Volume 19 July, 1933 No. 3

CHEMICAL WARFARE

A quarterly magazine devoted to the activities of the Chemical Warfare Service, of interest to all arms---

Edited by Staff, The Chemical Warfare School,
Edgewood Arsenal, Maryland

THE CHEMICAL WARFARE SCHOOL

Edgewood Arsenal, Maryland

Commandant

Lieutenant Colonel J. W. Lyon - Chemical Warfare Service

Assistant Commandant

Major William N. Porter - Chemical Warfare Service

Secretary

Captain Henry Linsert - Chemical Warfare Service

Faculty Board

Lieutenant Colonel J. W. Lyon - Chemical Warfare Service

Major William N. Porter - Chemical Warfare Service

Lieutenant Commander Geo. P. Brewster - United States Navy

Captain Henry Linsert - Chemical Warfare Service

Captain Rhey T. Holt - Cavalry

Captain M. E. Barker - Chemical Warfare Service

Captain W. W. Wise - Chemical Warfare Service

Captain John C. MacArthur - Chemical Warfare Service

Captain Alden H. Waitt - Chemical Warfare Service

First Lieutenant Milton T. Hankins - Signal Corps

CONTENTS FOR JULY, 1933

OUR NEW CHIEF

MAJOR GENERAL CLAUDE E. BRIGHAM
CHIEF, CHEMICAL WARFARE SERVICE

On May 24, 1933, the President announced the appointment of Col. C. E. Brigham, Chemical Warfare Service, to be Chief of the Chemical Warfare Service, with the rank of Major General. Colonel Brigham, who had been in command of Edgewood Arsenal for the preceding three and one-half years, reported to Washington for his new duties within a short time after the announcement of his appointment.

General Brigham's appointment is especially pleasing to the personnel of the Service - commissioned, enlisted, and civilian. As Executive Officer to General Fries, he had a large hand in the shaping of the policies which have guided us through troubled years; there is hardly any activity of the Service which has not been shaped by his guiding hand; and it is particularly appropriate that he should now be in complete direction of the machine of which he has had such a large share in the building.

CHEMICAL WARFARE

VOL. 19 JULY, 1933 NO. 3

ORGANIZATION OF MECHANIZED CAVALRY

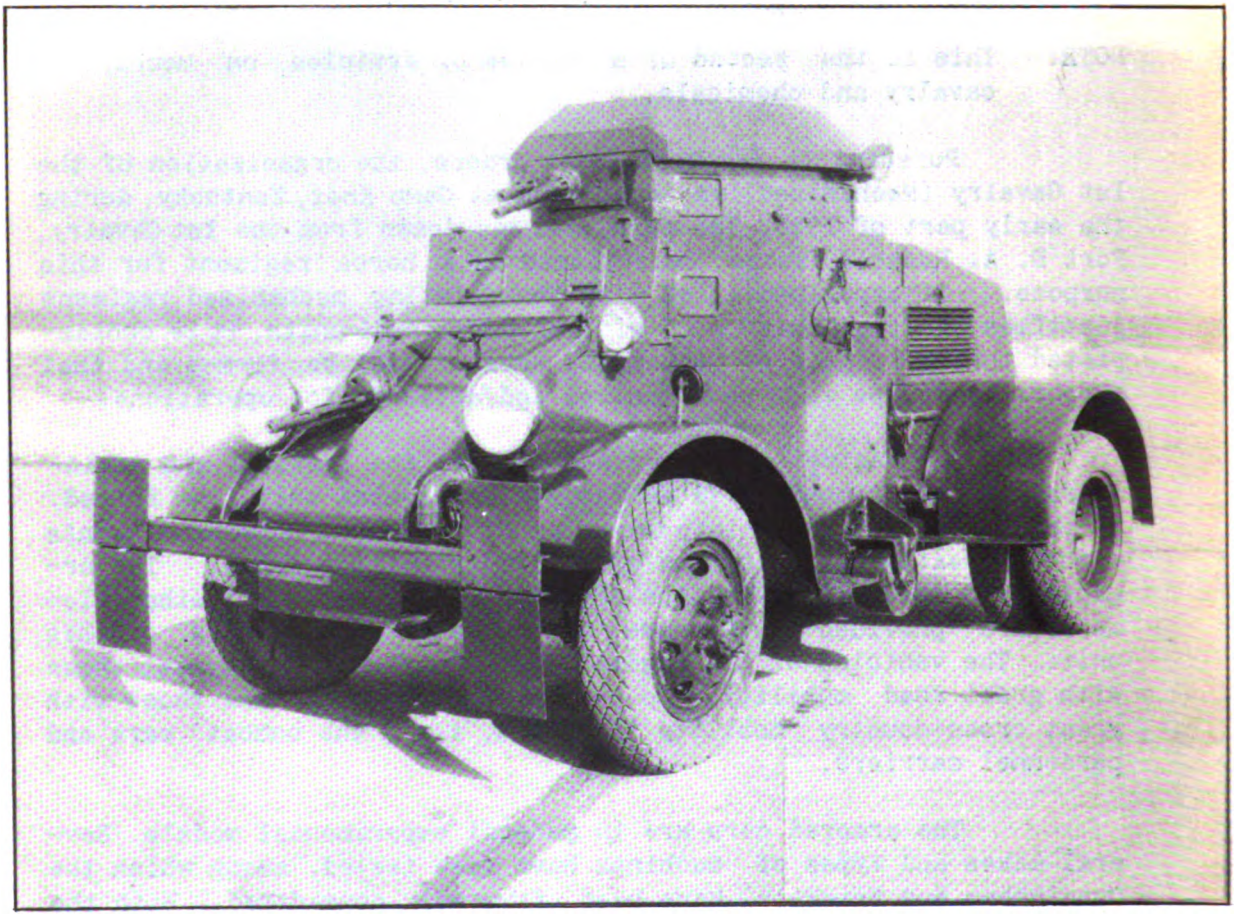
By: Captain Rhey T. Holt, Cavalry

NOTE: This is the second of a series of articles on mechanized cavalry and chemicals.

Pursuant to War Department orders, the organization of the 1st Cavalry (Mechanized) was completed at Camp Knox, Kentucky, during the early part of 1933. The personnel was drawn from the 1st Cavalry, Fort D. A. Russell, Texas, demobilized as a horse regiment for this purpose. If experimentation with the existing mechanized regiment justifies the organization of similar additional units, it is contemplated that a brigade of mechanized cavalry will be formed and that supporting troops will be organized and attached for operations.

The regiment is organized to meet the tactical and administrative requirements of a self-contained combat unit. As formed, it cannot be subdivided into two or more independent tactical elements without greatly weakening the effectiveness of the whole. The organization is built around the combat car squadron; all other elements are provided to increase the combat effectiveness of this unit. The vehicles of the regiment are of two distinct types; those with great road mobility, i.e., the armored cars; and those with great cross-country mobility in combat, i.e., the combat cars and personnel carriers.

The armored cars are in general experimental models. Several makes and types of machines have been tested, among which the Cunningham and Franklin have been favorably considered. With the desired armament and armor providing reasonable protection against small arms fire, these cars will weigh from 4 to 5-1/2 tons when equipped for combat. The Cunningham weighs about 5-1/2 tons. It has six wheels, a four wheel drive, with two spares so mounted that they act as idlers when crossing soft or rough ground. The Franklin is a lighter car, having a four wheel drive and dual wheels in rear. The armored car T-11 is a late development with characteristics somewhat similar to those of the Franklin four wheel drive. Armored cars are armed with one .50 caliber, two .30 caliber machine guns, and one .45 caliber sub-machine gun. These weapons permit the development of a considerable volume of fire during the light fast actions typical of reconnaissance and flanking operations. The vehicles have great road mobility in that they are capable of travelling at 60-80



ARMORED CAR T-11 (Four Wheel Drive)

miles per hour,while their cross-country mobility is fair. They normally travel about 300 miles on one filling of fuel, permitting a cruising radius of approximately 100 miles which includes the looping enroute. Certain of these vehicles, when equipped with communication facilities, are designated "command cars".

