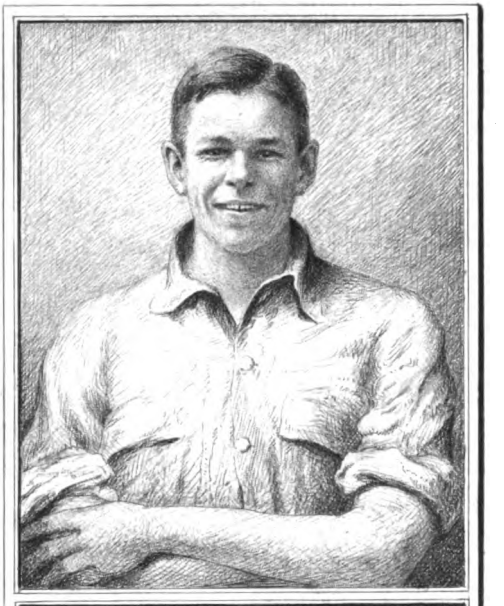

In Memory of
STEPHEN SPAULDING
1907 – 1925
CLASS of 1927
UNIVERSITY OF MICHIGAN

Henry Harding

THE

FIELD ENGINEER;

OR

INSTRUCTIONS UPON EVERY BRANCH

OF

FIELD FORTIFICATION:

Demonstrated by Examples which occurred in the Seven Years War

BETWEEN THE

PRUSSIANS, the *AUSTRIANS*, and the *RUSSIANS*;

WITH PLANS AND EXPLANATORY NOTES.

Translated from the *Fourth Edition* of the GERMAN ORIGINAL of

Johann Gottlieb

J. G. TIELKE,

LATE CAPTAIN OF ARTILLERY IN THE SERVICE OF

H. S. H. THE ELECTOR OF *SAXONY*,

BY

EDWIN HEWGILL,

ENSIGN AND ADJUTANT

IN THE COLDSTREAM REGIMENT OF FOOT GUARDS.

IN TWO VOLUMES.

VOL. I.

LONDON:

PRINTED FOR THE TRANSLATOR,

AND SOLD BY

J. WALTER, AT HOMER'S-HEAD, CHARING-CROSS.

M.DCC.LXXXIX.

TO

HIS ROYAL HIGHNESS

THE DUKE OF *YORK*,

BISHOP OF *OSNABURGH*,

LIEUTENANT GENERAL IN HIS MAJESTY'S SERVICE,

COLONEL OF THE *COLDSTREAM* REGIMENT OF FOOT GUARDS,

&c. &c. &c. &c.

SIR,

WHEN I SOLICITED THE HONOUR OF BEING PERMITTED TO DEDICATE THE FOLLOWING SHEETS TO YOUR ROYAL HIGHNESS, I WAS IMPRESSED WITH AN IDEA THAT THERE WOULD BE PECULIAR PROPRIETY IN SUBMITTING THEM TO YOUR PROTECTION: NOT ONLY BECAUSE I HAVE THE HONOUR, BY MY COMMISSIONS, OF SERVING MORE IMMEDIATELY UNDER YOUR ROYAL HIGHNESS'S COMMAND; BUT BECAUSE YOUR PERFECT KNOWLEDGE OF THE LANGUAGE FROM WHICH THEY

ARE TRANSLATED, ENABLES YOU TO FORM A JUDGMENT, HOW FAR THE SENSE OF THE ORIGINAL HAS BEEN FAITHFULLY PRESERVED, AND YOUR SKILL IN THE MILITARY PROFESSION, HOW FAR THE MANNER IN WHICH THE SUBJECT HAS BEEN TREATED, MAY DESERVE THE ATTENTION OF A MILITARY STUDENT.

IF MY ENDEAVOURS SHOULD BE HONOURED WITH YOUR ROYAL HIGHNESS'S APPROBATION, AND IF THEY SHOULD BE FOUND TO CONTRIBUTE TO THE INFORMATION OF MY BROTHER OFFICERS, I SHALL THINK MYSELF ABUNDANTLY REWARDED.

I AM, WITH GREAT HUMILITY,

SIR,

YOUR ROYAL HIGHNESS'S

EVER FAITHFUL,

OBEDIENT,

AND DUTIFUL SERVANT,

Manchester Buildings,
Jan. 20, 1789.

EDWIN HEWGILL.

THE

THE

TRANSLATOR's PREFACE.

THE Tranſlator of the following Treatiſe was induced to undertake the work by two conſiderations: firſt, that the ſubject of it, which is very important, is acknowledged to be judiciouſly and ſkilfully diſcuſſed, and the ſcience itſelf conſiderably improved; and ſecondly, that the language in which it is written is not generally underſtood in this country: a circumſtance equally to be admired and regretted; ſince it was originally the ſame, and ſtill bears a ſtrong likeneſs to our own, and abounds in ſenſible and ingenious writers.—It might further be added, that ſuch a Tranſlation was the more neceſſary, becauſe the Author was leſs happy in his mode of conveying his ideas than could have been wiſhed; being leſs converſant

with polite literature, than with the military ſcience: ſo that they who moſt admire his knowledge and abilities, do yet complain of the uncouthneſs and obſcurity of his diction.

The Plans have been drawn on an enlarged ſcale, with the addition of three plates; which will illuſtrate the meaning of the Author better than any verbal deſcription. The two former of which, with a note on the 126th paragraph, will be found uſeful to explain a mode of encamping an army in certain, and particularly in confined ſituations.

As it has been already mentioned, that the Author has, in ſome inſtances, been cenſured for expreſſing his thoughts obſcurely; to remedy this inconvenience, ſuch notes are ſubjoined as it is hoped will anſwer that purpoſe. Nor has the liberty been taken of omitting any part of the original, ſome few paſſages excepted, which were plainly repetitions, and as ſuch, unneceſſary; nor even this, without proper notice being taken of it, wherever

ſuch omiſſions were thought expedient. In the firſt and ſecond Parts every paragraph is preſerved faithfully and exactly; but in the third it has been thought proper, for the reaſons given above, to compreſs what was too diffuſe into a narrower compaſs; with a ſtrict attention however to the ſenſe of the Author, and in a manner that it is hoped will be more uſeful and ſatisfactory to the Engliſh reader.

It ſeems hardly neceſſary to make any apology for having omitted the 25th chapter of the third Part of this work, which deſcribes only a method of preparing water-colours, neither very curious nor uſeful; and which indeed, the Author himſelf ſuffered to retain its place in the ſecond edition, contrary to his own judgment, in compliance only with the importunity of ſome of his friends.

As the principles of the following work are founded on experience, and the rules laid down in it contain a great variety of military information, it is to be hoped that they will in ſome meaſure engage the

attention of military men.—The Tranſlator flatters himſelf he may reaſonably be thought not altogether unqualified for the taſk he has undertaken: not only from his long reſidence in Saxony, and the care and aſſiduity with which he ſtudied the German language; but particularly, from the great advantage he enjoyed of being intimately acquainted with the Author, to whom he communicated his deſign, and received from him an explanation of every difficult paſſage, and every information that could poſſibly be deſired.—Theſe he has endeavoured to communicate to the reader in a ſtyle plain and intelligible; elegance and ornament being neither proper to a work of this kind, nor to be expected from the pen of a ſoldier.

It may not be improper to conclude this ſhort Preface with ſome account of the Author, who was equally reſpected for his profeſſional knowledge and readineſs to communicate it, as for his virtues in private life. By an uncommon application to the Military Science in his early youth,

and the advantage of conſiderable abilities, he merited the reputation of an excellent Officer and of a complete Field-Engineer. —This honour he obtained not with impunity: his unwearied attention to his ſtudies having brought on him many and grievous diſorders, which put an untimely end to a life that cannot be ſufficiently valued, or the ſhortneſs of it too much regretted.

DIREC-

DIRECTIONS TO THE BINDER.

THE Plans are to be bound at the end of each Volume; and Plate XIII. terminates Vol. I.

The four Tables of Meaſures are to precede Pl. I.; the Tranſlator's firſt and ſecond Plans are to be bound between Pl. I. and II. and his third Plan between Pl. III. and IV.

The blank paper of the Plates is left for the purpoſe of extending them from the volume, when opened.

THE AUTHOR's PREFACE.

WHEN I publiſhed this treatiſe in the year 1769, *it was the only book of inſtruction for a Field Engineer: excepting thoſe of M. M. de Clairac and Marquard, on Field Fortification. The contents of the firſt and third Parts had never been explained.—Since that time however ſeveral publications have appeared on all theſe branches of the Military Science, but moſt of them are either bad or very moderate copies and compilations. The works of Gaudi, Struenſee, and Zach have undoubted merit, and even in ſome of our Military Journals there are paſſages highly deſerving of commendation.*

By the help of ſuch books, and an application of above eighteen years to this my moſt favourite

favourite ſtudy, my readers might reaſonably have looked for a more enlarged publication; but my health will not now permit me to undergo much fatigue; and, if that had not been the caſe, I ſhould have been unwilling to have made any conſiderable additions; leſt thoſe who are already in poſſeſſion of the work, ſhould have been led to ſuppoſe that the former editions of it were incomplete. Whatever may have been left ſhort, is fully explained in my "ACCOUNT of the moſt remarkable events of the late WAR," &c. *to which I have made references wherever they ſeemed to be expedient.*

The four tables have been carefully reviſed and augmented by M. Liebe of Freyberg.

Young officers, who are deſirous of ſtudying my works with advantage, eſpecially if they are not under the eye of a military inſtructor, may proceed in the following manner:

1*ſt. I recommend it to them to read the Field Engineer till they underſtand it thoroughly, without regarding the references.*

2*dly. I*

2dly. I adviſe them to ſtudy the ſix volumes of the "Account of the War," &c. *with great attention, and to refer to the Field Engineer whenever they may meet with ſimilar paſſages.*

3dly. I adviſe them to read one chapter of the Field Engineer after the other, and to conſider every reference till they are completely maſters of the ſubject before them; and,

Laſtly. To ſtudy good plans of poſitions and encampments, to compare them with the rules that are laid down in theſe works, to take up ground according to my directions, to conſider how troops ought to be poſted, retrenched, or defended in every poſſible ſituation, and in what manner the diſpoſitions muſt be made for the march and manœuvres of an army.

*To acquire a competent knowledge of the attack and defence of places, the laſt volume muſt be ſtudied with the greateſt care, as well as the third part of Struenſee's Military Science *.—By theſe means, they cannot fail*

* This is an excellent German work, of which no Engliſh tranſlation has hitherto appeared.—*Tranſlator.*

of

of being diſtinguiſhed, and of rendering themſelves of eſſential ſervice during a ſiege.*

* As the few remaining lines of the Author's Preface contain nothing more than a complaint againſt the Auſtrians for having printed a piratical edition of his works, I did not think them worthy of inſertion.—*Tranſlator.*

CON-

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CHAP-

ERRATA.

VOL. I. { Page 72, line 19, for *them*, read *him*.
Page 76, line 18, for *or of the*, read *or the*.

VOL. II. Page 137, firſt line, for *it*, read *them*.

THE

THE

FIELD ENGINEER.

PART I.

MARCHES AND CAMPS.

CHAPTER I.

Of the Duties of a Field Engineer.

§ 1. IT would be ſuppoſing that my readers had but very little judgment or military knowledge, were I to dwell too long in pointing out the uſe and importance of this commiſſion.

In the field it is particularly neceſſary that the Engineers ſhould poſſeſs much perſeverance, perſonal courage, and ability: for, if I was not unwilling to give offence, I could prove by repeated inſtances, that the beſt and moſt prudent

meaſures have been totally defeated by their inattention, their hurry, or their ignorance.

§ 2. In France the ſervice of the Field Engineers *(Ingénieurs Geographes)* is entirely different from that of the *Ingénieurs-de-place*, and they are properly under the miniſter of war. Some account of their duty and appointment is to be found in a ſmall work, entitled, *L'Art de lever les plans, par Monſ. Dupain de Monteſſon.*

In Germany they are generally taken from the corps of Engineers, and whenever their numbers are found to be inſufficient, eſpecially during the attack and defence of fortreſſes, more are ſelected from the different regiments, and charged with the duty. — Upon ſuch occaſions, every officer who has even a moderate knowledge of mathematicks, and of the duties of an Engineer, may be certain of recommending himſelf to the particular notice of his General and his Sovereign; becauſe the ſtudy of this eſſential part of the

the military profeſſion is almoſt univerſally neglected.

In the Auſtrian ſervice there is a corps of Field Engineers, conſiſting of Field Officers, Captains, and Firſt Lieutenants, who are immediately under the Quarter-Maſter-General. This corps has no connection with the corps of Engineers, but the officers who compoſe it are charged with the ſame duty; and whenever a detachment is formed, ſome of them are ſent with it.—This arrangement was made in the ſeven-years war by Count Lacy, who was at that time Quarter-Maſter-General; and it was found to be extremely beneficial to the ſervice.

The officers of whom I have hitherto treated, and who I ſhall in future diſtinguiſh by the name of *Engineers*, are of two kinds, viz. thoſe who properly perform the duties of Quarter-Maſters and Engineers, and thoſe who are merely attendant upon Generals and Volunteers of high rank, for the purpoſes of taking up ground, of drawing plans, and of ſerving

them occaſionally as Engineers, when detached from the main army.

§ 3. THE ſeveral duties of a Field Engineer conſiſt principally:

1. In reconnoitering a country or the poſition of the enemy, and in giving in a report *.

2. In directing and leading the march of an army †.

3. In repairing and making roads, in forming bridges, &c.

4. In chooſing, directing, and marking out encampments.

5. In retrenching camps or poſts.

6. In ſurveying and drawing plans of a country.

7. In making the detailed diſpoſitions for the attack or defence of a poſt or retrenchment, according to the general arrangement given by the Commander in Chief of the army.

* Vol. I. pages 20, 21; and Vol. II. ſect. 3.

† Vol. I. pages 20, 21; Vol. II. ſect. 4; and the order of the 28th of November, Vol. V. ſect. 2.

§ 4. AFTER

§ 4. AFTER what has already been ſaid, I think it is ſufficiently evident, that an Engineer can never diſcharge the duty of his profeſſion with credit to himſelf, or with advantage to the ſervice, unleſs he poſſeſſes great ſtrength of conſtitution, great application, great preſence of mind, and undaunted courage. Thoſe therefore who are not bleſſed with ſuch qualities had much better make choice of any other line, than embark in one that is attended with ſo much danger and fatigue.

CHAPTER II.

To reconnoitre a Country or the Poſition of the Enemy, and to give Intelligence to the General.

§ 5. ALL correct maps tend very much to facilitate the difficulty of this employment; eſpecially ſuch as ſhow the ravines, the ſhape of the villages, and the principal windings of the rivers: becauſe they enable the Engineers to draw the

outlines of their ſketches at home, and to go prepared with a general idea of the country that is to be reconnoitered. And if their ſcales are, at the ſame time, ſufficiently enlarged, they can expreſs the nature of the ground, and every material object that may preſent itſelf, with much eaſe and expedition.

§ 6. It is of great conſequence that a reconnoiterer ſhould be provided with a good horſe, and attended by a few dragoons or huſſars; whom he will order to patrole in his front and on each ſide, to give a ſignal and to retreat to him whenever they diſcover an enemy's party.—Too numerous an eſcort is by no means adviſable on ſuch occaſions, becauſe the duſt and glittering of arms may attract the enemy's attention, and tempt him to fire from his batteries: whereas a few diſperſed men will probably paſs unobſerved, or at any rate they need not be apprehenſive of danger as long as they keep out of the reach of muſket or grape-ſhot.

§ 7. He

§ 7. He muſt follow the high ground as much as poſſible, and be particularly cautious of entering ravines or hollow ways, for fear of being ſuddenly attacked or cut off. And whenever ſuch places are unavoidable, he muſt allow one of his men to advance two or three hundred paces, with orders to fire as ſoon as he ſees any of the enemy's troops.—Upon this ſignal, the whole party will make an expeditious retreat; for, in ſuch a ſituation, it would be highly improper to engage with them.

§ 8. He muſt have a guide who is well acquainted with the country, and if ſuch a man can be prevailed upon to attend him voluntarily, much will be gained; if not, he muſt be taken by force. In which caſe, he muſt never be truſted out of ſight, and threatened at the ſame time with immediate death, if he ſhould be either detected in telling a lie, or in miſ-leading the party. Too much ſeverity, however, ought to be avoided, leſt it ſhould

create in him a ſpirit of revenge or deſpair.

In general, money and good uſage will be found to have great influence over the minds of ſuch people, even in an enemy's country: eſpecially if they have not been much accuſtomed to military men.—Or if you can procure a proper perſon, who has a houſe and family in your power, the ſtricteſt confidence may be repoſed in his fidelity.—But this ſubject is more fully explained by the King of Pruſſia, in the 12th Article of his "*Inſtructions to his Ge-*" *nerals*."

§ 9. It is a duty incumbent upon every reconnoiterer to examine the country as he advances, particularly from the heights, to make diligent inquiry into the nature of the ravines, to learn the ſtate of the ground behind every hill that he cannot aſcend, to find out the names of the places to which the different roads lead, and to aſcertain the poſition of all moraſſes, ponds, rivers, fords, and bridges. He muſt alſo know

know whether the bridges are built of ſtone or of wood, if ditches are cut through the villages, if there are churches or walled church-yards in them, if and where there are abbatis or retrenchments, how and where the enemy's advanced poſts are ſituated, &c.

All theſe circumſtances muſt be accurately expreſſed on his ſketch; and, that he may be certain of gaining true intelligence, it will be neceſſary for him to ſuit his converſation to the capacity of his guide, to be patient and circumſtantial in all his inquiries, and frequently to put the ſame queſtions to him in different words.

§ 10. WHENEVER he meets with a hollow way, a ravine through which a road paſſes, or a village (eſpecially if it is ſituated in a ravine) he muſt ſee whether or not it will be poſſible for an army to march round them. For in ſuch places, troops are always ſubject to delay, and the more ſo, when attended by baggage-waggons or artillery.—This information will be of the greateſt

greateſt importance: therefore, if he has not examined the ground himſelf, it would be much better that he ſhould make no mention of it, than deliver an incorrect report; for which he would afterwards become reſponſible.

§ 11. He muſt meaſure the depth and breadth of every ford; he muſt obſerve whether the rivers are rapid or otherwiſe, if there is a probability of their being eaſily overflowed, and if there are trees or houſes near them with which bridges might be expeditiouſly formed; and laſtly, he muſt deſcribe the height and nature of the banks on each ſide. From theſe circumſtances, the General will be able to judge if infantry can paſs without danger, and how they ought to be formed for that purpoſe.

Whenever he finds a bridge, he muſt alſo deſcribe its length and breadth, the materials of which it is built, and the probability of its being ſtrong enough to bear loaded waggons and artillery.

§ 12. It

§ 12. IT frequently happens that there are two villages in a country, which, in the corrupted language of the peaſants, have almoſt the ſame names: therefore, to avoid the ſerious conſequences of a miſtake, the name of the neareſt town, or of a well-known place, ought, in ſuch caſes, to be annexed to each by way of diſtinction.

In the 535th year after the building of Rome, Hannibal was thrown into the greateſt embarraſſment by an error of this kind. He had directed his guide to lead him into the diſtrict of Caſſina, that he might occupy the only road of communication between the Romans and their allies: but the man, ſuppoſing he meant Caſſilin, conducted him through Alliſia, Callatia, and Cales, to the plains of Stella, before he was aware of the miſtake.

§ 13. WHENEVER the Commander in Chief of an army is determined to make a general attack, he muſt have an accurate deſcription of the country, and particularly

larly of all the defiles, roads, hollow ways, fords, and bridges that lie between him and the enemy, before he can make the neceſſary diſpoſitions for the march of the columns.—In ſuch a caſe, as many Engineers as can be ſpared muſt be immediately ſent out, with orders to reconnoitre and draw ſketches of the ground that is occupied by the enemy. This buſineſs muſt be completed in the courſe of one day; and, as it cannot be carried on with ſecrecy, they muſt ride through the outpoſts, and advance as near as poſſible to the encampment.—To ſome, ſuch an undertaking may bear the appearance of impoſſibility, but I can aſſure them from my own experience, that it is by no means attended with difficulty: for, in the firſt place, every poſſible precaution is taken to enſure its ſucceſs; and ſecondly, ſo many officers are uſually employed, that there is but a ſmall ſhare of labour allotted to each individual.

§ 14. As

§ 14. As ſoon as the Engineers have received orders for ſuch an expedition they muſt aſſemble together, draw a general plan of the country from a map, divide the ground into as many ſhares as its nature or the ſituation of the enemy may require, and agree with each other upon the method of joining their reſpective ſketches. When they are in the field, they will work entirely by the eye; becauſe it would neither be poſſible for them to meaſure the ground with accuracy, nor to give up the time that would be requiſite to ſuch a purpoſe.

Every Engineer muſt be attended by a guide on horſeback, who muſt be conſtantly watched by a careful dragoon or huſſar, leſt he ſhould make his eſcape.

§ 15. As this method of reconnoitering is frequently attended with ſkirmiſhes, and the neceſſity of repelling the enemy's out-poſts; thoſe on our ſide ought to be augmented before day-break: in order that they may have driven them back before

fore the Engineers begin their work. At the ſame time it is to be remembered, that too much engagement, or too rapid a purſuit, would be equally imprudent.—If the enemy can be made to retire by degrees the end is gained; and, for that reaſon, I would ſtrongly recommend the uſe of a few field pieces.—Commanding officers ſometimes refuſe their cannon on ſuch occaſions, leſt they ſhould fall into the hands of the enemy: but, with ſubmiſſion to their ſuperior judgment, I muſt beg leave to obſerve, that the loſs of two or three guns can never be an object of conſideration, provided the undertaking is properly executed.

§ 16. EACH Engineer muſt have an eſcort of ten or twelve light-horſe, and he will order three of the braveſt of them to remain near him; otherwiſe an enemy's huſſar may come unexpectedly upon him, and cut him down while he is engaged in drawing.—The remainder muſt be ſent out as patroles.

§ 17. IF

§ 17. If the enemy has intrenched the villages in his front, or defended himſelf by abbatis, the Engineers muſt not advance beyond thoſe poſts: for, an attempt at taking them would engage the troops too much, and coſt the lives of many brave men to no purpoſe.—It is ſufficient that they ſhould be able to ſee their ſituation, the approaches to them, and their batteries.

§ 18. If an Engineer ſhould be killed, his eſcort muſt give immediate intelligence to the next; who will then become charged with the additional duty of his unfortunate comrade.

§ 19. That intelligence which a General gains by this method of reconnoitering is undoubtedly of uſe, and it would be more frequently practiſed, if it could be done without the loſs of men, or without informing the enemy that an attack is intended.—But whenever it is determined that he is at any rate to be diſlodged, ſuch

means are adviſable, provided the attack is made before he can have had time to change or ſtrengthen his poſition;—for that is a rule which muſt be invariably adhered to.

§ 20. WHENEVER an Engineer is employed in either of the methods of reconnoitering and taking up ground, which I have now deſcribed; he muſt neither diſmount his horſe, nor go into a houſe upon any pretence whatever, while he is beyond the out-poſts of his own army; for many have been taken priſoners through ſuch imprudence.—When he returns he will re-examine his ſketch and his guide, and if he can find any people who are well acquainted with the country, he ought alſo to queſtion them with much attention, before he completes his plan for the inſpection of the General.

§ 21. IF an enemy's corps is poſted five, ten, or perhaps fifteen miles from us, and the General wiſhes to know its exact diſ-

tance, which cannot be meaſured; an Engineer muſt be upon the watch about ſunſet, and if he can ſee the fire of the evening gun and hear the report, it may be eaſily aſcertained.—The Academy of Arts and Sciences at Paris have proved, by repeated trials upon a ſpace of 14,636 toiſes, that ſound travels, in clear and in rainy weather, by day, and by night, at the rate of 173 toiſes in a ſecond; and that a ſtrong ſide-wind does not affect its progreſs. This being admitted, the Engineer will obſerve the flaſh or ſmoke, and count the number of ſeconds that elapſe before he hears the report. Conſequently, if he multiplies them by 173, the diſtance will be found. If, however, the wind and ſound are either in the ſame, or in contrary directions, its courſe will be conſiderably haſtened or retarded: but, even in that caſe, a juſt calculation may be made. For, if he knows the exact diſtance of a place on the ſame line, he can order a cannon or rocket to be fired from thence; and if he obſerves the number of ſeconds between the

flaſh and the report, (§ 26.) he will have a new ſcale which will give him the diſtance required. And, that he may know how much the wind has haſtened or retarded the courſe of the ſound, he muſt either ſubſtract 173 toiſes from the number found, or add them to it *.

If a corps is upon the march to join our army, or to relieve a beſieged town, its diſtance may be learned by the ſame means: for, if it is not too far off, intelligence may be conveyed to us, provided

* I will ſuppoſe for inſtance, that a cannon is fired at the diſtance of 5,318 Pariſian feet from me, and that I hear the report in 3″.—Therefore 5,318 : 3 = 1772 $\frac{2}{3}$; thus the ſound has travelled 1772 $\frac{2}{3}$ Pariſian feet in each ſecond, inſtead of 173 toiſes or 1,038 Pariſian feet: which would have been its courſe had there been either a ſide-wind or none at all. Hence 1772 — 1,038 = 734 $\frac{2}{3}$, the increaſed rate per″: conſequently 173 *toiſes or* 1,038 *feet* are here ſubſtracted from the number found. But, if I ſuppoſe the ſound to have reached me in 7″, inſtead of 3″; I find, by the ſame means, that it has only travelled at the rate of 759 $\frac{5}{7}$ Pariſian feet: conſequently 1,038 — 759 $\frac{5}{7}$ = 278 $\frac{2}{7}$, or the delay it has experienced in each ſecond. In this caſe *the number found* is ſubſtracted from 173 toiſes or 1,038 Pariſian feet.—I have added this example with a view of giving a fuller explanation of the author's meaning; and my calculations are made in *Pariſian* feet, becauſe they are more immediately connected with the original work.—*Tranſlator.*

the wind is not contrary, by a few two-pound or four-pound rockets; which will always anſwer this purpoſe better than cannon.—It muſt be remembered, however, that the ſeconds are only to be counted from the time of their burſting in the air, and not while they are on their aſcent.

CHAPTER III.

To reconnoitre an Enemy's Fortreſs.

§ 22. WHEN a fortreſs is to be attacked with advantage, and with a view of ſaving men, time, and expence, a good plan of the place and its outworks will be extremely neceſſary: otherwiſe, the principal attack may be directed againſt the ſtrongeſt, and not againſt the weakeſt part.

At the ſiege of Colberg in 1758, the Ruſſians carried on their approaches againſt the horn-work near the gate of Munde, which was ſo high that the ram-

ceſſarily tempted to fire upon them from the batteries.

At the before-mentioned ſiege of Colberg, the Quarter-Maſter-General Stoffeln was in great danger of loſing his life by this piece of imprudence. His red cloak ſerved as a mark for one of the enemy's bombardiers, who immediately fired two ſhot at him; and one of them came ſo near the place where he ſtood, that his horſe reared up, and fell upon him. By this accident he was obliged to walk a conſiderable diſtance along the ſide of a bank, where he was totally expoſed to the fire from the batteries.

At preſent I ſhall not ſay more upon this ſubject; becauſe part of it has already been mentioned in the preceding chapter, and the remainder will be more minutely explained when I treat of the methods of taking up ground.

§ 25. WHEN a fortreſs is blockaded, and the trenches opened, the Engineers muſt reconnoitre on foot.

Cannon

Cannon are ſeldom fired at a ſingle man, unleſs he is known to be an Engineer, or a perſon employed either in reconnoitering or in drawing a plan of the country round the place. And indeed, if a few ſhot were to be fired, it would probably be to no purpoſe; becauſe, as it is well known that the artillery muſt take their aim before him at ſome object upon the line on which he is going, and that they muſt fire when they ſuppoſe him to be at a proper diſtance from the ſpot; I can aſſert, from my own experience, that an obſervance of the following rules will afford him effectual ſecurity.

1. He muſt never remain long in the ſame place.

2. He muſt neither continue the ſame pace nor in the ſame track, whether on foot or on horſeback.

3. A watchful eye muſt be kept upon the enemy's batteries; but as that cannot be done by one perſon, whoſe attention will be taken up with other objects, I would recommend that two officers ſhould

go out at the ſame time; that they ſhould always remain about eight paces aſunder; and, that while one is employed in reconnoitering or in drawing, the other ſhould obſerve the batteries and call to his companion the inſtant a gun is fired.

It will not be neceſſary for me to make any mention of ſmall arms; for, when a reconnoiterer is within their reach, he muſt rely entirely upon chance.

§ 26. As light is known to travel at the rate of 38,000 German miles in a ſecond *, it is evident that I muſt ſee the flaſh of a cannon as ſoon as it is fired, however diſtant I may be from it: but after I have ſeen the flaſh I can count 6, 12, 16, or perhaps more, before the ball ſtrikes the ground where I am ſtanding.

An Engineer who is intent upon drawing his plan near the batteries, may poſſibly ſuppoſe he will have time to avoid the ſhot after he has heard the report;

* 38,000 German miles are = 184,966 $\frac{8}{10}$ Engliſh miles. *Tranſlator.*

but

but in this he will be deceived, for the report and the ball generally come together, (§ 21.)—I ſhall therefore point out the methods by which the danger may be avoided.

If he is advancing on horſeback, he muſt ſtop and draw back his horſe as ſoon as he obſerves the flaſh or the ſmoke, for the reaſons which I have given in the laſt paragraph: but if he has been any time upon the ſame place, he muſt immediately gallop forward.—When he is reconnoitering on foot, the methods are ſtill more eaſy. For, in that caſe, he can either run forward a few paces, or, by throwing himſelf upon the ground, allow the ball to paſs over him. This may be done with great ſafety, whether the ſhot is fired point blank, or *en ricochet* *.

§ 27. If there are heights or high buildings near the fortreſs, the Engineers muſt endeavour to reconnoitre from thence,

* A cannon-ſhot never flies quicker than at the rate of 600 feet per ″.—Vide Semler's Aſtrognoſia nova.—*Author.*

and,

and, when the ſuburbs of the town are occupied by our troops, the tops of the houſes or a church ſteeple will be ſtill more advantageous *. In ſuch a ſituation they need not be diſturbed if a cannon-ſhot ſhould accidentally come near them; nor will they have any danger to apprehend except from the enemy's rifle-men.

§ 28. IN the year 1656, the Chevalier de Ville publiſhed a work at Paris, under the title of "*Charge des Gouverneurs*:" from which I ſhall quote a paſſage that treats of the ſubject of this chapter.

"When a fortreſs is to be reconnoitered "in the night, either a very clear or a very "dark one are equally diſadvantageous. "For, in the firſt caſe, the reconnoiterer "will be too eaſily diſcovered, and in the "ſecond, he cannot make his neceſſary "obſervations.— As ſoon as he arrives "within a mile of the place, he muſt leave "his eſcort in a wood, or wherever it may "be moſt convenient; and having detach-

* *Vol. II. ſect. 4. pages* 378, 379, *&c.*

"ed

" ed a few vedettes, he will advance with
" twenty-five or thirty men as near as
" poſſible to the outworks, without run-
" ning the riſk of being heard. He muſt
" then order one or two of the braveſt and
" moſt active to diſmount, and lay aſide
" all parts of their cloathing, arms, and
" accoutrements, that are either heavy or
" likely to attract the notice of the ſenti-
" nels. If each man takes his ſword and
" a piſtol, he will be ſufficiently armed for
" ſuch an enterpriſe.—Thus prepared, the
" reconnoiterer and his two men will get
" as near the covert-way as they can, and
" remain perfectly quiet till the rounds
" are paſſed; that they may gain intelli-
" gence of the number of ſentinels and
" their poſts: for proper attention to this
" particular will enable them to keep clear
" of them afterwards.—They will then
" go along the covert-way and examine
" the ditch; and, if there are neither
" guards nor ſentinels in the outworks,
" they muſt not heſitate to enter them.—

" In

" In this manner they will proceed round " the fortreſs."

An officer who has never been charged with ſuch employment, will be apt to ſuppoſe that it is attended with the moſt imminent danger; but he may ſafely reſt aſſured of the contrary. And, in ſupport of my aſſertion, I will even imagine him to be diſcovered by a ſentinel, who fires off his piece and calls to the next poſt. I ſay, even in this caſe, he can eaſily place himſelf in ſecurity, and he may conſider the uproar which this event will have occaſioned in the town, rather as a ſubject of amuſement than of apprehenſion: becauſe they neither can, nor dare, attempt to take him. The guards are not intruſted with the keys of the gates, and at ſuch an hour the Governor will not allow them to be opened till the garriſon is aſſembled. It is probable, however, that ſome men may be ſent out through the ſecret doors, and that fire-balls may be thrown for the purpoſe of making a light near the place; but,

but, before that can be done, he will have ſufficient time to make his eſcape.

I ſhould not have ſaid ſo much upon this ſubject, unleſs I had thought it neceſſary for the encouragement of thoſe officers, who might not have been aware of the worſt conſequences of ſuch an undertaking. And, before I conclude, I will beg leave to recommend the employment of quick and ſenſible men, who are capable of judging diſtances with accuracy, and who underſtand the rules of fortification, as well as the effects of light and ſhade: otherwiſe they will not be able to form a juſt opinion of the poſition, ſtrength, or weakneſs of the ſeveral works.

CHAPTER IV.

To order and conduct the March of an Army, to repair Roads, form Bridges, &c.

§ 29. IT reſults from what has already been ſaid, that an exact knowledge of a country is of the greateſt im-

portance

portance in military operations. Here it is almoſt indiſpenſably neceſſary.

We have found by experience, that the march of an army muſt be made in columns; and, that it will be more or leſs expeditious and eaſy in proportion to their number: provided they do not croſs each other. For that can never be done without ſome delay, and frequently not without diſorder and confuſion.

When two columns meet, the fault is generally to be attributed to the inattention of the officer who has planned the march: but, as it may be ſometimes unavoidable, I ſhall explain the methods by which the inconveniences are in great meaſure to be removed.

We will ſuppoſe, for inſtance, that the corps B in Pl. I. fig. I. has covered the left of A, and that, according to the new order of battle, it is under the neceſſity of paſſing over to the right, and of joining the main army preciſely at the ſame time.—In that caſe, the battalion which arrives firſt at the interſection of the roads, muſt advance

advance as quick as poſſible, and both columns will immediately halt; then the leading battalion of the other column will march forward: and thus they will advance alternately till the whole have croſſed each other. If the head of either of the columns ſhould meet with a defile or obſtruction before this is completed, thoſe battalions which have not reached the place, will, if poſſible, march out of the road and form themſelves as deſcribed at *a*.—By theſe means all confuſion will be avoided, and the heads of the columns will remain parallel to each other. A ſtaff-officer of rank ought alſo to be poſted at the interſection of the roads, for the purpoſe of enforcing regularity and obedience to the orders *.

It may ſometimes happen, that two roads are joined together, and ſeparated again at the end of a few paces. In that

* This is a very old idea: for we find that Cyrus poſted two officers at a place where his companies were obliged to file off, to prevent irregularity and confuſion.—*Vide Xenophon de Cyri Expeditione. Book II. Chap. V.—Author.*

caſe,

caſe, the columns can march by the ſide of each other, provided there is ſufficient room, as ſhown by C and D. Or, if the nature of the country will admit of it, they can leave the road, and return to it at the moſt convenient place. For which purpoſe, conſpicuous marks ſhould be ſet up, as at *cc*.—Thus the order of battle will not be changed: the column C will remain upon the left, and the column D upon the right.

§ 30. Two columns of the French army had once the good fortune to croſs each other upon the march, without the leaſt delay or inconvenience, by means of the following expedient: the dryneſs of the ſeaſon enabled one of them to march along the bed of a river, while the other was paſſing over the bridge.—This circumſtance has led me to ſuppoſe, that a bridge might be occaſionally thrown over a hollow way with equal utility. And if the road ſhould not be of ſufficient depth to allow the loaded waggons a free paſſage, it

it would only be neceſſary that a little earth ſhould be taken from the bottom, and thrown upon that part of the banks where the bridge is intended to be made.

§ 31. IN general the number of columns will be regulated by the nature of the country and the roads. The beſt and ſhorteſt roads are given to the heavy artillery and baggage-waggons, and the longeſt to the cavalry: except when there may be particular reaſons to the contrary.

§ 32. WHEN the enemy is to be attacked, the Commander in Chief of the army will regulate the orders of march and of battle: therefore, it is not my buſineſs to treat of thoſe ſubjects.

§ 33. IF there are no particular reaſons for obliging the columns to follow the roads, they will gain time by marching croſs the country: becauſe they can then extend their front, and proceed in a more direct line to the place of their deſtination.

Hollow ways, ravines, and villages, muſt be carefully avoided; eſpecially when an enemy is near. Becauſe, in ſuch ſituations, the commanding officer will be under the neceſſity of contracting his front, and of courſe the march will be retarded. In the next place, becauſe diſorder will be unavoidable if he ſhould then be attacked. And laſtly, becauſe every village will give a favourable opportunity for deſertion *.

§ 34. WHEN an enemy is near, the march muſt either be covered by a corps of light troops, or the whole army muſt march in order of battle; the encampment cannot be marked out till the troops arrive upon the ground; and the place will be frequently choſen by accident or neceſſity.

§ 35. IF the roads, defiles, &c. have not been previouſly repaired, the Engineers

* See the march on the 12th of December, 1761, Vol. V. ſect. 2.

muſt

muſt go forward with the pioneers ſome hours, or, if poſſible, the day before the march of the army; that they may be put into as good a ſtate as time and circumſtances will allow. Or, if there ſhould be no pioneers, they muſt take ſome carpenters with them, and a ſufficient number of peaſants or ſoldiers, who will receive the neceſſary utenſils from the park of artillery.

§ 36. BEFORE the Engineers and their parties ſet out, they muſt make themſelves acquainted with the height and breadth of the loaded baggage-waggons and artillery, as well as the exact length of their axle-trees. For, if the columns are obliged to march through woods, all the branches or trees that are likely to be in their way muſt be cut down.—They muſt widen all deep and narrow ruts, and, wherever it is neceſſary, they muſt ſlope off the ſides of the hollow ways, except when they happen to be very hard or rocky. In that caſe they may raiſe their

bottoms with ſtones, rubbiſh, or the ſtems of young trees laid croſs-wiſe.

§ 37. EVERY hole muſt be filled up with ſtones and gravel; or, if a ſufficient quantity cannot be eaſily procured, ſtrong faſcines will anſwer the ſame purpoſe, provided they are laid acroſs them, and ſufficiently covered with earth.

When an army is thus circumſtanced, this is the moſt expeditious, and indeed the only method of putting roads into temporary repair; and as ſuch I mean it to be underſtood: for, if more durable repairs or new roads are neceſſary, other rules are to be attended to, which I ſhall explain in the ſixth chapter: with rules for the formation of bridges.

§ 38. IF there are ditches and moraſſes that have not been repaired, the artillery will be ſubjected to much delay, unleſs they are provided with ſome expedient, by which they may be enabled to paſs them in ſecurity. Therefore, before they

begin their march, I would recommend that a ſufficient number of green trunks of trees ſhould be collected, that a groove ſhould be cut along the centre of each of them, and that their ends ſhould be ſloped off, for the purpoſe of being conveniently joined together. If the park is large, as many of them ſhould be taken as will load two or three waggons; and whenever the artillery may have occaſion to croſs a ditch, a ſwamp, or an old wooden bridge, two rows muſt be placed ſo as to allow the wheels to paſs along the grooves. —Such an expedient will always be of great ſervice, eſpecially when a forced march is to be made.—I recommend green trunks of trees for ſuch a purpoſe, in preference to dry pieces of timber; becauſe they can be more expeditiouſly prepared, and are to be met with in all places.

