Direction Française des Usines Mauser — Übersetzung.

No. 1.195 / CO. — Oberndorf, den 26.2.46

Mitteilung für die Mauser-Werke

Ich bringe Ihnen zur Kenntnis, dass die beiden Musterstücke des MG 213 mit entsprechenden Zubehörteilen, um diese für Kaliber 2o und 3o mm einzurichten, (d.h. Läufe und Trommeln der verschiedenen Abmessungen) spätestens bis 12. April 1946 anstatt Anfang Mai, wie ich Ihnen früher bekanntgegeben habe, fertiggestellt werden müssen.

Ich mache Herrn Niemann besonders auf den Termin 12. April 1946 der unbedingt eingehalten werden muss, aufmerksam,,damit er jetzt schon alle notwendigen Massnahmen ergreifen kann, damitd dieser Liefertermin eingehalten wird.

Le Chef d'Escadron MICHON
Directeur Français des Usines Mauser

gez. Michon.

108 (left). An order for speeded-up production of sample MG231 aircraft cannon, translated as follows:

Oberndorf,February 26, 1946

Announcement to the Mauser-Werke

I herewith inform you that both samples of the cal 20 and 30mm MG 231 including the corresponding accessory parts (i.e. barrels and drums of different dimensions) have to be completed not later than April 12, 1946 (instead of the beginning of May as announced to you earlier). Especially I want to remind Mr Niemann of the date April 12, 1946, which must be observed absolutely. He shall start now to take any measures necessary in order to ensure the compliance with the delivery date.

Squadron Leader Michon
French Director of the Mauser factory
[signed] Michon

Special Plans for the Mauser Research and Development Group

Meanwhile, with regular factory production regimes re-established, attention was focussed on the erstwhile *Gruppe* 3 departments of the Mauser factory, which as discussed in Chapter One had been responsible for *Waffenforschungsanstalt sowie Waffenentwicklung* (Weapons Research and Development) under wartime director Ott von Lossnitzer.

The erstwhile Mauser development group of Department 37 was placed directly under DEFA (*Direction des Etudes et Fabrication d'Armement*) of the French War Department, and was renamed the DEFA Development Centre, Oberndorf. The workers and staff who remained were placed under contract.

By May, 1946 the day-to-day production at Mauser was being wound down in preparation for the dismantling of the factory. By October or November, 1946, the Mulhouse area of Alsace (Mülhausen in German), an historically oft-disputed border area which after WWII had reverted once again to French control, was selected for relocation of the Mauser *Centre d'Etude* following the closure of the Mauser factory in Oberndorf.


Übersichtsbericht

des

Forschungs-Instituts Mülhausen

Oberndorf / Neckar
März 1947

verantwortlich für die Zusammenstellung:

Niemann

109. The members of the Mauser Research Institute were required to sign a work contract with the French Ministry of Armament. This is the title page of an "Overall Report of the Research Institute" after its relocation to the French town of Mulhouse, the drawing up of which was the reponsibility of Rudolf Niemann, formerly Dr Maier's superior as the head of the Mauser Department 35, Weapons Research. courtesy Jacques Barlerin

The French Rearmament Programme of 1946

In the aftermath of World War II the French Army had found itself equipped with a catchall of small arms: French, American and British for the most part, but also German, Spanish and others. In 1946, as they had done in 1921, the French embarked on an ambitious programme to standardise and modernise their service small arms. Six specific types of weapons were to be developed: an automatic pistol (eventually the 9mm MAC Model 1950 was adopted); a machine pistol (submachine gun) which resulted in the adoption of the MAT49; a *carabine automatique* (self-loading carbine); a *carabine mitrailleuse* (selective-fire carbine); a semi-automatic rifle (the MAS49); and a universal machine gun (the MM52).

The choice of ammunition being chief among the initial considerations, it was decided to build the

pistol and submachine gun around the 9mm Parabellum round, while the semi-automatic rifle and machine gun would initially be developed jointly in the 7.5x54mm Model 1924 C French Service cartridge, and in .30-'06. As for the *carabine automatique and carabine mitrailleuse*, the choice lay between the US .30 M1 carbine (7.62x33mm) round and a new intermediate French cartridge based on the German 7.92x33mm *kurz* cartridge, which had not yet been designed.

The French automatic and self-loading carbine and intermediate cartridge programmes were pursued for several years, during which time a number of interesting prototypes were developed, some more practical than others, by the state-owned arsenals of Châtellerault, Saint-Etienne and Tulle, as well as by the team of expatriate German engineers of the Mauser *Centre d'Etude*.

Two French Development Programmes for New *Carabines*

Two new French small arms development programmes were instigated. The first, a temporary measure only, was begun in March, 1945, while the second was established in October, 1946. Both programmes made provision for the design and development of both *Carabines Mitrailleuses* (selective-fire carbines) and *Carabines Automatiques* (self-loading carbines). The term *carabine mitrailleuse* (literally "carbine-machine gun"), appears to be unique to French nomenclature, where it first appeared in a 1937 report on French Army trials of the Swiss SIG machine pistol model MKMO, in 9mm Mauser calibre.

By October, 1946 *l'Etat Major de l'Armée de Terre* (the French Army General Staff) had defined their specifications for the *Carabine Mitrailleuse*, and decreed that the French state arsenals *Manufacture d'Armes de St-Etienne* (MAS) and *Manufacture d'Armes de Châtellerault* (MAC), plus the newly established Mauser *Centre d'Etude* might commence their first studies based on these specifications.

The 7.65x35mm Model 1948 Short Cartridge

The self-loading and selective-fire carbines called for in the Programme of 1946 provided the impetus for the development of a new cartridge, intermediate in power between the specified 9mm pistol/submachine gun round and the 7.5x54mm Model 1924 C French service rifle cartridge.

Work effected during WWII by the Germans in this domain aroused a great deal of postwar interest among all the Allies, as witness the veritable flowering of "intermediate" cartridges, all inspired by the 7.92x33mm *kurz*.

In France, the study of intermediate ammunition was confined to two establishments. The cartridge case was developed at DEFA (*Direction des Etudes et Fabrications d'Armement*), and the projectile at LRBA (*Laboratoire de Recherches Ballistiques et Aérodynamiques*.

The new 7.65x35mm short cartridge case, slightly bottlenecked, made of copper, fitted with a Berdan primer and filled with "an American powder" was designed by DEFA under the project headed "Cartridge, 7.65mm for Carbine". This cartridge was known later as the "7.65mm MAS" and also the "7.65mm Vorgrimler". According to drawing ST ARM 8701, the case has a nominal capacity of 1.300mm^3.

The Annex of the LRBA at Satory undertook the study and development of projectiles in the desired 7.65mm calibre. In preliminary trials, these 6g (92.6-grain) bullets produced a muzzle velocity of 700m/s (2,296.5 fps). In order to conserve proportions compatible with retained mass, it was decided to fabricate the bullet with a composite core; the front portion made of aluminum and the rear of lead; which shifted the centre of gravity towards the rear.

The first shooting trials were effected in 1947, with bullets clad in copper and in aluminum, with encouraging results regarding chamber pressure, muzzle velocity and ballistic coefficient. However use of copper for the bullet jackets posed problems of supply, while the aluminum jackets proved difficult to anchor to the bullet cores, and sometimes resulted in the dangerous phenomenon of a stripped aluminum jacket heat-welded to the inside of the bore!

Experiments were therefore made using jackets from 7.5mm Model 1924 C French service bullets, pressed to the proper contour. One hundred such projectiles were made up, the resulting bi-ogival (pointed, with boattail) bullets measuring 24.3mm in length with a cylindrical portion 7.92mm in diameter. Trials results showed a muzzle velocity of 720

110. An actual-size comparison of several military cartridges. From left:
- 7.62x33mm (.30) M1 carbine
- 7.92x33mm *kurz*
- 7.5x35mm *Mle* 1948 French short
- 7.65x42.5mm ETVS Mle 1949 CRBA, Satory
- 7.62x51mm NATO
- 7.5x54mm *Mle* 1929.

courtesy William Woodin, Woodin Laboratory

m/s (2,362 fps), and a mean accuracy quotient of 31.6 cm H+L at 200 metres.

In order to determine which facilities would actually manufacture the new projectiles, a small series of 2,000 bullets was ordered from the *Atelier de Fabrication de Toulouse* (ATE). After comparing these against the dimensional plan, it was ascertained that their diameter was too large and that the meplat was too pronounced. Trials demonstrated that these bullets were less accurate than those of the preceding experimental series.

After reworking these projectiles at Satory by reshaping the bullet to the correct ogive and resizing to restore correct diameter, the trials continued.

An Interesting Comparative Trial

Comparative trials effected at distances of 200, 300, 400 and 600 metres using 7.65mm, .30 M1 Carbine, 7.92mm *kurz* and 7.5mm Mle 1929 C ammunition gave the following results:

Calibre	**7.65x35mm**	**.30 M1 (7.62x33mm)**	**7.92x33mm K**	**7.5x54mm Mle 29 C**
Bullet weight:	6g (92.59 gr)	7g (108 gr)	8g (123.45 gr)	8g (123.45 gr)
Chamber pressure:	2,300kg/cm^2 (32,714 psi)	2,100kg/cm^2 (29,891 psi)	2,400kg/cm^2 (34,136 psi)	2,500kg/cm^2 (35,559 psi)
Muzzle velocity:	716m/s (2,349 fps)	575m/s (1,886 fps)	671m/s (2,201 fps)	825m/s (2,707 fps)
Velocity at 200m:	478m/s (1,568 fps)	356m/s (1,168 fps)	485m/s (1,591 fps)	670m/s (2,198 fps)
Velocity at 300m:	388m/s (1,273 fps)	306m/s (1,004 fps)	411m/s (1,348 fps)	600m/s (1,969 fps)
Velocity at 400m:	328m/s (1,076 fps)	274m/s (899 fps)	354m/s (1,161 fps)	537m/s (1,762 fps)
Velocity at 600m:	269m/s (883 fps)	231m/s (758 fps)	291m/s (955 fps)	421m/s (1,381 fps)
Muzzle energy:	153kgm (1,107 ft. lbs.)	116kgm (839 ft. lbs.)	180kgm (1,302 ft. lbs.)	272kgm (1,967 ft. lbs.)
Energy at 200m:	70kgm (506 ft. lbs.)	45kgm (325 ft. lbs.)	96kgm (694 ft. lbs.)	183kgm (1,324 ft. lbs.)
Energy at 300m:	46kgm (333 ft.lbs)	33kgm (239 ft.lbs)	68kgm (492 ft.lbs)	147kgm (1,063 ft.lbs)
Energy at 400m:	33kgm (239 ft.lbs)	27kgm (195 ft.lbs)	51kgm (369 ft.lbs)	117kgm (846 ft.lbs)
Energy at 600m:	22kgm (159 ft.lbs)	19kgm (137 ft.lbs)	34kgm (246 ft.lbs)	72kgm (521 ft.lbs)
Groupings (H+L):				
- at 200m:	34cm (13.4")	32cm (12.6")	65cm (25.6")	35cm (13.8")
- at 300m:	54cm (21.2")	46cm (18.1")	92cm (36.2")	44cm (17.3")
- at 400m:	75cm (29.5")	98cm (38.6")	127cm (50.0")	52cm (20.5")
- at 600m:	152cm (59.8")	162cm (63.8")	206cm (81.1")	100cm (39.4")

Advantages of the 7.65x35mm French Short Cartridge over the .30 M1 Carbine Round

According to the trials report, the new 7.65mm carbine cartridge presented appreciable advantages in comparison with the US calibre .30 M1 carbine round. These advantages were itemised as follows:

1. a less critical ballistic coefficient;
2. higher muzzle velocity and residual energy;
3. accuracy comparable up to 300m, then superior.

Trials were resumed and the new round, designated "Cartridge, 7.65mm Model 1948 for Carbine", was put into production on a small scale at the *Cartoucherie de Valence*. In addition to the ball version, a red-pointed tracer variant was also produced. Certain lots were left unheadstamped, while others bear the only known headstamp to be applied to these cartridges, "VE C 48", indicating manufacture at the *Atelier de Fabrication de Valence* (*Cartoucherie de Valence*) in 1948.

A final drawing, dated July 11, 1950, depicts a 6g bullet design identical to its predecessors except for a sharp, slender duralumin core situated towards the rear and covered in a lead envelope. It is not known if this bullet was ever actually produced, but this plan heralded the end of the project, for by the beginning of the following year other developments had taken precedence.

111. The base of a typical 7.5x35mm Model 1948 carbine cartridge, showing the only known headstamp "VE 48 C". author's collection

The French Destroy the Mauser "Empire"

By November, 1947, the dismantling and transfer of the machinery and equipment in the Mauser factory in Oberndorf to a total of thirteen countries was well under way. The last of a total of 6,142 Mauser machines was removed in 1948. Meanwhile on November 5, 1947 the French Military Administration issued Instruction No 252, under which the Mauser company was officially declared dissolved.

The actual demolition was begun in July, 1948, and the total destruction of the Mauser *C-Bau* (buildings used for wartime weapons production) in Oberndorf was completed by the end of 1948.

Henk Visser recalled to the author that "streets of workers' houses and the school, etc, were sold to the town of Oberndorf for one mark, and later Chancellor Konrad Adenauer was forced to sign a retroactive agreement making all the French actions legal."

According to Wolfgang Seel, the final blow came at the end of 1953, when the Mauser headquarters in Berlin/Borsigwalde was destroyed.[1]

Seel: *Mauser—von der Waffenschmiede zum Weltunternehmen* (Stocker-Schmid, 1986)

Chapter Eight

Developments in 7.65x35mm

Establishing the *Centre d'Etudes et d'Armement de Mulhouse* (CEAM)

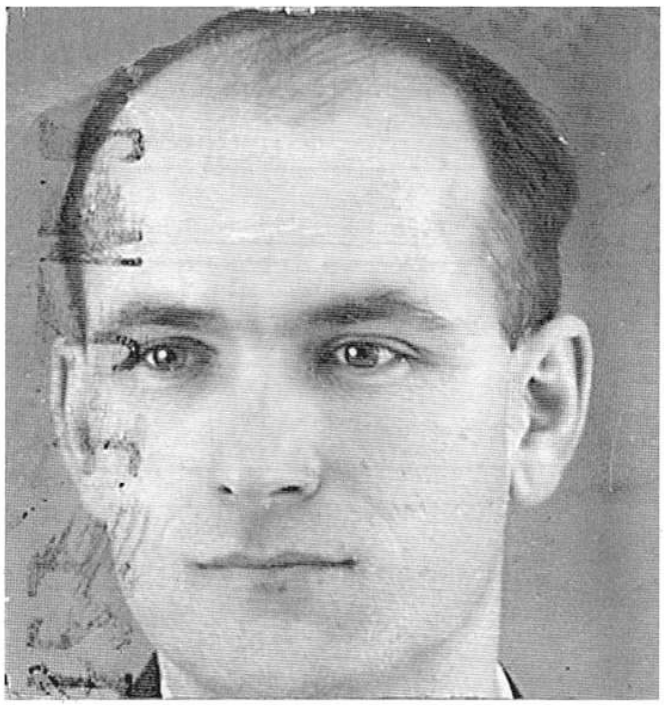
Early in 1947 the French had established a study office and workplace in Mulhouse at 147 rue de l'Espérance. The new facility, organised as a subsidiary of the French state arsenal at Châtellerault (MAC), was christened the *Centre d'Etudes et d'Armement de Mulhouse* (CEAM). The CEAM study office was initially a design facility only, with no means of production except as supplied by MAC.

The Year-Long Move from Oberndorf to CEAM

According to Ludwig Vorgrimler in his later recollections, "DEFA decided that the Development Group Mauser - 138 engineers and skilled workers - should be moved to Mülhausen in Alsace, where they were to continue work in their special fields." Over the next year, groups were moved successively from the Mauser *Centre d'Etude* in Oberndorf to Mulhouse. A new work agreement was proposed by the French *Ministère d'Armement* for all employees of the Mauser development group, in which CEAM was referred to as the *Forschungs-Instituts Mülhausen*. Under this agreement selected German technicians and designers from Mauser and other companies such as DWM, etc, were "more or less voluntarily employed", and the team of Mauser technicians under Vorgrimler, Löffler and Kunert were "invited" to continue their work on carbine designs utilising the half-locked roller action.

The personnel of the *Bureau d'Etudes du CEAM*, under manager Rudolf Niemann, consisted of ex-Mauser engineers Ludwig Vorgrimler and Theodor Löffler working on small calibre weapon designs, with a designer named Ludwig Hagner in charge of ammunition developments.

The move to Mulhouse was completed by the end of March, 1948, just four months ahead of the start of demolition of the weapons production buildings in Oberndorf.



112. A photo of Ludwig Vorgrimler (1912 - 1983) as an employee at CEAM, circa 1947.
courtesy Mlle Martine Destouches,
Centre d'Archives de l'Armement et du Personnel,
Châtellerault

The CEAM Light Weapons Group

Vorgrimler and Löffler Assigned Project 701

In February, 1948, Colonel Sales of DEFA tasked the two engineers Vorgrimler and Löffler of the CEAM "light weapons group" with the development of two new weapons. Both were to be chambered for the developmental calibre 7.65x35mm French short cartridge, and both were to employ the semi-rigid roller locking system developed at Mauser during the last year of the war.

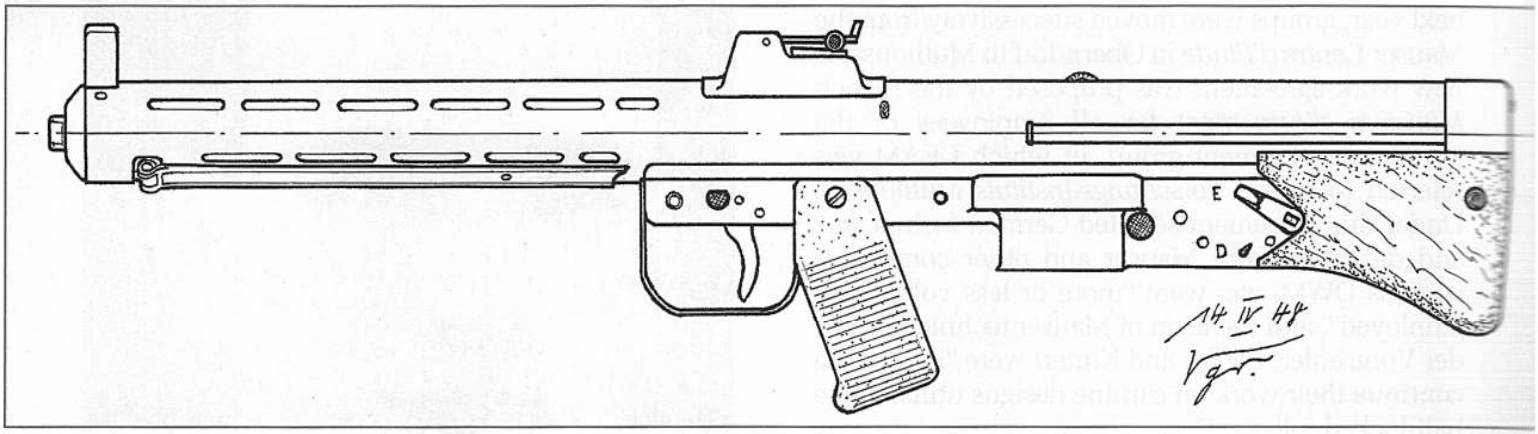
The first, "Project 701", was for a *Carabine Mitrailleuse* (heavy machine pistol), intended to correspond to the German MP44. Project 701 was assigned Priority 1, and both engineers were ordered to develop their own versions in response to the DEFA requirements. Otto Schulze later confirmed that Vorgrimler and Löffler worked independently of each other to develop, among other arms, roller-locked assault rifles chambered for the 7.5mm French short cartridge.[1]

The second, "Project 702", for a self-loading carbine patterned after the US M1 carbine, was assigned Priority 2. This short-lived project, which was managed by Ludwig Vorgrimler alone, is discussed on pages 117 and 118.

Plan SKL 02: the First Vorgrimler CEAM Prototype

Ludwig Vorgrimler began working on his first contract for DEFA on June 1, 1946. By the middle of February, 1948, Vorgrimler had begun work on his first Model I prototype, under the plan number SKL-02.

The Vorgrimler Pre-Project "Bullpup"



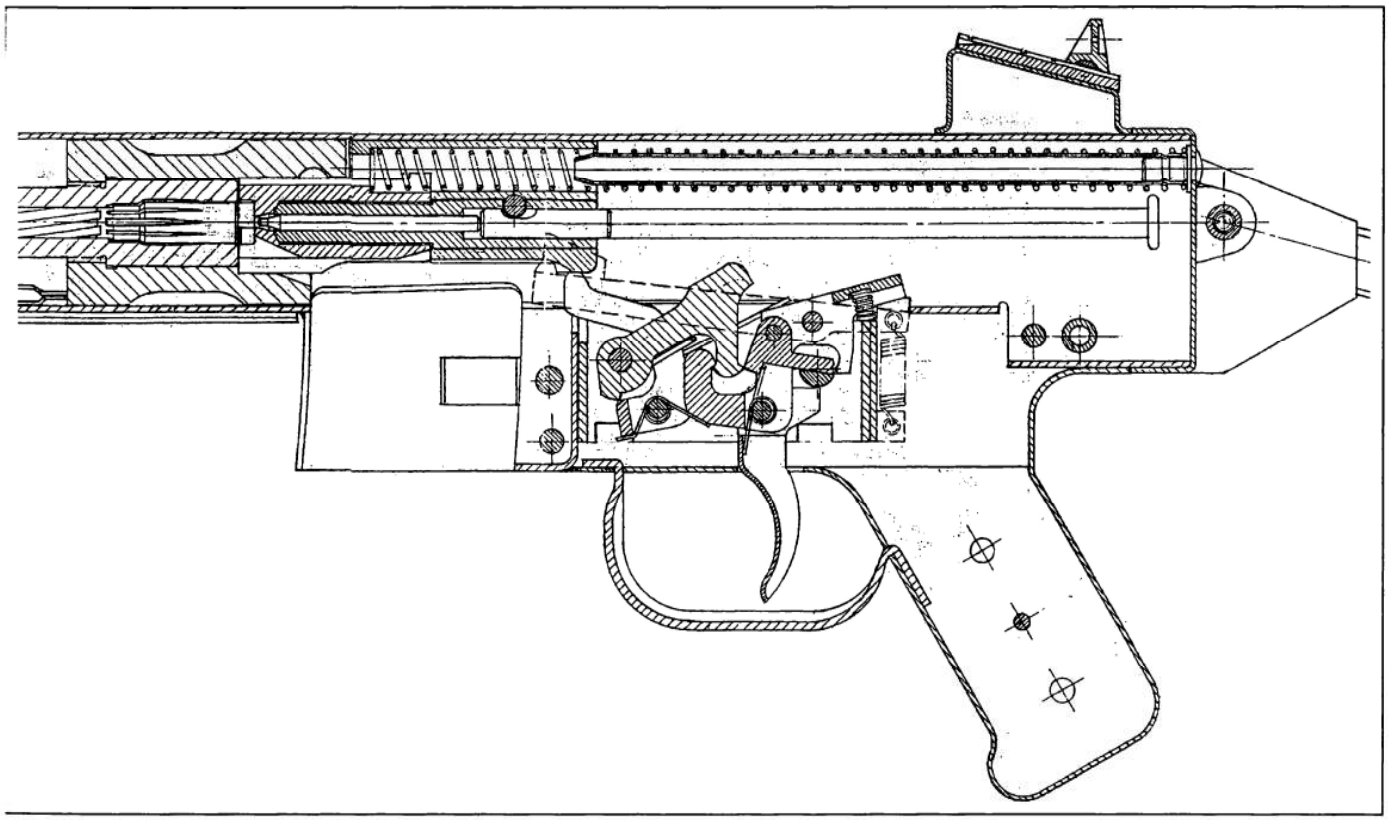
113. All that remains of a proposed "bullpup" version of Ludwig Vorgrimler's Model I carbine is this drawing, dated June 14, 1948. courtesy Jacques Barlerin

On April 14, 1948 Vorgrimler presented drawings of a pre-project "bullpup" design, under plan number SKL 02-3. This model never went beyond the drawing stage, and no actual weapon was constructed.

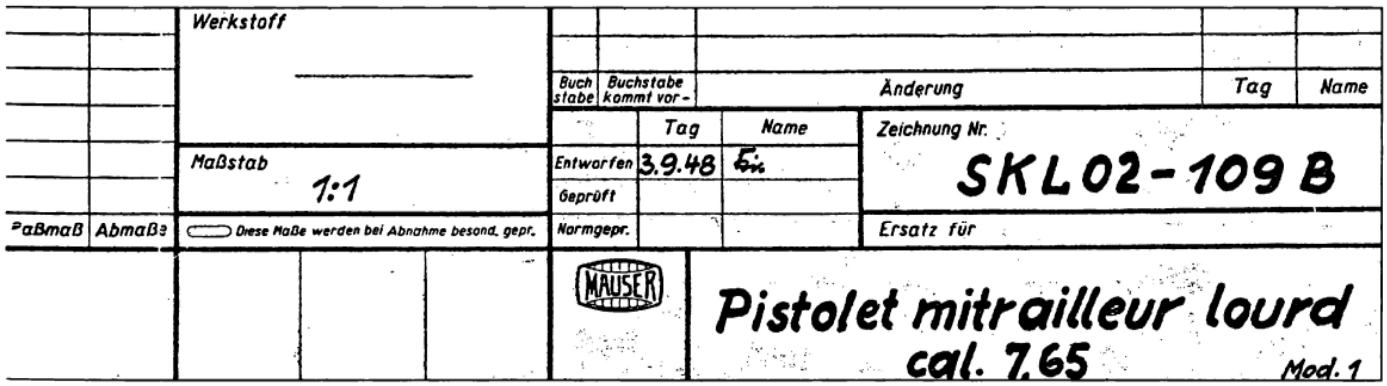
April, 1948 also saw the design, development and production of the first box magazines for the new *Carabine Mitrailleuse*, with a capacity of 30 rounds of the developmental French 7.65x35mm short cartridge.

1 *Kurze Angaben zur Geschichte des G3*, dated February 7, 1969

The Vorgrimler Model I/1 in 7.65x35mm



114. A closeup of the action of Vorgrimler's Model I carbine, taken from the plan drawing SKL 02.
Note the fluted chamber. courtesy Walter Schmid



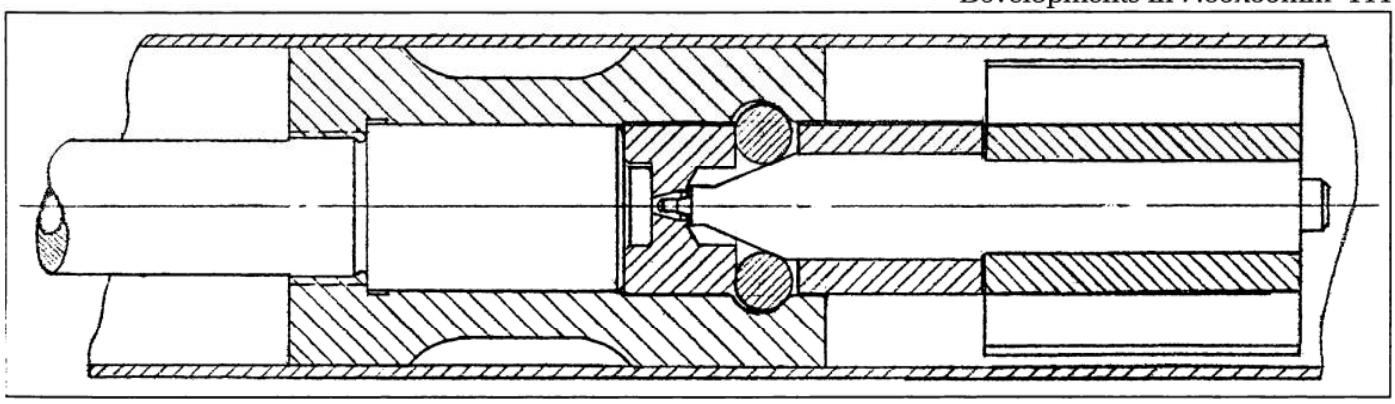
115. The title block for the above drawing, no SKL 02-109B dated September 3, 1948, titled *Pistolet mitrailleur lourd* (heavy machine pistol). courtesy Walter Schmid

Construction of Vorgrimler's first actual prototype weapon was begun during April and May, 1948. The first model, originally known as the "MP48" following an internal system of terminology then in use, was built around a long tubular receiver with an internal diameter of 38mm (the wartime *Gerät* 06H receiver had an internal diameter of 40mm), with the return spring located above the bolt. A folding stamped metal bipod was attached to the front of the receiver tube.

Constructed in accordance with the original specifications of October, 1946, the Model I/1 utilised the ingenious delayed blowback mechanism of the late-war Mauser *Gerät* 06H, also called the StG45(M), with the bolt semi-rigidly locked by means of lateral rollers. As discussed in Chapter Two, in the *halbstarrverriegelt* or "half-locked" system the bolt is never

116. Left and right side views of Ludwig Vorgrimler's Model I carbine, chambered for the Model 1948 7.5x35mm French short cartridge, showing butt and bipod extended. Note the trademark Vorgrimler tubular receiver, and the initial type of 30-round magazine.
courtesy Jacques Barlerin

117. Another left side view of the Vorgrimler Model I carbine to plan SKL 02, showing butt and bipod folded.
courtesy Jacques Barlerin



118. A section of the plan SKL 02 drawing, showing a top view of the roller-locked action of the Vorgrimler Model I prototype, as described in the text.
courtesy Walter Schmid

really locked but relies on the mechanical arrangement of the rollers and the *angled* walls of the *Steuerstück* or steering piece to provide a suitable delay or hesitation before unlocking. In this system the cartridge case is under constant movement, and Mauser engineers had long since recorded that fluting the chamber, thereby creating a more equalized pressure-zone on *both sides* of the cartridge case, was necessary in order to ensure reliable functioning.

The Vorgrimler Model I prototype 1 was completed by the end of June, 1948, and first fired in July. In its first tests, the Vorgrimler Model I/1 produced a firing rate of 650 - 680 rpm.

On September 1, 1948, the Vorgrimler MP Model I prototype 1 was demonstrated to Colonel Sales of DEFA. A brief written description and a sectioned drawing, identified as plan number SKL 02-109B, were also presented.

119. The front cover and title page of a small handbook prepared at CEAM to support the Vorgrimler Model I prototype. courtesy Walter Schmid

Characteristics of the Vorgrimler Model I/1 Prototype

The CEAM Model I/1 was furnished with a folding butt. in the manner of the MP40 submachine gun, although unlike the MP40 and indeed most submachine guns it was also furnished with a light folding bipod. A forward section in the same diameter as the cylindrical body, perforated for air circulation, contained the barrel. The weapon was blued, while the magazines were left in the white.

The cocking handle was located on the left side, oriented at a 45° angle upwards. The moving parts comprised the bolt carrier, a bolt head fitted with the locking rollers, and the *Steuerstück* (steering piece) carrying the firing pin. The barrel was screwed into an extension, wherein bolt locking took place. A pistol grip unit enclosed the trigger mechanism.

The barrel, bolt group and barrel extension were constructed of machined steel, while all the other metal parts were fabricated from stamped sheet metal. The grip panels were of wood or plastic material.

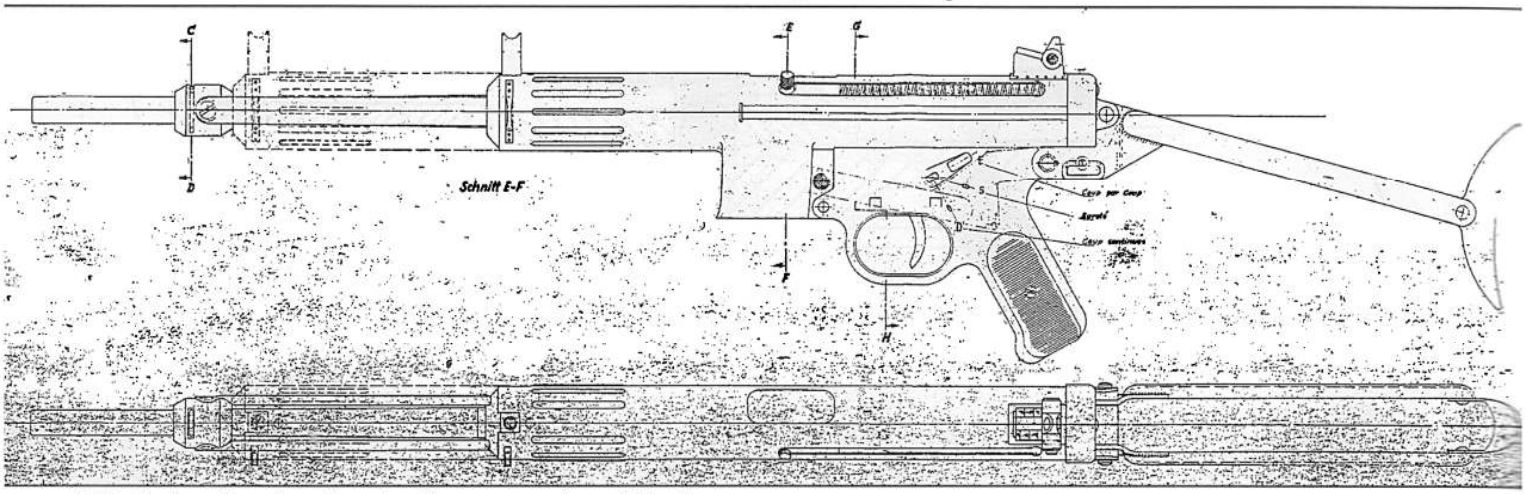
A three-position lateral lever mounted on left side of the pistol grip assembly provided full-automatic fire, safe, or semi-automatic fire.

Feeding was from a curved, vertical box magazine of 30 rounds capacity, inserted from below. There was no provision for a bayonet.

The 7.65mm Vorgrimler Model I/1 was described as follows:

weight:	3.35kg (7.4 lbs)
length:	845mm (33.3")
length with butt folded:	602mm (23.7")
barrel length:	350mm (13.8")
firing rate:	650 - 680 rpm
type of fire:	single shot and burst

Modifications Required by DEFA

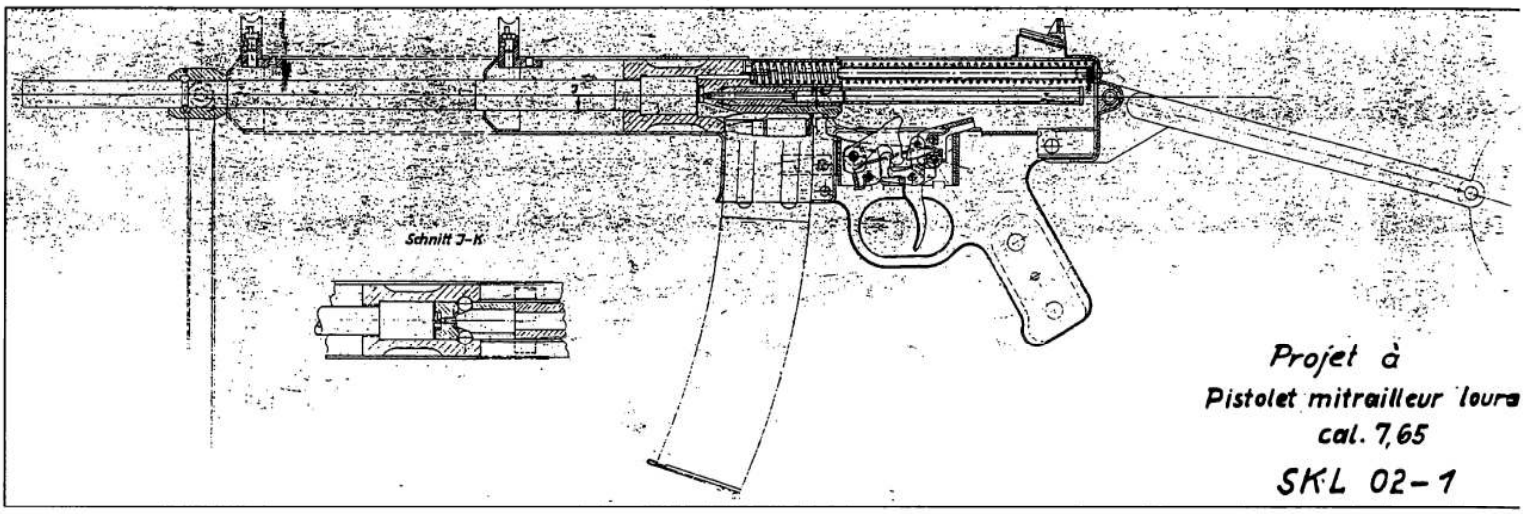


120. A plan drawing showing the proposed modifications made by Ludwig Vorgrimler to his Model I prototype, including reduced length of receiver tube, with the original long tube indicated by dotted lines, and a slightly lowered line of sight. courtesy Walter Schmid

On September 3, 1948, Colonel Sales requested that Vorgrimler make certain modifications to his initial prototype, the major ones being as follows:

1. attach the bipod to the barrel;
2. shorten the frame (receiver) and the butt;
3. lower the sight line.

The Unfinished Vorgrimler Model I/1 Specimen 2



121. A partially sectioned undated drawing of Vorgrimler's Model I/1 specimen 2, to plan SKL 02-1. courtesy Walter Schmid

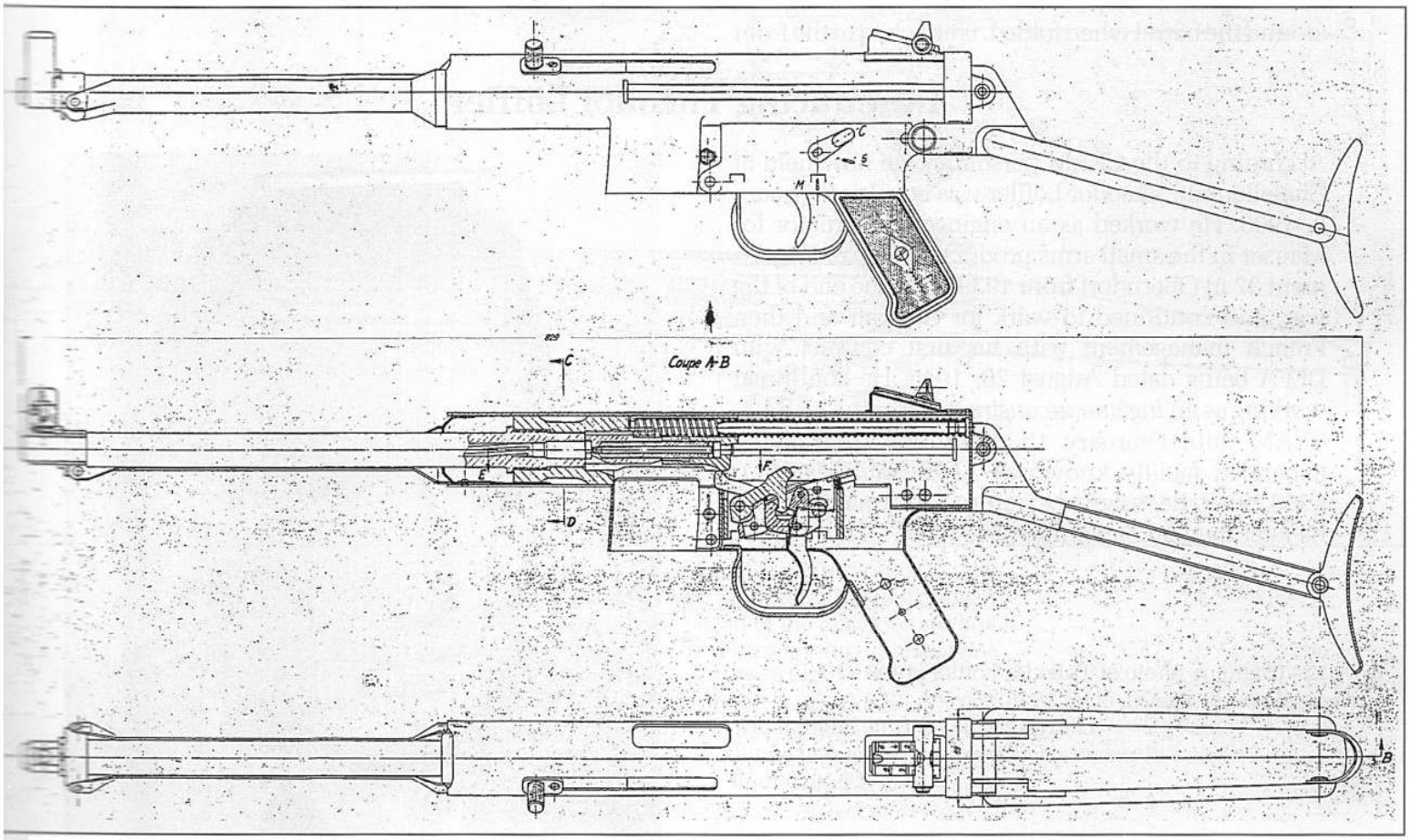
An undated drawing on plain paper labelled "*Projet à Pistolet mitrailleur lourd cal 7.65*", plan number SKL 02-1, illustrates Vorgrimler's response to Colonel Sales' request for modifications. It depicts a roller-locked carbine with folding stamped-metal stock and a stamped pistol grip/trigger housing attached by a transverse pin behind the magazine well, like the MP44. The louvred housing around the barrel is drawn in two suggested lengths, and a separate bipod assembly attaches around the barrel, as requested by Colonel Sales. The change lever markings shown in fig 120 are still in German ("E", "S", "D"; explained on the drawing as E = *Coup par coup*; S = *Sureté*; D = *Coup continues*.

