CHEMICAL WARFARE

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Of Interest To All Arms

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"Every development of science that makes warfare more universal and more scientific makes for permanent peace by making war intolerable." *Brigadier General Amos A. Fries.*

Editorial Comment.

WHERE ARE WE?

Numerous articles have appeared in the various papers and publications relative to the next war and how to prevent it. Advocates of various methods have flooded the country with propaganda.

We find those who advocate scrapping our Army and Navy and telling the world to "Look at us, you wouldn't kick a man when he was down".

We find those who say have the biggest and strongest Army and Navy in the world so we can be sure the other fellow will not attempt to whisper.

Societies are meeting to discuss war. One of the latest was a meeting in Washington where nine hundred women, representing nine national women's organizations met to probe "the cause and cure of war". It is reported their findings were that it could and should be outlawed but they had no cure to present.

In the past few weeks two articles have been published in prominent publications on future war. One in story form, visualizes the next conflict as an entirely different article from those in the past; the other deals with chemistry in peace and its use in war.

It is quite evident from the different views presented by large army, small army, no army, chemical warfare, air service, infantry, and other advocates the question is far from settled and those charged with the responsibility of our National Defense are having a hard time of it.

While we are a progressive people and plan for the future, it is not advisable to throw away our old suit of clothes until we know where the next one is coming from.

SCIENCE IN WAR.

By Dr. Norris F. Hall, Instructor in Chemistry.

Reprinted from Harvard Alumni Bulletin, December 4, 1924.

The subject of the rôle which science will play in future wars is one on which it is easy to talk an enormous amount of foolishness. It ought to be approached only by a man who has exceptional military staff training and ability. He should be experienced moreover in all modern forms of actual combat, be intimately acquainted with all branches of science and technology, and be a first rate clairvoyant.

If, therefore, half of what I say seems to military men foolish, or impertinent, and the rest unacceptable to scientific investigators, I shall not be too greatly surprised or humiliated on that account.

There are several cheap and easy ways of thinking about this subject that we ought to avoid if possible. The first is a naïve form of "wish-fulfillment" which runs something like this: "We peaceful folk are the dupes of great capitalists, *entrepreneurs*, diplomats, and generals. They start the wars and we finish them. In the next war these miscreants will all be blown to bits or gassed in the first twenty-four hours." The answer, of course, is that they won't. The picture is too "beautiful" to be true. Men who are capable enough to dominate the rest of us in time of peace will for the most part find means of protecting themselves in war.

Another unconvincing view is that of irresponsible, non-technical, speculative idealists like ourselves. Unwilling as we are to undergo the mental hardship necessary to understand the military art, we delight to seize upon some facile dream such as the all-destroying gas, the deadly bacterium, or the death-dealing "ray", which we can all understand, without learning ballistics, aeronautics, or machine design, and suppose that this will at once wipe the slate clean of the traditional soldier with his tactics and trajectories, and drill "by the numbers".

A third fallacy is complementary to this. It is the fallacy of the vested interest. It is the view held by the unreflective military man that, in spite of the changes in the world wrought by science and industry, his problem is still essentially the same as it was in his youth. He thinks that because there have always been infantry, there always must be infantry; that because tanks and gas are new-fangled, heterodox, and sometimes ineffective, their day is over and that the next war will be won by small-arms marksmanship, cavalry charges, and bayonet work. This view is typified by the characteristic remark heard at the time of the armistice: "Thank God, now we can get back to real soldiering!"

I shall try to avoid ethical considerations and subjective bias. My plan will be to consider briefly the future possibilities of some of the war devices we know today, and to try to trace their possible development and interaction in a not too distant future.

MENTAL ATTACK.

First of all it must be realized that, as the imposition of

some policy is always the ostensible object of war, and war would never be fought if all our potential enemies were always willing to accede to our wishes without argument or opposition, the primary object of war may be said to be psychological, that is, the leading of the adversary to adopt some particular state of mind. Today, in order to secure this result we find it necessary to destroy a large part of his property, annihilate his armed forces, and wear down the resistance of his population by famine and disease. This may not always be necessary. If through the labors of earnest technicians, *lying* can be brought to such a pitch of perfection as actually to deceive the enemy, we may find that the traditional methods will become completely obsolete. And the same thing is true of suggestion. It may some day prove possible to attack the will of a people in some subtle and rapid way through the sense organs of sight or sound so as to make them acquiesce docilely in a political plan they would otherwise indignantly reject. Leaving these fantasies, for the present, however, let us examine the usual material means of seeking a "decision".

MATERIAL MEANS.

One of the chief essentials of war is mobility, and we see that today movement is possible through water and air, as well as over the surfaces of land and sea.

Of these types of movement, the freest, the most rapid, the newest - in a word the type most suited to war - is motion through the air. Air travel uses two devices, the dirigible balloon and the airplane.

DIRIGIBLES.

Taking the less promising first, we see that the critical feature of a dirigible is the gas that keeps it up. Now, if there is one scientific prediction that can be confidently made, it is that no other gases than hydrogen and helium will ever be discovered that can be considered for airship use. Helium is only 25-27 as buoyant as hydrogen, costs a thousand times as much to prepare, and is extremely rare, but it will not burn or explode, and this quality is of absolutely overwhelming importance in these days of flame-throwers and incendiary ammunition. It is of course possible that substances can be found to mix with hydrogen in small proportions which, without destroying its buoyancy, will make it inert toward the oxygen of the air. This is only a remote possibility, however. The virtual monopoly of helium in the United States and Canada at present gives these countries at least a temporary advantage in this respect.

The utmost decrease in the weight of the frame of the dirigible that can ever be hoped from the use of different materials is about four-fifths of the present weight, so that the only other way to increase the lifting power is to increase the size. How far this can profitably be carried is uncertain, but it is easy to foresee the possibility of airships which could circumnavigate the globe, or carry a hundred tons and upwards for thousands of miles. Compared to the airplane the airship must always be slow, low-flying, conspicuous, easily attacked, and expensive. Nevertheless, until

the airplane learns to hover indefinitely without expending too much energy, and until its carrying power can be vastly increased, dirigibles will have a minor usefulness as bombers or transports. They may perhaps be employed as refilling stations for armored airplanes, which, because of the weight of their protection, must cut down their stores of fuel and with this their cruising radius. These dirigible aerodromes, hanging high in the heavens, would be relatively immune from attackers on the surface and would themselves perhaps be replenished from large supply submarines.

AIRPLANES.

When we turn to the airplane we find the weapon which now seems certain to draw first blood in the next war. Next to the projectile itself, it is the fastest material vehicle. Useful in peace as well as in war, and possessing a great surprise value, it is certain to be the first arm used at the outbreak of hostilities between any two nations not too distant to reach each other by this means.

The functions of an airplane, besides intelligence, liaison work, and similar minor duties, are combat with other airplanes, attack of objectives on the ground, and transport.

Let us make some very conservative assumptions about aircraft. Let us assume that some warring nation has enough fighting planes to secure, for the most part, command of the air, and in addition one or more fleets of heavy planes for bombing or transport. A fleet may contain say two hundred machines. The effective radius of action of such a fleet may be taken as 250 miles, and the lifting power per plane as twenty fully equipped infantrymen or two tons of bombs or supplies. All of these figures have already been surpassed in particular cases.

Allowing 75 per cent efficiency in bombing, such a fleet would be able to unload on its objectives 300 tons of bombs a day for several days. What would this mean? In the first place, what would be the objectives? It seems clear that these would not be in the first instance fortresses, military camps, or depots, - first because troop concentration might not yet have proceeded very far, and second because such military strongholds would enjoy a maximum of direct and indirect protection. Instead, the bombers would launch their attack against railway centers, plants capable of producing large quantities of munitions, and in general at crowded industrial or governmental districts where the destruction and disorganization caused by the attack would be a maximum.

It seems to me that city water supplies would be cut off by broken connections, if possible, at the same time that light and power stations would be blotted out and fires started with incendiary bombs. Government buildings would be natural targets, and movement would be hindered as much as possible by the blowing up of bridges, tunnels, etc. The situation which would ensue would be pretty bad and might result in a paralysis of government and of production. If one considers in addition the possibility of partly poisoning such water supplies as one could not cut off, the

possibilities of the method are seen to be increased and the attractions of metropolitan life somewhat diminished.