§ 39. INSTEAD of truſting too readily to a ford, which may have been deſtroyed either by a late flood or the enemy, it is better that one or two bridges ſhould be

formed: becauſe, if it is afterwards found to be ſafe, one part of the column can paſs through the river, while the other is marching over them.—Conſequently much time will be gained.

§ 40. WHENEVER a column is unexpectedly obliged to croſs a brook or river, (provided it is not too broad) the neareſt trees will enable you to make a bridge. And a column of infantry will only ſtand in need of a few rafters or planks, which are to be found in every village. It muſt be remembered, however, that thoſe planks are to be laid double, and covered with turf: otherwiſe their elaſticity and ſmoothneſs will be dangerous to the troops. —But as it may ſometimes happen, that there is no village within a conſiderable diſtance of the place, I ſhall proceed to explain the beſt methods of uſing trees on ſuch occaſions.

Two, three, or four trunks of trees muſt be laid over the water at equal diſtances, and fixed with pegs to the ground; others

others of about three inches in diameter are then placed croſs them, and cloſe to each other, the firſt and laſt being alſo faſtened in the ſame manner; and, if it ſhould be neceſſary, they may be bound together by means of a few laths.—Laſtly, the whole muſt be covered with turf.

If circumſtances will admit of more bridges than one, the paſſage will of courſe be completed with the greater eaſe and expedition.

§ 41. ALL bridges ought to be broad enough to allow the platoons to march over them without filing off; and it muſt be conſidered as a general rule, that the regularity of the march will be in great meaſure proportionate to their breadth.

§ 42. WHEN a bridge is to be made for baggage-waggons and artillery, the principal beams or trunks muſt be very ſtrong; and at leaſt four of them will be neceſſary, even if it ſhould not be above ſix or eight feet in breadth. As ſoon as they

are properly placed at equal diſtances, rafters or planks muſt be laid croſs them, and fixed to the ground as before explained: but with this additional caution, that the centre of the upper planks muſt cover the joints of thoſe below; and if there is reaſon to apprehend that the preſſure of the wheels may be too great, they muſt have their uſual covering of earth, and a ſufficient quantity of ſtraw under it. The ſame precaution may be taken before they truſt to old or weak wooden bridges; becauſe the elaſticity of the ſtraw will add as much to their ſecurity, as the trunks of trees which I have mentioned in the thirty-eighth paragraph.

In the year 1707, when Charles XII. found that the Weiſſel (Viſtula) near Warſaw was not entirely frozen up, he ordered wet ſtraw to be thrown upon it; which, in the courſe of a few hours, became ſo hard, that his whole army, baggage, and artillery marched over it *.

Before I conclude this paragraph, I have

* Vide Nordberg's Hiſtory of Charles XII.—*Author.*

only

only to obſerve, that, in a caſe of neceſſity, the Engineers muſt never heſitate to take beams or other materials from the neareſt houſes, or wherever it may be the moſt convenient.

§ 43. WHEN the beams are either too ſhort for the breadth of the river, or of ſuch length that they bend in the centre; the Engineers muſt collect as many boats as may be wanted, and by faſtening them together they can either lengthen or ſupport their bridges.

If there are no anchors, they muſt fill large baſkets with ſtones till they are of a ſufficient weight to reſiſt the ſtream, and tie one at each end of every boat;—or, pyramidical gabions may be eaſily made for the occaſion, and if encloſed at one end, they can be uſed in the ſame manner. By theſe means a bridge may be thrown over a river of conſiderable breadth without the help of pontoons.

§ 44. IN

§ 44. In the camp near Zeithayn, M. Pappeti, who was then a Captain of Pontoneers in the Saxon ſervice, made a bridge of caſks, which bore a very conſiderable weight: and, as ſuch a bridge would be of much uſe to an army, in caſe the pontoons ſhould have been loſt, and eaſily formed, on account of the abundance of the neceſſary materials in every town or village; I ſhall proceed to explain its conſtruction.

In the firſt place, all the holes were ſtopped up with great care, that no water might penetrate. A cord was then tied to the middle of a piece of wood, which was dropped through the bung-hole, and the bung was driven in again, *Pl.* 1. *fig.* 2; part of a rafter *d e* was laid croſs each pair of caſks, faſtened with the cords *x x*, and ſawn off at both ends that it might not project beyond the ſides of the barrels. When they were thus prepared, as many pairs of them as were thought neceſſary for the breadth of the bridge were placed lengthwiſe,

lengthwiſe, with a ſingle caſk at each end; and ſtronger rafters *a b* were bound upon thoſe deſcribed by *d e*.—Upon theſe, the beams *f* were laid, as well as a covering of planks.

Hence it appears, that the conſtruction of this kind of bridge differs but little from that of a bridge of boats: except that the rows of caſks are nearer to each other than pontoons, leſt they ſhould be preſſed into the water.—Conſequently the number of caſks muſt be in proportion to the weight they will have occaſion to bear.

§ 45. In Herodianus's Roman Hiſtory, we find the following account of a bridge of caſks:

"When Maximus had ſet himſelf up as "Emperor, and was haſtening with his "army into Italy to take poſſeſſion of "Rome, he met with a river near Aqui-"leia, which was too deep to be paſſed "without a bridge, and he could neither "procure wood nor boats. However, a "conſiderable

"conſiderable number of empty wine caſks "were found near the place, and the car- "penters gave it as their opinion, that, as "they were hollow, they might be uſed "inſtead of boats: and, that if they were "ſufficiently loaded with gravel, ſtrength- "ened with iron-hoops and pliant branches "of trees, and made faſt to each other, "there would be little reaſon to ſuppoſe "the ſtream could carry them away."— Maximus embraced the idea with eagerneſs, and his army marched over in ſafety.

In General Munich's campaign in the Ukraine, in 1736, each company was obliged to take a large barrel of water, on account of its extreme ſcarcity in the deſerts.—And he alſo gave orders that every regiment ſhould carry with it eight or ten thick planks, that the neceſſary materials for a light bridge might be always at hand. His pontoons were only uſed for the baggage and cavalry *.

* Vide General Manſtein's Account of Ruſſia.—*Author.*

§ 46. If

§ 46. If the water is not too deep, the two following methods of forming a bridge are by far the moſt expeditious.

Firſt, in proportion to the breadth of the river and the weight of the artillery, two, three, or more waggons may be placed from ſix to twelve feet aſunder, and covered with beams and planks as deſcribed in Pl. 1. fig. 3.—Or, if it ſhould be more convenient, the ſtrong wooden treſtles which are uſed by carpenters, may be taken inſtead of waggons.—In either caſe, the beams muſt be faſtened together with cramp-irons and ropes.

The *ſecond* method is with gabions, caſks, or treſtles.—If gabions are uſed, they muſt be made at leaſt ſix feet in length by four in diameter, and as ſtrong as poſſible; a ſufficient weight of large ſtones muſt be tied to them, that they may be ſunk to the bottom of the river (fig. 5. *x x*); and the ſpaces on each ſide muſt be filled up with dung, turf, or faſcines: the gabions themſelves remaining empty, that

that the ſtream may have a free paſſage through them.—The beams and planks muſt be laid as uſual.

If there ſhould be any reaſon to apprehend that the artillery may be too heavy, ſmaller gabions may alſo be made; and, by putting them within the others, you will give them an additional ſtrength, that will reſiſt a much greater preſſure.

Caſks will alſo anſwer the purpoſe of gabions; and, if they are covered with faſcines almoſt as high as the ſurface of the water, it will only be neceſſary to lay clods of earth upon them. In this caſe, therefore, the uſe of beams and planks will be avoided.

The method of making a bridge with treſtles is explained in *fig.* 4.

Whenever an unuſual degree of ſtrength is requiſite, a covering of ſtraw may be added (§ 42.); and before I conclude this paragraph, I will obſerve once for all, that neither the baggage-waggons nor artillery muſt be ſuffered, on any account, to halt

halt upon ſuch bridges; but, on the contrary, that they muſt paſs over them with the greateſt expedition *.

§ 47. WHEN the banks of a dike or rivulet are high, a bridge may be thrown over it by means of a pair of ſtrong folding doors; provided they are placed in ſuch a manner that the wings reſt againſt them, and join each other at the bottom of the water, as ſhown in *Pl.* 1. + *fig. a.* Or it may be formed with beams, extending from the top of one bank to the bottom of the other, as in the + *fig. b.*—This method is preferable to the former: firſt, becauſe the bridge will be ſtronger; and ſecondly, becauſe the ſtream will have a free paſſage under the centre as well as on each ſide: whereas in *fig. a*, it can only paſs under the ſides. The upper part

* I ſuppoſe the author means that the horſes ſhould be allowed to walk ſteadily and without ſtopping: for, if they were to proceed with great expedition, the bridges would be materially injured, if not altogether deſtroyed, by the firſt carriages that paſſed over them.—*Tranſlator.*

muſt

muſt be formed with faſcines or earth, as explained in the two plans.

§ 48. If the banks are too high, they ought to be ſloped off near the bridges, and the earth carefully thrown up on each ſide; that the baggage-waggons and artillery may march over with eaſe and ſafety.

CHAPTER V.

Of the Paſſage of Rivers.

§ 49. As this is now become one of the moſt difficult and important undertakings in the march of an army, on account of the general and increaſed uſe of artillery; it is incumbent upon every Engineer to be careful and circumſpect in this part of his duty, and in procuring all the intelligence in his power from the people of the country: eſpecially of thoſe places which he cannot reconnoitre himſelf.

The

The chief objects of his examination will be:

1. The depth and rapidity of the river.

2. Whether it will be eaſily overflowed in wet weather or not.

3. If and how it winds.

4. The height and nature of the banks.

5. The ſize, ſituation, and appearance of every iſland.

6. The fords and ſhallow places.

7. If the bottom is muddy or gravelly, and if there are large ſtones or quickſands.

8. The breadth of the river; or rather, the diſtance between its banks.

9. If there are heights near the banks, and at what diſtance; and if the oppoſite ſhore is within cannon-ſhot of them.

10. How and with what front the infantry muſt be formed for the paſſage.

11. If there are foreſts in the neighbourhood, &c.

§ 50. WHEN a river is neither very deep nor rapid, it may be paſſed without bridges; provided it ſhould appear, upon

careful examination, that the fords have not been deſtroyed by the enemy, and that their bottoms are ſufficiently hard: for I have known inſtances of their having been found ſo ſoft, that the troops in the rear of the columns have been unable to march over, particularly when they were headed by cavalry.

Alexander paſſed the Granicus in ſight of Memnon;—but, inſtead of marching in column, and in a ſtraight line, he advanced one of his wings and went obliquely down the ſtream, that he might preſent as large a front as poſſible to the enemy, and be in readineſs to form his army in order of battle when he reached the ſhore.

The Chevalier Folard ſays, in his Commentaries on Polybius *, that, in marching through rivers, the ranks ought to be ſomewhat opened, for the purpoſe of letting the ſtream paſs with as little interruption as poſſible, and that cavalry ſhould be poſted above the infantry: becauſe, by

* Book IV. Chap. XIV.—*Author.*

breaking its force, the paſſage will become leſs difficult and dangerous.

When Cæſar paſſed the Segra, he made ditches of ten feet in breadth to conduct part of the water aſide: and, during the paſſage of his army, he poſted cavalry above and below the place where the infantry marched; that the horſes above might break its rapidity, and that the men below might ſave all thoſe who were in danger of being drowned.

During Marſhal Belleiſle's paſſage of the Var in 1747, a row of countrymen were poſted in the water, to ſave the ſoldiers who were carried down by the ſtream. And, in a ſimilar manner, the Prince of Orange croſſed the Maeſe in the year 1586.

Charles XII. marched through the river or canal near Holowitz, in the face of the Ruſſians, notwithſtanding a great part of his army was obliged to ſwim *.

§ 51. In general, it was more the cuſtom among the ancients to paſs large rivers

* Vol. VI. Chap. XXII.

without bridges of boats, than it is in our days; of which I will produce a few ſingular inſtances.

Xenophon ſays, in his retreat of the 10,000 Greeks *; that, when they were hemmed in on one ſide by inacceſſible mountains, and on the other by a river, whoſe bottom was ſcarce to be reached by their ſpears, the officers aſſembled for the purpoſe of conſidering how they might extricate themſelves from ſo dangerous a ſituation. At this meeting a Rhode came forward, and offered to carry the army over the river, if they would give him what was neceſſary, and a talent (equal to about 1,000 dollars †) for his trouble.—Upon being aſked what he meant; "he told "them he only wanted 2,000 hides, which "he would ſow together by pairs, that the "water ſhould not penetrate, and then "make them completely faſt with the reins "belonging to the packſaddles; that he

* See the third Chapter of the third Book.—*Author.*

† A thouſand German dollars are worth between 165 and 170 pounds ſterling.—*Tranſlator.*

"would

" would tie large ſtones to them for the " purpoſe of keeping them in their proper " places; that he would cover them with " earth, for the ſecurity of the ſoldiers in " marching; and that, as each ſkin could " bear the weight of two men, he would " be able to tranſport 4,000 at the ſame " time." The invention was thought to be ingenious; and as the 2,000 hides might have been eaſily taken from the beaſts of burthen and cattle that were then in the camp, it would have been put to the trial, if the poſition of the enemy's cavalry on the oppoſite ſide of the river, had not rendered it impracticable.

We alſo find in Arianus's account of the campaigns of Alexander, that, upon his arrival at the Oxus, he ordered the ſkins of which the ſoldiers tents were made to be filled with dry branches of trees; and, when ſowed together, that the water ſhould not enter them, to be laid croſs the river inſtead of a bridge.—This contrivance anſwered his purpoſe ſo well, that the whole army paſſed in the courſe

of five days: notwithſtanding the water was very deep, very rapid, and ſix ſtadia * in breadth.—He alſo made uſe of the ſame expedient, when he croſſed the Tanais † in ſight of the Scythæ.

§ 52. ARIANUS has alſo given us ſo good and ſo clear an account of the bridges of boats that were uſed by the ancients, that I ſhall add a literal tranſlation of it ‡.

"The Roman method of forming a "bridge of boats, is perhaps the moſt ex- "peditious.—Their pontoons are firſt "fixed at equal diſtances from each other; "but above the ſpot where the bridge is "to be made, each is attended by a ſmall "boat with one man; who, by rowing "againſt the ſtream, counteracts its rapi- "dity, and guides the pontoon into its "proper place; where it is made faſt by "means of a large pyramidical baſket

* According to our meaſure a *ſtadium* was equal to 625 feet. *Author.*

† Rollin calls this river Taxartes.—*Author.*

‡ See the ſeventh Chapter of the fifth Book.—*Author.*

"filled

" filled with ſtones, and thrown over the " upper end of it. As ſoon as the firſt has " been anchored in this manner, the ſe- " cond is brought down; then the third, " &c.; and the planks are laid over them " as they arrive. Their diſtances from " each other are regulated by the weight " they will have occaſion to carry; and " rails are ſet up on both ſides, which is a " conſiderable addition to the ſtrength " of the bridges, and a ſecurity to the " horſes and beaſts of burthen."

§ 53. WHATEVER relates to the paſſage of troops over a bridge of boats, does not properly belong to this treatiſe; becauſe it is founded on tactics, and of courſe regulated by the Generals and not by the Engineers. But, as I have been deſired by ſome of my friends to introduce the ſubject; I will, in compliance with their wiſhes, give a ſhort explanation of the moſt material parts of it.

An army may either be obliged to paſs a river, (1) in advancing towards an ene-

my, when he is on the oppoſite ſide of it; or (2) in retreating from him.

In both caſes the following circumſtances are to be conſidered.

a. If the river is croſſed in ſight of the enemy.

b. If it is done in a country that is not occupied by the enemy; but into which a forced march may bring him.

c. If both the banks are within the reach of ſmall arms.—Or,

d. If they are only within the fire of cannon-ſhot.

§ 54. *a.* If the enemy's Generals have any idea of their buſineſs, if his train of artillery is ſuperior to our own, and if his troops have even a moderate ſhare of courage, it is almoſt impoſſible that we ſhould be able to paſs a river in his preſence: becauſe he has it completely in his power to deſtroy our pontoons, and to drive our cavalry back into the water. And indeed if the ſuperiority of artillery was on our ſide, ſuch an undertaking muſt ever be extremely

extremely hazardous, and the ſucceſs of it extremely doubtful. Therefore, whenever a paſſage is to be effected under theſe circumſtances, parapets ought to be thrown up in the night for our cannon and infantry (provided the river is not too broad); as ſhown by *a*. *b*. *c*. *d*. and *e*. in Pl. 17. fig. 2. The firſt muſt be occupied by all the heavy cannon and howitzes; and, if ſome of the floating batteries which I have deſcribed in the 290th paragraph, could be placed above and below the bridge, they would be of great ſervice to the undertaking.

§ 55. In this caſe the river muſt be paſſed in the day-time, that the artillery may fire with the greater accuracy and effect, and that all diſorder or irregularity may be avoided.

§ 56. When every thing is ready for the formation of the bridge, and the troops prepared for the paſſage, the heavieſt fire will be made from all the batteries and parapets,

parapets, with a view of ſilencing the enemy's artillery, of clearing the oppoſite bank of his troops, and of compelling him to retreat. — For ſuch a purpoſe howitzes loaded with caſe-ſhot will be extremely ſerviceable.

As ſoon as the enemy's batteries are ſilenced, the bridge muſt be formed with the greateſt expedition; and in the mean time ſome grenadiers, who have voluntarily offered their ſervices, may be ſent in boats with a few field-pieces (§ 290), to aſſiſt the pontoneers, and to keep the enemy at a diſtance. If it ſhould be neceſſary, two of the boats may be tied together and covered with planks, that the troops may be the more elevated.

§ 57. WHEN the bridge is almoſt completed, ſome ſquadrons of light-horſe ſhould be ordered to paſs the river at the moſt convenient places above and below it; provided the banks are neither too high nor too ſteep: becauſe the enemy cannot oppoſe their landing without detaching

taching a body of troops for that purpoſe, and of courſe he will weaken his front. And, on the other hand, if he ſuffers them to form, they will make a vigorous attack upon his flanks, and by driving back all they meet, render the greateſt aſſiſtance to the paſſage of the infantry.—At the ſame time, the boats muſt endeavour to land the volunteers, and the floating batteries will get as near the ſhore as poſſible, and keep up an inceſſant fire.

§ 58. THE infantry muſt march over in one deep column, with as large a front as the bridge will admit of; and the head of this column muſt be compoſed of the beſt and moſt reſolute troops, who will be ordered to reſerve their fire, and to repel the enemy with fixed bayonets as ſoon as they have paſſed the river. When the firſt diviſion is ſufficiently advanced beyond the bridge, the others muſt form up to the right and left with great expedition: but the fire muſt not be begun till ſeveral diviſions are in line, and it muſt then be kept

kept up with regularity; leſt the enemy's cavalry ſhould return to the attack after the ammunition is expended; for in that caſe a total defeat would enſue.—While the leading troops are gaining ground, to make room for thoſe in the rear, they muſt preſerve a ſemicircular form, that both wings may remain cloſe to the bank of the river.

FIRST REMARK.

§ 59. THAT part of a river which forms a curve, is of all others the moſt convenient for ſuch an undertaking; becauſe the batteries can effectually defend the bridge, as well as the paſſage of the troops. *A. b. Pl.* 17. *fig.* 2.

SECOND REMARK.

§ 60. As it is of great conſequence that a conſiderable body of troops ſhould be able to march over the river with expedition, there ought to be more than one bridge,

bridge. Thoſe for the infantry might be made with caſks, boats, or floats of timber: the laſt however are ſometimes dangerous.

§ 61. As ſoon as our firſt troops have gained an advantage, and are likely to maintain their ground, the artillery ought to be brought up; that the enemy may not be able to rally or make a ſecond attack. And, as there will be no time for the formation of a retrenchment, chevaux-de-friſe will be of great uſe in ſecuring them from the attacks of cavalry.—Whenever there are woods, villages, heights, or any other advantageous poſts on the enemy's ſide of the river, they ought to be taken poſſeſſion of without delay.

§ 62. A REGULAR and cloſe engagement ought never to be hazarded till all the troops have marched over: and, although the infantry may be unable to gain as much ground as is requiſite without the uſe

uſe of the bayonet, a rapid purſuit muſt be equally avoided. That part of the buſineſs ought to be left to the cavalry; whoſe attacks muſt be made with great regularity, and conducted in ſuch a manner, that in caſe of a repulſe, they may be able to retreat round the flanks of the infantry. For if they were to be driven back upon them, the whole would fly in confuſion to the bridges, the paſſage would be effectually ſtopped, and of courſe they would be either forced into the water, or cut down by the enemy's cavalry.

Whenever an old bridge is to be repaired, or a new one built, great care muſt be taken that it ſhall be ſtrong enough to bear the weight of the troops.—The want of proper attention to this particular had nearly coſt Charles XII. his life when he paſſed the Viſtula near Warſaw *.

§ 63. If the cavalry can neither march nor ſwim through the river, ſome regiments muſt go over the bridges as ſoon as

* See Nordberg's Hiſtory of Charles XII.—*Author.*

eight

eight or ten battalions of infantry are formed, and endeavour to make the enemy retreat.

When the paſſage of the whole army is completed, the regiments of cavalry will poſt themſelves upon the right and left of the infantry, and appuyer their flanks to the bank of the river.

FIRST REMARK.

§ 64. WHEN an army is advancing, the baggage-waggons, ammunition, and ſtores muſt be left behind, till a ſecure poſition has been taken on the other ſide of the river: but in a retreat, they are to be ſent before the columns. In both caſes, however, they muſt be under a ſufficient guard.

SECOND REMARK.

§ 65. WHEN an army is paſſing a river in ſight of the enemy, retrenchments are not formed; and for *two* reaſons: firſt, becauſe

becauſe there is a chance of his retreating, eſpecially if he finds himſelf too weak: and ſecondly, becauſe he may make an immediate and deciſive attack, for which all the neceſſary diſpoſitions will have been arranged before-hand.—But, if he ſhould not begin an attack, I would by all means throw up a retrenchment, and continue at work during the night; on account of the repeated misfortunes that have happened to armies, merely becauſe, under an idea of their own ſuperiority or ſafety, they have neglected to take the requiſite precautions.

§ 66. *b.* If the enemy is not actually in ſight, but at ſuch a diſtance that he can oppoſe us in the courſe of a few hours; the intended paſſage of our troops muſt be kept a profound ſecret: and while our real deſign is hid by falſe marches, by throwing up retrenchments, and by uſing all apparent means of ſtrengthening our poſition, we muſt be making every neceſſary preparation; that there may neither be

be diſorder nor heſitation when the army receives orders to march. In ſuch a caſe, there ought never to be leſs than two bridges: that, if one of them ſhould be deſtroyed by the ſtream or the enemy's artillery, an entire ſacrifice may not be made of thoſe who are gone over.

§ 67. WHENEVER there are iſlands in the river, great advantage may be derived from them: for, if we march over them, we can both ſhorten our bridges and form works upon them for our defence; or, if our bridges are made above and below them (which in ſome caſes is more adviſable), they will enable us to erect batteries to cover the paſſage of the troops, and to command the country in our front. —If the oppoſite ſhore is higher than the iſlands, it will of courſe be neceſſary that our batteries ſhould be proportionably raiſed. But this can never be attended with much difficulty, eſpecially when there is a ſufficient ſupply of wood: becauſe, by placing the trunks of trees croſs each

other, a kind of blockhouſe may be made, which will effectually anſwer our purpoſe.

§ 68. THE march towards the river muſt be conducted with the greateſt regularity and precaution.—All the grenadiers muſt be in the front, and the pontoons will follow in their rear, with ſome extra waggons and horſes; that the troops may not be delayed by any unexpected accident.—The time that will be required in bringing them to the appointed places, in forming the bridges, and in the paſſage, muſt be calculated with accuracy; that the army may neither begin the march too ſoon nor too late.

§ 69. THE troops muſt begin to march over the river in the night, that they may be entirely formed before day-break; and every obſtacle muſt be well conſidered. Becauſe the leaſt overſight or delay might deſtroy the undertaking, and occaſion a total defeat of the army.

§ 70. BEFORE

§ 70. BEFORE the bridges are begun, ſtrong patroles of cavalry ought to be formed, and ſelect troops ſent up and down the river in boats, for the purpoſe of ſtopping all travellers, veſſels, and ſpies till the paſſage of the army is completed.

REMARK.

§ 71. UPON all ſuch occaſions, and particularly when an army is retreating, a General Officer ought to be poſted at each bridge, to ſee that the troops are ſtrictly obedient to the orders, and that the waggons advance with regularity and in their proper turns.

§ 72. THE leading troops muſt begin to intrench themſelves as ſoon as they have croſſed the river; for it is always to be ſuppoſed that the enemy will march to attack them, when he receives intelligence of what has happened.

The nature and conſtruction of the

works will be hereafter explained in the *fourteenth* Chapter.

§ 73. NOT more than half the troops are to be allowed to work at the ſame time, and they muſt ground their firelocks two paces in their front. For, if they were to place them in bells of arms, as was formerly the cuſtom, each man would be at a loſs to find his own, and confuſion might enſue.—The working men muſt be relieved every two or three hours; and the reſt of the troops will form themſelves in line, and remain under arms.

If an attack ſhould be made before the parapets are completed, the working men muſt ſeize their firelocks and take poſt in the ditches, from whence their fire will be of great ſervice: the reſt of the army will be formed in line between the works *; and

* This is practicable notwithſtanding the retrenchments are intended to be encloſed, becauſe every intelligent Engineer will begin by putting the moſt material parts of his works into as good a ſtate of defence as poſſible. That is to ſay, he will firſt throw up the ſalient angles for the defence of the ground in his front,

and the batteries will do ſo much execution from the other ſide of the river, that the enemy muſt ſoon find his ſituation extremely dangerous, and the maintenance of it equally difficult.

§ 74. As it is here the principal intention that the army ſhould be expeditiouſly defended; flêches may be thrown up with a parapet between them, as in Pl. 14. fig. 4. and 5; or indented lines may be made uſe of, according to Pl. 11. fig. 9; Pl. 12. fig. 3, 4, 5, and 6; and Pl. 25. fig. 3, 4, and 5.

In either caſe, the works in front of each bridge muſt be formed as ſoon as poſſible, and joined together when a ſufficient number of men have marched over *.

M. de Clairac has alſo ſaid much upon this ſubject, in his tenth Chapter.

front, or ſimple flêches for 100 or 200 men, upon a weak profile of *ſix* feet, which will afford him a temporary defence. And, if an attack ſhould not be made, the lines may be continued between them in any direction, and wherever it is neceſſary, the profiles can be afterwards increaſed to *twelve* feet.

Tranſlator.

* Vol. VI. Chap. XIX.

If the direction of ſuch works depended upon me, I would only make uſe of redouts whoſe rear ſides were either very weak or merely formed with paliſades; which I would prepare beforehand, and float croſs the river.

§ 75. If we ſuppoſe an army of forty-two battalions and ſixty ſquadrons to be obliged to march over two bridges, which are twelve hundred paces aſunder; the four leading battalions of both columns, muſt throw up a redout ſome hundred paces in front of each bridge, in the manner explained in the 73d paragraph, and capable of containing at leaſt one battalion, with ſix or eight pieces of cannon. The two next battalions of each column muſt then join themſelves together between theſe two redouts, and throw up a third. The ſeventh, eighth, ninth, and tenth battalions will branch out; thoſe of the right hand column marching to the right, and thoſe of the left hand column to the left: and when they are

600 paces from the firſt and ſecond redouts, and not far from the banks, they will form two more.—The remaining battalions muſt advance beyond theſe works, and about 800 or 1,000 paces in front of the ſpaces between them, they will throw up ſix other works, of the ſame dimenſions, and 600 paces aſunder.

At firſt, the heavy artillery muſt be drawn up between the redouts; but, when they are completed, as many guns as are neceſſary will be placed within them, and the remainder will occupy the intermediate ſpaces.

§ 76. In caſe of an attack, *eleven* battalions will defend the *eleven* redouts, *fifteen* will be drawn up between thoſe in the front, and *ſixteen* will form a ſecond line in the rear.—The *ſixty* ſquadrons will be upon each wing in one or two lines, as their ſtrength and the nature of the ground may require; their flanks being appuyed to the redouts on one ſide, and to the banks of the river on the

other. But if any of the works ſhould be unfiniſhed, the battalions which were ordered to occupy them, will immediately throw themſelves into the ditches; and, at the ſame time, the cavalry will charge with the utmoſt vigour, that the enemy may be repelled; or, at all events, that a general engagement may be avoided.

§ 77. WITH ſuch retrenchments, it is evident that the troops will be ſoon covered; that they will be at liberty to extend their front as they march over; and that they will be enabled to manœuvre with freedom, and to attack the enemy whereever they pleaſe. Which are the greateſt advantages they can poſſibly attain.

REMARK.

§ 78. WHETHER the enemy advances in line or in column, the cavalry muſt wheel up and take them in flank.—If this manœuvre is performed with regularity, intrepidity, and firmneſs, it cannot fail of being attended with ſucceſs; becauſe their oblique

oblique poſition behind the redouts will have kept them in great meaſure out of ſight.

§ 79. *c.* If ſmall arms will carry croſs the river; and if the oppoſite bank is either lower than our own, or of equal height, parapets for the infantry ought to be thrown up in the night on each ſide the places where the bridges are to be made, and between the batteries. The beſt for this purpoſe are formed with ditches in their rear; as explained in the 291ſt paragraph; in Pl. 17. fig. 2. *a*; and in Pl. 8. *n*; for by theſe means we ſhall be able to keep back the enemy, while the paſſage of the army, and the têtes-de-pont are completed with eaſe and in ſecurity.

But if the flanks of thoſe parapets ſhould be laid near the bridges, the infantry behind them muſt not be permitted to fire; leſt they ſhould hit the men who are marching over, or at work on the oppoſite bank. And indeed, if it ſhould even be probable

probable that the ſhot would paſs above them, that part of our fire ought to be equally reſerved; leſt an idea of extreme danger ſhould ſtrike a damp into the perſeverance and courage of the troops below.

§ 80. *d.* WHENEVER a river is too broad for muſket-ſhot, great uſe muſt be made of our heavy artillery and howitzes; becauſe they will be particularly excellent in clearing the oppoſite bank, and in creating havock and diſorder among the enemy's cavalry.

§ 81. The rules which have been laid down in the foregoing paragraphs, are to be equally attended to, when an army paſſes a river without a bridge; and the undertaking is then much more difficult and dangerous. If boats or floats are made uſe of, the firſt men who have made good their landing, are in ſome meaſure cut off, and perhaps totally loſt, if any accident ſhould retard the paſſage of the reſt.

But

But this is not to be conſidered as the only inconvenience; for, if the ſoldiers are unable to govern them, watermen muſt be taken for that purpoſe; and it is highly probable they will either return, or throw themſelves into the water, as ſoon as the enemy begins to fire at them.

I have pointed out theſe difficulties, becauſe they will be generally met with: but, if floats are well made, and governed by ſoldiers, they will be of great ſervice; particularly when much expedition is required.

§ 82. CHARLES XII. who was very well acquainted with the methods of paſſing rivers, generally made uſe of floats for that purpoſe; which were compoſed of thick pieces of timber, bound croſs each other, and large enough to carry ſome hundred men, with one or two pieces of cannon, who could alſo fight during their paſſage. Thoſe with which he carried his army over the Sound to Frederick's Hall, in the year 1713, were very complete.—

plete.—They conſiſted of beams laid four times croſs each other, and ſurrounded by ſtrong rails: and every float contained 500 ſoldiers, with two eight-pounders.

His paſſage over the Dwina, upon the ninth of July 1701, was alſo remarkable. It was made by means of floats and boats, in ſight of the Saxons and Ruſſians, who occupied the oppoſite ſhore.—The leading infantry defended themſelves with chevaux-de-friſe, till five regiments and ſeventeen ſquadrons had effected a landing: when they attacked and repulſed the enemy.

§ 83. (2). No undertaking is ſo dangerous, or of ſuch importance, as a *retreat* croſs a river: becauſe it is generally done on account of the loſs of a battle, or of the ſuperior ſtrength of the enemy. And, in either of thoſe caſes, there will be as much difficulty in counteracting his advantages, as in obviating the ill effects of timidity on our ſide. Particular care muſt here be taken, that an attack is not made

upon us during our retreat, that the bridges are not deſtroyed when a part of the army has croſſed the river, and that the enemy's cavalry ſhall not be ſent over; leſt they ſhould charge our troops, and drive them back, before they can have had time to form themſelves. For that muſt either throw us into the greateſt confuſion, or occaſion our total deſtruction.

§ 84. WHENEVER we can get the ſtart of the enemy, either by means of a falſe or ſecret march, and paſs the river without his knowledge, the greateſt advantage will be gained, either in an advance or in a retreat.—With a vigilant adverſary, however, this will never be very probable, particularly in the latter inſtance: but, if we ſhould happen to ſucceed in the attempt, we muſt be conſtantly prepared for an attack; leſt he ſhould make a forced march and come up with us.

§ 85. WHEN a retreat is to be made without the help of retrenchments, the army

army muſt advance as near as poſſible to the river, and chooſe ground that will be thoroughly convenient for the paſſage, and, in caſe of an attack, equally proper for a field of battle: remembering at the ſame time, that it ought not on any account to be higher, but, if poſſible, lower than that which is oppoſite to it.—Here the troops muſt poſt themſelves in order of battle, and the cannon will be placed to the beſt advantage.

§ 86. THE infantry regiments of the *reſerve* will march firſt over the bridges (for in ſuch a caſe there muſt always be more than one), and they will be followed by thoſe of the *ſecond* line, with a conſiderable part of the heavy cannon and all the howitzes.—When the paſſage of theſe regiments is completed, they muſt poſt themſelves oppoſite the flanks of the *firſt* line, and the artillery muſt gain ſuch a ſituation as will enable it to cover them, and at the ſame time to rake the ground in front.—This is a matter of great importance,

portance, and an advantage which cannot be gained, except by making choice of a large bend in the river.—The infantry regiments of the *firſt* line muſt then begin to retreat from both wings, while thoſe in the centre and the cavalry keep drawing themſelves by degrees towards the bridges, that their flanks may be conſtantly appuyed to the river. The fire from the oppoſite ſide muſt alſo become heavier as the front diminiſhes, otherwiſe the enemy may fall upon the laſt regiments and drive them into the water.—At the concluſion of the retreat, the few remaining battalions muſt form themſelves into columns, and continue their fire till they are upon the bridges; when they will either cut away two or three of the *laſt* pontoons * or ſet them on fire.—Theſe battalions are uſually choſen on account of their known courage and good conduct.

§ 87. THE cavalry, or at all events ſome

* I ſuppoſe the author means thoſe pontoons which are neareſt to the enemy.—*Tranſlator.*

regiments

regiments of dragoons, muſt remain near the laſt battalions till they are upon the bridges, and then ſwim over the river.

§ 88. SUCH an undertaking cannot but be attended with much difficulty and the loſs of many lives, particularly when it is executed in the day-time; and perhaps the laſt regiments muſt be altogether ſacrificed.—Therefore, whenever it is poſſible, retrenchments and têtes-de-pont ought to be thrown up for the ſecurity of the army; and, if the enemy is near us, half or two-thirds of the infantry ſhould remain under arms, while the reſt are at work.

§ 89. THESE retrenchments may either be encloſed (*a*), or they may conſiſt merely of detached works or redouts (*b*).

(*a*). In this caſe the army muſt throw up as many flêches along its front as the nature of the country or the poſition of the enemy may require, and then join them together with parapets; as ſhown in Pl. 14.

Pl. 14. fig. 4, 5, 6, and, 7; or indented lines may be made uſe of, according to Pl. 11. fig. 9, and Pl. 12. fig. 5 and 6.

M. de Clairac has given us an accurate deſcription of the excellence and conſtruction of theſe lines.

§ 90. WHENEVER there is a wood near the river, I am of opinion that at leaſt one wing of the army ſhould be poſted in it, and defended by ſingle or double abbatis: becauſe the formation of them is leſs troubleſome than that of works, and they give the troops at the ſame time a favourable opportunity of retiring from one to the other, and of croſſing the river without being either diſcovered or purſued by the enemy.

§ 91. WHEN the retrenchments are completed in front of the army, the bridges muſt be formed, and each of them defended by a convenient tête-de-pont with two ſorties.

REMARK.

§ 92. THE baggage muſt be ſent firſt; and, if the oppoſite ſide of the river ſhould not be in our poſſeſſion, it muſt be attended by a ſtrong eſcort of infantry and cavalry, to ſecure it from the attacks of any of the enemy's cavalry that may have been ſent through the river for that purpoſe.

§ 93. As ſoon as we have ſent over all thoſe things, which are either likely to be uſeleſs or troubleſome in caſe of an attack; a conſiderable part of the cannon and howitzes muſt follow, and take poſt according to the rules laid down in the 86th paragraph.

§ 94. WHEN this is done, one part of the ſecond line or reſerve muſt defend the tetês-de-pont, while the other marches through them, over the bridges, and poſts itſelf along the banks and between the batteries, for the ſupport of the firſt line. —The firſt line muſt then face about, and keep

keep up a conſtant retreating fire, provided the enemy ſhould follow; and when it arrives near the works, the different battalions muſt break off, to allow the troops within to act with vigour, and afterwards poſt themſelves between them in as many ſmall lines as the nature of the ground may require.—Theſe lines will alſo begin their retreat from the rear, through the têtes-de-pont and over the bridges; and as ſoon as they have gained the oppoſite bank, they will take the moſt advantageous poſitions.

When all theſe troops have paſſed the river, the battalions of the ſecond line or reſerve, which have been in poſſeſſion of the têtes-de-pont, will retreat over the bridges; leaving only a few men with ſome pieces of cannon, who muſt neceſſarily fall into the hands of the enemy *.

§ 95. The bridge itſelf may be wheeled

* See the ſixth Vol. and nineteenth Chapter of my ACCOUNT of the WAR, &c.—*Author.*

to the ſhore *. But as it has been found by experience, that this is not to be done without much difficulty, or indeed, ſeldom with ſucceſs; it will in general be more adviſable to proceed according to the 86th paragraph: notwithſtanding the loſs of any of the pontoons may be ſeverely felt.

While the bridge is moving away, the ſoldiers who remain behind muſt fill the entrances into the têtes-de-pont with wood or faſcines ſteeped in pitch; and when they have ſet them on fire, they muſt take refuge in the boats or pontoons, and endeavour to gain the oppoſite ſhore in the beſt manner they are able.—Sometimes ropes are fixed to them for that purpoſe, and in that caſe a few men can eaſily draw them croſs the river.

§ 96. As encloſed lines are not to be formed without much labour and difficul-

* This is done by cutting away all the anchors, but without ſeparating the pontoons from each other: conſequently the whole bridge moves at the ſame time, and is brought by the ſtream cloſe under the ſhore.—*Author.*

ty,

ty, and are, after all, eaſily penetrated; I ſhould rather give the preference to ſuch detached works as have been deſcribed in the 74th paragraph *.—I would alſo add a circle of redouts in the rear of the army, where the paſſage is intended to be made; and each bridge ſhould be covered by a ſmall tête-de-pont with two convenient entrances.

REMARK.

§ 97. LITTLE objection can be made to the labour which is neceſſary in this, or in the foregoing inſtances, when it tends to the ſafety of a whole army.—Every man muſt exert himſelf to the utmoſt of his ability: and if half, or even one third of the troops are employed at the ſame time, and relieved once in two hours; the work will be in great forwardneſs at the end of the day.

* I have here omitted ſome lines of the original work, to avoid an unneceſſary repetition of the ſeventy-fourth paragraph. *Tranſlator.*

The formation of the intrenched camps of the ancients, and particularly thoſe of Cæſar, muſt have been extremely laborious; and if the ſoldiers in thoſe days had not worked with leſs reluctance than our own, I believe they would ſeldom have been completed.

