

Volume III

Number 3

***THE
FIELD ARTILLERY
JOURNAL***

JULY-SEPTEMBER, 1913

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Editor

**PUBLISHED QUARTERLY by
THE UNITED STATES FIELD ARTILLERY ASSOCIATION
601 STAR BUILDING, WASHINGTON, D. C.
\$4.00 PER ANNUM**

The Field Artillery Journal

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*Entered as second-class matter, March 14, 1911, at the Postoffice at Washington, D.
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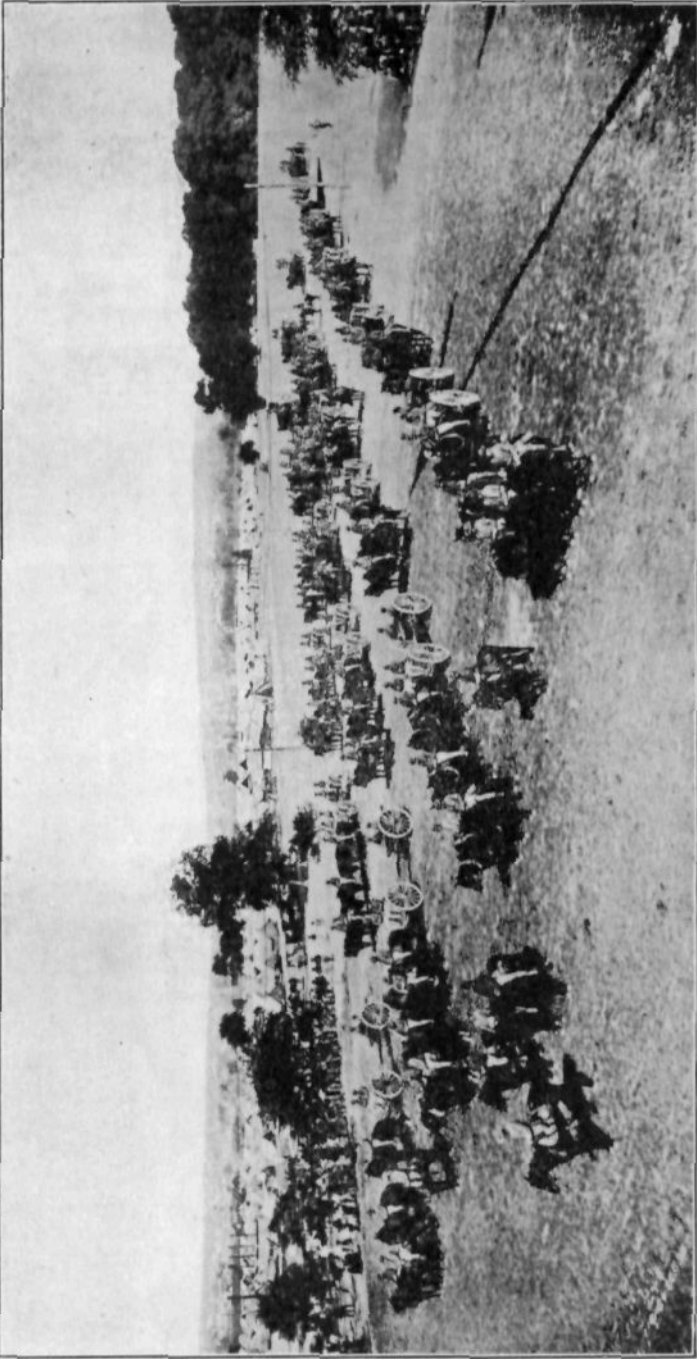
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A FIELD BATTERY AT WAR STRENGTH.

The Field Artillery Journal

Vol. III

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No. 3

A STUDY ON THE EFFICIENCY OF FIRE.

BY MAJOR TRÉGUIER, OF THE FRENCH FIELD ARTILLERY.

*Translated from the Journal des Sciences Militaires by Major W. S. McNair,
6th U. S. Field Artillery.*

At the conclusion of a very interesting article which appeared in the *Journal des Sciences Militaires*. July 15, 1912, Colonel Potel reaches the following conclusions:

1st. "Shorts" are always more effective than "overs."

2d. Shots 50 meters over give no effect whatever; those 25 meters over, very little.

3d. The range of the target is theoretically the most effective; practically it gives little effect, both by reason of the dispersion, and the difficulty of determining it precisely with time fire. The most effective ranges are from 25 to 50 meters short. Ranges 100 meters short are very good. Theoretically they are at the limit of effect for shrapnel bullets, but experience shows that effect reaches considerably beyond that distance.

4th. All fire at a single elevation against exposed targets should be at the short limit of the bracket diminished by 25 or 50 meters.

The first of these conclusions may be admitted without question, but not the other three.

If, for instance, it is true that the range of the target is theoretically the best, why does a range 25 or 50 meters short of this give better results in practice? Colonel Potel gives two principal reasons: the dispersion, and the difficulty of determining the true range of the target with time fire.

The effect of dispersion is to give rounds both over and short, with bursts sometimes high, sometimes low. To say that the range of the target is theoretically the best is to say that in consequence of the dispersion in the fire of a great number of rounds, it is the

range of the target which will give the best effect. Why, then, should one grant that, in a limited fire, the range of the target is less effective than one 25 or 50 meters short, which, in prolonged fire, will not be as good?

The second reason is the difficulty of obtaining the range of the target with time fire. If, as the regulations say, the adjustment is effected by 1 mil bursts, the probable range of the target is easy to determine, since it is the mid range of the bracket diminished by about 25 meters. But Colonel Potel says, with good reason, that there is too much tendency to use too high bursts in adjustment. If they were 2 mils, for instance, the probable range of the target in the 50-meter bracket is not the short limit of the bracket but this limit decreased by 25 meters. It seems that there would, then, be some advantage in diminishing the short end of the bracket 25 meters. But it must not be forgotten that the corrector for adjustment being increased by 2 for fire for effect, the latter will be with 4 mil and not 3 mil bursts. With the 3 mil bursts it might have been more advantageous to diminish the range 25 meters than to fire with the range to the target. But the fact of having a burst 1 mil higher withdraws the bursting point 25 meters toward the battery. To diminish the range 25 meters beside would draw the bursting point back 50 meters altogether. Is there any advantage in this operation? What follows will show that there is not.

Colonel Potel assumes further that the action of the upper nappe of the cone is greater than the lower. "It is difficult," says he, "to prove theoretically, as we believe, that the balls of the upper nappe give more effect than those of the lower, and no one has tried to prove practically that it is the more effective of the two nappes. We are satisfied to assume, *a priori*, that the best range is the range of the target, which is theoretically true when the number of rounds is sufficiently great, but which might be practically untrue if the number of rounds be limited; for, in this case, the dispersion should have the effect of making the action of one or the other nappe predominate. For my part, I think that the balls of the upper nappe have more effect than those of lower nappe, etc."

As a matter of fact, against a target in the open, the lower half of a single cone of dispersion is more effective than the upper. This has been shown by General Tariel in a very elaborate paper, and a simpler demonstration will be found below. This conclusion, however,

applies only to a single isolated cone, and hence no general deductions can be made from it.

The question of the comparative effect of the two nappes of the cone, of the range of the target compared with ranges 25 and 50 meters less, and of different kinds of fire for effect are still obscure, and evidently can be solved only by experiment. But we may nevertheless make a simple theoretical study of them.

This investigation can make no pretense of arriving at the absolute truth; but, being based upon a hypothesis generally admitted until now, and on the inevitable effects of the laws of dispersion, which are so often wrongfully neglected, it should throw some light upon the problems of fire effect. It leads, in any case, to conclusions which are, for the most part, in absolute conformity to the rules in the Drill Regulations.

Points studied.

1st. We shall first seek to determine the effect at a given point of a given cone of dispersion for any height of burst from 1 to 8 mils.

2d. Knowing the effect at a given point of a given sheaf which is well defined by the point of impact of the trajectory and by its height of burst, we will suppose a thousand rounds with a mean height of burst of 3 mils. The law of dispersion will give us the points of impact of the trajectories and the heights of burst. We can then calculate for any point the sum of the effects produced by each of the sheafs, and by dividing by 1,000 we will have the mean effect of one sheaf at this point. Thus we may determine whether or not the maximum effect is at the point of fall—that is, whether the range to the target is the most effective. In the same way we may determine the mean effect at any given point of a range 25, 50 or 100 meters greater or less than that of the target. The mean effect thus determined evidently will not be the mean effect produced by a small number of shots (which will vary in practice) but the mean determined by 1000 shots, and this latter is, *a priori*, what we are most likely to get with a small number of shots; in other words, it is the *probable* effect.

Many officers misunderstand the significance of this word probable. Giving it the commonly accepted meaning, they imagine that the probable effect is that which they will probably obtain in firing a limited number of rounds. It is nothing of the kind. When percussion

fire gives 2400 short—2500 long, we say that the probable range of the target is 2450. This means, not that the target is probably at 2450, but that if, in a great number of different firings we obtained the bracket 2400-2500, the most frequent position of the target would be at the 2450 meter range. The same meaning applies to probable effect.

If, with a given elevation, we fire 100 series of ten rounds each, the mean effect most often obtained would be an effect very near to the mean of that obtained in the continuous firing of 1000 rounds. Hence, while we are entirely uncertain what will be the mean effect of any short series, the mean of the long series is the result we are most likely to get; and we have no right to say, *a priori*, that the mean of any particular limited series will not closely approximate to it. We see, then, how we must understand the definition of *probable* effect.

3d. Knowing the probable effect obtained at a given point by a given elevation, we may compare the total probable effect of different kinds of fire.

4th. Supposing that the effect of the 1000 rounds is no longer secured with a mean height of 3 mils, but in one case with 4 mils and in another with 2 mils, we may then compare the probable effects with these different heights of burst and, in consequence, compare by the variations of these effects the influence of the height of burst on effect and the influence of the height used for adjustment.

*Study of the effect at a given point, of a single sheaf.
(Range 2500 meters)*

Let us take the target selected by General Tariel, that is one composed of vertical panels each 1.6 meters high and one half a square meter of surface. That is about the mean height and vulnerable surface of a foot soldier. With these panels placed side by side, we will form a target 100 meters long. The surface of the target is $100 \times 1.6 = 160$ sq. meters, and as all of the panels are half a square meter in area there will be 2×160 or 320 panels. Let us place this target (on level ground) on a piece of terrain effectively beaten by the sheaf (A B Fig. 1) and find the number of panels hit. From this we will deduce the percentage of hits, that is the effectiveness.

It is usual to assume that the balls of a shrapnel form a cone

of which the axis $E C$ is sensibly the line joining the point of burst E and the point of impact C of the trajectory, and that these balls, following rectilinear trajectories, are distributed about equally in the cone.

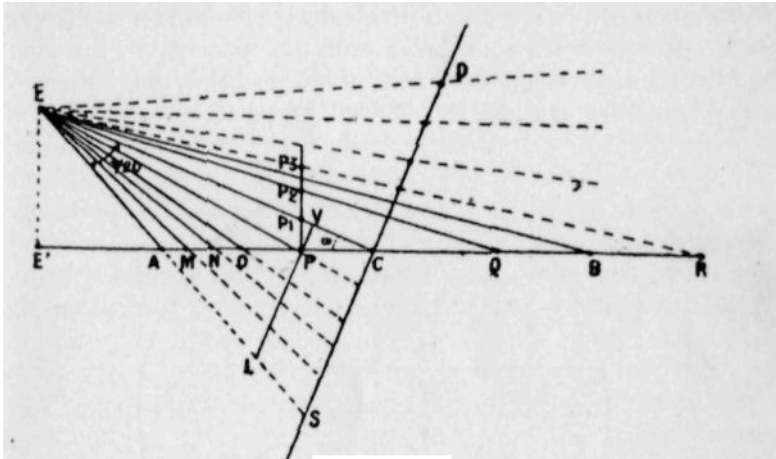


Fig. 1.

The target will be hit by N balls on a front F . The surface covered will be $F \times 1.6$, and the number of hits per panel (or each half square meter) will be

Let us designate this number of balls per panel by n . We have then:

$$N = 2 \times 1.6 \times F \times n.$$

This number (n) could be greater or less than unity according to the position of the target, as we will see later. If it be greater than 1, that is if there be more than one hit per panel, there will be less panels hit than there are balls, N , reaching the target. But by making $n = 1$, the product of $2 \times 1.6 \times F \times n$ will give us the number of panels hit. Similarly, if n is less than 1. Therefore if we confine ourselves to never giving n a value greater than 1, the product $2 \times 1.6 \times F \times n$ will always give the number of panels hit.

If, of the whole target containing $2 \times 1.6 \times 100$ panels, we have $2 \times 1.6 \times F \times n$ of them hit, for 100 panels we will have:

$$100 = Fn$$

Let the percentage at a given point then be the product Fn which we are going to calculate.

If n is equal to or greater than 1, the percentage will be F .

At the point of impact C , let us take a right section $D S$ of the cone and divide $D S$ into 10 equal parts. Through the points thus determined and through the point E let us take planes perpendicular to the plane of fire. We thus divide the cone into 10 parts of which each one contains a number of balls proportional to the surface which it intersects on the circle of the right section (Figure 2). These numbers* are 13, 27, 33, 35, 37.

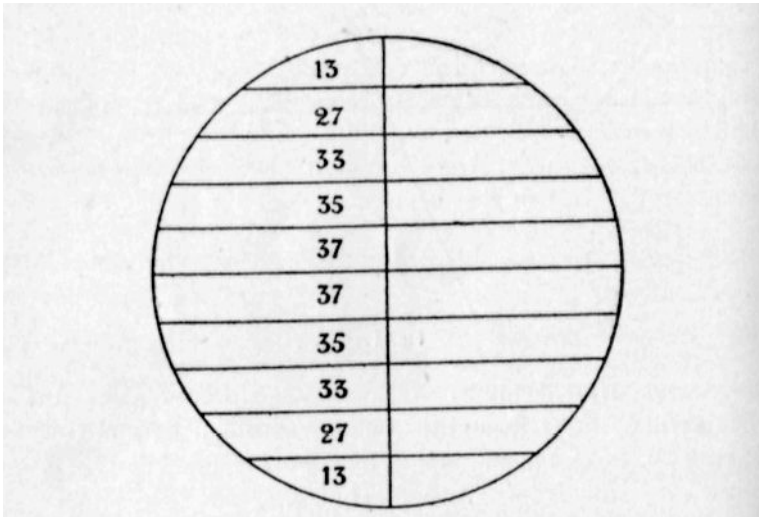


Fig. 2.

The planes which separate the groups of balls cut the axis AB of the trace of the sheaf on the ground at the points M, N, O, P, C, Q, R of which the distances to the point of impact, C , are given by simple formulae, such as:

$$1/5 CS = CP \left(z + \frac{1/2 O}{5} \right)^\dagger \quad 1/5 CS = CQ \left(z - \frac{1/2 O}{5} \right)$$

These distances CP, CQ , etc., vary with the value of CS , that is with the height of burst, since:

* These figures differ a little from those we have given in our Elementary course in field firing. The latter were taken without verification in consultation with Major Lagrange. A rigorous verification has shown us that they were not exactly correct and that they should be replaced by the ones here given.

† NOTE: O is the angle at the apex of the cone; z is the angle which the trajectory makes with line of sight, the ω of American nomenclature.

$$CS = EC \times \frac{1}{2}O$$

from which $EC =$

$$CS = EE' = EE'$$

for the trajectory of 2500 meters range for which $z = 90$ mils and $\frac{1}{2}O = 165$ mils.

We shall now place the target successively at the various points M, N, O, P, C, Q and calculate the product Fn for each of these points.

Take, for example, the point P. In order to ascertain how many balls, N, will be on the target, it becomes necessary to compare its height, 1.6 meters, with the vertical distances PP₁, PP₂, PP₃, etc., from the point P to the planes EP₁, EP₂, EP₃, etc., which separate the different groups of balls.

Now $=$. PC may be determined by one of the formulas above.

E'C is sensibly equal to $EC =$ for each mil in the height of burst, or, if we wish to be more exact, $E'C =$

PP₁ is thus determined, and we may calculate PP₂ and PP₃ in the same manner. The values found are the following:

| | | | | | | | | |
|-----------------|------|-----|-----|-----|-----|-----|-----|-----|
| Mils | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| PP ₁ | 0.65 | 1.3 | 1.9 | 2.6 | 3.2 | 3.9 | 4.5 | 5.2 |
| PP ₂ | 1.32 | 2.6 | | | | | | |
| PP ₃ | 2.0 | | | | | | | |

Hence we see that at the point P with a burst 1 mil high the target receives the whole of the fifth and sixth groups of bullets, and part of the seventh group equal to 35 $= 14$ or in all $37 + 37 + 14 = 88$ balls.

For the other heights of burst the number of balls received on the target will be:

| | | | | | | | | |
|--------|-------|----|----|----|----|----|----|----|
| Mils | ----- | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| Number | --- | 44 | 31 | 22 | 18 | 15 | 13 | 11 |

Now we know N and if, in the formula $N = 2 \times 1.6 \times Fn$, we were certain that n were equal to or less than unity, we would have

at once the percentage which would be But since n is unknown, it is necessary to seek the value of F in order to get n.

Now, F is the width of the sheaf at P. If, through P we pass a plane perpendicular to the axis of the cone, F will be the intersection of this plane with the horizontal plane passing through P, that is its intersection with the ground. It will be then, the chord IH (Fig. 3) passing through P and perpendicular to the radius KL.

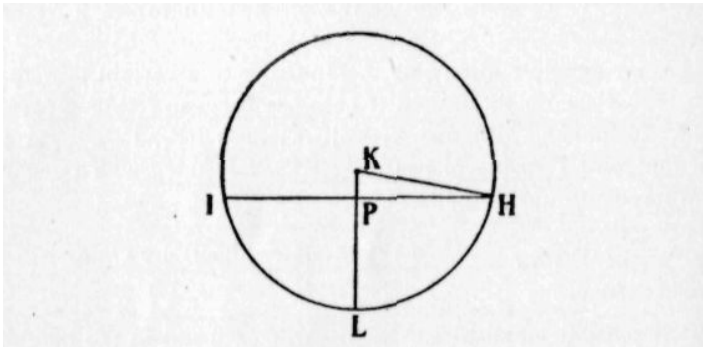


Fig. 3.

Now, $IH = 2 \sqrt{CPz}$ and as $KL = 5PK$, and $PK = CP$
 $\times z$, we have

$$IH = 2CPz = F.$$

We find for F the following values:

| | | |
|-------|--------|--------|
| 1 mil | 2 mils | 3 mils |
| 6.5 | 13.0 | 19.3 |

from which for 1 mil, $n = \frac{1}{6.5}$; hence $n > 1$

Therefore the percentage is 6.5

For 2 mils, $n = \frac{1}{13}$; $n > 1$; percentage = 13.

For 3 mils, $n < 1$; therefore the percentage will be $\frac{1}{n}$ which gives at

| | | | | | |
|--------|-----|-----|-----|---|-----|
| 3 mils | 4 | 5 | 6 | 7 | 8 |
| 9.6 | 6.8 | 5.6 | 4.6 | 4 | 3.4 |

If we make the same calculations for the points M, N, O, C and Q and for the point B, which is the extreme point of the effective sheaf, we will obtain the figures shown in the table below:

TABLE 1.

| | | | | | | | | |
|---|------|------|------|-----|-----|-----|-----|-----|
| M | 2.2 | 4.4 | 6.6 | 7.8 | 6.1 | 5.3 | 4.3 | 4.0 |
| N | 3.2 | 6.4 | 9.6 | 9.6 | 7.8 | 6.5 | 5.6 | 5.0 |
| O | 4.6 | 9.2 | 11.5 | 8.7 | 6.8 | 5.6 | 5.0 | 4.3 |
| P | 6.5 | 13.0 | 9.6 | 6.8 | 5.6 | 4.6 | 4.0 | 3.4 |
| C | 9.1 | 10.2 | 6.8 | 5.0 | 4.0 | 3.1 | .0 | .0 |
| Q | 11.8 | 6.2 | 4.0 | 3.1 | .0 | .0 | .0 | .0 |
| B | 3.2 | 3.1 | 3.1 | 3.1 | 3.1 | 3.1 | 3.1 | 3.1 |

By constructing the curve for each height of burst we will have the effect at any point of A.B. These curves are represented in Fig. 4.

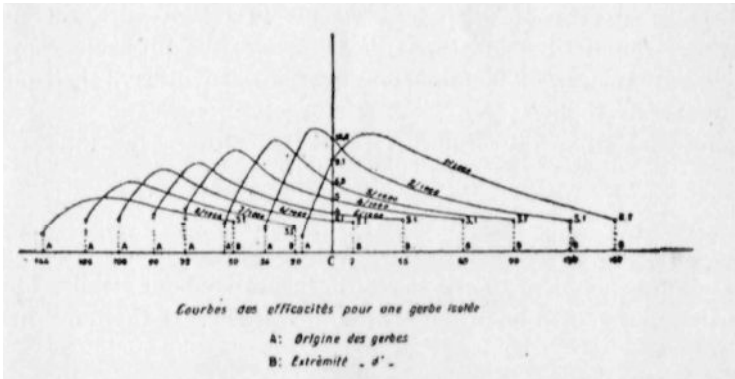


Fig. 4.

Curve of effects for a single sheaf.

A Origin of sheaf.

B Extremity.

Table 1 shows that for a single burst:

1st. The point of maximum effect is not at the point of impact, C, of the trajectory. Except for the 1 mil burst, it is in the lower nappe of the cone.

2d. The mean effect in the lower nappe between the point M and

REMARK.—These tables are based on the hypothesis that the sheaf forms a cone in which the balls have rectilinear trajectories and are uniformly distributed. This assumption is evidently not quite exact and the figures obtained are not rigorously correct in absolute value. But as in what follows we are making, above all, a comparative study, the conclusions at which we shall arrive will not be far from the truth.

the point of impact is greater, except for the 1 mil burst, than the mean effect in the upper nappe.

3d. The maximum effect is greater with 2 mils height of burst than with 3 mils.

4th. The effect diminishes as the height increases.

Therefore, judging by a single round, it seems, *a priori*, that it is better to have the target in the lower nappe—that is, that the range should be a little long. This would undoubtedly be true if all the trajectories had the same point of impact and all of the bursts had the same height. But, by reason of the dispersion, these conditions do not obtain, and it could well be that the law of dispersion might lead us to quite different conclusions.

Study of the effect with dispersion considered.

Let us suppose 1000 shots fired in succession with the mean height of burst of 3 mils. At 2500 meters, the probable error in range is 10 meters. Then the 1000 trajectories will have their points of impact as follows:

| | | | | | | | |
|------------|----|-----|-----|-----|-----|-----|-----|
| Groups—4th | 3d | 2d | 1st | 5th | 6th | 7th | 8th |
| 2% | 7% | 16% | 25% | 25% | 16% | 7% | 2% |
| 40 | 30 | 20 | 10 | C | 10 | 20 | 30 |
| 40 | 30 | 20 | 10 | C | 10 | 20 | 30 |

The probable error of the bursts in height is about 1 mil. Therefore, the bursts will be distributed with reference to the 3 mil height as follows:

| | | | | | | | | |
|-------|----|----|-----|-----|-----|----|----|-------------|
| Mils— | 7 | 6 | 5 | 4 | 3 | 2 | 1 | percussion. |
| | 2% | 7% | 16% | 25% | 25% | 7% | 2% | |

Furthermore, by reason of a law of the calculus of probabilities, it will result that, in each of the 1st and 5th groups, we will have:

| | | | | | | | |
|-------------|-------|-------|---------|---|-----|---|--------------------|
| 0.25 × 0.25 | or 62 | burst | between | 3 | and | 4 | mils. |
| 0.25 × 0.16 | " 40 | " | " | 4 | " | 5 | " |
| 0.25 × 0.07 | " 17 | " | " | 5 | " | 6 | " |
| 0.25 × 0.02 | " 5 | " | " | 6 | " | 7 | " |
| 0.25 × 0.25 | " 62 | " | " | 3 | " | 2 | " |
| 0.25 × 0.16 | " 40 | " | " | 2 | " | 1 | " |
| 0.25 × 0.07 | " 17 | " | " | 1 | " | 0 | " |
| 0.25 × 0.02 | " 5 | | | | | | percussion bursts. |

By making the same calculations for the other groups, we obtain finally:

| Groups | Percus sion | Between mils | | | | | | |
|------------------|----------------|--------------|-----|-----|-----|-----|-----|-----|
| | | 0-1 | 1-2 | 2-3 | 3-4 | 4-5 | 5-6 | 6-7 |
| 1st and 5th..... | 5 | 17 | 40 | 62 | 62 | 40 | 17 | 5 |
| 2d " 6th..... | 3 | 11 | 25 | 40 | 40 | 25 | 11 | 3 |
| 3d " 7th..... | 1 | 5 | 11 | 17 | 17 | 11 | 5 | 1 |
| 4th " 8th..... | 0 | 1 | 3 | 5 | 5 | 3 | 1 | 0 |

For the 1st and 5th groups we might say that:

$$\frac{62}{2} + \frac{62}{2} = 62 \text{ rounds burst at 3 mils.}$$

$$\frac{62}{2} + \frac{40}{2} = 51 \text{ rounds burst at 4 mils.}$$

$$\frac{40}{2} + \frac{40}{2} = 28.5 \text{ rounds burst at 5 mils.}$$

$$\frac{17}{2} + \frac{5}{2} = 11 \text{ rounds burst at 6 mils.}$$

$$\frac{5}{2} = 2.5 \text{ rounds burst at 7 mils.}$$

$$\frac{62}{2} + \frac{40}{2} = 51 \text{ rounds burst at 2 mils.}$$

$$\frac{40}{2} + \frac{17}{2} = 28.5 \text{ rounds burst at 1 mil.}$$

$$\frac{17}{2} = 8.5 \text{ rounds burst between 1 and 0 mils.}$$

5 burst on percussion.

We might very well assume that the $\frac{17}{2}$ bursts between 1 and 0 mils have sensibly the same effect as if they burst at 1 mil. The assumption will be practically true, for the comparative study we are making, since the results come out the same. Percussion bursts will be neglected.

By the same course of reasoning for the six other groups, we have:

| Groups | 1 mil | 2 | 3 | 4 | 5 | 6 | 7 |
|-------------|-------|------|------|------|------|------|-----|
| 1 or 5..... | 37.0 | 51.0 | 62.0 | 51.0 | 28.5 | 11.0 | 2.5 |
| 2 or 6..... | 23.5 | 32.5 | 40.0 | 32.5 | 18.0 | 7.0 | 1.5 |
| 3 or 7..... | 10.5 | 14.0 | 17.0 | 14.0 | 8.0 | 3.0 | 0.5 |
| 4 or 8..... | 2.5 | 4.0 | 5.0 | 4.0 | 2.0 | 0.5 | .0 |

In the first group, the 62 rounds which burst at 3 mils have their

points of impact between the point C and minus 10. The effect of each of these 62 bursts on a given point varies slightly with the position of the point of impact. But the mean effect of the 62 rounds will conform very sensibly to the effect of the sheaf whose point of impact is at the mean of the 62 impacts; that is, at minus 5. The total effect of the 62 then will be 62 times the effect of the single projectile, and this may be calculated since we know its point of impact and height of burst.

Similarly for the 51 bursts at 4 mils, the 28 at 5 mils, etc. And by the same reasoning for the other groups we may obtain for a given point, the sum of the effects of all the bursts. The results in round numbers are as follows:

| | | | | | | | | | | | | |
|-----|------|------|------|------|------|------|------|------|------|------|------|------|
| 100 | -75 | -50 | -25 | -5 | C | +5 | +25 | +50 | +75 | +100 | +125 | +150 |
| 350 | 1770 | 3610 | 6010 | 6430 | 6450 | 6290 | 5500 | 4140 | 2920 | 1720 | 880 | 240 |

The point where the effect is a maximum is the point of impact (C) of the mean trajectory. It is, therefore, the range of the target, which, at 3 mils has the maximum probable effect; it is then the range of the target and not that range diminished by 25 or 50 meters at which it is best to fire.

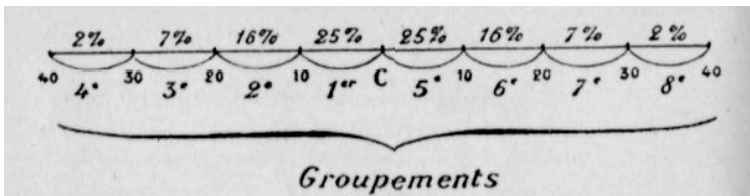


Fig. 5.

If we represent the effect at the point C by unity, we obtain the following relative scale:

| | | | | | | | | | | |
|------|-----|-----|-----|---|-----|-----|-----|------|------|------|
| .05 | .27 | .55 | .93 | 1 | .85 | .64 | .45 | .26 | .13 | .03 |
| -100 | -75 | -50 | -25 | C | +25 | +50 | +75 | +100 | +125 | +150 |

This scale, it can not be too often repeated, does not mean that in fire for effect at the range of the target we will surely obtain a greater effect than with any other range, and that in executing fire with a range 25 yards short of that we will obtain a relative efficiency of 85 per cent. These effects can be obtained only by firing a great number of rounds, and the scale of probable effects is true for such fire only.

According to this scale, a range 25 meters over will have a probable

efficiency of 93 per cent, which is superior even to the probable efficiency of a range 25 meters short. If such a result is obtained in the firing of a large number of rounds, why may it not be produced in limited fire?

A range 50 meters long, far from having no effect, would have a probable efficiency of 55 per cent, a little more than half of the probable effect which the range of the target gives. This result should astonish no one. The bursts of a fire for effect at 50 meters

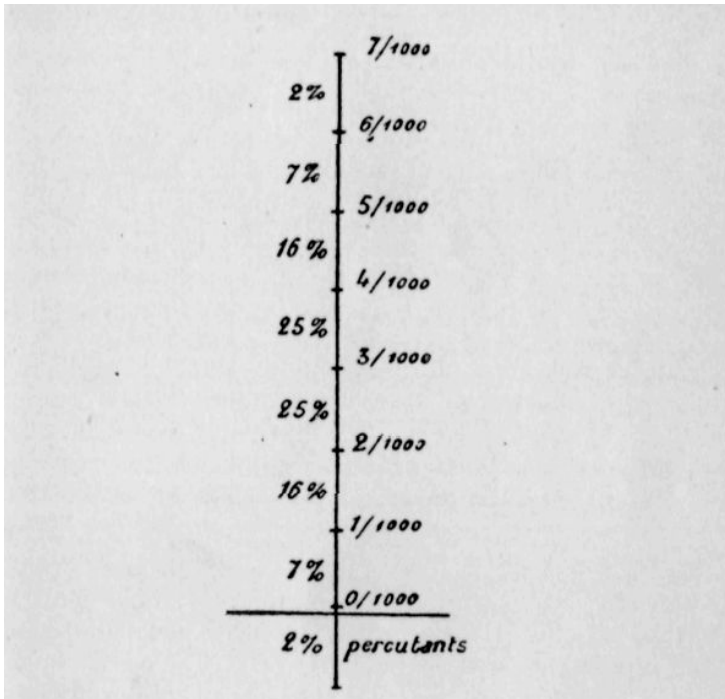


Fig. 6.

beyond the target would group themselves around the mean burst, which has its point of impact 50 meters beyond the target. But, if we go back to Table 1, we will see that the effect of this burst at 50 meters short of its mean point of impact, that is at the target, is about 6.5, while the mean burst which we obtain with the range of the target gives an effect of only 6.8.

The scale of probable effects likewise shows that a range 100 meters beyond the target has a probable efficiency of almost nothing,

while a range 100 yards short has an efficiency of about one-fourth that of the range of the target. Therefore, it is desirable that a fire for effect contain the fewest possible ranges greater than that of the target. The long limit of the bracket obtained with a 1 mil burst is at least 25 or 30 meters over, even when the target is as near as possible to the long limit of the bracket. Consequently, the long limit diminished by 50 meters will usually be long, and can not be short by more than 20 meters.

Now, a range 20 meters short has a greater probable effect than one 30 meters over, hence, it is always better, even where the target is as near as possible to the long limit, to use as the maximum range in fire for effect, 50 meters less than the long limit of the bracket. This is still more so if the adjustment has been effected with bursts higher than 1 mil, say 2 mils; for then the long limit is at least 50 meters over. If the target is as close as possible to the long limit, that limit reduced by 50 meters will be the precise range to the target.

Scales of probable effect with heights of burst of 2 mils and 4 mils.

