whilst, of necessity, the gun cannot be worked from the pit until its completion. Fig. 7 shows a gun pit which would take one man from 5 to 10 hours to construct, according to the nature of the soil; these pits rarely exceed fifteen inches in depth.

An epaulment is somewhat similar in plan, but varied according to local conditions.

Obstacles.—The strength of a post can be increased by the use of suitable obstacles. In selecting their posi-



tion a site should be chosen where they can be well hidden from the assailants, but will allow an easy advance on the part of the defenders. No particular materials are specified for this purpose; the most suitable are those that cannot be removed by the ordinary weapons or tools that the attackers would carry. As an obstacle, that to the best of my knowledge is not mentioned in military manuals. I suggest broken bottles, etc., with bottoms



set in concrete. Loose straw and leaves saturated with tar would be of advantage against a foe stalking on all fours. Orthodox obstacles include entanglements, pits and palisades; the former consist of wires: these, if set low, are about eighteen inches off the ground, fixed on stout stakes, well driven in and about six feet apart. The wires are twisted around the posts and carried horizontally and diagonally. An entanglement more difficult to negotiate is that with posts four feet above ground, with the wire from the base of one post taken to the top of another, and by crossing the wires a useful defence is made; barbed wire is, of course, preferable to plain.

In the absence of wire, pickets with pointed tops, trees, or brushwood fastened with points in the direction of the enemy, will form difficult impediments.

Military pits are planned on lozenge pattern and consist of small holes containing pointed pickets; an entanglement of wire over the surface is of advantage, and further improvement is made by erecting on the enemy's side a glacis, formed of the excavated earth. This should be eighteen inches in height, as near vertical as practicable on the defenders' side, with an easy slope towards the attackers, to facilitate their progress and hide the obstacle until it is reached.

Palisades may be erected in ditches that are controlled by the defenders' fire. A useful material is the pointed form of galvanized iron fencing. In the absence of stock patterns, by the use of an axe on the top edge, the plain pattern can be made very effective.

STREET PAVING METHODS.

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The repair of streets and roadways is one of the most important works that come under the direction of the municipal engineer. There are many causes for the defects that are constantly arising with ordinary paving, but perhaps the most prevalent is that the specification, in the first place, was not properly drawn up. Frequently pavements are laid with too weak a base, and cracks develop in all directions. Occasionally the lateral support is far from rigid. Where asphalt surface disintegrates in places it may be found that the decay is due to leakage from gas mains, in which case it is useless to try to patch the surface until things are properly adjusted underneath. The question is becoming pressing as to whether, in the course of the next few years, we shall not have to reconsider all our present methods of roadmaking. It is an open secret that many are investigating the behavior of materials under other methods of laying than those usually employed, under traffic conditions, and a number of interesting experiments have already been carried out. In connection with these it is interesting to recall the work done at Mankato, in Minnesota, a short time ago. First the driveway was narrowed to 30 ft., curbed and guttered, after which it was excavated to the depth of 6 in. and levelled. Five inches of dry crushed limestone, 11/2 in. to 2 in. in diameter, was then put on and rolled down with a 10-ton roller. Ordinary tar, brought to the boiling point, was then applied until the whole surface was covered. Then a layer of broken stone of I in. to I'4 in., mixed with coarse gravel, was applied on the surface, in the proportion of three parts of stone to one of gravel. This was first mixed dry on a platform and then thoroughly blended with hot tar, and applied on the surface to a depth of 2 in., and tamped into place to conform with the surface of the street. Dry domestic cement was then applied to the surface, and the street was again rolled, after which the road was heavily sanded and rolled for the last time. The road was allowed to stand for fourteen days before it was thrown open to traffic, and when hardened presented a very fine and somewhat resilient surface, which proved exceptionally durable.