§ 98. If detached works are made uſe of to cover our paſſage of a river, they muſt be well occupied, and the remaining battalions poſted in one or more lines in the intervals between the firſt chain of redouts. — When the retreat is begun (and in this caſe it is greatly facilitated); the rear lines march firſt through the têtes-de pont, and over the bridges; and, as ſoon as they are formed, the battalions of the firſt line follow them.—The works which compoſe the firſt chain, are then abandoned from both ends towards the centre; that the batteries on the oppoſite ſide of the river may keep off the enemy, in caſe he ſhould attempt to break in upon either of the flanks, or to attack thoſe

in the rear.—The ſecond chain is alſo quitted in the ſame manner *.

REMARK.

§ 99. THE battalions may either take their own cannon as they retreat from the redouts, or ſend them out beforehand. With this precaution, none will be loſt; except perhaps from the têtes-de-pont: and, when the army has made good its retreat, the troops which occupy them, will conduct themſelves in obedience to the 95th paragraph.

CHAPTER VI.

Of the Formation of Roads and Bridges.

§ 100. WHAT I have ſaid upon this ſubject in the fourth Chapter, relates only to caſes, which, on account of the neceſſary expedition, do not admit

* More may be found on this ſubject in the fifth Vol. and nineteenth Chapter of my ACCOUNT of the WAR.—*Author.*

of good or durable roads and bridges: but, if workmen and materials are to be had, and more time allowed, other methods are to be followed.—In military operations it is never intended that they ſhould laſt above one campaign: however, as an officer may be ſometimes charged with the formation of a durable road, I ſhall proceed to give a ſhort explanation of the rules which are then to be attended to, and to deſcribe the qualities of the different materials.

§ 101. RED CLAY, which generally contains a certain proportion of ſand and gravel, and BLUE CLAY of a ſlaty or limy quality, are equally uſeful in the formation of roads; either to bind together the ſtones which are laid for the foundation, or as an upper covering: becauſe the water cannot penetrate them. But black, red, and yellow earth, of a glutinous quality, or white clay, without ſand and ſtone, are unſerviceable; for, inſtead of throwing off the wet, they keep it upon the road.

§ 102. SAND

§ 102. SAND is always neceſſary towards the formation of a road.

Common ſandy earth cannot be uſed alone; becauſe, as it conſiſts entirely of a large proportion of earth with a little ſand, it muſt either turn to mud or duſt, according to the wetneſs or dryneſs of the weather.

Sand below the ſurface of the earth, is either black, gray, red, ſhining, or gravelly. The firſt kind is the worſt, the ſecond and third are better, and the two laſt are the moſt uſeful.—The ſand that is found near brooks is good, notwithſtanding it may not be mixed with gravel; becauſe it is of a much harder quality than any of the preceding ſorts. But river ſand or gravel is ſuperior to any other; and, if ſtones are not to be had, an excellent road may be made with it: provided it is well rammed down, and the old ruts carefully filled up. For, in the end, it will form itſelf into a maſs, too ſolid for the water to penetrate.

§ 103. STONE

§ 103. STONE may be of greater detriment than uſe, if ſufficient care is not taken in the choice and application of it.

The generality of hewn ſtone retains moiſture, and is apt to moulder away in very cold or wet weather: conſequently it ought never to be laid upon the road, without having been ſome time expoſed to the air for trial. The hardneſs of ſtone is aſcertained by the force that is required in breaking it: and its durability may be proved by ſteeping a piece of it in water; for, if it then acquires an additional weight, ſuffers itſelf to be cut with eaſe, or becomes muddy by friction, little ſervice is to be expected from it.

Every ſpecies of ſoft quarry-ſtone, as well as ſlaty or yellow lime-ſtone, are unfit for the foundation of a road: becauſe, as they cannot reſiſt the preſſure of loaded carriages, the centre muſt become hollow. And if they are uſed for the purpoſe of covering it, they will moulder away, and terminate in mud, as ſoon as they have been expoſed to froſt and rain.

SAND-

SAND-STONE is better; but not ſufficiently durable for the covering of a road, and ought never to be uſed till it has been properly ſeaſoned.

The following kinds are beſt adapted to every purpoſe; viz. Pebble-ſtone, rock-ſtone, (which may be blown in pieces with gunpowder), that ſpecies of lime-ſtone or marble from which lime is burnt, and well-ſeaſoned quarry-ſtone.—The hardeſt of theſe may be uſed for the foundation, but not for the covering of a road: becauſe they can neither be broken by workmen without extreme difficulty, nor by the conſtant preſſure of carriages. Conſequently as ſoon as the earth is waſhed away, the road will be full of holes.

The ſplinters that are made in quarries, or ſuch ſtones as are deemed unfit for the foundation, can always be uſed for the purpoſe of levelling the road; provided they are of a hard quality.

§ 104. THERE

§ 104. THERE cannot be a better covering for a road than the cruſts of metal and coal, which are found near furnaces or kilns; eſpecially for a clayey or limy ſoil: and it is only to be lamented, that they are not to be met with in greater abundance. Whenever they are uſed they muſt be carefully broken into ſmall pieces and rolled; otherwiſe they will be highly injurious to the horſes and cattle that paſs over them.

§ 105. RUBBISH may be uſed in a caſe of neceſſity: but, upon great roads, it will never be very durable.

§ 106. ALL deep ruts and holes ought to be filled up, when they are perfectly dry, with ſtones or gravel; and not with earth, if it can poſſibly be avoided.—Whenever there is a ſcarcity of theſe materials, the people of the country may be ordered to pick them up in the fields; and, when put into the ruts, they muſt be well rammed down, and covered with ſand or earth.

To

To make a hand-rammer for this purpoſe, you muſt take a piece of hard wood, of ſuch weight that a man may lift it without inconvenience; the upper part of which muſt be ſmaller than the lower, and a round piece of wood put through it, that it may be raiſed with both hands: this however is not otherwiſe neceſſary than for the eaſe of the workmen *.

§ 107. If a road is to be carried croſs a ſlough or bog, or, if there are any in an old road which is to be repaired, much labour will be neceſſary: for, as they are generally occaſioned by a ſtoppage in the courſe of a ſpring, brook, or drain, there would be but little uſe in filling them; and the evil would become ſtill greater, unleſs the cauſe of it was altogether removed. Therefore it is firſt to be conſidered, how the water can be let off; and, when that has been determined, a deep ditch muſt be

* In this paragraph I have found it very neceſſary to compreſs the Author's meaning into a narrower compaſs: and indeed I might have entirely omitted the latter part of it, without depriving my readers of any information.—*Tranſlator.*

continued

continued from the place, as far as may be required. In the formation of this ditch, it will be neceſſary that its ſides ſhould be ſloped, leſt the earth ſhould again fall into it; and, that the whole ſhould be completed, before the part which joins to the ſlough or bog is cut away. As ſoon as the ground is dry, the road may be continued; and, although it will be conſiderably raiſed, the courſe of the water muſt remain free and uninterrupted.—Whenever there is a ſpring in a bog, upon which a road is to be formed, a deep hole muſt be made, and conduits laid for the purpoſe of carrying away the overflowing water: or, if a road is injured by a ſtream which runs over it, ſuch a drain will be neceſſary as I have deſcribed in the 110th paragraph.

§ 108. WHENEVER a road is made in dry weather, the work muſt be regulated according to the ſtate of the ground in winter: therefore, if the perſon under whoſe direction it is carried on, is not well acquainted with the country, he muſt make

make inquiry among thoſe who are able to give him the beſt information.

§ 109. A ROAD cannot be effectually repaired or kept in good condition, unleſs a ditch is made on each ſide of it with a deſcent of about an inch and a half in every rood; which may be eaſily aſcertained by means of a common level. Too great a deſcent would be improper; becauſe the rapidity of the current might injure the banks at every angle, or wherever it met with particular reſiſtance.—With regard to the ditches themſelves, I need only obſerve, that the ſides of them muſt be well ſloped off, and that they ought to be at the leaſt four feet in depth, by four or ſix feet in breadth.—But this is not to be conſidered as a general rule: for their dimenſions will be regulated in all caſes by the nature of the ſoil, and the probable quantity of water they will have occaſion to carry away *.

* Experience has ſhown that theſe ditches are unneceſſary, except in a moraſs; and, that a road will be better, drier, and ſafer, without them.—*Tranſlator.*

§ 110. IT

§ 110. It frequently happens that the water in one ditch cannot run off, unleſs it is conveyed into the other.—In ſuch caſes, drains muſt be laid in a ſtraight line croſs the road, and of any dimenſions that may be required.—Their ſide-walls ought to be made of large ſtones cemented with moſs; and, if a ſmall ſlope is given them, they will be the better able to ſupport the weight that paſſes over them.—If their tops are covered with pieces of wood or flat ſtones, they will require a reſt of ten or twelve inches upon each ſide, to prevent their giving way; and if they are arched over, mortar muſt be uſed inſtead of moſs.

§ 111. The centre of the road muſt be raiſed either with gravel, or the ſoil that is pared away from the ſides, and then rammed down into a compact body.

§ 112. When a road paſſes over a hill, ſmall breaks or reſting-places muſt be made for the eaſe of the horſes in aſcending;

ing; to check the rapid deſcent of loaded carriages; and to conduct the water into the ditches, which might otherwiſe run down with violence and waſh away its ſurface. There muſt be a gentle ſlope to and from each of thoſe places: the upper ſlope may be made entirely of gravel; but, for the lower, there muſt be a foundation of ſtone, with a covering of ſand and gravel; otherwiſe they will ſoon be deſtroyed.—Large ſtones ought alſo to be placed on each ſide, to oblige the drivers of carriages to keep upon the road.

The trunk of a tree might be occaſionally laid croſs the road for the ſame purpoſes, and covered in a ſimilar manner.—In either caſe, if theſe breaks have an oblique direction, they will carry off the water better, and be more durable, than when formed in a ſtraight line.

§ 113. SMALL gutters ought to be made from the centre of every road, to convey the water from the ruts into the ſide ditches.—Their numbers will depend in

great meaſure upon the deſcent of the road, and if it is to be well preſerved, they muſt be frequently cleaned.—In general they are made at the diſtance of ten or twelve yards from each other.

§ 114. WHEN the banks of hollow ways are ſo hard that they cannot be widened, the bottoms of them ought to be raiſed, and ſuch ſtones as are likely to obſtruct the carriages muſt be blown up with gunpowder.—But if their ſides are ſloped off, the earth muſt be carried away, eſpecially if it is of a ſoft or limy quality *.

The following table will ſhow the ſpaces between the ruts in different parts of Europe, and my readers may rely on its accuracy †.

* Here ſome lines of the original are omitted, to avoid a repetition of the 36th paragraph.—*Tranſlator.*

† This table will be found to contain much uſeful information. For, in many caſes, the artillery and baggage would be ſubjected to frequent accidents and delay, where the roads are very bad, if their carriages were not conſtructed in ſuch a manner, that the wheels could paſs along both the ruts.

Tranſlator.

NAMES

NAMES of the COUNTRIES and TOWNS.	DRESDEN.		LONDON.	
	Ells.	Inches.	Feet.	Inches.
AUSTRIA	2	—	3	8,$\frac{44}{45}$
BERLIN, and in all parts of BRANDENBURG	2	8	4	4,$\frac{64}{135}$
BOHEMIA	2	—	3	8,$\frac{44}{45}$
BRUNSWICK	2	12	4	8,$\frac{2}{9}$
BRESLAW, and in all parts of SILESIA	1	18	3	3,$\frac{16}{45}$
DENMARK	2	10$\frac{1}{2}$	4	6,$\frac{22}{27}$
DANZIG	1	18	3	3,$\frac{16}{45}$
DRESDEN	2	—	3	8,$\frac{44}{45}$
EMPIRE	2	12	4	8,$\frac{2}{9}$
FRANKFORT on the MAYNE	2	6	4	2,$\frac{3}{5}$
FRANCE	2	12	4	8,$\frac{2}{9}$
HAMBURG	2	11	4	7,$\frac{77}{270}$
HANOVER	2	11	4	7,$\frac{77}{270}$
HUNGARY	2	—	3	8,$\frac{44}{45}$
LEIPZIG	2	3	3	11,$\frac{71}{90}$
LUBEC	2	11	4	7,$\frac{77}{270}$
MORAVIA	2	—	3	8,$\frac{44}{45}$
MECKLENBURG	2	—	3	8,$\frac{44}{45}$
MOSCOW	2	10$\frac{1}{2}$	4	6,$\frac{22}{27}$
NETHERLANDS	2	—	3	8,$\frac{44}{45}$
NURENBERG	2	6	4	2,$\frac{3}{5}$

NAMES of the COUNTRIES and TOWNS.	DRESDEN.		LONDON.	
	Ells.	Inches.	Feet.	Inches.
PETERBSURG	2	10½	4	6,$\frac{22}{27}$
POLAND	2	—	3	8,$\frac{44}{45}$
POMERANIA	2	—	3	8,$\frac{44}{45}$
RIGA	2	17	5	0,$\frac{49}{57}$
SWEDEN	2	10½	4	6,$\frac{22}{27}$
SWITZERLAND	2	6	4	2,$\frac{3}{5}$
THORN	1	18	3	3,$\frac{16}{45}$
THURINGIA	1	22½	3	7,$\frac{77}{135}$
WURTEMBERG	2	—	3	8,$\frac{44}{45}$
	2	12	4	8,$\frac{3}{9}$
ZITTAU	1	21	3	6,$\frac{1}{6}$

REMARK.

THE wheels are in general three inches in breadth: but the above calculations include only the diſtance from the inſide of one rut, to that of the other *.

§ 115. WHEN

* A Dreſden ell is = two Dreſden feet; and when a London foot has 1350 parts, a Dreſden foot contains 1265:—conſequently 1350 : 1265 :: 56 = 2 ells 8 inches : x, &c.

This

§ 115. WHEN a road paſſes along the ſide of a hill, with a precipice below it, care muſt be taken that it ſhall not incline that way: but, on the contrary, that it ſhall be higher on that ſide; on account of the danger to which all carriages would be otherwiſe expoſed. And, that it may not be injured by any torrents of water from above, a ditch ought to be made cloſe under the hill. At every corner, the road muſt be broad enough to allow carriages of every deſcription to paſs without danger or inconvenience.

§ 116. IN Poland, the roads are generally made with the ſtems of trees, and are called *Klippel-daemme* or *Klippel-bruecken*. Theſe are but of ſhort duration, and require frequent repairs.—However, they are by no means uſeleſs in foreſts, moraſſes, or flats, where the water cannot be carried

This compariſon is made upon the ſuppoſition of M. de Caſſini, that a degree of the ſpherical figure of the earth contains 57,060 toiſes = 342,360 feet.—*Vide Memoires de la Société royale de Paris*, 1718.—*Tranſlator.*

off, and on account of the expedition with which they can be made: eſpecially in ſuch countries as Poland, where wood is to be had in the greateſt abundance. There are two ways of making them, according to the nature or ſtate of the ground. If it is not very wet, trunks of trees may be laid in two rows lengthwiſe, from three to four feet aſunder, according to the breadth between the ruts, and ſmaller ſtems are then placed croſs them, cloſe to each other, and faſtened to the ground. But, if the moraſs is deep, their conſtruction is uſually reverſed: that is to ſay, the large trunks are laid acroſs them from ſix to twelve feet aſunder, and the ſmaller ſtems lengthwiſe.

§ 117. If the moraſs is of ſuch a depth, that both theſe methods are likely to be defective, you muſt harden ſtrong oaken piles in the fire, and drive them firſt into the ground.

§ 118. As ſuch piles cannot be driven into the ground without the help of a ramming

ming machine; I ſhall proceed to explain one or two kinds, which may be made uſe of in a caſe of neceſſity, and refer my readers for the conſtruction of ſuch as are more complete to Belidor's Hydraulics.

Let three or four ſtraight ſtems of trees be tied together at the top, and ſeparate their legs from each other at the bottom, that they may remain firm: or, if the ſoftneſs of the moraſs ſhould make it neceſſary, reſt them upon planks of wood. —This will enable you to raiſe a heavy log of wood with a common pulley and rope, and by letting it fall ſuddenly upon the piles, you will drive them with tolerable eaſe.—Or, if two beams are placed upright, and a third laid over them with a weight ſuſpended from its centre, it will anſwer the ſame purpoſe.—Every miller and carpenter can make ſuch machines, or they may be taken out of the park of artillery, where they are conſtantly uſed in raiſing cannon, mortars, &c.

The principal beams or trunks are laid upon theſe piles; and, in every other re-

ſpect, the formation of ſuch a road will be ſimilar to that which is deſcribed in the 116th paragraph.

When any part of a moraſs is ſo deep that the men are unable to work upon it, a bank of earth muſt be raiſed on each ſide, and continued as far into the place as may be neceſſary for the formation of a wooden bridge in the centre.—On ſuch an occaſion, the driving machine muſt be placed upon two boats with planks laid over them, and the heads of the piles muſt be prepared beforehand to receive the beams, which are afterwards to be fixed upon them.

§ 119. A DAM may be made through the deepeſt moraſs by means of water faſcines (§ 235), and a covering of rubbiſh or gravel of at leaſt a foot in thickneſs *.

§ 120. WHEN a new road is to be made, either for the purpoſe of keeping up a

* The remaining lines of this paragraph, as they ſtand in the original, are preciſely ſimilar to the 235th.—*Tranſlator.*

communication

communication between two corps, or to ſecure a retreat, the country through which it will paſs muſt be carefully reconnoitered.—If any low grounds or moraſſes are in the way, it ſhould be carried round them, rather than in a ſtraight line: becauſe, in ſuch places, a foundation cannot be made without much labour and expence. And, if there are ſteep hills which cannot be avoided, it muſt wind up them.—In that caſe, the road ought never to be leſs than ſixteen feet in breadth at the corners; and if the whole cannot be made ſo as to allow two carriages to paſs each other, there muſt be as many openings for that purpoſe as the nature of the ground will admit of.

§ 121. THE conſtruction of durable bridges which conſiſt of more than one arch, or of ſuch as are to be ſupported and ſtrengthened by the rules of mechaniſm or geometry, muſt be entirely regulated by builders, carpenters, &c.: and of courſe it

it cannot come within the limits of this treatiſe.

§ 122. WITH timber or long trunks of trees, a bridge may be made over a river of conſiderable breadth: provided the principal beams are either let into a wall at each end, or otherwiſe well fixed; and afterwards croſſed by rafters of equal thickneſs.

§ 123. IF the river is of ſuch breadth, that the beams either bend in the centre, or are ſuppoſed to be too weak, piles muſt be driven into the ground for their ſupport.

In all places there are carpenters, and perhaps ſeveral other countrymen, who may be equally ſerviceable in this inſtance, and in the formation of roads. Therefore, whenever an Engineer is intruſted with ſuch employment, he will find it to his advantage to converſe freely with ſuch people, and to pay attention to their advice:

for it frequently happens, that they have learnt by experience, what may have eſcaped the obſervation of a man of the greateſt theoretical knowledge *.

CHAPTER VII.

To chooſe and mark out a Place of Encampment, or the Poſition of an Army.

§ 124. TO know how to make choice of a good poſition is one of the moſt important branches of the art of war, and many a General has acquired the greateſt reputation by his prudence and foreſight in this inſtance: becauſe it is entirely founded on profeſſional knowledge, and requires an accurate *coup d'œil*, which can only be formed by long experience and attention. Conſequently my readers

* As we have found it adviſable to reject many of the rules which are laid down in this Chapter, I fear it will not be very inſtructive to an Engliſh reader.—That opinion of its utility has induced me to give only the ſubſtance of each paragraph, particularly in the latter part of it, and in as few words as I could, without deviating from the author's meaning.

Tranſlator.

muſt not expect me to lay down rules for the immediate attainment of ſuch an advantage.

The choice of a place of encampment is generally made by the Commander in Chief of the army, or by the Quarter-Maſter General. But, as it may ſometimes become the duty of an Engineer, who is low in rank; particularly in ſmall corps: I will explain, as well as I am able, what is principally to be attended to on thoſe occaſions.

§ 125. THE troops may be encamped in two ways, viz.

1. In the uſual manner with ſtreets; and
2. In order of battle.

The *firſt* is the moſt common method of forming an encampment when an army is aſſembled for exerciſe; and the *ſecond* is adopted only under particular circumſtances: as for inſtance, when there is not a ſufficient depth of ground, or when it may be ſuddenly obliged to be under arms, and in order of battle.

§ 126. IN

§ 126. IN the laſt Sileſian war the armies were frequently encamped in order of battle; when they were confined in the rear by hills, woods, &c. and particularly when they were in expectation of a ſudden attack.—In that caſe, it was uſual to ſend back the baggage, and ſubaltern Officers made uſe of the tents of private ſoldiers*.

§ 127. THE principal objects of conſideration in all encampments are theſe.

1. If it is to be formed entirely for parade or exerciſe.

* That this mode of encamping an army might be clearly underſtood, I have found it neceſſary to make an addition of two plans.—In the firſt of which the troops are thus diſtributed. —C is the quarter-guard.—The tents from H to *o* are occupied by the non-commiſſioned officers and drummers, as well as by the private ſoldiers of the three ranks; I I by the Captains and Lieutenants; K K by the ſtaff-officers; and L *l* by the batmen. M *m* are the horſes, *n n* the baggage-waggons, *p p* the meſs tents, *q q* the kitchens, *r r* the rear-guard, and *z z* the neceſſaries.—Every ſoldier has his firelock in his own poſſeſſion. Hence it is obvious that a regiment of infantry will not require half the uſual depth of ground, when encamped in order of battle, and that the lines can be formed at any time with the greateſt expedition.

In the *ſecond* plan, which repreſents the encampment of a regiment of cavalry, the diſtribution of the troops, &c. may be ſeen on the margin. But as the horſes muſt be in front of each row of tents, there cannot in this inſtance be a ſaving of more than 100, or 120 paces.—*Tranſlator.*

2. If

2. If the enemy is at ſuch a diſtance that he cannot reach us by a forced march.

3. If the enemy is ſo near, that an immediate attack is to be apprehended.

OF ENCAMPMENTS IN GENERAL; AND PARTICULARLY THOSE WHICH ARE FORMED FOR PARADE OR EXERCISE.

§ 128. A LEVEL country, abounding in wood and water, is preferable to any other for this purpoſe, and the encampment is generally formed in two lines.—The Huſſars and Dragoons muſt be poſted at each wing, the Cuiraſſier regiments next to them, and the Infantry in the centre according to their rank; the firſt or oldeſt regiment upon the right wing, the next in ſeniority upon the left, and ſo on. The Grenadier companies are uſually formed into battalions, and either encamped upon the flanks, or formed into a ſeparate corps: and, if there are horſe-grenadiers or carabineers,

rabineers, they may be alſo detached or placed upon the flanks of the cavalry.

The encampment muſt be accurately marked out, and levelled wherever it may be neceſſary; but the Engineers need only ſhow the ground which each regiment will occupy.

§ 129. WHETHER the front of the encampment is open or retrenched, there muſt be a ſpace of at leaſt 300 paces between the tents and the quarter-guards, that the troops may have room to form themſelves in order of battle, and that the cavalry may be able to make their movements without difficulty. In ſome ſituations, and frequently in hilly countries, it may be neceſſary to pitch the tents nearer the retrenchments. In that caſe, if the enemy ſhould make an attack, they muſt be immediately ſtruck, the pegs taken up, and every hole made as level as poſſible.

§ 130. THE length of the front or parade of each regiment, will depend upon the number

number of men it contains; becauſe the tents are to be entirely covered when they are under arms, and the intervals between the regiments muſt neither be too great nor too ſmall. One pace is generally allowed for each infantry ſoldier, and one and a half for each cavalry ſoldier.—For inſtance, a battalion of 200 men in front will require 200 paces, and a ſquadron of 50 men in front, 75 paces; the intervals between the battalions muſt be equal to one-eighth of their front, and thoſe between the ſquadrons to one-third. Hence the front of each regiment, and that of the whole army, may be eaſily regulated. The ſtreets between the battalions muſt be 20, 25, or 30 paces in breadth, as circumſtances may require, and in general there muſt be a ſpace of about 300 paces between the front of the firſt and ſecond lines. The intervals between the ſquadrons of cavalry ought never to be leſs than 20, nor more than 50 paces.—In this reſpect, however, no eſtabliſhed rule can be laid down: becauſe their exact length will always be proportioned

proportioned to the nature and extent of the ground that is to be occupied. Towards the end of a campaign, when the regiments become weaker, the front of the lines ought to be contracted; otherwiſe the intervals will be too great, and of courſe dangerous againſt an enterpriſing and an active enemy; which was once ſufficiently proved, to an Imperial corps, by the reſult of an attack which was made upon it by the Turks. We alſo find, in Feuquier's account of the battle of Ramillies, that the Duke of Marlborough beat Villeroi owing to the largeneſs of the intervals between his ſquadrons. For he ſays the ſquadrons of the ſecond line of Marlborough's cavalry fronted the intervals between thoſe of the firſt, and when they attacked the French cavalry, it appears that the ſquadrons of the ſecond line rode through the enemy's intervals, wheeled to the right and left, took them in flank, and gained a complete victory.

§ 131. If the ground and other circumſtances will admit of it, troops ought always to march and encamp in order of battle. The Engineers muſt therefore take care not to commit any miſtake in the extent of ground which is to be allotted to each regiment. In the German and French armies, the regiments encamp according to ſeniority: conſequently, the order of battle cannot be altered, except when the army is reinforced by other regiments, or when ſome are taken away.

§ 132. Too rigid an adherence however to this mode of encamping, according to the ſeniority of regiments, is perhaps a bad cuſtom, and may be ſometimes productive of miſchief.

The day before the battle of Nerwind* was fought, ſome regiments in the French army were diſſatisfied at not being poſted

* This battle was fought July 19th, 1693, between the allies under king William III. and the French under F. M. Luxemburg.—*Vide Feuquier's Memoirs, and the 14th Vol. of the Theatr. Europ. page* 463. *Tranſlator.*

for

for the action according to their rank; and, in conſequence of their requeſt, the order of battle was changed. This delay gave the enemy an opportunity of throwing up works in the night, which were not taken till three attacks had been made upon them, and many lives loſt.

At the battle of Torgau, the King of Pruſſia marched round the Auſtrians and came in their rear; in conſequence of this movement they countermarched, in order that they might change their front, and the ſecond line then ſtood upon the ground which the firſt had occupied, and the firſt upon that of the ſecond. The diſcipline of the Auſtrians enabled them to perform this evolution in a ſhort time; but, if the Pruſſians had left the wood ſooner, and made an attack before it was completed, they would have had ſufficient reaſon to repent of this attention to the rank of their regiments. In my opinion, it would have been much better if each regiment had faced to the right about upon its own ground; eſpecially as ſeniority is

not given to any corps on account of its ſuperior courage or ſervices, but according to the rank of its General.

§ 133. THE Ruſſians frequently change their order of battle, particularly when they are apprehenſive of a general engagement; from a perſuaſion of its being advantageous, that the enemy ſhould be ignorant of the poſition of the different regiments, and that he may therefore make his attacks againſt the ſtrongeſt and beſt corps in their army.

The Auſtrian order of battle is always in two lines with a reſerve; but, as the Ruſſians are accuſtomed to fight in ſquares, they regulate it accordingly *.

The annexed plans will ſhow the diſtribution and breadth of the ſtreets, and the poſition of the tents, guards, kitchens, &c. both for the infantry and cavalry, in the Saxon ſervice. In other armies there is ſome little difference.

* Vol. II. Pl. 3 and 4.

§ 134.

§ 134. PL. 2. repreſents the encampment of a regiment of infantry of three battalions. The whole front *a*, *b*, is 570 paces; the depth of the parade *a*, *c*, 30; and *c*, *d*, *e*, *f*, ſhow the ſpace which the battalions occupy when drawn up. The front rank is ſix paces in the rear of the line of Officers *c*, *d*; the three ranks are four paces aſunder; the non-commiſſioned officers are two paces behind the rear rank; and ſix paces behind them, are the Second Lieutenants. The Colours are 16, and the Bells of Arms eight paces in front of the line of tents *g*, *h*; the firſt tent of each company fronts the parade, and the laſt, towards the rear: the reſt front their reſpective ſtreets. The depth of *g*, *i*, and *h*, *k*, depends of courſe upon the number of men, and, in general, each tent contains five ſoldiers, their wives included *.

* In the original work, the author has given the grenadiers *h*, *k*, and *g*, *i*, four tents leſs than the other companies; becauſe their eſtabliſhment was proportionably ſmaller. But, as they have all been upon an equality in point of numbers ſince the year 1778, I have deſcribed them according to their preſent ſtrength.—*Tranſlator.*

The Captains tents *p*, *q*, are behind their companies, 15 paces from thoſe of the Lieutenants *n*, *o*, and are 10 paces in depth.—The Lieutenants tents are ſix paces in depth, and four from the private ſoldiers; the Firſt-Lieutenants are upon the right of their reſpective companies, the Second or Enſigns upon the left; and, unleſs two Subalterns ſleep in one tent, there muſt be another row of Sub-Lieutenants behind the Captains.—r, *t*, *t*, are the tents of the Majors; the Colonel's tent is marked *u*, 1, and that of the Lieutenant-Colonel *u* 2: theſe five tents are 12 paces deep, and 20 from the Captains.—The Adjutants are behind their reſpective Majors in the tents 1, 2, and 3; the Quarter-Maſter behind the Colonel in 4; the Auditor in 5, the Chaplain behind the Lieutenant-Colonel in 6, and the Surgeon in 7; all theſe tents are 20 paces in the rear of the Field Officers.

The Drum-Major and the Quarter-Maſter-Serjeant are in one of the tents *v*, *v*; the regimental Provoſt, and the Waggon-Maſter in the other; theſe tents are ſeven paces

paces behind the Adjutants, &c.—The Servants and Batmen are in the line *w*, *w*, ſix paces in the rear of *v*, *v*, the horſes *x*, *x*, two paces in the rear of the Batmen, and 10 paces in front of the Waggons *y*, *y*; the Meſs-tents are 20 paces behind the Waggons, and the Kitchens 26 behind the Meſs-tents.

A, *a* is the Quarter-Guard, and *b*, *b* the Rear-Guard.—The Rear-Guard is ſix paces from the Meſs-tents, and the Neceſſaries *tz*, *tz* are 150 behind the Kitchens.

§ 135. PLAN 3, ſhows the encampment of a regiment of Cavalry of four ſquadrons, and one company of carabineers.—When the regiment is drawn up, the front of each ſquadron is 50 paces, that of the carabineer company 25; the ſpace between it and the ſquadron upon the right 10 paces, and thoſe between the ſquadrons 20 each: conſequently the whole front is 295 paces in length. The place d'armes from *a* to *c*, and from *b* to *d*, is 30 paces; the breadth of each rank, or the length of

the horſes, is eſtimated at three, and the ſpace between each rank at ſeven. The depth of the company's ſtreets will depend upon the number of horſes.

The tents are five paces in depth, the diſtance between them and the pickets two, and the length of the horſes three. When the ground is divided, the ſpace between the carabineers *f*, *h*, *i*, *k*, and the ſquadron upon the right muſt be 25 paces, and thoſe between the ſquadrons 33, that the ſtreets may remain 16 paces in breadth *.

There muſt be two Lieutenants in each tent: the ſize of their tents, and the diſtance from them to thoſe of the Captains, Major, Lieutenant-Colonel, and Colonel is the ſame as in the Infantry.—N is the Colonel's tent, *m* that of the Lieutenant-Colonel, and *l* that of the Major; the Adjutant is in the tent *o*, ſix paces in the rear of *l*, the Surgeon in *p*, the Auditor and

* According to this calculation, the author ſeems to allow one pace for the length of each horſe's halter from the picket; otherwiſe the ſtreets would be 18 paces in breadth.

Tranſlator.

Chaplain

Chaplain in *q*, and the Quarter-Maſter in *r**.

The Servants and Batmen are lodged in the tents *v*, *v*, five paces in the rear of *s*, *t*, *u*, and two in front of the Horſes *w*, *w*; the Waggons *x*, *x*, are ſix paces in depth, and 10 behind the Horſes; the Meſs-tents are 20 paces behind the Waggons, and 20 in front of the Kitchens. The Standard-Guard, Rear-Guard, and Neceſſaries *tz*, *tz*, have the ſame ſituation as in a regiment of infantry.

§ 136. If the enemy is at a great diſtance, the encampment of an army may be formed in whatever manner may be moſt convenient for the troops. It may be in three, four, five, or more lines, according to the nature of the ground; and the cavalry, inſtead of being upon the flanks, may en-

* As an explanation of *s*, *t*, *u*, are omitted in the Original, it may not be unneceſſary to obſerve that theſe tents ſhould be ſix paces in the rear of *o*, *p*, *q*, *r*; and that they contain the Kettle-Drummers, Trumpeters, Quarter-Maſter-Serjeant, Waggon-Maſter, and Provoſt.—*Tranſlator.*

camp

camp near a river, or wherever they can get a ſupply of good water.

Upon the 2d of July 1759, the Auſtrian army was encamped near Reichenberg in ſix lines, one behind the other, with the cavalry of the right wing in the rear of the whole, near the river Neiſſe; and, if it was neceſſary, I could give many more inſtances of the ſame kind.—Under ſuch circumſtances, the ground need not be divided with accuracy in the front; and, as it is better that the intervals ſhould be too large than too ſmall, they may be meaſured by the eye. The Generals and Volunteers may alſo pitch their tents in the front of the army, or remain in the neareſt villages. — It ſeldom happens, however, that an army is in a ſituation to admit of ſo much liberty: for, if the enemy ſhould not be within the diſtance of 30 or 40 miles, it would be improper, from a principle which I have already mentioned, and which indeed cannot be too well remembered, viz. that nothing is more dangerous in military operations than

than to place too much confidence in the ſtrength or ſecurity of any poſition whatever.

§ 137. WHEN the enemy is near, every idea of eaſe and convenience muſt be laid aſide, and there cannot be too much caution in the choice of a camp or poſition. The following circumſtances are then to be attended to, and I ſhall treat of each of them in its proper turn.

1. The flanks muſt be well defended.

2. The country in front muſt not be diſadvantageous, in caſe of an attack.

3. The rear muſt be free, and at the ſame time covered.

4. The different kinds of troops muſt be poſted in a manner that will enable them to manœuvre with freedom, and to ſupport each other.

5. The head-quarters muſt be well defended, and every General as near as poſſible to his reſpective brigade.

§ 138. THE

§ 138. THE flanks are the weakeſt parts of every poſition, therefore great attention muſt be paid to their ſecurity, that they may neither be turned nor commanded. —That is to ſay, they ought to be appuyed to woods, rivers, moraſſes, heights, valleys, villages, or retrenchments, according to the nature of the country: and, as the King of Pruſſia has ſaid in his "INSTRUCTIONS *to his* GENERALS," that upwards of 200 different poſitions may be taken in the ſquare of five miles; the Commanding Officer of every army ought to know, at firſt ſight, how each object may be turned to the beſt advantage.

§ 139. IT is not to be conſidered, however, that all woods will afford a good defence, either for the flanks or front of an army; notwithſtanding abbatis may be formed in them with the greateſt eaſe: for I ſcarce remember an inſtance of their not having been carried by a judicious and reſolute attack.—In ſuch a ſituation, the fire of the defending corps will be alſo greatly

greatly obſtructed, while the ſtrength and movements of its aſſailants are effectually concealed.—Nor are theſe the only diſadvantages: for, the increaſed echo and rattling of cannon-ſhot among the trees will be apt to magnify the fears of the private ſoldiers, and to facilitate their repulſe.—In which caſe, openings can be made with much greater eaſe than is generally imagined, as well for the diviſions as for the artillery: becauſe, on theſe occaſions, the enemy will be attended by a ſufficient number of workmen with axes, ſaws, &c. for that purpoſe.—And I can aſſert from my own experience, that the braveſt troops will never make ſo good a defence from an abbatis, as when they are covered by a parapet.

The uſe of abbatis, and the different methods of forming them, will be explained hereafter.

§ 140. THE flanks of a poſition cannot be ſo eaſily or ſo effectually covered, as by a lake, moraſs, inundation, or unfordable river:

river: becauſe they neither ſtand in need of artificial defence, nor give the enemy an opportunity of concealing his movements. But even theſe protections demand a cautious and conſtant attention on our part; leſt he ſhould find means to paſs undiſcovered, and fall upon our rear*. Such an event befel the Ruſſians at the ſiege of Cuſtrin, and the battle of Zornſdorff was the reſult of it †.

Whenever our front or flanks are defended by a river, all the bridges and fords muſt be well guarded or deſtroyed. But I ſhall explain this ſubject more particularly in the 21ſt Chapter.

§ 141. HEIGHTS, mountains, and ravines afford a convenient defence to the flanks of a poſition; and, as the means of improving them by art, will be explained

* The ſucceſs of the late important attack upon Amſtelveen, will be an ever memorable inſtance of the truth and propriety of this obſervation.—*Tranſlator.*

† See the ſecond Volume and ſecond Section of my ACCOUNT *of the* WAR, &c.—*Author.*

in the 19th Chapter, I ſhall at preſent only conſider them in their natural ſtate.

If there are heights in front of thoſe to which our flanks are appuyed, which are as high or higher than our own, and within cannon-ſhot of them; our poſition muſt be extremely dangerous. Becauſe, if an attack ſhould be made, the enemy will not fail to take poſſeſſion of them, and we ſhall then be ſo much galled by the fire of his artillery from thence, that our army will probably be beat or thrown into confuſion. Commanding heights in the front of a poſition are not ſo diſadvantageous: for, in moſt caſes, they may either be encloſed within a part of our lines, or rendered leſs formidable by a judicious formation of them.

It frequently happens that a good poſition may be taken, notwithſtanding there are one or more heights in the front, which may be favourable to the enemy, if taken: in that caſe they ought to be well intrenched, and defended by grenadiers or other picked troops, with an abundant

abundant ſupply of cannon.—See Pl. 28, N° 23, and the 25th Chapter.

§ 142. As the choice, attack, and defence of poſitions are to be regulated by the ſhape and ſituation of the different heights, I think it incumbent upon me to give a more particular deſcription of them.

When one height is ſaid to command another, it is underſtood that they are within cannon-ſhot, and that the one is higher than the other. Some are able to determine the relative height of two hills at the firſt coup d'œil: but ſuch an advantage is not to be attained without much practice; and thoſe who have not had ſufficient experience, are apt to be miſled by the height of the eye above the ground, and the more ſo, when they are on horſeback. I would therefore adviſe every beginner to lay himſelf upon his belly, and to direct his ſight horizontally to the oppoſite hill, that he may form an opinion with greater accuracy: or, before he makes his final determination, he may

may place himſelf upon a third hill and examine them again from thence *.

If the heights which lie oppoſite to our poſition are ſomewhat lower than our own, we have a great advantage; becauſe our artillery will then be able to rake them by firing horizontally or *en ricochet*. But, on the other hand, if there is a conſiderable difference, the ſhot will be uncertain, and bury themſelves as ſoon as they ſtrike the ground. Pl. 30. fig. 3 †.

§ 143. THE next object of conſideration is, whether the ſides of a height are ſteep and rocky, or whether there is a continued and gradual ſlope from the top of them to the bottom.—For, if we wiſh to intrench ourſelves ſo as to make an attack impracticable, the firſt are to be preferred: but, if

* See the Firſt Volume of Tielke's ACCOUNT *of the* WAR, pages 91, 92, and 93, with Meſſrs. Craufurds' note on this ſubject.—*Tranſlator.*

† See the deſcription of *prof.* 2. in the ſecond Section of the firſt Volume, and the uſe of artillery in the third Section. *Author.*

we only intend to gain an advantage over the enemy by the ſuperiority of our poſition, the latter kind will be beſt adapted to our purpoſe. At the battle of Torgau the Auſtrian batteries occupied ground of this deſcription, which gave them ſo complete a command over the Pruſſian columns, that they mowed down whole ranks upon their coming out of the wood; and the grenadiers, notwithſtanding their uncommon firmneſs and intrepidity, were totally incapable of forming themſelves for the attack *.