Unlike Vorgrimler's earlier and later prototypes, all of which feature a simple strip of stamped sheet metal for the triggerguard, this model depicts a more complex assembly with an integral triggerguard

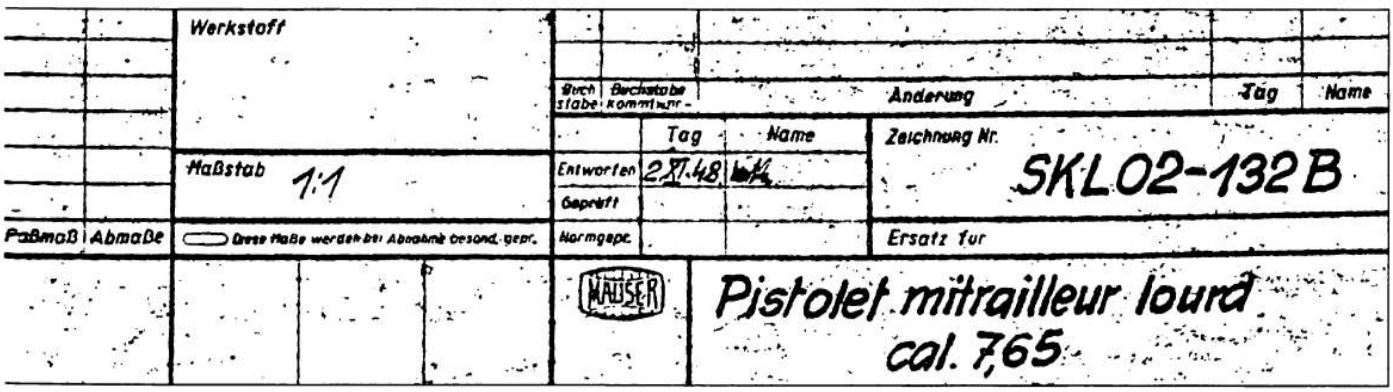
made as part of the pistol grip assembly, like the MP44 or the *Gerät* 06H.

Apparently an actual arm built to these specifications was left unfinished by the events described below.

The Vorgrimler Model I/2 Prototype



122. Drawings on leftover Mauser blueprint paper dated November 2, 1948 to plan SKL 02-132B, showing three views of the later Vorgrimler model with alterations incorporated. courtesy Walter Schmid



123. The title block from the above drawing, no SKL 02-132B, dated November 2, 1948, titled *Pistolet mitrailleur lourd cal 7.65* (heavy machine pistol). courtesy Walter Schmid

A further drawing, dated November 2, 1948, done on Mauser blueprint paper as plan number SKL 02-132B (fig 122), is also labelled "*Pistolet mitrailleur lourd cal 7.65*". The receiver tube is shortened, the sight line is lowered, and the first pattern of a simple stamped metal bipod, which also forms a sort of handguard around the barrel when folded, is attached to the front of the barrel. In addition the trigger guard has reverted to a simple curve of stamped sheet metal.

The change lever markings "C", "S", "M" are in French, the C standing for *coup par coup* (single fire); the S for *surété* (safe); and the M for *tir en mitrailleuse* (automatic fire).

Introducing Theodor Löffler

According to the CEAM personnel file now held at Châtellerault, Theodor Löffler was born on February 2, 1908. He worked as an engineer/constructor for Mauser in the small arms production side of Department 37 in Oberndorf from 1939 up to the end of the war, and continued to work for German and then French management with his first contract with DEFA being dated August 28, 1945. He continued working as an *ingénieur/constructeur* for the LRBA at CEAM until February 15, 1947, and then at the expanded facility known as AME until March 1, 1963, when he resigned to return to Germany, where he later died on September, 21, 1969.

124 (right). A photo of Theodor Löffler (1908 - 1969) as an employee at CEAM, circa 1948.
courtesy Mlle Martine Destouches,
Centre d'Archives de l'Armement et du Personnel,
Châtellerault

Plan SKL 03: the First Löffler Model II in 7.65x35mm

The initial study by Löffler for his first prototype, called the Model II (plan number SKL-03) was also begun in mid-February, 1948. It featured the same delayed blowback mechanism, with the bolt semi-rigidly locked by means of lateral rollers, and utilised the same 30-round box magazine as the Vorgrimler Model I/1.

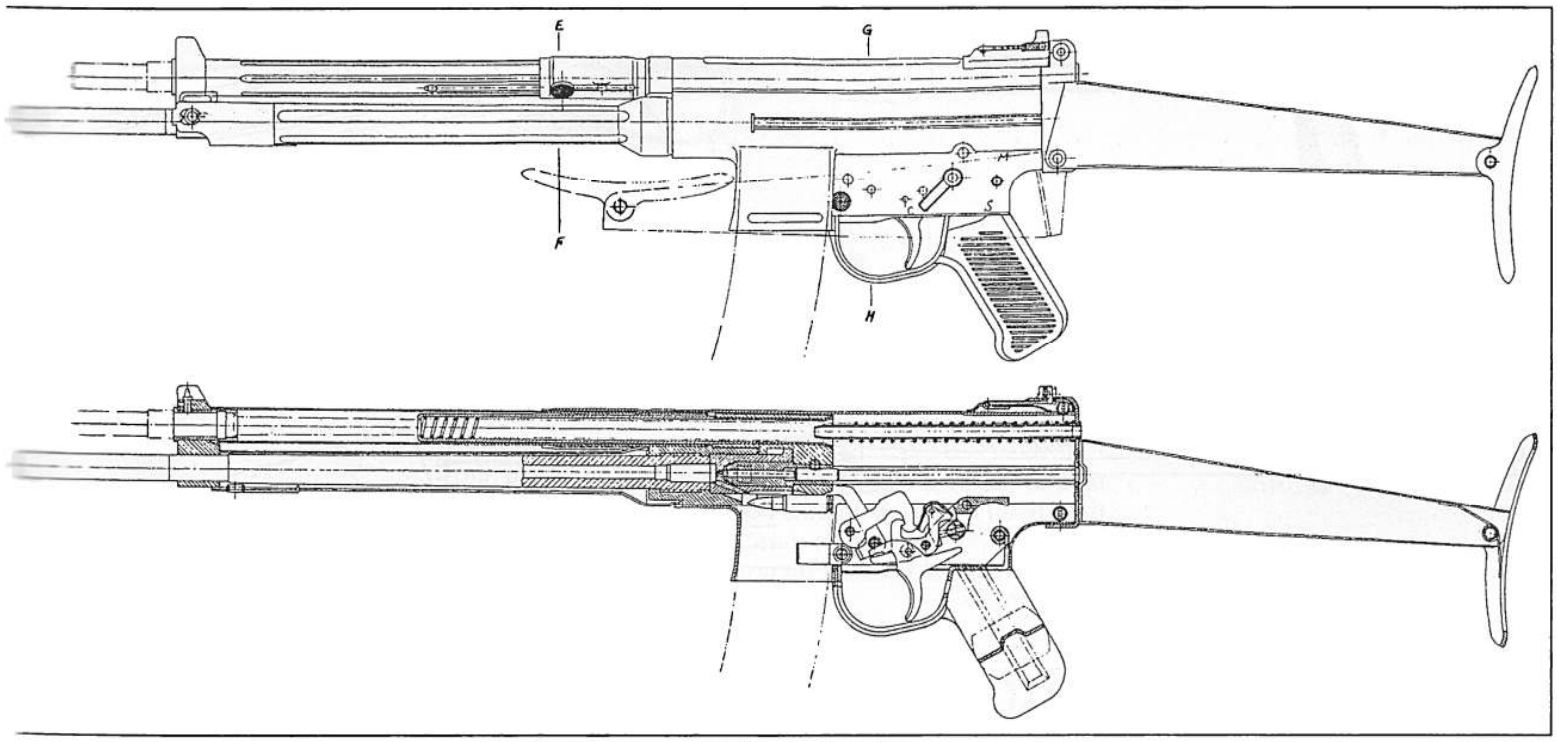
The Löffler Model II/1 prototype was completed in July 1, 1948, and in its first tests, carried out that month, firing was measured at the rate of 520 - 550 rpm, although some ejection problems were noted.

The Löffler Model II/1 prototype was exhibited to Colonel Sales of DEFA on September 1, 1948, along with the Vorgrimler Model I/1 described above.

Drawing no SKL 03-102B dated September 3, 1948, signed "Löffler" (fig 126), was done on leftover Waffenamt blueprint paper. It is titled *Pistolet mitrailleur lourd*, and depicts a roller-locked 7.65mm carbine with a folding metal stock, a folding bipod under the barrel, and a sliding peep rear sight. Change lever markings are in French: "C" = *Coup par coup* (single shot), "S" = *Surété* (safe), and "M" = *Mitrailleur* (automatic).

The Loffler Model II receiver design differs from the Vorgrimler Model I in that for the first time it features a forward front sight housing locating a separate tube above the barrel which contained a non-reciprocating cocking handle, like the later CETME and G3.

Characteristics of the Löffler Model II Prototype



125. Initial drawings of Löffler's Model II prototype to plan SKL 02-2, dated April 2, 1948. This marks the first appearance of the cocking handle ahead of the long forward bolt extension, which houses the return spring, in a separate tube above the barrel.

Note (above) the early change lever positions, with "M" (*Mitrailleuse*) at top rear, "S" (*Sureté*) above the rear of the pistol grip, and "C" (*Coup par coup*) just above the trigger.
courtesy John Cross

The 7.65mm Löffler Model II prototype was described as follows:

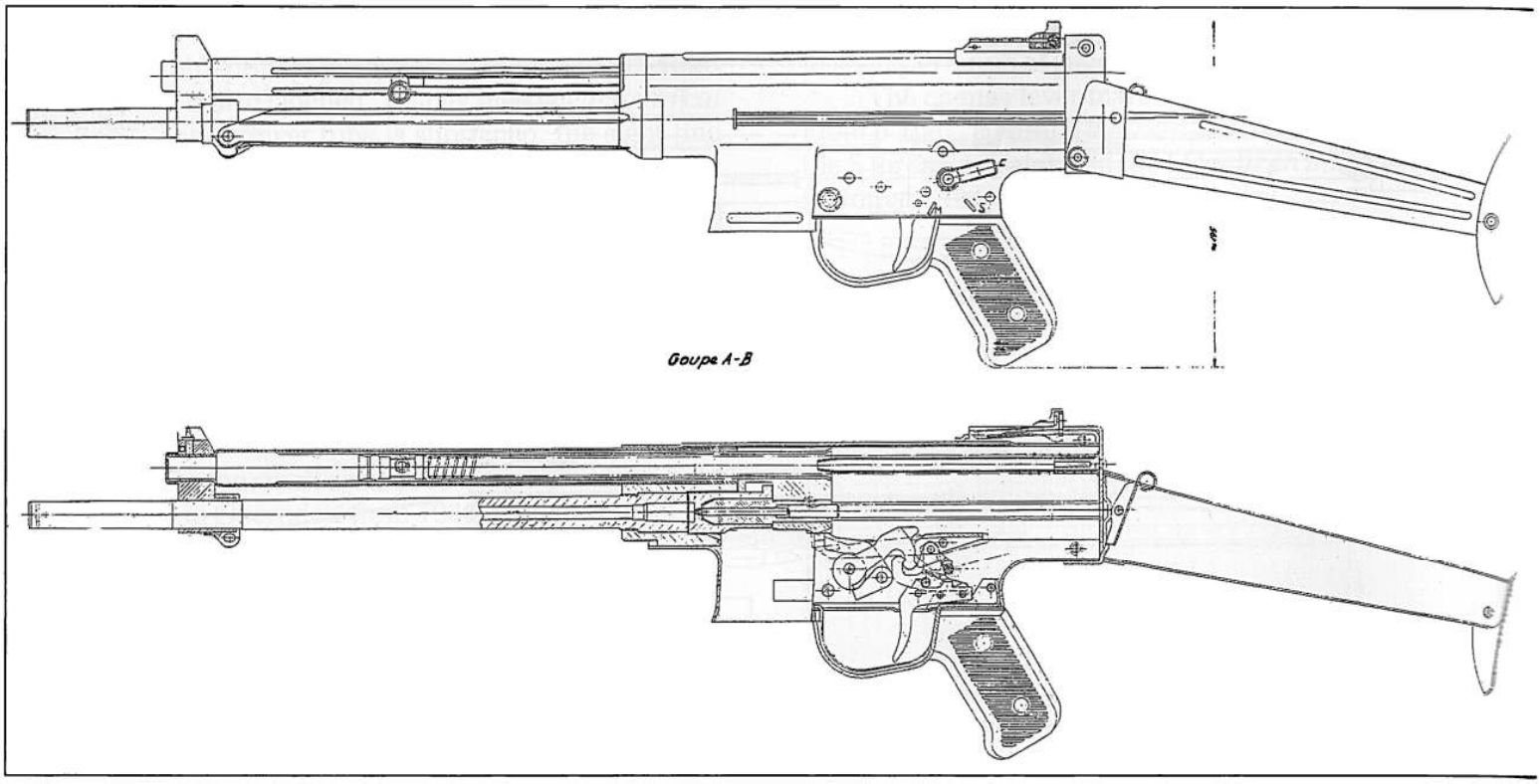
weight:	3.35kg (7.4 lbs)
length:	845mm (33.3")
length with butt folded:	595mm (23.4")
barrel length:	360mm (14.2")
firing rate:	520 - 550 rpm
type of fire:	single shot and burst

Modifications Required by DEFA

On September 3, 1948, following the initial demonstration, Colonel Sales also requested that Löffler make certain modifications to his initial prototype, the major ones being as follows:

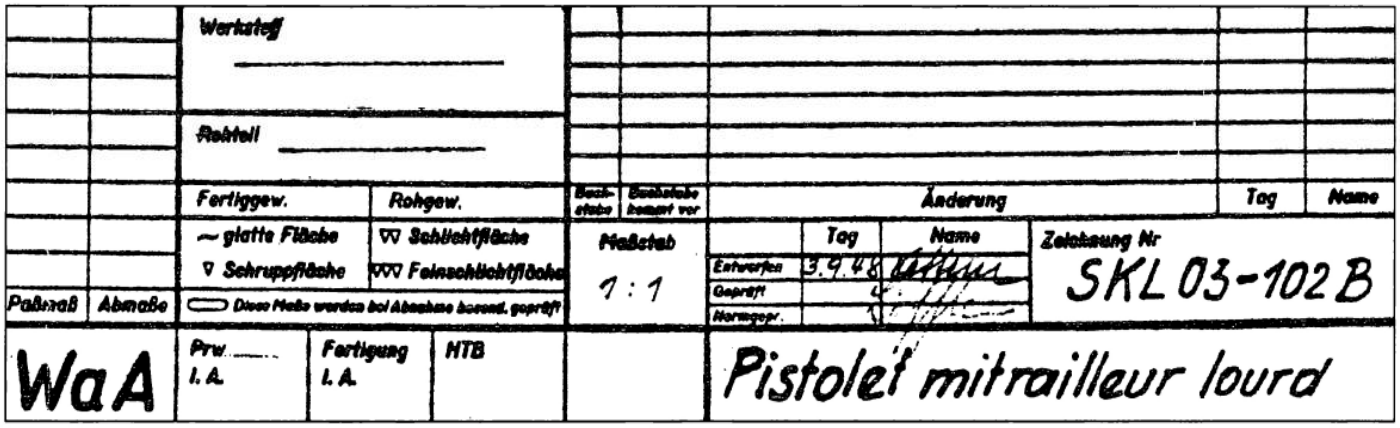
1. different bipod attachment;
2. shorter return spring;
3. modified ejection.

Two other engineers named Kimmich and Kettezer assisted Löffler in working on his Model II/1 prototype. By October 1, 1948 the modifications as requested by Colonel Sales were 90% completed, but no further progress appears to have been made until the watershed decision taken on November 16, 1948, discussed in Chapter Nine, to abandon further development in 7.65x35mm French short in favour of new versions chambered for the 7.62x33mm (.30 US Carbine) cartridge.



126. Drawings of Löffler's second prototype to plan SKL 03-102B, dated September 3, 1948.

Compare with fig 125: note the modified change lever positions, which now read (from top rear) "C" (*Coup par coup*), "S" (*Surété*), "M" (*Mitrailleuse*). Other differences in the action components and the configuration of the folding butt are also apparent. courtesy Walter Schmid



127. The title block from the above drawing, no SKL 03-102B dated September 3, 1948, drawn on leftover WaA (*Waffenamt*) blueprint paper, titled *Pistolet mitrailleur lourd cal 7.65* (heavy machine pistol).

courtesy Walter Schmid

128. Right side view of the Löffler Model II/1 built to plan SKL 03, with butt and bipod extended, shown fitted with the early 30-round 7.65x35mm magazine.
courtesy *Museum für Historische Wehrtechnik*, Nuremberg

Project 702: the Short-Lived Vorgrimler Self-Loading Carbine

129. Left and right side views of the Vorgrimler self-loading carbine, a roller-locked arm constructed in calibre 7.62x33mm (.30 US carbine) in accordance with Project 702. First exhibited by Vorgrimler at ETVS (*Etablissement d'Experiences Techniques de Versailles*) on March 30, 1949. courtesy Jean Huon

Initial sketchy characteristics for the "automatic" (self-loading) carbine were established in 1946, and were later refined by specifications dated June 28, 1949, which spelled out the features desired. The calibre was initially established as .30 M1 carbine (7.62x33mm), and the arm was to be equipped with a folding butt or barrel. The maximum length with butt open was to be 90cm (35.4"), the maximum

length with butt folded was to be 60cm (23.6"). The maximum barrel length was set at 40 to 45cm (15.75 to 17.7"). The maximum weight without magazine was set at 4kg (8.8 lbs). Initially it appears that this arm was also to be capable of selective fire, as the rate of fire was to be between 500 and 600 rpm. Accuracy at 200 metres was to be equivalent to that of the US M1 carbine when fired single shot, and to be equivalent to that of the F-M (*Fusil-Mitrailleuse*; "machine-rifle") Mle 24/29 on burst fire from a bipod. Accuracy at 100 metres was to be equivalent to that of the MAT49 SMG, after trials had determined such accuracy.

In addition the self-loading carbine was to be lethal to 300 metres, simple to manufacture, and easy to strip and handle.

A variant of the above, firing the newly-developed 7.65x35mm *Modèle* 1948 intermediate cartridge, was also desired. The rear sight was to be graduated to permit aimed fire as follows:

arm in .30 M1 cal.: . . . . . 0 to 400 metres
arm in 7.65mm: . . . . . 0 to 800 metres.

Meanwhile, as noted above, along with the two machine carbine models of Project 701 initiated in February, 1948, Colonel Sales of DEFA had also initiated Project 702 for a *Carabine Automatique* (self-loading carbine) capable of semi-automatic fire only, with a wood stock like the US M1 but featuring the half-locked roller action and firing the 7.65x35mm French short cartridge. Engineer Ludwig Vorgrimler was assigned to manage the project, which was graded as Priority 2 and assigned plan number 1CL.

The *Carabine Automatique* programme was officially established in calibre 7.65x35mm on June 19, 1948. French arms manufacturers were notified that two versions were planned, one with a fixed, and one with a folding, buttstock, both using 15-round magazines and capable of charger loading from 5-round stripper clips. "This arm, different but complimentary to the *Carabine Mitrailleuse*, corresponded to the US M1 and M1A1 but the ammunition was more powerful."[2]

Project 702, the *Carabine Automatique* programme, was mentioned on September 1 and again on October 1, 1948, when it was noted that the pre-project was completed, but that no further progress had been made because everyone was busy on Project 701. It appears that by this time the cartridge used in the Project 702 carbine had been switched to the 7.62x33mm (.30 carbine) round, as a note states that no .30 calibre carbine ammunition was as yet available.

An assembly drawing dated November 1, 1948, labelled "1 CL 7.62 *Selbstlader*", depicted a conventional wood-stocked carbine utilising the 15-round box magazine of the US M1 carbine.

On March 30, 1949 Vorgrimler exhibited one complete carbine at ETVS (*Etablissement d'Experiences Techniques de Versailles*).

By December 1, 1949 two specimen carbines had been completed and tested, and a third was finished shortly thereafter. Vorgrimler requested permission from Colonel Courtoux, the Director of CEAM, to be allowed to build five new specimens of the Project 702 carbine for tests, but it appears that the five new carbines requested by Vorgrimler were never made, and the mentioned three specimens were the only ones ever completed.

Characteristics of the Project 702 Self-Loading Carbine

In a single page description issued by the *Direction des Etudes et Fabrications d'Armement* of AME Mulhouse in 1949, the Project 701 self-loading carbine was described as an arm "with semi-rigid breech for single shot fire only, hammer-actuated, with a stamped metal receiver." The particulars supplied were as follows:

weight: . . . . . 2.8kg (6.2 lbs)
length: . . . . . 893mm (35")
barrel length: . . . . . 400mm (15.7")
magazine capacity: . . . . . 15 rounds
number of rifling grooves: 4
one turn in . . . . . 470mm (18.5")
ammunition: . . . . . 7.62 (.30 M1)

2 *Les Cartouches Militaires Intermédiaires Françaises, 1944 - 1970*, p 21

Chapter Nine

Switching to the .30 Carbine Cartridge

Abandoning the 7.65x35mm Short Cartridge

The intention to adopt the 7.62x33mm (.30 calibre) US carbine cartridge had been announced as early as November 16, 1948, although it was not until March 25, 1950 that the .30 carbine cartridge was officially adopted as the 7.62x33mm *Modèle* 1950.

Nevertheless, since all intermediate carbine developments were henceforth to be chambered for the 7.62x33mm cartridge, all work on both the Vorgrimler and Löffler 7.65x35mm designs was terminated late in 1948, and all later trials were held with guns in .30 M1 carbine calibre.

The Short-Lived Vorgrimler Model I/2 in 7.62x33mm (.30 Carbine)

.30. Left side view of the Vorgrimler Model I/2, in calibre 7.62x33mm (.30 carbine), fitted with one version of the new 40-round magazine. This was the last iteration of the Vorgrimler CEAM carbine to feature in competitive trials, although certain features of his design were retained in subsequent models.
courtesy Jacques Barlerin

Ludwig Vorgrimler had accordingly begun the alterations necessary to convert his Model I/1 specimen 2 into the Model I/2, in calibre .30 US carbine (7.62x33mm).

Meanwhile, in January, 1949, work was begun on the study and development of new 40-round box magazines dimensioned for the 7.62x33mm carbine cartridge, and for the first time the magazines used in the Vorgrimler and Löffler prototypes were not interchangeable.

The Löffler Model II/2, in 7.62x33mm (.30 Carbine)

131. Left side view of the Löffler Model II/2 prototype, in calibre 7.62x33mm fitted with a design-specific 40-round magazine marked "Mod. II/2". The bipod and butt are shown in the open position. courtesy *Museum für Historische Wehrtechnik*, Nuremberg

By November, 1948, Theodor Löffler had also begun alterations to his Model II/2 prototype, which was still in the early stages of manufacture, to fire the 7.62x33mm carbine cartridge. The Löffler Model II/2 prototype fired a short 15-round trial on December 12, 1948, but the trial was cut short when the hammer broke.

The Showdown: Vorgrimler's Design Rejected

Early in the new year the latest prototypes of both designers had advanced to the point where a two-day trial was held on January 19 and 20, whereupon Vorgrimler's Model I/2 was judged inferior to Löffler's Model II/2, for the following reasons:

1. The rate of fire of the Vorgrimler Model I was around 130 rpm faster than that of the Löffler Model II;
2. The forces to which the return spring in the Vorgrimler design were subjected were considered too high (around 180kg/mm2);
3. The bolt head exhibited cracks on the milled surface, propagating across the entire piece.

As a result, the two existing Löffler Model II prototypes—version 1, which had not been converted from 7.65x35mm to 7.62x33mm, and version 2, which was chambered for the carbine cartridge—were accepted for further development.

A meeting was held on January 22, 1949, at which the latest Vorgrimler prototype, the Model I/1 specimen 2, was presented, along with two 40-round 7.62x33mm box magazines. This arm was accepted as his Model I/2 (fig 130), but further development of the Vorgrimler carbine project was then terminated in favour of continuing with the Löffler designs.

An ETVS Evaluation of the Löffler Model II/2 Carbine

An evaluation of the Löffler design was scheduled at ETVS (*Etablissements d'Experiences Techniques de Versailles*) on February 3, 1949, but the Löffler Model II/2 was not ready.

On March 15, 1949 the Löffler Model II/2 was presented for the ETVS test, and on March 30 all the prototypes which had been developed at CEAM to date, with the exception of the initial Löffler model in 7.65x35mm, were presented for evaluation at Ver-

132. Right side view of the Löffler Model II/2 prototype, with butt and bipod folded.

The 40-round magazine, marked "Mod. II/2", was not interchangeable with the magazine used in the Vorgrimler Model I/2 prototype.

courtesy *Museum für Historische Wehrtechnik*, Nuremberg

sailles. These included the Vorgrimler Model I prototype 1 in calibre 7.65x35mm and the Model I prototype 2 in calibre 7.62x33mm, and the Löffler Model II prototype 2, also in calibre 7.62x33mm.

The Model 1950 is Born

As a result of this evaluation the decision was made to develop a "new" model, to be called the *Modèle* 1950, from Löffler's Model II/2 under plan number SKL 05.

Plan No SKL 05: Merging Features of Both Designs

By May of 1949, the new *carabine mitrailleuse* was under development. The initial specifications of plan number SKL 05 for the *Modèle* 1950 called for the following:

1. the pistol grip/trigger housing assembly of the Vorgrimler model was to be used;
2. a new 40-round box magazine was to be developed;
3. a folding stock like Models I and II was to be used, based on the plan dated April 14, 1949.

On June 28, 1949 these specifications were altered somewhat, and it was announced that the new *carabine mitrailleuse* should embody a fixed stock that could stand the strain of launching grenades, and a 30-round box magazine.

In order to accommodate these new specifications within the existing SKL 05 plan, a compromise folding stock made of wood, plus a heavier barrel suitable for launching rifle grenades, and a new 30-round box magazine, redimensioned for the slightly shorter 33mm .30 carbine case, were adopted under a plan dated July 13, 1949.

France Joins NATO

Meanwhile France had become a member of the North Atlantic Treaty Organisation (NATO) in April, 1949. and French studies of the US developmental T65 rifle cartridge, which later became the 7.62x51mm NATO round, began on June 9, 1949.

133. Left side view of the 7.62x33mm Löffler Model II/3, built to the specifications of plan SKL 05, shown with bipod and buttstock open.

Note the new 30-round magazine, the cocking handle located on the left side, and the early configuration of the butt locking lever in the rear of the beefed-up wooden folding buttstock.

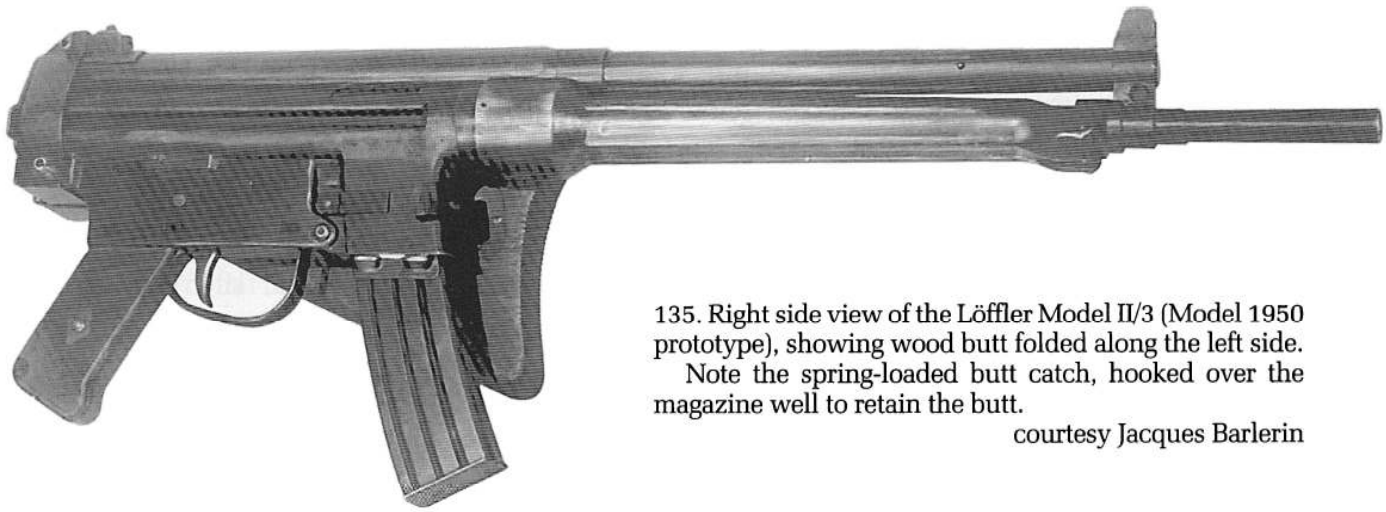
This was the first Löffler model to incorporate the Vorgrimler-designed *détente* system, with single shots fired from the closed bolt and automatic fire from the open bolt.

courtesy Jacques Barlerin

The Löffler Model II/3 Becomes the Model 1950

134. Right side view of the transitional Löffler Model II/3 which became the first Model 1950 carbine in January, 1950, shown with butt open and bipod folded.

courtesy Jacques Barlerin



135. Right side view of the Löffler Model II/3 (Model 1950 prototype), showing wood butt folded along the left side.

Note the spring-loaded butt catch, hooked over the magazine well to retain the butt.

courtesy Jacques Barlerin

By December 1, 1949, three prototypes of the Löffler Model II were in existence, as follows:

1. the initial Model II/1, in 7.65x35mm
2. the Model II/2, in 7.62x33mm (.30 carbine);
3. the Model II/3, also in 7.62x33mm, embodying the Vorgrimler-designed *détente* system with single shots fired from the closed bolt, and automatic fire from the open bolt.

A new Löffler model, constructed to drawing number SKL 05, was completed in December, 1949. This prototype became known officially as the "*Modèle* 50/1" in January, 1950.

On January 6, 1950, with the first Löffler *Modèle* 50 finished, a testing programme was announced, under which it was proposed to construct a total of six specimens of the latest Löffler design.

By May, 1950, the one Löffler Model II/3 in calibre 7.62x33mm, with six 40-round box magazines II/3, and the one Model 50/1 also in calibre 7.62x33mm, with five 30-round box magazines 50/1, were available.

A Retrospective on Three Vorgrimler Prototypes

During 1949 Ludwig Vorgrimler had perfected his *système de détente* (trigger mechanism), enclosed in a removable box-like metal trigger housing, which permitted full-automatic fire from the open bolt and semi-automatic fire from the closed bolt.

Even though the Löffler Model II had been chosen for further development, Vorgrimler had continued to revise his Model I/2 in calibre 7.62x33mm (fig 130), and a new similar prototype was constructed named the Model I/3.

A report, identified as no UM 102, dated December 12, 1949, described the three Vorgrimler prototypes constructed in response to Colonel Sales' Project 701 request. This document is excerpted in translation as follows:

Carabine mitrailleuse 7.62 M1

Principal Characteristics [of the Vorgrimler Model I/3]

Weight without magazine:	*3.865kg [8.52 lbs]*
Weight of empty magazine:	*0.200kg [.45 lb]*
Overall length:	*860mm [33.9"]*
Length with butt folded:	*602mm [23.7"]*
Barrel length:	*360mm [14.2"]*

Description of the arm

The carabine mitrailleuse *is classed within the group of arms with semi-rigid locking.*

Locking system

*This arm employs the semi-rigid roller locking system, where the rollers, lodged in the head of the bolt, are impelled by the return spring past the locking wedge [*Steuerstück*] to enter corresponding cutouts in the barrel extension, to which the barrel is firmly screwed.*

Firing system

The hammer firing mechanism permits the choice of firing single shots or full-automatic, by means of the selector lever located on the side of the pistol grip assembly, this lever also having a safety setting which ensures the security of the arm. As regards the construction of the arm, the mechanism is mounted in a trigger housing box which operates as follows:

In single shot fire, the arm always fires from the closed bolt position. In automatic fire, the bolt assembly is retained in its open position at each interruption of fire.

The firing system also possesses an automatic safety feature whereby the hammer cannot be released unless the bolt is fully forward and locked.

Handling the Arm

The selector lever, located on the side of the pistol grip assembly, is set at "M" for full-automatic fire. The cocking handle is pulled to the rear until the bolt assembly is caught in the open position. A full magazine is inserted into the well until it clicks on the catch, and the arm is ready for automatic fire.

If single shot fire is desired, the selector is moved to the position "C", whereupon the bolt will move forward safely and automatically to chamber a cartridge. The arm is now ready for single shot fire, which is the preferred mode of fire in most circumstances.

The magazine may also be attached when the bolt is forward. In this case, when the selector is in the position for single shot fire the bolt assembly must be drawn back as far as possible to the rear and the cocking handle released so that the bolt flies forward on its own under the influence of the return spring to chamber a cartridge. The arm is then ready for single shot fire.

For automatic fire starting with the bolt closed on a chambered cartridge, the selector is moved to the position "M" and the trigger pressed. The arm will fire the first round from the closed bolt position, but will come to rest in the rear or open position each time the trigger is released.

Disassembly

The bolt assembly must be in the forward position. The two transverse locking pins, located at the top and bottom of the butt ferrule, are withdrawn, and the stock and its ferrule, to which is attached the return spring guide, are withdrawn to the rear. The return spring is also removed to the rear. A brisk impulse on the cocking handle will bring the bolt assembly to the rear, where it too may be removed.

*By removing the transverse pin in the bolt carrier, the bolt head may be turned and pulled off to the front. The other components of the bolt assembly - the firing pin, spring, and control piece [*Steuerstück*], are also freed for removal.*

The locking pin ahead of the pistol grip assembly is withdrawn and the grip assembly removed. The selector lever is raised to its fully upright position, where it can be removed to the side, and the trigger mechanism housing can be lifted out.

The above actions will be sufficient to allow a thorough cleaning of the weapon.

State of development

Prototype 1 with its four in-the-white magazines has fired about 15,000 rounds, during the course of which several components were broken, as follows:

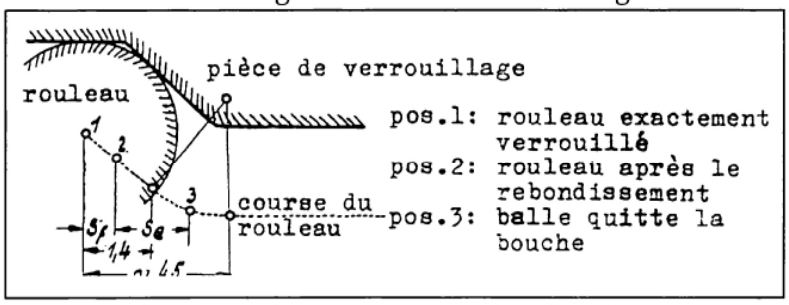
1. *The bolt carrier, following plan SKL 05-24 E, made of XC steel, fractured after about 8,000 rounds. In order to reduce its mass we had earlier reduced its diameter, and this was what caused the piece to fracture. Modifications necessary to strengthen this component are under way.*
2. *The hammer, following plan SKL 05-35 D in XC25 steel, broke after firing about 13,000 shots. Investigation revealed that the breakage was the result of a force stronger than had been expected during normal firing. We feel that the breakage was caused by a premature disengagement of the hammer, and for this reason we will add a positive means of holding the hammer in the cocked position until the bolt is locked and the arm is ready to fire.*

Prototype 3, with six blued magazines, has fired about 6,500 rounds, with no parts breakages to date. This version is fitted with a longer bipod than prototype 1 and a reinforced barrel, threaded at the rear. The location of the cocking handle and of the magazines themselves is a little different between the two designs, and for this reason the magazines used with prototype 1 and prototype 3 are not interchangeable.

Vorgrimler Surmounts the Bolt Bounce Problem

Even with the decision to terminate the further official development of his Model I series, engineer Ludwig Vorgrimler continued to fulfill the conditions of his employment by experimenting and producing viable solutions to ongoing problems.

Vorgrimler later recalled this period while he was in Spain and again encountering bolt rebound problems in his initial CETME *Modelo* 2, discussed in Chapter Ten. At that time, he commented,



136. A diagrammatic representation of the "bolt bounce" problem in the CEAM carbines, showing the consequences of three positions which the *rouleau* (roller) could occupy.
Position 1: roller completely locked.
Position 2: roller after rebounding.
Position 3: roller ceases to contact the locking recess in the barrel extension. courtesy Jacques Barlerin

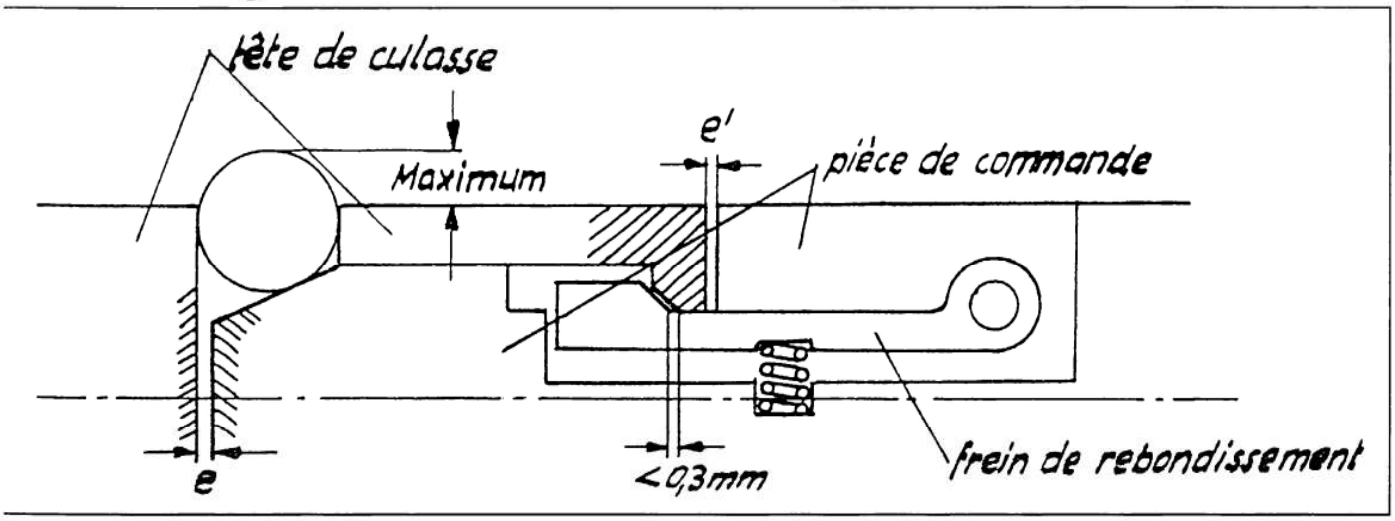
. . Because of its special construction requirements, no spring guide was included in my [Model 2 CETME] design, and we experienced the first problems with bolt rebound, as Altenburger had predicted. I had had experience with these bolt rebound problems in France while I was developing the special 7.65mm model; they resulted in ignition problems and broken locking system parts.

Technical report UM 140, prepared by the ex-Mauser engineer Herr Kunert and dated May 3, 1950, concerned investigations into bolt rebound, which was the only serious problem to plague the CEAM half-locked roller action. In the introduction to this document, translated as follows, Kunert took the opportunity to issue a warning concerning the large deviations in pressure encountered in early French loadings of the .30 carbine cartridge:

. . The 7.62 carabine mitrailleuse *for the .30 M1 carbine cartridge, now under study at CEAM, has been subjected to experiments to test the limitations of the design from the point of view of its faults and failings. Extensive trials have proven that, with the exception of a great susceptibility to problems caused by bolt rebound, no other functioning anomalies exist. Several methods of limiting bolt rebound have accordingly been studied.*

Taking into account the great dispersion of the ammunition (see report UM 136), measures which will reduce malfunctioning in the arm in question have been established as a result of further tests. However it is doubtful that we can adequately compensate for the vastly abnormal residual deviations in impulse produced by the ammunition in this weapon . .