If 1000 rounds are fired with a height of burst other than 3 mils, the scales of probable effects will not be quite the same. Recalculating for heights of 2 and 4 mils, we find the following amounts of effect:

| | -100 | -75 | -50 | -25 | -5 | C | +5 | +25 | +50 | +75 | +100 | +125 | +150 |
|----------------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| A 2 mils | 130 | 820 | 2560 | 4890 | 6720 | 6760 | 6820 | 6430 | 5140 | 3900 | 2580 | 1450 | 460 |
| A 4 mils | 1140 | 3090 | 5100 | 5880 | 5520 | 5390 | 5080 | 4120 | 2790 | 1750 | 840 | 400 | 90 |

This time, the maximum effect is no longer at the point of impact of the mean trajectory; it is a little beyond for 2 mils and a little short for 4 mils. It is then only for the 3 mil burst that the range of the target is theoretically the best. The higher the mean point of burst is raised, the more the point of maximum effect is short of the target and, consequently, the less one should diminish the range below that of the target. This might have been seen from the first, since the higher the burst the more the sheaf is drawn back toward the battery.

Now again considering unity as the efficiency obtained at C with the 3 mil burst, we have for the 2 mil and 4 mil heights the following efficiency scales:

| AT 2 MILS. | | | | | | | | | | |
|------------|-----|-----|-----|------|-----|-----|-----|------|------|------|
| -100 | -75 | -50 | -25 | C | +25 | +50 | +75 | +100 | +125 | +150 |
| .62 | .12 | .39 | .76 | 1.04 | .99 | .79 | .60 | .40 | .22 | .07 |
| AT 4 MILS. | | | | | | | | | | |
| -100 | -75 | -50 | -25 | C | +25 | +50 | +75 | +100 | +125 | +150 |
| .17 | .47 | .79 | .91 | .83 | .63 | .43 | .27 | .13 | .06 | .01 |

According to these scales, a range 25 meters short will, at 2 mils, have a probable effect a little less than that of the range of the target, and at 4 mils notably so. A range 25 meters over will, at 2 mils, have a decidedly less effect, but at 4 mils it will have a probable effect greater than that of the range of the target. A range 50 meters short will have: at 2 mils, a probable effect of .79; at 4 mils, a probable effect of .43. A range of 50 meters over will have: at 2 mils, a probable effect of .39; at 4 mils, a probable effect of .79.

According to these scales, a range 50 meters over will have, with 4 mils burst, the same probable effect as a range 50 meters short with a burst of 2 mils. *A priori*, these results appear to be false, so much are they contrary to the ideas of effect that one has had. And yet it is easily explainable, if one will note carefully that a sheaf at 4 mils having its point of impact 50 meters beyond the target, gives on the target an effect of about 9 (see Table I), and that a sheaf at 2 mils of which the point of impact is 50 meters short gives an effect on the target of only 5.6.

According to Table I, the maximum effect of a single burst is greater at 2 than at 3 mils. But because of the dispersion, there are at 2 mils more percussion hits than at 3 mils, and from that results a diminution of effect. It is, indeed, one of the reasons given to justify a 3 mil burst. We are going to see presently that it is not a very good reason. On the other hand, at 2 mils there are less high bursts; whence an increase of effect. Which of these two contrary effects predominates—that is, which height is better for fire for effect, 2 mils or 3 mils?

Referring to the efficiency scales, we find that, in spite of the dispersion the maximum effect is still greater at 2 mils than at 3 mils. If, in the two scales, we take the mean of the two probable efficiencies, we find:

At 2 mils, 0.492; at 3 mils, 0.473. Therefore, considering only the value of the probable effect, it seems that, in spite of the great proportion of percussion bursts, there is a slight advantage in firing at 2 rather than at 3 mils, and, consequently, in only increasing the corrector by one instead of 2 for fire for effect. This advantage

seems surer since the corrector for adjustment is generally too high. In reality this advantage does not exist.

Let us see what happens in practice. Suppose that the height for adjustment were really 1 mil, and let us examine the different fires for effect that could be executed.

Bracket 2450-2500.—The probable range of the target is 2450. Fire for effect executed at 2450 will give the probable effect: at 2 mils, of 1.04; at 3 mils, of 1.0. The difference is very slight.

Bracket 2400-2500.—The probable range of the target is 2425.

| | | Probable effect | |
|------------------------------------|--------|-----------------|-------------|
| | | 2 mils | 3 mils |
| 1st possible fire for effect ----- | { 2400 | 0.99 | 0.85 |
| | { 2500 | <u>0.12</u> | <u>0.27</u> |
| | | 1.11 | 1.12 |
| 2d possible fire for effect ----- | { 2400 | 0.99 | 0.85 |
| | { 2450 | 0.76 | 0.93 |
| | { 2500 | <u>0.12</u> | <u>0.27</u> |
| | | 1.87 | 2.05 |
| 3d possible fire for effect ----- | { 2400 | 0.99 | 0.85 |
| | { 2450 | <u>0.76</u> | <u>0.93</u> |
| (The best,* to our mind.) | | 1.75 | 1.78 |

In the three kinds of fire examined the advantage is rather with the 3 mils.

Bracket 2400-2600.—Probable range of the target, 2475.

| | | Probable effect | |
|---------------------------|--------|-----------------|-------------|
| | | 2 mils | 3 mils |
| 1st method possible ----- | { 2400 | 0.60 | 0.45 |
| | { 2500 | 0.76 | 0.93 |
| | { 2600 | <u>0.00</u> | <u>0.00</u> |
| | | 1.36 | 1.38 |
| †2d method possible ----- | { 2400 | 0.60 | 0.45 |
| | { 2450 | 0.99 | 0.85 |
| | { 2500 | 0.76 | 0.93 |
| | { 2550 | <u>0.12</u> | <u>0.27</u> |
| | | 2.47 | 2.50 |

* It is understood that we can not compare the totals of the 3d kind of fire with those of the 2d unless the number of salvos is considered. If we wish to make this comparison it is necessary to reduce the totals of the second kind of fire by one-third.

† See note on p. 337.

| | | | | |
|--------------------------|---|------|-------------|-------------|
| †3d method possible----- | { | 2300 | 0.00 | 0.00 |
| | | 2400 | 0.60 | 0.45 |
| | | 2500 | 0.76 | 0.93 |
| | | 2600 | <u>0.00</u> | <u>0.00</u> |
| | | | 1.36 | 1.38 |

In these three kinds of fire the advantage is still in favor of 3 mils. Colonel Potel recommends this 3d kind of fire for effect as a precaution against the case where the target is near the short limit.

Let us suppose it exactly at this limit—that is, at 2400.

The 2d and 3d methods give to 3 mils the following probable effects:

| | | | | | |
|----------------|---|------|------|---|------|
| 2d method----- | { | 2400 | 0.01 | } | 1.60 |
| | | 2450 | 0.55 | | |
| | | 2500 | 0.05 | | |
| | | 2550 | 0.00 | | |
| 3d method----- | { | 2300 | 0.26 | } | 1.31 |
| | | 2400 | 1.00 | | |
| | | 2500 | 0.05 | | |
| | | 2600 | 0.00 | | |

We see that, even in this case, the fire progressing by 50 meters starting at the short limit has a greater effect.

Case of the height of adjustment greater than 1 mil.

In reality, the burst used in adjustment is often nearer 2 mils than 1 mil. Let us suppose it is 2 mils and examine whether, in this case, there is any advantage in raising the corrector only 1 mil instead of 2 for fire for effect.

Let us take again the above effects.

Bracket 2450-2500.—Probable range of the target, 2425.

| | Probable effect | |
|--|-----------------|--------|
| | 3 mils | 4 mils |
| Fire for effect at 2450 ----- (The difference is slight.) | 0.93 | 0.91 |

Bracket 2400-2500.—Probable range of the target 2400.

† It would be well to emphasize, in passing, the great difference which exists between the probable effects of the 2d and 3d methods in the case of the 200 yards bracket.

| | | Probable effect | |
|----------------|---|-----------------|-------------------------|
| | | 3 mils | 4 mils |
| 2d method..... | { | 2400 | 1.00 0.83 |
| | | 2500 | <u>0.05</u> <u>0.17</u> |
| | | | 1.05 1.00 |
| 3d method..... | { | 2400 | 1.00 0.83 |
| | | 2450 | 0.55 0.79 |
| | | 2500 | <u>0.05</u> <u>0.17</u> |
| | | 1.60 1.79 | |
| 3d method..... | { | 2400 | 1.00 0.83 |
| | | 2450 | <u>0.55</u> <u>0.79</u> |
| | | | 1.55 1.62 |

There is, therefore, no advantage from the point of view of effect, in raising the corrector 1 mil instead of 2 mils.

Bracket 2400-2600.—Probable range of the target 2450.

| | | Probable effect | |
|------------------|---|-----------------|-------------------------|
| | | 3 mils | 4 mils |
| 1st method | { | 2400 | 0.64 0.43 |
| | | 2500 | 0.55 0.79 |
| | | 2600 | <u>0.00</u> <u>0.00</u> |
| | | 1.19 1.22 | |
| 2d method..... | { | 2400 | 0.64 0.43 |
| | | 2450 | 1.00 0.83 |
| | | 2500 | 0.55 0.79 |
| | | 2550 | <u>0.05</u> <u>0.17</u> |
| | | 2.24 2.22 | |
| 3d method..... | { | 2300 | 0.03 0.01 |
| | | 2400 | 0.64 0.43 |
| | | 2500 | 0.55 0.79 |
| | | 2600 | <u>0.00</u> <u>0.00</u> |
| | | 1.22 1.23 | |

Here again we see no advantage in changing the rule of increasing the corrector by 2 for fire for effect.

One would make a great error in deducing from what goes before that it is a matter of indifference whether we adjust with 1 mil or 2 mil heights of burst. In fact, what precedes shows that after adjusting

at 2 mils the probable effects will be about the same whether we raise the corrector 1 mil or 2 mils, that is to 3 mils or 4 mils. But that does not prove, at all, that, if we adjust at 1, instead of at 2 mils, we might not obtain better effect. It only remains to compare the probable effect obtained above in the same kinds of fire, adjusted in the one case with 1 mil and in the other with 2 mils, to establish that the probable effects are always greater in the first case. This involves the condition that the position of the target in the bracket is not the same in each case.

For example, take the fire by successive ranges increasing by 50 on a bracket 2400-2500. After adjustment at 1 mil and an increase of 2 mils in corrector, the probable effect is 2.05. After adjustment at 2 mils and an increase of 2 mils in the corrector the probable effect is not more than 1.79.

Then, if n is the number of hits in the fire for effect, the mean effect of each round will be in the 1st method, $\frac{1.79}{n}$ in the second method.

If the captain, who has adjusted with 2 mil bursts wishes to reach the efficiency 2.05, he must fire a number, X , projectiles, such that:

$$X \frac{1.79}{n} = 2.05 \text{ or } X = n(1.14).$$

When the captain who adjusts with 1 mil bursts has emptied 6 caissons (576 projectiles), the other will have expended, with the same probable results, $576 \times 1.14 = 656$; that is, 80 projectiles more, or about one caisson more. To constantly adjust at 2 mils is then equivalent to a battery commander's losing two of his twelve caissons.

If one adds that the 1 mil is that which gives the greater number of observable rounds, and which, consequently, most accelerates the adjustment, and finally, that a height greater than 1 mil constantly exposes one to the chance of errors in adjustment, we should be convinced of the importance of adjusting with a 1 mil height of burst.

The case of four pieces firing at one time.

In all that goes before we have considered only the fire of one piece. What will the results become when four guns fire together? Take the range 2500 and the height 3 mils, and suppose, for an instant, that the sheaf of each piece has its point of impact at 2500

and its burst at 3 mils. If the pieces have a deflection difference of 10, the front covered on the line of the points of impact, is about 100 meters, and it is about on this line that the neighboring sheafs begin to overlap. Therefore, from the origin of the sheafs to the line of the points of impact, the target with 100 meters of front which we have considered is longer than the front beaten by the lower nappes, and, consequently, the target is beaten by each one of the four lower nappes, as in the case which we have examined at the beginning of this study. This will not be rigorously true near the line of the points of impact, because of the probable errors in direction, but, except very near this line, we may say that the effect produced by the lower nappes of the four sheafs will be four times that produced by a single one of these sheafs.

But, beginning at the line of the points of impact, the width of the terrain beaten by the upper nappes is greater than 100 meters. Therefore, a certain number of balls of the extreme sheafs pass to the right and left of the target. The total number N' of the balls reaching the target will be, therefore, less than $4N$, N being the number of balls of one upper nappe which reach the target.

The surface of the target reached by the balls is: 100×1.6 . If for this surface there are N' balls, then per half square meter, or per panel there will be:

$$n' = \dots$$

The product $(2) (100) (1.6) n'$ gives the number N' of balls, but also the number of panels reached, because in the upper nappe n' is always < 1 .

As there are $(2) (100) (1.6)$ panels, the percentage will be:

$$(100) = 100 n',$$

or, replacing n' by its value, the percentage will be:

$$100 = \dots$$

It is the same expression which we have found for the value of the efficiency at a point of the upper nappe of a single cone; and as $N' < 4N$, the total effect of the four upper nappes will be less than four times the effect of a single upper nappe.

As the effect of the lower nappe of a single cone is greater than that of the upper nappe, it follows, *a fortiori*, in the fire of four pieces, if all the sheafs have their points of impact at 2500 and their bursts at 3 mils—that is if there were no dispersion—the action of the lower nappes would be greater than that of the upper nappes.

But, what will be the effect of the dispersion? The sheafs of neighboring pieces will overlap more or less; but this overlapping will mostly be by the upper nappes. As the overlapping diminishes individual effect of each nappe, the total effect of the upper nappes will, in the fire of a large number of rounds, be diminished more than that of the lower nappes.

Hence, in the fire of a battery, we have then, less than in the fire of a single piece, the right to say that the range of the target is less effective than that range diminished by 25 or 50 meters.

Objection is often made that in the space between the beginning of the sheafs and the line of the points of impact, there will be parts of the target which will not be hit, and that in the parts hit the same man will receive several balls, which is of no use, while in the upper nappe, the target will be beaten from end to end and each man hit will be hit by only one ball.

This is perfectly true; but we have just proven that the effect between the origin of the sheafs and the line of the points of impact will be sensibly four times the effect of one lower nappe. If one lower nappe puts five men out of the fight, the four pieces will put out 20 men. That is at least as good if not better than to have 10 men only out of the fight in a target of which no part is outside of the effect of the sheafs. In the calculations of effect multiple hits have been counted as single hits, and, in spite of this fact, the effect of the lower nappe is found to be greater than that of the upper.

CONCLUSIONS.

The results to which these studies lead us appear to be a little strange. To say, for example, that a range 25 meters over, with a 3 mil burst, gives a probable effect greater than that which is 25 meters short, is going contrary to the current ideas. The ideas we have of effect are, very wrongly, almost always based on the properties of trajectories and of single cones. From the fact that the inferior nappe of the cone for a 3 mil burst at 2500 meters has a depth of only 50 meters, one concludes that ranges 50 meters over

have no effect. We do not consider that this range could very easily give a burst of which the point of impact were even $50 - 20 = 30$ meters beyond the target, and which, by reason of that, would produce an effect even greater than if the round had been fired at the range of the target and had had its point of impact exactly at the target itself.

Of course, the range which is 50 over has equal chances of giving a trajectory $50 + 20$ meters beyond the target. So we have no right to say anything, *a priori*, as to the effect of such a range, and, in order to entertain an idea of the chances of obtaining an effect with that range, we must refer to the constant effect which it always gives in the firing of a large number of rounds—that is, the probable effect.

In the matter of effect we may count only on the probable effect, or on a great number of experiments. But experiment proves, we say, that short bursts only are effective. True, we must have in a fire which is at all effective, some short bursts, since a range 100 meters over gives almost no effect; and it is for that reason that we claim that the longest range should be the long limit of the bracket diminished by 50 meters. However, we must not have ranges too short, and, for instance, commence fire for effect 100 meters short of the short limit of the bracket.

It is not proven by experience that the short ranges alone are effective. The experimental firings, on which are based the efficiency figures given in the note of December 31, 1907, have been nearly always progressive firings which had short and long ranges, and nothing shows that the latter did not contribute to the effect produced. In order that the deductions may be proved, it will be necessary to do some firing for effect confined to range 25 meters short or 25 meters over.

However it may be, this study leads us to the following conclusions:

- 1st. Fire should be adjusted with 1 mil bursts, not only to render the adjustment more rapid and certain, but also to increase the effect of the fire;

- 2d. Against an exposed target, the range of the target is the best; therefore, fire at a single range should, conformably to the regulations, be executed at the short limit of a 50-meter bracket;

- 3d. Progressive fire gains in probable effect if the changes of range are 50 rather than 100 meters;

4th. The first range in progressive fire will generally be the short limit of the bracket. With equal expenditure of projectiles, it is better, from an efficiency point, to fire more on a smaller number of ranges, starting always at the short limit instead of that limit decreased by 100 meters;

5th. The action of the lower nappe of the cone is, in reality, greater than that of the upper nappe; but a long range loses its effect more quickly than a short range, since if it is 100 meters over, it has no effect, while if it is 100 meters short it still has some effect. It is therefore better in practice to avoid the long ranges and, consequently, to make the action of the upper nappe predominate, not with a view to greater effect but as a measure of security;

6th. The longest range for fire for effect, on a visible target which has a broad front, will generally be the long limit of the bracket diminished by 50 meters.

THE BATTLE WORK OF ARTILLERY ACCORDING TO RUSSIAN AND FOREIGN REGULATIONS.

SCOUTING.

Study of the enemy's forces and position previous to battle.

German Regulations.—Scouting should be executed by the senior artillery officer by means of officers' patrols and scouting parties. These have to ascertain every detail of importance for artillery. The reconnaissance of position is to be made with the greatest care. If a cavalry platoon be added for joint action the scouting may give still better results. The regulations state "A reconnaissance made in the required time and pushed through is the fundamental condition of success."

Austrian Regulations do not indicate if the scouting party is to be commanded by an officer, nor how far the party has to search the locality, but it is directed that when scouts are sent out they must continue to serve as connecting links with the advanced battle line of the operating army.

British Army.—English military authorities find that although desirable to have an officer with a scouting party, it is difficult to separate them from their direct duties of leading guns into action; they are already burdened with their own immediate work.

Italian Regulations speak only in general terms of artillery scouts, saying that good scouting will furnish the artillery commander before and during battle, important information concerning the locality, the disposition of neighboring troops, and the development of the fight on the enemy's positions. The instructions direct that scouting parties should be under the command of junior officers.

French Regulations direct that artillery scouting be executed under command of an officer (*owcers orienteur*), but the scouting parties should chiefly study positions, the formation of the ground, hillocks and crests which may be occupied by the enemy, the approaching roads that the enemy may follow, the base of his infantry, etc.

Russian Regulations.—The new Field Artillery Drill Regulations of March 12, 1912, have entirely changed the practice governing artillery reconnaissance. The former Instructions to Artillery

Scouts (1907) directed that scouting be executed by artillery soldiers only when not done by the cavalry or infantry. The new regulations, however, place great stress upon artillery reconnaissance, and make provision for its execution. All batteries are provided with 9 mounted and 3 dismounted scouts. At the commencement of the march each battery sends one officer and all of its mounted scouts not absolutely needed with the battery to report to the battalion commander. One of these three officers, presumably the senior (a captain), takes command of this reconnoitering force (3 officers and from 20 to 27 enlisted men). He is designated Chief of Scouts. He forms one or more advance reconnoitering patrols of 6 or 8 men each, whose duty it is to precede the column and thoroughly observe the country from such high points as afford good view. They are also to study the ground occupied by the enemy and endeavor to search out the positions of his artillery. They must also note favorable positions for their own artillery and the avenues of approach so as to be able to guide batteries into position. Guides and route markers are designated by the Chief of Scouts.

When the battalion commander receives his orders or mission from the chief of artillery, he starts a personal reconnaissance accompanied by his adjutant and such scouts as are not on the "advance reconnaissance" just described. His battery commanders (who normally march with him), accompanied by their signal details, and possibly some few scouts who have been retained with the batteries, follow the battalion commander, remaining under cover close by while the latter conducts his reconnaissance.*

The Chief of Scouts supplies the battalion commander with what information he has obtained, acquaints him with the dispositions already made, and awaits his further orders. He then sends route guides to report to battery commanders. During the action the Chief of Scouts remains under the orders of the battalion commander; the other two reconnaissance officers rejoin their batteries.

Russian military writers and officers who participated in the Manchurian war believe firmly in artillery reconnaissance. General Kolubakin writes that artillery scouting parties commanded by

* Each battery is provided with 8 signalmen, only 2 of whom are mounted. It is assumed that only the mounted signalmen accompany the battery commanders.

officers, and supported by protecting detachments, should seek to learn every movement, halt and disposition of the enemy's artillery, never losing sight of it, frustrating its attempts at ambush or sudden attack, and thereby preparing conditions for successful action by their own artillery. These scouts must maintain connection with the chief commanding officer and take their orientation from the chief of the protecting detachment (vanguard, rearguard or advanced outposts) and of the nearest detachment of scouting cavalry.

General Ivanoff says the conditions of successful battle-work of artillery require very minute scouting of the enemy's forces and position, close observation of its every movement over the whole terrain, while keeping constant connection with the artillery units and other arms.

General Slussarenko says that when a battle is expected and cavalry scouts have been stopped by the enemy, artillery scouting parties (3 or 4 men) commanded by an officer, should be sent out. Such parties should minutely reconnoiter the ground, find places for artillery positions and observation points, and discover means by which such localities can be reached unobserved. Such patrols, because of the weakness and necessity of exposure, should keep out of danger; that is, they remain within the sphere of cavalry or mounted infantry scouts for protection.

Mr. N. Kobylin says that the artillery of the vanguard must have its scouts among the outposts. When they have detected the enemy they must immediately advance and prepare for the action of the main force of artillery. Scouting parties should be led by an officer.

In the compendium of tactical instructions given by the military commanders during the Russo-Japanese war, it is said that during an advance, artillery scouts should follow the line of infantry troops, and at the first possibility establish advanced observation points.

Colonel Novikoff, writing from his own experience during the Russo-Japanese war, holds that artillery officers with scouts should operate with cavalry scouting parties and so ascertain more especially the enemy's artillery positions. Ruder (German) holds that scouts should penetrate as far as possible into the enemy's country, the officer sometimes having to pass the line of the enemy's centers, or outflank the enemy's cavalry in order to see what he wishes to know.

From the opinions and instructions quoted we may draw the following conclusions: Independent artillery scouting is necessary. Scouting should be lead by officers who must neglect no means, however near the enemy may be, for obtaining the intelligence required. In this respect the opinions of General Slussarenko and Mr. N. Kobylin are very sound. An indispensable condition of the success of artillery scouts is that they should remain exclusively at the disposal of the artillery chiefs and not be sent on other missions. It is difficult for artillery to detach a scouting party, and when scouts are gone there are no men to fill their places because every one has his own work to do.

All regulations and authors agree clearly on the subject of scouting for the choice of artillery positions and possible access thereto. The position chosen must correspond to the aim at hand; access thereto must be hidden as much as possible. If this is not possible, the guns will have to be driven thereto at night, or, one by one, at full speed and from various directions. The space in front of the position must be reconnoitered, as well as access to the next position and to the rear. There is no difference in the names of various types of positions, but there is a difference in the designation of hidden and "half-hidden" ones. German and Austrian regulations call "half-hidden" a position where the guns are hidden, but aiming can be direct; and "hidden" where direct aiming is impossible. Russian military writers call "hidden" a position so well concealed that even the point of firing is unseen.

COMMUNICATIONS.

Successful scouting and good means of communication amount to half the entire success. A military writer in 1902 advised the use of telephones, semaphores, flags, etc., for communication in the artillery. Critics retorted that such encumbrances would be impracticable. However, the Russo-Japanese war has led to telephones being generally adopted in all army units.

How are the reports of scouts to reach their commanders? If every scouting party were to send reports by orderlies, time would be lost, the scouts' numbers diminished, and the whole operation enfeebled. One permanent optic or telephone signal station assigned to and following the movements of every artillery battalion, with a secondary movable station established as far as the outpost lines

of the infantry, from the organization suggested by Major Judwin. Specialization of the information obtained is hardly desirable. All information from any and all scouting parties should converge at the movable telephone station which should have many lines of wire, and should be telephoned to the staff of the division, by whom it would be passed to the stations of the chiefs of separate units. By these means all interested will receive the information.

One of our militray authors states that during the maneuvers of 1908, one of the Guards' rifle brigade officers of the battle line was furnished with lithograph plans drawn to scale. All information received was marked on these sheets, and thi shelped to realize not only a picture of the enemy's position, but allowed conjectures as to the point of concealment of the enemy's artillery. Good positions are rarely found and often on a space of two to three squares (a superimposed net divides the plan into squares) one could guess the place of some fold of the ground occupied by a battery, and immediately begin firing at it. This is a useful contrivance and should be generally adopted.

Staffs frequently caused delay in passing on information received, because they try to shape it better. But prompt information is more desirable than good wording, as constant communication of news keeps attention and interest alive. A long dearth of news creates apathy. A system by which intelligence obtained from scouting parties is telephoned in all directions, will do much to assist troop units towards divining the enemy's intentions and movements.

The Germans advocate the wide use of the telephone and visual signaling. Messengers and relay posts for the transmission of messages are discouraged. When the infantry advances to the attack artillery officers proceed to a position from which they can clearly follow the action and from which they inform the artillery of the developments and needs of the infantry. These officers must establish and maintain either telephone or visual communication, according to circumstances.

ADVANCED ACTION.

Most regulations and authors speak little of the work of vanguard artillery.

French regulations recommend: (1) Go choose the best hidden

positions; (2) not to begin action with the full use of the guns, but to keep some force in hand; (3) to take advantage of mobility to change position as soon as firing has given the desired result.

The *German regulations* state the vanguard's task is to secure for the main force the space and time necessary to develop battle order. Firstly, the artillery position selected by the chief has to be protected. The vanguard may have unexpectedly break a strong resistance or to hold out steadily against superior force. In such cases artillery can act with great success.

Should the advance guard have gained decided advantage and is acting on the offensive, artillery will be thrown into the action as fast as it comes up, in order to maintain the advantage already won. If, on the other hand, it has been necessary for the advance guard to act with caution, serious action will be avoided until ample artillery is available for the fight.

A hidden disposition with extended front of the vanguard artillery can be used to deceive the enemy as to the number and distribution of one's own force. It is best to open fire almost simultaneously with the advance of one's own infantry in order to keep the enemy as long as possible in ignorance. However, such tactics will have to be dropped if the vanguard action requires the collaboration of the guns or, if it be necessary to open gun fire, in order to force the enemy to disclose his battle preparations.

The *Austrian regulations* examine separately the action in which vanguard artillery can be used to deceive the enemy as to the number and distribution of one's own force. It is best to open fire almost simultaneously with the advance of one's own infantry in order to keep the enemy as long as possible in ignorance. However, such tactics will have to be dropped if the vanguard action requires the collaboration of the guns or, if it be necessary to open gun fire, in order to force the enemy to disclose his battle preparations.

The Austrian regulations also consider the action of vanguard artillery in a fresh encounter, or in an attack of an already developed battle-scheme. In an encounter the batteries of the vanguard columns must move out promptly on a wide front, take the enemy by surprise, and fire at his marching order, not allowing him to develop his forces unmolested. The artillery must deceive him as to its own intentions, protect the advance of his troops and help the scouting. If, in an encounter fight, the enemy has time to

develop more artillery than oneself, the vanguard artillery must take up concealed positions on a wide front, and thus contrive to struggle against superiority in guns. If the locality be exposed, one should avoid needless firing but await in hidden positions the arrival of the main force of artillery, unless the necessity of helping one's own infantry requires otherwise. In actions against a widely extended front, or when the enemy has already reached the preparatory position, the vanguard artillery should proceed with the greatest caution until the batteries of the main force come nearer and the scouting of the battlefield has been done. The approach movement should be done in the dark.

Italian regulations give only summary instructions. On receiving orders from the vanguard commander to begin action, the chief of artillery moves his batteries into positions previously chosen, and orders them all, or in part, to open fire, according to the targets that are discernible, always chiefly considering the instructions of the commander of his corps.

Our military writer, Kobylin, says that it is impossible for vanguard artillery to occupy well-hidden positions requiring long preparations for firing, because: (1) vanguard artillery must move out hurriedly—a chief part of its success lies in the rapidity of developing fire; (2) every delay in opening fire may deprive one's own infantry of the necessary support, and its advance may be stopped by the fire of the enemy, if they reach the ground and are unlimbered earlier; (3) a delayed advance would have to be executed under the enemy's fire, whilst the infantry, obliged to linger, may lose the advantage of initiative.

Mr. Kobylin attaches such importance to vanguard artillery that he would increase the number of guns generally given to detachments, because in an encounter fight it enables a more intense fire on the enemy's most disadvantageous formations, his marching or deploying formations. In the Russo-Japanese war there was an average of 3.025 guns per battalion on our side and 3.74 on the Japanese side. Mr. Kobylin proposes a minimum of four guns per battalion in vanguard detachment. Other authors make no difference between the actions of vanguard artillery and the artillery of the main force.

From the above we see that advice and instructions are very different; but this will be readily understood, as each authority is

examining some particular case. But they are practically unanimous on one point; they recommend that vanguard artillery should occupy a front as extended as possible, in order to create false inferences as to the distribution of forces and the intentions in view. The ease with which this can be done increases with the number of guns at the disposal of the vanguard, and this gives better results in a sudden attack on an unsuspecting adversary. On the other hand, if one's vanguard is suddenly attacked, a superior number of guns moving out, even into open positions, has the advantage of obliging the enemy to divide his fire. Thus, even under unfavorable circumstances, a large number of guns can hold off the enemy's attack and help one's own infantry to develop battle order, or protect retreat if necessary. In short, strong vanguard artillery can serve the chief purpose of enabling the main force to have time and space for deployment.

POSITIONS.

The best positions are those that are covered, giving the least dead space, and which admit of running the guns quickly forward to an open position. A hidden position requires a certain time for preparation, and at the decisive moment batteries lose time in dragging the guns to an open position. This is very unfavorable for vanguard work. It is often only by a vanguard fight that an exact notion of the enemy's forces can be learned. Vanguard artillery must always be ready to help and protect infantry in attack, in a stubborn defence of occupied position, and in retreat. This is impossible from hidden position with a large dead space in front, for in such case when firing is most necessary, gunners will have to lose time in changing the positions of their guns.

Distances should be such that the guns can commence successful firing at once. Only when a detachment has received special orders, or if the enemy is seen in marching column, or when it is desired to show his battle order, should vanguard artillery occupy a distant position.

The Russian regulations classify positions as open, half-covered and covered. They show a decided preference for the covered position, at the same time emphasizing the fact that the position must be made subservient to the tactical end in view. The regulations state "In every case where the situation permits, it is advisable to utilize the covered positions which guarantee to the artillery freedom

of action and permit it to rest at the disposition of the commander." On the other hand, they also provide "The principal condition which an artillery position must satisfy is to fulfil the tactical end, i. e., to permit the artillery to carry out its mission in the fight."

Where it is not possible to occupy covered positions, half-covered ones will be selected. The open positions will not be occupied except where the situation is very clear, the objective visible, the artillery of the enemy far away or dominated, when a covered position cannot be found, or time is lacking for the necessary preparations which the covered position may entail. If the circumstances demand that fire be opened immediately, the choice of positions will not be retarded by secondary considerations. In this case all positions from which the artillery can fulfil its mission are good. It is much better to occupy a position that is fairly satisfactory than to risk depriving the infantry of the artillery support while endeavoring to find a better and more ideal location for the guns.

BEGINNING AN ENGAGEMENT.

English authors recommend offensive action at once, having in view an enemy in a definite position who has allowed the initiative to be taken by the oncoming foe. They hold that the advancing detachment will try first to find out what forces are in front of it. Energetic pressure along an extended line will enable it to judge the enemy's intentions, the number of his troops and the resistance opposed at different points of the front. They also recommend hidden positions at great distances. The number of batteries should be strictly within necessity, as the development of the battle may require that they be elsewhere for better protection of the infantry, and moving is always difficult during a fight.

The action begins always with an infantry advance and the enemy is forced to disclose, more or less, his dispositions in attempting to impede the approach. Then the artillery will have sufficient opportunity for action. The enemy will be fired at wherever he appears, but this firing will be more a provocation than serious action because its aim will be to force the defending troops to a struggle. Long-range heavy guns will be very useful here. The enemy's intentions will be disclosed by and by, but the artillery must not yet develop complete activity. It is desirable to wait until full information from the scouts is received, therefore batteries must be held in reserve.

