kerosene, reputed to be such a good carbon remover, was tried similarly and not only failed to remove any carbon, but actually left a deposit of its own, for it distilled in the same way that the cylinder oil had.

One of the chemicals now used to run through the carburetor of an automobile motor was also tried, but gave no better results than pure water.

Thus to sum up, steam removed the carbon that had reached an incandescent temperature, but did not affect the carbon deposit at a lower temperature; while water in the liquid state applied to a hot surface coated with a deposit of carbon loosened the deposit to such an extent that it could easily be blown away.

The greater part of the carbon in an engine cylinder, however, never under normal conditions reaches a temperature high enough to become incandescent; if it did, serious trouble from preignition would ensue. The carbon must, however, be deposited from the burning charge in a finely divided condition, and this carbon before its deposit would be incandescent.

From this the conclusion must be drawn that steam in any form will not remove the greatest part of the carbon deposit in a motor, or that part which does not reach incandescence, but it would, if mixed with the charge, oxidize the finely divided particles of incandescent carbon and prevent the formation of carbon deposits. Therefore, those devices on the market designed to mix a small amount of moisture or steam with each charge as it enters the cylinder should prevent the formation of carbon, if effective in introducing a sufficient amount of steam, but would not remove the carbon already there. On the other hand, the introduction of water into the cylinders in the liquid state should loosen the carbon deposit to such an extent that it could be easily blown out the exhaust. The action of the water seems to be that it gets in between the carbon particles and, upon being suddenly vaporized by the heat, loosens the deposit.

This is nothing new. In fact, the writer saw water used in this way several years ago, but had never heard an explanation of its action or seen any experimental proof of its effectiveness. Here, as in many other things in the gas-engine industry, practical experience has gone ahead of science and theory. Many instances in practical work bear out the conclusions.

Upon examining a cylinder having removable heads in which the gasket has leaked so that upon standing idle, water from the jackets will seep in, it will be found that the carbon deposit is loose and not nearly so heavy as in the other cylinders of the same engine where the water has not entered. Again, if water alone be run through the carburetor of a hot engine, clouds of carbon will issue with the exhaust gases.—Power.