Hence it is evident, (1), that our cannon and grape-ſhot muſt have their full effect when the deſcent is gradual; and (2), that our infantry and cavalry will be able to manœuvre with freedom, either for the purpoſe of taking the enemy in flank, or of lending aſſiſtance wherever it may be required.

§ 144. WHEN detached troops occupy a

* For the conſequences of an attack upon ſteep heights, ſee Vol. I, pages 28 and 29.—*Author*.

height

height whoſe ſide next the army is either very ſteep, or ſeparated from it by a ravine, the means of a retreat muſt be ſecured and pointed out to them: notwithſtanding it may be impoſſible to keep up a direct communication by making or repairing roads. — For the braveſt troops would conſider their ſituation extremely unpleaſant, if, in caſe of a repulſe, they were under the neceſſity of giving up their baggage and artillery, and of running headlong down a precipice. Such was the poſition of a brigade of Auſtrian grenadiers near Hohen-Gierſdorff in the year 1760, and ſuch were the melancholy conſequences of its defeat.

§ 145. THE moſt uſual manner of defending the wings of an encampment, is to appuyer them to villages; becauſe they are generally ſtrong without the aſſiſtance of art. — If they contain ditches, gardens, walls, and walled church-yards, it is extremely difficult to drive a body of determined troops out of them; and indeed,

if we were not ſo well acquainted with the methods of ſetting them on fire, I think I may venture to ſay, it would be almoſt impoſſible to attack them with ſucceſs.—On this account retrenchments ſeem to deſerve a preference.

In the courſe of my campaigns with the Auſtrians, I have known but very few inſtances of their having retrenched villages, or indeed, of their having made uſe of them at all for the defence of their flanks: provided their poſitions were ſtrong in other reſpects.—When there were any in front, or upon the wings of their encampments, works were thrown up at ſome diſtance from them, that their troops might maintain their ground after they had been ſet on fire.

In the year 1760, the Pruſſians covered the village of Jauernig, near Schweidnitz, with very ſtrong works.

§ 146. WHEN the flank of an army cannot be appuyed or defended after any of the foregoing methods, or, when the declivity

declivity of the height upon which it lies, admits the probability of an attack in that quarter; part of the troops may be formed *en potence*.—That is to ſay, ſome battalions may poſt themſelves ſo as to make a ſalient, and generally a rect-angle with the main line.—It is at the ſame time of the greateſt conſequence, that this flank of the poſition ſhould not be enfiladed.

§ 147. No ground is ſo favourable for the front of an encampment as that which expoſes the enemy to the fire of our artillery, keeps him always in our ſight, and enables us to diſpute every inch of his advance.—Theſe advantages are only to be acquired when we occupy a height from whence there is a gradual deſcent.

§ 148. ANOTHER advantage is to be derived from having a river in the front, whoſe banks are expoſed to the fire of our batteries. For in that caſe, if a reſolute enemy ſhould effect a paſſage, it cannot be done without much loſs; and after all,

he will be obliged to attack our poſition with fatigued troops.

§ 149. A RAVINE in the front of an encampment is alſo a very conſiderable addition to its ſtrength; eſpecially if the enemy is under the neceſſity of paſſing it before he can make an attack.

The Auſtrian General Brentano had ſuch a poſition near Adelſbach, on the 6th of July 1762, where he was attacked with the utmoſt vigour by a corps of Pruſſians: but their efforts were unſucceſsful.

As many officers have deſired me to give a particular account of this action, I ſhall proceed to deſcribe it in ſuch a manner as will enable my readers to form a correct idea of it, by referring to that part of Schubart's provincial map of Sileſia which comprehends the circle of Schweidnitz *.

* As this map of Sileſia is not much known in England, I have added a ſmall plan of the ground in queſtion, with the different poſitions of both the corps; and, although I cannot vouch for its extreme accuracy, I may reaſonably ſuppoſe it will convey a more clear and ſatisfactory idea of the action, than the method propoſed by Captain Tielke.—*Tranſlator.*

§ 150. GENERAL,

§ 150. GENERAL Brentano's corps, conſiſting of 18 ſquadrons, 7 battalions, and 2 companies of Jagers, was poſted near Adelſbach for the purpoſe of covering the rear and left flank of the Auſtrian army, while it was encamped near Freyburg and Kunzendorff, under the command of Field Marſhal Daun.

§ 151. THE ground which this corps occupied, viz. from the Zeiſkewald to Lieberſdorff, was about 8,000 paces in length, and the village of Adelſbach lay in a deep ravine in its front. The rivulet of Zeiſke paſſed through this ravine, and above it the heights roſe amphitheatrically on each ſide.—The ſummit, eſpecially towards Salzbrunnen, was compoſed of ſeveral hillocks; which, from their vicinity to each other, formed ſmall hollows or valleys, and in ſome of them there were running ſtreams.—From the end of the village of Adelſbach to the ruins of the old caſtle of Zeiſke (Zeiſke-Schloſs), and to the ſtone-bridges, the ſides of the ra-

vine were very ſteep, particularly at the Zeiſkewald.—At the junction of Adelſbach and Lieberſdorff, there were two woody hills of great height on the oppoſite ſide, called the Lerchenberg and Engelſberg. Upon the laſt-mentioned hill there was a battalion of Croats *, and between them a road which came from Lieberſdorff, went behind the oppoſite ſide of the ravine and the Zeiſke-Schloſs, and led to the village of Zeiſke-berg.—This road was croſſed by three others from Quolmſdorff to Adelſbach. The firſt of them paſſed through the right end of the village near the laſt mill, and divided itſelf at the Zeiſkéwald; one branch going to Zeiſkeberg and the other to Pilſnitz and Furſtenſtein.—On the right of this road one company of Jagers was poſted at the ravine; and near the laſt mill there were two round heights covered with trees: that on the right was occupied by two companies of Croats, and the other by one battalion and a half with four pieces of

* Inhabitants of Croatia, who act as light infantry.—*Tranſlator.*

cannon.—

cannon.—The ſecond road from Nieder-Salzbrunn, left theſe hills to the right, and paſſed through Adelſbach to Quolmſdorff.—To the left of that road there were two other high hills, which aſcended gradually from the village: upon one of them ſtood a battalion of grenadiers with four pieces of cannon, and upon the other, one battalion of Arberg with two pieces of cannon. Between theſe hills there was a hollow way, which came from Salzbrunn, paſſed through the yard belonging to a large houſe in Adelſbach, and went to Reichenau. — Laſtly, there was another high and ſteep hill covered with trees, which had a break near the bottom; and upon this hill there were two battalions of Bethlem with four pieces of artillery. To the left of this poſt there was another road leading from Lieberſdorff to Conradſdorff and Neu-Salzbrunn. — Here the ground was rather flat, the woody hill upon the left excepted. On this ſide, the huſſars of Kalnoki, St. Ignon, and the dragoons of Darmſtadt were poſted during the attack, to cover the left flank of the corps; and,

at

at the junction of Adelſbach and Lieberſdorff, there was one company of Jagers.

§ 152. In the evening of the 4th inſt. the King of Pruſſia, who was encamped near Jauernig, ordered the left of his rear line, in which there were ſome Ruſſian troops, to march and join General Neuwied; whoſe corps, conſiſting of 14 ſquadrons and 22 battalions, was then cantoned near Striegau. This reinforcement augmented the whole body to 30 battalions and 60 ſquadrons; and with them the King advanced againſt General Brentano.

If this expedition had been ſucceſsful, he would have gained the rear of the main army of the Auſtrians, he would have cut them off from Landſhut, and he would have obliged them to undertake a very difficult retreat over a mountainous country; probably with the entire loſs of their baggage and heavy artillery.

§ 153. On the 6th, at four o'clock, A. M. the Pruſſians began to drive back General Brentano's advanced poſts, and attacked

attacked the battalion of Croats, which was posted near the Engelsberg, with free parties *, hussars and Cosacks †. This battalion retreated through the village; but orders were immediately given that it should again advance and maintain the Engelsberg.—These orders were obeyed, for it remained in the wood between Liebersdorff and the Engelsberg as long as the action continued, under the support of the company of Jagers that was posted at the junction of Adelsbach and Liebersdorff. The two companies of Jagers were continually skirmishing with the Prussians, and took one colour.

§ 154. The Prussians, who had suffered much from Brentano's artillery during their advance, established five batteries upon the opposite heights, and formed behind them in two lines. When the cannonade had been maintained for some

* See a Note in Messrs. Craufurds' translation, Vol. I. pages 19 and 20.—*Translator.*

† Cosacks are inhabitants of the Ukraine, who were originally vagabonds from Poland, Russia, Hungary, Turky, Tartary, &c. and are at present a formidable people.—*Translator.*

hours

hours with conſiderable heat on both ſides; ſix battalions advanced croſs the ravine in three columns, and marched againſt the hill on which the two battalions of Bethlem were poſted. This hill covered and entirely commanded the left of General Brentano's poſition; and it was at the ſame time ſo ſteep, particularly the upper part of it, that an attack in that quarter was thought to have been impracticable.

§ 155. ONE of theſe columns marched through the large yard in Adelſbach, and the other two upon the left of it. The firſt advanced directly againſt the battalion of Arberg; while the third went up the left ſide of the hill to attack the ſecond battalion of Bethlem; but they were both driven back by the bayonet and grape-ſhot.

§ 156. THE ſecond or centre column marched in a ſtraight line up the hill, gained the break or projection, and advanced under cover of the trees and ſmoke to the ſummit; directing its courſe againſt the

the interval between the two battalions of Bethlem. Fifty or ſixty men were regularly formed for the attack, and more were endeavouring to crawl up, when Colonel Tillier fortunately diſcovered them as he was riding to the ſecond battalion. He immediately wheeled one diviſion and a half to the left, and made ſo ſudden a charge upon them with fixed bayonets, that they were driven headlong down to their own battalions, which were then formed upon the projection below. Both the Auſtrian battalions immediately ſlid down the hill after them, holding their ſwords in the right and their firelocks in the left hands, drove them to the bottom, purſued them croſs the ravine, and took one colour.

§ 157. In the mean time H. R. H. Prince Albrecht of Saxony came from the main army with two regiments of cuiraſſiers, to reinforce the Auſtrians. He poſted himſelf in the rear of the infantry, between the ſecond and third roads. Firſt, that he

might be ready to charge the Pruſſians, in caſe they ſhould have forced their way through Brentano's poſition; and ſecondly, that he might not be unneceſſarily expoſed to their fire.

§ 158. THE Pruſſians then made a movement as if they meant to attack Brentano's right wing. A column advanced along the ſecond road towards Nieder-Adelſbach; but the fire of the Auſtrian artillery, and of the company of Jagers upon their flank, obliged them to retreat.

§ 159. WHEN this attempt proved ineffectual, the whole Pruſſian corps retreated, and encamped behind Reichenau; where they received from the main army a reinforcement of two regiments of infantry, one battalion of grenadiers, and one regiment of huſſars. But theſe did not arrive till the fate of the action had been decided. A battalion of grenadiers was alſo ſent and poſted behind the ravine of Furſtenſtein, to cover the retreat of the Auſtrians:

Auſtrians: for when the enemy's ſtrength was made known to Field-Marſhal Daun, he had no doubt but that General Brentano would loſe the day.

§ 160. THE heavy cannonade from the Pruſſian batteries killed 300 Auſtrians: and, as the ground was ſo diſadvantageous, that their battalions could not fire during the attack, it may be reaſonably ſuppoſed that the loſs on their ſide, in killed, wounded, and deſerters, muſt have exceeded 1,000 men. I am notwithſtanding of opinion, that General Brentano's excellent poſition, the good conduct of his troops, and the peculiar bravery of the Hungarian regiment of Bethlem, would ſcarce have enabled him to have maintained his ground, if the Pruſſians had been able to attack with their whole front.—But it is now time for me to finiſh this digreſſion, and to return to the regular ſubject of the preſent chapter.

§ 161. WHEN hollow ways and ditches are parallel to the front of an encamp-

ment, they will be extremely uſeful in ſtopping the enemy's cavalry and artillery. But, if they run obliquely or in a ſtraight line to it, his troops will get into them, and approach our poſition without being expoſed to fire.—In ſuch caſes, therefore, they ought either to be filled up or rendered impaſſable, as will be more particularly explained hereafter.

§ 162. HEDGES and bruſh-wood in the front are alſo ſerviceable, becauſe they impede the advance of an enemy, without ſheltering him from our fire. — But, if many large trees are intermixed with them, they ought to be cut down and left upon the ground, that they may become an additional obſtruction.

If, at the ſame time, the country is ſo interſected with ditches, ponds, moraſſes, &c. that he muſt neceſſarily advance in column, our cannon will have their full effect. Of courſe the batteries ought to be augmented wherever he will have occaſion to paſs: for by thoſe means we ſhall

ſhall be doing him incredible injury before he can make any attack upon us.

When troops are able to march up to an attack in line, a cannon-ſhot will only deſtroy three men; unleſs it ſhould take them in flank: whereas, if the ground does not permit them to deployer from the column, its effect will be infinitely more terrible. To prove this aſſertion, I need only obſerve, that at the battle of Zornſdorff, one ſhot mowed down 42 men, belonging to the ſecond regiment of Ruſſian grenadiers *.

§ 163. HOWEVER ſtrong the ſituation of an army may be, the Commander in Chief of it ought always to be aware of the poſſibility of a defeat. Of courſe his rear muſt be free and open.—At the battle of Zornſdorff the Ruſſians loſt 24,000 men, becauſe their rear and flanks were too much ſurrounded by rivers and moraſſes

* To know the effect of the fire of ſmall arms under ſimilar circumſtances, ſee Vol. V. Sect 1.—*Author.*

to admit of a retreat. Hence it is evident that ſuch a poſition muſt be bad, notwithſtanding the ground in front may be advantageous in every reſpect.

The next object of our inquiry, ought to be into the poſſibility of an enemy's getting round the poſition, and of attacking the rear of the army: as was the caſe at the ever-memorable battles of Torgau and Zornſdorff *.—In the firſt inſtance, however, the ground was favourable to Field Marſhal Daun, wherever he directed his front: but in the ſecond, the ſituation of the Ruſſians was equally diſadvantageous on all ſides.

No poſitions are ſo completely defective as thoſe which are capable of being attacked in front and rear at the ſame time †.

§ 164. IN the diſtribution of the differ-

* See the detailed account and plan of this battle, Vol. II. Sect. 2.—*Author.*

† See the account of the battle of Maxen, Vol. I. Sect. 1. *Author.*

ent

ent kinds of troops within an encampment, it is above all things to be remembered, that they muſt be able to manœuvre with eaſe, to make the beſt uſe of their arms, and to ſupport each other.—Therefore the rule, or rather the cuſtom, of poſting cavalry upon the flanks ought to be in general diſregarded.

When the Auſtrians were encamped upon the high Eulen-Geburge, in the year 1762, their huſſars were behind the front.

§ 165. CROATS, free battalions, Jagers, and light infantry of every denomination, ought to be poſted in villages, hollow ways, woods, &c.; cavalry, upon the plains; and regular infantry upon the heights. At the ſame time it may not be improper to obſerve, that a line of cavalry will always make a more advantageous attack up hill, than when it is deſcending*; and, that the

* See the 1ſt Vol. of Meſſrs. Craufurds' tranſlation of Tielke's ACCOUNT *of the* WAR, &c. pages 29 and 161, and their notes upon thoſe paſſages.—*Tranſlator.*

caſe is reverſed with the infantry.—Heights ought to be crowned by battalions of infantry, and not by cavalry; becauſe their fire will hinder the aſcent of an enemy: but, if ſome ſquadrons are poſted in the rear, at the diſtance of two or three hundred paces, they will be ready to receive him as ſoon as he gains the ſummit, and to drive him back before he can have had time to make the neceſſary preparations for a regular attack *.

When a camp or poſition is interſected by rivers, ditches, or hollow ways, a ſufficient number of paſſes muſt be made over them; and, if the ſides of the hills are too ſteep, they muſt be ſloped off, and roads made wherever they are wanted: otherwiſe a free communication cannot be kept up, and of courſe the troops will be unable to ſupport each other.

§ 166. In a Ruſſian army the Generals are at all times obliged to ſleep in tents;

* Vol. I. Sect 3.—*Author.*

but,

but, in the ſervices of other European powers, they are allowed to have quarters, except when fighting againſt the Turks: and the camp generally takes its name from the village, in which the Commander in Chief is lodged. — Head-quarters ought to be as near as poſſible to the encampment, out of the fire of the enemy's artillery, and guarded againſt a ſurpriſe.— It ſometimes happens, however, that ſuch a ſituation is not to be had, and that they muſt be neceſſarily eſtabliſhed either upon one of the flanks, or in front of the poſition. In that caſe they muſt be covered by a ſeparate corps, placed there for that purpoſe; as at the Auſtrian camp near Krazkau, on the 15th of May, 1762.

Notwithſtanding the neceſſity of theſe precautions, they have been ſometimes diſregarded by our greateſt Generals; and in the year 1761, the King of Pruſſia would certainly have been made a priſoner by Captain Wallis of the Croats, if his ſcheme had not been diſcovered a few hours before it was to have been carried into execution.

§ 167. As I have now explained what ought to be attended to in the choice of camps, and in the diſtribution of the troops, I ſhall proceed to deſcribe the method of marking out the ground.

The Quarter-Maſter, Quarter-Maſter-Serjeant, and Camp-colour-men belonging to each regiment, muſt aſſemble at an appointed place, and march before the army with a ſufficient guard; either under the direction of the Quarter-Maſter-General, or an Engineer. The directing Officer will provide himſelf with a good map; and, if he ſhould not be acquainted with the country, he muſt take guides, with whom he or the junior Engineers will reconnoitre with as much attention as the time will admit of.

§ 168. As ſoon as the place of encampment is fixed, the directing Officer muſt conſider how the flanks are to be appuyed, and what will be the moſt favourable direction for the front of the poſition: ſecondly, he muſt either pace off the ground

or meaſure it by the eye, that he may know if there will be room for all the battalions and ſquadrons of the firſt line, or, if the line muſt be broken: thirdly, he muſt point out the ſpace which each regiment will be ordered to occupy, as well as the intervals between the different battalions: and laſtly, he muſt ſee that the camp colours are properly placed. If the ground is too narrow, or if there are obſtacles upon it which cannot be removed, ſome battalions may encamp in the rear or en potence: and on the other hand, if it is too extenſive, the intervals may be increaſed. In both theſe caſes, however, it muſt be remembered, that, if an attack ſhould be made, the troops will labour under great diſadvantages, whether the intervals are too large, or whether they are crowded together ſo as not to be able to manœuvre with freedom.—He muſt alſo make minute inquiry into the poſition, ſize, and extent of the different villages which are likely to be convenient for head-quarters; for the quarters of the Generals, Volunteers,

and Commiſſaries; as well as for the Magazines.—In this part of his duty, particular attention will be requiſite, leſt the villages ſhould not be able to contain the troops, horſes, waggons, ſtores, &c. when ordered into them: for it once happened, in the ſeven years war, that two regiments of cavalry were directed to take up their quarters in a vineyard called the Weiſſmauer, near Loſſnitz; becauſe an Engineer concluded it was a village, from having ſeen the name in his map, and reported it as ſuch.

The interior diviſion of the villages, and of the ground allotted to each regiment, will be left entirely to the Quarter-Maſters.

CHAPTER

CHAPTER VIII.

Of the Diſtribution of Poſts, Guards, and Detachments.

§ 169. IN the field there are three kinds of guards.

1ſt. Camp or regimental guards, which come under the deſcription of quarter, ſtandard, and rear-guards.

2dly. Pickets, which are only ready to march and to ſtrengthen the poſts during the night.—In ſome ſervices the reſerve always holds itſelf in readineſs for this duty, and ſupplies the place of the pickets whenever they are ordered to march.

3dly. Advanced guards.—This is the only ſpecies of guard which I need take into my conſideration: becauſe the firſt and ſecond are totally regulated by the Generals and Commanding Officers of regiments.

§ 170. AD-

§ 170. ADVANCED-GUARDS and outposts are intended to secure the camp, and to prevent surprises, or unnecessary alarms; which harass the troops exceedingly. It is therefore a matter of great importance that they should be placed with judgment, and well supported.

Posts and guards of infantry are regular, when composed of grenadiers and musketeers; and irregular, or (as the ancients called them) *light-armed*, when composed of Croats, Jagers, free corps, &c.

Advanced guards of cavalry consist either of heavy or light horse; viz. Cuirassiers, Carabineers, Dragoons, Hussars, &c.

§ 171. IN the course of a dangerous retreat or secret march, it sometimes happens that a post must be necessarily left in a situation where it will be exposed to the enemy's attacks; without being able to retire to another, or to receive the least assistance. But in every other case, and indeed whenever it is practicable, all the different kinds

kinds of troops which compoſe the advanced guards muſt be able to lend each other mutual ſupport.

§ 172. In theſe caſes the Commanding Officers of the different poſts generally receive orders to defend themſelves to the laſt extremity. It then becomes them to lay aſide every idea of their own preſervation: and, in pure conſideration of the good of their country and the honour of their Sovereign, they muſt endeavour, by the moſt undaunted reſolution, to do the enemy all the injury in their power.

§ 173. As it is the principal object of all armies to gain time, whenever they are thus circumſtanced; prudence is not leſs neceſſary in the diſtribution of the poſts, than courage in the defence of them. They ought therefore to be placed either in ſituations which are ſtrong by nature, or in ſuch as can be made ſo by art. Every Officer who is then left with the command of a poſt muſt fight as long as he

he is able.—And when he has diſcharged that part of his duty, he may ſhow ſigns of an intention to capitulate, and treat with the party that is ſent to him in a tedious and circumſtantial manner, that the army may have made ſome progreſs before the terms are finally agreed upon. This however cannot be done with ſucceſs, neither will he be able to benefit by any reſource that may be within his reach, unleſs he preſerves his preſence of mind, and a conſiderable ſhare of cool intrepidity.—If his enemy is really brave, he will know how to ſet a proper value upon his firmneſs, and, when driven to the laſt extremity, he will not heſitate to allow him an honourable capitulation. But, if he has no ſuch enemy to deal with, he muſt die with his ſword in his hand *.

Notwithſtanding a poſt may be in the greateſt danger, and even without the poſ-

* Military hiſtory does not produce a greater or a more glorious inſtance of the effects of courage and prudence, than Xenophon's retreat with his 10,000 Greeks: of which Monſ. le Cointe has given a particular account in his work, entitled "*Commentaires ſur la retraite de dix mille.*"—*Author.*

ſibility

ſibility of relief, it becomes the officer who commands it to conceal his ſituation, to encourage his men with a proſpect of ſucceſs, to ſhow confidence in their courage, and even to pretend to have promiſes of aſſiſtance. By theſe means he will create a ſpirit of perſeverance, which will be of the greateſt ſervice to him.—And, when the laſt puſh is to be made, he muſt endeavour to rouſe them to the higheſt pitch of rage and deſpair, that their defence may be attended with all the obſtinacy and horror imaginable, and that the enemy may have reaſon to repent of his dear-bought victory.—Of this Leonidas, the King of Sparta, gave a noble proof at the Straits of Thermopile *.

§ 174. BUT, as advanced guards and poſts muſt have ſupport in almoſt all caſes, it is generally given them in the

* There are alſo ſeveral inſtances of heroic intrepidity, both in attack and defence, in the 3d and 4th Sections of the 4th Vol. of my "ACCOUNT *of the* WAR," &c.; in the 1ſt and 2d Sections of Vol. V; and in the 16th and 20th Chapters of Vol. VI.—*Author.*

following

following manner; except when a mountainous or interſected country makes it neceſſary to adopt ſome other ſyſtem.—Light cavalry are ſupported by heavy cavalry; and heavy cavalry, Croats, Jagers, and free corps, by regular infantry.

§ 175. ALL out-poſts intended for the ſecurity of a camp or poſition, ought to be placed in ſuch a manner, that no part of the enemy's troops may be able to paſs the chain or to approach the army, without being ſeen and oppoſed by them. It is therefore eſſentially neceſſary that they ſhould be in a ſtate of mutual ſupport, and that their reſpective vedettes or ſentinels ſhould always be within ſight of each other.

The number of men upon each poſt muſt be regulated by the intention, ſtate, and poſition of the army; by the ſtrength of the enemy; by his uſual method of carrying on a war, and by the nature of the country.

§ 176. WHEN-

§ 176. WHENEVER the enemy approaches an advanced poſt of cavalry with a ſuperior force, it muſt retreat; either with a view of procuring a reinforcement, or of covering itſelf behind thoſe of infantry: which always maintain their ground as long as poſſible, unleſs they have expreſs orders to the contrary. Upon ſuch an occaſion, every officer will have a glorious opportunity of ſhowing his courage, judgment, and prudence in their brighteſt colours.

In the year 1762, when the Pruſſians had penetrated the Auſtrian retrenchments and abbatis near Burkerſdorff, during their blockade of Schweidnitz, a Lieutenant belonging to the green regiment * of Loudon defended himſelf above two hours in the redout, N° 1, with incredible bravery; and when he had expended the whole of his ammunition, he ſet fire to the ſmall abbatis in his rear, retreated through it with his few ſurviving men, and brought them ſafe into Schweidnitz.

* So called from the colour of their uniforms.—*Tranſlator.*

—This

—This is an example equally worthy of our praiſe and imitation.

§ 177. EVERY poſt muſt ſend out ſmall parties, which, at the approach of a ſuperior number of the enemy's troops, give an alarm, and retreat to the places from whence they were detached.

The principal poſts (eſpecially if compoſed of infantry) are to maintain their ground till they receive orders to the contrary: for, if one of them was to march to the ſupport of another, it would occaſion a dangerous opening in the chain; and no good whatever could accrue, beyond the reſiſtance of a feint, or, at moſt, a ſucceſsful oppoſition to one of ſeveral attacks.

A prudent General will always inform his poſts where they may be allowed to retreat, or from whence they are to receive ſupport *.—But if this ſhould have been

* To prove the ill effects of a want of attention to this particular, I refer my readers to an account of the attack which was made by the Pruſſians upon the fort N° 2. near Schweidnitz, Vol. IV. Sect. 2.—*Author.*

at

at any time neglected, the Officers who command them, muſt conſider it a part of their duty to make themſelves acquainted with every circumſtance attending their ſituation, as well as the beſt means of keeping off the enemy; remembering at the ſame time, that they are never to retire to any of the poſts upon their flanks, but upon all occaſions, towards the army: for *that* is a rule which admits of no alteration.

As ſoon as an Officer is upon his poſt, it is neceſſary that he ſhould acquire an exact knowledge of the country, roads, and paſſes on all ſides of him; that he ſhould conſider the different ways by which the enemy may approach or attack him; that he ſhould be conſtantly upon his guard, notwithſtanding the diſtant proſpect of danger or the well-known vigilance and attention of his men; and laſtly, that he ſhould frequently viſit the parties he has ſent out, eſpecially during the night, to

know if they are ſtrictly obedient to his inſtructions*.

§ 178. If an Officer ſuppoſes his ſoldiers to be incapable of judging of the propriety of his conduct, he will be greatly deceived. Their ſentiments are impartial, and their penetration quick and accurate; particularly when they have had the experience of a few campaigns.—If they obſerve confuſion, fear, or want of deciſion in his arrangements, a panick may ſeize even the moſt reſolute of his party, and occaſion the inevitable loſs of his poſt.—On the other hand, very moderate ſoldiers will fight well, if they find they can repoſe a thorough confidence in the courage and prudence of their Commanding Officer.

§ 179. I now proceed to treat of advanced guards and poſts, according to the different kinds of troops of which they may be

* Vide Vol. VI. Chap. X; and the diſpoſition for the defence of the retrenchments near Colberg, Vol. V. Sect. 1. *Author.*

compoſed:

compoſed: beginning with LIGHT-CAVALRY.

As it is no longer uſual for light-dragoons to act on foot, I ſhall conſider them and the huſſars in the ſame point of view.

Light-cavalry are extremely ſerviceable, eſpecially when they are under better diſcipline than Coſacks and Calmucks; who only lay waſte the country wherever they go, and ſubject their own army to want. The rule of oppoſing the enemy with troops ſimilar to thoſe with which he may make his attacks, is to be particularly attended to on this occaſion. For if he ſhould have a body of light-horſe ſo ſuperior in numbers to our own, that we are obliged to have recourſe to heavy-cavalry for our out-poſts; there is no doubt, but that we ſhall labour under a very great diſadvantage; on account of their being totally unfit for that method of ſkirmiſhing.

The Auſtrians became ſenſible of this in the year 1762.—For, when the King

of Pruſſia formed an alliance with the Ruſſians, and was reinforced by a *pulk* of 2,000 Boſniacks or Turkiſh light-horſe, the heavy cavalry of the former did duty in common with their light troops; in oppoſition to an enemy who always had a ſuperior body of men, properly armed and equipped for ſuch purpoſes.

§ 180. GUARDS and poſts of cavalry ought never to be in a confined place, from whence they cannot retreat without paſſing through hollow-ways or other obſtacles: or, where the enemy can have it in his power to come up to them without being obſerved.—Conſequently, whenever there are woods in their front, or upon either of their flanks, they will be expoſed to the dangers of a ſudden attack. If it is impoſſible to give them a free and open ſituation, as is ſometimes the caſe in very mountainous countries, they ſhould either have pickets in their front, or be intermixed with infantry.

In Bohemia and Sileſia it frequently happened

happened that the Auſtrian army was thus circumſtanced.

§ 181. THE vedettes ought to be placed upon the moſt elevated parts of the country, that they may diſcover the diſtant approach of an enemy; but the poſts to which they belong may remain in any hollows or valleys within ſight, with a view of ſheltering themſelves from the inclemency of the weather, and of concealing their ſtrength.—Towards the enemy there may be two or three vedettes in front of each other, eſpecially if the nature of the ground obſtructs their view.

The interior management and regulation of theſe poſts reſts entirely with their own officers.

§ 182. POSTS of INFANTRY cannot be too well covered.—Intrenchments are beſt adapted to *regular* infantry; and woods, hedges, ditches, ravines, houſes, &c. to all that come under the deſcription of *irregular* or *light-armed*. Of theſe, none are

better than Croats, when in ſome degree ſheltered, and under the orders of an officer for whom they have regard and attachment.

Croats, Jagers, and free-battalions ought neither to be poſted in the open field, nor expoſed to cavalry; becauſe they are not accuſtomed to the cloſe order of regular infantry, and conſequently they will be unable to withſtand their attacks.—In a wood they always act with peculiar excellence; and, as they are then guarded againſt cavalry and artillery, it is very difficult to drive them out of it.—Whenever it was practicable, I have covered each of their poſts with an abbatis, even when the trees have been brought from the neareſt woods for that purpoſe. And I have occaſionally made doorways in them, of about five feet in height, that they might relieve their ſentinels without a danger of being purſued too far by the enemy's huſſars: for, with the uſual openings, they would not have been ſecure from the enterpriſing ſpirit of thoſe troops.—Of this

this I ſaw a remarkable inſtance in the year 1761, at the Nonnen-wald near Freyberg.

§ 183. In the diſtribution of the poſts of regular infantry, I prefer a good retrenchment to any abbatis or village: becauſe, as I have already had occaſion to obſerve in the 7th chapter, the former are eaſily opened, and the latter, with the aſſiſtance of a few ſhells as eaſily ſet on fire.—No defence is more ſafe than a retrenchment, particularly againſt artillery. —Therefore, whenever it is neceſſary to retrench a village, I would make my lines at the diſtance of 150 or 200 paces, either in its front or rear, as circumſtances might ſeem to recommend. — If they were in front, I could make ſome ſtand in the village after the enemy had taken poſſeſſion of my works; it would ſtill enable me to cover my retreat; and, when ſet on fire, it would be a conſiderable check to the rapidity of my purſuers.—And, in the

ſecond inſtance, I could retard the advance of an enemy, by burning it at their approach.

Here it may not be improper to obſerve, that a village ought never to be deſtroyed, except in a caſe of abſolute neceſſity: not only on account of the cruelty of ſuch conduct towards its poor and innocent inhabitants, but becauſe it would indicate an unmanly ſtretch of power, by which your enemies would gain the entire goodwill of the people of the country.

§ 184. LET your circumſtances be what they may, I muſt again repeat the neceſſity of a careful examination of the country near every poſt. — If they are ſet in woods, the Commanding Officers muſt reconnoitre every part of them, as well as the roads and avenues which lead towards them: they muſt make themſelves acquainted with all the advantages and diſadvantages of the ground: and they muſt take particular notice of the places on which

which they can make a ſtand, provided they ſhould be driven from their firſt poſitions.

When a large advanced guard is ordered, the Commanding Officer of it ſhould procure a plan of a tract of country between it and the main army of about *five* miles in breadth, and increaſe his ſcale till he can inſert diſtinctly all the woods, villages, rivers, &c. If he ſhould ſtand in need of further information, he muſt either endeavour to examine the ground himſelf, or direct an intelligent officer to do ſo.—Sometimes, however, it will not be poſſible for him or any of his party to reconnoitre: in which caſe he muſt content himſelf with having obtained the beſt information in his power from the people of the country. By theſe means he will be enabled to fill up his ſketch ſo as to have a general idea of the nature of his ſituation.—But this part of the ſubject will be more particularly explained hereafter.

CHAPTER

CHAPTER IX.

Of Alarm-Posts.

§ 185. WHEN chains of posts are established for the security of an army in winter quarters, or cantonments, it is of the utmost consequence that the regiments should know where they are to meet and form in case of an attack. These are called *Alarm-Posts*, and such places are fixed upon for this purpose as will enable the troops to make the best defence. The regiments which lie near the enemy, and particularly the regiments of cavalry, must have alarm-posts wherever there is the greatest probability of their maintaining their ground, till the main body has had time to assemble. Marks must be set up to guide the march, and all obstacles removed which are likely to obstruct its expedition: and when the roads are new or unfrequented, these precautions are the more necessary.

If

If the troops have occaſion to paſs bridges or hollow ways, they ought alſo to be well occupied, and totally deſtroyed as ſoon as the columns leave them.

§ 186. BEACONS ought to be placed upon the higheſt parts of the country, that all the poſts may have intelligence of the approach of an enemy: and as they will be neceſſarily expoſed to heat, rain, and froſt, too much attention cannot be paid to their conſtruction: eſpecially ſince it has happened upon important occaſions, that Officers have been entruſted with the direction of them who were totally unacquainted with the buſineſs.—I have myſelf ſeen bunches of ſtraw which had been ſet up as beacons, with common ropes of ſtraw twiſted round their poles to the bottom.—Others where tar-barrels had been added, and ropes of the ſame kind covered with pitch, which ſoon became equally uſeleſs; for the heat of the ſun and the ſeverity of the weather dried up the pitch, broke the barrels, and deſtroyed the com-

buſtible matter within them.—And I once found a beacon, upon a poſt which had been of very great importance, without any barrel. Its head, and the rope whereby the fire was to have been communicated to it, were made of hemp and ſtraw with a thick covering of combuſtible matter. The weather had deſtroyed their effect, and the rope had been twiſted ſo tight that it was impoſſible to ſet it on fire, or even to make it blaze after it had been pulled in pieces.

As ſuch ignorance or inattention may be productive of the moſt fatal conſequences to an army, I conceive it to be my duty to point out thoſe methods which I have tried with ſucceſs, when charged with the duty of a Field Engineer; availing myſelf only of ſuch materials as were to be found in all places.

Take a ſmall barrel of about two feet in length, ſtrengthen its ſides and bottom with iron-hoops, and cover them effectually with ſtraw, that they may withſtand the effect of the weather. Melt about

about as much pitch as will fill the barrel over a moderate charcoal fire, allow an ounce of line or rape-ſeed-oil to each pound of pitch, and in the ſame proportion add half an ounce of gunpowder, and half a drachm of powdered brimſtone. —When they are ſufficiently melted and mixed, remove the pan from the fire, and throw in as much hemp or tow as will form the whole into a proper ſubſtance. The hemp or tow muſt be ſcattered over the ſurface, and the ingredients well-ſtirred together, after each handful.—You muſt then take out the combuſtible with a trowel, place each lump carefully in the barrel, and ſcatter a little mealed powder among them. If the air has a free paſſage between them, as well as at the ſides and bottom of the barrel, the fire will communicate to every part, and blaze up with great facility; which will never be the caſe if the maſs is preſſed or ſqueezed together, eſpecially in a hard froſt.—A ſpace ought alſo to be left open, above the combuſtible matter, into which the fire will

will be conveyed. In this ſpace five or ſix holes muſt be bored, at equal diſtances, to receive as many *ſtupines* *, and when they are all tied together within the barrel, it muſt be filled up with wild-fire. The other ends of the *ſtupines* muſt either hang out almoſt as far as the ground; or, if you have not got a ſufficient quantity, they may be again tied together below the barrel. In that caſe you muſt take as much hemp or tow as will make two cords of about the thickneſs of your finger, let them be lightly twiſted, and when rubbed over with turpentine and mealed powder, tie one of their ends to the *ſtupines*, and let the other hang within four feet of the ground. You muſt then either wrap them up in ſtraw which has been ſteeped in tar, or melted pitch, and twiſt them round the pole; or, they muſt be encloſed in wooden caſes or ſpouts, that they may be effectually defended from the weather.—Inſtead of the uſual top, three or four thin pieces of

* A ſtupine is a ſpecies of ſauciſſon, compoſed of combuſtible matter.—*Tranſlator.*

wood

wood ought to be nailed upon the upper edge of the barrel, tied together above it, and then defended or thatched with ſtraw: becauſe ſuch a covering will throw off the ſnow, which might otherwiſe form a lodgment upon it, and deſtroy the effect of the wild-fire.

A guard muſt be placed at every beacon, and, as ſoon as one of them is in flames they muſt immediately ſet fire to the reſt, that every part of the army may be aware of the firſt approach of an enemy.

PART

PART II.

FIELD FORTIFICATION.

CHAPTER I.

Of Retrenchments in general.

§ 187. NOTWITHSTANDING this branch of the military ſcience is founded upon the rules and principles of Fortification, it is by no means neceſſary that they ſhould be followed, except when the nature of the country, the object you have in view, and other concurring circumſtances ſhould make it adviſable to do ſo: and even then you are by no means compelled to adhere to the ſame degree of regularity *.—Theoriſts are too apt to forget that there is a material difference between the formation of retrenchments upon paper and in the field.—A fault which muſt be attended with dangerous

* See Vol. V. Chap. V.—*Author.*

conſequences: becauſe, unleſs proper attention is paid to the nature of the ground, and to the advantages which may be derived from it, there is no doubt, but that the beſt works will make a very moderate reſiſtance.—For inſtance, if I throw up lines along the ſide or ſummit of an elevated piece of ground, my angles muſt be either ſalient or rentrant, as its form or the ravines below may ſeem to require; and I muſt take care that there ſhall be the heavieſt croſs fire, wherever an enemy will be likely to penetrate, as in Pl. 22, 28, and 30. For, if in conformity to the rules of theoriſm, I was to place any part of my works at ſuch a diſtance from the edge of the height, that I could neither ſee nor fire upon my aſſailants, till they had gained the ſummit, or perhaps till they were within a few paces of my parapet, it is evident that I muſt commit a very great error, and at the ſame time expoſe the army to imminent danger *.

* See the note upon the ſeventh Chapter of the firſt Book of Folard's *Commentaries upon Polybius.—Author.*

§ 188. GREAT

§ 188. GREAT as this fault is, I have found frequent examples of it, and I cannot account for them otherwiſe, than by ſuppoſing the directors of them to have been too ſecure in the bravery of their troops, or in the facility of repelling an enemy, even after they had gained the ditch. —But experience has ſhown the abſurdity of ſuch reaſons, and has convinced us that every ſudden and unexpected event makes a ſtrong impreſſion upon the mind of a private ſoldier. If he can ſee his enemy and fire upon him at a diſtance, he will maintain his courage and diſpute his advance ſtep by ſtep: but, if he is taken unawares, he will neither repoſe confidence in the ditch and parapet before him, nor in the beſt arguments his Officer can make uſe of.