General Ivanoff, in his "Instructions for the Use of Field Artillery," shares the opinions of English military authors. He holds also that artillery must open fire with only the number of guns strictly necessary to the aim in view. However, in order to secure fire superiority on one's side, the advancing troops must have a greater number of guns in readiness, keeping them in hidden positions, awaiting action or an advance to the points where they will be needed.

The Austrian regulations recommend that the artillery of attacking troops should, to help its infantry, fire at the enemy's artillery, and contrive to obtain superiority in fire.

The German regulation makes it a general rule that the artillery should—in an advanced action—open fire suddenly from proper hitting ranges, approaching the enemy's positions as near as possible. The advantage of hidden positions should be utilized, but if rapidity of firing and change of targets be necessary, positions will have to be half-hidden, or open. With the development of the battle the hiding of artillery positions becomes less important. As long as the infantry remains at a great distance, the artillery must obtain superiority of fire. Therefore a great number of guns must be put in action.*

While the enemy is arranging the development of his battle formation the attacking troops have time to reconnoiter. They should begin their attack only when the enemy has finished his deployment. Then the principal body of artillery should begin firing. A closer advance to the enemy should be executed during darkness; the guns begin action in order to help the advance of the infantry and assist in learning the strength and dispositions of the enemy. Batteries have to be grouped so as to contribute to the general action against the enemy's front and to fire against it. Artillery fire will be most effective if a simultaneous infantry advance forces the enemy to occupy his fortifications and discloses his position and numbers.

French regulations recommend the endeavor to obtain the superiority of the enemy's artillery in the shortest time possible and with only the strictly necessary number of guns. Counter attacks should be made, that is, an energetic rush on the enemy's lines just at the time when the men there are occupied in pursuit of some other aim.

* The German Regulations, Par. 361, provide: "In order to leave the adversary in uncertainty it is important not to engage the artillery until the infantry is advancing."

If it be necessary to help the action of infantry, the artillery must continue a sustained fight (although the enemy's forces are prevailing) and may retire only when an order to retreat has been received.

Our military authority, Mr. Kobylin, in stating the old principle that superiority in fire will be with the army which the more quickly posts the greater number of batteries, recommends, as soon as the vanguard has begun the fight, to advance the main artillery force to back the vanguard and help the deployment of the main infantry force. Mounted scouts and the cavalry escort of the guns will form the protection. These troops will be needed for an enlarged region of scouting.

In attacking a defended position, all authors recommend first, a thorough artillery reconnaissance, using for this purpose one platoon for each verst* of the defender's front. If these scout guns be far distant from the defender's line they may occupy an open position in order to provoke the defender's fire. Yet, hidden positions must prevail. The range of scouting positions must be confined within the range of one's own guns and the extreme limit of decisive action, reckoning from the defender's rifle positions. In such cases the Japanese often used mountain artillery which has the great advantage of not being as visible as field batteries.

When the scout guns have attracted the enemy's artillery fire, they should stop firing and contrive to change positions. When the positions of the batteries of the enemy have been ascertained, the chief of the detachment should fix positions for his own batteries and call his main artillery to occupy them. In order to concentrate the shrapnel fire of a great number of batteries on any point of the enemy's front, the position chosen should be three or four versts from the defender's batteries.

To approach too closely to the enemy, if the conditions of fighting are not sufficiently ascertained, is risky. The position must allow an extensive and dispersed posting of the guns. Concealed positions best satisfy the conditions, as the dead space in front of a protected hillock crest has no importance during an advance movement because no targets are expected there. Firing must be opened by only the number of guns strictly necessary, the others remaining silent in expectation of action.

* 3500 feet.

Italian regulations enter into no details as to the beginning of a fight, but indicate only that if the enemy's batteries have been disclosed, the attacking artillery will try to crush them. If they remain unseen it is no advantage for the attacking troops to open fire. At least, they should limit their fire to the guns necessary for dealing with such targets as appear, and only when the enemy has shown his full force should the whole artillery be brought into action.

Another Russian military authority says that in attacking a fortified position the fight should begin with an advanced movement of the attacking artillery and the occupation of a position about six versts from the defender's artillery. From this point the enemy's vanguard troops should be fired on, and, if possible, forced to a rapid retreat. This done, the attacking troops should send vanguard detachments to occupy a firing line three versts distant from the enemy's infantry trenches, or nearer, if possible. Then the attacking batteries should advance under cover, using any protection available (crests, folds of ground, etc.), and fire at every weak point of the enemy's position, trying to provoke his fire and thus disclose his force. If there are no hidden roads, the artillery should wait for darkness to advance, and try to secure a position at from four to three versts from the line of infantry trenches. These will be the reconnoitering guns. Later on, more batteries will follow and take the best positions they can from which effective fire can be delivered.

From all these regulations and instructions, the following plan of operations seems to be the most suitable (excluding comparatively rare cases, such as no artillery being with the defense, or if the defense be very inferior in numbers): We assume that the initiative is on the side of the attacker. Detailed reconnoitering is absolutely necessary. Several batteries are sent to fire at the advanced positions of the enemy and provoke his gun fire. This scouting artillery must take positions on an extended front, partly to deceive the enemy as to one's own intentions and partly to be able to encircle the greatest part of the enemy's front. But in order to avoid being crushed by the enemy's batteries and having one's own artillery destroyed in detail, it will be necessary to send the greatest number of batteries possible into the firing line, keeping them in waiting or in observation.

The artillery positions will be very varied. Part of the guns will purposely occupy an open position, so as to provoke the enemy's fire. The batteries which contrive to reach the range of effective fire unobserved will remain hidden. The distance of approach should be three to four versts, but this depends on the conditions of the locality. The batteries should advance under cover of the terrain or darkness. The infantry will begin the fight so that the enemy will be obliged to disclose his position, because he cannot to his disadvantage allow us to occupy the positions nearest without trying to inflict losses upon us.

At last the enemy is forced to show his cards, and we obtain full information of his forces and dispositions. Now begins decisive action, preparing the attack. Our artillery obtains the upper hand in firing and causes great loss to the artillery of the defenders.

PREPARATION FOR ASSAULT.

German regulations require that prior to assaulting, the artillery should bring its fire to the highest pitch and, conjointly with the fire of the infantry and the machine guns, prevent the enemy from appearing from behind his defences until all the artificial obstacles are demolished and the infantry is able to rush to the assault.

French regulations recommend that all the batteries designated for concentrated fire in the attack, including heavy artillery, be placed under one command. With a view to strength and swiftness of movement, they should, without hesitation, occupy open positions when necessary. The chief aim is to get at the enemy's infantry. Part of the artillery accompanies the attacking infantry, following it by echelons and uses all efforts to destroy any resistance to its own infantry. If the latter has occupied the enemy's position this part of the artillery pursues the retreating enemy with its fire. In case of failure the artillery continues its resistance up to complete extinction, and in such circumstances the loss of guns is no dishonor.

Austrian regulations, while confirming the necessity at first of reinforced fire against the enemy's artillery and afterwards against the points of attack, recommend that separate batteries should, if necessary, continue to fire at the artillery, even if it has been weakened. A greater part of the batteries ought, however, to be called

to the support of the attacking infantry, and separate batteries should watch and repulse counter-attacks.

Italian regulations add to the above that the forward movement of the artillery is usually ordered by the chief of the forces. It may, however, also be effected by the initiative of separate commanders of groups and divisions and, in exceptional cases, of separate batteries, even at great loss, but always when it is necessary to offer strong support to the infantry.

First Lieutenant Ivanoff recommends concentrated fire against the most important points of the enemy's position. On changing position it should be sought to occupy the flanks. For a certain number of batteries special positions ought to be found for this purpose.

Mr. Kobylin seeks to fix the right moment for the artillery advance to another position, and does so on the following consideration: throughout almost all the time it has to fire over the heads of its own infantry. The fire will have to be stopped when the infantry has reached 250 sajens (1750 feet) from the point of aim, that is, just at the most dangerous moment, as it enters the range of the enemy's rifle fire. This seems to call for moving to new positions, as for many of the batteries the range would be closed by their own infantry.

Major Judwin, in illustrating some examples of attack, asks who is responsible for ordering an attack? Is it the chief commander or the commander of artillery, or should the assault be undertaken on the initiative of brigade or battery commanders? In view of the enormous variety of conditions in war it may be safely asserted that in this there can be no established rule. Each of the above commanders is responsible according to his knowledge of the conditions permitting him to make a decision. If the chief commander should fix the precise moment for artillery attack and fails to do so he deserves blame. If any of the artillery commanders, brigade or battery leaders, hesitates to take the responsibility to order an attack when he knows he ought to, then he is just as guilty. The assumption of initiative in this case should be encouraged by all means; it is better that one or two batteries be destroyed in the glorious attempt to support the infantry, rather than that artillery commanders should always look back to their superiors, awaiting orders from them, for fear of being blamed for acting on their own accord.

German regulations state that change of position is to be effected on the order of the commander of the forces, or with his approval. But if the conditions of combat require that the artillery should go forward so as to ensure definite success, then the artillery commander and the officers under his orders ought on their own initiative to second spontaneously the aim of the commander in chief; but they must not omit to report at once the decision taken.

French regulations require that the chief commander should give the order for a change of position in the course of combat. They add, however, that if a quick decision has to be taken and the artillery commander would have to await orders for movements called for by tactical requirements, he risks compromising very gravely, his honor and responsibility.

Captain Makhroff writes: "The artillery ought to endeavor always to support the infantry by its fire, to watch attentively all its movements and when necessary, to follow the infantry without waiting for order or instructions, the batteries outpacing each other to move to new positions, from which they may assist the infantry by their fire." This is from his article "The Maneuvers of the First German Army Corps in 1909."

Thus all authorities and regulations concur in their directions for the final combat which are: development of the utmost strength of fire, weakening the enemy's artillery and then, the advance of a smaller part of the artillery so as to continue to answer the enemy's guns, and finally the transfer of the fire of the greater part of the artillery to the place of assault and the surrounding terrain.

All regulations provide that the order to change position shall be given by the commander of the forces, and only in particular instances by the artillery commander. In quite exceptional cases it may be given by subordinate artillery leaders. It seems that more initiative should be given these last mentioned.

The commander of the force, on having acquainted the chief of artillery with the conditions of combat, informs him of the considerations which must guide him in opening fire, of the selection of aim, and of change of position. But the carrying out of the task in hand should be left entirely to the judgment of the artillery commander. He being in the region of his guns, using good field glasses, and knowing what he can demand from his batteries, will undoubtedly act with greater success when free from the necessity

of awaiting orders or asking permission to act on his own accord.

The circumstances of combat are subject to change. The commander of the force may be far from the artillery's observation points, and the communications are often imperfect. For this reason the text of regulations should be worded in the following sense: "The commander of the force gives the artillery a certain task; the ways and means for carrying it out are to be chosen by the commanders of artillery, if the commander of the force does not deem it necessary to order them to await his directions for fixing the moment for opening fire, for changing position, etc."

By wording in this way nothing is essentially modified, and yet it compels both the commander of the force and the artillery commander to reach beforehand a mutual understanding of the possible moments of combat and will make the artillery commander ready at all times to participate actively in all the operations on the field of combat. Then, if properly prepared in time of peace, the opportunities of combat will not be missed, and the artillery forces will be fully used. Certainly, in every past war there have been examples of initiative taken that have proved valuable.

Thus, for instance General Kolubakin writes that during the campaign of 1877 in Asia, the artillery in the Erivan forces was in all combats under the command of General Barsoff, commander of artillery. He directed the firing of the batteries, however far dispersed along the front. Hence, it is entirely a question of confidence in the commander of artillery. Should, however, the commander of the force, for reasons of his own, desire to keep the initiative to himself, he has only to issue an order to that effect.

The end of the combat, the assault, and the pursuit of the enemy are illustrated by all authorities and regulations in more or less the same way.

The attacking forces are accompanied by part of the artillery which from a position as near as possible, fire on those points of the enemy's position where most resistance is encountered. Other batteries attack the reserves if they are prevented from shelling the points of assault by fear of hitting their own infantry.

If the attack proves successful, the artillery crowns its work by endeavoring to cut into the enemy's flank, and pursues the enemy with fire without letting him reform. In such cases any act of audacity is justified.

If the attack has failed the artillery must, without heeding its losses, hold its position to the uttermost until it is ordered to retreat. "The losses of guns in such a case is in the highest degree honorable," say the German regulations.

DEFENCE.

German regulations thus portray the occupying of the defensive position.

The artillery position must be selected with a view to the possibility of concentrating fire on the probable directions of attack so as to reach the attacking infantry before its arrival at close distances, and to repulse any attempts on the flanks by the enemy.

The infantry position is in front of the artillery. A distance of 600 meters is desirable, so that the artillery is secure from the enemy's active rifle fire, and the infantry should not suffer loss during the artillery duel. The disposition of artillery in groups, concentrating the fire of the groups and the possibility of profiting by the locality for flank and cross fire, acquire great importance. Dead spaces in front of certain parts of the line should be covered by the fire of other elements. For this purpose small companies well supplied with ammunition are very useful. A close disposition is often very advantageous. But if it cannot be ascertained in advance that it will be possible to change from a covered to an open position during the combat, enough artillery must be assigned beforehand to cope with the infantry. In most cases field artillery should occupy at first a preparatory position, even when the fighting position is artificially fortified. Gradually as the direction of the enemy's attack is elucidated, preparations for the combat must be developed. The time to occupy a position must be fixed by the general commander, but special circumstances may oblige the senior artillery officer to give this order independently. A fighting position must be occupied after a general elucidation of the direction of the enemy's advance, but yet, if possible, before the enemy has moved his batteries. Usually the first shot is fired by order of the commander of troops; an early opening of fire will disclose one's position. Usually an artillery duel is begun by the attacking guns. As soon as the enemy's infantry commences the attack, the artillery must, to help its own infantry, direct its fire on the attacking infantry and continue to do so until the attack is over. Simultaneously

with the firing of the infantry, it should, as much as possible, engage the enemy's batteries; but the destruction of the hostile infantry is undoubtedly the chief object.

The commander of troops gives the artillery a certain task; the ways and means of carrying it out are to be chosen by the commanders of artillery, if the commander of troops has not ordered them to await his instructions. By wording it in this way nothing is essentially modified, yet the commander of troops and the chief of artillery are compelled to reach mutual understanding.

If the attack is pressed by the enemy's infantry, their riflemen will run over broad, open stretches. These stretches must be covered by fire. If before the beginning of an infantry attack, there is no hope of success in a continued duel against the enemy's artillery, the commander of troops may order his batteries to stop firing for a time. But as soon as the enemy's infantry are drawn into the attack, all the artillery must open fire against it without waiting for special orders. The commander of troops indicates at what places and with what forces the position must be occupied when a retreat is to be covered. Special attention must be given to the flanks. From flank positions separate batteries may facilitate a retreat.

French regulations give very limited and laconic instructions: Time should be utilized for preparing probable positions without occupying them—preparing approaches and ways out. Fire may be opened only by formal order. *Austrian regulations* repeat the German ones.

Italian regulations also concur with the German and add that: When the enemy's artillery fire makes it impossible for one's own batteries to continue, the latter's men should be hidden while the batteries suspend fire for a time and are removed to sheltered positions. In urgent cases this may be done on order of their commander. But they must be ready to reopen fire without losing any favorable chance, especially if the enemy's batteries change their positions.

Major Judwin, Lieutenant Ivanoff and other authorities adopt the above outline of action for the defensive side. The aims to keep in view in disposing batteries are: To make certain of hitting each likely line of the enemy's advance, to be concealed, and to pass easily to an open position.

Austrian, and especially Italian regulations, show more confidence

in their commanders of artillery than the Germans do. The latter require a special order from the commander of troops before the battery may stop firing, however great its losses. Italian regulations recognize that artillery commanders are the best judges of the state of their batteries, and that they may order firing to stop when it would require too much time to discuss the question.

Just as in the matter of conducting an assault, we hold that in the matter of defensive actions more initiative and freedom of action should be given to the artillery commanders.

SOME OBSERVATIONS OF THE INDIAN ARMY.

BY CAPTAIN MORRIS E. LOCKE, 3RD FIELD ARTILLERY.

The following observations were made during a month's trip through northern India in January, 1913. The limited time required most of the journey to be spent in general sight-seeing, but where opportunity was given to see something of the British Army in India it was embraced.

The Indian Army was reorganized by Lord Kitchener when Commander-in-chief in India, with results to be expected from his extraordinary gift of organization. Roughly, it is composed of 238,000 troops, of which about 76,000 are British and about 162,000 are natives, organized into divisions, of which one is stationed in Burmah and the others in India. The Indian divisions are formed into two armies, the Northern and the Southern, of which the greater part belong to the Northern Army, whose bulk is distributed along the Northern frontier where for various reasons self-evident to the military student they are most fittingly posted. Each division is a complete tactical unit, with staff and supply departments, transportation, etc., permanently assigned to it. In this they have simply attained the end in organization towards which our own Army is now working.

As the result of "chits" to British officers, supplied through the kind offices of friends, it was possible to see something of the troops in an informal way. I was without official status, and what I saw was what merely occurred incidental to the particular day's work. My route ran from Calcutta to Peshawar on the northwest frontier (9 miles south of the Khyber Pass), via Benares, Lucknow, Cawnpur, Agra, Delhi, and Lahore. From Peshawar I went to Bombay, stopping two days en route at Rawal Pindi, one of the great garrisons of India. This involved about three thousand miles of travel. The northwestern frontier is the great military region of India. "Whoso holds the passes holds India," and there the great garrisons are found. Here is the most attractive service the country offers to an energetic officer, and it is here that the troops reach their most perfect condition of readiness to take the field. The need for keeping the peace of the border, the various expeditions arising from time to time as a result of that need, and the fact that at all

times "Something greater from the north" might be expected, calls for strenuous soldiering. The tribes of the frontier are largely what is known as Pathans, who are Mohammedans by religion. They are big, fine-looking men physically, brave and warlike in character. For centuries they have led the life of marauders. They are fanatics. The "juramentado" or his counterpart is even better known about Peshawar than in Mindanao, and there, any evening, it is possible to see the reliefs marching on post with their *rifles chained and padlocked to their bodies* in order that the corpse must accompany the coveted rifle if it is filched by some enterprising tribesman. At that place many of the sentry posts are enclosed by barbed wire, and also the guard houses. When it is remembered that this is necessary around a garrison which is composed of an entire division, some idea is gained of how the troops there are living all the time under almost war conditions. The reader of Kipling will find this life all graphically set forth in his stories. That life still exists there today, as absorbing and active as ever. So interesting is it to see that it must form the excuse for this lengthy digression from the main subject.

There was nothing out of the ordinary in a military way to be seen at Calcutta, but it is here one sees the English "Tommy" in great numbers, as smart and spruce as he is everywhere, for that matter. If ever a soldier verifies the statement, "A clean soldier makes a good soldier," he does. Whether on parade, in garrison, or on pass, he is, by instinct and by training, an "orderly buckler." The names of battles embroidered on his regimental colors show what manner of man he is in the field. As these notes are somewhat concerned with him, I have felt moved to speak thus of him.

The attempt was made to see the troops at such places of interest to the general traveler where there were large garrisons. The first of these was Lucknow, where there was a division. Much of the garrison was out on maneuvers. The cool winter season is the period of "field training" in India. At that time the country is dotted with camps, and the work is hard. The men and officers frequently take the field for days without tents. The men's allowance of baggage not on their person at this time is twenty pounds, and an officer's, seventy. I did not verify this statement in detail, but I saw enough of them out in the field under such conditions that I am personally satisfied it is substantially correct. This applies to both native and European troops. All the Field Artillery was too far out

at target practice for me to get out to it, which I regretted. My time there was limited, so, having to make a choice, I chose a British cavalry regiment, the VIIIth (King's Royal Irish) Hussars, and the courteous chief of staff of the division arranged for me to visit their lines.

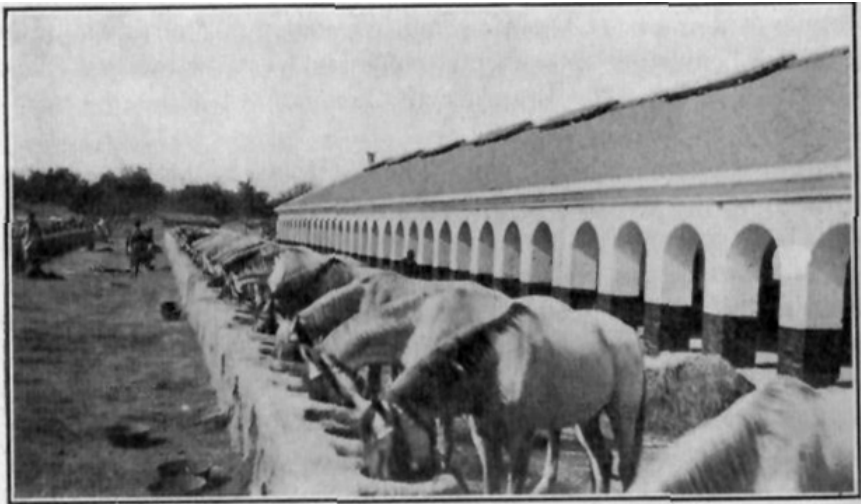
The regiment was preparing to go into the field for maneuvers the following day, and consequently was busy with preparations, but I arrived in time to attend the long midday stables from 11 a. m. to 1 p. m., visiting the stables of each of the four squadrons. At the risk of repeating some well-known information I will add the following: Each cavalry regiment is divided into four squadrons of 114 men (war strength) each, and commanded by a major who has a captain and four subalterns as assistants. Each of the latter commands a troop of about twenty-five men. A fourth major is second in command. Regimental command vests in the lieutenant colonel. The full colonels are usually honorary titles held by members of the nobility or royalty.

There are three stables a day. The one I saw is the longest, and at this one the horses are groomed and get their mid-day meal. "Kits" (horse equipments) are also cleaned at this time.

The horses of this regiment were all Arabs—the only regiment in India entirely so supplied. They were very hard and fit, but had not an ounce of extra flesh as they are hardly up to the work of carrying the loads imposed upon them in service, at times rising as high as seventeen stone (238 pounds). This increases the tendency to stumble possessed by all Arabs. The English are a nation of horsemen. They love horses, and the result is seen in their mounted service. Everywhere I visited in India the stable management, stable police, care of horses, feeding, watering, grooming, etc., were excellent. I have seen nothing in our service to surpass it. It is well to know that this standard of excellence is maintained (contrary to a belief somewhat prevalent) through the knowledge and attention of the officers, not the non-coms, although the latter are, of course, a fine type who can carry out instructions to the letter. At this stable all the officers were present and it was easy to see they knew what was needful for the welfare of their mounts and exacted it from their men. There was a smartness and precision with which everything was done about the stables that would be gratifying to any soldier. The regiment was supplied with mounts barely up to the requirements of weight and effort required of them, but by care

and intelligent methods these mounts were in as serviceable condition as it was possible to put them.

In India where labor is very cheap there are a great many natives employed to do much of the soldiers' scullion and police work, and these natives, I suppose, are paid by the men themselves. I saw natives doing such work about the stables, but the actual grooming and care of equipments was done by the troopers themselves. The grooming was thorough to the last degree. The interior of the stables as to design and arrangement was very similar to ours. They had no saddle rooms.



PICKET LINE VIIIITH (KING'S ROYAL IRISH) HUSSARS.

Horse equipments are hung on the heel posts, as is done in our field artillery, and are kept in perfect condition. I saw nothing in the equipment which possessed greater merit than similar articles of our own. They use a single bit with double reins and heel ropes instead of a picket line. All horses in India wear a leather eye-fringe when not in actual use, for protection from the sun's glare. This might be an advantage in our tropical stations. (See photograph.)

The horses stand outside a great deal, in front of long clay or adobe mangers having two holes, one for water, which is always filled, and the other for grain.

In the field the trooper carries on his horse or person the clothes he wears, his arms (rifle and sword for the hussars), 150 rounds of

ammunition, greatcoat, saddle equipment, mess outfit, and one day's forage. In the "first line transport" (combat train) composed of pack animals, go the extra ammunition, entrenching tools, a supply of drinking water, and similar articles whose need is purely tactical. Everything else, including the rest of the trooper's "service kit," goes into the "second line transport" (regimental train).*

The baggage allowance of the troops under normal conditions is twenty pounds. In this season of the year the thermometer in India falls well below 50 degrees F. in the night and early morning, yet this regiment was taking the field without tentage of any sort and with only the allowance of baggage above supplied. I was told by the chief of staff of the division that he had seen troops do a similar thing up about Peshawar when the thermometer was down to 20 degrees F. I suppose their clothing was heavy woolen stuff, but it argues in any event, troops inured to hard field service.

The forage issued to horses in India is very poor in quality. The daily allowance for horses of this regiment was eight pounds of grain and twenty pounds of hay. Their officers told me that this allowance was too small, and various expedients are used to supplement it. The hay I saw was poor. Only a portion of the grain ration is fed as oats, and these are not of a high grade. The remainder of the grain allowance is a sort of a grain about the size of a buck-shot, called "gram." Whether this is more of a bean or more of a cereal I do not know. It is a product of India and is fed to the horses (after being boiled) in the form of a sort of mash. Barley is at times fed this way. I saw the cooking places, one for each stable, where this stuff was being prepared by coolies. The excellent condition of the horses is all the more noticeable when the indifferent character of the ration is considered. Local conditions permit no better supply. As one officer described it, "It is very difficult to keep the beasts fit on such muck." Their success certainly speaks well for their methods.

While at Lucknow I saw my first Indian polo. It is played all over India by both European and native officers of every arm of the service. Many of the Englishmen there, both civil officials and merchants,

* NOTE.—The British infantry soldier carries on his person the unused part of the day's ration, 2 days in the second line transport, 3 days in the supply column, and 4 days in the big parks in rear: 6 days total in the rolling supply.

play the game. It is a poor station indeed that does not boast one polo field at least. India is a large country, much of it very flat, so there is almost everywhere an abundance of suitable ground. The game is played usually three days a week. A great deal of it is what is called "station polo." That is, prior to the afternoon's play every man who expects to play that day sends in his name and number of ponies to the official charged with arranging the day's play. The latter then arranges two teams to begin the play, and as men drop out they are replaced by others from the list of names so sent in. As high as 15 or 20 periods of this "station polo" may be played in an afternoon, and the number of games going on at a time depends on the size of the station. I have seen as many as three games at once. This "station polo" is not adapted to develop team play, but it gives the necessary exercise and some individual practice. Undoubtedly there is much chance for teams to play together as a whole, for match games and tournaments are frequent affairs.

Some of the individual players at Lucknow were men noteworthy in their way; one of them was the English Number 4 in the Meadowbrook games of 1911. Another was Lt. General Bryan Mahon, the division commander, a man of 51 years, who led the relief column into Kimberly. He was only one of a number of gray-haired elderly soldiers who are playing the game, and playing it well.

Generally speaking, the play was good. The men rode hard and hit well. I regretted that I saw no match games, so there was no chance to see what their team play was like. Later, I saw polo at various places, the last at Cairo, but none of it match games. India is a very cheap country, one of the cheapest in the world for everything except polo ponies. They seem to cost pretty much there what good ones command in Manila or anywhere else. They are of all kinds, Walers, English, native, Arab, etc. Many officers economize in something else in order to play the game. Indeed, in all branches of the service there are many keen sportsmen at all "horse" games, which include polo, steeple chasing, hawking, pig sticking, riding to the hounds, and horse races of all sorts. All these sports flourish. To be known as a good horseman and rider is taken as quite a matter-of-course qualification for English officers in India. The social side of these polo afternoons is very pleasant. At almost all fields there is a small grandstand and rows of wicker chairs along the side lines for spectators. Naturally for Britons, the

afternoon tea table is also in evidence at these affairs. English women turn out for the polo and the social atmosphere of it all is very pleasant.

At Delhi the principal military feature of interest was the 9th Ghurkas. These little infantrymen are quite like Japanese (see Ian Hamilton's "Staff Officers Scrap Book") both in physical and mental make up. They are particularly good soldiers in mountain work. Their best work is done on the offensive. In defense the British officers give greater credit to the Sikh. The Ghurkas march with a short, fast step. They seemed to be maneuvered a great deal in "quarter column" (closed in mass), and their deployments from this formation were very rapid. The scenes



BULLOCKS OF THE 86TH HEAVY BATTERY, R. G. A.

about Delhi connected with the great siege of 1857 are particularly interesting to an artillery officer, as the siege is a striking example of the successful breaching of defenses by artillery prior to taking by storm.

Peshawar and its environs have been alluded to before. The city lies nine miles south of the Khyber pass, which is well worth a visit. At the cantonments (garrison) two miles out of Pshawar an entire division is stationed. While in Peshawar I visited the lines of the 86th Heavy Battery, Major R. P. Molesworth commanding.

The battery is composed of four, 4-inch (25-pounder) guns. Each gun with limber approximates a weight of four tons, drawn by eight-horse

teams. One gun, two limbers, and one caisson are assigned to each section, 92 rounds per gun with the battery. Additional ammunition is carried in four big, two-wheeled carts drawn by bullocks. This constitutes the battery's reserve. Guns and equipment were in excellent condition. The guns are old pattern with no recoil system, soon to be replaced by 60 pounder quick firers. The battery also had an old 40 pounder muzzle-loading rifle, which was used merely to shoot off its archaic ammunition while giving training in the observation of fire.

The cannoneers of the battery are Europeans, the drivers Mohammedans. The horses here were in excellent condition, and good stable management was everywhere apparent. The ration



HORSES OF THE 86TH HEAVY BATTERY, R. G. A.

allowance is three rupees per day per hundred horses. A day's feed for a horse consists of 5 pounds of barley, 5 pounds of grain, 4 pounds of bran, 1 pound of carrots, and some dry treacle. In addition, the horses get a gross allowance of sorts. The bullocks of the ammunition train feed and thrive on the threshing floor chaff. Horses are fed five times a day as follows: 7:30 a. m., 3½ pounds; 10 a. m., 2 pounds; 1 p. m., 3½ pounds; 5 p. m., 2 pounds; 8:30 p. m., 3½ pounds. At 5:00 p. m. and 8:30 p. m. 1 pound of the barley fed is boiled. I did not learn at what time of the day they fed the carrots. Watering is done three or four times daily. The battery commander

personally makes out the above feeding and watering schedule each week. Each horse always has water in reach when on the picket line. I saw but two horses of this battery in poor condition of flesh, and one or two sore backs. I saw no sore shoulders. The heavy batteries use a leather collar; breast straps are used by the field and horse guns. The number of horses for a heavy battery, at war strength, is 96; at peace strength 112; the surplus animals go into the ammunition column in war time. Saddlery and blacksmith shops were well kept. It was certainly a pleasure to see the way all material was cared for.

I saw the battery commander at work in his orderly room for a few minutes, and evidently their service is as much cursed with paper work as we are. Their clerks, however, seem to be efficient.

While at Peshawar I learned that there was big target practice camp at Akora, about one and a half hours distant by train, where there were three field batteries and three mountain batteries encamped. Through the kindness of officers to whom I had cards I was enabled to make the run down there and witness a day's shooting of the mountain artillery who use the "screw guns" of Kipling. I would have preferred to see the shooting of the new rapid-fire field guns, but it was impossible to make arrangements to be present on days when they were shooting, so I took what I could. I got to the camp in time for breakfast at the mess, where I met the general officer commanding the artillery of the division, and other officers. A horse and a mounted native orderly had been provided for me, and everything was done to make things pleasant for me as a visitor. The day's shooting was conducted in pursuance of the following problem, which was not even made known to the divisional artillery commander until just prior to leaving camp.

MOUNTAIN ARTILLERY BRIGADE TACTICAL DAY.

General Idea.

Hostilities have broken out between a southern and northern state.

Special Idea.

TROOPS.
Vanguard.
 26th Mountain
 Bty. *Main Body.*
 No. 1 Mtn. Art.
 Bde.
Flank Guard.
 Flank Guard
 Commander.
 Major Goring
 Jones, Durh. L.
 Infantry.
 Two coys. D. L. I.

Southland, on the morning of the 22nd January has thrown a bridge across the KABUL R at AKORA, and commenced crossing the river. A strong detachment consisting of a brigade of infantry and 3 mountain batteries with one troop of cavalry (imaginary) has been detached to the E. N. E. to watch the right flank.

At 8:45 a. m. the general officer commanding detached force receives the following helio message from a British officer with cavalry patrol at JAHANGIRA:

"Local inhabitants state that a large force of all arms was camped on the morning of the 21st at LAHORE."

At 9:45 a. m. cavalry patrols report that a strong hostile force is advancing from the direction of JALBAI.

At 9:45 a. m. the detached force is in the following position:

Vanguard (infantry imaginary) No. 26 mountain battery by some scrub jungle and rocky ground on the track running from NANDRAK at a true bearing of 355° to TORU.