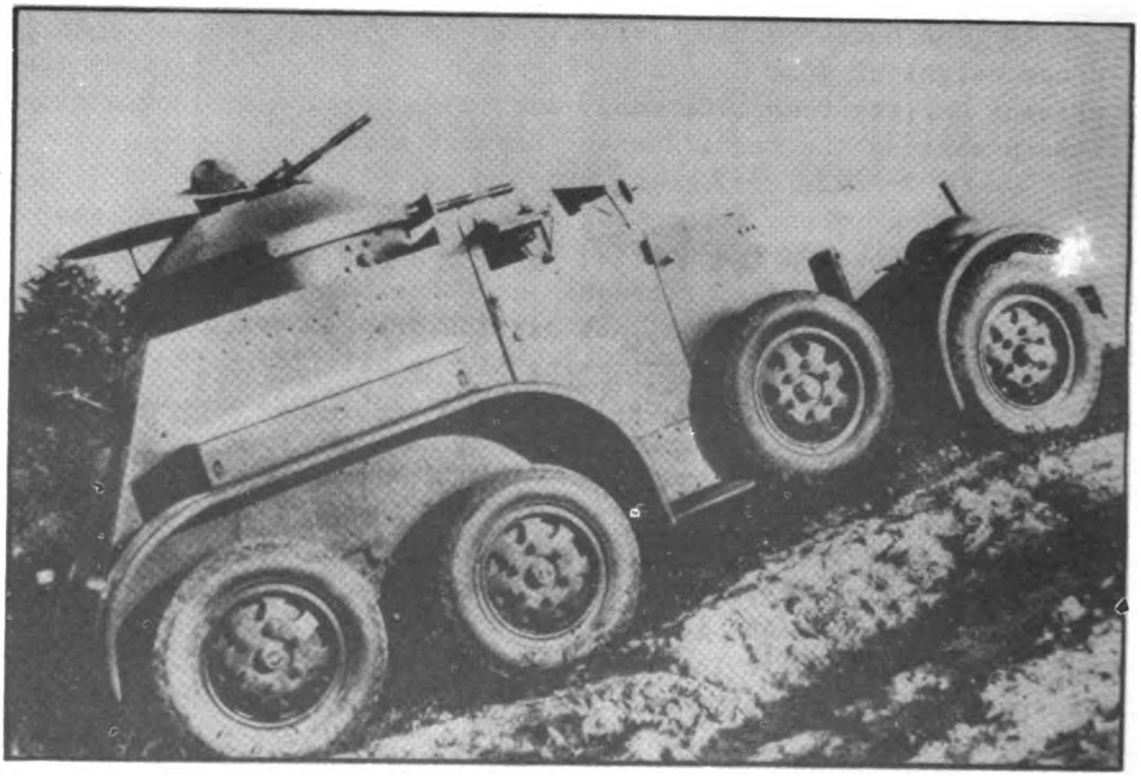
The combat cars are armed and armored vehicles of "wheel with track" design (similar to the Christy fast tank). These cars are experimental models designed to meet certain cavalry requirements,and have great cross-country mobility for combat. Individually, over fairly level terrain, such vehicles are capable of making 40 miles per hour on tracks, and on roads, 60 miles per hour on wheels. Approximately 10 minutes and 15 minutes are required, respectively, to detach and to attach the tracks. The armament consists of one .50 caliber and two .30 caliber machine guns and one .45 caliber sub-machine gun. The armor, in connection with the body design, provides protection against small arms fire and reasonable protection against the .50 caliber and 37mm guns. The total weight of the car,equipped for combat, is approximately 10 tons - a little heavier than is desired. Certain of these cars,when provided with communication facilities, are designated "command cars".

A more recent development, the Combat Car E-4, has a gross weight of some 8 tons. This vehicle will out-perform the present Christy Combat Car and should constitute a long stride toward meeting the requirements for such a weapon.

The close supporting guns are 1.85 inch (47mm) semi-automatic. These are converted naval guns, mounted on self-propelled mounts of similar chassis construction as used for the combat cars. This gun is not particularly accurate when fired from a moving mount, necessitating its normal firing to be conducted while halted, with certain consequent tactical disadvantages.

The personnel carriers are of the "wheel with track", track, or semi-track laying construction. Their cross-country mobility is similar to that of the combat cars. They are designed to carry either one machine gun squad or one rifle squad with full field equipment. The vehicles now used for this purpose are experimental. The personnel carrier T-1 is a recent development of this class.

CHRISTIE COMBAT CAR



CUNNINGHAM ARMORED CAR

The command and staff organization of the mechanized regiment conforms to that of the horse regiment with the exceptions that in the regimental staff, S-2 is charged with liaison, and a "Motor" officer is added.

For all commanders of combat units,down to and including the troop, command cars are provided. These vehicles will not again be mentioned except when included in the smaller elements. Control in organizations capable of great tactical mobility is extremely difficult, necessitating intensive training in teamwork among the members of the staff and all commanders, and rapid communications.

Communications facilities include radio telephone and telegraph receiving sets for all tactical elements down to the platoon, and sending sets for all the units down to the troop. For the regiment and squadrons, radio and message center personnel is provided by the communication platoon in the regimental headquarters troop. The troop provides its own communications personnel. Motorcycles or cross-country passenger cars, for reconnaissance and messenger service, are provided for all units down to and including the troop. Visual color codes for use with flags, lights, or pyrotechnics are used by all elements. Control of the smaller combat elements is affected in part by the direction and speed of the commander's car.

Supplies, including ammunition, fuel, etc., for one day's operations, are carried in the individual vehicles. One additional day of supplies is carried in the troop trucks. For combat and when the situation demands, the troop trucks are grouped and moved under the control of S-4.

Maintenance for the regiment is divided into four echelons as follows:

1st Echelon - The Car Squad - Daily service and inspection.

2nd Echelon - The Troop - Daily inspection, adjustments and replacement of unit assemblies as far as facilities and parts extend.

3d Echelon - The Regiment - (Maintenance Platoon) - All other repairs and replacements as far as

facilities and parts permit.

4th Echelon - The Agency without the regiment to which vehicles are evacuated for repair.

General supervision of all maintenance within the regiment, and particularly of preventive maintenance, is the function of the Motor Officer.

