THE PRINCIPLES O
SANITARY TACTICS

MUNSON

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4 INCH MAP


MAP
of
FORT LEAVENWORTH, KAS.
and
VICINITY
Compiled from Surveys made by the Staff Corps of 1904-05, 1905-06
Under the direction of the
COMMANDANT
of the
INFANTRY AND CAVALRY SCHOOL, SIGNAL SCHOOL AND
STAFF COLLEGE
January 1907
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MISSOURI
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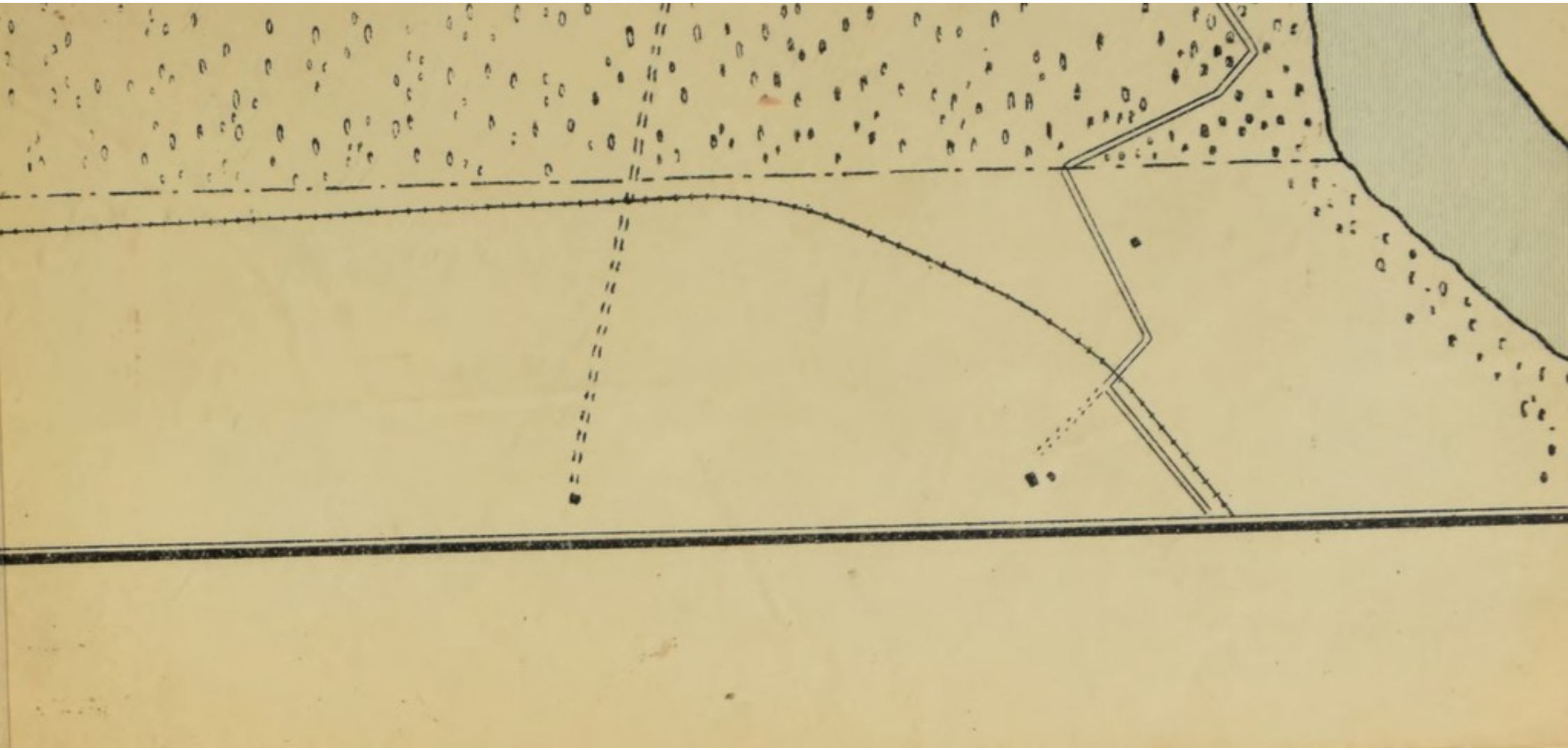
CITY OF LEAVENWORTH



Historical Volumes

To -

Lieut. Col. M. W. Ireland.

With the best regards of the

Author.

THE PRINCIPLES OF SANITARY TACTICS

A HANDBOOK

ON THE

USE OF MEDICAL DEPARTMENT DETACHMENTS AND ORGANIZATIONS IN CAMPAIGN

By

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PREFACE.

In respect to the tactical use of the sanitary service with troops in campaign, there is undoubtedly far too hazy a conception in the minds of many officers of the line and Medical Department as to its importance, scope and methods of employment. The subject is one which has suffered grievously through ignorance, indifference and default. Those who have given it even casual consideration have been few and isolated. Little has been written upon it, and so far as known there has been no effort in any army to consider it in all its aspects with such thoughtful completeness as its great importance deserves.

The present work is the expression of an effort to meet a need which it is believed unquestionably exists; not only in respect to the giving of general information relating to sanitary tactics as a whole, but also in a sense looking to the standardization of instruction thereon, both for the individual and group, in garrison, armory, maneuver camp and war, so that all may have opportunity to be equally grounded in the fundamentals of a sanitary tactical education.

The so-called applicatory method of instruction here employed will be so readily understood as to need no explanation; and its superiority over all other methods of teaching military and sanitary tactics, after a sufficient knowledge of fundamental principles is secured, is so well established as to call for no discussion. But the method is not adapted to casual reading, and will result in little benefit unless there be close application with map, dividers, pencil and paper. Inasmuch as the problems here presented are intended to elicit independent thought and

deduction rather than invite perusal, it is important that officers work out their own solutions and comments, preferably in writing, before reading those given in the text. This will require much time, labor and study; but there is no short cut to arrival at a competent knowledge of sanitary tactics, and a few problems carefully worked out in detail will undoubtedly give better results in respect to training than a large number only superficially considered.

In a general way, the series of problems here given is intended to form a progressive course of study to extend over a considerable period of time and to include examples of the more important sanitary situations which officers may be liable to be called upon to meet. While their scope is by no means complete, it is believed that they fairly well illustrate the main general principles through which all sanitary problems, whether the situation be theoretical or actually encountered in campaign, will have to be solved. They have been treated in considerable detail for the benefit of those to whom the subject, as a whole, is largely new. With these as a suggestive basis, sanitary situations may readily be devised to fit practically all tactical problems, so that the officer who completes this preliminary course with satisfaction to himself should have no difficulty in subsequently developing a larger and better one for his own individual study. For war-games, these problems should suggest the general principles on which the appropriate sanitary tactical moves should be based. For sanitary tactical walks or rides, and for practical sanitary exercises at maneuver camps, either without or in conjunction with the combatant troops, these problems are intended to indicate typical situations which may be applied, with suitable modifications, to local conditions of organization, environment and terrain.

As this book is intended for the information of officers

generally, it has not been thought worth while to extend its scope to forces of greater magnitude than the division, nor to touch upon the sanitary service of the line of communications or the base except by implication.

The military situations and movements presented in the following problems are possibly not always ideal from the standpoint of military tactics. This is of no importance to the present inquiry. They are not planned to represent tactical studies but to illustrate reasonable conditions upon which typical sanitary situations can be based. So far as the tactical functions of medical officers and their organizations are concerned, quality of military leadership does not enter into their resulting problems other than as it may modify methods of sanitary tactics and render the application of the latter more or less difficult. The general tactical situation is one which the sanitary service can never control. The commander of the forces as a whole is alone responsible for its nature. Whether this be the result of Napoleonic genius or gross incompetence, it is the function of medical officers merely to adjust their actions to the moves of commanders, with sanitary efforts calculated to increase the rewards of success on the one hand, or to redeem something from failure on the other.

The author desires to express grateful appreciation of the warm encouragement, helpful advice and material assistance given him in the preparation of this book by Lieutenant Colonel J. F. Morrison, General Staff, Senior Instructor in Military Art, The Army Service Schools, and by Captain LeRoy Eltinge, 15th Cavalry, Instructor in Military Art, The Army Service Schools.

E. L. M.

The Army Service Schools,
Fort Leavenworth, Kansas.
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PART I

PRELIMINARY

CHAPTER I.

On the Organization of the Sanitary Service With Fighting Troops.

As prerequisite to the employment of sanitary tactics, it is essential that sanitary organizations shall exist. These latter, as compared with organizations for fighting purposes, are of comparatively recent development. Such development has, in turn, depended upon the transition of the practice of medicine and surgery from the crude, barbarous, empirical and uncertain into life-saving sciences based on demonstrated fact and applied with delicacy and exactitude; likewise upon the growth of humanitarian ideas which revolt at any unnecessary horrors of war. Impelled by these considerations to make provisions for the care of their wounded, commanders soon came to find that these could be turned to good account from the tactical standpoint.

While the Roman legions are known to have had their surgeons, after the decline and downfall of Rome armies seem to have been without surgical assistance of any sort for many centuries. Wounded were removed and looked after, as best might be, by their comrades and the women who followed the military forces of the period. No special provision for the care of wounded was made in any way. Up to the 13th Century, the practice of surgery was in the hands of the monks, and when this was prohibited by Papal decree, it fell into the hands of the barber-surgeons, of whom such as were attached to troops remained for several hundred years almost the only representatives of a sanitary service with fighting units. As time went on and the healing art developed, a few better educated men came later to occupy the higher medico-military positions, but in a general

way there was no organized medical service in armies until about the 16th Century. Even then the sanitary service was most primitive, and little was attempted for the removal or relief of other than the less severely injured. As illustrative of conditions of the time, it is recorded that Ambroise Paré, the foremost military surgeon of the period about 1550, saw three desperately wounded soldiers placed with their backs against the wall. An old campaigner inquired, "Can those men get well?" "No." said Paré. Thereupon the old campaigner went over to them and cut all their throats, as the chronicle puts it, "sweetly and without wrath."

The first recorded sanitary organization with armies called for the attachment of a barber-surgeon to each company, and a staff physician was assigned with the headquarters of each large force. Sick and wounded were treated in their company camps by the company barber-surgeons, and nursed and fed by women camp-followers. When an army moved, the serious cases were turned over to the nearest local authority, others were carried in the provision wagons. Deduction was sometimes made from the men's pay to provide medicines and instruments; in other cases, the barber-surgeons themselves provided them. Later, about 1700, medicine chests were provided as part of the equipment of regiments. About 1725, the training of a better class of men as military surgeons was begun. Such men were placed in the new position of regimental surgeons and supervised the company barber-surgeons. About this time, military hospitals began to be established in garrisoned towns, and to these as base hospitals, as we would now call them, wounded were removed in the most practicable way. Partly mobile hospitals came into restricted use about 1750, but were not capable of accompanying marching troops. The Napoleonic period brought out the amplification of the sanitary resources with regi-

ments by the use of combatant soldiers detailed as litter-bearers and surgeon's assistants. About this time, the company barber-surgeons were being generally replaced by trained surgeons, several of whom were attached to regiments. Medical staff officers were being placed in charge of the sanitary work with armies to coordinate their resources. Ambulance wagons to transport wounded appeared as part of the equipment of regiments. About 1810, so-called flying hospitals, able to follow troops, began to be roughly organized. A further great improvement in the type of medical men with the colors occurred after this period, with corresponding improvement in their status. Light field hospitals able to accompany troops with supplies, surgeons, apothecaries and assistants, came into being about 1850, but these had no organization of litter-bearers to bring wounded to them and depended on requisitioned country carts for transport of the disabled. The Crimean War emphasized the necessity for some mobile transport organization, and litter-bearer sections were organized as part of the light hospitals in several armies. The fate of the wounded had heretofore been pitiable, though the short range of weapons and the close order of battle formations had been factors which greatly facilitated collection and succor of the injured.

About this time, our own Civil War broke out. Recent improvements in military arms and ammunition, notably rifling and the conoidal bullet with the percussion cap and fixed ammunition, had caused great increase in the ranges at which battles occurred and tactics began to adjust themselves acordingly. Danger zones increased in depth, and increased rapidity and precision of fire brought thinning and lengthening of the lines. As a result, wounded were scattered in much larger areas than heretofore. Our sanitary service was then divided into that at the front, con-

sisting of several surgeons and a small hospital for each regiment, a fairly mobile hospital under canvas for each division, a division surgeon to administer the foregoing, and numerous vast fixed hospitals at the military bases and elsewhere. The system was cumbersome and impractical in that it retained with regiments seriously disabled men and bulky sanitary supplies, neither of which should have had place there. It was destructive of tactical efficiency through interfering with the mobility of fighting units, and undesirable from a humanitarian standpoint through retaining sick and wounded at the front where their care and comfort could not be properly considered. Infectious diseases, also, were materially spread by retaining the sick near the well. Moreover, such sanitary conveniences as belonged to regiments were usually far back with the trains during and after action when most to be desired. No reserve mobile sanitary organization existed for bridging the often great gap between the firing line and the division hospitals, or from the latter to the advance base, or for reinforcing the sanitary services attached to commands overwhelmed by a high proportion of casualties. The whole sanitary service between the firing line and the mobile hospital labored under such crippling disability that the Surgeon General, on August 21, 1862, after the war had continued sixteen months, reported that in no battle since the outbreak of hostilities had wounded been reached, succored and removed with proper efficiency; and submitted a plan for an independent sanitary organization to be used with mobile troops, apparently the one of Medical Director Letterman, subsequently referred to, for consideration by the Secretary of War. This plan met with such complete disapproval at the War Department that it was temporarily abandoned by the Surgeon General.

But on August 30th, the second battle of Bull Run was

fought, with its 4,000 wounded in the Federal force, and the resulting conditions were so intolerable as, a week later, to evoke the following letter:

"Surgeon General's Office,
September 7, 1862.

HON. EDWIN M. STANTON,
Secretary of War.

Sir: I have the honor to ask your attention to the frightful state of disorder existing in the arrangement for removing the wounded from the field of battle. The scarcity of ambulances, the want of organization, the drunkenness and incompetency of the drivers, the total absence of ambulance attendants are now working their legitimate results—results which I feel I have no right to keep from the knowledge of the Department. The whole system should be under the charge of the Medical Department. An ambulance corps should be organized and set in instant operation. I have already laid before you a plan for such an organization, which I think covers the whole ground, but which I am sorry to find does not meet with the approval of the Commander-in-Chief. I am not wedded to it. I only ask that some system may be adopted by which the removal of the sick from the field of battle may be speedily accomplished, and the suffering to which they are now subjected be in the future as far as possible avoided. Up to this date 600 wounded still remain on the battle-field in consequence of an insufficiency of ambulances and the want of a proper system for regulating their removal in the Army of the Virginia. Many have died of starvation; many more will die in consequence of exhaustion, and all have endured such torments which might have been avoided. I ask, sir, that you will give me your aid in this matter; that you will interpose to prevent a recurrence of

such consequences as have followed the recent battle—consequences which will inevitably ensue on the next important engagement if nothing is done to obviate them.

I am, sir, very respectively, your obedient servant,

(Signed) WILLIAM A. HAMMOND,
Surgeon General."

This letter was returned with an endorsement from the Commander-in-Chief reiterating his disapproval of the whole plan, in face of which no further steps at Army Headquarters could, for the time, be taken.

But in the meantime, medical officers of independent commands had been endeavoring to improve conditions within the immediate jurisdiction of their commanders, and in the Army of the Potomac, Medical Director Letterman had convinced General McClellan of the need for some special provision for the first aid and transportation of wounded. On August 2, 1862, three weeks before the Surgeon General had tried to have a similar system adopted for all the armies, General McClellan issued an order accepting and embodying Letterman's plan—which latter was so complete and practical as to have since served as the basis for similar organization of the sanitary service in the field in all the armies of the world.

Letterman's plan, in rough outline, called for the organization of an independent ambulance corps for each army corps, officered in the proportion of one captain for each corps, one first lieutenant to each division, one second lieutenant to each brigade and one sergeant to each regiment. The transportation allowance was to be based on 1 transport cart, 1 four-horse and 2 two-horse ambulances for each regiment, 1 two-horse ambulance for each battery, and 2 two-horse ambulances for corps headquarters. Each ambulance carried two litters. Two men and a driver were

detailed from the line of the army to each ambulance and one to each transport cart. The captain commanded the organization under the direction of the Medical Director. He was responsible for its internal economy, drills, etc. and was especially charged with the transportation of sick and wounded from the field and to and from the hospitals. His work in this connection was assigned him by the Medical Director. The first lieutenant had similar functions in relation to that section of the corps belonging to a division. Sergeants maintained discipline and made inspections. All officers and non-commissioned officers were mounted. The selection of the personnel was to be made only by reason of special fitness. Two medical officers, and a hospital steward with a medicine wagon, were to be attached to the ambulance corps from each division. The transportation was to be used "for transporting the sick and wounded to various points and procuring medical supplies," and for "nothing else." No person outside this corps was to remove any sick and wounded from the field. The organization was to work where needed, between the firing line and the division hospital, or in case of need, to the rear of the latter.

The advantages of the foregoing organization speedily became manifest, and at the battle of Antietam, in the following month, it gave admirable service. Of its operation in the battle of Fredericksburg an official report states:

"Being appointed Medical Director of the Sixth Corps a few days prior to the battle of Fredericksburg, December 13, 1862, I had the opportunity of putting in operation the Field Hospital organization devised by the Medical Director of the Army, and witnessing its beneficial results. Within a very few hours after the positions were designated for the Field Hospitals on December 12th, all the necessary appliances were on hand, and the arrangements necessary

for the proper care of the wounded were as thorough and complete as I have ever seen in a civil hospital.

"During the engagements of the 13th, the ambulances being guided and governed with perfect control and with a precision rare even in military organizations, the wounded were brought without any delay or confusion to the hospitals of their respective divisions. Not a single item provided for in the organization of the Field Hospitals suffered the slightest derangement, and the celerity with which the wounded were treated, and the system pervading the whole Medical Department, from the stations in the field selected by the assistant surgeons with the regiments, to the wards where the wounded were transferred from the hands of the surgeons to be attended by the nurses, afforded the most pleasing contrast to what we had hitherto seen during the war.

"Both military commanders and medical officers agree that it would have been impossible for wounded to have received better care and treatment than they did in that battle."

In the operations at the time of the battle of Chancellorsville in the following May, the Sixth Corps charged and took Marye's Heights behind the town of Fredericksburg. The Medical Director of the Corps, in his report, says:

"The charge was made at 1 P. M., the heights were taken, and in less than half an hour we had over 800 wounded. Two hours after the engagement, such was the celerity and system with which the ambulances worked, the whole number of wounded were in the hospitals under the care of the nurses."

In the battle of Gettsyburg, the orders of the Commanding General had not only reduced materially the number of supply wagons for the Medical Department, but the

exigencies of the closely contested conflict did not admit of those that were at hand being brought on the field. But the ambulance organization was intact, and such was the perfection of its administration, that on the early morning of the 4th of July, the day after the battle ended, not one wounded man of the great number who had fallen (over 14,000) was left on the ground. The Inspector General of the Army himself reported this fact from personal examination. No better example of efficiency of the newly developed ambulance system than this and that already mentioned at the capture of Marye's Heights could be given.

The success of Letterman's plan, as approved and put into operation under McClellan, induced Grant to adopt in its essentials in the Army of the Tennessee, in an order dated March 30, 1863.

Finally Congress tardily passed an Act, approved by the President on March 11, 1864, establishing a uniform system of ambulance service throughout the military forces. This Act of Congress was based on the original sanitary organization devised and put into practice by Letterman. In addition, the Medical Director was given complete control over the organization, a fixed number of enlisted men were to be detailed to it on the basis of the transportation authorized according to the strength of the command to which it was attached, and army wagons were added for the conveyance of sanitary supplies. The Act also specified in considerable detail the equipment with which the ambulance corps should be furnished. Prohibition of the use of ambulances for other than hospital purposes was made a matter of law, for a second infraction of which the penalty was fixed at dismissal from the service. No persons, other than medical officers or these belonging to the ambulance corps, were to be permitted to accompany sick or wounded

to the rear, either on the march or in battle. The uniforming of the ambulance corps in a distinctive manner was authorized.

The value of this mobile, independent sanitary organization, in the saving of blood, suffering and tears and in promoting the tactical efficiency of troops, can not be overestimated. The organization and plan worked out with such conspicuous success by the American, Letterman, remains today the foundation upon which the mobile sanitary service in all armies is largely built, though experience has shown that, from the highly technical character of its work, its personnel should exclusively be composed of officers and men belonging to the Medical Department. With its adoption, the subject of sanitary tactics, as a necessarily correlative branch always to be considered in connection with the art of war, became an established fact and part of the necessary education of medical officers.

The present sanitary organizations or detachments in our service which need receive tactical consideration with fighting troops are as follows:

(1) The battalion sanitary personnel, and resources (including transportation);

(2) The regimental sanitary personnel, its aid station, and resources (including transportation).

(3) The Ambulance Company, including:—

(a) Its bearer section, and resources;

(b) Its dressing station section, and resources, together with the dressing station;

(c) Its ambulance transportation section.

(4) The Field Hospital, including:—

(a) Its personnel section;

(b) Its supply section;

(c) Its transport section.

(5) The Reserve Sanitary Supply Train.

While the internal organization, economy and administration of the above-named tactical units present important, wide and interesting fields of study, they cannot rereive consideration in the present work, the subject of which relates not to the management of the Medical Department within itself, but pertains exclusively to its management in so far as the latter is directly related to and is influenced by the tactical direction of combatant troops and the art of making war.

The subject of the sanitary service of the line of communications and of the base, though broad and of much importance, partakes less of a tactical character than does the foregoing and is never one possessing the character of such immediate urgency. Relatively few medical officers will be called upon to decide such tactical questions as may relate to this sanitary "service of the rear," while in the "service of the front" each and every one may at any time be expected to play a tactical part. It is realized that these two services, through their correlation, must often necessarily overlap, but for the purposes of this work a line of demarcation has somewhere to be drawn, and this naturally falls in front of the semi-mobile Evacuation Hospitals.

For convenience of reference in respect to the solution of the following series of problems, a tabular statement of the authorized personnel, mounts and transportation pertaining to the sanitary organizations above mentioned, as components of the division, and to be considered in connec-

tion with the special provisions of Field Service Regulations and the Manual for the Medical Department, follows:—

THE INFANTRY DIVISION.

Sanitary Personnel.

	Lieutenant Colonels	Majors	Captain and Lieutenants	Total Commissioned	Sergeants 1st Class	Sergeants and Corporals	Priv., 1st class and Privates	Total Enlisted	Grand Total
Division Headquarters	1	1	1	3	1	..	6	7	10
Inspection	1	..	..	1	..	1	1	2	3
Infantry, 9 regiments	..	9	27	36	9	27	180	216	252
Cavalry, 1 regiment	..	1	3	4	1	3	20	24	28
Artillery, 2 regiments	..	2	4	6	2	4	36	42	48
Engineers, 1 battalion	..	..	3	3	..	3	6	9	12
Signal troops, 1 battalion	..	..	2	2	..	2	4	6	8
Ammunition train	..	..	2	2	1	1	6	8	10
Supply train	..	..	1	1	..	1	3	4	5
Ambulance Companies (4)	..	1	20	21	8	29	281	318	339
Field Hospitals (4)	..	5	16	21	12	25	193	230	251
Reserve Supplies (a)	..	..	1	1	1	1	9	11	12
Total	2	19	80	101	35	97	745	877	978

(a) With supply train.

Mounts and Transportation.

	Mounts			Transportation					
	Officers	Enlisted men	Total	Ambulances	Wagons	Draft animals	Pack animals	Tot. draft & p'ck animals	Total animals
Division Headquarters	5	5	10	..	..	..	..	..	10
Inspection	2	2	4	..	..	..	..	..	4
Infantry, 9 regiments	45	72	117	..	9	36	9	45	162
Cavalry, 1 regiment	5	22	27	..	1	4	1	5	32
Artillery, 2 regiments	8	38	46	..	2	8	2	10	56
Engineers, 1 battalion	3	6	9	..	..	..	..	..	9
Signal troops, 1 battalion	2	6	8	..	..	..	..	..	8
Ammunition train	2	4	6	..	..	..	..	..	6
Supply train	1	2	3	..	..	..	..	..	3
Ambulance Companies (4)	22	54	76	48	12	240	16	256	332
Field Hospitals (4)	26	34	60	..	32	128	..	128	188
Reserve Supplies (a)	1	3	4	..	6	24	..	24	28
Total	122	248	370	48	62	440	28	468	838

(a) With supply train.

Note.—One led horse for each officer above the grade of captain.

CHAPTER II.

On the Tactical Education of Medical Officers.

In donning the military uniform, the medical man assumes obligations which carry him not only beyond the care and prevention of diseases but into such general knowledge of military methods and elementary tactics as is necessary to enable him to manage his own sanitary organizations and units to best advantage. In this matter, as in maintaining the health of troops, there should and must be no sharp line of demarkation between the fields of study of line and medical officers, but rather a twilight zone into which both may explore to a limited extent with mutual benefit and to the advantage of the service as a whole. The sanitary resources within the immediate control of medical officers are too vast and valuable to be left in their utilization to chance, whim and hazard. There must be methods for their management which are best alike from the tactical, administrative and humanitarian standpoints; and nothing would seem to be more logical than that such management should be based on the tactical purposes and movements of commanders, supplementing them in a parallel but subordinate manner. Unfortunately there seems to be tacit acceptance in some quarters of the supposition that the Medical Department of an army neither possesses nor requires the use of any tactical principles or methods for the employment of its personnel, transportation and supplies in campaign. Such, however, is very far from being the truth, as would very quickly be demonstrated in connection with the handling of the vast aggregations of men and supplies required in modern war.

In every case where medical officers, for one or another

reason, are unable to play their part and execute the measures with which they are officially charged, the battlefield will inevitably be converted into a scene of indescribable suffering and horror. The history of our Civil War, for example, as already mentioned, is full of instances which prove the truth of this assertion. Officers of the Medical Department, and they alone, are relied upon to bring swift and sure relief and order out of military chaos. After a severe engagement the responsibilities which devolve upon the senior medical officer of a large command are far greater than those of any other staff officer except the Chief of Staff, and cannot properly be met save as the result of wide military experience fortified by special forethought and study. If untrained in matters of field service, officers will not only prove helpless themselves but largely paralyze the energies of those under them. And even with the best preparation, problems may not rarely be expected to arise whose solution must strain to the limit the medico-military machine and sorely test the knowledge and capacity of those who have its management in charge.

Modern arms, with their flat trajectory, deadly precision and almost incredible rapidity of fire, force troops to deploy early and at considerable intervals if they would escape annihilation. Wounded, instead of falling in limited areas, as was the case a generation or so ago, may now be expected to be scattered widely over danger zones of great depth and much increased width. Collection of the disabled steadily tends to become more difficult, distances over which wounded must be transported to increase, and danger to the sanitary personnel from aimed fire and overshots to be more and more serious. A larger and more carefully organized and administered sanitary service has thus become necessary. These facts and changes are too much disregarded by students of the art of modern warfare.

In a general way, the greater the size of the military forces, the extent of the battle line and the length of the line of communications the greater the need for sanitary organization and its efficient tactical direction. Conversely, where commands are small the less the need for sanitary tactics. The sanitary service with a battalion requires relatively little forethought or provision; and the same is true, in less degree, in respect of the regiment. But serious sanitary situations requiring the exercise of much forethought and method begin to rise with the brigade, and develop with the division into problems of much administrative difficulty and complexity. With such large forces as the latter, the factors of time and distance become predominant, and economy of road-space and facility of deployment are essentials. With smaller commands, the sanitary service will rarely go far wrong if merely accompanying the organizations to which it is attached; but with large commands, where sanitary units are administered separately as such, the latter will equally rarely do the right thing unless intelligently directed in accordance with preconceived purposes and plans. Things do not merely "happen" in the Division and Field Army, either in the sanitary service or out of it, but every move by any organization has its definite object, relates to other moves by other organizations, and has been foreseen and worked out in advance to prevent friction, inco-ordination, misdirected energy and delay. And in this general co-ordinating scheme of tactical administration the sanitary service plays one of the more important parts, though subordinate and finding its proper functions only when following the leads of the combatant forces. Hence the sanitary officer should inform himself on military organization in general as well as that relating to his own branch of the service, and at least understand the elements of strategy and principles of tactics sufficiently to recognize

their general purposes and deduce their consequent results. Without this modicum of military information he will largely fail of his full usefulness in war, since in its absence his tactical use of his sanitary units and subordinates will not partake of that complete, harmonious and intelligent co-operation which must apply between all its parts in every thoroughly efficient military force. While the sanitary service is a subordinate, it is also a co-ordinate, branch of the military service as a whole; and after it has received general orders relating to the purpose in view, it should be capable of administering itself and its units in a tactical sense, within itself and in relation to the other components of a military force, in thorough consonance with such general purpose. The thoughtful must admit that a certain tactical education is important for medical officers. This applies to all, but especially within the division to the Chief Surgeon and the officers in supervisory or immediate command of the divisional sanitary units. Field Service Regulations specifically provide that "the senior medical officer of an army or smaller command is charged with the general control of the sanitary troops serving therewith, and commands the independent sanitary units. He may be authorized by the commander to make assignments of the personnel, and in emergencies the entire sanitary service of the command may be placed at his disposition." The senior medical officer of a division is thus at once a staff and a commanding officer; the latter over a personnel numerically greater than that of the Engineers and Signal Corps, with transportation taking a road space as long as that of a regiment of Field Artillery and requiring almost as much ground to camp upon as two infantry regiments. Of the best measures for the tactical use of such resources it is essential that medical officers shall be informed. It is true that the commander may retain and assert his com-

mand over the divisional sanitary troops in battle, but in practice this may often not be the case if the Chief Surgeon is recognized as fully qualified to perform the proper duties of the position which he occupies. After the initial disposition of the troops has been made and the battle is in progress, it will be of very material aid to the commander if he is able to give his whole attention to tactical matters, secure in the knowledge that sanitary situations, as they arise, will not only be efficiently handled but in a way harmonious with his own plans, by his staff officer of the sanitary service.

But the latter, from the very nature of his position and function, can give only very general tactical orders to his subordinates. Inasmuch as he cannot be informed as to local detail, he must refrain from laying down any detailed rules or restrictions. These will have to be deduced and applied by his sanitary subordinates in respect to the situations which they actually encounter. For example, having received from higher authority the general locality for position of a battery or a dressing station, the exact location of either must be chosen by the commanders of the artillery or sanitary troops with a view to greatest safety and usefulness. The internal operations of both these co-ordinate organizations rest with their battery and company officers. If such subordinates do not fully understand their purpose and the best means of achieving the required results, their organizations, whether of the line or the sanitary service, by so much fall short of accomplishing their full usefulness. And the same applies to all medical officers, whatever be their grade or assignment to duty. It also applies, at least in respect to the minor sanitary tactics relating to small combatant organizations, to non-commissioned officers and the better class of privates of the Hospital Corps; for they must understand the proper

measures of procedure in case medical officers are killed or are absent attending wounded or on other duty. At such times, much responsibility falls upon the senior enlisted man in charge of a sanitary detachment.

The foregoing does not imply that the medical officer should study tactics with a view to commanding combatant troops. Far from it. But he needs such study to interpret the significance of the battlefield drama which is played all around him, that his dispositions of his non-combatant organizations may be of best advantage at once for the service of his country and humanity. For this reason, the tactical situation of some of the earlier problems of the following series is very minutely entered into and considered to show how such military tactical conclusions are reached.

Under Field Service Regulations, the Medical Department of our army is specifically charged, among other things, with the following responsibilities and obligations:—

"3. The care of the sick and wounded on the march, in camp, on the battlefield, and after removal therefrom.

4. The methodical disposition of the sick and wounded, so as to ensure the retention of those effective and relieve the fighting force from the non-effective.

5. The transportation of the sick and wounded.

6. The establishment of hospitals and other formations necessary for the care of the sick and injured.

7. The supply of the sanitary material necessary for the health of troops and for the care of the sick and injured."

The above requirements must, in time of war, give rise to problems of vast scope and great complexity. With an army in active service in the field, they relate little to the professional, more to the administrative and perhaps most of all to the tactical. From the latter they cannot be dissociated. It is required, as above, not only that these problems shall be taken over and solved by the Medi-

cal Department, but that the manner of their solution shall be "methodical," and it goes without saying that the methods implied must conform to military methods in general and with least interference with military purposes. It is, of course, officially contemplated that this sanitary relief work shall be efficiently accomplished. But whether expectation and realization will coincide in these respects must depend entirely upon the way in which the Medical Department and its personnel of the sanitary service take their extra-professional obligations to heart and endeavor to prepare themselves to grapple successfully with conditions and problems which, though never arising in peace, at once become the rule in war.

Undoubtedly none would be found to maintain that the Medical Department requires no training of any kind in order properly to anticipate and provide for the needs and contingencies of warfare. Possibly it is true that actual experience is the best teacher, but certainly its price is costly. In a military sense its lessons are often imparted at the expense of irretrievable tactical error; in the management of sanitary affairs such knowledge as comes through experience is largely purchased by otherwise unnecessary agony and death. Moreover wars come rarely; possibly not much more than one in each generation. Nor do nations enter into wars that its generals may learn to command men, nor send those men to death, crippling and injury that its medical officers may thereby be instructed how to cope to best advantage with the sanitary problems of the battlefield. Even if war develops, experience is a slow teacher, taking its own time to demonstrate between the right and wrong and indicating the proper course for the future by past mistakes and failures quite as much as by past successes. Nor will the magnitude and cost of modern wars permit their continuance over such periods and

through such operations as would be required to give all a thorough practical training in the duties of their positions. Prior to a generation ago, wars dragged on through long periods of years. Now the issue would be decided before the results of errors could begin to be counterbalanced by appreciative corrections. Examples by which to profit will be few; in the Russo-Japanese war, Oku's army, for instance, participated in but six battles. Actual experience of the past can thus be counted upon little, if any, in anticipating the probable contingencies of the future and planning the necessary measures of provision. So if it is desirable to make any preparation at all for sanitary service in campaign, and certainly war ought not to be entered upon without all possible preparation, the latter must of necessity be based upon theory.

But study based on theoretical conditions is by no means as impractical and valueless as some would affect to believe. On the contrary, the reverse is absolutely true. There is probably not a single art or science in which the theoretical study of principles should not precede or accompany their application. This is recognized as a preliminary, for example, to diminish error, suffering and death in relation to the practice of medicine, surgery and hygiene, and is equally the case in respect to the art of war, whether the latter relates to the activity of officers in general or only to those having to do alone with the sanitary service. Von Moltke, like other great modern military leaders, clearly recognized this fact and put his appreciation into such practice that his peace-trained German army quickly annihilated not only the battle-practised Austrians but also the French forces which, with their leaders, had had vast and recent experience on the battlefields of the Crimea, Italy, Mexico and Northern Africa. Of the war of 1870, General Langlois wrote:—"Our antagonists, Prussians who had

not fired a shot in fifty years, knew how to make war. We had to surrender to evidence and acknowledge that it is possible to learn in time of peace how to make war. Very soon events showed that it is no longer possible to learn in any other way."

Von Verdy says: "Although military education is at present chiefly promoted by the performance of actual duties, this alone is not sufficient. In addition, we need intelligent guidance, and no one will deny that even practical training will bear better fruit if it proceeds simultaneously with a progressive theoretical education."

If the greatest military minds thus regard theoretical military training as of such fundamental importance in respect to general military preparedness and operations, it is probably quite safe for medical officers to accept that the same is at least equally true with respect to their own subordinate and coordinate department with its restricted field of activity and usefulness.

In a general way, the routine training of combatant troops in time of peace has its basis in the conditions which will probably be found in campaign, and the tactical exercises daily practiced and the equipment in every-day use are the same which will be employed should such troops be sent against an enemy, but the same is unfortunately not at all true with respect to the Medical Department. Outside of the professional and personal care of the disabled, and in a certain way the administration of hospitals and the direction of subordinates, the duties of the Medical Department in peace give it little if any training in its functions in war. Its peace training practically meets the needs of peace conditions only, its endeavors are directed almost exclusively to the management of peace routine, and war finds it in a state of far less preparedness to take the field than the combatant organizations which it must accompany.

Its technical equipment and supplies in campaign largely differ either wholly or materially from those to the use of which in garrison its personnel has become accustomed and familiar. Field conditions create a bewildering succession of new environments with untried difficulties. A different organization of personnel, the management of vast and unaccustomed transportation, and the interjection of unconsidered problems of supply and evacuation, further combine to complicate the situation. And the value of the study of sanitary tactics, as a means of foreseeing many of these sanitary problems, and in advance considering and solving their difficulties, seems to have been largely overlooked. This, in a sense, is only what would have to be expected with a Medical Department whose personnel is numerically so small that its energies must be largely devoted to meeting the actual professional needs of the moment with consequent little regard and preparation for its possible administrative and tactical functions for the future.

The efficiency of the Medical Department for war likewise suffers by reason of the too popular idea, not only outside the army but to some extent within it, that its purpose is wholly humanitarian, and that the sole function of its personnel, like that of doctors and nurses in civil life or that of the Red Cross or other similar relief organizations, is the care of the disabled. It is, of course, true that the care of the sick and wounded is a most important function of medical officers, as with their professional brethren in civil life. But including the above duty, medical officers are charged under Field Service Regulations with the performance of eight distinct functions, and the difference in ability to execute the other seven, relating to sanitary, administrative and tactical duties, represents the difference between the civilian doctor and the military medical officer. These functions all require special study and

training in advance for their proper execution, since peace conditions in military garrisons give little inkling of those pertaining to the sanitary service in campaign. In the latter case, the accustomed stage settings, mechanism and conditions are abruptly replaced by the new and untried, the functions of the Medical Department are largely broadened, and questions of administration of sanitary organizations and of the transportation service insistently press for prompt and proper solution. These latter responsibilities, though in a way extra-professional, are not without a highly humanitarian side, since, whatever the motive for sanitary activity, in its results it operates for the welfare of the disabled and the relief of the suffering.

But however much beclouded by sentiment and humanitarianism they may be, the motives primarily actuating the sanitary service are, after all, tactical and economic. The efficiency of sanitary aid and evacuation may have a most direct and important influence upon the plans of the commander and the movement of his troops; hence also upon the conduction and outcome of campaigns. Even though it be theoretically true that such motive should not govern, it is more than probable in fact that many a commander has shrunk from taking tactically desirable action because of the torments of the unrelieved wounded certain to ensue. And history shows many instances in which a commander has found his strategy brought to naught, or the full fruits of victory denied him, through being hampered in his movements, in the absence of properly organized sanitary relief or its inefficient direction, by the crippling incubus of wounded whom motives of humanity, as well as public and private policy, would not permit him to disregard. For example, Meade, at Gettysburg, excused his failure to utilize his advantage, follow up a partially defeated foe, and perhaps bring the war to an earlier end, by a statement that he was unwilling to abandon his wounded. Hence whether the

sanitary service can or can not relieve him from the necessity of taking the disabled into account in the preparation and execution of his plans thus becomes of great practical significance to a commander and materially influences the conduct and outcome of campaigns. That the work of sanitary transportation and relief by the Medical Department shall coordinate and operate in entire harmony with that of all other branches of the service is not only essential to its own high efficiency but is demanded in the interests of the military force as a whole, considered as a tactical unit. The Medical Department cannot be regarded or administered as a dependency or excrescence of a properly organized military force, but as one of its absolutely essential constituents, and there must be coordination in purpose and effort by all the departments and branches of an army. But such harmonious action in relation to the Medical Department implies a competent knowledge by medical officers of not only how to handle sanitary organizations and units but presupposes a fair degree of insight into the purpose and methods of coordinate branches of the military service.

Such requirements bring us to the admission of the necessity for and existence of sanitary tactics. These, after all, are merely the expression of broad general principles which, under varying conditions, may be relied upon to bring about the most satisfactory results from the activities of the sanitary service in campaign, whether as a whole or in respect to one or more of its component parts. In their application, they consist of those dispositions and methods of the sanitary service as will cause the bringing together of the wounded, the medical officer and the appropriate sanitary supplies or establishment with the minimum of discomfort and delay and with least interference with military purposes.

This last qualifying statement is the controlling factor.

Sanitary tactics can never stand by themselves on an independent status or be studied or employed apart from general military situations and conditions. They are always to be regarded as consequent upon and subordinate to general military tactics. Acceptance of such proper limitations and relations involves no belittling of the necessity, or diminution in the importance, of sanitary tactics, but is essential in the orientation of their field of application and usefulness in respect to the military service as a whole. And with such acceptance must come, as a corollary, appreciation of the fact that the medical officer who undertakes their study must first have sufficient understanding of the essentially military conditions, purposes, measures and methods upon which they depend. What should be the proper extent of this basic military education it is impossible to define; each student must decide for himself. With longer study it will undoubtedly appear that any attempt to lay down minimum requirements would be more than ill-advised, and conversely that the broader the general military education the clearer and better the appreciation of the proper management of sanitary organizations and the more effective their utilization.

Accepting, therefore, the necessity for some general and much specially technical military training for medical officers, in addition to their required professional qualification as sanitarians, physicans and surgeons, it becomes necessary to consider how such special training can be secured. The field service school for medical officers now in existence in our army is operated solely to this end, but in the nature of things can never reach but a small fraction of the medical officers of the regular and militia forces. The number so instructed might ultimately suffice to fill the most important positions of the sanitary service in time of war and by their rank and authority could do much for its tactical and administrative efficiency, but the vast majori-

ty of medical officers will of necessity have no opportunity to secure such systematized instruction. Much may be done in the diffusion of knowledge by those so instructed, if they are required to give instruction in sanitary tactics in the garrisons or organizations to which they return. Something also can be accomplished to this end at the brief and infrequent medical or general maneuver camps, where there is usually some opportunity to demonstrate that which has been learned in theory is thoroughly applicable in practice. The correspondence school for medical officers, recently established and participated in by some thirty such annually, is intended to supplement clearly inadequate facilities for the instruction of all; but from the nature of things its instruction is and must be imperfect, fragmentary and unsatisfactory both as to scope of instruction and number reached. Thus even at the best there remains a great majority who, if they take up the study of this one of their several officially required functions, must do so largely without full appreciation of what is expected, without clear understanding of the methods employed or the reasons therefor, and without the advantage of official guidance, facilities or oversight. Moreover, in undertaking the study of sanitary tactics, as in other sciences, it is the first steps which are the most difficult to take. If there can be personal instruction by specially qualified medical and other officers, war games and tactical walks and rides can be carried out. But in many instances this is not the case, and limitation of effort toward self instruction of the individual by the study of map problems is ordinarily necessary. With the use of such sanitary map problems, however, medical officers can not only be quite efficiently trained to a knowledge of the better utilization of their own department but are brought to take a broader view of the situation as a whole and to cooperate more intelligently and earnestly for the attainment of the common purpose of military success.

CHAPTER III.

On the Solution and Preparation of Problems in Sanitary Tactics.

Sanitary map problems have a very practical value to medical officers through their ability to teach, through demonstration, the methods by which sanitary personnel or organizations may be employed to best advantage under the diverse situations arising in campaign. They represent the simplest type of the sanitary situation, for each such situation is considered, cameo-like, by itself, and the information so far as it goes, is exact. Like tactical exercises and the war game, such problems are but aids to maneuvers and war. But they can be practiced without troops, when maneuvers are impossible and during periods of profound peace, not only teaching the principles of sanitary tactics, but that in the quickest way. In their purpose, the solving of such problems is largely suggestive. Their solution, in sufficient number and variety, gradually demonstrate the broad general principles upon which either the efficient solution of such theoretical problems, or the handling of actual conditions liable to be encountered in the field, must depend.

More than this, the premises of such sanitary problems must necessarily include much information of a purely tactical nature, so that the consideration of a number of well selected situations will carry with it illustrations of the more important principles upon which the art of war as a whole is based. Through the necessary correlation of these two features, the medical officer not only learns the better management of his own branch of the military service, but at the same time the fundamental principles governing the direction and disposition of the combatant forces whom it is the function of the sanitary troops to relieve, assist and

support. Besides thus broadening their military knowledge, sanitary map problems afford medical officers excellent practice in logical deduction and the development of the powers of decision and qualities of "tactical sense."

It has been said that a successful officer must possess an ability to reach a clear and intelligent decision, be able to communicate this decision clearly and unmistakably to others, and possess the necessary knowledge required to carry out his intentions thus formed. These requirements apply quite as truly, though in a somewhat more restricted sense, to medical as to other officers. Such valuable qualifications can be developed in a very material way by practice in the solving of concrete problems, necessitating the formulation of a large number of definite decisions and the outlining of appropriate action dependent thereon. With an increasing ability to arrive at prompt and correct decisions and plans with respect to hypothetical situations on the map, will come similar ability with respect to the handling of actual conditions which may be encountered in the field.

In the solution of map problems, it is not sufficient to arrive at general conclusions alone. To do that and no more would be of comparatively little value. What is desirable is the formulation of a well-defined line of procedure having sufficient detail to be a thoroughly workable plan if the conditions, instead of being assumed, were really in existence. This means a mental picture of the terrain and of the disposition of the troops concerned, a due appreciation of the relation of the factors of time and space, of the nature and magnitude of the object to be accomplished, and resultant arrival at an appropriate and clearly cut decision as to the action to be taken.

It follows, therefore, that one of the necessary requirements for the solution of map problems is the ability to read a map correctly; another, to apply this reading in

an imaginative sense. In this necessary map reading, medical officers need not seek to acquire such high degree of ability as is possessed by many of their confréres of the line, but they should be able to interpret the meaning of conventional signs, reckon distances, and comprehend details in such a way that these will form themselves into a complete and harmonious whole in which the salient features of the terrain appear and are recognized without conscious mental effort.

In solving a map problem, the first step is the careful reading of the problem and the location on the map of any military positions described. This may best be done by the use of colored pins, or, where distance is concerned, by strips of colored paper. With the birdseye view of the situation thus obtained, the problem should be carefully reread. The more complex the problem, the greater the care which is necessary in determining its provisions and limitations. In tactical problems, the forces of both sides are usually no more clearly indicated than would be the case in maneuvers or actual war. There is usually very definite information regarding the combatant and sanitary troops composing one's own command, but much regarding the enemy's forces is generally unknown. The same is true with respect to casualties and their distribution; one's own are reported with considerable accuracy and promptness but those of the enemy can only be roughly estimated. And the sanitary situation, so far as hostile wounded are concerned, is further complicated by the fact that even if their number and location are fairly well known, one can have little if any exact knowledge as to the provisions and abilities of the enemy in respect to the succor, removal and care of his disabled. The "fog of war," which surrounds the enemy's tactical situations, shrouds equally his sanitary conditions.

After determining the actual and relative positions of one's own troops and those of the enemy, the next step is to consider any such configuration or conditions of the terrain as may affect the problem in hand. Topography is of tremendous significance in relation to sanitary tactics. The location of points of sanitary relief, and the facility of the collection and removal of wounded, are largely dependent upon the nature of the country concerned. One should get oriented upon the situation, and it is repeated that the latter will be best understood if approached in a fairly imaginative sense. The student should approach it in such mental attitude as he would assume if the situation were real instead of being hypothetical.

Having thus placed one's self in the position of the medical officer concerned, the true mission of the latter must be specifically determined. This may or may not be determined for him by higher authority. Usually, however, the latter is the case. If so, it will probably be expressed in the form of orders couched in general terms. Much may be implied, and as the sanitary situation develops from the tactical, the senior medical officer concerned will be left to deduce its details in their sequence and importance and direct or execute the mission of his sanitary service, as he understands it from the conditions of the problem or situation, with the general purpose of his commander kept at all times in mind. It may be that, as in war, no orders are issued regarding the sanitary situation beyond directions to the medical officer to take it over and handle it. Such directions naturally imply his possession of the confidence of his superior. If the commander does not so appreciate the necessity as of his own initiative to share all military information with his medical staff officer which is essential to the proper performance of duty by the latter, it must be asked for in the interests both of the command and of

the wounded. Efficient sanitary direction is not possible except where every tactical possibility as well as actual condition needful to make sanitary plans is fully understood and duly considered.

In respect to the accomplishment of the true mission, the troops of both forces, together with the terrain, are to be considered with reference to the manner and degree in which these elements must affect results. Here the scale and dividers are freely used. The frontage and depth of positions are measured. Possible convergent points for wounded are considered in the light of protection, and facility of access and evacuation as indicated on the map. For marches and transportation of the disabled the distance between objectives is measured; and the time required for the movement under the assumed conditions of roads, weather, season, time, transportation, morale, etc., is, if necessary, calculated.

The time factor is of great and often controlling importance. If the art of war largely consists in "getting there first with the most men," it is clear that the factor of time available will not infrequently impose serious limitations upon the extent, degree and success of sanitary work. And distance, with which factor that of time is necessarily coincident, has to be considered as an allied element of prime importance. One or both of these last factors may affect a sanitary decision to a greater extent than all others combined.