Main guard (infantry imaginary) No. 1 mountain artillery brigade on the above mentioned track just west of the northern slopes of the round hill about one mile north of NANDRAK.

Flank guard. Two double companies on the track running from NANDRAK towards point 1310. (The track runs up a nullah on the east side of the round hill which lies 1 mile north of NANDRAK, about 1½ miles N. N. E. of NANDRAK.)

At 10:00 a. m. the general officer commanding detached force sends the following message to the artillery:

"To O. C. No. 1 Bde R. F. A., 20th January, 1913, No. 20. Enemy estimated at 2 brigades and 2 batteries is advancing west from the direction of JALBAI. It is the intention of the G. O. C. to hold the line NANDRAK to the high ground with scrub and rocks about 1½ miles northwards.

"No. 1 brigade mountain artillery will come into action in the vicinity of the high ground on north slopes of the round hill north of NANDRAK.

"No. 26 battery will come into action in the vicinity of the above mentioned scrub and rocks."

High hill 1 mile N. of NANDRAK

Copy to O. C. No. 26 bty.

by mounted orderlies at 10:00 a. m.

A. JONES, Major,
B. M., X infy bde.

"21st January, 1913, No. 21 to Major Jones, D. L. I., O. C. right flank guard.

You will retire on to the main position north of the round hill (1 mile north of NANDRAK) AAA. On reaching the main position you will move down to west of the broken ground at the north end of the above mentioned round hill where you will remain in reserve.

High hill 1 mile N. of NANDRAK.

by helio 10:10 a. m.

A. SMITH, Major,
Bde. Major,
X infy bde.

2nd Phase.

The G. O. C. detached force received the following message from divisional headquarters:

"To—General Smith, G. O. C. detached force 21st January, 1913, G. 5. Retire slowly westwards towards the main body AAA. The G. O. C. intends to deliver a counter attack against the enemy's right flank.

H. BROWN, General Staff,

5 miles N. of MISHI BANDA on TORU track.

11-0 a. m.

by helio.

The G. O. C. detached force gives verbal orders to O. C. mountain artillery to cover the retirement, on which officer commanding mountain artillery disposes of his batteries as under—

No. 1 brigade mountain artillery takes up a position in the vicinity of the high hill about 1 mile north of MUGHALKI.

The 26th mountain battery takes up a position about 1 mile west of their present position.

The O. C. infantry reserve is told verbally to retire and take up a position north of MUGHALKI

HILL to cover the retirement (imaginary) of the rest of the infantry.*

NOTE. Abbreviations:

O. C. Officer commanding.

G. O. C. General officer commanding.

Bde Brigade.

R. F. A. Royal Field Artillery.

D. L. I. Durham Light Infantry.

To get to the day's shooting, a march of two and a half miles was necessary. This route lay over the Kabul River, and a pontoon bridge had been thrown across the stream for the purpose, so there was no need to go "Across the ford of Kabul River in the dark" as Kipling writes of it.



MOUNTAIN BATTERY CROSSING PONTOON BRIDGE OVER KABUL RIVER.

Arrived at the rendezvous position, a mountain-battery captain kindly assembled for my inspection one of the "screw guns." They are quite long, as a result of being carried in two parts that are screwed together. They have no recoil system, and are, of course, an obsolescent type of gun. Projectile weights ten pounds, caliber 2.75 inches, weight of charge 7 oz. cordite, M. V. 1250 f. s. The guns are equipped with goniometers of a rather ingenious design, and their quadrants have an angle of *site* attachment. Altogether, the sighting apparatus of their mountain artillery is superior to ours, although the guns themselves are not as good as the Vickers Maxim. I saw a device of one officer for indicating targets to his chiefs of

sections. It consisted of a parallel ruler that could be folded up and carried in the pocket. Each ruler carried two little sights on it, front and rear. The officer points one ruler at the target, and the other person to whom the object is being showed looks along the sights of the other ruler, which then points to the target.

The enlisted men of these batteries were all natives. These are the only batteries in which natives are enlisted. All the field and horse batteries are composed of British soldiers.

The cannoneers carry rifles, and the drivers sabers. There are five English and two native officers to each battery of six guns each. Mules, and all leather equipment were in the pink of condition. All officers witnessing the fire were told off under the guidance of an officer in charge of spectators, and as they were not allowed to



SCREW GUNS.

remain in close proximity to the guns I could not get a close view of the firing batteries. Fire discipline was good. Targets were both fixed and appearing. Firing was both direct and indirect, and for the type of gun used I should say that the shooting was fair. Ranges I estimated as between 1,300 and 3,300 yards at various stages of the problem's development.

Two double companies of infantry were actually present to represent the infantry on the side of the artillery. I did not see that their presence did much good, and many of the infantry officers

thought and said so, too. Far better if all the infantry officers had been enabled to join the observing party and witness the shooting. The allowance was 24 rounds per battery. Observing officers were apparently not required to keep record of observations, although most of them watched the shooting fairly closely. After the shooting there was a "critique" by the division commander who had come down from Peshawar to witness the firing, but this affair was *defendu* to an outsider, so that ended my acquaintance with the day's operations.

The following are a few stray notes upon the British field artillery in India:

Battery organization consists of 6 guns, 12 caissons, 173 men (war strength), 173 horses (field battery), 230 horses (horse battery). One ammunition column for each brigade (battalion)—one section for each battery. Ammunition is carried in vehicles something like our escort wagons. Target allowance for the year is about 80 rounds per gun. Batteries all carry a "director" (B. C. telescope). The mil is not used, but degrees and minutes.

Sheets of corrugated iron with the ends bent up are used as sleds to carry single mounted silhouettes used as moving targets. The arrangement gives a very light target not easily broken and one quickly made.

The battery consists of 1 major (commands battery), 1 captain (replaces casualties and ammunition and assists major), 3 subalterns—each commands a "section" (platoon), 6 sergeants—each commands a "sub-section" (section).

Colonels command brigades (artillery battalions).

At Rawal Pindi I visited the lines of the field and horse batteries. They had just returned from their maneuvers and target practice, and much of the material had been dismounted and was being overhauled by the ordnance mechanics. The gun used by the horse batteries is a 13-pounder, and the load behind the horses is about 3000 pounds. I saw but one field battery harnessed up. They were returning from drill. The British artillery is noted for its smart appearance, and this battery justified the reputation. Except for being covered with dust, men, horses, and material were in excellent condition. The harness is good looking and its russet color is maintained. The men wear a very neat leather legging, and their uniforms fit perfectly. The painting of guns and carriages is very

well done. Their horses are groomed to the limit, and the *tout ensemble* when they are on the march is one to make glad the heart of any artilleryman. The field artillery is admittedly one of the *corps d'élite* of the British Army. Its officers are a keen, hardworking, active lot of men. Among them an officer is regarded as having attained substantial recognition of his efficiency when he gets "his jacket," *i. e.*, an assignment to a horse battery, and this accounts for the statement that the British horse batteries have the cream of the commissioned artillery personnel.

THE BATTLE ACTION OF ARTILLERY IN THE BATTLE OF LIAO-YANG.

Translated from the Russian.

NOTE.—The dates given are the Russian or old style. The new style dates are shown in parentheses.

The results of combined joint action of artillery and infantry on a battle field help best to elucidate questions of artillery tactics, which, as a matter of fact, are wholly based on a study of the ground, the quality of the artillery, and of its work in connection with other branches of the army. Hence, the proposed study touches many questions regarding artillery tactics to which I shall consecrate a special chapter. The article is divided into three parts: In the first part the course of the Liao-yang combat is narrated, so far as the work of the artillery is concerned; the second is devoted to those questions of artillery tactics which are mentioned in the first; the third part gives a general brief résumé of the action of the Russian forces in the Liao-yang battle.

I.

The forces of the sides were as follows:

The Russians had altogether 210 battalions, 157 sotnias and squadrons, and 644 guns. In addition, the Russians had several siege batteries which, however, took no part in the battle. The organization of the army consisted of the I, II, III and IV Siberian and the X and XVII Army Corps. By the time of the Liao-yang battle the V Siberian Corps had arrived from Russia. From among the corps engaged, several independent bodies were improvised. The I, II and III Siberian Corps consisted of the East Siberian Rifle regiments of three battalions each; the other corps consisted of regiments of four battalions. The artillery consisted of brigades, comprising two and three battalions, joined to the infantry divisions, of separate battalions of a 2 battery formation, and of separate horse,

EDITOR'S NOTE. The spelling employed is that of the maps issued with the official history prepared by the Historical Section of the British Committee of Imperial Defense. Such spelling is designated by hyphens. For places which could not be located on these maps the Russian spelling has been retained. These latter are not hyphenated.

mountain and mortar batteries with six, four and eight guns. The artillery was armed mostly with quick-firing guns of model 1900. The brigades and battalions of the IV Siberian corps also had screwguns. There were some field mortars, and the so-called "Argentine" guns in the batteries of the frontier. One mountain horse battery had guns of the model of 1883.

The Japanese forces advancing on Liao-yang were divided into three separate armies, comprising jointly 124 battalions, 43 squadrons, 484 guns. The first army, under General Baron Kuroki, consisted of three divisions of infantry with corresponding cavalry and artillery regiments and pioneer battalions, of four reserve regiments, and of separate batteries and squadrons. Its total forces were: 44 battalions of infantry, three sapper battalions, 10 squadrons, 84 field and 36 mountain guns. Among others it contained a battery formed of six guns that had been captured from the Russians.

The fourth army of General Count Nodzu consisted of two divisions with artillery, pioneer battalions and cavalry, one reserve brigade and two 15 centimeter mortars. The total forces were: 30 infantry battalions, 2 pioneer battalions, 6 squadrons, 72 mountain guns and 2 mortars.

The second army of General Baron Oku consisted of three divisions with sappers, cavalry and artillery, of a separate cavalry brigade with a horse battery (evidently formed during the war), of a separate artillery brigade of three regiments of a two battalion formation (total 108 guns), of one reserve brigade and heavy artillery consisting of mortars, howitzers and long guns (10.5 centimeters), making a total of 68 guns. In all it comprised 41 infantry battalions, 4 pioneer battalions, 27 squadrons, 222 field and 68 heavy guns.

The Japanese divisions supplied with artillery, cavalry and pioneers, represented entirely independent bodies. Such an organization is well adapted to mountain warfare, where our corps proved to be much too heavy. The Japanese regiments engaged consisted of 3 battalions each; and the reserve regiments of two; the cavalry consisted of regiments of 3 and 4 squadrons.

The field artillery was formed into regiments, which were divided into two battalions of a 3 battery formation. Each battery had six guns. The mortars and heavy guns were formed into separate mortar battalions and heavy batteries. The field artillery was equipped with field and mountain guns supplied with goniometers. The

field artillery fired with shrapnel reaching over a range of about 4 versts, the mountain artillery up to $3\frac{1}{2}$ versts.* The field artillery besides fired with "Shimose" shell. On the whole, the field guns of the Japanese occupied, for their ballistic quality, a position between our screw guns and quick firers, their great advantage being that they were light, a particularly important consideration in a mountain warfare. The mountain guns of the Japanese being lighter still, possessed, on the whole, a rather weak ballistic quality, but in exchange, were easily transportable in the mountains.

On comparing the forces on the two sides it becomes evident that at Liao-yang, the forces of the Russians were, by far, superior to those of their adversary. However, General Kuropatkin could not engage all his forces in the battle, but only 183 battalions, 90 sotnias and squadrons, and 592 guns. The rest of his forces, 27 battalions, 67 sotnias and squadrons and 52 guns, divided into separate detachments, being employed for the protection of various points and regions, could not possibly take part in the combat.

In accordance with the estimates of the military-historical commission in its description of the Russo-Japanese war, the Japanese army advancing on Liao-yang was reckoned at from 58,240 to 72,800 bayonets, 2,900 sabers and 402 guns. (The German General Staff counts 484 guns.) Should we estimate the forces of the Russian battalions engaged in the battle at not more than 500 to 600 bayonets (A. Sveitchin estimates them at 640 to 800 bayonets) and the sotnias at 80 to 100 sabers, we find that the Russians had between 91,500 and 109,800 bayonets, 7,200 to 9,000 sabers and 592 guns. On reckoning the infantry force in accordance with annex 2 to Vol. III (part 1 and 2) we find that the Russian army had 131,420 bayonets on August 15 (August 28th); deducting 27 battalions not engaged in the battle, we obtain 115,220 bayonets. After the battle at Lang-tzu-shan and rear guard engagements at An-shan-chan, late at night on August 14 (August 27th), Marshal Oyama, Commander-in-Chief of the Japanese armies, gave the order for a further advance of the Japanese on Liao-yang preparatory to an assault upon that city, with a left flanking movement of the enemy's positions. A big portion of the first army which Marshal Oyama decided to throw over to the right shore of the Tai-tzu was destined for the latter task.

The Marquis of Oyama knew that the Russians were numerically

* 1 verst = 3500 feet.

stronger, in view of which the Japanese plan of attack was very, very risky. In fact, only if numerically stronger may a flanking movement be undertaken with any certainty of success; moreover, the flanking movement connected with the passage of a portion of the army to the right shore of the Tai-tzu could result in the destruction of the Japanese armies in sections, even if they had been stronger than the Russians. But Marshal Oyama had already had time to estimate the chief quality of his adversary—passiveness. Events proved that he was right in his calculations.

In accordance with the orders of the commander-in-chief, the Japanese armies advanced on Liao-yang, having the I Army on the right flank, the IV in the center, and the II Army on the left flank. Reconnaissances in force carried out by the Japanese on the entire front had already on August 16 (August 29th) elucidated to them that the Russians occupied the Liao-yang front positions and that they intended to defend them stubbornly.

By that time the staff of the Manchurian army estimated the Japanese forces at 184 battalions of 153,000 bayonets, 568 guns and 4,500 sabers, yet General Kuropatkin decided to offer resistance to the enemy. Did the commander-in-chief of the Russian army have sufficient grounds for such a decision? Out of general surmises on subsequent actions stated in Vol. III (part 1, page 45) it appears that General Kuropatkin reckoned on taking the offensive only after the arrival in Manchuria of the V Siberian and the I Army Corps. He evidently believed the Japanese forces to be stronger, and he did not consider the Liao-yang positions to be good. It is to be concluded from the above that Liao-yang was to General Kuropatkin a kind of Borodino, and that in effecting methodically his plan of slow retreat for the purpose of gaining time, it is not likely that the commander-in-chief of the Manchurian army would have stubbornly defended Liao-yang. This accounts partly for the indecisive action in this battle.

In accordance with the decision made on August 16 (August 29), Disposition No. 2 was issued for locating our troops for the defence of the front. The troops were about to take up their positions when, later on the same day, they were given a new Disposition No. 2, ordering a change. Owing to this latter order, the reason for which has never been made clear, it so happened that the village of Wu-lun-tai, for us an important place on the right flank, was occupied

by the Japanese before the force of Major General Mistchenko were able to reach it.

At dawn of August 17 (August 30th), the Japanese armies took the general offensive. The I Army directed 1½ divisions to cross the river Tai-tzu. The rest were to attack the Kao-li-tsun positions. The I Army detached a special force under General Umezawa, consisting of 4 battalions, 1 squadron and six mountain guns, which was to secure the right flank and the rear of the army. The IV Army, consisting of two divisions and one reserve brigade, advanced with its right on Tsao-fan-tun and with its left flank on the left of the Ma-yeh-tun positions. The II Army consisting of 3 divisions, one reserve brigade, one field artillery brigade (the army artillery) and the entire heavy artillery, advanced in three columns: the right moved along the Mandarin road, the center one along the railway line and the left one 8 versts to the west of the railway. The left flank of the army was protected by the cavalry brigade of General Akiyama. General Oku directed his army field artillery (the 1st Artillery Brigade) to follow the center column, having kept it at his disposal; he likewise directed there the entire heavy artillery. One regiment out of the 1st Artillery Brigade was employed by General Oku to strengthen the 3rd Division.

The advancing Japanese armies were encountered by the Russian troops who had occupied the Liao-yang front positions, in accordance with the Disposition No. 2, in the following way: The Ma-yeh-tun position to be occupied by the I Siberian Corps of Lieutenant General Stackelberg, consisting of 24 battalions, 8 quick-firers, 64 guns, 10 squadrons and sotnias, 6 horse guns and one sapper battalion. The Tsao-fan-tun position and the valley of Ta-ssu were to be occupied by the III Siberian Corps of Lieutenant General Ivanov, consisting of 24 battalions, 64 guns, 6 sotnias, 8 horse mountain guns and one sapper battalion. The Kao-li-tsun position was to be taken up by the X Army Corps of Lieutenant General Slutcheffsky, consisting of 32 battalions, 112 guns, 8 mountain guns, 12 mortars, 6 sotnias, and one sapper battalion.

The positions on the right shore of the river Tai-tzu were intended for the XVII Army Corps, General Baron Bilderling, consisting of 24 battalions, 64 guns, 6 sotnias, 8 horse mountain guns and one sapper battalion. The general reserve was to be disposed in four groups: the 1st under the command of Lieutenant General

Zarubaiev, consisting of 28 battalions, 32 guns, 6 sotnias and one sapper battalion, was to take up its position near the North Liao-yang wall; the 2nd, under the orders of Lieutenant General Zassoulitch, consisting of 28 battalions, 8 quick-firers, 32 guns, 2 sotnias and one sapper battalion, 3 versts to the south of Liao-yang; the 3rd group under the general command of Lieutenant General Dembovsky, consisting of 19½ battalions, 48 guns, 6 sotnias and a sapper battalion was to be divided into two parts of which the south one was to be placed near the town of Liao-yang on the right bank of the river Tai-tzu, and the north one near the village Shakhe, about half way between Liao-yang and Mukden; the 4th group consisted of 19 sotnias, and 6 horse guns under General Samsonoff, which was to be disposed near Fort No. 5. The guarding of the flanks was entrusted on the left to the XVII Army Corps, on the right to two forces: 1st that of General Mischenko, consisting of 21 sotnias and 12 horse guns, which was to occupy the village Wu-lun-tai, and 2d that of Major-General Grekov, consisting of 1½ battalions, 6 guns, 12 sotnias and 6 horse guns which was to take up positions along the lines of the Fort No. 8, Siaobeikhe and Davan. Moreover, the extreme right flank was to be guarded by the forces of General Kossakovski, of 6½ battalions, 9 sotnias, 16 guns and the left flank by three separate forces, consisting in total of 6 battalions, 10 guns, and 12 sotnias. In accordance with the Disposition No. 2, General Kuropatkin also had his army heavy artillery under General Holodoffsky, which, however, was not engaged in the battle of Liao-yang.

Actually, the Russian troops were disposed as follows: the I Siberian Corps consisting of 8½ batteries, 48 guns, 8 quick-firers, with 16 battalions, 14 guns in the reserve occupied a front over 8 versts. The Japanese developed against the I Siberian Corps 53 battalions, 20 squadrons, 258 field and 48 heavy guns, yet, in spite of these heavy conditions, the I Siberian Corps successfully repulsed the attacks of the skillful, courageous, and numerically stronger enemy.

The III Siberian Army Corps which took up the Tsao-fan-tun positions extending over 4 versts, consisted of 15 battalions, 48 guns and 13 battalions with 4 mountain guns in the reserve. The Ta-ssu section (4 versts) was occupied by the artillery group of Lieutenant Colonel Kristafovitch consisting of 4 batteries (32 guns) under cover of 6 battalions and 6 sotnias. This separate section was disposed behind the entire III Siberian Corps. both the active forces and the reserves.

The X Army Corps occupied the Tsao-fan-tun positions extending over 7 versts, having 17 battalions, 88 field guns and 12 field mortars in the active forces, and 15 battalions with 24 guns in the reserve. Here is found the separate group of batteries of Colonel Sukhinsky (46 guns) disposed behind the active right section of the corps and forming his improvised corps artillery.

Against these forces, viz.: the III Siberian and the X Army Corps, the Japanese developed 91 battalions, 29 squadrons and 402 guns.

The general reserve of the army was divided into 5 groups: 1st, the II Siberian Corps of Lieutenant-General Zassoulitch, consisting of 13 battalions, 8 quick-firers, 32 guns, was located 3 versts to the south of Liao-yang; 2d—the IV Siberian Corps of Lieutenant-General Zarubaiev (25 battalions, 6 sotnias, 32 guns) was 2 versts to the north-west of Liao-yang; 3d—the Siberian Cossack Division of Major-General Samsonov (19 sotnias, 6 horse-guns)—near Fort No. 5; 4th—the detachment of Major-General Orlov, consisting of 8 battalions, 16 guns, 2 sotnias—near the station Shakhe (about two marches to the north); 5th—the detachment of Major-General Eek, consisting of 7½ battalions, 24 guns, 2 sotnias was collected on the right shore of the river Tai-tzu, to the east of Liao-yang.

The service of protection of the nearest flanks lay with the detachment of Major-General Mischenko and with the XVII Army Corps which was located near the village of Khvankufen. The active forces consisting of 12 battalions, 44 guns, 12 mortars and 2 squadrons occupied the heights 151 and 131. The total reserve of 12 battalions, 104 guns and 5 sotnias was to the north of height 131.

For the service of protection of the farthest flanks and of the rear, General Kuropatkin formed 8 separate detachments, making a total of 18½ battalions, 50½ sotnias and 52 guns.

On comparison of the orders of the Japanese and the Russian one is struck by the surprising simplicity of the Japanese orders and with the extraordinary complexity of the Russian dispositions. The Japanese commander-in-chief kept in communication on the battle field with only 3 commanders of separate armies, whereas the chief commander of the Russian forces kept in direct communication with 16 units, i. e., with 3 corps in the active lines, 5 groups of reserves, 2 units protecting the nearest flanks and 6 the farthest flanks. Moreover, there were the garrison in Liao-yang, a separate reconnoitering sotnia of General Kuropatkin, and other units in the rear which

bring the number to 20 units, all in direct communication with the commander-in-chief.

The Japanese and Russian commanders in chief have an entirely different way of using the reserves. The part of the active reserve in the Japanese army was effected by 1½ divisions of Kuroki's army, to whom was assigned the task of making the flanking movement. Subsequently, when the outflanking operation had been sufficiently developed, the Guards represented a kind of reserve. In general, the Japanese introduced all their troops into action from the start. In the case of General Oku's army only 6 battalions out of 45 formed the reserve. Marshal Kuroki at first had 18 battalions and later only 12 in the reserve. As to their artillery, the Japanese introduced it almost wholly from the outset of the battle; on August 18th (August 31st), 408 guns were engaged, 84% of the entire number available. On the Russian side, however, in this battle only 235 guns were engaged out of 673 in the Manchurian army, or 35%. About the same proportion was observed in the infantry. No wonder then that the Japanese always happened to be stronger than the Russians.

The accumulation of a series of general and particular reserves, which was observed throughout the entire campaign, was the irreparable mistake of the Russians. If it is undesirable to carry on a battle with only one-third of the infantry, keeping two-thirds in the reserve, it is absolutely unpardonable to act so with artillery. General Langlois justly believes that modern artillery placed in concealed position may always be comparatively easily withdrawn from combat. Owing to this, the commander may always form and reform artillery masses on various sections of the battle field. It is therefore quite useless to keep great forces of artillery in the reserve, and, on the contrary, it is most advantageous to deploy from the start, the greatest number of guns. It is true that in this way the artillery of the I Siberian Corps would have had to be reinforced by the entire artillery, say of the IV and II Siberian Corps. This would make a kind of improvisation, but then it would have been impossible to completely avoid something of the kind. Anyhow, to have created a temporary artillery force would have been better than to have let 82 guns of the I Siberian Corps be swallowed up by the 306 guns of the enemy, as in the case of the battle of August 18th (August 31). We must add that we had artillery not only in the general, but also in the particular reserve, which is absolutely contrary to the elementary requirements of tactics. Hence, in the

Liao-yang battle we have, from the outset, shown our complete ignorance of using our artillery, which was excellent both in number and in quality.

On comparing, now, the general disposition of the Russian and the Japanese reserves, we find that the Japanese had in front of their flanks two recesses—in front of the left flank one division, and in front of the right one and one-half, subsequently, two divisions. Thus, although numerically one and one-half times weaker than the Russians, they sought to envelop both of their opponents' flanks. Owing to this course the center of the Japanese dispositions was extremely weak, and only the complete passivity of the Russian commanders permitted the Japanese to emerge with honor from a very risky position. Lieutenant-Colonel A. Svietchin in his history of the Russo-Japanese war considers that the Japanese left recess had a defensive character. This, however, does not prevent him from maintaining, on the whole, the same view of the riskiness of the Japanese dispositions. On the whole, although the Japanese battle order did not conform entirely with the numerical proportion of the belligerents, it had, in return, an active character: it corresponded entirely with the general spirit of their action in this combat.

The commander of the Russian forces disposed the chief mass of his reserve near Liao-yang, that is, in the center. As A. Svietchin justly believes, such a disposition helped little with the proposed effective action on the right shore of the river Tai-tzu. For such action it would have been more correct to have placed the chief mass of reserve echeloned in an angle behind the left flank of the XVII Army Corps. The Japanese most economically used their forces for the protection of the flanks and the rear, whereas we have been surprisingly wasteful in this respect.

On the whole it appears that although the Japanese battle order was not compelled to reckon with a numerically stronger enemy, it was, by far, too much spread out, and exposed the army to the risk of being defeated by sections; yet it responded to the spirit of effective action, was very simple and easy for command, and permitted the development from the start of powerful action on the part of most of the troops, particularly the artillery.

The Russian battle order did not respond to the main idea of action. It was difficult for command (16 units) and prevented the infantry, and particularly the artillery, from developing energetic

action. Thus it was not adequate to the elementary requirements of tactics—convenience of command and action.

On August 17th (August 30th) the Japanese decided before all else to take the Tsao-fan-tun position. This task seemed to be the easier for them and, moreover, the Russians, upon being driven from these positions, would have had to retire on the entire front. In view of this procedure the combat first broke out in the III Siberian Corps. Here, on the right battle section of General Daniloff, we had advanced positions of the 23rd East Siberian regiment which were attacked by numerically stronger forces. The riflemen, having sustained great losses, were able to retreat to the positions of their regiment only with a part of their greatly disorganized companies. When they reached the main position of the regiment, over 2 versts distance, only 5½ companies remained.

It is with reason that many tacticians refuse downright to occupy advanced positions. Although such a decision, as every rule, can not be taken as unalterable, still, as the experience of war has proved, the advance positions may be occupied only when the locality is particularly favorable to that effect. Great range of sight and a *safe* concealed road for retreat are necessary.

The action was saved by two batteries of the 6th East Siberian Artillery Brigade standing just behind the crest occupied by the 23rd Regiment and coming to the rescue. These were entirely "infantry" batteries used for protection, and closely connected with their regiment. Lieutenant-Colonel Pokotillo, commander of the III Battery, having quickly estimated the danger of the position and on seeing that it was impossible to rout the attacking enemy from behind the crest, immediately started to run his battery by hand, on to the crest. The enemy's infantry, however, was already within 400 paces distance. In several minutes the battery lost half of the actual staff, and was obliged to return to its post behind the crest without having fired a single shot. Then, the chief of the division, General Daniloff, ordered that at least one gun should be brought forward. Three guns were run up, but the losses of the battery were so great (the commander was killed) that only one gun fired. This gun was personally commanded by Hnd Captain Kostroff, and after he had been twice wounded, by an artilleryman, Petroff. The attack was finally repulsed. This instance gave proof of the value of quick-firing artillery. One gun stopped the attack.

Lieutenant Shaliapin formed a squad from the remaining men,

who maintained the fire against the enemy's infantry, thus carrying out the work of an infantry battery for the defence. The 4th battery of the 6th East Siberian Brigade was likewise brought up on the crest at the moment of the attack and actively assisted the riflemen in their work. When the danger was over, the guns were replaced in the trenches.

The Japanese attack against this front was terrible, partly owing to the extremely stubborn defence of our riflemen in the front trenches and, partly, to the assistance of the Japanese artillery. Four entire Japanese batteries (24 guns) disposed themselves at a distance of but 2 versts, 200 sajenes* from our infantry trenches, and under the cover of their fire the infantry advanced safely. Twelve of the enemy's guns were placed at 4 versts from our positions.

The chief of the 6th East Siberian division, on seeing that the position was dangerous, energetically supported the active work of the defence by utilizing the reserves. Thanks to this, all the attacks were successfully repulsed. The following detail is noteworthy: A half battery of the group of Lieutenant-Colonel Kristafovitch assisted among others in repulsing the attacks directed against the 23rd and 24th East Siberian Rifle Regiments. It withdrew its guns from the trenches, and hit the enemy with flanking fire. Thus the "counter-battery" which the artillery groups of Kristafovitch was meant to be, excellently performed the task of the foot artillery. But the special work of a counter-battery was exercised very unsuccessfully on that day, for the reason that, as it was posted too far back (900 sajenes beyond the line of the nearest trenches), its fire could not reach the enemy's artillery. Meanwhile, the Japanese put 36 guns against the 10 guns of General Daniloff which were all the time engaged in repulsing the attacks of the infantry. Two batteries of the left section of the X Army Corps then became engaged in an "artillery duel" with this Japanese artillery. On the Ta-ssu section our counter-battery repulsed the infantry's attack with shrapnel fire. As a result we see that the counter-battery fired at the infantry, and the infantry batteries against the artillery.

It was the 1st Japanese Guards Brigade that attacked the left section of the III Siberian Corps, occupied by the 3rd East Siberian Rifle Division of Major General Kashtalinsky. By this time the artillery duel between the four batteries of the III Siberian and the X Army Corps and the two battalions of the Japanese artillery (24

* 1 sajene = 7 feet.

guns) acting against General Daniloff ceased. The enemy's batteries were silenced. The commander of the 1st Guards' Brigade decided not to take the offensive so long as he had reached the upper hand in fire over the enemy's artillery. In this, however, he did not succeed. As a result, his troops, after having advanced 1,800 paces towards our trenches, refraining from attacking. Even then, some parts sustained serious losses.

In such cases it is better that the infantry should advance at all costs. Then the artillery of the defense will, *nolens volens*, be obliged to turn its fire on the advancing infantry, and, in this way the artillery of the attacking side is left free to carry out its chief task, that of assisting in the attack. It is often impossible, even with greatly superior forces, to obtain the upper hand in fire.

On the extreme left flank of the III Siberian Corps the position was likewise extremely serious. Here, one of the enemy's batteries, which had not been correctly located by the Russians, had literally demolished the trenches of the Eleventh East Siberian regiment. The Japanese were attacking this section with two regiments. This would have been disastrous had it not been for a newly arrived battery (probably from the reserves) which had rapidly determined the position of the hostile battery so actively assisting its infantry. The fire of the latter was silenced, the attack weakened at once, and was repulsed. This incident is a convincing illustration of the importance of artillery, both for defensive and offensive action.

The entire army of Oku, with the exception of 1½ divisions, was deployed before the front of the 1st Siberian Corps. from early in the morning. During the forenoon 48 guns of this corps became sharply engaged with 150 Japanese guns. Considering that the Russian batteries were called upon not only to fight against the enemy's artillery, but also to assist their infantry in repulsing the attack, it becomes clear that the conditions of combat were far too unequal. Particularly heavy losses were inflicted upon 3 of our batteries of the 1st East Siberian Rifle Artillery Brigade on the right flank. It was the Japanese horse battery of General Akiyama that inflicted most damage. General Stackelberg ordered out the 2nd Trans-Baikal Cossack brigade against it, and one of the batteries of the 1st East Siberian Artillery Brigade turned its front by 90°. All these measures proved of no effect, and our guns did not succeed in locating the Japanese battery. The result was that by noon only one officer remained in the ranks of the 1st East Siberian Artillery Brigade,

and one of the batteries was compelled to stop its fire entirely. This case shows the great importance of an artillery maneuver having for its object the occupation of advantageous positions—in the present case a flank one. On the other hand, it points to the necessity of teaching the artillery to change the front rapidly, and to adapt the construction of trenches to the possibility of firing in all directions.

The Japanese deployed 18 battalions against the left battle section of the I Siberian Corps (Gen. Kondratovitch) occupied by 9 Russian battalions. Here, as in the case of the III Siberian Corps, the infantry batteries effectively assisted the riflemen in the repulse of attacks.