The Regiment includes the following subdivisions:

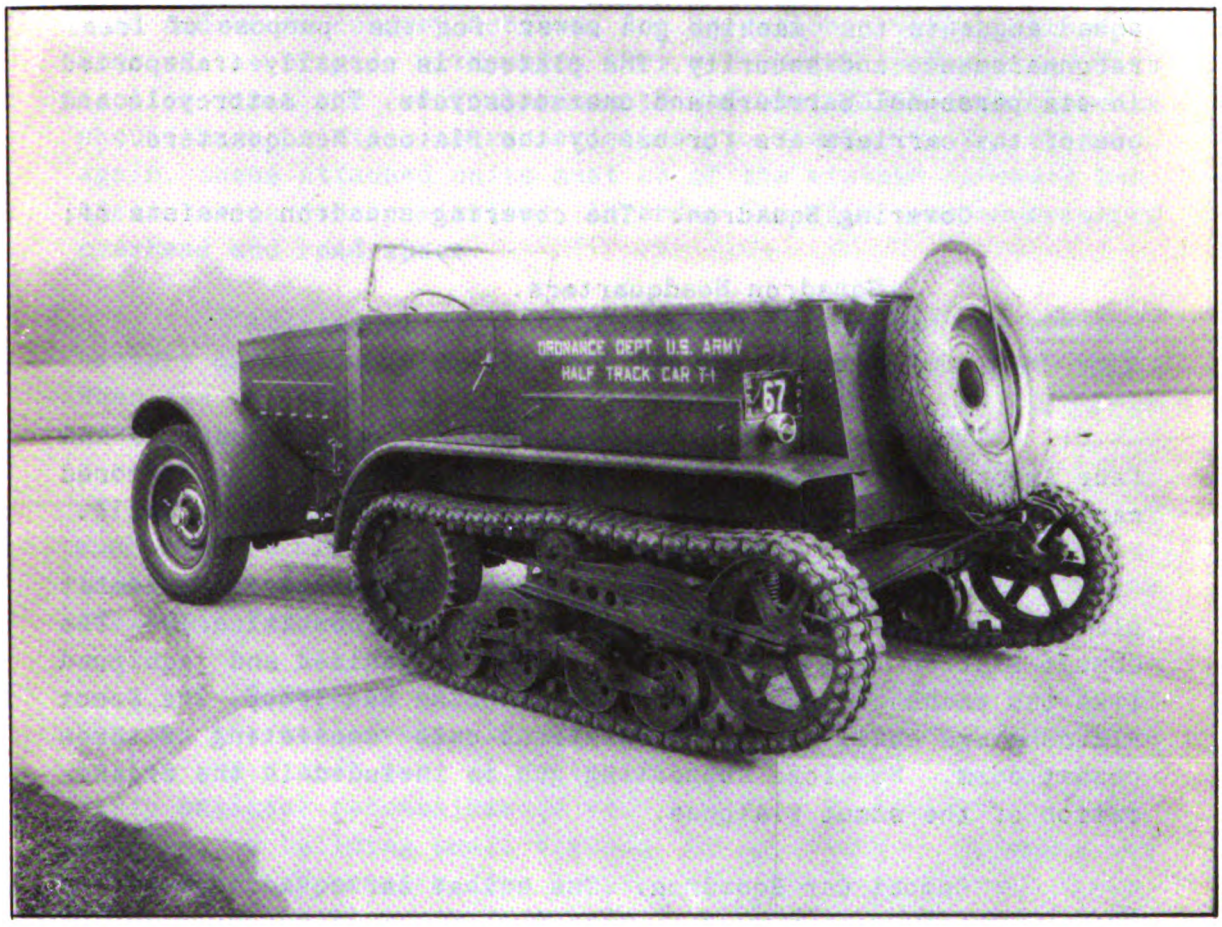
Regimental Headquarters and Band.
Headquarters Troop.
Machine Gun Troop.
Covering Squadron.
Combat Car Squadrons.

The Regimental Headquarters consists only of the regimental commander and the necessary staff officers to insure efficient control and functioning of the unit in combat. The Band is a separate organization commanded by the regimental adjutant and may be attached to any unit of the regiment for administration and supply.

The Headquarters Troop includes:

Troop Headquarters.
Staff and Personnel Platoon.
Supply and Transportation Platoon.
Communications Platoon.
Maintenance Platoon.

The Troop Headquarters comprises all the personnel required for troop administration, supply and maintenance. The staff and personnel platoon is composed of the enlisted clerical force required for regimental and squadron headquarters. The supply and transportation personnel is that required for operation and control of regimental vehicles and for control of the trains,under S-4, when troop vehicles are grouped. All communications personnel, radio and message center, required for regimental and squadron operations is grouped in this communications platoon. The maintenance platoon includes the necessary personnel for conducting the repairs and replacements for all vehicles in the regiment as provided for in the 3d Echelon.



Personnel Carrier T-1 (Half Track)

Machine Gun Troop. The machine gun troop consists of:

Troop Headquarters.
Three Machine Gun Platoons.

Each of the machine gun platoons contains eight machine guns and is organized into two sections,each composed of two squads,while each squad includes two machine guns and their crews. One rifle squad augments the machine gun power for the purpose of local reconnaissance and security. The platoon is normally transported in six personnel carriers and one motorcycle. The motorcycle and one of the carriers are for use by the Platoon Headquarters.

Covering Squadron. The covering squadron consists of:

Squadron Headquarters.
Armored Car Troop.
Scout Troop.

The armored car troop includes Troop Headquarters and four Armored Car Platoons. Each of the platoons has one armored car, command; three armored cars, fighting, and one motorcycle.

The scout troop includes Troop Headquarters,one combat platoon (machine gun) and two scout platoons (combat car). The Combat Platoon is a machine gun platoon organized and equipped like the Machine Gun Platoon in the Machine Gun Troop. The Scout Platoons are small combat car platoons each consisting of three combat cars. No close supporting gun is included in the organization of the scout platoons.

Combat Car Squadron. The combat car squadron consists of:

Squadron Headquarters.
Two Combat Car Troops (Troops E and F).

Each of the combat car troops includes a troop headquarters and three combat car platoons. Each of the combat car platoons comprises one combat car, command; three combat cars, fighting; and one gun, self-propelled, 1.85 S.A.

In the regimental organization provided for in T/O 423 P (Special), one combat car squadron only is included. The war

strength organization is subject to further experimentation. The following tables contemplate three combat car squadrons in the regiment. These are used for the purpose of illustration only.

The mechanized brigade is a powerful combat unit. To fully utilize its capabilities of mobility and crushing power certain auxiliary elements must be contemplated as reinforcements. It is essential that such organizations have the required road and cross-country mobility for operations with those echelons of the brigade with which they will normally function. This implies that the vehicular mounts of the supporting elements should have similar characteristics to those in the brigade. Again, these attached units must be of the minimum strength consistent with their missions in order to eliminate unnecessary overhead and road space.

Additional fire support must be provided for counter-battery of the enemy's light artillery and heavy anti-tank guns. When the brigade is opposed to enemy forces of considerable strength, but with inferior mobility, a brigade reserve in the form of supporting fire may at times be the most effectual means of influencing the action. Both the weapon and the mount for such support are still subject to decision. A fire unit similar in strength to a battalion of 75mm pack howitzers is considered advisable for the brigade.

Specially trained and equipped engineers are required. Due to the relatively limited defensive power of mechanized units, the utmost use of obstacles must be made. On the march early engineer reconnaissance with the view to strengthening,repairing, or building small bridges is important. Possible gas situations may require the cutting of paths through such areas. As this work will be in line with the normal functions of these detachments,special protective gas training and equipment may be required. An Engineer troop is advisable for employment with the brigade.