If for any reason it were desired to secure even greater disorganization, while at the same time large scale property destruction and loss of life were avoided, this could be accomplished by the use of gas. Even 200 tons a day of many of the gases now available would paralyze completely all industrial life in a large city, and the gas could be chosen so as to cause a perfectly insignificant loss of life while making the city uninhabitable, or the streets could be piled high with dead without causing more than a trace of actual property damage.

It may be said that such an inhuman method of war will never be resorted to. In the first place, it may be remarked that cruelty is not at present *inhuman*, or uncommon, but on the contrary thoroughly human and fashionable so long as it can be practised at some slight distance from the victim. In the second place, it should be pointed out that the progress of technology has for the first time made these attacks *feasible* at the very moment when the interlocking of industries, the mechanization of war, and the increased dependence of armies on their home industrial organizations have given such attacks a greatly increased military importance.

The other possible use of airplanes would be in transport. The last war was the first in which there were no flanks to be turned. The battle front extended over the entire distance from the mountains to the sea, and so became indestructible. It could be pushed back in places, perforated for short distances, but could not be, or at least never was, rolled up. The result was position warfare, with all that that term implies of the indefinite prolongation of war's agony. In the next war, because of the perfection of air transport, armies will have a third flank. The possibility will always be present of landing an armed force through the air at some point directly on the enemy's line of communication. A little computation will show that such a fleet of planes as I have suggested could transport a brigade a day, for several days, and then keep the resulting two or three divisions supplied as long as they could defend themselves on the ground, provided command of the air were not lost.

The question of defense at once rises to our lips. I suppose no one will dispute the statement that the best defense is to keep far out of the path of war, if that is possible. The next best is clearly to have command of the air yourself. Other forms of defense are unsatisfactory. The only adequate answer to an airplane is another airplane.

It is a practical impossibility to move all the important parts of the industrial mechanism of a great city far enough under ground to be out of reach of airplane bombs, though much can be done in this direction, if necessary. Anti-aircraft artillery is, and I believe always will be, ineffective.

Against gas, the only thoroughly effective way to protect a city that occurs to me is to cover every square foot of its streets,

squares, and roofs with small fires, say jets of burning illuminating gas. These would effectually disperse any war gas after the entire surface had been maintained at a good high temperature, say the boiling point of water, for an hour or two. Meanwhile the inhabitants could retire into gas-proof cellars and do cross-word puzzles. This does not seem a very practical plan! Another fairly effective method against some gases would be to sprinkle the surface of the city thinly but thoroughly with some material, like chloride of lime, that would attack them chemically. There is no question that this would cut down casualties. In a long war the civil population could perhaps be trained to wear gas-proof clothing and gas masks. But it would be absolutely impossible to guard against an *initial* attack by these means.

THE FUTURE ARMY.

Having now given the civilian population a taste of war, let us see what the real soldiers will be doing.

How will the land army of the future look as compared to an army of today? It seems probable that we are witnessing another transformation in the conception of military mobility such as marked the introduction of the railroad. But, while the railways mainly affected strategical mobility, the new departure will be in tactical mobility. After the rail head is left behind, armies today must perforce progress slowly and *one-dimensionally* along such existing roads as may be available. The motor truck and armored car have made a beginning, it is true, of increasing the speed of movements, but this process will be vastly hastened when the perfection of the caterpillar tractor permits the free use of the second dimension - wholesale cross-country movement at high speed. This development will not come at once, and the details are of strictly military interest, but the final goal seems to be an army consisting almost exclusively of airplanes and tanks, mostly tanks.

TANKS.

In several ways the tank seems the logical converging point of many features of land warfare. Take the infantry. The effectiveness of the infantry depends on its weapons, and the apotheosis of infantry weapons is the machine gun. Automatic and rapid-firing, it is ideal for defense. Its chief disadvantage is its lack of mobility. This disadvantage, together with the infantryman's constitutional lack of protection, forces the machine gunner completely to immobilize himself in a concrete pillbox or a trench where he is likely to be drenched with gas, burnt out with thermite, blinded with smoke, and squashed like a louse under the tread of an advancing tank.

Let him once get into the tank and his troubles are over. His mobile mounting is now also a shield, which can be made proof against all projectiles smaller than a one-pounder at least. His air can be filtered against gas and smoke, his speed gives him a fair chance even against field guns using direct laying, and if he can once get near them he can mow down the gunners and then flatten the gun into the mud.

Consider the light field artillery. In a fixed emplacement the guns or crews are liable to destruction by counter battery work with high explosives, shrapnel, and gas, and to loss or capture if the enemy makes a little advance. To deceive hostile observers and to attain new targets, they must continually pack up and trek to a new position, plowing slowly and painfully through the mud, behind unreliable horses that may at any minute be put out of business by a shell or a bullet. They can, of course, use tractors, but how much better to mount the guns and protect the crews by means of a tank, adding a couple of machine guns for auxiliary weapons!

Consider the cavalry. What is a charge of light tanks but a cavalry charge translated from a dead language into a modern tongue? And what chance has cavalry against tanks? Except for occasional despatch riding, liaison, etc., the place for the horse in war is at home, in a park or a riding academy; and the place for his rider is inside a tank.

The engineers of the future, themselves riding in tanks, will probably be chiefly charged with satisfying the very modest demands of the tank for a passable terrain and with keeping the tank army in good mechanical condition. Thus the conditions of land warfare will more and more closely approach conditions of sea warfare as two-dimensional mobility increases. And much of the romance of life on the ocean wave may be claimed by the tank fighter of the future. The first ground battles of the war will be tank battles, battles of machines snorting and bellowing in seas of smoke and gas. After one side has gained tank supremacy, his hosts will career about his enemy's country, destroying and terrorizing, until they themselves are destroyed by land mines or artillery.

The further possibility that the tank of the future may be amphibious has been frequently suggested, and we may find new use for the well-known Marine Corps either in the under-seagoing tank which can cross seas beneath the surface, crawl up the beach, and set out merrily across country, or in the large tank-carrying submarine, which, lying at night off a favorable shore, may disgorge a whole swarm of artillery and infantry tanks.

Of course such tanks as these are far in the future, but even today we hear of a twenty-ton tank, mounting a light cannon and several machine guns, which is capable of making as high as twenty-five miles an hour over average terrain.

To come back to the laboratory, whence we are continually lured by the pleasures of the battlefield, what actual improvements in war materials can be expected as the result of research?

IMPROVED ORDNANCE.

The range and effectiveness of artillery of all calibers can probably be considerably increased by improved steels and other alloys. The use of successive explosions of improved propellants and very high angle fire may make it possible to shell Coblenz from Paris, or Boston from New York, but it seems doubtful if dispersion can be controlled sufficiently to make that a very useful procedure. High explosives can probably be made somewhat "higher", but, as long

as they depend on a chemical reaction, the total energy of explosions cannot be much increased, and it seems doubtful if their violence can be radically intensified.

Shrapnel can be made perhaps a little more thorough in its action by the use of explosives and poisoned bullets, in case it should seem desirable to try to make every casualty a death, and the same possibility of course applies to machine guns and small arms ammunition in general. Whether any more concentrated form of energy than high explosives can be applied to destructive purposes is an interesting question. A source of such more concentrated energy appears possibly to exist in the disintegration or building up of the atoms of the elements themselves, but we seem still very far from controlling it on a practical scale.

CHEMICAL WARFARE.

The most spectacular side of chemical warfare is, of course, the use of gas and smoke. Public knowledge of gas warfare is so limited and frequently so inaccurate that, if I had time, I should like to describe its present status at some length. Gases used in war are all transported to the field as liquids or solids, and then are either vaporized by the release of pressure from a cylinder, atomized by the burst of a bomb or shell, sprinkled from airplanes or tanks, or set adrift by heat.

They are classified according to the effect they produce on the body. Some are merely tear gases, causing weeping and temporary blindness; and some are used to produce sneezing, vomiting, headache, and minor symptoms; some are vesicant, causing blisters to form over the skin of the entire body; others are definitely toxic or even lethal. Death may be caused by suffocation from a spasmodic contraction of the throat, from congestion of the lungs, or by absorption into the blood streams through the lungs.

From a military point of view a gas is either deadly, or else merely harassing - good to impair the enemy's efficiency, but not likely to cause many deaths. It is important also to know whether a gas is persistent or non-persistent, whether it will render an area covered with it untenable for days, or whether it will blow away in a short time, so that one's own troops can advance easily over a recently gassed area.