With respect to the enemy, the information available will habitually be more or less incomplete. Only on very rare occasions will a commander have full and accurate knowledge of the enemy's strength, position, intentions, morale, etc. But there must always be some knowledge of this sort in the possession of commanders, and of such of this as is known at headquarters the staff surgeon should be kept

fully informed. Strength, position and composition of forces, of both the enemy and ourselves, have a very close relation to probable number and location of casualties; so, too, intentions—actual or probable—as to where, when and how an attack will be delivered or received. Terrain, also, is a factor of determining importance in these latter respects, affecting not only the probable number and distribution of casualties but their collection and evacuation. In respect to the work of sanitary relief, terrain may render the latter relatively safe and easy or entirely impossible. But fortunately the cover under the protection of which troops would choose to advance to the attack should be more or less practicable to the accompanying or following sanitary troops. With the defense, some protection with safe and easy access to and from the rear is of course a tactical desideratum. From a sanitary standpoint, the terrain occupied by our troops, in the front to the lines of the enemy, and to the rear of our own lines, especially need the most carefully study in advance. If the enemy yields his position, sanitary work can be performed thereon or anywhere in the battlefield at the most convenient points.

In every problem and in every situation in maneuvers or war, an "estimate of the sanitary situation," whether particular, general or both, must be reached. Though frequently not specifically called for by the terms of the inquiry of the problem itself, it must nevertheless be formulated as essentially preliminary to arrival at any intelligent purpose and appropriate plan. In beginning the study of map problems as a whole, it is best to write out such estimates, so that the medical officer may demonstrate to himself to his own satisfaction that he has arrived at his conclusions and determined upon his action as a result of logical sequence of thought. "Only in this way does the best solution attain its full value, while a poorer solution can,

if reasonably deduced, claim a lenient judgment." In drawing these deductions, general principles and not fixed rules must invariably be used. No set of rules can govern the art of war, nor can they govern the tactical management of a correlating sanitary service. Each situation must be handled on its merits, for no two will be found alike. This implies careful consideration of every possible factor which can affect the situation before arriving at the final decision to be deduced. It will not rarely be found that what at first seems an unimportant matter is in reality a controlling factor. A proper sense of perspective and of consequent relative importance must therefore be cultivated.

The "estimate of the sanitary situation" is based on facts which are known or may fairly be inferred, and is the expression of a process of thought which, when applied to a concrete instance, either in theory or fact, permits arrival at a suitable decision as to the purpose to be entertained and the measures thereby necessarily to be employed. It culminates in a decision as to definite plan of action, either expressed or left to be inferred; since where a condition is clearly recognized the necessary executive measures will often at once suggest themselves.

Sanitary work in campaign being primarily dependent upon tactical conditions and considerations, it follows that sanitary estimates cannot properly be based on sanitary matters alone. The tactical situation is paramount. On this depends not only the need for the provision of sanitary relief but the places at which such is required. It fixes the limits of time and space in and through which such relief must be provided, and through these factors it affects its character and degree. Finally, the tactical situation may be such that the resultant sanitary situation may have to be wholly or in large part disregarded. Wars are waged as a

last resort to achieve certain objects. Everything is subordinated to securing results. The same interests which deliberately seek or accept battle, recognizing in advance its immeasurable agonies, will not hesitate to accept, if need be, further suffering among the injured as part of the price of military success. Hence, it may be repeated that the sanitary situation can never be considered by itself, nor a sanitary estimate made, without full consideration of the tactics concerned, whether these be antecedent, concurrent or consequent.

An "estimate of the sanitary solution" thus involves a careful consideration, from the point of view of the medical officer concerned, of all the circumstances affecting the problem. In any case a full understanding of his mission is of importance at the outset. After that he should consider all available information about the enemy, such as strength, position, movements, probable intentions, etc.; then similar factors in relation to the combatant forces of his own command. He then considers the sanitary force, organizations, transportation and supplies at his disposal, with their location and their utility and sufficiency for the relief work in question under the existing tactical conditions. He should know where wounded have fallen or are likely to fall, with their probable number and nature. The terrain must again be studied to determine not only the most desirable but most practicable situations for establishments for sanitary relief, together with the lines of sanitary advance and evacuation. He then compares the various modes of action open to him and decides upon that plan which will best enable the accomplishment of his mission in greatest consonance with military purposes.

While problems may be solved in whole or in part without putting them in writing, such is not to be commended except after much practice. Practice makes perfect and

the mind acts not only more rapidly, but more correctly in accustomed channels of thought. For the bringing out of clearness and completeness of details, nothing can compare with placing them on paper. On rereading such written solutions, it will frequently be seen that important matters have been overlooked and omitted. On the other hand, it will not unlikely be found that unimportant matters, which have no real influence on the situation, have received undue attention and perhaps should even be dropped from consideration. With the reaching of greater familiarity with the mental processes involved in the solution of such problems, the need for setting everything on paper becomes proportionately less; and map situations may even finally be considered and solved by the practiced without any writing at all—as similar problems on the terrain itself would be so solved.

To recapitulate, in solving sanitary map problems, the true mission must of course be first clearly understood. Then the positions of the hostile and friendly troops, with those of the wounded and the sanitary resources of both, must be considered in relation to all the influences which are dependent on terrain. The manner and sequence selected should merely be those which are most logical. The elements of time and space have usually to be considered. Such various plans of action as seem to be open for selection should then be compared as to their relative advantages and disadvantages, and the most practicable one determined upon. Sometimes solutions are faulty from undue haste in arriving at conclusions before all possibilities have been duly weighed. The final decision, once reached, should be set forth in clear and unmistakable terms, readily transmutable into orders if such be indicated. Once the plan is settled upon, it should be pushed through vigorously. The Japanese Field Service Regulations contain the follow-

ing: "There are two things that should be avoided above all by military commanders—inaction and hesitation. To act resolutely even in an erroneous manner is better than to remain inactive and irresolute." The same applies to medical officers in their execution of sanitary measures.

From the foregoing, it should be clear that such solutions as are given for the following problems are not in any sense to be regarded as the only proper solutions, for it is quite conceivable that dissimilar measures or combinations may give the same or equally good results. It is also thus apparent that the solutions in question are not to be considered as being necessarily the best solutions. Undoubtedly they can be materially improved upon. As given, they are merely intended to be the crystallized expression of ideas and schemes which may fairly be regarded as reasonably complete, and as quite workable and practicable under the conditions assumed. They must, therefore, be accepted as suggestive and not as absolute.

With respect to the preparation of sanitary problems, either for solution on the map or terrain, all must have a basis on a tactical situation. The latter may be specially planned to illustrate any particular feature of sanitary tactics desired; conversely any purely tactical problem may be used as a foundation on which to base a further inquiry in respect to the coordinate sanitary tactics necessary. This latter form of problem is often of very great value and requires least thought and study for preparation. It is not always easy, however, to find tactical problems at hand which will fully meet the needs of the sanitary officer desirous of carrying on a graded or progressive course in the special tactics of his own service. In field maneuvers with troops, the sanitary service will usually have to accept for its own work the tactical problems presented to the command as a whole, though these can often be modified

in the interest of the sanitary service with no detriment to the general tactical situation concerned.

The preparation of special sanitary problems is in itself excellent training for the solution of others of similar character, for the processes of reasoning and deduction concerned, though reversed, must naturally move along the same lines of thought and study. But the preparation of special sanitary problems should imply a certain knowledge of the elements of general tactics. It is quite true that whether the tactical management of troops be good or bad, the sanitary service merely follows the commander's moves; but problems for medical officers should possess the dual purpose of endeavor to teach good general as well as good sanitary tactics Hence it is always desirable to ensure, by one or another way, that the tactical premises assumed in sanitary problems under preparation are correct.

In the general consideration of the formulation of problems there are only a few main dispositions of troops upon which accessory disposition of the sanitary service need be made. In general terms, these are advance guard formation and attack, and rear guard formation and occupation of a defensive position. Success and defeat, partial or complete, bring their special conditions. All the rest particularly depend upon the coordinating factors of size, character and disposition of troops, terrain, routes of evacuation, character of roads, length of line of communication, quality of service of communications, climate, season, weather, physical state of troops and similar modifying conditions. Some of all of these factors must appear in the construction of all problems.

In planning a series of problems, care must be taken that they do not cause undue repetition of similar situations. It is desirable, also, that that should be sufficient variation in the terrain concerned.

In respect to the details necessary to the proper preparation of special sanitary problems, the following points should receive consideration:—

(1) The problem should possess a semblance of reality. It should be a situation which might naturally arise in a state of war.

(2) It should be as simple and brief as possible. Complicated and involved statements are generally unnatural and are fruitful sources of misunderstanding.

(3) It should advantageously illustrate that principle of sanitary tactics concerning which special study is desired. The solution of a problem is a lesson.

(4) It must be made as instructive as possible. This means the leaving to the student officer as many of the decisions as the time allows, and as much latitude as may be necessary to force him into a position where he must exercise his own judgment and skill.

(5) It should be adapted to the number and character of the troops involved. Abnormal sanitary situations are the exception and not the rule.

(6) It should contain only such information as the commander of the troops, or his sanitary subordinates specially concerned, might be supposed to possess. The proper employment of the resources of the sanitary service as an accessory means of procuring and transmitting sanitary information is one of the most important lessons for the medical officer to learn.

(7) If contact with the enemy has resulted, this should be on ground which is tactically permissible. It is highly undesirable, with terrain more naturally adapted to military operations in the immediate vicinity, to stage a battle with its consequent sanitary activity on ground over which commanders would not naturally elect to fight.

(8) It should introduce as few unnatural conditions as possible. The desirability of this is apparent, since one of the chief functions of sanitary tactics is to teach medical officers how properly to judge and utilize ground, either as represented by maps or by the terrain itself.

(9) It must include the disposition of the troops and sanitary personnel upon whom the problem and its solution depends. The reason for this is obvious.

Specific information as to how to prepare special sanitary probems cannot be given, since no two medical officers would probably go about such a task in the same way. But it is well to first gain a clear idea of what it is desired to illustrate, and how, in general terms, this should be done. Next the map or the ground should be studied to find terrain well adapted to the purpose. Then the troops are located thereon in such way as best to illustrate the principle. A hypothesis is then assumed in a way to make the above situation occur naturally and in a manner and under circumstances likely to occur in war. The whole is then checked up, to see that each factor coordinates with the rest in fulfilling the general conditions assumed. Finally, the requirements of the problem, for the solution of which the assumed conditions furnish the necessary data, are then set forth in as few words as possible.

CHAPTER IV.

On Participation by Medical Officers in War Games, Terrain Exercises, Tactical Walks and Rides, and Field Maneuvers.

After arriving at a competent knowledge of the principles involved in the solution of sanitary map problems, and after sufficient training in the processes of deduction by which conclusions are reached and final action is determined, the medical officer is in position to undertake his part in the playing of the war game. During the inclement season, such games will probably be held from time to time in all large garrisons of the regular army, and in the armories of the better type of organizations of the National Guard. Medical officers should lose no opportunity to broaden their tactical education by participation, both as observers and contestants, in this valuable form of military exercise. If war games are not otherwise held, it is perhaps not beyond the capacity of better trained medical officers to prepare and direct them so far as the sanitary service is concerned.

While in a map problem the sanitary situation to be met is single, and the information bearing thereon is exact, the conditions pertaining to the war game more closely approximate those which will be encountered in actual war. But the personal equation of troops, being here represented by colored pins rather than fallible human beings, is military perfection; they do not straggle or make mistakes in executing the will of the players. Here the scene steadily and often rapidly shifts as the game progresses, and the problem is varied with every movement of troops until the final result is apparent. The war game, then, is in one

sense a coordinate series of problems possessing the advantage of promptly disclosing through subsequent developments any errors in decision and action, and thereby checking up the suitability of measures taken, the correctness of which, in map problems, could only be academically determined. While information regarding one's own force and sanitary organizations remains reasonably exact in the war game, that relating to the enemy is vague and obscure, being revealed by the director of the game only and to such extent as the tactical moves actually made would, if in actual war, bring about such disclosures. While the commander, especially on the offensive, will have his definite plan of action on which his senior medical officer will build his own sanitary purpose, both alike will have to work out in advance harmonious alternative plans intended to meet any probable moves of the enemy to best advantage. These plans, in greater or less detail, will naturally be subject to change as the game progresses and as clearer information is secured of the strength, character, position and probable purposes of the enemy. The latter, especially with the defensive, may not rarely cause the abandonment or material modification of the original plans. Needed training is therefore secured in adaptability in promptly abandoning preconceptions to meet actual conditions, while participation by the medical officer in the deliberations of the contending parties affords him excellent opportunity for grasping the principles of tactics as well as illustrating to him the practical difficulties which beset commanders in making their plans and alternatives. Particularly is the latter the case in the early stages of the game, when conditions relating to the enemy are clouded with doubt and the cavalry and advance detachments are endeavoring in every way possible to secure more extensive, specific and accurate information. It is true that in these first preliminary stages of an action,

whether on paper or in war, the larger sanitary organizations would not ordinarily be used but be held in reserve; but nevertheless the working out of the perplexing sanitary problems, for example, attached to the rapid movements and wide dispersion of scouting cavalry will give excellent training during this stage of the game. As larger bodies get into touch with the enemy, the magnitude of the sanitary probems proportionately increases, although time here may not be as controlling a sanitary as a tactical factor. Only after the game has well progressed will the independent sanitary organizations come into play, but the medical officer charged with their direction has in the meantime had ample opportunity for mental exercise and deduction as to the probable use which may have to be made of them.

The tactical education of medical officers by means of war games should habitually be begun by such officers in the capacity of observers only. As such, they can watch the play on both sides, follow in detail and thereby fully understand the situations as they develop, and get a comprehensive idea of the tactical management of mixed forces in relation to each other and to the enemy. It is probably best that these earlier war games should present only the purely tactical side, so that the attention of the observer should be focussed on such matters and not be subject to the necessary distraction which would follow the injection of sanitary situations and problems. The medical officer should know first how war in general is conducted before starting to learn how best to play his own accessory part. Several games should be attended in such capacity as spectator, in some of which the medical officer may with advantage act as recorder for the director of the game, effort being made toward the end of this preliminary work to follow the more important tactical moves as they are made with an appropriate mental sanitary decision.

As soon as the general principles of tactics and the war game are understood, the medical officer should become an active participant. If only a single medical officer is concerned, he should, for wider experience and practice, with each game vary the official position whose duties are assumed by him. If several medical officers are concerned, all may play together their specific parts in relation to each other and to the tactical situation as a whole. Probably no more than three medical officers should play in any combined war game at any one time, as the addition of the tactics of the sanitary service in any detail will, in problems based on the management of large bodies of troops, materially delay the development of the final tactical situation, which, by itself, will ordinarily require several hours of play. Under such conditions, and for a game to be completed in a single session, the assignment of one medical officer, say as chief surgeon, one as regimental surgeon of an infantry regiment, and one as surgeon of advance cavalry, or as commanders of separate sanitary organizations or similar assignments, will probably be all that, in justice to the tactical side of the game, can be attempted.

But where a considerable number of medical officers are to play, and their instruction is the chief purpose of the game, the tactical side of matters can be subordinated to the sanitary. To this end the so-called "one-side" war game can be played, in which the director of the game himself carries out the sequence and detail of tactical moves, giving a rapid series of sanitary situations which the medical officers, very possibly assigned to all the various organizations concerned, would be called upon to meet. But at the outset of instruction through war games, too much should not be attempted in respect to participation by a large number of medical officers, since the less experienced are liable to become confused and unable to

follow in their sequence the many sanitary details which are thus developed.

To conclude the instruction given in a series of war game, a problem assuming large numbers of men, and participated in by a considerable number of line and medical officers, may with advantage be slowly worked out through several consecutive sessions of play.

In the war game, all estimates of the situation are mental and all decisions are orally announced. The reasons for the action taken are not usually stated, though they may be asked for in order to explain a procedure or situation. If there be undue delay in reaching a decision, a time limit for its submission may be imposed. Nothing is written unless orders, in due form, are demanded by the director of the game. The tactical and sanitary situations are indicated for each side by means of colored pins, strings of beads, strips of paper, etc. manipulated by the director. The playing of the war game cannot properly be attempted until competent ability to read a military map has been secured.

Terrain exercises are assumed situations staged on the actual ground instead of on the map. They differ from tactical walks and rides only in that the solution is rendered in writing on the ground, and the discussion relative to the correctness of the solution is deferred until later when the solutions have all been worked over by the instructor. They may be either single, in which respect they resemble map problems, or they may be coordinate and progressive situations, in which case they approximate war games. Solutions of problems based on the terrain may be required with or without the additional aid of maps. Frequently a valuable part of the exercise will take the form of a comparison of the actual terrain with the map intended to represent it, with a determination of the differences

actually found and which may in general reasonably be expected. Small scale maps must necessarily be lacking in many details and merely serve as a general guide to the country. It is important, therefore, to demonstrate that maps of this sort cannot too closely be relied upon. Inequalities which may be sufficient to afford more or less complete protection to combatant troops and in aiding and removing wounded may very likely not be shown on maps of other than the largest scale. And the terrain covered by the map is continually changing. Cover may have grown up or been destroyed; new roads may have been opened and others abandoned; buildings may have been erected or torn down. However, all preliminary and general sanitary dispositions will be based upon the map, higher authority taking care to leave details of position and method to the discretion of sanitary subordinates on the ground itself.

Terrain exercises have the great advantage over maps that the positions assumed to be occupied by troops, the zones of casualty and the routes of evacuation of wounded are actually on ground, the details of which can be ridden over and inspected. Limitations of time and space are demonstrable factors. Distances and difficulties of transportation appear in their proper light. Of much importance to medical officers is the rapid but careful estimation on the ground itself of the quantitative and qualitative value of the probable sanitary resources afforded by farms, hamlets, villages, etc., within or available to the zones of conflict, evacuation and supply. If the medical officers participating have been previously well grounded through problems and war games, the situation which is now unfolded to them on a large and natural scale will be much more readily grasped and given appropriate decision. In problems on the terrain there is usually a time limit fixed in which such decisions must be rendered. This time limit

is usually planned to give about as much time for decision as would probably be available in actual war; thereby cultivating the faculty of rapid judgment as well as sound conclusion.

Progressive terrain exercises, in which one situation is planned to follow another in logical sequence and period, are usually termed tactical walks or rides, provided the answers are verbal and the discussion thereon takes place immediately on the terrain itself. They represent the higher type of practical field training, being inferior to actual maneuvers only in not taking consideration the physical and psychological equation of the soldier and the matter of human inertia and fallibility.

Staff rides represent the very highest type of field work without troops, the problems being drawn on a large scale, being progressive, and carried over such a considerable area of country as to require many days of steady riding. Few medical officers need participate in this final course of training, as they can acquire sufficient knowledge of general and sanitary tactics for their special purposes through less elaborate measures of instruction.

Finally come maneuvers with troops in the field, which as Von Schellendorf says, serve a purpose of instruction in sanitary tactics second as to character of results only to war itself. It should go almost without saying that the progressive medical officer will never let slip opportunity to attend maneuvers with troops; and, in so attending, that he will not be content to perform routine professional work only, but in addition will use every effort to participate, with every possible member of his sanitary personnel, in the field work. It is no preparation for campaign for medical officers to remain in camp, merely conducting a professional routine under canvas such as they had previously carried out under a roof. Maneuver camps are places of instruc-

tion for war, from the benefits of which it is not officially intended that the sanitary service shall be excluded, even though it has not rarely appeared in the past to work out in such manner in practice.

At maneuvers, every factor pertaining to war and controlling tactical and sanitary conditions is present except the results of actual fire. Even these can be simulated for the sanitary service, and hypothetical wounded collected, dressed and removed under service conditions well calculated practically to test the administrative efficiency of medical officers and the physical qualities of the sanitary personnel and animals. But without adequate preliminary education and training in the theory of war, the movement and disposition of troops at maneuvers must, to the uninstructed, partake largely, because not understood, of the nature of a mere military spectacle, apparently without either general significance or personal application. This last applies especially to a certain class of medical officers, chiefly of the militia and volunteers, some few of whom seem to regard anything but professional knowledge as foreign to their purpose and calling, while others, appreciative of the necessity of a general and sanitary tactical training, find it difficult to secure this training through the apathy or opposition of the combatant officers with whom they are associated.

Finally, maneuvers in the field bring into play a factor which must of necessity be disregarded in the theoretical study of tactics, both general and sanitary, and which falls peculiarily within the purview and field of duty of the medical officer. This relates to the physical ability of troops to perform the various tasks to which they are set in the solution of problems and execution of tactical and sanitary plans. This factor is largely dependent upon the hygienic care of troops, which is the first duty with which

the Medical Department is charged in peace and war. It is an intangible quality which is readily apparent to the trained observer, though not to be expressed on paper any more than can the mental state which may stimulate to victory on the one hand or result in disorganization, defeat and rout on the other. It is true that well conceived plans, worked out by leaders, are necessary to success, whether tactical or sanitary—but the final and controlling factor is, after all, the quality of ability to execute military purpose possessed by the men behind the guns.

PART II

VISIBILITY PROBLEMS

CHAPTER V.

Visibility in Relation to Location of Stations for Sanitary Relief.

Problem No. 1.

(Based on 4 inch map of Fort Leavenworth and vicinity.)

Situation:

A Blue force is attacking from the west and northwest against a Red force holding the hills about Fort Leavenworth and Leavenworth.

The Chief Surgeon of the Blues asks for authority to put in a field hospital near Kickapoo. He is told by the Chief of Staff that he may do so, but that he must select a point on the 43—41—23 road where the tents will be out of sight of the enemy, who is believed to have an artillery observation station on the Sheridan's Drive Ridge at about the letter "H" in Hancock of "Hancock Hill."

You are Director of Field Hospitals. The Chief Surgeon repeats his wishes and instructions to you and says that, aside from any question of visibility, a location at either 23 or 41 would be equally satisfactory to him.

Required:

The point, of the two just noted, to which the field hospital would be ordered.

(Note: An artillery observation station is a low entrenchment with overhead protection so that the eye of the observer is only slightly above the level of the ground.)

A Solution:

The field hospital will be ordered to establish at 41.

Explanation:

The problem may be solved by the profile method,

as demonstrated in Problem No. 2, but for purposes of comparison the following method is used.

A straight line is drawn from the letter "H" in Hancock of Hancock Hill to the point 23, representing an imaginary line of sight.

The elevation of the point 23 may be taken as 845 feet, it lying between the 840 and 850 foot contour lines. As the visibility of the field hospital is being considered, to this must be added the height of the hospital tent, which is 11 feet. The altitude of the tent ridge at point 23 is therefore 856 feet. The elevation of the point "H" is 1080 feet.

The difference in altitude between "H" and the ridge of the hospital tents at 23 is therefore 224 feet.

The distance between the two points, measured along the imaginary line of sight, is 4600 yards. Hence the line of sight slopes downward 224 feet in 4600 yards, or at the rate of 4.9 feet per 100 yards.

Inspection of the imaginary line of sight shows several eminences which may need be considered in connection with obstruction of vision; viz, the hill near 15, the 862 hill south of Plum Creek, the spur southwest of 45, and the little spur south of 25.

From "H" to hill near 15 is 900 yards, therefore the line of sight has dropped 9 x 4.9 feet, or 44.1 feet, or is at 1080—44.1, or 1035 feet. But the map shows the hill to be 860 feet high, hence the line of sight clears this hill by 1035.9—860 feet, or 175.9 feet. It is clear, therefore, that hill 15 will not screen the field hospital from observation.

From "H" to hill 862 is 2300 yards, hence the line of sight at this point is $1080-(23\times4.9)=967$ feet in altitude As the hill itself is 862 feet, it is evident that the difference of 105 feet would very much more than bring the field hospital fully into view.

From "H" to where the line of sight crosses the spur southwest of 45 is 3700 yards. Hence 1080—(37×4.9)= 898.7. But as the spur has an altitude of but 852 feet it clearly does not interfere with the view.

From "H" to the small spur south of 25 is 4300 yards. Hence 1080—(43×4.9)=869.3 feet. But the elevation of that part of the spur is 855 feet. The difference between 869.3 and 855 is 14.3 feet. The tent ridge is 11 feet above the ground. Hence not only the tent ridge, but the body of the tents and also the ground on which they stand would be visible. The orchard of M. Aaron lies south of the line of vision and would not screen the tents. Hence under the terms of the problem the field hospital cannot be put at 23.

Applying the above method to the visibility of point 41, we have the following:

Elevation of "H"	= 1080 feet
Elevation of 41	= 870 feet
Difference of elevation	= 210 feet

Distance from "H" to 41 approximately 5000 yards. Drop therefore equals 4.2 feet per 100 yards.

From the foregoing solution, and from inspection of the new line of sight, it is evident that there is no eminence which could obstruct vision unless it be the hill southeast of 31. The distance to this hill from "H" is 4500 yards. Hence 1080—(45×4.2)=891 feet. But the point 31 is on the 910 foot contour, or 19 feet higher than the ground at 41 The line of sight would therefore pass 8 feet above a tent ridge 11 feet from the ground. A field hospital at this point would be invisible from "H," and would be put in at this point with directions that it be extended eastward for still better protection under the 31 ridge.

Comment:

The special purpose of this problem is practice in the determination of matters of visibility. The latter will frequently be of material importance to the Medical Department; for stations for sanitary relief should either be so thoroughly concealed that the enemy will not suspect their whereabouts and they will not draw fire as possibly suspicious formations, or they must be placed so completely in view that their nature will be fully recognized and fire against them will be refrained from intentionally.

CHAPTER VI.

Determination of Zones of Probable Casualty in Relation to Sanitary Preparedness.

Problem No. 2

(Based on 2 inch map of Fort Leavenworth and vicinity.)

Situation:

The enemy holds a position on Mount Olivet. It is believed that his artillery is posted along the general line from 112 to the orchard three-quarters of a mile north.

The brigade, to which an ambulance company under your command is attached, is ordered to move against the enemy's position west from Leavenworth along the 68—48—104—108—110 road.

Required:

Statement as to whether you will probably have to handle casualties from artillery fire anywhere on the proposed line of advance?

If so, where on the map is the danger zone which is exposed to the enemy's view; what is its depth; how long would infantry crossing it be under fire?

Show in detail how you arrive at your conclusions.

A Solution:

There are two zones in which casualty from artillery may fairly be anticipated.

The first zone extends from just east of 108 about 600 yards to the eastward. Small columns would cross it in 4 or 5 minutes. The casualties here would be cared for by the ambulance company after the combatant organizations and their sanitary detachments had passed over and hostile fire had been diverted.

The second zone begins at a point some 300 yards east of 110, and on the eastern crest of the 110—126 ridge, and extends westward for some hundreds of yards (variable with terrain but 700 yards on the line in question) until blanketed from the hostile artillery by the east slope of Mount Olivet. Troops crossing the ridge would be thus exposed over zones from say 500 to 1,000 yards deep. Rapidity of movement across this area would be largely determined by volume of hostile fire and cannot be definitely stated.

Probably it would take from 15 to 30 minutes to cross this exposed area after deployment was accomplished. There would be many artillery casualties here, together with some from long range rifle fire.

Explanation:

The terms of this problem clearly contemplate direct fire only.

The extreme range of field artillery is given by Straub as 6,500 yards. Field Service Regulations class ranges for field artillery which are over 4,500 as "distant," between 3,500 and 4,500 as "long," and between 2,500 and 3,500 yards as "effective."

It is clear, then, that troops on an exposed area within 6,500 yards of hostile artillery may suffer more or less casualty. The hill at 104 is so exposed, so far as artillery is concerned, and is about 6,000 yards from the hostile guns. The exposed zone in question is of about 500 yards in depth. But the timber shown on the map to the west presumably screens it, materially if not entirely, from the enemy. Under any conditions, Field Service Regulations make it almost certain that an enemy would make no use of artillery fire on such a distant area even if this be exposed to view.

The first true area of danger is one of about 600 yards in depth lying a little to the eastward of 108. This area is from about 4,300 to 5,300 yards from the enemy's guns. It will afford the only opportunity which the enemy will have to interfere with the advance until the advance reappears near 110, which last point is only about 2,000 yards, or "distant range" for rifle fire (Sec. 255, F. S. R.,) from the probable lines of hostile infantry entrenchments on the military crest of Mount Olivet. The enemy will therefore presumably open up with his guns when the advance appears about half a mile east of 108. By the terms of the problem, about half of them are so placed as to reach this area. After a few shots, the fire will become fairly effective. It will be met by moving the advancing troops out of the road and forwarding them over the exposed area in small columns. They will be sent forward at double time, or at the rate of 160 yards per minute. This would enable each man to cross this second exposed zone in about 4 minutes. In spite of these tactical precautions a moderate number of casualties may here be expected. They will be scattered in small groups over an area approximately a third of a mile in depth and with a probable frontage of—say—500 yards:

The advance would again come into effective range for direct fire about 300 yards east of 110. This fire, at 3,000 yards distance, would compel deployment under protection of the ridge and the seeking of cover to prevent heavy losses in the advancing force. The latter would, after emerging from shelter, remain under fire until it had crossed the 110 ridge and begun to descend into the valley to the westward, when the eastern slopes of Mount Olivet would blanket the guns. At this time, however, the advancing force would have come under long range (1,500 yards) fire from the hostile infantry. It is probable, of

course, that guns on the line in question would be moved forward or to a flank to avoid being blanketed during the final advance.

There are several ways by which the areas of exposure to fire may be determined. For the purpose of this problem, the graphic or profile method, given herewith, in which distances and elevations are transcribed on plotting paper, the base line showing horizontal distances and the ruled squares altitudes, is perhaps the best. The method is so simple that explanation is deemed unnecessary.

With artillery on a line ¾ mile long, several profiles would be required to completely illustrate the situation, but for the purposes of this problem only one in necessary.

Comment:

The chief purpose of this problem is to indicate the practical value of determining the visibility of points or areas, in relation to the possible necessity and extent of providing sanitary relief thereat, under conditions of combat.

In attack, especially, the areas of possible loss should be foretold with considerable accuracy, and measures of relief tentatively planned in advance.

Special Note

On some of the 2″ maps, the heavy contour line on Mount Olivet is erroneously labeled 1,000. It should read 1,100. This error is of course apparent on referring to other features of the map.

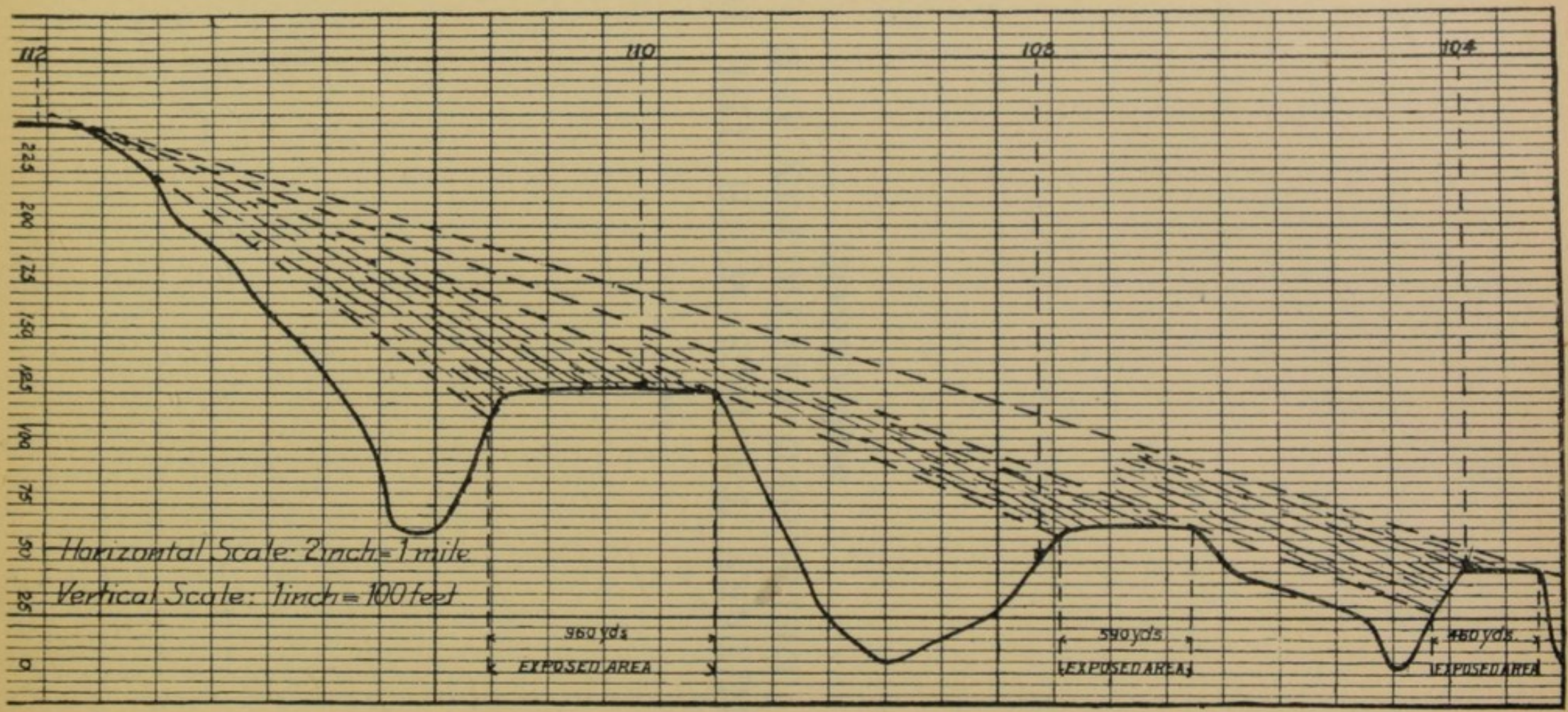


CHART ILLUSTRATING SOLUTION OF PROBLEM NO. 2

PART III

SANITARY TACTICS WITH THE DE-DETACHED BATTALION AND SQUADRON

CHAPTER VII.

Sanitary Service with the Detached Battalion in Advance Guard Formation and Attack.

Problem No. 3.

(Based on 4 inch map of Fort Leavenworth and vicinity.)

General Situation:

A Red force in hostile territory is using the Missouri Pacific R. R. as a line of supply and is guarding it against hostile raids by detachments at various points. Among the points guarded is the bridge over the mouth of Salt Creek. Friendly inhabitants state that for this purpose two companies of infantry have taken station on Salt Creek hill, and have constructed the ordinary standing trenches without other obstacles. There is also a detached post of 12 men at the bridge itself.

A Blue regiment has pushed forward from the west to break the railroad at various points. From this force Major A with the 1st Bn., 1st Inf., a machine gun platoon, and Lieut. B, Medical Corps, with the sanitary quota of the battalion and one ambulance, has been sent with orders to destroy the above mentioned bridge, damage the railroad track as far as possible and return to a rendezvous at a point 5 miles west of 15 on the Millwood road by 4 P. M. today. Major A is informed that the rest of the regiment will coöperate with other Blue troops north and south in attacking all other guarded points for a distance of 8 miles each way from the bridge.

At 8 A. M. Major A has just arrived at the Kern house (east of 15).

Special Situation and Estimate:

Major A now outlines his plans to several officers, including Lieut. B, the battalion surgeon.

His mission is to destroy the bridge over Salt Creek and injure the track in the vicinity. To accomplish this he must first drive away the troops now entrenched on Salt Creek hill, for their presence in this position will prevent the accomplishment of his mission.

It is now 8 A. M. To reconnoiter and get into position will take at least an hour; the attack, if vigorously pushed, will take at least an hour, and to march from the railroad to the rendezvous will take about 3 hours. At most, there will be three hours in which to wreck the bridge and road; also to perform any work of sanitary relief for the wounded.

He decides to drive the enemy from his position as quickly as possible. The force opposed to him he knows, and he fears no interference by other forces of the enemy as they are to be engaged by other detachments of the Blues.

The enemy's trenches are located on Salt Creek hill. The map shows that the latter commands the bridge at a distance of 300 yards. At the foot of this hill on the west flows Salt Creek, difficult to cross and thinly timbered; on the east about 300 yards away is the Missouri River with the railroad between the hill and the driver. To the southeast lies North Hill about 700 yards away and about the same height as Salt Creek hill. To the southeast from Salt Creek hill an open ridge extends for a considerable distance. The slopes of the north half of Salt Creek hill are steep, to the southwest fairly gentle, to the east quite steep, to the south is the open ridge. The wood road from 11 to 13 is under fair cover from the view and fire of the enemy.

Major A states that to attack the enemy from the west

would necessitate recrossing Salt Creek and moving north until opposite the position. This would take more time than to attack from east of the stream. Moreover, the attack would be hard to make as he would have to effect a difficult crossing at short range and then attack up a very steep slope if at the north end of the west face, or a fairly gentle slope if he moved up the nose of the hill. An attack on the northern part of the line would subject the attackers to fire in flank and rear from the detachment at the bridge and the attackers would be apt to become exhausted and get out of hand. Its advantages are that such ground nearly always affords dead spaces that give shelter, while the enemy is apt to over-shoot.

The attack might be delivered along the west side of the ridge with a secondary attack up the nose of the hill. Objections to this are the greater time required, the fact that the attack is visible for so long a distance and that for a time it would be divided by a difficult obstacle. Otherwise the ground is fairly favorable.

A third plan is to move by the wood road to 13, thence to southeast of North Hill, place the machine guns near here where they could fire on the enemy at a range of about 700 yards and use the infantry to make a primary attack from Albrecht against the east face of the enemy's position, with a secondary attack to deploy near Shafer and advance from the south, its left across the ridge after crossing the road. The disadvantage of this plan is the ground which the attack must pass over; the primary attack having a steep ascent to climb and the secondary some very open ground to cross. The advantages are some cover from trees for the primary attack up to short range, a good position for the machine guns where they can fire over the advancing infantry until they arrive at a short distance from the enemy, the secondary attack could obtain

some cover from the ground at several points, the troops could be kept well in hand, and the attack would probably take least time.

Major A states that he proposes to adopt this latter plan. Having moved to 13, he sends out scouts to drive in those of the enemy, assembles his commanders, with Lieut. B, Medical Corps, and gives them verbal orders which, if written, would be in the following form:

	1st Bn. 1st Inf.
Field Orders	13, Kansas,
No. 1	1 Sept. 10, 8:30 A. M.

1. Two companies of the enemy's infantry are entrenched on SALT CREEK HILL, with a detached post of 12 men at the bridge over mouth of SALT CREEK.

Other detachments of our army are to attack this morning all guarded points on the railroad for 8 miles each way from here.

2. We will attack the south and east faces of the enemy's position, drive him therefrom and destroy the bridge and railroad track. The main attack will be from the south.

3. (a) Lieut. Y with the machine gun platoon will proceed to the vicinity of the northwest crest of NORTH HILL and establish his guns in a position to bring an effective fire on the enemy. He will take advantage of cover and not reveal his position until Company A deploys and commences its advance, when he will open fire and support the advance.

(b) Capt. C will take his company (A) and proceed to the vicinity of ALBRECHT, deploy, and advance against the east face of the enemy's position.

(c) Capt. D will take his company (B) to the

vicinity of SHAFERS, deploy, and advance against the south face of the enemy's position.

(d) Lieut. X, with 12 men of Company D, will move to a point on the railroad about 900 yards southeast of the bridge, and occupy the enemy's detachment at the bridge.

(e) Cos. C and D, under my immediate command, will constitute the reserve.

(f) I will be at 13 at first, and then follow the main movement.

A,
Major.

Required:

1. A suitable disposition of the sanitary resources with the column on its march to the Kern house.

2. The provision, if any, affecting the sanitary service, which should be included in the above order.

3. The directions and information which Lieut. B, battalion surgeon, gives his sanitary subordinates as a result of his own information and orders.

Solution.

1st Requirement. With any such tactical situation as is detailed above, the Blue battalion of about 450 officers and men would undoubtedly be disposed in a general way in accordance with an advance guard formation. In this formation, generally speaking and subject to modification from terrain or other causes, with a force of the above nature, there is a vanguard, formed of a "point" and an "advance party," here composed of a section, with a distance between them of about 150 yards, dependent largely on terrain. Somewhat in rear of the "point," and parallel with the line of march are the "flankers," variable in number with terrain and tactical requirements. Mounted scouts precede the vanguard by a variable but considerable interval.

Back of the "advance party" comes the "support," the distance between them, of about 300 yards, being determined largely by the tactical needs, and also bridged by "connecting files." The support, composed of the other three sections of the company, also has its outlying "flankers," who usually move at a greater distance than the others from the line of march and parallel to it. The "main body," consisting of the rest of the command, here three companies, follows the "'support," the approximately 400 yard interval between being likewise bridged for purposes of communication by "connecting files." Forces of less than a regiment ordinarily have no "reserve" in the advance guard. The commander may ride at the head of the "main body," or if action is imminent with the "support."

The usual sanitary quota for a battalion operating independently would be 1 medical officer, 1 sergeant, Hospital Corps, 1 orderly, Hospital Corps, and 4 privates, 1st class or privates, Hospital Corps. To this would be added 1 ambulance, mules and driver, all assigned from an ambulance company. The only supplies of this sanitary detachment are carried in their pouches, together with the box of dressings carried under the jockey seat of the ambulance.

The problem of the disposition of these sanitary resources with an advancing battalion is of the simplest and most elementary character. The force is so small that neither the factor of road space, nor the consequent one of time, need be considered. Protection against possible attack is of some importance. With an advancing column, the ground on which any wounded may fall will soon be gained by the sanitary detachment participating in the advance of the force as a whole. Until need for their services arises, this detachment is held together as much as possible.

An appropriate disposition in the advancing column therefore suggests itself as follows:

Lieut. B, Medical Corps, followed by his mounted orderly, rides out of camp with Major A at the head of the main body, securing information and learning the tactical plans. At the rear of the main body march the four privates of the Hospital Corps, followed by the ambulance; and with the sergeant, Hospital Corps, mounted, bringing up the rear in general supervision and to look after stragglers. If the surgeon is needed at the rear, he can be quickly summoned; if the command comes in contact with the enemy, he will drop back and take charge of his detachment.

As to the *2nd Requirement,* Major A's order is very defective and would, if uncorrected, result in unnecessary suffering among the considerable number of wounded certain to occur in a fight of the nature in question. Mutual coöperation can only be secured by mutual information. Major A's order, interpreted in its sanitary significance, indicates to Lieut. B the organizations in which the greatest number of casualties may be expected, and consideration of the terrain and distances with which they will be concerned during the attack permits of fair determination in advance of the general localities in which the greatest number of hits will be incurred. But while Lieut. B thus has a quite accurate idea of where the wounded will chiefly fall, he also clearly recognizes the fact that these danger areas are so exposed as to render sanitary work under fire entirely impossible, while the ranges in question are so short and the trajectory of the rifle so flat as to keep these exposed areas more than hazardous during the entire advance. Little could thus be done for the helpless wounded during the attack, nor would Major A be justified in letting Lieut. B, the only surgeon with the command, unduly

expose himself or his sanitary assistants at this time. If he is killed or injured, the wounded of the command and of the enemy, if the latter are dislodged, will be in a bad way. If the command were larger and another surgeon were present, the loss of Lieut. B would not be so completely disastrous. As it is, he must not be permitted to take unnecessary chances.

But while thus excluded from the most dangerous areas during the attack, and thereby prevented from attending to the helpless wounded lying thereon, Lieut. B will be brought into contact during this time with more than sufficient wounded to keep him very busy. Wounded will make every effort to leave fields exposed to fire, and the sight of blood and uncertainty as to the severity of the wounds they have received will cause the vast majority of wounded to endeavor to seek the surgeon. Under the conditions of terrain and distance existing in this problem, probably as many as half of the total hit would seek and be able to reach shelter and they could also reach the surgeon and have their wounds dressed if they know the general locality where the latter is to be found. Since Major A's original order gives no information on this important point, it will have to be amended in this respect, and Major A calls on Lieut. B for the necessary recommendation.

Lieut. B, who has already carefully examined his map in the light of the information given him by Major A, recommends that the following paragraph be inserted in Major A's order:—

"4. Lieut, B, with the necessary sanitary assistants, will take a suitable position in the edge of the timber south of the wood road running west from Albrecht, as soon as the advance passes west of that position. The ambulance will remain at 13."

This order the company commanders will transmit to

their subordinates in more colloquial terms, if possible pointing out the location or at least the direction of the places mentioned.

Lieut. B reaches the conclusion embodied in the above recommendation as follows:

The point thus selected in general terms is central and easily reached from both wings. It is sheltered, screened and probably can be evacuated under cover. The map indicates that a little water may be expected there. After the main attack has reached the zone of greatest casualty, it is the nearest point of shelter. There is clearly no one place at which he will be immediately available to all, but Lieut. B believes that his position at this point will be for the greatest good to the greatest number.

Company A, advancing from Albrecht, will probably lose few if any men before reaching the edge of the timber; then not many as the attack is only of a secondary nature and will not be very vigorously pushed. The left of the line of Company A will probably pass close to what, from the map, is apparently the best point for sanitary relief, which is near the base of the west slope of the ravine just north of the little nose and protected by it from fire. Casualties occuring in Company A can readily reach this convenient point unless helpless.

The main attack of the other 3 companies will probably not incur much loss until its advance passes north of the scattered trees 200 yards west of Shafers. Any few individuals who may happen to be wounded prior to this time will naturally work back to 13, where Major A has ordered the ambulance to remain. The greatest part of the wounded will fall in moving along the open ridge north of the clump of trees and south of the wood road, a space of 300 yards. If the Blues are able to pass north of the

wood road, thus getting within some 250 yards of the Red trenches, the enemy probably will not stand. The proposed position for sanitary relief will lie just outside the right of this main attacking line. Lieut. B realizes that wounded do not ordinarily tend to retire from exposed areas by a flank but to drift more directly toward the rear; but in this instance the small frontage, size of the command, terrain, distances and cover favor such action. It is also in the general direction from which the Blues came. Besides, a deciding factor in this case is the fact that orders specifically indicate this locality as that to which wounded should resort to secure relief. Those few wounded who return over the ground upon which they advanced will receive attention at 13. The sanitary personnel will by no means move out of the cover until the fight is over. Only in the case of complete success of the Blues can their helpless wounded lying on the exposed ridge be reached and dressed. If the attack is repulsed, the latter will have to be abandoned and cease to cause any official concern to Lieut. B

With respect to the *3d Requirement,* Lieut, B would say:

"Sergeant K, you, my orderly and Privates L, M and O will go with me to render first aid near the firing line. Major A directs that we locate somewhere south of the wood road running east from Albrecht where it crosses this ravine (pointing it out on the map) about half a mile from here. Wounded able to walk from the front will be dressed and directed back here to the ambulance either over the wood road by way of Albrecht or up the ravine under cover of the trees and by way of the Shafer house. Have our horses tied here near the ambulance. You and your men fill canteens from the tanks, stuff your pockets and shirts full of extra dressings from the box under the ambulance seat, take a litter and return here. As soon as

the advance is started, we will move down into the ravine under cover of the trees back of Shafer's."

He would also say:

"Private P, remain here with the ambulance until further orders. Dress the wounds of any man who reaches here without having had previous attention. Examine the dressings of all previously dressed to see that they are properly adjusted and bleeding is controlled. There are plenty of dressings in the box under the ambulance seat. Direct all slightly wounded able to walk to start at once to work their way back along the road we came, past the school house near the first cross roads they come to, to a point about 4 miles west on the same road where the regiment is to reassemble by 4 o'clock this afternoon. Have any wounded who seem unable to walk back lie down in the shade near the ambulance. You heard my orders to Sergeant K, so you know the point for which we are leaving. If you are sent for, ride and lead forward our horses."

To the ambulance driver:

"Private Q, you remain here with the ambulance until further orders. If sent for by me, follow this road north a quarter of a mile, then turn to your left. You will get in touch with us about where the road crosses the ravine a quarter of a mile from the turn."

Comment.

Such a problem as the foregoing illustrates the tactical use of the sanitary service with the smallest tactical unit. It shows a phase of sanitary tactics in its most elementary and simple form. With forces smaller than a battalion the details would remain about the same. With similar situations and larger forces, up to those of the greatest magnitude, the general principles involved would

be the same, though the special methods of their application necessarily vary with conditions and their employment becomes a more and more complex matter as the factors of time and distance must enter in larger part into consideration.

In this and the following—and companion—problem the purely tactical side of the assumed situation has been quite minutely entered into, so that the student might gain at the outset a more comprehensive idea as to the factors, alternatives and line of reasoning which go to form the tactical decision, upon which alone any sanitary purposes and plans must rest and to which they must conform.

If the cover at the point of the map suggested as the station for sanitary relief is found by inspection of the place itself to be too thin, the latter would have to be located further back, perhaps as far as 13. Should necessity thus force a change of position Lieut. B would promptly report to Major A the new point at which sanitary assistance should be found. If approved by him, the latter in turn would notify his company commanders. Any change of an expressed sanitary plan demands the full information of all concerned.

CHAPTER VIII.

Sanitary Service with the Detached Battalion in Rear Guard Formation and Occupation of a Defensive Position.

Problem No. 4.

(Based on 4 inch map of Fort Leavenworth and vicinity.)

Situation:

Major X, in command of a small but valuable convoy, is retreating eastward into Missouri along the Millwood road.