§ 189. RETRENCHMENTS, and indeed all other means of defence ought to be placed where the troops can command the advance of an enemy, and do him the moſt material injury with eaſe to themſelves.

If, when we are in poſſeſſion of the high banks of a fordable river, or the heights near it, I was to place my retrenchments upon their ſummits, with a view of oppoſing the paſſage of an enemy, and of ſecuring them at the ſame time from his fire, as in Pl. 22. fig. 3. *i*, *g*, and Pl. 30. fig. 5; I ſhould at once defeat the intention of my labour. For he would then gain thoſe places unmoleſted, which, if fortified, could either have hindered his advance, or have enabled me to do him material injury.—If the hills are very high, as in Pl. 30. fig. 5, he may advance from E to B, and my artillery cannot hurt him; or, in Pl. 22, I ſhall not be able to ſee him from my works, on account of the inequality of the ground, till he has gained *q*, *m*, *r*. Conſequently, when he is ſo near my ditch, thoſe difficulties which ought to have been the greateſt, are ſurmounted, and his attack muſt terminate with ſucceſs.—But, if I intrench myſelf upon the ſmaller heights near the river or ravine, according to the 291ſt paragraph, *c*, *d*,

Pl. 22.

Pl. 22, and *c*, Pl. 30. fig. 5, or upon the declivity of a hill where I can ſee and rake every ford or paſs; without conſidering whether I am commanded from the oppoſite ſide or not: I can diſpute his progreſs ſtep by ſtep, and deſtroy many of his men, before they can have formed themſelves for a regular attack. The higher their batteries are, the leſs we ſhall have to apprehend, on account of the uncertainty of ſhot, when fired in ſuch a direction. (Chap. VI. § 256.)—My principal batteries and works ought nevertheleſs to be upon the heights above, as in Pl. 22, *i*, *h*, *g*, and Pl. 30. fig. 5, B, as well for the purpoſe of ſilencing thoſe of the enemy, as of covering my parapets below. Paliſaded or other ſecure paſſes ought alſo to be made between them, that my troops may be able to retire whenever they find it neceſſary; Pl. 22. fig. 3, *r*; Pl. 28. N° 1; and Pl. 30. fig. 5, *f*.

§ 190. IN many reſpects great attention muſt be paid to the prejudice, temper, and

genius of the private ſoldiers. For we have frequently found that the ſame men will withſtand the heavieſt cannonade with undaunted firmneſs in the open field, and loſe their courage when fighting behind a parapet or within a retrenchment, as ſoon as a few ſhot come amongſt them. It is therefore evident that they ſhould either be placed in complete ſecurity; or, when that is impracticable (as in the commanded works which I have deſcribed in the foregoing paragraph) that they ſhould be informed of what may happen, and every argument uſed to keep up their reſolution. In ſhort, I am always of opinion, that a private ſoldier is never ſo much affected by the greateſt danger when he is aware of it, as by a trifling accident or difficulty of which he has had no previous idea. This is the ſource of that panick terror which ſpreads itſelf with aſtoniſhing rapidity, and generally occaſions the defeat of the poſt, corps, or army in which it originates.

§ 191. It

§ 191. It is a general rule in fortification, that a place muſt be made equally ſtrong on all ſides; otherwiſe the enemy will direct his approaches againſt the weakeſt part. — But in field fortification this rule may be laid aſide. It is then ſufficient that the Commanding Officer ſhould be thoroughly aware of the real ſtrength or weakneſs of his poſt.—And in the diſtribution of his troops he ſhould never neglect thoſe parts, which he may have reaſon to deem inattackable: for if his enemy is reſolute and firm, he will probably make his firſt attempt upon them. —Of this, the affairs of Adelſbach and Maxen are remarkable inſtances *.—In the latter action, the Pruſſians had but very little idea that the main attack of the Auſtrians would have been on the ſide of Hauſdorff; becauſe no part of their poſition was ſo difficult of acceſs.

In retrenching a poſt or encampment, I believe you ought to pay attention to the

* See Vol. I. Sect. 1.—*Author.*

kind of troops, arms, and artillery by which you will be attacked; and to conſider at the ſame time whether you intend to conſtruct your works ſo as to avoid an action altogether, or only to oblige your enemy to advance againſt ſome particular place.—In the firſt inſtance, nothing muſt be neglected, which can render an attack impracticable: and, in the latter, you muſt tempt him, if poſſible, to march againſt that part, where in reality you are in a ſituation to make the beſt defence.

§ 192. WHEN there is no particular reaſon for avoiding an attack, I ſhould make my works very weak, wherever the enemy would be moſt expoſed to the fire of my artillery, as at a gradual deſcent, &c. or, perhaps I ſhould not fortify them at all.—Every other ſide ſhould be at the ſame time of great ſtrength, eſpecially above precipices or deep ravines, where oppoſition is only to be made by the fire of ſmall arms or the bayonet.—For, by thoſe means, moſt of my troops would be at

at liberty to act againſt the main attack; they would be prepared to expect an aſcent, where they might otherwiſe ſuppoſe it to have been impracticable; and they would not be compelled to truſt entirely to the bayonet;—a weapon which requires more reſolution and firmneſs in its uſe, than ſoldiers are at all times in the poſſeſſion of.

§ 193. IN the choice and defence of a poſt, you ſhould take particular care not to ſubject yourſelf to attacks on all ſides; or in your front and rear at the ſame time: becauſe nothing would be ſo likely to create a panick as ſuch a poſition.—But, if this diſadvantage is not to be avoided, the occupied ground ſhould be of conſiderable breadth, or defended by heights; that the ſhot which are fired by the enemy againſt one ſide, may not reach the men who are acting in the defence of another. At the battle of Torgau the Auſtrians were attacked in front and rear at the ſame time.

§ 194. WHEN

§ 194. WHEN the enemy has been ſo much galled, during his advance againſt our poſt, that he is evidently in doubt, whether he ſhall retire or not; his retreat ought not to be too much obſtructed. That is to ſay, we ought rather to direct the fire of our artillery againſt the front, than againſt the rear of an attacking column; notwithſtanding we might be able to reach any part of it: otherwiſe the troops would preſs forward with greater rapidity, that they might leave the place in which they found themſelves ſo much expoſed. But, as ſoon as they were actually in flight, it might be directed wherever it would do the moſt miſchief; and a few ſhot ſhould be occaſionally fired before them, that thoſe in the front might know they were within our reach.—Proper attention to this particular would probably throw a column into the greateſt confuſion, and increaſe our advantage in every reſpect *.

* A further deſcription of the attack and defence of retrenchments may be found in the ſixth Vol. of my ACCOUNT *of the* WAR, &c.—*Author.*

CHAPTER II.

Rules concerning Retrenchments.

§ 195. LET the ſituation of an army be what it may, it will be found at all times, that retrenchments are either intended to keep off a ſuperior enemy, or to enable the troops to fight advantageouſly. Every rule muſt be favourable to theſe reaſons, and an Officer of quickneſs and penetration will eaſily find out the beſt, and apply them with judgment in all caſes.—With a view of giving inſtruction to the inexperienced, and of avoiding tedious repetitions, I ſhall inſert the general principles, and refer to them occaſionally hereafter *.

§ 196. (1). WE muſt endeavour to give our troops and artillery the beſt defence in

* More upon this ſubject in the third Vol. Sect. 3. *Author.*

our

our power, againſt the fire of ſmall arms, and particularly againſt cannon-ſhot *.

§ 197. (2). WE muſt make the enemy's approach and attack as difficult as poſſible, by means of ditches, parapets, paliſades, &c †.

§ 198. (3). THE ground muſt always be cleared within muſket-ſhot of a retrenchment, that the enemy may not find any ſhelter from our fire ‡.

§ 199. (4). ALL lines muſt be formed ſo as to allow the ſoldiers to fire ſtraight before them. — If the rentrant angle of a redans, (Pl. 4. fig. 1. *e*, *d*, *c*), or if the angle, which the flank *c*, *b*, in fig. 2. makes with the line of defence *e*, *f*, has leſs than 90°, the men will fire upon each other; and, if it has above 100°, (as in fig. 1. *e*, *f*, *g*, and fig. 2. *n*, *o*, *g*), the lines *f*, *g*,

* Vol. III. Sect. 3. Chap. II. III. &c.—*Author.*

† See Vol. III. Sect. 3. and Vol. VI. Chap. X.—*Author.*

‡ Vol. V. Chap. VII.—*Author.*

and

and *g*, *q*, which ſtand moſt in need of defence, will be totally expoſed *.

§ 200. (5). EVERY line muſt be weak, which can only defend its own front, without being flanked by any other or by a battery.

§ 201. (6). ARTILLERY muſt be placed with judgment, and not too much divided. —If we ſuppoſe our cannon to be at equal diſtances from each other, oppoſite the front of an enemy's line of 4,000 paces; and, that they deſtroy 3,000 men, or about one file in four (which muſt be a very favourable ſuppoſition), the openings may ſtill be filled up as they are made, and the advance continued without interruption. But, if the ſame number of cannon are placed in three or four batteries, and each ſweeps off 1,000 men, they cannot be filled up. Fear and diſorder will get the better of the troops, and they will either retreat

* Vol. VI. Chap. XII. and XVIII.—*Author.*

immediately,

immediately, or hesitate whether they ought to proceed or not: in which case, our cavalry can make a charge upon them, penetrate the openings, and throw the whole body into confusion *.

§ 202. (7). ALL works ought to be proportioned to the number of men and cannon intended for their defence. If they are too small, the troops will obstruct each other, and when the enemy has forced his way into them, they will not be able to perform the manœuvres which are necessary for his repulse. And, if they are too extensive, the defenders will not be capable of resisting a vigorous attack; consequently, by endeavouring to defend too much, it is probable that the whole may be lost.

§ 203. (8). A SALIENT angle ought never to have less than 60°, otherwise, much

* In the fifth Vol. Chap. VII. and in the sixth Vol. of my ACCOUNT *of the* WAR, &c. I have explained the use of artillery in every kind of retrenchment.—*Author.*

ground

ground will be undefended in its front, as ſhown by *i*, *e*, *b*, Pl. 4. fig. 1; and the ſpace within will be too narrow.

§ 204. (9). THE works which are in front of a retrenchment muſt be ſo ſituated and conſtructed, that, if taken, they ſhall not cover the enemy from the fire of our principal batteries *.

CHAPTER III.

To retrench a Camp or Poſt.

§ 205. THIS is an undertaking by which an Engineer may gain or loſe much honour: and, as the lives of many brave men are concerned in it, the greateſt penetration and reflection ought to be made uſe of. But when the plan is once fixed, it muſt be proſecuted with activity, vigour, and perſeverance, in ſpite of every obſtacle.

* See Vol. III. Sect. 3, and Chap. IV.—*Author.*

§ 206. WHEN

§ 206. WHEN retrenchments are not merely formed for the purpoſe of deceiving the enemy, and of maſking our real deſign, the directing Engineer muſt take the following points into conſideration, as ſoon as he has been made acquainted with the General's intention.

1. Whether the works are meant to keep off the enemy altogether, or only to give the army an advantage, in caſe of an attack.

2. If the poſt is to be maintained for any length of time or not.

3. If magazines are to be covered by them, communications kept up, or a rapid and unexpected advance upon the main army to be prevented.

4. The advantage or diſadvantage of the ſituation, and the nature of the ſoil.

5. Their proper extent, in proportion to the number of men by whom they are to be occupied.

6. The ſtrength of the enemy, and the poſſible means of an attack.

7. The

7. The number and kind of workmen to be employed.

8. If, and where, the neceſſary materials, utenſils, &c. are to be procured, and in what quantity.

§ 207. WHEN the Engineer has ſufficiently weighed all theſe points, he muſt reconnoitre that part of the country where the retrenchments are to be formed, with great accuracy. If he is in poſſeſſion of a plan of the ground, he ought to ſee whether it is correct, or otherwiſe: and, in the latter caſe, he muſt make one, as complete as the time will admit of.—For, by theſe precautions, he will be enabled to make his ſketch of the works with judgment, and the whole of his undertaking will be greatly facilitated.

§ 208. (1). THE more our inferiority of numbers, and other reaſons, may make us wiſh to avoid an attack, or to be apprehenſive of the ill effects of one, the more ought our retrenchments to be increaſed

in ſtrength. The different poſts ſhould be ſituated ſo as to ſupport each other, and the whole army muſt be capable of manœuvering with freedom, eſpecially if a battle is to be hazarded.—For inſtance, if I make trous-de-loups where my cavalry could act againſt the enemy, or purſue him with advantage, they would be productive of much greater injury than benefit.

§ 209. (2). WHEN a poſt is to be occupied for any length of time, the Engineer muſt have abundance of faſcines, pickets, gazons, &c.; but, when the General has a contrary intention, time and expence ought to be ſpared as much as poſſible.

§ 210. (3). IF a poſt is to be retrenched for the purpoſe of defending a magazine, of keeping up a free communication between the main army and a fortreſs, or between the main army and another corps, it is evident that nothing muſt be neglected which can add to the ſtrength and durability of the works. But, if a temporary

rary advantage is the only object in view, ſuch meaſures will be unneceſſary. Firſt, becauſe an intelligent and expert enemy will probably oblige the corps to quit its poſition, perhaps without the riſk of a battle: and ſecondly, becauſe it will only be wiſhed that they ſhould enable the troops within them to make a reſiſtance, till the main army has received intelligence of their ſituation, and put itſelf into a proper ſtate of defence.

§ 211. (4). THE choice of the ſituation does not always depend upon the Engineer; for in ſome caſes it is neceſſary that a poſt ſhould be left in a particular place, whether the ground is favourable or unfavourable for ſuch a purpoſe. On thoſe occaſions he will have an opportunity of diſplaying his abilities and profeſſional ſkill: for, by a judicious conſtruction of his lines, he can aſſiſt and correct many of the greateſt defects.—The dimenſions of his profiles will depend principally upon the nature of the ſoil.—In ſand they muſt

be ſtronger, and the ditches deeper and broader than in clay: and upon rock, where there is but a thin covering of earth, it muſt be pared away till a ſufficient quantity is procured for the formation of a parapet.—But I ſhall ſay more upon this ſubject in the 9th chapter.

§ 212. (5). THE General ſpecifies the number of men who are to occupy the retrenchments, and the Engineers muſt regulate their extent accordingly.—In ſome caſes, however, eſpecially if the poſts are ſmall, the whole may be left to their management and direction.

§ 213. (6). IT is ſcarce poſſible that a poſt can be well retrenched, unleſs the Engineer is firſt aware of the methods in which it may be attacked.—For inſtance, trous-de-loup ſhould be made, and ſhort ſtakes driven into the ground wherever cavalry can be expected, ſtrong parapets ſhould be formed againſt batteries, and weak parapets againſt ſmall arms.

No

No greater advantage can be required than an obſtruction of the enemy's march or advance; eſpecially when he is obliged to form under your fire.—This object may be attained by means of trous-de-loup, ditches, hewn trees, hollow ways, hedges, chevaux-de-friſe, barriers, &c. provided they are diſpoſed ſo as not to afford him any ſhelter.

§ 214. WHEN the ſides of a height are ſo ſteep that the enemy cannot fire upon you during his aſcent, retrenchments are ſuperfluous, provided his artillery cannot rake our own.—At any rate, a very weak profile, or mere paliſades, will be found to anſwer your purpoſe in ſuch a ſituation *.

* Although this may ſeem to contradict what I have already ſaid in the 192d paragraph, both are to be thus underſtood:—Upon a ſteep height, when the enemy cannot make uſe of his artillery, I conſider retrenchments as unneceſſary: but, when ſuch a height forms a part of an extenſive poſition, which may be attacked in ſeveral places, it ought to be retrenched in the ſtrongeſt manner, that it may be ſecure againſt any deſperate puſh, which he might be otherwiſe diſpoſed to make in that quarter.—*Author.*

CHAPTER IV.

Of Workmen.

§ 215. WHEN works muſt be completed within a given time, it is firſt to be conſidered, whether ſoldiers or peaſants are to be employed, and how the neceſſary utenſils are to be procured. —For, if an Engineer was to form a plan, which could not be completed on account of the want of time and workmen, he would commit one of the greateſt errors in military operations.

§ 216. IF the labour is to be performed by ſoldiers, there is no reaſon to be apprehenſive that the works will not be ready at the appointed hour. With countrymen, however, the caſe is ſo very different, that it is abſolutely neceſſary they ſhould be brought together by force, and conſtantly watched; leſt any of them ſhould run away. This duty is done by huſſars and dragoons,

dragoons, who are ſent to the bailiffs, conſtables, or magiſtrates with written orders, that they ſhall get together a certain number of workmen at a given time, with ſhovels, ſpades, pickaxes, hatchets, wheelbarrows, mallets, &c.—But as it frequently happens that they ſend very old people and children to make up the number, the application ought to be made for more than are actually wanted; particularly upon important occaſions. The magiſtrates will direct how many are to be ſent by each village, and the Commanding Officer's orders muſt be returned to him, that he may ſee they have been ſtrictly obeyed.—When every thing is ready, the Engineer will divide the men as he thinks proper, and put them under the care of non-commiſſioned officers, who will keep them at work and ſee that it is properly executed.

§ 217. If circumſtances will not admit of a relief of workmen; or, if the enemy has got poſſeſſion of their habitations, they will undoubtedly endeavour to run

away. They ought therefore to be locked up every night under a ſtrong guard; and a liſt made of their names, with thoſe of the villages to which they reſpectively belong.

§ 218. THE workmen muſt be proportioned to the quantity of labour, to the time allotted for the completion of the retrenchments, and to the numbers who are capable of being employed at the ſame time. For whenever there are too many in any one part, they will obſtruct each other.—In ſuch caſes they ought rather to be divided into different reliefs, and the work continued, if neceſſary, during the night.—When the ditches are very broad, the workmen may be poſted in two rows, and if they are narrow, in one. In the firſt inſtance, the earth will be thrown by thoſe who are at the outward edge of the ditch to the ſecond row, and by them upon the parapet: for which reaſon the ſecond row ought to be twice as numerous as the firſt, Pl. 15. fig. 1 and 2. The workmen ought

ought never to be leſs than two paces or four feet from each other: and two men with ſhovels ſhould be preceded by one with a pickax.—If, however, the retrenchments are to be completed with more than uſual expedition, one man with a wheelbarrow or baſket may be added to ſix or eight with ſhovels. For inſtance, if a ſquare redout is to be formed, whoſe ſides are 80 feet in length, and a ſpace of four feet is to be allowed to each workman; 80 men will be required when they are placed in one row, and 120 when in two.—The cubic contents of the ditch will be found thus: The breadth of the upper part, *a*, *b*, Pl. 4. fig. 3, is 12 feet; that of the bottom, *c*, *d*, 4; and the depth, 6. Conſequently, to find the line *c*, *f*, $12+4=16:2=8$, or the line required; 8×6 (the depth of the ditch) will alſo produce 48, or the ſurface *a*, *b*, *c*, *d*; and 48×4, give 192, the cubic feet to be dug by each man.

§ 219. THE

§ 219. THE various changes of weather, ſoil, utenſils, and workmen, make it very difficult to fix the time in which a work may be completed. In ſummer it is ſuppoſed a man will dig 216 cubic feet of earth in the courſe of one day; but this is ſeldom found to be the caſe: and, notwithſtanding Marſhal Saxe's aſſertion to the contrary *, I am perſuaded that if a work is completed in 24 hours, it will be as much as the beſt and moſt diligent workmen are capable of doing; even when relieved every four or ſix hours, and abundantly ſupplied with faſcines, paliſades, pickets, &c. Twenty-four hours are generally allowed for the formation of a weak profile, forty-eight for one of middling dimenſions, with a revetement of faſcines, and ſeventy-two for the ſtrongeſt.

§ 220. FOR the revetement of a work,

* M. Saxe ſays, at the concluſion of the ninth Chapter of his Reveries, that 288 men will throw up a redout in *five* hours; of courſe, if we coincide with Capt. Tielke, ſuch an aſſertion is inadmiſſible.—*Tranſlator.*

two

two men ought to be allotted to every ſix feet, to place the faſcines, with one to anchor them and to tread down the earth.—The ſame number ought alſo to be employed in finiſhing the inſide of the parapet; that is to ſay, one in looking out the twigs and two in weaving them.—Theſe calculations are made upon a ſuppoſition that the faſcines, pickets, and twigs have been previouſly prepared, and laid upon the ground.

§ 221. It reſults from what has been ſaid, that, to the men with ſhovels, there ſhould be one-third of their number with pickaxes; that there ſhould be one-ſixth, or one-eighth (if neceſſary), with wheelbarrows or baſkets; and that one man ſhould be allowed to every two feet of the whole extent, to lay the faſcines and finiſh the parapet.—Thus we can at once aſcertain, how many men are to be employed at the ſame time: and of courſe, if they are to be relieved twice or three times, what

what additional number will then be requiſite.

§ 222. WHENEVER there is reaſon to apprehend that the workmen may be diſturbed, either by a real attack or artillery from any of the neighbouring heights, the retrenchments ought to be formed by ſoldiers; becauſe countrymen will undoubtedly run away as ſoon as a few ſhot have been fired.

§ 223. WHEN country-people are ſent for, the utenſils they are to bring with them ought to be particularly ſpecified in the order; and it is by no means improper to make application for more than will probably be wanted: otherwiſe they may find themſelves deficient in thoſe which the nature of the ground may render the moſt neceſſary *.

* The ſenſe of this paragraph might have been added to § 216, with the greateſt propriety and in very few words.
Tranſlator.

§ 224. IF

§ 224. If ſoldiers are employed, the park of artillery will ſupply them with utenſils of every kind; except when it happens to be at too great a diſtance. In that caſe, parties may be ſent to collect them in the neareſt villages: but this ſhould not be too much depended upon, becauſe the inhabitants will hide all that are ſerviceable to them, and only give up ſuch as are almoſt worn out and of no further value.

§ 225. In a ſandy ſoil three-fourths of the workmen generally uſe ſpades, and one-fourth pickaxes; in clay, two-thirds uſe ſpades, and one-third pickaxes; and upon rock or gravel, one half ſhould have ſpades and the other pickaxes *.

* In this paragraph I have only tranſlated a few lines of the German original, becauſe every other part of it may be found in the 216th, 217th, and 223d paragraphs.—*Tranſlator.*

CHAPTER V.

Of the Materials which are neceſſary in the Formation of a Retrenchment.

FASCINES.

§ 226. A CALCULATION muſt be made of the number of faſcines, gabions, pickets, paliſades, chevaux-de-friſe, and other neceſſary materials, before the work is begun.

If the ſide where I intend to add a revetement of ſix foot faſcines * is forty feet in length and ſix in height, forty-nine will be required; that is to ſay, ſeven for the length, and ſeven rows for height: becauſe each of them will be ſqueezed from its original thickneſs of one foot, into about ten inches. At the end of

* At preſent theſe faſcines are ſeldom made uſe of for the revetement of a battery; becauſe it has been found that thoſe of twelve feet in length and eight inches in diameter, are made with equal eaſe, that they can be bound much tighter, and that they are in every reſpect better adapted to ſuch a purpoſe.

Tranſlator.

every

every three feet, a picket muſt be driven through them; that they may remain firm in their proper places *. The banquette muſt be equal to the height of two faſcines.

I can alſo aſcertain the neceſſary number of paliſades and fraiſes by multiplying their breadth, and the ſpaces between them, by the whole length of the ſides.

§ 227. IN fact the artillery ought to direct and ſuperintend the people who are employed in making faſcines, and cavalry ſhould carry them wherever they are wanted.—But, as the Engineers are generally obliged to take this duty upon themſelves, and to employ people who are totally ignorant of the buſineſs; a particular deſcription of them, and of their different dimenſions, will neither be unneceſſary nor foreign to the purpoſe.

§ 228. SAUCISSONS and faſcines are always compoſed of thin branches of trees

* See my additional figures c and d, Pl. 4.—*Tranſlator.*

or bruſhwood, and differ only in length and thickneſs, which may be increaſed or diminiſhed whenever it is convenient.—But this will be fully explained hereafter.—When they are made, poles of about ſix feet in length are driven into the ground two feet aſunder, ſo as to form croſſes three feet high, and tied together in the middle with twigs or cord. (Pl. 4. fig. 4.)—It is of conſequence that theſe croſſes or faſcine-treſtles ſhould be of equal height, and at each end a pole ought to be fixed perpendicularly, to limit the length of the faſcines; fig. 4. *d*.—When this is done, as much wood as is thought neceſſary for a faſcine is laid upon the treſtles, well ſqueezed together with a twitch, and bound with birch, hazel, or other pliant twigs from foot to foot.—Three men are uſually employed at each treſtle, with two to cut and prepare the materials.

The twigs which are uſed in binding faſcines ſhould be laid over a fire till the ſap is dried up, and afterwards twiſted till they become perfectly pliant. Fig. *f*, repreſents

preſents a board, with which the people who make the faſcines can know when they are of the intended thickneſs; and fig. *e*, the twitch.—This may be either a ſhort chain or rope with two wooden handles.—In regard to the choice of wood, I am of opinion, that birch or fir are preferable to all other kinds: but in general you will be obliged to take whatever is to be met with in ſufficient quantities.

§ 229. THE number of faſcines which ought to be finiſhed within a given time, cannot be aſcertained with preciſion, eſpecially if your men have not been accuſtomed to the work: neither is it by any means adviſable to give peremptory orders on that head, leſt they ſhould ſend ſuch as will fly open as ſoon as the pickets are driven through them.—At the ſame time you ought to conſider how the wood is to be procured; if the workmen ſtand in need of much inſtruction; and if they can be occaſionally relieved.

In general a ſauciſſon of 18 feet in length may be finiſhed at each treſtle in the courſe of half an hour; conſequently a ſhorter faſcine will require leſs time: and, when ſix feet faſcines are wanted, ſauciſſons may be made, and afterwards ſawn into three equal parts.

§ 230. FASCINES have different names, according to their ſize and uſe, viz.

1. Sauciſſons.
2. Battery faſcines, or half ſauciſſons.
3. Trench or tracing faſcines.
4. Covering faſcines.
5. Water faſcines.
6. Fagots-de-ſappe.

§ 231. (1). SAUCISSONS are compoſed of the thinneſt and moſt pliant twigs;—they are generally eighteen feet long by ten or twelve inches in diameter: and uſed either for the revetement of the embraſures, or to form the corners of a parapet.

§ 232.

§ 232. (2). BATTERY-FASCINES or half fauciſſons are from eight to twelve feet long, and from ten to twelve inches thick. —Theſe need not be very pliant, becauſe they are only intended for the revetement of the parapet and for the banquette.

§ 233. (3). TRACING or trench faſcines are uſed in ſieges; —they are generally from four to ſix feet long, and eight or nine inches thick.

§ 234. (4). COVERING faſcines are made uſe of to form the tops of magazines and ſaps.—They ought therefore to be compoſed of the ſtrongeſt branches, with the addition of a few hop-poles, that they may be able to bear a conſiderable weight.

§ 235. (5). WATER faſcines are ſix feet in length by one or two feet in diameter; and, as they are uſed in water and moraſſes, ſtones muſt be tied up in them, that they may ſink to the bottom without difficulty.

§ 236. (6). FAGOTS-DE-SAPPE are three feet long and one and a half in thickneſs. —When they are to be made uſe of in a ſiege, a pointed ſtake is fixed in the centre of each; but if they are only intended to fill the gabions, thoſe ſtakes are unneceſſary.

§ 237. FASCINES are anchored in their proper places with long twigs of birch, hazel, or willow, which have undergone the following preparation:—Three pickets are driven into the ground cloſe to each other, as in Pl. 4. fig. 4, *g*; and, when the twigs have been well-dried over the fire, as explained in the 228th paragraph, the thickeſt end of each is faſtened between them, while the other part is wound round and twiſted at the ſame time, till it becomes extremely pliant. A loop is alſo made at each end.—If they are not wanted for immediate uſe, they ought to be buried, or ſoaked in water; otherwiſe they will become hard and loſe their pliability.

§ 238.

§ 238. THE thickeſt end of each twig is put through the loop at the other, to receive the faſcine; and, when it has been pulled as tight as poſſible, a picket is driven into the ground till only an inch of its head is viſible *.

§ 239. THE pickets which are driven through the faſcines for the purpoſe of fixing them together, ought to be about one inch thick, and from two to three feet long, that they may paſs through two of them and into a third †.

OF GABIONS.

§ 240. THE number, length, and ſtrength of the pickets ought of courſe to be regulated by the ſize of the gabions you wiſh to make, and by the pliability or ſtiffneſs of the twigs.

* See my additional fig. *d.* Pl. 4.—*Tranſlator.*

† See my additional fig. *c.* Pl. 4.—*Tranſlator.*

§ 241. SMALL gabions are made with the leaſt trouble, and one man can carry, place, and fill them with eaſe. They are uſually three feet high by two in breadth: but the pickets upon which they are made, ought to be an inch and a half or two inches thick, and four feet long, that they may be driven one foot deep into the ground.

§ 242. LARGE gabions are ſix feet high by three in diameter, and require two men to carry them.—It was once cuſtomary to make them even of nine feet in height by four in diameter; but thoſe have long been exploded, on account of the extreme trouble which attended the making, carrying, and filling them.—And, even when epaulements are to be formed, it is found more convenient to place three foot gabions upon others of ſix feet, rather than to make uſe of thoſe of nine feet.

§ 243. THE ſmalleſt ſized gabions, which are ſet upon the parapet, for the purpoſe of

of guarding the ſoldiers againſt the fire of ſmall arms (eſpecially when the enemy has a more elevated ſituation than yourſelf) are formed upon pickets of one inch in thickneſs and one foot in length. They are twelve inches in diameter at the top, but only *eleven* at the bottom: becauſe, when two are placed together, it is intended that there ſhould be room to point the muzzle of a firelock between them *.

§ 244. In the formation of all gabions, you muſt either deſcribe circles upon the ground of the ſize of thoſe you wiſh to make, or prepare round pieces of wood as models. (Pl. 4. fig. 6, *a*.)—In the firſt caſe, your pickets are be driven into the ground at equal diſtances; and in the ſecond, they are to be put through the notches which have been cut for that purpoſe. A ſmall gabion will require ſeven or eight pick-

* Although the muzzle of a firelock might be ſqueezed through a ſpace of two inches in breadth, I believe it would be much more convenient and advantageous, if theſe gabions were not more than nine inches in diameter at the bottom.

Tranſlator.

ets, and a large one from nine to eleven.—You muſt weave a few twigs round the upper ends of the pickets to prevent their flying open, fig. 6, *b*: then, beginning at the bottom, keep working upwards till you come near that part, and let the whole be driven down with a mallet before you finiſh the top. Laſtly, both ends are to be ſecured by twigs wattled through the ſides, as explained in fig. 6, *c*.—The twigs of willow, birch, hazel, alder, poplar, and beech trees, are almoſt equally uſeful in making gabions.

Four men ought to be allowed to each gabion, with two axes, a bill, a mallet, and a ſpade; two of whom will collect and chooſe the wood, while the others are employed in making it.

§ 245 WHEN workmen are diligent, a three-foot gabion may be made in the courſe of half an hour.

§ 246. To make the hurdles, Pl. 4. fig. 5, which are uſed in attacks, to cover the ene-

my's

my's trous-de-loup, and to enable the troops to ſtand with ſafety upon a moraſs; you muſt drive ſtakes into the ground, at equal diſtances, upon a line marked for that purpoſe, and wattle them as deſcribed in the 244th paragraph. Remembering only that the thinneſt ends of the twigs muſt be wove round the firſt and laſt ſtakes; otherwiſe they will not be of equal ſtrength and thickneſs in every part.—As ſoon as a hurdle is finiſhed, pull it up from the ground, and ſaw off both ends of the ſtakes upon which it has been made.—Theſe ſtakes ought never to be leſs than two or three inches in thickneſs.—Their length and number will of courſe depend upon the intended ſize and ſtrength of the hurdles. In general, they are from four to ſix feet long, and about eight, ten, or twelve inches aſunder.

§ 247. WHEN the revetement of the interior talus of a parapet, or of a work *en cremaille*, is to be formed by twigs wattled upon ſtakes; it is only neceſſary to ſecure the

the top after the manner of the gabions. If you have an abundant ſupply of materials, and can allow one man to every two paces, the whole revetement may be finiſhed in the courſe of one day; which is ſeldom practicable when faſcines are to be made uſe of, unleſs they have been prepared beforehand and are ready upon the ſpot.—In a ſandy ſoil this kind of revetement is always preferable for the interior talus; becauſe it is very difficult to anchor faſcines, and they generally give way.

§ 248. As the method of making chevaux-de-friſe, Pl. 4. fig. 11; barriers, fig. 12; paliſades, fig. 8; and fraiſes, fig. 9, and 10, may not be properly underſtood by the carpenters, who are always charged with ſuch buſineſs; I ſhall proceed to explain what is moſt neceſſary to be attended to: but without entering into a detailed deſcription of them. Common chevaux-de-friſe (fig. 11.) are twelve feet long, and when placed, four feet high. The beams, through which the ſpikes or teeth

teeth paſs, are ſix inches thick. — At one end, there is an iron ring, and at the other, a ſwivel, for the purpoſe of hanging them together. Their teeth are of hard wood, an inch and a quarter in thickneſs, ſhod with iron at each end, and about ſix feet five inches long *. The holes which receive them are one foot aſunder, and bored in ſuch a manner, that the teeth of one row ſhall always be half a foot from thoſe of the other.

Formerly chevaux-de-friſe were in general uſe in almoſt all armies; and they are ſtill common among the Ruſſians, eſpecially when oppoſed to the Turks, as a defence againſt their light cavalry. During the march of a Ruſſian army, the beams are carried in the waggons and the teeth by the ſoldiers.

The principal uſe of chevaux-de-friſe is to encloſe the gorge of a fleche, or the entrances into a retrenchment. In the

* Theſe chevaux-de-friſe are perfectly proper as a defence againſt infantry; but thoſe which are uſed againſt cavalry ought to ſtand ſix feet above the ground, conſequently their teeth muſt be *nine* feet long.—*Author and Tranſlator.*

laſt

laſt caſe, one end generally turns upon a poſt, while the other is ſupported by a wheel; that it may be opened with the greater eaſe and convenience.

§ 249. THE barriers which are ſometimes placed croſs the ends of villages, ſtreets, defiles, or roads leading through a retrenchment, are conſtructed after the manner of chevaux-de-friſe; but with ſtronger teeth.—They may be made either to lift up at one end, or to wheel round as deſcribed above.—The firſt method is the moſt common in open or fortified towns, and the latter in paſſes through a retrenched poſition.—Whenever the openings are twenty-two feet wide or upwards (as is generally the caſe in large retrenchments), the barriers ought to turn upon a poſt fixed in the centre; and, in that caſe, there ſhould be a wheel at each end.

When barriers are made with teeth, it is to be remembered that they ſhould only have three rows of them *; that the ſol-

* See my additional figure *e*, Pl. 4.—*Tranſlator.*

diers

diers may be able to keep off the enemy with more eaſe, and to prevent his cutting them down.—If the teeth cannot be ſhod or pointed with iron, they muſt be very ſtrong, and well fixed in the beams.

§ 250. PALISADES ſhould be from two to three feet deep in the earth, and ſeven feet above it; and fraiſes are uſually eight or ten feet in length, that one end may project from two and a half to three feet beyond the edge of the berm, while the other is well fixed in the parapet. The former ſhould be four, or four inches and a half in thickneſs, but the latter need not be quite ſo ſtrong.—Both are pointed at one end.

When paliſades are placed in ditches, their length muſt depend entirely upon the depth of thoſe ditches; becauſe they ought never to be above a foot higher than the counterſcarp, leſt they ſhould be ſhot away by the enemy's artillery. They muſt be three inches diſtant from each other, and ſtrengthened by rafters nailed about

about a foot and a half below their tops.—But more will be ſaid upon their uſe and application in the 293d, and three following paragraphs.

CHAPTER VI.

Of Artillery and their Portée.

§ 251. BEFORE I give a particular account of the uſe and conſtruction of works in the field, I think it neceſſary to make ſome mention of the portée of cannon, according to the direction in which they are fired; and of the conſequences of heights commanding each other: becauſe theſe are matters which cannot be too well conſidered or underſtood, when a poſt is to be choſen or retrenched.

Shot will have different names, according to the direction of the cannon out of which they are fired, viz.

1. Horizontal and *viſir* * ſhot.

* Meſſrs. Craufurd have explained the meaning of this German term, in the table of diſtances, &c. which they have added to the firſt volume of their tranſlation of Capt. Tielke's ACCOUNT *of the* WAR, &c.—*Tranſlator.*

2. Aſcending, when the gun is elevated;—and,

3. Deſcending, when it is depreſſed.

Each of theſe may be again divided into point-blank or curved ſhot.

§ 252. (1). WHEN a cannon is planted in ſuch a manner that the bore, or rather the axis of the bore, is in a direct line with the object at which you fire, the ſhot will be horizontal; and although the mark may be higher or lower, the ſhot will be point-blank, provided it can fly ſo far in a ſuppoſed ſtraight line. Theſe ſhot always have the greateſt degree of force; and a battery can never be ſaid to be properly placed againſt any fixed object, unleſs it can be reached by them. But, as it is well known that a cannon-ball never flies in a ſtraight line, on account of the attraction of the earth, the oppoſition of the air, and other phyſical reaſons which need not be mentioned here; I ſhall only obſerve, that the cannon ought to be more or leſs elevated, in proportion to the required length of its flight.

flight. An angle of 45° will give the greateſt extent of range; but at the ſame time the ſtrength and certainty of the ſhot will decreaſe according to the elevation of the cannon *.—If a cannon is fired at the elevation of one degree, it is called a *viſir* ſhot, and may be conſidered here as horizontal without impropriety; becauſe this ſmall elevation is merely given with a view of counteracting a depreſſion of the ball, and of enabling it to hit a diſtant object.

All horizontal or point-blank ſhot do incredible miſchief when they take the head of a column or the flank of a line. Of which a ſufficient inſtance has been given in the 162d paragraph.

§ 253. (2). WHEN a cannon is elevated from one to forty-five degrees above its horizontal poſition, the range of the ſhot

* It is evident that theſe lines ought not to have been inſerted in this paragraph; and I believe it has been found that an angle of about 43° 30′ will give the greateſt amplitude of range.—*Tranſlator.*

muſt

muſt be curved; unleſs it reaches the intended mark during its aſcent.—To hit a diſtant object is at all times attended with difficulty, eſpecially if it is much higher than your own battery; becauſe you are under the neceſſity of taking aim above it, to counteract the effect of the air upon the rapid motion of the ball: and, excluſive of this diſadvantage, it is to be remembered that you can only ſtrike one point.

Theſe conſiderations induce me to give the preference to howitzes; except when you wiſh to looſen the walls of a work, that they may be afterwards battered down with the greater facility.

§ 254. CURVED ſhot may have a vaſt amplitude of range; but when they hit the intended mark, more is to be attributed to accident, than to the particular ſkill of the artillery-men by whom they were projected: and if they are productive of any confuſion or miſchief, where a number of troops are crowded together in a confined ſpace, they do all that can be re-

quired or expected.—I am therefore of opinion, that this method of firing is an idle expenditure of ammunition, which might be otherwiſe applied with real advantage to the ſervice.

§ 255. I HAVE added the following table, to ſhow how far different pieces of cannon are capable of carrying in proportion to their calibres; and I conceive ſuch an addition to be by no means unneceſſary; becauſe it will prove whether the poſition we intend to occupy is within the reach of the enemy's batteries or not.—It has been found by experience that the length of the bore, the quality of the powder, the weather, and many other cauſes, will alter the flight of almoſt every ball which is fired out of the ſame kind of ordnance, with the ſame charge, and in the ſame direction: conſequently, theſe calculations can only point out the *probable* extent of their range.

