20,080 FEET IN A SECOND.

GREAT SPEED GIVEN TO PROJECTILES—SEVEN PIECES OF BOILER IRON PIERCED.

A little man with a dark mustache, who stood in the sand at Sandy hook, dived one hand into his coat-pocket suddenly and fished out a metal cartidge two inches long. It was packed with powder, and had a hole through the center from end to end.

"If you lit that," he said, "it would fizz away harmlessly, just like a Fourth of July flower-pot. Watch what it does when I let it off in this gun-barrel.

A common smooth-bore, breech-loading gun barrel, that the man had bought in town for $2, lay in the sand. It was just four feet long, and had a bore five-sixteenths of an inch in diameter. In front of it, resting right against the muzzle of the barrel, was a little square target. It was made of nine sheets of boiler-iron screwed together tightly. Each sheet was one quarter of an inch in thickness. The little man fitted the cartridge in the breech, and right ahead of it laid a thin rod of tempered steel. It was nine inches long, and weighed nine and one-half ounces.

"There is nine-tenths of an ounce of powder in that cartridge," he said as he got into a bomb-proof on the sands, "and here she goes."

He yanked a string that was attached to the gun hammer. There was an explosion and then a thud. The little man came out from the shelter of the bomb-proof and picked up the little target. He got a hammer and a wedge and pried it apart. The steel rod had been forced straight through seven thicknesses of the boiler iron, then it had been turned up and broke off. The broken piece was wedged between the last two boiler plates. The topmost inch of it had penetrated the fiber of the iron perpendiculary. The little man gazed at the ruin of the target in admiration.

"That beats the record all hollow," he cried exultantly. "The best that anybody has been able to do hertofore with a cartridge of that size is to drive a steel projectile through an inch of boiler iron. It would burst the gun to put it to such a test with a cartridge of ordinary make.

He dodged behind the bomb-proof again and tried it with an ordinary coarse-grain cartridge. There was a big explosion when he yanked the string, and through the peep-holes of the bomb-proof the spectators saw the gun barrel blown to flinders. The little man fished up another of the new fangled cartridges from his pocket and said:

"This thing was invented by the man who invented the multicharge gun. The idea consists in the character of the powder used and in the boring of a hole through the middle of it after it has been packed in the cartridge. The superiority of the cartridge over anything that has heretofore been gotten up in the same line is the immense power it imparts to the projectile and the great reduction of the strain usually caused upon the gun by the force of the explosion necessary to fire a projectile. These results are secured by arranging the powder so that the force generated at the moment it is ignited will be comparatively small, and will increase continually until the whole charge is consumed. This arrangement starts the projectile gently at first and then imparts to it gradually increased motion, and equalizes the strain upon the walls of the gun. To accomplish this, the powder, which is of very fine grade, is packed in the shell in a solid mass, and then perforated with the central hole, so that when it is ignited by a primer it will throw a stream of fire downward through this perforation. The stream of fire ignites the powder along the internal walls of the perforation, and as this perforation is comparatively small, but as the combustion proceeds the fire surface continually increases until the entire mass of the powder is consumed. By properly proportioning the size and shape of the powder cake relatively to the projectile to be used, and to the length of the barrel through which it is to be driven, the force exerted upon the projectile by the powder may be regulated practically at will, and so as to do the most effective work in any given case."

Can this principle be applied to cannon as well as small arm? was asked.

"Certainly," the little man replied. "All that is necessary is to pierce the solidly packed powder longitudinally with a number of holes instead of one, and then make corresponding holes in the head of the shell, and arrange the head so that the holes can communicate with each other. This can be secured by the introduction into the powder-cake perforations of a number of tubes projecting rearwardly from the cartridge head, so that they will rest against the breech lock of the cannon, and leave a space between the lock and the cartridge head. The construction insures the instanteous and simulantaneous ignition of the powder perforations at their head. It is essential that the powder-cake be hard and dense so that the fire can not penetrate into it but will burn only on its surfaces—that is, as distinguished from cakes made of gangular powder, which, though solid in form, are ganguiar in structure, and burn in all directions through their mass. This method will maintain the maximum pressure uniform all the way to the muzzle, and overcome the inertia of the projectile, instead of applying a maximum pressure suddenly before the inertia of the heavy projectile is overcome, and suffering a reduction of velocity thereby,

"We haven't tested the cartridge in a cannon yet," the little man said, but with small arms we have propelled a projectile 20,080 feet per second, and that beats record for speed, as the perfortions of the boiler-iron plate beats the record in overcoming resistance."—*New York Sun.*

UNIVERSAL AND RADIAL DRILLS.

In accompanying illustrations we give a description of the "Universal" and "Radial" drills manufactured by the Universal Radial Drill Company, of Cincinnati, Ohio.

In Fig. 1 is shown the Universal. The column which carries the arm, driving gear frame, etc., is bored and fitted over a stationary stump has sufficient length of bearing to prevent colum from swaying, and is provided with an adjustable pivot bearing upon an elastic diaphragm in the column, which, when the bolts in the flange at the lower end of column are slackened, takes the weight of the machine off the flange bearing, and allows the column with arm, etc., to revolve easily the entire circle. For ordinary drilling the bolts in flange need not be tightened, but when extraordinary rigidity is required a partial turn of the wrench will bind the column fast to the sole plate. The sleeve which carries the arm and gear frame is fitted snugly to the column and may be raised and lowered by power, and is provided with clamping bolts. The table has both horizontal and vertical faces, and is provided with T slots. The arm and spindle frame have swivels that will revolve the entire circle—so that a horizontal line of holes may be drilled at any angle parallel with each other by adjusting the angle of the arm, traversing the saddle on the arm and a vertical line may be drilled at any angle by adjusting the angle of the spindle frame, and moving the arm vertically to any point desired on the column. A hole may be drilled vertically downward, vertically upward, or at any angle within the range of the arm.

The counter shaft consists of a frame with horizontal shaft and T and L pulleys, and a pair of cut miter gears to connect with vertical shaft at center of top of column.

The spindle, feed screw and elevating screw are made of machinery steel and the feed worm is made of the best tool steel and hardened, all thrust bearings are provided with phosphor bronze washers.

All gears are cut, and the bevels and miters in spindle frame are made of cast steel and cut.

Has power feed and back gear.

Every machine is belted and tested before leaving the shop.

Fig. 2 represents the Radial drilling machine. This machine will drill or bore a number of holes parallel with each other—vertically downward—anywhere within the range of the arm.

The spindle is geared with unusual power, has quick return and is counter-balanced. Well adapted for heavy boring.

The column which carries the arm, driving gear frame, etc., is bored and fitted over a stationary stump, bolted fast to the sole plate, the stump has sufficient length of bearing to prevent column from swaying, and is provided with an adjustable pivot bearing upon an elastic diaphragm in the column, which, when the bolts in the flange at the lower end of column are slackened, takes the weight of the machine off the flange bearing, and allows the column with arm, etc., to revolve easily the entire circle. For ordinary drilling the bolts in flange need not be tightened, but when extraordinary rigidity is required a partial turn of the wrench will bind the column fast to the sole plate. The sleeve which carries the arm and gear frame is fitted snugly to the column and may be raised and lowered