The position of the I Siberian Corps was so grave that the commander was compelled to ask for reinforcement. Gen. Kuropatkin would not consent for a long while to send them, fearing chiefly for the fate of the III Siberian Corps, but he finally sent one regiment and 1½ batteries from the reserve. With the first section of the corps (Maj. General Gerngross) all was comparatively quiet throughout the morning. But here, also, threatening events were coming on, seeing that 2 divisions of General Oku had successfully outflanked the corps on its right and were preparing to attack. Owing to a change in Disposition No. 2 which took place on August 16 (August 29), as before mentioned, there were almost no posts of protection on the right flank of the 1st Siberian Corps between 5 a. m. and 8 a. m. on August 17th (August 30). In view of this General Akiyama's cavalry occupied Wu-lun-tai and the adjoining villages unopposed and left the Japanese infantry to maneuver at their leisure. It was only at 8 a. m. that Gen. Mischenko's cavalry appeared in front of the Japanese flank, but by that time the Japanese had already succeeded in outflanking our Ma-yeh-tun positions. Thus, by noon the Japanese were also ready here and started their attacks, which were repulsed, however, by the infantry and quick-fire guns.

Gen. Kuropatkin, on receiving Gen. Stackelberg's report of the movement of his right flank, for some reason believed that only a far distant flanking movement was possible in this case, whereby it would not be the 1st Siberian Corps, but Gen. Mischenko's forces, that would be attacked. He did, nevertheless, send 2 battalions as reinforcement to Gen. Stackelberg, but on the condition that this reserve should only be employed after the entire reserve of the corps had been used up. The position of the 1st Siberian Corps throughout

the day was so grave that the commander was forced to draw upon all his reserves. Meanwhile, Gen. Kuropatkin had gradually reinforced his right flank. By 5 p. m. Gen. Alexeiev reached the village Hsiu-chia-tun with 4 batteries of quick-firers and 16 guns. A detachment of 4 batteries of quick-firers and 18 guns was also drawn from the general reserve and sent to Yu-chuang-miao. Thus, Gen. Alexeiev's forces were increased by 12 additional guns; Gen. Mischenko's forces were likewise increased. Altogether on August 17 (30) Gen. Kuropatkin drew 15½ battalions, 24 guns and 8 quick-firers from his reserves, but 6 batteries and 12 guns were sent back to the reserve on the night of August 18 (31).

Speaking of all these reinforcements, it may be said that it is a pity that Gen. Kuropatkin sent them in such small numbers and that he did not place a strong force of artillery at Gen. Stakelberg's disposal, for instance, the entire artillery of the IV Siberian Corps.

At dawn August 17 (August 30), the battle began on the front of the X Army Corps (Major-General Gershelmann). Here 8 Japanese battalions were advancing under cover of the fire of 4 batteries. Seven Russian batteries (56 guns against 24) became engaged against the Japanese artillery. As soon as the grave position of the III Siberian Corps became evident, Gen. Kuropatkin ordered that a regiment from the reserves of the X Army Corps be sent to Tsao-fan-tun. Eventually, the action on the right developed by degrees; 14 battalions became concentrated there. Here, too, a mortar battery was drawn from the village of Ching-chua-chin, where a mortar battalion was located. It can only be regretted that the other two batteries remained in the rear, and that the battery after advancing, was, towards night, withdrawn. Finally, towards five in the afternoon, the Japanese were completely repulsed; but the commander of the corps had used up all his reserves (only 2 battalions remained). "In view of this," as is said in the History of the War (vol. 3, p. 3, page 79), "the commander of the corps asked the commander of the army to strengthen the corps by an infantry brigade, which was refused." The battle operations of the X Corps lead to the following conclusions: 1st, The artillery should not be kept in reserve, particularly when the flanks of the force occupying a position are completely secure, as in the case of the X Corps; it should be expected that once the mortar battalion was brought to the point of battle it should have played a far more effective part. Probably the 14 battalions would not then have been used up on the

right section. 2d. The Siberian Riflemen fought much more stubbornly than the X Army Corps.

As a result of the battles on August 17 (August 30), the Japanese were repulsed on the entire front of their positions. Throughout the day they had 390 guns, 78 battalions and 26 squadrons, or 62% of artillery, 63% of infantry and over 50% of cavalry engaged. On the Russian side there were directly engaged in battle: 78 battalions, 249 guns, 42 sotnias and squadrons, or 37½% of infantry, 38.6% of artillery, and 26.7% of cavalry. Hence, on that day, the pressure exercised by the Japanese was almost double that of the Russians.

At first it might seem that the Russians were more economical, more calculating, that they would make use of their fresh forces and take the offensive the next day. This, however, was not the case. Although in the course of August 17th (August 30), the Russian army used only about one-third of its forces, yet, Gen. Kuropatkin drew from the reserve 22 battalions and 56 guns. On the other hand, the Japanese commander-in-chief had not used a single soldier out of his active reserve (1½ divisions).

Here, as in all the other battles, we see that the Japanese deal most cleverly with their reserve, to which they allot a small number. Marshal Oyama had only about 20% of the entire force, but he used them for a definite purpose at the decisive moment. The Russians accumulate an enormous reserve out of which, from the beginning of the battle, they draw troops in small numbers which melt away unobserved, so that at the necessary moment the commander remains empty-handed. These are the characteristic features of the two opposing forces, and are to be noticed running like a red thread through the entire campaign.

Desiring the greatest possible force in order to start the offensive, Gen. Kuropatkin on the night of August 18 (August 31), drew from Liao-yang all the forces that he had allotted to the I and III Siberian Corps. Only 4 battalions and 12 guns were left at the disposal of Gen. Stackelberg. At the same time the extreme northern body, at the Shakhe station, was ordered on August 18 (August 31), to move over to the Yentai station. This order must meet with approval.

Unfortunately, Gen. Kuropatkin did not start any decisively offensive action, but gave the order to continue the defense of the front positions and "That the commander of the corps would take

the offensive in those cases when any of them would deem it necessary and useful." (Vol. III, p. 3, page 82.)

In order to give a complete picture of all that followed, we must note that in the course of August 17 (August 30) our troops, who were guarding the left flank of the army, had disclosed the presence of only a very inconsiderable part of the enemy on the right shore of the Tai-tzu.

What did the battle of August 17 (August 30) reveal to the Russian commander-in-chief? 1st, The chief blow on this day was directed against the I Siberian Corps; 2d, very decisive action was developing on the front of the III Siberian Corps; 3d, less serious attacks were conducted against the right flank of the X Corps; and 4th, absolutely nothing serious was going on on the right shore of the Tai-tzu. What conclusions could be drawn from the study of this battle? 1st, The Japanese conducted their chief attack through their left flank, while on the rest of their front there was only an energetic demonstration; 2d, the Japanese were carrying out a serious demonstration against our right flank and front, with the object of drawing our reserves there and eventually dealing a blow at the left flank, or even outflanking it along the right shore of the Tai-tzu.

These two possible surmises lead to the following conclusions: 1st, in the decisive action the chief attack should have been conducted by the right flank of the army, the X Corps, which should have been strengthened for the purpose of rendering it more adequate for the offensive; and 2d, the chief blow should have been inflicted through the left flank after having strengthened the weak positions of the I Siberian Corps, which already had been outflanked. Neither of these decisions would have presented danger in the event of the enemy effecting a distant flanking movement over the right shore of the Tai-tzu, for in such an event he was taking the dangerous risk of being defeated in detail. Moreover, there were solid protecting forces to act against the troops making the flank movement, for instance the XVII Army Corps and the detachments of Gen. Orloff and Gen. Eek. It is noteworthy that at that time, owing to the reavy rains, the river Tai-tzu could have been crossed only at very few places and would therefore have served as a serious obstacle, separating the forces who must have operated on different shores.

And yet Gen. Kuropatkin did not adopt any of these decisions,

preferring to wait until the Japanese line of action had taken a more definite aspect.

The fight of the 17th of August (August 30th) proved to be a very serious test for the Japanese armies, of firmness and cool blood. In fact, this battle showed clearly that the Russians did not intend leaving their advanced positions. Was it advisable under such conditions to undertake a very risky outflanking movement of the Russian left flank along the right bank of the Tai-tzu? Certainly not, but from the "Chronicle of the Russo-Japanese War" we learn that Keneral Kuroki risked it because, during the whole day of the 17th August (August 30), he was receiving communications on the expected retreat of the Russian army from Liao-yang. It is true that this information was, in fact, dubious, but it prompted him to take the risk and helped the success of his operations. How often blind luck helps the execution of the most daring plans!

Thus, in the night of the 18th of August (August 31*), the 12th Japanese division (from Kuroki's army) crossed the Tai-tzu near the village Lien-tao-wan, while other troops continued their persistent attacks on the positions of Siberian Corps, but were constantly repulsed with great losses. Then, under cover of the darkness and of the diversion caused by the attacks, the Japanese reinforced their artillery against the Ma-yeh-tun positions, concentrating there 234 field and mountain guns and 72 heavy guns. On the Russian side there were on this spot only 82 guns, including General Mischenko's artillery.

The Japanese posted their artillery in the following manner: The 1st Field Artillery brigade of Gen. Oku's army was employed by regiments; one artillery regiment reinforced the artillery of the 3rd Division; another, the 6th, went to increase Gen. Nodzu's army (10th Division). The heavy artillery was disposed in a compact mass. There is no data to judge how the fire control was organized, but it must be mentioned that from the development of the battle of August 18th (August 31), it appears that a considerable portion of the groups of separate batteries did not act conjointly with the infantry.

Gen. Oku's heavy and field artillery were located at a distance of 3½ kilometers from our batteries; Gen. Akiyama's horse artillery was posted at a distance of 3 kilometers from Gen. Mischenko's

* EDITOR'S NOTE.—The crossing by the 12th Division at midnight, August 30.

batteries; Gen. Nodzu's (4th Army) artillery profited by more convenient terrain and generally decreased the distance to 3 kilometers; the Japanese Guard Artillery opposite to our X Army Corps—when their guns were predominant in number—took positions at a distance of more than 4 kilometers.

At daybreak the guns began their deadly action and soon the whole front of the I and III Siberian Corps were firing incessantly; 127 guns were here on our side—102 on the Japanese. The fight was fiercest on the positions of the I Siberian Corps. Here 52 Japanese battalions were attacking our 28. Threatened on three fronts, the 1st Siberian Corps had a very difficult time. Its 78 guns had to struggle against 300. Certainly our artillery could not even attempt to begin an artillery duel with the Japanese batteries. To help our infantry repel the furious attacks of the enemy on our positions was all our gunners could do, and they did it with great success. The valorous platoon of Lieutenant Pustchin did wonders on this occasion. At several points along the line where the trenches were already partly in Japanese hands, our troops found themselves in a critical, almost desperate, situation, but every time fresh troops from the reserves came to help, and our soldiers regained their positions. Reserves, in the heat of action, often advanced by their own initiative further than was ordered (Col. Znamerovsky) and even against formal orders (Gen. Kondratovitch). Many such facts proved that the tendency to mutual help and a keen appreciation of the conditions by subaltern chiefs were not lacking.

The action of the Japanese artillery against our Ma-yeh-tun positions offer the greatest interest for our study. Previous to each attack of their infantry, the Japanese guns poured a hail of projectiles on the respective positions, firing so as to cover a vast area behind the position and impede the arrival of reserves, or destroy the nearest shelter in the rear. Thus, by order of Gen. Oku, more than 200 guns were preparing the attack on Gen. Krause's position, occupied by 2 Russian infantry regiments.

In the sense of a skillful concentration of a mass of guns on given points of attack, the Japanese troops acted very well. But the same cannot be said in regard to the co-ordinated action of the artillery with their infantry. I happened to observe three instances when the Japanese artillery fired at their own infantry, thus helping us to regain our entrenchments, and how many more cases there may have

been cannot be said. Col. Svetchin states, also, that the preparatory gun action of the Japanese is open to criticism.

Gen. Mischenko's detachment acted very energetically on the right flank of the I Siberian Corps, engaging the brigade of Gen. Akiyama and parts of the 4th Division, thus impending free action of the latter.

On the Ta-ssu position all was quiet on the 18th of August (August 31st). The III Siberian Corps had only artillery firing to do. There were 72 guns on our side against 90 Japanese guns, but the artillery duel ended to our advantage. Only scouting parties of the enemy tried to execute an advance movement. Anyhow, the commander of the corps did not profit by his advantage and, notwithstanding an order of the commander-in-chief, made no offensive operation. Towards 3 p. m. the useless artillery firing completely ceased.

The X Army Corps did not even see the Japanese infantry on that day. The right wing made a feeble demonstration without result, and on the left wing the Japanese retired to the southeast. This was reported by our scouts to Gen. Vassilieff (posted there) who realized at once that a gap must have unexpectedly occurred in the lines of the Japanese troops acting against the X Corps. At last he decided to execute an advance movement, but went with only one battalion and one battery! What could they do? Yet the moment was very well chosen. Only 4 companies protected the rear of the Japanese troops who had crossed at Lien-tao-wan, and all the trains of the 1st army were assembled near To-han-po-ling. If the commanders of the III Siberian and X Army Corps had executed Gen. Kuropatkin's order of a decisive advance by numerous forces, the defeat of the Japanese armies would have been a certainty. The British military observer, Gen. Hamilton, states that the least semblance of an advance of Russian troops caused an indescribable panic and disorder in the staff of the 1st Japanese Army.

But the Russian army had suffered from a series of unsuccessful actions, was constantly ordered to retreat, a spirit of doubt had spread, and the loss of confidence in the wavering decisions of chiefs made itself felt, and thus no energetic active movement could be executed by the tired troops.

Gen. Kuropatkin did not approve the advance movement of Gen. Vassilieff and, instead, issued an order to the army corps reserve to move. The 85th Vyborgsky Infantry Regiment, reaching Liao-yang

on August 18th (August 31) as the head echelon of the 1st Army Corps, and was also sent to the reserve.

Thus, during the 17th and 18th August (August 30-31) the Russian army very successfully defended its advanced positions. The principal burden of the fight fell heavily on the valorous troops of the I Siberian Corps. We lost 6,329 soldiers; the Japanese lost 11,899. With the arrival of the 85th Infantry Regiment our numerical supremacy was, on August 19 (September 2d), 9,186 men.

What did the fights on August 18 (August 31) tell? 1st, Furious attacks by the enemy on the positions of the I Siberian Army Corps; 2d, an artillery duel on the front of the III Siberian Army Corps, where we had the upper hand; 3d, non-participation of the X Army Corps and the retreat to southeast of the Japanese troops, who took position opposite to the left wing of this corps, and 4th, information of the crossing of a Japanese division to the right shore of the Tai-tzu.

The picture is clearly outlined. In any case the main part of the Japanese armies were acting on the left bank of the River Tai-tzu and was already much shaken by two days' unsuccessful fighting. An energetic blow struck at its left flank would have finally destroyed it, giving us besides the advantage of cutting the enemy off from the railway, his main line of communication with his base. After such a double blow, we should have turned our action against the Japanese troops on the right bank of the river. These troops would have been unable to come to the timely rescue of Gen. Oku's army attacked by our troops, superior in number. This plan was easy of execution, even if the Japanese were numerically stronger (as Gen. Kuropatkin presumed), because we could have beaten each group of the dispersed Japanese forces separately, one after the other, with almost all our troops united.

Now let us see what Gen. Kuropatkin's plan was. In the night of the 17th to 18th August (August 30-31), the 12th Japanese Division crossed the Tai-tzu near Lien-tao-wan, passing to the right bank. The protection was formed by 5 batteries of the brigade which was to follow the 12th Division (this brigade belonged to the 2nd Division, which was to cross after the 12th). These batteries were posted on the Bank near Ying-shou-pu. In all, the crossing was to be executed by 17½ battalions, 60 guns and 6 squadrons; besides, Gen. Umezawa was directed at the same time to force the

crossing near Bensihoo with 4 battalions, 6 mountain guns and 1 squadron.

Already at 9 a. m. on the 18th August (August 31), the staff of XVII Army Corps received from the commander of the Nejinsky Dragoons Regiment, information that a Japanese division was crossing the Tai-tzu and moving in a northerly direction. However, neither our cavalry nor any other force made any attempt to impede the crossing. Instead of displaying energetic action, the XVII Army Corps occupied positions on the line: hill 151, hill 131, Hsiquan-tun, Nejinsky hillock. General Prince Orbeliani's cavalry detachment, protecting the army corps' left flank, even took position 2 kilometers in rear of this flank. At the same time Gen. Lubavin, posted opposite Gen. Umezawa's troops, although with superior forces under his command, opposed no resistance to the advancing enemy, but left Bensihoo and began retreating toward Mukden without fighting and without losses. Towards the evening of August 18th (August 31st) the Japanese built a pontoon bridge near Chiang-kuan-tun and began crossing their field artillery and the parks.

The battle actions during this day on the front of the XVII Army Corps were limited to some artillery firing and night scouting. By the latter it was ascertained that the line Kuan-tun was occupied by the enemy in considerable strength. Gen. Bilderling estimated them to be about six regiments with guns, and he was right.

The first information regarding the crossing of the river (though not quite exact) was received by Gen. Kuropatkin on the 16th August (August 29), and this news immediately roused his apprehensions as to the fate of the detachment posted near Bensihoo. The first correct information of the crossing of large Japanese detachments was received in the staff of the Manchurian army at 11 a. m. on the 18th of August (August 31). In order to protect the left flank of the XVII Army Corps, Gen. Kuropatkin ordered Gen. Orloff's detachment (8 battalions and 16 guns), posted near station Yentai, to occupy the Yentai coal mines, and Gen. Eek's detachment (7 battalions and 8 guns) to join the reserve of the XVII Army Corps.

As mentioned in the "History of the Russo-Japanese War," Gen. Kuropatkin had expected since early in July that a considerable part of Kuroki's army would probably cross the Tai-tzu somewhere

between Liao-yang and Bensihoo, outflanking the left flank of our army, or perhaps, even its rear. This preconceived idea created in its turn a preconceived decision—to execute maneuvers on the right bank under protection of the Liao-yang fortifications. His plan, Disposition No. 3, announced in the morning of August 18 (August 31), was: 1st, In order to shorten the front line of offense and in order to leave a greater mass of troops free for offensive action, to abandon the advanced outpost lines in front and reinforce the main positions, a front of 14 kilometers, with the IV and II Siberian Army Corps; 2d, the XVII Corps to continue the protection of the left flank of the army, remaining in its position; 3d, to form a general reserve of the I, III and VI Siberian and the X Army Corps, with which he intended to act on the right bank of the river; and 4th, Gen. Mischenko's and Gen. Samsonoff's cavalry detachments were also to cross to the right bank.

If a battle field is to be looked on as a chess-board we must acknowledge that Gen. Kuropatkin's plan was a very good one. On the left bank of the Tai-tzu the Japanese had developed 71 battalions, 23 squadrons and 364 guns for the attack of our Liao-yang positions, defended by Gen. Zarubaieff with 48 battalions, 112 guns and 7 Cossack sotnias. Our forces were sufficient here, because we occupied a position which had been properly fortified. Part of the Japanese troops (12 battalions and 42 guns of the Japanese Guard Division) was blocked by Gen. Yanjul's detachment (8 battalions and 36 guns) posted just opposite, and impeding its action. Gen. Kuroki could not contrive to concentrate more than 27 battalions and 60 guns with 6 squadrons on the left bank of the Tai-tzu, whereas General Kuropatkin had posted here 90 battalions, 335 quick-firing guns and 72 sotnias and squadrons. Thus, if living troops were quite like chess-board figures, not losing moral and physical strength when moved back, this plan would have been a very good one.

The one unlucky detail of this scientifically perfect disposition was that the material success of the defense of the advanced outpost lines became absolutely nullified by the retreat move. On the other hand, the apparent failure of the Japanese troops was trebly compensated by the high moral triumph known to every soldier. Every Japanese understood clearly that the repeated attacks on Russian positions, although repelled and unsuccessful, finally

led to victory, because the adversary gave up position after position, and retired. Moreover, our retreat maneuver gave the whole initiative into Japanese hands, because it resolved the Russian action into mere opposition and resistance to a Japanese outflanking movement.

During the night of August 19 (September 1) our troops began to execute Gen. Kuropatkin's plan. They left the advanced Liao-yang positions, which were immediately occupied with mighty cries of "Banzai" by the Japanese, who had so stubbornly fought for them without result and with enormous losses during the two previous days. However, the Japanese were so much exhausted by the previous fighting that they did not dare molest our troops. The latter executed their retreat march quietly and concentrated on the main fortified positions as ordered.

In the morning of August 19th (September 1) the Russian army was posted in the following disposition: The south front of the Liao-yang fortifications from the railway to the river Tai-tzu was occupied by Gen. Zassoulitch's detachment (20 battalions, 50 guns and 2 sotnias); the west front was occupied by 28 battalions, 62 guns and 5 sotnias under General Levestam. In the general reserve of these fortified positions was posted the III Siberian Army Corps (24 battalions, 72 guns and 6 sotnias). Thus the defense of the Liao-yang position was entrusted to 72 battalions, 184 guns and 12 sotnias, under the command of Gen. Zarubaieff.

Against these troops, on the curved line Chou-chai-pu-tzu to Tashih-men-ling, 15 kilometers long, stood the 2nd and 4th Armies (in all 71 battalions, 23 squadrons, 222 field, 72 mountain, 60 mortars and 10 siege guns).

On the right bank of the Tai-tzu we had the following separate groups: 1st, Two Mu-chang detachments, protecting the left flank of the fortified positions (total, 3 battalions and 24 guns); 2d, on hill 151, Gen. Yanjul's detachment (8 battalions, 36 guns and 2 squadrons). Against these two groups (total, 11 battalions, 60 guns and 2 squadrons) the Japanese posted 18 battalions, 48 guns and 3 squadrons on the left bank of the river; 3d, Gen. Dobrjinsky's detachment (16½ battalions, 104 guns, 6½ sotnias and squadrons) occupied the line of hill 131, Hsi-kuan-tun and Nejinsky hill, with its general reserve near village Sha-ho-tun; 4th, Gen. Prince Orbeliani's detachment (2 battalions, 6 guns, 11 sotnias) took position

behind the left flank of Gen. Dobrjinsky's detachment; 5th, the reserve of the XVII Army Corps under Gen. Eek (7 battalions, 8 guns, 2 sotnias) stood near the village of Hsing-cheng and Tou-tao-kou. All these groups, the Mu-chang detachments excepted, were under the command of Gen. Baron Bilderling, commander of the XVII Army Corps; 6th, the X Army Corps (22 battalions, 95 guns, 4 sotnias) was posted near the village of Hsin-cheng; 7th, the 1st Siberian Army Corps (24 battalions, 62 guns, 10 cossack sotnias) was posted near village Inshuissa; 8th, Gen. Mischenko's detachment (10 sotnias and 12 guns) protected the railway bridge; 9th, Gen. Samsonoft, with 19 sotnias and 6 guns, occupied the Yentai mines, where a special garrison of one company with two guns had already been posted; 10th, Gen. Orloff occupied part of the road to the Yentai mines with 11 battalions, 20 guns and 2 sotnias, viz., Gen. Kuropatkin had concentrated on this point, toward this time of the day, 82½ battalions, 345 guns, 73½ sotnias of troops, all free for active operations. Gen. Kuroki, on his side, had on the line Kuan-tun—Shang-fen-kow 21½ battalions, 6 guns and 6 squadrons; but while the latter held his troops in his fist on a front line of only 4 kilometers, Gen. Kuropatkin had dispersed his detachments which were to execute an offensive advance over a vast area; they occupied a front of 10 kilometers, and some distant reserve parts were stationed as far as 15 kilometers from the scene of the expected conflict.

For the protection of the outer right flank and of the rear of the Manchurian army two detachments (8½ battalions, 30 guns and 23 sotnias) were posted on approaching roads. There were no Japanese troops at all against these. The left flank was protected by the detachments of Gen. Lubavin and Gen. Romishevsky; total, 4 battalions, 10 guns and 11 sotnias, which retreated before 4 battalions, 6 guns and 1 squadron of Gen. Umezawa's troops without fighting, and were at that time already at a distance of 7-8 kilometers to the north of the Yentai mines. Moreover, the outer left flank was protected by 3 detachments, in all 6 battalions, 11 guns and 11 sotnias strong. These troops had to fight with unimportant parties of Hunhuzes led by Japanese instructors.

The troops of Gen. Zarubaieff occupied their positions only toward 3 p. m. on the 19th of August (September 1st). Here we see again an unusual preponderance of reserves, especially in the IV

Siberian Army Corps, which kept 17½ battalions in the reserve out of 28, almost two-thirds of its forces. The disposition of the guns appears also somewhat strange; one battery of the 28th Brigade is posted just behind battalions of the 1st Siberian Artillery Brigade, at 1 kilometer distance. However, this may have been caused by the fact that all the trenches were full of water, and everything had to be changed and done anew.

As soon as our troops had left the advanced positions and retired to the main one, the Japanese occupied the first and began bombarding Liao-yang early in the morning of the 19th (September 1st). The evacuation of the railroad station had to be done in haste under a hail of shells. Nothing particularly important occurred this day, and the operations were limited to artillery firing and scouting. By neglecting to previously secure or mark good observation posts, our artillery was badly handicapped in its struggle with the enemy's guns. Our infantry helped as much as possible, sending the information gained by its own scouting. In many cases infantry officers sent to artillery groups the drawings of the enemy's disposition, obtained with the greatest difficulty. In war, the importance of mutual aid is a very keen sense and one which is quickly awakened.

During the night of the 20th of August (September 2) the Japanese executed partial attacks on our positions and pushed their artillery ahead as much as possible; thus in front of Gen. Zassoulitch's battle line, they contrived to establish a battery at 1 kilometer's distance from our infantry entrenchments and 1½ kilometers from our artillery line. During this night the commander of the III Siberian Corps received the order to cross to the right bank of the Tai-tzu with 18 battalions, 48 guns and 4 sotnias. The Liao-yang fortifications were, therefore, defended by 54 battalions, 136 guns and 900 Cossacks, while on the right bank of the river the number of troops for the attack increased. But Gen. Kuroki also received reinforcement (7 battalions), and had, on the 21st (September 3), 27 battalions, 60 guns and 6 squadrons.

The staff of the commander had the whole day of the 19th (September 1) for quietly making dispositions. Nothing important occurred on the right bank of the Tai-tzu. A general offensive advance, to be executed on the 20th of August (September 2), by the troops of this section, was planned. About this time Gen. Kuropatkin had become convinced that the outflanking of our left wing by Gen.

Kuroki's army, 30,000 or 35,000 strong, was an undeniable fact. As we have seen, Kuroki had far from such numbers.

On the morning of the 19th (September 1) Gen. Kuropatkin received disagreeable news to the effect that the Japanese had crossed near Bensihoo and Gen. Lubavin was retreating towards the north; also, that there had been an enormous expenditure of gun ammunition. The first information caused him to order that the head of the arriving 1st Army Corps be kept in Mukden. The second was rather perplexing; on the evening of the Liao-yang fight there were 100,000 rounds in reserve; after two days' fighting only 24,000 remained. Gen. Kuropatkin was obliged to warn the troops that economy in firing was necessary and to send a message to Harbin, asking for immediate supply. Two express trains were immediately sent from Harbin and, luckily, arrived safely in due time.

During the 19th (September 1) Kuroki's army was constantly pushing ahead, executing artillery scouting. Our batteries committed the error of answering at once, thus disclosing their location, instead of allowing a closer advance of the enemy and then silently, instantly, pouring an unexpected, deadly hail of shells from superior forces, thus reducing the Japanese guns to silence. Five of their batteries pushed ahead as far as Kung-ku-fen, and were firing with deadly aim.

The right bank group of Gen. Kuroki's forces developed its front to west and north in one line almost without reserves; 54 guns out of 60 at once occupied battle positions. Such hasty action was rather risky, but Kuroki was laboring under the idea that the Russians were retreating to Mukden, and that he had before him only feeble flank bodies. In such a case to employ at once nearly all his available guns was quite normal.

At this moment of the fight Gen. Dobrjinsky's detachment occupied the Hsi-kuan-tun positions (the east slopes of the hill 131, Hsi-kuan-tun and Nejinsky hillock), having in the battle line $8\frac{1}{2}$ battalions and 48 guns, whilst the reserve, near Hsi-kuan-tun, numbered $10\frac{1}{2}$ battalions, 56 guns, $4\frac{1}{2}$ squadrons; the left flank was protected by Gen. Prince Orbeliani's cavalry detachment (12 squadrons and 6 horse guns).

Again we have to remark the strange disposition of feeble active parts and enormous reserves. Of course, the first news of the Japanese advance caused Gen. Dobrjinsky at once to move his reserves out of all proportion, thus changing his battle order almost during

the action; moreover, in sending a brigade of Siberian field artillery to a position east of Sha-ho-tun, he gave orders to fire at the Nejinsky hillock as soon as our troops should leave it. This proves that he considered this position as an advanced post only, and did not intend to defend it to the last. This hillock was occupied by only 6½ battalions, under the command of Col. Istomin, who had to repel the most furious and violently persistent attacks of the Japanese during this whole day.

About 2 p. m. Gen. Kuroki received information that a considerable Russian force was advancing from the Yentai mines toward the south, menacing the right flank of his army. It was Gen. Orloff's detachment. Nevertheless, Kuroki continued attacking the Nejinsky hillock, only protecting his troops by one brigade, posted with its front to the north; 13 battalions and 7 batteries were attacking the hillock. Under protection of a heavy gun fire, Gen. Okasaki led his brigade across a large kaoliang field and advanced to a distance of 1,000 yards from our positions. At 8 p. m. the Japanese ceased their fire suddenly and the infantry rushed to attack. Here we see the same action which our troops were often compelled to use; it must be explained by local conditions. The high kaoliang plants concealed the advancing troops, the gunners were unable to see the latter's progress, and the fear of hitting our own people made it necessary that the moment for ceasing firing be previously established by fixing some hour, before which the infantry was not to risk a movement over a certain space, and after which the artillery was to fire no more at this respective part of the battle field. In all, Nejinsky hillock was attacked by 13 Japanese battalions. Its northern slope was energetically defended by Col. Istomin, but the southern part was abandoned by Col. Paradeloff without fighting, which must not seem strange, as the chief of the detachment (Gen. Dobrjinsky) as mentioned before, was under the impression that this point was not to be defended very stubbornly, because the whole army was expected to move back.

With the approach of darkness Gen. Okasaki, having been repelled, and apprehending disorder which could easily arise among his troops scattered in the darkness in the kaoliang fields, recalled them. Meanwhile, a panic arose in the troops posted on the Hsi-kuan-tun position when Col. Paradeloff moved off, and 5 batteries posted between the Nejinsky hillock and Sha-ko-tun rode off to join the general reserve, thus barring the defense of the hillock. Col.

Istomin here made a serious blunder, riding away in order to report personally to Gen. Dobrjinsky. As soon as the moon appeared the Japanese artillery again began firing, and after some time renewed the attacks on the hillock.

The general result of this night fight was 5½ Russian battalions twice repulsed the attacks of 10 Japanese battalions; two and one-half battalions of the Novoingermanland regiment did not fight to the last; ten battalions of Gen. Dobrjinsky did not fight at all; Gen. Dobrjinsky made not the least attempt to back Col. Istomin, and the latter was finally obliged to retreat toward Sha-ko-tun where Gen. Dobrjinsky's whole detachment had moved during the night.

For the Japanese, all attacks on the hillock were repulsed. Having fought persistently and daringly, they had not the satisfaction of driving the enemy off at the point of the bayonet. However, the Russians having abandoned the hillock towards morning, the Japanese immediately occupied it and renewed the entrenchments.

During the night of the 20th of August (September 2d) alarming news reached Gen. Kuropatkin's staff from two sides. At first came an unverified report that considerable Japanese forces had outflanked our right flank. Instead of organizing an energetic cavalry reconnaissance, Gen. Kuropatkin sent from his reserve reinforcements to Gen. Grekoff's detachment, and concentrated on the line: Fort No. 2—Saobeihe, three detachments, in all 13 battalions, 22 guns, and 12 squadrons and ordered at the same time Gen. Zarubaieff to make a demonstration advance between Forts No. 5 and 8. Then came the news of the Nejinsky regiment's failure on the Hsi-kuan-tun position. However, before receiving this news, and notwithstanding the good report of Gen. Baron Bilderling, Gen. Kuropatkin issued the following disposition (No. 4); 1st, 54 battalions, 128 guns, 24 mortars, 10 sotnias and 2½ sapper battalions to remain for the defense of the Liao-yang fortifications; 2d, on the right bank of the Tai-tzu there were to be: (a) the vanguard of Gen. Baron Bilderling, on the Hsi-kuan-tun positions (23 battalions, 122 guns, 18 squadrons); (b) right column of Gen. Sluchevski (21 battalions, 80 guns, 6 sotnias, 1 sapper battalion) was to advance to Sai-chia-tun—Sha-ko-tun; (c) left column of Gen. Baron Stackelberg (18 battalions, 62 guns, 8 sotnias and one squadron, 1 sapper battalion) was to advance to the village of Lo-ta-tai and north of Sha-ho-tun; (d) the general reserve, under Gen. Ivanoff (18 battalions; 48 guns, 4 sotnias, 1 sapper battalion) was to advance

to Chan-hsi-tun; (e) Gen. Mischenko's cavalry detachment (21 sotnias and 12 horse guns) was to take position near Lai-chia-tun; 3d, the protection of the right flank of the right bank group was entrusted to a detachment of 16 battalions, 68 guns and 3 sotnias, who occupied the position Mu-chang—Tsao-fan-tun; the protection of the left flank had the detachments of Gen. Orloff and Gen. Samsonoff, concentrated near the Yentai mines (12 battalions, 28 guns and 22 sotnias).