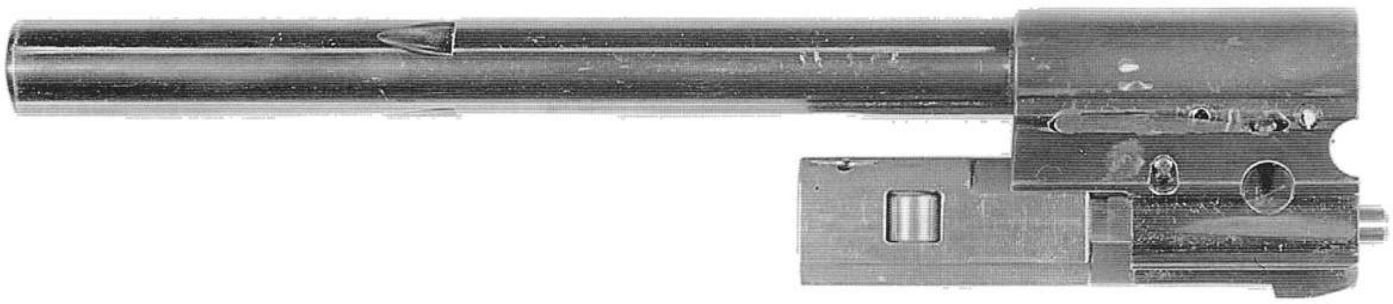
Dealing with *Rebondissement*: the Vorgrimler *Rückprallsperre*



137. Diagram drawn by Herr Kunert illustrating the principle of Vorgrimler's *Rückprallsperre* (bolt rebound device), showing roller in maximum contact with its locking recess and the spring-loaded, hook-like device, mounted in the bolt body, grasping the bolt head to prevent the two parts from separating due to bolt bounce.
courtesy Jacques Barlerin

A notarised statement concerning the development of the *Rückprallsperre* (rebound brake or locking device) was made on June 15, 1965 by engineer L Grossmann, who was Ludwig Vorgrimler's assistant at Mulhouse. This short document is translated as follows:

. . Early in 1950 Mr Vorgrimler, who at that time was Manager of "Light Weapons" at the Centre d'Etudes et Fabrication *at Mulhouse, came to my workshop and brought along a sketch of a lever, which he wanted to be mounted into the assault*



138. Left side view of the bolt assembly of a Model 1950 CEAM *Carabine mitrailleuse*, showing Vorgrimler's spring-loaded *Rückprallsperre* installed in the bolt body, with its front hook in contact with the bolt head to prevent bolt bounce. courtesy H&K GmbH

rifle cal 7.65 Model I, which I was looking after in the workshop. Mr Vorgrimler explained to me the connections and the additional changes to the breechblock carrier and breech mechanism head. Since due to the urgent workload no machinery was available, I agreed to perfect and manufacture the lever by hand. After heat treatment of the parts, both of us together made the first large firing test of about 1,600 shots in bursts, without, as had happened before the alteration, the locking device breaking, or the breech mechanism head jolting against the roller windows, or showing cracks, as had happened before after firing only a few hundred shots.

Mr Vorgrimler insisted that the new findings should also be incorporated into Model II, where it had previously been tried to prevent the jolt of the breech mechanism by breaking the lining at the roller windows. However, after just a few shots, this resulted in a change of headpsace and deflection of the lock was the result.

I can therefore confirm that the Rückprallsperre *(recoil locking device) was Mr Vorgrimler's idea, and the first practical application was done by me.*

Vorgrimler himself later commented, "I designed and developed a so-called recoil brake, later patented under No 1 119 726".

An Omnibus Presentation at ETVS

On May 3, 1950, engineer Ludwig Vorgrimler issued a report "on the presentation of the arms developed at CEAM to the ETVS (*Etablissement d'Experiences Techniques de Versailles-Satory*), from April 25 to 27, 1950". The weapons displayed included Vorgrimler's own Model I/3 and the self-loading carbine, plus Löffler's Model II/3 and Model 50/1.

This document is excerpted in translation as follows:

. . . After they were unpacked, the arms were quickly stripped by the ETVS technicians, the corresponding differences of the models were explained, and the arms were reassembled.

The carabine mitrailleuse *Model I/3 was the first to be fired. It fired 9 x 30 = 270 rounds in single shot and burst fire with no malfunctions or incidents. Then the Model 50/1 was fired 5 x 30 = 150 shots without incident.*

Then the medium-power machine gun, mounted on a Model 34 tripod, was fired 350 shots, in the course of which one failure to feed of the last cartridge in the belt was the only incident. The prototype MG fired from the bipod stopped after the first round, but after substituting a new belt, the weapon functioned without interruption for more than 250 shots.

The self-loading carbine fired more than 45 shots without incident.

In the course of further firings in the afternoon of April 25, the same weapons were fired by the ETVS technicians, so that they might familiarise themselves with the new arms.

With the Model I/3 carabine mitrailleuse *they fired 6 x 30 = 180 rounds; with the Model 50/1 they fired 5 x 30 = 150 rounds; and with the Model 50/2 they fired 4 x 30 = 120 rounds, all without incident.*

Following this prototype II of the cal 7.62mm medium-power machine gun was fired 16 x 30 = 480 shots off its bipod, during which two cartridges were misfed, each being the last round

in magazine no 3. This magazine was therefore eliminated. The feed system was changed to belt feed, and the weapon was mounted on the tripod. It then fired 480 shots, in the course of which the belt was rolled out and the gun had to pull it up a distance of 2 metres, with no malfunctions or incidents occurring during the course of this trial. After refitting the weapon for magazine feed, it fired a further 3 x 30 = 90 rounds without incident.

The following objections were raised by the representatives of ETVS:

It was noted that the bases of the ejected cartridges were strongly bulged, especially when the weapon was magazine-fed, and it was feared that should any cartridge rupture it would lead to serious problems. This problem was ameliorated by fitting an extractor which did not eject the cases so powerfully. It was obvious however that the two methods of feed were fitted for different angles of ejection. During the last-mentioned trial of 3 x 30 = 90 rounds, no incidents were observed, leading to the conclusion that the new extractor had solved the problem.

The initial prototype then fired normally off the bipod a further trial of 100 shots.

During the 6 x 15 = 90 shots fired with the self-loading carbine, two doubles and one misfeed were recorded. This shoot concluded the trial of April 25. The arms were returned to the ETVS workshop for disassembly and cleaning on the morning of April 26, with the assistance of some soldiers detailed to the ETVS.

Representatives of [the state arsenals at] St Etienne and Tulle] assisted in the firing trials of the carabine mitrailleuse *Model I/3. A total of 6 x 30 = 180 rounds [were fired], during which one double was recorded.*

The carabines mitrailleuses *Models 50/1 and 50/2 functioned normally in firing more than 5 x 30 = 150 and 4 x 30 = 120 rounds.*

The self-loading carbine was then fired more than 3 x 15 shots, producing one "double" and several light strikes. Examination showed that faulty heat treatment had allowed some stretching which caused the headspace to open up slightly, which meant that the firing pin was not able to deliver a sufficient blow to the chambered cartridge to fire it. Since no major spare parts were available, no further firing was done with this weapon . .

When the firing trials were completed, it was discovered that the bolt head of carabine mitrailleuse *Model 50/2 had sustained a light crack through the angle of the roller housing, which meant that this component was no longer useable.*

In the course of post-trial discussions the following observations were made:

After the trials at Satory it was decided that the old model 34/42 cartridge belt was better than the one introduced towards the end of the war, both from the standpoint of functioning and durability. Plans for further fabrication will thus be geared to the older model of belt.

[In the carabines*] the rollers should be fixed in the bolt head in such a manner that they remain in place when the arm is disassembled. Colonel Sales advises that the spring which secures the rollers can easily be lost by the troops during disassembly and cleaning.*

The cocking handle of the carabine mitrailleuse *should definitely be located on the left side, as on previous models.*

Describing the Model 1950

Conceived in the same manner as the Löffler Model II 3 but better finished, the components (notably magazines) of the Model 50 were not interchangeable with those of the Model II/3.

A hinged wooden butt, which folded laterally along the left side, replaced the butt designs previously used.

Functioning remained by means of the delayed blowback mechanism, with the bolt semi-rigidly locked by means of lateral rollers. However the method of functioning as it concerned open-bolt automatic fire was changed, and the Model 1950 functioned from a closed breech regardless of the fire mode selected. This feature was contrary to the 1946 specifications, but it did not appear detrimental to the security or functioning of the arm, the construction of which was moreover simplified.

Theodor Löffler himself prepared a six-page report, number UM 142, dated May 24, 1950, which described both the Models II/1 and 50/1. This interesting document is excerpted in translation from the original French as follows:

Carabine mitrailleuse 7.62mm M1, Models II/3 and 50/1

Principal Characteristics	*Mod II/3*	*Mod 50/1*
Calibre	*7.62x33mm*	
Muzzle velocity	*~600m/s [1,968.5 fps]*	
Chamber pressure	*~2,800kg/cm^2 [39,826 psi]*	
Rate of fire	*520 - 550 rpm*	
Magazine capacity	*30 rounds*	
Locking	*semi-rigid*	
Rifling, one turn in	*470mm [18.5"]*	
Weight	*3.865kg [8.5 lbs]*	*4.060kg [8.95 lbs]*
Weight of empty magazine	*210g [7.4 oz]*	
Weight of full magazine	*600g [21.16 oz]*	
Length overall	*860mm [33.8"]*	*900mm [35.4"]*
Length with butt folded	*602mm [23.7"]*	*658mm [25.9"]*
Length of receiver	*265mm [10.4"]*	*280mm [11"]*
Length of barrel	*360mm [14.2"]*	*400mm [15.7"]*
Length of bipod	*245mm [9.65"]*	*290mm [11.4"]*
Thickness of sheet metal in bipod	*1.25mm [.05"]*	*1.5mm [.06"]*
Length of butt	*260mm [10.24"]*	*248mm [9.76"]*

Description of the arm

The two carabines mitrailleuses *discussed herein are classed within the group of arms with semi-rigid locking.*

Locking system

*These arms employ the semi-rigid roller locking system, where the rollers, lodged in the head of the bolt, are impelled by the return spring past the locking wedge [*Steuerstück*] to enter corresponding cutouts in the barrel extension, to which the barrel is firmly screwed.*

Firing system

The hammer firing mechanism permits the choice of firing single shots or full-automatic, by means of the selector lever located on the side of the pistol grip assembly, this lever also having a safety setting which ensures the security of the arm. The firing system also possesses an automatic safety feature whereby the hammer cannot be released unless the bolt is fully forward and locked.

The versions II/3 and 50/1 present different design approaches to the two types of fire.

In the Model II/3, conforming to the specifications, a mechanism is incorporated in the firing assembly which ensures that single shot fire always takes place from the closed bolt position, while for automatic fire the bolt assembly is retained in its open position at each cessation of fire.

The Model 50/1 incorporates a simplified firing mechanism in which the arm always fires from the closed bolt position in both single shot and automatic fire, which based on our trials is largely sufficient.

Method of Operation

Model II/3

The selector lever, located on the side of the pistol grip assembly, is set at "M" for full-automatic fire. The cocking handle is pulled to the rear until the bolt assembly is caught in the open position. A full magazine is inserted into the well until it clicks on the catch, and the arm is ready for automatic fire.

If single shot fire is desired, the selector is moved to the position "C", whereupon the bolt will move forward safely and automatically to chamber a cartridge. The arm is now ready for single shot fire, which is the preferred mode of fire in most circumstances.

The magazine may also be attached when the bolt is forward. In this case, when the selector is in the position for single shot fire the bolt assembly must be drawn back as far as possible to the rear and the cocking handle released so that the bolt flies forward on its own under the

influence of the return spring to chamber a cartridge. The arm is then ready for single shot fire.

For automatic fire, starting with the bolt closed on a chambered cartridge, the selector is moved to the position "M" and the trigger pressed. The arm will fire the first round from the closed bolt position, but will come to rest in the rear or open position each time the trigger is released.

Handling the Model 50/1

In this model the bolt assembly is always in the forward position. A full magazine is affixed as above and, since the bolt is already forward, the cocking handle must be withdrawn fully to the rear and released, whereupon the bolt, under the influence of the return spring, will fly forward to chamber a cartridge and lock behind it. The arm is now ready for for single shot or automatic fire, depending on the position of the selector.

Disassembly

The bolt assembly must be in the forward position. The two transverse locking pins, located at the top and bottom of the butt ferrule, are withdrawn, and the stock and its ferrule, to which is attached the return spring guide, are withdrawn to the rear. The return spring is also removed to the rear. A brisk impulse on the cocking handle will bring the bolt assembly to the rear, where it too may be removed.

*By removing the transverse pin in the bolt carrier, the bolt head may be turned and pulled off to the front. The other components of the bolt assembly - the firing pin, spring, and control piece [*Steuerstück*], are also freed for removal.*

The locking pin ahead of the pistol grip assembly is withdrawn and the grip assembly removed. The selector lever is raised to its fully upright position, where it can be removed to the side, and the trigger mechanism housing can be lifted out.

The above actions will be sufficient to allow a thorough cleaning of the weapon.

State of Development

Model II/3

The Model II/3 prototype has fired approximately 13,000 rounds. The bolt assembly used, which was taken from the Model II/2 prototype, has fired a total of 18,000 rounds without any component failures.

*After the last presentation at Versailles, a rebound brake [*Rückprallsperre*] has been installed in the bolt head, which works very well. A new stronger spring has been installed in the rebound brake, and in this condition the arm has fired 3,000 rounds.*

Model 50/1

Until now this arm has fired approximately 9,000 rounds, during which the following component failures have occurred:

1. *one extractor, made of XC 65 steel, failed after about 7,500 rounds. The extractor has been repositioned in a new bolt, and has already fired about 1,600 rounds without the least inconvenience.*
2. *a firing pin broke after about 8,000 shots, seemingly as a result of its having been cut or gashed. A modification has been made.*

The magazines of the two weapons are not interchangeable, and the position of the cocking handles is also different on the two arms.

The Model 50/1 is fitted with a simplified firing mechanism with which the arm always fires from the closed bolt, both in single shot and in automatic fire.

As the barrel is heated in sustained burst fire, the risk of a cook-off of a chambered cartridge increases.

In trials the Model 50/1 has fired without interruption (except for changing magazines) through 20 magazines, that is, 600 rounds, in bursts of three to six shots each. After these 600 rounds were fired, a single cartridge was left chambered for five minutes without cooking off.

This trial demonstrates that the specification regarding full-auto fire from the open bolt can be withdrawn, as the arm as ready for issue to the troops will not be susceptible to cook-off despite the most strenuous use.

On May 24, 1950, the date of the above report, Löffler's initial Model 50/1 prototype fired 9,000 rounds, with one broken extractor and one broken firing pin.

Model 50 Variants

The Model 50/1: Cocking on the Right

139. left and right side views of the Model 50/1, fitted with the cocking handle onthe right side.
Compare with fig 133: note the redesigned butt latch in the rear of the folding wooden buttstock.
courtesy H&K GmbH

Two variant versions of the actual Model 50 were produced. The first, the Model 50/1, featured the cocking handle located on the right side.

140. Left side view of the Model 50/1, partially stripped. The butt pin has been removed, the butt, captive recoil spring guide and separate recoil spring disassembled, the trigger group lowered and the 30-round magazine removed. courtesy H&K GmbH

141. Left side closeup of the Model 50/1, which was noticeably better finished than the previous prototypes, showing markings.

As noted in Löffler's report, translated above, this version was fitted with a simplified firing mechanism wherein both semi- and full-automatic fire were from the closed bolt.

courtesy H&K GmbH

The Model 50/B: Cocking Returned to the Left Side

142. Left side view of Model 50 carbine serial no 5, with bipod folded and a spare 30-round magazine included.
Note the cocking handle has been returned to its original position on the left hand side.
courtesy Jacques Barlerin

143. Left side view of Model 50 carbine serial no 6, with bipod extended.
Note the heavy barrel, beefed up for use in launching rifle grenades.
Compare with serial no 5, above: note the further redesign of the butt latch in the rear of the folding wooden buttstock. courtesy Jacques Barlerin

On the other variant, the Model 50 B, of which several examples were constructed, the cocking handle was returned to the left side, as recommended in the ETVS trial report dated May 5, 1950, excerpted above.

Vorgrimler's Trigger System Patent Application

On June 13, 1950 Ludwig Vorgrimler applied for a French patent on the trigger system he had devised for the *carabine mitrailleuse*. In the later document numbered L15, rather ironically prepared by his competitor Löffler and dated February 9, 1956, (almost six years after Vorgrimler had departed for Spain), the patent specifications were listed as follows:

1. *A* système de détente *(trigger system), permitting single shot fire from the closed bolt position, or automatic fire from the open bolt position in an automatic weapon.*
2. *A* système de détente *(trigger system) as described above, in which the entire mechanism is mounted in an easily interchanged block.*
3. *A* système de détente *(trigger system) as described above, characterised by the fact that switching from the closed bolt fire position to the open bolt firing position - that is, from single shot to automatic fire - is by means of a cam lever which also permits a selection whereby the security of the weapon is assured.*
4. *A* système de détente *(trigger system) as described above, embodying a safety feature whereby the hammer is blocked until the breech block is completely locked.*

The patent application on Vorgrimler's trigger mechanism was contested by the French Army.

Ludwig Vorgrimler Moves On

It appears that these improvements were Ludwig Vorgrimler's last contributions to the French automatic carbine program. The former Mauser engineer was in any case unhappy in France, but the main reason for his departure to Spain was the lack of further meaningful work, due to the preference shown for Löffler's Model II and later designs. The upshot of this was that Vorgrimler left the Mulhouse establishment on June 30, 1950 to go to Madrid, where, in conjunction with other expatriate German engineers and scientists, he continued his work with the roller-locked action in the development of the CETME assault rifle. He actually left the French facility on June 15, and spent the rest of the month on paid vacation. Vorgrimler's name was excluded from all new CEAM documents dated after September 15, 1950.

Meanwhile, back at Mulhouse, the CEAM name was again changed in 1952, and the facility was thenceforth known as *l'Atelier de Fabrication de Mulhouse* (AME). A number of other prototype weapons utilizing various action systems were developed at Mulhouse after the departure of Ludwig Vorgrimler and before the closure of the establishment in 1967: an automatic pistol; a submachine gun; a semi-auto carbine; an automatic rifle; a "medium power" machine gun, the early trials of which are discussed above; a 12.7mm (.50 cal) machine gun, and automatic cannon in 20 and 30mm.

It is interesting to note that the majority of the documents found in the AME archives relating to these designs (technical notices, correspondence, plans, etc) were written in German.

Cancelling the CEAM *Carabine* Programmes

On April 25, 1951, CEAM asked DEFA to return the Model 50 prototypes for repair after a 2,500-rd firing test.

It appears that only six *Modèle* 50 prototypes were produced in total, as both the *carabine automatique* and *carabine mitrailleuse* programmes were discontinued in the early 1950s. The underlying reason for this was largely political: large quantities of US small arms, notably M1 and M2 carbines. were being supplied to the French during this period. in the hope that better-equipped French Expeditionary Forces in Southeast Asia might give the Chinese something else to contend with besides the Americans fighting in Korea. This vast store of US carbines, supplied as a fully-developed logistical "package" complete with ammunition, training aids, tools and spare parts, prompted the practical decision on the part of the French General Staff to give up searching for a new carbine of their own, and to concentrate

instead on the further refinement of the full-power self-loading rifle.

An excerpt from a document entitled "The State of the Study" dated January 1, 1952 sums up as follows:

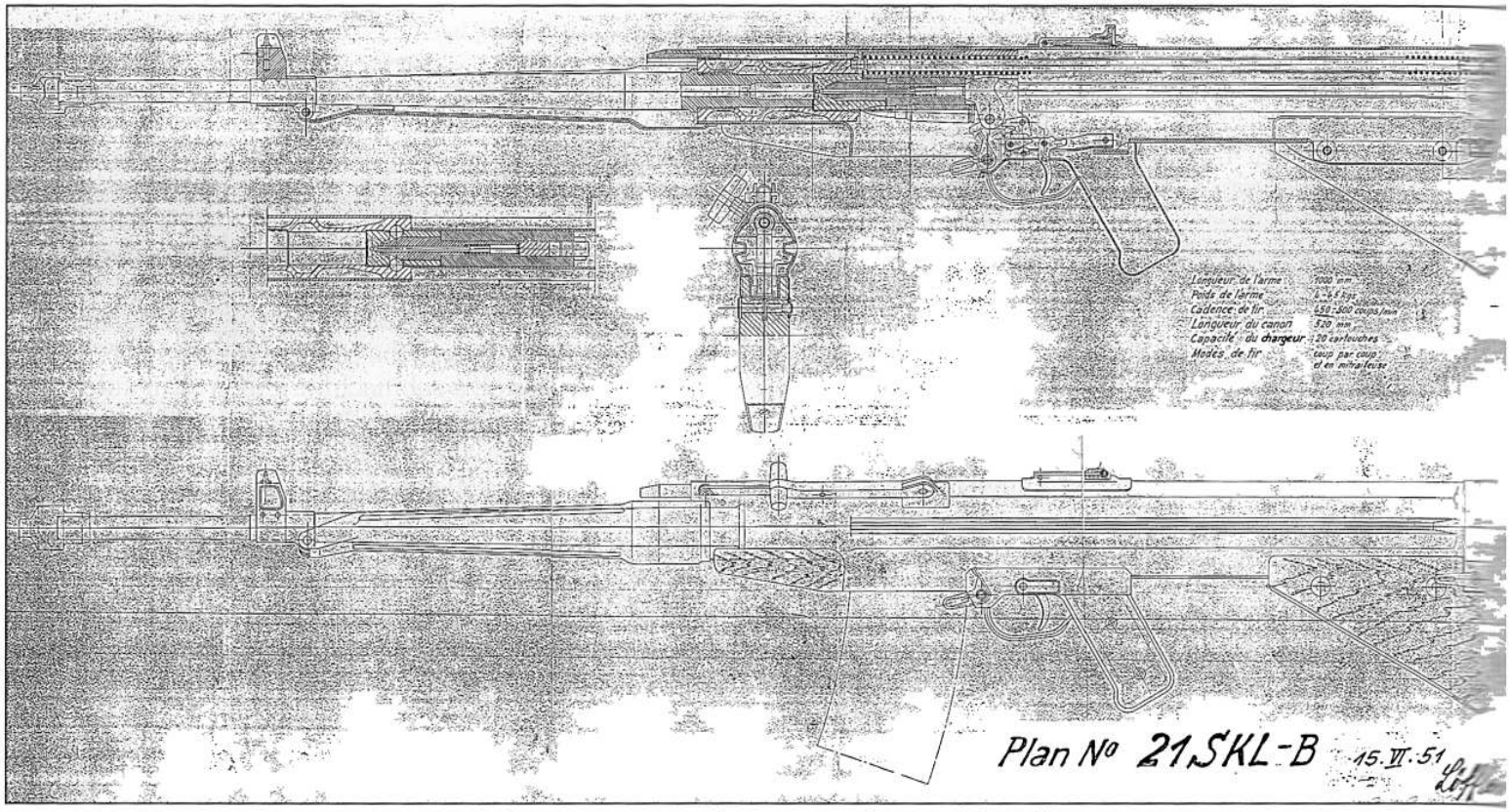
> . . . *the* carabine mitrailleuse *in 7.65mm special, (and) the automatic carbine in .30 M1, are actually suspended; [as] the envisaged cartridge(s) did not possess, one or the other, satisfactory performance.*

Latter Days at Mulhouse

The French state purchased a defunct metalworking factory, located next to the CEAM facility in Mulhouse, in 1952. This factory had previously been occupied by the *Fabrique d'Objets Métalliques du Haut-Rhin* (FOMHAR), which had manufactured pressed-metal kitchenware plus some contracts for heavy-calibre cartridge cases for the French military.

With the addition of the FOMHAR metalworking facilities, CEAM became independent of the state arsenal at Châtellerault (MAC), as it was now able to produce its own designs. To reflect this the name *Centre d'Etudes et d'Armement de Mulhouse* (CEAM) was accordingly changed to *Atelier de Construction de Mulhouse* (AME).

The Löffler *Fusil Mitrailleur* (Machine Rifle) to Plan 21 SKL-B



144. Plan drawing, in rather poor condition, of the roller-locked calibre 7.5x54mm machine rifle designed to Plan 21 SKL-B, signed by Löffler and dated June 15, 1951, roughly a year after the departure of Ludwig Vorgrimler for Madrid. courtesy Jacques Barlerin

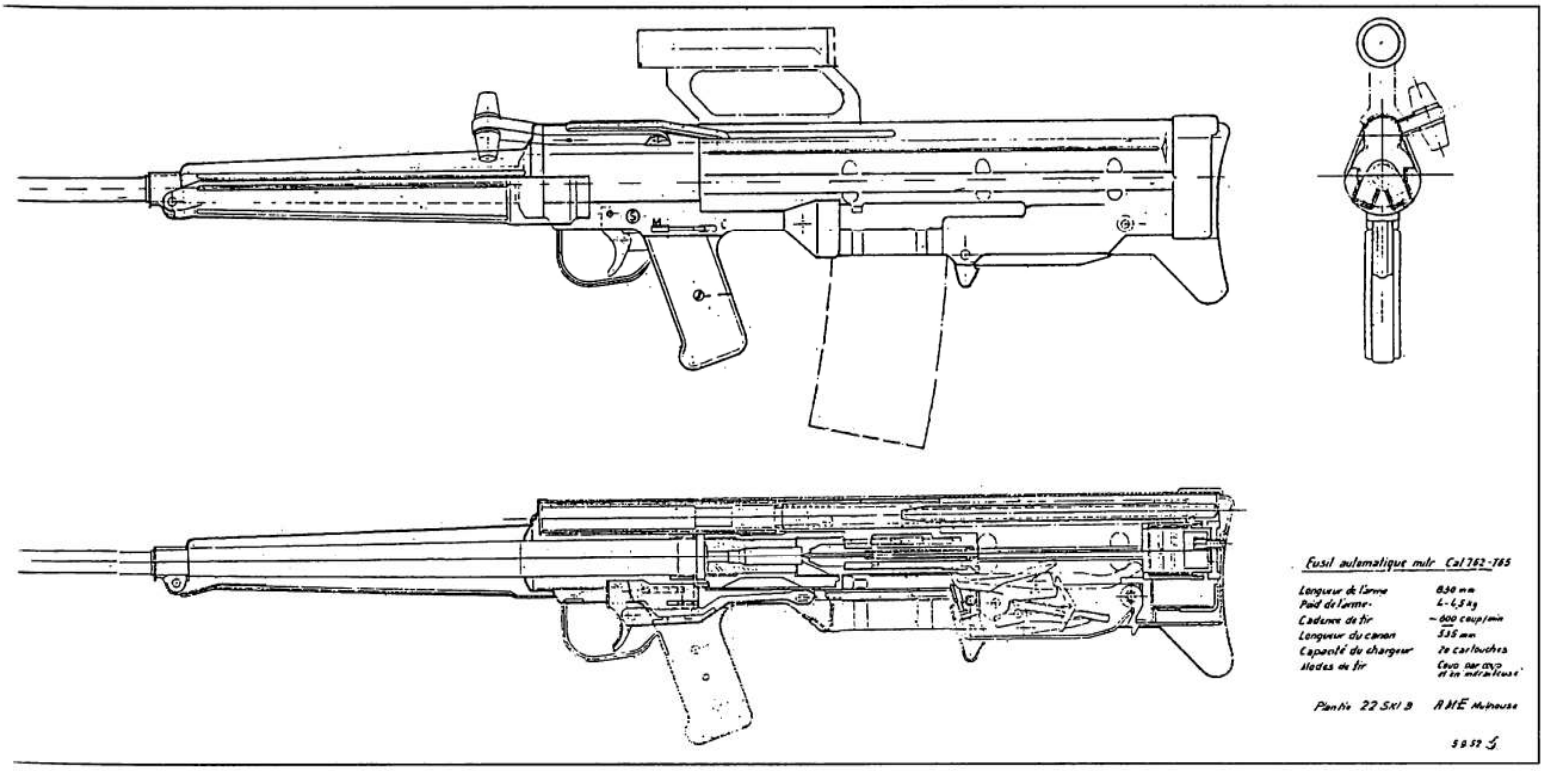
After the demise of the *carabine mitrailleuse* programme Löffler initially applied the roller lock action to a scaled-up, full-power selective-fire automatic rifle, designed under Plan 21 SKL-B dated June 15, 1951, chambered for the standard French service 7.5x54mm *Modèle* 1929 rifle cartridge. This version eliminated the forward tube arrangement of the bolt carrier and featured a redesigned trigger mechanism and a long return spring in the rear, as used in the earlier Vorgrimler carbine design. The specifications

of the *fusil mitrailleur* were listed on the drawing as follows:

Length overall: . . . . . 1,000mm (39.4")
Weight: . . . . . 4 - 4.5kg (8.8 - 9.9 lbs)
Firing rate: . . . . . 450 - 500 rpm
Barrel length: . . . . . 520mm (20.4")
Magazine capacity: . . . . . 20 cartridges
Modes of fire: . . . . full and semi automatic

Another drawing to Plan 21 SKL 01 U5B, dated December 4, 1951 illustrates a different version of this rifle receiver, of which an actual specimen is unknown.

The Löffler Calibre "7.62 T65" Bullpup, to Plan 22 SKL-B



145. Further drawings, dated September 5, 1952, of a bullpup version of Löffler's full-power roller-locked rifle, rechambered for the 7.62mm "T65" cartridge, the early name for what became the 7.62x51mm NATO round in 1954. This was the last French design to feature the roller lock.

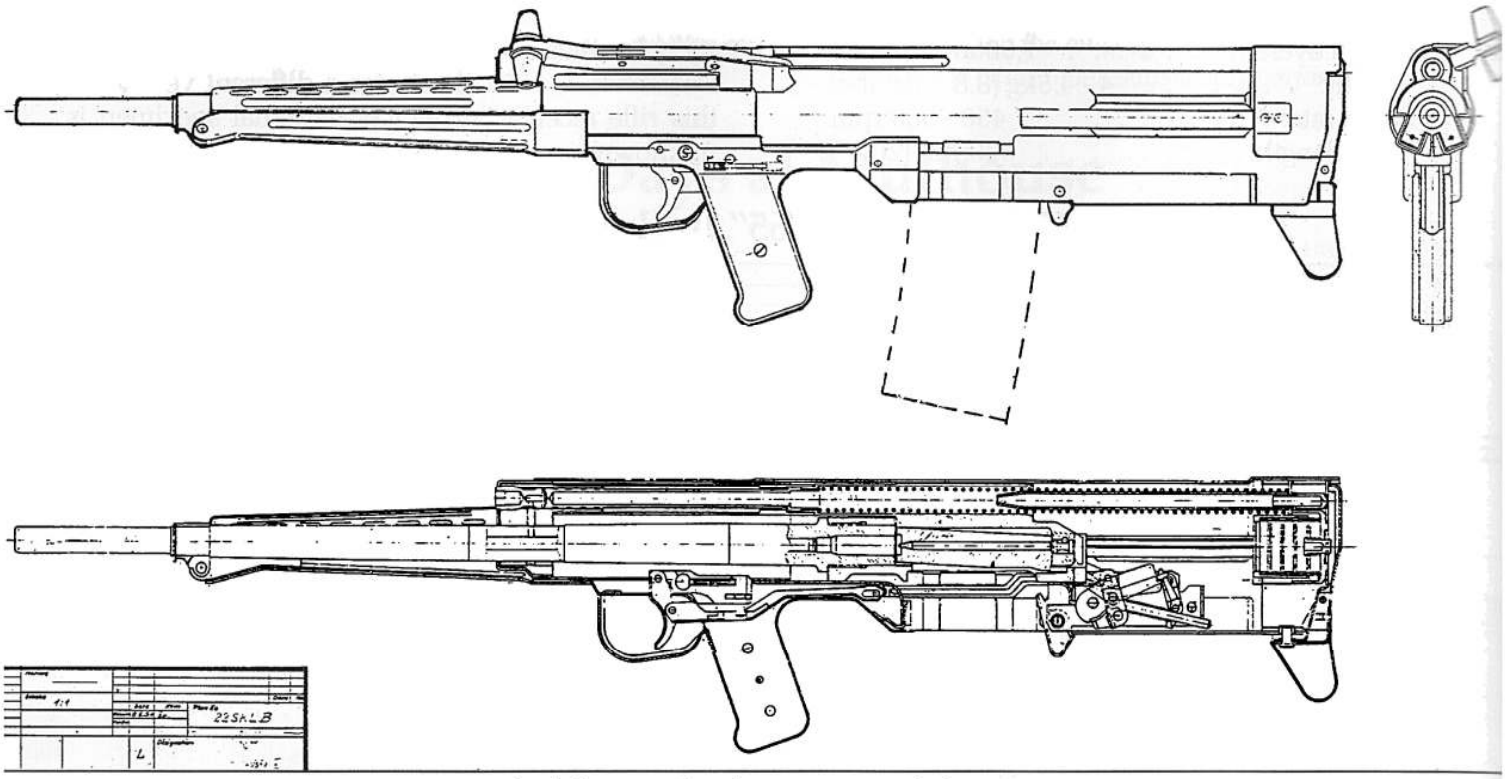
The general layout, in particular the optical sight and carrying handle configuration, is strongly reminiscent of the British EM-2. courtesy Jacques Barlerin

A later drawing dated September 5, 1952, to Plan 22 SKL-B illustrates a new roller-locked bullpup rifle in calibre "7.62 T65", fitted with an optical sight incorporated into a central carrying handle, reminiscent of that of the British EM-2. A specimen of this model is also unknown, but the specifications are listed on the drawing as follows:

Length overall: . . . . . 830mm (32.7")
Weight: . . . . . 4 - 4.5kg (8.8 - 9.9 lbs)
Firing rate: . . . . . ~600 rpm
Barrel length: . . . . . 535mm (21")
Magazine capacity: . . . . . 20 cartridges
Modes of fire: . . . . full and semi automatic

In March, 1954 France first officially adopted the 7.62x51mm NATO round, the finalised version of the "T65" cartridge adopted by NATO in Ottawa in January, 1954.

Abandoning the Roller Lock



146. A final drawing, dated June 8, 1954, of a later version of the Löffler bullpup rifle, utilising a gas-operated, rear-locking, tilting bolt design like that of the MAS 49.
courtesy Jacques Barlerin

The last Löffler rifle design we have seen was prepared at Mulhouse and shown on a drawing to Plan 22 SKL B dated June 8, 1954. This was a revision of the roller-locked bullpup rifle described above (in calibre 7.62mm), fitted with a MAS-type rear-locking dropping block similar in design to the bolt used in the FAL rifle.

According to document L15, Löffler was still working at Mulhouse as late as February 9, 1956.

The End of the Road for AME

The AME Small Calibre Department was closed in 1964. The entire AME facility was closed in 1967, one year before the state arsenal at Châtellerault (MAC) was also shut down.

Part III: The Roller Lock in Spain, I

Chapter Ten

The CETME Programme Begins

The story of the further development of the roller lock action at CETME (*Centro de Estudios Technicales de Materiales Especiales*) in Spain is taken largely from postwar memoirs written by the two people who were the most intimately involved in the programme. The first document, dated March 19, 1977, is titled "Development History of the CETME Rifle/German Army G3". This valuable document was prepared by Ludwig Vorgrimler, the wartime designer of the roller-locked Mauser MG215 aircraft MG who, as we have seen, also designed the Model I *carabines mitrailleuses* and the *carabine automatique* at CEAM in Mulhouse shortly after the war, and was the designer of what was to become the CETME rifle itself. The second document, titled "Development History of the CETME Assault Rifles (*Sturmgewehre*)", dated March 1962, was prepared by the German head of development at CETME, *Dipl-Ing* Werner Heynen, formerly *Wehrwirtschaftsführer* and General Manager of the Gustloffwerke weapons factory in Suhl.

The Impossible Dream

In 1949, representatives of the Spanish government approached the former General Manager of the Gustloff-Werke, *Dipl-Ing* Werner Heynen, who in the final years of the war had been president of the board of directors for "automatic weapons" within the Speer Ministry, to put together a group of German specialists to work in Spain on the planned development of new military small arms, including an automatic rifle to replace the Model 98-37 bolt-action Mauser.

Conditions of Development

With Werner Heynen installed as the head of this development programme, a meeting was held on February 1, 1950 at the *Centro de Estudios Technicales de Materiales Especiales* (CETME) in Madrid, at which government representatives outlined a requirement to equip special troops, officers, and the rank-and-file generally with, among other things, an automatic carbine, chambered for a 7.92mm short cartridge, with the following characteristics:

- a folding stock;
- effective range from 800 to 1,000m:
- maximum weight 3kg (6.6 lbs);
- possibility for the attachment of a bayonet and a grenade launcher.

Towards this goal, research was to be conducted to establish:

1. with which largest calibre these demands could be met; and
2. which method of production would be most advantageous, keeping in mind that the use of pressed sheet-metal would be acceptable.

The Reasoning Behind the Requirements

To anyone with any experience whatsoever in small arms design, the requirement for aimed burst fire from a weapon weighing only 3kg (6.6 lbs) being effective at 1,000 metres appears at first glance to be downright ridiculous, and one can imagine the comments made in private by the members of Werner Heynen's design team as they initially contemplated these specifications.

However, after some reflection it was perhaps remembered that Hitler himself had rejected the intermediate-range assault rifle concept on three separate occasions during the war. One of the main reasons for his first refusal on April 14, 1942 had been that "The effective range of 500 metres was too short, because in desert warfare a range of 1,200 to 1,500 metres would be necessary"[1]. And speaking of desert warfare, one of the few remaining areas of Spanish influence abroad in the early 1950s was in the troubled Spanish Sahara region of northwest Africa.

Then again, perhaps one or other of the officers responsible for the specifications had themselves seen long-range combat in Russia during WWII with the Spanish *Legión Azul* (Blue Legion).

Coupled with this, after having survived the war and endured the first few postwar years of penurious insecurity in Germany, Werner Heynen could hardly be blamed for taking the project seriously as a chance to secure a safe and remunerative niche for himself and his colleagues for some years to come.

The Design Group's Initial Response

The design group responded to the above-mentioned conditions on February 28, 1950 by recommending a weapon along the lines of the German StG44, which had been the most valuable weapon developed during WWII, paying particular attention to improvements gained from experience. These, for the most part, consisted primarily in improvements in the production of stamped sheet metal components. The StG44 was the first German weapon designed to utilise sheet metal stampings, such attempts tracing right back to 1938, when "a developmental contract . . had already been signed between the WaA and the Haenel arms factory of Suhl on May 18, 1938. One of the main demands of this contract was that the weapon be capable of manufacture largely from plain carbon steel stampings"[2].

It was further proposed to eliminate the high line of sight apparent in the StG44, and to adopt a simpler breech mechanism, such as the "half-locked" roller system employed during the last year of the war. At that time there was already talk of a "family of weapons", consisting of a simple kind of "machine pistol", an assault rifle (such as the StG44), and a machine gun with mount, all based on an *Einheitswaffe* (all-purpose weapon) patterned after the WWII German *Sturmgewehr*.

Werner Heynen's own account of these initial events is excerpted as follows:

> *. . Concerning the calibre, it was proposed to stay with 7.92mm until an international standard was adopted; obviously a NATO matter.*
>
> *The intended weight of 3kg (6.6 lbs) was considered too light for accurate burst fire. To keep the weapon aimed with reasonable ease in such a case, a weight of at least 4kg (8.8 lbs) would be required.*
>
> *These proposals were discussed with management in various meetings, as well as questions rather common in every infantry weapon development programme, such as which should be adopted; a recoil-operated or gas-operated action?*
>
> *Much skepticism was shown towards the idea of trying a half-locked breech. All theoretical and mathematical examination of the matter seemed to indicate that the pressure per square area would be too high, and durability therefore low. Against this stood the practical German experience gained towards the end of the war, which had proven these concerns unwarranted.*
>
> *On March 20, 1950 order no O.T. 69 was handed down: "To develop a project for an automatic carbine, along the lines of the WWII German* Sturmgewehr *but with greater effective range and without an increase in weight."*

1 *Sturmgewehr!* p 109
2 Ibid, p 84

Ludwig Vorgrimler Moves to Madrid

Ludwig Vorgrimler, who as we have seen was not happy in France, recalls the next step as follows:

> . . *Since I was dissatisfied with the working conditions in Mülhausen, I decided, upon the request of my acquaintance* Dipl-Ing *Heynen, to join the Spanish group as the only one from Mauser. The French initially made it difficult for me to leave the French occupied zone by rejecting my passport request, so I was not able to leave for Madrid with my family until September, 1950.*

147 (right). The last official photograph of German designer Ludwig Vorgrimler taken in France before his departure for Madrid.

