

had not previously been adopted in such a calibre. The re-designed weapon was the MG-213C and was the first modern revolver cannon for aircraft use.

Like the original 213A, the new gun was gas-operated; but the gas piston, instead of driving a heavy breech block, was merely attached to a light two-stage reciprocating member, known as a rammer, the function of which was to take cartridges out of the belt and ram them into one of five chambers of a cylinder identical in form with the cylinder of a revolver. At the same time, the reciprocating motion of the rammer turned the cylinder (anti-clockwise, seen from the rear), by means of a diagonal cam on the operating slide and a cam follower on the cylinder. Most MG-213s were fitted for left-hand feed and consequently each new round was inserted into the chamber at "5 o'clock" viewed from the rear, the belt being driven by a feed-wheel on the cylinder shaft. The round was carried to the 12 o'clock position, in line with the barrel, and fired by an electric igniter.

At the moment of firing, the cartridge was held solely by the cylinder chamber, which was rendered gas-tight by packing of heat-resistant steel on the cylinder and barrel (see diagram, p. 107). The base of the shell case was supported by a rigid breech body in which the cylinder was mounted. The gas tapping for operating the weapon was placed very close to the chamber and, as the breech was not opened by rotation of the cylinder (and also owing to the very low inertia of the moving parts) it was possible for the mechanism to be in full motion before the projectile had left the barrel and while the gas pressure was still extremely high. This alone permitted a significant increase in the cyclic rate of fire; another good feature was that each round did not have to pass through the whole cycle of operations before the next cycle could begin, for in the revolver cannon there are always at least three rounds passing through the gun together, each at a different point in the firing cycle (feeding, firing and extraction). Other advantages of the arrangement are that cooling is easier and that the calibre of a design can be changed more readily than can that of a conventional weapon.

So far as is known, the MG-213C was never used in air combat, but there is no doubt that it was years ahead of any other aircraft gun. In fact there was no comparable weapon, and it soon engaged the attention of armament experts everywhere, once captured specimens became available after the German capitulation. Three of the chief lines of development of the gun are those which have taken place in this country, Switzerland and the U.S.A.

Of British work, little can yet be disclosed. In the spring of last year, Mr. Duncan Sandys, then Minister of Supply, made official reference to a new cannon known as the Aden (a contraction of "Armament Development, Enfield") with a bore of 30 mm. The Minister made the following statement at that time: "With this powerful cannon, the Swift is capable of bringing to bear against an enemy aircraft eight times more high explosive than was possible with earlier types of guns. Its revolutionary design gives the Aden cannon about twice the rate of fire of the 20 mm Hispano gun, which has been our standard fighter weapon since 1941. Trials have proved that the Aden, with its advanced type of gun-sights and quick-acting fuse, is capable of inflicting devastating damage. The introduction of the Swift, with its superb flying performance and terrific fire power, is a milestone in the progress of Britain's air defence."

It was probably a very wise move to standardize the calibre of the Aden at 30 mm, although the corresponding American weapon has a bore 10 mm less. No details of the gun have been released for publication, but the mere fact that development has taken about eight years can be taken as indicative of its quality. It is, incidentally, the first wholly British gun since the Great War to become standard armament in the R.A.F. From the Minister's statement, it would seem that a single Swift or Hunter with four Adens can bring to bear roughly the same fire power as can a whole squadron of Meteors. Incidentally, the initial air-firing trials and much of the development of the Aden were carried out with the weapon mounted in Meteor airframes. Prototype Adens were manufactured by the Ministry of Supply Royal Ordnance Factories, and the gun is now in large-scale production, a principal contractor being the B.S.A. company.

In Switzerland, the renowned Oerlikon company are maintaining their position as one of the world's principal suppliers of automatic weapons. From the MG-213C they have developed two superb revolver cannon, the 206 RK (20 mm) and the 302 RK



A development model M-39 on test, firing at long range in the open air. Points worth noting are the ammunition feed and electric ignition cable. The photograph was probably taken during 1952.