Anti-aircraft protection is important. The brigade, when conditions permit normal open and flexible march formations, will not form an economical target for bombardment aviation. However, it will at times be vulnerable to aerial attack when in bivouac,crossing a defile,and when in closed formations. These attacks may be with either HE or chemicals. The armament of combat and many of the supply vehicles include machine guns

ORGANIZATION OF THE CAVALRY REGIMENT (MECHANIZED). - The cavalry regiment (mechanized) is organized in accordance with the following table:

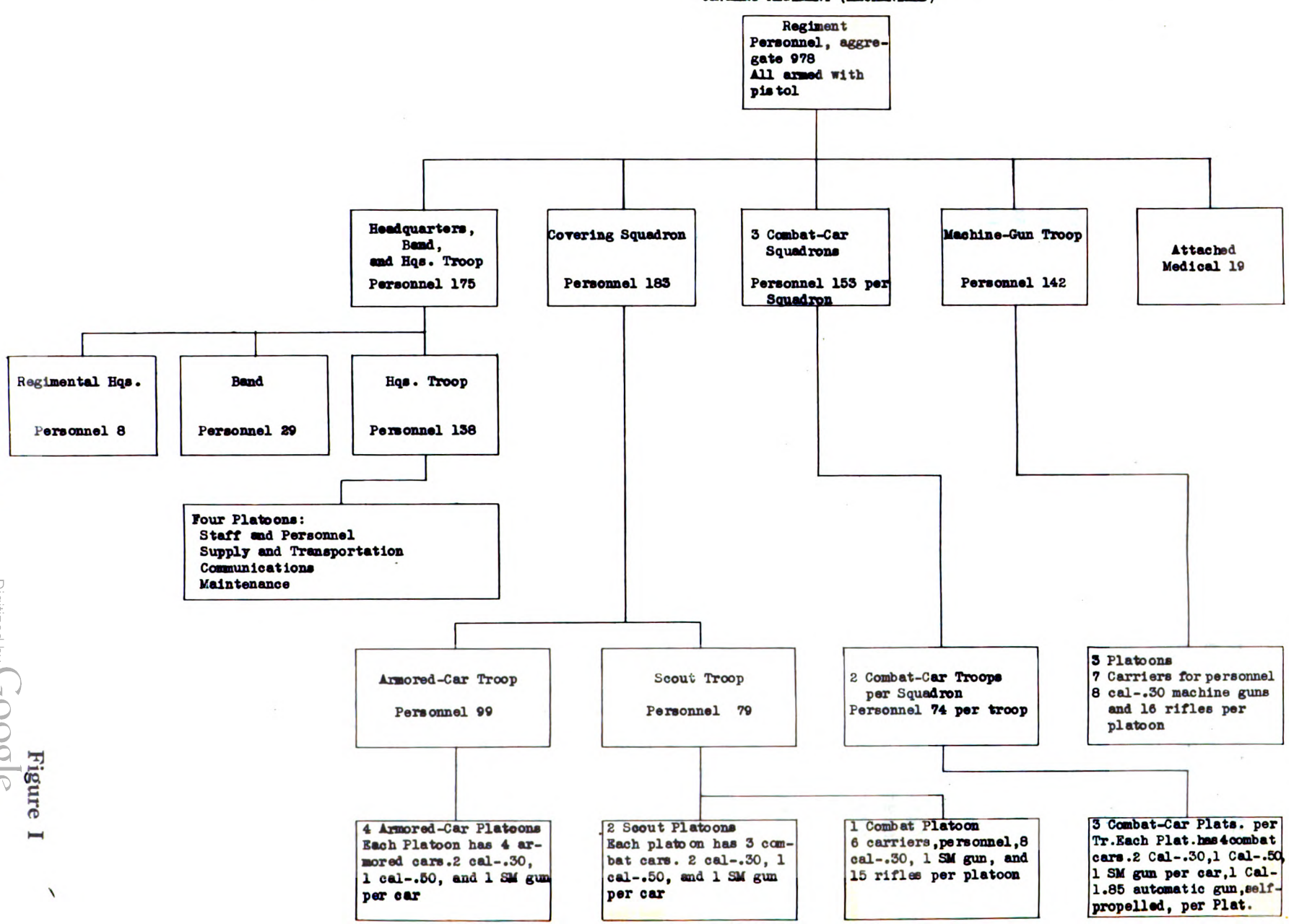


Figure I

CAVALRY BRIGADE (MECHANIZED) (REINFORCED)

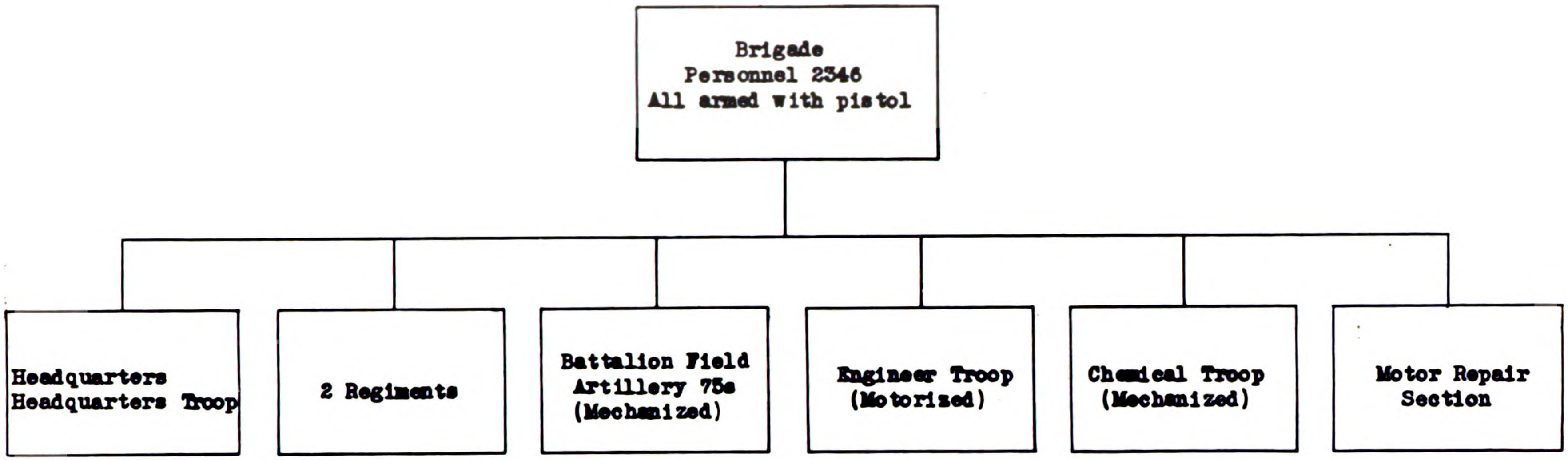


Figure II

mounted for all around overhead fire. Due to the importance of the brigade as an objective for hostile aircraft, these guns should be augmented by a powerful anti-aircraft machine gun organization. One anti-aircraft machine gun battery should provide this supplementary protection.

Mechanized cavalry is very sensitive to terrain. This characteristic will at times require the neutralization of ground which the vehicles cannot negotiate but which may be traversed or occupied by enemy forces. Chemicals are the most economical means to this end. The hostile anti-mechanized defense organization will often include guns so emplaced that only the general area may be located. With only HE available, supporting fire is uncertain under such conditions. Chemicals,particularly smoke, may be all important for these neutralization purposes. When combat car units are held up or forced to rally under enemy fire, from either the front or a flank, smoke may be their only salvation. Chemical mortars employed under general control or in close support of the attacking echelons are often of inestimable value. A chemical troop of four 2-mortar platoons fulfills the normal requirements of the brigade.

CHEMICAL WARFARE

By: James E. Mills

Reprinted, by permission, from the quarterly review FOREIGN AFFAIRS (New York), April 1932

Three new and powerful weapons of warfare were developed in the World War - aeroplanes, gas and submarines. It is fortunate for the world that two of these - aeroplanes and gas - are bound up with the development of the industries of the world. It is axiomatic that every effort should be made to prevent war; but if war cannot be prevented, then it is very much better for the world that when it comes it should be fought with weapons that have not required an immense outlay of funds during years of peace. Mine fields, submarines and aircraft can now aid in giving protection to harbors, with the result that expensive coastal fortifications have become less necessary. Surprise attacks become more difficult, and modern transportation facilities enable both armies and armaments to be shifted rapidly to meet any new attack. In many cases the influence of local interests is the only factor preventing the closing of navy yards, fortifications and army posts no longer really needed for defensive purposes. If individuals and statesmen desire disarmament, and are willing to examine the facts carefully, then material reduction of expensive armaments can probably be secured without sacrifice of national security.