His force consists of the 1st Battalion, 1st Infantry and machine gun platoon. The usual sanitary quota, with one ambulance, is present with the battalion. He is being pursued by a force he estimates at two battalions of infantry, now about 1 mile behind. As the head of his column reaches 17 he learns that the bridge over Salt Creek is impassable and that it will require an hour to repair it. The stream, from recent rains, is unfordable.

Special Situation, tactical estimate and action:

Major X's mission is to get his convoy safely into Missouri, to do this without fighting if he can, but to fight if he must.

On receiving word that the bridge on his direct road is damaged and will delay him for an hour and knowing that the enemy is only one mile behind him, or say a twenty minutes march, he realizes that he must either find some other route, fight a delaying action, or lose his convoy.

The enemy has two battalions of infantry and he only one and a machine gun platoon, and the enemy probably knows his exact strength, as he has been following his

trail. This is another unfortunate condition, for Major X realizes there is no use making a false deployment to deceive the enemy as to his strength and gain time while the enemy cautiously seeks information on this point, for already knowing Major X's strength, he would take prompt advantage of any opening offered.

From his knowledge of the country and his map he sees that by turning south at 17 and moving to Frenchman, he might pass Salt Creek there and thus gain the Missouri river bridge. This route is only about one mile further than by the road he is now on and seems to be as good a road.

Major X appreciates at once the following disadvantages of this route: The bridge at Frenchman may have been wrecked by the same parties that injured the one in front of him; if so and he turns down the 17—H road he will be in a pocket and ruined; the enemy being superior to him in strength and knowing it may have sent a force from farther west direct to that bridge, in which case he would lose his entire command; if neither of the above conditions exist, his march will be promptly observed by the enemy and will partake much of the nature of a flank march. While it will require an hour to repair the Millwood road bridge sufficiently to pass loaded wagons, it may be much more speedily rendered serviceable for hostile infantry.

Major X observes that the terrain in his immediate vicinity offers advantages for fighting a delaying action and considers that the risks of attempting the route via Frenchman are too great to warrant him in taking it, much as he would like to avoid a fight.

How now considers the terrain with reference to a delaying action. With the leading element at 17, the rear of his main body would be about where the fence crosses

the road west of A. Daniel and his rear point on top of the hill.

The position at Sprong he rejects as it would require a retrograde movement, gives the enemy too good a position to attack from, and unless the line be too long for proper resistance it would be too easily turned.

About midway between 17 and 19 there appears to be a good position, but to hold it properly would require more men than he has. If he concentrates near the road his left flank could be easily turned, and if he extends to Hill 900 and north far enough to look after his right flank, his extension will be too great. He considers this better than the first position considered but will not accept it if he can find a better one not too close to the bridge. A position at 17 seems to fulfill the requirements better. It is far enough from the bridge to prevent the enemy's fire from reaching there while he holds his ground; it can be held without undue extension and is favorable to his withdrawal. The disadvantages of the position are that the field of fire is not as extensive as desired and the 900 foot hill to the southwest will afford some cover for a close approach. Major X considers 17 as a good position for the machine guns. From there they can sweep the country to the west and northwest and bring effective fire on a large part of 900 foot hill. By placing a detachment at the southwest point of 880 foot hill he covers the face of the 900 hill and would prevent an enveloping movement on his left. Another small detachment on the point about 500 yards northeast of 17 will look out for his right. His reserve should be so placed as to promptly support either flank detachment or his firing line.

Major X believes the enemy will promptly attack in front and try to envelope his left and that he may have detached troops to go to Frenchman. To meet this latter

contingency, a patrol should be sent there to injure the bridge or bridges and delay crossing there, this patrol to join later at the Missouri river bridge.

Withdrawing is a problem for Major X to consider, and he believes he can withdraw with small loss if he can hold his ground until his convoy is safely across the stream.

The first troops withdrawn, with which would probably go the machine gun platoon, would hasten to the vicinity of 15, which they could reach in about twelve minutes. A part of the reserve should be in position at this time on Hill 875. Shortly after the detachment started for 15 the remainder of the firing line could be withdrawn. As soon as under cover of slope they could take the run across the stream. The detachment at Hill 875 suddenly opening a heavy fire would check the enemy temporarily and the covering detachment would withdraw as soon as the others were far enough ahead so as not to block the bridge for them.

The ground is particularly favorable to this plan if the enemy does not get too close before the withdrawal begins. As soon as the covering detachment starts it is covered from fire of the enemy until the latter reaches the crest of the bluff, but here the enemy would be met by the fire of the troops near 15.

Major X would not include instructions for withdrawing in his order, although he considers them in making his plan.

It is assumed that the special troops with the wagons are sufficient to repair the bridge. If not, a small detachment should be made from the leading company.

The companies in order of march are A, B, C, D, the last being rear guard.

While coming to a decision, Major X has allowed

the column to advance until his main body has reached 17.

Major X decides to take up a defensive position at 17; to place his machine guns at the cross roads; to deploy Company B north of the Millwood road with one squad on the spur to the northeast; Company C south of this road with two squads on the southwestern spur of 880; Companies A and D as reserve near the road under cover about 400 yards east of 17; Company A to send at once one squad to Frenchman as previously explained; to hold the wagons under cover east of J. E. Daniel's, with orders to cross as soon as possible and move as rapidly as they can until safe from fire.

Major X having previously sent a squad from Company A to Frenchman, assembles his company officers (excepting those of Company D,) Lieutenant X of the machine gun platoon and his staff, including the battalion surgeon, Lieutenant W, and gives the following orders:

"The enemy's force, about two battalions of infantry, is pursuing us. His leading element is about one mile in rear of our rear guard.

"The bridge over Salt Creek in our front has been damaged and will take about an hour to repair.

"We will take up a position here to hold the enemy in check until the bridge can be repaired.

"Lieutenant X, put your machine guns in position at this cross roads in whichever angle you can get the best field of fire, and open on the enemy at first opportunity.

"Captain B, deploy your company (B) north of Millwood road with your left about twenty-five yards from it, and just east of 17—H road. Send one squad to that spur about 300 yards to the northeast (pointing) as right flank detachment.

"Captain C, deploy your company (C) with your right about twenty-five yards south of Millwood road, and just

east of the 17—H road, sending two squads to that spur 300 yards to the southeast (pointing) giving them instructions to look out for the enemy near 900 hill and to protect our left flank.

"Both flank detachments are to report promptly any movement of the enemy in their direction, to hold him in check until reinforced, and fire on any good target offered.

"Companies A and D will constitute the reserve and will take post under cover near the Millwood road about 350 yards east of here.

"One hundred and twenty rounds of extra ammunition will be issued at once and the ammunition wagon will then join the others.

"Lieutenant Y, (battalion quartermaster,) go at once and have all wagons placed under cover east of J. E. Daniel's. Send me word as soon as bridge is repaired and hurry the wagons across.

"I will be near 17 for the present."

Lieutenant G (battalion adjutant) is sent to impart this order to Captain of Company D.

NOTE:—It is assumed that the trees along the 17—H road are such as not to interfere with the fire from the troops; if this row of trees forms a thick hedge, then the firing line will be placed to their west and ample openings provided for withdrawal.

Required:

(1) The disposition of the sanitary resources of the battalion in the column prior to reaching 17.

(2) The orders of Major X for the location of the sanitary resources of the battalion, as recommended by Lieutenant W, battalion surgeon, when it takes up its position.

(3) The reasons upon which Lieutenant W bases his recommendations to the battalion commander, and the plans which he makes at this time.

A Solution.

With regard to the *1st Requirement,* the disposition of the sanitary sources in the battalion would depend upon its column formation. With a superior force following in pursuit only a mile away, this formation would be that of a rear guard, or approximately the same formation as was given in the preceding problem (Problem No. 3) but reversed. The exact disposition varies somewhat with terrain. But, generally speaking, there is a "rear point" nearest the enemy, preceded a couple of hundred yards by a "rear party," which in turn follows the "support" at an interval of some 300 yards. The "main body" precedes the "support" by some 400 yards. A force called "advance troops," followed by the convoy, precedes the "main body." Intervals are bridged for purposes of communication by "connecting files." The commander would usually ride at the rear of the "main body"; so long as only a rear guard action is to be anticipated.

The usual sanitary quota for a battalion operating independently has been specified in the preceding—and companion—problem.

The disposition of the sanitary resources of a battalion column on the retreat is not by any means as simple as that with a similar force on the advance. In the latter, the purpose is to attack vigorously with the expectation of success. With the former, the purpose is to avoid action as far as possible, and if forced into an engagement to make the latter indecisive and merely intended to delay; retreat must be resumed at every possible opportunity in order to prevent the receipt of crushing injury. The road space required is about the same as with an advance guard formation; but with a retreating force, even as small as a battalion, distance becomes a material factor in respect to sanitary aid, since the column, with its sanitary resources,

constantly tends to retire from any areas of casualty and thus increase distance thereto with a correspondingly increased difficulty of sanitary assistance and removal. With this formation, too, the time factor becomes of paramount importance. In contradistinction to an advance, where the work of the sanitary service can go on relatively leisurely under the protection of an advancing line, in a retreat such sanitary service as can be given must be of such a hasty nature as would naturally depend upon the fact that the column is practically at all times in the position of being shortly about to withdraw its assistance and protection. Whatever aid the sanitary personnel may be called upon to do will therefore have to be rendered quickly. This time requirement can be rendered less difficult in two ways; first, by limiting sanitary aid to the barest necessities; second, by such disposition of the sanitary service as would render it most immediately available in case of casualty. Both of these measures will be employed. The zone of probable casualty moves along with the rear guard, which would be the first part of the command to suffer in attack by the enemy. Hence sanitary dispositions must take special cognizance of this fact. Fortunately the vastly greater difficulty of succor and removal of wounded under these conditions is compensated for in part by the fact that the number of casualties requiring attention in a rear guard action would be relatively small. In other words, while the general sanitary problem is made up of factors individually much more difficult to handle, the probable number of such individual factors is materially less and the situation, as a whole, becomes proportionately relieved thereby of sanitary gravity.

Bearing the above facts in mind, and recalling that the column in the necessary formation will be more than

three quarters of a mile long, the battalion surgeon, Lieutenant W, recommends the following disposition:

He himself, followed by his orderly, will ride with the battalion commander at the rear of the main body, securing tactical information on which to base his own plans. If the rear guard becomes engaged, he will drop back with his orderly to the ambulance, or still farther to the rear if his services are required.

The ambulance will immediately precede the "support" of the rear guard. This seems to be the nearest location to the rear which affords reasonable safety. Here the ambulance can pick up soldiers falling out of the main body through disability, while it is in contact with the "support" and can be at once halted if need arises in the latter. The "support" is so small that its road space need not be considered. Only the "rear point," "rear party" and "flankers" are left unprovided for. The number included in these latter formations with a battalion is inconsiderable and will have to take their chances of being unable to reach transportation. However, under certain tactical conditions and favorable terrain, it is conceivable that the ambulance may be able, if necessary, to pull out of the road, await wounded being brought up from the rear party, and then rapidly rejoin the "support."

The Hospital Corps sergeant, mounted, and the four privates of the Hospital Corps, with litters, march with the ambulance. They will be held back out of fire until the need for their services is required. Notification of casualty occuring in the "rear party" or "rear point" would be transmitted verbally through the connecting files, or by prearranged visible or other signal. A "Hospital Corps call" on the bugle is laid down in the Drill Regulations for the Hospital Corps, and may be employed in indicating the need of assistance. On receipt of such in-

formation, the sergeant gallops back, hastily examines the injury, and if necessary summons a litter squad and halts the ambulance while he promptly proceeds to dress the case. If the column at the time is retiring rapidly, those wounded near the rear of the column, unless themselves able to walk as far as the ambulance, would probably have to be abandoned to the enemy, whose surgeons, under such conditions, would come up and take over the work of sanitary assistance within a very brief period. This from the reason that about the time the litter squad would be able to reach the wounded man, the last element in the retreating column would be withdrawing its protection. If the wounded man be loaded on the litter, the latter can only keep up with the retiring force back to the ambulance through the temporary detail of several infantrymen to assist the Hospital Corps bearers, since a loaded litter with two bearers only cannot greatly exceed the speed of about two miles per hour, or less than that of marching troops.

Wounded in the "rear point" will usually have to dress their own hurts and make their own way back, at least as far as the "rear party." Severely wounded in the "rear point" can ordinarily neither be reached, dressed nor removed by the Hospital Corps during withdrawal. The allied and dominating factors of time and distance will probably make their abandonment unavoidable.

The provision of sanitary relief cannot be guaranteed all wounded soldiers under all conditions; only such can be provided as the tactical situation permits. And especially with such a force as an independent battalion, the already scanty sanitary assistance and resources cannot be unduly hazarded, since there is no sanitary reserve from which additional aid can be sent as need requires, as is possible with the regiment and larger forces.

Second requirement:

The orders of Major X, which are, of course, given verbally, would be about as follows:

To the battalion surgeon, "Lieutenant W, locate your relief station near the head of the ravine about 175 yards east of the 17 cross roads. Halt your ambulance on the Millwood road about 600 yards east of 17."

To the battalion quartermaster, "Lieutenant Y, have your convoy wagons take on any wounded sent to them by the surgeon."

To the company commanders, "You heard the location of the surgeon; inform your commands of it. Wounded will be moved to the Millwood road and then in the direction of the convoy."

Third requirement:

With regard to the plans and recommendations upon which the orders of Major X are based, the battalion surgeon, Lieutenant W, clearly can make no suggestions until the tactical disposition of the combatant organizations is settled. Their location and relation to each other practically determine, within certain limits, the positions which his sanitary resources should occupy. This, in a general way, and so far as his relief station is concerned, should be central, as near to the firing line as possible with due consideration of protection, be reasonably safe of access from front and rear, and be on the natural line of evacuation of the command. Under such conditions those who may be wounded anywhere on the line will receive attention with least effort and delay.

With these considerations in mind, Lieutenant W, who has been examining his map and the terrain, observes that local conditions are very favorable to the convenient location of his relief station. The slope of a crest some

20 feet high affords protection from fire south of the Millwood road in the immediate rear of Company C; while a broad ravine, everywhere at least ten feet deeper than the promontory to the west occupied by Company B, slopes north from the Millwood road immediately behind the position of the later company. The map and terrain show the west slope of this ravine to fall away at least 10 feet in 25 yards, or in the ratio of 1:7.5. This slope, at any range at which the present action would be conducted, affords perfect protection from rifle fire. Such would not be the case if artillery fire had to be considered, but Lieutenant W has already ascertained from Major X that there is no reason to believe that there is any artillery with the pursuing force. A relief station just north of the Millwood road at the foot of the steep slope would be about 150 yards equidistant from the center of the lines of Companies B and C, and with ready access under shelter from both those organizations and the machine gun platoon. Wounded from the flank detachments could readily reach this station, but Lieutenant W does not anticipate any great number of casualties in these detachments if the enemy delivers a frontal attack. Should the enemy make a flank attack from the southwest, a relief station in the position under consideration would still be conveniently located and well protected. Only if the enemy attacks from the direction of J. Aaron and points east will it become unduly exposed and otherwise undesirable, in which latter case it would have to be re-established in the next swale about 150 yards to the east, or be dropped back to the position which Major X has designated for the ambulance, depending on the disposition of the battalion which its commander may make to meet such a tactical situation. Lieutenant W notes that evacuation of wounded to the rear from a relief station at the point

under consideration can probably be quite safely effected during action for men on foot or on litters. The road crosses a ridge about 500 yards east of 17 where for a short distance there might be a little danger from fire or overshots; but such danger could practically result only from shots fired by an enemy located directly on the Millwood road, since the crest to the south gives excellent protection all the way from fire from the southwest, while the hedge would screen movement, and the cut just west of the exposed narrow rise of ground mentioned would give some protection against an enemy in the northwest. The battalion surgeon therefore decides in favor of the location of his relief station in the position the merits of which he has been considering as above. And since the positions occupied by Major X's command will probably be developed by the enemy through fire, as a result of which casualties will probably occur, he will proceed with his sanitary personnel to that point at once, remaining there in any case until the plan of the enemy's attack is developed or the location becomes untenable.

Lieutenant W proposes to keep his battalion sanitary quota together at this point as long as possible. His orderly is ordered to return there after taking the mounts to the sheltered position designated as the station for the ambulance, tying them there out of the way. Lieutenant W can get more efficient service out of his detachment if it is held together, and the present situation gives no warrant for its dispersion. The location of his station is such that practically all wounded will have to pass through or near it. He plans to remain there himself with his orderly and two privates, Hospital Corps, as assistants; his sergeant, with the two other Hospital Corps men as litter bearers he will send nearer to the line as soon as any casualties occur to apply the wounded men's first aid bandages and see

that they reach him on foot or litter. If many wounded needing dressing accumulate on the line or at the relief station, Lieutenant W. will stop the transportation work and direct his entire detachment to dress injuries to prevent bleeding and infection as the matter of most immediate necessity.

Lieutenant W naturally desires to keep his ambulance as close to the firing line as possible, for the better removal of casualties as they occur. But the nearest point to which the ambulance can work without undue exposure and danger is to the protection of the ridge a little west of midway between the bridge and the 17 cross roads. He will not send it further west since, as it is the only vehicle of the kind with the command, he cannot afford to risk a material chance of its being disabled. If the enemy is repulsed, it may be brought forward safely if need requires; in the meantime the point selected to which it shall work is but some 400 yards down the road in the rear of his relief station. All but the severely wounded should be able to walk such a short distance, and the litter conveyance of the helpless to that point is no great task. From there to the convoy wagons at the bridge is a little less than half a mile, so that the ambulance can readily make a trip to that point and return in fifteen minutes or less. Several ambulance trips are thus possible in the period during which Major X expects to be delayed. Lieutenant W directs his ambulance driver to remain at this point; and whenever two or three tagged wounded reach him who appear to be hardly able to walk to the convoy wagons, to drive them rapidly to the latter, unload and return immediately.

Lieutenant W properly regards the convoy wagons as a sanitary resource. With a fight of half or three quarters of an hour's duration his battalion may conceiv-

ably suffer several dozen casualties, with many more severely wounded than his single ambulance can transport. Moreover, after the command repairs the bridge and crosses Salt Creek, the map shows that the route of retreat passes over a high elevation through dense woods, making a climb for wounded which undoubtedly would be so difficult and exhausting as to be liable to result in injury and straggling. He will therefore load the convoy wagons with all his wounded able to sit up, except perhaps the trivial cases, for transportation over this next couple of miles at least. And he will endeavor to get these wounded to the convoy wagons while the latter are delayed at the bridge, since the moment the latter is repaired the orders are to expedite their retirement and the valuable sanitary assistance they will be able to give up to that time will be at once withdrawn. While the number of convoy wagons is given as "small," several wounded can ride in each, and they, with the ambulance, will probably suffice for the transportation of all the wounded for whom it is necessary.

The further sanitary resources available are the company litters, which Lieutenant W has taken from the battalion ammunition wagon and has had carried to his proposed relief station. He also sends there the litter carried by his two Hospital Corps bearers. The four litters belonging to the ambulance will be held in reserve with it pending developments of the fight, and to be sent to the front to replace those which may be sent back in the transportation of helpless wounded. The surgeon will endeavor to have several empty litters at his relief station at the time the troops are withdrawn, so that the latter may themselves be able to assist in carrying back with them any helpless wounded from the front, as the small Hospital Corps personnel will be themselves unable to remove more than a couple of such wounded.

As the fight is to be only a delaying one and the troops are quite well protected, probably no more dressings than the first aid packets carried by the men themselves and those contained in the pouches of the Hospital Corps detachment will be necessary. But if more should be required, the box of reserve dressings conveyed in the ambulance will be available and can readily be drawn upon.

Comment.

The concluding remarks relative to the preceding problem apply in this also.

The general principles here illustrated on their smallest scale in respect to military tactics and the co-ordinate provision of sanitary relief are equally applicable with respect to larger forces as a whole and in relation to the various battalion units of which they are composed. Whether the firing line is that of a regiment, brigade, division, or larger force, we may consider that the first provision of sanitary relief is the sum total of that of its component battalion units engaged, each of which has its own separate, and often widely dissimilar sanitary problems to solve dependent upon an always different terrain, the use of artillery and other factors.

The use of the single ambulance here shown is the prototype of the employment of such wheeled transportation on a large scale and perhaps under a separate organization, authority and direction.

CHAPTER IX.

Sanitary Service With a Squadron as Advance Cavalry.

Problem No. 5.

(Based on 2 and 4 inch maps of Fort Leavenworth and vicinity.)

Part I.

Situation:

The Missouri River divides the Blue (eastern) from the Red (western) states. The Blue main army has crossed the river at Kansas City but has been stopped by the Reds about 15 miles west of that place. There are no practicable bridges between Kansas City and Atchison.

The Blue commander has determined to try to draw some of the Reds from his front by a demonstration southwest from Atchison by the 5th Blue Division.

The 16th Blue Cavalry, covering this movement, camped 5 miles north of 57 on the night of April 1st. It is accompanied by pack transportation but has no wheeled transportation with it.

On the morning of April 14th the Colonel gave the following orders:

"The regiment will move to Lowemont, where, in pursuance of division orders, a small supply depot will be established by way of the A. T., & S. F. R. R. from Atchison, which will be guarded by the cavalry till the arrival of infantry on the morning of the 15th.

The 1st Squadron, Major X, will precede the regiment and reconnoiter the country to the south for a distance of 10 miles beyond Lowemont.

Regimental headquarters will be at Lowemont. Noth-

ing has been seen of the enemy, but Army headquarters report that on the 13th hostile cavalry was well north of the hostile position in its front."

Major X directs as follows:

"Squadron headquarters and Troops A & B will proceed slowly south by the 69-P-90-118-168 road, observing the valley of Big Stranger Creek and the 77-87-108-158 road.

Troops C & D, Capt. B, will proceed by routes east of the 77-87-108-158 road and observe between that line and the Missouri river.

The sanitary service will be disposed as the surgeon may recommend."

The surgeon is Lieut. A, who is accompanied by the usual sanitary quota for a squadron.

Required:

Disposition of the squadron sanitary detachment, as recommended Lieut. A, with reasons therefore.

A Solution.

The mission of the 1st Squadron is that of advance cavalry generally, to guard against surprise, to secure all possible information of the enemy and to prevent the latter from securing similar information in return. While his object is not to fight, Major X will not hesitate to accept action on favorable terms in order to accomplish his general purposes and execute his specific instructions. He has been directed to reconnoiter an area 15 miles long and 10 or 12 miles in width within which there is every likelihood that hostile cavalry will be encountered. To comply with his orders, it is necessary for him to split up his squadron, but he will endeavor to hold as many men as possible in hand so as to strike the enemy's cavalry if it is encountered. He has therefore divided his command into two parts of two

troops each, which will thorouhly beat up the zones assigned to them for observation. He proposes to do this with the two troops under his own command about as follows:

The main force will proceed slowly along the designated main road, at a rate probably not exceeding 3 miles per hour. He will send out a succession of small patrols on each flank, each composed of say a noncommissioned officer and 4 men, with orders to ride rapidly along certain designated roads to given points and then return by other specified routes to pre-arranged points where the main body will be held awaiting them. His patrols to the west will thus traverse all roads to the Big Stranger, while those to the east will go as far as the 87-96-128 road, to which road the patrols from the other two troops of his squadron will work from the eastward. Several such small patrols will be away scouting at the same time.

Lieut. A, the squadron surgeon fully appreciates the special difficulties which will beset the sanitary service with his command. Casualties will undoubtedly occur but where they may happen he cannot foretell. With his squadron largely dispersed over a frontage of 10 miles and only a small sanitary personnel available, he cannot entertain any idea of providing for all possible contingencies but must limit his arrangement to those calculated to bring the greatest good to the greatest number. He reflects that the sanitary quota for the squadron, like that of a battalion, consists of 1 medical officer, 1 sergeant, Hospital Corps, 1 orderly and 4 privates of the Hospital Corps. These are all mounted. He has neither ambulance nor litters, so transportation of wounded, for such as can neither walk nor ride a horse, will not be possible unless he can impress vehicles or improvise transportation facilities. His difficulties are added to by the fact that the country is hostile

and inhabitants unfriendly, and that the essence of the orders received by his squadron commander implies its more or less continuous movement.

It is apparent that, in case of casualty, Lowemont is the logical place to which wounded should be sent. This for the reason that it is the point at which the headquarters and probably at least one squadron of the regiment have been ordered to halt and guard supplies. The bulk of the sanitary personnel and supplies of the regiment will therefore be found at that point, where also some sort of transposition can undoubtedly be secured. Moreover, Lowemont has good buildings and other facilities and is on a practicable railroad by which wounded can be evacuated to the rear. Capt. B's force is going the further of the two from this point and from any possible sanitary assistance which might be derived therefrom; moreover the country over which he has to travel is much more broken and the roads more devious.

With these facts in mind, Lieut. A decides to split his sanitary detachment. He therefore recommends to Major X that the sergeant and two privates of the Hospital Corps remain with squadron headquarters, and that he (Lieut. A) his orderly and two privates of the Hospital Corps be directed to accompany Troops C and D.

Part II.

Special Situation.

When Capt. B had reached 17 at 10 A. M., he handed Lieut. A the following message:

"Patrol No. 2, Troop D,
Bridge 600 yards north of 21, 9:40 A. M.

To Capt. B.

Bridge here broke while we were crossing and Pvt. Y is severely injured by his horse falling on him. As far as

I can tell he has broken his hip and dislocated his collar bone. I am leaving him here in the brush with one private and will continue on with the rest of the patrol. Bearer can find his way back. Z,

Sergt. Tr. D."

Captain B asks: "What can we do for him? I am going to march on at once to those heights (pointing to the Sheridan's Drive ridge)."

Required:

Recommendations and action, if any, of the squadron surgeon, with reasons therefore.

A Solution.

The question asked and information given by Captain B require immediate decision by Lieutenant A as to the character of the sanitary service which it is practicable for the injured trooper to be given; also whether he should be left where he is or moved elsewhere—and if moved, where to and by what means.

But as a necessary preliminary to deciding these questions, Lieutenant A considers the accuracy of the information about Private Y's injuries. Sergeant Z is not a surgeon and it may very conceivably be that the injuries of Private Y are over-rated as to gravity and that he is merely bruised, or has injured his collar bone without fracture of the hip. In either of these contingencies he will need little or no professional attention and can look out for himself and work his way back on foot or horseback, without assistance, to Lowemont about 5 miles in the rear and along a practicable and easily followed road.

Some one better qualified professionally than Sergeant Z should pass upon Private Y's injuries. As the distance to the latter is only about a mile and a quarter, the surgeon would himself ride there if Captain B intended to hold his

command much longer at 17. But instead of so remaining, the command is starting immediately for country several miles away and of a nature such that hostile cavalry would be apt to seek it for purposes of observation and defense. Moreover, that country is rough and heavily wooded and the surgeon might be delayed in rejoining at a time when his services with the command might be urgently needed by a number of injured. He weighs his possible utility with the large number of men with the two troops, which may any time come under fire and suffer a number of casualties, with that relating to a single individual whose injuries are problematical, may be exaggerated and in no case imply danger from bleeding or wound infection—and decides to remain with the command himself on its advance.

The map shows a house at 19 about three quarters of a mile from the broken bridge on the way to Lowemont; but the country is hostile, and if conveyed to the house Private Y might be in some danger from the occupants. Moreover, if Private Y is so injured as to require recumbent transportation, any impressed farm vehicle used to convey him to the house at 19 might better continue on to Lowemont and the medical attendance to which he will in any case ultimately have to be taken, and he would be in no more danger while en route than in the house. The surgeon therefore believes that Private Y should be started back by himself if able to walk or ride, sent back if helpless and wagon transportation can be quickly found at 19, or left hidden in the brush for later removal after receiving attention if his leg is really broken and no wagon can be quickly secured.

The squadron surgeon, Lieutenant A, therefore says to Captain B: "I believe that I should go ahead with the command, sending a Hospital Corps man to look after Private Y with directions to rejoin us as quickly as he can."

On Captain B assenting, the surgeon would say: "Private X, go back to the first turn north on the road over which we came. Stop at the house there and see if any wagon transportation is available. Then go north about three quarters of a mile to the broken bridge, near which you will find an injured man concealed in the brush. See if his leg and collar bone are broken, as reported. If his leg is not broken, start him back at once on horse-back or foot toward Lowemont, accompanying him yourself until he is well past the house at 19. If the leg is broken, splint it quickly and attend to his wants. If you found no suitable transportation at the farm house at 19, leave the man where he is, telling him that he will be removed later. If there is suitable transportation at the farm, return there and impress it and a driver and load on Private Y in such a way that with his revolver he can control the driver's actions on the way to Lowemont. In any case rejoin us as soon as you can on those heights (pointing) or beyond them."

On this, Captain B, would say to the messenger, "Go back with the Hospital Corps man and help him in any way you can. If Private Y cannot ride, you and the man now left with him rejoin this force with his horse as soon as possible."

Turning to the surgeon, Captain B would say: "If Private Y has to be left there, I will report the fact to the Colonel the next time I report my position and other information to him, and ask to have a wagon sent out to get the man."

Part III.

Special Situation.

At 10:35 A. M., while the bulk of Troops C and D is at Hancock Hill, a lieutenant came up to Capt. B and, in Lieut. A's presence, reported:

"Captain, I went to that house, (pointing) and tried to work the rural telephone for some information. I got hold of Lieut. R, Squadron Adjutant, on the wire. He says their two troops had a fight near 90 and have several killed and wounded, but drove off the enemy and are moving forward."

Required:

The action of the squadron surgeon, if any, with reasons therefore.

A Solution.

This information relating to wounded in the other part of the squadron is of interest to the squadron surgeon, but in no wise affect the situation so far as he is now concerned. He has not been ordered to take any action relative to the wounded in Troops A and B, and his original reason for accompanying Troops C and D still holds good. The fight at 90 has occurred some 9 miles away from his present position but was only about 3 from Lowemont. Even if he wished to go to the battle field and take charge, Captain B undoubtedly would not permit it. There would be no use for him to try and get into touch with the situation at 90 by the telephone, even if this were possible, which is probably not the case.

Lieutenant A hopes that the sergeant of the Hospital Corps who accompanied squadron headquarters has asked Major X to send word of the fight to Lowemont and apply to have surgical assistance sent out from there at once. Such assistance could be at 90 in half an hour.

He himself will do nothing.

Part IV.

Special Situation:

At 11:20 A. M., Capt. B discovered a hostile troop on the open ground southwest of Fort Leavenworth and

promptly attacked, mounted. The fight lasted less than 5 minutes, the enemy being defeated and driven south. As the two troops quickly reformed, Lieut. A noticed that there were 10 or 15 wounded, some of them hostile troopers, on the ground. Some were bruised from their horses being thrown over back on them and then being stepped on. Some had sabre wounds and several had pistol wounds. There were about 10 prisoners, some of whom were slightly wounded.

Capt. B hastily reformed his available force, left the wounded and prisoners behind under a small guard of a sergeant and 12 men and, saying nothing to Lieut. A, who was attending a sabre wound, galloped off in pursuit.

The garrison of Fort Leavenworth had been withdrawn at the beginning of hostilities and the post is under charge of a few civilian care-takers.

Required:

The action of Lieut. A, with reasons therefore.

(Assume that nothing is heard from Capt. B for a considerable time and that the guard over the prisoners is willing to comply with any suggestions Lieut. A may make.)

A Solution.

The number and character of wounded in this situation is quite sufficient to warrant the remaining behind of the squadron surgeon. This fact Captain B tacitly recognized when he galloped away without giving Lieut. A any orders. With a numerically inferior, defeated and disorganized enemy retreating rapidly before him, Captain B will naturally expect very few casualties in his own force and required no great amount of surgical assistance. The squadron surgeon likewise appreciates this, but to anticipate any casualties he orders Private V, Hospital Corps,

to jump on his horse, catch up and accompany the rear troop. He can properly do this as most of the present injured, while numerous, do not seem to be much hurt or to have injuries requiring any great amount of attention. Moreover, if Private X, sent to attend the injured man at the bridge north of 21, has not yet rejoined, he should shortly do so and help with the work, being expedited and directed to the scene of action by the sound of firing. In the meantime, with his orderly and perhaps a little assistance from some of the guard, the surgeon can handle the situation well enough. Lieutenant A is not concerned at Captain B's departure, for while he has no idea where the latter is going, the latter is sure to return and well knows where he himself can be found in the meantime, if necessary.

Lieutenant A's first action is to dress all wounds to prevent their infection. To this end, wounded able to walk themselves come to him, probably near where the sergeant is holding his prisoners, both wounded and unhurt, after disarming them. Any helpless wounded the surgeon, in the absence of any litters, probably attends where they lie.

Lieutenant A's second action is to start promptly for Lowemont, by the shortest route, all slightly wounded able to ride back their horses. They will ride together, under the supervision of one of their number designated to take charge of such detachment.

Lieutenant A's third action is to secure transportation by which helpless wounded, friend or foe, may be conveyed to Lowemont. He will use wagons, if they can be secured; otherwise he will improvise travois. To this end he asks the sergeant in charge of the guard to send in to Fort Leavenworth and impress three or four wagons, with teams and drivers, making the vehicles more comfortable

by placing a thick layer of hay in their beds. On the arrival of these wagons, the severely wounded are at once loaded into them, and, attended by Private X, Hospital Corps, and guarded by two troopers, they are started off at once for Lowemont. The slightly wounded of the enemy, who are able to walk back, are retained with the other prisoners for greater security.

Lieutenant A wishes to get himself and his command free from the encumbrance of wounded as soon as possible, so that he may be able to give service elsewhere should it be needed and that his force may not be hampered. Fortunately there have been no desperately wounded to consider; if there were, they have to be moved to a suitable building in Fort Leavenworth and turned over to the mercies of the local civilians until the regimental surgeon could provide for their care or removal. Otherwise, the tactical situation is at present such that the facilities afforded by Fort Leavenworth cannot properly be utilized in caring for wounded. The command, including its sanitary personnel, must continue its movement, and the sanitary situation and its responsibilities must be shifted from the squadron surgeon and the vicinity of Fort Leavenworth to the regimental surgeon and his greater facilities at Lowemont.

Lieutenant A, with his remaining sanitary personnel, remains with the guard and prisoners until Captain B and his command return, or orders are received directing independent action.

Comment.

This problem in its several phases, is intended to illustrate some of the great difficulties and succession of emergencies which medical officers on duty with the smaller cavalry commands are liable to encounter by reason of

the great mobility of the latter. Service with cavalry is one which tries out the efficiency of the Medical Department to the utmost. It is fortunately true that no high proportion of casualty is ordinarily liable to occur in this arm of the service, but those who are injured usually receive their injuries under conditions which unfavorably affect prompt treatment and removal. No such greater sanitary resources and advance preparations as may be quite practicable with infantry commands are ordinarily possible with scouting cavalry, the sanitary relief with which will, through necessity, naturally be always imperfect and often unsatisfactory. Nevertheless, much may be done for the relief of the injured if the cavalry surgeon be active, shrewd of judgment, quick of decision and fertile in improvisation and expedient.

The same remarks apply in large part to the sanitary service with mountain batteries.

Large mounted commands are usually well kept together and move slowly, seldom faster than a walk. For these reasons, good sanitary provision with such commands is practicable under ordinary conditions.

Friday - July 4

PART IV

SANITARY TACTICS WITH THE DETACHED REGIMENT

CHAPTER X.

Sanitary Dispositions With a Regiment Moving To Attack.

Problem No. 6.

(Based on 2 and 4 inch maps of Fort Leavenworth and vicinity.)

Situation:

A Blue force encamped about ten miles south of Leavenworth has sent out a regiment of infantry, under Colonel A, with its full allowance of sanitary personnel, sanitary supplies and ambulances, with orders to proceed to Lowemont and destroy Red supplies reported to be stored there under guard of about a battalion. No other Red force is reported east of the Big Stranger Creek or within eight miles of Lowemont on the north.

The Blue regiment, marching west on the Atchison Pike, has reached the point I. No wagons except those of the combat train accompany the command.

Required:

A suitable disposition of the sanitary service with the command at this time, with reasons therefor.

A Solution.

The tactical situation outlined implies a purpose to seek out and attack an enemy; the specific object of such purpose is in this case immaterial, so far as the sanitary service is concerned.

Conditions are such as to warrant the assumption of an advance guard formation by the column. While the composition of the advance guard of a regiment will vary with the tactical situation expected to be encountered, in

the present instance a satisfactory disposition of the combatant troops may be assumed to be about as follows:

A "mounted point" of one non-commissioned officer and four scouts.

Following the mounted scouts, at a distance of about a mile, would be the "point," composed of a non-commissioned officer and a squad.

Following the dismounted "point," at a distance of about 150 yards, would be the "advance party," consisting here, say, of Company M, less the "point" and "flank patrols." Of the latter, one composed of two squads under an officer will parallel the road on the north at a distance of about half a mile; the other, of one squad under a sergeant, will parallel the road on the south at a distance of about 500 yards.

Following the "advance party," at a distance of about 400 yards, comes the "support," consisting of the remainder of the 3rd Battalion.

Following the support, at an interval of about 600 yards, is the "main body," consisting of the 2nd and 1st Battalions.

Following the last battalion, without interval, might come the machine gun company.

The remainder of the mounted scouts patrol the parallel roads.

With such a tactical formation as is thus outlined, it is to be expected that when the enemy is encountered casualties will first occur at the head of the column. But it is not desirable to provide any great amount of sanitary relief to accompany the most advanced detachments of the column, for in such positions the sanitary personnel would be exposed to increased danger without any compensating advantage; since if the resistance encountered is so strong that the advance detachments are forced back, any

effort to attend to their wounded under such heavy fire would largely be futile, while if the resistance is so weak that the advance detachments are able to continue forward, or are merely halted, a continuation of the purpose to advance will soon cause the arrival of additional forces on the area of any casualty, bringing with them a sanitary personnel able to handle the local situation. And inasmuch as the numerical strength of these advance detachments, intended to observe rather than fight, is not large, it follows that no great number of casualties may be expected in them. Nevertheless, it is evidently very desirable that, as soon as may be, a sanitary force should be able to take charge of wounded from these advance detachments without undue delay.

But with an organization the size of a regiment, the factors of distance and time begin to assume importance in relation to the provision and distribution of sanitary relief. From the dismounted "point" to the rear of the "main body" is about a mile, and the column is composed of three battalions, each a tactical unit and therefore requiring provision in advance for its own sanitary needs on the firing line. A certain part of the sanitary service with the regiment also should be held out in reserve, to be used to supplement the efforts of the sanitary detachments with one or more battalions as need may require. As this sanitary reserve will not be used until conditions have actually developed which call for its employment, it will be kept back out of the way but in a position in close touch with the regiment.

Transportation for wounded in vehicles being one of the later functions of the sanitary service during and after action, it naturally follows that the ambulances will take a position further in the rear, where they will be available to pick up disabled from the column en route, fall out at

any desired point, or perform any other duty without interfering with the movement of the command.

The sanitary resources with the regiment are as follows:—

4 medical officers, mounted,
4 non-commissioned officers, Hospital Corps, mounted,
4 orderlies, Hospital Corps, mounted,
16 first aid and litter men, Hospital Corps,
1 pack mule, with supplies for regimental aid station,
3 ambulances, with drivers,
The regimental band, obtained for accessory assistance.

With these resources in mind, Colonel A, the regimental commander, on the recommendation of the regimental surgeon, would very likely have made their following assignments:

With Colonel A himself, who for facility of information and administration probably marches at the head of the support of the advance guard, will ride the regimental surgeon and his orderly. As they ride, the surgeon is familiarized by Colonel A with the latter's general plans and purposes.

With each battalion will march its usual sanitary quota of 1 medical officer, 1 orderly, 1 non-commissioned officer, and 4 privates of the Hospital Corps. The sanitary quotas of the 2nd and 1st Battalions will each march as units, with two litters, at the rear of their respective battalions. There is here no special need for the battalion surgeon to ride with his battalion commander, as both are subordinates at the time merely executing the plans for which higher authority, both line and medical, will be responsible. But before the battalions go under fire, each battalion surgeon will seek his battalion commander and endeavor to find out as much as possible regarding the purposes and plans of the latter in the special situation confronting them. The

surgeon of the last battalion of the column (here assumed as the 1st Battalion) will habitually march in the rear of his organization to be available in case professional services are required in connection with disabled falling out of the column during the advance or needing assistance in the ambulances following close in his rear.

In the 3rd Battalion, assumed as furnishing the vanguard, the battalion surgeon will direct his orderly, non-commissioned officer and two privates to march with him in the rear of the three companies forming the support of the advance guard, but he will very likely order his two remaining privates to accompany Company M, which as "point," "flankers" and "advance party," is a considerable distance in his front and may well be provided with some sanitary assistance.

Immediately following the machine gun company, which brings up the rear of the main body, will follow the regimental "aid station party," consisting of the senior non-commissioned officer of the Hospital Corps and 4 privates. Two of the latter carry a litter, while a third leads the pack mule which carries the reserve supplies of the regimental aid station. Colonel A has undoubtedly turned the band over to the regimental surgeon for temporary duty, inasmuch as he shortly anticipates an engagement. Carrying the company litters, they march in the rear of the "regimental aid party," to whose assistance they have been assigned.

Closely following the reinforced "aid station party" come the three ambulances, assigned to accompany the regiment on its detached service and driven by Hospital Corps men detailed for this purpose from an ambulance company belonging to the main force encamped south of Leavenworth.

The senior Hospital Corps non-commissioned officer

with the "aid station party," who is mounted, has been directed to take charge of these ambulances, and part of the time he rides at their rear to keep them closed up and see that they pick up any disabled authorized to be received. He is authorized, if the services of a surgeon are needed, to call for those of the battalion surgeon of the 1st Battalion, who is marching in the rear of his organization just ahead of the machine gun company, "aid station party" and ambulances.

With the above sanitary dispositions, if the command deploys for action, the battalion sanitary detachments will be at once available to accompany their organizations. The regimental surgeon would plan at first to remain with Colonel A, sending his orderly back to halt the "aid station party" and ambulances at a designated point or points approved by the commander. If, as action continues, reports to regimental headquarters should indicate that the battalion sanitary service anywhere needs reinforcing, he proposes, with the approval of the regimental commander, to bring up and locate his "aid station party" and band litter-men, taking direct charge of their work himself and perhaps summoning additional sanitary assistance from one or more of the battalions which have suffered least.

Monday - 14

CHAPTER XI.

Sanitary Dispositions With a Regiment in Rear Guard Formation.

Problem No. 7.

(Based on 2 and 4 inch maps of Fort Leavenworth and vicinity.)

General Situation:

Continuation of the preceding problem (No. 6.)

Special Situation:

On reaching the point I, Colonel A, marching at the head of the support, sees hostile infantry halted on the road and hill near 80. About this time a scout from the hill northwest rides up and reports that this hostile infantry seems to be about two regiments strong; and a country doctor who comes driving down the road says he has just passed through Lowemont and saw not only the infantry garrison which had been stationed there, but four or five hundred Red cavalrymen who had just ridden into the town.

On this information, Colonel A halts the column, faces its organizations about and gives orders for a retreat toward Leavenworth.

Required:

Suitable dispositions of the regimental sanitary service on the march.

A Solution.

The situation outlined indicates liability to sustain an attack at any time from a pursuing enemy, and implies necessity for a strong rear guard.

Under such assumption, a satisfactory formation for

the combatant troops would be about the reverse of that in the preceding problem, or as follows:

1st and 2nd Battalions as main body.

3rd Battalion to form rear guard and divided as follows: Companies I and K as reserve; Companies L and M as support.

The last provides the rear party, rear point and flankers.

The machine gun company probably is now sent to form part of the rear guard.

In any formation the matter of probable loss largely determines the sanitary distribution. It is evident that during a retreat such loss as occurs will practically fall on the rear guard, and to the greatest proportionate extent on that portion furthest to the rear and most exposed to hostile fire. The time factor is here also of much importance, for it is clear that with retreating troops the provision of first aid must be prompt if the wounded are to receive it at all. Moreover, it is not the purpose to abandon to the enemy any of the disabled whom it may be possible to remove, and it therefore follows that sufficient provision for transportation must be quickly available. Finally, distance to the main body and a retreating movement combine to require that the rear guard shall be reasonably self sufficient in a sanitary sense.

All these features of concentration of wounded, short time limit and necessity for immediate removal to a distance make the sanitary problem in question more difficult than with an advancing force, where the two last factors, at least, are not ordinarily of such paramount importance. To partially offset this, however, a rear guard formation implies a desire to avoid contact with the enemy or at least a reduction of casualties to the least possible number. The casualties, as previously mentioned, while relatively hard to care for, will probably not be numerous.

Colonel A decides that a somewhat larger proportion of his sanitary personnel should march in the moving area of greater probable casualty. But he will not strip the rest of his command of sufficient sanitary assistance to meet its own possible needs if unexpectedly called into action.

To assist in the transportation, he directs that the ammunition wagons shall receive and transport the disabled as far as possible.

Colonel A briefly consults with his regimental surgeon, upon which the following assignments are made:

(1) To precede the main body without interval—

1 sergeant, 1st class, Hospital Corps, in charge;

2 Hospital Corps men, one leading pack mule carrying aid station supplies;

The band, less 4 litter squads, with litters;

2 ambulances, in reserve.

This sanitary reserve is under immediate control of the regimental surgeon, who, with his orderly, may reinforce and organize an aid and ambulance station from it if need requires.

(2) To the 1st Battalion, and immediately preceding it on the march, its usual sanitary quota, consisting of—

1 junior medical officer, mounted;

1 non-commissioned officer, Hospital Corps, mounted;

1 orderly, Hospital Corps, mounted;

4 first aid and litter men, Hospital Corps.

(3) To the 2nd Battalion, its regular sanitary quota, as above specified, to immediately precede the battalion.

(4) To the 3rd Battalion (which now becomes the rear guard) its regular sanitary quota, as above specified, reinforced by two additional Hospital Corps men and 8 bandsmen. One ambulance will also report to this battalion.

The surgeon of the 3rd Battalion, on the approval of his commander, distributes the above as follows:

(a) The ambulance to immediately precede the reserve. It will pick up disabled from the 1st and 2nd Battalions and will pull aside and halt if required to await the bringing up of wounded from the rear guard. If filled, it will be sent ahead and one of the reserve ambulances will be summoned to halt or drop back and take its place.

(b) Following the ambulance, and preceding the rear guard reserve, will come:

1 non-commissioned officer, Hospital Corps, mounted;

2 first aid and litter men, Hospital Corps;

8 Bandsmen, with company litters.

(c) Immediately preceding the support, will march:

1 medical officer, mounted;

1 orderly, Hospital Corps, mounted;

4 first aid and littermen, Hospital Corps.

(5) To ride with Colonel A himself, who probably marches at the rear of the main body for facility of communication and administration:

The regimental surgeon;

The regimental surgeon's orderly, Hospital Corps.

Comment.

The distance factor is of such relative unimportance in respect to the sanitary service with battalions that it would make little practical difference whether the sanitary personel of the 1st and 2nd Battalions faced about on the road and retired in advance of their organizations or remained at the halt and fell into column as the rear of their retiring organizations passed by. These organizations will scarcely come under fire unless turned to repel an enemy; in the latter case the sanitary detachment would certainly

have to pass to the tactical rear and this position might as well be assumed at the outset. The reinforced personnel with the 3rd Battalion is so disposed as at once to assist stragglers from the front and wounded from the rear.

The regimental "aid station party," reserve bandsmen and ambulances will probably not be needed during a rear guard action. Only if the troops are forced to turn and make a determined stand will they probably be required, in which case their position at the head of the column places them at once in good position in the rear of the new battle line.

CHAPTER XII.

The Sanitary Service in the Forced Occupancy of a Defensive Position by a Regiment.

Problem No. 8.

(Based on 4 inch map of Fort Leavenworth and vicinity.)

General Situation:

This problem is a continuation of the two preceding (Nos. 6 and 7.)

Special Situation:

On being hard pressed, the Blue regiment takes up a defensive position along the line Atchison Hill—Government Hill, and after a severe action lasting an hour, in which all the Blue reserves are engaged, the Red force is repulsed.

The disposition of the Blue forces at the end of the fight is as follows:

1st Battalion, from a point just north of the Atchison Pike cut, west following the contour line on the crest of the ridge and south along the edge of the timber.

2nd Battalion, from the right of the 1st Battalion along the contour line on the crest of the ridge nearly to the nose on the northwest aspect of Atchison Hill.

3rd Battalion, Company K to extend to the right of the 2nd Battalion; Companies L and M on the line northeast from Company K to the railroad cut; Company I to act as flank guard on the western slope of Southwest Hill.

Required:

The distribution of the sanitary personnel of the Blue regiment, and the approximate location of its sanitary relief at this time.

A Solution.

In the situation in question, the regimental surgeon has, of course, been told in advance by Colonel A approximately the lines which the latter proposes to try and hold. A glance at the map shows that no matter whence the direction of fire or attack, the head of the ravine a couple of hundred yards northeast of 16 offers the facilities of excellent protection against the fire of small arms, nearness to all parts of the main line, opportunities for evacuation under cover during the fight, and, later, fairly close approach by road for ambulances. The map also indicates the presence of water and timber. The colonel agrees with the tentative selection of this point by the surgeon as the main position of sanitary relief.