Another important question of gas tactics is whether a given gas is effective in small amounts, or whether a great deal must be used. If it turns out that a persistent gas, capable of producing serious harassing effects in a concentration of one part in one hundred million parts of air, is available, it may often pay to use it instead of non-persistent lethal gas that must be expended in quantities one hundred times as great in order to be effective.

For most purposes the ideal gas would be vesicant, persistent, lethal, efficient, and cheap, and should be difficult to protect against. This ideal was approached by the mustard gas used in the Great War, and has been surpassed, for all I know, in the fighting and research which have taken place since that war came to an end.

SECRECY.

Here we touch the most important feature of chemical warfare, which gives it a surprise value like that of airplanes - the practical impossibility of effective chemical disarmament. The munitions industry is a war-time industry. It requires plants which can easily be inspected. If you are making a sixteen-inch gun or a tank,you cannot persuade an inspector or a spy that your product is a drain pipe or a houseboat. But you may be carrying out a research to discover a new gas,and even the other chemist at the next bench can hardly be sure you are not making some harmless dye or perfume. Once planned, the manufacturing process can be developed in separate steps,scattered through a large chemical manufacturing plant in such a way that the very division superintendents do not know what it is they are working on. Finally, the finished product can be stored in ordinary looking containers, marked "naphthalene" or "Bismarck Brown", and trickled out through a variety of agents, to be again secretly concentrated at strategic points to await the outbreak of war.

The more efficient,well-organized,and powerful is the chemical industry of a country, the more capable it is of suddenly turning out the enormous quantities of harmful products necessary for a first-class, up-to-date war. In case a thoroughly unified chemical industry is not available,another solution is possible. Great government arsenals can be built which can be used for large scale production of war gases. As these cannot successfully compete commercially in peace-times,this is always a wasteful plan. The existence in the Rhineland of the enormous chemical trust called the Interessen-Gemeinschaft, which controls the greatest facilities of the production of gases the world has ever seen, is what has been called in a recent book "The Riddle of the Rhine".

SMOKE.

A sideline of gas-warfare is smoke, which may be used either to conceal a friend or blind an enemy,may be made colored for signaling, mixed with gas to conceal or simulate a gas attack, or may be made poisonous and penetrating to turn the enemy's mask into a mere useless emcumbrance. Smoke and thermite, which is a spray of white-hot molten iron,proved the best medicine for machine gun nests in the last war, next to running a tank over them.

FUTURE DEVELOPMENTS.

What can be hoped in the future in the way of improvements in gas warfare? One thing may confidently be expected. The relative importance of gas will greatly increase. Because of its cheapness, because of its surprise value,because of its peculiarly varied and interesting tactics, we may expect it to be used on a scale that will make the gas warfare of 1917 and 1918 look like child's-play. If position warfare is ever resumed,it is not difficult to foresee such wholesale inundations of gas as will make a twenty-five mile strip of country totally and permanently impassable except to men in gas-proof tanks or wearing complete outfits of gas clothing and masks.

What this will mean in reduction of fighting efficiency everyone can understand. For the peculiarity of gas is this: Against civilians or low grade troops it may be instantly, murderously, and completely effective. The same in a somewhat less degree may be true against the best of troops, provided some element of surprise is involved - some new gas, for instance, against which the mask or clothing fails to protect. Once used, against highly trained troops a given gas rapidly loses its terrors as their skill in protection increases, but every increase in protection involves a loss in efficiency - difficulty of breathing, sluggishness of movement, dimming of vision.

Then we may expect better gases than we had in the last war. We may never get them quite so good as the newspaper stories made them out, but a good vesicant, persistent gas which is quickly and effectively lethal is certainly a modest ambition. In his more inspired moments the gas officer dreams of other ways of afflicting the human body or paralyzing the brain. General paralysis can now be produced by very small injections of certain anaesthetics. Insanity and death follow the breathing of certain industrial gases, though the effects at present are too slow to be useful. Balance is said to be maintained through the movement of certain hairs in the fluid which fills the semi-circular canals behind the ears. Might this mechanism somehow be deranged so as to cause a sudden loss of all muscular coördination? These as yet are merely dreams. We see no method of attacking the problem. The eyes, the respiratory system, the digestion, and the skin seem the only physiological avenues of approach to the brain.

Let us not accept too uncritically our first involuntary reaction of loathing to such methods of war. Is not much of our feeling due to the novelty of the method rather than to its actual effects? In the Great War, as subsequent statistics have shown, a man who was gassed had twelve times as good a chance of complete recovery as a man wounded by shrapnel or high explosive. Moreover, the possibility is always present that a gas may be found of such properties that it can secure complete victory without killing or maiming, which is totally impossible with other weapons of war.

DEFENSE.

Let us briefly now consider methods of defense, the other side of the picture. Here it is probable that the one good means of defense will be in the future, as in the past, the counter-offensive. It is better to sink the enemy's fleet before he shells your coast; it is better to shoot down his aeroplane as it rises from the ground than to wait till it gases your city; it is better to attack his tank from another tank than on foot; it is better to break up his supply system than to wait until he cripples your own; it is better to fight the war on his countryside than on yours. This is the hopeless, fatal, abominable logic of war, inevitable if war is once accepted as a method.

There are, of course, secondary methods of defense. Getting underground and living on filtered air is excellent practice when the airplanes start dropping bombs and gas, and some day we may

see all munitions plants, all army camps, all airplane hangars constructed underground, and the war planes will come roaring up their tunnels and take the air at full speed, like a nest of infuriated bumblebees.

The land for miles around these valuable points may be sown thick with mines of gas and high explosives to shatter the tanks as they come charging across country, and great dry moats may also be used to check their advance.

Aerial "watch-dogs" will fight off approaching planes, and anti-aircraft artillery will contribute its share to the defense.

When desired, the entire country can be clouded with smoke to make bombing uncertain, and it may prove useful to bring about rainstorms or high-voltage electrical discharges for warlike purposes.

It seems to me that from this brief survey two widely different conclusions may be drawn. On the one hand, a new world war may be decided by some quick and overpowering blow, embodying a new application of some scientific discovery, before the war has gotten well under way, so to speak. In this case, however vast the destruction, however appalling the sacrifice of life, I should be inclined to regard such a solution as preferable to its alternative, a long war. This would mean a war with stabilized fronts, a war of mud, disease, and vermin, a war of starvation, exhaustion, brutalization, and madness.

PRESIDENT ELIOT'S REMARKS.

President Eliot, introducing Dr. Hall, said:

"Fellow Students: We have all come here tonight with the same purpose, I have no doubt. We want to learn something about our duty as Americans, as patriots; our duty, in the first place, towards suffering Europe, not only suffering but in a chaotic condition, well-nigh hopeless in some countries and needing help and encouragement of every sort; our duty, too, towards our brothers who fell in battle or died of disease attempting to further in the world the cause of democracy and the great cause of human liberty; and then we want to be sure that we ourselves not simply think or meditate on what ought to be done, but do ourselves by act and deed something toward the solution of these terrible problems. We all feel that we want to be guided to right conduct ourselves.

"We meet under the auspices of a scientific fraternity. From my point of view, that is encouraging, because it seems to me that the great hope of the future for Europe and for ourselves must proceed from what we call scientific study, research, inquiry, from confident reliance on the great method of scientific research.

"Every one of the speakers this evening is thoroughly competent to instruct us on these topics of intense interest. Of course, for me it is an added inducement to come here and listen, that all three speakers are not only graduates of some department of Harvard University or other, but every one of them is also a teacher in Harvard University at this moment.

"I have the honor of presenting to you as the first speaker, whose subject is 'Science in War', Dr. Norris F. Hall, formerly a captain in the Chemical Warfare Service of the American Expeditionary Force. He could not have a better warranty for speaking to us".

At the conclusion of Dr. Hall's address, President Eliot said:

"I am sure that Dr. Hall has satisfied us all that no considerable war can hereafter be fought, or even undertaken, except by a nation which has highly developed manufacturing and chemical industries. Now, that is on the whole rather an encouraging consideration, because it throws out, so to speak, from nations capable of aggressive war a very large proportion of the nations of the world. It reduces to a comparatively small number the nations capable of carrying on war. Isn't this a great gain for the world as a whole? It is not a gain, of course, for the backward, non-manufacturing nations, because it is to them a plain exhibit of a condition fundamentally mortifying, but it is a gain for the world at large,and I think Dr. Hall has fully satisfied us that this gain has already been achieved.