In order that our conclusions regarding chemical warfare may be sane, we must study the facts disclosed by experience.

During the World War a total of about 100,000 tons of gas was used by the various nations involved. The gas casualties produced have been estimated at 534,000 for France, Great Britain, the United States, Italy and Germany, and of those casualties approximately 4.2 percent resulted in death. As regards Russia, the facts are very uncertain. Her troops were poorly protected against gas, however, and suffered heavily; the gas casualties in the Russian armies have been estimated at 475,000, of which 11.7 percent resulted in death.

Many different chemicals were used. These can be roughly divided, according to the effect produced, into four classes:

Lacrimatory compounds, commonly known as tear gases, force the closing of the eyes. Gas masks afford efficient protection, but a man without a mask is helpless. Effective tear gases are known which produce no casualties and no deaths. Such gases are efficient agents with which to control mobs or for use against an army without masks.*

Toxic smokes in exceedingly low concentrations cause severe irritation of the mucous membranes of the nasal passages and throat, the effect being much like that produced by red pepper. A very efficient mask is required for protection. Some casualties are caused and a few deaths. During the war the Germans manufactured about 14 million "Blue Cross" toxic smoke shell, and expected to secure great results because of the ineffective masks then in use by the Allies. Fortunately these shell, due to the manner of dispersion of the toxic smoke, were almost a total failure insofar as their gas content was concerned, though of course the heavy explosive charge which they carried was effective.

Mustard gas was, and is, the most efficient warfare gas known. Probably 12,000 tons of mustard gas were used during the World War and caused in the neighborhood of 350,000 casualties among the French, British, Americans and Germans. Of these casualties about 2.5 percent died. The gas mask provides protection for the eyes and lungs, but the gas or liquid penetrates the clothing and produces skin burns of a nature very hard to heal. At the time of exposure no pain is produced and no discomfort, so that it is exceedingly difficult to enforce wearing of masks. Mustard gas is persistent, and an area heavily treated with it may be untenable for two weeks or even longer.

The phosgene and chlorpicrin type of gas produces a high rate of deaths in proportion to casualties. An unprotected army can be practically annihilated. Gas masks afford efficient protection and during the World War the importance of these gases decreased as the masks improved. Three cloud gas attacks against the Russians resulted in total casualties of 140 officers and 21,000 men dead and disabled. Probably none of these attacks

*Some lethal gases also produce lacrimation. In this article the term "tear gas" refers to gases which will not poison in the field concentration used. The lethal tear gases are classified with the phosgene-chlorpicrin gases.

lasted more than twenty minutes.

The total number of special gas troops in actual service at the front at any one time was very small, amounting to only about 17,170 men for the armies of France, Great Britain, the United States and Germany. The same nations used nearly 60 million gas shell, a figure representing probably between 5 and 10 percent of the total amount of shell which they used.

These facts enable us to draw some important conclusions. Gas cannot displace the older weapons. At the same time, the use of gas results in a large increase in casualties, and no one who understands the facts would dare send into the field an army which is unprotected against gas, relying for its protection upon a treaty signed years before the war began.

Moreover, we may question whether it is wise for any nation to agree that in time of national danger gas shall be discarded and that a more expensive weapon, and one in fact more brutal, shall be maintained in its place. A nation at war thinks itself in the right and is struggling for its life. Is there any sound reason why it should not use gas as a means of defense?

In reality - the propaganda against it notwithstanding - gas is the most humane weapon which exists today for use in actual warfare. More than 24 percent of the total American battle casualties resulted in death. Only 2 percent of the American gas casualties resulted in death. In the British Army, of all gas casualties only 3.3 percent died. The Surgeon General's report for 1920 showed conclusively that gassing does not increase tuberculosis in after years and that permanent injury of any kind from gas is comparatively rare. Gas does not mutilate the body, and it seldom causes extreme pain - usually no pain whatever at the time it is breathed. Later on, in the hospital, a seriously gassed case can probably best be compared to a case of pneumonia. The first gas used in the war, chlorine, was extremely irritating and painful. The change to less painful chemical agents was not due to any humanitarian consideration. It was merely found that a gas which poisons without pain is far more effective for the pain warns of danger and the soldier puts on his mask.

No attempt is being made here to argue that chemical

warfare is humane. There is little humanity in any sort of actual combat. The facts are stated only to show that gas cannot be barred as a weapon of war on the ground that it is barbarous. There are anti-aircraft installations that fire one thousand rounds per minute. Would it not seem a little absurd for the nations of the world to rule that the aviator could not drop tear gas to confuse the aim of his humanitarian opponent?

If we were to stop with the foregoing statement as to the relative inhumanity of gas and other weapons of war an injustice would be done to gas warfare, for there is a further important difference between them - gas warfare can be made humane if the nation using it desires; other weapons cannot. Once the bullet or the shell has been started on its course all control over it is gone. There is no way of tempering the injury done. Whoever stands in the way will suffer mutilation and possible death. Gas is a weapon the effect of which can be controlled. Tear gas can be used to disperse a mob with the certainty that no one will be injured. If the tear gas is not sufficiently effective then a toxic smoke can be used. If the opposing force is so well trained and protected that these two gases are not sufficient, then it is not a mob but an organized army. Mustard gas may even then accomplish the purpose with a relatively small loss of life. Perhaps the time will come when it will be considered barbarous to use rifles, machine guns and explosives against a mob, or against some unorganized or uncivilized nation, when the situation could be controlled by the use of gas without loss of life. These facts make it improbable that any general agreement for the complete abolishment of gas warfare will ever be reached.

A nation fighting on the defensive generally fights at home. The use of chemicals, aeroplanes and submarines tends toward equalizing fighting ability among civilized nations. They are relatively cheap weapons; the raw materials required are abundant; and no large number of fighting men are required. For a variety of reasons, moreover, as the distance from a secure base increases there is a decrease in the possibility of using these weapons effectively. The diminution of the power to fight successfully at a distance seems likely to tend strongly towards peace among the nations. Thus it is possible to prophesy that the new and powerful weapons of war made possible by science may be a gain to the world.

Gas warfare is particularly powerful as a defensive weapon. This fact arises primarily because mustard and similar gases can be used to prevent the occupation of the homeland by a foreign foe. They also can be used by a retreating army, but their use by an army on the offensive would block that army's own advance.

These considerations require most careful attention at the hands of those who are dealing with the vexed question of arms limitation. If gas warfare were outlawed, a nation on the defensive would in all probability be the heaviest sufferer from such limitation in time of war. Moreover, any treaty requiring the signatories to array themselves against a nation using gas in warfare would be dangerous, for such a provision might easily require the signatories to join against a nation using gas only as a means of defense against some aggressor. No treaty should forbid a nation the right to use any weapon whatever within its own territory.

Is chemical warfare a menace to civilization? Terrifying pictures have been drawn of possible uses of gas against cities. It has been stated that twelve large bombs of Lewisite could annihilate the population of a city the size of Chicago or Berlin. As a matter of fact, Lewisite is not quite twice as toxic as mustard gas and is not today considered to be nearly so effective a warfare agent. This is because Lewisite is destroyed by moisture or by rain, and Lewisite vapor does not penetrate clothing to the same extent that mustard gas does. During the World War one ton of mustard gas caused on the average about thirty casualties. If the inhabitants showed proper care, twelve large gas bombs would probably injure few people more than a hundred yards distant from their bursts, while many close at hand could escape without any injury whatever. So let us temper imagination with reason.

The power of all chemical warfare gases to injure depends upon two entirely separate and distinct factors. One is the concentration of the gas in the air, and the other is the time of exposure. The injury is proportional to the product of the concentration and the time of exposure.