In all the attack on General Kuroki's army was to be executed by 92 battalions, 352 guns, 79 sotnias and squadrons and 4 sapper battalions, viz., 57,000 infantrymen and 5,000 horsemen. Gen. Kuroki at that moment could oppose only 23,530 infantrymen and 600 horsemen. His disposition for the next day ran thus: "The First Army to occupy height 131, then advance on the line Sandepu—Lo-ta-tai. The Guard will, if possible, cross the Tai-tzu near Kao-cheng-tzu and occupy height 151." He continued still to believe that he had before him only buffer flank troops, concealing the movement of the main army.

At daybreak of the 20th of August (September 2) our troops began to execute Gen. Kuropatkin's disposition No. 4. At this time the 2nd and 4th Armies, composed of 71 battalions, 300 guns, 5 pioneer battalions, 23 squadrons, were on the left bank of the Tai-tzu continuing the attacks on the Liao-yang fortifications, occupied by General Zarubaieff, with 56 battalions, 128 guns, 10 sotnias and 2½ sapper battalions.

The Japanese Guards, consisting of 12 battalions, 42 guns, 3 squadrons, in the region Shih-chang-yu—Char-lu-tzu, represented a sort of reserve of Field Marshal Oyama, ready to support either the group on the right bank of the river or the left bank one. It was, however, under the order of Marshal Kuroki. Opposite to the Guards, on the right bank of the river, were the detachments of General Yanjul, Col. Galkovsky and Col. Smolensky, representing a total force of 12 battalions, 60 guns, 3 sotnias.

On the right bank also, in the triangle Ta-yao-pu—Hsi-kuan-tun—Kuan-tun, the chief part of Gen. Kuroki's army was disposed. It represented a force of 27½ battalions, 60 guns, 6 squadrons, and 2 pioneer battalions. Opposite to this group, on the Sha-ko-tun positions, were placed 24 battalions, 118 guns, 22½ sotnias and 1 sapper battalion of Gen. Baron Bilderling. Besides, at Sai-chia-tun

there was a cavalry detachment of Gen. Mischenko, consisting of 19 sotnias and 12 horse guns. On the Yentai positions, to the north of Ta-yao-pu, Gen. Orloff's 12 battalions, 22 guns, 3 sotnias, and near the Yentai mines Gen. Samsonoff's detachment, consisting of 12 sotnias, 6 horse guns were disposed. Thus, in all, against the group of Gen. Kuroki were disposed 26 battalions, 158 guns, 63½ sotnias and 1 sapper battalion. About half a march behind these troops there were the X Army Corps and the I and III Siberian Corps, ready to be moved, and representing an efficient force of 57 battalions, 174 guns, 18 sotnias, 3 sapper battalions. In all, on the right bank of the Tai-tzu, opposite to Gen. Kuroki's troops, Gen. Kuropatkin deployed, under his own personal command, 93 battalions, 332 guns, 81½ sotnias and squadrons, 4 sapper battalions.

Major General Umezewa, with 4 battalions, 6 horse guns and 1 squadron, had taken possession of Sianshantzy at the time. Major General Lubavin was retreating before him with 4 battalions, 12 guns and 17 sotnias.

Besides, for the distant protection of the flanks, and the rear, we had a whole number of separate detachments, amounting in all to 27 battalions, 48 guns, 34 sotnias, out of which 20 battalions and 48 guns could, without any detriment to the others, be employed in the theater of war.

At daybreak on the 20th (September 2), only 7½ battalions of the Japanese were occupying the Nejinsky Hill. Gen. Dobrjinsky was disposing his retreating troops in the region to the west of Hsi-kuan-tun.

Seven companies were occupying the Hill 131, the detachment of Col. Martynoff—4 battalions, 24 guns—was placed on the heights to the northeast of Hsi-kuan-tun; still further north Gen. Orbeliani's cavalry (12 sotnias and squadrons, 6 guns) was disposed, keeping in contact with Gen. Orloff. For the protection of his troops Gen. Dobrjinsky placed to the east of Sha-ho-tun the detachment of Col. Orloff (5 battalions, 16 guns) and ordered them to maintain contact with the heights 131 and Col. Martynoff. On the whole, Gen. Baron Bilderling had in the region Hsi-kuan-tun—Tou-tao-kao, 24 battalions, 112 guns, 10½ sotnias and squadrons, out of which 11 battalions and 40 guns were on the positions. Thus, we again and again repeated our old mistake, refusing to profit by our artillery, which surpassed that of the enemy, both in quality and quantity.

Meanwhile, Gen. Dobrjinsky gave a singular order to Col. Orloff, namely: "Not to provoke a battle,"—"in case of need" to retreat toward Fan-quan-tun—Erh-tao-kou, and not to open fire. Consequently, our artillery was forced to look on while the Japanese were reinforcing their position on the Nejinsky hill.

About 8 a. m. Gen. Bilderling arrived at Sha-ho-tun and decided to take possession immediately of Nejinsky hill and the village Hsi-kuan-tun.

First of all, he moved forward to a position to the west of Sha-ho-tun 40 guns of the 35th Artillery Brigade, and afterwards dispatched "instructions" to Gen. Dobrjinsky, informing him that he might reckon on the support of the brigade of General Eek.

Instead of reinforcing the active forces by his reserve troops, Gen. Dobrjinsky ordered Col. Orloff to move on to a "convenient firing position." Gen. Bilderling decided to prepare the attack of the Nejinsky hill by the fire of 56 guns placed on the positions.

At that time the troops of Gen. Kuroki were disposed as follows; 8 battalions were occupying the Nejinsky hill, Hsi-kuan-tun and the hill lying to the southwest of the latter; 6 battalions were placed on the heights to the southeast of Madiapoo; 7 battalions were occupying the heights to the south of Ta-yao-pu and in the general reserve at Kavlotsay there were, in all, 5½ battalions and 3 squadrons.

Meantime, in conformity with the Order No. 4, the X Army Corps and the I and III Siberian Corps were advancing toward the east. At 8 a. m. the heads of the X Army and III Siberian Corps were at a distance of only 4¾ versts from Sha-ho-tun, the III Siberian Corps, forming a general reserve, was at Fen-shang.

At 10 a. m. Gen. Kuropatkin, with the staff of the detachment, arrived on the heights near the village Chan-hsi-tun and immediately began to receive a series of contradictory reports from General Bilderling. First of all, the latter reported that during the night the Japanese had been repulsed; after that he sent a report of his intention to attack the Hsi-kuan-tun positions; lastly, the chief of the staff of the XVII Corps sent information that the Hsi-kuan-tun positions were occupied by the Japanese. It will be seen further that these contradictory reports were owing to the insufficient information that Gen. Bilderling had in regard to the position of the troops of his corps. At that time Gen. Kuropatkin, already observing the explosions of the Japanese shrapnel near the Yentai

mines, was able to perceive that all was not going well in Gen. Orloff's detachment. In view of this, Gen. Kuropatkin ordered Gen. Bilderling to get into close contact with Gen. Orloff and sent the I Siberian Corps to occupy the space between the mines of Yentai and the XVII Corps. Answering the question of the Commander-in-Chief as to how the troops of the XVII Corps were disposed, Gen. Bilderling replied that "this could not be well ascertained, as the troops had taken the offensive." As a matter of fact, his troops at that time had no idea of moving from their places. In his further reports Gen. Bilderling mentions the intended attack on Hei-ying-tai, after the taking of the Nejinsky hill, and says nothing of the plans for the attack of the Hsi-kuan-tun positions. At last Gen. Kuropatkin became fully convinced that the Hsi-kuan-tun positions had been relinquished to the enemy. Nevertheless, he alters his primary decision of placing the entire X Corps under the command of Gen. Bilderling, and leaves at this disposal only the vanguard of the X Corps, consisting of 8 battalions, 24 guns and 3 sotnias, under the command of Gen. Vassiliev.

The XVII Corps had, therefore, 32 battalions, 136 guns, and 13½ sotnias and squadrons.

Gen. Kuropatkin ordered Gen. Vassiliev to give his assistance to the 35th Division (Gen. Dobrjinsky) in its attack on the Nejinsky hill. For this purpose Gen. Vassiliev moved one regiment to the fighting line of the 35th Division and placed all his guns (24) on the position to the west of the village Sha-ho-tun. Thus, at that time, 10 battalions and 80 guns were deployed for the attack.

On the morning of the 20th (September 2d) the 24 guns of Col. Martynoff opened fire on the Nejinsky hill; at 3 p. m. the above-mentioned 80 guns were also at their places, and preparations for the attack were being carried out by 104 guns. Under cover of their rather slow fire the infantry kept on moving by degrees; Col. Orloff in the center, and on the right flank, along the heights 131, the Penza regiment (from the troops of Gen. Vassiliev). But neither Gen. Bilderling nor Gen. Dobrjinsky knew anything of the matter. In consequence of the total absence of general orders and unity of action, 7 companies of Col. Orloff's command threw themselves into the attack without any support; naturally, they were beaten and obliged to retreat. Thus ended the so-called "First attack" of the Nejinsky hill.

Failure was inevitable; Gen. Vassiliev failed to get into touch

with his chief, the commander of the XVII Corps, and sent his reports direct to Gen. Kuropatkin. Gen. Bilderling was under the impression all the time that the whole of the X Corps was under his command, but he was busy with plans for the future and not with the attack. The organization of the attack was carried out in a singularly hesitating way by Gen. Dobrjinsky, who also knew nothing of the movement of the Penza regiment; lastly, the commander-in-chief also gave his orders direct without informing either Gen. Bilderling nor Gen. Dobrjinsky. An instance is when he moved the entire brigade of General Eek after General Vassiliev on to Height 131.

At 12:10 Gen. Kuropatkin received Gen. Bilderling's first report, informing him that he had gotten into touch with the detachment of Gen. Orloff and that the latter had resolved to commence the attack. But at that moment, as will be seen later, Gen. Orloff had already experienced defeat. At the same time Gen. Bilderling again repeated his intention of occupying the Nejinsky hill towards evening. Gen. Kuropatkin again questioned the commander of the XVII Corps as to the disposition of his forces, remarking that Gen. Bilderling ought to take the organization of the attack into his own hands. However, he obtained no answer to his most natural and reasonable inquiries.

In fact the troops which were to carry out the attack were disposed thus: the right flank consisted of three lines: on the first line on the eastern slopes of heights 131, were placed 8 battalions of Gen. Vassiliev; on the second line on height 131 were disposed $2\frac{3}{4}$ battalions having no general chief; lastly, on the third line at Tou-tao-kou there was Gen. Eek with 7 battalions. The center at Sha-ho-tun was occupied by Gen. Dobrjinsky with 9 battalions, and the left flank by Col. Martynoff with 4 battalions, 24 guns, to the north of Sha-ho-tun. The artillery, with the exception of these 24 guns, was disposed as follows: A group of 24 guns of the 31st Artillery Brigade was placed at Erh-tao-kou; to the east of Sha-ho-tun were placed 32 guns of the I and III Siberian Artillery divisions. To the west of Sha-ho-tun were placed 5 batteries (40 guns) of the 35th Artillery Brigade, and 8 guns of the 3rd Artillery Brigade. Towards 4 p. m. at Erh-tao-kou there were also 24 guns of the 9th Artillery Brigade of Col. Sliusarenke and 8 guns of the 28th Artillery Brigade from General Eek's detachment.

Thus we had an effective force of 31 battalions, 138 quick-firing and 16 piston guns. At that time Gen. Gerschelman's column was halting at Tsovchinzy, the I Siberian Corps was stationed on the line Lin-chia-chuang—Lin-lin-kou, the head of the III Siberian Corps had reached Chan-hsi-tun, Gen. Mischenko's detachment was placed at Sai-chia-tun. Gen. Orloff's detachment was retreating towards Ta-tai-lien-kou, and Gen. Samsonoff was near the Yentai mines.

The Japanese were occupying the Hsi-kuan-tun positions with 14 battalions, 6 battalions were pursuing Gen. Orloff, and 8 battalions remained in reserve.

At the same time when our artillery proceeded to sweep with fire the Nejinsky hill, Gen. Okasaki, occupying the same, ordered his troops to move off from the positions leaving in the trenches only a small force.

Thanks to this action, his troops were able not only to eat during the battle, but even to sleep. This is what comes of firing without attacking at the same time.

Towards 1 p. m. Gen. Dobrjinsky gave the following order for the attack: Col. Istomin with 7 battalions was to occupy the Nejinsky hill and the village of Hsi-kuan-tun.

Meantime, Gen. Dobrjinsky sent warning that the attack would be prepared by the fire of 11 batteries. The commander of the 35th Artillery Brigade, Gen. Terpilovsky, was ordered to take the general command of the artillery and to cover with fire the Hsi-kuan-tun positions from 2 to 3 p. m., then to suspend the fire for an hour, and then again to open a strong fire from 4 to 5 p. m., after which to begin a general attack by storm.

The preparations for the attack were not very energetic. At 3 p. m. the 3 battalions of Col. Martynoff, which had been firing longer than the others, had fired 1,888 rounds, i. e., 78 to 79 per gun. The 5 batteries of the 35th Artillery Brigade, had at that time fired 448 rounds, i. e., 11 to 12 per gun. The slow fire of this group may be explained by the following facts: it arrived rather late; 2d, it did not know where our infantry was posted, nor the object of its own action, and 3d, the batteries of this group were ordered by the inspector of the artillery to be careful of the ammunition, as the "real battle was to take place on the next day."

Col. Sliusarenke, with a battalion (2 batteries) at Ehr-tao-kou, occupied an admirable observation post from where he could see both our own and the Japanese infantry. As soon as Gen. Vassiliev's

infantry moved forward, he ordered Col. Sliusarenke to cease fire. Vainly did Col. Sliusarenke assure him that it would be perfectly safe and absolutely desirable to continue the firing. Gen. Vassiliev peremptorily ordered him to silence his batteries.

It appears that the infantry was chiefly assisted by the 16 piston guns of the I Siberian Artillery Division, stationed further to the front than the others (to the west of Sha-ho-tun) and which evidently were in close contact with Col. Istomin. These were the real "infantry" batteries of the attack.

Two batteries from the detachment of Gen. Yanjul also participated indirectly in the preparation of the attack, by firing at the Japanese artillery stationed near Kung-ku-fen.

Thus the attack was prepared by 154 quick-firing guns and 16 piston guns. The defense had only 42 guns. The Japanese answered our fire, but slowly. Their ammunition was nearly exhausted.

The commander-in-chief watched the issue of the combat from the heights near Fan-quan-tun. Judging by the explosions of the Japanese shrapnel, it could be seen that Gen. Orloff was retreating. However, no disquieting news was received from this side up to 1 p. m.

From Liaoyang the reports were most satisfactory. Gen. Vassilieff sent information that he had occupied the heights 131, and that the enemy had been driven off from the northern slopes. But at 1.30 p. m. a telegram was received from Gen. Samsonoff communicating information of the failure of Gen. Orloff, and that Gen. Samsonoff's detachment was retreating towards Yentai. Immediately Gen. Kuropatkin sent orders to Gen. Stackelberg to guard the direction towards the Yentai station. In this order it was said: "Hold on as long as possible, avoiding combat with superior forces." Very probably, on learning that the I Siberian Corps was at that time on the line Liu-lin-kou-Hsiao-ta-lien-kou, Gen. Kuropatkin, at 3.45 p. m., ordered the commander of the troops not to move further, as his position was already an advanced one. This same order commanded the corps to act against the right flank of the enemy. At the same time Gen. Kuropatkin stated that the aim to be pursued by the army on the 21st of August (3d of September) was to gain possession of the line Kung-ku-fen—Handialatzy. He placed Gen. Orloff under the command of Gen.

Stackelberg, left the choice of the direction of the blow to the latter, enjoined the duty of establishing a contact with the XVII Corps, gave information regarding his plans for attacking the line Kung-kufen—Kane and ordered this line to be reconnoitered. Thus, on the one hand, the I Siberian Corps was told to hold on and not accept combat with superior forces, on the other, to take up aggressive actions against the right flank of the Japanese army.

At 6 p. m. Gen. Kuropatkin asked Gen. Stackelberg also to support the attack on the Nejinsky hill.

Not seeing any signs of attack on the Hsi-kuan-tun positions the commander-in-chief ordered the commander of the X Corps, Gen. Sluchevsky, to send all his forces to reinforce the XVII Corps, "placing under the command all the troops sent out on the battle line."

Thus the functions of a chief of the battle line were established, which certainly, was quite against the principles of deep tactics. Naturally, Gen. Sluchevsky was not only unable to lead the attack, but even to enter into contact with all the commanders of the different detachments into which the XVII Corps was divided.

At last the attack on the Hsi-kuan-tun positions was carried out in the following way: The artillery fire was, at the request of Col. Istomin, continued not until 5 p. m., but until 6 p. m., after which the artillery took no further part in the battle.

On this subject it must be said, that even in the night, artillery fire during an attack is desirable. The batteries might fire in the rear of the Japanese positions. This would probably not cause much damage to the enemy, but it would have had a certain moral influence. A great connoisseur of the soldier's soul, Gen. Souvoroff, justly apprised this fact; during the storming of Ismail, when the artillery fire could have hurt our own troops, Souvoroff ordered the gunners to fire with blank cartridges, but only not to remain silent.

At 6 p. m. our 25 battalions, destined for the attack, occupied a curve around the Nejinsky hill, extending over 3½ versts. The troops were placed at 1½ versts from the hill. When the cannonade ceased, all the troops moved to the attack without any connection between their actions. A sort of chess board order was the result. At first the troops of the right flank, the Vyborg and Penza regiments, began the attack, after them came the Kosloff regiment, a little later a blow was struck by the 7 battalions of

Col. Istomin and the 33rd Infantry, Eletz regiment (this latter was directed by Gen. Kuropatkin personally). The Tchembarsk regiment moving in rear of the Vyborg and the Penza regiments came up to the foot of the Nejinsky hill, attacked their own troops and were attacked by them, took no part in the attack on the enemy, and moved off towards Erh-tao-kou. They had one soldier killed and 28 wounded or lost. The movement of the battalions was carried out on radii of a circle—from the periphery to the center. Owing to the thickness of the kaoliang in the fields, the darkness, the absence of general direction and contact, the movement of the battalions on intersecting lines, the troop became intermingled from the outset. In a word, the attack was carried on in the utmost disorder. But this was redeemed by the tremendous energy and most devoted bravery. The result was that at 8:30 p. m. the Nejinsky hill and the Hsi-kuan-tun village were in the hands of the most daring and energetic companies of different regiments.

Gen. Okasaki, who was defending the Nejinsky hill, seeing the ever increasing disorder among his troops, gave the signal to retreat. The Japanese signal was mistaken for our own by some of our troops and they began to retreat. However, those who had attained the summit of the hill, did not leave it.

Seeing the disordered retreat of separate companies and groups of soldiers (mostly reservists), Gen. Vassilieff, who was in Sha-ho-tun at the time, sent a report on the failure of the attack to the commander of the X Corps. However, at midnight Gen. Bilderling reported that Sha-ho-tun, Hsi-kuan-tun, and the Nejinsky hill had been won in battle by his troops, before the arrival of the troops of the X Corps. This report was not quite correct, but the main point was true.

Gen. Kuropatkin informed Gen. Bilderling of his further plans to attack Kuroki's right flank by means of the I and III Siberian Corps. In view of this the commander of the XVII Corps sent orders to Gen. Dobrjinsky not to move back, and recommended to him to leave only a small force on the Nejinsky hill.

About 2 a. m. a note was received on the Nejinsky hill from the staff of the X Corps, in which the troops of that Corps occupying the hill were ordered to retreat towards Sha-ho-tun. This was called forth by the order of the commander-in-chief, by which all

the troops of the X Corps were to be concentrated into the reserve after the attack. This note, referring only to the troops of the X Corps, was shown to Lieutenant Colonel Martoff, acting as substitute for the wounded Col. Istomin, and he ordered the troops of the XVII Corps also to retreat towards Sha-ho-tun.

The result was that the success of the attack, obtained with such serious sacrifices by our courageous troops, was, by reason of bad management, turned into a failure. It is difficult to criticise the organization of the attack, as with each new order the general disorder was increased. The immediate reasons were: the complete ignorance of our troops regarding the general position of the combat (in consequence of which Lieutenant-Colonel Martoff commanded the retreat) and the inability of our chiefs to justly apprise the importance of the Hsi-kuan-tun positions won during the fight.

Our troops during the battles for the Hsi-kuan-tun positions on the 19th and 20th of August (September 1 and 2), lost 3,281 men. The Japanese losses were 1,291.

On the left flank, during 19th and 20th August (Sept. 1 and 2) matters were as follows:

At 11 a. m. on the 19th (September 1st) 12 battalions, 32 sotnias, and 34 guns, under the command of Major General Orloff, were concentrated in the region Fang-shen—Yentai mines. Against these forces a brigade under the command of Gen. Shimamura, consisting of 6 battalions, 18 mountain guns and 3 squadrons, was slowly and carefully advancing. The commander-in-chief ordered Gen. Orloff's detachment to guard the left flank of the XVII Corps. In the event of the Japanese moving down the river Tai-tzu. Gen. Orloff was to attack the flank of the enemy. Should the main forces of the Japanese attack his detachment, Gen. Orloff was to retreat towards Yentai station. According to order No. 4, Gen. Orloff was to advance in the direction of Fan-chia-tun, but this order was not received by him.

On the evening of the 19th (1st), Gen. Orloff learned that he was placed under the orders of Gen. Bilderling and that he was to attack the Japanese in the event of their attacking the XVII Corps, or retreat to Yentai station in the event of their attacking him with superior forces. In fact, as was ascertained, the Japanese were moving towards the north against Gen. Orloff, and to the west

against the XVII Corps at the same time, but with very insignificant forces.

On the morning of the 20th (September 2d), while watching, from his position near the Yentai mines, the combat going on in the XVII Corps, Gen. Orloff ascertained that the Nejinsky hill was occupied by the enemy, which meant that the Japanese had successfully attacked the positions of the XVII Corps.

In view of this, Gen. Orloff quite rightly decided to assume the offensive, which was organized thus: 2 battalions, 8 guns, 3 sotnias were left at the Yentai positions; the cavalry of Prince Orbeliani was ordered to move forward; it executed some reconnoitering in front of the detachment and was then called back to form the reserve. On the right wing 4 battalions were directed towards Sha-ho-tun; on the left 4 battalions also were moved towards the Nejinsky hill. In the reserve there followed 2 battalions and the cavalry; 20 guns, under the command of Major-General Alieff, were ordered to move in rear of the advancing infantry. This group, however, did not find a suitable place for itself and did not take part in the fight, thus depriving its infantry of the artillery support so needful to it. Only one battery from Gen. Alieff's artillery, occupying a position near the railway, too far in the rear, fired a few shots into its own troops. Naturally, it did not in the least influence the issue of the battle. Meanwhile, the Japanese were advancing on both banks of the river from the hill lying to the south of the village of Ta-yao-pu. It thus happened that the enemies did not meet.

The Japanese troops moved carefully, keeping well in contact with one another. Their artillery actively aided the infantry. Our troops soon lost themselves in the thickly growing kaoliang. The 18 Japanese guns quickly silenced our 8 guns, placed near the Yentai mines, so that it became necessary to remove them to another position, which was done with great difficulty.

Instead of placing a screen on the left against the enemy advancing from the river Tai-tzu, Gen. Orloff moved his reserve to the right. His troops came under the flank fire, not only of the Japanese infantry, but of the artillery as well. The group of Gen. Alieff was silent and failure became inevitable.

Thus, when the vanguard of the I Siberian Corps came up to Hsiao-ta-lien-kou, Gen. Orloff's troops were in full retreat. On perceiving this Gen. Stackelberg, first of all, stopped the 20 guns

of Gen. Alieff and placed them in position to the south of Hsiao-talien-kou. Meantime, the Japanese pursuing the retreating troops of Gen. Orloff, took possession of the heights to the east of Hsiao-talien-kou. The commander of the I Siberian Corps immediately directed the first regiment towards this hill, and when the main forces of the corps came up, he reinforced this regiment with 4 battalions and placed 32 guns near Hsiao-talien-kou, leaving 8 battalions in the reserve.

He then commanded Gen. Orloff, who had just come up, to call up his retreating troops and move them to the attack of the enemy. Gen. Orloff attempted to lead the men personally, but he was wounded by a Japanese bullet, after which nothing could restore order and stop the panic-stricken retreat of the greater part of the detachment. The demoralized troops raised a panic near post No. 8 on the Yentai railway line, one battery even opening fire against its own infantry and the transport troops of the I Siberian Corps. Such is the result of failure, especially when it occurs in the beginning of the battle. The attacks carried out by the 7 battalions of Gen. Stackelberg, which were not previously prepared by the artillery, did not meet with success. The corps took up a position on the south of the village of Hsiao-talien-kou, down to the railway line. Col. Zapolsky's detachment, consisting of 2 battalions and 2 guns, was placed on the heights to the west of the Yentai mines; Gen. Samsonoff took up a position to the north of the mine. The contact between the I Siberian Corps and the XVII Corps was established by means of the cavalry detachment of Gen. Mischenko, placed between both these commands. Gen. Mischenko, however, informed Gen. Stackelberg that the commander-in-chief had ordered him, on establishing the contact, to retreat towards Tai-chia-tun.

In all, there were concentrated here 25 battalions, 84 guns, 47 squadrons and sotnias, and 1 sapper battalion. Against these were 6 battalions, 18 guns, 3 squadrons of Shimamura, which, on occupying the line Fang-shen—Madapoo, did not move on farther, but entrenched themselves.

In the battles of the 20th August (September 2d), near the Yentai mines, we lost 1,458 men and 44 officers. The Japanese lost 181 men.

On the 20th of August (September 2d), the following took place on the south front:

Against the southern part of the western front of the Liao-yang fortifications, occupied by 4 battalions, 32 guns, under the command of Gen. Oganovsky, the 4th division and a brigade of Gen. Akiyama (11 battalions, 42 guns, 11 squadrons, 1 pioneer battalion), were advancing. Three divisions, 2 reserve brigades and all the heavy artillery, in all, 59 battalions, 338 guns, were moving against the southern front occupied by the detachment of Gen. Zassoulitch, consisting of 22 battalions, 18 guns.

Gen. Okasaki at once deployed all his artillery and nearly all his infantry, keeping only the reserve brigade (12 battalions) in reserve. Directing the chief blow against the forts Nos. 3 and 4, he gave the 6th division his army field artillery (72 guns of the 1st Artillery Brigade) and all the heavy artillery.

The 4th army was deployed along the line Ta-ta-pei-hu—Tung-pa-li-chuang.

The Japanese artillery almost at all points occupied positions at a distance of about 4 versts from our batteries—that is to say, within the range of shrapnel fire. It is to be supposed that it was only thanks to this circumstance that our batteries were not at once silenced by the superior forces of the enemy.

At this time Gen. Zarubaiev, in accordance with the orders of the commander-in-chief, gave orders to carry out a demonstration attack "for the purpose of ascertaining the forces of the enemy and drawing him out on himself."

This sortie was entrusted to Gen. Levestam, and for this purpose 14 battalions, 16 guns and 2 sotnias were placed at his disposition. Thus, for the immediate defense of the positions there only remained 42 battalions, 112 guns, 8 sotnias, against which the Japanese had deployed 71 battalions, 380 guns, 5 pioneer battalions and 23 squadrons.

The demonstration attack was carried out by two columns: the right one under the command of Gen. Shileiko (7 battalions, 8 guns, 2 sotnias) was directed against Ter-chuang-tzu—Yang-yu-chi; the left one, under the command of Gen. Rebinder (7 battalions, 8 guns), on Chiang-shih-chiao-tzu.

Because the assembling of the right column was difficult, the advance movement was carried out by echelons from the left. The batteries ordered to move with the columns, placed themselves near the forts and did not move on with the infantry. It is to be presumed that they acted rightly, as it is really very difficult to

choose positions in a field of kaoliang. They would certainly have had to move forward if the infantry had moved on farther. But they could quite as successfully have begun the battle from the line of forts. On the whole, the artillery greatly assisted the infantry, especially during the retreat of the latter. The result was that both our columns reached the Hsia-wan-tzu—Chiang-shih-chiao-tzu—that is, they moved out only to a distance of 1 verst from the forts. The Japanese continued to receive reinforcements, the regiments suffered great losses, and the commanders of the columns, without touching the reserves, began the retreat. When passing the completely bare esplanade of the forts, the retreating troops suffered great losses, but they continued moving in excellent order, carrying off not only their wounded, but also the dead. In this fruitless attempt we lost 1,227 men and 47 officers. The Japanese lost only 469 men.

While this fruitless and unsuccessful sortie was taking place on the western front, the 24 battalions of Generals Zassoulitch and Oganovsky were repulsing the attacks of 60 Japanese battalions, and our 9 batteries (72 guns) were struggling against over 300 guns of the enemy.

Naturally here was no question of an artillery duel; our guns could only hope that they would not be destroyed, and, in conjunction with the infantry, might be able to parry the furious onslaughts of the enemy. One battery of the 3rd artillery brigade occupied a front of 500 paces, so as to avoid excessive losses, but this proved ineffective, and in the night it had to change its position.

According to the words of one of the witnesses of this battle the Japanese artillery acted with most wonderful precision. They contrived to concentrate on one point of attack the fire of almost all their guns, although they were rather dispersed along a front of over 9½ versts, and, moreover, belonged to different units.

The attack was chiefly carried out against forts Nos. 2, 3, 4 and redoubt D (near the railway line). Under cover of the fire of the artillery the infantry gradually increased the entrenchments, digging trenches at a distance of 1,000, 700 and even 400 paces, and then throwing itself into the attack, but the energetic volleys of our infantry, and the case shots fired by our artillery, parried all attempts of the enemy to seize our fortifications, and caused him to suffer great losses.

At 6:35 p. m. Gen. Zarubaieff received a report from Gen. Zassoulitch informing him of a lack of ammunition on his front, and Gen. Zarubaieff hastened to inform Gen. Kuropatkin. But the alarm was premature, the supply had been replenished in due time by a train arriving from Harbin. Gen. Zarubaieff also reported that he had only 3 battalions in reserve and asked that the brigade of Gen. Kondratovitch be sent to Liao-yang. For some reasons, this request was not granted.

The cannonade ceased only at 9 p. m. At 10 p. m. it broke out again, and from that hour on the Japanese repeatedly made furious attacks along the entire southern front, beginning with fort No. 1, and ending with redoubt D. Towards 2 a. m. these attacks were also repulsed.

On the night from the 20th to the 21st (September 2-3), the Japanese moved nearly all their artillery to our fortifications. They placed one artillery regiment (36 guns) at a distance of only 1,000 sajaens from fort No. 4. At daybreak the Japanese artillery again opened fire on the Liao-yang fortifications. Three hundred and forty-two Japanese guns concentrated all their fire against the positions of Gen. Zassoulitch and Gen. Oganovsky, who had only 82 guns.

Early in the morning cries of "Hurrah" were heard in the forts; a false report had been spread regarding a victory which it was said had been won over Kuroki's army. But the cries had hardly time to be silenced, when news was received of the proposed retreat from Liao-yang. The first order of the commander-in-chief regarding the immediate retreat of the Liao-yang garrison was received by Gen. Zarubaieff at 7:12 a. m. and was immediately communicated by him to the commanders of the battle zones. The way that this order was transmitted to the troops nearly led to a catastrophe. Gen. Zassoulitch ordered his troops to commence the retreat at once, whereas Gen. Levestam first called all the commanders of divisions to his staff. Thus the south front was being evacuated, while the extreme left flank and the western front still retained their places.

Certainly, the fault lay, not in the different way that the order was transmitted to the troops, but in the order itself, which was to evacuate the positions immediately. It should have been definitely stated when to begin the evacuation, and the order in which it was to be carried out, what troops were to move first, which

after them; and the most important points to be held until all others had been evacuated. Such are the laws of tactics.

Luckily, at 8:40 a. m. a new order was received from Gen. Kuropatkin to evacuate Liao-yang at twilight. Only the complete exhaustion of the Japanese troops, who could not energetically watch over our armies, enabled us to regain the fortifications, and to repulse the attacks of the enemy during the whole day.