"Dr. Hall did not dwell much on the subject of cruelty;but may I not suggest that the utmost use of cruelty occurs when one nation undertakes to destroy the civilian population in great cities or in manufacturing districts? That seems to me much more cruel than the attempt on the part of a conquering nation to crush its opponent's armies. Therefore I have sometimes wondered at the readiness with which pacifists propose the embargo. Isn't that by far the most cruel thing which one nation can do to another?"

THE CHEMICAL WARFARE SCHOOL.

On February 21st the third class to receive instruction in chemical warfare during the present school year will graduate. Thirteen students from the Navy are in this class.

One class of eleven Army officers and three Marine Corps officers completed a ten weeks course November 22nd and a class of fifteen Naval officers completed a six weeks course December.

Four more courses are contemplated for the present school year. A Line and Staff officers course of ten weeks begins March 2nd. It is expected that approximately thirty Army and Marine Corps officers will attend. On the same date a four weeks course for non-commissioned officers will start at which it is expected about forty non-commissioned officers from the different branches will be present.

A course for officers of the Naval Construction Corps is planned for June and the usual two weeks course for Reserve Officers is planned for July.

The courses past and future will have furnished the school a very active year and it is felt a long stride will have been taken in this work.

WORLD WAR 'SALVAGE'.

By Colonel J. Edward Cassidy, CW-ORC.

Contrary to all precedents established in previous wars, there has been some "salvage" of decided interest to the national defense carried over from the World War, and by this trained or partially trained personnel is referred to rather than materials. The outbreak of every war in which this country has been engaged has found the national defense in a really pitiful state, and the outbreak of the world war was little different. It is true, National Guard elements had received some useful training on the Mexican border in 1916, particularly as regards administration of larger units of troops. In the material end, we had no type of machine gun, field artillery, or howitzers, worthy of consideration. We had a most excellent rifle, but one that could not be produced for practical use to any extent. Not half a dozen officers regular, or otherwise had ever seen a combat division in operation, and not a single one had ever seen a division with all of its auxiliary troops even in a maneuver. It developed after we entered the war that little attempt had been made by the General Staff to consider the problems incident to modern warfare, and tactical problems involving divisions, corps and armies were about as familiar to the officers of the army as Sanskrit is to a Choctaw Indian. We had been told we were too proud to fight and evidently the rank and file of the country believed it, and being too proud to fight, why spend any money or take any time developing equipment.

The national defenses of the country were in better shape following the Civil War than they have been at any other time. Large numbers of soldiers had become veterans after four years of bloody fighting, and the complement of officers consisted of men who had won their rank, not by political preferment, but by their work on the battlefield. There were exceptions, but in general the War had been too serious for the survival of any officers but those who were fitted for commands consistent with their rank. It is well to study problems in time of peace and cast up every possibility and weigh it for what is in it, but there is no kind of training in peace time which will take the place of training in battle. Academic officers may make good on the battlefield and they may not, it all depends on the individual.

The great veteran army at the close of the civil war was allowed to disintegrate with no effort to utilize the vast experience gained in four grilling years of war. The Spanish American War was of too little moment to be of any great value, yet it demonstrated many things. Even the training secured and the small amount of battle experience was little utilized, so in reality the salvage was little so far as providing for national defense is concerned.

The real "salvage" from the World War consists largely in the trained personnel in the regular army, the National Guard, and the Reserve Corps. We have also borrowed some excellent designs of artillery, tanks, etc., from other nations, and have adopted a

machine gun which will fill a much needed want. In aeroplanes, we have little salvage. Materials and equipment soon become obsolete even in peace time, so the important feature is to keep abreast of the times in the development of weapons of war though as a matter of fact, a supply other than a reserve and for training purposes, is hardly warranted for what may be first class today is obsolete tomorrow. No matter what advancement may be made in weapons and munitions of war, nothing is decided until man power meets man power. Probably the prehistoric men fought their battles with bare fists before progressing to clubs and stones, then one day some genius figured out the advantage by fastening the stone to a club, later he fastened a sharpened flint to a slender reed and shot it at his enemy with a bow. This was highly advanced work in those days, but even so, the process was merely whittling down ones enemies until superior man power could get in effective work. Sixteen months tunneling work was carried on by the British at Messines Ridge, masses of artillery were brought to bear on the ridge and adjoining areas, gas, high explosive shells, poured in profusion on the German works for days and weeks prior to the actual attack. Following the exploding of the 24 mines and an intensive artillery preparation, the British infantry went forward to take and hold the ridge. All of this effort was used to get the British infantry at grips with the German forces, so after all it came back to the man power.

Man power has been and probably always will be the deciding element, and the nation that is best equipped with trained man power will have the advantage of the other nation not so well equipped.

Prior to the War our National Guard while organized was considerably disorganized because of the lack of definite plans for national defense. Our Reserve was mostly a paper one, consisting of a few hundred officers, and I believe an enlisted reserve of sixteen men. The World War has left us with a highly efficient national guard composed of officers and men most of whom saw service in the World War, the Guard now numbering about 50% more than the Regular Army. There is in the Officers' Reserve Corps something over 80,000 officers, most of whom have a definite assignment in the Army of the United States. The bulk of these officers have had World War Training and a considerable number of them battle experience.

No matter what may be done, it is clear that when war comes again, if it should come, we will not be prepared as we should be. If we can survive for six months or a year, sufficiently to shake ourselves together and bring our enormous resources into play, we can win out. However, to hold out in the first line of defense until the unorganized forces and the peace time industries can be mobilized for war, is going to involve sacrifices such as this nation has never before experienced. The Regular Army with the National Guard will have to take the first shock, and as a distribution of officer personnel must be made to meet the organization conditions, the Reserve Corps will be drawn on for large numbers of officers. If War should come while there are still large numbers of men with

World War experience, the formation of new units could go forward rapidly and drafts of men with experience be used to fill up the ranks of the Regular Army and National Guard units as losses occur. No matter what sacrifice may be necessary, the Regular Army and the National Guard must hold that first line of defense until the mass of the Army of the United States can be brought into play. This is going to be an extremely costly proposition and the cream of trained troops will be wiped out just as the British had but 2,000 men and officers left of the first Seven Regular Divisions after the Battle of the Ypres.

The "salvage" which has been possible by adopting some plan for National Defense has put us in a position to utilize the lessons learned in the World War, and it is this "salvage" which will give us a better chance of holding out until the resources of the nation can be brought into play back of the first line of defense, which at the best, will be pitifully small. If war does come, it will be certain that the opposing nation or nations will have studied their problems thoroughly, and they will know quite well that their chance of success lays in winning before our enormous forces can be brought into play. Therefore, they will exert every effort to put over the finishing stroke in the least possible time, and it is against this supreme effort, our "salvage" of trained or partially trained man power must hold out successfully no matter what the cost.

THE REASON?

The following extracts from a report of the Christmas dinner of Company A, 25th Infantry published in "The Bullet" may explain the reason some men like the Army.

A very elaborate dinner was served to the members of Company A and their friends on Christmas Day, with Mess Sergeant Walter Evans acting in the capacity of Santa Claus.

The interior of the Mess Hall was festooned with vari-colored streamers, while tinsel-bedecked Evergreens, appropriate to the occasion, colored lights and Christmas bells completed the decorative scheme and gave the large newly painted Dining Room a brilliant appearance.

At 1:00 P.M., the guests were ushered into the dining room by a staff of five waiters attired in snow white uniforms and were promptly seated at the many tables which were laden with Christmas delicacies.

Following is the menu which was carefully prepared by the Company's culinary artists: Celery, lettuce, stuffed olives, sweet mixed pickles, oyster soup and crackers. Roasts: Roast turkey with oyster dressing and cranberry sauce, roast pork with apple sauce, New England baked ham. Salads: Lobster and shrimp salads. Vegetables: Creamed peas, stewed corn, candied sweet potatoes, creamed carrots, mashed parsnips. Pastry: Mince, green apple, sweet potato, cocoanut and pumpkin pies. Chocolate, cocoanut and plain cake. Fruits: Southern California apples, oranges and grapes. Refreshments: Lost soldier punch, orange ice cream, mixed nuts, candies, cigarettes and cigars.

FIRE SUPERIORITY VERSUS SMOKE.

By Major C. R. Alley and Major Leigh F. J. Zerbee.

The idea appears to be more or less general that smoke interferes with fire superiority. It is the purpose of this article to examine into the subject and prove, if possible, that fire superiority may be obtained more easily by the aid of smoke, correctly used, than without.