As he notes, above, the French objected to the loss of his valuable talents for their own arms development programme, and held up his passport request as long as possible. courtesy Mle Martine Destouches, *Centre d'Archives de l'Armement et du Personnel*, Châtellerault

The 7.92x41mm Cartridge: Rocket Science Applied to Small Arms

The first task facing the design team was to select a cartridge with flat trajectory and good accuracy over long range, but with no increase in recoil to adversely affect the precision of full-auto fire.

This was no simple matter, for, as Werner Heynen quickly realised, the specifications laid down by the Spanish government—a maximum range of 1,000 metres (1,094 yds) from a rifle weighing less than seven pounds—could not be met with any cartridge then in existence. In this regard he commented knowledgeably,

> . . *All experience suggested that a recoil impulse of 0.75 kg/sec should not be exceeded with a lightweight, selective-fire assault rifle. This fact was the basic reason for our development of a new cartridge: management's range requirement of 1.000m was roughly double the capability of the well-known German 7.92x33mm* kurz *cartridge. and was thus diametrically opposed to the wish for a short cartridge with minimal recoil.*
>
> *A solution, proposed and then actually realised, was remarkably unconventional. The bullet, weighing 6.8g [104.9 gr], was very light, and consisted of an aluminum core with a partial copper jacket. Stabilisation demanded a rifling pitch of 8 degrees. Not a short cartridge, but rather a relatively long one, was necessary to achieve the required range, although muzzle energy of 222kg/m [1,605.8 ft lbs] and a recoil impulse of 0.7kg/sec barely exceeded the corresponding data for the German* kurz *round. The vertex of the trajectory lay near 6.93 metres; this ammunition satisfied all conditions regarding overall performance and ballistic characteristics. Even the various scruples regarding the partial copper jacket being in nonconformance with the Hague convention were unfounded . .*

The developer of the 7.92x41mm CETME cartridge was *Dr-Ing* Gunther Voss, a former *Luftwaffe* ballistician, who employed the *Haack* principle, named for its inventor, to design a very long, light 7.92mm bullet, weighing only just over 100 grains and measuring 44mm (almost six calibres) in length. Producing a muzzle velocity of 2,690 fps but with a remarkably low recoil impulse, the 100-gr Voss bullet, unprecedentedly long but lighter than many pistol bullets, was chosen as the only solution which would meet the requirement for a light rifle able to hold on target in burst fire with range up to 1,000m.

It was decided that Dr Voss' cartridge would manufactured in the state ammunition factory in Palencia, with powder purchased in Belgium, since other than the flake powder used in the then-standard 7.92x57mm rifle cartridge, no other suitable powder was available in Spain.

Cartridge Development Subservient to Weapon Development

The specifications laid down by the Spanish government were, as noted, the underlying reason for the unorthodox 7.92x41mm cartridge. Werner Heynen commented on this as follows:

> . . *At CETME the ammunition development was from the beginning subservient to the weapon development, because what was required was ammunition with characteristics suitable for the weapons. The road to the production-ready aluminum-core light ammunition developed for the first types of weapons was particularly difficult and its success particularly remarkable, in view of the fact that nearly every instrument needed for measurement in such a difficult development task did not even exist [in Spain]. The development of the bullets as well as the research towards the dimensioning of the cartridge and all the necessary tests took place under highly improvised conditions. The acquisition of suitable powder within Germany caused equally great difficulties as in foreign countries, wherein the lack of sufficient hard currency played a considerable part. However, when the weapons engineers needed larger quantities of ammunition for their tests, they got them. It is safe to say that if we had had then the test facilities and machinery that we have now, today's NATO ammunition would definitely look different.*

Two-Fold Initial Development

Ludwig Vorgrimler recalled the less-than-fulsome welcome which awaited him on his rather tardy arrival in Madrid in September, 1950 as follows:

> . . *Our group in Spain consisted of ten engineers and scientists, all but me from the American or British occupied zones, so they had already been able to start their work in January [1950]. Since I arrived in Spain nine months late, two specialists from Rheinmetall had already finished designs according to the Spanish conditions for a* Sturmgewehr *using a gas-operated locking system, to be used with a cal 7.92mm medium cartridge, which was still in the planning stages.*
>
> *My start in Madrid was rather difficult, since I had to contend with two jealous engineers from a former competitor, but also with a report from German experts from the Eschede barracks concerning this same semi-rigid roller breech mechanism . . I can mention today, that our former group manager,* Dipl-Ing *W Heynen, was like a father figure to me at that time, and defended me objectively against the preconceived opinions of the Spanish engineers and technicians, as well as against the German observations.*

The Two CETME Models: Model 1 Has a Head Start

Dipl-Ing Heynen commented on the initial development of the two models as follows:

> . . *The experts [Vorgrimler] succeeded in putting to rest management's heavy doubts regarding the use of such a [half-locked] system and the time required to develop a weapon so different from the known approach.*
>
> *It was further determined to develop two different solutions to the problem:*
>
> - *Model 1: gas action, with locked, "bracewing" [flap-locked] breech [similar to that of the WWII G43].*
> - *Model 2: recoil action with half-locked [roller] breech.*

148. Left side view of the CETME *Modelo* 1, a flap-locked, gas-operated rifle constructed by Rheinmetall designer Hartmut Menneking.
courtesy the late Dr Edward C Ezell

The two initial prototypes within O.T. 69 were developed totally independently from each other, by two different engineers. The designer for Model 1 [Hartmut Menneking] began right away; while the designer-engineer (Ludwig Vorgrimler) did not begin his work on Model 2 until September, 1950.

Vorgrimler Begins the Initial Prototype of the Model 2 CETME

Ludwig Vorgrimler recalled the initiation of his *Modelo* 2 roller-locked carbine design as follows:

. . Spurred on by my late start in Spain, I put all my energy into my work, aided by several Spanish assistants. However, it was difficult to find suitable deep-drawing sheet steel in Spain, as well as factories somewhat knowledgeable in processing this metal, or the stamping procedure. Pertinent state factories refused to accept stamping techniques for weapon manufacture, as was formerly done in Germany. Nevertheless, we succeeded in producing the sheet metal stampings in a test workshop of a factory in Pinto near Madrid, using makeshift tools . .

Regarding the Spanish requirement for a folding stock, Vorgrimler commented,

. . When I finally presented my design and the necessary instructions, the Spanish gentleman in charge, even though distrustful at first, decided to give my design a chance as a second model. Since Spanish design conditions required that the weapon be later be used for special units like tank or paratroopers, etc, a folding stock was required. Therefore the mainspring could not be located in the stock, as was possible with the StG45(M) or StG44 (Haenel).

Production of Three Initial Prototypes of Each Model

Werner Heynen recalled the early days of this two-fold development as follows:

. The projected time for the production and testing of three prototypes of each model; that is of the gas-operated locked-breech design [Model 1] and the recoil-operated half-locked breech weapon [Model 2]; was two years. Faster development, considering the existing conditions, was not possible; even this two-year estimate was highly optimistic. Such a programme was something totally new for Spain. There was no test and development machine shop; the military weapons factories lay hundreds of kilometres apart; and neither engineers nor skilled workers, not to mention assemblers with experience in arms construc-

149. Left side view of the roller-locked CETME *Modelo* 2, designed by Ludwig Vorgrimler, who due to obstacles put in his way by the French did not arrive in Madrid until nine months after the CETME programme had begun. In the text, Vorgrimler records his "late start" and the "difficult" reception accorded him by "two jealous engineers from a former competitor."

courtesy the late Dr Edward C Ezell

tion, were available. There was however, from all co-workers, a tremendous amount of goodwill, and also remarkably good theoretical knowledge. Interchangeability was an alien concept, at least practically; thus an enormous amount of time was needed to teach and instruct. It was one of the goals of CETME to develop expertise in tolerancing and interchangeability. Today, CETME has for its own use the best-equipped test shops and ranges staffed with expert personnel capable of every possible sort of research for measurement that one might wish for. But something like this, ten years ago, was unheard of.

On June 2, 1950, the AEM agreed to a CETME proposal under which three prototypes of each model of rifle were to be produced. The prototypes for the Model 1 were produced at the Fábrica Nacional de Toledo, and the Model 2 at the firm Armamento de Aviación de Pinto.

Neither had ever built any weapons before, but they had the necessary machinery and equipment, steel-hardening capabilities, and a well-qualified core of specialists such as lathe operators, machinists, and so on. The first drawings were sent to Pinto in January, 1951, after the measurements for the cartridge had been finalised. The Instituto Nacional de Industria *(INI) gave final agreement to the undertaking in February, 1951, and allowed the financial credit.*

The planned acquisition of barrels from the Fábrica Nacional de La Coruña took too long; however the firm Echeverría "Star" (Eibar) was able to deliver the first barrels for the Model 2 prototype on March 12, 1951. These barrels were acceptably machined but were unsuitably hardened (180 instead of 225 Brinell), but since at that point they were only to be used for function testing, they sufficed. At this time 40% of the drawings for the Model 1 prototype had been sent to Toledo, and all of the Model 2 drawings had been received at Pinto.

Presentation of First Prototypes to the *Alto Estado Mayor* (AEM)

Werner Heynen records the timetable for the first presentation of prototypes as follows:

. . The initial prototype ("pre-project") of the Model 1 was presented to the Alto Estado Mayor *(AEM) on September 14, 1950, while the initial Model 2 was presented on December 15, 1950. Both these pre-project models however were not equipped with folding stocks, in order to not unnecessarily increase possibilities of faults. Such a folding butt is only really necessary for a few troop units, such as tank and armoured vehicle crews, parachutists, and special commandos . .*

Describing the Vorgrimler Model 2 Prototype

A later confidential document titled "Fusiles de Asalto CETME", produced in 1982, described the CETME *Modelo* 2 as a semi-locked assault rifle with a fixed barrel, firing a special 7.92mm cartridge with a light bullet. The first small experimental series of these weapons had the following principal characteristics:

overall length: . . . . . 970mm (38")
barrel length: . . . . . 435mm (17.1")
weight without magazine: . . 4.25kg (9.4 lbs)
magazine capacity: . . . . . 20 or 32 rounds
wt of full magazine (20 rds): . . 380g (13.4 oz)
wt of full magazine (32 rds): . . . 480g (17 oz)

The three-position selector was marked "S" (*Seguro*); "T" (*Tiro*) and "R" (*Tiro y Rafagas*).

The First Firing Demonstration of the CETME Model 2

Werner Heynen's account continues as follows:

. . The work of testing the Model 2 at Pinto went very smoothly, and on July 2, 1951 a demonstration of one protoype of the weapon took place in front of the Chief of State (Generalissimo Franco) and a small circle of others.

Ludwig Vorgrimler, who personally conducted the shooting demonstration before Franco, recalled this pivotal event (one or other of these accounts is out by a month in timing) as follows:

[The fabrication of the initial prototype on makeshift tooling, as described above, made it] possible to show the first weapon to the then head of state, Generalissimo Franco, near his residence in the Pardo, on June 2, 1951. Enough of the necessary ammunition had to be ready as well, and it was my job to develop and have ready the necessary ammunition testing equipment like gas pressure gauges . .

I had to shoot for the first time at 600 metres, at the personal request of Franco. Pioneer troops had to cut down enough trees for this 600m range. The score from this distance, where the weapon had been mounted on a special light but strong tripod, made a huge impression on all officers as well as Franco.

Preparing for the 30-Weapon *Null-Serie*

Werner Heynen's account continues as follows:

. The results of this demonstration were very satisfying, and thus on July 4, 1951 the AEM ordered 30 weapons of the so-called Null-Serie *[zero series] so that tests on a much broader basis, even in practical tactical use, could be made. The munitions factory in Palencia was advised to make every necessary preparation for the delivery of the necessary 150,000 rounds of ammunition for these tests.*

During those preparations for the production and testing of the zero series, the tests with the prototypes continued. There were at that time simply no facilities for the study of the movements of the weapons' parts and the resulting internal forces during firing, or for the measurement of such forces. Thus there was considerable improvisation on the one hand, and where this was not sufficient, the necessary instrumentation had to be constructed from scratch. In such tests it was found that Pinto had used different materials for the production of the breech locking rollers than had been specified in the drawings, and that the hardening process had been improperly performed. It had to be driven home in a merciless fashion that such an attitude would lead not only to danger for the soldiers and test personnel, but would also necessarily produce the wrong test results, which would endanger the entire project. However well-meant the deviations from the specifications might have been, their effect on all those engaged in the development of the test instruments was devastating. Everyone who had had the slightest connection with these deviations was rigourously informed!

To allow the use of the rifle as a sharpshooter's rifle, an optical sight had to be attached, and since a suitable one was not available, it was produced under order no O.T. 166. Later, this sight was replaced by one from the LTIEMA, which was also offered and shown in Germany by ENOSA.

Similarly, there were studies to allow the attachment of a bayonet, as well as attachments to allow

the firing of rifle grenades. After this, finally, came the idea to replace the wooden stock with a plastic one.

On September 26, 1951, a patent was applied for which covered the trigger system of the Model 2.

The Also-Ran: the Menneking Model 1

Dipl-Ing Heynen picks up the story of the more conventional Model 1, designed by the ex-Rheinmetall engineer Hartmut Menneking, the first prototype of which had been presented to the AEM on September 14, 1950, as follows:

. . Meanwhile the trials with Model 1 had also begun, and on March 13, 1952, three various versions of the Model 1 were demonstrated in front of the Chief of State. Immediately following, on March 14, there was a demonstration to the German Chiefs of Staff, and on March 17th, another in front of the American Ambassador and the gentlemen of the US Military Mission . .

Ludwig Vorgrimler was not quite so diplomatic in his recollection of how the Model 1 had fared in the (June or July) 1951 demonstration before Franco:

. . There were still initial problems with the Model 1 gas-operated weapon; it was not shot, only shown. It was decided here that three more prototypes were to be built of my Model 2, for sustained fire testing of more than 10,000 shots each, while the Model 1 had yet to prove functional . .

Transplanting the *Rückprallsperre*

Ludwig Vorgrimler next recalls the recurrence of the problem of bolt bounce, which had plagued the Mauser *Gerät* 06H and the early CEAM *carabines mitrailleuses* he had designed at Mulhouse:

. . Because of design requirements, I had to omit the main spring guide piece used in Mauser weapons, and thus during further tests, I experienced the predicted recoil problem with the breech mechanism. I had had the same problem while working with the French, with an MP-model designed by me. Continued ignition misfires, but mainly premature breakage of the locking parts were the result.

This problem was viewed as a catastrophe at CETME. With the aid of parallel light equipment and an experienced German colleague as well as quickly supplied testing installations by the Spaniards, I was able to analyse the operating safety problem and the reason for the premature breakage, as well as find a remedy. I designed and developed a so-called recoil block, later patented under No 1 119 726, which was a spring-loaded locking lever attached laterally to the breech block carrier, which during the locking action hooked together the breech mechanism rollers with the guide piece and breech head, so that the breech mechanism rollers remain locked and the breech block carrier with guide piece remains still, and the hammer always hits the firing pin and does not hit the rebounding breech block carrier, thus causing a misfire.

Increasing the *Null-Serie* to 100, and then 120, Examples of the Model 2

Ludwig Vorgrimler's memoir continues as follows:

. . Kinematic-optical photographs made with parallel lighting equipment confirmed the operational safety of this innovation. [The recoil locking lever] improved the expected lifespan of the parts, so that the Spanish decided to manufacture 100 Null-serie *weapons, and later on 120, to be used in future troop trials.*

While concurring with Vorgrimler's account, *Dipl-Ing* Heynen describes some of the serious doubts that overshadowed the fledgling CETME programme in the light of new small arms developments in other, more experienced countries, as follows:

. . Towards the end of 1951 articles appeared in Le Monde *and* Engineer, *both discussing the simultaneous development of similar-purpose weapons in England [the EM-2], Belgium [the early FN FAL] and North America [the T25]. At the same time the difference of opinion between England and America regarding the choice of 7mm or 7.62mm as the standard calibre ended with the decision that 7.62mm was to be standardised for all NATO weapons. In Spain, in addition to the*

demonstrations there were of course lively discussions which all in all gravely endangered the continuation of the CETME project, since no one was quite sure whether it was on the right track, or even if it was proper to compete with other countries so much more experienced in weapons design and construction; but the publications in particular showed clearly the great international interest in the Sturmgewehr *concept.*

On March 18, 1952, under the chairmanship of the Chief of the AEM, General D Juan Vigón, and in the presence of his successor, the then War Minister General Muños Grandes, a very thorough discussion took place wherein the directors of CETME were able to demonstrate convincingly that it was absolutely correct to proceed with all speed to complete the development of the Model 2 still chambered for the light ammunition, presently at least retaining the calibre 7.92mm. It was decided that the Null-Serie *should be increased from 30 to 100 weapons, and that the development of Model 1 should go ahead at normal speed until the insights gained in the tests of Model 2 should allow a decision to be made as to which model should be chosen. It was further decided that one million [7.92x41mm] cartridges should be produced by the Fabrica Nacional de Palencia [headstamp "FNP"] in Palencia. Such an order was given in writing on March 29, 1952, and on April 23, 1952 the number of weapons in the projected* Null-Serie *was again increased from 100 to 120.*

Parcelling Out the *Null-Serie* to Spanish Industry

Werner Heynen continues:

. . Thanks to the far-sighted decision taken on March 18, 1952, the work with the Null-Serie *was given new impetus. However, the work that had begun as a result of the order O.T. 159 given by the directorate on August 28th, 1951, ran into various difficulties. The manufacturing engineers had studied the weapon from the standpoint of production, while the development engineers tested the results of these studies. Since CETME itself at this time did not possess adequate facilities for production of the entire* Null-Serie, *it was proposed to have the component parts of the weapons made by different companies selected as being suitable for the various types of work involved. The parts would then be assembled in a test or research shop that was to be created by CETME. Since the guiding thought in the development of the weapon from the outset was to avoid as much as possible "difficult" parts which would require special machinery and talented specialists, and to use materials that were easily available in Spain at any time (a viewpoint that in case of mobilisation was of considerable importance), it was thought that the problem of the manufacturing engineers, seen from a technical viewpoint, would not be difficult. It is however absolutely necessary to recognise that not only technical and economical but also political considerations play a considerable part [in Spain]: for how else could it be understood that companies which were technically fully in a position to produce such parts, did not do so but refused with the most flimsy of excuses (Mondragón); and also later we shall see again and again the influence of "*Politik*" which did not allow us to make effective use of technical advances.*

On April 17, 1952, the directors of the company were given a list of the absolute necessities for the production of the Null-Serie, *and following this military and private firms, mainly in the north of Spain and in and around Madrid, were visited.*

Finally the production of the Null-Serie *was subcontracted among the following firms:*

- *FN de Armas, La Coruña: barrels*
- *Orbea, Eibar: various parts*
- *Valenciaga, Eibar: springs; pistol grip parts*
- *EISA, Aranjuez: breech parts*
- *CASA, Getafe: sheet-metal pressings*
- *Messeguer, Madrid: sheet-metal pressings*
- *FAICA, Madrid: magazines and tools*
- *EN de Hélices, Madrid: pistol grip parts and tools*

(Only the most important subcontractors have here been named).

Production of the most difficult part of the CETME Sturmgewehr, *the sheet-metal receiver housing and its assembly, was executed in the CETME test shop which had meanwhile been erected. Thus the manufacturing engineers could instantly identify mistakes and correct them at the outset. With all weapons, the receiver is the most difficult part to produce, requiring remarkably close tolerancing and expert workmanship. In the case of the CETME* Sturmgewehr *the housing is stamped out of sheet metal, then formed and welded along the long seam.*

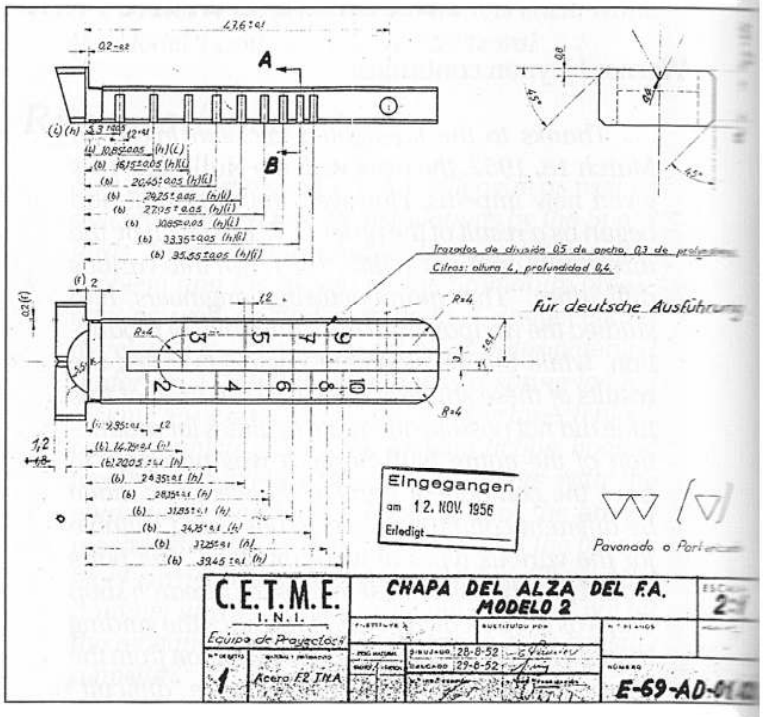
All sheet-metal parts for the Null-Serie *were produced with tools that had already been devised for use in final mass production. In this fashion it was ensured that production conditions would not be exposed to unknown influences. The most important benches, tools and gauges were those necessary to ensure interchangeability, at least among groups of components. A production office had to be created to produce these, and the necessary personnel had to be trained. Permission to undertake this work was granted by the INI on June 30, 1952, and on October 24, 1952, the test shop reported that the first operations in the production of the housing were proceeding as planned. Thus the most difficult and important part of the project —establishing a facility in Spain capable of production from materials available in Spain—was secured.*

To make sure that the parts produced by the various subcontractors also conformed to the blueprints, thus allowing the proper assembly and safe use of these parts, a separate proving facility had to be erected, which although rather improvised at first, succeeded in proving 100% the dimensional accuracy of the parts as they were delivered. Success with this crucial part of the job brought great merit to the manufacturing engineers and the supervisors of the research machine shop/laboratory.

Choosing the Roller-Locked Model 2

Werner Heynen continues by briefly recalling the momentous decision made by the Spanish government to terminate the Menneking Model 1 project in favour of continuing with the development of Vorgrimler's roller-locked Model 2, as follows:

> *. . As a result of trials in May, 1952, several proposals for changes were made; it was however decided to hold on to these ideas until the decision was made over which model should be promoted, and which model set back. Such a decision was finally made in July, 1952, and was in favour of Model 2.*



150 (right). The earliest CETME manufacturing drawing seen, dated August 28, 1952, titled *Chapa del Alza del F.A. Modelo 2* (Rear Sight Leaf of Assault Rifle Model 2).

Note the open "V" sight configuration, top right, and the range graduations from 200 to 1,000 metres.

courtesy Walter Schmid

Trials of the CETME Model 2 *Null-Serie*

Dipl-Ing Heynen's account continues with a description of the difficulties experienced in securing sufficient quantities of ammunition for the necessary trials:

> *. . Ideally, the configuration of the* Null-Serie *weapons would consistently be guided by the results of the technical and tactical tests of the original prototypes. Here, however, the programme failed to progress as a whole. For one thing, sufficient ammunition for sustained-fire testing necessary to prove the absolute reliability and safety of the weapon's various components (the magazine, for example) could not be provided, because the rather primitive system of ammunition production was not capable of sufficient speed; also the modifications to various parts took enormous amounts of time.*
>
> *Finally however, the testing could be continued, and on November 11, 1952, the first sustained-fire trial—over 11,000 rounds—was completed with satisfying results. Only the rate of barrel erosion was unsatisfactory, because it was too high. Every-*

thing else—stoppages; parts breakages—could rather simply be changed or corrected.

The World Starts to Notice the CETME

Werner Heynen next recalls the initial interest shown after the CETME rifle was first revealed:

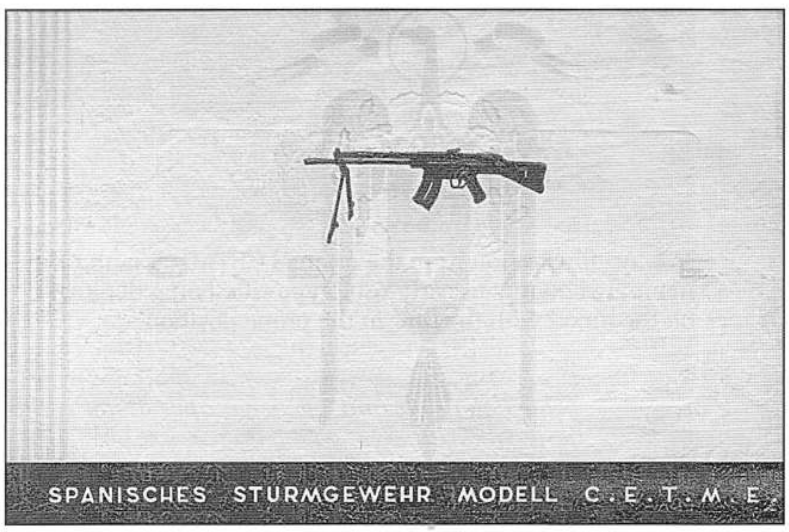
. . in October, 1952 one of the CETME prototypes, along with some accompanying brochures, was first unveiled to the public in an exhibition of new arms and machinery developed in Spain in front of the Academia General Militar *in Zaragoza, and left a good impression.*

Ludwig Vorgrimler also recalls this period with some personal reminiscences, and intimations of future international developments which would soon overshadow the entire Spanish CETME programme in importance, as follows:

. . At this time first contacts were made with representatives from German government and industry. The former chief of the Spanish Defence Department, General Vigón, a former teacher of Franco in the Military Academy and a successful leader in the Spanish Civil War, was always very supportive of the work our team did. His stated opinion was "What you develop here in Spain should also benefit your homeland, Germany." General Vigón was the one who had kept General-Feldmarschall *Sperrle's baton, which was decorated with real diamonds, and returned it after the war to Sperrle's Bavarian home . .*

The First CETME Handbook

151. Cover of the Spanish-language edition of the first CETME assault rifle handbook, issued in May, 1954 to support the issue of 50 Model 2 CETME rifles to the Infantry School for troop trials. courtesy Nigel Hinton



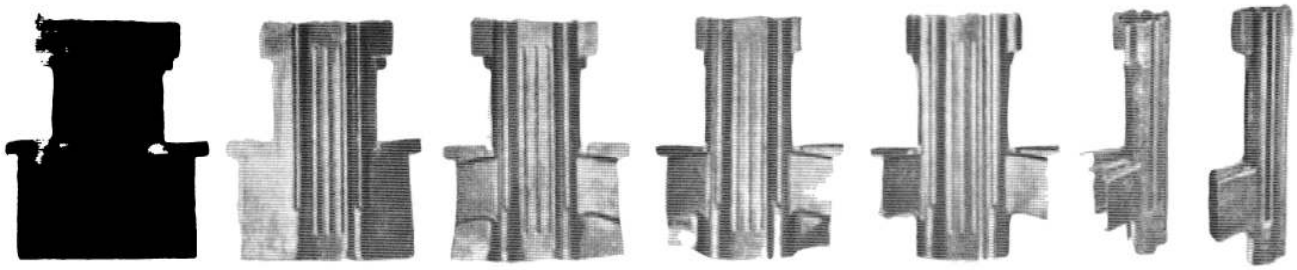
152. Cover of the German-language edition of the first CETME assault rifle handbook, issued in May, 1954. This handbook also appeared in an English edition. courtesy Reiner Herrmann

In May, 1954 a fairly extensive 50-page handbook, measuring 191 x 125mm (7 1/2 x 4 7/8") in size, was produced in Spanish, German and English, which described and illustrated the CETME weapon and its unorthodox but effective cartridge. The brochure begins with an overview which reflects strongly on the Cold War attitude which then prevailed.

The English edition, titled "Spanish Submachine Gun C.E.T.M.E. Model", is excerpted as follows with emphasised sections bolded as in the original:

Antecedents

The experience gained during World War II, in the war in Korea and Indochina, and particularly that gained by the Germans at the Russian front, makes obvious the necessity of giving the infantry again a fire power. fire range and mobility which allow the performance



153. A series of illustrations from the May, 1954 CETME assault rifle handbook, showing the sequence whereby the receiver was stamped and formed in stages from an initial flat sheet of steel. courtesy Reiner Herrmann

154. An illustration from the original CETME assault rifle manual showing an early prototype rifle being deployed off the bipod with the firer in the prone position. As can be seen the Spanish military helmet of the day closely resembled the WWII German style. courtesy Nigel Hinton

of defensive and offensive operations without the encumbrance brought about by heavy weapons.

Any war which may occur in the near future between the Western and Eastern powers, would confront us with masses of troops, attacking in waves according to the typical Russian practice. In order to withhold these attacks, the usual armament of the infantry would not be sufficient; it is necessary that the elements of the platoon or section be equipped separately with a weapon that besides its single action with automatic loading, would also be capable of automatic firing at a given moment. But in order to make this firing efficient, it is vital that the shooter be able to keep the weapon on the target in both cases.

Up to the present, the infantry does not have any weapon which fulfills these requirements. Even the automatic rifles developed in Europe as well as in America after World War II do not meet all the specifications required. The basic failure of these weapons rests upon the poor aiming achieved in automatic firing . .

CETME Ammunition

Physical properties

The ammunition developed for the new CETME submachine gun differs substantially, as to its characteristics, from all infantry ammunition known up to the present all over the world.

The bullet, with a length of 5.8 calibres, is the longest one employed in all existent small arms. Its weight is smaller than that of any rifle bullets used up to now, and with its 6.8g [105

155. Another illustration from the May, 1954 CETME handbook, intended to show off the proposed versatility of the CETME assault rifle. Here a prototype is fitted with a Spanish Mauser "bolo" bayonet, mounted under the barrel muzzle. courtesy Nigel Hinton

156. A final illustration from the May, 1954 CETME handbook, showing the prototype fitted with a mockup of an optical sight.

Note the bayonet lug under the front sight block, and the rebated front end of the flash hider, dimensioned to accept the ring on the bayonet crossguard. Neither of these features appear on later versions. courtesy Nigel Hinton

gr] it is even placed at the lower limit of the normal values for pistol bullets, whereas its muzzle velocity, much higher than the common one for pistols, reaches with its 820m/sec [2,690 fps] the upper limit of the normal value for rifles.

The adoption of such extreme and unusual characteristics seems very strange at first glance, but it proved to be a necessity in order to reach the objective established when the development of the weapon was started.

Requirements for the new weapon

Firstly it was desired that the weight of the weapon be nearly the same as that of the rifles developed after World War II in other countries, namely, 4kg [8.8 lbs], and secondly that the effective range be enlarged up to 1,000 metres . .

. . Besides the external shape of the bullet and its length of 5.8 calibres, the second ***specially significant*** *characteristic of the new ammunition is its small recoil impulse, which amounts to only 0.74kg/sec (the normal PP cartridge has 1.26 kg/sec). This small impulse was adopted in order to favour good aiming of the weapon in automatic firing. The fire accuracy in automatic firing is also very appreciable, indeed.* ***It can be guaranteed that a good shot, at a distance of 1,000 metres and in a burst of one second, namely about 9 rounds, has a 50% chance of obtaining at least one impact on a human target*** *. .*

An Engineering Analysis of the Unorthodox CETME Bullet

Charles R Fagg, PE, a long-time employee of the US arsenal system and now an independent ballistics and forensic firearms consultant, kindly prepared the following remarks for use herein which provide a much deeper understanding of the reasoning behind the unorthodox, but exceedingly well chosen, parameters of the partially copper-clad aluminum CETME projectile (figs 162 and 163):

. . It is often said that longer bullets require a higher [rifling] twist rate than do shorter bullets. Strictly speaking, this is true only if the material and construction of the two bullets remain approximately the same. If this constraint is removed, as is the case with the CETME ammunition, this statement is no longer universally true . .

Mr Fagg then quotes from an article by NRA Staff writer E H Harrison titled "Projectile Stability" (*American Rifleman*, July, 1962), as follows:

". . After a qualitative description of the projectile's motion about its center of gravity, it is easier to follow a quantitative one.

The quantities we must consider are:

- *"A" = projectile's moment of inertia about its longitudinal axis . .*

The stability factor ["s"] is:

$$s = A^2N^2/4B\mu$$

- *"B" = moment of inertia about an axis through the center of gravity, perpendicular to the longitudinal axis . .*
- *"N" = spin . .*
- *"μ" = moment factor . .*

. . The moment factor expresses the tendency to overturning by the aerodynamic forces on the projectile . . In stable flight, the angle of yaw becomes and remains small.

The primary requirement for stability is that "s" be greater than one . ."

Mr Fagg continues:

[The above equation] expresses the stability factor "s" (an unknown) in terms of bullet, barrel, air and velocity characteristics . . The most important consideration for understanding the long, aluminum CETME bullet is an understanding of the meaning and the effect of "A" and "B" in the stability equation.

"A" and "B" are the "mass moments of inertia" of the bullet about two different axes. "A" is the mass moment of inertia of the bullet about a longitudinal axis through the center of gravity. The mass moment of inertia is a mathematical concept which allows quantitative evaluation

of the effect of both the quantity of matter in an object, and the distribution of that matter about some chosen axis. It is of particular interest in the study of bodies undergoing angular motion and/or acceleration. An intuitive understanding can be realized if one thinks of handling a long iron rod. If the rod is balanced on end, and rotated about an axis along its vertical center line, it is easily rotated. If, however, one holds this same rod horizontally, at the balancing point, and attempts to rotate it about an axis perpendicular to its length, it poses much more resistance to being rotated. This is because of the difference in the distribution of the mass about the two axes of rotation . . The numerical value of the moment of inertia is strongly dependent upon the distance of the matter from the axis chosen, and to a lesser extent upon the mass of the matter involved.

Within this definition, it is evident that if one considers two objects of identical form, one made of aluminum and one made of lead, the object made of lead will exhibit the larger moment of inertia about any axis common to both objects. In this case, the difference is purely due to the difference in the mass of the two objects. It is also clear that if the matter in an object is located in a manner which distributes that matter at a larger distance from the chosen axis, the moment of inertia will be larger than if the same matter is concentrated near the axis. As an example, think of the iron rod previously considered. When it is being rotated about a longitudinal axis, the matter is all close to the axis of rotation, and the moment of inertia is small. When it is being rotated about a transverse axis, much of the matter is at considerable distance from the axis of rotation, and the moment of inertia is much larger.

The same thinking may be carried one step further if one considers two dimensionally identical cylinders such that their length is equal to their diameter; one cylinder of aluminum, and one with an aluminum core surrounded by a copper ring or jacket around the circumference. The copper has a density about 3.3 times that of the aluminum. Not only is the copper jacket a heavy material, it is, at all points, a maximum distance from the longitudinal axis of the cylinder. When compared with the solid aluminum cylinder, this heavy ring or jacket markedly increases the moment of inertia of the composite cylinder about a longitudinal axis. On the other hand, if one imagines a transverse axis through the center of gravity of this same cylinder, and assesses the distribution of the copper ring or jacket with respect to this axis, it is seen that none of the copper is any further from this axis than it is from the longitudinal axis, and that most of the copper is nearer to the transverse axis than it is to the longitudinal axis. Therefore, the effect of the copper jacket on this transverse axis is not as great as on the longitudinal axis. There will be some length at which the increase in "B" would become larger than the increase in "A", but for relatively short cylinders, this would not be the case.

To increase the stability factor, it is not even necessary to increase the moment of inertia about the longitudinal axis more than about the transverse axis. In the expression for the stability factor, note that "A", the projectile's moment of inertia about its longitudinal axis, appears in the numerator and is squared. This means that increases in "A" will strongly increase the stability factor. Note also that "B", the projectile's moment of inertia about a transverse axis, an axis through the center of gravity perpendicular to the longitudinal axis, appears in the denominator, and is only to the first power. This indicates that increases in "B" will decrease the stability factor, but that the effect will not be as strong as the effect of increasing "A".

The CETME ammunition was based on a good understanding of these concepts, and a clear perception of the requirements of automatic fire. By constructing the bullet of aluminum, it is light enough to result in low recoil impulse, as required for effective automatic fire, and is, at the same time, long enough to allow a low drag shape. The latter is important in maintaining a reasonable effective range with light bullets. If, however, the bullet were of solid aluminum, it would exhibit a large "B" (moment of inertia about the transverse axis), and a correspondingly small "A" (moment of inertia about the longitudinal axis). A quick look at the stability equation reveals that this leads to a low stability factor. This problem was alleviated by placing a short band of gilding metal (about 90% copper) around the circumference of the bullet. This . . increases both "A" and "B". but the effect on "A" is much stronger than the effect on "B" [and is] sufficient to produce gyroscopic stability . .

The *Null-Serie* is Complete: the CETME Goes On Parade

Dipl-Ing Heynen continues, "Meanwhile, manufacture of the *Null-Serie* weapons had been completed, and, on April 1, 1954, for the first time, a group of infantry soldiers was allowed to carry the CETME *Sturmgewehr* in a victory parade."

The CETME at Aberdeen Proving Ground

Ludwig Vorgrimler introduces this important step for the CETME rifle up the ladder to the world's stage as follows:

> *. . General Vigón, who was friends with the American General Kissner, Commander of the US Military Mission, was offered a chance to have the CETME weapon tested free of charge in the US, and together with his adjutants supervised the tests, demonstrating his personal interest. In the summer of 1954 I also spent several weeks at Aberdeen Proving Ground, and witnessed the American tests.*

A trial of two *Null-Serie* CETME rifles was conducted by Ordnance Engineer L F Moore at Aberdeen Proving Ground from June 15 through July 6, 1954. The 52-page report on this trial, prepared as the Thirty-Eighth Report on Project TS2-2015, was dated August 5, 1954, and was originally classified as "Confidential".

Some interesting excerpts from this important document are as follows:

A Test of Two Spanish 7.92mm Assault Rifles

Object

To determine the characteristics of a Spanish 7.92mm assault rifle and special 7.92mm ammunition.

Summary

Two rifles [serial numbers 145 and 179] were subjected to examination, accuracy, endurance, extreme cold, rain and dust tests, and the ammunition was subjected to a time-of-flight test.

Discussion

A shoulder weapon using a special 7.92mm round has been designed and made in Spain. Two rifles and 4,000 rounds of ammunition were made available for test. It was desired to determine the performance characteristics of this weapon and ammunition . .

Description of Materiel

A. Rifle, Assault, 7.92mm, Spanish is a shoulder-fired weapon capable of either semiautomatic or automatic fire. A delayed-blow-back type of mechanism is employed. The rifle is equipped with a bipod, twenty and thirty-two round magazines, a flash suppressor, and metallic sights.