Warfare gases with high boiling points (low vapor pressure) cannot be obtained in the air in high concentrations, for according to well-established laws high concentrations of

such gases condense out immediately and deposit as a liquid, which falls to the ground and evaporates slowly. Both mustard gas and Lewisite belong to this type of gas. The average mustard gas casualty reported to the First Aid Station about eight hours after exposure. Immediate danger with these gases arises only from the liquid or close to the shell or bomb burst.

If a volatile gas such as phosgene or hydrocyanic acid were used in an attack upon a city, high concentrations from a chemical warfare standpoint could be produced, not indeed by a few bombs, but by the use of many tons of gas. A gas concentration of only one part by weight in ten thousand parts by weight of air, over an area five miles by five miles, to a depth of thirty feet, would require eighty tons of gas. Gas in this concentration would be fatal if breathed continuously by an unprotected man for about an hour. Many immediate fatalities would indeed result and there is no intention of minimizing the horror of such an attack. But the bulk of the population could save themselves by going at the first intimation of danger into any ordinarily tight room and closing the doors, windows and ventilators, for a volatile gas is blown away by the wind and even a four-mile-an-hour wind takes the gas away very quickly and dissipates it into the upper regions of the air.

Certain and complete evacuation of the civilian population of a city could be compelled by the use of tear gas, without the production of any casualties. There is no military necessity for the use of lethal gas against civilian populations, and those who are tempted to make such use of it will probably be dissuaded by the fear of retaliation and the fear of the condemnation of all right-thinking and civilized peoples. As Professor Nolf, President of the Belgian Red Cross, said at the opening of the International Congress of the Red Cross at Brussels in January, 1928: "I believe it my duty to declare that the principal safeguard of civilian populations appears to me always to be that primordial rule that the operations of war between civilized peoples must be limited to the armed forces alone. If in the future a belligerent nation breaks this rule and attacks the population of defenseless cities back of the front, and submits them to the horrors of death by asphyxiating gases, it deliberately places itself under the ban of civilized peoples and exposes itself to the harshest and most justifiable reprisals."

Nevertheless, we should consider whether it is possible to take effective steps to limit the manufacture of lethal gas and its use in war. Certain technical facts must first of all be understood. Table salt, water, coal, sulphur and starch or sugar are the only raw materials needed for the production of two of the most powerful war gases. Add to these lime, phosphate rock, arsenic ores, bromides and bauxite, and you have almost completed the list of materials needed for the manufacture of chemical warfare agents. The list should also include titanium and zinc compounds, which are used in the production of smoke screens. All of these raw materials find numerous uses in everyday commerce. To supervise or limit their production or sale is obviously impossible.

In the process of manufacturing the actual gas a number of so-called "intermediates" are produced. The list of intermediates is rather long, but the most important will be mentioned here because it has been proposed to limit or supervise the production of such intermediates "for use in war". The list includes chlorine, sulphuric acid, hydrochloric acid, caustic soda, benzol, alcohol, acetic acid, acetone, calcium carbide, bleaching powder, aluminum chloride, sodium nitrate, sodium cyanide, chlorhydrin, diphenylamine, thiodiglycol, sulphur monochloride and arsenic trichloride. Every compound mentioned except the last three is an important industrial compound and is in large everyday use. No industrial expert would consider it remotely possible to control their manufacture or sale. The last three compounds are, or may be, used in the manufacture of mustard gas and Lewisite; but no gain would result from an agreement to regulate their manufacture.

The whole situation is well illustrated by the history of mustard gas. This compound had been known for years before the war, but large-scale manufacture was considered impossible until the Germans produced it from chlorhydrin, which they used in making indigo. The Allies had no supply of chlorhydrin and only after strenuous effort lasting a year did they succeed in the manufacture of mustard gas. Two new processes were found; neither of them required chlorhydrin. Thiodiglycol and sulphur monochloride may be used in the manufacture of mustard gas but they are not necessary. Arsenic trichloride is so easily manufactured that regulation of its production in time of peace would have no effect on the supply available in time of war.

After the war, an inter-Allied commission of chemists visited Germany to learn her secret processes for the manufacture of chemical warfare agents; they were shown the factories, but they learned almost nothing new. The factories were the same factories that for years had manufactured harmless products,such as dyes, perfumes and medicines. "It took forty years and more to develop these factories. Yet forty days saw many of their plants producing huge tonnages of poison gas, and as many hours were sufficient for others." Whether a chemical factory is to turn out beneficial medicines or death-dealing poisons depends upon the will of the operator. Generally speaking, the same retorts, filters, stills, centrifugals, boilers and machinery are as necessary and as useful for the one as for the other, and almost the same raw materials. In fact,the task of producing containers such as shell and bombs for use with gas would in all probability cause more delay in preparing for extensive chemical warfare operations than would the task of adapting chemical factories to the manufacture of war gases.

If in writing regulations for the manufacture of chemical warfare agents and intermediates we insert the words "for use in war", how could we discover the use which is really intended? The task would be hopeless. Often the manufacturer does not know who his customer will be and often he could only guess at the use to which the product is to be put.

This whole technical discussion is rendered almost useless by the fact that nations do not in the least care to manufacture and store chemical warfare agents in time of peace. Storage is troublesome and expensive; and it is easy enough to arrange to manufacture them beginning with the date of mobilization. Any nation with a well-developed chemical industry possesses ipso facto the means to manufacture chemical warfare agents. The size and character of the factories will be determined by the extent and nature of the nation's industries and not by treaty. Statesmen may decree that the product of these factories shall not be used in war, but they cannot diminish the size or equipment of the factories themselves. In other words, neither statesmen nor treaties can limit the real weapon - the power to manufacture gas.

Nor is it possible by abolishing chemical warfare to limit research for new poisonous compounds. They are a necessity of modern civilization. They play a necessary part in the

development of insecticides, fungicides, germicides, disinfectants, preservatives,fumigants and medicinals. It has been estimated that the destruction caused by insect and animal pests in the United States reaches the astounding total of more than two billion dollars a year. The bubonic plague in India alone cost 8,000,000 lives in the first ten years of this century. Eliminate the rat, mosquito, flea and louse, and such diseases as malaria, bubonic plague, yellow fever and typhus would disappear from the face of the earth. It is certain that the death toll inflicted by these pests has far exceeded that of all the wars of all the centuries. Poisons from the chief weapons used in combatting them,and we may therefore conclude that research upon poisonous compounds will certainly continue, and that it is essential that it should continue. Why fear increasing knowledge? It brings new powers as well as new responsibilities.

Efforts to agree to limit peace-time expenditures for chemical armament seem futile. For the fiscal year 1931 the total appropriation for the military establishment of the United States was $341,050,664, of which sum the Chemical Warfare Service's allotment was $1,295,215. Thus only 0.38 percent of the total appropriation of the Army was given by special appropriation to the Chemical Warfare Service. During the World War 19.39 percent of the total casualties produced in the American Army were gas casualties. The appropriations for chemical warfare made throughout the world today are probably actually insufficient to provide adequate protection for the armed forces now maintained by the nations,and therefore could not wisely be subjected to further limitation.

Certain clauses in the Treaty of Washington and the Geneva Protocol are purposely worded so as to prevent the use of tear gas. But since it is now generally recognized that tear gas is a humane weapon, and can be effectively used to control mobs or an enemy not equipped with gas masks, it has been suggested that the term "poisonous gases" be substituted, apparently with the idea of permitting the use of tear gas. At this point it is necessary to make one of those statements which appear so contradictory to readers who are not familiar with chemistry. Most tear gas compounds are in themselves very toxic and poisonous. The most effective and harmless tear gas known is probably equally as poisonous, weight for weight, as phosgene, one of the most deadly of warfare compounds. The fact that the tear gas never produces fatalities or serious casualties is due to its

physical properties,which are such that only very low concentrations can be obtained in the air under field conditions of use. These low concentrations are irritating to the eyes, but do not cause serious injury.