The regimental aid station has therefore been established at this point as the attack developed, battalion commanders and surgeons have been so notified, and it is found there at the end of the fight. Its reserve of supplies was brought in on the pack mule. Its personnel would here consist of the regimental surgeon, his orderly, and a couple of privates of the Hospital Corps. To supplement this, the sanitary quota of the 2nd Battalion, whose line is just above on the ridge, and needs no special collecting point of its own, is called in. It is also reinforced by the band, less other assignments of the latter, which brings the company litters and is especially employed in collection work.

A non-commissioned officer and two privates, Hospital Corps, have remained with the ambulances and ammunition wagons, which would have been halted at Atchison Cross, and have been caring for wounded working to that point during the fight, since all lines of evacuation converge here. At the conclusion of the action, they move back to the aid station; and the vehicles load, some near 16 and some probably near 12, perhaps working north of 10.

Other sanitary distributions are about as follows:

With Company I, the flank guard, which is little liable to casualty, one private Hospital Corps and two bandsmen, with instructions to move out wounded by the 18—14 road. Wounded would probably be told to collect at some sheltered point near 20.

With the 1st Battalion, its usual sanitary quota reinforced by six litter bearers from the band. Its wounded northeast of the road cut would go direct to the regimental aid station in the ravine near; the cut otherwise seriously interfering with the use of this station by the rest of the battalion. The collecting point for the part of the battalion southeast of the road would therefore probably be found at some sheltered place in the timber a couple of hundred yards northwest of 16; but if fire came from the west the battalion surgeon would probably move to just southeast of 16.

The sanitary needs of the 2nd Battalion are directly provided for by the regimental aid station, reinforced as already outlined.

The 3rd Battalion (less Company I) has with it one medical officer, one orderly and three privates Hospital Corps, and is reinforced by six litter bearers from the band. This personnel operates from the shelter of the nose and timber on the northeast aspect of Atchison Hill.

Battalion surgeons keep battalion commanders and the regimental surgeon informed as to their positions.

All promptly evacuate the wounded able to walk by the most practicable route to Atchison Cross, en route to the rear.

As soon as the wheeled transportation comes up after action is over, many wounded will be removed directly from the firing line to the loading points to save time and labor.

Comment.

In the sanitary dispositions in the foregoing problem, the same general principles would apply, so far as the regiment is concerned, whether it was operating independently, as assumed in this case, or was one of many such tactical units forming a larger force. But in a firing line composed of many regiments, while the same general principles would govern the special sanitary dispositions within them, the methods of their application would necessarily have to vary with the dissimilar tactical situations with which such component regiments would in all probability be confronted. As the location and nature of the sanitary relief with battalions varies with local conditions, so too with respect to the regimental aid stations, which in a general way are intended to form a second line of sanitary assistance. Whether these aid stations are to be located near, far, or behind one or another battalion only the terrain and tactical situation can determine.

In the present problem, the practicability and desirability of at times absorbing part or all of the sanitary personnel of a battalion into a regimental aid station is illustrated.

CHAPTER XIII.

Evacuation of Wounded From the Regimental Battle Line.

Problem No. 9.

(Based on 4 inch map of Fort Leavenworth and vicinity.)

General Situation:

This problem is a continuation of the three preceding (Nos. 6, 7 and 8.)

Special Situation:

The commander of the Blue regiment, Colonel A, decides to endeavor to withdraw his regiment and escape across the Terminal bridge to friendly territory before the enemy is reinforced and renews the attack.

His battalion commanders estimate their casualty losses as follows: In the 1st Battalion, 10 per cent; 2nd Battalion, 20 per cent; 3rd Battalion, 6 per cent.

Colonel A notifies his regimental surgeon that the retreat will be resumed within about half an hour and the rear guard will withdraw in about an hour.

Required:

The number and character of Blue wounded which could probably be evacuated across the Terminal bridge under the existing conditions, assuming that the regimental combat train and ambulances furnished the only wheeled transportation available.

(Note.—Under actual conditions, assumption that Colonel A would have to limit himself to the above transportation would probably be unwarranted.)

A Solution.

The factors to consider in this instance are:

(a) The factor of the time limit;

(b) The total number of casualties;

(c) The general classification of battle casualties in relation to transportation, as applied to the present situation;

(d) The nature of the terrain and disposition of the wounded, as influencing their collection;

(e) The amount and capacity of the transportation available;

(f) The distance for transportation, considering also roads, weather, etc.

After full consideration of the above factors, the solution of the present problem resolves itself into a matter of simple mathematics.

(a) The time factor is paramount. All those who cannot be started for the rear within an hour after the action ceases must be abandoned to the enemy. It also determines the fact that all dressings must be of a hasty and temporary character and that no surgical work taking any considerable time can practically be attempted.

(b) The average loss in the three battalions (455 officers and men each) figures out as twelve per cent., or a total of one hundred and sixty-four casualties; no losses being reported from the headquarters, band or sanitary troops.

(c) The general classification of battle casualties in relation to transportation, but to be regarded as suggestive rather than absolute, is as follows:

Killed	20 per cent
Severely wounded, non-transportable	8 per cent
Slightly wounded, able to march to advance base	12 per cent
Total not ordinarily requiring transportation	40 per cent

Wounded able to walk to dressing station and field hospital .....28 per cent
Requiring transportation sitting up .....20 per cent
Requiring transportation recumbent .....12 per cent

Total that may require transportation .....60 per cent

The above general figures, applied to the special situation in question, give the following gross numbers:

Killed 33
Severely wounded, non-transportable 13
Slightly wounded, able to march to advance base.....20

Total not here requiring transportation 66
Wounded able to walk to dressing station and field hospital 46
(NOTE.—Assumption in these figures is that a field hospital is located beyond artillery fire, or say a distance of about 3 miles.)
Wounded requiring transportation recumbent 20
Wounded requiring transportation sitting up 33

(d) The lines are extended, covering (less Co. I, assumed to have suffered no casualty) a frontage of about 1500 yards. The average litter carriage to points readily approachable by wheeled vehicles, as 16 and the 12-10 road, approximates four hundred yards. The ground is rough, the slopes are steep and the area is largely wooded—all of which features tend to make collection difficult and transportation slow.

(e) We may assume that the regiment has with it a total of twenty litters, allowing two for loss or breakage and disregarding the four carried by each ambulance for use as cots for recumbent wounded en route. It appears that a total of fifty-three wounded require litter transportation an average of four hundred yards. Such a round trip, with dressing, will take more than half an hour. A few only of this class of helpless wounded could have been removed during the fight. As the combatant

forces are to be withdrawn as rapidly as possible, they will be able to render but little, if any, assistance in policing the battlefield.

There are three ambulances present, of which each can carry four recumbent and one sitting up, or nine sitting up, giving a total accommodation of twelve recumbent with three sitting up, or of twenty-seven sitting up.

There are six ammunition wagons, which, from the character of the situation, would assuredly be empty at this time. They would have been held for sanitary service, as the tactical situation rather operates against the need of, as well as the ability to supply, more ammunition before a place of safety is reached by the regiment. Each might carry three recumbent and one sitting up with the driver, or by crowding for a short haul over good roads, six sitting up. This allows for the wagon evacuation at one trip of eighteen recumbent and six sitting up, or of thirty-six sitting up.

(f) The minimum distance for transportation to a safe point, i. e., across the Terminal bridge, is about four miles. The roads are good, but the distance is too great to permit of more than one trip by the vehicle within the time allowed.

From the above classification of casualties, it is evident that about thirty-three killed, and thirteen desperately wounded physically unfit to be transported, will have to be left on the field under any circumstances. There have been twenty slightly wounded capable of walking many miles. This latter class was able to apply early for treatment, required only brief attention and was promptly started for the Terminal bridge, reaching that point with—or in some instances earlier than—the main body.

There are forty-six wounded who would ordinarily be classed as "able to walk to Dressing Station and Field

Hospital," or a distance of some three miles or so, largely variable on account of conditions of road, weather, etc. For the more seriously wounded third of these, as is seen later, wagon transportation will probably be available. The far side of the Terminal bridge is about four miles away, but the extra distance is perhaps compensated for by excellent roads and practically steady down grade. Practically all of these wounded would probably be able to make this distance, under the stimulus of probable early pursuit by the enemy, and the incentive of assured safety only a relatively short distance away. They will be encouraged to make the attempt, the sanitary troops and bandsmen giving them assistance by litter and in other ways as they overtake them with the retreating rear guard. The ambulances, after discharging their loads, may also return part of the way to pick up stragglers and help in this connection. The consequences of failure to complete the journey, from the military standpoint in respect to capture, are no worse than if these wounded had made no effort to leave the field. To a few individuals, however such efforts to get away might be physically detrimental.

There remain fifty-three wounded who require litter transportation to the aid station and the vehicles. The very great majority of these cannot be moved from where they were hit until the action ceases. A very considerable number probably had not been previously dressed. Dressing of wounds, especially those with broken bones, takes time. A very much greater time is necessary to find, collect and withdraw the wounded under the local conditions here prevailing. As the average distance for litter carriage is about 400 yards and the terrain quite unfavorable for collecting and litter work, it is therefore very probable that at least a third of the wounded unable to walk could not be brought in to points for loading ve-

hicles in the short time limit. If we assume thirty-two as the total collected of this class, the three ambulances will provide for the removal further to the rear of twelve recumbent and three sitting, leaving seventeen sitting cases only to be provided for in ammunition wagons having a capacity of thirty-six. The severely wounded thus left behind are not evacuated, merely because they cannot reach the wagons within the short period prior to the necessary retirement of the latter. The nineteen remaining wagon accommodations would therefore be available for about forty per cent of the fairly severely wounded who could otherwise be required to attempt to walk.

Colonel A would probably abandon the field, leaving his thirty-three dead, twenty-one severely wounded uncollected and thirteen desperately wounded men unfit to stand transportation. The remainder of the wounded, about 100 in number, including all those most liable to again be fit for duty, are safely withdrawn. Under the assumed conditions and to comply with requirements of the Hague Conference, a junior medical officer, a sergeant and four privates, Hospital Corps, would probably be directed by Colonel A to remain to look after the needs of the wounded left on the field and to get into communication with the enemy with a view to the prompt assumption of their sanitary charge by the latter.

Comment.

The controlling factors in this problem are that of the time limit and its present complement, the amount of available transportation. Both, separately and combined, create disabilities under which, with any considerable proportion of wounded, the sanitary service will always labor in a humanitarian sense if not in a tactical one. Even if military necessity does not curtail the care and removal of

wounded, the sanitary service nevertheless will in every case be stimulated to its maximum activity by the desire to relieve suffering as quickly as possible. Even if a field is victoriously occupied and the sanitary troops can work unmolested, some delay in attending to all the wounded cannot be avoided. But if the time limit and available transportation are unduly small for the task to be accomplished, a variable and proportionate number of wounded will have to remain unsuccored and be abandoned. The sanitary service can give no assurance that all or any wounded will be reached and attended to without delay; it merely proposes to do its best to those ends under such limitations as a variable tactical situation may create.

The valuable sanitary service which bandsmen may render on and near the firing line is here emphasized. At present, bands are too little considered as an auxiliary sanitary asset in battle and are too frequently disregarded in respect to the careful sanitary training which they should habitually receive.

PART V

SANITARY TACTICS WITH THE REENFORCED BRIGADE

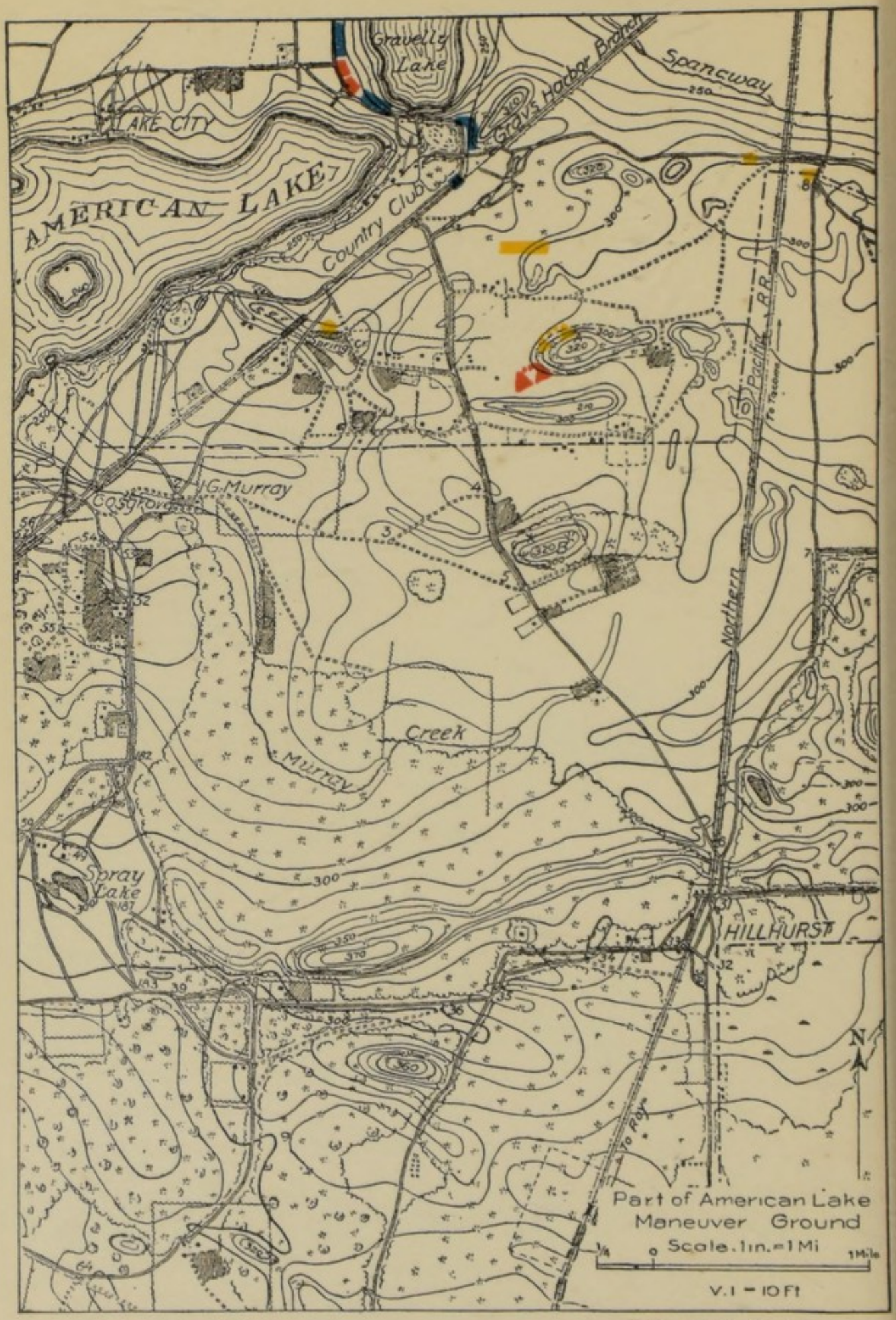


Plate Map No. 1
Blue forces ▬ or ●

Time 7:00 A. M.
Hostile forces ▲...▲ or ▲

Roy to Mile Spring

CHAPTER XIV.

Sanitary Dispositions in the Brigade Column and Its Advance Guard.

Problem No. 10, Blue.

(Based on Plate Map No. 1, American Lake, Wash., Maneuver grounds.)

General Situation:

A Blue force, based on Tacoma, 12 miles to the north, is moving against a Red force, based on Roy, 10 miles south, and supposed to be of about equal strength. The Red force is reported as having arrived last night at the woods northeast of Murray Creek and to have bivouacked there. The Blue cavalry sent ahead, seized the pass between American and Gravelly Lakes yesterday afternoon, driving out, without action, a small force of Red cavalry which had been destroying communications to the north.

The Blue force consists of three regiments of infantry, one squadron of cavalry, two batteries of artillery, Ambulance Company No. 1, and the 1st Field Hospital. All other transportation except combat trains is absent.

The Northern Pacific R. R. between Tacoma and Roy is undisturbed, and with plenty of rolling stock. The Grays Harbor Branch R. R. and the electric railroad running south of American Lake were temporarily disabled by Red cavalry yesterday. The electric railroad running from Tacoma along the north shore of American Lake was likewise disabled for a distance of two miles north of the lake.

The weather is fair and cool and the roads good.

Special Situation:

The time is 7 A. M.

The cavalry has just come in contact with hostile cavalry on the northeast aspect of Hill A, and a few moments later are fired upon by artillery from the same direction. About this time the cavalry patrol of ½ platoon on the left flank encounters and attacks a few Red cavalry near 8. The combatant forces are moving with positions shown on Plate Map No. 1, and in the following order:—

Advance Cavalry:

1st Squadron, 1st Cavalry.

Advance Guard:

1st Infantry (less 3rd Bn.)

Main Body:

3rd Battalion, 1st Infantry.
Battery A, 1st Field Artillery.
Battery B, 1st Field Artillery.
2d Infantry.
3rd Infantry (Not yet shown on map).

Required:

(1) The probable position of the Chief Surgeon.

(2) The disposition of the sanitary personnel and supplies of the 1st Infantry within that regiment, with reasons therefor.

(3) The disposition of the personnel and transportation of Ambulance Company No. 1 in respect to the entire command, and within itself, with reasons therefor.

(1) The disposition of the 1st Field Hospital in respect to the column, and within itself, with reasons therefor.

A Solution.

First Requirement:—

The office of Chief Surgeon is not officially provided for in the organization of a brigade forming part of a

larger force; but where such a tactical unit is serving independently, and particularly if the infantry is reinforced by other branches of the service, including unattached sanitary organizations, some central directing agent to coordinate the relief work is necessarily attached to the staff of the commander. Field Service Regulations provide for such staff. The medical officer directed to fill this higher staff position may be detailed from the sanitary personnel of the force itself or appointed from an outside source.

The position of this acting Chief Surgeon in the field is habitually with the staff of the Brigade Commander, wherever the latter may happen to be. This for the better securing of information, both tactical and sanitary; the better preparation of sanitary plans practicable in relation to appreciated tactical limitations and necessities; and for the better accomplishment of the sanitary measures which may appear to be required and will frequently have relation to matters outside the immediate jurisdiction of the sanitary service.

Under present conditions, the Brigade Commander and his staff would very likely be riding at the head of the main body, a position at once favorable for the receipt of information and the direction of the command as a whole.

Second Requirement:—

The advance guard formation of a brigade differs in no important respect from that of an infantry regiment, as already detailed in Problem No. 6, except in the addition of another reinforcing body known as the "reserve" and in the fact that all the components of the vanguard are proportionately stronger.

The force in advance of the "reserve" would here be composed of the 1st Battalion, complete; the sanitary distribution within this battalion being more or less identical

with that described for the advance guard of a regiment in the problem above mentioned, except that the advance guard commander would very likely ride with the "reserve."

The sanitary disposition within the 2d Battalion would be practically identical with that described for the 2d Battalion in the same foregoing problem, except that the regimental surgeon, followed by his orderly, will ride with his colonel, as above mentioned, at the head of the reserve.

The sanitary disposition within the 3d Battalion is identical with that described for the 1st Battalion in Problem No. 6.

The disposition in the regimental column of the regimental "aid station party," with the pack mule, is the same as described in the same problem.

There are now no ambulances to be considered with the regiment; these having been ordered to rejoin Ambulance Company No. 1 to which they belong in preparation for action.

The regimental band may march anywhere in the column. It is quite possible that the colonel, 1st Infantry, will not turn over its services to the regimental surgeon until his regiment starts to deploy for action. If the latter is the case, the company litters of the regiment will be carried until that time on the battalion ammunition wagons.

The reasons governing the distribution of sanitary personnel and supplies in the regimental column, as detailed in Problem No. 6, apply here with equal force.

Third Requirement:

Ambulance Company No. 1, as a unit, will follow the 3d Infantry at a few yards interval.

There is no need to place it, either in whole or in part, further to the front, as the factor of distance—with the co-ordinating one of time—does not require it. An am-

bulance company does not go into action until the command is well engaged; and not then until the sanitary personnel with the battalions and at the aid stations of the regiments engaged have demonstrated and reported their inability properly to handle the number of casualties which have occurred.

The distance from Ambulance Company No. 1 in this column to the "reserve" of the advance guard, as determined by road space, is as follows:

	YARDS
3d Infantry	880
2d Infantry	880
Btry. A. 1st Field Artillery	320
Btry. B, 1st Field Artillery	320
3d Bn., 1st Infantry	210
Brigade Headquarters	20
	2630
Add 10 per cent for elongation	263
	2893
Add interval between main body and reserve of advance guard	1000
Total, say	4000

This distance of 4000 yards, or about 2¼ miles, would be traversed with route marching in about 45 minutes; or a litter bearer section, either on an unobstructed road or traversing the level, open country shown on the map, could be hurried forward to the advance guard in a little over half an hour.

But engagements by large forces are deliberate rather than hasty; it takes times for such troops to deploy, hostile fire to become effective and regimental sanitary services to find themselves becoming overwhelmed by an aggregation of wounded. In any probable situation, therefore, an ambulance company personnel at the rear of a brigade can

arrive at a point of casuality about as soon as its services would be required.

Within itself, Ambulance Company No. 1 would march about as follows:

(1) The company commander, and his trumpeter, The latter will carry an orderly pouch.

(2) The litter bearer section, composed of 1 medical officer; 5 sergeants; 1 orderly; and 40 Hospital Corps privates, with 20 litters.

(3) The dressing station section, composed of 2 medical officers; 1 sergeant; 1st class; 1 sergeant; 10 privates, of whom 2 are orderlies, 1 is cook and 4 lead the pack-mules carrying dressing-station supplies; 1 dressing-station supply wagon and driver.

(4) The ambulance section, composed of 1 medical officer; 1 sergeant, 1st class; 1 sergeant; 12 privates as drivers; 3 privates as musician (carrying an orderly punch), saddler and farrier; 12 ambulances with mules.

This disposition of the component units of an ambulance company, with their tentative organization as given above, is based on cogent reasons, as follows:

The personnel of the ambulance section is alone a fixed quantity. It only suffices to drive and care for the animals and vehicles and direct their work.

The personnel of the litter-bearer and dressing-station sections are not fixed. At the outset of their operations, relief work on the field and collection and withdrawal of wounded is the first necessity; hence every available man will be assigned to the litter bearer section. At this early period, the dressing station section personnel, as outlined here, is abundantly large enough to establish its station and attend to the wounded arriving there.

But the influx of wounded, when the litter bearer section gets fairly at work, will ultimately prove more rapid

than their dressing and disposal by the original personnel of the dressing station section. Hence, as the abilities of the personnel of the latter begin to be overtaxed, the ambulance company commander will begin to detach members of the original litter-bearer section therefrom and assign them to assist in caring for the wounded already at the dressing station. When the field is largely cleared, or if victory or other reason permits assistance by the combatant troops in the transportation of the wounded, it may be that the litter-bearer section may dwindle to a few squads doing first aid work only on the field, or this section may conceivably be entirely absorbed in the process of temporarily reinforcing the dressing station while the ambulances come up and begin the evacuation of the wounded to the rear. This quality of elasticity of the organization of the ambulance company, to better meet the needs of actual service, is highly important and must not be overlooked.

The other two wagons belonging to Ambulance Company No. 1 and not mentioned above, carry rations, forage, baggage and supplies. As action was expected, they remained with the Field Train of the command, to which they belong.

The reasons for this formation of Ambulance Company No. 1 on the march are as follows:

If the ambulance company is ordered into operation it would ordinarily proceed as a unit to the furthest point near the zone of casualty which it can reach without being unduly exposed to fire.

On reaching such a point, the ambulance section, which forms a large mark liable to be struck through overshots, or through intent as a result of its nature being unapparent to the enemy, is in position to be detached and halted to await further orders. If the fire is very heavy,

the dressing station wagon is also halted; otherwise it goes forward with the dressing station section of which it is a part and for whose professional needs it conveys more abundant and elaborate facilities and supplies.

On reaching the most suitable point at which to undertake its work, the dressing station section, with its pack mules—and its wagon, if the latter be present—is detached, falls out and establishes its station.

The litter bearer section, now alone remaining, continues on to get into touch with the regimental sanitary service and to succor, collect and remove the wounded from the zone between regimental relief points and the dressing station.

The above method of bringing up, locating and utilizing an ambulance company of course varies with the tactical situation and terrain.

Fourth Requirement:

The 1st Field Hospital follows the column, near enough to it to be readily available when required—far enough from it not to interfere in any way with the troops. Tactical considerations absolutely control the length of this interval and make it variable. Even if it follows four or five miles in the rear of the column, it would ordinarily be able to arrive when needed about as soon as required. In the present instance, it might march about 500 yards in the rear of the Ambulance Company, thus bringing up the brigade column. Ordinarily with no expectation of conflict it would march with the trains.

Field hospitals are practically never required until action has considerably progressed and the number and location of casualties is well determined or can be fairly anticipated. This, in forces of a size warranting the use of field hospitals, might take several hours. In its pres-

ent position, the 1st Field Hospital is about 2½ miles from the advance guard and can readily be brought up within an hour if required.

A field hospital is normally composed of two parts on the march, and proceeds about as follows:

(1) The field hospital commander, and his trumpeter, the latter carrying an orderly pouch.

(2) The personnel section, composed of 3 medical officers; 2 sergeants, 1st class; 5 sergeants; 3 orderlies; and 34 privates.

(3) The transportation and supply section, composed of 1 medical officer; 1 sergeant, 1st class; 1 sergeant; 1 orderly; 9 privates, of whom 8 are drivers and 1 is cook; 8 wagons with sanitary equipment and supplies.

Pending the establishment of the field hospital as a unit, its personnel section may be detached for sanitary work on the field like the personnel section of an ambulance company, litters being either carried by the marching command or being secured from the wagons when their need arises. At such times the wagon section would ordinarily be detached and remain behind awaiting orders.

CHAPTER XV.

Sanitary Tactics of an Advance Guard Rencounter. Problem No. 11, Blue.

(Based on Plate Map No. 2.)

General Situation:

Same as in Problem No. 10, Blue.

Special Situation:

The time is 7:30 A. M.

The main cavalry advance was checked by well directed rifle and artillery fire until the two battalions of the advance guard came up in support and deployed on the right. The hostile force then disappeared, a few Red cavalry being shortly afterward observed at the edge of the woods northeast of Hill B. The deployed forces are now reassembling. The positions of the combatant troops are shown on Map No. 2.

About 50 Blue casualties have occurred, mostly between the unimproved road and Hill A. The enemy did not seem to have suffered severely and left behind him but half a dozen dead and dying.

Required:

The plans, orders and action, if any, with reasons therefor, based on the above Blue situation, of the:

(1) Cavalry surgeon.
(2) Regimental surgeon, 1st Infantry.
(3) Chief Surgeon.

A Solution.

First Requirement:

The cavalry surgeon properly has no plans at this time for either the immediate or later care of the wounded.

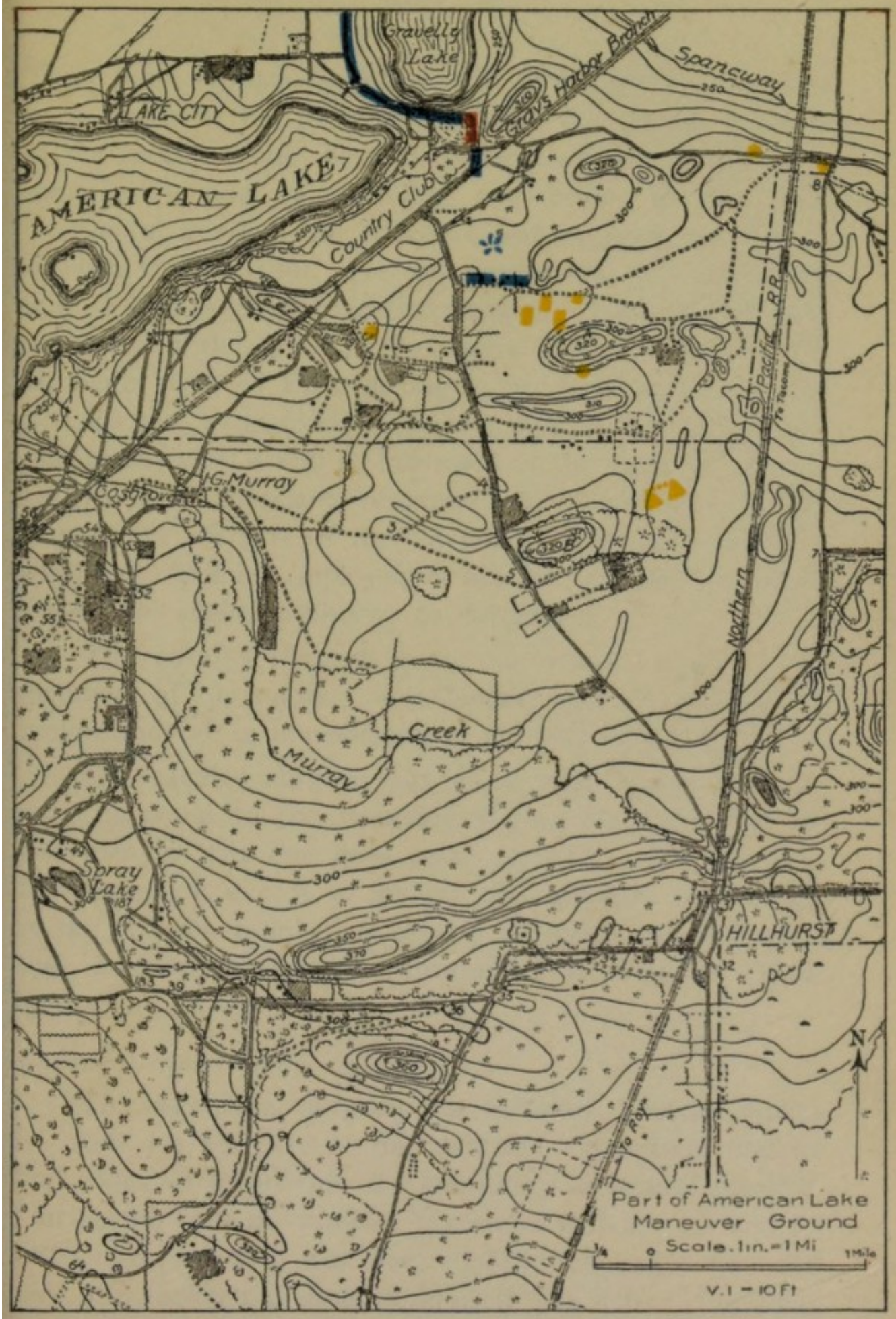


Plate Map No. 2 *Time 7:30 A. M.*

Red forces ▬ *or* ● *Blue headquarters* ✱ *Hostile forces* ▲..▲ *or* ▲

These must be made by others. In such a general situation as is given in the previous problem, the proper position of the cavalry would be well to the front and flanks. His squadron is now reassembling, presumably to carry out its general mission and function, and he must accompany it when it moves out. He can remain and give assistance only so long as his organization remains. He is not officially concerned with regard to the future care of the wounded, although many of them belong to his own squadron. He perhaps saw Brigade Headquarters ride on the field, knows that in any case it will be informed of the fight, and knows further that abundant resources are available with the brigade for the care of the wounded. How these sanitary resources shall be employed is not his to consider, but a matter for higher authority to determine.

The cavalry surgeon gives no orders except to the members of his sanitary detachment, who are directed to mount and fall in immediately at the rear of the squadron.

The cavalry surgeon has given what surgical assistance he could to the wounded during the fight, but his activities in that line now cease abruptly. He takes no further action except to inform his squadron commander of the probable number of cavalry wounded and to request that this information be transmitted to Brigade Headquarters.

Second Requirement:

The regimental surgeon, 1st Infantry, likewise makes no plans for the care of the wounded, other than that he will endeavor to provide any temporary assistance possible. During the fight the sanitary personnel with the 1st and 2d Battalions have done what they could to relieve the wounded —as the regimental surgeon himself has done. But their ability to assist as detachments is coming to an end, as their

battalions are now reforming and will shortly resume the advance after the cavalry has got well ahead. The sanitary personnel must accompany their commands, which, still composing the advance guard, will again be the first to come under any hostile fire. And, from what the colonel of the 1st Infantry has told him of the probable position of the enemy, the regimental surgeon believes that this will not be long deferred. But the surgeons, their orderlies and the non-commissioned officers of the regimental sanitary detachment are mounted, and under present conditions can move far more rapidly than the foot troops to which they are attached. The map, terrain and information indicate to the regimental surgeon that the advance guard would probably not come under fire for at least twenty minutes after it resumed the advance.

Sending the dismounted sanitary privates to resume their former position in relation to their combatant units, as outlined in Problem No. 10, he will therefore direct the surgeon, orderly and sergeant attached to the 1st Battalion to remain and assist with the wounded for about fifteen minutes and then gallop on to their organization.

He will give similar directions regarding the surgeon, orderly and sergeant of the 2d Battalion, except that they are to remain and continue their work for about twenty minutes.

By a headquarters orderly, he will send an "urgent" verbal message to the surgeon of the 3d Battalion, with the main body, for the latter officer, his orderly and sergeant to come up as rapidly as possible. The sergeant, 1st class, with the aid station party is similarly summoned. But he will not summon any of the dismounted sanitary personnel since they could not move much faster than will the main column and would scarcely reach the field and begin work before their organizations would be passing by and they

would have to rejoin to keep up. But the mounted personnel can reach the field in ten minutes, the 3rd Battalion will be passing by in twenty, and the regimental surgeon, assisted by this last personnel, can continue the relief work for nearly half an hour longer before having to gallop with them after the regiment and battalion; by which latter time higher authority should have been able to make other provision for its continuance and the disposal of the wounded. In the meantime, the regimental surgeon can and will provide, of his own initiative, sanitary assistance equivalent to an hour's work in wound dressing by two surgeons and four trained enlisted men of the Hospital Corps. As they will attempt nothing but the rapid protection of wounds against infection, they can accomplish much to this end. In the meantime, sanitary service among the unwounded members of the 1st Infantry will not in any way suffer or be jeopardized.

He briefly outlines the above plan to his colonel, and receives the approval of the latter.

His orders are verbal and merely such as put the above plan into action.

His action is such as is contemplated in the above plan. In addition, he requests his colonel to inform Brigade Headquarters of the probable number of wounded in the 1st Infantry, and of the fact that several surgeons of the regiment will be able to remain with the wounded for about three quarters of an hour. If the Chief Surgeon rides with Brigade Headquarters to the field, as would probably be the case, the regimental surgeon will meet and give him the same information which he has just given the colonel of the 1st Infantry.

Third Regiment:

The Chief Surgeon probably rides rapidly with Brigade Headquarters to the field, or he may go alone. In such

case he sees conditions for himself and briefly confers with the regimental surgeon, 1st Infantry. But even if he does not proceed to the field at once, he is informed as to the general sanitary situation thereon, through the reports which should be promptly sent to the Brigade Commander by the commanders of the organizations engaged. He is thereby able to promptly take the necessary action.

It is quite evident to him that the sanitary personnel of the 1st Infantry can only temporarily be used to meet the situation and must shortly rejoin their own organization. To aid them in their work, he at once sends his orderly on the gallop with verbal orders to the regimental surgeons of the 2nd and 3rd Infantry to each send two medical officers with their orderlies and two noncommissioned officers to the field as rapidly as possible. The distance and terrain is such that the last of these can get up within about 15 minutes, assist the regimental surgeon of the 1st Infantry and relieve him of the care of the wounded when he and his personnel are forced to depart.

The van of the 2nd Infantry will not reach the field for half an hour, and the rear of the 3rd Infantry for three quarters of an hour. As with the 1st Infantry, the part of the sanitary personnel so detached from the 2nd and 3rd Infantry, being mounted, can safely delay some little time after their regiments pass and then rejoin at a gallop in sufficient season.

The Chief Surgeon sends this order to his sanitary subordinates himself, by reason of general authority granted by Field Service Regulations to Chief Surgeons to act independently in such respects in emergencies.

But he realizes that in due course the sanitary assistance drawn from the 2nd and 3rd Infantry must likewise be returned to these organizations. Other provisions must therefore be made for taking the wounded over perman-

ently. This personnel will have to be drawn from the independent sanitary organizations. The wounded will largely have their wounds protected and temporarily dressed by the time assistance from these independent organizations can arrive, but they will still need to be collected, made comfortable, prepared for transportation and perhaps two or three operated on to save life. More or less work in their litter transportation to the collecting point also will be necessary.

To take up and carry out this work, the Chief Surgeon can draw upon either his ambulance company or field hospital. In making his choice, he reflects that the present action is undoubtedly only a minor affair and that the main action is yet to come. The ambulance company and field hospital are so near each other in the column that their availability is practically the same. But use of the field hospital will certainly not be required for several hours, while the ambulance company will very likely have to come into operation much sooner. The work of the latter will also probably be more exhausting and its energies should be conserved as much as possible. It seems preferable, therefore, to hold the ambulance company in reserve and have the field hospital take over this sanitary situation direct, until such time as affairs shape themselves more definitely as a result of the coming conflict. But no more of the 1st Field Hospital personnel should be used in this work than is necessary, and a reserve should be left which may be at once available for other purposes. And as the main force of the enemy seems almost certain to be in the vicinity, as outlined in the general situation given in Problem No. 10, there will be no necessity or advantage in bringing the remainder of the field hospital personnel and its transportation nearer to the probable zone of conflict, while in the case of reverse it might be in the way, block the road and be more subject to capture. If the

enemy occupies the woods along Murray Creek, as the Brigade Commander has informed his Chief Surgeon that he believes, the pass between Gravelly Lake and American Lake will only be about 2½ miles in the rear of the brigade deployment. The 1st Field Hospital wagons and reserve personnel had therefore better halt at this point, whence they can readily come forward or retreat as necessary and will in the meantime be located on the natural route to the rear along which wounded and skulkers would tend to drift.

But this further plan has its relations to the brigade as a whole and is not alone a matter of the internal administration of the sanitary service. In the absence of specific authority by the Brigade Commander for complete independent action by the Chief Surgeon, such matters must receive the approval of the General or his accredited representative. The Chief Surgeon therefore at once writes the following order, takes it to the Brigade Adjutant, briefly explains its purpose and requests him to send it out:

1st Brig. ½ mile south of Country Club,
——— 7:42 A. M.

C. O. 1st F. H.

Rear of column.

Halt off the road between Gravelly and American Lakes, sending half your available personnel with litters to take over 40 wounded at this point. Collect in houses north of unimproved road. Expedite.

A,
Brig. Adjt.

This order being approved and forwarded, the Chief Surgeon expects the necessary personel of the field hospital to arrive well within an hour; or by the time that the medical officers of the last infantry organizations will have to relinquish their sanitary work to rejoin their commands.

The required orders and action of the Chief Surgeon are covered by the foregoing.

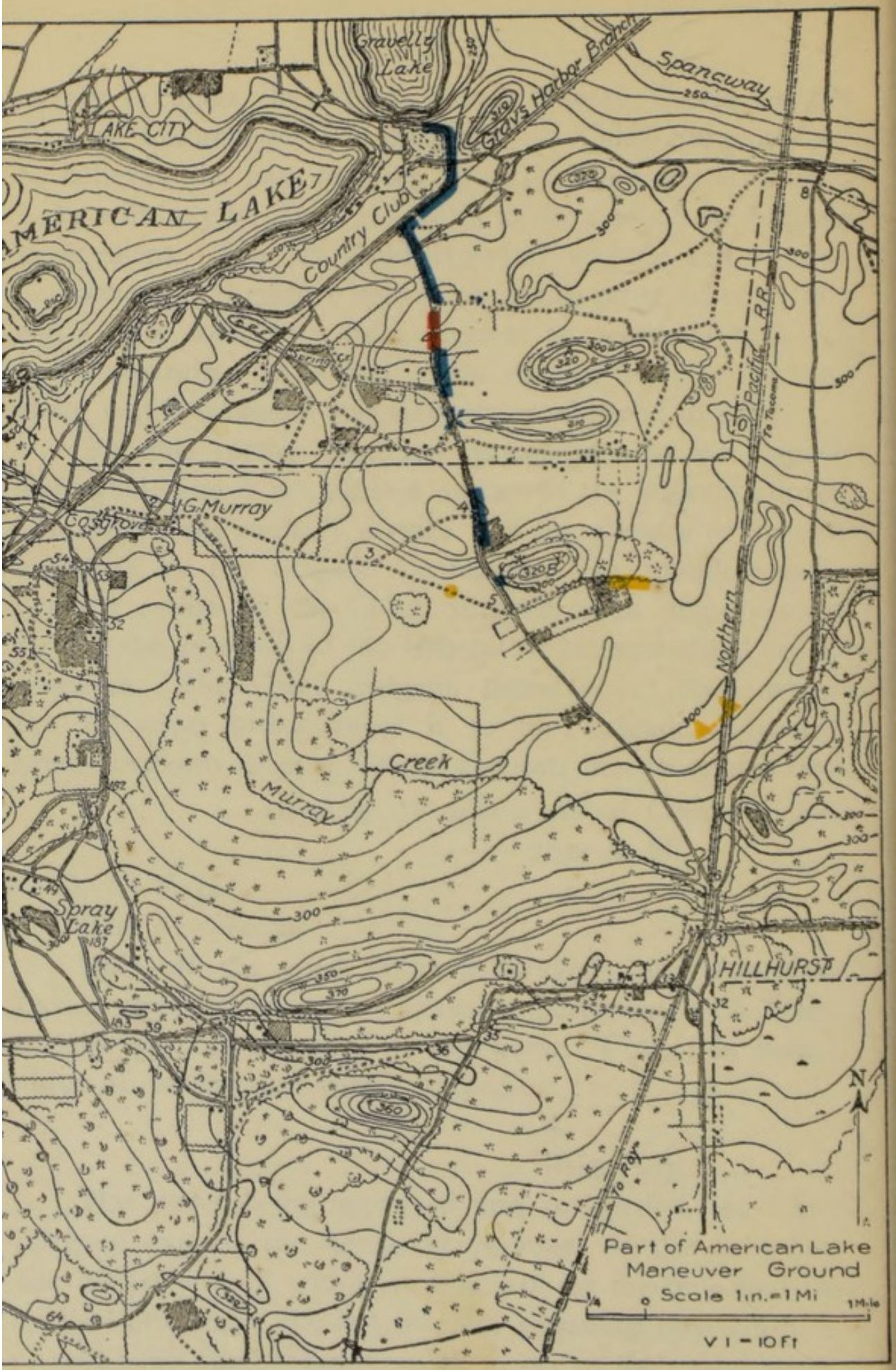


Plate Map No. 3 *Time 8:00 A. M.*

Blue forces ▬ *or* ● *Blue headquarters* ✢ *Hostile forces* ▲..▲ *or* ▲

CHAPTER XVI.

Sanitary Service with an Outpost During an Advance. Problem No. 12, Blue.

(Based on Plate Map No. 3)

General Situation:

Same as in Problem No. 10, Blue.

Special Situation:

The time is 8 A. M.

The advance guard has reformed and the column continues its march. The cavalry squadron has just reached the southeast edge of the timber extending east of Hill B and is reconnoitering. A few Red cavalry are seen near the railroad about a half mile southeast.

The positions of the combatant forces are shown on Map No. 3.

About this time, a member of the cavalry patrol sent out on the left rides up and informs his squadron commander, in the presence of the surgeon, that his patrol has driven a small body of Red cavalry from near 8 to the woods about three-quarters of a mile southeast, and that there are three severely wounded of his own force and two of the enemy near 8 in urgent need of medical assistance.

Required:

An outline of the way, if any, in which the wounded cavalrymen at 8 can be assisted without undue delay or interference with the interests of others.

A Solution.

At the time the cavalrymen rides up and makes the above report, the squadron as a whole is in contact with

(NOTE:—8 is near the northesast corner of the map.)

the enemy in the vicinity of a general position which the latter, according to reliable information, occupies in force. Action may be expected to begin at any time shortly. Under such conditions the squadron surgeon certainly cannot leave his command without a medical officer while he rides away a couple of miles, nor does he feel justified in detaching any of his small sanitary personnel under such conditions. It is true that there are five wounded, but two of those belong to the enemy and only three belong to the Blue forces. There are 3½ troops with the main force of cavalry, and many times three casualties may very likely occur in them within a few minutes after action begins. The cavalry surgeon will only do as he did in the action of about an hour before—shift his sanitary responsibilities to others better able to handle them than he is himself, even though the injured belong to his own force. He himself can have no knowledge as to the organization from which the sanitary assistance desired can best be sent nor where such organization is at present located. But he knows that a chief function of a Chief Surgeon is to possess and secure such information, upon which the latter has the power to act in matters of this nature.

With the approval of the squadron commander, the squadron surgeon therefore says to the trooper: "Tell this about the wounded to the Chief Surgeon, who rides with Brigade Headquarters, probably somewhere near the head of the column. Say that I sent you, as I and my detachment must remain with the squadron."

In compliance this order, the trooper proceeded to headquarters, which he found riding at the head of the main body about a mile south of the Country Club, and repeated his message and instructions to the Chief Surgeon. The latter considered the practicability of sending assis-

tance from the sanitary detachments with combatant organizations; but only to reject the idea at once, as such assistance would shortly all be needed with their own forces. The ambulance company and field hospital are both logical sources of such assistance and are about equally available. But the same considerations, which previously impelled him to keep the former unit intact, still prevail. He therefore orders the cavalryman to ride rapidly to the pass between Gravelly and American Lakes, where the 1st Field Hospital has been ordered to halt, and to give the following note to the Field Hospital Commander:

C. S. O. Brig.,
1 mile south of Country Club,
——— 8:05 A. M.

C. O. 1st F. H.

Pass east of American Lake.

Take charge of the wounded near 8 as reported to you by bearer.

X,
Chf. Surg.

On reaching the pass between the lakes, the trooper finds the 1st Field Hospital halted, with its transportation parked off the road. He delivers his message and repeats his report to the field hospital commander. The latter shows the note to another medical officer with whom he was at the time conferring, and says "You heard what the man said. Take the necessary assistance to look after these wounded and rejoin as soon as possible."

The junior medical officer thus directed reflects that under present conditions, the wounded in question will probably have to remain some time where they are; for just now there is neither any official wheeled transportation available to send for them nor any fixed general

relief point or facilities at hand to which at present they could be conveyed. The ambulances the Chief Surgeon evidently regards as necessary for duty elsewhere. The field hospital is only halted temporarily and not unpacked; and if it is later established, this will probably be somewhere nearer the battlefield, the exact location of which is still problematical. At this juncture, therefore, there is no point to which wounded might be evacuated nearer than Tacoma, wagon transportation over the 12 mile distance to which would very likely be dangerous to severely wounded even under the best conditions. His map shows him that the railroad runs close by 8. His best plan is apparently to get the wounded together at some convenient point after dressing their injuries. If the outcome of the battle is successful, railroad trains to evacuate wounded to the base will undoubtedly be sent up from Tacoma and the wounded at 8 can then be easily and safely removed. As there are at least 5 severely wounded, a Hospital Corps man should be left with them. The junior medical officer thereupon directs a private to mount behind his orderly on the latter's horse. He tells the trooper to come along and show him where the wounded are lying. All ride rapidly to 8, which is only a couple of miles away and should be reached in ten or twelve minutes.

After reporting to the squadron surgeon and being started on his further errands, the trooper rode rapidly. There was no appreciable delay at any of his stopping points. The total distance which he covered was five miles, and conditions were not unfavorable to good time. He could ride at the rate of at least 10 miles per hour, and thus could return to 8 with surgical assistance for the wounded there in about 30 minutes after he had reported its necessity to the surgeon of his squadron.

Comment.

Even if the squadron surgeon had desired and been permitted to leave with his orderly about the time his command was apparently going into a fight, he could have arrived at 8 no more than about fifteen minutes sooner than would the sanitary relief sent up from the rear. The slight delay was a matter of no special importance to the few troopers already wounded, and it meant much, under the circumstances, to retain the entire sanitary personnel at once available for duty with the squadron. Moreover, the sanitary personnel sent up from the rear is not under such immediate necessity of rejoining as would be the cavalry surgeon or his assistants and they can give more time to the dressing of the wounds and the comfort of the injured than would be possible for the latter to give. Thus, under the method of relief above outlined, the wounded troopers, on the whole, probably fare better.

In this situation, conditions were such that the Chief Surgeon could promptly send surgical assistance from where it could readily be spared without detriment to the sanitary situation of the command as a whole. But if conditions had been such that all available sanitary personnel was about to be required on or near the main battlefield, the Chief Surgeon would have kept his main purpose and probable necessities in mind, left these few wounded without attention for the time, told the trooper that assistance would be sent later, and merely sent a memorandum to the ambulance company commander, giving the number and location of the injured and directing him to take charge of them when he had opportunity.

CHAPTER XVII.

Sanitary Dispositions in Brigade and Regiment Preliminary to Attack.

Problem No. 13, Blue.

General Situation:

Same as in Problem No. 10, Blue.

Special Situation:

The time is 8:45 A. M.