Fire superiority consists in maintaining such a relation between the effect of our own fire and that of the hostile fire that the advance of our troops is made possible. It is made up of a great number of factors. Among them are leadership, determination and morale, but the most prominent factor is hits per minute. Hits per minute is dependent on accuracy of fire and volume of fire. From time immemorial successful commanders have striven for fire superiority, principally through an increase in hits per minute. The statement attributed to Napoleon "God is on the side which has the heaviest artillery", means simply that he saw the possibility of fire superiority by increasing the volume of fire. Forrest's formula for winning battles "Get there fustest with the mostest men" can be translated similarly, and the caution attributed to the American officer at Bunker Hill "Don't fire until you see the whites of their eyes", shows that the Commander there appreciated the factor accuracy in obtaining fire superiority. May it not be that those who oppose the use of smoke on the ground that it interferes with fire superiority, consider that fire superiority depends solely on hits per minute? The effect of fire does depend on "hits per minute", and one factor which may be of importance in obtaining fire superiority is to make more hits per minute than the enemy does, since if other conditions are equal, this will probably permit an advance. But let us consider in detail the effect of variation of hits per minute on fire superiority.

Hits per minute = hits per shot x shots per minute.

Hits per shot depends chiefly on accuracy, since unless fire is accurate, only chance hits are obtained and the effect of those is negligible. From this formula it is seen that anything which increases our own accuracy or volume of fire or decreases the accuracy or volume of hostile fire, tends respectively to increase our own hits per minute or to decrease enemy hits per minute. Either effect will have an important bearing on fire superiority. However, it is easily seen that it is possible to have fire superiority with very few hits per minute if some method is used to render the hostile fire inaccurate. Smoke offers one means for accomplishing this result.

Now, let us consider the effect of smoke on all factors. If smoke is placed between ourselves and the enemy, it will affect both alike, but it has been demonstrated that it is much easier to fire from outside of a smoke cloud on a target covered by smoke than it is to fire from within the cloud on a target outside. Smoke placed on the enemy, therefore, affects his accuracy much more than

it affects our own.

Our own hits per minute reduce hostile hits per minute by reducing both his accuracy and volume, while smoke reduces both our own and hostile accuracy without affecting volume. However, the effect on hostile accuracy is so much greater than on our own, that the product of the enemy's greatly reduced number of hits per shot and undiminished shots per minute with smoke, will be much less than the product of his slightly reduced number of hits per shot and slightly diminished shots per minute which might result from our own greater number of hits per minute obtained without the use of smoke.

Accuracy of fire depends upon the existence of a definite aiming point and an entrenched enemy does not offer a definite aiming point. The best an attacker can do ordinarily, is to fire at the place where he thinks the enemy is located. Smoke placed accurately on this sort of target by artillery or chemical troops really gives a better aiming point than the indefinite, camouflaged enemy position. But a moving skirmish line in the attack does offer a definite aiming point to an enemy on the defensive. Thus we see that smoke on the entrenched enemy and not on us (the attacker), in this particular case, actually increases our accuracy of fire.

The argument that the number of chance hits of an enemy shrouded in smoke, will be just as great as if there were no smoke is untenable, as it implies that the value of training in marksmanship, fire discipline, etc., is nullified under the excitement of battle.

Although it is believed that smoke, properly placed, will lower accuracy of fire of a first class enemy much more than our hits per minute, let us assume for the sake of argument that our smoke will lower his hits per minute only to the same extent as would our greater number of hits per minute. Still one thing is certain and that is our infantry will arrive within assaulting distance with more ammunition than if they had used this ammunition in maintaining fire superiority. This reduces the problem of ammunition supply.

Other things being equal, the rate of infantry advance against an enemy, shrouded in smoke, will be doubled due to its being no longer necessary for one-half of the infantry to halt and fire while the other half advances. This should reduce losses 50%, as our infantry is exposed to fire only half the time. Now assuming that in order to accomplish a certain result it is necessary to place a certain number of men in assaulting position, we may start our attack with a smaller number of men at the jump-off, because there will be fewer casualties in gaining the assaulting position. This, taken with the ammunition saving, might be considered as a measure of value for smoke.

Tacticians seem to agree that in future wars, night attacks will be the rule and that they will be necessary due to the greater losses that are incurred in daytime precluding day attacks. Now a smoke screen placed on the enemy gives all the advantages of a night attack without its chief disadvantange - loss of direction.

To sum up:-

(1) Opposition to the use of smoke, on the ground that it reduces fire superiority, is believed to be largely due to a lack of clear thinking. Smoke really tends to give fire superiority for the following reasons:

(a) Anything which increases our own accuracy or volume of fire, or decreases the accuracy or volume of hostile fire, tends respectively to increase our own hits per minute or to decrease enemy hits per minute, either of which tends toward our own superiority of fire.

(b) It is possible to have fire superiority with very few hits per minute if some method is used to render the hostile fire inaccurate. Smoke undoubtedly will do this when used so that it does not reduce the accuracy of our own fire to the same extent.

(c) In some cases, smoke on the enemy actually increases our fire superiority by lowering enemy hits per minute and increasing our own, since the enemy's accuracy is reduced and our own is increased, when the enemy is in smoke and we are not.

(2) The use of smoke reduces the problem of ammunition supply.

(3) Its use cuts down the number of casualties by having our troops under fire, while advancing, for only half the time. It thus permits an attack to be launched with few men on the line of departure.

(4) A smoke screen gives all the advantages of a night attack without its chief disadvantage - loss of direction.

SMOKE.

During the progress of the last Line and Staff Course at the Chemical Warfare School, the class engaged in a practical exercise of rifle fire in smoke.

The results of this demonstration when studied, bear out the article in this issue by Majors C. R. Alley and L. F. J. Zerbee, C.W.S., and should furnish food for thought for personnel of all branches and particularly that of the Infantry.

The data of the exercise follows:

Number of men firing	15
Range	300 yards
Target	"D"

Condition 1 - 5 rounds per man without smoke.
Condition 2 - 5 rounds per man - smoke on the firing point.
Condition 3 - 5 rounds per man - smoke on the target.

Bull's Eye Hits

Condition 1 - 22
Condition 2 - 1
Condition 3 - 8

Deductions

1st - The placing of smoke on the firing point reduced the efficiency to one twenty second of that without smoke.

2nd - The placing of smoke on the target reduced the efficiency to eight twenty seconds of that without smoke.

3rd - The efficiency in firing with smoke on the target is eight times that of the fire with smoke on the firing point.

Assuming then that the fire efficiency of two opposing forces was equal without smoke, one force by the use of smoke on the opposing position, while reducing its own efficiency to eight twenty seconds of its former value, has reduced that of its opponents to one twenty second and it now has an efficiency of eight to one over its opponents.

Figures for all hits support the above deductions though to a smaller degree.

Under condition 1, 65 hits with an average value of 3.9 were obtained. Under condition 2, 7 hits with an average value of 3.14 were obtained. Under condition 3, 41 hits with an average value of 3 were obtained.

Following the same line of reasoning it is found that deduction 3 shows the relative efficiency is approximately 5.

AN APPRECIATION.

General A.A. Fries, Chief, Chemical Warfare Service, is in receipt of the following letter from Griffin, Ga.

CITY OF GRIFFIN

Griffin, Ga. Jan. 10, 1925.

Gen. A.A. Fries,
Chief, Chemical Warfare Service,
Washington, D.C.

Dear Sir:

As Chairman of the Commissioners of the City of Griffin, I wish to express to you our appreciation for the work you and your men have done in an effort to free the cotton raising belt from the evil of the boll weevil. We greatly appreciate what you have already done and trust that the results of the experiments will prove of great value to the Nation.

We further wish to congratulate your branch of the army upon the high character of the men associated with your work. Messers. Walker, Sacks and Gehauf, while engaged in work at the Georgia Experiment Station, conducted themselves in a most gentlemanly manner and won a large number of friends, both for themselves and for the Chemical Warfare Service. We trust that when the work here is resumed the same men will be again assigned to the work and we also trust that you yourself will do us the honor of again visiting us.

The City of Griffin stands ready at all times to assist you in any way and we trust that you will feel free to call on us.

Yours truly,

J. S. TYUS.

GENERAL FRIES REAPPOINTED CHIEF, CHEMICAL WARFARE SERVICE.