1. *The rifle appears to be comparatively inexpensive to manufacture. A number of stamped and welded parts are used. A considerable number of pins, many of which are peened to prevent disassembly, are employed. The manufacturing tolerances do not appear to be rigid.*
2. *A stamped receiver of 0.060-inch steel is attached to a machined block by welding. The block supports the barrel and it contains recesses to accommodate two rollers in the bolt assembly. A tube, which houses a forward projection on the bolt carrier assembly, is assembled to the top front of the receiver. The forward lower section of the receiver forms a magazine housing. A spring-loaded catch is located on the right side of the receiver, and is operated by a lever located on the left side behind the magazine. A grip frame, which houses the trigger housing group, is assembled to the receiver by means of a rivet at the front and two pins at the rear. The pins,*

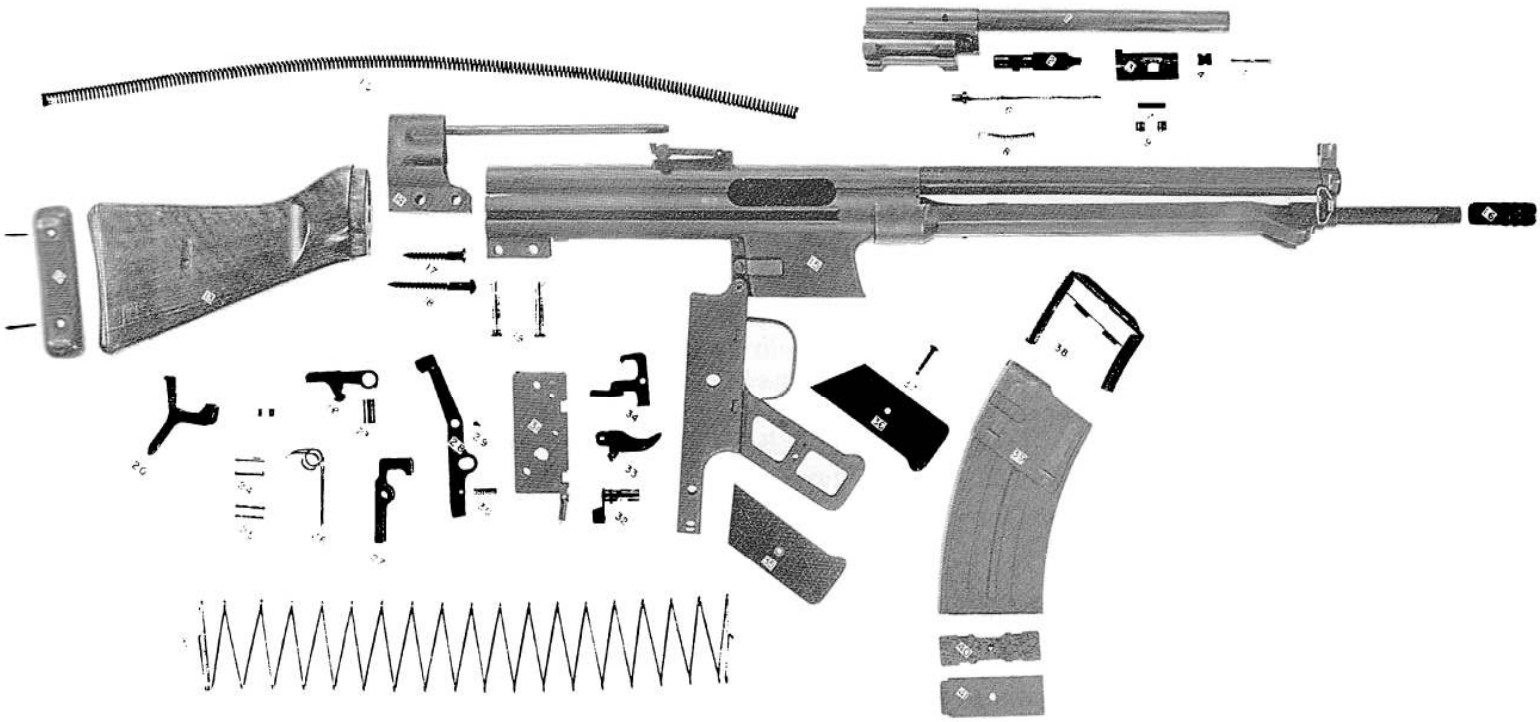
157. Left and right side views of one of the CETME *Null-serie* prototypes which were tested at Aberdeen Proving Ground from June 15 through July 6, 1954. As noted in the text, two such rifles, serial nos 145 and 179, "were subjected to examination, accuracy, endurance, extreme cold, rain and dust tests, and the ammunition was subjected to a time-of-flight test."

Note the accessory grenade launcher and sight, above left, and the two sizes of magazines, of 20 and 32 round capacity. APG photo no A99059 dated May 20, 1954, courtesy the late Ludwig Olson

which are held in assembly by springs assembled to the pins, also hold the stock group in assembly with the receiver.

3. *The barrel has a fluted chamber.*
4. *The rifle operates on a delayed-blow-back principle. The bolt is assembled to the bolt carrier and it is permitted to move longitudinally 0.25 inch independently of the bolt carrier. The bolt contains two rollers which, when the bolt is in its forward position, are forced outward into recesses in the locking ring by a cam attached to the bolt carrier. When a round is fired, the bolt is forced rearward. A cam surface on the locking ring forces the rollers inward against the cam which in turn is forced to the rear with the bolt carrier. The bolt carrier assembly weighs 1.52 pounds as compared with 0.25 pound for the bolt assembly. A large operating spring is employed. The spring is made of wire having a diameter of approximately 0.055 inch; it is about 23 inches in length, and it has an outside diameter of 0.45 inch. The spring is positioned within a tube, which is partially closed at the forward end and is assembled to the top of the bolt carrier. The tube protrudes forward from the bolt carrier a distance of 10.8 inches. A 0.315-inch diameter tube attached to the stock group serves as a guide for the spring. Indentations in each side of the receiver form guide rails on which the bolt group reciprocates.*

5. *The receiver is closed at the rear by the stock group. A short, wood, stock is assembled to a part, fabricated from sheet metal by stamping and welding, by two screws. The metal part fits over the rear of the receiver and is held in assembly by two pins which also retain the grip frame. A stamped, metal butt plate is assembled by two screws.*
6. *A rugged, claw-type extractor is employed. It is spring loaded and operates in grooves in the bolt.*
7. *The ejector is a part of the trigger housing group. It is pivoted on a pin and is spring loaded. It functions in a groove on the underside of the bolt.*
8. *The firing pin extends through the bolt carrier. A spring is used to force the firing pin against the rear of the bolt carrier.*
9. *The trigger housing group is held in assembly within the frame group by the change lever. The mechanism is designed to give semiautomatic fire from the closed-bolt position and automatic fire from the open-bolt position. When the change lever is rotated upward to a point marked "T" (for semiautomatic fire) the automatic sear is rotated downward and out of line with the bolt group. A groove in the change lever permits the hammer catch to rotate into position to engage the rear hammer hook when the trigger is at the rear. When the rifle is fired, the hammer is rotated to the rear by the bolt carrier and the rear hook engages the hammer catch. A disconnector serves as a safety device to prevent the hammer from falling when the bolt group is out of its forward position. When the trigger is released, the sear moves to the rear permitting the rear hammer hook to disengage from the hammer catch. The front hammer hook then engages the sear. With the bolt group in its forward position and a round in the chamber the rifle will then fire with a rearward movement of the trigger. If the change lever is rotated to a horizontal position and a point marked "S", the sear and hammer catch are locked preventing disengagement of the hammer. When the change lever is rotated downward to the position marked "R" (for automatic fire) the automatic sear is permitted to raise up to engage the bolt when it moves forward, and the hammer catch is rotated out of position to prevent its engagement with the hammer. When the trigger is moved to the rear, the automatic sear is moved downward permitting the bolt to go forward. When the bolt carrier reaches its forward position, it forces the disconnector downward disengaging it from the hammer. The hammer then rotates forward to contact the firing pin. The rifle will fire as long as there are rounds in the weapon and the trigger is held at the rear.*
10. *A retracting handle protrudes from the left side of the tube which contains a longitudinal cut to accommodate the handle. The handle is attached to a carrier located forward of the bolt carrier assembly. The handle can be used only for retracting the operating parts since it is not attached to them.*
11. *The rifle is equipped with a tapered, post, front sight which is threaded to a bracket on the barrel. The bracket also supports the front end of the tube. The post is eccentric with the threaded portion to permit windage as well as elevation adjustments for obtaining a sight zero. The rear sight is an open V notch on a spring-loaded leaf. Elevation adjustments are provided by means of a slide which operates between the leaf and a cam on the base. Graduations on the leaf marked from 2 to 10 are expected to represent the range in hundreds of meters. No windage adjustment is provided in the rear sight.*
12. *A flash suppressor is attached to the muzzle by means of threads. No lock is provided to prevent disassembly during firing.*
13. *Provisions are made for use of a carrying strap. A front sling swivel is attached to the right side of the bracket and an opening in the stock is provided to accommodate the sling.*
14. *A bipod having stamped, metal, legs is provided. The legs can be folded back against the barrel when not in use. A small amount of rotation of the bipod base on the barrel is permitted.*



158. Right side view of one of the two CETME rifles tested at Aberdeen Proving Gound in 1954, shown completely stripped. According to the test report, the CETME contained "99 parts, 11 coil springs and 8 flat springs".
courtesy the late Ludwig Olson

15. *Wood grips are attached to the grip frame by a single screw.*
16. *Two sizes of detachable magazines are provided. They are similar except for length. A convenient means for disassembly of the magazine is provided. A part containing a stud is attached to the lower end of the magazine spring. The stud fits into a hole in the base of the magazine. For disassembly, it is only necessary to depress the stud to disengage it from the base and withdraw the base from the magazine tube . .*

B. The round used in the Spanish assault rifle has a length of 2.95 inches. The bullet has a diameter of 0.324 inch and a length of 1.80 inch. The propellant has an irregular shape . .

Observations

1. *The rifle is easy to field strip. Because of this and the comparatively small number of parts in the rifle [99 parts, 11 coil springs and 8 flat springs], normal first-echelon maintenance can be performed quickly and conveniently. However, the trigger housing assembly is difficult to disassemble because of its complicated nature. Unless the rifle were subjected to adverse conditions, such as rain, dust or mud, there would be few occasions which would require the disassembly of this mechanism. There are five pins and four springs in this mechanism, not considering the change lever. The pins have a tendency to fall out during the disassembly or assembly and, when these operations are performed under field conditions, there is a possibility of losing parts. The springs are difficult to assemble and there is a possibility of damage to parts, especially if the assembly is performed by untrained personnel.*
2. *While the recoil of the rifle was light, several features made the rifle uncomfortable and inconvenient to fire:*

a. The stock is extremely short and poorly shaped. While the distance from the trigger to the butt is about average for military rifles, the length of the stock is short because the receiver extends to the rear for a considerable distance. A low line of sight is used and, therefore, there is insufficient space to accommodate the face of an individual of average, or greater than average, size . . . Also, the lack of a proper radius at the edges of the stock added to the discomfort of the shooter.

b. The operating devices are not located for convenient operation. The retracting handle is located so far forward that it is difficult for an individual of average size to reach it while in the prone position. The retracting handle was found to be difficult to operate, especially when the rifle was subjected to adverse conditions. All individuals employed in the accuracy tests injured their hands while operating the retracting handle. A considerable force is required to move the retracting handle to the rear because of the heavy operating spring and friction between the moving parts. Therefore, when this operation was performed quickly from the prone position, as in the rate-of-fire test, the individual's hand came in contact with the sharp edge of the receiver causing cuts which resulted in bleeding. The magazine catch was found to be difficult to operate. For the removal of a magazine from the rifle it was found necessary to use both hands while the rifle was supported on the ground or by other means. The magazines, and especially the 32-round magazines, were found to be difficult to assemble in the weapon because of the location of the magazine housing and the size of the magazine. The magazine is inserted into the weapon at a point which the shooter is unable to see while in the firing position. Therefore, the shooter must insert the magazine by feel or he must get out of his firing position, or he must rotate the weapon into a position which will permit him to see the opening in the receiver, which accommodates the magazine. The 32-round magazine is so long that it contacts the ground when firing from the prone position with bipod on uneven terrain or when firing at an elevation. This feature not only caused stoppages in the rate-of-aimed-fire test but it made control of the rifle more difficult. Because of the length and weight of the 32-round magazine it was difficult to withdraw from and assemble to the receiver when firing from the prone position.

c. While the bipod was found to be a desirable accessory for firing from the prone position, it lacked rigidity and adjustment for height. No lock is provided to prevent the legs from rotating to the rear. Therefore, the legs were not always in their foremost position during firing in the rate-of-aimed-fire test. While the height of the bipod was found to be satisfactory for the individuals employed and the conditions in this test, it would probably be more effective when employed by different individuals under various conditions if adjustments were incorporated for controlling the height of the barrel above the ground.

d. The rifle is not equipped with a forearm. The bipod folds against the barrel when not in use and occupies the space normally used by the forearm. Some difficulty was experienced when firing from the various positions in finding a satisfactory means for supporting the rifle. It was found that, when the rifle was held by the magazine, stoppages occurred. One individual burned his hand sufficiently to cause a blister when he contacted the barrel during the rate-of-aimed-fire test. The receiver and barrel become too hot to hold comfortably after firing about 50 shots in a short period of time . .

3. A large number of stoppages occurred in firing the two rifles submitted for test.

a. The most common stoppage was a failure to feed. When firing semiautomatically, this stoppage was generally caused by a deficiency of the magazine system. The magazine is held in the receiver by the catch which is located on

the right side of the magazine. The front of the magazine is not secured and, since the magazine has considerable mass, it tends to rotate about the catch when the rifle is fired. When the magazine is gripped by the firer it is also rotated about the catch. Should the magazine be rotated during the feeding operation, the front of the bullet is likely to stub against the rear of the locking ring in the receiver. This not only causes a failure to feed but it damages the round by deforming the bullet or by forcing the bullet back into the case. An attempt to feed this damaged round through the magazine would probably result in another failure to feed. Frequently this stoppage could be cleared by tapping the magazine into its foremost position. Should the round be forced partially or completely from the magazine and the retracting handle moved fully to the rear, another round will be forced forward and a stoppage will result which is difficult to clear. The magazine can be detached and the rounds forced through the cut which accommodates the magazine. A brief test was conducted to determine if a safety hazard exists when one round is in the chamber and another round is forced from the magazine against it. It was determined that no serious hazard exists since the bullet of the second round hit the base of the case rather than the primer of the first round. When firing automatically, the bolt group frequently caught on the hammer on the first round in a burst and feeding of the round was not accomplished.

b. *A number of failures to eject occurred. There were two causes for this failure. If the bolt carrier failed to travel to the rear sufficiently for the empty case to contact the ejector, the case was not ejected. This condition occurred in the adverse conditions test. The ejector jumped out of the groove in the bolt carrier during firing and a failure to eject occurred. Normally the cases were ejected from the right at about the four-o'clock position with a great deal of force. Many of the cases were ejected a distance of thirty feet.*
c. *It was necessary to withdraw one rifle [serial number 179] from the rain test because the trigger could not be moved to the rear to disengage the sear from the hammer. After the rifle had been removed from the rain test the hammer was modified by Mr Vorgrimler. A number of malfunctions then occurred in which two or more rounds were fired with one rearward movement of the trigger with the change lever set for semiautomatic fire.*
d. *No malfunction occurred which indicated a deficiency in the principle of operation.*

4. *While only one part breakage, which affected the operation of the rifle, occurred in firing 3,906 rounds in this test, a number of parts showed damage from firing.*

a. *It was not possible to disassemble the cam from the bolt carrier after firing a large number of rounds because the bolt carrier was deformed at the points of contact with the cam.*
b. *The hammer became deformed at the point of contact with the bolt carrier.*
c. *The stock plate was deformed in the rain test. The rifle was fired from a spring-loaded rest in this test and the recoil was not absorbed in the same manner as when firing from the shoulder.*
d. *All the magazines showed deformation at the top front as a result of movement of the magazine during firing.*
e. *The retracting handle assembly on each rifle failed to operate properly when the rifles were received. A spring-loaded plunger is provided which is intended to engage in a depression in the tube to retain the handle in its forward position. An increase in the deformation of the tube at its forward end was noted during this test . .*

5. *Several objectionable characteristics of the rifle were observed in the accuracy test.*

    a. *Because the bipod is attached to the barrel, the rifle has a different center of impact when firing prone with the bipod than when firing from a rest with the bipod folded against the barrel.*
    b. *The sights on this rifle were objectionable, especially to an individual trained in the use of an aperture rear sight. The effectiveness of these sights would depend greatly upon the individual. This was demonstrated in the rate-of-aimed-fire test in which one individual fired an average of 67 shots in a one-minute period obtaining 100 percent hits while the other two experienced riflemen employed in the test fired an average of 46 and 62 shots obtaining 57 and 84 percent hits . .*
    c. *Automatic fire was found to be less effective in the rate-of-aimed-fire test than semiautomatic fire because a smaller percentage of the shots fired automatically hit the target and because a larger number of stoppages occurred in automatic fire, making it impossible to fire as many rounds in a one-minute period. When firing automatically, it was not possible to aim during a burst because of the rapid movement of the rifle, smoke, dust, etc. Therefore, the only aimed shot is the first shot in each burst. The firing by Mr Vorgrimler at a range of 50 yards from the standing position demonstrated that this type of fire, even in very short bursts, would be much less effective from this position than when firing from the prone position. Furthermore, the length of the burst is important in evaluating automatic fire since the first shot in each burst is fired under the same conditions and in the same manner as one fired single shot or semiautomatically and, therefore, should not be considered an automatically fired shot.*
    d. *It was observed that in automatic fire the rifle frequently fires from the closed-bolt position. Whether the bolt stops in the open or closed positions at the end of a burst is dependent upon the time, with relation to the operating cycle of the rifle, that the firer releases the trigger. This feature may confuse the gunner because the rifle has a different weight of trigger pull when firing from the open-bolt position than when firing from the closed-bolt position.*

6. *The magazines were found to be inconvenient to load because of the pressure required to seat the round, the tendency of the rounds to move forward causing the bullet to catch on the top front of the magazine, and the sharp edges which caused injuries to the hands.*
7. *No provision was made for manually closing the bolt on this rifle. While a heavy operating spring is used and no difficulty is experienced in moving the bolt to its forward position under normal conditions, it would probably be desirable to close the bolt manually were the weapon exposed to some adverse conditions.*
8. *A considerable amount of fouling was observed in the mechanism after firing a large number of rounds . .*

Observers

- *Lt Col Fernando Gonzales Caminol*
- *Major Luis Wilhelmi Castillo*
- *Mr Ludwig Vorgrimler*

Interestingly, since this was an unofficial trial (i.e. a trial of a non-US developmental weapon), there were no Conclusions or Recommendations. However Ludwig Vorgrimler, whose account must of course be considered somewhat prejudiced, concluded that the Aberdeen trial was an outstanding success for the CETME rifle:

> *. . Our four [sic] weapons passed all tests, especially the cold, rain and mud tests, with sensational*

results. We could still find empty shells of the British EM-2 weapons and the Belgian FN rifle which had failed these tests miserably a few weeks earlier, as well as the American T47 test weapon.

Dipl-Ing Heynen also recorded his recollections of the Aberdeen trial and its immediate aftermath as being very positive for the CETME rifle, as follows:

. . An additional three [sic] weapons, meanwhile, were sent for testing to the Aberdeen Proving Ground in America. There . . the weapons were exposed to extremely rigourous tests, including proper functioning of the normal, oiled weapon, function trials after the weapon had been totally degreased with gasoline, then dust, sand, mud, rain and cold trials, and so forth. In all this, precision and sturdiness were tested. The result was a great success; the engineers being told that not one of the weapons previously tested at Aberdeen had turned in such positive results as the CETME.

Following this, the same engineers demonstrated the CETME in Portugal from July 18 - 22, where the results were substantially the same. All this led to recognition of the CETME weapon, although we had to allow for a certain skeptical reception of the "light" [7.92x41mm] ammunition.

*Not surprisingly the United States, despite the astounding success of the CETME weapon, decided against its adoption, for at the same time similar weapons were being developed at Springfield [Armory]. It was known that, since the beginning of 1954, a new American rifle called the T44 was being compared with the Belgian FN rifle. One of these, apparently, was slated to become the new international standard weapon, to replace the Thompson .45 SMG, [the M1 carbine], the Garand .30 calibre semi-automatic rifle and the Browning BAR: according to newspaper reports of the day (*New York Times *February 4, 1954), the new FN rifle was favoured.*

The *Null-Serie* Completed - Plans for Production

Ludwig Vorgrimler's account continues as follows:

. . Meanwhile the Null-Serie *had been completed and weapons were shipped regularly to Spanish troops for testing. All reports received were positive, so that Spain decided to start producing the weapon. For this reason they ordered stamping tools for mass production from the Württemberg Metallwarenfabrik (WMF) in Geisslingen. Duplicates of these tools were later purchased by Heckler & Koch, along with the presses, and shipped to Oberndorf.*

Chapter Eleven

A Fateful Fork in the Road

Introducing Heckler & Koch

In 1948, two ex-Mauser employees, Edmund Heckler, formerly an *Abteilungsleiter*, and Theodor Koch, formerly a *Werkmeister*—neither with any engineering titles—founded the *Ingenieurburo* Heckler, with an office located in Heckler's home, on the second floor of the house of a printer, Herr Diefel, at Haupstrasse 8 in Oberndorf.

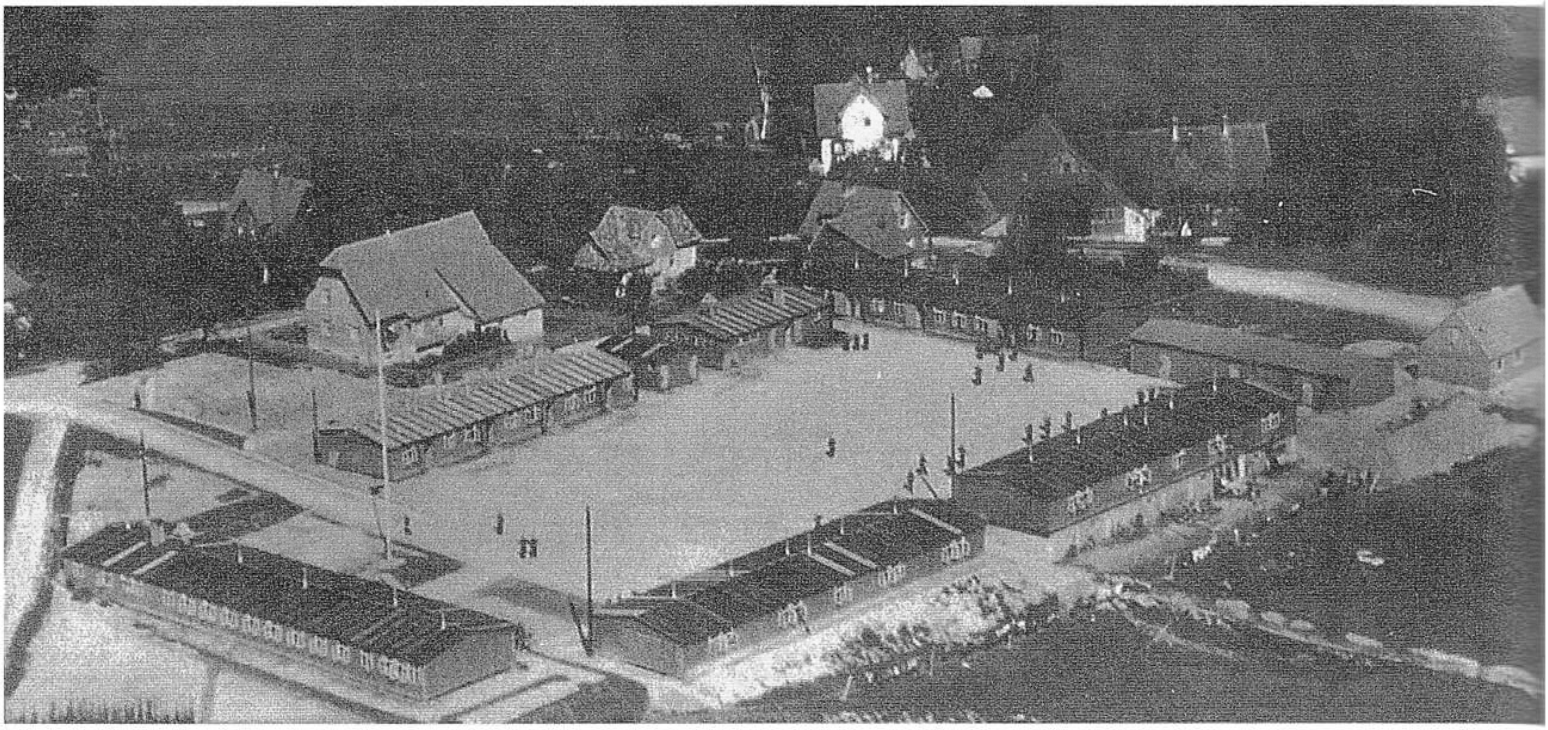
In 1949 Alex Seidel, an ex-Mauser engineer from Altenburger's Department 37, the *Konstruktion und Werkstatt für leichte Militärwaffen* (Design and Production of Light Military Weapons), became a junior partner in the new firm, and as such his name was not included in the official company name. Herr Seidel was initially allotted office space in the attic of the same house. During the war Seidel had been in charge of pistol construction, and had, at Ott von Lossnitzer's request, designed the double-action Mauser HSc pistol as a direct competitor to the Walther PPK. The firm of Heckler & Koch GmbH was incorporated in the Commercial Register on December 28, 1949.

Alex Seidel, in a speech given to a visiting ARRADCOM delegation to Heckler & Koch GmbH in Oberndorf on January 8, 1979, by which time the company was employing more than 2,000 workers, made the following comments about the inception of H&K:

. . Heckler & Koch was founded in its present form of a GmbH [limited company] in 1949 with a capital that consisted of no more—but also no less—than a good portion of self-assurance . . The workshop of the new company was situated in the first aid room of a previous air raid shelter of the city of Oberndorf. Administration and a so-called R & D office with one member each were established in the home of our late co-founder, Mr Heckler.

159. A view of the house of Herr Diefel, a printer, located at Haupstrasse 8 in Oberndorf (to right of fountain). In 1948 Edmund Heckler and Theodor Koch founded the *Ingenieurburo* Heckler with an office located in Heckler's home on the second floor of this house.
courtesy Walter Schmid

. . Our efforts to reintegrate the numerous skilled labourers from the Oberndorf region dictated a production line which required the employment of highly qualified experts. Experts, by the



160. A view of the Reich Labour Service barracks at Lindenhof, taken in 1936.
In 1950 these buildings, located in an Oberndorf suburb, were leased and used as the first manufacturing facility for the fledgling firm Heckler & Koch.
courtesy Walter Schmid

way, whose personal experience and skills were known to each founder of the company.

[This] facilitated the determination of products, since, at that time, there was a gap for every quality product of the metal industry.

Thus we started with:

- *mass production of high-quality pieces and assembly groups for household and industrial sewing machines, whereby we acted as sub-contractors for German and foreign sewing machine manufacturers*
- *production of special tooling (tools, fixtures and gauges) for office machines, radio manufacturers and other high precision industries;*
- *design and production of a milling machine for our own use and sale.*

In 1951 we left our air raid shelter and . . moved into some barracks which were left over from the war. Out of these barracks, three are still in use . .

Walter Schmid, in a letter to the author, confirmed that "as manufacturing grew, several barracks of the former Reich Labour Service at Lindenhof were leased."

The Postwar Arms Production Moratorium in Germany

Except for production authorised and supervised by the occupying Allied powers, absolutely no weapons development—in fact, no metalworking of any kind—was allowed on the premises of former weapons factories such as Mauser. As the manager for international co-ordination at H&K, retired *Bundeswehr* Major Volker Kurtz, exclaimed to the author, "You couldn't shoe a horse in Oberndorf right after the war!"

Breaking the Silence

Gradually, these tight restrictions were eased. In his ARRADCOM speech, Alex Seidel recalled that H&K received their first arms-related contract from SIG in Switzerland during 1953 - 1954, for various pistol and machine gun gauges.

The 10,000-man German Border Guard (*Bundesgrenzschutz*) was organised in 1951 as the first federal police force in postwar Germany and one of the first units in the German Federal Republic to be allowed to bear arms since the end of WWII. The *Bundesgrenzschutz* arsenal initially included WWII-vintage K98ks and a quantity of surplus MG42s purchased from Denmark. With fully-automatic arms and mortars, the BGS was more heavily armed than the various state police units.

In his ARRADCOM speech, Alex Seidel continued the story as follows:

. . Shortly afterwards we received an order from the German Border Guard for the production of a blank cartridge attachment to be used with their old MG42. At the same time we got a redesign contract for that machine gun.

On the occasion of the function-testing of these guns, shots were heard again in Oberndorf and thus the spell was broken . . that had crippled Oberndorf's true professional capacity, which is the design and production of small-calibre infantry weapons.

Pipedreams of the *Bundesgrenzschutz* (BGS)

Initial BGS Trials of Two *Null-Serie* CETMEs

Dipl-Ing Heynen takes up the story of how the BGS, which always wore German WWII-style helmets and was to "call the shots" regarding the conduct of the CETME programme within Germany until 1955, first encountered the CETME rifle:

. . The acquisition department of the sole unit in the German Federal Republic then allowed to bear arms, the Bundesgrenzschutz *or Border Guards, was connected to Spain mostly through contracts regarding the delivery of munitions and other things.*

This is how the German Border Guard Command officially discovered the development of the CETME assault rifle. The Chief of the AEM, General Don Juan Vigón, not only allowed a thorough exchange of information, but received the representative of the Border Guard Command, and suggested a co-operative effort.

On April 27, 1953 the German Border Guard, together with the Spanish Ministry of Economy and the administrative department [the "Amt Blank"*, which later became the West German Defence Ministry], first met officially. It was immediately apparent that all concerned had great interest in the CETME weapon. At this meeting it was first discovered that the Germans, due to the wishes of the Americans, had had to change to the 7.62mm calibre for infantry weapons.*

After a thorough proving of about 100 of [the Null-Serie*] weapons, two were chosen to be handed over to the German Border Guard . . so that they, through exact testing, could be convinced of the useability of the weapon and its precise functioning, low weight, and simplicity of production. CETME received an accurate report of these tests in October, 1953, the trials weapons being left with the German Border Guard for further testing into 1954.*

A Mistaken Path: the CETME in 7.62x41mm

At this point a well-intentioned mistake was made which caused some delay. For some time after the inception of the Voss cartridge, the Spanish authorities had not been party to the details of the US developmental "T65" cartridge programme. The BGS had mentioned that the Americans were insisting on 7.62mm calibre, but had not bothered to relay the fact that the US cartridge case was 51mm in length. Dr Voss and his collaborators accordingly necked down the existing 7.9x41mm Voss cartridge to develop the 7.62x41mm Model 53 cartridge, fitted with a half-jacketed aluminum bullet 46mm long, weighing 7g (108 gr), which was also manufactured by Fabrica Nacional de Palencia.

Ludwig Vorgrimler continues the story as follows:

. . Meanwhile others had noticed the CETME rifle, and the weapons were displayed and tested in Portugal, Sweden, France, the Netherlands, Italy, Austria, Ecuador, Brazil, Chile and by the Border Guard of the Federal Republic of Germany.

Up to that time the weapon was still shooting the medium calibre 7.92x41mm cartridge which had been developed in Spain. However the Ameri-

cans suggested that this cartridge be reworked to 7.62mm calibre. This [7.62x41mm] ammunition gained international acclaim, especially as far as trajectory flatness was concerned—at 600 metres it was suitable fror NATO requirements (1m trajectory increase), and even at 1,100 metres it still penetrated all well-known military helmets, even though the bullet interior was made of light metal.

The First General Demonstration of the CETME Rifle in Germany

Dipl-Ing Heynen's account continues as follows:

. . This so-called "light" ammunition was demonstrated in December 1953, at the first general showing of the CETME Sturmgewehr *in Germany. Interestingly however we did not come to the introduction of this ammunition, because at that time the dominant opinion was that no weapon would be acceptable unless it was chambered for the standard NATO ammunition. Thus the calibre had to be reduced to 7.62mm, to conform with the NATO cartridge "T65" . .*

A request from Bonn for a demonstration there was answered in the affirmative, and the desired demonstrations took place in front of a large circle of experts on December 17 and 18, 1953. The weapon created very strong interest and remarkable respect, particularly with regard to its mild recoil, its outstanding shooting precision and simplicity of construction. The naked aluminum core of the original CETME bullet met with considerable opposition – it was claimed that it would blow apart in the human body, and therefore contravene international agreements (the Petersburg agreement and the Hague Convention). A full metal jacket was demanded, in calibre 7.62mm, in exchange for which the effective range requirement was reduced to only 600 metres.

Developments along this line within a cartridge case conforming to the American dimensions were executed by CETME with the resulting ammunition being dubbed "Police ammunition", and out of this, in time, the NATO-CETME "light" ammunition was developed.

Making the H&K Connection—by the Merest of Chances

By early 1954, German interest in the CETME rifle had prompted the Spanish to begin looking for a suitable German firm with which a co-production agreement might be reached. The Spanish military had traditionally respected the Mauser name, and Spain had indeed manufactured and used Mauser bolt-action rifles for well over half a century, so a visit to the Mauser offices, located next to the old monastery building in Oberndorf, was logically their first stop.

The late Henk Visser, then the director of the Dutch arms firm NWM, who enters the story very significantly a little later on, recalled in a taped interview with the author that a delegation consisting of General Caltero and Major Wilhelmi was received by Dr Dr Dörge, one of the ex-wartime directors who was now in charge of what little remained of the Mauser empire. Once seated in large leather chairs across from Dörge's desk, the officers explained that the Spanish had developed the CETME rifle, based on the half-locked roller action brought to Spain by Ludwig Vorgrimler, and that its success on the world stage now seemed, if not immediately within their grasp, certainly a distinct possibility. They went on to say that they would like to present the design package to Mauser as a token of their esteem, as long as Mauser would take up and underwrite the necessary production-engineering development. This, they intimated, would be a golden opportunity for Mauser to become the pre-eminent manufacturer of a modern weapon design of considerable merit, and thus to regain some of its former glory. Laughing uproariously, Dr Dr Dörge dismissed the Spanish delegation, and their offer, out of hand.

Not surprisingly the Spanish were deeply insulted by this, and proceeded to another destination, also conveniently located in Oberndorf—the fledgling facilities of Heckler & Koch.

Establishing the CETME - H&K Co-Production Agreement

The upshot of Dr Dr Dörge's exceedingly ill-conceived rejection of the Spanish request was that H&K were officially invited by the Spanish government to prepare and manufacture the CETME rifle.

In his ARRADCOM speech, excerpted initially above, Alex Seidel corroborated the timing of the first contact between CETME and H&K as follows:

. . During [1954] we also established first contacts with INI-CETME in Madrid, Spain.

There a group of "frozen" German weapon designers, led by a former colleague of the H&K founders, had developed the so-called CETME assault rifle based on a German design from 1945 . .

Early Changes to the CETME *Null-Serie* Model

Werner Heynen's account continues as follows, first recounting the continued favourable results of troop trials in Spain, and then picking up the story of the increasing German involvement in the CETME programme:

. . In May, 1954, 50 weapons were delivered to the Escuela de Aplicación y Tiro de Infanterie *for combat tactical trials. At this time the first printed brochures in German, English and Spanish were made generally available, to facilitate familiarisation with the weapon. Also in May, 1954, the weapon was demonstrated to the President of the Dominican Republic . .*

The trials and the various demonstrations continued consistently, and last but not least the Commission which the War Ministry had named, under the guidance of the EMC, recommended (at almost all demonstrations the same, by the way) the need to adopt certain changes (20-round magazine; new magazine release; new cocking tube and lever; new trigger; new method of attachment of the sights; longer buttstock, and so on). All these changes had first to be incorporated into the drawings, and afterward a weapon built to the modified drawings came to trial, and was found satisfactory. It was then, on October 15, 1954, given as a present to the Caudillo *[Franco].*

. . At the end of October, 1954, representatives of the German Border Guard visited CETME to discuss all the questions that had arisen out of the trials of the two prototypes that remained in Bonn.

The Border Guard's intention was to order 150 weapons for trials by its own troops, once the few specified modifications to the design could be made. A new demonstration was consequently agreed upon, which took place from January 17 to 23, 1955 in Bonn. Here also the calibre 7.62mm light-core ammunition was demonstrated, and another weapon, useable with standard T65 ammunition.

In a letter to the Chief of the AEM, the German Federal Minister asked for information about the timetable for the introduction of the weapon in Spain: had such been drawn up; and could the 150 weapons for the Border Guard troop trials be taken from serial production of the weapon intended for Spanish troops? In his reply, the Chief of the AEM reported that the Spanish Ministries for Air and Marine Defence had not yet made a final decision to adopt the CETME, and so serial production had not as yet begun. In this letter, interestingly, it was also mentioned that, although the presented CETME "light" ammunition was considered "insurpassable", a new ammunition was being developed, according to a request from above, that would be interchangeable in the same weapon with the standard US loading of the T65, notwithstanding that such ammunition defeated the purpose of the assault rifle concept.

From January 17 - 23, 1955 the trial took place before a considerable number of experts, among them German Generals Schneider, Henrici and Kittel, the Vice-Chief of the AEM and the Spanish Ambassador, wherein the CETME weapon was tested in comparison with other weapons (FN). At this demonstration, representatives of the firm Heckler & Koch took part. It was the intention of the German Border Guard and the Ministry of Economy that this firm be considered for possible production of the weapon in Germany, and to this end H&K had been in contact with CETME since April of 1954, regarding preparations for modern production in Germany.

The official trials report stated that the performance of the CETME weapon could not possibly have been better. It was the first demonstration of its kind for Spain, executed as it was against foreign competition, and while the competing firm, FN, had great experience, an impeccable reputation and the psychological advantage in this field, the results were nevertheless surprising, particularly with regard to production technique—the simplicity of producing the weapon, its accuracy, and all its other advantages. The report was very much in favour of the CETME weapon: it was a success for Spain.

The [aluminum core] CETME ammunition, however, did not gain any converts. While the theoretical data had to be accepted as outstanding, the aforementioned problems were still in evidence, and, as said, there was no applause.

The overall judgement was that the CETME rifle came closest to German demands for a weapon,

except for its ammunition. For the future, the following changes were demanded:

For the weapon:

- *the bipod must be made stronger;*
- *the magazine should have at most 25 rounds (up to then the longer magazine had held 32 rounds);*
- *a different sight system (the rear sight closer to the shooter and configured as a 'U' shape and not a 'V'), and a post front sight;*
- *no muzzle brake was desired for use with the T65 ammunition.*

For the ammunition:

- *calibre 7.62mm, conforming to the external measurements of the NATO cartridge;*
- *a shortened bullet;*
- *recoil as with the old German* kurz *cartridge;*
- *the bullet was to be ballistically improved, with a full-patch (closed) jacket;*
- *necessary effective range only 600 metres.*

Concerns about the 7.62x51mm NATO Cartridge

Ludwig Vorgrimler remembered the historic first visit of German officials to Madrid to discuss armament for the new West German Federal Army (the *Bundeswehr*), as follows:

> *. . In January, 1955 German officials came to Madrid for the first time, led by Ministry Director* Dipl Ing *Bohlan, to discuss delivery of 40 CETME rifles to the German* Bundeswehr *for troop trials. The German committee rejected the Spanish 7.62x41mm cartridge with an impulse of 0.74kg [1.63 lbs] like old German 7.92x33mm assault rifle cartridge, and requested the 7.62x51mm so-called NATO cartridge, recently adopted in Ottawa, Canada, with an impulse of 1.16kg [2.56 lbs], which was barely 10% less than the old German 7.92x57mm infantry cartridge, or other infantry cartridges of the world. Our objections against such a strong cartridge used with such a light weapon, which during burst fire could not be held well enough to fire accurately, were understood by all participants, but Germany being the newest NATO member was not allowed any extra decisions at that time and had to accept the NATO cartridge . .*
>
> *By making a simple change and because of the adaptability of the semi-rigid roller breech mechanism, I was able to convert the weapon for other ammunition by altering the guide piece, and within three weeks after the visit I was able to fire a 6,000-round test with the .308 Winchester cartridge, which resulted from and is [dimensionally] identical to the NATO cartridge. For this ammunition the weapon needed a breech mechanism buffer, something not necessary for the Spanish medium cartridge, where the breech mechanism deadlocks on the main spring, making it a smoother shooting weapon . .*

An Inside View of a Not-So-Simple Conversion

Even when reading between the lines of both the Heynen and Vorgrimler accounts, the extent of the problems encountered in converting the relatively fragile stamped-receiver CETME to fire the much more powerful 7.62mm NATO cartridge are not so obvious. The late Henk Visser, then the director of the Dutch arms firm NWM, explained this issue to the author in more detail, as follows.

Vorgrimler had argued that in addition to redesigning the bolt, the receiver should be made longer to accommodate the more powerful recoil thrust of the NATO cartridge, and he had pleaded for the extra time and funding this major redesign would have required. As the head of the CETME programme, *Dipl-Ing* Heynen realised that the newly-aroused *Bundeswehr* interest was a golden opportunity with fantastic potential, but in order to even be in the running, the CETME had to be demonstrably able to fire the NATO cartridge as quickly as possible. He therefore ordered that the changeover had to be made within the basic parameters of the original rifle.

The initial result, when firing the full-power version of the NATO cartridge in a converted *Null-Serie* CETME, was that the thin carbon steel of the stamped receiver soon developed cracks, and the rollers themselves were quickly crushed. The life of the rifle was estimated at only a few hundred rounds.