When the advance guard reached Hill B about half an hour ago, it received effective artillery fire which swept the road from the south and caused some twenty casualties. Thereupon the column as it came up left the road for the cover of Hill B and its woods.

About the time the Red artillery opened up, word reached General A from the cavalry patrol on the right that Red infantry in small numbers could be seen at several points southwest and west along the edge of the woods near Murray Creek. Shortly after, a report was received from the main body of cavalry that several troops of hostile cavalry were near the railroad about a mile southeast of Hill B, that at least a battalion of hostile infantry was entrenched just east of the 5—6 road and that several batteries of Red artillery seemed to be posted a little to the rear and to the west of the road.

General A informs his Chief Surgeon that he will at once attack the enemy's position near the 5—6 road, sending forward the 1st Infantry for the purpose.

The positions of the combatant forces conforming to this decision are shown in Map No. 4, the 1st Battalion, 1st Infantry having been reformed.

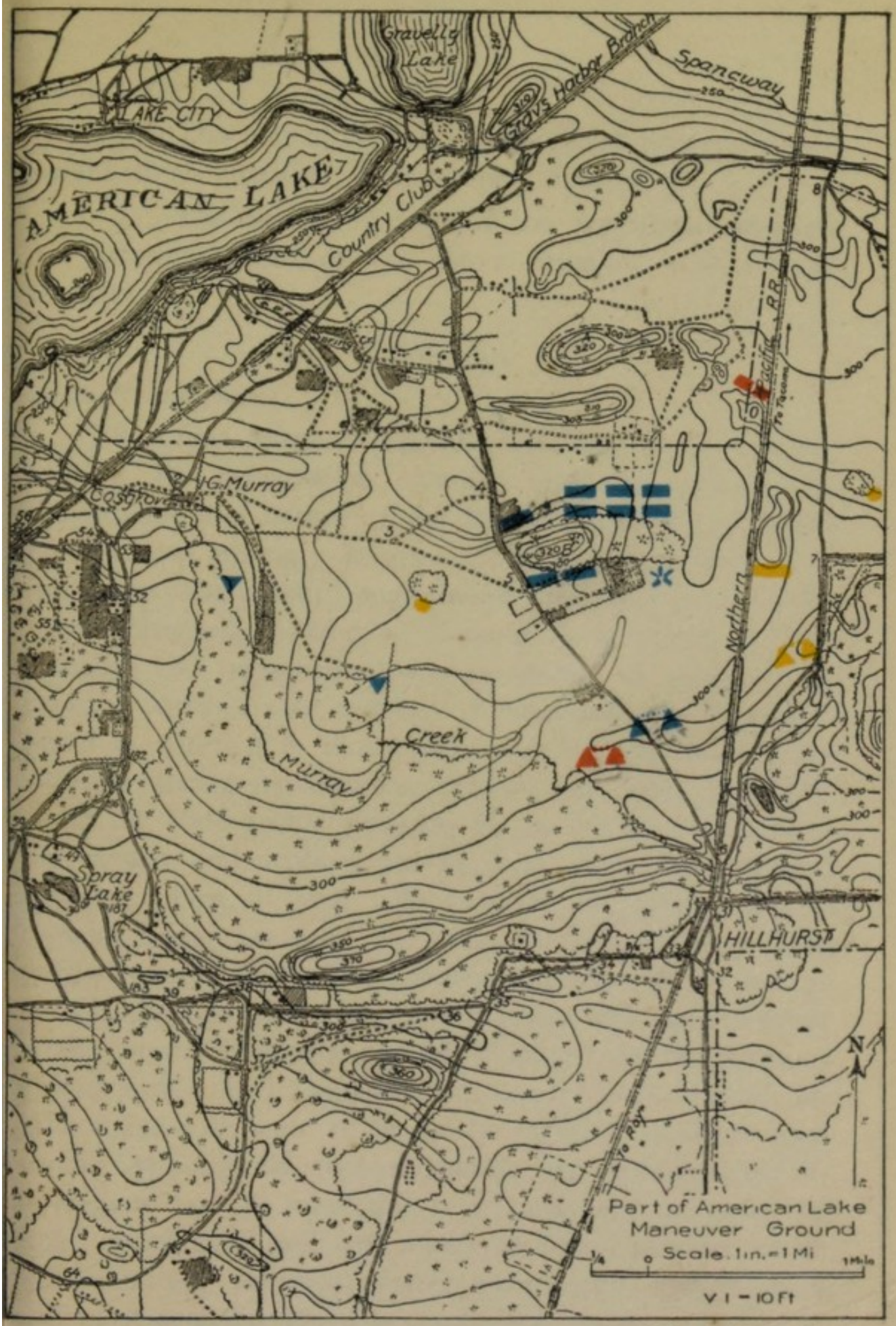


Plate Map No. 4 *Time 8:45 A. M.*

Blue forces ▬ *or* • *Brigade headquarters* ✳ *Hostile forces* ▲...▲ *or* ▲

benefits of any station for sanitary relief will be very materially curtailed and may, under some conditions, be almost nullified. Specification of the route of evacuation is also always important to prevent the wounded from straggling and keep them moving on lines along which sanitary assistance will be provided; in large forces it has great tactical importance in relation to keeping certain roads clear for the rapid bringing up of reinforcing troops and ammunition. It also is important in enabling the avoidance of depressing sights by reinforcing or reserve troops. In the present instance, wounded moving back along the designated route could at the present time, if it were necessary, secure assistance from the sanitary service of the 1st Infantry at work back of Hill B; from the Ambulance Company back of the 310 ridge half a mile further to the rear; from the first aid party of the field hospital which took over the little battlefield half a mile north of Hill A; finally at the Station for Slightly Wounded still further on the way to the rear.

The most convenient sanitary organization or detachment will usually furnish the facilities for the last named station. Inasmuch as the 1st Field Hospital is in this instance halted, awaiting use, near the point designated for this station, it will be best and most conveniently drawn upon for the small personnel and limited amount of supplies necessary for its establishment.

The Chief Surgeon therefore sends an orderly back with the following message:

C. S. O. —— Brig.
Hill B,
——— 8:50 A. M.

C. O., 1st F. H.

Pass east of American Lake.

Open a Station for Slightly Wounded near the fork

in the road just west of the pass between Gravelly and American Lakes.

X,
Chf. Surg.

Second Requirement:

The regimental surgeon, 1st Infantry, would have rejoined his organization from the scene of the advance guard action at the time the 1st Battalion received hostile artillery fire. As his regiment took cover in the rear of Hill B, he probably rode forward under the protection of the latter to a point near the area of present casualty and close to where the 1st Battalion was being reformed. At this point, the battalion surgeon would already be causing the wounded to congregate to have their injuries dressed under shelter of the hill and heavy timber. As the regiment moved up, followed by his aid station party and the bandsmen assigned to its assistance, the regimental surgeon probably summoned these to reinforce the sanitary personnel of the 1st Battalion. This assistance was at first contemplated by him to be only casual, as he had no way at that time of knowing that the advance was any more than temporarily checked. His action was merely in line with the general purpose to give sanitary assistance at every possible opportunity not incompatible with military purposes. He unpacked no supplies and was prepared to rejoin the regiment with the aid station party at any moment.

But as soon as the colonel, 1st Infantry, received orders to deploy for an attack, the latter would have summoned the regimental surgeon, and pointed out the ground over which the regiment would advance against the Red entrenchments. He probably would have stated that he proposed to attack with the 3rd and 2nd Battalions, holding the 1st Battalion in reserve, by reason of the fact that it has already suffered severely. From the nature of the

terrain and the character of the Red defense, it would be apparent to both the colonel and the surgeon that the 1st Infantry would probably suffer many casualties during its advance. This zone of greatest casualty, as already determined in this problem by the Chief Surgeon, would be some 600 yards deep, and for the 1st Infantry, with two battalions deployed, would have a frontage of some 500 yards extending east of the 5—6 road. Wounded, if they got back at all during the advance, would probably move directly to the shelter of the timber on Hill B and thence toward the road to the rear. Whether they went over this hill or around it, they would probably tend to converge near its northwest aspect. This locality is perfectly protected from rifle fire from the trenches, though open to some danger from shrapnel if the enemy should shell the woods. However, when the Blue artillery came into action, the hostile artillery would scarcely be apt to do this as it would have to direct its fire on the former in the effort to protect itself. The conditions appear to be such that an Aid Station should be established to assist with the casualties soon to occur in the 1st Infantry, and the terrain and nature of the enemy's defense make the point in question the nearest logical position for such a sanitary formation. Moreover, it is a point at which a considerable number of wounded are already being congregated and dressed by the battalion sanitary personnel and aid station party.

The regimental surgeon therefore requested permission to put in an Aid Station at that point and take charge of it himself. The colonel assenting, the surgeon asked that battalion commanders be notified to inform their subordinates of the fact, and that he himself be authorized to withdraw to that point such portions of the battalion sanitary personnel as might seem to him necessary. To this the colonel assented.

The regimental surgeon thereupon returned to the northwest aspect of Hill B, ordered his supply mule unpacked and the Aid Station established, and directed the entire sanitary personnel of the 1st Battalion to work therein while its battalion was held in reserve. Recognizing the practical difficulty, due to unfavorable terrain, of doing any effective sanitary work in the 2d and 3d Battalions while these organizations were advancing under fire, and being unwilling to risk any more than necessary of his personnel to the danger of loss without compensating advantage, he ordered the surgeon, orderly and two sanitary privates with the 2d Battalion, and the sergeant and two sanitary privates with the 3d Battalion, to fall out and report to the regimental Aid Station for duty. Here they could do good service during the fight and be able to rejoin their commands promptly in the case of either victory or defeat. But he would not strip the battalions entirely of their sanitary personnel. Though little actual sanitary work could be done with them during their advance, from a tactical standpoint the surgeon could not afford to disregard the psychological fact that troops fight far better if they believe that some assistance will be promptly available in case they should be injured. A small amount of sanitary assistance was therefore left with each battalion to accompany it into action.

CHAPTER XVIII.

The Sanitary Service with the Attack Under Fire.

Problem No. 14, Blue.

General Situation:

Same as in Problem No. 10, Blue.

Special Situation:

The time is 9:30 A. M.

The 2d and 3d Bns., 1st Infantry, were ordered against the hostile infantry position, supported by the Blue artillery. The 1st Bn., 1st Infantry, reassembled and took position as reserve under cover in the edge of the woods southwest of Hill B. The ammunition wagons were sent to the cover of the 310 ridge, about 1,000 yards in the rear of Hill B.

The 2d and 3d Bns., 1st Infantry, on advancing across the enclosed field, suffered considerable loss. On arriving within 1000 yards of the enemy's position, the latter's fire suddenly increased as a result of apparent reinforcement and became so severe as to stop the Blue advance. General A thereupon hurried the 2d Infantry forward to reinforce the 1st Infantry, extending the line on the left.

The positions of the combatant forces at this time are shown on Plate Map No. 5.

Required:

(1) The action, if any, of the regimental surgeon, 1st Infantry, with reasons therefor.

(2) The action, if any, of the battalion surgeon accompanying the 3d Battalion, 1st Infantry, with reasons therefor.

Plate Map No. 5 *Time 9:30 A. M.*

Blue forces ▬ *or* ● *Blue headquarters* ✳ *Hostile forces* ▲...▲ *or* ▲

(Note. 1—The 3d Battalion, 1st Infantry, is the second one east of the 5—6 road.)

(Note. 2—The map scale is insufficient to show the disposition of companies within the battalions.)

A Solution.

First requirement:

The tactical situation is now developing about in the manner which the regimental surgeon, 1st Infantry, had anticipated and therefore in accordance with his plans and arrangements, as detailed in the previous problem. His Aid Station just northwest of Hill B is already in busy operation; a sergeant and a couple of privates of the Hospital Corps, with half a dozen or so bandsmen and several litters, having been sent to the south edge of the timber on Hill B in the rear of the 2nd and 3rd Bns., with orders to assist such wounded as may reach there and see that they are directed, assisted or conveyed to the Aid Station. The sanitary personnel selected for the latter duty is part of that attached to the 1st Bn., which has been moved nearer to the vicinity of where this personnel is to work and with which it thereby continues to remain associated. The regimental surgeon, 1st Infantry, has also directed the sergeant with this detachment to send word back to him if the battalion is ordered to deploy, since in that case he may wish to make further disposition of its sanitary personnel.

The reinforcement of the firing line by the 2nd Infantry may or may not result in the establishment of an Aid Station for that regiment. If such is established, it will probably be located on the northeast aspect of Hill B. In any case, it may mean that additional wounded may have to be cared for in the Aid Station of the 1st Infantry;

since the latter is located more on the direct line to the road to the rear, and while wounded from the 2nd Infantry would naturally tend to move in that direction, movement of wounded from the 1st Infantry would, on the other hand, scarcely occur away from the line of retreat toward any Aid Station of the 2nd Infantry. In any case, but especially if the latter Aid Station is not promptly established, that of the 1st Infantry must expect to receive a good many 2nd Infantry wounded.

The regimental surgeon, 1st Infantry, therefore plans and acts accordingly.

Second requirement:

The battalion surgeon, 3rd Bn., acts upon the fact that the presence of sanitary personnel on the firing line under conditions like the present is more for psychological reasons and encouragement than for actual utility. However, some little real assistance may from time to time be possible during the advance if it be immediately at hand. But it will probably be quite impracticable to send sanitary assistance even over the few yards separating one organization from another under exposure to such a destructive fire as may be expected. Nor can any assistance within an organization be possible under such conditions other than the stanching of hemorrhage by the rubber tourniquet or by bandage, and the hasty covering of wounds with a first aid dressing.

The battalion surgeon therefore says to a couple of Hospital Corps men:

"Private A, report to Company I for duty during the attack. Private B, you report to Company K. Tell your company commanders that I will be with L and M, which form the battalion support, and that our regiment Aid Station is the other side of this hill near the road. If practic-

able, start wounded there able to make their own way. But probably it will be best, after your companies have gone three or four hundred yards, to tell any wounded to lie quietly in the nearest little protected spot while the action continues. Give what temporary help you can without unduly exposing yourselves."

The battalion surgeon then reports his action to the battalion commander and, with his orderly, follows the battalion support in its advance against the enemy's position.

CHAPTER XIX.

The Sanitary Service Under A Tactical Reverse.

Problem No. 15, Blue.

General Situation:

Same as in Problem No. 10, Blue.

Special Situation:

The time is 9:45 A. M.

The hostile fire has been very heavy, again suddenly increasing in volume, and the Red infantry line seems to have been extended eastward by several companies. The Blue advance suffered severely on passing within the 1,000 yard range; seeing which the Chief Surgeon, about 9:30, with the approval of the Brigade Adjutant, directed Ambulance Company No. 1, less vehicles, to move to the shelter of Hill B and await orders.

However, by reinforcing the Blue line with the 3d Bn. 2d Inf., it has been able to work forward over exposed ground to within some 600 yards of the enemy's position.

At this juncture, a force of Red infantry, apparently a couple of regiments strong, moves out of the woods near Murray Creek, deploys against the flank of the Blue advance and opens fire at a distance of about 1000 yards. Red machine guns, massed in the woods near Murray Creek, open up with great effect at a distance of about 1200 yards.

General A at once orders the 3d Infantry against this new force. He notifies the Chief Surgeon that as soon as he can withdraw the 1st and 2d Infantry to the cover east and north of Hill B and its woods, within an hour or less, he proposes to retire on Tacoma, using the 3d Infantry and 1st Bn., 1st Inf. as rear guard and making a deter-

Trolley and Steam road to Tacoma

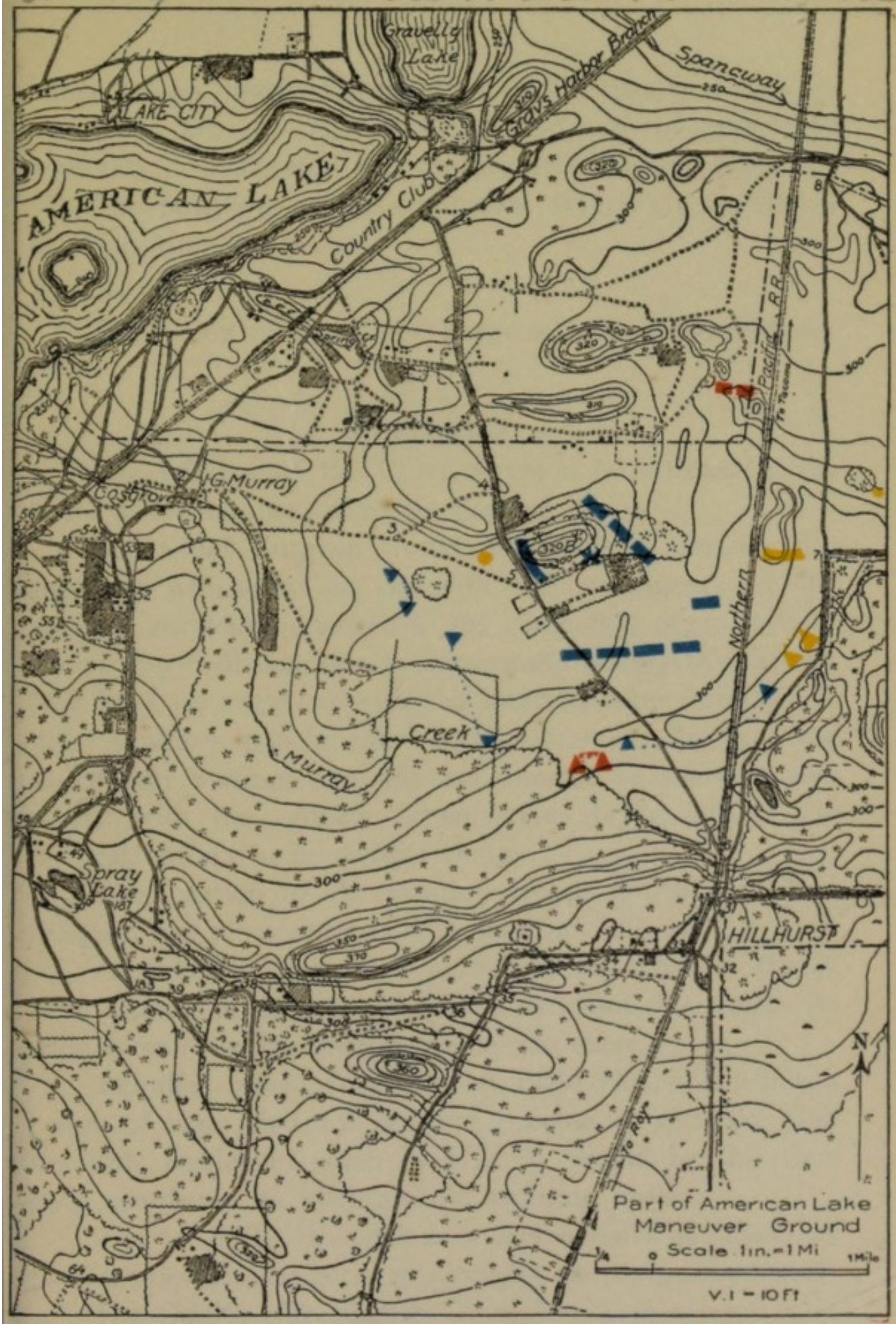


Plate Map No. 6 *Time 9:45 A. M.*

Blue forces ▬ *or* ● *Blue headquarters* ✣ *Hostile forces* ▲...▲ *or* ▲

mined stand between American and Gravelly Lakes if pursued. He directs the Chief Surgeon to make the necessary disposition of the sanitary units and the wounded.

The positions of the combatant forces are as shown in Plate Map No. 6.

Required:

The action of the Chief Surgeon, with reasons therefor.

A Solution.

The mission of the Chief Surgeon is outlined in the order given him, as above, by General A.

The Chief Surgeon would not concern himself with anything which has to do with the movements of the sanitary personnel attached to the combatant organizations, which they will continue to accompany during the retreat. Nor does he interfere with the internal administration of these sanitary detachments; such matters as the breaking up of Aid Stations and any assignments of sanitary personnel with the retiring organizations being left to the medical officers in immediate charge.

The location of the sanitary troops which the Chief Surgeon has to consider is now about as follows:

Ambulance Company No. 1, less its vehicles, should have arrived in the rear of Hill B at about this time. Its train remains in the shelter of the 310 ridge.

The detachment from the 1st Field Hospital, which a couple of hours ago was ordered to come up and take over the little battlefield north of Hill A, should by this time have completed its work and be awaiting orders.

The 1st Field Hospital, less detachments, is halted off the road on the pass between Gravelly and American Lakes.

The Station for Slightly Wounded is in operation at the fork in the road west of the 1st Field Hospital.

All the above personnel, transportation and supplies must, for their own safety, be removed. But prior to and during their removal they should accomplish as much as possible for the relief and withdrawal of wounded. This relates to those who will be wounded during the retreat and rear guard action quite as much as those wounded on the battlefields proper.

The disposition of the wounded as a whole is a matter requiring the direction of the Chief Surgeon. Their handling, as individuals or small groups, must be delegated to subordinates whose energies he merely coordinates. The location of the wounded is about as follows:

North of Hill A, some 40 wounded, of whom some 10 have been started back on foot and perhaps 30 require transportation, of which 10 are recumbent. All these can and should be removed.

Near 8, some half dozen wounded. They will have to be abandoned.

At the Aid Station of the 1st Infantry, near Hill B, about 16 wounded, of whom 4 have been started back on foot and 12 require transportation, 4 of these recumbent. Also many less severely wounded from the attacking line.

The present tactical situation is such that all helpless wounded lying any distance south of Hill B seem to be beyond Blue aid and will have to be abandoned. This is confirmed by the statement of General A that he will retire as soon as he can do so. The number of those already wounded here is not known but must be very considerable, since the Blue advance has been twice stopped in spite of strong reinforcements and many were seen to fall. During the retirement of the troops from this area they are sure to suffer heavily. The Chief Surgeon estimates that some 75 or 100 of these wounded have already made their way back to Hill B, and probably at least that number more

will do so under the stimulus of defeat and the dangers of a hostile cross fire.

There will also be a large number of wounded in the 3rd Infantry, now being moved up against the Red flanking force, together with the 1st Bn., 1st Infantry. Where these losses will occur the Chief Surgeon cannot know until these organizations take position and General A issues orders specifying their line of retreat. Probably most of their severely wounded will likewise have to be abandoned.

There are some wounded in the cavalry and artillery. These, of all but the most serious class, can probably be more or less completely removed.

The Chief Surgeon cannot possibly tell at this time how many wounded will reach the shelter of Hill B and its timber before the rear guard withdraws. He can only assume that they may aggregate several hundred, of whom the greater part, under the stimulus of fear, should be able to walk back the three miles to the region of comparative safety beyond the pass between the lakes.

In any case, the accommodations of the ambulance train will be exceeded, for distances to any desirable unloading point are such that no more than one trip from Hill B will be possible. Either additional transportation must be secured or a considerable proportion of wounded must be left behind. Effort will be made to the former end. If unsuccessful, the recumbent cases will be the first to be left behind, since four such occupy an ambulance space into which ten cases able to sit up could be crowded for the present comparatively short distance and easy country.

But the tactical situation appears to be such that the Blue troops may very likely be forced to the eastward away from a line of retreat along the 5—4—Country Club road and probably have to retire fighting both a rear and

flank guard action. Such a movement across country, even though the latter is fairly level, would render evacuation of wounded materially more difficult. Should this movement be necessary, the unimproved roads will be of some little assistance.

Heretofore nothing for the reception and care of wounded north of American and Gravelly Lakes, and short of Tacoma, has been provided. The provision of some such hospital facilities now becomes necessary, and this under such conditions as will permit the sanitary organizations in all their parts to remain in touch with the combatant troops,for whose further assistance they may be necessary. And to keep these organizations as mobile and efficient as possible by relieving them of wounded, suitable transportation and personnel should be sent out from Tacoma to remove the injured to that point without unnecessary delay.

The arrival at the pass between the lakes of a large number of wounded improperly dressed as a result of insufficient time, and exhausted through undertaking a task of retreat only possible to them through the stimulus of defeat and fear, will require the reinforcing of the sanitary personnel of the Station of Slightly Wounded until the arrival of the rear guard at the pass permits it to be broken up.

The announcement by General A that the command will retire from the present battlefield within an hour introduces a time factor which further complicates the sanitary situation and controls sanitary work.

With the above estimate of the sanitary situation in mind, the Chief Surgeon decides as follows:

To start at once for the rear on foot, all wounded able to walk to or beyond the pass between the lakes; to send there in ambulances and wagons all less severely wounded unable to walk but capable of riding a few miles

sitting up; to remove such helpless wounded as may be readily reached and for whom litter carriage or any additional transportation may be at once available; to withdraw all his sanitary resources north of the pass between the lakes; to establish sufficient hospital facilities at a point further to the rear but convenient to this pass and with ready communication with Tacoma; to secure from the latter point any additional assistance which may be required.

With these purposes in mind, the Chief Surgeon turns to the Brigade Adjutant and requests that the empty ammunition wagons which he had informed himself had been halted back of the 310 ridge, be hurried forward to Hill B and turned over to the commander of the ambulance company, now at that point, to supplement the transportation for the wounded. He also requests that a message be sent to the commanding officer of the base, at Tacoma, to have the sanitary service of the latter take over several hundred less severely wounded, now en route, at the end of the practicable electric railroad, two miles north of American Lake.

Both of these requests being approved, the Chief Surgeon gallops to the rear of Hill B and addresses the commander of Ambulance Company No. 1 about as follows:

"The brigade will retire as soon as possible by way of the pass between American and Gravelly Lakes; the rear guard will withdraw within an hour. Send your wounded back as rapidly as you can, providing for the less severe cases first. You will not be able to do much for the helpless wounded south of this hill (B). Most of them will have to be abandoned. Send two ambulances for less severely wounded collected at the houses near the unimproved road north of Hill A. Bring up the other ambulances here, where all available empty ammunition wagons with the brigade, perhaps ten or a dozen, will

shortly arrive and be reported to you for duty. Send off these vehicles as fast as you can load them, directing them to deliver their wounded to the 1st Field Hospital, which will move from the pass between the lakes, where it is now halted, to a point near the end of the practicable electric railroad line, about two miles north of American Lake. As soon as they are unloaded, have them return along the line of retreat as rapidly as they are able until they come in touch with the rear guard, picking up wounded south of the pass en route. Those thus reloaded return to the 1st Field Hospital; those unloaded collect at the place of rendezvous for your company. Pressure by the enemy will very likely stop movement on this road (4—Country Club) and make you evacuate your wounded to the east and under protection of Hill A and thence across country to the pass between the lakes.

"The 3rd Infantry and 1st Bn., 1st Infantry, will form the rear guard and make a determined resistance on the pass between the lakes. Get in touch with its commander. As soon as you learn that it is about to retire, send half your litter bearer section and a few vehicles, if any remain empty, to report to its commander for duty during the retreat. Then move your company, less its detachments, to the house at the first road fork beyond the pass between the lakes and take over any wounded there."

To the detachment of the 1st Field Hospital on the field northeast of Hill A he would send the following order:

"C. S. O., ——— Brig.,
Hill B,
——— 9:50 A. M.

C. O., Det. 1st F. H.

After loading ambulances with less severely wounded, move your detachment to the Station for Slightly Wounded just beyond American and Gravelly Lakes pass, and rein-

force it until further orders. Carry your helpless wounded there on your litters.

X,
Chf. Surg."

The orderly sent with the above message would continue on with the following:

"C. S. O. ——— Brig.,
Hill B,
——— 9:55 A. M.

C. O. 1st F. H.

This brigade is retiring. Establish your hospital without delay at a suitable point convenient to end of electric railroad two miles north of American Lake. Several hundred less severely wounded now being evacuated on that point, where service of rear has been notified to take them over. I have ordered your detachment sent near Hill A to reinforce sanitary personnel at the Station for Slightly Wounded. Direct your personnel to rejoin you promptly when the Ambulance Company arrives there.

X,
Chf. Surg."

Comment.

As the emergency exists at the front, the energies of the Chief Surgeon are first directed there. Further to the rear the time factor ceases to have such immediately paramount importance. Everything must now be subordinated to getting wounded away from the field and into the region of probable safety north of the lakes. For this work all the available sanitary resources are concentrated behind Hill B.

The Chief Surgeon might have brought up to that point the detachment from the 1st Field Hospital which had taken over the wounded north of Hill A. He did not do so since its numbers are not large and it could not arrive

in time to perform more than a very little work before having to retire. Moreover, the Station for Slightly Wounded would need heavy sanitary reinforcements to handle the large number of exhausted fugitives, many with wounds untended or requiring attention, who would stream in panic by its location. This reinforcing personnel could not come from that remaining with the 1st Field Hospital, since the latter would have to accompany the wagons to the new point—where large numbers of wounded are to be received and cared for—and establish and operate their own sanitary formation. And by assisting in the Station for Slightly Wounded until the arrival of the rear guard shuts off the flow of injured, this detached personnel would be able to give much assistance which, would otherwise have to be deferred with material detriment to the wounded and no advantage whatever to the sanitary service, until the injured struggled on a couple of miles further to the hospital itself. Rapidly rejoining the 1st Field Hospital when the rear guard closes in, this personnel should arrive in plenty of time to supplement the efforts of the remainder of their organization in operating their establishment and before a number of the more slowly moving wounded could themselves arrive. As their present distance to the Station for the Slightly Wounded is only about a mile and a half, the detachment can convey there on their litters, for further transportation to the rear by ambulance, the 10 helpless wounded of whom they are now in charge.

The Chief Surgeon in no way interferes with the internal administration of his independent sanitary organizations and formations, merely directing their energies in a general way best calculated for the general welfare and based upon the information which he alone is in position to possess.

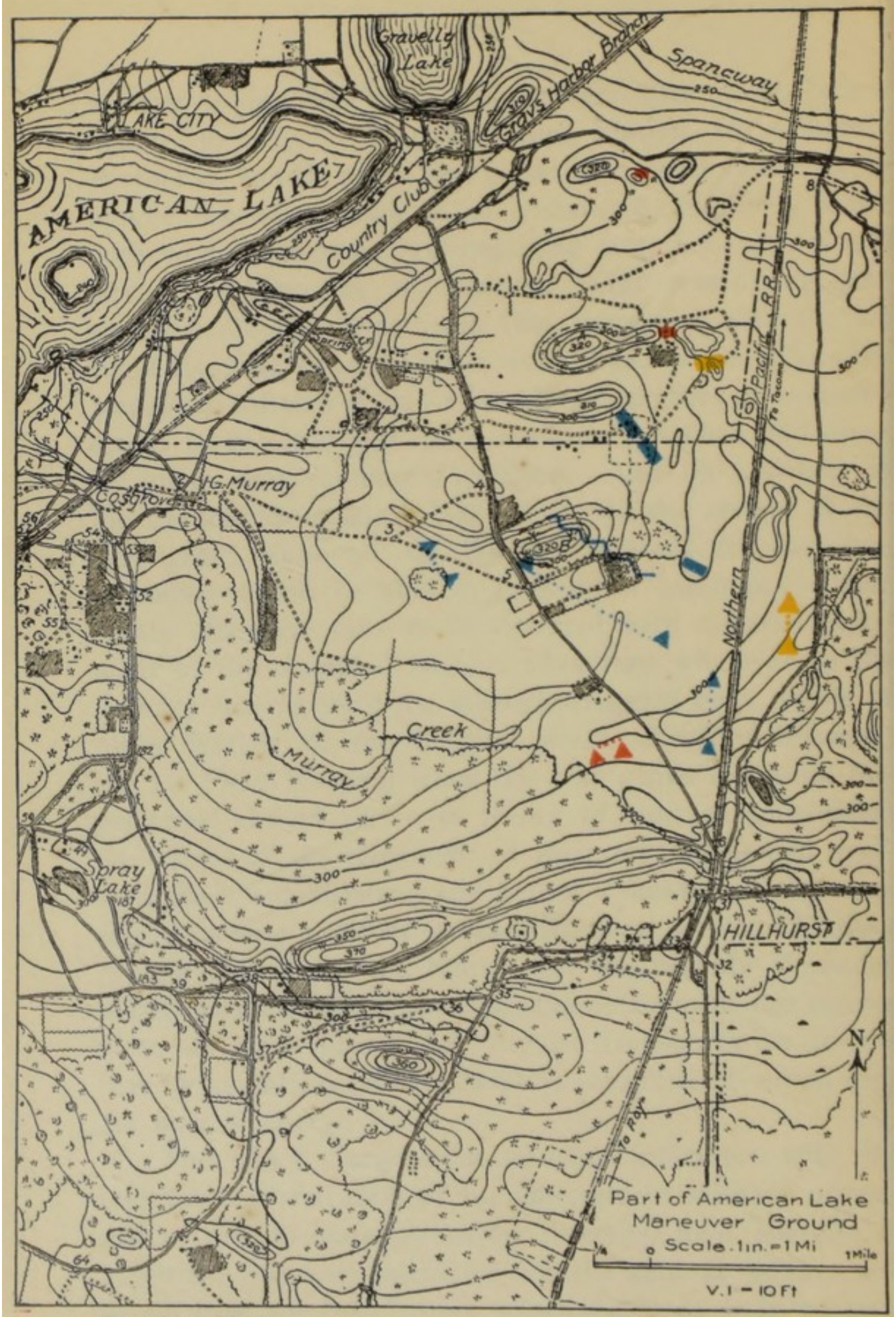


Plate Map No. 7
Blue forces ▬ *or* ⩘

Time 10:15 A. M.
Hostile forces ▲...▲

Jones

CHAPTER XX.

The Sanitary Service With a Retreating Force.

Problem No. 16, Blue.

General Situation:

Same as in Problem No. 10, Blue.

Special Situation:

The time is 10:15 A. M.

The 3rd Infantry had extended the line of the 1st Bn., 1st Infantry, its own left being extended by the 3rd Bn., 2nd Infantry. This line ran from the western border of Hill B southeast half a mile to the cultivated field and orchard. While the 2nd and 3rd Bns., 1st Infantry, and 1st and 2nd Bns., 2nd Infantry, passed through it in great disorder to the rear, many having thrown away their arms, this line put up a stout resistance, but at the expense of heavy losses and the dispersion of the 1st Bn., 1st Infantry and 1st Bn., 3rd Infantry, which had to bear the brunt of the hostile advance.

Effort was made to reform the broken battalions of the 1st and 2nd Infantry under cover of the Hill B woods, but this was only in small part successful and ceased when the fragments of the 1st Bn., 1st Infantry, and 1st Bn., 3rd Infantry, were driven back under an enfilading fire and joined the confused mass of fugitives streaming toward the pass east of Hill A.

The Blue and Red infantry lines were now only about 500 yards apart. Red cavalry is rapidly moving to the little hill on the left of the Blue line just abandoned by the Blue cavalry. The Red infantry, previously entrenched, is forming in column to join in the pursuit.

While the Blue infantry line held, the Blue artillery

batteries in succession galloped back to new positions, followed by the cavalry on the flank and rear. One battery with the cavalry took position temporarily on the east of Hill A; the other battery took position at the little hill south of the road running west from 8. The 2nd and 3rd Bns., 3rd Infantry, retired to the 310 ridge north of Hill B soon after, under protection of artillery fire from the battery at Hill A, assisting in turn with their fire in the withdrawal of the 3rd Bn., 2nd Infantry, to the latter elevation west of the battery.

The position of the combatant forces about 10:15 A. M. are shown on Plate Map No. 7.

With respect to the sanitary situation, the ambulances and empty ammunition wagons, summoned by the Chief Surgeon, reached Hill B ten or fifteen minutes ago. The Blue second line was already being driven back, and these vehicles, after being sent along the north edge of the timber, were hastily filled with wounded and started for the rear at a gallop by way of the unimproved road around Hill A. Shortly after they got away, and before the ambulance company commander had received any directions from the colonel, 3rd Infantry, to whom as rear guard commander he had sent a medical officer with request for orders, the rear of Hill B was enfiladed by volleys fired by a considerable force of the enemy who were advancing from the little woods 600 yards west of 5. Before anything could be done, several of the medical officers and a number of the Hospital Corps men, belonging to the 1st Infantry and Ambulance Company, were struck down. Almost immediately the 1st Bn., 1st Infantry broke in great disorder.

Required:

(1) The action of the regimental surgeon, 1st Infantry, up to 10:15 A. M., with reasons therefor.

(a) The action of the commander, Ambulance Company No. 1, up to 10:15 A. M., with reasons therefor.

A Solution.

First Requirement:

The regimental surgeon, 1st Infantry, must have been well informed as to the great danger to which the 2nd and 3rd Bn. of his regiment were exposed when the Blue line was flanked by the enemy under a heavy cross fire. He may have seen the situation for himself; certainly wounded and the Hospital Corps and bandsmen returning from the south edge of the woods would have informed him of it. That these battalions could scarcely escape heavy losses and dispersion would be apparent. When a force breaks, its losses pile up very rapidly, usually exceeding all losses previous to the break. But so long as any part of the regiment held its ground, it was his duty to remain with it with his personnel and give such assistance as might be possible. While never uselessly exposing himself or his subordinates to danger, he would not hesitate to do so where need demanded. He therefore continued the work at his Aid Station.

But when the hostile advance brought this station under fire, it at once became necessary to shift its position or break it up entirely. This was not because some of his sanitary personnel were killed, but because a location so dangerous for attendants would be equally so for wounded and quite untenable as a place for their resort and treatment. He might perhaps have moved his Aid Station to some little protected point in the woods back of his 1st Bn. and there continued his work, had not the rout of the latter organization rendered such action useless. As it is, the situation has become such that his special mission is fulfilled. It remains now to seek the safety of

his detachment. Immediately ordering his personnel to accompany him with the pack mule, he abandons to the enemy his Aid Station with its helpless wounded, whom he has now become unable either to remove or further assist, and follows the edge of the woods eastward toward the main line of the Blue retreat.

But although he no longer has any combatant organization of his own to join and aid, he and his personnel, if kept together, may still be of much assistance to the wounded of the action as a whole. To that end, he will follow the general rule with a defeated force and attach his personnel to the first organized command encountered. This, in the present instance, is probably the ambulance company, which, as has been stated, has been working in the immediate vicinity of his Aid Station and north of Hill B.

Second Requirement:

After loading and dispatching the vehicles with wounded, the ambulance company commander had kept himself well informed, by ways already suggested, in respect to the Blue situation south of Hill B. With the defense breaking and the enemy enfilading the area in which his company had been working, he could do no more; and nothing remained but prompt withdrawal of his command to a place of greater safety and further usefulness. For part of his company his orders required that this place should be well in the rear of the final defensive position. Inasmuch as no authority remained at hand to whom he could apply for orders relating to assistance of the rear guard, the selection of a place suitable for such work devolved upon him. It was apparent to him that the several elevations on the way back to the pass between the lakes would furnish commanding and protected points from

which defense could best be continued during the retreat. At this time he could see artillery galloping to the rear toward the eastern aspect of Hill A, shortly followed by Blue cavalry, while a considerable body of Blue infantry, apparently several battalions, was moving rapidly toward the 310 Ridge. A large number of fugitives and wounded were struggling north of Hill B toward the gap east of Hill A. At this moment the surgeon of the 1st Infantry, with a medical officer, eight or ten enlisted men of the Hospital Corps, and about a dozen bandsmen, came up and joined his company.

The ambulance company commander, in compliance with his general instructions, then took the following action:—

He ordered a junior medical officer to take half the litter bearer section on the double time to the 310 Ridge and report for duty with the Blue infantry just gaining that elevation. Wounded able to walk were to be bandaged and started toward the pass between the lakes with all despatch; followed by the above sanitary detachment as soon as the temporary position was to be abandoned.

He himself, with the remainder of the company, followed by the sanitary personnel and bandsmen from the 1st Infantry, rapidly moved toward and joined the steadily augmenting stream of fugitives. He then marched more slowly, ordering his subordinates to hold the organization together, but to bring in to its column and help along to the rear any wounded that might be overtaken. He expected that in a short time a considerable number of wounded would thus be gathered in by the command; some few would be on litters largely carried by uninjured fugitives who would be forced to help out with this severe work, but

most of the wounded would be able to continue, with or without assistance, on foot.

By encouragement and assistance, the ambulance company commander expected that his sanitary nucleus would thus be able to bring off from the field a considerable number of wounded who, if thus unaided, would never be able to reach a place of safety.

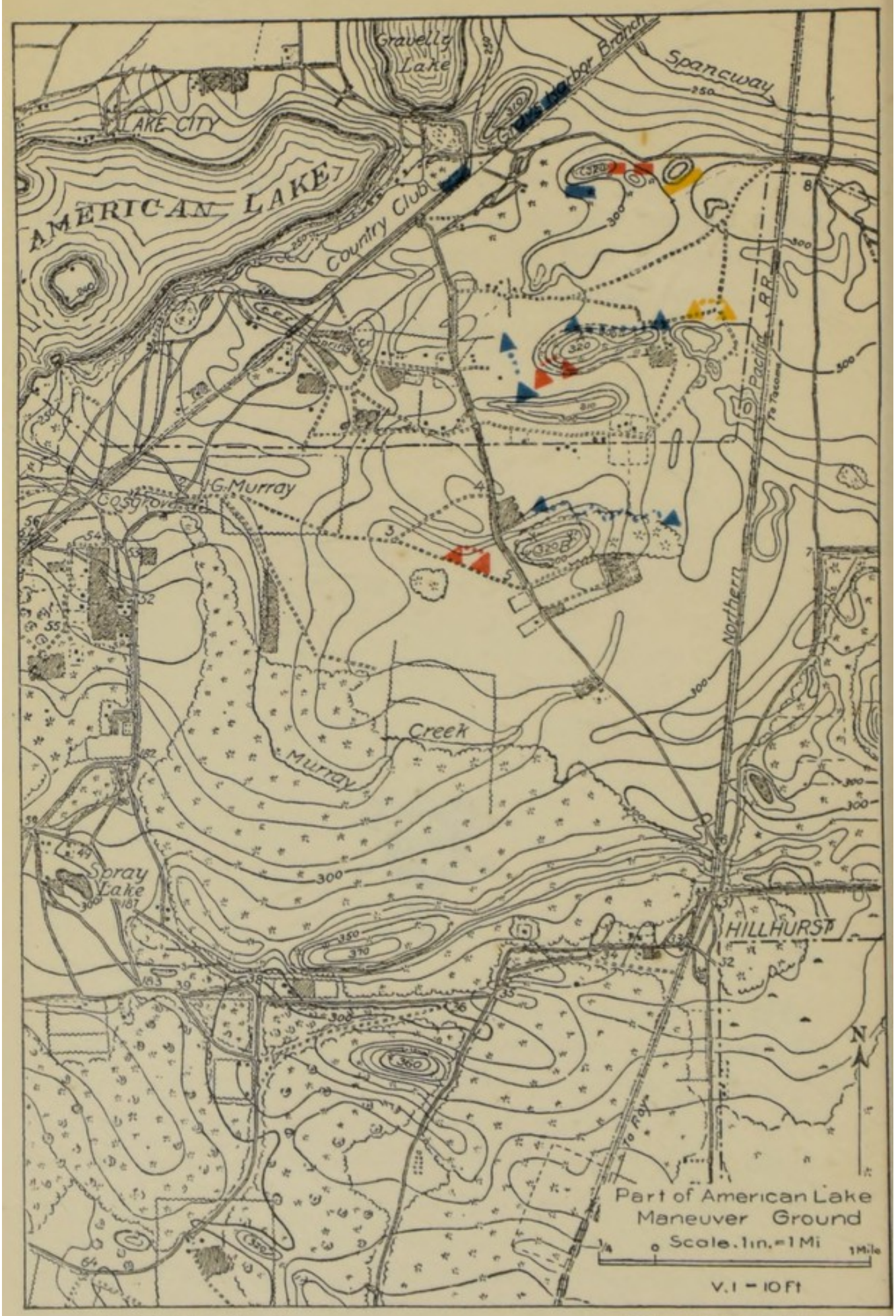


Plate Map No. 8 — *Time 11:15 A. M.*

Blue forces ▬ — *Hostile forces* ▲...▲ *or* ▲,^^^^▲

Metcalfe

CHAPTER XXI.

Estimation of the Sanitary Situation With a Defeated Force.

Problem No. 17, Blue.

General Situation:

Same as in Problem No. 10, Blue.

Special Situation:

The time is 11:15 A. M.

When the enemy's main line, disorganized in passing through the dense woods and underbrush of Hill B, appeared on its northern border, it was checked by several volleys from the 2nd and 3rd Battalions, 3rd Infantry, in position on the 310 ridge, and the battery posted on the eastern edge of Hill A, and forced to delay for the purpose of reforming.

The 3rd Battalion, 3rd Infantry, preceded by the Ambulance Company detachment, was then started back to take position back of the railroad embankment just south of the pass between the lakes; but when the 2nd Battalion, 3rd Infantry, likewise attempted to withdraw, its only protection was fire from the battery located east of Hill A and it was broken up by the hostile fire.

The battery and cavalry east of Hill A then dropped back to new positions. Under cover of their fire, that of the other battery and the 2nd Battalion, 3rd Infantry, and under the protection of Hill A, the 3rd Battalion, 2nd Infantry which had taken station on the east end of Hill A, had no great difficulty in withdrawing to a position on the little hill just west of the artillery.

In the meantime a Blue company still retaining its

organization was thrown across the road leading through the pass between the lakes, and fugitives with arms and equipment were halted, reformed and sent to join two provisional battalions being made up to occupy the 310 ridge just east of that pass. To the aid of these battalions was sent the surgeon of the 1st Infantry and his entire detachment. Troops and fugitives moving north of Hill A were fired upon by Red artillery moved to a position northwest of 5.

The Red advance had itself suffered no small loss.. Its offensive became weaker, and after 11 A. M. the Red forces showed little inclination to advance further.

The positions of the combatant troops at this time, 11:15 A. M., are shown in Plate Map No. 8.

Required:

Estimate of the sanitary situation in the Blue force at this time.

A Solution.

Blue wounded are scattered over the country from half a mile south of Hill B to a couple of miles north of the pass between the lakes. A large number of casualties have occurred. It is impossible even to approximate the number of these under conditions of disorder in which a large number of the unhurt would likewise be missing. All Blue wounded south of the line of Hill A, and this class includes the greater part of the total casualties, have become prisoners of war and need not be considered further in this connection. A number of wounded are in the area between the present lines. Those who had reached the scattered timber within that area will probably be able to gradually slip away during the afternoon; the others on or south of the 300 foot table land to the unimproved road will very likely have to lie there until nightfall permits

their retirement or collection. Some wounded probably moved east of the Blue artillery and cavalry positions, thence to the pass along the road from 8. These are now arriving. But the great majority of such wounded as the Blue Chief Surgeon will have to consider, several hundred in number, have already passed between the lakes to a region of safety and where time and facilities permit of their further care and their transportation to hospital conveniences. But as soon as they realized that they were safe, many wounded, previously spurred on to great effort by fear, would have collapsed from hemorrhage, shock and exhaustion. The Chief Surgeon had this contingency in mind when he ordered Ambulance Company No. 1 to retire to the first forked roads northwest of the pass. Until the arrival of the latter, the reinforced Station for Slightly Wounded near this point had looked after the injured, its personnel rejoining the field hospital to which it belonged as soon as the ambulance company came back and took over their wounded and duties. The more or less simultaneous arrival of Ambulance Company, No. 1, its equipment and a large number of wounded, would practically have converted the Station for Slightly Wounded into a Dressing Station—this especially since the location of the former, about half a mile in the rear of the final line of defense, on the only road of evacuation, makes it very convenient for the purpose of the latter. To this point the ambulance section of the ambulance company is now returning after delivering its loads of wounded at the field hospital and will promptly take on other wounded and return to the latter. The 1st Field Hospital is already in operation, but as yet is only partially established, the conveniences of houses taken over for the purpose largely being utilized. Electric cars carrying sanitary personnel and supplies should be starting from Tacoma, if they

have not already started, to receive and evacuate wounded from the field hospital. Automobiles will very likely also be sent out for the same purpose, and these may safely ply as far as the position of the ambulance company near the pass and evacuate directly from there into Tacoma without reporting their wounded at the 1st Field Hospital.

As to the condition of the sanitary personnel and supplies of the Blue brigade at this time, the estimate would be about as follows:—

Those of the Field Hospital, whose functions have kept it at all times completely out of the area of fire, are intact and can provide the full amount of sanitary relief to be expected under the best conditions.

Ambulance Company No. 1, whose duties brought it further to the front and into a zone of considerable danger, lost a number of men but maintained its organization. In the hasty return of its ambulance section from Hill B with wounded, one or more ambulances may have been disabled through accident or fire. The supplies for its Dressing Station have scarcely been touched; those in the wagon being hurried back from the 310 ridge, and those on the pack mules brought back from Hill B, where a Dressing Station could scarcely have properly been established under the unfavorable tactical conditions. In spite of the tactical reverse, Ambulance Company No. 1 has been able to accomplish much and still remains in a condition to accomplish more. If the last line of defense holds, some of its reserve of dressings will be sent forward for use by the sanitary personnel with that line.