A TABLE,

A TABLE,

To ſhow how far each kind of cannon is capable of carrying, with a charge of powder equal to half the weight of its ball.

The Cannon.	Viſir or point blank.	Engliſh feet.	With an elevation of 45°.	Engliſh. feet.
Whole *cartauns*, or 32-pounders -	from 1,200 to 1,400 Rhinland feet.	from 1,236 to 1,442	14,400 Rhinland feet.	14,837
Half *cartauns*, or 24 pounders -	from 1,020 to 1,920 Rhin. feet.	from 1,051 to 1,978	from 12,180 to 14,400 Rhin. feet.	from 12,550 to 14,837
Sixteen-pounders -	1,920 Rh. feet.	1,978	19,200 Rh. feet.	19,783
Quarter *cartauns*, or 12-pounders	from 900 to 1,080 Rhin. feet.	from 927 to 1,112	from 10,560 to 12,000 Rhin. feet.	from 10,880 to 12,364
Regimental 8-pounders - -	from 780 to 960 Rhin. feet.	from 803 to 989	from 8,640 to 10,800 Rhin. feet.	from 8,902 to 11,128
Four-pounders - -	720 Rh. feet.	741	7,200 Rhin. feet.	7,419
Two-pounders - -	360 Rh. feet.	370	3,600 Rhin. feet.	3,709

§ 256. THE following reaſons will ſhow the diſadvantages you labour under, whenever you are obliged to fire at an object below your battery, and they will prove that thoſe diſadvantages increaſe in proportion to the neceſſary depreſſion of the cannon.

1. Your ſhot can only hit one point.

2. The cannon and their men muſt be expoſed.

3. The conſtruction of the guns ſeldom admits of ſufficient depreſſion.

4. Their portée is neceſſarily diminiſhed; and

5. They are always uncertain, eſpecially when the object is near them.

§ 257. BY an *enfilading* fire it is either meant, that your artillery can take the enemy in flank or in rear.—In the firſt caſe, the ſhot are generally fired *en ricochet* *, and they do the greateſt execution.

a. The

* When ſhot are fired en ricochet, the cannon muſt have ſuch a charge of powder as will merely throw them out of the muzzle of

a. The fire will be horizontal, when the battery and the object at which you fire are of equal height.

b. If the object is higher than the battery, the range will be curved.

c. If it is lower, the enfilade will be extremely dangerous, and the enemy cannot defend himſelf without the greateſt difficulty.

When your batteries enfilade the enemy's rear, his ſituation is particularly hazardous, becauſe it very rarely happens that he can cover himſelf: eſpecially if you can enfilade his flank at the ſame time.

§ 258. THE laſt deſcription of fire which I ſhall take notice of, is, when your lines are conſtructed in ſuch a manner, that the fire of two or more batteries croſs each other at certain points. Theſe are termed *croſs-fires*, and they are of the greateſt ſer-

of the piece; for inſtance, inſtead of three our four pounds, there muſt not be more than four, ſix, or eight ounces.—Every ball will then bound forcibly along the ground, and do incredible miſchief wherever it goes.—*Author.*

vice both in attack and defence: becauſe they ſilence all the enemy's batteries within their reach, and ſoon bring down their works. While the heavieſt ſimple fire upon their front will only looſen and injure the walls.

CHAPTER VII.

Of Heights commanding each other.

§ 259. WHAT I have already ſaid upon this ſubject in the 142d paragraph, and upon the fire of artillery in the preceding chapter, will be ſufficient to prove that the uſual apprehenſion in ſuch caſes is generally carried too far. If there is but little difference between our own heights and thoſe which command us, we ſhall be expoſed to conſiderable injury; becauſe cannon-ſhot will rake them completely (Pl. 30. fig. 1, B): but, if they are much more elevated, and do not extend upon our flanks, we cannot labour under any material diſadvantages,

vantages, beyond the difficulty of concealing our movements, and the idea of danger, which will probably ſpread itſelf among the ſoldiers, when they ſee an enemy ſo much above them. On that account, however, his ſuperiority is much more imaginary than real; for he will find great difficulty in pointing his cannon; his ſhot will only hit one point, and immediately bury themſelves in the ground: as may be ſeen in Pl. 30. prof. 3.

§ 260. CONSEQUENTLY, when an attack is made upon a ſteep height, the fire of enemy's artillery will almoſt loſe its effect as ſoon as you are near the foot of it. By the profiles 3 and 5, in Pl. 30, it is proved that you will be completely under his fire within *c* and *e*; becauſe the guns are not capable of further depreſſion: and, if there are hillocks in front of the main height, as at B in prof. 3, you can puſh on the attack with vigour till you reach them, and then give your men reſt in ſecurity.

As I have now pointed out the diſadvantages which the enemy muſt labour under in the defence of ſuch heights, I ſhall proceed to ſhow that the aſſailants will have ſtill greater difficulties to encounter, and that they will be expoſed to very conſiderable danger.—In the firſt place, when you attack a height, your cannon will have little or no effect, unleſs you can command it from others; and, if the enemy retires a few paces from the edge, all your ſhot will paſs above him. Pl. 30. fig. 2.—It is therefore evident, that artillery ſhould not be uſed upon ſuch occaſions, and that every thing muſt depend upon expedition, and a firm reliance on the bayonet: 2dly, Your cavalry will be unſerviceable when the aſcent is ſteep: 3dly, Your infantry will be obliged to reſerve their fire during the advance, that the ammunition may not be ſquandered without effect: and laſtly, Your troops will be ſo much fatigued when they gain the ſummit, that they will probably be driven back without difficulty.

§ 261.

§ 261. WHENEVER there are heights near our poſition from whence it can be commanded by the enemy's batteries, we muſt conſtruct our lines ſo as to avoid an enfilade, in caſe he ſhould take poſſeſſion of them, and endeavour to cover ourſelves by epaulements.

§ 262. IF the front of our poſition is covered by a fordable river, whoſe oppoſite banks are higher then thoſe which we occupy, it will be conſiderably to our advantage to intrench ourſelves upon the ſide of the declivity in the manner deſcribed in the 291ſt paragraph.—By thoſe means we ſhall impede the enemy's paſſage, and be at the ſame time too far below his batteries to have much cauſe of apprehenſion.—Should it be neceſſary, we can alſo add to our ſecurity by making the parapet higher than uſual, with two or three banquettes, as in Pl. 30. fig. 5, *c*, and by covering the embraſures with ſtrong faſcines.

§ 263.

§ 263. HEIGHTS with a gradual descent are by far the most favourable to the defenders, because the enemy must be continually exposed to fire during his attack. Pl. 30. fig. 4.

CHAPTER VIII.

Observations upon Lines, Angles, and Polygons.

§ 264. THE ditch and parapet are the essential parts of every retrenchment. The ditch furnishes materials for the parapet *; and both are intended to be very considerable obstacles in the way of an enemy during his advance against us. Consequently they ought to be of sufficient dimensions to answer those purposes. This advice is by no means unnecessary; for, singular as it may appear, it frequently happened in the seven-years war, that even cavalry penetrated into retrenchments in spite of such obstacles.

* See DITCH, Vol. V. Sect. 3. and Chap. VIII.—*Author.*

One

One of the ſeveral inſtances, which came within my knowledge, may, with propriety, be laid before my readers; becauſe I happened to be an eye-witneſs of the fact.

§ 265. WHEN the Auſtrians were marching to the relief of Dreſden in 1760, M. Zeſchwitz, at the head of his ſquadron, forced his way into a large incloſed retrenchment near the Weiſſen-Hirſch, upon the 19th of July, and took poſſeſſion of it.—M. Zeſchwitz was at that time Captain of cavalry in the Auſtrian ſervice.

§ 266. As the parapet ought to defend us from the enemy's artillery, it muſt be thick enough to reſiſt all cannon-ſhot *.

At the ſiege of Colberg, a cannon-ball came through one of the parapets and took off the head of an artillery-man who was ſtanding near me.—Such circumſtances tend very much to create fear and diſcontent among the troops.

* See PARAPET, Vol. V. Sect. 3, and Chap. VIII.—*Author.*

§ 267.

§ 267. UNLESS parapets flank each other, the fire from them will not be ſtronger than that of lines drawn up in the open field; neither will the troops derive any advantage from ſuch a ſituation, beyond that of being covered. And, as their aſſailants will then be able to preſent a larger front than themſelves, even with an equality in point of numbers, I believe even that advantage will prove much more imaginary than real.—It is conſequently evident that ſuch parapets muſt be too weak, and that the fire of two or more lines ought always to croſs each other: which cannot be effected but by means of *ſalient* and *rentrant* angles.

§ 268. WHEN a ditch is of ſufficient depth and breadth, it is of itſelf capable of doing much ſervice. Becauſe, if we ſuppoſe the aſſailants to have got into it, after having forced their way through our fire, they will ſtill be unable to make uſe of their muſkets in ſtorming the work, while we can either fire with great advantage, or

or have recourſe to the bayonet.—And if it is at the ſame time ſtrengthened by paliſades, your lines will be almoſt in perfect ſecurity, eſpecially with a fraiſed parapet, provided the troops behind them can be perſuaded to maintain their ground.—But experience has repeatedly proved to us, that, in ſpite of the beſt paliſades and fraiſes, all works are uſually deſerted as ſoon as the enemy makes his appearance upon the edge of the ditch.

This is one of thoſe circumſtances for which I am at a loſs to aſſign any well-grounded reaſon, unleſs it proceeds from cauſes ſimilar to thoſe which will be explained in the ſequel: for cuſtom and prejudice always have a conſiderable influence over the minds of private ſoldiers.

§ 269. In the exerciſe of troops it is cuſtomary, and indeed almoſt reduced to an eſtabliſhed rule, that, after a few rounds, the defenders muſt either retire from their works, or lay down their arms, as ſoon as the enemy comes near them. Conſequently,

§

quently, the ſoldiers form an idea, that the caſe will be ſimilar upon actual ſervice. The aſſailants are therefore inſpired with courage and confidence of ſucceſs, while thoſe who are to ſuſtain the attack take it for granted they muſt give up the point.—Another cauſe may proceed from the opinion too generally entertained among ſoldiers, that the firelock is only of uſe in keeping the enemy at a diſtance from them *.

§ 270. As prejudice is found to operate ſo ſtrongly upon the minds of common men; perhaps M. Saxe's idea of

* In the latter part of the original paragraph, Capt. Tielke recommends *flails* as inſtruments peculiarly adapted to the defence of a retrenchment; but as ſuch an idea appears to be equally whimſical and ridiculous, I have taken the liberty to omit a tranſlation of it.—And indeed, if we admit the full extent of what he has ſaid before, it ſhould ſeem that reſiſtance is ſeldom or ever to be made when the aſſailants have gained the edge of the ditch, and that the bayonet is almoſt an unneceſſary appendage to the firelock.—But experience has repeatedly ſhown, that the minds of brave men are very rarely influenced, in ſo ſhameful a degree, by any cuſtom or prejudice whatever, and that the enemy may be driven back by the bayonet, even after he has gained the parapet. Of which, he has himſelf given a remarkable inſtance in the 271ſt paragraph.

Tranſlator.

arming one rank with long pikes, would, if adopted, be of more ſervice than the bayonet in the defence of a parapet.—General Schmettau was of the ſame opinion; for when the Turks beſieged Belgrade in 1739, he was deſirous of putting fifty men with pikes into a redout of much conſequence; from a perſuaſion that they would do very great execution with them *. If the troops employed in the defence of a work, could be brought to place a firm and manly confidence in their bayonets, there is no doubt but that they would be effectually enabled to keep off the aſſailants, and to throw them headlong into the ditch, as ſoon as they ſhould venture to mount the parapet.

§ 271. THE laſt ſiege of Schweidnitz produced the following ſpecimen of what brave men are capable of doing in the defence of a common retrenchment.—One of

* "GEHEIME NACHRICHTEN *von dem* KRIEGE *in* UNGARN," during the campaigns of 1737, 1738, and 1739, publiſhed at Leipzig, ann. 1772.—*Author.*

the

the fleches, which had been newly thrown up in front of the fortreſs, was ſtormed ſeven times by the Pruſſians without effect. In one attempt they had actually forced their way upon the parapet, but were repulſed by the heroic conduct of Captain Brady and his ſoldiers; and, although they had carried on the ſap ſo near the work itſelf, that their gabions were placed even upon the edge of the glacis, they were torn down with hooks, and the poſt was glorioufly maintained till after the town had capitulated *.

In the year 1761, the Ruſſians were alſo under the neceſſity of making regular approaches againſt Werner's corps, when it was retrenched near Colberg †.

§ 272. Of all *rentrant* angles, thoſe of 90° are the beſt, as may be ſeen by Pl. 4. fig. 1.—For inſtance, the line *a*, *b*, is defended and flanked by the line *b*, *c*; and, as *b*, *c*, is at right angles with *a*, *b*, the

* See the operations on the 18th, 26th, and 27th of Auguſt, Vol. IV. Sect. 4.—*Author.*

† See Vol. V. Sect. 1. and 2, and Pl. 1.—*Author.*

ſhot

ſhot which are fired from the one muſt fly parallel to the other; conſequently their ditches and the ground between them will be effectually raked. — If the angle is obtuſe, or above 90°, as *e*, *f*, *g*, the lines of fire, *f*, *k*, *e*, *i*, are no longer parallel to *f*, *g*; of courſe, they can neither defend the ditch nor the ſpace *f*, *g*, *k*; and if the angle is acute, or under 90°, the defenders may fire upon each other, and the ditch will be as ill defended as in the former caſe.—*C*, *d*, *e*.

§ 273. A SALIENT angle ſhould not have leſs then 60°. Firſt, becauſe the expoſed ſpace in front of the points *e* and *c* will be greater in proportion to the acuteneſs of the angle; and 2dly, becauſe the inſide of the work will be ſo narrow, that there will neither be room at the point for infantry, nor even for a piece of artillery.

§ 274. I THINK it will appear, from what has already been ſaid, that the beſt ſtar-

forts cannot be very ſtrong.—Their ſalient angles are generally too narrow within, and the defence of the lines muſt be imperfect; becauſe the ſhot can never fly parallel to them, unleſs the ſoldiers fire obliquely, and with the greateſt nicety: and theſe are points which muſt not be looked for in the time of action.

§ 275. A TRIANGLE is by far the moſt inconvenient polygon, on account of the acuteneſs of its angles; and thoſe who wiſh to learn the formation of ſuch works, may examine the 5th plate of M. de Clairac's treatiſe on field-fortification, fig. 2*.

The generality of ſquare works will only have a ſimple or front-fire, with a conſiderable expoſed angle at every point.—M. de Clairac recommends a method of defending the ſquare by means of flanks, which may be ſeen in the ſame plate, fig. 3. I

* See FLECHES and TRIANGULAR FIGURES, Vol. VI. Chap. XI.—*Author.*

§ diſlike

diſlike his idea, and am decidedly of opinion that it is much better to adopt any other figure of a more convenient ſhape, and with a more perfect defence *.

The methods of cutting off the angles of a ſquare, with a view of increaſing its ſtrength, or of forming its ſides *en cremaille*, will be taken notice of when I explain the conſtruction of works †.

In a caſe of neceſſity, a flank defence may be given to a pentagon; but it is by no means ſo well adapted to ſuch a purpoſe as the hexagon and other polygons; which I ſhall take into conſideration hereafter ‡.

* See SQUARE-WORKS, Vol. VI. Chapter XI.—*Author.*

† See Muller's tranſlation of the Field-Engineer of M. le Chevalier de Clairac, Chapters I. and II.—*Tranſlator.*

‡ See PENTAGON, Vol. VI. Chapter XI.—*Author.*

CHAPTER IX.

Of the Profile.

§ 276. THE profile of a work ſhows the contents and ſtrength of every part of it.—A good profile is therefore of the greateſt importance in building fortreſſes and in the formation of every ſpecies of retrenchment; for it is as evident that a well-proportioned profile will improve a very moderate deſign, as that the beſt deſign will become weak if executed upon a bad profile.—In all caſes the profile ought to be thus regulated: firſt, by the view with which the work is formed; ſecondly, by the time and materials; and thirdly, by the nature of the ſoil.

§ 277. THE intent of a work implies, whether it will have occaſion to reſiſt the fire of artillery, or of ſmall arms; and whether it is to be of long or ſhort duration. At the ſame time it muſt be particularly remembered

remembered by the Engineers, that nothing but the impossibility of erecting batteries against it, should induce them to make their parapets too weak. For, according to the present mode of carrying on war, it very rarely happens that a post is attacked, or indeed that any military project is carried into execution, without the help of artillery.

§ 278. WHEN works are only intended to give a temporary defence, they may be formed entirely of earth; but, if they are to be of long duration, they ought to have a good and well-anchored * revetement of fascines: unless the want of time and materials should make it necessary to adopt some other method.—I was once under the necessity of constructing works in so severe a frost, that the ground could not be dug up without pickaxes; and, as it was neither possible for me to form the interior talus with the lumps of earth

* The method of anchoring fascines has been explained in the 237th paragraph.—*Translator.*

while they were in ſuch a ſtate, nor to procure faſcines for that purpoſe, I had recourſe to another expedient, viz. I drove ſtakes into the ground at the diſtance of about four feet from each other, and laid boards behind them, which I got from a neighbouring village. I made the parapet rather higher than uſual, that it might be of ſufficient height when the froſt was at an end, and added a temporary banquette of boards placed upon ſquare pieces of wood, that it might be afterwards removed without trouble. Theſe works were not as pleaſing to the eye as thoſe which are made in the uſual manner; but they effectually anſwered the purpoſes required of them.

If you wiſh to throw up a permanent work with more than uſual expedition, and have no faſcines in readineſs, the revetement of the talus may be formed with twigs wattled upon ſtakes, as before explained; or with branches laid looſely behind them. In the firſt caſe, the twigs of willow

willow or birch are preferable to all others, and in the ſecond, branches of fir.

§ 279. THE neateſt and beſt method of forming the revetements of a work is with clods of earth of about a foot ſquare. For if they are laid upon each other with the grown ſides downwards, and faſtened together with wooden pegs, they will ſoon unite themſelves into a compact body and acquire incredible firmneſs *.

OF THE DIFFERENT SOILS.

§ 280. THESE are either; (1), clay or ſtiff earth; (2), ſand; (3), rock or gravel; and (4), moraſs.—Each of them will require a different profile, which I ſhall en-

* Here the author ſeems in ſome meaſure to contradict what he has ſaid at the beginning of the laſt paragraph; therefore, I think it neceſſary to add a few words by way of explanation. In one caſe, he means to ſay, that works may be expeditiouſly thrown up, as a temporary defence, without any revetements whatever; and in the other, that a very durable and permanent revetement may be made with clods of earth, if they are properly cut and placed. Conſequently, the works which are recommended in this paragraph, are not in a ſtate of perfection for ſeveral months after they have been formed.—*Tranſlator.*

deavour to explain in as few words as poſſible.

I. OF THE PROFILE IN A CLAYEY OR STIFF SOIL.

§ 281. RETRENCHMENTS in ſuch a ſoil are more durable than in any other, and thrown up with greater expedition; becauſe it is neither neceſſary to add a revetement of clods or faſcines, nor to give the profile ſo much length of baſe as in a looſe ſoil *. — It has been found by experience, that balls from one to four pounds will always bury themſelves in clay about four or five feet deep; thoſe of ſix or eight pounds, about ſix or ſeven feet, and thoſe of twelve pounds, about eight or nine feet: conſequently the parapet need not be above twelve, fourteen, or ſixteen feet in thickneſs †. — Every other dimenſion

* See Capt. Tielke's note upon the 283d paragraph. *Tranſlator.*

† See Vol. V. Sect. 3, and Chap. VIII.—*Author.*

and

and proportion may be ſeen by the profiles in the 4th and 5th plans *

The profiles A, B, C, are thrown up againſt heavy artillery; D, E, F, againſt ſmall arms: B, D, have only one banquette, A, E two, and C, F, would require three; but, inſtead of the firſt and ſecond, the ground is gradually ſloped off.

The laſt-mentioned profiles are formed with a view of ſheltering us effectually from the enemy's fire when he has an elevated ſituation, and of giving us the command of more ground than we could otherwiſe have had. It is of courſe underſtood that no banquette muſt be made in thoſe places where cannon are planted. The glacis of each profile is made with the ſuperfluous earth, which is thrown out of the ditch: in A, C, F, they are three feet high; in D, E, two; and in B eighteen inches.

* In the original work the author ſays he has only marked the dimenſions upon the firſt profile, becauſe they can be eaſily found by the ſcales which are annexed to each plan. For the convenience of my readers, I have added figures to all of them; conſequently a tranſlation of thoſe lines would have been unneceſſary.—*Tranſlator.*

—All

—All their banquettes are a foot and a half high and three feet broad. The interior talus of each parapet is one foot, and the exterior talus is equal to half the ſlope: therefore, in the profile A, it is 3 feet; in B, 2¼; in C, 3¼; in D, 2½; in E, 3¼; and in F, 4.—In A, the baſis of the parapet is 16 feet; in B, 15¼; in C, 16¼; in D, 8½; in E, 9¼, and in F, 10.—The height of the parapet above the banquette muſt never exceed four feet and a half, and when you fire from a height into a valley, it may be ſtill lower. Pl. 8, U. It may alſo be neceſſary upon other occaſions to give the parapets leſs than four feet and a half in height, as will be ſhown in the 352d paragraph. The ſuperior talus of the parapet muſt be regulated by the glacis and the ground in its front, becauſe it is of the utmoſt conſequence that the enemy ſhall never get under your fire; which would undoubtedly happen if it was too inconſiderable. In A, B, C, D, there is a ſlope of 1½, and in E, F, of 1 foot.—In A, the top of the ditch is 21 feet in breadth; in

in B, 18; in C, 27; in D, 11; in E, 14; and in F, 17: in A, E, their depth is 7½ feet; in B, D, 6; and in C, F, 9: and their breadth at the bottom is, in A, 13½ feet; in B, 12; in C, 18; in D, 5; in E, 6½, and in F, 8.

§ 282. THESE and the ſubſequent profiles are without covert-ways; becauſe, in field works they are unuſual, and ſeldom of the ſmalleſt advantage. If they are not occupied, they only aſſiſt the aſſailants in gaining the ditch; and, if they are occupied, a determined enemy will force his way into them ſword in hand, cut down your men, or perhaps get poſſeſſion of the work itſelf, by means of a rapid and vigorous purſuit, in caſe the defenders ſhould be permitted to make their retreat: — but if the counterſcarp is well paliſaded, and made with one, two, or three banquettes, as in Y, Pl. 8; you will acquire a more horizontal fire from thence than from the parapet: and of courſe the ſtrength of the work will be greatly augmented.

Whenever

Whenever you wiſh to form a covert-way, you muſt take in about twelve or fourteen feet of ground, after the ditch has been traced; raiſe a parapet upon its outward edge, with or without a banquette; and add a glacis of twenty-five, thirty, or perhaps forty feet in length, Pl. 17. fig. 3, *k*, *h*.—This parapet and glacis muſt be in a line with the ſuperior talus of the main parapet, that they may be effectually raked by the fire from thence; and before each rentrant angle there muſt be a ſmall place of arms. Paliſades ought alſo to be placed cloſe behind the interior talus *i*, with the addition of a ſtrong lath or ſpar about three or four inches below their tops, which will increaſe their ſtrength and give the troops a convenient reſt for their firelocks.

In Pl. 16. fig. 2, I have added a covert-way to one of M. Clairac's têtes-de-pont, with a ſalient angle in front of the curtain or ſortie *; which I conceive to be much

* See COVERT-WAY, Vol. V. Sect. 3, and Chap. VIII. *Author.*

more

more convenient than a flêche or ravelin. For thoſe works would effectually obſtruct the fire from the great flanks, which ought to command the whole of the ground in front, unleſs they were ſunk below the ſurface; and, in that caſe, the men who occupied them would be in continual danger of the fire of the main parapet, particularly during the night.

2. OF THE PROFILE IN A SANDY SOIL.

§ 283. WHENEVER retrenchments are to be thrown up in ſuch a ſoil, an interior revetement is indiſpenſably neceſſary; and indeed, if they are intended to be durable, or if the enemy can bring artillery againſt them, an exterior one will be equally requiſite: unleſs you can procure as much good earth or turf as will cover the ſurface, and prevent its being waſhed into the ditch, or blown away by the wind *.

* It has hitherto been cuſtomary to give the profiles in ſuch a ſoil a very unneceſſary degree of ſtrength; for late trials have proved that ſand will always reſiſt cannon-ſhot ſooner than the ſtiffeſt clay.—In ſand a revetement of planks is preferable to any other.—*Author.*

The

The plans 6 and 7 ſhow the dimenſions of every part, and the proportion they bear to each other.—G, H, I, are erected againſt artillery, and K, L, M, againſt muſketry.—The parapets of G, H, I, are 12 feet thick. The whole baſis of G, is 18 feet; that of H, 19½; and that of I, 21. Two feet are allowed in each for the interior talus, and the exterior talus is formed by the natural fall of the ſand when thrown up from the ditch; that is to ſay, of equal breadth and height. Conſequently G has a ſlope of 4 feet; H, 5½; I, 7; K, 5; L, 6½; and M, 8.—The ſcarp and counterſcarp of the ditch are made by the ſame rule: but, when the exterior talus of the parapet is to have a revetement of faſcines, it will only require a ſlope equal to half its height.—The top of the ditch of G is 21 feet in width; of H, 25; of I, 30; of K, 15; of L, 19½; and of M, 24. The bottom of G is 9 feet; of H, 10; of I, 12; of K, 3; of L, 4½; and of M, 6.—The depth of G is 6 feet; of H, 7½; of I, 9; of K, 6; of L, 7½; and of M, 9.

§ 284.

§ 284. As it is alſo neceſſary that works ſhould be thrown up for an expeditious and temporary defence againſt cavalry and light-troops, or to ſecure our rear from a ſurpriſe; I have added ſome profiles which appear to me to be beſt adapted to ſuch purpoſes.

N, in Pl. 7, is formed in ſand: its ditch is four feet and a half in depth, 9 in breadth, and brought to a point at the bottom; which muſt be an advantageous method when the ditches are not deep, becauſe the enemy can neither ſtand in them, nor aſſiſt each other in getting into the work. The parapet has no banquette, and its baſis is nine feet in length.

The profile O ſhows the dimenſions in a good ſoil. The baſis of the parapet is 6 feet; the top of the ditch is 7½ feet in width, the bottom 3; and the depth 4½,

P repreſents a ſmall parapet, ſupported by paliſades. The earth is dug out of a ditch of ſix feet in breadth, and three in depth.

The

The ſtrength of theſe parapets, and the depth of their ditches, may be increaſed at any time, provided the berms are of ſufficient breadth.—They are particularly ſerviceable in covering the débouchès of villages or farm-yards, the gorges of retrenchments, and in joining detached works. The chevaux-de-friſe, Q, may be alſo applied in the ſame manner, and the earth that is taken out of the ditch in their front will fill up the lower part as far as the centre beam. This ditch is four feet in width and two in depth.

3. OF THE PROFILE IN A ROCKY SOIL.

§ 285. IN this inſtance, every profile muſt be made as the nature of the ground will allow. The ditch cannot be deep; conſequently it muſt be increaſed in breadth, till a ſufficient quantity of earth can be procured for the parapet;—or, if the rock ſhould not be above a foot below the ſurface,

ſurface, a ſecond ditch may be made within the work, (Pl. 8, v).—Sometimes, however, both theſe ditches will be inſufficient, and in that caſe, more ſoil muſt be brought from ſome other place.—Trunks of trees can alſo be laid behind the exterior talus, with a covering of earth of about a foot in thickneſs.—Your parapet will then be well formed; your troops will be free from danger on account of the ſplinters; and, if a ſpace of 14 or 18 inches is left between the interior talus and the ſecond ditch, the natural ground will form a convenient banquette. Pl. 7, R, S, T.

REMARK.

§ 286. It is by no means unneceſſary that theſe parapets ſhould be one and a half, or perhaps three feet higher than uſual, and that they ſhould have two or three banquettes; to counteract the diſadvantages of ſo ſhallow a ditch.

§ 287. THE profiles R, W, in the 7th and 8th plans, are only intended as a defence againſt ſmall arms; S, T, U, V, X, Y, againſt artillery: and, as their conſtruction is different from that of parapets in general, I ſhall take them ſucceſſively into conſideration.

The profile R, in Pl. 7, has a baſis of 7 ½ feet, and it is only 3 feet high, that the troops may be enabled to fire more conveniently down the ſide of the hill upon which it is formed. The earth is taken from the ditch behind it; which is 5 feet in width, 2 in depth on the ſide neareſt the parapet, and 2 ½ on the other, with a ſmall channel or gutter to carry off the rain.—For, whenever ditches are made within a work, there ſhould be a ſlope of 1, or 1 ½ foot from the parapet, that no water may lodge near it.

The profiles S, T, are thrown up againſt cannon, and the only difference in their conſtruction is, that in the firſt, the neceſſary height of the parapet is gained by the depth of the ditch, and in the ſecond by its

its breadth.—U is alſo thrown up againſt cannon, and with the ſame view as the profile R.—V is formed where the earth is only one foot in depth, and its front is defended by chevaux-de-friſe, which are either fixed to the ground or to the parapet.—It is to be remembered, however, that chevaux-de-friſe ſhould not be placed before a work or ditch, if they are likely to be hit by the enemy's artillery; becauſe their ſhot will immediately deſtroy them, and the ſplinters will wound the ſoldiers who are behind the parapet.

The profiles W, repreſent two expeditious methods of forming parapets againſt muſketry by means of gabions. In one they are placed horizontally, and in the other perpendicularly.—Sand and woolſacks, or caſks filled with dung, may be uſed in the ſame manner.—X ſhows how works may be formed with ſand or woolſacks, and a covering of earth, to reſiſt a cannonade.—A parapet might alſo be formed with planks or rafters, ſo as to withſtand the heavieſt fire of artillery, if

their ſlope was equal to ſix times their perpendicular height. The upper ends ought to be ſupported by treſtles, upon which bundles of ſtraw or wool-ſacks have been laid with a view of increaſing their elaſticity; and their banquettes may be made of wood *.—The principal objection to this kind of parapet is, that the enemy can march over it with great facility.

§ 288. A PARAPET might alſo be made upon rock, or a traverſe formed croſs a ſtreet or bridge, by means of ſtrong wooden boxes, containing ſand, earth, wool-ſacks, &c.—When they are uſed as parapets, (as was the caſe in the camp near Hohen-Gerſdoff, in the year 1762), the materials with which they are filled ought to project eighteen or twenty inches above the wood on the inſide, that the troops behind them may not be wounded by ſplinters. But, if they are only

* My additional fig. *f*, repreſents the profile of ſuch a parapet, according to Capt. Tielke's deſcription.—*Tranſlator.*

intended

intended to act as traverſes, that precaution is unneceſſary, and their height muſt be increaſed.

In the year 1759, the Auſtrians formed ſeveral of theſe traverſes in the New-Town, when they took Dreſden from the Pruſſians. Pl. 9, fig. 1ſt and 2d.

4. OF THE PROFILE IN A MORASS, OR SWAMPY SOIL.

§ 289. WHENEVER it is impoſſible to dig up the ground in conſequence of its extreme wetneſs, a parapet may be formed either with faſcines or with the boxes deſcribed in the laſt paragraph. But if the water ſhould only ſpring up by degrees, as is generally the caſe, your works will have the advantage of a wet ditch, and of courſe a better defence.—In both caſes, hurdles or planks ſhould be laid within the retrenchment, wherever they may be required; and, if the water ſhould ſtand above the ground, they muſt have a foun-

dation of beams or faſcines, otherwiſe they will not be ſufficiently raiſed.—Their banquettes may be made either with faſcines, planks, or rafters.

In the 9th plan I have given the profiles of three parapets, which are all of ſufficient ſtrength to reſiſt a cannonade.—z is formed with the earth that has been taken out of its ditch : *tz*, by means of gabions filled with faſcines, and a covering of earth or mud : and *zz*, ſhows a method of uſing water faſcines, to gain a foundation in very wet ground. Its parapet is made entirely of gabions filled with ſand or woolſacks.

§ 290. WHEN the Auſtrians intended to take Dreſden by ſtorm, in the year 1759, they provided themſelves with ſuch floating batteries as I have repreſented in the 9th plan, fig. 3.—But, as they never had occaſion to make uſe of them, I cannot ſpeak with certainty as to their goodneſs; however, I am inclined to think they might be of

of uſe in ſurpriſing and putting an enemy into confuſion; eſpecially in the night.

In the year 1746 Count Gages, who was at that time General in the Spaniſh army, made twenty-four floating batteries; each of which conſiſted of ſix boats, well faſtened together with beams, and ſurrounded by a ſtrong parapet. They contained 400 men, excluſive of artillery: and with them he carried a conſiderable body of troops down the Lambro, croſs the Po, drove off the Auſtrians who were poſted on the ſhore, and threw three bridges over the river *.

At the ſiege of Colberg in 1758, when the Ruſſians found it impoſſible to procure the neceſſary materials for a bridge, they had an idea of paſſing the main ditch upon floats of timber, which were ſecured on all ſides with ſtrong beams †. But, the day before their plan was to have been carried into execution, the Pruſſian ſuccours arrived, and obliged them to march

* Krieg's Bibliothek, 3 Verſuch, page 261.—*Author.*

† See Vol. II. Sect. 2.—*Author.*

away.—I was desirous of seeing whether this dangerous undertaking would have succeeded or not; because I was almost convinced in my own mind, that those brave men would have been sacrificed to no purpose.

§ 291. It frequently happens that you are obliged to make your ditch behind the parapet, as in trenches; and, indeed, it is sometimes advantageous to do so.—But this subject will be more minutely explained hereafter: therefore I shall only point out two objects at present, which ought to be particularly attended to, viz.

1. Steps must be made at each sortie, or the earth gradually sloped off for the convenience of the soldiers.

2. A small gutter must be cut in the bottom of the ditch to carry off the water, as in Pl. 8, U *.—Sometimes the want of a descent may make it necessary to let these gutters pass under a part of the works :—

* More profiles may be found in Vol. III. Pl. 6; Vol. V. Pl. 4, 5, and 6; and Vol. VI. Pl. 12.—*Author.*

In

In that caſe, drains muſt be made, with a covering of planks or faſcines, before the parapet is thrown up.

§ 292. As it is always more probable that retrenchments will be taken by ſtorm, than that they will be battered down by artillery; they ought to be ſtrengthened with paliſades, fraiſes, trous-de-loup, and abbatis.—When fraiſes are to be made uſe of, the parapet will require a berm of two feet in breadth, and they muſt be nailed upon a rafter of ſix inches ſquare, as in Pl. 10. fig. 1, *a*. Their points ſhould have a deſcent of two inches, while the other ends are buried three feet deep in the ground, and faſtened to a ſecond rafter or beam to prevent their being torn away, B.—They ought therefore to be laid before the parapet is finiſhed, and afterwards covered with earth, Pl. 15, *o*, *p*, *q*.—The principal reaſons for depreſſing their points are, firſt, that the enemy's cannon-ſhot may be the leſs likely to break them; and ſecondly, that his ſhells, inſtead of lodging

ing upon them, may roll back into the ditch. In ſome caſes, however, their points are elevated, as is ſhown by Y in Pl. 8*.—Fraiſes are generally four inches thick, and ſeldom leſs than nine feet in length, that they may project four feet beyond the edge of the berm. They are pointed at one end, and faſtened about eight inches aſunder, with very long nails.

§ 293. PALISADES are cut out of ſtems or arms of trees, of about ſix or ſeven inches in diameter; and their length depends in all caſes upon their intended application.

If they are uſed as tambours, (Pl. 23. fig. 5.), or for the purpoſe of barricading gorges or débouchés, they ought to be nine feet long: that, when their ends are two feet deep in the earth, they may remain ſeven feet above it. — Sometimes they are placed perpendicularly and ſometimes obliquely, as in Pl. 4. fig. 8; but in either caſe they muſt not be expoſed to the

* See FRAISES, Vol. V. Sect. 3.—*Author.*

enemy's

enemy's cannon: conſequently they are ſeldom of much ſervice in the open field.

§ 294. IN Pl. 10, fig. 2, the paliſades *b*, have an oblique direction, and are in ſome meaſure covered by the earth which has been thrown out of the trous-de-loups. A circumſtance which ought at all times to be attended to, otherwiſe they will ſoon be ſhot away by the enemy's artillery.—In the preſent inſtance, their points are not more than four feet above the ground; which is equal to the perpendicular height of the hillocks by which they are defended.—With theſe precautions they will be extremely ſerviceable.—I have alſo made uſe of paliſades at the foot of a height with equal advantage, when they did not interfere with the fire of our own batteries; and in ſome caſes, if they were not much expoſed, I have placed two rows of them about a foot aſunder: the firſt ſloping very much towards the enemy, while the ſecond ſtood in a perpendicular direction.—By which means they could not be cut down,

down, and it was equally impoſſible for any troops to get over them.

For theſe reaſons I recommend a general uſe of paliſades in hilly ſituations; and, when they are not in danger of cannon-ſhot, I would prefer a double row of them to any parapet.

§ 295. THE tops of paliſades ought never to be more than three or four inches above the counterſcarp: conſequently, if the ditch is of ſufficient depth, they may ſtand perpendicularly, otherwiſe they muſt have an oblique poſition.—But in either caſe, I diſapprove of their being in the middle of the ditch; becauſe they are then a conſiderable hinderance to the fire of your flanks, and in ſome meaſure a defence to the enemy while he is cutting them down.—Whereas if they have the poſition of *e* in Pl. 10, fig. 1, or of *a* in fig. 2, every diſadvantage is done away.—In the firſt inſtance the enemy cannot ſtand in the ditch till they are removed, and in the ſecond, he will not be able to get

get into it without expoſing himſelf to danger. If they are placed under the ſcarp of the parapet, an oblique poſition is undoubtedly the moſt favourable; fig. 1, *d.*

Whenever paliſades are to be uſed, you ſhould make a gutter of two feet in depth, and as ſoon as they are put into their proper places, the earth muſt be thrown in again and well rammed down on both ſides.

§ 296. THE paliſades which are placed behind a parapet (Pl. 17, fig. 3, *i*), ought never to be above five feet higher than the banquette; and, as I have already obſerved, a ſtrong lath or ſpar muſt be nailed along the inſide of them, about half a foot below their tops, for the joint purpoſes of binding them together and of giving the troops a convenient ſupport for their firelocks.

The author of the "*Amuſements militaires*" is of opinion that theſe laths or ſpars ought to be nailed on the outſide rather than in the manner above mentioned.

tioned. Becauſe in that caſe, he ſays, a cannon-ſhot will only carry away one, or at moſt two paliſades, while in the other it may deſtroy three times that number. I much doubt the validity of ſuch a reaſon, and am perſuaded that my method will give an enemy the greateſt difficulty in tearing them down.

If you are either obliged to make your ditch within the work, or to form a work without the help of a ditch, as in the profiles U, V, W, and X, in Pl. 8, paliſades may be placed behind the parapet.

§ 297. IN Pl. 10. fig. 2, I have only ſhown the application of trous-de-loup, becauſe their conſtruction will be accurately deſcribed in the 15th chapter.

§ 298. THE counterſcarp of a ditch may be defended either by chevaux-de-friſe * or by an abbatis; in which caſe the ſtems of the trees ought to be buried in the ground. Pl. 10. fig. 2, *e* †.

* See CHEVAUX-DE-FRISE, Vol. V. Sect. 3.—*Author.*

† See Vol. V. Plans 4, 5, and 6.—*Author.*

CHAP-

CHAPTER X.

Of the Methods of marking out Lines, Angles, and Figures upon the Ground.

§ 299. THIS is uſually done by the eye, and an experienced officer will find no difficulty in marking out a required angle at firſt ſight, eſpecially if it is a rectangle.—And on account of its ſuperior defence, it is generally preferred to all others.—In throwing up retrenchments, an error of three or four degrees is of little conſequence: but if much accuracy is required, the Engineers ought always to make uſe of a line.