Developing the Face-Saving "CETME-NATO" Cartridge

161. The base of an original 7.92x41mm Voss cartridge, showing the headstamp reading "FNP 7.92 - 953", indicating manufacture at *Fábrica Nacional de Palencia* in 1953.
author's collection

A history of the development of the CETME rifle titled *Fusiles de Asalto CETME*, produced by the *Cia de Estudios Tecnicos de Materiales Especiales* in Madrid, describes the rationale behind the lesser-powered CETME-NATO cartridge as follows:

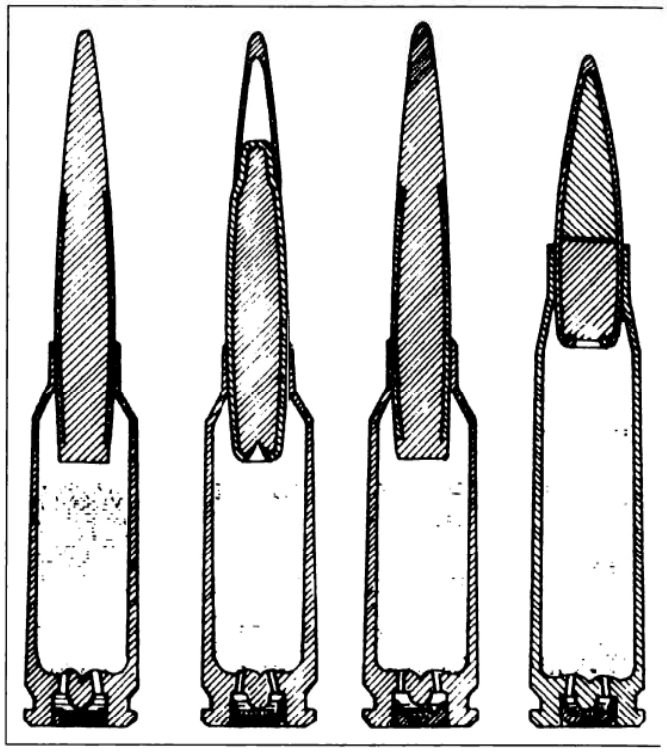
. . . When the NATO nations decided on standardising their rifle-calibre cartridge and the choice became known as the "Cartridge 7,62x51mm NATO", it was also decided that the CETME rifle should fire this ammunition. However, there were grave considerations concerning its excessive muzzle energy and high recoil impulse. Accordingly CETME designed a new 7.62x51mm version called the "CETME-NATO" cartridge, which matched the external dimensions of the NATO round and functioned exactly the same in automatic rifle actions, but was fitted with a special bullet of CETME design, the CSP-003, with a plastic/lead core which reduced its weight. The combination of the lighter bullet and a somewhat reduced powder charge produced a lower muzzle velocity, but did not appreciably affect the other ballistic characteristics of the full-power NATO cartridge.

162. An actual-size comparison of four Spanish CETME cartridges.
Left: the original long-bulleted 7.92x41mm round, developed by Dr Voss in response to the requirements set for a 1,000-metre lightweight assault rifle.
Second from left: the short-lived 7.62x41mm "mistaken path".
Second from right: an even shorter-lived attempt to maintain the long-range characteristics of the Voss projectile in the 7.62x51mm NATO case.
Right: the face-saving 7.62x51mm "CETME-NATO" round. courtesy William Woodin, Woodin Laboratory

An Interesting Ballistic Comparison

The ballistics of the initial CETME-NATO cartridge, termed the CSP-003, was the subject of a detailed comparison against the FN SS-77 7.62x51mm NATO loading, which was recorded in the Spanish history *Fusiles de Asalto CETME*. The plastic/lead-cored CSP-003 bullet weighed 7.3g (112.6 grains), while the SS-77 bullet weighed 9.3g (143.5 grains).

Interestingly, the following comparative table of remaining velocities and residual energies of the two projectiles, in 100-metre increments from the muzzle to 1,000 metres, shows much less deviation in the velocity measurements than in the residual energies at short ranges, and as the range increases the difference between both performance parameters becomes increasingly negligible:



163 (right). Sectioned views of four Spanish CETME cartridges.

Left: the original 7.92x41mm CA-001 of 1953, loaded with a naked aluminum projectile with a partial copper sleeve, weighing 7g (108 grains).

Second from left: the 7.92x41mm CAP-001, redesigned projectile with lead-antimony core and aluminum ogive with full copper jacket, weighing 13g (200.6 grains).

Second from right: the7.62x41mm CA-002, of 1953 - 1956, loaded with a naked aluminum projectile with a partial copper sleeve.

Right: the 7.62x51mm CSP-003 CETME-NATO (1957 - 1958), projectile with plastic-over-lead core and full copper jacket, weighing 7.3 g (112.6 grains).

from *Fusiles de Asalto CETME*

Distance	CSP-003 Remaining Velocity (m/s)	SS-77 Remaining Velocity (m/s)	CSP-003 Residual Energy (kg)	SS77 Residual Energy (kg)
0	760	770	214	281
100	688	698	176	231
200	618	628	142	187
300	551	560	113	149
400	487	495	88	116
500	426	437	68	90
600	370	385	51	70
700	330	340	40	55
800	303	307	34	45
900	285	287	30	39
1,000	272	271	27	35

The 7.62mm NATO Calibre CETME Model A

Dipl-Ing Heynen's account continues as follows:

. . In March, 1955, the German Ministry for Internal Affairs thanked CETME for the successful demonstration, and wished it great success with the further development of the ammunition. On this basis further contacts were maintained in various sustained-fire tests to test durability, in order to allow the production of a new set of blueprints. The intended changes were worked into the existing weapons of the Null-Serie, *and, as a result, the changeover to the 7.62mm calibre was also expected for Spain.*

Naturally there was a need to maintain contact with the [BGS] offices in Bonn, and for that we used the services of SIDEM International in Bonn as a mediator. The Bonn officials, however, did not consider the inclusion of a mediator necessary, and retained the existing personal contact.

164. Left side view of the CETME Model A, marked on the magazine well "FA CETME/A-585", shown with bipod covered.

Compare with fig 157: note the redesigned magazine well and 20-round magazine, the carrying handle folded down on the right side, and the thick rubber buttplate.
courtesy the late Dr Edward C Ezell

The CETME Model A in the Second *Bundesgrenzschutz* Trial

Dipl-Ing Heynen's account continues with a description of the events surrounding the second BGS trial, which marked the first appearance of the redesigned CETME Model A, chambered for the 7.62mm NATO cartridge:

> . . . *In April, 1955 the German Federal Ministry of Internal Affairs asked whether a larger number of weapons, including the necessary ammunition, could be delivered within the same year, and for what price. While we told them in May that we saw no possibility of filling such an order, a modified weapon, suitable for use with the T65 as well as the NATO-CETME "light" ammunition, was demonstrated on June 1, 1955 in Bonn. Again the results were very good, and it was determined in writing that the demands of January were all filled and an enlarged order for 250 weapons for troop trials was given.*
>
> *Due to a fundamental decision of the AEM the relations with Bonn were very much in the foreground, despite the interest of several other foreign countries in the CETME weapon. There were repeated conversations among various Commissions from Spain with the German Border Guard, the "*Amt Blank*" and the Ministry of the Economy. These seemingly endless discussions can only be understood within the then-existing context of the rearmament of the* Bundeswehr, *the forces of the German Federal Republic, wherein was much talk of delivery times and terms, quantities and price, as well as the possibilities of production in Spain and Germany.*
>
> *Following the demonstration of the weapon to the German Border Guard on June 1, 1955 in Bonn, the same weapons were introduced to the Border Guards in Sweden, with great success. In France, through the urging of the firm Manurhin, a similar demonstration was held in the fall of 1955 and again, in accordance with the wishes of the military attachés, also in front of an Italian Commission. By this time articles about the CETME weapon were being featured in various gun publications, which helped to compensate for many bitter disappointments and gave us courage to persevere.*

Dr-Ing Gunther Voss Makes A Case for the CETME-NATO Cartridge

In a letter to Colonel Büscher of the Federal Department of the Interior dated June 11, 1955, *Dr-Ing* Gunther Voss, writing from Madrid, commented on the June 1 trial mentioned above and offered a rather lengthy justification for the CETME-NATO cartridge.

This interesting and informative letter is excerpted as follows, in a translation by Dieter Handrich:

Re: The CETME Assault Rifle

Dear Colonel!

During the demonstration of our assault rifle on the 1st of the present month there was unfortunately no more time for a discussion regarding the ammunition. At least I was able to represent the benchmark figures and tactical possibilities of this new ammunition to Col Bohlan and Lt Col Reinhardt in a brief outline. Since these questions are of interest for you too I would like to summarise my thoughts even if they constitute a repetition of that which I reported to you on December 12, 1953 and January 17, 1955.

The assault rifle ammunition we demonstrated on June 1, 1955 did not satisfy you a hundred percent, as Mr Heynen noted. Only the demands regarding the outer shape of the cartridge, which correspond to that of the NATO T65 cartridge, and the recoil impulse, which is not higher than 0.75kg/sec, were met. In addition, this ammunition seems to have quite good precision. Until now we have not fired too many rounds of this ammunition, although the few existing dispersion patterns are quite satisfactory. For example, at a firing distance of 600m the radius of the 50% dispersion pattern was only 28cm [11"]. A smaller dispersion pattern is hard to achieve with assault rifle ammunition . . As to the demands for a low ballistic trajectory, at a firing distance of 600 metres and a target height of 1m, the area sprayed with fire is only 65 to 70m instead of the demanded 80 to 100m. This is quite remarkable performance for an assault rifle. Nevertheless, I don't consider it impossible that this performance can be improved by a more aerodynamic bullet. However, we must be aware that a lower ballistic trajectory brings with it other disadvantages, such as the deterioration of the dispersion pattern, i.e. an increase of the ammunition-related dispersion. A good stability of flight and a sufficient decrease of the precision- and nutation motions are harder to achieve with a ballistically high-grade ogival bullet with a conical boat tail than with a short bullet with an inferior outer shape. Therefore, ballistically high-grade bullets have a poorer precision than regular bullets. This is the reason why the artillery, if hitting the target is more important than a high firing range, renounces the use of ballistically high-grade shells. In Germany as well as in other countries this applies especially to the Navy, where shells with a conical boat tail were very seldom accepted.

The question, if in this case the assault rifle should have better precision or better low ballistic trajectory, must be decided by the tacticians. I personally would always prefer a better low ballistic trajectory in favour of better dispersion with reference to the assault rifle . .

In the case of an assault rifle, the same principle applies as it does for the Navy; namely: "hits go before range". Nevertheless, in our case the circumstances are completely different compared to the fire of heavy Naval artillery where the target range is always measured exactly and meteorological conditions are determined and eliminated correspondingly.

When firing a rifle such target correction data are not available. In this case one can only try to reduce the aiming errors caused by meteorological influences and range estimation errors by a ballistic trajectory as low as possible, even at the expense of reducing the hit probability somewhat. Low ballistic trajectory would increase the hit probability achievable in a real firefight considerably, so that the resulting minor deterioration of the dispersion can be accepted without demur. In case of the above mentioned firing at a range of 600m, the 50% dispersion in height was 35cm. This is 0.6 mil in relation to the range. If one wants to determine the angle of elevation with the same precision of 0.6 mil, the target range must be determined exactly, to be accurate with a deviation of not more than 20m. An alteration of the angle of elevation by 0.6 mil would result at this firing range in a change of distance of 20m. However, the rear sight is graduated in 100m increments, which means that the imprecision of the sighting equipment causes aiming errors which are five times higher than the ammunition-related dispersion. The aiming errors resulting from the wrongly estimated range must be added, which are at least as high as the errors resulting from the imprecision of the rear sight

setting. Still more unfavourable are the conditions in regard to the determination of meteorological influences, which are even harder to estimate than the target range.

I want to refer to that which I brought forward regarding the former German assault rifle on January 17 of the present year. At a firing range of 800m and a crosswind of 5.0m/sec, the bullet had a deflection of 6m. Compared to the ammunition-related deflection, this is more by the power of ten. Therefore, if one wants to increase the accuracy of an assault rifle - and thus its combat effectiveness - one must concentrate on improving the aiming-related parameters. But an increase of these parameters would inevitably result in aiming methods that are applied in artillery firing and which require procedures and equipment that may be acceptable for heavy machine guns, but not for assault rifles. For the time being, the only possible way to increase the precision of assault rifles is by an improved low ballistic trajectory. At present this is a subject ignored to a great extent. The reason for this is that the assault rifle idea is not yet accepted, and with rifles firing a full-power cartridge an improved low ballistic trajectory is not as important as it is for an assault rifle, for two reasons:

1. *the low ballistic trajectory to be achieved with a full-power cartridge is already considerably better than that of an assault rifle cartridge, and*
2. *because the effective range of a rifle with a high muzzle performance is considerably less than that of an assault rifle with a low muzzle performance.*

At the first glance no 2 sounds absurd, but it is a reality that can be proven simply. With a rifle one can fire at distances up to 500m, although the energy of the sS cartridge and that of the T65 NATO cartridge is sufficient to cause lethal injuries at distances of some thousand metres. Thus, the criterion for the effective range of a rifle is the rapidly decreasing hit probability with increasing firing range. At a distance of 500m, a good gunner can hit a man standing erect with one shot with a probability of 50%. At 1,000m he can expect not more than a 10% hit probability, which means that he will fail to hit the target with a probability of 90%. But if the gunner misses the target the enemy fired at will take cover, so that the following shots will have no effect as well. Continued firing would have a moral effect only, and would result in nothing else but a waste of ammunition. The reaction time that the enemy fired at needs to take cover is assumed by the Americans to be five-eighths of a second, while the Spaniards assume it to be more than two seconds. Thus, in any case the reaction time will be shorter than the period of time a gunner needs to fire the second shot. Captain Albert, for example, needed 50 seconds to fire 20 rounds of NATO ammunition at the demonstration on the 1st of the present month, which is an average time of 2.5 seconds for each shot.

Regarding the assault rifle, the situation is completely different if sustained fire is applied. If for example the gunner fires a burst of 10 rounds at an enemy 1,000m away, there would be for each shot a hit probability of w = 7%, which means that . . a 50% probability exists that at least one of the ten shots will hit the enemy during his reaction time. Thus, the burst fired with an assault rifle at a range of 1,000m has about the same hit probability as a shot fired with a rifle at a range of 500m. Therefore one can say without exaggeration that the effective range of an assault rifle with a low muzzle performance is twice as high as that of a rifle with a high muzzle performance.

This distinctive characteristic of the assault rifle was not made the most of during the last war. Only with the Spanish assault rifle was the fact considered that in the case of sustained fire, a reduction of the recoil impulse would increase the effective range. However, a prerequisite is that the bullet must have a low ballistic trajectory to achieve a hit at a far distant target not only at the firing range but also in a real firefight. This prerequisite can be considered to be met with the newly-developed light core [CETME-NATO] bullet. Thus, the effective range of 800 to 1000m of the Spanish assault rifle is not a pure formality but is a reality. The discrepancy of the sS ammunition in regard to a limited effective range of 500m, determined by the hit probability, compared to an actual effective range of 3,000m determined by the ballistic energy, does not exist with the Spanish light-core ammunition, which has 1,000m for both values.

The objection that sustained fire applied at long ranges would result in a waste of ammunition does not hold true as long as the troops are trained in fire discipline. Because as already mentioned above, the efficiency of firing during the reaction time, which is successful only if the fire is concentrated by means of sustained fire, is considerably higher than the fire applied at an enemy who has taken cover. If one considers that during the last wars up to 50,000 rounds were fired to achieve one hit, it must be assumed that in the case of applying sustained fire the ammunition expenditure would not increase but rather decrease.

All these ideas conflict with the current prevailing opinion worldwide that a rifle for long-range engagement is no longer needed [above Voss mentioned that the assault rifle idea is not yet accepted]. I made no secret of the fact that I personally consider this opinion to be questionable, or at least not universally applicable. The fact that targets at ranges exceeding 500m were not engaged with the rifle during the last war is merely evidence that no light small arm capable of long-range firing existed, not proof that demands for such a weapon did not exist! Additionally, one must consider that our experiences gained during the Russian campaign are relatively one-sided. A possible future war might well show completely different forms of warfare such as airborne operations, guerilla warfare and the methods of infiltration as practiced in Korea and Indochina. In all these cases the infantrymen must fight to a great extent without the support of heavy weapons, and thus they are dependent solely on their own rifles to fight targets at long ranges, in contrast to the fighting circumstances experienced in former wars. Each metre gained in effective range would be of decisive importance. The same applies for warfare in mountainous and wooded terrain where heavy machine guns and mortars cannot be sited.

I mention this all in order to attract your attention to the importance of the long-range capabilities of a rifle, not to reduce the importance of the assault rifle concept. On the contrary, I want to convince those who dislike the assault rifle idea at the moment by pointing out new and not yet realised methods for the employment of an assault rifle.

As I have mentioned above, improved low ballistic trajectory may result in increased ammunition-related dispersion, but we will try to improve low ballistic trajectory without a decrease in precision. It cannot be said in advance if and when this will be achieved. For short-term deliveries, only the type of ammunition that was demonstrated to you on the 1st of the present month can be considered. This will do for the police, but in view of their operational task, not for the Army. The bullet of this ammunition consists of a tombac sheath and a two-part core . . Maybe the tombac sheath can be replaced later by a copper-plated steel sheath. Mass production of such a bullet is certainly no more expensive than for a common lead-core bullet.

The ogival shape of the bullet corresponds to that of the Belgian T65 bullet. Only the conical boat tail was increased from 4.5 to 7.5mm to achieve a lower drag. Bullet weight and muzzle velocity correspond approximately to those of former German [MP44] assault rifle cartridge, i.e. the bullet weight is 8.2g [126.5 gr] and the V_0 is about 700m/sec [2,297 fps]. As already mentioned above, with these parameters the area sprayed with bullets at a firing distance of 600m can be expected to be 65 to 70m. This is compared to the 43m achieved by the German assault rifle, 123m achieved by the Spanish [7.9x41mm CETME] assault rifle, and, according to FN documents, 168m for the T65 cartridge. These figures prove that the new [CETME-NATO] ammunition shows better results than that of the former German assault rifle but it did not yet reach the possible optimum.

The powder charge used is a regular nitrocellulose flake powder. The powder weight is about 1.7g, compared with 3g for the original T65 cartridge. The shape of the cartridge case is pretty much the same as that of the T65 cartridge. Only in regard to the primer the former German [Berdan] design was used instead of the American [Boxer] design. The complete cartridge weighs about 10% less than the Belgian version of the T65 cartridge.

That was in general the content of my conversation with Mr Bohlan and Mr Reinhardt, who will receive copies of this letter as requested.

I hope to have served you with these data, and I remain

yours faithfully,
(Voss)

Dr Ing Voss was of course a former *Luftwaffe* ballistician, and here he was trying to make the best case for the infantry assault rifle in general and the compromise CETME-NATO cartridge in particular.

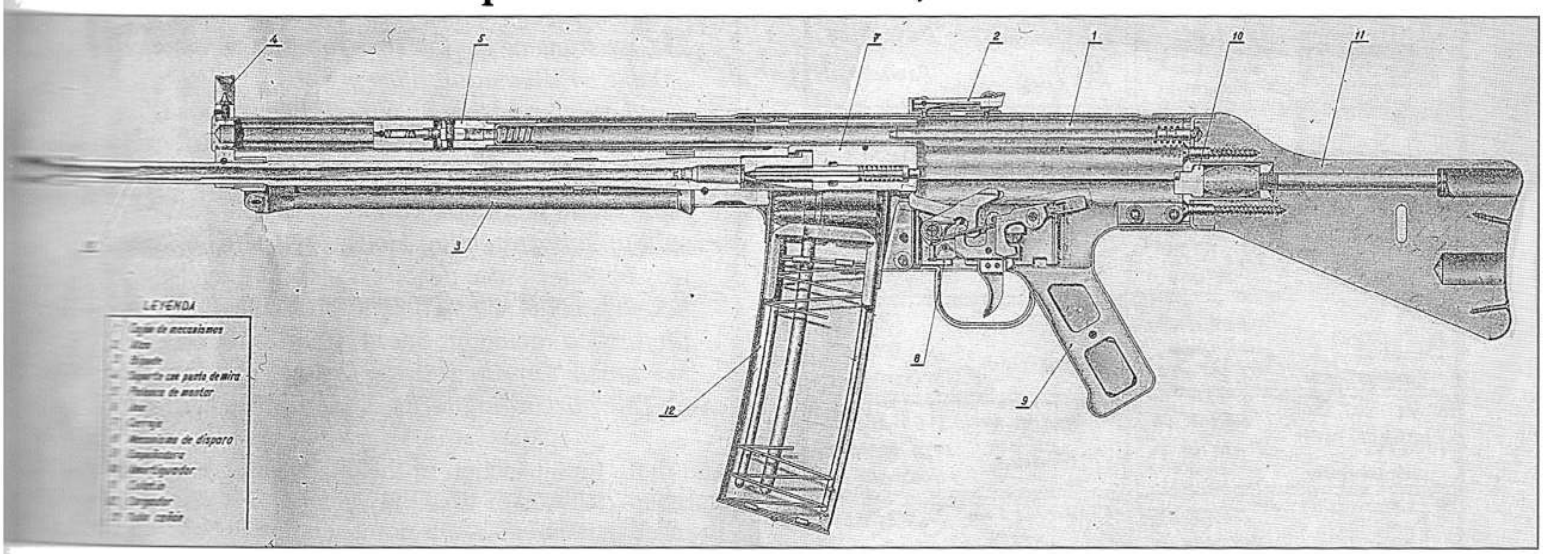
Dieter Handrich Comments

Dieter Handrich, the prizewinning German military historian and author of the 2004 Collector Grade title *Sturmgewehr!*, to which this present volume can be considered a sequel, comments on Dr Voss' quite interesting letter as follows:

> *. . It appears that the experiences gained during the employment of the MP44 in WWII, especially in Russia, are ignored and called into question by Dr Voss.*
>
> *All of the "new" forms of warfare which he describes were encountered in Russia, where engagement ranges varied, from short to medium in northern Russia to extremely long ranges in the steppes of southern Russia.*
>
> *Thus the battles in Russia constitute the best scenario for the employment of an assault rifle, but they also proved that, especially at long ranges, neither a regular rifle nor an assault rifle was capable of replacing the effects of LMG and HMG fire, both of which were regarded as absolutely essential.*
>
> *Furthermore, Dr Voss' contention that HMGs and mortars cannot be used in mountainous terrain is simply not true. Even in WWI mortars and the MG08, which was really a heavyweight compared to the MG34 and MG42, were sited and used at the highest elevations on the Alpine Front.*

Divvying Up the CETME for Production

Short-Lived Preparations for the First 5,000 Rifles for the BGS

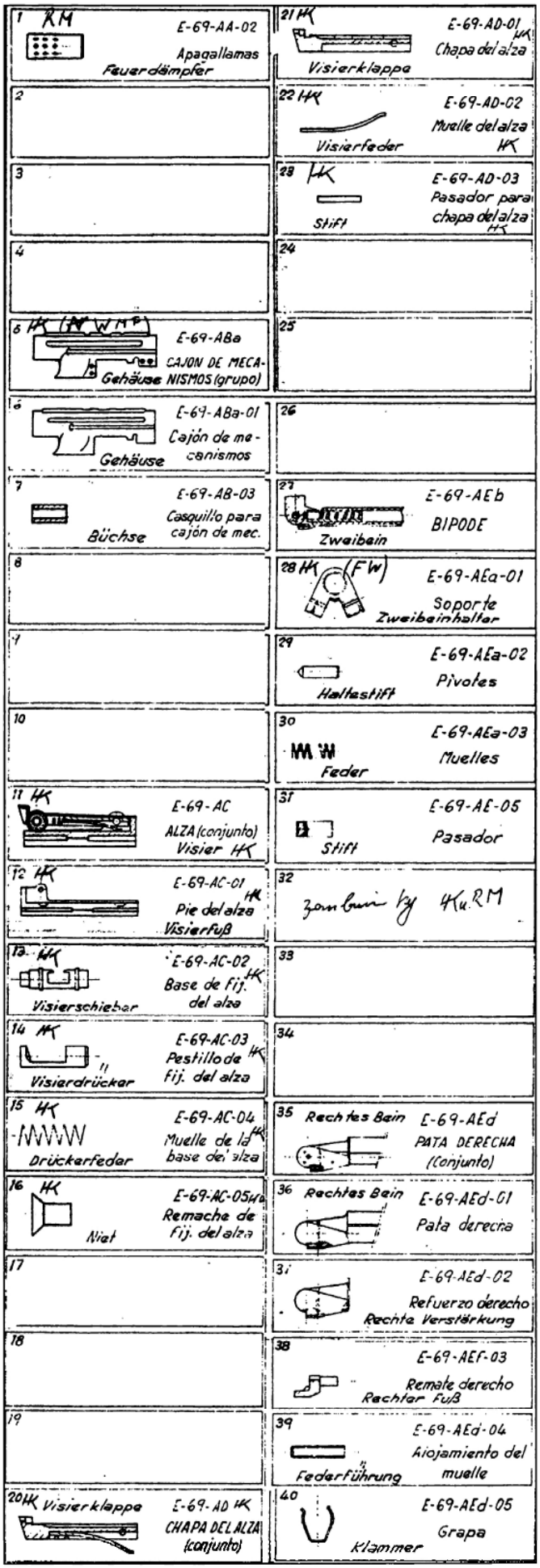


A sectioned drawing of the Model A CETME which had up a chart depicting each of the component parts of the weapon, reproduced in detail below, drawn up in preparation for manufacture as designated under the Spanish German co-production agreement.

Compare with fig 158: note the first appearance of a rubber buffer in the head of the butt, added to cushion the components from the heavy recoil impulse of the powerful 7.62x51mm ammunition. The rubber buffer is shown in more detail in fig 177. courtesy Walter Schmid

Heymen next records the events which, based the formation of the international Spanish/German co-production agreement, now moved ahead actual production plans, as follows:

> *. . Due to the very positive trials results, and the obvious interest shown in the CETME weapon at demonstrations by people from all around the*



world—we even had some enquiries from Japan—series production was the next logical step. Since this was an undertaking of some magnitude, and since no suitable venue existed in Spain, the work was done in conjunction with the German firms Heckler & Koch GmbH of Oberndorf/Neckar, and the Württembergische Metallwarenfabrik of Geislingen [WMF - well known in Europe today for cutlery, etc.].

Due to recommendations from Bonn, in April of 1954 a co-production agreement had been arranged, and these firms had received orders. Firstly, the work plans were produced, then the necessary machinery and the projected production times were determined. From this came the final work plans, and then the actual necessities—benches, work tools and gauges—were blueprinted, the German firms handling about 40% of this work. There were numerous visits and ready agreement on all points to have the necessary uniformity of opinion. Finally, on April 27, 1955 the production means themselves were ordered under O.T. 229 and produced in the same German-Spanish ratio as the tooling blueprints.

More frequent requests were received for sample weapons for testing and trials, but firm orders could only be expected when short-term delivery could be assured (as in the case of the German Border Guards). On July 19, 1955, the order O.T. 231 was given, for the first production series of 5,000 CETME assault rifles.

Where should these weapons be produced? Experiences during the production of the Null-Serie *in Spain did not encourage embarking on large-scale series production under the same system of split-up subcontracting. However no other solution was possible, since despite the earlier determination to become self-sufficient, such a single-source production facility in Spain would have required too much time to set up. Despite the fact that CETME, according to its original determination,*

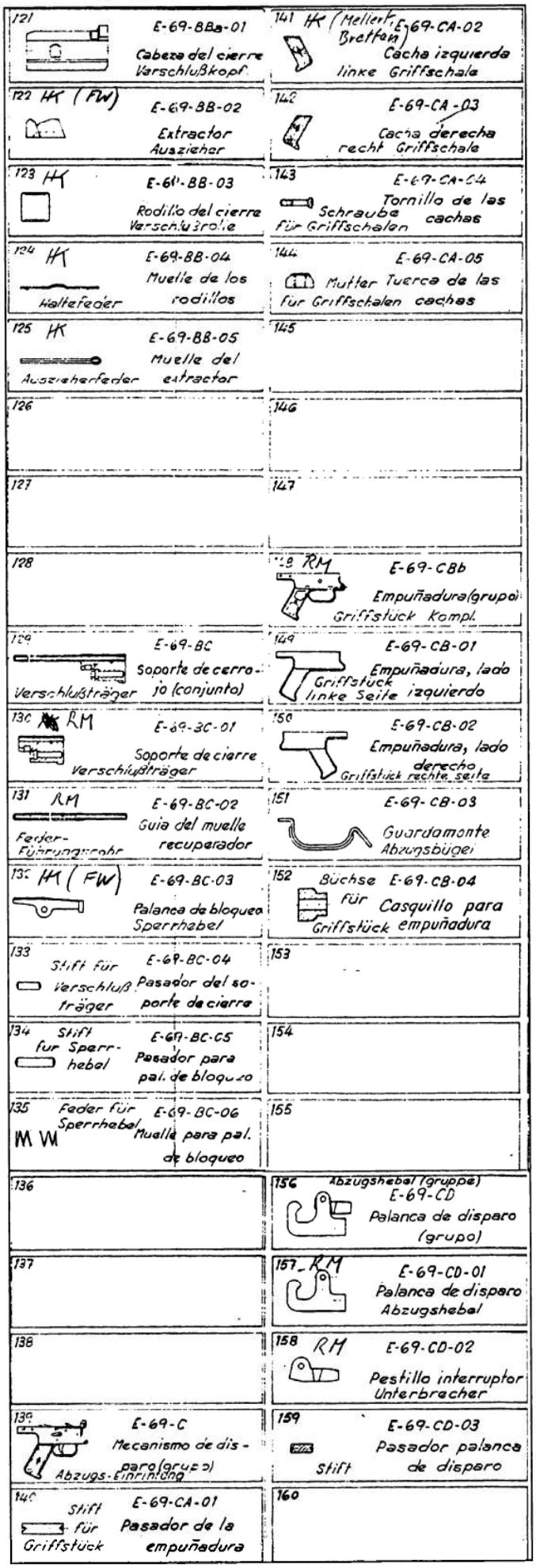
166 (left). Initial section of the chart listing components numbered 1 through 40 of the Model A CETME, illustrating each part and giving its nomenclature in both Spanish and German, along with a notation as to who was to manufacture it. courtesy Walter Schmid

167 (facing page, left). Second section of the chart. [illegible] and illustrating components numbered 41 through [illegible] the Model A CETME. courtesy Walter Schmid

168 (facing page, right). Third section of the chart. [illegible] and illustrating components numbered 81 through [illegible] the Model A CETME. courtesy Walter Schmid

41 E-69-AEd-06 Remache de la grapa — Klammerniet	61 HK Magazin-Halter E-69-AFa-05 Reten del cargador
42	62 HK Magazin-Drücker E-69-AFa-06 Pulsador del reten
43	63 HK E-69-AF-07 Casquete de tapa — Abschußkappe
44	64 HK Magazin-Halte-feder E-69-AF-09 Muelle de suj. del cargador
45 Linkes Bein E-69-AEe PATA IZQUIERDA (Conjunto)	65 HK Korn E-69-AFa-10 Punto de mira
46 Linkes Bein E-69-AEe-01 Pata izquierda	66 HK Korn-Halte-schraube E-69-AFa-11 Tornillo de suj. de mira
47 E-69-AEe-02 Refuerzo izquierdo — Linke Verstärkung	67
48 E-69-AEg-03 Remate izquierdo — Linker Fuß	68
49 E-69-AEd-04 Alojamiento del muelle — Federführung	69
50 E-69-AEd-05 Grapa — Klammer	70 HK Tragring E-69-AG Anilla con soporte (grupo)
51 E-69-AEd-06 Remache de la grapa — Klammerniet	71 HK E-69-AGa-01 Soporte para anilla — Ringhalter
52	72 HK E-69-AGa-02 Anilla — Ring
53	73
54 Ge	74
55 Lauf mit Gehäuse E-69-AFa Cañón con cajón de mecanismos (grupo)	75
56 HK u. RM E-69-AFa-01 Tubo cañón — Lauf	76 Ladeschieber E-69-AHa Palanca de montar (grupo)
57 E-69-AFb-01 Tubo cañón — Lauf	77 HK E-69-AHa-01 Soporte de palanca — Griffträger
58 HK evtl. + RM E-69-AFa-02 Pieza de bloqueo — Verriegelungsstück	78 HK E-69-AHa-02 Tornillo — Schraube
59 HK (FW) E-69-AFb-03 Pie de mira — Kornfuß	79
60 HK E-69-AFa-04 Pasador de fij. del cañón — Haltestift	80

81	101 HK E-69-AL-01 Palanca de montar — Hebel
82 HK Fangbolzen - Befestigung E-69-AJ Fijación de remache (grupo)	102 HK E-69-AL-02 Empuñadura — Griff
83 HK E-69-AJ-01 Guia de la pal. de montar — Durchladerohr	103
84	104
85	105
87 HK Anschlag stück E-69-AJ Tope (grupo)	106 E-69-AM Traggriff — Asa de transporte
88 HK Anschlagstück E-69-AJ-01 Soporte del émbolo	107 RM E-69-AM-01 Traggriff — Asa
89 HK Anschlagstift E-69-AJ-02 Embolo	108 E-69-AM-02 Griffschale — Cacha
90 HK Feder E-69-AJ-03 Muelle del embolo — M. W	109 E-69-AM-03 Niet — Remaches
86	110
91	111
92	112
93	113 E-69-B Cerrojo completo (grupo) — Schloß kompl.
94 HK E-69-AK Remache (grupo) — Fangbolzen	114 HK u. RM E-69-BA-01 Portapercutor — Steuerstück U
95 HK E-69-AK-01 Remache — Fangbolzen	115 E-69-BAa-02 Percutor — Schlagbolzen
96 HK E-69-AK-02 Guia del remache — Auflaufkeil	116 HK E-69-BA-03 Muelle del percutor — W.W Schlagbolzenfeder
97	117
98	118
99	119
100 HK E-69-AL Palanca (grupo) Ladegriff	120 RM E-69-BB Cabeza del cierre (conjunto) — Verschlußkopf Kompl.



had had nothing to do with questions of production, it seemed obvious that the control of any such project would also have be taken on by CETME, in order that the experiences gained during the production and assembly of the Null-Serie *should not be lost or forgotten. The AEM, however, still regarded the subcontracted production plan (with CETME as the mother-firm) as very desirable, because [weapons would thus be made available quickly enough to] allow trials in the case of mobilisation. The parts for which the production means existed in Germany would be produced in Germany, while the parts to be made in Spain would be split up again, with the assembly being done at the CETME production facility.*

Among the Spanish firms involved in the production of this first series were the following:

- *EISA, Aranjuez: bolt head*
- *Iberavia, Madrid: bolt carrier*
- *Bressel, Madrid: firing pin; pins; trigger mechanism housings*
- *Laguna de Rinz, Zaragoza: screws; rivets*
- *Valenciaga, Eibar: springs*
- *Cointra, Valencia: pistol grip*
- *CASA, Getafe: trigger housing*
- *FAICA, Madrid: lathe and milling machine parts*
- *Kienzle SA, Madrid: lathe parts*
- *ENOSA, Madrid: buffer; flash hider*
- *FN de Armas, Coruña: barrels and buttstocks*
- *FN de Armas, Oviedo: trigger parts; tools; gauges*

The production of this series was, for all the engineers involved, a considerable challenge, for up to this time an undertaking of this kind was unknown in Spain. In addition more tests had to be made to discover the ultimate weaknesses of the design, to reduce the weight of the weapon and to experiment with plain unalloyed steel. Trials with cold-drawn tubes [or pipes] were also made which,

169 (left). Fourth section of the chart, listing and illustrating components numbered 121 through 160 of the Model A CETME. courtesy Walter Schmid

170 (facing page, left). Fifth section of the chart, listing components numbered 161 through 200 of the Model CETME. courtesy Walter Schmid

171 (facing page, left). Sixth section of the chart, listing components numbered 201 through 240 of the Model CETME. courtesy Walter Schmid

161

162

163 Abzugs-Einrichtung E-69-CE
Mecanismo de disparo(grupo)

164 RM. E-69-CEa-02
Martillo
Hahn o. Hammer

165 RM E-69-CE-03
Palanca de seguridad
Sicherungshebel

166 RM. E-69-CE-04
Palanca de agarre
Fanghebel

167 HK u. RM E-69-CE-05
Expulsor
Auswerfer

168 E-69-CE-06
Casquillo para martillo
Büchse für Hammer

169 E-69-CE-07
Muelle del martillo
Hammerfeder

170 E-69-CE-08
Pasador del martillo
Stift für Hammer

171 E-69-CE-09
Pasador del gatillo
Stift für Abzug

172 E-69-CE-10
Pasador del expulsor
Stift für Auswerfer

173 Abzugsfeder E-69-CE-11
Muelle palanca de disparo

174 Feder E-69-CE-12
Muelle del bloqueo de cierre

175 E-69-CE-14
Muelle del expulsor
Auswerferfeder

176 E-69-CE-15
Pasador para palanca seguridad
Stift für CE-03

177

178

179

180 E-69-CFa
Eje del seguro(grupo)
Sicherungsachse

181 RM E-69-CFa-01
Eje del seguro
Sicherungsachse

182 RM E-69-CFa-02
Palanca del seguro
Sicherungsflügel

183 RM E-69-CF-03
Muelle del seguro
Sicherungsfeder

184

185

186

187 RM E-69-CG
Gatillo (grupo)
Abzug

188 RM E-69-CG-01
Gatillo
Abzug

189 RM E-69-CG-02
Tope del gatillo
Abzugsstollen

190 RM E-69-CG-03
Remache del gatillo
Niet

191

192

193

194 RM E-69-CHb
Caja de disparo (grupo)
Abzugskasten

195 E-69-CHb-01
Caja de disparo
Abzugskasten

196 E-69-CH-02
Chapa de sujeción
Halteblech

197 E-69-CH-03
Remache caja disparo
Niet

198

199

200

201 Haltestift E-69-CI
Pasador de sujeción (grupo)

202 E-69-CI-01
Pasador de sujeción
Haltestift

203 E-69-CI-02
Muelle para pasador
Feder zum Haltestift der sujeción

204

205

206

207 E-69-DB
Culatin completo(grupo)
Kolben Kompl.

208 HK E-69-DAa-01
Culatin
Kolben

209 E-69-DAa-02
Cantonera del culatin
Kolbenblech

210 E-69-DA-03
Tornillo de fij. del culatín
Halteschraube

211 Halteschraube E-69-DA-04
Tornillo de fij. del culatín

212 Halteschraube E-69-DA-05
Tornillo de fij. cantonera

213 Halteschraube E-69-DA-06
Tornillo de fij. del culatín

214 Federnde Unterleg-Scheibe E-69-DA-07
Arandela Grower

215

216

217

218 Kolben-Haltestück E-69-DB
227 HK (WMF)
Caja de fijación del culatín (grupo)

219 E-69-DB-01
Chapa de fondo
Bodenblech

220 E-69-DB-02
Brida de sujeción del culatín
Halte-stück

221 E-69-DB-04
Casquillo guia del cajón
Buchse

222

223

224

225 E-69-DBa
Guia del recuperador(grupo)
Federführung

226 E-69-DBa-01
Guia
Führungsrohr

227 E-69-DBa-02
Portaguia
Führungsträger

228

229

230

231 E-69-DC-01
Muelle recuperador
Schließfeder
M W

232

233

234

235 HK E-69-DD
Amortiguador
Puffer

236 E-69-DD-01
Caja del amortiguador
Puffer gehäuse

237 E-69-DD-02
Tope del amortiguador
Anschlag

238 E-69-DD-03
Tapón
Stopfen

239 E-69-DD-04
Amortiguador
Gummipuffer

240

241	261 224-710-010-04 Transportador(grupo) Zubringer(gruppe)
242	262 224-710-010-04-100 Transportador Zubringer
243	263 224-710-010-04-101 Federn. Chapa de sujeción Halteblech del muelle
244	264 224-710-010-04-102 Abdeckblech Tapa
245	265
246	266
247	267
248	268
249	269
250 224-710-010 Cargador para munición T-65 (Conjunto) Magazin	270 E-69-Y Porta-fusil (Conjunto) Gewehr-Riemen
251 224-710-010-00-100 Muelle de trans-portador Zubringerfeder	271 E-69-YA-01 Hebilla Schnalle
252 224-710-010-01 Cuerpo del cargador Magazin	272 E-69-YA-02 Corchete 5x9
253 224-710-010-01-100 rechte Magazin-Hälfte Cargador lado derecho	273
254 224-710-010-01-101 linke Magazin-Hälfte Cargador lado izquierdo	274
255 224-710-010-02 Refuerzo(grupo) Verstärkungsstück	276 E-69-YB Correa (Grupo)
256 224-710-010-02-100 rechte Verstärkung Refuerzo lado derecho	277 E-69-YB-01 Correa
257 224-710-010-02-101 linke Verstärkung Refuerzo lado izquierdo	278 E-69-YB-02 Refuerzo
258 224-710-010-03 Fijación del muelle (grupo) Feder-Befestigung	279 E-69-YB-03 Refuerzo
259 224-710-010-03-100 Chapa de fijación del muelle Befestigungsblech	280 E-69-YB-04 Remache tubular 4x10
260 224-710-010-03-102 Pivote de sujeción Haltestift	281 E-69-YB-05 Hilo

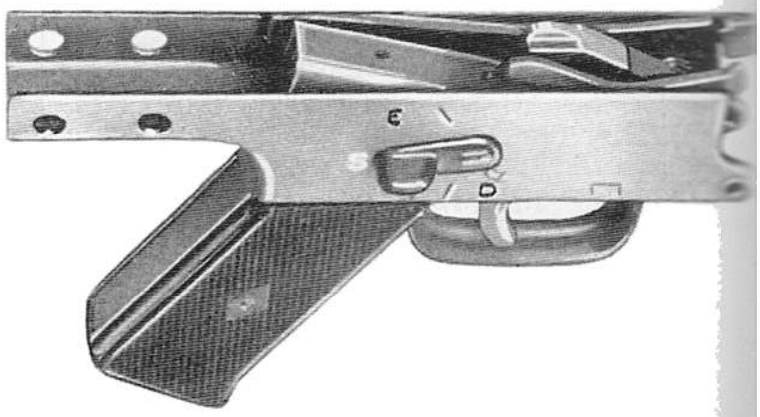
172 (left). Seventh and final section of the chart, listing and illustrating components numbered 241 through 281 of the Model A CETME. courtesy Walter Schmid

KURZBESCHREIBUNG DES

CETME-GEWEHRES

KALIBER 7,62 mm

173. Cover of the small (105 x 150mm; 4 1/8 x 6") 32-page handbook prepared for troop use with the CETME rifle as taken over for German production.
courtesy Walter Schmid



174. Top right three-quarter view of the pistol grip assembly of the Model A CETME as taken over for German production.
Note the change lever is located on the right side.
courtesy Walter Schmid

although these did not promise greater life expectancy, produced very cleanly-drawn parts in far less time. While the reports dealing with the previous trials experiences of various troop units such as the Army, Air Force, Marine (Navy) as well as the Guardia Civil and Policía Armada were all very positive, a number of extra modifications had been suggested which if at all possible were to be incorporated into this first production series.