It is certain that no Aid Station for the 3rd Infantry was ever established. The regimental aid station parties probably suffered no inconsiderable loss and left the field in a somewhat depleted and disorganized condition, abandoning or losing most or all of their supplies. However,

their personnel should have been fairly well kept together and have been halted at the pass and distributed to assist along the rear of the several Blue positions. During the retreat, each has served as a nucleus which unattached Hospital Corps men and wounded fugitives would be made to join. They are still capable of giving some organized assistance, though by no means as effective as was origiually the case.

The sanitary personnel sent under fire with their battalions suffered equally with the latter and were probably completely disorganized, except with the few combatant units which themselves still retained their organization. As individual fugitives, their services were of practically no value. Some of the latter may have been rallied at the pass and sent to assist at the last line of defense.

Lecture 18, 19.

CHAPTER XXII.

Tactical Information in Relation to Sanitary Dispositions for a Planned Defense.

Problem No. 18, Red.

General Situation:

A Red force, under Brigadier General B, moving up from an advance base at Roy, about 8 miles to the south, arrived near Hill B about sunset last night. On being informed that a strong force of Blue cavalry had seized the pass between American and Gravelly Lakes, General B ordered his command to take up a defensive position along the edge of the woods northeast of Murray Creek, from a little east of the Collins House (about a mile northwest of 6) to about half a mile southeast of the house of I. G. Murray. He proposes to take a strong defense here, in compliance with his general instructions, against a Blue force believed to be of about equal strength and known to have moved south from Tacoma yesterday morning. To facilitate movement of troops, he orders that roads be cut through the woods during the night.

The Red command consists of the 4th, 5th and 6th Infantry; Batteries C and D, 2d Field Artillery (mountain); 2d Squadron, 2d Cavalry; Ambulance Company No. 2 and the 2nd Field Hospital. One section of an Evacuation Hospital is at Roy. The Northern Pacific R. R. between Tacoma and Roy is undisturbed and with plenty of rolling stock. The weather is fair and cool, and the roads good.

Special Situation:

The time is 5:30 A. M.

A messenger from a cavalry patrol has just ridden in

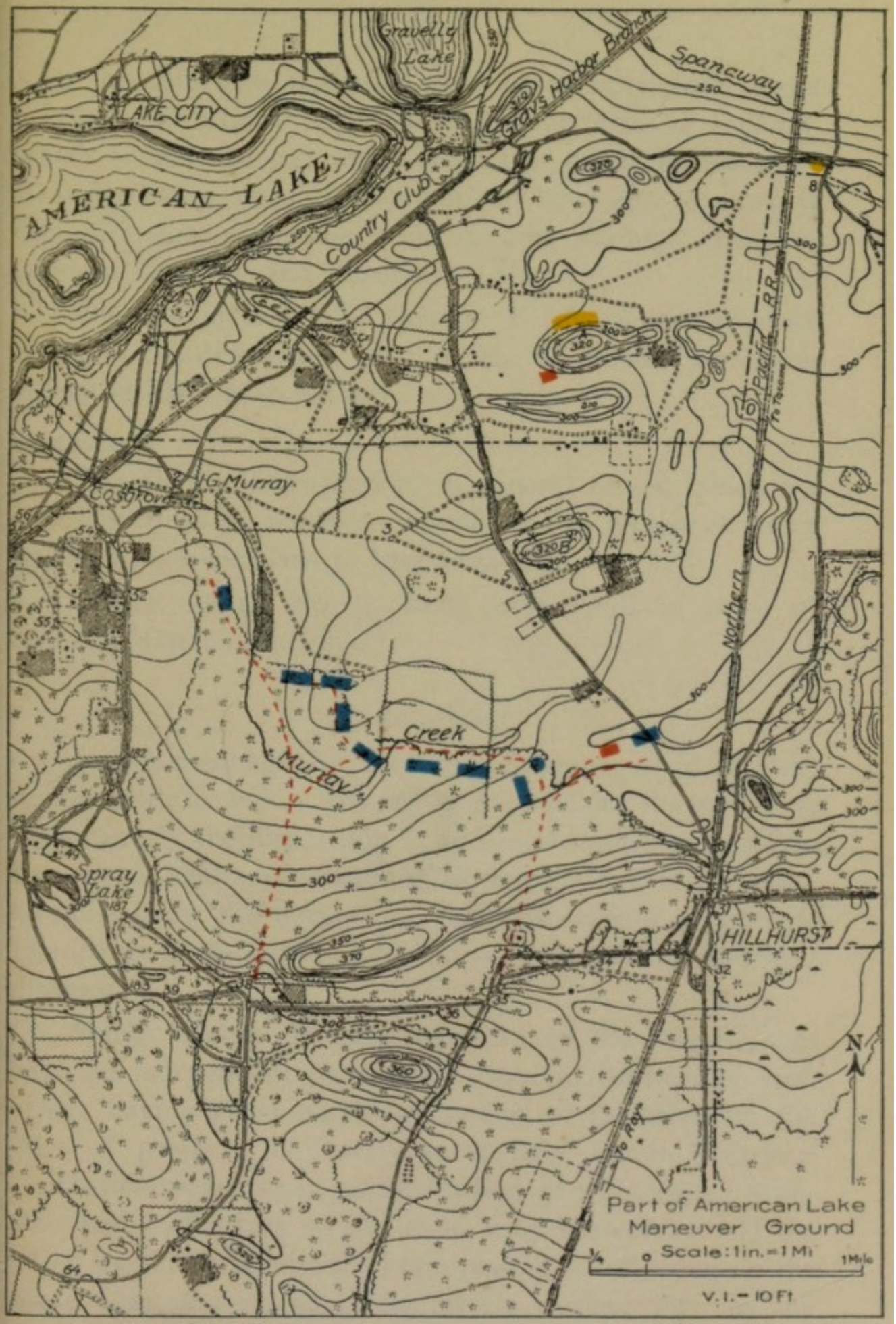


Plate Map No. 9 *Time 7:00 A. M.*

Red forces ▬ or ● Disposition of Blues shown in Plate Map No. 1.

Dotted red lines—Military road.

with the information that a Blue force, apparently about a brigade of infantry with one or two batteries of artillery, which bivouacked last night about two miles northwest of Gravelly Lake, started about half an hour ago to move in this direction along the road running through the pass between Gravelly and American Lakes.

On this information, General B issues orders which result in the disposition, at 7 A. M., of the Red forces as shown in Plate Map No. 9.

Required:

The further information, in general terms, which the Chief Surgeon of the Reds would need to receive in order to make his own plans to best advantage.

(NOTE:—Map No. 9, Red, corresponds in point of time to Map No. 1, Blue.)

A Solution.

It is not enough for the Chief Surgeon, or in fact the senior medical officer of any force on the defensive, to know merely the disposition of the combatant organizations for whose sanitary assistance he is expected to provide; he must know the purpose of such dispositions and be informed as to the results which it is expected that they will produce.

While General B, as commander of the defense, can have no independent plan of his own, in conformity with orders having given up the advantage of initiative for the sake of position, he surely must have planned various alternative measures of tactical action in resisting all probable modes of attack on his position by the enemy. If the latter should be repulsed, certain plans for following up the success can and should be tentatively worked out. In any event, plans including the direction, route and manner of

retreat, should this become necessary, will always have been carefully prepared. On all such matters, general and in detail, which can affect his work, the Chief Surgeon, for the sake of the promotion of greater efficiency of his sanitary subordinates and independent organizations, must be informed. Without this information the areas of probable greatest casualty cannot accurately be foretold by the Chief Surgeon, nor can he so dispose his sanitary units as to make them of the greatest usefulness in any probable contingency.

CHAPTER XXIII.

Disposition of Independent Sanitary Organizations in a Planned Defense.

Problem No. 19, Red.

General Situation:

As given in Problem No. 18, Red.

Special Situation:

As given in Problem No. 18, Red.

In addition to the information of the preceding problem, General B has informed his Chief Surgeon that he proposes to accept battle along the general line indicated on Map 9, shown with Problem 18, keeping his force concealed in the woods and concentrating it under cover along the newly cut road at such part of the line as may receive the enemy's main attack.

If the enemy advances against his left flank, he will hurry troops there to oppose him and then endeavor to envelop the hostile left flank with his reserve, located in the woods forming the salient.

If the enemy advances by way of the road and Hill B, he will take similar action, but enveloping the hostile right flank. As this is the more natural line for the enemy's advance, General B made his tentative dispositions accordingly. He proposes, in addition, to draw the enemy in that direction by a show of force and to that end has sent his cavalry and a battery to Hill A, with orders to delay the enemy. The artillery is then to keep under cover and rejoin the other battery; the cavalry to retire slowly, keeping in sight of the enemy, and then extend the line on the right.

In case of General B's success, if the enemy attacks his left, he will endeavor to force him back against American Lake; if the enemy attacks his right, he will try and force him north away from the pass between the lakes. In either contingency, he will probably not pursue more than a few miles, as his purpose is to check an advance and the enemy may have a strong force at the Blue base in Tacoma.

In case of the defeat of General B, he will retreat on Roy, fighting a delaying action in the dense woods as he retires. The railroad, the road from Hillhurst through 35 south, and the 38-37-66 road all lead to Roy; which of these lines of retreat is used in case of defeat will depend upon what part of his line the enemy attacks.

(NOTE:—Map. No. 9, Red, corresponds in point of time to Map No. 1, Blue).

Required:

The recommendations of the Red Chief Surgeon, based on all the foregoing information, as to the disposition of his independent sanitary units and formations, with reasons therefor.

A Solution.

Inasmuch as General B can have no definite plan and it is uncertain which part of his tentative line of defense will be attacked, the independent sanitary units should merely assume a "position in readiness" until the need for their services is developed.

Such a position, for the sanitary service, should present suitable facilities for easy access to all parts of the line of defense and the area in its front, and afford ready opportunities for withdrawal to the rear along a natural line of retreat. It should not be exposed to danger from hos-

tile fire or capture, yet should be accessible enough to be able, when summoned, to come up to any part of the general position without delay. Inasmuch as such a position is merely preliminary and not a location in which sanitary work will likely be carried out, such sanitary facilities as water, buildings, fuel, hay, etc., are of no special importance.

A glance at his map, on which the newly cut roads through the woods have been traced in red ink, shows the Chief Surgeon that the road south from 35 is most convenient for evacuation toward Roy. The cross-road at 35 is the logical point for the stationing of his sanitary reserves, since it fulfills all the above requirements. This point is about a mile from the center, and two miles from either flank. From it, the sanitary resources can move in all directions, with a choice of two ways of reaching either flank. Distance, heavy timber and the 340 foot ridge completely protect it from fire. The farm 600 yards north of 35, where the military road through the woods comes in, might be considered as a halting point, but affords no advantages and possesses certain obvious slight disadvantages as compared with the position last named. In a general way, the point 35 represents about an ideal "position of readiness" for an ambulance company in relation to a firing line. While the "position in readiness" assumed by a field hospital is perhaps usually further to the rear, in this instance the terrain is such that it can quite as well be brought well forward, and the absence of the field train enables the roads to the rear to be used without raising any apprehension as to their undue congestion and clogging. There is no special reason for or against halting ambulance companies and field hospitals at the same point; it is purely a matter of tactical convenience, which exists in the present case.

The Chief Surgeon therefore requests that Ambulance

Company No. 2 and the 2nd Field Hospital be sent to 35 to await orders.

He does not at this time recommend any point at which to establish a Station for Slightly Wounded. He properly decides to await developments before committing himself to any position the convenience of which must at present be problematical. The point 35 may perhaps prove to be best; on the other hand, if the flanks are attacked, other points will be better.

CHAPTER XXIV.

Protection of Sanitary Positions Against Fire.

Problem No. 20, Red.

General Situation:

As given in Problem No. 18, Red.

Special Situation:

At 5:30 A. M., General A ordered the 4th Infantry to entrench a position for two battalions on the ridge lying mostly east of the 6—5 road and about ¾ of a mile north of 6. These trenches extend from about 150 yards west of the road nearly to the Northern Pacific railroad.

The regimental surgeon, 4th Infantry, at first thought, sees no better place for sanitary assistance than behind these trenches at the bottom of the swale behind the gently rolling ridge. (See Plate Maps Nos. 9 and 10.)

He considers the following locations as positions for sanitary assistance:—

For the west battalion, the rear of its center, or a point a little east of the 6—5 road. Here the center of the swale seems about 9 feet below the crest of the ridge.

For the east battalion, and any troops sent to extend its right flank, a position midway between the 6—5 road and the railroad. Here the center of the swale seems about 18 feet below the crest of the ridge.

But before deciding on their suitability for his purposes, he reflects that he must know something more regarding the probable nature and direction of the anticipated attack. On his inquiry, his colonel informs him that the hostile advance will probably come from Hill B and its woods, covered by the fire of machine guns in the edge of the latter, and by that of artillery, the most suitable posi-

tion for which seems to be back of the little hill west of the railroad and appearing on the map near the letter "P" in "Pacific."

Required:

(1). Statement as to whether the regimental surgeon finds either, neither, or both of the two points suggested for sanitary assistance to be naturally protected from small arms "overshots" during a Blue attack as outlined above, with reasons therefore.

(2.) Statement as to whether the regimental surgeon finds either, neither, or both of the two points suggested for sanitary assistance to be naturally protected from shrapnel fire during a Blue attack as outlined above, with reasons therefor.

(3). The action of the regimental surgeon, 4th Infantry, if he finds that any special measures of protection of these points of sanitary assistance will be necessary.

A Solution.

The regimental surgeon, 4th Infantry, measures on his map the distance from the 300-foot contour line on the south of Hill B to the center of the swale at a point near the road. The distance is 1750 yards. The distance from the same point on Hill B to the line of entrenchments on the crest just east of the 6—5 road is 1450 yards. The center of the swale, its deepest point, is thus 300 yards, or 900 feet, behind the crest of the ridge. The drop in this distance is 9 feet, giving a reverse slope of the rolling ridge in the ratio of 1:100.

But the slope of fall of the United States military rifle projectile is as 1:8.4 at 2000 yards and 1:15.8 at 1500 yards. It is clear, then, that machine gun fire from the Hill B woods on the 300-foot level would, with its overshots, completely sweep the reverse of the ridge and that

part of the swale in the rear of the west battalion—the projectiles striking the ground nearer to the trenches the closer they passed over them, and vice versa.

If hostile infantry advances from Hill B, firing on the the trenches as it moves forward, it will shorten the distance between these two points and thereby decrease the angle of fall of the rifle projectiles as they strike or pass over the trenches. As the powder charge and initial velocity remain the same, the effect of this advance would be to cause any bullets which pass over the trenches to strike further and further to their rear. In the present problem, if the hostile infantry advances from Hill B it will not only draw nearer to the Red entrenchments but will also be more or less steadily moving to a lower level until it reaches the swale some 600 yards from the Red position. If the track of the bullet could be represented by a straight line, any descent of the firing troops would proportionately increase the height at which such overshot bullet would pass over the heads of individuals in the rear of the target but out of line of sight. But such a hypothesis is not true, for line of sight and curve of trajectory are two quite different things. The point of aim—in this case the trenches—would be the same at any distance, sights being altered accordingly. Only at very short battle ranges would line of sight and trajectory approximate so closely as to be comparable in respect to deciding a question as to the sufficiency of shelter, as in the present problem.

Hence, so long as the angle of fall of a projectile is equal to or greater than that of slope of terrain, any position in the rear of the point of aim is exposed to fire. The regimental surgeon, 4th Infantry, has already determined that the slope on reverse of his trenches at the point in question is in the ratio of 1:100. He knows that rifle fire at 1500 yards has a fall of 1:15.8; that at 1300

yards it is 1:25.5; that a 1000 yards it is 1:38.3; and that at 800 yards the fall is 1:63. It is thus apparent that until the enemy's infantry gets to well within 800 yards of his proposed relief station near the road, or within 500 yards of the Red entrenchments in front of it, the reverse slope and swale back of the west battalion will be open to fire not only from machine guns but from the infantry advance.

The regimental surgeon then applies the above data and reasoning in respect to the security of an Aid Station in the swale midway between the 6—5 road and the railroad. The middle of the swale, its deepest point, is 300 yards, or 900 feet, from the line of entrenchments. The fall from the crest of the ridge is about 18 feet in this distance, or a general slope of about 1:56. It is thus apparent that the proposed location of the Aid Station in the center of the swale will be continuously exposed to machine gun fire overshots, and to overshots from the Blue infantry advance until the latter arrives within about 850 yards of the Red entrenchments.

But at this last position, for a part of the total distance from the trenches to the center of the swale, the gradient is not even. It occurs to him that an Aid Station located in this special area of steeper gradient might be safe from fire. Measuring the distance on the map between the 300 and 310 contour lines here, this is found to be 1-40 inch = 1-40 mile = 44 yards or 132 feet. As the contour interval is 10 feet, the slope here is 10-132, or 1:13.2. This gradient is a little steeper than the angle of fall of fire from hostile machine guns posted at a distance of 1500 yards, but in this problem their distance is about 1700 yards from the trenches or about 1850 from the suggested Aid Station. At such extreme ranges, or even those beyond 1000 yards, bullets rapidly lose velocity and their

angle of fall proportionately increases. Undoubtedly the ground of the situation in question would be exposed to machine gun overshots. But to the fire of hostile infantry more than 1350 yards from the trenches it is clear that the surface of the ground at this site would not itself be exposed. However, in deciding the question of the shelter of a point of sanitary assistance, not the ground slope alone, but the ground fall minus the height of a standing soldier, say 6 feet, has to be considered. Thus 10—6 = 4 feet, which in 132 feet gives a fall of 4-132 or 1:33. As has been mentioned, the angle of fall of the rifle bullet is 1:25.5 at 1300 yards and 1:38.3 at 1000 yards. The proposed Aid Station here would be about 135 yards in the rear of the trenches; hence until the hostile infantry has advanced to within 1000 yards or less of the trenches, persons moving about at an Aid Station here would be in danger from their overshot fire. That portion of the ridge in front of the area of greatest fall will give no protection, since the map shows at once that its gradient is less than that of the locality under consideration.

The proposed and alternative points for an Aid Station back of the east battalion, though protected by a ridge twice as high and having a gradient materially greater than that for the west battalion, are thus seen to be highly unsafe from machine gun and rifle fire.

Second Requirement:

As to exposure of the proposed two positions to shrapnel fire, the distance between the probable Blue artillery position near "P" in "Pacific" and the Red entrenchments is about 2700 yards. The Aid Stations are about 300 yards in the rear of the entrenchments and therefore come within the limits of the danger area of the cone of dispersion of shrapnel directed at the trenches. The bursting angle of

shrapnel is 14°; and its angle of fall at 3000 yards is 1:7.4. But 1 degree=an angle represented by the proportion of 1:57.3; hence 1:7.4=7.8 degrees. Therefore to this latter angle of fall must be added one half the bursting angle, making a total of about 15 degrees, or a total angle of fall having a ratio of about 1:3.7. This is very much greater than the gradient of the ridge, either as a whole or at its steepest part.

It is therefore quite clear to the surgeon, 4th Infantry, that the swale in the rear of the entrenchments of his regiment, though wholly screened from the enemy's view and perhaps at first thought to be quite well protected, is, in fact, everywhere entirely exposed to small arms and artillery fire at probable battle ranges.

Third Requirement:

The regimental surgeon, 4th Infantry, after carefully examining his map and checking it up on the terrain, sees that the country to the rear and south of the swale for nearly half a mile is entirely exposed to hostile fire. It will be impossible to operate relief stations at any convenient points on that area or to move wounded over it during action. A point protected against rifle fire from the direction of Hill B will be found immediately east of the railroad fill crossing the swale behind the trenches—but this is far to a flank away from the natural line of movement to the rear, wounded and others moving to and from it behind the ridge would constantly be exposed to rifle overshots and shrapnel, and they would probably also come into direct view in crossing the railroad fill, in itself an obstacle not easy for severely wounded to surmount. Movement of wounded down the swale to the west, which would be their natural line of evacuation, would scarcely be possible, as it has been shown that the swale is everywhere

exposed to fire and such a route would be particularly unsafe as it necessarily leads through the position of the batteries, which would be certain to attract the attention of the enemy's artillery.

The regimental surgeon, 4th Infantry, therefore sees that his wounded can not be evacuated by the flanks or rear under fire, nor can they remain behind the ridge with any degree of safety unless some special measures of protection against shrapnel and small arms overshots are taken.

He therefore takes the following action:—

(1) The sanitary supplies are taken off his pack mule and the latter led back to Hillhurst and tied, to escape what would be otherwise certain destruction.

(2) Battalion surgeons, with their detachments, instead of being stationed behind the lines, are ordered to prepare and take suitable positions in the entrenchments occupied by their battalions. They are probably more safe there than in any other place, not specially protected, anywhere in the vicinity. They can give some assistance to helpless wounded, and during lulls they can start wounded back to the Aid Station. If "cover trenches" are put in for the reserve, one surgeon might take station there.

(3) He decides to put in a protected Aid Station for the entire line. The best point for this is probably about midway between the road and the railroad and at the foot of the steep slope in the rear of the two battalion entrenchments. Wounded in the west battalion will thus tend to withdraw from the dangerous proximity of the Red artillery and the hostile fire which it assuredly will attract. He will not put it in the bottom of the swale but on the reverse slope of the hill about 135 yards in the rear of the trenches. This location will certainly be less exposed to fire than a position further back, and wounded more-

over can reach it more quickly and with consequent less danger of further injury. And particularly as the hostile infantry advances to battle ranges where rifle fire becomes heaviest will their overshots tend to strike beyond rather than around this point.

If the colonel of his regiment will supply him the additional labor necessary to assist the Hospital Corps detachment, say a detail of 30 men, the regimental surgeon would cause a roofed shelter for his Aid Station to be hastily constructed. This would be built of fence posts or logs firmly set in the ground to a height five feet above it and supporting ridge poles aggregating a length of about 40 feet. Resting against this ridge would be leaned other poles in such a way as to make a shed covering a leveled ground space 6 or 8 feet wide and opening away from the enemy. The spaces between the roof timbers would be covered with boards, window shutters, doors or similar material torn from the buildings a few hundred yards distant on the 6—5 road, or with evergreen branches, taken from the nearby woods whence plenty of timber can be secured. The roof of this "lean-to" will be covered with earth to a depth of about a foot and a half, such a thickness of loose earth affording perfect protection from rifle bullets and shrapnel at any ordinary battle range.

If his colonel can not make such an arrangement, the surgeon will ask to have a trench dug at the position designated, as large as opportunity permits. The earth will be piled in front of it and a part of it may be covered with posts, timber or material supporting a protective cover of earth. This specially protected portion of the trench will be open at both ends for better access by wounded and their attendants. The position trenches will, of course, be provided with intersecting trenches permitting of evacuation of the former out of sight of the enemy.

CHAPTER XXV.

Disposal of Slightly Wounded With the Planned Defense.

Problem No. 21, Red.

General Situation:

As given in Problem No. 18, Red.

Special Situation:

The time is 9:00 A. M.

The movements of the enemy indicate that he is about to make his main attack against the right flank of the defense.

General B is just ordering the 2nd Bn., 4th Infantry, from the timber to reinforce the 1st Bn. under cover of the swale.

The 5th and 6th Infantry, less the 3rd Bn. are concentrated under cover against the enemy's right flank. Red machine guns are concentrated at the edge of the timber near Murray Creek, some 600 yards west of the artillery position.

The main position of the combatant forces at this time is indicated on Map No. 9, Red.

NOTE:—Map No. 9, Red, here about represents the same period of time as Map No. 4, Blue.)

Required:

The action of the Chief Surgeon, if any, at or about this time.

A Solution.

Under the above conditions, it is now apparent that the greatest number of wounded will fall on the right flank, drained by the 5—6 road. Although the terrain of this

sector renders the movement of wounded extremely difficult during action, nevertheless some few wounded will be starting back whose relief should be provided for. A Station for Slightly Wounded is needed; Hillhurst, only about a mile in rear of the right of the line, with its material advantages of crossroads, houses and protection by the ridge and heavy timber to the north is the logical place for its establishment, at least for the present, whether the Reds drive back the enemy, are themselves forced back, or merely hold their position. The services of neither the ambulance company nor field hospital are at present required, and the former is probably here, with the situation on the defensive, the more logical source of the personnel required in the Station for Slightly Wounded.

The Chief Surgeon, with the approval of General B, therefore sends his orderly with a message to the ambulance company commander to open a Station for Slightly Wounded at Hillhurst. The Brigade Adjutant at the time notifies all organization commanders of such establishment.

Until further developments, no other action by the Chief Surgeon is necessary.

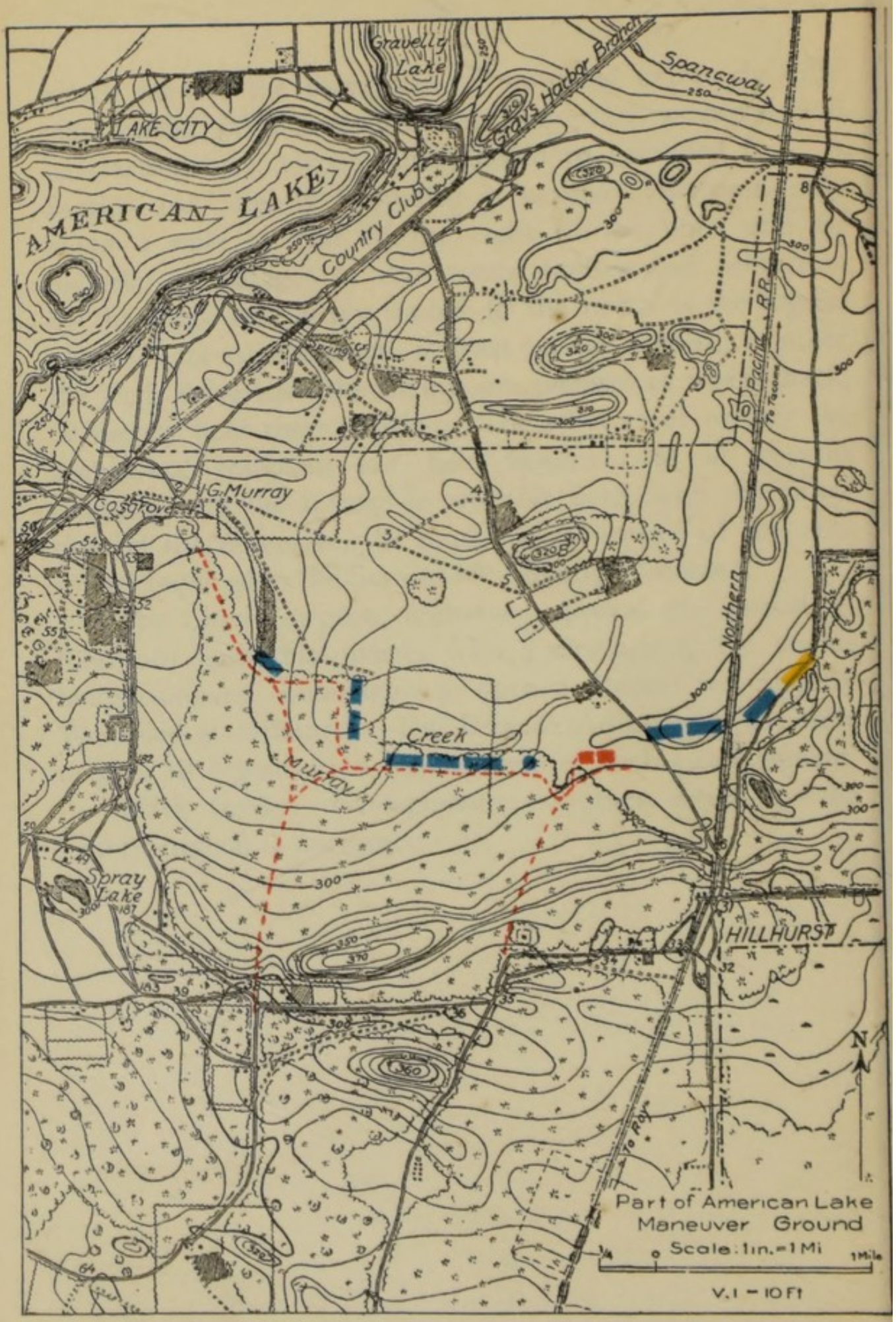


Plate Map No. 10 *Time 9:30 A. M.*

Red forces ▬ or ● Disposition of Blues shown on Plate Map No. 5.

Dotted red lines—Military road.

CHAPTER XXVI.

Sanitary Dispositions With Cavalry and Artillery In Action.

Problem No. 22, Red.

General Situation:

As given in Problem No. 18, Red.

Special Situation:

The time includes the period from 8:45 to 9:30 A. M. The positions of the troops in question at the latter time are indicated on Map No. 10, Red.

Map No. 10, Red, about coincides in point of time with Map No. 5, Blue.

Required:

(1) The location of the sanitary relief for the cavalry, with reasons therefor.

(2) The location of the sanitary relief for Batteries C and D, with reasons therefor.

(3) The method, if any, of evacuating cavalry and artillery wounded between 8 and 9:30 A. M.

A Solution.

First Requirement:

The squadron surgeon with the cavalry would take position with his sanitary detachment back of the little hill in the rear of the position occupied by his squadron, just inside the edge of the woods. This position is chosen as being readily accessible, screened from vision and protected from fire. It is probably also near the position taken by the troop horse holders and mounts.

Second Requirement:

The surgeons with Batteries C and D would probably combine their sanitary personnel and resources and work together in the woods at a point near where the military road emerges from the timber. They could not remain, with the existing terrain, in the immediate vicinity of their batteries, which will draw shrapnel and probably shell fire, unless they constructed bomb-proof shelters. The ground to the rear of the artillery position is fire swept. The same objection applies to the right flank, which moreover is away from shelter and the natural line of evacuation. But with their position about 300 yards west of the guns, and materially protected by the timber, they will largely escape searching fire and be out of the way of aimed fire. They will also be on a road to the rear and in the direction in which the battery horses are held. Their stations will be small; local inequalities of the ground, fallen timber or a few trees felled for the purpose will afford reasonably good protection from chance shots.

Third Requirement:

Less severely wounded in the cavalry and artillery will very probably start back from the firing line to their surgeons as soon as hit. If the fire is very heavy, they may have to remain where struck until a lull occurs. In such latter periods the surgeons would send out parts of their detachments to assist back to them the more severely wounded.

After reaching these relief stations, the more severely wounded would be quickly dressed and set aside to remain until the outcome of the action. Wounded able to walk would, after bandaging, be started back along the edge of the timber and under its cover, as individuals or groups, to Hillhurst, the artillery wounded having the additional protection of the 300 foot ridge a large part of the way.

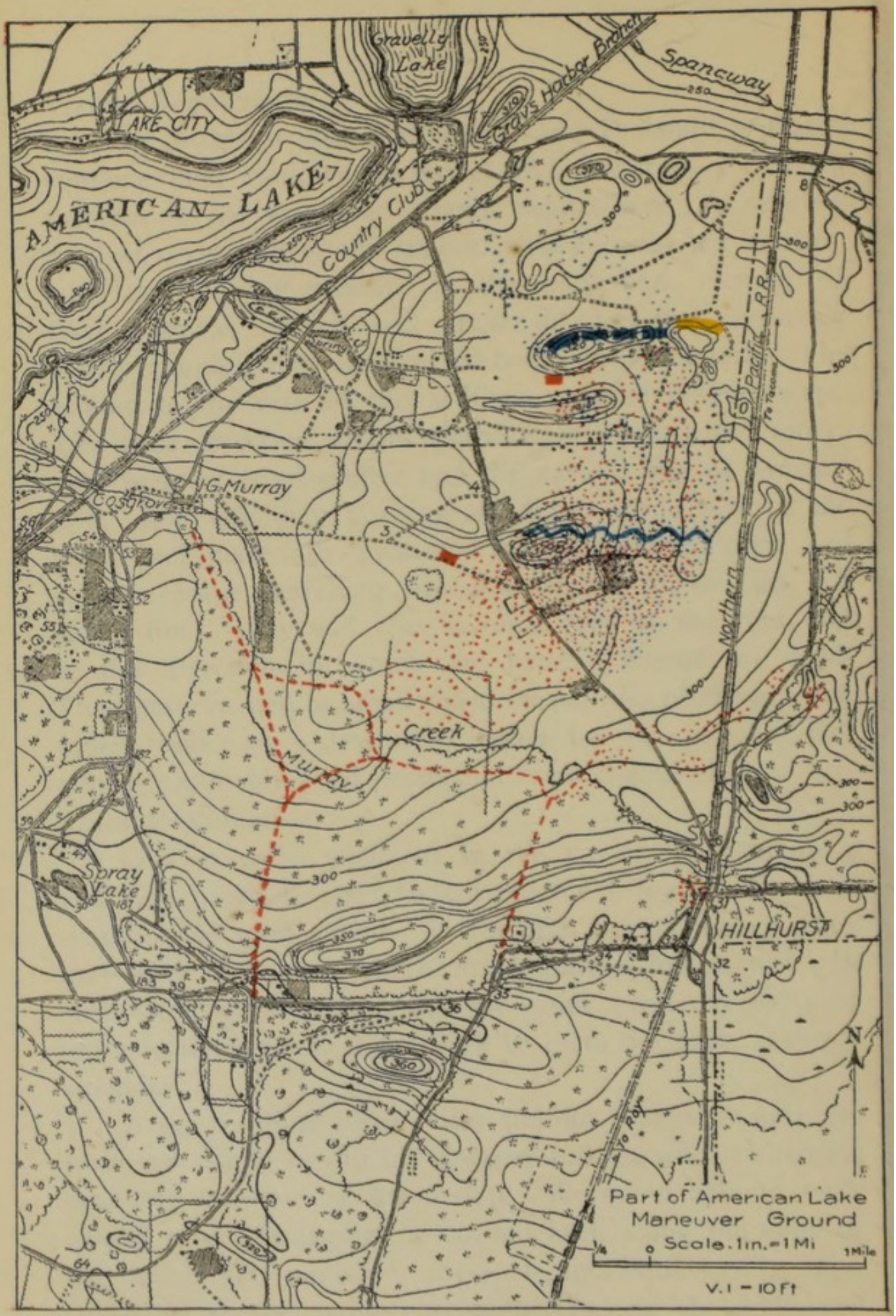


Plate Map No. 11 *Time 11:00 A. M.*

Red forces ▬ *or* ⩘ *Location of Casualties shown by red and blue dots.*

Dotted red lines—Military roads.

CHAPTER XXVII.

The Sanitation of an Occupied Battlefield.

Problem No. 23, Red.

General Situation:

As given in Problem No. 18, Red.

Special Situation:

The time is 11:00 A. M., and later.

The final disposition of the Red forces about this time or a little later is as shown in Map No. 11, Red.

General B, in personal command of the pursuing force, left the field about 10:30; after ordering the Chief Surgeon to remain behind and take charge of the sanitation of the battlefield and to collect all wounded and get them started for Roy as soon as possible.

The Chief Surgeon could have no definite knowledge at this time of the number of Red casualties, but roughly estimates them for the main battlefield south of Hill B at about 300, about half of which occurred in the 4th Infantry, together with a possible additional loss of a hundred or more during the pursuit which is now going on. The Blues seem to have left about twice that number south of Hill B, most of their slightly wounded having made good their retreat; and riding over the field to the latter point the Chief Surgeon saw the enemy's route of retirement to the north dotted with wounded from fire from the pursuing infantry and from a mounted charge by the Red cavalry. His estimate of the total wounded which will have to receive attention is in the neighborhood of 1200 to 1400, of whom probably about a third belong to his own forces and the remainder to the enemy. As near as he can determine at this time, these casualties are dis-

tributed about as indicated by red and blue dots on Map No. 11 Red.

In point of time, Plate Map No. 11, Red, about corresponds with Plate Map No. 8, Blue.

Required:

The action and recommendations of the Chief Surgeon at about this time, as a result of his orders from General B, with reasons therefor.

A Solution.

Prior to the action, as soon as he was informed by General B of the purposes of the latter and the probable moves of the enemy, the Chief Surgeon carefully studied his map in considering possible tactical situations in all their sanitary relations. When the enemy was driven from the main battlefield he again carefully examined it in connection with the sanitary situation as it had actually developed.

The first point for him to consider was the location of the wounded generally, and also in respect to the distribution of those of both sides. From the nature of the action most of the Red wounded would be in two main groups, one on or near the ridge half a mile north of 6; the other well south of 5 and west of the 5—6 road. Blue wounded would lie on an area east of the 5—6 road from the swale between the lines north to Hill B, and extending east and northeast of the latter. In the areas passed over by both forces, Red and Blue wounded would lie together.

The best route of evacuation of these wounded to the rear and the advance base at Roy would be by the railroad; by wagon transportation the route to the same destination would be by the 5—6 road to Hillhurst, thence either of the roads running south from 32 and 35 could be used. Excellent routes thus exist for readily draining the battle-

field of the disabled, and General B has issued no orders excluding any of them from such use.

The matter of the existence of any special facilities available for sanitary purposes on or near the battlefield would then be considered. The map shows a farm house about a quarter of a mile south of 5, and a farm house and barn near the 5—6 road nearly midway between Hill B and 6. There are no other buildings in the vicinity. These three buildings would have undoubtedly suffered much injury during the fight but are probably still standing. They would certainly afford good water supplies, fuel and perhaps hay, possibly cooking outfits, utensils of various kinds and other facilities adaptable to sanitary purposes. Though damaged, they would afford material shelter to a considerable number of wounded. The locations of these buildings are convenient to wounded in different parts of the field, and one or all of them may be utilized. They and their appurtenances become of especial value in view of the great number of wounded to be cared for and the limited sanitary shelter and equipment with the brigade. Without them, the condition of the wounded would be far less favorable.

But, though charged with responsibility for the care of all the wounded, the Chief Surgeon would naturally make such disposition of his sanitary resources as would give preference, if such proves to be necessary, to the earlier relief of suffering among the wounded of his own forces. He has but a single ambulance company and field hospital at his disposal, and it is clear that these ought to be located at points of greatest usefulness.

His map shows him that the farm nearly midway between 5 and 6 not only possesses the advantage of two buildings but is a point from which, as a center, a radius of 1000 yards in length would include more than three quarters of

the Red wounded and a very considerable proportion of the Blue wounded. This farm is further to the rear and in the direction in which all wounded will ultimately have to be moved. But the farm south of 5 lies nearer the zone of greatest casualty for the battlefield as a whole; and a radius of the above length, with this farm as a center, would include about half of the Red wounded and about an equal proportion of the Blue wounded. While not so near to the rear and the service of evacuation, its location further to the front makes it thereby proportionately more accessible to the Red and Blue wounded lying mixed east and northeast of Hill B and thus more valuable to the service of collection. The latter clearly is the first consideration and should be made as easy as possible. It is easier to move a few sanitary resources up than a large number of wounded back. Hence, while there is perhaps no great difference as to choice between these two points, the Chief Surgeon would probably decide on the farm house south of 5 as the main collecting point, with a subsidiary one at the other buildings about half a mile down the road. This collection of wounded at more than one point, of course implies the splitting up of the organized sanitary units on a basis of the sanitary situation that each fraction would have to meet. A sanitary organization would not ordinarily be split up if it could be avoided; but in this case the wounded are widely scattered and the divided facilities afforded by the farm houses much more than compensate for the evils of dispersion.

There is here no time factor to dominate the situation. The work of relief, once begun, can probably continue until completed. Wounded will, of course, be collected and removed as rapidly as possible, but there is no reason to apprehend that all of them can not ultimately be reached and receive attention.

The Chief Surgeon would therefore order Ambulance Company No. 2 to take its position at the house south of 5, collecting at that point wounded north of a line drawn 500 yards south of the house along the road; detachments from it would collect the wounded south of that line, including those in the infantry entrenchments and artillery positions, at the other house. As the distance from 35 is but three miles along the quite level road, by loading the dismounted men into the ambulances and moving at a trot Ambulance Company No. 2 should be up in half an hour after receiving the order to come to the front.

The 2nd Field Hospital would also be ordered into position at the house south of 5, detaching about a third of its personnel and supplies, less tentage, to organize and outfit a hospital in the house and barn about half a mile south of the former. As its wagons could move little faster than a walk, the field hospital should be up in about an hour from its position at 35.

To supplement the above independent sanitary personnel, which is quite insufficient adequately to handle the existing sanitary situation with its more than a thousand wounded, the Chief Surgeon would order the senior surgeons attached to the combatant organizations to send three quarters of the sanitary personnel with the infantry regiments now reforming, and half of that with the artillery and infantry on the firing line, to report for duty to the commander of the field hospital to go in south of 5. Pending arrival of this hospital, they would engage in first aid work near Hill B with their assistants.

To further assist the quite inadequate sanitary personnel in collecting and caring for wounded, he at the same time orders the regimental surgeons to send the regimental bands, with company litters, who had been placed under their direction prior to the beginning of the

fight, to report to Ambulance Company No. 2, at the same point without delay, to cooperate with the latter.

That the location of the 2nd Field Hospital may be generally known, the Chief Surgeon sends request to the Brigade Adjutant to inform organization commanders that it will be on the road south of Hill B. In the meantime, the hospital flag will attract attention.

For further necessary assistance, he sends a message to the Brigade Adjutant, asking that a company of infantry, as soon as it can be spared, be sent to report without arms to the ambulance company, at the house south of 5, for duty therewith.

To get rid as soon as possible of all wounded at the front who are able to travel, he likewise asks that a train made up of a dozen or fifteen of the most available railroad cars be ordered sent up from Roy without delay, bringing with it a sanitary personnel sufficient to receive and care for the wounded on the return trip.

That the authorities in the rear may be prepared to receive and care for the wounded which it is proposed to evacuate upon them, he also requests that the commander at Roy be notified that he will have to handle in that town, or forward to the main base, during the next twenty-four hours, about a thousand wounded of all classes.

He further asks that Hillhurst be designated as a loading station for the railroad trains removing wounded. On this being done he will at once direct the rendezvous there of all wounded able to walk, and as soon as informed when the hospital train will probably arrive, he will order ambulances to start moving the less severely wounded there in anticipation of its arrival. As the distance between the field hospital and Hillhurst is about 1½ miles, the ambulances should be able to load, unload and make the round trip in something less than an hour.

He recommends, in concluding his message to the Brigade Adjutant, that, if practicable, a truce be arranged with the enemy so that railroad trains to remove wounded may be moved as far north as Hill A, without danger from artillery fire, to convey directly to the rear wounded in the vicinity. The enemy should be especially disposed to grant such a request as his own wounded would be the ones chiefly benefited by this measure. Under the same truce, collecting parties should remove wounded from between the lines.

The Brigade Adjutant is probably very busy at the time this message reaches him, but will act on the above requests as opportunity offers and probably without great delay; in the meantime, the Chief Surgeon has done his own duty in the matter and started his administrative sanitary machinery into proper operation.

For the present the Chief Surgeon will leave the Station for Slightly Wounded to continue in operation in Hillhurst, since as soon as the enemy's fire against the Red trenches ceased, a considerable number of the wounded there would have seized the opportunity to make their way to the rear and are now there requiring considerable attention. And when the hospital train comes up and the main flow of wounded into Hillhurst begins, this Station for Slightly Wounded will automatically cease to be such only to continue its work with practically the functions of a Rest Station on the line of communications and the need for the services of a similar sanitary personnel.

As for himself, the Chief Surgeon will proceed to the Field Hospital as soon as it comes up to assist in and supervise the work there. He will notify the Brigade Adjutant of his whereabouts in his message above outlined. In the meantime he hurriedly rides over the battle-

field to get a better idea of the situation with which he is confronted.

General Comment on the Brigade Series.

The foregoing series of problems with the reinforced brigade is intended particularly to illustrate, in their simplest form and with the smallest organization including all arms of the service to which they would ordinarily be attached, the tactical employment of ambulance companies and field hospitals. Detached commands somewhat smaller than a reinforced brigade might have sections of the above named sanitary organizations assigned to their assistance, but such division would not normally be the case.Conversely, larger detached commands, but those of less size than the division, would have a proportionately larger number of such independent organized sanitary units assigned to them; though the relative number of each of these would very likely depend upon the tactical situation and the purpose of the commander.

In any case, the methods of tactical use of ambulance companies and field hospitals, here illustrated, would apply whether employed in connection with single sanitary units of this character or with a number working together and in co-operation.

But it must not be assumed from the foregoing that, where brigades are merely component tactical units of larger forces, there should be specific assignment to them of their independent sanitary organizations. It is true that regiments and battalions have a fixed amount of sanitary assistance officially attached to them whether these organizations are under fire or not; but the same does not apply in respect to larger tactical organizations of less size than the division. The services of independent sanitary organizations, under such conditions, are not assigned to military

units of the division; they are assigned to zones of casualty. A brigade not under fire would neither need or receive any assistance from an ambulance company or field hospital; while another brigade in the same division, which bore the brunt of action, might have assigned to its sector the greater part of or all such sanitary organizations with the division. Thus while, as previously indicated, the battalion and regimental sectors of a long firing line would each possess within itself an equal amount of primary sanitary assistance, this rule is not necessarily extended to a brigade sector of such a line and its secondary sanitary assistance. But wherever ambulance companies and field hospitals are actually employed, the general principles governing their tactical employment are similar for each, irrespective of the size of the forces with which one or several of them may be employed.

With the extension of problems to commands the size of a brigade or larger, and the consequent introduction of the independent sanitary organizations as tactical units, comes necessity for consideration of the service of evacuation in the rear of the firing line and battlefield. These independent sanitary formations are intended for supplementary, occasional and temporary use only, and if evacuation toward the rear does not bear close relation to the reception of wounded from the front, they soon lose their mobility, thereby defeating the purpose for which they are organized and maintained—that of bridging the gap between the regimental sanitary service and that of the line of communications.

While this brigade series of problems is planned to illustrate various typical phases of sanitary service in war, one of its chief purposes is to demonstrate the absolute dependence of the latter upon the tactical situation; also the need for complete mutual understanding between the

commander and his medical staff officer, and between the latter and his sanitary subordinates, in respect to military information in all matters in any way affecting the sanitary service and in coöperation with the management of the latter toward the best accomplishment of military purposes.

It is important to note that while a schematic system of sanitary organization in theory assumes the formal establishment of an Aid Station with each regiment under fire, the establishment of ambulance company Dressing Stations during action and the moving up of field hospitals into positions of final service, in practice such a formal scheme is probably never carried out in its entirety. This fact is particularly well illustrated by the Blue side of the foregoing series of problems, in which probably only a single Aid Station would have been established for the three regiments engaged, no Dressing Station was ever formally put into operation, the field hospital finally went into position in a location totally different from that originally anticipated, and the efforts of the whole Blue sanitary service practically resolved themselves into the provision of hasty first aid dressing and attempts at removal of only the slightly wounded, with a few whose injuries were of a somewhat more serious nature.

On the Red side, also, only one regimental Aid Station would have proved to be possible under the conditions of the combat, though the entire force was engaged and probably all its organizations suffered considerable losses. But in respect to the management of his ambulance company and field hospital, conditions were such that the action of the Red Chief Surgeon was there more in consonance with the theoretical and formal use of such organizations.

With these problems, some of the functions of the sanitary service of the line of communications begin to

be indicated. They cannot be arbitrarily dissociated from those of the sanitary service of the front, since these two coordinate branches must supplement each other if the final result is to be properly secured.

The whole series of problems well illustrates the fundamental fact that the tactical use of sanitary detachments and organizations is always to be based on general principles which must be adapted to local conditions, and can not be governed by set rules and iron-clad preconceptions.

PART VI

SANITARY TACTICS WITH THE INFANTRY DIVISION

CHAPTER XXVIII.

Divisional Sanitary Organizations in Column, With Map Reading, Elongation of Columns.

Problem No. 24.

(Based on 4 inch map of Fort Leavenworth and vicinity.)

Situation:

A train composed of all the ambulance companies and field hospitals of the 1st Division is moving north on the Frenchman—17—47—45 road.

Major X, Medical Corps, in command, is riding at the head of this train and is nearing the house of J. Aaron, north of 17, when a staff officer rides up and orders:

"Halt your train as soon as the rear wagon clears the Millwood road."

Major X continues on at the head of his train.

Required:

The point on the map where he gives the order to halt.

A Solution.

He gives the order to halt where the 860 contour line crosses the road on the map, or about 225 yards north of 47.

Explanation:

It is assumed that there is no depletion of these organizations through temporary assignment of ambulances to regiments.

Field Service Regulations give the road space of four ambulance companies as 1,160 yards, and of four field hospitals as 680 yards. An interval of twenty yards be-

tween the two may fairly be assumed. The total road space is thus 1,860 yards.

But elongation of the column, due to straggling, has to be considered. Field Service Regulations state that this may amount to as much as 25 per cent. The degree of elongation of course depends largely on favorable conditions of roads, weather, animals, etc. The problem gives no information on these points. Conditions therefore may be assumed as satisfactory and elongation as but 10 per cent, or 186 yards.

