After this take away the cord of the perpendicular, and thus continue the same operation as long as you please, or are able, in order to trace all the other turnings or windings of the trenches.

This whole operation ſuppoſeth that you know exactly the distance of the point G, the extremity of the line or direction to the top E of the ſaliant angle of the covert­way. This distance may be found by the common rules of trigonometry, or by the following simple method pointed out by marſhal Vauban : Let A (fig. 5.) be the vertex of the ſaliant angle of the covert way, and AB the line of di­rection of the trench whose length you want to take. At the point B, draw BC perpendicular to AB, to which give what meaſure you pleaſe, as 80 or 100 fathoms, and at the point C draw CD perpendicular to BC : In CD take any point E, and in the line of direction between it and the angle A place a picquet G in the line BC. Meaſure GC and CE, and say, as GC : BG : : CE : AB.

When once you have found out by this, or ſuch other methods as you may make use of, the length of the line of direction EG (Plate DXXX. fig. 2.), you will be always able to know the distance that remains to the ſaliant angle of the covert-way, and to the points I, N, P, through which the parallels or places of arms are to paſs. These points being determined, it would be an easy matter from geometry to find out a method of deſcribing the parallels that are to paſs through them, if their situation admitted the engineers to perform the operation quietly by day-light ; but they are to be traced in the dark, and under the fire of the place ; ſo that there is no other way to trace them than by aporoximation, that is, to move as nearly parallel to the circuit of the place as you can by your judgment ; and to plant picquets, with cords tied to them at proper intervals, the whole length of the line. But you can trace with cords only the first parallel ; for the others are too near the place to permit you to perform this operation : you are therefore to proceed in tracing them almost in the same manner, as we ſhall obſerve when ſpeaking of the sap, to which they belong, and which is carried on by that method.

6. *Obſervations on the properest Part for making the Attacks.*

While the lines are perfecting, the neceſſary materials are to be got ready for the construction and operations of the attacks. The materials consist of faſcines, picquets three feet long and about an inch or two in diameter, ga­bions, and picquets for gabions. There must likewiſe be a provision of the ſeveral instruments or tools necessary for theſe operations.

The engineer, who has the direction of the siege, will likewiſe make uſe of this time to examine into the parts most convenient for carrying on the attacks, and where they will be most simple and expeditious. There are few fortreſſes in Europe of which plans are not to be had ; but as it is preſumed that the enemy hath increaſed the fortifi­cations of a town which is threatened with a siege, care ſhould be taken to get intelligence thereof from ſome ſkilful perſon that has been in the place, and made all the obſer­vations poſſible in regard to the works lately raised, with­out giving any ſuſpicion of his intentions. The danger of ſuch an undertaking is very well known, ſo that the perſon employed cannot be too cautious in keeping himſelf concealed.

While the circumvallation is making, the engineers may at a distance, or, as we have already obſerved, out of musket- shot, examine ſome part of the out-works ; and afterwards, from the report of the perſon ſent into the place, and from what they know themselves, they may settle with the gene­ral the properest and fittest place for carrying on the attacks. On this occaſion there are many things to be obſerved, as well with regard to the ground as to the fortifications ; but in a work of this nature, it is ſufficient to consider the points of most importance.

First of all, the nature of the ground about the place must be well obſerved, Whether there are any ditches or hollow ways, that may ſerve as a cover to guards of horſe and foot against the cannon of the place ; whether there are any parts that command the town, and may ſerve for the erecting of batteries; and whether the ground is fit for the works. The moſt favourable circumstance is to find a soil eaſy to dig ; then the works advance with eaſe and leſs loss, becauſe the ſoldier is ſoon under cover, and the cannon does not do half the miſchief as in stony places. If the ground about the place is a pure rock, or a moraſs, the operations are extremely difficult ; and there will be occaſion for a vast quantity of faſcines, sand bags, wool-packs, &c. becauſe the workmen are in much greater danger.

The rivers which run through the town, or in the neigh­bourhood, likewiſe deserve consideration ; for they ſeparate the attacks, and it may happen by ſome stoppage of the water, or other accident, that the bridges of communica­tion being broke dowm, the ſeparation of the attacks will expoſe the army of the besiegers to be defeated, by which means the place may be relieved. It is proper alſo to in­quire, whether thoſe rivers are not subject to inundations, which, if they were to happen during the siege, and to break in upon the attacks, would oblige the besiegers to abandon the trenches, and to raiſe the siege. In a word, whether the town can command any quantity of water ſo as to make an inundation round the place, and to lay the ground appointed for the attacks under water. All theſe points, and a great many others which we do not mention, deserve the most ſerious attention.

After choosing the properest ground for the attacks, a general is to consider the front which is least fortified and least covered with outworks. All other things being the same, it is evident, that the fewer outworks there are, the easier will be the attack. But if the place be situated in a moraſs, or upon an eminence, then he must neceſſarily make his attack on the accessible side, be its outworks what they will. In a word, the whole choice of the attacks consists in finding out the properest ground, and the weakest side ; but as it is to be presumed that the enemy are acquainted with the nature of the ground about the place, and there­fore have taken care to fortify more exactly thoſe parts which are most favourable to an attack, the besiegers ſhould not hesitate to make their approaches on that side ; where, by the situation of the ground, they may gain, what the increaſe of the fortifications might otherwiſe make them loſe.

7. *Of opening the Trenches.*

Every thing being ready for opening the trenches, the ground pitched upon, the attacks settled and drawn upon a plan, and stores or magazines of all the materials neceſſary on the occaſion being within reach of the place where the pioneers propoſe to work ; the general having alſo settled the round of duty for the guard of the trenches, both of horſe and foot, as likewiſe the number of horſe for bringing the faſcines, with the number of pioneers and troops to support them; and the chief director of the engineers having ac­quainted the rest of the corps with his plan of attack, and the manner they are to act ; in a word, every thing being ready for execution, the troops designed for the ſervice of the first night being prepared and drawn up in battalia at the place of rendezvous, and the pioneers provided with faſ­cines, picquets, shovels, and pick-axes ;—in the dusk of the