Major changes, however, only became necessary when the German Border Guard handed over its share of the entire matter to the Federal Defence Ministry (BVM). They demanded the exclusive use of full-power NATO ammunition, and this in turn forced the adoption of a recoil buffer as well as several reinforcements to handle the greater recoil impulse (1.06kg/sec).

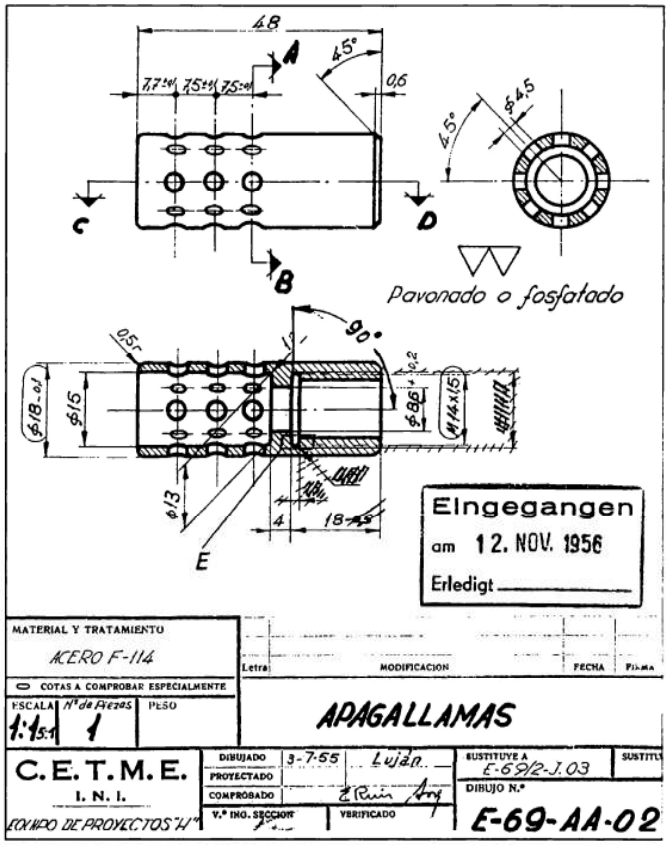
Right side view of a CETME Model A, shown with bipod folded and carrying handle raised, fitted with -round magazine.

Note the change lever markings: "T" (*Tiro a tiro*; semi-automatic); "S" (*Seguro*; safe); "R" (*Ráfagas*; full-automatic). courtesy the late Dr Edward C Ezell

A Comparison Table from H&K

part of their intital investigations a three-page titled *Vergleichstabelle über versch. Waffen* parison Table of Various Weapons) was painstakingly drawn up by H&K, dated June 14, 1955. This document is excerpted as follows, with additional data supplied for Imperial measurements:

	StG CETME			StG44	StG FN	M1 Carbine	M1 Garand	K98k
mmunition	**CETME-munition**	**NATO 7.62**	**CETME-NATO**					
mm)	7.90	7.62	7.62	7.9	7.62	7.62	7.62	7.92
velocity (m/sec)	800	850	700	685	850	600	840	755
velocity (fps)	2,625	2,789	2,297	2,247	2,789	1,969	3,084	2,477
er pressure (kg/cm^2)	3,200	3,200	3,200	3,200	3,200	2,800	3,500	3,200
er pressure (psi)	45,515	45,515	45,515	45,515	45,515	39,826	49,782	45,515
weight (g)	6.9	9.3	8.1	8.1	9.3	7.1	10.9	12.8
weight (gr)	106.5	143.5	125	125	143.5	109.6	168	197.5
energy (kg/m)	222	340	202	194	340	130	391	372
energy (ft lbs)	1,606	2,459	1,461	1,403	2,459	940	2,828	2,691
impulse (kg/sec)	0.76	1.13	0.74	0.71	1.13	0.515	1.28	1.27
ge length (mm)	75	71.2	71.2	48	71.2	42.5	84	80.6
ge length (in)	2.95	2.8	2.8	1.9	2.8	1.67	3.7	3.17
ge weight (g)	18	24	21.5	18	24	12.5	26.8	27.5
ge weight (gr)	278	370	332	278	370	193	414	424
er charge (g)	1.85	2.9	1.7	1.6	2.9	1.0	3.16	2.9
er charge (gr)	28.5	44.8	26.2	24.7	44.8	15.4324	48.8	44.8
apon								
length (mm)	435	500	450	410	533	450	610	600
length (in)	17	19.7	17.7	16.1	21	17.7	24	23.6
grooves	4	4	4	4	4	4	4	4
diameter (mm)	7.9	7.62	7.62	7.9	7.62	7.62	7.62	7.9
e diameter (mm)	8.2	7.92	7.92	8.2	7.92	7.85	7.85	8.2
m in (mm)	180	210	210	240	305	470	470	240
m in (in)	7	8.3	8.3	9.4	12	18.5	18.5	9.4
um range (m)	3,000	~4,000	3,000	~2,800	~4,000	2,460	4,650	~4,600
e range (m)	1,000	600	6 - 800	4 - 500	600	300	600	600
re (shots/min)	500	650	650	550	650 - 700	20 - 25	20 - 25	8 - 10
e capacity (rds)	25	25	25	32	20	15/30	8	5
e wt empty (kg)	.87	1.02	.95	.976	.710	.39/.515	-	-
n wt w/o magazine	4.25 w/bipod	4.5 w/bipod	4.4 w/bipod	4.4	3.9 w/o bipod	2.5	4.475	4.0
n wt w/full mag (kg)	5.17 w/bipod	5.32 w/bipod	5.25 w/bipod	5.376	4.61 w/o bipod	2.9/3.2	4.617	4.133
n length (mm)	970	1,035	985	940	1,050	914	1,120	1,110
n length (in)	38.2	40.7	38.8	37	41.3	36	44	43.7
t adjustment (m)	1,000	1,000	1,000	800	600 (yd)	200 (yd)	1,200 (yd)	2,000

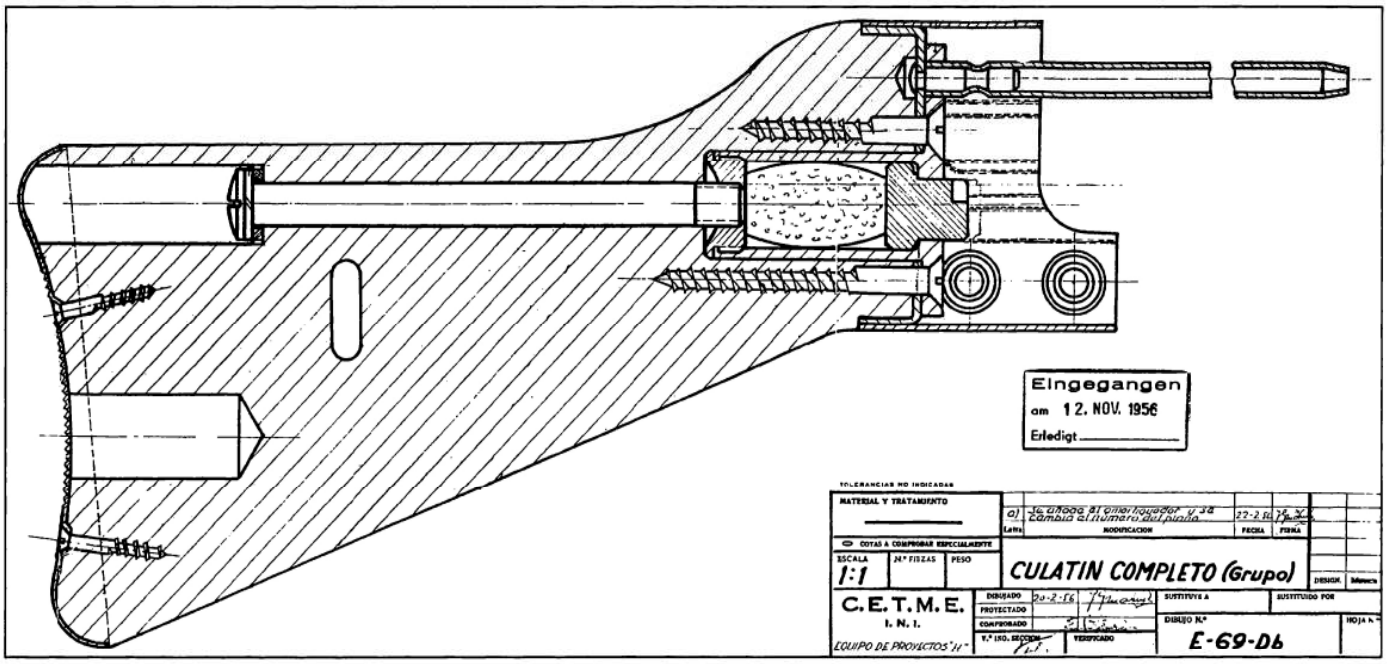


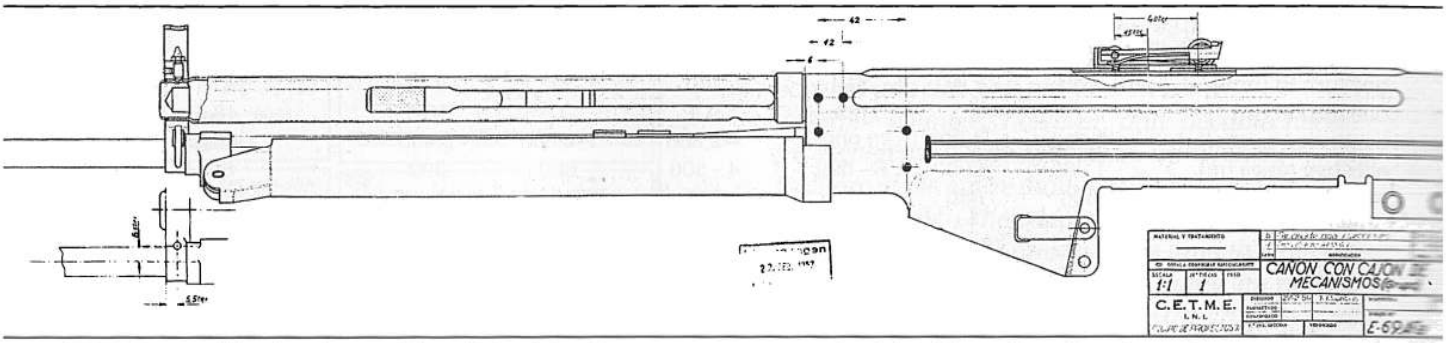
176 (right). Dimensioned CETME manufacturing drawing number E-69-AA-02 of the *Apagallamas* (flash hider), dated July 3, 1955.

According to the rubber stamp at right centre, this drawing was *Eingegangen* (taken in or accepted) by H&K on November 12, 1956. courtesy Walter Schmid

177 (below). CETME assembly drawing no E-69-D6 of the *Culatin Completo (Grupo)* (buttstock assembly, complete), dated February 20, 1956, accepted by H&K on November 12, 1956.

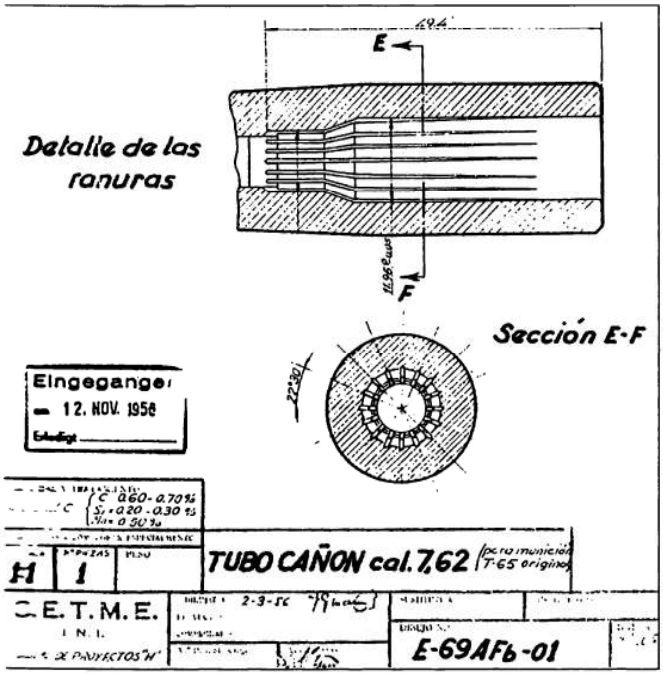
Note the construction detail of the rubber buffer. courtesy Walter Schmid





178. CETME assembly drawing no E-69.AFa of the *Cañon con Cajon de Mechanismos (Grupo)* (barrel and receiver assembly) dated February 27, 1956, accepted by H&K on February 22, 1957.

Note the folded bipod, no handguard, no provision for a holdopen on the cocking handle tube, the 1,000-metre tangent sight, and the magazine catch located on the right side only. courtesy Walter Schmid

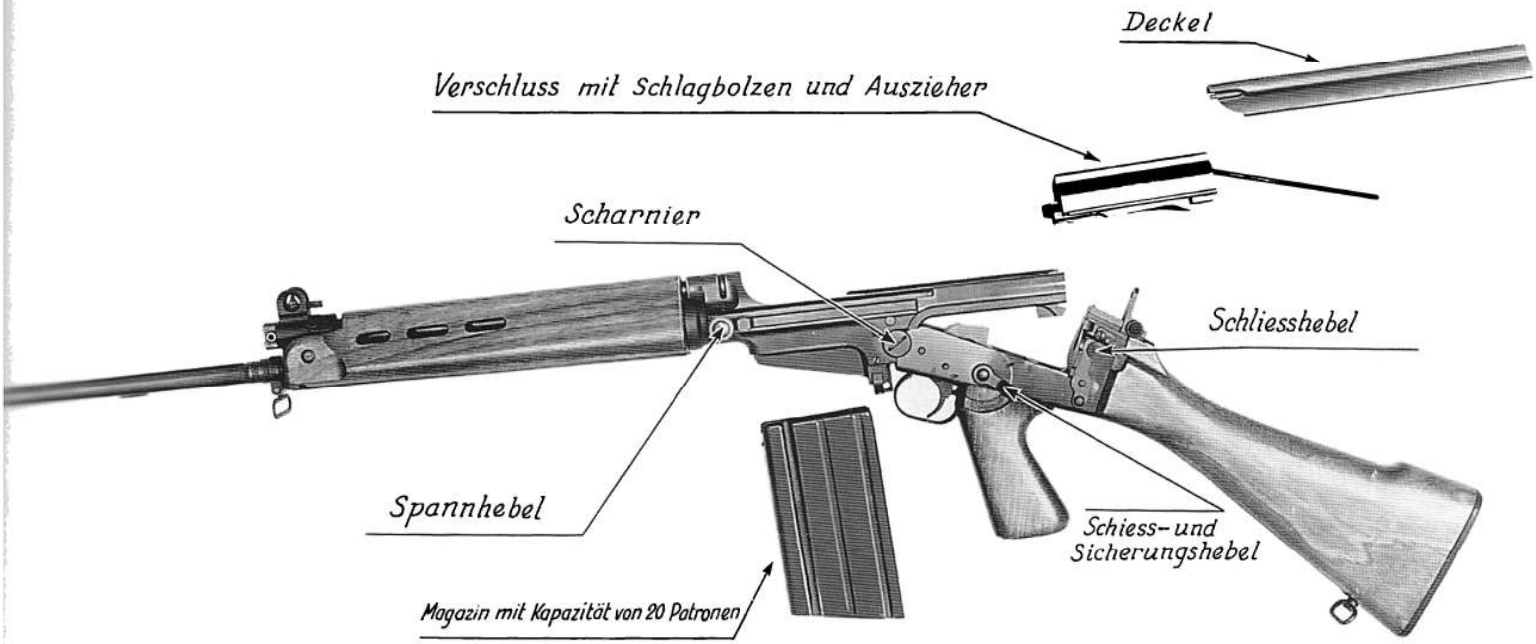


179 (left). CETME drawing no E-69 AFb-01 of the *Tubo Cañon cal 7.62 (para municion T-65 original)* (Barrel tube cal 7.62 for original T-65 ammunition), dated March 2, 1956, showing details of the 16 *ranuras* (flutes) in the chamber. This drawing was accepted at H&K on November 12, 1956.

Note (at top) the chamber length is shown as 49.4mm, indicating that this was for the second of three cartridge lengths in the US "light rifle" cartridge programme which resulted in the 51mm NATO case.

courtesy Walter Schmid

The FAL in the Ointment



Left side view of prototype FAL rifle serial no 47, which was featured as the "specimen" in the initial nine-page FN typescript instruction handout prepared for the BGS, titled *Leichtes Automatisches Gewehr FN Browning Kal 7,62mm* (Light Automatic Rifle FN Browning Cal 7.62mm).

FN photograph no 18-6173 dated January 10, 1955, author's collection

as discussed at length in *The FAL Rifle*, by this time the Belgian armsmaking consortium Fabrique Nationale d'Armes de Guerre had perfected the NATO-calibre FAL rifle, which had already been, or would soon be, adopted by an impressive number of countries. So far these included the initial adopting country Canada, in 1953, and then Great Britain, Belgium and Venezuela in 1954, Israel and Argentina in 1955, and Luxembourg and Paraguay in 1956. In addition, over 3.000 FAL "Canada" rifles had been purchased in 1954 by US Army Ordnance for troop trials, indicating that the FAL was already regarded by many as the next US Army rifle.

Three regular-production FN FAL "Canada" rifles, serial nos DEU 1 - 3, had already featured in a successful BGS trial in December, 1954, and a second BGS trial had been performed during a presentation by FN of their rifles and ammunition at the Wahnerheide range on January 18, 1955. An FN Ballistic Laboratory report of these extensive trials, which included function-firing, accuracy, rapid fire, burst

181. Left side closeup of FAL "Canada" serial no 2168, typical of the first of two deliveries to the *Bundesgrenzschutz*, fitted with wood furniture, high sights, and hand-tuned triggers.

Note receiver marking "Gew Kal 7.62mm FN", and the special change lever markings "EF" (*Einzelfeuer*; single fire) and "DF" (*Dauerfeuer*; automatic fire).

FN photograph no 13-10723 dated March 7, 1957, author's collection

fire and grenade launching demonstrations, concluded as follows:

> *"We fired in total about 2,500 rounds without the occurrence of a single stoppage or incident."*

After the first trial 100 "*Gewehr* FN" rifles were acquired by the BGS—whether by purchase or on loan is unclear—then 20 rifles known as the initial Series "A" were purchased. These initial rifles were standard "FAL Canada" models of the period, without flash hiders.

The *Bundesgrenzschutz* Cancels their Order for 5,000 CETME Rifles

Werner Heynen records the dismaying news that, while negotiations concerning CETME production for the *Bundeswehr* were plagued with seemingly endless delays, the BGS was no longer a potential customer for the fledgling CETME rifle:

> *. . On September 26, 1955 a telegraphed renewed offer was demanded, and the Spanish Ambassador reported that the [CETME] weapon had been demonstrated to the Minister "Blank", and that he had decided in its favour. Also according to this report, certain steps would have to be taken regarding NATO. The defence technical monthly publications [*Wehrtechnischen Monatshefte*] reported in October, 1955 the possibility of the introduction of the CETME weapon in Germany. Despite the pressing need, however, the order was*


Schmitt: Waffentechnisches Unterrichtsbuch

Mit Groß-Farbtafeln

25. Auflage

MG 1/MG 2 (7,62 mm×51)
G1 (7,62mm×51) u. ält. Serien
Schießlehre und -ausbildung
Pistolen: 35, Astra, SIG
Maschinenpistole Beretta
Granatwerfer 81 und 55
Handgranate A. / D-Fernrohr
Signalpistolen 1 u. 2 (26,5 mm)
Munition aller Waffen
400 Abbildungen

R. Eisenschmidt GmbH Verlagsbuchhandlung Frankfurt/Main

182 (left). The cover of an early manual of small arms issued to the BGS, Germany's first postwar Federal Police Force. Copyrighted in 1951, this issue was revised in 1956 to cover the 7.62x51mm MG1/MG2 and G1 (FAL) rifle, as well as other weapons and equipment, as shown.
courtesy Wolfhart Fritze, FGS Frex Ltd

persistently delayed. The delivery time became increasingly more pressing and shorter, and finally a large number of [FN FAL] weapons was ordered from Belgium [for the Bundesgrenzschutz*] because there, as a result of ongoing production, shorter delivery times could be guaranteed, while the Spaniards were still not yet even in production.*

CETME received the sobering news on January 17, 1956 from the Ministry of Internal Affairs that, due to the reorganisation of the German Border Guard, they were no longer in a position to order the [5,000] offered CETME weapons!

Foreign Interest in the CETME Production Licence Seen as Encouraging

Dipl-Ing Heynen next records that inquiries, received from other countries regarding the license to produce the CETME rifle, had resulted in honours for Vorgrimler and Voss and approval for expansion of the CETME facilities:

. . At this time various interested parties began to make inquiries about buying the license to produce the CETME weapon; among others Germany, France, Holland, Italy, Japan and Sweden. [Thus the achievement of] a certain success was undeniable, and was even recognised by INI, inasmuch as in September 1955 the further enlargement of the test facilities for the purpose of producing the CETME weapon was begun. On March 1, 1956 the leader[s] of the groups of development engineers responsible for the weapon and the ammunition [Ludwig Vorgrimler and Dr Voss] were decorated with the Encomienda de Alfonso X el Sabio, *a very high and rather rare decoration.*

Theodor Löffler Documents a Comparison in France

Document "L15", written by Theodor Löffler at Mulhouse and dated February 9, 1956, provided a late overview of the Vorgrimler and Löffler *carabine mitrailleuse* programmes as developed at CEAM. This document also noted the few differences and many similarities between the by-this-time-defunct Löffler Type II and *Modèle* 50 carbines and the Spanish Model A CETME, a specially prepared example of which had recently been presented for examination by the *Centre d'Essais de l'Armée Française* (ETVS) in Versailles (fig 183). This is not actually too surprising, considering that Ludwig Vorgrimler was a key figure in both programmes.

The section of this memorandum dealing with the comparison of the two arms is excerpted in translation as follows:

Subject: The Spanish CETME Machine Rifle

. . When one compares the Modèle 50 carabine mitrailleuse *with the Spanish CETME machine rifle, the strong resemblance is evident.*

The same size and form of receiver, the same organisation and design of pivoting pistol grip assembly, the same tube above the barrel housing the charging handle, the same position of the grip, and the same bipod.

183. Left and right side views of a Model A CETME rifle, specially prepared for the French in 1956 and *essayé par le Centre d'Essais de l'Armée Française à Versailles (ETVS)* (tested by the French Army Trials Section at Versailles).

Several features of this arm appear unique, including the exceptional high degree of finish and the block located behind the rear tangent sight, presumably for the attachment of an optic sight. courtesy Jacques Barlerin

The two arms differ only in the size of the magazine, the butt (fixed on the Spanish rifle), the configuration of the sights, and the muzzle brake.

In general, the position of the bipod and its use as a handguard when folded first appeared on the Type II CEAM prototype, and whether this was copied, or simultaneously developed, in Spain is not known.

Many of the components of the Spanish rifle are similar, dimensionally as well as in form and function, to those of the CEAM prototypes, as is the firing mechanism housing, which contains the components for selecting the type of fire and putting the weapon on safe.

Moreover the Spanish weapon fires single shots from the closed bolt position, and full-automatic fire from the open bolt position, as does the Type II CEAM prototype . .

The Mysterious Direx (DUG) Assault Rifle

Concurrently, another short-lived half-locked roller-action light rifle was produced by an unnamed designer, some components of which, notably the trademark tubular receiver, very closely resembled those of the *Modèle* I and II assault rifles which Ludwig Vorgrimler had designed prior to 1950 for the French at CEAM.

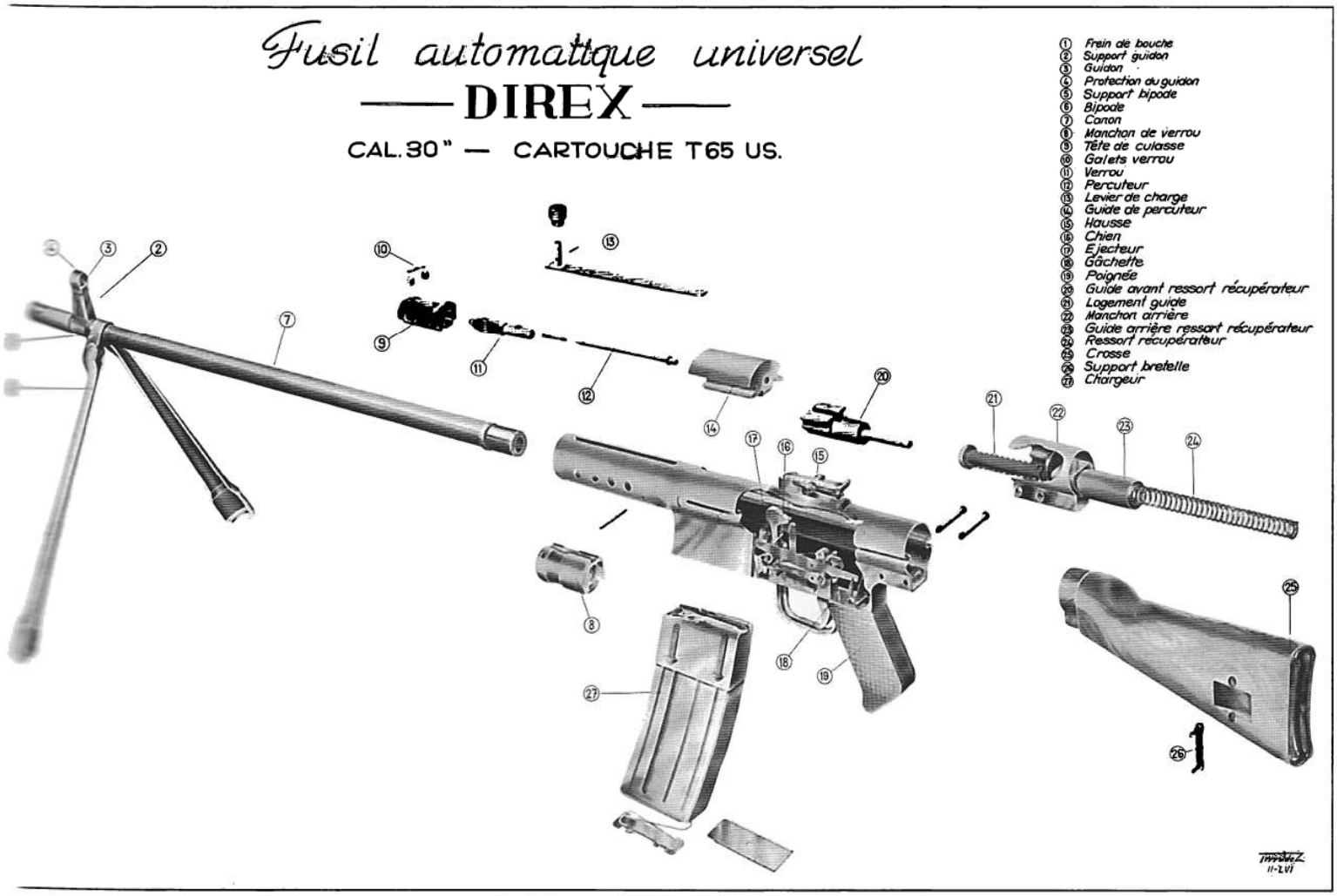
A short undated typewritten brochure has come to hand, in French, titled "*Fusil d'assaut DUG*" (the DUG assault rifle, DUG presumably standing for "Direx Universal Gun"), wherein the calibre is given as "Cal 30 - Cartridge T65 US".

An exploded-view drawing of the Direx, headed "*Fusil automatique universel DIREX Cal .30 - Cartouche T65 US*" (fig 185) is dated "II-'LVI" (February, 1956), and a manufacturing drawing of the *Steuerstück*, titled *Guide arrière du percuteur* (rear firing pin guide, fig 187) on drawing paper headed "Rexim SA, Genève", is dated June 26, 1955.

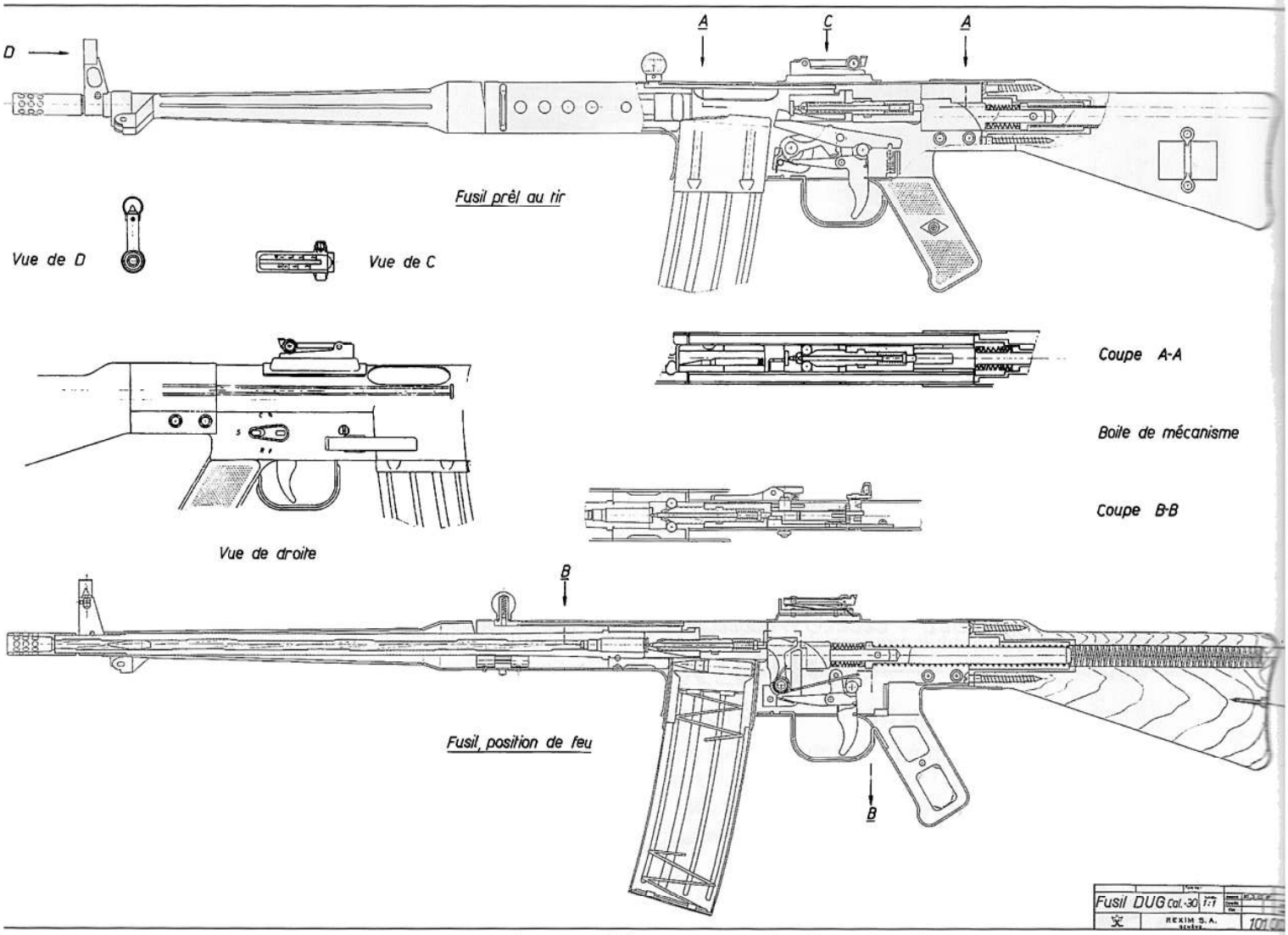
Further information, from Nelson and Musgrave's *The World's Assault Rifles*, reads as follows:

. . In the early 1950s there existed a firm known as Rexim SA, with offices in Geneva [Switzerland]. Rexim offered several military items for sale, the best known and most successful being a submachine gun. Actual fabrication of the weapon was accomplished in Spain . . The Rexim company commenced exploitation of an assault rifle called the DIREX. This rifle also followed the basic prin-

184. Right side view of the mysterious Direx assault rifle, with 30-round magazine fitted and bipod lowered.
Very little is known about this enigmatic arm today.
courtesy H&K GmbH



185. An exploded-view drawing of the roller-locked Direx assault rifle, headed "*Fusil automatique universel DIREX Cal .30 - Cartouche T65 US*", dated (at lower right) "II-'LVI" (February, 1956). courtesy Matthias Schörmal



186. A series of views of the Direx assault rifle, reduced from large-format drawing no 101001 dated March 16, 1955, which shows the rifle full-size.

The title block at lower right reads "Fusil DUG Cal .30", prepared by "Rexim SA, Genève".

Matthias Schörmal collection, photo by Dr Elmar Heinz

ciple of the StG45(M), in that it had a retarded-blowback action with twin roller locks. There are minor differences from the CETME, such as the location of the charging handle and the arrangement of the driving spring, but the close relationship between the two guns is apparent . .

Additional data on the operating philosophy of the Rexim company and its offerings was supplied to the author by the German researcher Matthias Schörmal, as follows:

. . Rexim had no production facilities of their own. The company made some technical developments and tried to function as an entrepreneurial trade organisation. For example, they offered the Porsche 597 Jagdwagen, *a 4WD vehicle developed around 1951 for the not-yet founded postwar German* Bundeswehr, *and produced a catalogue featuring pictures of the first prototype of this vehicle. Rexim's only more-or-less economically viable venture was the Rexim Favor submachine gun, which was produced in Spain at the La Coruña arsenal.*

The French-language brochure on the DUG assault rifle is translated as follows:

The DUG Assault Rifle

The necessity to equip the infantry with individual automatic arms is admitted today in all countries. This new augmentation of firepower for each individual soldier cannot result in any detriment to his mobility, as strict limits on the weight of equipment carried are considered absolutely necessary in order to maintain the momentum of modern warfare.

Military doctrine therefore strives to combine lightness, efficacy and accuracy in the construction of individual weapons in an attempt to combine, in a single new and unique type of arm, the qualities of the rifle, the automatic rifle and the light machine gun. The advantages of such arms, proven as self-evident in trials, include:

- *an increase in the overall striking power of the entire squad or unit;*
- *a reduction in the number of heavy crew-served automatic weapons, and a consequent reduction in the number of troops dedicated to them;*
- *a reduction in size of the basic combat unit;*
- *a simplification of training and instruction.*

The recently developed DUG assault rifle is particularly representative of this type of modern individual armament. Its design features have long been awaited and respond closely to those required in a truly multi-purpose arm.

Handy and supremely well-balanced, it presents the lightest possible and most manoeuverable personal weapon. It fires bursts or single shots at will. Its rate of fire of 600 shots per minute can, on demand, be very easily increased. The rifled length of the barrel is 490mm [19.3"], and since the effective range of the weapon approaches 1,000 metres, the rear sight is graduated from 200 to 1,000 metres. The magazine of the DUG assault rifle is located under the receiver ahead of the grip, which permits ease of fire and reloading. The magazine holds 30 rounds of the new US T65 ammunition, which is an entirely new development. This ammunition is particularly distinguished by the following:

- *light weight;*
- *eminent ballistic qualities;*
- *high muzzle velocity of 860 m/s [2,822 fps], with a maximum chamber pressure of 3,200 kg/cm^2 [45,515 psi].*

The felt recoil is very mild, and has been further noticeably diminished by a carefully designed muzzle brake. The DUG assault rifle is simply constructed from a limited number of components, and functions reliably even under adverse conditions.

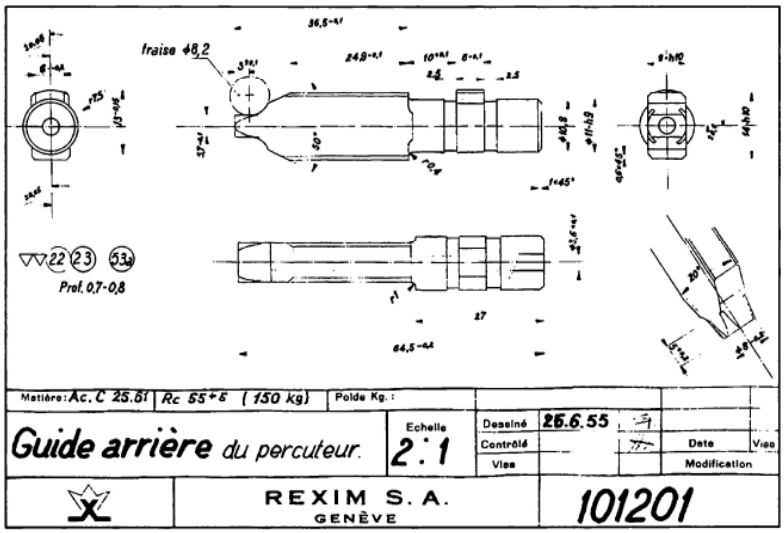
The DUG assault rifle represents an elegant, simple solution to the problems of modernising today's infantry armament.

A robust, effective, multi-purpose arm, it is the perfect answer to all technical exigencies of the military art.

Concerning "a competitive weapon" which could very well be the Direx—certainly no other possible candidate comes to mind—*Dipl-Ing* Heynen's account contains the following aside:

> *. . . It should be mentioned, somewhat as a curiosity, that in one of the Spanish military factories a competitive weapon was developed that, however far removed from the possibility of living up to the required conditions, was nevertheless conscientiously tested and compared by a Commission which the War Ministry had named, under the guidance of the EMC; interestingly, even though the final conclusions of this Commission stated that while neither weapon could be regarded as fully developed, they had to concede that the CETME possessed certain essential advantages.*

Nelson and Musgrave's brief entry concerning the Direx in *The World's Assault Rifles* concludes as follows:



187. Dimensioned manufacturing drawing no 101201 dated June 26, 1955, showing various views of the *Guide arrière du percuteur* (*Steuerstück*) of the Direx rifle, a product of the enigmatic company Rexim SA of Geneva.
courtesy Matthias Schörmal

> . . *Probably no more than one or two prototypes [of the DIREX] were made. The venture was unsuccessful, and was soon abandoned.*

Fascinatingly, this is all that remains of the Direx assault rifle today. One can but wonder whence the impetus for the programme originated, and who actually designed the weapon. The fact that no one objected to its obvious similarities to the CEAM and CETME models, both as regards its identical roller-locked action principle and general appearance, reveals that no thought of patent protection had yet arisen.

Most of all, perhaps, one wonders who funded the Direx project, as certainly the design, tolerancing and manufacture of all the components needed for even the "one or two prototypes" which were produced would have entailed quite a considerable financial commitment.