This gives a total present length of column of 2,046 yards. But commands on the march ordinarily close up to proper interval at the halt. Major X would therefore ordinarily disregard the factor of elongation in bringing his column to position at the halt, but in this instance his map shows him that he is coming to a steep hill (grade about one in six) on Plum Creek, with the road passing through a deep cut and opening immediately and at an angle on a bridge passing over a considerable stream with steep banks, and presumably unfordable. The bridge is probably of the ordinary country variety, none too wide or strong. A wagon train halted on this area, which covers some 200 yards, or a distance just about compensating that of the elongation of the sanitary train, may not only find it difficult to hold wagons in position, but may block the road or bridge, or overload the latter. Major X will therefore halt his train in two sections, the rear wagon of the forward portion being closed up so as to just clear the bridge and the forward wagon of the rear section stopping at the entrance of the cut on Plum Creek Hill. He will leave a subordinate at this latter point to carry out this plan.

Major X, knowing the present length of his column, therefore lays off that distance north from 17 on his map.

When he reaches the point which the map shows to be 2,050 yards from 17, he gives the order to halt.

Comment:

One purpose of this problem is to bring out the magnitude of the organized sanitary units which the Medical Department uses with the complete tactical unit—the infantry division. Organizations requiring such road spaces cannot be disregarded in any plans or calculations having to do with the movement of troops.

Another is the necessity for considering the factor of elongation with marching troops.

Another is the necessity for careful reading of the map and the use of all information which it gives before arriving at any final conclusions of a tactical nature.

CHAPTER XXIX.

Sanitary Administration Within the Marching Infantry Division.

Problem No. 25.

(Based on 2 inch map of Fort Leavenworth and vicinity.)

Situation:

An infantry division is marching west by the single road 56—54—16—18—Terminal Bridge—Shawnee St.—48—110—94—90—86.

The bulk of the cavalry is used as independent cavalry; the advance guard consisting of one squadron of cavalry, two regiments of infantry, one battalion field artillery, one company engineers, one ambulance company.

The weather is hot and fair; the roads dusty.

The Chief Surgeon, riding with the Division Commander at the head of the main body, reaches Easton at 12 noon and learns that the wagons containing the Reserve Sanitary Supplies, which had not previously joined, have caught up and are following at the rear of the supply train.

He at once sends a message by his orderly to the Medical Supply Officer marked "ordinary."

Required:

(a) The point on the map at which the wagons with the Reserve Sanitary Supplies are at this time.

(b) The point on the map at which the orderly will meet the Medical Supply Officer.

(c) The time at which the Chief Surgeon, who re-

mains at Easton, may expect to receive a reply, assuming that the Medical Supply Officer writes one without delay.

(d) The distance that the orderly will ride in performing this duty.

(NOTE:—Use table of approximate road spaces given in Field Service Regulations. Assume about three miles interval between rear of column and head of train.)

A Solution.

Answer:

To (a) The wagons containing the Reserve Sanitary Supplies are about one mile west of 56, near the angle in the road.

To (b) The orderly meets the Medical Supply Officer in the immediate vicinity of 18.

To (c) The Chief Surgeon receives his reply about 7 P. M.

To (d) The orderly rides about twenty-eight and a half miles in performing this duty.

General Consideration:

It must be remembered that "road space," as referred to in Field Service Regulations, is to be modified according to the tactical disposition of troops on the march, intervals and elongation.

By the terms of the problem, the troops in advance of the main body need not be considered. The sanitary organization included in the advance guard is less its wheeled transportation. (Sec. 302, F. S. R.)

The organizations composing the remainder of the column, with combat trains, with their normal road spaces, as given in Field Service Regulations, are:—

Division Headquarters, say	45 yards
Half troop of cavalry	45 yards
1 regiment of infantry	880 yards
2 brigades of infantry	5600 yards
1 brigade field artillery, (less 1 bn.)	3370 yards
2 companies of engineers	350 yards
2 companies of signal corps	380 yards
1 ambulance company, train only	250 yards
3 ambulance companies, complete	840 yards
4 field hospitals	680 yards
Total	12420 yards

The advance guard formation indicates that opposition may be considered, hence the sanitary organizations march in advance of the field train. For the same reason, it is assumed that ambulances are concentrated, though concentration or dispersion makes no difference as to road space.

To the above is added the road space of the field train composed of the field wagons of all the organizations of the division. (Field Service Regulations, Sec. 230.) This is determined by subtracting road space with combat trains from total road space with field trains as follows:

Division Headquarters, 7 wagons (Sec. 34, F. S. R.)	140 yards
1 regiment of cavalry	500 yards
3 brigades of infantry	2510 yards
1 brigade of field artillery	900 yards
1 battalion of engineers	110 yards
1 battalion of signal troops	80 yards
Total	4240 yards

Then follows the ammunition train:

5 wagon companies	2100 yards

To this is added the road space of the supply train (less sanitary reserve):

6 wagon companies	2500 yards
Field bakery	230 yards
Pack train	100 yards
Total	2830 yards

These aggregate normal distances are as follows:

Column of troops (head of main body to rear) with combat trains	12420 yards
Field train of entire division	4240 yards
Ammunition train of entire division	2100 yards
Supply train of entire division (less sanitary reserve)	2830 yards
Total	21590 yards
Add for intervals between combatant units	200 yards
Add for intervals between combatant units and field train	2500 yards
Add for interval between field train and ammunition train, heading supply train	6000 yards
Total addition for intervals	8700 yards
Total normal length of road space	30290 yards

or in round numbers say, thirty thousand yards.

To this, however, we must add twenty per cent for elongation of actual column length. This does not imply elongation of intervals. The problem gives the weather as hot and the roads as dusty. Reference to the map shows country hilly and irregular, the road crooked, with one long bridge to cross. These combine to cause unavoidable extension of the marching column.

From the Chief Surgeon at the head of the main body to the sanitary reserve at the rear of the supply train is thus some thirty-four thousand six hundred yards, or almost exactly twenty miles.

Explanation of (*a*).

Measurement of the distance from Easton back along

the designated route to 56 shows it to be thirty-six thousand two hundred and fifty yards; the length of the column from the head of the main body to the Reserve Sanitary Supplies has been shown to be thirty-four thousand six hundred yards; hence the latter must be sixteen hundred and fifty yards, or about a mile west of that point, or just west of the angle in the road west of 56.

Explanation of (b).

The orderly on receiving a message marked "ordinary," will endeavor to ride at the rate of approximately five miles per hour. (Sec. 64, Field Service Regulations). He can not do much better than this as the narrow country road is choked with moving troops. The wagon train, especially in view of hilly country, dusty roads and heat, can make no more than two miles per hour. (Sec. 147, Field Service Regulations). They are approaching each other at a combined rate of seven miles an hour, the orderly moving five-sevenths of the total distance. This total distance has been shown to be twenty miles. They will therefore meet at about fourteen and three-tenths miles from Easton (24860 yards), in the immediate vicinity of 18.

Explanation of (c).

The orderly can not start to return until about 3 p. m. He has about fourteen and a half miles to make, has just completed a similar distance, and presumably had about completed an ordinary day's march when the Chief Surgeon sent him off at noon. This means that he will have had to ride at least thirty-eight miles, perhaps more, since starting in the morning. With hot weather, dust and hilly country, his horse will probably be nearly exhausted before he reaches Easton. To get there at all, the orderly can probably not return faster than three and one-half to four miles per hour.

Explanation of (d).

The orderly has to travel double the distance required by (c), shown to be a little more than fourteen and one-fourth miles, or a total of something over twenty-eight and a half miles. It will be more rather than less than this, from the necessity of at times leaving the road and making detours to pass moving organizations.

Comment.

This problem is intended to illustrate, among other things:

1. The tactical composition of an infantry division on the march.

2. The magnitude of the smallest complete tactical unit used in modern war; as shown by the fact that when the rear wagons of the column are only about a mile from the east boundary of the territory covered by the map (the latter practically covering territory twenty miles from border to border), the main body is just at its western border, and the advance guard has passed off the map a number of miles further to the westward.

3. The influence of terrain, roads and weather on elongation and speed of marching.

4. The speed of mounted orderlies.

5. The imperative necessity for mounted training for Hospital Corps men, all of whom are liable to orderly or other mounted duty. With the infantry division, 28 per cent of the sanitary troops are mounted.

CHAPTER XXX.

Disposition of Ambulance Companies in the Division Attacking in Single Column.

Problem No. 26.

Situation:

The advance guard of an infantry division is unexpectedly engaged.

The column moves forward a short distance and then halts, occupying the road.

The Chief Surgeon, riding at the head of the main body, desires to send forward to the advance guard the bearer and dressing station section of an ambulance company, marching in the rear of the main body. The roads are ordinary but level country roads and the weather is cool and fair.

The main body consists, in its organization of troops and their order of march, as follows:

Division Headquarters
3rd Infantry Regiment
Hq. Field Artillery Brigade
1st Field Artillery Regiment (less 1 battery)
2nd Infantry Brigade
2nd Field Artillery Regiment
3rd Infantry Brigade
Battalion Engineers (less 1 company)
Battalion Signal Corps (less ½ company)
Ambulance Companies Nos. 1, 2, 3 and 4.

Required:

The duration of the delay before a suitable quota of the sanitary troops above mentioned can arrive for duty.

A Solution.

Answer:

About 4¼ hours.

Explanation:

The solution of this problem primarily depends upon the road space from the head of the main body to the nearest sanitary organization, and the interval between the former and the reserve of the advance guard.

The former is as follows: (F. S. R., p. 219).

Division Headquarters	50 yards
3d Infantry Regiment	880 yards
Hq. Field Artillery Brigade (estimated)	20 yards
1st Field Artillery Regiment (less 1 battery)	1830 yards
2d Infantry Brigade	2800 yards
2d Field Artillery Regiment	2150 yards
3d Infantry Brigade	2800 yards
Battalion Engineers (less 1 company)	350 yards
Battalion Signal Corps (less ½ company)	290 yards
10 ambulances, distributed through column. (See Sec. 144, F. S. R.)	200 yards
Total	11370 yards

By the terms of the problem, the ambulance companies will be found immediately following the Signal Corps. The distance from the Chief Surgeon to the nearest ambulance company is thus 11,370 yards, or about 6½ miles.

Elongation on the march is not here considered, for the column of troops on halting is closed up.

It is assumed that communication is by mounted messenger, as the sanitary service receives no training in receiving or sending messages in other ways.

The Chief Surgeon gives his orderly an order, marked "urgent," for the nearest ambulance company to send its bearer and dressing station section to the advance guard

as rapidly as possible. "Urgent" means the highest speed consistent with certainty of arrival. (Sec. 64, F. S. R.). Were the road clear, the orderly could deliver his message in about 30 minutes, but the problem states that the troops have halted, occupying the road, presumably awaiting orders and in more or less uncertainty. This will force the orderly to go more slowly and make detours, delaying him very materially, depending largely on local conditions of terrain and road of which nothing is stated. But it is safe to assume that the orderly will be so delayed as to prevent his delivery of the message under about 50 minutes.

The transportation of the ambulance company ordered up is left behind, from the terms of the problem, from the fact that the road is blocked, and the further fact that tactical considerations would not permit it to come to the front at this time.

Were the roads clear, the bearer and dressing station section could, with urging, march to the front at the rate of about 3½ miles per hour. But the reverse is the case, and these sanitary detachments will have to march across country, parallel with the road.

Under such conditions, they could presumably move no more rapidly than 2¼ miles per hour.

This would bring the detachment abreast of Division Headquarters about 3 hours and 40 minutes after the Chief Surgeon sent off his orderly.

But the "duty" of the sanitary detachment, referred to in the problem, lies with the advance guard. The rear of the reserve of the latter is probably at least 1½ miles in advance of the main body (Sec. 110, F. S. R.) and it will take at least half an hour more for the detachment, which can now use an open road, to reach the reserve, or a total of about 4¼ hours.

It will probably go no further forward without halting,

for a sufficient force to attempt to stop a division would probably have long since driven in those at the immediate front and brought the reserve of the advance guard into action.

During this delay of 4¼ hours, the entire relief work in the troops engaged has devolved upon the sanitary personnel attached to regimental and other organizations. The interests of the wounded have probably materially suffered through this delay; which could have been avoided by a suitable sanitary assignment with the advance guard in the first place.

Comment:

This problem is intended to illustrate, among other things:

1. The length of the divisional column and its component organizations under the assumed conditions.

2. The usual interval between the main body and advance guard of a large command.

3. Speed of a mounted orderly under difficult conditions.

4. The rate of movement of a small detached command, under the assumed conditions.

5. The necessity for a proper distribution of sanitary organizations in the column of a large command on the march in campaign.

CHAPTER XXXI.

Disposition of Sanitary Units of a Division, Attacking in Two Columns.

Problem No. 27.

(Based on 2 inch map of Fort Leavenworth and vicinity.)

General Situation:

A Blue division is advancing against Leavenworth from the west. It bivouacked for the night in the following positions:

1st Brigade
1st Bn. 1st F. A.
Troop A, 1st Cav.
Co. A, 1st Bn. Eng.
Det. Signal Corps

on the stream northeast of 90, with outposts on the line P (inc.)—94—110 (inc.).

2nd Brigade
Troop B, 1st Cav.
Co. B, 1st Bn. Eng.
Det. Signal Corps
Amb. Co. No. 1,

about a mile east of 114, with outposts on the line 110 (exc.)—120 (inc.).

The 1st Cav., less Troops A and B, are near 154. The remainder of the division is just east and southeast of 88.

The 1st Section of the trains is just west of Easton.

The 2nd Section of the trains is about seven miles southwest of Easton.

The Field Train, after issuing all its rations, joined the pack train two miles west of Easton.

The Reds, in the strength of one division, are known to have prepared and occupied a position extending from Hund Hill to 136, with an advance position on the ridge west of 102.

General A, of the Blues, has orders to attack the Reds early tomorrow morning. He proposes to envelop the Red left flank, to prevent the latter from withdrawing across the Terminal Bridge, the Rock Island Bridge having been destroyed.

General A intends to attack in two columns, the 1st Brigade from the prolongation of the 92-94 road east; the 3rd Brigade along the 110-104 road southeast. The engineers are ordered to build a road tonight from 90 to the bend in the road west of 110. The artillery positions at first will very likely be south of 92 and 110. The 2nd Brigade is held in reserve on the right to move along the 122-128 road.

Required:

(1) The probable location last night of the various sanitary organizations with the division.

(2) The disposition which General A should make in the field orders he is about to issue, in respect to his ambulance companies, field hospitals and reserve sanitary supplies, with reasons therefor.

A Solution.

First Requirement:

By the terms of the problem, Ambulance Company No. 1 bivouacked with the 2nd Brigade about a mile east of 114.

The probable location last night of the remaining three

ambulance companies and all four field hospitals is with the Field Train, 2 miles west of Easton.

The reasons for such disposition of the divisional sanitary organizations would be about as follows:

Under the tactical situation, the Blue division would have moved eastward with a heavy advance guard consisting of probably a reinforced brigade. To this force, by reason of its size and of the length of the division, an ambulance company, with or without wheeled transportation, should have been assigned. It therefore seems probable from its composition as well as position that the force which bivouacked east of 114 formed such an advance guard. Had the Blue division moved eastward by more than one road, an ambulance company would probably have been sent with the other brigade in advance, which in this case, from the terms of the problem and its position in relation to the other troops, would probably have been the force bivouacked northwest of 90. But there is no ambulance company with these latter troops, hence they probably formed the leading element of the main body in a division advancing by a single road.

But under Field Service Regulations, the ambulance companies and field hospitals held in reserve with the marching division would follow the combatant troops with the Field Train, either following the latter under ordinary conditions or preceding it if action is imminent. The former disposition was probably the case yesterday. When the column halted and the troops were moved out on a wide front for bivouac, the natural disposition of the reserve sanitary units above mentioned would be to bivouac near the Field Train which they were accompanying. They therefore move up with it and go into camp 2 miles west of Easton, while the Field Train moves forward to the troops, delivers supplies and returns to that point as directed.

The latter point is quite well suited for the location of these sanitary organizations at this time, being only about three or four miles in rear of the combatant troops and thus in a position to come forward quickly if required, or to retire safely if it be necessary. In the meantime, while available, they are out of the way of the combatant forces. The ambulances of the ambulance company encamped east of 114 will be available and sufficient to bring back the sick who should be evacuated from all the troops at the front before further movement begins tomorrow.

The wagons containing the Reserve Sanitary Supplies, for the emergency need of which there is little likelihood at any time, are probably with the second section of the trains, 7 miles southwest of Easton.

Second Requirement:

The field orders to be issued by General A as a result of his purpose to attack, so far as they relate to the sanitary organizations, would contain the following paragraph:

"4. Ambulance Companies Nos. 1 and 2 will move to the orchard near 90 and await orders.

Ambulance Companies Nos. 3 and 4 will follow the 2nd Brigade, halting under cover just east of 126 and there await orders.

The Field Hospitals will reach Easton by 7 A. M., and await orders just southeast of that town.

The trains will remain in their present positions until further orders."

Reasons:

At this time, General A can do no more than place his sanitary organizations in positions of readiness. As yet

there are no wounded to consider. The points which should be chosen should be convenient to probable zones of casualty, on good lines of communication, not near enough to the front or otherwise so exposed as to cause organizations there to come under fire, nor, on the other hand, not so far to the rear as to prevent them from being promptly available when they are required. Moreover, they must not interfere with the movement of troops.

With these general requirements in mind, and knowing that considerable loss will occur in driving the enemy from his advance position on the hill west of 102, General A will provide assistance for these preliminary casualties by sending Ambulance Company No. 2 to 90. This point is about 5000 yards from the enemy's advance position and is thus far enough from the latter to be safe from rifle fire; it will also escape artillery fire through distance and because it is screened, and being well on the flanks and to the rear of the artillery position, it will thereby escape aimed fire or shots directed at the latter.

He sends Ambulance Company No. 1, previously marching with the 2nd Brigade and which has probably been temporarily engaged in clearing the combatant organizations of sick, to the same point for both convenience and safety. The 2nd Brigade, with which it has encamped, will scarcely need its services until it has advanced well east of 110; and if it then does, the ambulance company can be moved forward to it by the 90—94—110 road, or by the new military road opened directly between 90 and the angle west of 110. If required as a sanitary reinforcement on the extreme right flank, it can readily continue on there via either 122 or 110. If the casualties in taking the enemy's advance position are unexpectedly heavy, it is in position to reinforce Ambulance Company No. 2.

In the meantime the general principle of avoiding the

unnecessary dispersion of any military organization is observed.

Ambulance Companies 3 and 4 are to follow the reserve brigade, halting for further orders just east of 126. General A sends them to this point, as his plans contemplate that the main attack on the enemy's position will develop east of that point and he must make provision for the many casualties which undoubtedly will occur in that sector. The point near 126 is most convenient for his purpose, being neither too near, too far nor exposed to fire. If the 124—126 road is for a time exposed to fire from artillery posted on the enemy's advance position, the ambulance companies would delay crossing the 110—126 ridge until the enemy had been driven out.

The ambulance companies will not be merely directed to follow brigades without being given a halting point. They are not under the orders of Brigade Commanders. General A must know where to find them and be assured that they can promptly obey his orders at any time to take position and open up. To let the latter depend upon the judgment of subordinates, uninformed as to the sanitary situation as a whole, would be bad policy. General A will know best when and where their services will be needed most.

All the field hospitals are moved forward in due season to Easton and held concentrated there awaiting developments and for facility of direction. The reason is that in case of reverse they are across the Big Stranger, in itself an obstacle to pursuit, and can fall back without delay or clogging of the roads; in case of success they are nearly an hour's march nearer the field of battle and can promptly come forward to any desired position. They are also at the logical point to which the flow of wounded will be directed over several available roads to the rear, for

trans-shipment by railroad to hospitals further back. If the enemy is driven out, it may be that some wounded should be moved forward into Leavenworth rather than back to Easton; but this is problematical, and in any case will not occur until after many hours of severe fighting during which some line of evacuation of wounded will have to be established. Outside of Leavenworth, Easton is the only community affording suitable facilities in the shape of shelter, supplies and assistance for the care and further evacuation of numerous wounded and convenient to the battlefield. Some sanitary provision will almost certainly have to be made there; and until the line of communications sanitary service can make it, it will have to be derived from one or more field hospitals. It is proper forethought, therefore, to have the field hospitals concentrated and in readiness at Easton, a point at which, or in advance of which, their services will be needed.

The wagons containing the Reserve Sanitary Supplies will continue to remain with the 2nd Section of the Supply Train, which holds its position 7 miles southwest of Easton. There will probably be no sanitary reason for changing the location of these supplies until the final issue of the battle is apparent.

CHAPTER XXXII.

The Service of Sanitary Information and Orders.

Problem No. 28.

(Based on 2 inch map of Fort Leavenworth and vicinity.)

Situation:

As given in Problem No. 27.

Required:

(1) An outline of the channels by which the Chief Surgeon and his sanitary subordinates will endeavor to keep in communication during the coming action.

(2) The general nature and importance of the information which the Chief Surgeon should receive prior to and during the coming action, with reasons therefor.

(3) The general nature of the information, recommendations and orders which the Chief Surgeon may expect to give during the coming action.

A Solution.

First Requirement:

There are two general channels of communication through which the Chief Surgeon and his sanitary subordinates will endeavor to keep in touch during the coming conflict.

One is through the general service of communication and information, conducted under the Signal Corps, and extending in its ramifications from division headquarters to brigade, artillery, cavalry and other independent commanders and through them down to the commanders of minor tactical organizations, units and detachments. This

service represents the military channels for the transmission of information, and would habitually be used. It is planned to operate on a basis of tactical efficiency and in a manner by which the sanitary service is included only indirectly. Speed in the transmission of military intelligence is an important essential. Through this service, information is transmitted by telegraph, buzzer, telephone, flag, heliograph, night lamp, wireless telegraph, and messengers on foot, mounted, on bicycle, motor cycle or car, or flying machine. In the present instance, communication by wire, wireless, flag and messenger would probably be maintained. Wire communication would probably be laid to connect division headquarters with the brigades engaged and with the artillery positions. But whatever the general system of transmission of intelligence employed, it is, when necessary, at the disposal of the sanitary service. Through these agencies of communication, information is sent in at frequent intervals and from many sources to higher authority, and now and then an order based thereon is sent out. Through them ordinarily would go all messages of sanitary significance in which others as well as the Medical Department are concerned. Thus knowledge of sanitary conditions on the firing line would reach the Chief Surgeon through the Chief of Staff, after being reported by the battalion surgeon to his commander, and transmitted by the latter to the colonel, who would have informed his regimental surgeon before forwarding such of the information to the brigade commander as higher authority should know. In their use of this method of communication during battle, subordinate medical officers would usually not directly appear, they merely prompting the action which itself is taken by their commanders. Likewise directions desired sent by the Chief Surgeon during action would, in the absence of specific authority, be submitted to the Chief of Staff and usually

emanate from him for the purposes of transmission in the form of orders.

The second and subsidiary channel of information which connects the Chief Surgeon with his subordinates and these with one another, is directly under the control of the Medical Department and consists in the sending of written or verbal messages or reports by medical officers, their mounted orderlies, by Hospital Corps men detailed as messengers on foot or in ambulances, by litter bearers plying between relief stations and the firing line, and by wounded moving from the front on their way to the rear. These agencies are at times insufficient and should be supplemented by the training of at least four men in each sanitary organization in visual signalling, along the lines as now laid down for the regimental signal service. This subsidiary system of transmitting intelligence may work in conjunction with, or be independent of, in whole or part, the general system of communication just mentioned. It is used practically only for transmitting information on matters which concern the sanitary service alone and which have no direct relation to the military force as a whole. But between medical officers and sanitary organizations it is the chief and often the most ready means of communication. This service of information and orders for the Medical Department is improvised as need requires. It is slow in transmission over long distances, but would rarely be utilized under such conditions. But over short distances and with small organizations and particularly during action, it serves a most valuable purpose. By it, the regimental surgeon keeps in touch with his sanitary subordinates on the firing line, learning many things which might not otherwise be brought to his notice at the time, and sending word regarding them either to the firing line or rear. So, too, the commanders of divisional sanitary organizations in opera-

tion by this means keep informed of conditions in their front, and communicate with the Chief Surgeon relative to affairs with which their respective commands are concerned.

Second Requirement:

The nature of the information which the Chief Surgeon must receive prior to action is almost wholly tactical. Besides being informed as to everything known about the enemy which would concern his work, the Chief Surgeon will of course know the general intention and plans of General A, as given in the general orders of the latter. From this order he will have deduced, by the help of the map and examination of the terrain with his field glasses, the probable location of the greater part of the casualties. He will also need to know in advance the anticipated result of the fight, and be informed as to the route of retreat when the latter is determined upon and the location of any defensive positions to be occupied in case of non-success and counter-attack or pursuit by an unexpectedly strong enemy. He must get an authoritative opinion as to the probable character of the fighting, based on the probable position of the different arms of the enemy, so that he may endeavor to estimate the probable number and nature of casualties as well as their location—and though this estimate can only be a rough guess it will be of much service to him in making his plans. He will need to know the route or routes by which wounded may travel, and those which must be kept unimpeded for movement of troops or supplies to the front.

The nature of the information which the Chief Surgeon should receive during action is both tactical and sanitary. Information on tactical matters and the progress of military events is secured by him from the Chief of Staff, who is kept conversant with every phase of changing

military conditions on all parts of the battlefield by reports forwarded from combatant sources. This information, of course includes anything having to do with the position, location of various arms, strength, probable intentions, apparent change of plan, etc., of the enemy as developed by the action, without which a proper estimate of the situation—both tactical and sanitary—cannot be reached by the Division Commander. The information necessary to intelligent action by the Chief Surgeon of course includes in addition a progressive summary, based on the above, of the purposes and plans of such commander himself. If this is not given by the Chief of Staff of his own initiative, it must be asked for. The general information received at headquarters from the front should also include statements of losses by casualty where these are of any magnitude; these having much military importance as indicating depletion of the firing line and possible lowering of morale of his troops to the Commanding General and at the same time giving information of much value to the Chief Surgeon in making the details of his plans for the provision and distribution of sanitary relief by organizations in reserve. Exact figures in respect to casualties could not, of course, be furnished during action, but it is quite feasible and highly desirable that a commander whose force is engaged should, when sending any message to higher authority, report his losses as "small," "moderate," "severe" or "very heavy," as the case might be. Medical officers attached to troops in action must, therefore, from time to time, inform their commanders in respect to the sanitary situation within their commands and, if the latter be of any material significance, request that information thereon be included in the next report to higher authority. And if the casualties are sufficient in number to be placed in the last two classes mentioned above they would warrant

the transmission of a special message to higher authority relating alone to sanitary conditions.

Besides the sanitary information included in general reports from commanders at the front and of which the Chief Surgeon is made aware by the Chief of Staff, the former should receive much special information of this nature from the Director of Ambulance Companies, one main duty of whom is to keep in touch, by personal investigation during action, with the sanitary situation in a zone containing wounded and ultimately including the dressing stations and extending as far to the front as the regimental aid stations and as far to the rear as the field hospitals. From time to time he will either send his orderly to the Chief Surgeon with information as to the number, character and location of wounded, and with recommendation as to appropriate action for their care and evacuation, or he will ride to division headquarters himself for personal conference. If the action is long continued and field hospitals come into operation, occasional reports as to the number and character of the wounded received in or evacuated from these formations will be made by the Director of Field Hospitals. In addition, the Chief Surgeon may himself leave division headquarters for brief periods as opportunity permits, to personally check up sanitary conditions on the field and verify information received in the matter.

The importance of the information which the Chief Surgeon should receive during action is fundamental. Information is the agent which converts various dissociated sanitary resources into an harmonious whole capable of being applied effectively to the achievement of one or more objects. Upon information he, like his commander, bases all his plans. The more complete it is, the clearer will be his understanding of the sanitary situation and the more effective will be his action in the provision of

sanitary assistance under the tactical limitations recognized. The Chief Surgeon can be of very great assistance to General A in helping the latter carry out his plans and purposes. To do this, the former must be ready at any time, when called upon by the Chief of Staff, to submit a plan carefuly thought out to meet any sanitary need or emergency and coördinating with any tactical situation or necessity as has arisen or may develop. Prompt, full and accurate information in respect to every phase of the action, past, present and future, is the sole basis upon which he can efficiently make such sanitary plans. Without it, he can have no plan; and the work of the sanitary service becomes by so much hap-hazard, incomplete and unsatisfactory, while the necessary element of coördination to the military scheme as a whole is lacking. And not only must he at all times be able to recommend a satisfactory plan for the use of the sanitary service from the tactical standpoint, but he should be able to determine whether the official sanitary resources at hand are adequate to handle any existing or prospective sanitary situation; and if not, to recommend the sources from which additional transportation, assistance and supplies can best be drawn. More than this, he ought to be able to tell his subordinates, in part at least, the duties which will be expected of them, so that they may prepare accordingly. All this takes time, and is dependent upon the knowledge by the Chief Surgeon of all information which, directly or indirectly, has a bearing on the work of the sanitary service.

But the Chief Surgeon, like any other officer, can not appreciate the nature of a situation merely through intuition, but bases his action only on definite reasons logically drawn from known facts. However, these essential facts will not be known to him unless subordinate officers at the front, both line and medical, do their full part by making

prompt report to their superiors of all matters of importance which affect the sanitary service. Information originates with, and is transmitted by, these subordinates. It is of the utmost importance that medical officers realize the importance of their own responsibilities in these respects.

Third Requirement:

The nature of the information, recommendations and orders which the Chief Surgeon may expect to give during the coming action will largely depend upon the sanitary information, as modified by tactical necessities, which he himself receives. In a general way, he will give out little information except to the Director of Ambulance Companies, to whom he will furnish memoranda, based on reports received at headquarters from the front, showing the severity and location of losses incurred. He will also, if authorized by the Chief of Staff, give an outline of the tactical situation and purpose to the Director of Ambulance Companies to furnish the latter with a working basis for his own plans.

The recommendations of the Chief Surgeon will be made to the Chief of Staff, or to the Division Commander, and during action would include requests for designation of a route for the evacuation of wounded; the location of a Station for Slightly Wounded; the movement, disposition and operation of one or more Ambulance Companies, the bringing up and location of one or more Field Hospitals; the use of empty wagons belonging to the trains; also such action by the Chief of Staff as would ensure thorough coöperation in the care and removal of wounded by the sanitary service of the line of communications.

The orders issued by the Chief Surgeon himself during action therefore will be few. Unless specifically authorized to the contrary, the approved wishes of the Chief Surgeon on important matters will be transmuted into orders for him

by the Chief of Staff. Only if the action is successful, and at its conclusion, can the direction and management of the sanitary personnel and supplies with propriety be turned over to the Chief Surgeon. While the result of battle is undecided, the approval of the Chief of Staff is an absolute prerequisite to any action looking to any change in the tactical disposition of any part of the forces. While under Field Service Regulations the Chief Surgeon is authorized, in emergency, to direct the energies of his sanitary subordinates to best advantage, he will probably take little, if any, action in this respect during battle. If the latter is long continued, he may temporarily detach sanitary personnel and supplies with organizations suffering little or no casualty and send them to the assistance of such as have suffered severely; but here, also, he would ordinarily consult the Chief of Staff, lest the troops whom he proposes to deplete be ones which the commander plans shortly to move against the enemy.

CHAPTER XXXIII.

Employment of Divisional Sanitary Units During Action.

Problem No. 29.

(Based on 2 inch map of Fort Leavenworth and vicinity.)

General Situation:

As given in Map Problem No. 27.

Special Situation:

At 8 A. M., the Blues have captured the ridge west of 102, with loss of about 200 wounded now being collected at aid stations just west of the ridge.

From this ridge, General A sees the hostile defensive works extending from Hund Hill to south of 50. Trenches are visible at intervals. The slope from 100 to 50 has been cleared of underbrush and obstructed with abatis and wire entanglements.

General A decides to continue the attack, the 1st Brigade to form line along the ridge west of 102, the 3rd Brigade to advance with its left on the 108-104 road and extending 1000 yards south. The 2nd Brigade forms the reserve and is now in column on the 126-128 road with head of 128.

The artillery has been ordered to positions about 500 yards northwest of 96; also south of the road running west from 102 behind the ridge west of that point.

Enough wagons have been brought up to 90 from the 1st Section of the trains to refill the battalion ammunition wagons, all empty, now assembled at 90.

Required:

The orders affecting the divisional sanitary service, if any, issued at about this time, with reasons therefor.

A Solution.

At the request of the Chief Surgeon, the following order is issued and sent by messenger, marked "urgent."

——— Div.
Hill West of 102,
——— 8:10 A. M.

Director, Amb. Cos.,
Near 90.

Move one ambulance company south of 94-96 road to east of 98-108 road and take over about 200 wounded lying in that vicinity. Evacuate wounded to Easton.

X,
Chief of Staff.

A second order, supplementing the foregoing, immediately follows:

——— Div.,
"Hill west of 102,
———, 8:12 A. M.

C. O. Eng. Bn.,

Make a route practicable for ambulances from road angle east of 94 to bridge on 98-108 road without delay.

X,
Chief of Staff."

The above orders are based on the following:

A preliminary action has been had, but the main battle remains to be fought and the great majority of casualties are yet to occur. A total of about 200 wounded at present requires attention. This number, considering the area of casualty and the facilities of evacuation therefrom, can readily be handled by a single ambulance company, especially with the aid of the sanitary personnel attached to

the 1st Brigade, which undoubtedly will continue dressing and collecting wounded during the hour which the brigade will require to reform and start deployment against the enemy. This brigade sanitary personnel, consisting of 12 medical officers and 72 enlisted men of the Hospital Corps, probably assisted by about 75 bandsmen, would have been engaged in relief work for more than an hour before the ambulance company, with its first-aid contingent of 4 medical officers and 60 enlisted men, arrived to reinforce it. This ambulance company would get up in about three-quarters of an hour after the order for its movement was issued. Many of the wounded would have been ready for removal at the time of its arrival, and the preparation of the remainder would not be long delayed. With 200 wounded, some 30 would be able to walk back, and about 20 could not stand transportation. Of the remaining 150, one-third would have to be transported recumbent and two-thirds would go sitting up. This number implies two trips of the ambulance section of the company with about 25 miles for it to travel if all go to Easton. However, before the second trip is practicable the field hospitals may very possibly come nearer. Pending further developments, therefore, the other ambulance companies can remain in reserve.

In making his recommendations for the assistance of these wounded, the Chief Surgeon did not overlook the fact that 18 wagons of the train had arrived at 90 with ammunition, to be transferred to the battalion ammunition wagons of the 1st and 2nd Brigades. These empty wagons, if the battle were over, would of course have been ordered forward to receive wounded and take them to the rear. But under present conditions, their obvious duty is to start back directly and at once for the additional ammunition which may sorely be needed, and without their being subjected to the danger and delay incident to coming nearer

the front. If any wounded were on hand at 90, they would take them; as it is, they will return empty. In other words, military purpose and necessity is made to take precedence humanitarian desirability.

On receiving his orders, the Director of Ambulance Companies would verbally order the commander of Ambulance Company No. 1 about as follows:—"Load your dismounted men in your ambulances. Go east on this road to the turn about 500 yards east of the school house, thence down into the valley, following the stream to the 98-108 road. There are 200 wounded between that road and the ridge to the east, occupied by our troops. Put in a Dressing Station if necessary. Start the wounded to Easton as soon as you can."

His orders from headquarters ordinarily would leave such details as how he shall get his ambulance company to the field to the Director of Ambulance Companies.

But in this case the company required is ordered to advance south of the 94—96 road, since the Chief of Staff knows that the new artillery position is northwest of 96 and that road will shortly be under fire—a fact of which the ambulance company commander could have no proper knowledge. By ordering the ambulance company in a direction southeast of 94 to the bridge on the 98—108 road it will be screened from the enemy's sight and fire. To make sure that this route is practicable, the Engineer Battalion commander is required to make at once any minor improvements which his inspection of the ground might show to be necesary and otherwise cause delay in the moving of the sanitary train.

The general locality to which the ambulance company is ordered is screened from observation, and the ambulance company commander is left to select the exact point at

which his organization should locate, dependent on distribution of wounded, terrain and protection from overshots.

Intimation in the above order as to the number of wounded indicates the gravity of the sanitary situation to be handled and enables preparations to be made accordingly.

The question as to whether a Dressing Station is necessary is naturally passed on to the commander of Ambulance Company No. 1 to decide, as a result of the conditions which the latter will find on the field after actually arriving there. One will very likely be desirable; and with the pushing of the attack against the enemy's main position, a Dressing Station west of the ridge now occupied by the 1st Brigade will probably be suitably located for the handling of the further casualties to be expected.

A third order from Division Headquarters, necessary properly to supplement the first already quoted, is also issued at the request of the Chief Surgeon, as follows:

"——— Div.,
Hill west of 102,
———, 8:14 A. M.

Director, Field Hospitals,
Easton.

Open one field hospital in Easton convenient to railroad and prepare for several hundred wounded.

X,
Chief of Staff."

The above order is probably sent by wire, as the trains have probably been thus brought into communication with the front. Such an order is necessary to give opportunity to prepare for the reception of the considerable number of wounded. The latter should arrive in something less than 3 hours, assuming that it takes the ambulances about an hour

to get to the wounded and load, and about two hours to return with them to Easton over the intervening six miles. The present number of wounded needs no more facilities than one field hospital affords—some will not be seriously wounded and others too desperately injured to stand transportation to that point. As the main atack is yet to come, the other three field hospitals are held in reserve pending the probable outcome of the further action and the need for their movement nearer the zones of casualty, wherever the latter may be. The location near the railroad of the field hospital to open in Easton is to facilitate transfer of wounded therefrom to railroad cars. The intimation as to the number of wounded to be expected in Easton is to enable the Director of Field Hospitals to plan accordingly, which he will undoubtedly do by preparing suitable and convenient buildings, with such additional supplies as he can procure locally, for their reception. He will naturally refrain from pitching any more of his hospital tentage than he thinks will be necessary; for this is a fixed general principle of the sanitary service on which he does not now need to be informed. Moreover, his map shows that there is no sufficient shelter in the form of buildings sufficient for many wounded closer to the lines. Plenty of suitable buildings are, however, available in Easton. It will be necessary to use some sanitary supplies in outfitting them as hospitals, but these can be largely replaced without great delay from the stores in the wagons of the Reserve Sanitary Supplies, halted about 2½ hours march from Easton. In case of need, the remainder of the field hospital can be sent forward with the others and all available personnel, and the Reserve Supply wagons will be summoned and drawn upon to make good deficiencies either before this hospital leaves Easton or after it arrives nearer the lines at the point at which it is to be established. In any case, when the line of communica-

tions sanitary service begins its operations at Easton, the field hospital which has been in operation, complete except for a few expendable supplies, can promptly start forward.

The Director of Field Hospitals, on receiving the foregoing order, at once verbally orders the commander of the 1st Field Hospital about as follows:

"Prepare to receive several hundred wounded in Easton in two or three hours. Select and outfit buildings suitable for temporary hospital use and as convenient as possible to the railroad. Unpack no tentage and only such supplies as will probably be absolutely necessary. I will look up and send you such supplies and assistance as the town affords."

The Director of Field Hospitals has in mind not only the orders he has received but the necessity for the further removal of wounded beyond Easton with no great delay. Such evacuation would be accomplished by railroad trains, transfer of wounded to which from the improvised hospital should be made as easy as possible. Hotels, churches, schools, warehouses, stores, etc., suggest themselves as suitable buildings for the purpose in question. Much can probably be secured locally in the way of procuring and improvising facilities for bedding, cooking, feeding and cleansing wounded as they arrive, and there are two or three hours in which such local resources can be got together. The personnel of four field hospitals is available and will be used in the work of preparation, entirely or in part as needed, up to the time they are ordered away from Easton. The provision of excellent improvised hospital facilities is thus ensured.

Fourthly, the Chief of Staff would issue orders verbally to the Brigade Commander, 1st Brigade, and to the Chief Surgeon, about as follows:

"An ambulance company will shortly take over wounded west of this hill. Evacuation of these wounded

will be accomplished as rapidly as possible to a field hospital opened in Easton. The 88—94—110—108 road will be kept clear for vehicles moving to the front. Take the necessary action."

The information and orders thus given the Brigade Commander and Chief Surgeon are so that the former may notify his subordinates—line and sanitary—that additional sanitary assistance is coming to the front and where it will, in a general way, be found. After his arrival, the Ambulance Company commander will promptly send word by litter bearers and messengers to troops and Division Headquarters of the exact location of the Dressing Station which he has established.

The evacuation of the wounded is to be expedited so as to get as many wounded on their way to the rear as possible, on foot or in ambulances, during the time that the troops are getting into position for the main attack. This to free the ambulance company personnel for duty with casualties to come as well as for the benefit and security of those which have already occurred.

Mention of the point to which wounded must resort or be conveyed is obviously necessary to enable them to secure the benefit of the sanitary provisions which are being made for them. In the absence of proper information as to where sanitary assistance can be found, it will be reached only by part, after hurtful delay, and with much undesirable straggling. Easton is named as the concentration point for wounded in the rear, for the reasons already given in connection with the temporary location of the field hospitals at that town. The fact that hospital facilities will be found there prepared to care for wounded should be indicated. To facilitate the movement of ammunition and supplies from the rear to the front, a road must be kept open. This route the Chief of Staff specifies.

Wounded evacuated to the rear by any other route will likewise not be subjected to delay and inconvenience resulting from meeting troops or trains on the same road and moving in an opposite direction. The routes remaining available for wounded thus drain both flanks, and through them the center of the probable battle line; a "turn out," if necessary, being made through the open country northwest of 94 to give access to the 92—82 road from that point.

The above information and directions will be promptly transmitted by the Brigade Commander and the Chief Surgeon to their respective subordinates, so that both the wounded and those who are to have them in charge may be duly informed of the plan of evacuation in the prevention of uncertainty, friction, delay and suffering.

The above orders and directions, while issued by the Chief of Staff would habitually be based on recommendations made to him by the Chief Surgeon with such modifications as the tactical situation would seem to the former to render necessary.

CHAPTER XXXIV.

Sanitary Service With a Repulse and Entrenchment of Position.

Map Problem No. 30.

(Based on 2 inch map of Fort Leavenworth and vicinity.)

General Situation:

As given in Map Problems Nos. 27 and 29.

Special Situation:

The time is 11 A. M.

The Blue attack has failed. The 3rd Brigade, which made the main attack in the direction of 48 and south of that point, was repulsed with heavy loss when the advance reached the eastern fork of the stream running northwest, and is now holding the ridge south of 104. On the repulse of the 3rd Brigade, the 1st Brigade, which had also suffered, especially from artillery fire, was ordered to reoccupy the ridge west of 102. The cavalry, after severe fighting and heavy loss, holds a position near 140. One regiment of the 2nd Brigade is in position near 134; the other two are east of the angle in the road 108—128.

General A has wired the commander of the 1st Field Army of the situation, and has been ordered to entrench and hold his position and informed that two brigades will arrive to reinforce him about 11 P. M. tonight and that the attack is to be renewed tomorrow.

Required:

Orders dependent on the sanitary situation which General A will issue, with reasons therefor.

A Solution.

As soon as General A saw that his attack had failed and that the enemy would not attempt a counter attack,

the following orders would have been issued, based on the recommendations of the Chief Surgeon:

(1)

".....

.... 11 A. M.

Dir. Amb. Cos.

Near 90.

Open Dressing Stations near 108, in the edge of timher about 1500 yards northwest of 128, and in the vicinity of 134.

X,

Chief of Staff."

(2)

".....

.... 11:02 A. M.

Director, F. H.

Easton.

Open one field hospital near 92 and two a little east of 126 without delay.

X,

Chief of Staff."

(3)

Verbally to the Chief Surgeon:

"Put in a Station for Slightly Wounded near 108."

(4)

".....

.... 11:05 A. M.

C. O., Ammunition Train.

Have any empty wagons returning from the front after 1 P. M., report at field hospitals near 92 and 126, to remove wounded to Easton.

X,

Chief of Staff."

(5)

"..... .... 11:07 A. M.

Field Orders, No. ...

A Station for Slightly Wounded is located near 108.

Dressing Stations are located east of 98—108 bridge; near 108; about a mile northeast of 128; and near 134.

Field Hospitals are located just east of 126; near 92, and in Easton.

Wounded will be evacuated to EASTON without unnecessary delay.

The 88—94—110—108 road is reserved for troops and supplies moving to the front.

X,

Chief of Staff."

Copies to Division Staff, Brigade, Artillery, Cavalry and Engineer commanders, and to the Director of Ambulance Companies and Director of Field Hospitals."

These orders are based upon the fact that the tactical situation with the Blues has resolved itself into one of temporary defense in a position of necessity rather than one of election. The reinforcing brigades are not due to arrive until nearly midnight. They will then undoubtedly need rest, and night attacks are not usually looked upon with favor, so that it is clear that the attack cannot be resumed before daylight. Inasmuch as the enemy made no counter attack immediately after the repulse, it is not probable that one may now be expected. There will thus be a period of about 18 hours in which no material change in the sanitary situation may be anticipated. The latter is very serious, as the losses have been reported as very heavy in all the organizations engaged, and the casualties are distributed over a frontage of about 3½ miles in length. Moreover,

the terrain is not as favorable as could be desired for the operation of ambulance companies close to a considerable portion of the line. Many of the wounded also lie between the lines in a fire-swept area and can scarcely be removed until nightfall.

The orders relating to the sanitary service would still be given by the Chief of Staff. The action is not over but merely suspended. If the enemy were routed and the problem merely to clear an occupied battle-field, General A might properly tell his Chief Surgeon to take over the sanitary situation, as little if any tactical considerations would remain as controlling factors. But in the present situation the tactical considerations are still paramount. Both the Chief of Staff and Chief Surgeon know in a general way the areas in which additional sanitary assistance is needed, from reports of casualty and positions of troops sent in from the front by line and medical officers.

Orders affecting the ambulance companies are first considered. These organizations are the normal source of primary assistance to the regimental sanitary personnel, and in the present case they are also the most quickly available. It is possible that one of them may have been put into operation before the time given in the above order, to assist with casualties occurring on the right of the line.

The Dressing Station previously put in under protection of the hill west of 102 will continue its service with the 1st Brigade, and with any new casualties occurring in the latter, without further orders. It is also quite convenient to the new artillery positions.

The Dressing Station to go in near 108 is about half a mile in the rear of the line, and about 2500 yards from the probable positions of the enemy. It is near a road fork, screened and protected from rifle fire by distance, and from artillery fire by screening and location

away from the positions of any troops. There is some exposure for wounded and their assistants moving over the ridge east of 108, but distance and the fact that they move only in small groups prevent any danger of importance. This station would drain a frontage of about half a mile bisected by the 108—104 road. Ambulances can reach it from either flank and the rear without danger, and wounded can be evacuated from it to either field hospital position as interests may require.

The Dressing Station to be established on the edge of the timber about 1500 yards northwest of 128 is only about 500 yards in rear of the Blue intrenchments. This brings it in some danger from overshots, but the slope of the ground and the heavy timber to its front will give it a material protection. Besides being screened from the enemy, it is probable that there will be little heavy fighting until the reinforcements come up. It can be of such great service at this point—draining a frontage of 500 yards north and 1000 yards south of the 128—106 road—as to warrant exposure to more danger than would actually here be incurred. Protected by the terrain and timber, ambulances can ply as far as the angle in the road east of 128, and perhaps even to the Dressing Station some 500 yards further on. While the entrenchments will undoubtedly be exposed to artillery fire, an ambulance station at the turn of the road east of 128 would probably be quite safe from artillery overshots; as shrapnel would be timed to burst over the trenches, the danger zone of shrapnel extends only about 300 yards beyond the point of burst, there is no great fall of ground slope and this turn in the road is about 700 yards in the rear of the entrenchments. In case long-range infantry or machine-gun fire on the trenches is attempted, ambulances at the turn in the road would be safe from overshots, except ricochets, as the slope from

the ridge to the turn in the road is 1:52.5 and at 2000 yards the angle of fall of the rifle bullet is 1:8.4; hence all but the wildest overshots would strike the ground within a few hundred yards of the trenches. It cannot be expected always to find positions for sanitary organizations which are entirely protected against danger. They will unhesitatingly be subjected to risks if the results to be achieved are to be commensurate. In this instance, the importance of bringing ambulances so close to the front is very great and the risk which they incur, though appreciable, is insignificant when compared with the benefits which their presence will bring to the wounded. It is possible that the protection of the timber on the slope south of 104 may enable searching parties from this Dressing Station to slip down into the ravine between the lines and give first aid assistance during the day, getting the wounded together but reserving their removal until after dark.

The Dressing Station to locate in the vicinity of 134 will handle a sector including the heads of the ravines south and southeast of 106 and the cavalry position near 140. Its exact location will be determined on the ground. The removal of helpless wounded from the ravines will be largely impracticable during the day by reason of the open nature of the country to be traversed to the rear; however, small sanitary parties can slip over into the ravines and be of much assistance to the wounded there without incurring great danger. The terrain makes removal of cavalry wounded from near 140 a simple matter. Ambulances can work to this Dressing Station and continue on almost to 140 in perfect safety, though they may have to move for part of the way along the slope south of the Lecompton road, rather than the road itself, in order to keep out of sight of the enemy. After nightfall the ambulances can move to the head of the ravines and receive wounded littered out to them.

All these new Dressing Stations should be in operation within an hour after receipt of orders.

