

necessary rotative movement to the projectile resulting from the twist of these grooves. The action is in fact similar to that of the common elongated bullet for the rifle musket, or the application of the Minie ball to cannon. The projectile is 2.9 inches. R. P. Parrott, Esq., West Point Foundry, has produced a field-gun for firing this elongated bullet reinforced by wrought iron, the idea of which is not novel, but which he claims to have arranged in proper proportions, and otherwise to have brought into practical shape so as to make a safe, cheap, and good rifled cannon. The gun has, in reference to the projectile, three grooves and a twist of one turn in 10 feet. It has not yet been before a board, but has been successfully tried before officers of the army. (Consult Sir Howard Douglas; Hyde; Wilcox. See AMMUNITION; Arms; BUT-LET; CARBINE; Firing; Percussion; PROJECTILE.)

**RIFLE PITS**—are holes or short trenches, about four feet long and three feet deep, forming, with the earth thrown out in front of them, cover for two men. There is generally a loophole on the top of the breastwork, made, by placing two sand-bags across the parapet, and a third resting on these, in the direction of it, to cover the head and shoulders of the riflemen. A rifle pit of this construction is shown in plan, section, and elevation in Fig. 203.

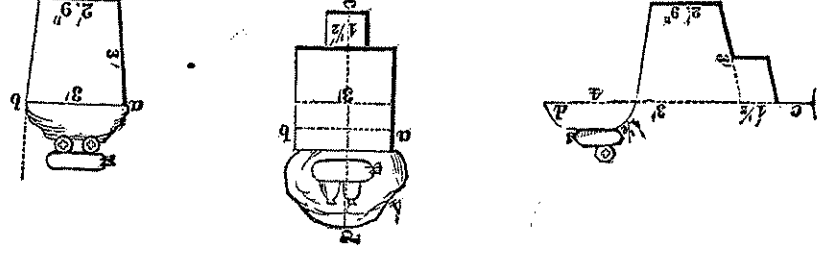


FIG. 203.

**RIOT.** (See EXCITATION OF LAWS.)

**ROADS.** When it is proposed to construct a line of road, extending between two places, the officer upon whom such duty devolves, first makes himself well acquainted with the surface of the country lying between the two places; he is then to select what he thinks, all circumstances being taken into consideration, the best general route for the proposed road. But previously to laying it out with accuracy, it is necessary to make an instrumental survey of the country, along the route thus selected; taking the levels from point to point throughout the whole distance, and making borings in all places where excavations are required, to determine the strata through which such cuttings are to

be carried, and the requisite inclinations of the slopes or slanting sides as well of the cuttings as of the embankments to be formed by the material thus obtained. It is also requisite, in the selection of the route for the proposed road, to have regard to the supply of materials, not only for first constructing it, but for maintaining it in repair. The results of such an investigation should be reduced to plan and section; the plan of the road being on a scale not less than 66 yards to an inch, and the section not less than 30 feet to an inch. The loss of *tractive power* and consequent danger produced by steep acclivities, render it necessary that a proper limitation should be imposed on the acclivities or inclinations on every line of road. As, however, this reduction of hills in a country where much inequality of surface exists, is attended with great labor and expense, greater rates of inclination must be allowed to hills or roads where the traffic is not sufficient to repay the expense of excavations. A dead level, even where it can be obtained, is not the best course for a road; a certain inclination of the surface facilitates the drainage, and keeps the road in a dry state. There is a certain inclination or acclivity, which causes, at a uniform speed, the traces to slacken, and the carriages press on the horses, unless a drag or break is used; the limiting inclination within which this effect does not take place is called the *angle of repose*. On all acclivities less steep than the angle of repose, a certain amount of tractive force is necessary in the descent, as well as in the ascent; and the means of the two drawing forces, ascending and descending, is equal to the force along a level road. The exact course of the road, and the degree of its acclivities being determined, the next thing to be considered is the formation of its surface. The qualities which ought to be imparted to it, are twofold: first, it should be smooth; secondly, it should be hard; and the goodness of the road will be exactly in proportion as these qualities can be imparted to it, and permanently maintained upon it. The means resorted to accomplish these objects are: 1. *Gravel Roads.* A coating of four inches of gravel should be spread over the road bed, and vehicles allowed to pass over it, till it becomes tolerably firm—men being required to take in the ruts as fast as they appear; a second coating of 3 or 4 inches of gravel should be then added and treated like the first, and finally a third coating. 2. *Broken Stone Roads,* or Macadam roads. French engineers value uniformity in size of the broken stone less than Macadam. They use all sizes from 1½ inches to dust. Macadam considers from 7 to 10 inches of depth of stone on the road sufficient for any purpose. He earnestly advocates the principle, that the whole science of road-making consists in making a solid