The Swiss military agent, von Gertch, calls the stubborn resistance of the Liao-yang garrison "wonderful." In explanation of his idea, he says: "During the whole course of the war the Russians could awaken no enthusiasm. They fought only because they were guided by a sense of duty, which frequently was put to severe tests!"

During the fights on the Liao-yang fortifications on the 19th, 20th and 21st August (September 1, 2, 3), we lost 77 officers, 2,292 men; the Japanese lost 6,374 men.

On the right bank of the Tai-tzu, the night from the 20th to the 21st of August (September 2d-3d), passed quietly. At 2:30 a. m. the staff of the army was sending out orders for the advance on the 21st (September 3d). But soon three disagreeable reports were received: 1st, Gen. Zarubaieff reported that nearly all his ammunition and reserves were spent; 2d, Gen. Stackelberg sent word that his position was very serious and that he was retreating towards Liu-lin-kou, where he would await orders, as he could not accept a battle; 3d and lastly, at 5:30 a. m. Gen. Bilderling reported that he was retreating towards the line of Erh-tao-kou.

Gen. Kuropatkin issued the following dispatch: "Very sad. Owing to Stackelberg's retreat we have to retreat towards Mukden and farther. There the troops will assemble, be completed and move forward, 21-8 Kuropatkin."

The absolutely unmolested retreat of our troops on the 21st (September 3), shows that the dispatch sent by the commander-in-chief was undoubtedly premature.

Knowing as we do now the position of affairs in the Japanese army, we can not but believe with the British military agent, Gen. Hamilton, who says that "the Japanese were very glad to be rid of the Russians."

Analyzing separately each of the motives for the retreat, the following conclusions must be reached: The report of Gen. Zarubaieff concerning the lack of ammunition must be set aside; ammunition

was brought up to him in time; the reserve of the Liao-yang garrison might have been completed by the brigade of Gen. Kondratovitch; Gen. Bilderling's retreat from the Hsi-kuan-tun positions could be of no great importance so long as we occupied the heights 131, as the Japanese could not break through to the railway; lastly, Gen. Stackelberg's report was also of no great consequence, as this general, so brave in battle, reported always in the beginning of the fight on the difficulty of his position, and always demanded support and the permission to retreat. He acted thus at Tashitchao, again when he was on the advanced posts at Liao-yang, and he was doing the same thing now. When, however, he had to take part in battle, he always bravely and stubbornly fought with superior forces and never thought of retreating.

Gen. Kuropatkin feared also that Kuroki had not used all his troops during the battles of the 20th of August (September 2d), but the retreat proved that Kuroki had no more troops. The Japanese generally used to lead all their troops into battle; at all events, they always deployed all their artillery from the beginning of the fight. It was not difficult to ascertain the number of guns acting on the right bank of the Tai-tzu, and consequently it was possible to determine the rest of the enemy's forces.

The fear that our left flank might be outflanked by superior forces of the enemy was also unfounded. Gen. Levestam was retreating without fighting, and consequently he could not know what troops were acting against him. Moreover, the considerable force (2 divisions), employed for carrying out a deep flanking movement, created a very advantageous position for Gen. Kuropatkin—the possibility of dealing with the enemy in detail.

REPORT OF BOARD OF OFFICERS COVERED TO CONSIDER QUESTIONS CONCERNING TYPES OF FIELD GUNS AND AMMUNITION SUPPLY.

PRELIMINARY CONCLUSIONS.

The field army is the smallest unit containing all the elements required in field warfare, and in considering the proportion of the several types of field guns the board has found it necessary to base its decision upon a *type* field army. The type adopted for this purpose is a field army composed of 3 divisions and 1 auxiliary division, the infantry component of the auxiliary division being one brigade.

Under Field Service Regulations the number of guns per division is fixed at 48. For auxiliary divisions the number is fixed at 8 guns per division in the field, or 24 heavy field pieces per type field army.

PROPORTION OF MOUNTAIN HOWITZERS.

Having in view the natural features of considerable portions of our own country as well as of the majority of those foreign countries in which operations of United States troops are most probable, it is recommended that two divisions be equipped with mountain howitzers.

NUMBER OF GUNS FOR TYPE FIELD ARMY.

For the type field army, the field artillery of each of the first two divisions should consist of a brigade of two regiments, one battalion of one regiment being equipped with 3.8-inch field howitzers, the remaining three battalions of each field artillery brigade being equipped with 3-inch field guns. Each of the first two divisions would therefore have 9 batteries, or 36 3-inch guns, and 3 batteries, or 12 3.8-inch howitzers. For the third division of the type field army, the field artillery should consist of a field artillery brigade of two regiments, one battalion being equipped with 4.7-inch field howitzers, the remaining three battalions of the brigade being equipped with 3-inch field guns. In order to give the 4.7-inch field howitzers approximately the same mobility as the 3-inch field guns, all vehicles of the 4.7-inch howitzer matériel in the third division should have 8-horse teams.

The third division would thus have 9 batteries, or 36 3-inch guns and 3 batteries, or 12 4.7-inch howitzers.

For the Auxiliary Division of each type field army, the field artillery should be composed of one regiment of 3 battalions of 2 batteries each, two batteries being equipped with 6-inch field howitzers, two with 4.7-inch field guns, and two with 4.7-inch field howitzers. The 4.7-inch field howitzer matériel with the Auxiliary Division should have 6-horse teams.

The Board further recommends that the number of caissons with limbers for 4.7-inch guns and 6-inch howitzers be increased from 8, as has been previously contemplated, to 12 per battery. It will be observed that the recommendation to equip two divisions with mountain howitzers causes a departure from the type field army. In arriving at the total figures, it is considered to be advisable to equip the division, which, under the type organization, would be added to the two divisions, having mountain matériel, with 3-inch field guns for 9 batteries and with 4.7-inch field howitzers for 3 batteries.

NUMBER OF GUNS FOR CAVALRY DIVISIONS.

The Board recommends that each cavalry division have a regiment of 6 batteries, 24 guns, of 3-inch caliber.

TOTAL NUMBER OF GUNS AND TYPES REQUIRED FOR MOBILE TROOPS WITHIN THE UNITED STATES.

Based upon the above the following tabulation shows the number and types of guns required for 6 field armies and 2 cavalry divisions:

TABLE I.

*Guns required for 6 Field Armies, and 2 Cavalry Divisions.
(18 divisions, 6 auxiliary divisions, and 2 cavalry divisions.)*

| Type | Batteries | Guns |
|-------------------------------|-----------|------|
| 3-inch mountain howitzer..... | 24 | 96 |
| 3-inch field gun | 156 | 624 |
| 3.8-inch field howitzer | 30 | 120 |
| 4.7-inch field howitzer | 30 | 120 |
| 4.7-inch field gun | 12 | 48 |
| 6-inch field howitzer | 12 | 48 |
| Total | 264 | 1056 |

GUNS FOR INSULAR POSSESSIONS.

It is understood that the field artillery components, which have

been fixed for the mobile forces of Insular Possessions, are as follows:

| | |
|-------------------|-------------|
| Philippines | 6 batteries |
| Hawaii | 6 batteries |
| Panama | 3 batteries |

The Board recommends that one-half the batteries in the Philippines be provided, as now, with 3-inch field guns, the other half being provided with 3-inch mountain howitzers, and that all the batteries in Hawaii and in Panama be equipped with the 3-inch field guns. The Board further recommends that one battery of 4.7-inch guns and one battery of 6-inch howitzers be provided in the Philippines.

TOTAL GUNS FOR UNITED STATES AND INSULAR POSSESSIONS.

Combining the above, the following table has been prepared:

TABLE II.

Table showing amount and classification of batteries of field artillery required for 6 type field armies, 2 cavalry divisions and Insular Possessions.

| Type of gun | United States | | Philippines | | Hawaii | | Panama | | Total | |
|--------------------------------|---------------|------|-------------|------|--------|------|--------|------|--------|------|
| | Batt's | Guns | Batt's | Guns | Batt's | Guns | Batt's | Guns | Batt's | Guns |
| 3-inch mountain howitzer | 24 | 96 | 3 | 12 | — | — | — | — | 27 | 108 |
| 3-inch field gun | 156 | 624 | 3 | 12 | 6 | 24 | 3 | 12 | 168 | 672 |
| 3.8-inch field howitzer | 30 | 120 | — | — | — | — | — | — | 30 | 120 |
| 4.7-inch field howitzer | 30 | 120 | — | — | — | — | — | — | 30 | 120 |
| 4.7-inch field gun | 12 | 48 | 1 | 4 | — | — | — | — | 13 | 52 |
| 6-inch field howitzer | 12 | 48 | 1 | 4 | — | — | — | — | 13 | 52 |
| Grand total | 264 | 1056 | 8 | 32 | 6 | 24 | 3 | 12 | 281 | 1124 |

The above guns only provide for such mobile forces as must be raised *at once* upon the outbreak of war.

As bearing upon the number of those guns which should be provided in time of peace, as well as upon the question of providing reserve guns, the following estimates by the Chief of Ordnance are of interest:

"It would take five months from the date of an order for manufacturer to begin deliveries of complete batteries of 3-inch or 3.6-inch field artillery matériel; they could then be produced for two months at the rate of six batteries per month, and thereafter at the rate of ten batteries per month; 4.7-inch howitzer, 4.7-inch gun, or 6-inch howitzer batteries could be delivered in place of 3-inch or 3.6-inch as follows: First battery in 7 months after date of order; 3 batteries per month for 2 months thereafter, and 5 batteries per month thereafter.

The delivery of batteries of 3-inch mountain howitzer matériel, *in place of above*, could begin in four months from the date of the order, eight could then be delivered for one month, and thereafter fourteen per month.

The rate of production of practically any combination of types may be figured from the above."

Based upon the above estimates it may be said that almost one year would be required to supply a single *type* field army, of a little less than 70,000 men, with field artillery matériel. It may be pointed out that with but few exceptions no war within the past 45 years has had a duration of one year. Even in the exceptions the actual fighting has been of a less duration than one year. Inasmuch as in a war with a first-class power we would have to raise far more than 450,000 troops, it is believed that a small reserve should be added to the guns shown in Table II.

A reasonable reserve would be sufficient guns for one additional field army.

It is therefore recommended that the number of guns below be procured in time of peace:

TABLE III.

Table showing amount, classification, and distribution of batteries of field artillery which should be procured in time of peace.

| Type of gun | United States | | Philippines | | Hawaii | | Panama | | Total | |
|--------------------------------|---------------|------|-------------|------|--------|------|--------|------|--------|------|
| | Batt's | Guns | Batt's | Guns | Batt's | Guns | Batt's | Guns | Batt's | Guns |
| 3-inch mountain howitzer | 24 | 96 | 3 | 12 | — | — | — | — | 27 | 108 |
| 3-inch field gun | 183 | 732 | 3 | 12 | 6 | 24 | 3 | 12 | 195 | 780 |
| 3.8-inch field howitzer | 36 | 144 | — | — | — | — | — | — | 36 | 144 |
| 4.7-inch field howitzer | 35 | 140 | — | — | — | — | — | — | 35 | 140 |
| 4.7-inch field gun | 14 | 56 | 1 | 4 | — | — | — | — | 15 | 60 |
| 6-inch field howitzer | 14 | 56 | 1 | 4 | — | — | — | — | 15 | 60 |
| Grand total | 306 | 1224 | 8 | 32 | 6 | 24 | 3 | 12 | 323 | 1292 |

AMMUNITION AND AMMUNITION TRAINS.

General Principles.

It is necessary to consider these subjects under a single head. The entire question is complicated by two diametrically opposed considerations.

On the one hand it is desirable that enough ammunition be carried on wheels to prevent any probability of a shortage of ammunition occurring; on the other hand it is imperative that the ammunition columns be limited to the smallest length that may be consistent with assuring a *fair* supply of ammunition. It should, however, be pointed out that guns without ammunition are not only

useless but are a positive and serious disadvantage to their friends.

It is thus apparent that the decision must be a compromise. In attempting to obtain a satisfactory solution the Board adopted certain guiding principles which form the basis leading to the final recommendations, and which are therefore stated in this report. They are as follows:

(a) To insure the prompt and efficient resupply of ammunition on the battlefield, it is essential that all ammunition carried with the troops (both with the batteries and with the ammunition train) be transported in caissons.

(b) The ammunition trains should be manned by an enlisted personnel and should be commanded by officers.

(c) The unit of supply should be so adjusted as to provide the greatest number of vehicles which can be supervised efficiently by one officer, while at the same time admitting of ready subdivision for supplying a battalion or a single battery.

(d) The supply now prescribed by the Field Service Regulations for the 3-inch field gun lends itself to suitable arrangements in organization and is reasonably sufficient.

(e) The number of rounds for the heavier types of guns and howitzers provided by Field Service Regulations is not in harmony with the actual capacity of caissons as finally adopted. Furthermore the Board believes that the amount provided by those regulations for the heavier types is inadequate.

(f) The general principle, enunciated in the Field Service Regulations, of providing a number of rounds at the advance supply depot equal to that on wheels with the troops, including the ammunition train, is correct in so far as concerns all types of guns and the 3.8-inch field howitzer. It is impossible to provide an ample supply of ammunition on wheels for the 4.7-inch and 6-inch howitzers on account of undue lengthening of trains. To meet this condition the Board recommends that, for the 4.7-inch and 6-inch howitzers, the number of rounds to be kept in the Advance Supply Depot be fixed at double the number on wheels with the troops. Inasmuch as the extensive employment of heavy field artillery matériel is, in general, the result of a very considerable resistance, bringing about a combat of several days' duration, the Board believes that ample time will be afforded to make more or less elaborate arrangements, and that, as a consequence, the plan which is

here recommended will assure a sufficient supply of ammunition for the heavier howitzers.

(g) Spare guns and limbers should be attached to ammunition trains so that disabled matériel may be replaced. The number of such guns should be limited and the proportion should vary approximately inversely as the number of guns of the several types available for the firing line, since the fewer the guns the more serious the disabling of a single one.

COMPOSITION OF AMMUNITION TRAINS.

Based upon the above principles the Board recommends that the part of the ammunition train of each division and of each auxiliary equipped with mountain howitzer matériel, each ammunition battalion of three ammunition batteries. Except for those divisions equipped with mountain howitzer matériel, each ammunition battery should contain 24 caissons and limbers, 1 store wagon with limber, 1 battery wagon with limber, 1 spare gun and limber, and such supply wagons as may be necessary. For the divisions, other than those equipped with mountain howitzers, the first ammunition battery would be equipped with caissons, etc., of the 3-inch field gun type; the third ammunition battery would be equipped with caissons, etc., either of the 3.8 or 4.7-inch howitzer type, according to the armament of the particular division; the second ammunition battery would be a mixed battery, one-half of the caissons and all other artillery vehicles being of the type for the 3-inch field gun, the remaining caissons being of the 3.8 or 4.7-inch field howitzer type. For auxiliary divisions, one ammunition battery is equipped with caissons, etc., for the 4.7-inch field howitzer; one with matériel for the 4.7-inch field gun, and one with matériel for the 6-inch field howitzer. Efficient organization requires that each battery be commanded by a captain, and be divided into two half batteries, of 12 caissons each, commanded by lieutenants; that each half battery be divided into three platoons, of 4 caissons each, commanded by sergeants, and that each platoon be divided into two sections, of two caissons each, commanded by corporals. Cannoneers should be provided for handling ammunition at the rate of two men per caisson. It may be pointed out that the above organization facilitates in every way the supply of ammunition. For example, the half battery contains a number of caissons exactly equal to the number of guns in a battalion, the half battery is the appropriate

unit to carry out the actual supply of a battalion in action; similarly the platoon is the appropriate unit for supplying an isolated battery in action.

The Board considers that it is a fundamental principle that the ammunition supply should be carried on automatically from rear to front. It is, therefore, necessary to provide the ammunition battalions with a personnel destined to maintain the necessary communication with the firing batteries.

To this end, a small number of men have been assigned to battalion headquarters and one lieutenant has been added to each ammunition battery.

Due to differences in the number of horses in teams, the number of men in the ammunition battalion varies with the types of pieces. The following tables show the strength recommended by the Board for the several types:

TABLE IV.

Table showing Personnel of Battalion Headquarters for all ammunition battalions except those with divisions equipped with mountain howitzers.

- 1 major,
- 1 adjutant (captain),
- 1 quartermaster and commissary (1st lieutenant)
- 1 veterinarian.
- 1 sergeant major (m)
- 1 quartermaster sergeant (m),
- 3 mounted orderlies (m),
- 3 sergeants (agents) (m.),
- 3 corporals (agents) (m),
- 1 cook,
- 1 private (wagoner),
- 1 field wagon.

Recapitulation, Battalion Headquarters.

- 3 officers,
- 1 veterinarian,
- 13 enlisted men (11 m),
- 1 field wagon,
- 16 horses,
- 4 mules.

TABLE V.

Table organization of ammunition battery equipped with matériel for supplying 3-inch field gun batteries or 3.8-inch field howitzer batteries.

| | 1st Half Battery | | | 2d Half Battery | | | | Total |
|-------------------------------|------------------|-------------|------------|-----------------|-------------|------------|------------|-------|
| | Battery Staff | 1st Platoon | 2d Platoon | 3d Platoon | 1st Platoon | 2d Platoon | 3d Platoon | |
| Captains | 1 | — | — | — | — | — | — | 1 |
| Lieutenants (1st or 2d) | 1a | 1 | — | — | 1 | — | — | 3 |
| Total Commissioned | 2 | 1 | — | — | 1 | — | — | 4 |
| 1st Sergeants | 1 | — | — | — | — | — | — | 1 |
| Q. M. Sergeants | — | — | — | — | — | — | 1 | 1 |

(a) Reconnaissance officer and agent of communication.

| | | | | | | | | | |
|----------------------------------|----|----|----|----|----|----|----|-----|-----|
| Stable Sergeants | — | — | — | — | — | — | — | 1 | 1 |
| Sergeants | — | 1 | 1 | 1 | 1 | 1 | 1 | 1b | 7 |
| Corporals | — | 2 | 2 | 2 | 2 | 2 | 2 | — | 12 |
| Chief Mechanics | — | — | — | — | — | — | — | 1 | 1 |
| Horseshoers | — | — | — | — | — | — | — | 2 | 2 |
| Mechanics | — | — | — | — | — | — | — | 2 | 2 |
| Musicians | 1 | 1 | — | — | 1 | — | — | — | 2 |
| Cooks | — | — | — | — | — | — | — | 3 | 3 |
| Privates { Drivers | — | 12 | 12 | 12 | 12 | 12 | 15 | 9 | 84 |
| { Cannoneers | 2c | 8 | 8 | 8 | 8 | 8 | 8 | — | 50 |
| Wagoners | — | — | — | — | — | — | — | 4 | 4 |
| Total Enlisted | 4 | 24 | 23 | 23 | 24 | 23 | 26 | 24 | 171 |
| Guns and limbers | — | — | — | — | — | — | 1 | — | 1 |
| Caissons and limbers | — | 4 | 4 | 4 | 4 | 4 | 4 | — | 24 |
| Store wagons and limbers | — | — | — | — | — | — | — | 1 | 1 |
| Battery wagons and limbers | — | — | — | — | — | — | — | 1 | 1 |
| Field wagons | — | — | — | — | — | — | — | 4 | 4 |
| Total Vehicles | — | 4 | 4 | 4 | 4 | 4 | 5 | 6 | 31 |
| Horses, draft | — | 24 | 24 | 24 | 24 | 24 | 30 | 18d | 168 |
| Horses, riding | 6 | 5 | 3 | 3 | 5 | 3 | 3 | 8 | 36 |
| Mules | — | — | — | — | — | — | — | 16 | 16 |

(b) Mess Sergeant.

(c) 1 as guidon, 1 as assistant to reconnaissance officer.

(d) Includes 1 spare team.

NOTE:—1st Battery of battalion equipped with 3-inch matériel, 2d Battery equipped with 3-inch matériel, except that 12 caissons are for 3.7-inch matériel, 3d Battery equipped with 3.8-inch matériel.

TABLE VI.

Table showing recapitulation of ammunition battalion (complete) for divisions equipped with 3-inch field guns and 3.8-inch field howitzers.

15 officers,
 1 vetermanian,
 526 enlisted men,
 72 caissons and limbers (36 3-inch guns, 36 3.8-inch howitzers).
 3 battery wagons and limbers,
 3 store wagons and limbers,
 3 spare guns and limbers (2 3-inch field guns, 3.8-inch field howitzers).
 13 field wagons,
 644 horses,
 52 mules.

TABLE VII.

Table showing organization of mixed ammunition battery (2d Battery of Battalion) for supplying 3-inch field gun batteries and 4.7-inch field howitzer batteries.

| | 1st Half Battery | | | 2d Half Battery | | | Supply Section | Total |
|-------------------------------|------------------|-------------|------------|-----------------|-------------|------------|----------------|-------|
| | Battery-Staff | 1st Platoon | 2d Platoon | 3d Platoon | 1st Platoon | 2d Platoon | | |
| Captains | 1 | — | — | — | — | — | — | 1 |
| Lieutenants (1st or 2d) | 1a | 1 | — | — | 1 | — | — | 3 |
| Total Commissioned | 2 | 1 | — | — | 1 | — | — | 4 |
| 1st Sergeants | 1 | — | — | — | — | — | — | 1 |
| Q. M. Sergeants | — | — | — | — | — | — | 1 | 1 |
| Stable Sergeants | — | — | — | — | — | — | 1 | 1 |
| Sergeants | — | 1 | 1 | 1 | 1 | 1 | 1b | 7 |
| Corporals | — | 2 | 2 | 2 | 2 | 2 | — | 12 |
| Chief Mechanics | — | — | — | — | — | — | 4 | 1 |

(a) Reconnaissance officer and agent of communication.

(b) Mess Sergeant.

| | | | | | | | | | | |
|---|------------------|----|----|----|----|----|----|-----|-----|----|
| Horseshoers | — | — | — | — | — | — | — | 2 | 2 | |
| Mechanics | — | — | — | — | — | — | — | 2 | 2 | |
| Musicians | 1 | 1 | — | — | 1 | — | — | — | 3 | |
| Cooks | — | — | — | — | — | — | — | 3 | 3 | |
| Privates { | Drivers | — | 12 | 12 | 15 | 16 | 16 | 16 | 9 | 96 |
| | Cannoneers | 2c | 8 | 8 | 8 | 8 | 8 | 8 | — | 50 |
| Wagoners | — | — | — | — | — | — | — | 4 | 4 | |
| Total Enlisted | 4 | 24 | 23 | 26 | 28 | 27 | 27 | 24 | 183 | |
| Guns and limbers (3-inch) | — | — | — | 1 | — | — | — | — | 1 | |
| Caissons and limbers (3-inch) | — | 4 | 4 | 4 | — | — | — | — | 12 | |
| Caissons and limbers (4.7-inch) | — | — | — | — | 4 | 4 | 4 | — | 12 | |
| Store wagons and limbers (3-inch) | — | — | — | — | — | — | — | 1 | 1 | |
| Field wagons | — | — | — | — | — | — | — | 4 | 4 | |
| Total Vehicles | — | 4 | 4 | 5 | 4 | 4 | 4 | 6 | 31 | |
| Horses, draft | — | 24 | 24 | 30 | 32 | 32 | 32 | 18d | 192 | |
| Horses, riding | 6 | 5 | 3 | 3 | 5 | 3 | 3 | 8 | 36 | |
| Mules | — | — | — | — | — | — | — | 16 | 16 | |

(c) 1 as guidon, 1 as assistant to reconnaissance officer.

(d) Includes 1 spare team.

TABLE VIII.

Table showing organization of ammunition battery equipped with matériel for supplying such 4.7-inch field howitzers as have 8 horse teams or for supplying 4.7-inch field gun batteries or 6-inch field howitzer batteries.

| | 1st Half Battery | | | 2d Half Battery | | | | Supply Section | Total |
|----------------------------------|------------------|-------------|------------|-----------------|-------------|------------|------------|----------------|-------|
| | Battery Staff | 1st Platoon | 2d Platoon | 3d Platoon | 1st Platoon | 2d Platoon | 3d Platoon | | |
| Captains | 1 | — | — | — | — | — | — | — | 1 |
| Lieutenants (1st or 2d) | 1a | 1 | — | — | 1 | — | — | — | 3 |
| Total Commissioned | 2 | 1 | — | — | 1 | — | — | — | 4 |
| 1st Sergeants | 1 | — | — | — | — | — | — | — | 1 |
| Q. M. Sergeants | — | — | — | — | — | — | — | 1 | 1 |
| Stable Sergeants | — | — | — | — | — | — | — | 1 | 1 |
| Sergeants | — | 1 | 1 | 1 | 1 | 1 | 1 | 1b | 7 |
| Corporals | — | 2 | 2 | 2 | 2 | 2 | 2 | — | 12 |
| Chief Mechanics | — | — | — | — | — | — | — | 1 | 1 |
| Horseshoers | — | — | — | — | — | — | — | 2 | 2 |
| Mechanics | — | — | — | — | — | — | — | 2 | 2 |
| Musicians | 1 | 1 | — | — | 1 | — | — | — | 3 |
| Cooks | — | — | — | — | — | — | — | 3 | 3 |
| Privates { | Drivers | — | 16 | 16 | 16 | 16 | 20 | 12 | 112 |
| | Cannoneers | 2c | 8 | 8 | 8 | 8 | 8 | — | 50 |
| Wagoners | — | — | — | — | — | — | — | 5 | 5 |
| Total Enlisted | 4 | 28 | 27 | 27 | 28 | 27 | 31 | 28 | 200 |
| Guns and limbers | — | — | — | — | — | — | 1 | — | 1 |
| Caissons and limbers | — | 4 | 4 | 4 | 4 | 4 | 4 | — | 24 |
| Store wagons and limbers | — | — | — | — | — | — | — | 1 | 1 |
| Battery wagons and limbers | — | — | — | — | — | — | — | 1 | 1 |
| Field wagons | — | — | — | — | — | — | — | 5 | 5 |
| Total Vehicles | — | 4 | 4 | 4 | 4 | 4 | 5 | 7 | 32 |

(a) Reconnaissance officer and agent of communication.

(b) Mess Sergeant.

(c) 1 as guidon, 1 as assistant to reconnaissance officer.

| | | | | | | | | | |
|----------------------|---|----|----|----|----|----|----|-----|-----|
| Horses, draft | — | 32 | 32 | 32 | 32 | 32 | 40 | 24d | 224 |
| Horses, riding | 6 | 5 | 3 | 3 | 5 | 3 | 3 | 8 | 36 |
| Mules | — | — | — | — | — | — | — | 20 | 20 |

(d) Includes 1 spare team.

TABLE IX.

Table Showing Recapitulation of Ammunition Battalion (Complete) for Division Equipped with 3-inch Field Guns and 4.7-inch Field Howitzers.

| | |
|-----|---|
| 15 | officers, |
| 1 | veterinarian, |
| 567 | enlisted men, |
| 72 | caissons with limbers (36 for 3-inch field guns, 36 for 4.7-inch field howitzer). |
| 3 | battery wagons and limbers (2 for 3-inch gun matériel, 1 for 4.7-inch howitzer matériel). |
| 3 | store wagons and limbers (2 for 3-inch field gun matériel, 1 for 4.7-inch field howitzer matériel). |
| 3 | spare guns and limbers (2 3-inch field guns, 1 4.7-inch field howitzer). |
| 14 | field wagons, |
| 708 | horses, |
| 56 | mules. |

For the auxiliary division it will be remembered that it is proposed that the ammunition battalion be composed of three batteries, one for each type of piece, and that the ammunition battery carrying supplies for the 4.7-inch howitzers have 6-horse teams. The latter ammunition battery would then have the same composition as the ammunition batteries for supplying the 3-inch field guns or the 3.8-inch field howitzers.

Combining the headquarters of the ammunition battalion and the three ammunition batteries we have the following as the recapitulation of the ammunition battalion of each auxiliary division:

TABLE X.

Table Showing Recapitulation of Ammunition Battalion (Complete) for Auxiliary Division.

| | |
|-----|---|
| 15 | officers, |
| 1 | veterinarian, |
| 584 | enlisted men, |
| 72 | caissons and limbers (24 for 4.7-inch field howitzer, 24 for 4.7-inch field gun, 24 for 6-inch field howitzer). |
| 3 | battery wagons and limbers (1 for 4.7-inch field howitzer matériel, 1 for 4.7-inch field gun matériel, 1 for 6-inch field howitzer matériel). |
| 3 | store wagons and limbers (1 for 4.7-inch field howitzer matériel, 1 for 4.7-inch field gun matériel, 1 for 6-inch field howitzer matériel). |
| 3 | spare guns and limbers (1 4.7-inch field howitzer, 1 4.7-inch field gun, 1 6-inch field howitzer). |
| 15 | field wagons, |
| 724 | horses, |
| 60 | mules. |

AMMUNITION SUPPLY FOR DIVISIONS EQUIPPED WITH MOUNTAIN ARTILLERY MATÉRIEL.

All of the ammunition accompanying divisions equipped with the 3-inch mountain artillery matériel should be carried on pack mules. This condition limits the amount of ammunition which can be carried. It is believed, however, that it is practicable to carry 212.5

rounds of ammunition for each 3-inch mountain howitzer and that this amount is sufficient, if consideration be taken of the fact that the terrain in which mountain artillery is usually called upon to operate limits, to some extent, great expenditure of ammunition.

Of the 212.5 rounds, 100 should be carried in the ammunition train. This arrangement will permit limiting the personnel of the brigade of field artillery, forming a part of the division, to approximately the same number as now prescribed by Field Service Regulations for brigades equipped with the 3-inch field gun.

Upon the basis above indicated the following table shows the personnel necessary for the artillery ammunition trains of divisions equipped with the mountain howitzer:

TABLE XI.

Table Showing Personnel of Field Artillery Ammunition Battalion for a Division Equipped with 3-inch Mountain Howitzers.

Battalion Headquarters.

- 1 major,
- 1 adjutant (captain),
- 1 quartermaster and commissary (1st lieutenant),
- 1 veterinarian,
- 1 sergeant major (m),
- 1 quartermaster sergeant (m),
- 3 mounted orderlies (m),
- 3 sergeants (agents) (m),
- 3 corporals (agents) (m),
- 1 cook (mounted on riding mule),
- 3 privates (packers) (mounted on riding mules),
- 9 pack mules (2 for officers' mess, 3 for officers' baggage and tents, 1 for men's surplus kits and rations, 3 for forage).

Recapitulation.

Battalion Headquarters.

- 3 officers,
- 1 veterinarian,
- 15 enlisted men (m),
- 16 horses,
- 9 pack mules,
- 4 riding mules.

Each battalion to have 3 batteries, organized as shown below:

AMMUNITION BATTERY MOUNTAIN ARTILLERY.

| | 1st Half Battery | | | 2d Half Battery | | | Total |
|---------------------------------|------------------|-------------|------------|-----------------|------------|----------------|----------|
| | Battery Staff | 1st Platoon | 2d Platoon | 1st Platoon | 2d Platoon | Supply Section | |
| Captains | 1 | — | — | — | — | — | 1 |
| Lieutenants (1st or 2d) | 1a | 1 | — | 1 | — | — | 3 |
| Total Commissioned | 2 | 1 | — | 1 | — | — | 4 |
| 1st Sergeants | 1 | — | — | — | — | — | 1 |
| Q. M. Sergeants | — | — | — | — | — | 1 | 1 |

(a) Reconnaissance officer and agent of communication.

| | | | | | | | |
|---------------------------------------|----------|-----------|-----------|-----------|------------|-----------|------------|
| Stable Sergeants | — | — | — | — | — | 1 | 1 |
| Sergeants | — | 1 | 1 | 1 | 1 | 1b | 5 |
| Corporals | — | 2 | 2 | 2 | 2 | 2 | 10 |
| Chief Mechanics | — | — | — | — | — | — | 1 |
| Horseshoers | — | — | — | — | — | 2 | 2 |
| Mechanics | — | — | — | — | — | 2 | 2 |
| Musicians | 1 | 1 | — | 1 | — | — | 3 |
| Cooks | — | — | — | — | — | 3 | 3 |
| Privates { Drivers | — | 40 | 40 | 40 | 45 | — | 165 |
| { Cannoneers | 2c | 5 | 5 | 5 | 5 | — | 22 |
| Chief Packers | — | — | — | — | — | 2 | 2 |
| Packers | — | — | — | — | — | 8 | 8 |
| Total Enlisted | 4 | 49 | 48 | 49 | 53 | 23 | 226 |
| Guns and carriages | — | — | — | — | 1 | — | 1 |
| Ammunition packs | — | 40 | 40 | 40 | 40 | — | 160 |
| Tool packs | — | — | — | — | — | 1 | 1 |
| Forge and Ordnance supply packs | — | — | — | — | — | 3 | 3 |
| Supply packs | — | — | — | — | — | 54 | 54 |
| Total Packs | — | 40 | 40 | 40 | 45* | 58 | 223 |
| Mules, pack | — | 40 | 40 | 40 | 45 | 69d | 234 |
| Horses, riding | 6 | 5 | 3 | 5 | 3 | 21c | 43 |

* Guns and carriages require 5 pack mules.