On January 31, the Senate confirmed the reappointment of Brigadier General Amos A. Fries as Chief, Chemical Warfare Service.

General Fries was born in Debello, Vernon County, Wisconsin, March 17, 1873, and entered the Military Academy from the State of Oregon, graduating in the class of 1898, and being assigned to the Corps of Engineers. He served with engineer troops during the Spanish-American War, and in the Philippine Insurrection. He has been detailed as District Engineer in charge of river and harbor work in several engineer districts, and has been Director of the Engineer School at Washington Barracks.

During the World War he was a Brigadier General (temporary) and Chief of the Chemical Warfare Service of the A. E. F. After his return to the United States, and after short periods of duty in the Office of the Director of the Chemical Warfare Service, and in command of Edgewood Arsenal, he was appointed Chief of the Chemical Warfare Service, July 16, 1920, a post which he has held since that date. General Fries has been awarded the Distinguished Service Medal (United States); and is a Commander of the Legion of Honor (France) and a Companion of the Order of St. Michael and St. George (England). His Distinguished Service Medal citation is as follows:

"For exceptionally meritorious and distinguished services. As Chief of the Chemical Warfare Service, he was charged with the important task of training and equipping our troops for a form of warfare in which the American Army had had no experience prior to the present war. Both in securing proper defensive measures against gas and in developing new methods for its use as an offensive agency, he performed his arduous duties with marked success, thereby rendering valuable services to the American Expeditionary Forces".

FIRST CORPS AREA NOTES.

At a dinner and meeting held on Wednesday evening, January 21st, at the Engineers Club, Boston, Mass., the Boston Section of the United States Chemical Warfare Association was formed.

Arrangements for the meeting were made by Captain T. J. Johnston, Corps Area Chemical Warfare Officer. Mr. S. W. Wilder, President of the Merrimac Chemical Company, was elected temporary Chairman, and Dr. W. K. Lewis, Department of Chemical Engineering, Massachusetts Institute of Technology, was elected temporary Vice Chairman.

Among those who spoke were Mr. Wilder, Doctor Lewis, Captain Johnston, Dr. Dradley Dewey of the Dewey & Almy Chemical Company, and Lieut. Alden H. Waitt, U.S.A. Forty chemists, industrialists and Chemical Warfare Reserve officers attended the meeting.

It was decided to hold a second meeting about March fifteenth, at which time General Amos A. Fries, Chemical Warfare Service, will be present.

MILITARY NOTES

Furnished By

The Military Intelligence Division, G. S.

JAPAN.

Naval Aviation Program: While nothing definite can be ascertained about Naval Aviation Programs, the following reports from the Teikoku (Imperial) News Agency may be of interest:

"The following program for aerial expansion will be presented in the 1924-1925 session of the Diet at the instance of the Navy Department: 1925 - One Squadron, 1926 - Two Squadrons, 1927 - Two Squadrons, 1928 - One Squadron.

"Total by April 1, 1929 - Seventeen Squadrons.

"It is probable that completion of the program will be speeded up by legislative action when the Diet again considers Naval Aviation in the 1925-1926 session. It seems likely that 10 additional squadrons will be authorized at a later session of the Diet".

ARGENTINA.

Flight from Buenos Aires to Lima: Wednesday, December 3, 1924, the Argentinian Aviator, Guillermo Hillcoat, arrived in Lima, having flown from Buenos Aires by way of Santiago, and the coast, using a 160 H.P. Curtis Oriole.

Hillcoat left Buenos Aires November 26th, arriving in Mendoza the same day. From there he made two unsuccessful attempts to pass the Andes, and finally succeeded on a third attempt. He followed the general route of the Trans-Andine Railway from Mendoza to Santiago.

Captain Alvarillo, of the Peruvian Air Service, who was trained in the Argentine, went out to meet Hillcoat in a "Bristol", but due to motor trouble had to land near Pisco. He has returned to Lima for parts for some necessary repairs.

While the flight along the coast from Santiago to Lima is not difficult, the crossing of the Andes, at any time and under any conditions, may be considered as a feat.

Hillcoat remains in Lima as the special guest of the Peruvian Government for the Centennial celebration.

GERMANY.

Emergency Ration: The emergency ration of the Reichswehr consists of the following: 200 grams tinned meat, 150 grams tinned vegetables, 250 grams Zwieback, 400 grams Egg-Zwieback, 25 grams coffee, 15 grams salt.

The field ration is based on 3,000 calories per man.

Cruise of the "Berlin": The German cruiser "Berlin", on a training cruise with 60 cadets and a crew of 320 arrived at Vera Cruz, Mexico for a ten-day visit on January 11, 1925. On leaving Vera Cruz, the "Berlin" will return to Kiel via Havana, La Guayra, and Porto Rico.

(Continued on page 23)

ITS GREATER SERVICE TO PEACE.

From Gazette Times, Pittsburg, Pa., November 24, 1924.

President Coolidge recently summarized the peace-time activities of the Navy, showing that its contributions to the welfare of mankind in directions utterly unrelated to war have been of incalculable value. The government a few months ago awarded a contract for the largest order for explosives ever given, not excluding war-time contracts, and every pound of it is to be employed in works of peace. Now comes Brig. Gen. Amos A. Fries, Chief of the Chemical Warfare Service, with a report indicating that this branch of the nation's protective forces is wonderfully advancing human progress.

Incidentally the General declares "ridiculously foolish" a lot of stories that have been told of the development of electrical and chemical means of destruction which have been described as capable of exerting virtually "supernatural" power. The Chemical Warfare Service, we are left to understand, has made important discoveries and developed valuable weapons for use if this country ever again is called upon to defend itself. But the Chief regards its labors as peace work principally.

It is the most universal of sciences today, he says, and the claim is by no means extravagant. The Service is proving an invaluable aid to medical science; it has developed a successful treatment for whooping cough with chlorine gas. The tear gas that seemed so terrible when spread over the battlefields of Europe has been made available for police use and is employed in preserving order and protecting lives and property. Chemical protection and preservation of materials necessarily exposed to destructive agencies, the fight against the cotton boll weevil that has greatly reduced the world supply of an important staple and increased the cost of clothing and other articles of which cotton is a constituent part, are some of the useful activities of the Chemical Warfare Service. Can we have too much preparedness for war if the "by product" of it is so beneficial to life and so great a factor in increasing wealth as are this Service's labors?

UNITED STATES CIVIL SERVICE EXAMINATION.

The United States Civil Service Commission announces the following open competitive examination:

OCCUPATIONAL THERAPY AIDE, $1,680
OCCUPATIONAL THERAPY PUPIL AIDE, $1,000

Applications for the positions named above will be rated as received until April 30. The examinations are to fill vacancies in the Veterans' Bureau throughout the United States, at the entrance salaries shown above. Advancement in pay may be made without change in assignment up to $2,040 a year for occupational therapy aide, and up to $1,400 a year for occupational therapy pupil aide.

The duties of occupational therapy aides consist of giving instruction in the arts and crafts or in any one or more of the academic or commerical subjects considered under the subject of occupational therapy, keeping a daily record of the work and progress of each and every patient coming under direction and instruction, and making the required reports of the activities of the reconstruction work in occupational therapy.

The duties of occupational therapy pupil aides are, under the supervision and instruction of the chief aide, to apply occupational therapy by means of teaching arts and crafts, agriculture, floriculture, or allied subjects other than academic and commercial subjects; to keep a daily record of the work and progress of patients; and to make the necessary reports of the activities of the reconstruction work in occupational therapy.

Competitors will be rated on their physical ability, and education, training, and experience.

Full information and application blanks may be obtained from the United States Civil Service Commission, Washington, D. C., or the secretary of the board of U. S. civil-service examiners at the post office or customhouse in any city.

MILITARY NOTES

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The Military Intelligence Division, G. S.

FRANCE.

French Superior War Council: The Superior War Council is composed of the six marshals of France and of eight major generals who have commanded large units or have held the post of Chief of Staff of the Army.

At present, the six marshals of France are the following: Marshal Joffre, Marshal Foch, Marshal Petain, Marshal Lyautey, Marshal Franchet d'Esperey, and Marshal Fayolle.

General Weygand was recently relieved as French High Commissioner in Syria by General Sarrail who has been in retirement since his relief from command of the Salonica Armies in December, 1917. He has now been reinstated to the active list pursuant to a special law passed in August of last year and is now given an important command.