The needs of the wounded reaching Easton require that the field hospital already established there shall continue its work for the present and until the Chief Surgeon, Line of Communications, takes over the sanitary situation in that town. Then it will pack up and be ordered to come forward, if necessary, to assist nearer the field. It should be able to do this by nightfall, when the bulk of the sanitary work on the wounded removed from between the lines would be receiving attention.

One field hospital is put in near 92, where the map indicates the presence of shelter, trees, and habitations of man and the conveniences usually to be found with the latter and of material assistance in supplementing hospital resources. It is well located to meet the needs of the left flank, the situation in the 1st Brigade having undoubtedly been already materially relieved by despatching an ambulance train load of wounded, with all who could walk, direct to Easton. This hospital is about two miles by the new military road from the Dressing Station near the hill west of 102; ambulances working from the latter point ought to make the round trip in about an hour. It is about three miles from the Dressing Station near 108 via the bridge on the 108—98 road, so that a round trip by ambulance from that point should be accomplished in about an hour and a half.

The two field hospitals in the valley east of 126 are one and three-fourths miles from the Dressing Stations near 108 and in the timber northeast of 128, so ambulances should make the round trip inside an hour. They are about three and one-half miles from the Dressing Station near 134, which means about two hours for each round trip of the ambulances. Two field hospitals are sent to this point because the wounded are not only much more

numerous on the right of the line but because this point is about three miles further from Easton, to which all wounded will ultimately have to be evacuated. Some wounded able to walk could manage to continue on to Easton after reaching 92 who could not do so from a point as distant as 126. Each of these hospital positions can be readily reached from the center and either flank, and can be drained back into Easton, without use of the road reserved for the advance of supplies and reinforcements. They are completely protected from fire, are near enough to the front to permit of rapid transportation of wounded therefrom, and far enough to the rear to let the hospital formations be able to get away in large part if the Blue forces should have to fall back.

If his orders reached the Director of Field Hospitals by wire, and his organizations started promptly, these would get away from Easton on or before 11:30. It would take him until 1 P. M. to reach the position near 92 with them, and until 2 P. M. to reach the other position near 126. These hospitals will be entirely ready for patients within about an hour after arrival at the positions designated for them; very likely some wounded will be awaiting them on their arrival at these points, as a result of the activity of the Director of Ambulance Companies.

All the divisional resources, both ambulance companies and field hospitals, are put in at this time. The tactical situation will probably remain in a state of practical suspension for some eighteen hours; wounded are many, and every consideration demands that they should be cared for and removed during that period. As the enemy did not promptly follow up the check of the Blue assault with a counter attack, it is not probable that he will do so later; but if he does, the locations of sanitary relief already selected will excellently serve to meet the needs of such a conflict. It is true that heavy fighting will occur to-

morrow and plans to care for the resulting casualties will have to be made, but sanitary assistance actually needed will not be withheld from the wounded of today for that reason. The sanitary personnel will be worked to the point of exhaustion over the two days of fighting if necessary, though the sanitary quota which will undoubtedly accompany the two reinforcing brigades to arrive tonight will be expected to bear the brunt of the sanitary work tomorrow.

The Station for Slightly Wounded is necessary to keep trivial cases out of the Dressing Stations and Field Hospitals. It might very likely have been located before the time of the verbal order above quoted. Under the terms of the problem, however desirable such advance action might be, its location could scarcely have been designated in the orders for the attack or until the enemy's advance position had been taken. Certainly the present point would at such time have been impracticable of selection. The point 108 is a cross roads draining the area of greatest casualty and on the natural line of retirement to Easton. The Chief Surgeon may assign the personnel and supplies of this station from the ambulance company to go in in its vicinity, or from the regimental sanitary personnel of the regiments held in reserve near the angle of the road south of 108.

The order to have returning empty ammunition wagons take on wounded is in conformance with the general principle that no unloaded wagon shall return from the front during or after an action without assisting in the evacuation of wounded, where this can be done without detriment to the matter of resupply. The Chief of Staff must decide this point in each case. In the present instance, the ammunition supply to replenish the expenditures of the main action would probably come forward as far as 92 and 126

before transferring, so the taking on of wounded at these points would imply no appreciable delay in their return. Wounded will be at these points by the time mentioned.

The Field Orders here given are the necessary and final expression of the sanitary scheme as a whole. Until they are issued the sanitary service fails of its usefulness. Their issue at once indicates to commanders where wounded shall be told to resort and whence assistance may be expected or summoned. For the sanitary service, these orders are necessary to enable collection and evacuation to be so systematized as to proceed with minimum friction and delay to and through the several relief points to the final point of concentration in the rear, and without the chance of leaving portions of the battlefield either over-patrolled or unsearched.

If the sanitary service needed assistance from the line in searching out and collecting wounded, the necessary detail would be designated in this order.

If resupply of the ambulance companies and field hospitals were necessary at this time, a paragraph ordering up the Reserve Medical Supply wagons to a suitable point or points, would be included in this order.

Although not required by the conditions of this problem, it may be mentioned that General A would have included in his wire to the Commanding General, 1st Field Army, mentioned in the foregoing special situation, a statement of his probable casualties, the fact that he would evacuate them as rapidly as possible to Easton, and a request that the sanitary service, line of communications, be ordered to take them over at that point without delay. This final action by General A would establish a steady flow of wounded to the rear, by which their undue congestion at any point of sanitary relief would be avoided and his action on the present sanitary situation would be completed.

CHAPTER XXXV.

The Tactical Location of Dressing Stations. Problem No. 31.

(Based on 2 and 4 inch maps of Fort Leavenworth and vicinity.)

Situation:

The enemy is attacking from Leavenworth.

Your forces hold the high ground from Atchison Hill extending two and one-half miles southwest, with general line of evacuation through Lowemont.

You are Director of Ambulance Companies. The commander of Ambulance Company No. 1 suggests that he be allowed to put in a dressing station just east of the little fork in the creek a quarter of a mile from and a little north of west of the figures 1100 on the Eleven Hundred Hill (southwest quarter of 4″ map).

Required:

(1) The reasons for or against this location which might occur to you on examining the map.

(2) If Ambulance Company No. 1 is sent by you to some other point in this vicinity, the reasons, in detail, which determine your action.

A Solution.

First Requirement:

The paramount consideration which governs the location of an ambulance company dressing station is the location of the wounded. They must be reached and given attention, irrespective of whether the conditions under which they lie are, or are not, relatively favorable to the work of the Medical Department. Questions of terrain,

transportation, etc., are wholly secondary, and give rise to problems which press for solution only after those of collection and sanitary relief have received attention. It follows, therefore, that if a large number of wounded lie in the immediate vicinity of the point suggested by the commander of Ambulance Company No. 1, this or another similar organization will be ordered by higher authority to go into operation in that general locality, irrespective of any disadvantages which such situation may seem to have, so far as facility of sanitary work is concerned.

But the problem does not state where casualties have occurred or their number, but merely gives the general lines of the defense. Until areas of considerable casualty have actually been determined, you, as Director of Ambulance Companies, will hold your sanitary organizations in reserve, awaiting general instructions from higher authority. But you will desire to ascertain in advance the various positions which an ambulance company or companies might have to occupy.

Since these tentative positions must depend in turn upon the tactical dispositions of troops and the probable lines of attack by the enemy, your possession of some elementary knowledge of tactics is important.

By the terms of the problem, the line of defense is two and one-half miles long. This implies a defending force of a strength of at least a division and presumably of all arms.

This force will clearly be distributed at such commanding points as may be included in the assumed line of defense. The map shows that such points for infantry evidently are Atchison Hill, Government Hill, Southwest Hill (both shoulders), Zimmerman Hill east of 42, hill west of 68; cavalry on flanks, say part near 136 and part on Cemetery Ridge north of target range; artillery divided

between Government Hill and hill crossed by 50—68 road. The main reserve will have to be at some central point with ready access to both flanks—say near 26 on the Zimmerman Road. As the map shows slopes of positions to be heavily wooded, the infantry lines would probably be well down the eastern slopes near the edge of the timber.

The terrain makes the position especially strong in the center. Frontal attacks are also not usually made. It may be concluded therefore that the main attack will fall on one of the flanks. The left (north) flank seems somewhat more probable, as although it is strong, success here means control of the railroad and a shorter distance to intersect the line of retreat.

With some such general situation in mind as is outlined above, you, as Director of Ambulance Companies, again examine the map.

The position suggested for the dressing station west of Eleven Hundred Hill is seen to be behind the center of the line as a whole. It offers the advantages of protection from fire, and timber and water, but these are merits common to various other positions also. Against its selection are the facts that it is off all roads or trails, the nearest being 1,000 yards away, and thus is not so situated that wounded would readily find it or naturally gravitate toward it; it is down a steep grade (about 1 in 4) which would render access by wounded on foot or litter a matter of great difficulty. (Page 223, F. S. R.) Its outlet to the north is obstructed by deeply gullied creeks, rendering it inaccessible by wheeled transportation from the rear, and helpless patients which actually reached this point would have to be littered some 1,000 yards to reach at a practicable point, the railroad running to Lowemont; or about 1,300 yards to wagon transportation if an ambulance station is established at the Baker house and a practicable crossing of

Salt Creek is made at that point by scaling down the steep banks. The country back of the suggested point is also densely wooded, and is fairly rough east of the creek, which is bridged only by a railroad trestle. There are no buildings or similar facilities anywhere near the point suggested. These factors combine to render the location highly undesirable as a Dressing Station. When distances from it to the various points on the line of defense are measured, they are seen to range from 2,000 to 3,000 yards; this fault in itself alone is a fatal objection to the point for the purpose. A Dressing Station here would clearly impede rather than facilitate relief work. You therefore decide unhesitatingly against the establishment of a Dressing Station at the location suggested.

Second Requirement:

On further examining the map it is seen that no ideal situation for a Dressing Station is presented. Merely the best use of existing conditions which are imperfect from the standpoint of sanitary relief, is possible. But it appears that wounded from the right flank and center will jointly drain rearwards through the 28—30—100 road, the right flank over the 50—44—28 road and the center over the unimproved 22—Zimmerman—28 road. As these roads, with the Atchison Pike, are necessarily used also for supply, congestion will have to be guarded against.

If a strong attack seemed to be developing against the right wing, the company with ambulances would be sent to the division reserve in the vicinity of 28, pending such time as the point of most usefulness could be determined.

If the right flank is attacked, some point near 50 would probably be suitable. If a strong attack is made against the center, a position just north of the point 22

would offer the essential advantages of nearness to firing line (500-600 yards), protection of slope, accessibility and easy evacuation under cover by practicable roads. It would not interfere with the movement of troops or supplies. It lacks a local water supply, but this is desirable rather than essential in view of the supply carried on the pack mules and ambulances. The latter could probably work along the ridge road without much danger, as the firing would be at a much lower level.

The map shows that the left flank is naturally drained through the Atchison Cross—G—H road. There is access to and from the center over the rough road following the ridge and which the engineers would probably have improved. But wounded are not readily evacuated by a flank—they tend to drift as directly as possible back to the rear. The Moore house is at the fork of the G—16—Atchison Cross and the G—F—E roads and on the direct line of evacuation; it permits of direct loading on the railroad to the base and offers the natural advantages and facilities possessed by farm houses for the purpose in question. But it is further to the flank than is desirable, and if the enemy occupies Sheridan Ridge, a Dressing Station at Moore's would have to move to another point for better protection. Sending its ambulances back to Frenchman, the ambulance company would in such case remove its station to the protection of the cut near 16. Cuts are usually undesirable as locations for Dressing Stations by reason of possible mutual interference between the interests of moving troops and of the wounded, and the present instance is no exception in this respect. But nearness and protection are fundamental necessities.

With the enemy on Sheridan Ridge, the area between Atchison Hill and Sentinel Hill would be fire swept and evacuation of wounded over this area would be impractic-

able. But such evacuation could still be continued during action from a Dressing Station at 16 over the unimproved road to 22 and beyond.

You, as Director of Ambulance Companies, therefore decide that Ambulance Company No. 1 will not go into operation at the point suggested by its commander, but feel sure that it will ultimately need to be located at some other one of the points considered in this connection. And it is even conceivable that you may have to occupy all of them with the four ambulance companies at your disposal.

Comment:

The purpose of this problem is to illustrate, among other things:

1. The complete dependence of the tactical use of sanitary units in battle upon the tactical use of the combatant forces. The former never can be considered alone.

2. The importance of elementary knowledge by the medical officer of the general principles governing the art of war.

3. The fact that while tentative plans for use of an ambulance company can and should be made in advance, no actual disposition should be made until the need arises.

4. That ambulance companies go into operation only under general instructions from the Commander or Chief Surgeon, leaving the necessary detail of position to the Director of Ambulance Companies.

5. That a Dressing Station, once established, is no more fixed in its position than that of combatant organizations, but must change position if the tactical situation requires.

CHAPTER XXXVI.

The Drafting of Orders for the Sanitation of the Battlefield.

Problem No. 32.

(Based on 4 inch map of Fort Leavenworth and vicinity).

Situation:

Fort Leavenworth has been occupied by a Red reinforced brigade, holding the Sheridan Ridge. The Red main army is near Kansas City. The Blue main army is near Atchison, based on Omaha.

Sept. 23rd, at 6 A. M. General A, of the Blue Army, with a division, unexpectedly appears before the Red position and attacks. After a severe engagement lasting four hours, the Red force is routed, retreating through Leavenworth. General A orders the 1st Brigade, previousely held in reserve, together with all the cavalry and one regiment of artillery, to take up the pursuit. From prisoners he learns that the balance of the division to which the defeated force belongs left Kansas City this morning.

It is estimated that the reinforced brigade of the Blue forces attacking between the points "Atchison Hill" and "Curran" has lost 8 per cent by casualty; and that two infantry regiments making a secondary attack in the vicinity of "Bell Point" have lost 5 per cent. There are apparently about 400 casualties in the Red force, which were left behind on its retreat.

Required:

General A's orders for the policing of the battlefield.

Estimate of the Situation.

It appears from the conditions of the problem that the Blue forces are completely masters of the situation, the Red force being routed and retreating through Leavenworth in the direction of its main army. This permits General A to make his disposition of the dead and wounded without any present consideration for the movements of the enemy and influenced solely by local facilities and conveniences for their collection, evacuation, shelter, care and disposal.

General A has at once dispatched in pursuit the 1st Brigade, previously held in reserve, reinforced by the divisional cavalry and a regiment of artillery. With these troops should go their proper quota of divisional sanitary troops, one Ambulance Company (No. 1) and one (1st) Field Hospital, since provision must be available for the casualties which this pursuing force will suffer in its attacks, for the possible holding of a position against a heavily reinforced enemy, and for the care of the hostile wounded which the retreating enemy has left along the road. These troops have contributed little or nothing to the casualties in the battlefield along the front of Sheridan Ridge, and equally they will not be available to render assistance to the same. General A therefore does not further consider them in the special problem of the sanitation of the battlefield before him.

The fact that the Missouri Pacific Railroad is undisturbed is an important factor in this problem, since it permits any point on this railroad to be used by General A as a temporary advanced sanitary base and point of transshipment of wounded back to the base at Atchison or the main base at Omaha. A glance at the map by General A shows Fort Leavenworth to be such most generally suitable and convenient point available from the main battlefield, affording an abundance of buildings directly planned or

well adapted to hospital purposes, as well as probable conveniences in the shape of water, fuel, lights and medical and other supplies. It is also the logical point to which the wounded of his pursuing Blue brigade, and of the retreating Red enemy, would be removed during part of the pursuit.

But knowledge that a Red force somewhat equal to his own left Kansas City on the morning of the battle, presumably moving in his direction, indicates that General A has the element of time very seriously to consider in policing the battlefield, evacuating the wounded to the rear and freeing the field hospitals and ambulance companies so that they may be ready to perform their proper part in the new action which seems impending. As the distance from Kansas City is 28 miles, the enemy would march to Fort Leavenworth in about two days, or come in contact with the pursuing Blue force about nightfall of the 23rd; and sooner if the railroad can be utilized. It is therefore clear that all the Blue sanitary troops and their equipment may be urgently required by General A for new service on the following day, September 24th, when a severe general action may begin.

The weather and terrain conditions are assumed to be bright, fair and cool, with roads firm yet free from dust and mud. These conditions are practically ideal for the policing of the battlefield and evacuation of wounded.

A Solution.

Based on the above conditions and estimate, General A issues the following order:

"1st Div., 1st Army,

Field Orders Frenchman, Kansas,

No. 2. 23 Sept. '09, 10:30 A. M.

1. The enemy has been completely routed and is retreating south through Leavenworth, pursued by our 1st

Brigade, Divisional Cavalry and 1st Regiment of Artillery.

2. Brigade commanders of the 2nd and 3rd Brigades will cause their commands, immediately and with all dispatch, to police their fronts and the ground over which they passed under fire, making a thorough search for all dead and wounded.

3. Wounded will be conveyed to the dressing stations located immediately west of Sentinel Hill and at M. Kern west of Bell Point. Points on Sheridan Drive east of Bell Point and Curran, and at 10, east of Atchison Hill, are designated as stations for collection of Red wounded. The Chief Surgeon will assign one medical officer from each regiment for duty at Red collecting stations.

4. The 2nd Field Hospital will be established at Kickapoo, using existing buildings so far as practicable.

The 3rd and 4th Field Hospitals and the Reserve Sanitary Supply will proceed at once to the vicinity of the post hospital, Fort Leavenworth, and establish a hospital at that point. They will pitch no tentage, using such buildings as hospitals as may be designated by the Chief Surgeon for that purpose.

Ambulance Co. No. 2 will operate in the district Bell Point—Kickapoo; Ambulance Companies Nos. 3 and 4 will operate in the vicinity Sentinel Hill—McGuire—Fort Leavenworth.

5. The Chief Surgeon will promptly begin the evacuation of all suitable wounded to the hospital at Omaha, via the M. P. R. R. All serious cases able to stand transportation will be evacuated as rapidly as possible. To this end the Chief Quartermaster of the Division will assign to the Medical Department, as hospital trains, such available engines and rolling stock as the Chief Surgeon may require.

6. Dead will be buried in the immediate vicinity of

the National Cemetery, Fort Leavenworth, to which place they will be immediately removed by organizations policing the battlefield. Transport wagons will be furnished by the Chief Quartermaster to assist in the work of removal. The Sanitary Inspector of the Division will supervise the work of burial. The necessary labor for digging graves will be furnished by the Battalion of Engineers, the Commanding Officer of which will apply to the Sanitary Inspector for instructions. All chaplains and three medical officers, the latter to be detailed by the Chief Surgeon, will immediately report to the Sanitary Inspector for the purpose of examining and identifying bodies preparing the required records.

7. The carcasses of dead animals will be buried or destroyed in the most convenient manner.

8. I shall be at Fort Leavenworth.

A,
Major General,
Commanding 1st Div., 1st Army.

Official:

B,
Adjutant General.

Copies to Brigade Commanders, Chief Surgeon, Chief Quartermaster, Sanitary Inspector, Director of Ambulance Companies, Director of Field Hospitals, C. O., 1st 1st Bn. Engineers."

Comment.

Instead of the above lengthy order, General A might issue one of say two paragraphs, the first placing the Chief Surgeon in charge of the sanitation of the battlefield and the second to his brigade commanders identical with Par. 2 of the above order. Such an alternative order

would save General A time and trouble and would make his Chief Surgeon not only the judge of what should be done but his executive in ordering it. If General A had personally accompanied his pursuing column, this latter course of action would very likely be the one adopted. But the situation to be handled on the battlefield remains the same under any conditions, and its needs imply that the necessary orders for sanitary betterment must of course contain the same provisions, irrespective of who issues them. In any case, the Chief Surgeon will be called upon to furnish the full information and recommendations upon which such orders can alone be based. It has seemed best, for the purposes of this problem, to let one order, from high authority, rather than several emanating from subordinates, summarize and provide for the needs of the sanitary situation in question.

Details also may be varied. It is quite possible, for example, that the engineers may be needed with the pursuing force; and that a battalion of infantry should be utilized in its place. Tactical considerations, only, determine such matters.

CHAPTER XXXVII.

Location of Divisional Stations of Sanitary Relief During and After Action.

Problem No. 33.

(Based on 4 inch map of Fort Leavenworth and vicinity.)

Situation:

Same as given in Problem No. 32.

Requirement:

Suitable location of the Dressing Stations and Field Hospitals during and after the action.

Estimate of the situation:—

Same as given in solution of Map Problem No. 32.

A Solution.

General A has naturally informed his Chief Surgeon in advance that the main Blue attack would be along the Atchison Hill—Curran line. As the road J. Aaron—17—Frenchman is largely exposed to artillery fire from Sheridan Ridge, the Chief of Staff, on the recommendation of the Chief Surgeon, directs that all four Ambulance Companies proceed from Kickapoo along the road 23—21—19, halting in the protection of the knoll lying east of A. Daniels. At this point Ambulance Company No. 1 is directed to remain intact in reserve. The ambulances and wagons of Companies 2, 3 and 4 are directed to remain for further orders, while their bearer sections with pack outfits will follow about a half mile in rear of the Blue forces as they deploy for attack. Ambulance Companies Nos. 3 and 4, with pack mules but less wheeled transportation, proceed across country toward Frenchman

under cover as much as possible, until they strike the trees on Salt Creek, behind which they proceed to a point west of Sentinel Hill, just north of Gauss, and establish their Dressing Stations near each other. They find that Frenchman, an otherwise desirable location, is exposed to artillery fire from both Atchison Hill and Sheridan Ridge, but that complete protection is afforded by Sentinel Hill, also a natural landmark. They remain here until the conclusion of the fight, when they are rejoined by their transportation via Millwood road—17—Frenchman, caring for such wounded in the meantime as work their own way back or can be removed by litter squads operating under shelter of the trees and banks bordering Salt Creek. Nothing can be done during action for such wounded as fall in the open fire-swept fields between Salt Creek and Sheridan ridge. After the battle is over and the work here has become about completed, the Chief Surgeon, with the approval of his commander, directs Ambulance Company No. 3 to pack up and proceed with all transportation to evacuate such of the enemy's wounded as have been collected along Sheridan Drive and the road McGuire—E—Atchison Cross. It is shortly followed by Ambulance Company No. 4. After the field is cleared, Ambulance Companies Nos. 3 and 4 rejoin the field hospitals at Fort Leavenworth.

Ambulance Company No. 1, intact in reserve, would have been ordered to follow the pursuing Blue Brigade with all despatch, immediately after the enemy has evacuated his position. The 1st Field Hospital, probably ordered at the same time, proceeds more leisurely.

Ambulance Company No. 2, less wheeled transportation, has been assigned to accompany into action the two regiments of the 3rd Brigade, which largely utilize the cover of the eastern feeders of Salt Creek rising near

Bell Point. This ambulance company establishes its Dressing Station on the west feeder of Salt Creek near the east end of the Taylor orchard, under the protection of the knoll just to the eastward. During the fight it remains here. As soon as the enemy is driven off Sheridan Ridge, it is immediately removed east about ¾ of a mile to the M. Kern house. In this way it gets closer to the majority of wounded, secures direct access by ambulances and especially avoids the serious hindrance to moving wounded by litter found in the deep cut and steep banks of Salt Creek. It is rejoined in its new location by its transportation via Millwood road and the private road 15—F. In this new situation it may evacuate either to Kickapoo or Fort Leavenworth, the distance to the latter being shorter but the grades much more difficult.

When the several Dressing Stations break up after the field is cleared, severely wounded unable to bear further transportation are made comfortable in the adjacent Gauss and M. Kern houses and are left there in charge of a suitable medical detail, due information of this fact being sent to the Chief Surgeon.

Following the Blue Division as it moves southward from Atchison, the wagons of the four Field Hospitals have found their natural halting point at Kickapoo as the Blue force deploys to advance against the enemy holding Sheridan Ridge. This point has at this time the following special advantages for hospital purposes:

(a) It is the nearest safe point to the attacking force.

(b) It is beyond the range of artillery fire.

(c) It offers ready communication to the front and rear, and to a great part of the battlefield, over excellent roads.

(d) It is on the natural line of communications if the attack of the Blue force is unsuccessful.

(e) It is on a practicable railroad running direct to the base, by which supplies may be readily secured and wounded quickly evacuated.

(f) It presents a considerable number of good buildings and supplies adaptable to hospital use, together with water, fuel, etc.

Before and during action, the official attitude of these field hospitals is purely one of expectancy. They remain packed awaiting determination of the probable outcome of the battle, which will decide upon their places of ultimate greatest utility. It will be a grave mistake to establish them at this time and thereby temporarily destroy their mobility and usefulness elsewhere. During action, the road Frenchman—17—47 will largely be under artillery fire and evacuation of the dressing stations by ambulances will therefore be impossible. During the action, which lasts but four hours, only a few slightly wounded will be able to work their way back, and these can be comfortably cared for in the village houses, utilized for hospital purposes. All others must remain where they received first aid or in dressing stations, until cessation of fire renders their evacuation practicable. The wounded are therefore not suffering any detriment from this proper hesitancy to convert an immediately mobile organization into a relatively fixed establishment.

The wisdom of this delay is at once seen on receipt of the order directing the 1st Field Hospital and Ambulance Company No. 1 to accompany the pursuing brigade; and the slightly later order already quoted directing the 3rd and 4th Field Hospitals to proceed immediately to Fort Leavenworth and there establish themselves.

After the battle, on receipt of orders to establish itself at Kickapoo, the 2nd Field Hospital is unpacked in all respects except tentage and located at 39 in direct proximity

to, and utilizing, the houses in the northwest corner. This hospital will chiefly receive the wounded from the Bell Point battlefield. One house serves as a receiving ward, and severely wounded are placed in the others where they can remain comfortable if this Field Hospital is ordered forward. The slightly wounded are sent to the houses across the road for shelter, food and treatment.

As it appears later that some 175 wounded will probably find their way to this hospital, and as there are but ten small buildings conveniently located, it may be necesary to pitch a part of the hospital tentage. This, however, is only done as the absolute necessity for it becomes demonstrated.

At the earliest opportunity, evacuation of wounded by hospital train from Kickapoo Station is begun, the 2nd Field Hospital, as will be shown, being able to pack up and rejoin the Blue force at Fort Leavenworth about noon on Sept. 24th. A small number of wounded unable to stand transportation are left behind in the Kickapoo houses under suitable medical and hospital attendance, in which the villagers are required to assist.

The action of the 3rd and 4th Field Hospitals, ordered to establish themselves at Fort Leavenworth, is similar to that of the 2nd Field Hospital left at Kickapoo. They, however, receive the Blue wounded from the main battlefield, practically all of those of the Red defenders, and many such wounded of both sides as will result from the rear guard action conducted by the retreating Red brigade. To meet their greater needs they are accompanied by the wagons of the Reserve Sanitary Supplies—but in the hospital at Fort Leavenworth and its neighboring barrack building they find abundance of excellent accommodation for the wounded of all classes and both forces. No tentage is unpacked, and only such other articles as are absolutely

necessary. Conforming to instructions from the Chief Surgeon, evacuation of wounded to the base by hospital train begins immediately with the establishment of these field hospitals; every effort is made to prevent the wounded able to travel from accumulating.

Comment.

This problem particularly well illustrates the following points:

The value of compact sanitary units as part of the divisional forces, which can be sent as need demands to reinforce a locally overwhelmed sanitary personnel. The ability to throw an additional ambulance company to the relief of the 2nd Brigade enabled the battlefield, as will later be shown, to be cleared in all its parts in about the same length of time, without which sanitary reinforcement the work of evacuation from Gauss would have lasted well into the night, to the detriment of all concerned.

The imperative necessity of regarding all sanitary units, service of the front, as at all times mobile forces; and as considering field hospitals not as instiutions to be anchored for the lengthy treatment of wounded, but as more elaborate relief stations at which wounded merely stop briefly on their way to the true hospitals at the base.

The fundamental importance of not establishing field hospitals until there is indication as to the probable outcome of the conflict, so that localities of greatest convenience, especially from the litter, ambulance and railroad transportation stand-point, may be selected for their establishment. The great importance of using existing buildings, facilities and supplies in connection with field hospitals is also here demonstrated.

The independent or co-operative action of sanitary units, is required by varying conditions of terrain, casualty and military necessity.

CHAPTER XXXVIII.

Estimation of the Time Required for the Sanitation of a Battlefield.

Problem No. 34.

(Based on 4 inch map of Fort Leavenworth and vicinity.)

Situation:

Same as given in Problem No. 32, and as developed in Problem No. 33.

Requirement:

Estimation of the time required for removal of the wounded from the battlefield to the field hospitals, with reasons therefor.

A Solution.

The estimate of time required for the policing of any battlefield depends upon: (a) the number of casualties; (b) the character of these casualties as affecting transportation requirements; (c) the distribution of these casualties on the field; (d) the amount and character of transportation facilities available; (e) the distance over which wounded have to be transported, by litter and by wagon; (f) terrain, soil, vegetation, weather and season as affecting facility of collection and transportation; (g) the amount of labor available for sanitary police purposes. This last factor may here be disregarded, as General A, under a previous problem, (No. 32) has ordered the entire available command to police the battlefield.

The actual number of casualties is readily determined from the percentage of losses given. It may be assumed that the force attacking the Atchison—Hill—Curran line

includes the entire 2nd Brigade, with the 7th Infantry of the 3rd Brigade. This gives a maximum paper strength of 6,768 infantry. We may practically disregard the artillery, cavalry and signal troops serving with the brigade, for the purpose of this problem, since in an engagement of this nature their losses will not be heavy and the chief loss will occur among the infantry. Of these latter about 8 per cent are estimated to have been hit, causing a total of 541 casualties.

The two infantry regiments attacking Bell Point have an aggregate maximum strength of 3,384 men, and lose 5 per cent, or 170 men, disregarding any artillery also engaged.

The casualties of the enemy left on the field are reported to be about 400.

These figures give the following summary for the entire battlefield:

Total Blue casualties at Atchison Hill—Curran.....	= 541
Total Blue casualties at Bell Point	= 170
Reported total casualties of Red force remaining....	= 400
Grand total	=1111

In round numbers, 1,100 casualties.

In utilizing the above figures to determine the time factor required in this case to evacuate the battlefield, it is next necesary to know the proportionate severity of the casualties so incurred in order to calculate the amount and nature of the transportation required. This factor must naturally vary with battles, according to the character of weapon used, ranges, whether troops are entrenched or not, and various other conditions. But for the purpose of the present problem we may use the classification of casualties, with the percentage in each class, officially accepted in our service as a tentative standard and basis of estimate. This is as follows:

Total number hit	= 100
Killed outright	= 20
Non-transportable (except over very short distances)	= 8
Able to walk to field hospital	= 28
Able to march to advance base	= 12
Percentage not considered in respect to transportation	= 68
Requiring ambulance transportation sitting up	= 20
Requiring ambulance transportation recumbent	= 12
Total requiring ambulance transportation	= 32

All cases requiring ambulance transportation, and thereby belonging to a general class unable to walk, are necessarily regarded as litter cases for purposes of collection on the field.

The above figures can only be regarded as suggestive for general use, with special modification dependent on local conditions. Thus in determining the percentage of the wounded able to walk back to field hospitals and the advance base, question at once arises not only as to the distance from the battlefield of such establishment or point, but the nature of the terrain, character of roads, climate, season, weather, previous labor of troops, stimulus of pursuit by the enemy, and other variable factors which at once suggest themselves. It thus happens that such figures as are given above will vary very materially for different battles. But for the purpose of the present problem, in which all these various factors except pursuit by an enemy combine to simplify and facilitate the evacuation of wounded, the above percentage classification may safely be accepted.

Applying these general percentages to the total casualty

list of the present problem, the actual figures are as follows:

Total number of casualties ..... =	1100
Killed outright ..... =	220
Non-transportable, except over very short distances.. =	88
Able to walk to field hospitals..... =	308
Able to march to advance base ..... =	132
Number not considered in transportation from field. =	748
Requiring ambulance transportation sitting up ..... =	220
Requiring ambulance transportation recumbent .... =	132
Total requiring litter and ambulance transportation.. =	352

These gross numbers must, however be further considered in the light of the distribution of casualties on the field.

The next factor to consider is the amount of litter and wheeled transportation here available for the work to be performed. Deducting Ambulance Company No. 1, sent with the pursuing brigade, we have three ambulance companies remaining, each provided with 20 litters, or a total of 60; and there are 21 litters with each regiment, 8 with its Hospital Corps detachment and 1 with each company, including the machine gun company, or 126 litters with the 6 infantry regiments. This gives a total available of 186 litters, discounting those with the engineers, signal and artillery troops as being probably sufficient only to make good other deficiencies elsewhere due to loss, breakage and lack of provision. Of this total number of litters, 124 are available with the troops attacking the Atchison Hill—Curran line, and 62 with those attacking Bell Point.

Field Service Regulations provide 12 ambulances to each ambulance company, or 36 here available in all. Each ambulance can carry 4 recumbent patients, or 8 sitting up, together with one on the driver's seat; allowing the evacuation of 144 recumbent and 36 sitting up patients, or 324 sitting up, per trip of the total ambulance trains.

A variable number of ammunition wagons returning empty to the rear, transport wagons emptied for the purpose, and local vehicles impressed into service, may also be available but cannot be definitely counted upon. In this problem, from the short haulage required, it will be seen that they are unnecessary.

It has been seen that there were 541 Blue casualties incurred in capturing the Atchison Hill—Curran line. These are divided about as follows:

Killed outright	= 108
Non-transportable	= 44
Able to walk to any relief point	= 216
Able to travel sitting up	= 108
Able to travel recumbent only	= 64

The 172 wounded above requiring transportation will have to be littered to the Dressing Station at Gauss.

These casualties in the reinforced 2nd Brigade occur almost entirely in the area bounded by the lines 16—Curran —Sentinel Hill—Kasten. The average distance within this area to the Dressing Station at Gauss is about ¾ of a mile. The map shows that the country is rough, gullied and partly wooded. Under such conditions, a litter squad could probably average one round trip per hour, and with the forces operating over this area there are 126 litters. There are 172 wounded in this area requiring transportation; hence about a couple of hours should suffice to bring them all to the dressing station, as the bands and combatant troops furnish abundance of bearers.

The distance from Gauss to the hospital at Fort Leavenworth is about 2 miles. The road is good but the map shows one 200-foot grade to surmount. An ambulance should average one round trip every 1¼ hours, and the 24 ambulances available should evacuate the 64 recumbent and about 50 sitting patients in one trip of 1¼ hours,

and the remaining 60 sitting up, using 8 ambulances, from Gauss to Fort Leavenworth, in 1¼ hours more. Some of this work of evacuation would be done while litter collection of wounded is still going on, and after they made a single trip 16 ambulances would be available for service elsewhere. A rough estimate of the time of evacuation of Atchison Hill—Curran battlefield would therefore be about as follows:

Time spent in litter collection of wounded	2 hours
Average delay of wounded at Dressing Station	2 hours
Transport from Dressing Station to Fort Leavenworth	2½ hours
Total	6½ hours

This part of the battlefield would thus probably be completely evacuated about 4:30 P. M., at which time the entire transportation of Ambulance Companies Nos. 3 and 4 could be turned over, if necessary, to evacuation of the remaining Red wounded.

Turning to the Bell Point battlefield, the two infantry regiments attacking this position have a strength of 3,384 men, and lose five per cent. or 170 men. The artillery loss may be disregarded. Few helpless wounded will be treated during the fight, while the Dressing Station is at the Taylor orchard. The new station at M. Kern, taken after the action is over, will practically be in the center of the battlefield, and the distance over which the patients must be littered does not average more than one fourth mile. The country is rough and not more than two round trips per hour can be made. There are 62 litters available here, hence all the 50 helpless wounded should certainly be at the dressing station at the Kern house in an hour. Twelve ambulances are available to evacuate this station to Kickapoo, and eight can accomplish this in one trip, the other four therefore being sent to assist with the Red

casualties. The distance to the field hospital at Kickapoo is about three and one-half miles over good roads without heavy grades; hence a round trip, with loading and unloading, can be made well within two hours. A fairly close estimate of the time required for complete evacuation of the Bell Point battlefield is therefore about 3½ hours, divided as follows:

Time spent in litter collection of wounded	1 hour
Average delay of wounded at Dressing Station ...	1½ hours
Transport from Dressing Station to Kickapoo	1 hour
Total	3½ hours

The probable slighter delay at the Dressing Station in this case is due to the actual and relatively lesser number of wounded handled. The Blue wounded at Bell Point battlefield are therefore completely evacuated by about 1:30 P. M. and the ambulances should be back by 3:30 P. M.

The Red casualties left on the field remain for final disposition. Their distribution is not given. There are stated to be about 400 of these; probably about all of them being either dead, desperately wounded or unable to walk. These classes represent about 60 per cent of the total casualties. The other 40 per cent is composed of wounded able to walk longer or shorter distances and now straggling southward through Leavenworth. The latter need not be considered, though if overtaken by the pursuing Blue force they become a charge upon its attached ambulance company.

The above 400 casualties are thus all severe and are probably divided about as follows:

Killed outright	= 135
Non-transportable, except over very short distances..	= 53
Requiring ambulance transportation sitting up	= 135
Requiring ambulance transportation recumbent	= 80

Here the distance is so short that perhaps half of the

more desperate cases, usually classed as "non-transportable," can probably be carefully moved to the hospital at Fort Leavenworth in ambulances or carried on litters by litter squads.

The distance from the Red lines of defense to the points named by General A, in the order already given (Problem No. 32) is short and the terrain is not difficult. Since about 1:30 P. M., the details made from the brigades to assist in collecting the wounded have been available here, working under the general supervision of the Director of Ambulance Companies as the representative of the Chief Surgeon in such matters.

At about the same time, the litter bearer and dressing station sections of Ambulance Company No. 2, under orders from the Director of Ambulance Companies, climb the hill from the Dressing Station at the M. Kern house, now evacuated except for the desperately wounded left behind with a small detachment to care for them, and complete the collection of Red wounded and assist the Blue regimental service in applying first aid. Four surplus ambulances from the train of Ambulance Company No. 2 had previously reached there, and 4 from Co. No. 3 and 12 from Co. No. 4 are just about arriving on the ridge. These ambulances are despatched individually to the field hospitals in Fort Leavenworth as fast as loaded with wounded. The average distance thereto from the Red collecting points specified in General A's order is about one and one-quarter miles, with good roads and over no elevations, and can be readily covered at a walk in half an hour; making the round trip, with all delays, in about an hour. The 20 ambulances available can move 80 recumbent and 20 sitting patients at a trip, and two such trips with these 20 ambulances available will more than suffice to remove all Red wounded. They could start away from the field by about

3:30 P. M., leaving it cleared except for desperately wounded to be brought in on litters by ambulance company men with great care, and such as must remain behind through being unfit even to stand such careful transportation by hand. At about this time the 8 ambulances sent to the field hospital near Kickapoo should be rejoining and capable for further additional service if it were required. Those still working from Gauss would be available somewhat later.

It seems possible, therefore, that the battlefield can be entirely cleared by 4:30 P. M. But matters will probably not be conducted as rapidly and smoothly in practice as appears possible in theory. Some allowance should, in addition, be made. However, considering the local conditions and the abundance of transportation, a considerable amount of which practically becomes surplus after 3:30 P. M., the Chief Surgeon would have no hesitancy in estimating that he could clear the field of all wounded able to be removed in an hour additional, or by 5:30 P. M., or about an hour before sunset.

Comment.

The conditions for the rapid sanitation of the battlefield are exceptionally favorable under the terms of this problem. Terrain, roads, season, weather and distribution of wounded, with the highly important factor of short distance to the points of discharge, all combine to facilitate collection, dressing and removal. Such fortunate combination can rarely be expected in practice, but methods of procedure similar to those above outlined would be followed whether the situation be simple or complicated.

CHAPTER XXXIX.

The Service of Evacuation From Field Hospitals. Problem No. 35.

(Based on 4 inch map of Fort Leavenworth and vicinity.)

Situation:

Same as given in Problem No. 32 and as developed in Problem Nos. 33 and 34.

Requirement:

Outline of a general plan for the evacuation of the wounded from the Field Hospitals to the rear, with estimate of the time required for such evacuation and loading.

Estimate of the situation:

Same as given in the solution of Problem No. 32.

A Solution.

This problem relates to conjoint service between the sanitary services of the front and of the line of communications, the transportation problem required practically resolving itself into the simple one of railroad evacuation almost directly from the field hospitals.

Deducting slightly wounded which can shortly be sent back to their regiments, there will remain about 675 Blue and Red wounded requiring prompt evacuation, of which number about 180 must be transported lying down. Hospital trains are equipped to carry 200 patients each. If passenger cars are available, 7 ordinary tourist sleepers will carry the recumbent, and 13 day coaches of average capacity will accommodate the remaining wounded, preferably made up in several trains. Such trains would evacuate

direct to the Base Hospital at Omaha; stopping at Atchison to transfer into the Evacuation Hospitals, undoubtedly established at that point, such wounded as should not be subjected to further travel. If passenger cars are not obtainable, ordinary freight box cars may be used, averaging 34 feet long and 8 feet 4 inches wide. They will be bedded with hay or straw, on which the wounded will lie. In loading such less comfortable cars, all wounded should be regarded as recumbent cases, and not more than 25 patients loaded per car. About 30 such box freight cars would be required to meet existing conditions and probably one-half the patients at least should under these conditions preferably be transferred at Atchison to the evacuation hospitals. Temporary medical and Hospital Corps details for care of the wounded in these trains would be made by the Chief Surgeon, provided the wounded were not taken over by the sanitary service of the Line of Communications, as they should be, on evacuation from the field hospitals. The time required for evacuation of the wounded to the Missouri Pacific Railroad from the Kickapoo and Fort Leavenworth field hospitals is a matter of no great importance. From the Kickapoo field hospital to Kickapoo Station is only about ¼ mile, down a 200 foot grade. Probably two round trips could be made per hour. There are about 175 wounded, of whom only some 20 require recumbent transportation. The 12 ambulances available here could therefore evacuate the hospital to the railroad in about an hour, even including those patients who are able to walk.

From the Fort Leavenworth field hospitals to Leavenworth Station is about ½ mile, down a 100 foot grade. About two round trips could be made per hour, and there are 24 ambulances available. There are some 565 Red and Blue wounded requiring transportation, about 115

lying down and 450 sitting up. These could all be removed in three trips, or in about 1½ hours. If we include possible additional wounded from the rear guard action, it could still be done in 2 hours. Even if this work of evacuation of field hospitals is delayed until sunrise of Sept. 24, it is apparent that all wounded could be transferred to the hospital trains by 8 A. M.; and that by 9 A. M., the ambulance companies should be packed and assembled in readiness to respond to any order from General A directing them to proceed to the front, and that within another hour or so the field hospitals should be able to replenish supplies from the Reserve Sanitary Supply wagons packed near by and be in suitable condition to follow. In just about 24 hours, therefore, the entire sanitary work resulting from the battle should, so far as the "service of the front" is concerned, be satisfactorily completed.

Comment.

It will probably not often happen in campaign that conditions will be so favorable for moving disabled from front to rear as they are in this problem. But the general principles and methods the use of which is here illustrated are such as are generally applicable under all circumstances. After determining the number to be carried, the facilities by which to carry them and the distance to be transported, and after duly considering the modifying factors of terrain roads, weather, season, etc., problems in transportation become problems in simple mathematics, requiring no complicated formulae for their solution.

One point which this problem well illustrates is that given a practicable railroad and plenty of rolling stock which can be pushed reasonably close to the battlefield, even the most vast and complicated problems of sanitary transportation to the rear are at once simplified. Even if

the sanitary service of the line of communications is not prepared, for one or another reason, to take over a sanitary situation at rail head, there are always plenty of cars bringing up supplies and troops which, after emptying, are readily available for the evacuation of sick and wounded. Once the latter are loaded on such cars and started for the rear, they cease to be a factor in the sanitary service of the front.

In conclusion, the entire foregoing series of problems, ranging from the smallest to the largest units, illustrates the importance of a properly organized and intelligently directed sanitary service in promptly and efficiently relieving sanitary situations which, from motives of humanity and policy, commanders cannot afford to disregard in preparing their purely military and strategic plans. The sanitary troops, though ranked as non-combatants because they are not a destructive agency to be used against an enemy, play by no means a minor part in the winning of victories and campaigns through the great assistance which they give, as a constructive force, in promoting military mobility, physical efficiency and fighting spirit in the commands of which they necessarily form an integral part. Instead of being, as some of the less well informed might affect to consider it, an incumbrance and liability which must be tolerated in the name of humanity, the sanitary service must be regarded not only as powerful agency in the relief of suffering but as at all times thoroughly practical and essentially valuable military asset to a commander.

ADDENDUM.

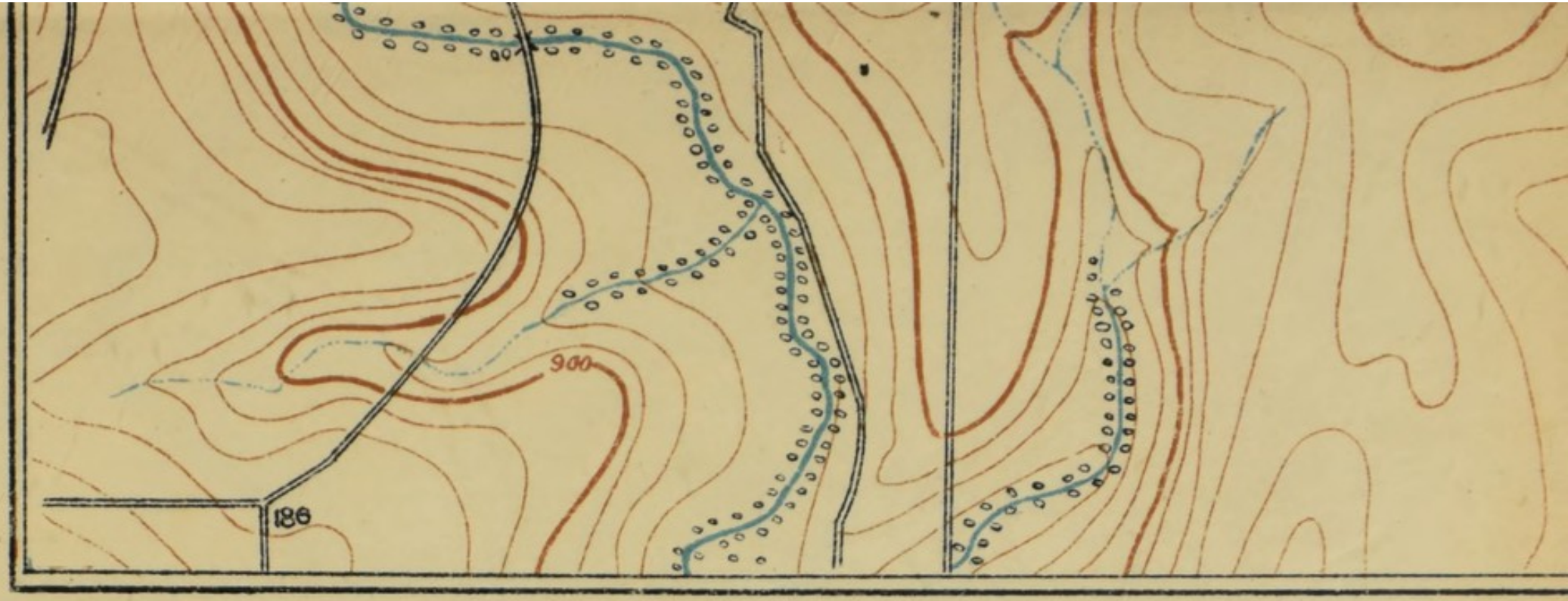
The several problems in this book are intended to gradually lead the student, through separate consideration of the sanitary tactics relating to smaller units and more or less isolated situations, toward a clearer conception of the combined employment, under progressive military phases and conditions, of the combatant organizations and sanitary detachments and units of the infantry division in modern war.

A problem illustrating the latter, worked out in much detail from both the tactical and sanitary aspects and to the extent of some 250 pages, will be found in "A Study in Troop Leading and Management of the Sanitary Service in War," by Lieutenant Colonel John F. Morrison, General Staff, and Major Edward L. Munson, Medical Corps, which may be obtained from the U. S. Cavalry Association, Fort Leavenworth, Kansas.

The general principles employed in solving the problems included in the present volume and the one mentioned above will be found formulated in "Medical Service in Campaign," a book of some 165 pages by Major Paul F. Straub, Medical Corps (General Staff), which may be obtained from P. Blakiston's Son & Co., 1012 Walnut Street, Philadelphia, Pa.

These three books, of uniform size and appearance, are planned to supplement each other in covering the whole subject of the tactical use of the sanitary service in the field—including, as they do, the enunciation of the general principles and rules of organization and tactics concerned together with the practical employment of the latter in a wide selection of typically illustrative concrete examples. Having been officially approved by the Surgeon General and published by authority of the War Department, they may be regarded as authoritative guides for any interested in the subject of which they treat.


MAP OF FORT LEAVENWORTH, KANSAS
AND VICINITY
2 INCH MAP
KICKAPOO ISLAND
MISSOURI
RIVER
MILLWOOD
LOWEMONT
CITY
OF
LEAVENWORTH
EAST LEAVENWORTH
FARLEY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