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THE KRNKA-HEBLER BULLET.

By Captain F. L. NATHAN, R.A.

ONE of the latest developments of the small-bore magazine rifle question, is the tubular bullet, invented by Charles Krnka, of Prague, and William Hebler, of Küssnacht, and recently patented in this country. The inventors point out that one of the chief causes which detrimentally influence the velocity of a projectile through the air, is the resistance of the atmosphere, which arises from two causes, viz. :—

1. The condensation or compression of the air strata immediately in front of the projectile; and
2. The formation of a vacuum immediately behind the projectile.

In carrying out their invention, which is mainly designed to diminish, as far as possible, the resistance under both of the above heads, they make the projectile pointed at both ends, and with an air channel or passage through it.

FIG. 1.

FIG. 2.

The sketches represent two forms of hollow bullet for small-bore rifles. In Fig. 1 the projectile has a steel envelope only; in Fig. 2 the hollow also is lined internally with a tube of steel, which gives to 5-mm. (0.197-in.) bullets the necessary rigidity. To impart

rotation, the bullets are made with a projecting ring (R) where they enter the neck of the cartridge case. A sabot (S) of paper, or similar material, is fitted to the base of the bullet to prevent it oscillating in the bore, and also to prevent the escape of gas; this sabot frees itself from the projectile as the latter leaves the gun. Instead of being made of lead with steel envelope, the bullet can be made entirely of steel or other metal; in the case of steel, a ring or band of some softer metal being attached to the bullet.

Professor Hebler, in an article recently published in the "Allgemeine Schweizerische Militär-Zeitung," and which has been reproduced in several foreign service periodicals, states that the first experiments with tubular bullets date from 1874, but for a long time they met with no success, as the soft lead bullets of those days were distorted in the barrel. With the introduction, however, of the modern small-calibre bullet with its steel or nickel alloy envelope, the difficulty disappeared, and as the result of experiments with a variety of patterns, that just described was decided upon as giving the best results. The best diameter for the central channel was found to be about two-fifths of the actual calibre of the bullet. He determined, from experiments with this bullet in the German 7.9-mm. (0.311-in.) rifle, and in his own 5-mm. (0.197-in.) rifle, that for all velocities between 100 and 1,000 m. (328 to 3,280 f.s.) the resistance of the air was nearly proportional to the square of the velocity.

He points out that the penetration is diminished, but the trajectory is flatter, particularly at short and medium ranges, and the pressures and recoil are less; also, the ammunition being lighter, the soldier can carry more cartridges.

The only alterations to existing rifles which the use of these bullets entails are, the regraduation of the sights, and a slight increase in the length of the small cylinder of the chamber, owing to the extra length of the neck of the cartridge case, to enable it to grip the projecting ring of the bullet.

In order to compare the decrease in the resistance of the air, this resistance with the German rifle, Pattern 1888, may be represented by 1,000, 541, 216, and 89 respectively, according to which of the following bullets are used, viz.:—

1. The service bullet.
2. The service bullet with flat base and improved ogival point.
3. The service bullet with ogival base the same as the point.
4. The tubular bullet with ogival base and point.

With the 5-mm. (0.197-in.) rifle, the muzzle velocity being 750 m. (2,460 f.s.), these figures become 1,000, 463, 285, and 63.

The increase in the flatness of the trajectory will be seen from the following figures:—

At 1,000 m. (1,093 yds.), with the 11-mm. (0.433-in.) Mauser rifle, Pattern 1871, the danger zone is 20 m. (21.87 yds.). With the 7.9-mm. (0.311-in.), Pattern 1888, rifle and service bullet, it is 42 m. (46 yds.); with the same rifle and tubular bullet, it is 218 m. (238.4 yds.); and finally, with the 5-mm. (0.197-in.) rifle and tubular

bullet, it is 400 m. (437·4 yds.), or 20 times that of the Pattern 1871 rifle.

The following are some of the more important results given by Professor Hebler, of the experiments carried out by him:—

German Rifle, Pattern 1888.—The muzzle velocity obtained was 787 m. (2,582 f.s.), whilst that of the service bullet with the same charge (2·75 grm. (42·43 gr.) smokeless powder) is 640 m. (2,100 f.s.); 182 cartridges weigh 4 kilos. (141 oz.), which is the weight of 145 service cartridges. The maximum pressure was 1,550 atmos. (10·2 tons per sq. in.); with the service bullet, it is 3,000 atmos. (19·7 tons per sq. in.). The penetration into pine was: at the muzzle, 117 cm. (46 in.); at 1,000 m. (1,093·6 yds.), 75 cm. (29·53 in.); at 2,500 m. (2,734 yds.), 30 cm. (7·8 in.).

Hebler 5-mm. (0·197-in.) Rifle.—The muzzle velocity was 1,050 m. (3,445 f.s.), (797 m. (2,615 f.s.) with the ordinary bullet), with a charge of 1·64 grm. (25·3 gr.) of the Cologne Rottweil smokeless powder, normal charge being 15 grm. (23·15 gr.); 321 cartridges weigh 4 kilos. (141 oz.), which is the weight of 276 cartridges with the ordinary bullet. The maximum pressure was 2,400 atmos. (15·75 tons per sq. in.); with the ordinary bullet, it is 3,633 atmos. (23·85 tons per sq. in.). The penetration into pine was: at the muzzle, 204 cm. (80·32 in.); at 1,000 m. (1,093·6 yds.), 143 cm. (56·3 in.); at 2,500 m. (2,734 yds.), 84 cm. (33 in.). The effective range was 5,234 m. (5,724 yds.); the total range was 9,172 m. (10,030 yds.).