General Weygand will assume the post of Commandant of the Center of Higher War Studies on his return from Syria.

Marshals and General Officers: The active list of general officers of the French Army is as follows: 6 Marshals of France; 3 Major Generals (Castlenau, Sarrail, and Guillaumat) who remain on the active list for life; 1 Major General (Berthelot) who is held on the active list until reaching the age of 65 years; 1 Major General (Peltier), detached; 117 Major Generals, of whom 15 are with colonial troops; and 233 Brigadier Generals, of whom 32 are with colonial troops.

The senior general officer is General Gourand followed by Generals Mangin and Debeney, in order.

CHANGES - CHEMICAL WARFARE OFFICERS' RESERVE CORPS.

NAME AND RANK	ASSIGNMENT JURISDICTION	REMARKS
LT. COLONELS		
Lowenstein, Arthur	O.C.,CWS	5132 Greenwood Ave., Chicago, Ill. Apptd. 11/29/24; accptd. 12/5/24. BA Group, Technical Div., OC-CWS.
Miner, Carl S.	O.C.,CWS	9 South Clinton St., Chicago, Ill. Apptd. 12/13/24;accptd. 1/3/25. BA Group, E.A.
Willard, Frederic W.	Unassigned	224 South Ridgeland Ave., Oak Park, Ill. Apptd. 1/6/25; accptd. 1/13/25.
MAJORS		
Beckstein, William H.	O.C.,CWS	933 O St., N.W., Washington, D.C. Apptd. 12/17/24; accptd. 12/29/24. BA Group, Technical Div., OC-CWS.
deHoll, Henry R.	Unassigned	4120 Parish Ave.,East Chicago, Ind. Apptd. 1/9/25; accptd. 1/17/25.
Dyer, Harry E.	O.C.,CWS	Havre de Grace, Md. Apptd. 12/19/24; accptd. 12/31/24. BA Group, Edgewood Arsenal.
Elwell, Kenneth R.	O.C.,CWS	35 North Fifth Ave., La Grange,Ill. Apptd. 11/19/24; accptd. 11/29/24. BA Group, 4th C.W.S. Procurement Dist.
Lawrence, Ruben B.	Unassigned	62 North Harrison Ave.,Belleville, Pa. Apptd. 1/14/25. accptd. 1/21/25.
McGovern, Thomas F.	Haw. Dept.	Schofield Bks., H.T. Warrant Officer. (Incorrectly reported in December 15th Chemical Warfare as Enlisted man).
Millard, Earl B.	O.C.,CWS	Mass. Institute of Technology, Cambridge, Mass. Apptd. 12/20/24. accptd. 12/30/24. BA Group, Edgewood Arsenal.
Miller, George E.	Unassigned	Permanent add: 150 York St., Gettysburg, Pa. Temp. add: Edgewood, Md. Apptd. 1/5/25; accptd. 1/10/25.
Phipps, Francis H.	O.C.,CWS	Address chgd. from:Room 2700, Municipal Bldg., N.Y.C., to: 102 South 6th Ave., Mt. Vernon, N.Y. BA Group, Plants & Prod. Div., E.A.

NAME AND RANK	ASSIGNMENT JURISDICTION	REMARKS
MAJORS (Cont'd)		
Popp, Earl C.	1st C.A.	14 Allen Ave., Westfield, Mass. Apptd. 1/8/25;accptd. 1/19/25. TA Group.
Purman, James W.	O.C.,CWS	Add. chgd. from: 1480 Monroe St., Washington, D.C., to: #2 South Clinton Ave., Trenton, N.J. BA Group, Plants & Prod. Div., E.A.
CAPTAINS		
Bray, John L.	Unassigned	Purdue University, Lafayette, Ind. Apptd. 1/9/25; accptd. 1/21/25.
Brockman, Charles J.	Unassigned	336 Hill St.,Athens,Ga. Apptd. 1/6/25; accptd. 1/17/25.
Coblentz, Siegfried P.	8th C.A.	P.O. Box 399, Laredo, Texas. Apptd. 1/8/25;accptd. 1/21/25. TA Group.
Couch, James F.	Unassigned	Bureau of Animal Industry, Washington, D.C. Apptd. 1/9/25; accptd. 1/19/25.
Denson, John V.	4th C.A.	Opelika, Lee County, Ala. Apptd. 12/1/24; accptd. 12/24/24. TA Group.
Douglas, Julian L.	O.C.,CWS	125 East 57th St., Chicago, Ill. Apptd. 11/29/24; accptd. 12/12/24. BA Group, E.A.
Finley, Mark F.	O.C.,CWS	University Club, Washington, D.C. Apptd. 11/28/24; accptd. 12/8/24. BA Group, Military Intelligence Div., OC-CWS.
Jones, Russell M.	O.C.,CWS	1967 Biltmore St., Washington, D.C. Apptd. 11/24/24; accptd. 12/2/24. BA Group, School Battalion, E.A.
Miller, Helmick R.	O.C.,CWS	310 West Pine St.,Chisholm,Minn. Trans. from Cav-ORC 6/5/24. BA Group, Replacement Center,E.A.
Montgomery, William J.	---	Edgewood Arsenal,Md. Declined appointment as Captain,CW-ORC.
Noble, George	9th C.A.	Add. chgd. from: 218a North Louise St., Glendale, Cal. to: 125a West Burchett St. , Glendale, Cal. TA Group.
Peeples, William M.	O.C.,CWS	Add. chgd. from: American Packing Corp., Evansville, Ind., to: Gen. Del., Tampa, Fla. BA Group, Chemical Div., E.A.

NAME AND RANK	ASSIGNMENT JURISDICTION	REMARKS
CAPTAINS (Cont'd)		
Pelham, Thomas W., Jr.	O.C.,CWS	5 Agawam Road, Newton 62,Mass. Trans. from QM-ORC 12/10/24. BA Group, 1st C.W.S. Procurement Dist.
Price, Ralph H.	O.C.,CWS	5505 West Washington Blvd., Chicago,Ill. Apptd. 12/16/24; accptd. 1/20/25. BA Group, Edgewood Arsenal.
Riker, Carleton B.	Unassigned	190 Montrose Ave.,South Orange, N.J. Apptd. 1/16/25; accptd. 1/23/25.
Sibley, Benjamin C.	O.C.,CWS	c/o Louisiana National Bank, Baton Rouge, La. Apptd. 11/25/24; accptd. 12/27/24. BA Group, Edgewood Arsenal.
Skinner, Glenn S.	O.C.,CWS	Add. chgd. from:803 State St., Madison, Wis. to: Butler, Mo. BA Group, Chemical Div., E.A.
Snell, Harry S.	O.C.,CWS	5141 West End Ave., Chicago, Ill. Apptd. 1/8/25; accptd. 1/15/25. BA Group, Edgewood Arsenal.
Thayer, Floyd K.	O.C.,CWS	5009 North Ashland Ave., Chicago,Ill. Apptd. 8/23/24; accptd. 12/11/24. BA Group, Edgewood Arsenal.
Trammell, Scott	O.C.,CWS	335 - 9th St.,S.E.,Washington, D.C. Prom. from 1st Lt. 12/31/24. Reassgd. from BA Group (enlisted) to BA Group, Training Div., OC-CWS.
Van Voorhees, Harold E.	5th C.A.	Add. chgd. from: 2018 North Alabama Ave.,Indianapolis,Ind. to: 3024 North Penna. Ave., Indianapolis, Ind. TA Group.
FIRST LIEUTENANTS		
Benkelman, Alvin C.	Unassigned	Box 81, West Lafayette, Ind. Apptd. 1/10/25;accptd. 1/16/25.
Carloss, Howard	O.C.,CWS	c/o Como Chemical Co., Kokomo, Ind. Apptd. 12/11/24: accptd. 12/18/24. BA Group, Edgewood Arsenal.
Horne, Frank S.	O.C.,CWS	Add. chgd. from: Waite Phillips Co., Okmulgee,Okla. to: Waite Phillips Co., Wichita, Kas. Box 1200. BA Group, Edgewood Arsenal, Chemical Div.