There is an old argument that any treaty which forbade the use of gas, and which would be observed and could be enforced, should be extended to other weapons, with the result that war itself would be prevented. Without answering this argument, which has some merit, the writer suggests that a treaty attempting solely to limit the use of gas should, if adopted, be worded somewhat as follows: "The signatory powers bind themselves not to use beyond the limits of their own territory gases or other chemical agents capable of producing fatalities in the concentrations used." This would permit the use of tear gases and also would allow a nation to use any chemical warfare agents whatever within its own territory. The use of chemicals as a means of defense would not be prohibited. And since no nation would use gas in a way to injure its own non-combatant population, a provision so worded would protect civilian populations against gas to the extent that such protection can be afforded by treaty.

TRAINING PROGRAM FOR A MEDICAL REGIMENT

During the latter phases of instruction in The Chemical Warfare School, students in the Line and Staff Officers' Course prepare a program of instruction for units of their branch. The following program for a Medical Regiment was prepared by Major Samuel A. White, M.C., and Major Seth C. Dildine, V.C. This program represents the thought of these officers after a close study of chemical warfare and its influence on the activities of the Medical Corps. Major White later prepared a detailed outline of instruction to carry out the program. Space does not permit of the publication of the entire outline, but its contents have been summarized and included herein. The views of Major White and Major Dildine, as expressed herein, should be of interest to officers of the Medical Corps.

Headquarters, 901st Medical Regiment,
Fort Blank, Blank.

October 1, 1933.

TRAINING MEMORANDUM)
) TRAINING PROGRAM FOR THE TRAINING YEAR
NO. 00.) November 1, 1933, to October 31, 1934.

* * * * *

X. CHEMICAL WARFARE.

a.- Objective: The proficiency of all personnel in individual and collective protective measures (including actual training with non-lethal agents), the basis for and application of first aid treatment, and sufficient knowledge, on the part of all officers and certain non-commissioned officers, of the tactical use of chemical warfare agents by the combatant arms to enable them to properly select locations for all medical service installations and routes of evacuation and supply.

b.- Regimental Training: (1).- All officers of the Regiment will attend an initial two-hour period (1:00 - 3:00 PM, December 1, 1933), at which time the course of training will be outlined and the training film "Defense Against Chemical Warfare" shown.

(2).- During the period of regimental tactical exercises (May 1 - 15, 1934), advantage will be taken of all opportunities for the introduction into such exercises of applicable chemical warfare situations.

c.- Battalion Objectives: To conform to that outlined for the Regiment, with special reference to their varying individual needs - Ambulance, Collecting, and Hospital.

Battalion training will begin January 11, 1934, (immediately upon completion of the chemical warfare section of the Officers' School (see under "Schools")) and will be completed by March 31, 1934; and there will be allotted to each company within the battalion such periods of training as will enable all companies to spend the final week of the battalion period (March 24 - 31, 1934) in general battalion training and preparation for the battalion tactical exercises beginning April 1, 1934.

d.- Battalion Commanders will cooperate in the use to the best advantage of all protective equipment and training agents available.

There will be at least 60 masks per battalion, plus such other protective equipment and supplies of non-lethal chemical agents as can be obtained; and Battalion Commanders, with the Commanding Officer of the Veterinary Company, will decide as to the pooling of such equipment and supplies, and as to the sequence of company training within the battalions and Veterinary Company which will produce best results.

e.- Standards of proficiency shall be as prescribed in current Regimental Training Guide.

* * * * *

Y. SCHOOLS.

a. OFFICERS' SCHOOLS.

x.- Chemical Warfare.

(1).- Dates: December 1,1933, to January 10,1934.
(2).- Scope: Agents and their tactical use by the combat arms, with special reference to

the effect of such use upon the location of medical service installations; protection - individual, collective, and tactical; first aid; and elementary course in weather.

(3).- Instructor: The Regimental Gas Officer.

(4).- Assistant: The Divisional Gas Officer (for special lectures).

(5).- Students: All officers.

(6).- The Regimental Gas Officer will submit to these Headquarters, not later than November 15,1933, a schedule and outline of the proposed instruction.

b. NON-COMMISSIONED OFFICERS' SCHOOLS.

x.- Chemical Warfare.

(1).- Dates: January 11, to January 31, 1934.

(2).- Scope: Same as for officers, due regard being had for the shorter period of instruction and for the difference in need for instruction in tactical use of chemicals.

(3).- Instructor: The Regimental Gas Officer.

(4).- Assistants: Qualified Officers from the Regiment.

(5).- Students: One non-commissioned officer from each company, and two from each battalion and the regimental headquarters company.

(6).- The Regimental Gas Officer will submit to these Headquarters, not later than December 15,1933, a schedule and outline of the proposed instruction.

SUMMARY OF OUTLINE OF INSTRUCTION

Time Allotted (hours)

Subject	School Phase		Organization Training Phase
	Officers	Gas N.C.O.'s	Company
General Instruction	2	2	2
Agents	3	3	3
Weapons	4	3	1
Weather	1	1	
Protection	26	35	29 (**)
Tactics(*)	10	5	
Training Methods	1	1	
TOTAL	47	50	35
Type of Instruction			
Conferences & Lectures	26	24-3/4	11-1/2
Practical Exercises	17	21-1/4	23-1/2
Problems	8	4	

(*) Two problems for officers and one for N.C.O.'s designed for training in Tactical Protection.

(**)Includes practical work during field exercises.

CHEMICAL WARFARE

(Reprinted from the Journal Royal United Service Institution, February, 1933)

When all else fails in the way of agreement to disarm, resort has been had again and again by the Powers, severally and collectively, to a solemn pronouncement outlawing all forms of chemical, incendiary and bacterial warfare, but there are certain practical and technical difficulties involved in this prohibition and in supervising its enforcement. Those have formed the subject of a report prepared by a Special Committee, in reply to a questionnaire submitted to it by the Bureau of the Disarmament Conference.

In the first place, the Committee considers that such protective devices as masks, respiratory apparatus, etc., are necessary in order to guard against the effects of chemical weapons, and that, since such devices are also used in time of peace in a number of industries, their manufacture cannot be prohibited. Further, the testing of this protective material involves the use of a small quantity of poisonous substances.

Again, with regard to offensive material, the Report points out that chemical, incendiary and bacterial warfare does not necessarily require any special implements and little, if any, special training. To give two examples, apparatus intended for producing therapeutic clouds when combating diseases of trees can also be used for creating clouds of poisonous substances, and certain fire-extinguishers can easily be converted into flame-projectors which can be used either in a military sense or in destroying locusts.

The Committee draws attention to the fact that "in a country possessing an important chemical industry it will always be possible to use chemical weapons; and chemical warfare can always be rapidly organized, even though no special preparation has been made in peace time". Moreover, the Committee emphasizes its opinion that no restrictions must be imposed which might hinder chemical research and the growth of human knowledge or which might retard the progress of the legitimate chemical industry. It also recommends that prohibition of preparations for chemical warfare should not apply to research work (and) the preparation . . . of apparatus for giving protection against poisonous substances, the preparation of measures of collective protection, the training of troops and of the population in pro-

tective measures against poisonous substances, and therapeutical research in regard to casualties due to poisonous substances, but such prohibition should give a transgressor a decisive superiority and so increase the temptation to use the chemical arm.