(b) Mess Sergeant.

(c) 1 as guidon, 1 as assistant to reconnaissance officer.

(d) Includes 6 spare mules.

(e) Includes 1 bell mare.

NOTES—Chief packers may be civilians.

RECAPITULATION.

Ammunition Battalion (Complete) for Supplying Mountain Howitzers.

15 officers,
 1 veterinarian,
 693 enlisted men,
 3 spare guns and carriages (3-inch mountain howitzers),
 145 horses,
 711 pack mules,
 4 riding mules.

AMMUNITION FOR HORSE ARTILLERY WITH CAVALRY DIVISIONS.

The Board believes that the vehicles of batteries belonging to cavalry divisions should have a smaller load behind the team than is now the case. At the same time the Board is of the opinion that cavalry divisions must depend, in general, upon the nearest divisions for their supply of ammunition, and that, as a consequence, it is undesirable to give horse batteries a gun using different ammunition from that used by those guns which form the major portion of the field artillery of the army. To meet these two conditions the Board recommends that, as a rule, the limbers of horse batteries be not loaded with ammunition. This would reduce the number of rounds per gun, carried with the battery, to 214. The saving in weight would be about 666 pounds per vehicle; a saving sufficient to greatly increase the mobility of horse artillery. To further increase the mobility of cavalry divisions the Board recommends that that portion of the ammunition train of the cavalry

division which carries field artillery ammunition be abolished. Coupled with these recommendations it is believed that the number of rounds to be maintained at the advance supply depot for each gun of the horse artillery should be fixed at 428 (double that on wheels).

The Board realizes that these recommendations contemplate a considerable reduction in the number of rounds now prescribed. It is believed, however, that the amount recommended is sufficient for the typical cavalry action, and that arrangements can be made to meet special necessities, such as the use of cavalry divisions to execute an enveloping attack, etc.

It is further believed that the necessity for rendering the cavalry division more mobile is so great as to outweigh possible shortages in ammunition resulting from the employment of cavalry divisions for special purposes, or, perhaps, to meet emergencies.

ORGANIZATION OF UNITS OF AMMUNITION SUPPLY OTHER THAN AMMUNITION
TRAINS.

Inasmuch as the personnel required along the line of communications will necessarily vary with the situation, length of the line, means of transportation, etc., it is not practicable to fix a definite personnel for this service. In many cases transportation of ordnance supplies up to the advance supply depot may be accomplished in the usual way, by the quartermaster's department upon bills of lading. In other cases it may be necessary to organize ordnance supply trains (composed of such means of transportation as may be available) under the command of ordnance officers.

The Board believes, however, that it is possible to fix a *minimum* ordnance personnel for the advance supply depot. It is, therefore, recommended that the following be adopted as the *minimum* ordnance personnel for the advance supply depot of each field army:

One colonel or lieutenant colonel in command of the ordnance personnel and matériel.

And in addition the following force for each division in the field army: One major, 2 clerks (civilian), 1 ordnance sergeant, 1 sergeant of ordnance, 4 first-class privates of ordnance, 4 second-class privates of ordnance, 6 laborers (civilians), 1 ordnance machinist (civilian), 1 armorer (civilian), 1 saddler (civilian), 1 carpenter (civilian).

It is to be noted that the personnel above recommended is intended to handle *all* ordnance supplies at the advance supply depot (artillery ammunition, small arms ammunition, stores, etc.).

ORGANIZATION OF REGIMENTS OF MOUNTAIN ARTILLERY AND HEAVY FIELD
ARTILLERY.

A definite organization of regiments equipped with this matériel has not yet been prescribed. In order to show the number of rounds of ammunition to be supplied and to show the total field artillery personnel required, it is necessary to adopt an organization. With the data now available, it is believed that a very close approximation to a correct organization can be laid down.

It is recommended that the following tentative organization of batteries of field artillery equipped with the 3-inch mountain howitzer be approved:

TABLE XII

(Omitted. An order prescribing organization will shortly be issued.)

It has already been recommended that the regiment of heavy field artillery forming part of the auxiliary division be divided into 3 battalions of 2 batteries each, 1 battalion being equipped with 4.7-inch field howitzers, 1 with 4.7-inch field guns, and 1 with 6-inch field howitzers.

It is now recommended that the organization of regimental and of battalion headquarters be identical with that now prescribed for organizations equipped with the 3-inch field gun.

The organization of the two batteries of 4.7-inch field howitzer matériel in the regiment of heavy field artillery should be identical with that now prescribed for light batteries.*

The following table shows the tentative organization recommended for batteries of 4.7-inch field guns and of 6-inch field howitzers; as well as for those batteries of 4.7-inch howitzers which should be given, under the recommendations of this Board, sufficient mobility to accompany infantry divisions:

* EDITOR'S NOTE.—See G. O. 47, W. D., July 21, 1913.

TABLE XIII.

Organization of 4.7-inch Field Gun Batteries, 6-inch Field Howitzer Batteries, and of such 4.7-inch Field Howitzer Batteries as are Equipped with 8 horse teams.

| | Firing Battery | | | | | | | | Combat Train | | Total |
|----------------------------------|----------------|-------------|------------|------------|-------------|-------------|-------------|-------------|--------------|----------------|-------|
| | Battery Staff | 1st Section | 2d Section | 3d Section | 4th Section | 5th Section | 6th Section | 7th Section | 8th Section | Supply Section | |
| Captains | 1 | — | — | — | — | — | — | — | — | — | 1 |
| Lieutenants (1st or 2d) | 1 | 1 | — | 1 | — | — | 1 | — | — | — | 4 |
| Total Commissioned | 2 | 1 | — | 1 | — | — | 1 | — | — | — | 5 |
| 1st Sergeants | 1 | — | — | — | — | — | — | — | — | — | 1 |
| Q. M. Sergeants | — | — | — | — | — | — | — | — | — | 1 | 1 |
| Stable Sergeants | — | — | — | — | — | — | — | — | — | 1 | 1 |
| Sergeants | — | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1b | 9 |
| Corporals | 2a | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | — | 18 |
| Chief Mechanic | — | — | — | — | — | — | — | — | — | 1 | 1 |
| Horseshoers | — | — | — | — | — | — | — | — | — | 2 | 2 |
| Mechanics | — | — | — | — | — | — | — | — | — | 5 | 5 |
| Musicians | 1 | 1 | — | — | — | — | 1 | — | — | — | 3 |
| Cooks | — | — | — | — | — | — | — | — | — | 3 | 3 |
| Privates { Drivers | — | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 12c | 76 |
| { Cannoneers | 4d | 6 | 8 | 8 | 8 | 8 | 7 | 7 | 7 | — | 65 |
| Wagoners | — | — | — | — | — | — | — | — | — | 4 | 4 |
| Total Enlisted | 8 | 20 | 19 | 19 | 19 | 19 | 19 | 18 | 18 | 30 | 189 |
| Guns and limbers | — | 1 | 1 | 1 | 1 | — | — | — | — | — | 4 |
| Caissons and limbers | — | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 2 | — | 12 |
| Store wagons and limbers | — | — | — | — | — | — | — | — | — | 1 | 1 |
| Battery wagons and limbers | — | — | — | — | — | — | — | — | — | 1 | 1 |
| Field wagons | — | — | — | — | — | — | — | — | — | 4 | 4 |
| Total Vehicles | — | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 6 | 22 |
| Horses, draft | — | 16 | 16 | 16 | 16 | 16 | 16 | 16 | 16 | 24c | 152 |
| Horses, riding | 10 | 4 | 2 | 2 | 2 | 3 | 5 | 3 | 3 | 11 | 45 |
| Mules | — | — | — | — | — | — | — | — | — | 16 | 16 |

- (a) 1 as signal corporal, 1 as scout.
- (b) Mess sergeant.
- (c) 4 as drivers, spare team.
- (d) 1 as scout, 2 as signalers, 1 as guidon.
- (e) Includes 1 spare team.

The total personnel of the heavy field artillery regiment with each auxiliary division would, therefore, be as follows:

45 officers,
2 veterinarians,
1218 enlisted men.

It may be pointed out that the personnel of those regiments (6) which have 1 battalion of 4.7-inch field howitzers with 6 horse teams, in lieu of 3-inch field guns, should be increased from the strength shown in Field Service Regulations by 54 men.

To show the number of rounds per piece, carried in caissons or on pack animals, and constantly accompanying the troops, the following table has been prepared:

TABLE XIV.

Table Showing Number and Distribution of Rounds per Piece Carried with the Batteries and in the Ammunition Train.

| | 3-inch Mountain Howitzer | 3-inch Field Gun | 3.8-inch Field Howitzer | 4.7-inch Field Howitzer | 4.7-inch Field Gun. | 6-inch Field Howitzer |
|--|--------------------------|------------------|-------------------------|-------------------------|---------------------|-----------------------|
| Rounds per ammunition pack | 10 | — | — | — | — | — |
| Rounds per carriage | — | 4 | — | — | — | — |
| Rounds per gun limber | — | 36 | 24 | — | — | — |
| Rounds per caisson limber | — | 36 | 24 | 12 | 28 | 14 |
| Rounds per caisson | — | 70 | 24 | 18 | 28 | 14 |
| Caissons or packs per gun with battery | 11½ | 3 | 3 | 3 | 3 | 3 |
| Rounds per gun with battery | 112½ | 358 | 108 | 90 | 168 | 84 |
| Caissons with limbers, or packs, per gun with ammunition train | 10 | 1 | 3 | 3 | 3 | 3 |
| Rounds per gun with ammunition train | 100 | 106 | 144 | 90 | 168 | 84 |
| Total rounds per gun on wheels or packs | 212½ | 464 | 312 | 180 | 336 | 168 |

The above table shows the ammunition which should be *constantly with the troops*.

The following table combines all of the ammunition (and shows its distribution) which should be available at the commencement of, and which should be constantly maintained during the course of a campaign:

TABLE XV.

Table Showing Number and Distribution of Rounds per Piece Which Should be Available at the Commencement of a Campaign, and Constantly maintained During its Progress.

| | 3 inch Mountain Howitzer | 3-inch Field Gun | 3.8-inch Field Howitzer | 4.7-inch Field Howitzer | 4.7-inch Field Gun | 6-inch Field Howitzer |
|--------------------------------|--------------------------|------------------|-------------------------|-------------------------|--------------------|-----------------------|
| On wheels and packs | 212½ | 464 | 312 | 180 | 336 | 168 |
| In Advance Supply Depots | 212½ | 464 | 312 | 360 | 336 | 336 |
| At base or in arsenals | 425 | 928 | 624 | 540 | 672 | 504 |
| Total available | 850 | 1856a | 1248 | 1080 | 1344 | 1008 |

(a) For Cavalry Division the number of rounds per piece is 1284.

AMMUNITION AND MATERIEL FOR AMMUNITION TRAINS WHICH SHOULD BE PROVIDED IN TIME OF PEACE.

The great length of time required to manufacture matériel for ammunition trains is too well known to make it necessary to insist

that the necessary caissons, etc., should be provided in time of peace.

As for ammunition, it may be pointed out that the ordnance department estimates the *maximum* output of the *entire country* at 250,000 rounds for the first 6 months after giving orders to run at *maximum capacity*. This amount is less than the Russians fired at the Battle of Mukden. The Board, therefore, considers that it is absolutely essential that all of the ammunition shown in table be provided in time of peace.

The supply thus recommended is by no means a complete supply for war with a first-class power but is merely that which should be available immediately upon the outbreak of such a war.

The following tables summarize all of the above recommendations as to matériel for ammunition trains and as to the total number of rounds of ammunition which should be provided in time of peace:

TABLE XVI.

Table showing matériel for ammunition trains for 18 divisions, 6 auxiliary divisions, and 2 cavalry divisions.

| | TYPE. | | | | | |
|---------------------------------|---------------------------|-------------------|--------------------------|--------------------------|---------------------|------------------------|
| | 3-inch Mountain Howitzer. | 3-inch Field Gun. | 3.8-inch Field Howitzer. | 4.7-inch Field Howitzer. | 4.7-inch Field Gun. | 6-inch Field Howitzer. |
| Caissons and limbers..... | — | 576 | 360 | 360 | 144 | 144 |
| Battery wagons and limbers..... | — | 32 | 10 | 12 | 6 | 6 |
| Store wagons and limbers..... | — | 32 | 10 | 12 | 6 | 6 |
| Spare guns and limbers..... | 6(a) | 32 | 10 | 12 | 6 | 6 |
| Ammunition packs..... | 950 | — | — | — | — | — |
| Other ordnance packs..... | 24 | — | — | — | — | — |

(a) For "spare guns and limbers" read "spare guns and packs."

TABLE XVII.

Table showing ammunition which should be provided in peace for 18 divisions, 6 auxiliary divisions, and 2 cavalry divisions.

| | TYPE. | | | | | |
|----------------------------------|---------------------------|-------------------|--------------------------|--------------------------|---------------------|------------------------|
| | 3-inch Mountain Howitzer. | 3-inch Field Gun. | 3.8-inch Field Howitzer. | 4.7-inch Field Howitzer. | 4.7-inch Field Gun. | 6-inch Field Howitzer. |
| Rounds per piece..... | 850 | 1,856 | 1,348 | 1,080 | 1,344 | 1,008 |
| Pieces to be supplied..... | 96 | 624a | 120 | 120 | 48 | 48 |
| Total rounds to be supplied..... | 81,600 | 1,130,688a | 149,760 | 139,600 | 64,512 | 48,384 |

(a) 48 guns for cavalry divisions at 1284 rounds per piece are included.

The above table does not consider ammunition for guns in Insular Possessions. Provision should be made for these guns at the same rate as for other pieces. The total number of rounds should therefore be increased by 10,200 rounds for 3-inch mountain howitzers, by 89,088 rounds for 3-inch field guns, by 5,376 rounds for 4.7-inch field guns, and by 4,032 rounds for 6-inch field howitzers.

PROPORTION OF FIELD GUNS PER THOUSAND TROOPS.

With the same number of guns, it is apparent that the proportion of guns will vary according to the base assumed for comparison. Thus the figures showing the number of guns per thousand of gross strength, per thousand infantry and cavalry, per thousand cavalry, per thousand infantry rifles, per thousand cavalry sabers, etc., will vary for the same total of guns, with each method of making the computation. For instance, since there are a great many infantry soldiers who are not armed with rifles, for a certain number of guns with any force there will be a smaller number of guns per thousand infantry than per thousand infantry rifles.

On account of certain misunderstandings which have arisen through the use of different methods of computing the number of guns per thousand, computations made under the various methods usually followed are inserted in this report.

To show the proportion of field guns it is necessary to show in detail the composition of such mobile forces as we would have to raise *immediately* upon the outbreak of war with a first-class power.

TABLE XVIII.

Table showing strength by Arms of the Service of 18 Divisions, 2 cavalry divisions, 6 auxiliary divisions, and certain troops for Lines of Communications, Hospitals, etc.

| | 18 Infantry Divisions. | 2 Cavalry Divisions. | 6 Auxiliary Divisions. | Separate Brigades, Coast Artillery Supports, Lines of Communications, etc. | AGGREGATE. |
|---|------------------------|----------------------|------------------------|--|------------|
| Division Headquarters | 1,386 | 150 | 456 | ----- | 1,992 |
| Brigade Headquarters | 288 | 16 | 24 | 20 | 348 |
| Infantry | 251,262 | ----- | 27,918 | 15,510 | 294,690 |
| Cavalry | 22,338 | 14,892 | ----- | 1,241 | 38,471 |
| Field Artillery | 42,768 | 2,340 | 7,578 | ----- | 52,686 |
| Engineers | 9,288 | 648 | 3,096 | 516 | 13,548 |
| Signal Troops | 3,924 | 436 | 1,308 | 216 | 5,886 |
| Sanitary Troops attached to Organizations | 6,768 | 480 | 900 | 511 | 8,659 |
| Ambulance Companies | 6,102 | 336 | 504 | 339 | 7,281 |

| | | | | | |
|--|---------|--------|--------|--------|---------|
| Field Hospitals | 4,518 | 248 | 372 | 251 | 5,389 |
| Medical Reserve Supplies | 216 | 24 | ----- | 12 | 252 |
| Ammunition Trains, Small Arms | 1,944 | 144 | ----- | 180 | 2,268 |
| Ammunition Trains, Field Artillery | 10,336 | ----- | 3,600 | ----- | 13,936 |
| Supply Trains | 3,886 | 216 | 1,296 | 216 | 5,616 |
| Pack Trains | 252 | 56 | 84 | 14 | 406 |
| Field Bakeries | 1,732 | ----- | ----- | 99 | 1,881 |
| Evacuation Hospitals | ----- | ----- | ----- | 6,680 | 6,680 |
| Transport Columns | ----- | ----- | ----- | 380 | 380 |
| Base Hospitals | ----- | ----- | ----- | 4,380 | 4,380 |
| Medical Supply Depots | ----- | ----- | ----- | 340 | 340 |
| Hospital Trains | ----- | ----- | ----- | 180 | 180 |
| Hospital Ships | ----- | ----- | ----- | 90 | 90 |
| Q. M. Comsy., Sig. Corps and Ord. Dept. at Depots | ----- | ----- | ----- | 5,000 | 5,000 |
| AGGREGATE | 367,060 | 19,986 | 47,136 | 36,177 | 470,359 |

TABLE XIX.

Table showing number of guns per thousand in forces shown in Table xviii. (Computed in various ways.)

| | Total. | Guns per thousand. |
|-----------------------------------|---------|--------------------|
| Guns | 1,056 | |
| Gross strength | 470,359 | 2.22 |
| Gross infantry | 294,690 | 3.58 |
| Gross infantry and cavalry | 333,161 | 3.16 |
| Infantry rifles | 250,610 | 4.21 |
| Infantry and cavalry rifles | 283,439 | 3.72 |
| Gross rifles (all arms) | 296,150 | 3.56 |

It is to be noted that the above table does not take into account the troops stationed in insular possessions or the coast artillery. If these troops be taken into consideration, it will be found that the recommendations of this Board allows about two guns per thousand gross strength of all arms.

As illustrative of the misunderstandings which are likely to arise due to different methods of computation, the following may be cited:

In Table XIX the column showing infantry rifles gives the actual number of infantrymen equipped with rifles. On the other hand a similar computation made in the memorandum approved 4th of February, 1911, takes as a basis, rifles of infantry considered as "available" for the firing line and is obtained by ignoring all sergeants, scouts and men not forming a part of "squads" as defined by the Infantry Drill Regulations. Naturally the resulting figures showing the proportion of guns per thousand infantry rifles are at variance.

Another instance:

The general misunderstanding has been that the memorandum submitted by the General Staff on the 5th of May, 1905, recommending that the proportion of guns be fixed at 3.35 per thousand infantry (gross strength), was based upon the needs of the entire mobile army. As a matter of fact the memorandum referred to

specifically stated that this proposition did *not* include horse artillery or heavy field artillery.

To avoid confusion, it is recommended that in the future the proportion of guns to troops be referred to in terms of guns per thousand *gross* strength of *infantry and cavalry*, and that the proportion determined upon include heavy field artillery and the horse artillery for cavalry divisions.

The proportion of guns per thousand gross strength of infantry and cavalry recommended for the United States and that adopted by other countries is as follows:

| | |
|---------------------|------|
| England | 6.72 |
| Germany | 4.91 |
| France | 4.21 |
| United States | 3.16 |

For the United States the figures just given do not include the guns provided for Insular Possessions, nor do they include the garrisons of those possessions.

For the foreign countries the figures were obtained by considering existing organizations raised to a war footing.

While comparing the recommendations made for the United States with proportions adopted by other countries it may be well to mention the relative number of howitzers as compared with total guns. The number of howitzers recommended by this Board forms a considerable part of the total number of guns, and, in fact, is greater, relatively, than the actual practice of any other country. At the same time the necessity of curved fire to obtain effect against troops which now universally shelter themselves from fire, is generally recognized. The tendency of all countries is toward a relative increase in howitzers.

The next general rearmament in Europe will probably witness a very large increase in both light and heavy howitzer matériel.

SUMMARY OF MOST IMPORTANT RECOMMENDATIONS.

1. Two divisions should be equipped with mountain howitzers.
2. Of the remaining 16 divisions, 10 divisions should have 9 batteries of 3-inch field guns and 3 batteries of 3.8-inch field howitzers, and 6 divisions should have 9 batteries of 3-inch field guns and 3 batteries of 4.7-inch field howitzers, the latter batteries having 8 horse teams.

3. There should be 6 auxiliary divisions. Each auxiliary division should have one regiment of heavy field artillery of 3 battalions of 2 batteries each. In each regiment, 1 battalion should be equipped with 4.7-inch field guns, and 1 battalion should be equipped with with 4.7-inch field howitzers, 1 battalion should be equipped 6-inch field howitzers. The batteries of 4.7-inch howitzers in the auxiliary divisions should have 6 horse teams. The tentative organization of regiments of heavy field artillery should be as shown in Table XIII (page 436) and in the remarks immediately following that table. Final organization for heavy field artillery should be determined upon as soon as sufficient experience has been had with the new material.

4. In addition to the batteries needed for 18 divisions, 2 cavalry divisions, and the Insular Possessions, a small reserve (42 batteries, 168 guns) should be provided. There should, therefore, be provided in time of peace 323 batteries, 1,292 guns, distributed among the several types as shown in Table III, page 426.

5. Ammunition trains for field artillery should be organized and provided with personnel as shown in Tables IV and XI inclusive, pages 429-423.

6. Cavalry divisions should not be provided with field artillery ammunition trains. Horse batteries with cavalry divisions should have the loads behind teams reduced by removing the ammunition from all limbers.

7. The minimum ordnance personnel for advance supply depots should be as set forth on page 428.

8. Regiments of field artillery equipped with 3-inch mountain howitzers should be tentatively organized as shown on pages 423 to 424, Exact strength in personnel should be decided upon after this material has been in service for a sufficient time to acquire the necessary experience.

9. Matériel (as shown in Table XVI, page 439) for ammunition trains should be provided in time of peace.

10. The ammunition shown in Table XVII (page 439) and in the remarks immediately following that table should be provided in time of peace.

11. * * * * *

12. Field Service Regulations should be amended to conform to the recommendations contained in this report.

13. The following tables summarize the recommendations of the Board as to batteries, other material, and ammunition, and show the cost of material, etc., which is yet to be provided.

BATTERIES REQUIRED AND COST OF THOSE YET TO BE PROVIDED.

| | | | | | | | | |
|--|---------|-----------|---------|-----------|-----------|---------|-----------|------------|
| Batteries required | 27 | 151 | 44 | 36 | 35 | 15 | 15 | 323 |
| Batteries already provided for | 6 | 95 | 18 | 12 | 7 | 10 | 8 | 156 |
| Batteries to be provided for | 21 | 56 | 26 | 24 | 28 | 5 | 7 | 167 |
| Cost per battery | 33,920 | 78,655 | 34,375 | 104,448 | 132,073 | 127,928 | 142,626 | |
| Total cost of batteries to be provided | 712,320 | 4,404,680 | 893,750 | 2,497,152 | 3,698,044 | 639,640 | 998,382 | 13,843,968 |
| Extra caissons and limbers required | | | | | | 60 | 60 | 120 |
| Cost of 1 caisson and limber | | | | | | 5,600 | 6,400 | |
| Total cost of extra caissons and limbers | | | | | | 336,000 | 384,000 | 720,000 |
| | 712,320 | 4,404,680 | 893,750 | 2,497,152 | 3,698,044 | 975,640 | 1,382,382 | 14,563,968 |

To the above figures must be added 10% for necessary spare parts. The total cost of batteries yet to be supplied is, therefore \$16,020,364.80.
 NOTE:—The 60 extra caissons for 4.7-inch guns and the 60 for 6-inch howitzers are necessary for the increase from 8 to 12 caissons per battery.

MATERIAL REQUIRED FOR AMMUNITION TRAINS AND COST OF THAT YET TO BE PROVIDED.

| | | | | | | | |
|--|---------------------------|---------------------|--------------------------|--------------------------|-------------------|------------------------|-------------------|
| | 3-inch Mountain Howitzer. | 4.7-inch Field Gun. | 4.7-inch Field Howitzer. | 3.8-inch Field Howitzer. | 3-inch Field Gun. | 6-inch Field Howitzer. | Total, all Types. |
| Caissons and limbers (or packs) required..... | 984 | 576 | 360 | 360 | 144 | 144 | ----- |
| Cost per caisson and limber (or packs)..... | 100 | 3,300 | 5,000 | 3,850 | 5,600 | 6,400 | ----- |
| Total cost of caissons and limbers (or packs)..... | 98,400 | 1,900,800 | 1,800,000 | 1,386,000 | 806,400 | 921,600 | 6,913,200 |
| Store wagons and limbers required..... | ----- | 32 | 12 | 10 | 6 | 6 | ----- |
| Cost per store wagon and limber..... | ----- | 2,000 | 2,000 | 2,000 | 5,600 | 5,600 | ----- |
| Total cost of store wagons and limbers..... | ----- | 66,000 | 24,000 | 20,000 | 33,600 | 33,600 | 175,200 |
| Battery wagons and limbers required..... | ----- | 32 | 12 | 10 | 6 | 6 | ----- |
| Cost per battery wagon and limber..... | ----- | 2,600 | 2,600 | 2,600 | 6,000 | 6,000 | ----- |
| Total cost of battery wagons and limbers..... | ----- | 63,200 | 31,200 | 26,000 | 36,000 | 36,000 | 212,400 |
| Grand total cost..... | 98,400 | 2,048,000 | 1,855,200 | 1,432,000 | 876,000 | 991,200 | 7,300,800 |

To these figures must be added 10% for necessary spare parts. The total cost of materiel for ammunition trains is, therefore, \$8,030,880.00.

NOTES—None of the materiel for ammunition trains is on hand. The necessary spare guns and limbers are provided for in the 10% extra for the spare parts.

AMMUNITION REQUIRED AND COST OF THAT YET TO BE PROVIDED.

| | | | | | | |
|---|-----|-----------------|----------------|----------------|----------------|-----------------|
| Guns to be supplied | (a) | 672 | 120 | 52 | 52 | 1,124 |
| Rounds per gun | | 1,856 | 1,248 | 1,334 | 1,008 | 1,124 |
| Total rounds to be supplied | | 1,219,776 | 149,760 | 69,888 | 52,416 | 1,713,240 |
| Rounds already provided for (b) | | 110,275 | 1,519 | 8,870 | 3,181 | 128,359 |
| Rounds to be provided for | | 1,109,501 | 146,341 | 61,018 | 49,235 | 1,584,881 |
| Cost per round (c) | | \$9.20 | \$17.97 | \$28.78 | \$42.72 | \$42.72 |
| Total cost ammunition yet to be provided | | \$11,339,100.22 | \$2,663,890.77 | \$1,756,098.04 | \$2,103,319.20 | \$22,031,329.47 |
| <p>(a) 48 guns for cavalry divisions, supplied with 1284 rounds per piece, included in totals. (b) Ammunition for target practice to a value of about \$100,000 is included. The total cost, therefore, should be increased by \$100,000, making a grand total of \$22,131,329.47. (c) Cost per round is obtained by averaging the cost of shell and shrapnel in the proportions now furnished.</p> | | | | | | |

HARNES REQUIRED AND COST OF THAT YET TO BE PROVIDED.

| | | |
|--|--------|-------------|
| Sets wheel harness required | 6,704 | |
| Sets wheel harness already provided for..... | 2,242 | |
| Sets wheel harness to be provided for | 4,462 | |
| Cost per set wheel harness..... | \$165 | |
| Total cost wheel harness to be provided..... | | \$736,230 |
| Sets lead harness required | 14,400 | |
| Sets lead harness already provided for..... | 4,227 | |
| Sets lead harness to be provided for..... | 10,173 | |
| Cost per set, lead harness | 130 | |
| Total cost lead harness to be provided..... | | \$1,322,490 |
| Grand total cost | | \$2,058,720 |

The above figures include harness of batteries now serving in Insular Possessions, but exclude a small reserve in the Philippines.

It is to be noted that the ammunition here provided for is simply that which should be on hand at the *outbreak* of war and is in no sense a complete supply for war.

It will also be noted that no ammunition, material for ammunition trains, or harness, are included for the 42 reserve batteries (168 guns) provided in the tables.

The following summary shows the total cost of material, ammunition, etc., needed to complete the supply which should be provided in time of peace:

| | |
|------------------------|-----------------|
| Batteries | \$16,020,364.80 |
| Ammunition trains..... | 8,030,880.00 |
| Harness | 2,058,720.00 |
| Ammunition | 22,131,329.47 |
| | \$48,241,294.27 |
| Total | |

All of the figures shown in this report are confined to field artillery material proper. Personal equipment, horse equipment, and barrack equipment furnished by the Ordnance Department have not been included, nor have articles furnished by other departments been included.

| | |
|--|-----------------|
| Grand total guns to be supplied with ammunition..... | 1,124 |
| Grand total rounds to be supplied | 1,713,240 |
| Grand total rounds already provided for..... | 128,359 |
| Grand total rounds to be supplied | 1,584,881 |
| Grand total cost ammunition yet to be supplied..... | \$22,031,329.47 |

The above figures include ammunition for target practice to a value of about \$100,000, the total cost is, therefore, \$22,131,329.47.

APPENDIX II.

The Following Shows Data Relating to Ammunition Supply in France and Germany.

FRANCE.

| | | | |
|--|---------|---------------|---------------|
| Caliber of guns..... | 75 m.m. | 120 m.m. How. | 155 m.m. How. |
| Corresponding to U. S. types..... | 3-inch | 4.7-inch How. | 6-inch How. |
| Rounds per limber (piece or caisson) | 24 | | |
| Rounds per caisson | 72 | | |
| Caissons per gun in battery..... | 313 | | |
| Rounds per gun in battery | 312 | 88 | 103 |
| Rounds per gun in ammunition train..... | 189.5 | 132.5 | 100 |
| Total rounds per gun in battery and ammunition train | 501.5 | 220.5 | 203 |
| Compare Table XIV, p. 20, U. S..... | 464 | 180 | 168 |

The French basis of organization is the Army Corps—about 29,000 infantry rifles and 144 guns.

The ammunition train of the corps contains both infantry and field artillery ammunition; it is difficult, therefore, to separate the personnel. However, the personnel of the ammunition train, concerned solely with supplying field artillery ammunition, is at least 30 officers and 1,600 men.

For each army, probably 3 army corps, the French have one group (3 batteries, of 120 m.m. howitzers, and two groups of 155 m.m. howitzers. For this heavy material (3 groups) there is an ammunition train with a strength of about 20 officers and 1,000 men.

In addition to these trains, large trains are maintained on the lines of communication, but data regarding these are kept secret.

Various statements indicate that possibly 5,000 rounds for each light gun are maintained in peace.

GERMANY.

| | | | |
|--|---------|---------------|-------------|
| Caliber of guns..... | 77 m.m. | 105 m.m. | 150 m.m. |
| Corresponding to U. S. types | 3-inch | 3.8-inch How. | 6-inch How. |
| Rounds per gun in battery | 130 | 86 2-3 | 72 |
| Rounds per gun in light ammunition column | 102 2-3 | 67 2-3 | 54 |
| Rounds per gun in ammunition train..... | 139 | 71 | 170 |
| Rounds per gun in battery and ammunition train | 371 2-3 | 225 1-3 | 296 |
| United States | 464 | 180 | 168 |

The German basis of organization is the Army Corps,—about 25,000 infantry rifles and 144 guns (126 77 m.m. guns and 18 105 m.m. howitzers).

The light ammunition columns of the corps have 32 officers and 1,504 men. The ammunition train has 24 officers and 1,464 men. These strengths do not include personnel for infantry ammunition.

For probably every corps, the Germans would put into the field a battalion of four batteries of 150 m.m. howitzers.

These battalions have a light ammunition column of 5 officers and 265 men, and an ammunition train with 16 officers and 824 men.

In addition to the above trains other trains are maintained on the line of communications, but data as to the number of such trains are kept secret. It is believed that about 500 rounds for each 77 m.m. gun are maintained on wheels.

Information which is believed to be accurate indicates that 2,800 rounds per light gun are maintained in peace.

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