

numbers. Many artillery horses are being replaced by tractors, and mechanical transportation may be expected to change the wars of the future.

CHEMICAL WARFARE

By Capt. S. J. M. Auld, 4th (Terr.) Battalion Royal Berks Regt. Lecture delivered on Dec. 8, 1921, at the School of Military Engineering, Chatham, England. 15 pages.—*Royal Engineers Journal*, Feb., 1922, p. 57.

This lecture was delivered by a former lieutenant colonel of the British wartime Gas Service, who, as the British gas liaison officer in the United States was an important factor in the inception of the measures taken during the World War to place the American Army on a proper basis of gas preparedness, training and organization. The paper is of interest as showing the present thought in England, from the viewpoint of a recognized gas enthusiast, of chemical tactics as developed during the World War, and of the present status and future developments of the same.

Continued Use of Gas. The lecture, it is to be noted, was delivered a month before the adoption by the Washington Arms Conference of the resolution proscribing the use of gas in the future. The speaker emphasizes from beginning to end, however, his belief that, regardless of any international conventions that might be adopted, the use of chemicals has come to stay. "No case is known of a successful new weapon or a tactical advantage having been discarded once its value was approved. No agreement or treaty has proved strong enough to bind an unscrupulous enemy seeking an advantage, or for that matter one with its existence at stake."

Cloud Attacks. Captain Auld's statements regarding World War chemical tactics are generally in accord with the teachings at these schools. As to cloud-gas (cylinder) attacks, the method is said to be very crude, but to have nearly always proved very effective because of the ground it covers. After falling more and more into disuse, this method, just before the close of the war, enjoyed a wonderful revival in special circumstances by the organization of

highly concentrated "beam" attacks, delivered from light trains instead of from trenches. Around Lens and in the Ypres Salient, advantage was taken of the network of narrow gauge lines to bring up trains loaded with many thousands of cylinders of gas, which were discharged simultaneously by electricity. As many as 6,000 cylinders, from three trains in echelon, have been discharged over a short front in the space of a few minutes.

Use of Gas by Artillery. Stress is placed on the importance of the use of artillery chemical shell. While artillery shell contain relatively little gas compared with projector drums, or even Stokes mortar bombs, more gas was used in the form of artillery shell than in any other way. The reasons are chiefly the longer artillery range; greater independence of wind direction; the fact that the use of gas by artillery does not necessitate special personnel, nor interfere with the activities of other troops; rapidity of fire and coordination of fire direction; better organization and greater simplicity of ammunition supply.

When the British started to use gas in 1915, less than 5 per cent of the total shell were chemical-filled. This proportion increased to 25 per cent by 1918, with a prospect of still more in the future. The Germans, during 1918, Captain Auld states, actually supplied their dumps with 50 per cent of chemical shell.

Casualties vs. Neutralization. In gas attacks there are two main objects—the infliction of casualties, and neutralization. Generally speaking, the infliction of casualties is the more important, because, if sufficient in extent, it achieves the second object more effectively and for a longer period. But so far, the casualties, though enormous, have never been sufficient in themselves to produce results of the strategical value of neutralization. Indeed, there were many cases in the last year of the war where the casualties produced by a heavy bombardment were of secondary importance—merely incidental to the denial of mobility and terrain to the other side.

Even when an enemy is able to recognize a gas attack and to adjust his protection in time, a considerable tactical advantage is gained by compelling him to retain it. Inconvenience is caused, activity greatly restricted and vision in-

terfered with, especially at night. Heavy tasks, like digging and carrying, are interrupted owing to the increased exertion, and the duties of observers, wiring parties and, in fact, everyone, suffer considerably.

Although the possibility of exhausting the enemy's masks was not great during the war, yet in the event of a siege, where renewal of the gas mask would be impossible, it would assume great importance.

Mustard Gas. The introduction of mustard gas changed the whole aspect of war. When first used, as a defensive agent, it delayed the British attacks of the autumn of 1917 by a fortnight. The use of toxic persistent gases is most important, enabling a commander to deny whole areas to his opponent, to contain successfully the strongest fortified posts, or to effect their neutralization, and, above all, to rest his attack on artificial flanks.

Gas Defense. Stress is placed on the necessity for adequate gas defense. "I could give you instance after instance where our gas discipline saved lives, saved positions, saved armies." Consolidation of a position against gas attacks should be automatic and should rank with consolidation against bombardment or direct assault.

Future Developments. As to future developments, the lecturer affirms that this will be all round—in weapons, tactics, materiel. Gas will apply to all arms. With the infantry it will probably start with rifle grenades and toxic smoke candles. The mobility of the cavalry will be used for the swift transport and installation of cloud generators, and for the carriage of light mortars. Tanks will be particularly concerned with chemical warfare, more especially in the defense against gas. The whole tank may have to be turned into a kind of gigantic respirator, and that means making it air-tight. Gas may prove to be the Achilles' heel of the tank. Probably all artillery shell will be partly filled with chemicals. Consider the added effect of chemicals to a long-range bombardment of villages, camps or cross roads. It is pointed out, however, that gas is fundamentally independent of heavy ordnance. An enemy with little or nothing in the way of heavy guns can still be a formidable opponent by combining skillful entrenchment with a copious supply of chemicals to be fired from the lightest of mortars, from pro-

jectors, or for use as a toxic smoke. Chemicals will be used by airplanes and against airplanes.

As regards materials and the dependent tactics, even the immediate future is difficult to forecast. The possibilities of chemistry are almost infinite, and after all, important as chemical warfare is, we are still in the blunderbuss stage.

In some form or other gas is applicable to every phase of war. Action and reaction are equal and opposite. Sooner or later defense balances offense. But there is a lag, sometimes a big lag, before the balance is adjusted. The duration of that lag may decide a war.

THE ADMINISTRATIVE SERVICES OF THE BRITISH EXPEDITIONARY FORCES DURING THE GREAT WAR

10 pages.—*Army Quarterly*, Jan., 1922.

This article gives an excellent bird's-eye view of the development and operations of the supply machine in the British army during the war. The subject is already in very condensed form, and is therefore difficult to condense further. The article is especially interesting in the light of the splendid results that we know were achieved by the Remount, Veterinary and Salvage Services.

The supply problem was a very difficult one, not only because of the enormous number of combatants, but also because of the new inventions and the abnormal development of equipment, and because of the economic scarcity in the later stages due to world exhaustion. For this kind of war none of the combatants had had any previous experience of much value, least of all the British Empire. An interesting contrast is presented in the fact that, during the Napoleonic wars, such a painstaking and intelligent observer as Jane Austin could write a series of novels without indicating once that her country was involved in a great campaign.

The British army in France was really a nation in concentrated extract. The army was in very great measure its own lumberman. It was in some measure its own farmer,