After examining various suggestions for supervision, the Committee is of opinion that, although conceivable in theory, they would prove impossible in practice. It will, therefore, be especially important to define the procedure and penalties to be applied in cases of infringement of the undertaking not to resort to the use of the prohibited weapons against an adversary. In this connection the Committee makes certain constructive suggestions for the rapid establishment of the facts by a "commission for urgent initial investigation," for procedure, and for concerted aid to be given to the attacked State.

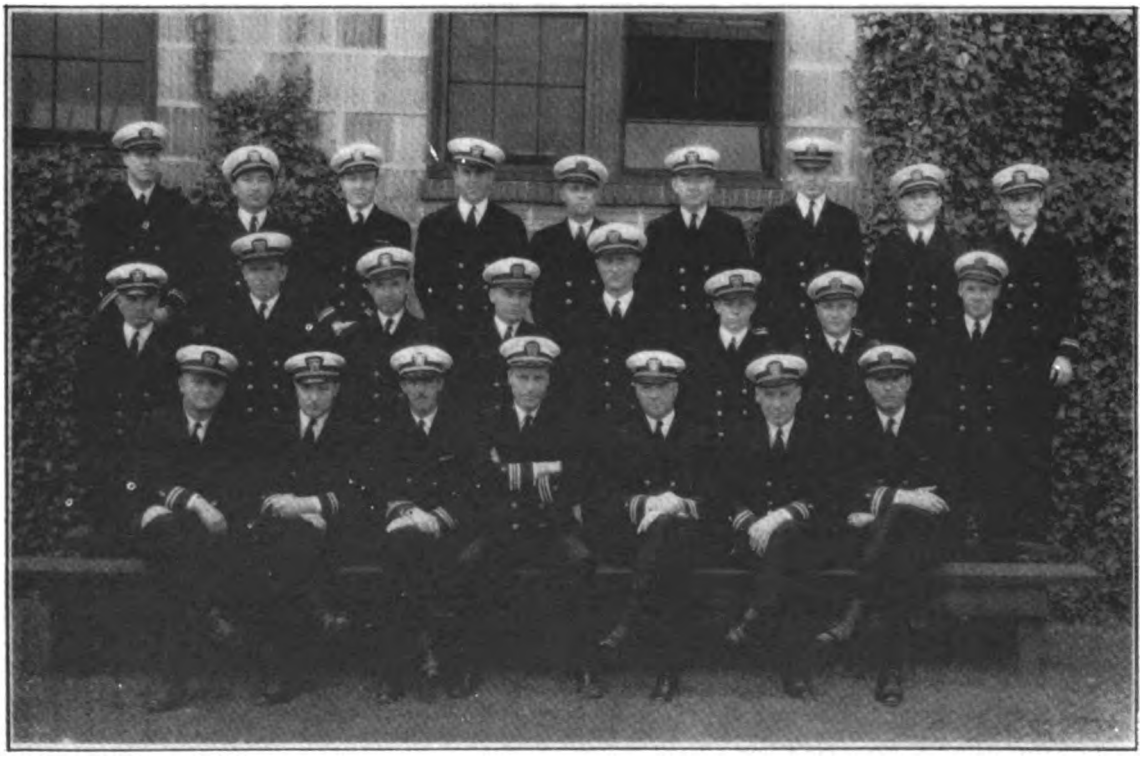
The ten following States were represented on the Special Committee: Great Britain, Denmark, France, Italy, Japan, the Netherlands, Poland, Spain, Switzerland and the United States of America.

NEWS ITEMS AND COMMENTS

NAVY LINE OFFICERS' COURSE, 1933

The following officers attended the course beginning May 7, 1933, and ending June 17, 1933.

Lt. Comdr. Donald W. Loomis
Lt. Arthur F. Folz
Lt. Joseph A. Clark
Lt. Van Fitch Rathbun
Lt. George F. Cooper, (MC)
Lt. Ralph H. Hofler, (MC)
Lt. Charles R. Wilcox, (MC)
Lt. (jg) James H. Ward
Lt. (jg) Herald F. Stout
Lt. (jg) Frederick A. Davisson
Lt. (jg) Clarence Broussard
Lt. (jg) Stanley G. Nichols
Lt. (jg) Diggs Logan
Lt. (jg) John K. Reybold
Lt. (jg) Charles Jackson
Lt. (jg) Lawrence H. Martin
Lt. (jg) Eugene S. Karpe
Lt. (jg) Charles J. Whiting
Lt. (jg) Charles R. Rohweder
Lt. (jg) Benjamin R. Crosser
Lt. (jg) Thompson P. Elliott
Lt. (jg) Carr E. Bentel, (MC)
Lt. (jg) James G. Neff, (MC)
Lt. (jg) James R. Reid, (MC)



A MORALE BOOSTER

The published Hearings Before the Committee on Military Affairs, House of Representatives, of General Douglas MacArthur, Chief of Staff, on the general state of the national defense, contain on page 18 the finest bit of morale uplift that has come the way of this Service in many years. The National Defense Act requires the Chief of Chemical Warfare Service and his officers to perform certain defense functions in the interests of national defense. Threats at the separate life of the branch itself and at the duties laid down for it have been detrimental to morale to an extent which would have been exceedingly harmful but for the fine esprit de corps of the Chemical Warfare Service.

General MacArthur's statement as to the necessity for a separate Service and his appreciation of its duties and functions shows his keen insight into all that concerns us.

The paragraph in question follows:

"Separate existence for our Chemical Warfare Service, for example,has been criticized. Considering the potentialities of a major war, no one can logically assert that we are devoting too much time and money to the study of chemical warfare. Every officer in the corps is devoting his efforts to this speciality, and under any other type of organization an equal number would be needed. Consolidation then would do nothing but save the difference between the salary of a major general and a colonel, some $2,500 per year. But considering the great expansion which Chemical Warfare Service activities might experience in war, it seems the part of common sense to keep this group of specialists as a separate establishment. They are responsible for the development of chemical materials and weapons, the technique of gas defense,and in many cases for the actual employment of these materials on the battlefield. The Chemical Warfare Service thus constitutes both a fighting arm and a research and procurement service. Its consolidation with the Ordnance Department,so long as employment of chemicals in war remains a real possibility, would give rise to many difficulties, since the latter Department specializes particularly in the production and supply of weapons and ammunition."

FIELD OFFICERS' COURSE, 1933

This course began on July 5, 1933, with a highly representative class of twenty-five officers from the Army, Navy and Marine Corps. The course will end August 4, 1933.

THE FIELD OFFICERS' CLASS, THE CHEMICAL WARFARE SCHOOL, 1933.

BACK ROW: 2nd Lt. Pearl H. Robey, A.C. Captain Clifford A. Best, M.C. Captain F. E. Stack, U.S.M.C. Captain A. H. Waitt, C.W.S. Captain E. F. Bullene, C.W.S. 2nd Lt. T. J. Cody, Sig. C. 2nd Lt. Merrick H. Truly, (Inf.) A.C.

MIDDLE ROW: Captain W. C. Ellis, Sig.C. Lt.Comdr. D. H. Clark, U.S.N. Lt.Comdr. A. R. Early, U.S.N. Major C. T. Phillips, A.C. Major J. A. Rogers, M.C. Lt.Comdr. J. C. Jones, Jr., U.S.N. Lt.Comdr. M.R.Browning,U.S.N. Captain O.P. Smith,U.S.M.C.

FRONT ROW: Major Herbert W. Taylor, M. C. Major Wm. C. Crane, F. A. Major P.R.Faymonville,Ord.Dept. Lt.Col.W.W.West,Jr.,Cav. Captain I. I. Yates, U.S.N. Rear Adm. C.H. Woodward, U.S.N. Lt.Col. W. C. Baker, C.W.S. Major A. C. Gillem, Jr., Inf. Major James Kirk, Ord.Dept. Major Floyd R. Waltz, Inf.