(30 mm). Both have a layout similar to the German gun, with a five-chamber cylinder mounted below the line of the barrel so that the round being fired is indexed at the 12 o'clock position. Both the Oerlikon weapons are fired by a belt (left- or right-hand feed) pulled into the gun by a star-wheel floating axially on the cylinder shaft. The cylinder is loaded by a two-stage extension to the gas-operated slide which turns the cylinder.

The gun casing is rigidly attached to the airframe and carries an axially floating barrel on a drum casing, which can recoil against a pair of springs. Early versions of the guns were equipped for cocking by a pneumatic system working at 560 lb/sq in; the modern 206 RK and 302 RK are cocked by a specially developed cartridge device, a magazine of 12 electrically ignited cartridges being available for one mission. Ignition of the main ammunition is also electric, and when the gun ceases firing one round is left in the firing position.

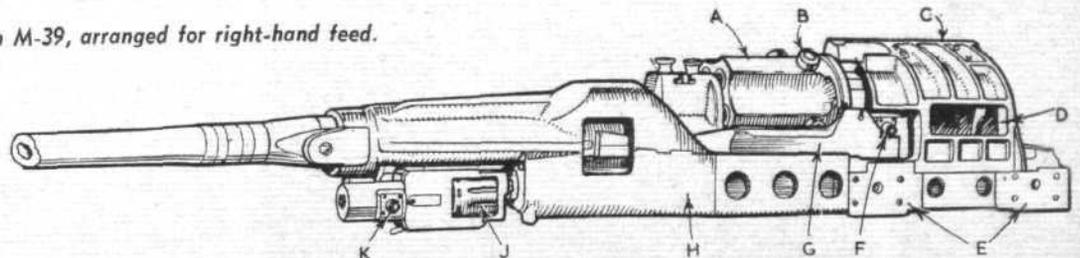
The third important descendant of the MG-213C is a cannon which is rapidly coming into large-scale service with the U.S.A.F. and other American services under the designation M-39. Original development from the Mauser gun was carried out by the Armor Research Foundation of the Illinois Institute of Technology assisted by the Springfield (Mass.) Armory. Various experimental weapons (models A, B, C and D) were produced and, in the course of development, a bore of 20 mm was accepted as final and the German mechanism was partly inverted, the axis of the M-39 cylinder being above that of the barrel.

The outbreak of war in Korea caused the work to be urgently accelerated and, late in 1950, the Ford Motor Company was called in to produce the M-39D and assist in further development. The company formed a special weapon development group under Ray L. Morrissey (a scout pilot in the Great War and a cannon production expert in World War 2), who promised to have a working model ready in four months. Utilizing the resources of Ford's Dearborn tool and die plant, the first gun from the original designs was completed one month early, in June, 1951. This weapon jammed frequently, but a redesign was effected by July. By December, several of the improved guns, designated M-39E, had been delivered.

The Army Ordnance Department, who are responsible for U.S.A.F. guns, then decided that this was the answer to their search for a new rapid-fire aircraft cannon, and Ford were awarded a further development contract for several hundred M-39Es for test purposes. The company built a special firing range in the Rouge factory, a test stand being illustrated overleaf. Late in 1952, several M-39Es were installed in F-86F Sabres and, after a shake-down test at Edwards A.F.B., were shipped to the Far East for combat suitability trials.

A test team, headed by Maj. Raymond E. Evans, of the U.S.A.F.

Standard 1954 production M-39, arranged for right-hand feed.



A, five-chamber cylinder, mounted above the axis of the barrel; B, cylinder-drive stud; C, ammunition feedway; D, link-ejection opening; E, mounting faces; F, electric ignition socket; G, main yoke-piece; H, bed-frame; J, cylinder for indexing and firing cocking-cartridges; K, electric socket for indexing and firing cocking-cartridges.