NAME AND RANK	ASSIGNMENT JURISDICTION	REMARKS
FIRST LIEUTENANTS (Cont'd)		
Latshaw, William H.	O.C.,CWS	Add. Chgd. from: 624 Hamilton Road, Pittsburgh, Pa., to: 624 Hamilton Road, Crafton Station, Thornburg, Pa. Trans. from TA Group to BA Group, 3rd C.W.S. Procurement Dist.
Leake, Chauncey D.	Unassigned	Science Hall, Madison, Wis. Apptd. 1/9/25; accptd. 1/15/25.
Mottern, Albert J.	O.C.,CWS	Add. chgd. from: 4623 Smith Road, Norwood, Ohio, to: 408 Vandam Bldg., 1001 Market St., Philadelphia, Pa. BA Group, Chemical Div., E.A.
Schavoir, Frederick H.	O.C.,CWS	Gurley Road, Stamford, Conn. Apptd. 1/5/25; accptd. 1/14/25. BA Group, 1st C.W.S. Procurement Dist.
Silver, Frank V.	O.C.,CWS	Add. chgd. from: 618 Wellington Ave., Chicago, Ill. to: 3755 Rokeby St., Apt. #2, Chicago, Ill. BA Group, Chemical Div., E.A.
Snow, Robert D.	Unassigned	730 South Clinton St., Iowa City, Iowa. Apptd. 1/13/25; accptd. 1/22/25.
Webber, Matthew E.	O.C.,CWS	8217 Van Buren St., Venita Park, St. Louis,Mo. Apptd. 12/13/24; accptd. 12/20/24. BA Group, Edgewood Arsenal.
SECOND LIEUTENANTS		
Beach, Howard T.	Unassigned	217 East Davenport St., Iowa City, Iowa. Apptd. 1/7/25; accptd. 1/15/25.
Beisler, Harold A.	O.C.,CWS	Correct address: 1096 Chancellor Ave., Hilton, N.J. Incorrectly reported in Jan. 15th Chemical Warfare as Milton, N.J.
Berryhill, Robert H.	Unassigned	233 North Mt. Vernon St., Prescott, Ariz. Apptd. 1/5/25; accptd. 1/16/25.
Carlson, Reuben T.	2nd C.A.	Baker St. Extension, Jamestown, N.Y. Apptd. 12/5/24; accptd. 1/15/24. TA Group.
Cronin, John J.	Unassigned	Permanent add: 8 Walnut St., Needham, Mass. Temp. add. to 6/25/25: Durham, N.H.

NAME AND RANK	ASSIGNMENT JURISDICTION	REMARKS
SECOND LIEUTENANTS (Cont'd)		
Day, Curtis B.	O.C.,CWS	1625 West 22nd St., Oklahoma City, Okla. Apptd. 12/15/24; accptd. 12/27/24. BA Group, Edgewood Arsenal.
Disney, William D.	Unassigned	Edgewood Arsenal, Md. Apptd. 12/11/24; accptd. 12/31/24.
Donner, Joseph	O.C.,CWS	6745 Dorchester Ave., Chicago, Ill. Trans. from Med-ORC 1/5/25. BA Group, Edgewood Arsenal.
Fiske, William M.	O.C.,CWS	Add. chgd. from: 822 Newport Ave., Chicago, Ill. to: 596 Hawthorne Place, Chicago, Ill. BA Group, Chemical Div., E.A.
Fischer, Sidney	2nd C.A.	3657 Broadway, New York City. Apptd. 1/10/25; accptd. 1/19/25. TA Group.
Fisher Harry C.	Unassigned	8411 Wiswell Avenue, Cincinnati, Ohio. Apptd. 1/2/25; accptd. 1/12/25.
Flint, Clyde M.	1st C.A.	Add. chgd. from:35 Pleasant St., Concord, N.H. to: Box 32, Laconia, N.H. TA Group.
Fritts, James E.	O.C.,CWS	Add. chgd. from: Cowden, Ill. to: 863 Seward Ave., Detroit, Mich. BA Group, Edgewood Arsenal.
Fuwa, Tyler	O.C.,CWS	Name chgd. to Chaplin Tyler. Add. chgd. from: Box 219, M.I.T., Cambridge, Mass. to: Chemical & Metallurgical Engineering, 10th Ave. & 36th St., New York City, BA Group, Chemical Div., E.A.
Gatewood, Edwin McC.	O.C.,CWS	715 North 12th St., Ft. Smith, Ark. Apptd. 12/1/24; accptd. 12/11/24. BA Group, Edgewood Arsenal.
Greene, Luther W.	O.C.,CWS	1815 South 58th St., Philadelphia Pa. Trans. from Inf-ORC 12/24/24. BA Group, Edgewood Arsenal.
Griffin, Robert I.	4th C.A.	57 Radcliffe St., Charleston, S.C. Apptd. 1/12/25; accptd. 1/19/25. TA Group.

NAME AND RANK	ASSIGNMENT JURISDICTION	REMARKS
SECOND LIEUTENANTS (Cont'd)		
Hale, Edwin A.	O.C.,CWS	523 Surf St., Chicago, Ill. Apptd. 12/16/24;accptd. 12/30/24. BA Group, Edgewood Arsenal.
Helfenbein, Herman F.	4th C.A.	1315 Highland Ave., Knoxville, Tenn. Apptd. 12/26/24;accptd. 1/7/25. TA Group.
Hilberg, Frank C.	1st C.A.	Box 78, Lawrence, Mass. Trans. from CA-ORC 12/29/24. TA Group.
Hoerger, Winfield S.	O.C.,CWS	6525 South Peoria St., Chicago, Ill. Apptd. 12/11/24; accptd. 12/19/24. BA Group, Edgewood Arsenal.
Howe, Charles H.	O.C.,CWS	Permanent add: Chapman, Kas. Temp. add. to 6/15/25, Dept. of Agricultural Economics, Agriculture Hall, University of Wisconsin, Madison, Wis. Apptd. 12/8/24; accptd. 12/19/24. BA Group, Edgewood Arsenal.
Jacobson, Orin B.	O.C.,CWS	Add. Chgd. from: 1008 First Ave., Sioux Falls, S.D. to: 1103 West Illinois St., Urbana, Ill. BA Group, Chemical Div., E.A.
Jenkins, George W.	O.C.,CWS	37 Circular St., North Attleboro, Mass. Apptd. 11/20/24; accptd. 12/3/24. BA Group, 1st C.W.S. Procurement Dist.
Kaplan, Joseph	Unassigned	2003 Linden Ave., Baltimore, Md. Trans. from Inf-ORC 1/8/25.
Lane, Wallace C.	O.C.,CWS	421 Heard Bldg., Phoenix, Ariz. Trans. from Training Div., E.A. to 1st Gas Regiment. BA Group.
McFadden, Herbert J.	O.C.,CWS	229 East 6th St.,Loveland, Colo. Apptd. 11/24/24; accptd. 12/3/24. BA Group, Edgewood Arsenal.
MacKinnon, Wallace L.	O.C.,CWS	Y.M.C.A., Racine, Wis. Trans. from Inf-ORC 10/22/24. BA Group, Edgewood Arsenal.
Marquette, George H.	4th C.A.	Add. chgd. from: 443 Boyd Ave., Baton Rouge, La. to: Central Stewart, Stewart Camaguey, Cuba. TA Group.

NAME AND RANK	ASSIGNMENT JURISDICTION	REMARKS
SECOND LIEUTENANTS (Cont'd)		
Money, Edwin H.	O.C.,CWS	5 Poplar St., Attleboro, Mass. Apptd. 12/23/24; accptd. 12/31/24. BA Group, 1st C.W.S. Procurement Dist.
Mortimer, John E.	O.C.,CWS	Add. chgd. from: 1402 Hamilton St., Wilmington, Del. to: c/o Guantanamo Sugar Co., Guantanamo, Cuba. BA Group, Production Div., E.A.
Newsome, Philip T.	Unassigned	1028 West Dayton St., Madison, Wis. Apptd. 1/19/25; accptd. 1/24/25.
Sutcliffe, Albert J.	8th C.A.	Warren, Ariz. Apptd. 1/6/25. accptd. 1/16/25. TA Group.
Warren, William D.	2nd C.A.	328 Hartford Place, Utica, N.Y. Apptd. 12/20/24; accptd. 1/3/24. TA Group.
Williams, Alexander	2nd C.A.	53 Ambrose St., Rochester, N.Y. Apptd. 1/9/25; accptd. 1/15/25. TA Group.

RESERVE OFFICERS PLEASE NOTE.

It is requested that any errors or omissions noted in these lists of Reserve Officers, be reported to the Personnel Section, Office, Chief, Chemical Warfare Service, Munitions Building, Washington, D.C.

TABLE OF CONTENTS.