

These zigzag trenches are called "saps", and have short T-head trenches at the front. In trench warfare as in siege warfare, when the front trench is to be advanced into closer striking distance, these "T-heads" may be connected together and will form a new firing line, in siege war called a "parallel". But where the front trench lies sufficiently close and there is a clear observation, there may be no such outpost line, but the front trench itself becomes "outpost". This trench is lightly held, the remainder of the garrison (the battalion in line) being sheltered at supporting distance in trenches and dugouts to the rear. In form of construction, the fire trench in addition to giving concealment, affords as much protection as possible by a "parapet" in front, by "parados" which protects from back explosion of high explosive shell, and it is protected from enfilade fire by being made either zigzag or wavy, or by thick "traverses" at short intervals, say 18 ft. Traverses also localize, within one "bay", the effect of a shell exploding in the trench. The bays are provided with a "fire step", giving 4 ft. 6 in. height to the crest of the parapet. Each bay will be provided with not more than one loophole (box or steel plate) for observation or sniping. Out in front of the trench is an obstacle, a continuous belt of barbed wire, varying in depth from a few feet to many yards. Both the obstacle and trench are considered as ideally sited when their front so bends in and out that when the enemy attacks he is brought into position where he will be enfiladed by the fire of other portions of the line, by machine guns operating from positions in the front trench or commanding positions in the rear, and by the artillery.

The wire is placed far enough in front to hold the attacker outside of effective bombing distance of the trench, say 35 yards or more. The lighter trench artillery, such as Stoke's guns, may operate from the front trench, while the heavier and less mobile trench mortars are in concealed emplacements rearward.

Secondary Trenches.

Behind the firing line, at a distance of forty to sixty feet, and parallel with it, may be a "supervision" trench, connected with it at very short intervals by "connecting" trenches. When it can be built and maintained it is a very useful trench, taking up side traffic of troops coming and going from fire stations, messengers, pro-

vision parties, etc. The Germans call it a "circulation" trench, and the French call it a "doubling" trench, and they organize it as a second fire trench, place their rest shelters there, as well as machine gun positions.

The Support and Reserve Lines.

But the next most important trench is the "support", from one to two hundred yards rearward. It is a traversed fire trench like the front trench, and when the latter is yielded to the enemy, become the firing line. Normally a certain proportion of the garrison occupy the support line where there are dugouts, including deep "mined" dugouts which with twenty or more feet of earth head cover are completely bomb proof. The remainder of the battalion in line occupy the "reserve" line, either a trench or other suitable shelter. These three trenches, running not exactly parallel, but in the same general direction, and giving mutual support to each other, form the ordinary "front line" of defensive trenches. But often there will be only two, the fire trench and support. These trenches establish communication sideways between the various centers of resistance, the fire from which will cover their fronts also.

Communication Trenches.

Communication from front to rear is by means of "communication" trenches. They may be lie more or less of a right angle to the trenches just mentioned. When organized, as they are now, as fire trenches, with fire steps each side, they serve to bring enfilade fire upon an enemy which has broken through the front trench or trenches. In trace they are zigzag or wavy, to protect against enemy observation and fire. There are various other details designed for the defense of the trench communication along its length. Out from it lead various other "transversal" trenches, such as lead into concealed machine gun pits, deep dugouts used by machine gun sections, company and battalion commanders, signallers, ammunition stores, etc., or as additional side communications. Communication trenches are to be as numerous as possible. During a heavy engagement certain ones are designated for use of incoming and others for outgoing traffic, although they are of double width so as to allow men with kits to pass easily in normal times.

Switch Lines.

Instead of through perpendi-

cular communication trenches, approach will be sometimes by so called "switch" lines. These lie diagonal to the other lines, and being organized with fire step and with wire in front, they will, in case of a successful enemy attack, become the front of the line and not leave a dangerous salient or angle projecting into enemy territory. Numerous switch lines also enable some of them to be used as support trenches. As an airplane photograph will not show whether they are occupied or not, the enemy will not be able so readily to locate the real lines of resistance, serving as dummy trenches, a greater area of trench must be destroyed, a greater amount of artillery ammunition expended, before the attack. This system seems to have such advantages over the other that the German high command, reflecting upon the terrific pounding of the British in front of Passchendaele, and when obliged to abandon his trench system in favor of the scattered concealed machine gun system (shell craters, pill boxes, etc.), recommended the switch line system of trenches.

Behind the first infantry zone of defenses is the artillery, the lighter guns being more advanced, the heavier ones to rear. One of these trenches or still another, may be designated as the artillery protection line. Wherever the artillery, especially the heavy, less mobile pieces, come into the action, the whole front infantry defenses may be said to be "outpost" for the artillery, guarding it against surprise attack and protecting its numerous direct observation points.

Protection for the Artillery.

Other defensive lines are usually prepared in rear to fall back upon. In this respect the Germans have been much more thorough than the British.

Strong Points.

In addition to the various centers of resistance above spoken of, there will be numerous lesser points, wherever machine guns can be concealed. Sometimes these will be a single machine gun position camouflaged over and connecting with a deep dugout, and with some nearby trench. Coming under the general head of "strong points", these rearward positions all do their work by adding the element of surprise to deadly enfilade fire. These machine gun positions may be merely concealed so as to escape the usual preliminary bombardment, or may also be protected by reinforced concrete emplacements. Their effect is most deadly, and

is ordinarily able to hold up attacks. But the Germans, in the present great offensive, seem to have resolved upon disregarding their deadly effect and to pay the terrible cost as the price of victory. Their divisions were sent forward, in a new formation, the advance regiments going ahead, past and through, at whatever cost, leaving the following men to reduce the strong points by bombs and other explosives. In previous offensives the "moppers" have gone with the first waves.

Subways.

Last year, both sides put into operation "subways", deep underground, leading right up to the front line. The "Hindenburg Tunnel" was one such, and the British, before Vimy, had, so returned soldiers say, a hundred of them, one of which was 3,000 yards in length. These subways do not, however, take the place of the transversal trenches, but only give protected communication from front to rear.

In preparation for a general advance, there will be still other kinds of trenches such as "Assembly" and "jumping-off" trenches, but these do not belong to the strictly defensive scheme.

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