TO MARK OUT, TRACE, AND MEASURE A STRAIGHT LINE.

§ 300. THE extreme points are marked with ſtakes, and, cloſe to the cord which is extended between them, the turf is cut away with a pickaxe or ſpade. But if this

is to be done in the night, a white object muſt be fixed upon each ſtake or pole, and a rope of ſtraw ſhould be uſed inſtead of a common cord.—If the line is very long, more ſtakes will be requiſite.—In that caſe, the Engineer who ſtands at one end muſt fix his eye upon the oppoſite pole or ſtake, and direct his aſſiſtant to move to the right and left till his pole or ſtake is entirely hid by that in the centre. —In this manner a ſtraight line of any length may be marked out with accuracy: and if knots are made upon the cord at the diſtance of a rood, perch, or yard from each other, its length will be known at the ſame time.

TO ASCERTAIN THE POINT ON WHICH TWO LINES WOULD MEET IF PROLONGED, AND TO KNOW THEIR ANGLE.

§ 301. WHEN the lines *a*, *e*, and *b*, *c*, in Pl. 10. fig. 3, have been meaſured, a perſon

ſon muſt be ſent forward, we will ſuppoſe from E; who will continue in the direction of that line, till he finds himſelf alſo in a line with *b c*. He then puts down his ſtake at *d*.—For the ſake of greater certainty and expedition, another perſon may keep his eye fixed upon him from *b*.

TO FORM A RECTANGLE UPON THE GROUND.

§ 302. DIVIDE your cord or chain into as many equal parts as may be neceſſary: carry *three* of them along the line A B, Pl. 10. fig. 4, leave one end in B; with *five* of the parts make a ſweep at E, and with *four*, make another ſweep from A. Thus the ſides of your triangle will contain *three*, *four*, and *five* equal parts; and conſequently the angle A muſt be a rectangle, or an angle of 90°.—By theſe means all ſquares and parallelograms may be formed: for, if we ſuppoſe the given line A B, in fig. 5, to be divided into *ſeven* equal

parts, we need only carry *four* of them from A, and five from X, as before deſcribed, and the point is found through which the ſide A C, muſt paſs.—When the ſame operation is made from Y and B, the third ſide is given; and of courſe the fourth, or the ſide C D.—The ſame methods may be uſed in marking out all redouts, or in fixing the direction of the ſtreets in an encampment.

If extreme accuracy is required in raiſing a perpendicular upon a given line, you may make one end of it the centre of a circle, carry two equal parts along the circumference on each ſide the point of interſection, and draw a ſtraight line between them *.

* Meaſure a few feet upon your given line back from one of its extreme points, as from A to *b*, in my + fig. G, carry the ſame length from A to *c*; make one ſweep from *b*, and another from *c*, for the point X: which muſt be perpendicular to A.—Conſequently the line A X, will be perpendicular to the given line A H.—In my opinion this is the moſt ſimple method, and with the leaſt attention it is ſcarce poſſible that the operation ſhould be inaccurate.—*Tranſlator.*

TO

TO FIND THE PARALLEL OF A GIVEN LINE.

§ 303. ERECT two perpendiculars upon your given line at any diſtance from each other, let them be of equal length, and the line which is drawn from one to the other will be parallel to the given line.—The ſame method is uſed in marking out the ſides of a ditch, and all other parallel lines belonging to a parapet.

TO DESCRIBE A CIRCLE. PL. 10. FIG. 6.

§ 304. FIX one end of your cord in A, and if the diameter is to be ſix feet in length, faſten a pointed piece of wood or iron at the end of three feet, and you will deſcribe the circle required.

TO FORM AN ANGLE OF 60° UPON A GIVEN LINE.

PL. 10. FIG. 7.

§ 305. DIVIDE your cord into three equal parts, fix one end of it at A, the other at B (the exact length of one of thoſe parts), let it be pulled tight, and drive in a ſtake at the centre C.—Thus you will have an equilateral triangle, and of courſe each angle muſt contain 60°.

TO MAKE AN ANGLE OF 100° UPON A GIVEN LINE.

PL. 10. FIG. 8.

§ 306. CARRY ſix parts of your cord or chain along the line A B, make a ſweep with *ſeven* of them from the point A, and another with *ten* from B, which gives the point C.—The angle B A C, will then contain 100°.

TO

TO FORM AN ANGLE OF 108° UPON A GIVEN LINE.

PL. 10. FIG. 9.

§ 307. LET *four* parts of your cord or chain be carried along the line A B, make one ſweep with *nine* from B, another with *ſeven* from A, and the angle B A C, will contain 108°.—The proper angle for the formation of a pentagon.

I conceive it to be unneceſſary to add more angles, becauſe they are ſeldom of uſe; and whenever they are required, thoſe which I have already given may be increaſed or diminiſhed by the eye.

TO FORM A TRIANGLE-ISOSCELE UPON A GIVEN LINE.

PL. 10. FIG. 10.

§ 308. EACH angle of an equilateral triangle contains 60°: therefore if the baſe is ſhorter than the other two ſides, it is evi-

dent that there muſt be one angle under 60°; or, if it is longer, that there will be one above 60°. To execute this upon the ground, you muſt divide your given ſide into a certain number of equal parts.—For inſtance, if the baſe A B, is 42 paces in length, and divided into *ten* equal parts (for the overplus is of no conſequence), you may take *nine* of them, or 36 paces for the other two ſides; and the angle which is formed by them will have 68°: or, if you take only *eight*, *ſeven*, or *ſix*, it will conſequently be the more obtuſe.—With *eight* parts the angle C would contain 77° 30′; with *ſeven*, 91° 30′; and with *ſix*, 111° 30′.

TO FORM A SQUARE UPON ANY GIVEN SIDE.

§ 309. As a ſquare contains two triangles, it may be eaſily formed upon the ſame principle.

The ſides of a ſquare bear nearly the ſame proportion with their diagonal, as *ſeven*

ven to *ten:* conſequently, if we ſuppoſe the length of a given line to be 42 paces:

7 : 10 :: 42 : x.

10

7)420(60=x. Therefore if I form two equiangular triangles upon the diagonal line of 60 paces, whoſe ſides are 42 paces each, I have the ſquare required: Pl. 11. fig. 1.—It is true this calculation will not be perfectly accurate, becauſe the proportion is ſomewhat below *ſeven* to *ten*; but, as extreme nicety is not requiſite, the diagonal line may be ſhortened in proportion to the length of the ſides.—Other methods of forming a ſquare have been already explained in the 302d paragraph.

THE FORMATION OF A RHOMB OR LOZENGE.

§ 310. A RHOMB is formed in the ſame manner as a ſquare, and the baſe of the triangles may be as long, or as ſhort as you pleaſe.—Pl. 11, fig. 2, and 3.

TO FORM A PENTAGON UPON A GIVEN SIDE.

PL. II. FIG. 4.

§ 311. A PENTAGON contains *three* triangles, and we will ſuppoſe the given line *a b* to be *thirty* paces in length. Therefore, if *a b* is divided into ſix equal parts, each of them muſt contain *five*, which being multiplied by *ten*, will give the diagonal lines *a c* and *b c*; and, when the length of the given ſide is carried from *c* to *e*, and from *b* to *e*; from *c* to *d*, and from *a* to *d*, the pentagon is formed with ſufficient accuracy, and may be made more perfect by a ſmall reduction of the diagonals proportionable to the length of the ſides.

A pentagon may alſo be formed by laying down an angle of 108° upon both ends of the given line, according to the 307th paragraph.

TO

TO FORM AN HEXAGON UPON A GIVEN SIDE.

PL. II. FIG. 5.

§ 312. LET the diagonal line be twice the length of the given ſide, make two equilateral triangles upon each half of it, *c d b*, *c b g*, *a c f*, and *a c e*; draw a line between the four points *e*, *d*, *f*, *g*, and you will have the hexagon required.

An hexagon may alſo be formed with greater expedition and accuracy by carrying the radius of your circle (*a b*, fig. 6.) ſix times round the circumference, which will always divide it into ſix equal parts.

As I have now deſcribed the figures which are generally made uſe of in the conſtruction of ſtar-forts, I conſider it unneceſſary to enter into an explanation of ſuch polygons as are ſeldom or perhaps never required for ſuch purpoſes.

OF THE FORMATION OF STAR FORTS.

§ 313. ACCORDING to the following proportions, let fall a perpendicular from the centre of each ſide of your figure; that is to ſay, if it is a ſquare, the perpendicular muſt be equal to one-ſeventh or one-eighth of the length of the ſide; if a pentagon, to one-ſixth; and if an hexagon, to one-fifth.—Draw a line from the ends of each face to that of its perpendicular (fig. 6, 7, and 8); or, if it ſhould be neceſſary, you may meaſure off one-third of the length of the new faces on each ſide the points *c*, which will give the points *d*, *d*; and, by forming the equilateral triangles *d*, *e*, *d*, your works will have double the number of flanks.

OF TETES-DE-PONT,

PL. II. FIG. 9.

§ 314. TETES-DE-PONT may be formed in the ſame manner.—For inſtance; throw up

up a ſalient rectangle *a b c*, regulate the length of the faces *c d*, and *c e*, according to the number of men intended for the defence of the work; make the line *e g* parallel to *c d*, *d f* parallel to *c e*, and give them both the neceſſary length. Draw the line *g i* parallel to *c b*, *f h* to *a c*, *i l* to *e g*, and *k h* to *f d*.—Thus you will have an excellent Tête-de-pont, and a figure which would be equally ſerviceable upon other occaſions; becauſe it has a rectangular defence at all points.

§ 315. SECONDLY: you may mark out a triangle *a c b*, Pl. 12. fig. 1. Let *c* be either a rectangle, or not more than 93°; divide its ſides into three equal parts and mark them with pickets. Let fall a perpendicular from the ſecond pickets, equal to one-fourth of one of thoſe diviſions, as deſcribed by *d b*, and *i e*; draw the lines *c i g*, and *c b f*, ſet off the flanks *f k*, and *g l*, perpendicular to *c a*, and *c b*, lengthen them till you find yourſelf in a line with *d*, and *e*; then draw the faces *k m*, and

l n,

l n, give them one-third of the length of *a c*, or *a b*, and from *m n* continue your lines to *a b*.

§ 316. THIRDLY: form a triangle *a b c*, Pl. 12, fig. 2, whose salient angle *c*, shall have 68° (§ 308); divide its two sides into three equal parts, mark them with pickets, and measure a line from *d* to *e*.—Then let fall the perpendicular *f g*, from the centre of that line, equal to half its length, which will give you the flanks *d g*, and *g e*.—Set off from *a* and *b*, along the base, one-sixth of the sides of your main triangle, let the lines *k b*, and *l i*, be drawn from the third pickets, measure off ten paces from *k* and *l*, for the points *m*, *n*, and from thence you may continue the lines to *a b*.—The flanks *a o*, and *b p*, must be equal to the breadth of the ditch, and will give you a complete command of it. The figure shows that they are at right angles with *c a*, and *c b*.

TO

TO FORM A TENAILLE, WHICH MAY BE USED AS A TETE-DE-PONT.

PL. 12. FIG. 3.

§ 317. MAKE the line *a b* of any length. I will here ſuppoſe it to be *fifty* paces, let fall a perpendicular equal to one-fourth, one-ſixth, or one-eighth of it from the centre, and draw the lines *a c*, and *b c*.—Form an angle of 90° at *a*, and another at *b*, for the ſides *a d*, *b e*, and let them be as long as circumſtances may require. Then ſet off angles of 90° at *d* and *e*, for the flanks *e g*, *f d*; and laſtly, draw the lines *g i*, and *f h*, perpendicular to *g e*, and *f d*.—Theſe lines are to be continued to the banks of the river, or to whatever you may wiſh to defend.

TO FORM A HORNWORK, WHICH MIGHT BE USED AS A TETE-DE-PONT.

PL. 12. FIG. 4.

§ 318. THE only difference between the conſtruction of this and the foregoing tenaille,

naille, is, that when the faces *a c*, and *b c*, are formed, you muſt divide them into two equal parts, *k*, *l*; lengthen them with one-fourth more to *m n*, and draw the flanks *k n*, *l m*, and the curtain *n m*.— Such a work is uſually about fifty or ſixty paces from the bridge, or whatever object you may wiſh to defend; and the line *a b* muſt be parallel to them.

A REDANS WHICH MIGHT BE SERVICEABLE EITHER AS A TETE-DE-PONT OR COMMON RETRENCHMENT.

PL. 12. FIG. 5.

§ 319. MAKE the line *a b* as long as may be neceſſary (perhaps *thirty* paces), form a triangle upon it, whoſe ſalient angle *c* ſhall have 77° (§ 308); at *a* and *b* ſet off angles of 100° (§ 306), and let the flanks *d a*, *e b*, be equal to half the length of the faces *a c*, and *b c*: form the lines *d f*, and *e g*, at right angles with *b e*, and *a d*, give them twice their length, and ſet off the ſecond flanks at angles of 100° from *g* and

and *f*.—Thus you may proceed till you reach the object which is to be covered.

TO FORM A REDANS.

PL. 12. FIG. 6.

§ 320. FLECHES are thrown up about 300 paces aſunder. Their ſalient angles uſually contain 91° 30′, and their baſes are from *ſixty* to *eighty* paces in length, as explained by *a*, *b*, *c*.—A rectangle is laid down at *a*, and half the length of the face carried along that line to *d*, where another angle of 100° is formed for the line *d e*; which is equal to *a c*.—The rectangle *e* is then formed, and the flank *e f* is preciſely ſimilar to *a d*.—Thus the ſides of two flêches will form a rentrant angle at their junction; before which an equilateral triangle *b i*, ſhould be formed, whoſe ſides are not to be leſs than *ten* or *fifteen* paces in length, to cover the entrance at *g*.

CHAP-

CHAPTER XI.

To regulate the Conſtruction of Parapets and Retrenchments, according to the Number of Men intended for their Defence; to diſtribute the Workmen, &c.

§ 321. BEHIND a parapet ſoldiers are uſually formed two deep. One pace is allotted to each file, and four or five paces to each field-piece. Therefore, if I am ordered to throw up a ſquare redout for 300 men with two field-pieces, I can find the neceſſary length of their ſides in the following manner:—Three hundred men will make 150 file; conſequently, they will require 150 paces;

The cannon	-	10, and
The ſortie	-	8
Total	-	168 : 4 = 42

paces, or the length of each ſide. But as the banquette will take off two or three paces, I ought to add that number to the

length of the ſides, which will increaſe them to about forty-five paces.

REMARK.

§ 322. THE ſpace within ought alſo to be large enough to enable the men to move and lie down; which may be eaſily aſcertained by the following calculation.

Every ſoldier requires 18 ſquare feet, and each field-piece 216; therefore, if the number of men are multiplied by 18, and 216 by the number of field-pieces, the neceſſary dimenſions are found.

Whenever a redout is to be formed according to this calculation, you need only extract the ſquare root of the whole, and you will have the required length of one ſide (provided they are equal), or one-fourth of its circumference.

If you wiſh to know the inward contents of an old redout, which has either the ſhape of a rhomb or long ſquare, the length muſt be multiplied by the perpendicular height. If it is triangular, the baſe

muſt be multiplied by half the height; and if circular, one-fourth of the diameter by the circumference, or one-half of the cumference by the whole diameter *.

In the ſecond part of M. Boehm's Magazine for Engineers, page 337, there are algebraical forms, written by an Engineer in the Daniſh ſervice, by which the number of men neceſſary for the defence of every ſpecies of work may be aſcertained with the greateſt accuracy, without any tedious calculations †.

* See Vol. III. and the latter part of Sect. 3.—*Author.*

† Soon after the publication of my Field Engineer, this officer ſent me his calculations; but, as I was well aware that many of my readers would not be able to apply them, and that a very exact knowledge of the contents of a work is ſeldom required in the field, I have never given them a place in my publications. In this edition, however, I have explained as much of them as can be neceſſary for my preſent purpoſe. Thoſe who underſtand algebra will be highly ſatisfied with his demonſtrations, and I think the method which he propoſes, will make errors much leſs frequent.

In the fifth Vol. of my ACCOUNT *of the* WAR, &c. Sect. 3, and Chap. VI. a part of my calculation is erroneous; for, inſtead of *eighteen* Rhineland ſquare feet, or three and a half Rhineland ſquare paces, I have inſerted *nine* paces. I muſt therefore requeſt that the end of that ſentence may be diſregarded, and that this may be conſidered as the juſt calculation.—*Author.*

A Rhine-

A Rhineland rood * is ſometimes divided into *twelve* Rhineland feet, and ſometimes into *ten* decimal feet or *five* paces.

A pace is equal to $2\frac{2}{5}$, or two decimal feet. *Eighteen* ſquare Rhineland feet (the ſpace to be allowed to each man) contain $\frac{25}{2} = 12\frac{1}{2}$ Rhin. decimal ſquare feet, or $\frac{25}{8} = 3\frac{1}{8}$ ſquare paces. The length of *twelve* Rhineland feet, or *five* paces, will be neceſſary for each cannon at the parapet: and altogether it will require a ſpace of 216 Rhineland ſquare feet = 150 Rhineland decimal feet, or $37\frac{1}{2}$ ſquare paces.—Conſequently, if $3\frac{1}{8}$ are multiplied by the number of men, and $37\frac{1}{2}$ added for each gun, you will at once know whether the inward ſpace is ſufficiently large or not; and, by extracting the ſquare root, you will have one ſide of the ſquare.—In all other regular polygons, if you multiply the root by four, and divide the ſum into

* A Rhineland rood is equal to 12 feet, and a Rhineland foot is an eſtabliſhed meaſure in Germany, eſpecially in military operations. With an Engliſh foot it bears the proportion of 1440 to 1391 $\frac{1}{2}$.—*Tranſlator.*

as many parts as there are ſides in the work, the product will ſhow the length of each in paces. — Therefore, when five paces are ſubſtracted for each gun, the remainder will give the whole number of men, if in one rank; and half their number, if in two.

Hence it is evident, that no encloſed redout can be made for leſs than *fifty* men in each rank, provided they are to lie down in it: and even this is diſadvantageous; for it has been found by experience, that large works are by far the moſt uſeful, if the extent of the ſides does not weaken the fire from the parapet: becauſe in every confined ſpace the enemy's ſhells will do incredible miſchief.— Whenever the ſoldiers are to be formed two deep for the defence of a work, and to lie down in it, it cannot be formed for leſs than 184, and in that caſe there will ſcarce be room for the ſmalleſt reſerve.—But, if it is thrown up for 200 men, with two pieces of cannon, you need only make the parapets long enough for the number of files and the

the guns: for the inward ſpace will then be abundantly large.

§ 323. To know how many men will be neceſſary for the defence of a finiſhed work, you need only meaſure one of its ſides, provided they are equal, and then multiply its length by the remaining number.—But if they are unequal, all of them muſt be meaſured; and when you have ſubſtracted the neceſſary ſpace for each field-piece, multiply the paces by two, and you will have the queſtion required.

We will ſuppoſe, for inſtance, that the ſides of a ſquare redout, in which four field-pieces are to be placed have, been found to meaſure 300 paces: conſequently 75, or the length of each ſide — 5 for its field-piece = 70 × 4 = 280 paces or files; which being again multiplied by 2 = 560 (if two deep), and allowing a reſerve of 40 men, the whole will amount to 600.— If, at the ſame time, you wiſh to find its internal contents according to the rule

which I have mentioned in the laſt paragraph, it will appear, that $75 \times 75 = 5625 - 150$ for the cannon $= 5475 : 3\frac{1}{2}$, the neceſſary room for each man $= 1752$. Almoſt three times as many men as are wanted for the defence of the parapet.

2. If all the ſides are found to meaſure 100 paces, the defenders may be poſted two deep, and there will be room for them, but none for a reſerve.

3. If they exceed 120 paces, there will be ſufficient room for the men two deep, and for a conſiderable reſerve.

It is to be obſerved, however, that inſtead of encamping the men within an encloſed work, where confuſion would be unavoidable in caſe of an attack, it is much better that they ſhould remain on the outſide of it: or, if that is impracticable, that a wooden ſhed or houſe ſhould be built in the centre, which would effectually cover the men from the ſeverity of the weather, and keep their arms and ammunition from injury in a wet ſeaſon.

§ 324.

§ 324. WHEN the plan of a work has been proportioned to the number of men intended for its defence, or to any other circumſtances which the peculiar exigence of the caſe may ſeem to point out; the lines which have been explained in the foregoing chapter are to be conſidered as the internal length of the parapet (*f f*, Pl. 15. fig. 1 and 2.) to which all the others muſt be parallel, and at ſuch diſtance from each other as the profile may require.—When this is done, the workmen are to be placed two paces aſunder, at the line *c c*, fig. 1, which marks the counterſcarp of the ditch.

The earth, when dug up, muſt be thrown as far as poſſible towards the internal line of the parapet.—If the ditch is broad, the ſame number of workmen ſhould be placed at the line or ſcarp, *b*, *b*, *b*, fig. 2, and half that number at the counterſcarp, *c*, *c*, *c*.—Care muſt be taken that the ſides of the ditch ſhall not be too ſteep, and particularly thoſe of the ſcarp; that they may be able to ſupport the weight of the parapet.

The beſt and ſafeſt method is to begin by digging out as much of the middle of the ditch as the profile may direct: that is to ſay, only between *c c* and *b b*, leaving the ſides perpendicular; and then to form the ſlope of the ſcarp and counterſcarp, foot by foot.—Whatever earth may not be wanted for the parapet, will form a glacis; which will be equally ſerviceable in giving you a more effectual command over the enemy, and in adding to the depth of the ditch.—If any earth ſhould remain after the formation of the glacis, it may be uſed for the banquette; if not, a ſufficient quantity may be taken from the middle of the work; eſpecially if it ſtands upon a height.

Whenever the banquettes are not formed entirely with turf, they ſhould have a revetement of faſcines,

§ 325. WHEN a new work is building, the faſcines are uſually laid at the ſame time, and anchored as before explained. But as this cannot be done when a revetement is to be added to an old parapet, they

muſt

muſt be fixed entirely with pickets: which are driven in ſuch a manner, that about two inches of their heads remain above each row of faſcines, as an additional ſupport for thoſe which are placed upon them *.—The pickets for the lower rows of faſcines ought in that caſe to be about two feet and a half in length, for thoſe in the middle about three feet and a half, and for the upper rows five feet.—If the ſoil is good, ſome three foot pickets may alſo be driven horizontally through the faſcines by way of greater ſecurity.

§ 326. If you are under the neceſſity of adding a revetement to the exterior talus of an old work, which has no berm; the faſcines muſt be continued from the bottom of the ditch to the top of the parapet. But, if a new work is thrown up, a berm of a foot and a half or two feet in breadth will afford a ſecure reſting-place for the firſt row of them, and at the ſame time prevent the looſe earth from rolling down.

* See my + fig. c, Pl. 4.—*Tranſlator.*

§ 327.

§ 327. WHEN the revetement is carried on with the work, all the pickets may be two feet and a half in length, and the uſual anchors muſt be fixed at the end of every three or four feet; beginning with the third row from the bottom.—But in ſome caſes, when an expeditious, rather than a durable method is to be adopted, common boughs of trees will in great meaſure ſupply the place of anchors; provided they are cut with hooks to take hold of the faſcines, while their other ends, unſtript of their twigs and leaves, are buried within the parapet.

§ 328. THE firſt row of faſcines ought to be laid as flat as poſſible, and buried about three inches deep in the earth.—A faſcine of twelve feet in length will require four pickets, which muſt be driven through it at equal diſtances, and always between two bindings; otherwiſe they will probably fly open. The bindings of every row ought alſo to be in an exact line above each other,

other *, and as ſoon as a few rows are fixed in their places, the earth muſt be filled up behind them and well rammed down.

§ 329. IN laying and anchoring the faſcines for the revetement of a work, three men will be ſufficient for every twenty-four feet: who are to be provided with two wooden mallets, a ſaw, and a bill or hatchet.

§ 330. THE interior revetement ought never to begin at the banquette, but at the bottom of the parapet. Therefore, whenever one or more banquettes are found in an old work, they muſt be previouſly cleared away.

§ 331. WHEN thin branches of trees are wattled upon ſtakes in the manner already explained, they may be of much ſervice in the formation of a revetement, provided it is not intended to be of long duration: becauſe it will be completed with tolerable expedition, and

* See my + fig. *c*, Pl. 4.—*Tranſlator.*

leſs

leſs wood will be required than when faſcines are made uſe of.—And if you ſhould ever be obliged to add ſuch a revetement to the exterior, as well as to the interior talus of a work, (for it is ſeldom done except in a caſe of neceſſity) the berm muſt be three feet in breadth, otherwiſe there will not be ſufficient hold; and in a ſandy ſoil it may be alſo adviſable to have recourſe to anchors. Theſe ſtakes muſt be of equal length, one foot diſtant from each other, two feet deep in the ground, and driven with a ſlope proportionate to that of the parapet.—That this may be done with eaſe and regularity, a certain number of them ought firſt to be placed at the diſtance of three or four feet from each other, to guide the direction of thoſe which are to fill up the intermediate ſpaces.—The embraſures and banquettes ought in all caſes to have a revetement of faſcines or turf: which latter method is particularly advantageous for the embraſures, becauſe it cannot be ſet on fire.

§ 332.

§ 332. WHENEVER a ſufficient quantity of turf or clods can be procured, a revetement formed according to the 279th paragraph, will make ample amends for a ſcarcity of wood, if they have a ſlope of at leaſt one foot in five, to enable them to ſupport the weight of the parapet.

CHAPTER XII.

Batteries.

§ 333. THE word *battery* has three ſignifications,

1ſt. It implies a number of cannon placed together in the open field, without either parapet or platform.

2dly. The ſmall platforms for ſingle cannon in retrenchments; and,

3dly. The platforms which are formed for heavy artillery in fortreſſes and ſieges. But as this belongs immediately to the ſervice of the artillery, I ſhall paſs over it, and only take the firſt and ſecond into conſideration.—

ſideration.—Batteries in field-works, are again divided into two kinds: that is to ſay, (1), they may be formed with embraſures; or (2), the earth may be raiſed ſo as to enable you to fire over the parapet *.

§ 334. If none but regimental field-pieces are to be made uſe of in a work (as is generally the caſe), nothing more is neceſſary than that the ground ſhould be levelled where they ſtand; or perhaps, in ſome caſes, that a few beams or ſleepers ſhould be placed under them, according to either of the following methods.

§ 335. (1). When much expedition is required, you may take three planks of about eight or nine feet in length, and let them into the ground till they are level with its ſurface; Pl. 13, fig. 1.—Upon theſe, the wheels and trail of the gun will reſt, both when it is fired and after its recoil. But if the ſoil ſhould be very ſoft, it may be alſo neceſſary to reſt the planks

* This is uſually termed a barbet-battery.—*Tranſlator.*

upon

upon ſtrong wooden pickets, of two, three, or four feet in length.

In either caſe, pickets ſhould be driven down on each ſide, for the purpoſe of fixing them in their proper places; as may be ſeen by fig. 1, 2, and 3.

§ 336. (2). If the cannon ſhould be very heavy, two ſtrong beams muſt be buried in the earth; as before deſcribed; (Pl. 13, fig. 2; *a, b*): and the trail will reſt either upon a third beam (*c, d*), or upon a common plank.

§ 337. (3). The third method requires more time and materials.—When the place on which each cannon is to ſtand, has been carefully levelled; you muſt let three or four beams or ſleepers into the earth, (Pl. 13, fig. 3 and 5); fix them as before deſcribed, either with or without a foundation of pickets, according to the nature of the ſoil (fig. 4, *a a*; and fig. 6, *d d*); and then add a covering of boards.—Theſe

boards may be faſtened either with nails or wooden pegs.

The length and breadth of the platforms will of courſe depend upon the ſize of the cannon: for regimental field-pieces they are uſually about *ſixteen* feet in length by *ſix* or *eight* in breadth; and for 12, 18, or 24 pounders, about *twenty-four* feet by *ten*.

§ 338. IF the cannon are to be occaſionally fired in an oblique direction, the platforms muſt be broader behind than in the front (Pl. 13, fig. 5). In general, a difference of *four* or *ſix* feet is fully ſufficient.

§ 339. WHEN the fire is to be entirely confined to one ſmall object; ſuch as a ford, hollow-way, &c. the front of the platforms may be ſunk about *ſix* or *eight* inches: which will diminiſh the effect of the recoil, and enable you to bring up your cannon with more eaſe (fig. 6, *b c*). But if you wiſh to fire obliquely, this method is inadmiſſible: becauſe it would alter the direction

tion of the piece, and make it impoſſible for you to take a regular aim.

Whenever the front of a platform is lowered, a ſtrong piece of wood ſhould be placed as at *e* *, about *ſix* inches from the parapet, to receive the firſt ſhock, when the cannon is fired; and to guard it againſt the preſſure of the wheels.

§ 340. THE *genouillere a, b, c, d,* fig. 9, or that part of the parapet between the platform and the embraſure, is from 2 ½ to 3 ½ feet in height; as the cannon may require. The embraſure is 1 ½ or 2 feet in width at the platform, by 5, 6, or 7 feet on the outſide, to give you a more ample command of country, and its bottom is alſo lowered about a foot towards the field; (*c b,* fig. 9).—Conſequently it will be only 1 ½, 2, or 2 ½ feet above the edge of the ditch.

* The artillery call this piece of wood a *hurtoir*, from the French word *heurtoir*. It is uſually *nine* feet in length, and about *nine* or *ten* inches in thickneſs.—*Tranſlator.*

§ 341. THE *merlon b, d, e, f*, fig. 8, muſt be at leaſt *ſix* feet thick, otherwiſe it will not reſiſt the ſhot which may be fired againſt it *.

§ 342. IN general, powder magazines are only formed behind batteries of heavy artillery; but in ſome caſes they may be equally neceſſary in field works.—They are uſually holes dug in the ground, lined with boards or ſtraw, and covered with planks and earth.—Their entrances are made in the rear, and in general, (eſpecially if the ſoil is ſwampy) the barrels are placed upon ſquare pieces of wood or benches. Pl. 13, fig. 7.

If, at the ſame time, it ſhould be neceſſary to make ſuch magazines bomb-proof; they muſt be firſt covered with ſtrong beams *b c*, afterwards, with two rows of faſcines, and laſtly, with at leaſt two feet depth of earth. Or, inſtead of faſcines, a

* To avoid an unneceſſary repetition of the latter part of the 231ſt paragraph, I have here omitted a few lines of the original work.—*Tranſlator.*

covering

covering of ſtraw, of ten or twelve inches in thickneſs, will be found to anſwer the ſame purpoſes, and perhaps its ſuperior elaſticity may make them ſtill more ſecure.

§ 343. (2). BARBET-BATTERIES are much uſed in Field Fortification, and approved by many officers of experience.

A parapet without embraſures will undoubtedly withſtand the fire of the enemy's artillery better than any other, and enable you, at the ſame time, to fire in any direction: but, on the other hand, it will neither afford the cannon nor their men a ſufficient defence, according to the preſent mode of attack; becauſe the gabions, which are uſually placed upon the parapet for that purpoſe, are by no means capable of reſiſting a cannonade.

§ 344. FOR theſe reaſons, I always diſapprove of barbet-batteries, except when a work is formed upon an uncommanded height; or when the ground ſlopes from

it, ſo as to keep it entirely out of the reach of a horizontal fire.

§ 345. THE platforms in a barbet-battery muſt be raiſed with earth, as high as is neceſſary to enable you to fire over the parapet, and their dimenſions will depend entirely upon the ſize of the cannon, their recoil, and the different directions in which it may be neceſſary to fire them.—The *appareille a, b, c, d*, fig. 12, is made for the convenience of drawing up the cannon to the parapet.

Theſe platforms are ſometimes made on the ſides of a work, but generally at the ſalient angles. In that caſe, a part of them muſt be cut off, as at *e, f, g*.

§ 346. SUNK batteries are extremely uſeful upon heights which are expoſed to the fire of artillery, and wherever our poſition is higher than that of the enemy. During their formation, the workmen are ſufficiently covered, a very conſiderable part of the uſual labour is ſaved by the natural ground,

ground, and a ditch is altogether unneceſſary; becauſe the upper part of the parapet may be formed with the earth which has been dug up within the work.—And when completed, their peculiar advantages are equally obvious.—In the firſt place, the artillery and their men are in great meaſure concealed; 2dly, the outſide of the parapet is not more than half as high as uſual; and laſtly, they give an excellent horizontal fire.

The Auſtrians formed ſeveral of theſe batteries upon the rocks at Plauen near Dreſden, in the year 1759.

§ 347. A RICOCHET battery is made with the uſual platforms, and either with or without a ditch. Their only peculiarity conſiſts in the formation of the embraſures: becauſe, as it is only intended that the ſhot ſhall form a curve when they come out of the mouths of the cannon, they are cut from the outward edge of the ſuperior talus of the parapet down to the genouillere,

genouillere, and are conſequently inviſible to the enemy, *a b*, Pl. 13.. fig. 11. And, if howitzes are to be made uſe of in this method of firing, the ſame rule is to be adhered to.

Fig. 10, ſhows the plan of ſuch a battery, and fig. 11, its profile.

§ 348. THAT the embraſures may not be diſcovered or aimed at by the enemy's artillery, it is ſometimes uſual to place blinds in them, even with the exterior talus of the parapet, as ſoon as the cannon have been fired.—To make theſe blinds or maſks, you muſt firſt bore holes in ſquare pieces of wood to receive the pickets, upon which green willow twigs are wattled; and when that is done, they are cut into the exact ſhape of the embraſures by means of a model or board.—And, if the enemy's jagers or riflemen are near your battery, the inſide of them ſhould be lined with wood, that their ſhot may not paſs thro' while your men are loading the guns.

§ 349. In all batteries there ſhould be a ſmall banquette on each ſide of the embraſures, that the men who are employed at the guns may be able to ſee the effect of their fire. Pl. 13. fig. 8 and 10, *g g*; and fig. 12, *h*.

§ 350. Whenever the enemy's ſhells come within your batteries or retrenchments *, the moveable traverſes in Pl. 32 will be extremely uſeful: becauſe your troops can always find ſufficient ſhelter by running round to one of the oppoſite ſides.—For inſtance, if they ſhould fall into *a* or *b*, they will be in ſecurity in *c*: and *vice verſa*.

Fig. 6, ſhows the conſtruction of the frames, which are placed about *five* feet aſunder to receive faſcines of *eighteen* feet in length; and fig. 7, their poſition after they have been filled †.

* See Vol. VI. Chap. IX.—*Author.*

† A more enlarged deſcription of batteries in general, and of the uſe of artillery, may be found in the fifth Vol. of my Account *of the* War, &c. Chap. VII.—*Author.*

END OF THE FIRST VOLUME.

TAB. I. AND TAB. II.

The Proportions which the Feet and other ſimilar Meaſures in the undermentioned Places bear (I.), to the *Pié Royal*, or Paris Foot, when divided into 1,440 Parts, and (II.), to the Rhineland Foot when divided into 1,000 Parts.

Towns, Countries, &c.	The Foot, &c.	I. Proportions to the Paris foot.	II. Proportions to the Rhineland foot.
Aix-la-Chapelle	The foot - -	1,285	923 $\frac{6}{10}$
Alexandria -	The ordinary - -	1,533	1,101 $\frac{8}{10}$
Amſterdam -	The large - -	1,258	904 $\frac{2}{10}$
	The mean of *eleven* inches -	1,255	902
	The ſmall - -	1,253	900 $\frac{6}{10}$
	The rood - -	16,315	11,726 $\frac{2}{10}$
Anſpach - -	The foot - -	1,320	948 $\frac{7}{10}$
Antioch - -	- - -	1,892	1,359 $\frac{8}{10}$
Antorf - -	- - -	1,265	909 $\frac{2}{10}$
Antwerp - -	- - -	1,266	909 $\frac{9}{10}$
Augſburg - -	- - -	1,313	943 $\frac{7}{10}$
Avignon - -	- - -	1,100	790 $\frac{6}{10}$
Babylon - -	The half *cubitus ſacrus* - -	1,633	1,173 $\frac{7}{10}$
	The ſmall - -	1,631	1,172 $\frac{3}{10}$

Towns, Countries, &c.	The Foot, &c.	I. Proportions to the Paris foot.	II. Proportions to the Rhine-land foot.
Baſil	The foot	1,322	950 2/10
	The rood	21,152	15,202 7/10
Bavaria	The large foot	1,294	930
	The mean	1,280	920
	The ſmall	986	708 7/10
Berlin	The common	1,373	986 8/10
Bern		1,300	934 4/10
Beſançon		1,371	985 4/10
Bologna		1,682 6/10	1,209 3/10
Brabant		1,266	909 9/10
Brunſwick	The large	1,265	909 2/10
	The ſmall	1,260	905 5/10
Bremen	The large	1,288	925 7/10
	The ſmall	1,282	921 4/10
Breſcia	*Braccio*	2,075	1,491 4/10
Breſlau	The large	1,266	909 2/10
	The ſmall	1,260	905 6/10
Briel	The large	1,486	1,068
	The ſmall	1,475	1,060 4/10
Bruges	The large	1,226	881 2/10
	The ſmall	1,113	800
Bruſſels	The foot	1,290	927 3/10
Burgundy		1,513	1,087 4/10
Buxtehude		1,290	927 3/10
Cagliari	*Palma*	898	645 4/10
Cairo	*Derah*	2,459	1,767 2/10

Calenberg

Towns, Countries, &c.	The Foot, &c.	I. Proportions to the Paris foot.	II. Proportions to the Rhine-land foot.
Calenberg	The foot	1,295	930 $\frac{7}{10}$
	The rood	20,736	14,903 $\frac{6}{10}$
Carrara	*Palma*	1,081	776
Caſtello	The foot	1,370	985
Caſtile		1,253	900 $\frac{6}{10}$
	Palmos	940	675 $\frac{6}{10}$
	The rood	3,710	2,666 $\frac{8}{10}$
	Toeſas	7,518	5,403 $\frac{5}{10}$
China	The field-foot	1,417	1,018 $\frac{3}{10}$
	Kongpu, or the builders foot	1,431	1,028 $\frac{5}{10}$
	Mathematical	1,477	1,061 $\frac{56}{100}$
	The Mercers	1,500	1,078 $\frac{7}{10}$
Cleves	The foot	1,310	941 $\frac{5}{10}$
Cologne		1,220	876 $\frac{9}{10}$
Conſtantinople	The large	3,140	2,256 $\frac{8}{10}$
	The ſmall	3,120	2,242 $\frac{5}{10}$
Copenhagen	The large foot	1,391 $\frac{3}{10}$	1,000
	The ſmall	1,299	933 $\frac{6}{10}$
Cracow	The large	1,580	1,135 $\frac{6}{10}$
	The ſmall	1,540	1,106 $\frac{9}{10}$
Denmark	The large	1,403 $\frac{4}{10}$	1,008 $\frac{7}{10}$
	The mean	1,391 $\frac{3}{10}$	1,000
	The ſmall	1,299	933 $\frac{6}{10}$
	The rood	13,913	10,000
	The fathom	8,347 $\frac{8}{10}$	6,000

Towns, Countries, &c.	The Foot, &c.	I. Proportions to the Paris foot.	II. Proportions to the Rhine-land foot.
Danzig	The foot	1,275	916 4/10
	The ſmall	1,272	914 2/10
	The rood	19,080	13,713 4/10
Dijon	The foot	1,392	1,000 5/10
Dole	- -	1,583	1,137 8/10
Dort	The large	1,596	1,147 1/10
	The mean	1,460	1,049 4/10
	The ſmall	1,050	754 7/10
Dreſden	The large	1,275	916 4/10
	The ſmall	1,255	902
Egypt	*Derab*	2,459	1,767 9/10
Emden	The foot	1,313	943 7/10
England	The large	1,351 6/10	971 4/10
	The mean	1,350	970 3/10
	The pace	6,758	4,857 2/10
	The fathom	8,109 6/10	5,828 6/10
	The rod of *two* paces	13,516	9,714 4/10
	The pole	22,300	16,027 7/10
	The yard	4,054 8/10	2,914 3/10
Erfurth	The foot	1,251	899 1/10
	The rood	17,514	12,587 9/10
Eyderſtadt	The foot	1,313	943 7/10
Florence	*The Pertiche*	12,150	8,730 3/10
	The builders ell	2,430	1,746 5/10
	The fathom	2,580	1,854 3/10

Franconia

Towns, Countries, &c.	The Foot, &c.	I. Proportions to the Paris foot.	II. Proportions to the Rhine-land foot.
Franconia	The foot	1,391 3/10	1,000
	The rood	16,696	12,000
France	Royal foot	1,440	1,035
	Toise, of six royal feet	8,640	6,210
	Perch	25,920	18,629 6/10
Frankfort on the Mayne	The large foot	1,281	920 7/10
	The small	1,270	912 8/10
Geneva	The large	2,163	1,554 6/10
	The small	2,160	1,552 5/10
Genoa	Palma	1,113	800
Geometrical	The foot	1,085	779 88/100
	Pace, according to Piccard	8,216 6/10	5,905 561/100
	According to Cassini	8,250	5,929 56/100
	According to Maupertuis	8,246	5,926 69/100
	The mean, according to Bouguer	8,223	5,910 16/100
	The mean, according to Maupertuis	8,223 5/10	5,910 52/100
	According to both the means	8,223 2/10	5,910 31/100
Germany	The old foot	1,460	1,049 1/10
	The common labourers foot	1,263	907 8/10

Gibraltar

Towns, Countries, &c.	The Foot, &c.	I. Proportions to the Paris foot.	II. Proportions to the Rhine-land foot.
Gibraltar	The foot	1,253	900 6/10
Gieſſen	-	1,320	948 7/10
Goes	The large	1,329	955 2/10
	The ſmall	1,327	953 7/10
Gotha	The ordinary	1,275	916 4/10
Goettingen	-	1,290	927 2/10
Grenoble	-	1,512	1,086 7/10
Greece	The large	1,449 8/10	1,042
	The mean	1,358	976 1/10
	The ſmall	1,350	970 3/10
Groeningen	The ordinary	1,295	930 8/10
Haag	-	1,440	1,035
Halle	-	1,320	948 7/10
Hamburgh	-	1,270	912 8/10
	The rood	20,320	14,604
Hanover	The large foot	1,295	930 8/10
	The ſmall	1,290	927 2/10
Harlem	The large	1,267	910 6/10
	The ſmall	1,266	909 9/10
Hebraical	The ancient	1,590	1,142 8/10
Herforden	The ordinary	1,310	941 5/10
Heydelberg	-	1,235	887 6/10
Hildeſheim	The ordinary	1,242	892 7/10
	The rood	19,872	14,282 7/10
Holſtein	The foot	1,323	950 9/10

Inſpruck

Towns, Countries, &c.	The Foot, &c.	I. Proportions to the Paris foot.	II. Proportions to the Rhine-land foot.
Inſpruck	The large	1,408	1,012
	The ſmall	1,407	1,011 3/10
Ireland	The rood	28,350	20,376 2/10
Italy	The geometrical foot	1,231	884 8/10
Koenigſberg	The ordinary	1,364	980 4/10
	The ſmall	1,363	979 6/10
Leiden	The ordinary	1,390	999
Leipzig	The large	1,397	1,004 3/10
	The mean	1,252	899 9/10
	The ſmall	1,251	899 1/10
	The builders	1,253	900 6/10
Lions	The ordinary	1,515	1,088 9/10
Liſbon	The large	1,501	1,078 8/10
	The ſmall	1,387	996 9/10
	Palmos crav.	1,000 7/10	719 2/10
	The ſmall palmos	972	698 6/10
Louvain	The large foot	1,266	909 9/10
	The ſmall	1,265	909 2/10
London*, ſee England.			
Lottringen	The large	1,291	927 9/10
	The mean	1,287	925
	The ſmall	1,270	912 8/10
	The rood	19,840	14,259 7/10

* Here I have omitted ſome lines, and refer my readers to the word "England" to avoid unneceſſary repetition.—*Tranſlator.*

Towns, Countries, &c.	The Foot, &c.	I. Proportions to the Paris foot.	II. Proportions to the Rhine-land foot.
Lubeck - -	The foot - -	1,290	927 $\frac{2}{10}$
Luneburg -	- - -	1,290	927 $\frac{2}{10}$
	The rood - -	20,640	14,834 $\frac{7}{10}$
Liege - -	The foot - -	1,275	916 $\frac{4}{10}$
Magdeburg -	- - -	1,257	903 $\frac{4}{10}$
Manheim - -	- - -	1,286	924 $\frac{3}{10}$
Mantua - -	*Braccio* - -	2,062	1,482 $\frac{1}{10}$
Maſſon - -	The foot - -	1,482	1,065 $\frac{2}{10}$
Maeſtrick - -	- - -	1,245	894 $\frac{8}{10}$
Mayence - -	- - -	1,335	959 $\frac{5}{10}$
Malines - -	- - -	1,239	890 $\frac{5}{10}$
Mecklenburg -	- - -	1,290	927 $\frac{2}{10}$
Mellen - -	- - -	1,238	889 $\frac{9}{10}$
Middelburg -	The large - -	1,336	960 $\frac{2}{10}$
	The ſmall - -	1,330	955 $\frac{9}{10}$
Milano - -	The foot - -	1,760	1,265
	Braccio - -	2,166	1,556 $\frac{8}{10}$
Moſcow - -	The foot - -	1,483	1,065 $\frac{9}{10}$
Mumpelgard	The large - -	1,274	915 $\frac{7}{10}$
	The ſmall - -	1,273	914 $\frac{9}{10}$
	The rood - -	20,384	14,650 $\frac{6}{10}$
Munchen -	The large foot -	1,280	920
	The ſmall - -	986	708 $\frac{7}{10}$
Naples - -	*Palma* - -	1,169	840 $\frac{2}{10}$
Neufchatel -	The foot - -	1,330	955 $\frac{9}{10}$
Nurnberg -	- - -	1,347	968 $\frac{1}{10}$
	The rood - -	21,552	15,490

Oldenburg

Towns, Countries, &c.	The Foot, &c.	I. Proportions to the Paris foot.	II. Proportions to the Rhine-land foot.
Oldenburg	The foot	1,313	943 7/10
Osnabrug	-	1,238	889 3/10
Padua	-	1,570	1,128 4/10
Palermo	*Palma*	1,073	771 2/10
Paris *, see France.			
Parma	*Braccio*	2,423	1,741 5/10
Pavia	-	2,080	1,495
Persia	*Arish*	4,310	3,097 7/10
Piacenza	*Braccio*	2,423	1,741 5/10
Pommerania	The foot	1,295	930 3/10
Portugal	*Barros*	5,016	3,606
	Cavidos	3,060	2,199 3/10
Prague	The foot	1,338	961 7/10
Ratzeburg	-	1,290	927 2/10
Reggio	*Braccio*	2,348 5/10	1,687 9/10
Rhine, &c.	The foot	1,391 3/10	1,000
	The rood	16,696	12,000
Riga	The foot	1,215	873 3/10
Rimini	*Braccio*	2,410	1,732 2/10
Rival	The foot	1,187	853 1/10
Rome	The ancient	1,403 4/10	1,008 7/10
	The large foot of Vespasian, of which 625 make a stadium	1,571 9/10	1,129 8/10

* Here some lines are omitted, to avoid a repetition of what the author has annexed to "France."—*Translator.*

Rome

Towns, Countries, &c.	The Foot, &c.	I. Proportions to the Paris foot.	II. Proportions to the Rhineland foot.
Rome	The small ancient foot	1,320	948 7/10
	The new	1,306	938 7/10
	The builders rod	9,900	7,115 5/10
	The large *Palma*	990	711 9/10
	The small	977	702 2/10
Roſtock	The foot	1,282	921 4/10
Rotterdam		1,385	995 4/10
Rouen		1,200	862 5/10
Ruſſia	The large	3,187	2,290 6/10
	The ſmall	2,386	1,714 9/10
	The Engliſh	1,350	970 3/10
	The Rhineland	1,391 3/10	1,000
Saxony	The rood	19,004	13,658 9/10
Samos	The foot	1,534	1,102 5/10
Sardinia	*Palma di Sardegna*	1,113	800
	Palma di Cagliari	898	645 4/10
Savoy	The large foot	1,211	870 4/10
	The ſmall	1,200	862 5/10
Sileſia	The rood	19,147	13,761 6/10
Scotland	The foot	1,359	976 8/10
Sweden	The large	1,320	948 7/10
	The ſmall	1,316	945 9/10
	The fathom	7,896	5,675 1/10
	The rood	21,056	15,133 7/10
Switzerland	The foot	1,330	955 9/10
Sedan		1,230	884

Siam

Towns, Countries, &c.	The Foot, &c.	I. Proportions to the Paris foot.	II. Proportions to the Rhineland foot.
Siam	*Ken*	4,260	3,061 $\frac{2}{10}$
Spain	The foot	1,253	900 $\frac{6}{10}$
	Palmos	940	675 $\frac{6}{10}$
	Toeſas	7,518	5,403 $\frac{5}{10}$
Stade	The foot	1,290	927 $\frac{2}{10}$
Stettin		1,253	900 $\frac{6}{10}$
Stockholm		1,316	945 $\frac{9}{10}$
Straſburg	The country	1,309	940 $\frac{8}{10}$
	The town	1,282 $\frac{7}{10}$	921 $\frac{9}{10}$
	The ſmall	1,240	891 $\frac{2}{10}$
Stuttgard	The foot	1,268	911 $\frac{4}{10}$
Toledo	The large	1,253	900 $\frac{6}{10}$
	The ſmall	1,206 $\frac{6}{10}$	867 $\frac{2}{10}$
Turin	*Braccio*	2,270	1,631 $\frac{5}{10}$
	The foot	1,432	1,029 $\frac{2}{10}$
Ulm	The large	1,350	970 $\frac{8}{10}$
	The ſmall	1,281	920 $\frac{7}{10}$
Urbano	The foot	1,570	1,128 $\frac{4}{10}$
Utrecht	The large	1,210	869 $\frac{7}{10}$
	The ſmall	1,209	868 $\frac{9}{10}$
Venice	The foot	1,540	1,106 $\frac{9}{10}$
Verden		1,290	927 $\frac{2}{10}$
Verona		1,540	1,106 $\frac{9}{10}$
Vienne	The ſmall	1,430	1,027 $\frac{8}{10}$
Vienna	The large	1,420	1,020 $\frac{6}{10}$
	The ſmall	1,400	1,006 $\frac{2}{10}$

Wittenberg

Towns, Countries, &c.	The Foot, &c.	I. Proportions to the Paris foot.	II. Proportions to the Rhine-land foot.
Wittenberg -	The foot - -	1,255	902
Wurtenberg -	- - -	1,304	937 2/10
	The large rood -	20,870	15,000
	The ſmall Rhine-land D° - -	16,696	12,000
Zelle - -	The foot - -	1,290	927 2/10
Zirik-zee -	The large - -	1,376	988 9/10
	The ſmall - -	1,374	987 3/10
Zurick - -	The large foot -	1,340	963 1/10
	The mean - -	1,331	956 7/10
	The ſmall - -	1,330	955 9/10
	The fathom - -	8,260	5,936 7/10
	The rood - -	13,300	9,559 4/10

REMARKS

REMARKS *upon these* TABLES.

I.

A LINE, a ſuperficies, or a ſolid, may be divided into any number of parts; and the ſize of thoſe parts will always be proportionate to their number, provided they are all equal.

II.

THE foot, when conſidered as a line, may be either *decimally* or *duodecimally* divided: firſt into 10 inches, each inch into 10 lines, and each line into 10 parts; or, ſecondly, into 12 inches, each inch into 12 lines, and each line into 10 parts.—The former, however, is the moſt uſual and convenient method.

III.

THE Paris foot is longer than the Rhineland foot, and when the former is divided into 1440 parts, the latter will only contain $1391\frac{3}{10}$. Therefore, as $1391\frac{3}{10}$ are to 1440, ſo is the Rhineland to the Pariſian foot, and *vice verſâ*.

In

In Geometrical proportions, the product of the two Extremes is equal to the product of the Means; consequently, 13913 Par. feet = 14400 Rhin. feet.—Therefore the Par. foot is = $\frac{14400}{13913}$ Rhin. foot, or 1 $\frac{487}{13913}$ Rh. foot; and, on the other hand, the Rh. foot is = $\frac{13913}{14400}$ Par. foot.

By the decimal arithmetic, the Par. foot will be equal to 1 $\frac{35}{1000}$ Rh. foot, and the Rhin. foot will be equal to $\frac{966118}{1000000}$ Par. foot.

Duodecimally, the Par. foot is equal to 1 Rh. foot, 0 Inches, 5 Lines, and $\frac{4}{10}$ of a Part; and the Rh. foot is equal to 0 Par. foot, 11 Inches, 7 Lines, and 1 $\frac{3}{10}$ of a Part.—And *Decimally*, the Par. foot is equal to 1 Rhin. foot, 0 Inches, 3 Lines, and 5 Parts; and the Rhin. foot is equal to 0 Par. foot, 9 Inches, 6 Lines, 6 $\frac{18}{100}$ Parts.

IV.

IN Tab. I, the measures are compared with the Par. foot when *duodecimally* divided into 1440 parts; and in Tab. II, with the Rhin. foot when *decimally* divided into 1000 parts.

V.

As 1373 : 1220
or,
As 986 $\frac{8}{10}$: 876 $\frac{9}{10}$

} So is the foot of Berlin to that of Cologne. — Or you may say that 1373 Col. feet = 1220

= 1220 Ber. feet, or that 986 $\frac{8}{10}$ Col. feet = 876 $\frac{9}{10}$ Ber. feet.—Consequently, a Berlin foot will be equal to $\frac{1373}{1220}$ C. foot; or to $\frac{986\frac{8}{10}}{876\frac{9}{10}}$ C. feet; or to 1 $\frac{1254}{10000}$ C. feet.

Or secondly,

As 1270 : 1290 } So is the foot of Hamburg
or, } to that of Goettingen.—
As 912 $\frac{8}{10}$: 927 $\frac{2}{10}$ } Therefore 1270 Goet. feet = 1290 Ham. feet, or 912 $\frac{8}{10}$ Goet. feet = 927 $\frac{2}{10}$ Ham. feet.

Hence 1 Hamb. foot = $\frac{1290}{1270}$ G. feet; or to $\frac{912\frac{8}{10}}{927\frac{2}{10}}$ G. feet; or to $\frac{91845}{100000}$ G. feet.

These examples will be sufficient to explain the methods of comparing the measures of different countries with each other.—And if you wish to know the length of 17, or any other number of Berlin feet on a scale of Cologne feet, the following process will be necessary: As 1220 : 1373 :: 17 : x.—Answer 19 $\frac{1312}{10000}$.

VI.

The measures in the first table have been selected from various works, but particularly from *Krusen's Hamburgischem Contoristen*, and from the "*Recueil de*

" *Tables Logarithmiques, Trigonometriques et autres Ne-*
" *ceſſaires dans les Mathematiques Pratiques,*" &c. de Berlin; and whenever I have found a difference in the accounts, I have marked them under the heads of *Large*, *Mean*, and *Small.*—Their proportions to the Rhineland foot have alſo been made with the greateſt accuracy.

TABLE

TABLE III.

A Comparative View of the MEASURES of different Countries.

ELLS.	PLACES.	Compared with the Paris Foot, when divided into 1440 Parts.
The ELL.	Aix-la-Chapelle -	2,960
	Alexandria - -	3,000
	Altona - -	3,065
		2,540
	Amſterdam - -	3,150
		3,060
	Anſpach - -	2,720
	Antwerp - - -	3,078
		3,034
	Augſburg - -	2,702
		2,626
	Bamberg - -	3,235
	Bantzen, or Budiſſen -	2,553
	Bayreuth - -	2,662
	Berlin - -	2,956
	Brabant - -	3,065
	Brunſwick - -	2,530
	Bremen - -	2,564
	Breſlaw -	2,553
		2,438
	Cairo - -	3,000

ELLS.	PLACES.	Compared with the Paris Foot, when divided into 1440 Parts.
The ELL.	Carlſbad - -	3,002
		2,623
	Caſſel - -	2,488
	Coblentz - -	2,474
	Cologne - -	3,080
		2,545
The PIK.	Conſtantinople -	2,966
		2,872
The ELL.	Copenhagen - -	2,782
	Cracau - -	2,735
	Danzig - -	2,544
	Dreſden -	2,509
		2,506
	Dublin - -	5,069
	Edinburgh - -	4,212
	Elbingen - -	2,505
	Emden - -	2,972
	England *Linnen*	5,069
	England *Woollen*	3,110
	England *Tapeſtry*	3,041
	Erfurth - -	2,437
		1,790
	Erlangen - -	2,924
	Frankfort on the Mayne - -	2,392
	Frankfort on the Oder	2,941
	Freyberg - -	2,512
		2,506

Geneva

ELLS.	PLACES.	Compared with the Paris Foot, when divided into 1440 Parts.
The ELL.	Geneva - -	5,275
		5,070
	Goerlitz - -	2,499
	Goettingen - -	2,588
	Hague - -	3,060
	Halle - -	2,956
		2,532
	Hamburg - -	3,065
		2,540
	Hanover - -	2,580
	Hoff - -	2,825
		2,506
The PIK.	Jeruſalem - -	3,041
The ELL.	Inſpruc - -	3,485
	Ireland - -	*See England.*
	Konigſberg - -	2,548
The PIK.	Lacedemonia - -	2,027
The ELL.	Langenſalza - -	2,562
NEW ELL.	Leipzig - -	2,506
	Lauben - -	2,499
The ELL.	Leiden - -	3,028
	Lions - -	5,205
	Lubec - -	2,558
	London - -	*See England.*
	Luneburg - -	2,580
	Liege - -	2,445
	Magdeburg - -	2,956

ELLS.	PLACES.	Compared with the Paris Foot, when divided into 1440 Parts.
The ELL.	Malta - -	9,935
	Manheim - -	2,473
	Mantua - -	2,062
	Morocco - -	2,233
	Marſeilles - -	5,187
	Mayence - -	2,433
The COBID	Mecca - -	3,041
The ELL.	Malines - -	3,034
	Minden - -	2,566
	Modena - -	2,838
	Moſcow - -	3,154
	Munchen - -	3,701
	Munſter - -	3,584
	Naumburg - -	2,506
	Neuenburg in Switzerland - -	4,932
	Norway - -	2,782
	Nurenberg - -	2,924
	Oſtend - -	3,100
	Paris *Silk* - -	5,275
	Paris *Cloth* - -	5,264
	Paris *Linnen* -	5,240
	Parma - -	2,423
	Perſia *Royal* -	4,190
	Perſia *Common* -	2,793
	Poland - -	2,735

Prague

ELLS.	PLACES.	Compared with the Paris Foot, when divided into 1440 Parts.
The ELL.	Prague - -	2,619
	Preſburg - -	2,474
	Regenſburg - -	3,595
The PIK.	Rhodes - -	3,351
The ELL.	Riga - -	2,430
CANNE.	Rome *For the Meaſurement of Linnens*	9,264
BRACCIO.	Rome *For the Meaſurement of Linnens*	2,814
CANNE.	Rome *In Commerce* -	8,820
BRACCIO.	Rome *In Commerce* -	3,759
PALMA.	Rome - -	1,103
	Rome	990
	Rome	977
OLD ELL.	Rome	2,640
	Roſtock - -	2,564
	Rotterdam - -	3,060
ARSCHINE.	Ruſſia - -	3,154
The ELL.	Salzburg *Silk* -	3,559
	Salzburg *Linnen* -	4,458
RASI -	Sardinia - -	2,433
PALMA -	Sardinia - -	1,113
RASI -	Savoy -	2,433
The ELL.	Sileſia - -	2,553
	Scotland - -	*See England.*
	Sweden - -	2,632
	Switzerland - -	2,662
CANNE -	Sicily - -	8,584
PALMA -	Sicily - -	1,073

ELLS.	PLACES.	Compared with the Paris Foot, when divided into 1440 Parts.
The PIK.	Smirna - -	2,966
The ELL.	Speyer - -	2,440
	Stade - -	2,580
	Stettin - -	2,885
	Stockholm - -	2,632
	Stralſund - -	2,580
	Straſburg - -	5,272 2,386
	Straubingen - -	3,585
	Thoren - -	2,525
CANNE.	Toulon - -	8,596
The ELL.	Treves - -	2,474
The PIK.	Turky - -	2,966 2,873
RASI -	Turin - -	2,674
The ELL.	Ulm - -	2,520
BRACCIO.	Venice *Woollen* -	2,956
	Silk - -	2,782
NEW ELL.	Warſaw - -	2,735
The ELL.	Vienna - -	3,445
	Wiſſmar - -	2,584
	Wittenberg - -	2,985 2,506
	Wurzburg - -	2,573
	Zelle - -	2,580
	Zittau - -	2,526
	Zurich - -	2,660

Meaſures

The LACHTER*.	Contents. According to Paris Measures. Toises.	Feet.	Inches.	Lines.	According to Leipzig Ells. Ells.	Inches.	Lines.
In Freyberg, according to Weidlerm, Oppel, and Kastnerm, $6\frac{324653}{1000000}$ Rhineland Feet - -	1	—	1	$3\frac{969}{1000}$	3	12	$3\frac{319}{1000}$
Or,							
According to Scheidhauerm and Lempem, $6\frac{14388}{100000}$ Rhin. Feet -	—	5	11	$11\frac{305}{1000}$	3	10	$8\frac{16}{100}$
In Eisleben, according to Weidlerm, $6\frac{41321}{100000}$ Rhin. Feet - -	1	—	2	$4\frac{289}{1000}$	3	13	$5\frac{484}{1000}$
Or,							
According to the Supposition of others, $6\frac{40754}{100000}$ Rhin. Feet - -	1	—	2	$3\frac{5}{10}$	3	13	$4\frac{548}{1000}$
In Clausthal, or Oberhartz, according to Weidlerm, $6\frac{13492}{100000}$ -	—	5	11	$1\frac{57}{100}$	3	9	$8\frac{981}{1000}$
Or,							
According to the common Supposition, $6\frac{12939}{100000}$ Rhin. Feet - -	—	5	10	$-\frac{8}{10}$	3	8	$6\frac{282}{1000}$
In Joachimstal, according to Weidlerm, $6\frac{23612}{100000}$ Rhin. Feet - -	1	—	—	$3\frac{65}{100}$	3	11	$1\frac{156}{1000}$
Or,							
According to the Supposition of others, $6\frac{21073}{100000}$ Rhin. Feet - -	1	—	—	$2\frac{9}{10}$	3	11	$-\frac{277}{1000}$

* The Lachter is nearly equivalent to an English Fathom. Translator.

TABLE IV.

A Comparative View of the MILES in different Countries.

NAMES of PLACES.	The MILE, &c.	The Paris foot $= \frac{1440}{1414}$	The Rhineland foot $= \frac{1391\frac{1}{3}}{1440}$	Common Paces of $\frac{7}{4}$ Parisian feet.	10,000 parts of a Degree of the Equator = 15 Geographical Miles, or 342,636 Par. Ft.
ALEXANDRIA -	The *Stadium* -	805	833	345	0.0023
		631	653	$270\frac{3}{7}$	0.0018
ALSATIA - -	The large - -	21,737	22,498	$9,315\frac{6}{7}$	0.0634
	The small - -	19,100	19,768	$8,185\frac{5}{7}$	0.0557
ARABIA - -	The large mile -	11,110	11,499	$4,761\frac{3}{7}$	0.0324
	The mean - -	6,046	6,258	$2,591\frac{1}{7}$	0.0176
	— —	5,135	5,315	$2,200\frac{5}{7}$	0.0150
	The small - -	3,625	3,752	$1,553\frac{4}{7}$	0.0106
AUSTRIA - -	The large mile -	42,795	44,292	$18,340\frac{5}{7}$	0.1250
	The small - -	42,251	43,730	$18,107\frac{4}{7}$	0.1233
BAVARIA - -	The large - -	36,810	38,100	$15,775\frac{5}{7}$	0.1074
	The mean - -	26,335	27,257	$11,286\frac{3}{7}$	0.0768
	The small - -	22,577	23,367	$9,675\frac{6}{7}$	0.0659

BOHEMIA	The large	23,941	24,779	10,260$\frac{3}{7}$	0.0699
	The small	20,138	20,843	8,630$\frac{4}{7}$	0.0588
BOULOGNE	The mile	5,481	5,673	2,349	0.0160
BRANDENBURG		34,987	36,212	14,994$\frac{3}{7}$	0.1021
BRUNSWICK		32,594	33,735	13,968$\frac{6}{7}$	0.0951
BULGARIA	The *Leucas*	19,324	20,000	8,281$\frac{5}{7}$	0.0564
BURGUNDY	The mile	17,391	18,000	7,453$\frac{2}{7}$	0.0508
CATALONIA	The large	19,602	20,288	8,400$\frac{6}{7}$	0.0572
	The small	17,118	17,717	7,336$\frac{2}{7}$	0.0500
CHINA	The great *Ly*	1,771$\frac{3}{5}$	1,833$\frac{7}{10}$	759$\frac{2}{7}$	0.0052
	The small *Ly*	1,449	1,500	621	0.0042
	The *Puu*	14,493	15,000	6,211$\frac{2}{7}$	0.0423
	The *Can*	144,928	150,000	62,112	0.4230
DENMARK	The large	52,854	54,704	22,651$\frac{5}{7}$	0.1542
	The mean	34,236	35,435	14,672$\frac{4}{7}$	0.1000
	The small	23,188	24,000	9,937$\frac{5}{8}$	0.0677
EGYPT	The *Schoena*	24,154	25,000	10,351$\frac{5}{7}$	0.0705

Names of Places.	The Mile, &c.	The Paris Foot $= \frac{1440}{1444}$	The Rhineland Foot $= \frac{1391\frac{1}{3}}{1440}$	Common Paces of $\frac{7}{4}$ Parisian feet.	10,000 Parts of a Degree of the Equator = 15 Geographical Miles, or 342,636 Par. Ft.
England	The large Mile	5,250	5,434	2,250	0.0153
	The mean of 1760 Yards	4,956	5,129	2,124	0.0146
	The small D° of $1666\frac{2}{3}$ Yards	4,693	4,857	$2,011\frac{2}{7}$	0.0137
	The Sea	$5,710\frac{2}{7}$	5,910	$2,447\frac{3}{7}$	0.0166
	The League, or 3 Sea Miles	17,132	17,731	$7,342\frac{2}{7}$	0.0500
Finland	The Mile	19,020	19,685	$8,151\frac{2}{7}$	0.0555
Flanders	-	19,324	20,000	$8,281\frac{5}{7}$	0.0564
Florence	-	5,349	5,537	$2,292\frac{3}{7}$	0.0157
France	The large	15,561	16,107	6,669	0.0454
	The mean	15,217	15,750	$6,521\frac{4}{7}$	0.0444
		15,000	15,525	$6,428\frac{4}{7}$	0.0438

FRANCE	The small	12,000	12,420	$5,142\frac{6}{7}$	0.0358
	The League	13,705	14,185	$5,873\frac{4}{7}$	0.0399
		13,694	14,173	$5,868\frac{6}{7}$	0.0399
	The Sea Mile	17,132	17,731	$7,342\frac{2}{7}$	0.0500
		17,118	17,717	$7,336\frac{2}{7}$	0.0500
FUNEN, or FIONA		22,010	22,780	$9,432\frac{6}{7}$	0.0642
GERMANY	The Geographical or Geometrical Mile	22,842	23,642	$9,789\frac{3}{7}$	0.0666
		22,830	23,629	$9,784\frac{2}{7}$	0.0666
		22,824	23,623	$9,781\frac{5}{7}$	0.0666
	The common large Mile	28,530	29,528	$12,227\frac{1}{7}$	0.0833
	The mean	25,677	26,577	$11,004\frac{3}{7}$	0.0750
		24,155	25,000	$10,352\frac{1}{7}$	0.0705
		24,148	24,993	$10,349\frac{1}{7}$	0.0705
		21,734	22,495	$9,314\frac{4}{7}$	0.0634
		19,324	20,000	$8,281\frac{5}{7}$	0.0564
		19,319	19,995	$8,279\frac{4}{7}$	0.0564
		19,020	19,685	$8,151\frac{3}{4}$	0.0555

Names of Places.	The Mile, &c.	The Paris Foot $= \frac{1440}{1444}$	The Rhineland Foot $= \frac{1391\frac{1}{3}}{1440}$	Common Paces of $\frac{7}{3}$ Parisian Feet.	10,000 Parts of a Degree of the Equator = 15 Geographical Miles, or 342,636 Par. Ft.
Gothland	The large Mile	45,648	47,246	$19,563\frac{3}{7}$	0.1332
	The small	28,530	29,528	$12,227\frac{1}{7}$	0.0833
Grisons	The Mile	42,795	44,292	$18,340\frac{5}{7}$	0.1250
Greece	The Stadium	604	625	$258\frac{6}{7}$	0.0017
		473	489	$202\frac{5}{7}$	0.0014
Hamburg	The Mile	23,118	24,000	$9,937\frac{5}{7}$	0.0677
Hesse	-	31,072	32,160	$13,316\frac{4}{7}$	0.0907
Holland	The large	23,188	24,000	$9,937\frac{5}{7}$	0.0677
	The mean	21,397	22,146	$9,170\frac{1}{7}$	0.0625
		18,033	18,664	$7,728\frac{3}{7}$	0.0526
		17,387	17,995	$7,451\frac{4}{7}$	0.0508
	The small	17,118	17,717	$7,336\frac{2}{7}$	0.0500
Hungary	The large Mile	34,236	35,434	$14,672\frac{4}{7}$	0.1000

HUNGARY	The mean	25,698	26,597	11,013 3/7	0.0751
		24,454	25,310	10,480 2/7	0.0714
	The ſmall	19,603	20,289	8,401 2/7	0.0572
JAPAN	*Coſæ*	11,584	11,989	4,964 4/7	0.0338
INDIA		11,421	11,821	4,894 5/7	0.0333
INDOSTAN	*Coſæ*	11,584	11,989	4,964 4/7	0.0338
IRELAND	The large Mile	8,566	8,866	3,671 1/7	0.0250
	The mean	7,608	7,876	3260 4/7	0.0222
		7,288	7,543	3,123 3/7	0.0213
	The ſmall	6,847	7,087	2,934 3/7	0.200
ITALY	The Mile	5,711	5,911	2,447 4/7	0.0166
		5,707	5,907	2,445 6/7	0.0166
		5,706	5,906	2,445 3/7	0.0166
LAPLAND	The large	18,007	18,637	7,717 2/7	0.0525
	The ſmall	15,216	15,749	6,521 1/7	0.0444
LIVONIA	The large	22,012	22,782	9,433 5/7	0.0642
	The ſmall	19,020	19,685	8,151 3/7	0.0555
LITHUANIA	The large	27,536	28,500	11,801 1/7	0.0804

Names of Places.	The Mile, &c.	The Paris Foot $= \frac{1440}{1444}$	The Rhineland Foot $= \frac{1391\frac{1}{3}}{1440}$	Common Paces of $\frac{7}{3}$ Parisian Feet.	10.000 Parts of a Degree of the Equator = 15 Geographical Miles, or 342,636 Par. Ft.
Lithuania -	The mean - -	27,488	28,450	$11,780\frac{4}{7}$	0.0802
		22,824	23,623	$9,781\frac{5}{7}$	0.0666
		19,563	20,248	$8,384\frac{1}{7}$	0.0571
	The small - -	17,118	17,717	$7,336\frac{2}{7}$	0.0500
London - -	$1666\frac{2}{3}$ Yards -	4,693	4,857	$2,011\frac{2}{7}$	0.0137
The Circle of Lower Rhine	The Mile - -	19,324	20,000	$8,281\frac{5}{7}$	0.0563
Moravia - -	The large - -	33,012	34,168	14,148	0.0963
	The small - -	28,530	29,529	$12,227\frac{1}{7}$	0.0833
Milan - -	The Mile - -	5,187	5,369	2,223	0.0151
Modena - -	- -	5,187	5,369	2,223	0.0151
Naples - -	- -	5,187	5,369	2,223	0.0151
Netherlands -	The Hour - -	17,422	18,032	$7,466\frac{4}{7}$	0.0508
	The Sea Mile -	17,132	17,731	$7,342\frac{2}{7}$	0.0500

NORWAY	The Mile	28,986	30,000	12,422$\frac{4}{7}$	0.0846
NURENBERG	-	24,155	25,000	10,424$\frac{4}{7}$	0.0705
PARIS	The Hour Mile	13,694	14,173	5,868$\frac{6}{7}$	0.0399
PARMA	The Mile	5,187	5,369	2,223	0.0151
PERSIA	*Farſangas*	18,116	18,750	7,764	0.0529
	The ſmall Mile	17,132	17,731	7,342$\frac{2}{7}$	0.0500
	Paraſangas	15,418	15,958	6,607$\frac{5}{7}$	0.0450
		15,406	15,945	6,602$\frac{4}{7}$	0.0450
POLAND	The large	19,179	19,850	8,219$\frac{4}{7}$	0.0560
	The mean	17,132	17,731	7,342$\frac{2}{7}$	0.0500
		17,118	17,717	7,336$\frac{2}{7}$	0.0500
	The double	34,236	35,434	14,672$\frac{4}{7}$	0.1000
PORTUGAL	The Mile	20,554	21,273	8,808$\frac{6}{7}$	0.0600
PRUSSIA	The large	26,335	27,257	11,286$\frac{3}{7}$	0.0769
	The mean	25,409	26,299	10,889$\frac{4}{7}$	0.0742
		24,206	25,053	10,374	0.0707
	The ſmall	23,850	24,685	10,221$\frac{3}{7}$	0.0696

Names of Places.	The Mile, &c.	The Paris Foot $= \frac{1440}{1444}$	The Rhineland Foot $= \frac{1391\frac{1}{3}}{1440}$	Common Paces of $\frac{7}{3}$ Parisian Feet.	10,000 Parts of a Degree of the Equator = 15 Geographical Miles, or 342,636 Par. Ft.
Rhodes	The *Stadium*	$449\frac{583}{1000}$	$465\frac{318}{1000}$	$192\frac{9}{14}$	0.0013
Rome	The *Stadium* of Vespasian	$682\frac{248}{1000}$	$706\frac{126}{1000}$	$292\frac{29}{70}$	0.0020
	The ancient *Stadium*	$570\frac{746}{1000}$	$590\frac{722}{1000}$	$244\frac{51}{70}$	0.0017
		567	587	243	0.0016
	The ancient Mile of 8 *Stadia*	4,536	4,695	1,944	0.0133
	The new Mile	4,755	4,922	$2,037\frac{6}{7}$	0.0139
Russia	The Mile	3,622	3,749	$1,552\frac{2}{7}$	0.0106
	Werstes of 1500 *Arschines*	3,290	3,405	1,410	0.0096
		3,285	3,400	$1,407\frac{6}{7}$	0.0096
Saxony	The large Mile of the Ancients, of 33,274 *Dresden* Ells	57,976	60,005	$24,846\frac{6}{7}$	0.1692

SAXONY - -	The Common Mile of 27,000 *Dresden* Ells - -	47,044	48,691	20,161 1/7	0.1373
	The mean of 16,000 *Dresden* Ells, used in measuring the Frontiers, and marked by Mile Stones - -	27,878	28,854	11,947 3/7	0.0814
	The Geographical Mile of 12,000 *Dresden* Ells, established by Augustus - -	20,908	21,640	8,960 4/7	0.0610
	The hunting Mile of the Elector Augustus, of 11,025 *Dresden* Ells - -	19,210	19,882	8,232 6/7	0.0560

Names of Places.	The Mile, &c.	The Paris Foot $= \frac{1440}{1444}$	The Rhineland Foot $= \frac{1391\frac{1}{3}}{1440}$	Common Paces of $\frac{7}{3}$ Parisian Feet.	10,000 Parts of a Degree of the Equator = 15 Geographical Miles, or 342,636 Par. Ft.
Silesia	The large Mile	27,321	28,277	11,709	0.0797
	The mean	24,433	25,288	10,471 $\frac{2}{7}$	0.0713
		19,945	20,643	8,547 $\frac{6}{7}$	0.0582
	The small	19,789	20,481	8,481	0.0578
Scotland	The large Mile	8,566	8,866	3,671 $\frac{1}{7}$	0.0250
		8,559	8,859	3,668 $\frac{1}{7}$	0.0250
	The mean	6,847	7,087	2,934 $\frac{3}{7}$	0.0200
		5,797	6,000	2,484 $\frac{3}{7}$	0 0169
	The small	5,586	5,782	2,394	0.0163
Suabia	The Mile	42,795	44,292	18,340 $\frac{5}{7}$	0.1250
Sweden	The large Mile	45,563	47,158	19,527	0.1329
	The small	32,900	34,052	14,100	0.0960
Switzerland	The Mile	25,764	26,666	11,041 $\frac{5}{7}$	0.0752
Sicily	-	5,477	5,669	2,347 $\frac{2}{7}$	0.0160

SINA	The LY	8,214	8,501	3,520 2/7	0.0240
SPAIN	The *Legas*	19,025	19,691	8,153 4/7	0.0555
	of 5000 *Varas*	13,052	13,509	5,593 5/7	0.0381
	The Sea Mile	19,563	20,248	8,384 1/7	0.0571
	The ſmall	17,118	17,717	7,336 2/7	0.0500
SUDERMANIA	The large Mile	45,648	47,246	19,563 3/7	0.1332
	The ſmall	28,530	29,528	12,227 1/7	0.0833
TARTARY	The Mile	217,395	225,004	93,169 2/7	0.6345
		5,434	5,625	2,328 6/7	0.0158
TURKEY	The large *Berri*	5,140	5,320	2,202 6/7	0.0150
		5,135	5,315	2,200 5/7	0.0149
	The ſmall	4,831	5,000	2,070 3/7	0.0141
	The Sea	5,706	5,906	2,445 3/7	0.0166
UPLAND	The large	45,648	47,246	19,563 3/7	0.0133
	The ſmall	28,530	29,528	12,227 1/7	0.0833
WESTPHALIA	The Mile	32,608	33,750	13,974 6/7	0.0952

ACCORDING to Dodſon's Tables, the proportion of the fractions, $\frac{1440}{1444}$ to $\frac{1391\frac{1}{3}}{1440}$ is conſiderably nearer the proportion of the Paris to the Rhineland foot, than that of 1440 to $1391\frac{1}{3}$; but it is evident that the Calculator has uſed the latter ratio in this, as well as in the preceding tables.—For inſtance, as $1440 : 1391\frac{1}{3} :: 833 : 805$, (the Alexandrian Stadium) and ſo of others. If the fractions, $\frac{1440}{1444}$ and $\frac{1391\frac{1}{3}}{1440}$ are not miſprinted, they are certainly taken from ſome author, as expreſſing the ratio of the Paris and Rhineland foot, though not adopted by M. Liebe *; and even that ratio is not ſo accurate as it might have been.

Another obſervation may be made on his *mode of dividing the Paris foot, as explained* in the remarks of Tab. I. and Tab. II; for he there tells you that the Pariſian foot may be *duodecimally* divided into 1440 parts, and to that end he multiplies the 144 lines by 10.—Now, I ſay, that cannot be deemed *duodecimal* arithmetic.

I have compreſſed the Calculator's remarks on Tab. I. and Tab. II. into a narrower compaſs, but without omitting any uſeful or explanatory paſſage; and in the latter part of Tab. III. I have found it equally expedient to reject an account of ſome ancient meaſures, as tedious and uninſtructive.

Tranſlator.

* See the Author's preface.