Part IV: The Roller Lock Returns to Germany

Chapter Twelve

The German "STG CETME"

The *Bundeswehr* Needs Arms

The discouraging news that the German Ministry of Internal Affairs had cancelled the ordered 3.000 CETME rifles for the BGS in favour of FALs was eclipsed by reports of the impending rearmament of the new West German Army, the *Bundeswehr*. As Werner Heynen records,

> *. . The demonstrations and negotiations with the German Border Guard resulted in rising interest on the part of the German Federal Defence Department, which during the period January 24 to 28, 1956 delegated a Commission to investigate the technical and economical advantages of the CETME weapon. In its final protocol it stated "It is suitable to propose the ordering of a trials series of weapons for the purpose of troop trials, however the weapons would have to be specially constructed to be suitable for use with NATO ammunition. It is herewith fully recognised that the weapon has been developed to take advantage of the most modern production principles, employing a quick start-up time, low production costs, and a very low employment of machines and expert personnel."*
>
> *In various conversations the Commission pointed out that, in case the decision should be taken in favour of the adoption of this weapon by the* Bundeswehr, *the purchase of the production licence also for export would be not only desired but would have to be part and parcel of any such agreement. The faultless execution of sustained fire in two weapons using T65 [sic: 7.62mm NATO] ammunition was one condition. Within the Commission the thought of a so-called "weapons family" consisting of an SMG, assault rifle, and machine gun, also caused great interest. On February 3rd, 1956, the offer was handed over, and the first sustained-fire test on February 27th and the second on March 3rd were very successful.*

Ordering the First 400 H&K "STG CETME" Rifles

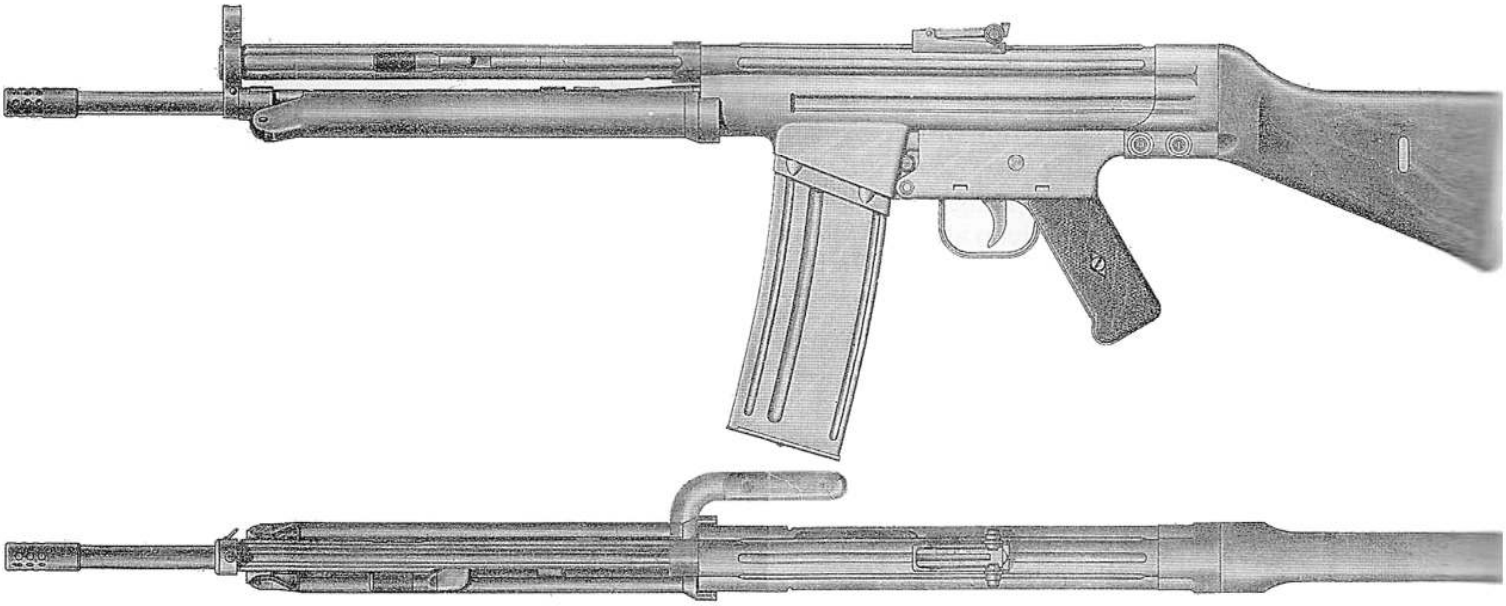
Ludwig Vorgrimler records the agreement to order 400 weapons for the upcoming *Bundeswehr* troop trials, provided they were produced in Germany, as follows:

> *. In April, 1956 the German contract was agreed upon, however, the condition was that Heckler & Koch of Oberndorf/Neckar, was to assemble the 400 weapons, so there could be German supervision at all phases of assembly.*

Werner Heynen expands on this somewhat, as follows:

> *. . On April 17, 1956 the German Defence Ministry ordered 400 CETME weapons along with 1,600 magazines and various spare parts, with a delivery date of July 1, 1956; the assembly of the 400 weapons to take place in Germany. Starting the previous January, German daily newspapers had already started carrying reports that the* Bundeswehr *was to rearm with a new assault rifle developed in Spain.*

Ensuring the Supply of German CETME Rifles



188. A reduction of a CETME wall chart titled *Fusil de Asalto* (Assault Rifle) depicting the Model A CETME, 400 of which were ordered in April, 1956 to be produced by H&K in Germany for *Bundeswehr* trials.
courtesy Walter Schmid

Werner Heynen's account continues:

> *. . Right after the April, 1956 order of 400 weapons for troop trials, discussions were held with German planning officials regarding the measures necessary to guarantee contingencies of necessary weapons for the newly-created German forces. To achieve this, close co-operation between CETME and H&K was absolutely necessary. It was intended that the parts which up to then had variously been manufactured in Germany and in Spain would continue to be made in these respective countries, while the assembly should take place half in Germany and half in Spain. The means of production in Germany owned by CETME should remain until the companies were able to supply a new set of tools particularly suited to the German purpose. On October 10, 1956 the German Defence Ministry declared its interest in the CETME weapon despite the necessary order of FN weapons, and highly recommended that measures be taken to assure delivery of the necessary number of pieces.*

Another Squeeze Play - from Fabrique Nationale

Dipl-Ing Heynen continues with an account of reasoning behind the order of 100,000 FAL rifles for the *Bundeswehr* from Fabrique Nationale of Herstal, Belgium, as follows:

> *. . Since foreign currency necessary for the production of parts had already been provided at the beginning of the year, the assembly at Heckler & Koch had begun with considerable speed. Only through these farsighted measures was it possible to assume that the demanded short term of delivery could be fulfilled. The short span of time was necessary because various powers within the German Defence Ministry wanted a binding declaration saying that the CETME weapon was ready for adoption. The acquisition of a greater number of weapons was considered absolutely necessary: as one of our engineers acting in Germany pointed out, very soon the decision would be made whether 30,000 or even 100,000 weapons should be ordered, likely from the competition [FN], since they were the only ones in a position to deliver immediately. Thus the assumption was that, with such an order, the final decision about which rifle the* Bundes-wehr *would adopt was only all too obvious: the competition had won.*

The FAL was not destined to win out in the long run as Germany's new postwar service rifle, but certainly in the short term it was available, and all of the teething problems concerning the NATO cartridge had long since been ironed out. As recorded in *The FAL Rifle*, the definitive order for 100,000 FAL rifles for the *Bundeswehr* was placed with Fabrique Nationale d'Armes de Guerre on November 13, 1956.

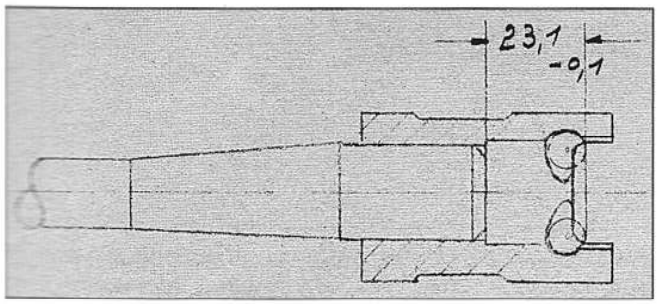
Production of the First 400 STG CETME Rifles

The Assembly Procedure

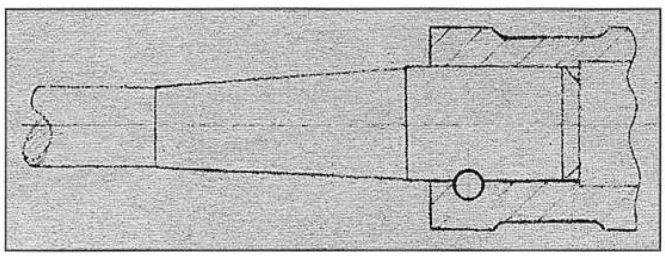
The "STG CETME" manufacturing programme continued, even in the face of the 100,000 FALs ordered from Fabrique Nationale.

The actual assembly process was meticulously planned and drawn up in a document titled *Arbeitsplan - Teil Fertigmontage für StG CETME*. Details of all 56 operations, listed in order of their occurrence, were as follows (in a translation kindly provided by Ralf Dieckmann). Some of the stages of assembly were accompanied by an illustration, and these follow in the pages ahead:

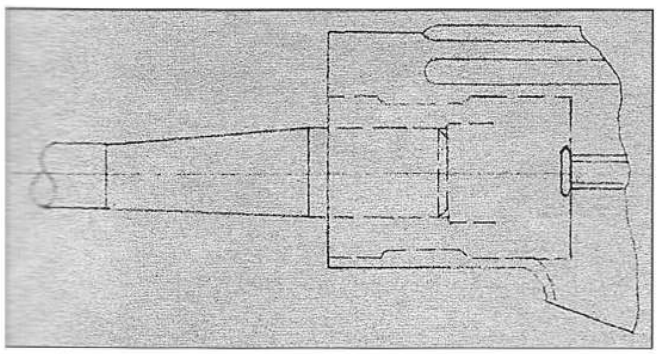
	Operation	Machine
1.	Press barrel into barrel extension	Special machine SK 2012
2.	Drill barrel/barrel extension assembly	Drill press
3.	Jig ream barrel/barrel extension assembly	
4.	Pin barrel/barrel extension assembly	
5.	Press barrel/barrel extension assembly into receiver	
6.	Electric weld barrel extension to receiver	Electric welder
7.	Clean welded area	
8.	Engrave serial number (receiver)	Engraving machine
9.	Engrave supply number [NSN]	Engraving machine



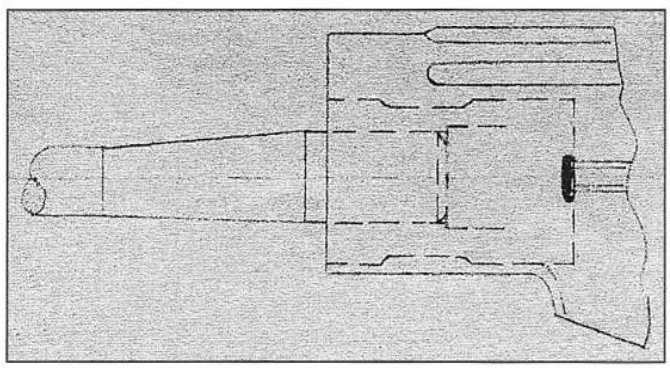
189. Illustrating assembly step 1, showing headspace as-sured by measurement from base of barrel to rear of locking lug recess in the barrel extension. courtesy Walter Schmid



190. Illustrating assembly steps 2 to 4: drilling and reaming the hole for precise location of the barrel pin, and inserting the pin. courtesy Walter Schmid

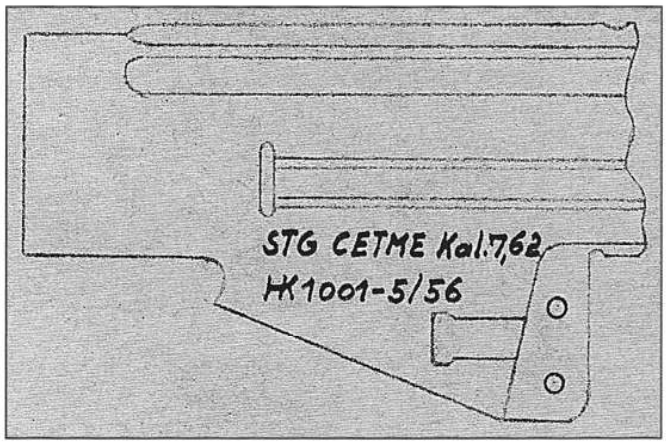


191. Illustrating assembly step 5: pressing the barrel and barrel extension assembly into the receiver. courtesy Walter Schmid



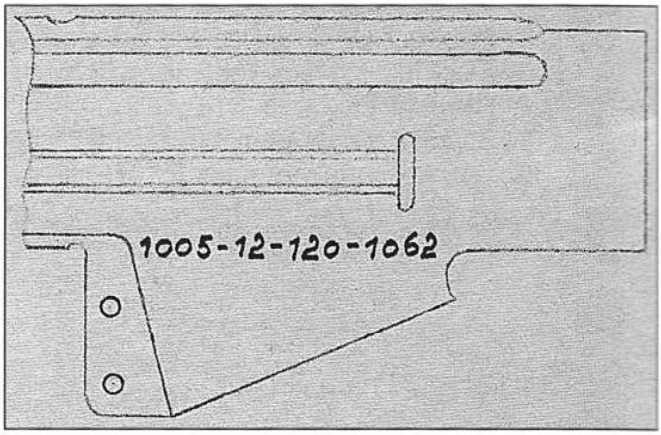
192. Illustrating assembly step 6: electric welding the barrel extension to the receiver. courtesy Walter Schmid

Operation	Machine
10. Assembly loading lever tube/carrying handle ring assembly to receiver	
11. Spot weld loading lever tube/carrying handle ring assembly to receiver	
12. Spot weld receiver and barrel extension	*Schlatter* welding machine
13. Clean weld spots in the receiver area	
14. Straighten barrel	Barrel straightener
15. Straighten receiver	
16. Seal barrel at both ends	
17. Sandblast receiver/barrel/loading lever assembly	
18. Bonderise receiver/barrel/loading lever assembly (proprietary phosphate coating)	
19. Clean receiver/loading lever tube assembly in mineral oil (naphtha)	
20. Smoothen loading lever tube with a round wire brush	
21. Assemble stop abutment, run-up plunger and rivet to loading lever tube	
22. Rivet stop abutment/run-up plunger assembly	



193. Illustrating assembly step 8: engraving the model, calibre, serial number and date on the left side of the receiver.

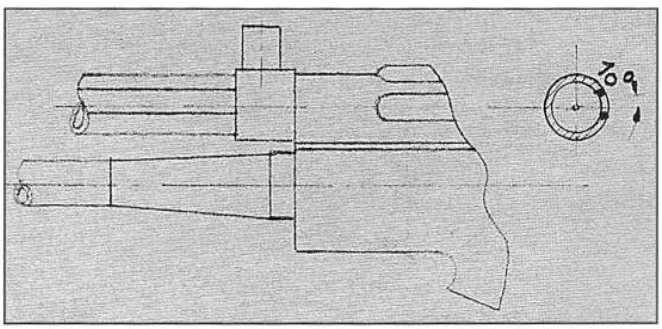
Note that the series started at serial no 1001, in May, 1956. courtesy Walter Schmid



194. Illustrating assembly step 9: engraving the supply number (the NSN; NATO Standard Number) on the right side of the receiver.

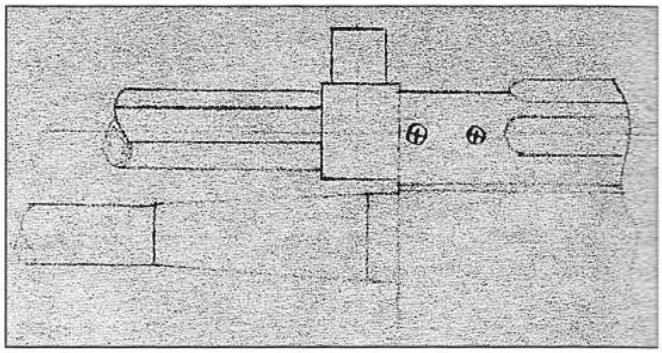
"1005" is the NSN class reserved for weapons, and "12" is the country code assigned to Germany.

courtesy Walter Schmid



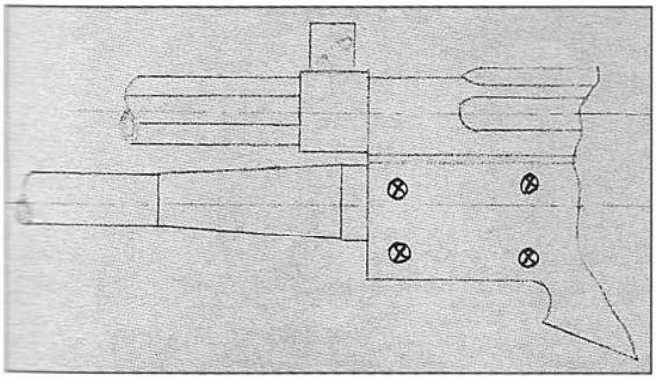
195. Illustrating assembly step 10: assembling the loading lever tube and carrying handle ring to the receiver.

courtesy Walter Schmid

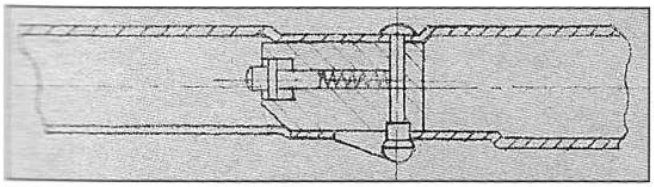


196. Illustrating assembly step 11: spot welding the loading lever tube/carrying handle ring assembly to the receiver.

courtesy Walter Schmid

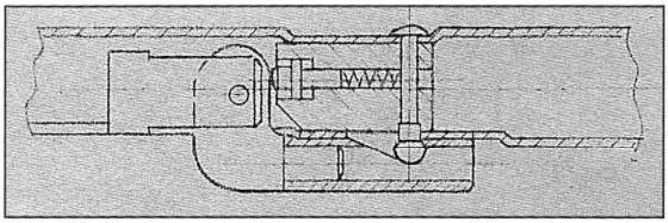


197. Illustrating assembly step 12: spot welding receiver and barrel extension. courtesy Walter Schmid

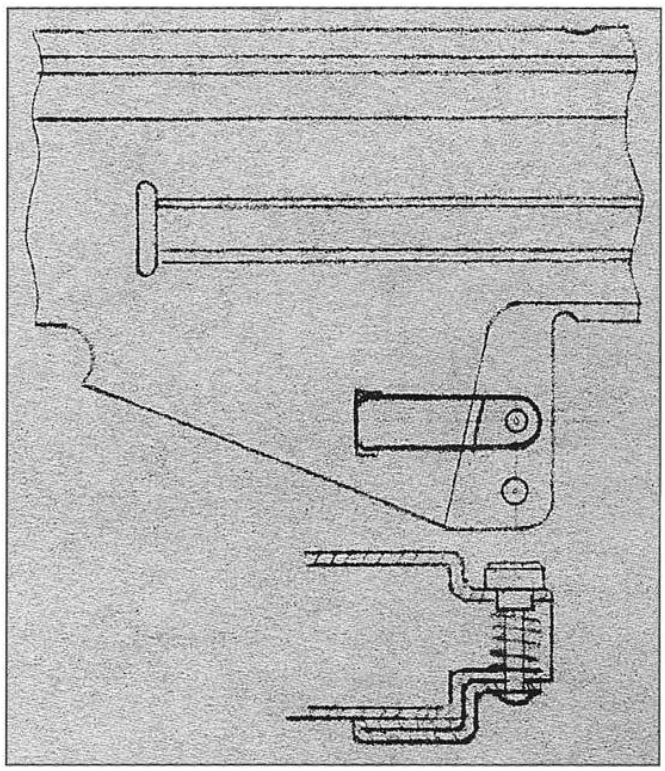


199. Illustrating assembly step 22: riveting the stop abutment run-up plunger assembly. courtesy Walter Schmid

198. Illustrating assembly step 21: assembling the stop abutment, run-up plunger and rivet to the loading lever tube. courtesy Walter Schmid



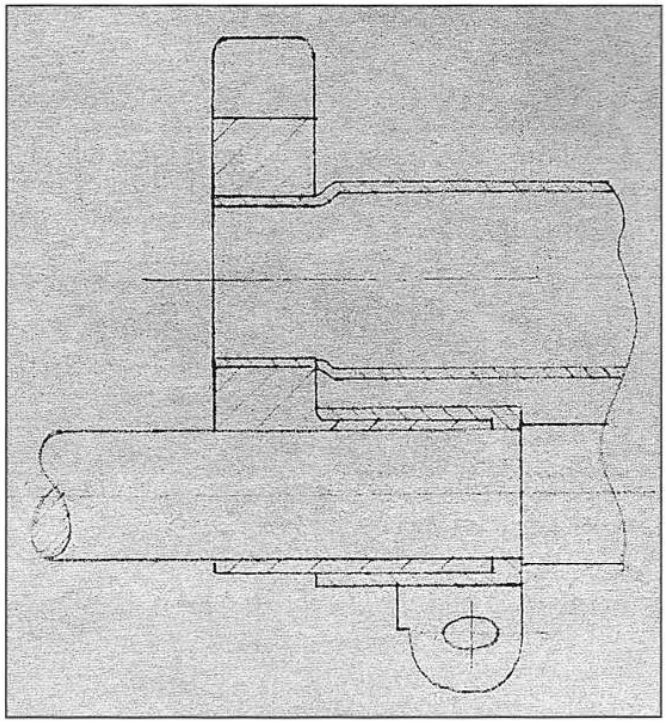
200. Illustrating assembly step 23: assembling the loading lever/loading lever support assembly. courtesy Walter Schmid



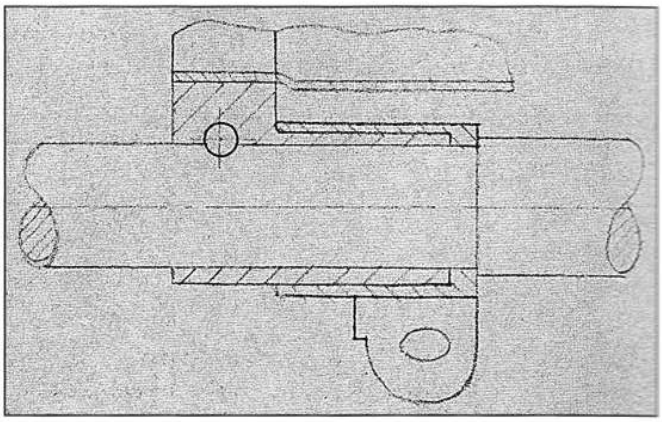
201 (right). Illustrating assembly step 24: assembling and riveting the magazine catch. courtesy Walter Schmid

	Operation	Machine
23.	Assemble loading lever/loading lever support assembly	
24.	Assemble and rivet magazine catch	
25.	Check barrel alignment and straighten if necessary	Straightening machine
26.	Control receiver (run in axially)	*Trudelmaschine*[1]
27.	Assemble front sight base and bipod support	Special fixture with drill unit
28.	Drill and ream barrel/front sight base assembly	

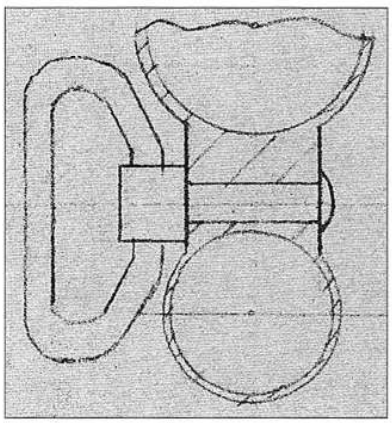
[1] Special precision measuring gauge used to test for "runout", i.e. the concentricity of one component to another; in this case, barrel and receiver



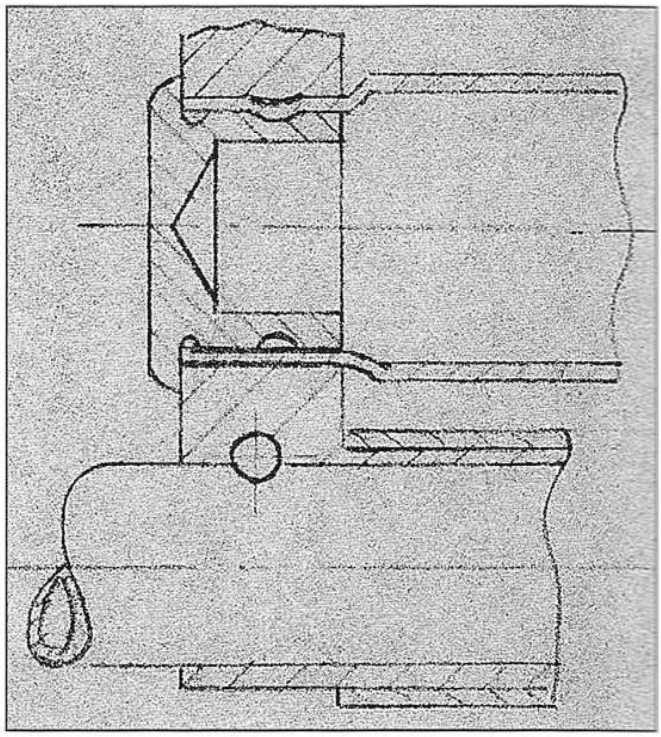
202. Illustrating assembly step 27: assembling the front sight base and bipod support. courtesy Walter Schmid



203. Illustrating assembly step 28: drilling the barrel and front sight base assembly. courtesy Walter Schmid

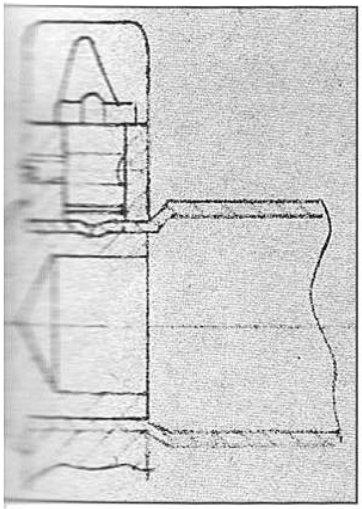


204 (left). Illustrating assembly step 29: assembling and riveting the sling swivel assembly.
courtesy Walter Schmid

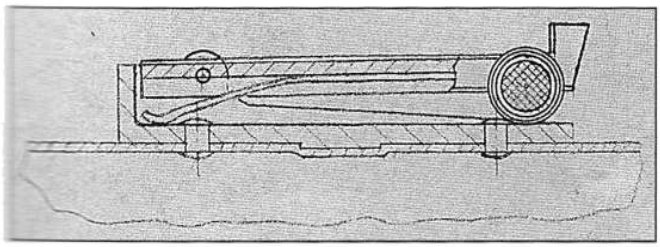


205. Illustrating assembly step 30: assembling and staking the cover plug. courtesy Walter Schmid

Operation	Machine
29. Assemble and rivet sling swivel assembly	
30. Assemble and stake cover plug	
31. Assemble front sight and front sight retaining screw to front sight base	
32. Drill rear sight base in assembly and rivet lightly	
33. Assemble rear sight leaf to rear sight base and align rear sight base/rear sight leaf assembly in rear sight alignment fixture	Calibration machine SK 2010
34. Remove rear sight leaf and permanently rivet rear sight base	
35. Assemble rear sight leaf	
36. Align front and rear sights (rear sight alignment fixture)	Calibration machine SK 2010
37. Assembly breech bolt assembly and check for functionability (adjust if necessary)	

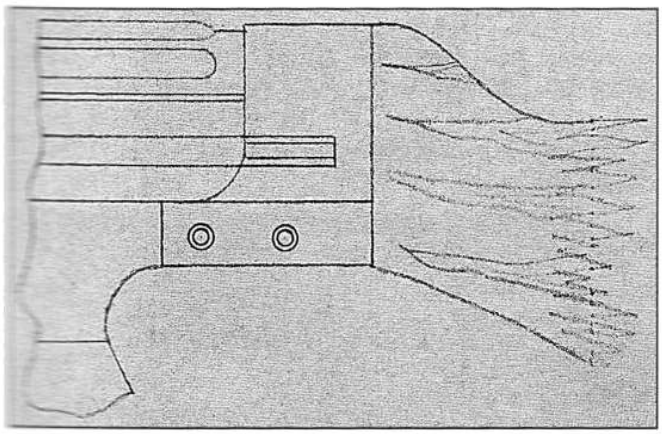


206 (left). Illustrating assembly step 31: assembling the front sight and front sight retaining screw to the front sight base.
courtesy Walter Schmid



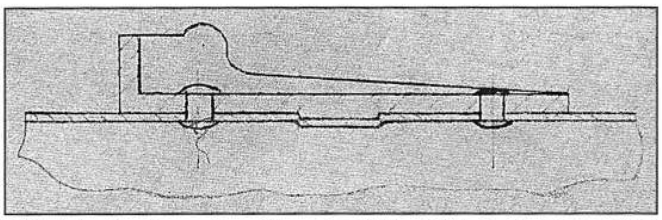
Illustrating assembly step 35: assembling the rear leaf.
courtesy Walter Schmid

right). Illustrating assembly step 38: assembling the trigger housing and inserting the rivet loosely.
courtesy Walter Schmid

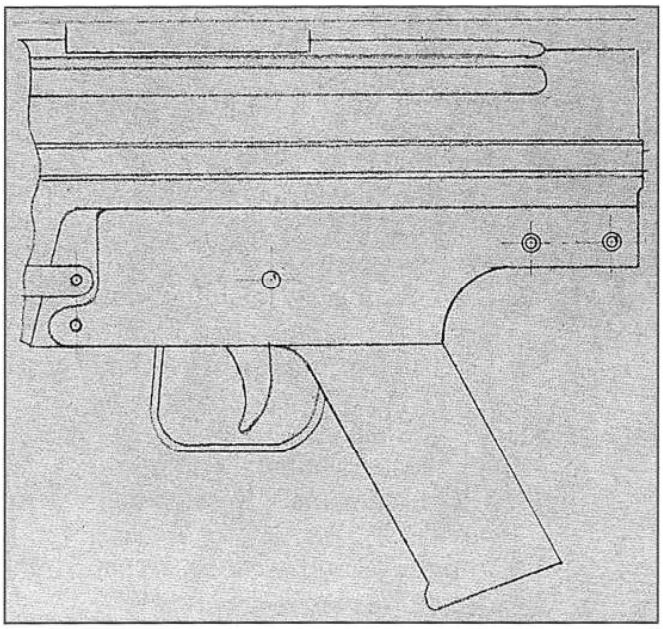


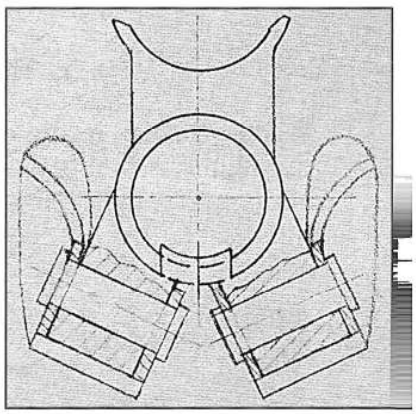
Illustrating assembly step 40: assembling the stock return spring, line reaming the trigger housing, stock support and receiver in assembly, and assembling the stock support.
courtesy Walter Schmid

right). Illustrating assembly step 42: assembling the handle.
courtesy Walter Schmid

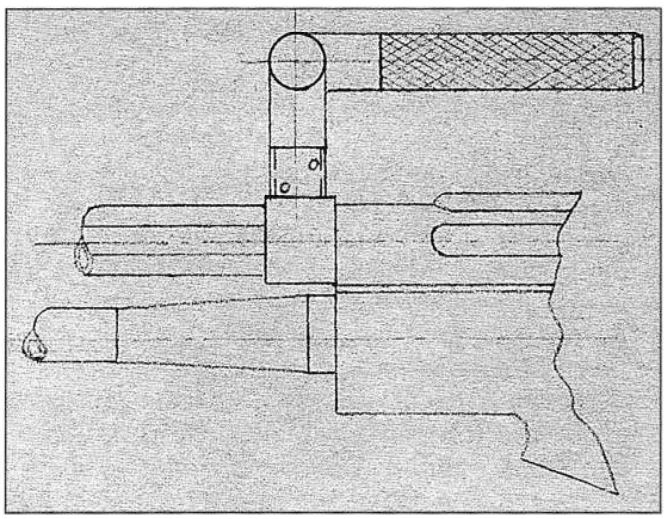


207. Illustrating assembly step 32: drilling the rear sight base in assembly and riveting lightly.
courtesy Walter Schmid





211 (right). Illustrating assembly step 41: assembling the bipod.
courtesy Walter Schmid



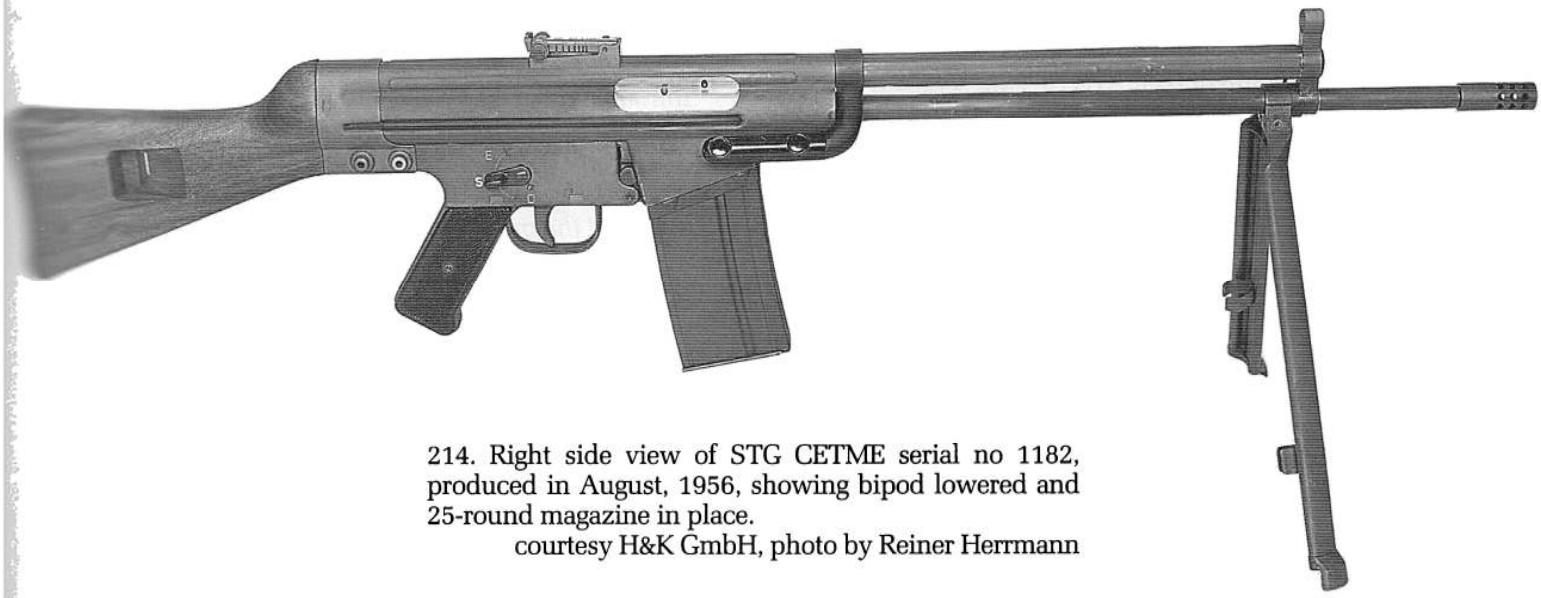
Operation	Machine
38. Assemble trigger housing and insert rivet loosely	
39. Impress serial number into stock support	
40. Assemble stock and return spring, line ream trigger housing, stock support and receiver in assembly, assemble stock support	
41. Assemble bipod	
42. Assemble carrying handle	
43. Thread flash suppressor to barrel	
44. Proof test (1 proof test cartridge)	
45. Impress proof test stamp into barrel flange and receiver	
46. Function fire	
47. Inscribe serial number into bolt carrier, bolt head and locking piece	
48. Accuracy test	
49. Stake front sight retaining screw and apply index mark	
50. Rivet all pins (rear sight leaf, hand grip housing and bipod)	
51. Clean weapon	
52. Fill in letters in hand grip housing (red and white)	
53. Fill in index mark in safety lever with fluorescent paint	
54. Impress second acceptance stamp into receiver	
55. Grease weapon	
56. Assemble carrying sling	

Too Many Fingers in the Pie Leads to Delays in Assembly

Werner Heynen records some of the problems faced during the assembly process of the first 400 rifles at H&K, particularly as these involved well-meaning interference from the Quality Control Commission and other "experts":

> . . *Meanwhile, Heckler & Koch had immediately begun the assembly programme, wherein two engineers from CETME were ordered to assist. All this work was under the pressure of time from the beginning. As always, in beginning a production run, things occur that are not easy to foresee: the best experience suggests that these things are unavoidable. The assembly of the CETME weapon in Germany had its share of these occurrences. Among the worst problems were wandering impact points in precision shooting, and cracks appearing in the stamped receiver housing. These were the most unpleasant ones. The causes were of course quickly recognised, but since the German Quality Control Commission was present already at the beginning of the assembly run, and since these discoveries were immediately reported to the German Defence Ministry, faith in the weapon's ability to handle the full-power NATO ammunition was shaken.*
>
> *The German Defence Ministry believed that well-meaning advice would speed up the production process and some wild theories were advanced, which resulted in unnecessary debates. It would have been infinitely better if Heckler & Koch. together with the CETME development and assembly engineers, had been given the responsibility to perfect the assembly process and then hand the finished weapons over to the Quality Control Commission for inspection. The Commission literally did everything to prevent the delivery within the given time limit, and thus nervousness among all the participants increased. The presence of the Quality Control Service, which was meant to be an advantage inasmuch as decisions could immediately be made, proved in reality to be a considerable hindrance. It was very obvious also with this Commission, that the competition [FN] knew every detail of our troubles, and used this information to its own advantage.*
>
> *Technical experts of the Defence Ministry demanded continuous modifications to the weapons*

213. Left side view of "STG CETME" serial no 1182, produced by H&K in August, 1956 as one of the first 400 *Bundeswehr* trials rifles.
courtesy H&K GmbH, photo by Reiner Herrmann



214. Right side view of STG CETME serial no 1182, produced in August, 1956, showing bipod lowered and 25-round magazine in place.
courtesy H&K GmbH, photo by Reiner Herrmann

215. Left side closeup of H&K STG CETME serial no 1182. Note the initial application of the German selector markings "E", "S", "D". The selector is located on the right
courtesy H&K GmbH, photo by Reiner Herrmann

216. Further closeup of H&K STG CETME serial no 1182, showing markings on left side of magazine well.

Compare with fig 12-31: note the absence of German acceptance stamps on this pre-trial rifle.

courtesy H&K GmbH, photo by Reiner Herrmann

being assembled in Germany. Many of these people had considerable experience from the Second World War and were familiar with the latest conditions of technical warfare, and it became apparent that the development of the CETME weapon in Spain, which had relied strictly on technical skill, had sorely lacked the input of military experience. The numerous modification requests in almost all cases concerned trifles and petty details that were nevertheless important, but also included some changes of a very basic kind; for instance, the ability to cock the weapon while the safety was engaged, and the kind of bipod used. There can be no doubt that these changes offered advantages in the use of the weapon and simplifications in its production, but just as surely they helped to defer the delivery date again and again, and thereby contributed considerably to the decision to abandon the programme.

It is to the honour of the firm Heckler & Koch that despite all these disturbing circumstances and the back-and-forth of opinions, they steadily followed their course. They never left anything untried, and with all their might they worked for the introduction of the CETME weapon to the Bundeswehr, *particularly trying to please everyone who had a say in the decision. With that of course it should be mentioned that it was a great disadvantage that the main development engineer [Ludwig Vorgrimler] was hired away from the programme by the firm of Mauser in Oberndorf, and despite an agreement with Heckler & Koch, there was no further trust or co-operation between H&K and the new Mauser-CETME alliance from September 14, 1956. It is always bad when a father can no longer look after his child, and has to give control into someone else's hands . .*

Bundeswehr Troop Trials with the STG CETME

Dipl-Ing Heynen's account next—very briefly—describes the troop trials of the HK CETME rifle by the *Bundeswehr*:

*. . Finally, however, in December, 1956 the very last weapons of the order were delivered to the various military departments, and a comparison trial with the FN FAL could take place. In January, 1957, one of the large-circulation German magazines [*Der Spiegel*] reported very favourably on the testing of the CETME weapon in Germany. It was around this time also that it became known that the Swiss* Bundeswehr *was equipped with the SIG rifle, a weapon weighing more than 1kg more than the CETME, which even for that reason alone could not be considered a serious competitor.*

Three Phases of Post-Trial Modifications

Werner Heynen next records in detail the aftermath of the *Bundeswehr* troop trials, and the modifications which were to be incorporated into the series production weapons in three distinct phases, as follows:

. . The results of the first troop trials were released in March, 1957, indicating that the CETME weapon satisfied all conditions regarding handling, precision, and reliability. Naturally, as always in these situations, each particular unit had next to its list of common desires for changes and modifications a few special ones as well. All these were collected by the Technical Department, and were to be included into the blueprints in three steps. After completion of the trials, these particular changes were to be incorporated into the series production weapons.

For the record it is interesting to include herewith this list of changes, beginning with the Phase

217. Left side view of STG CETME serial no 1508, produced in September, 1956, with butt pins removed, butt assembly, bolt group and 25-round magazine disassembled. and trigger group lowered.

Note the wood section added to increase the length of the buttstock, one of the post-trial Phase One changes noted below. courtesy FN Herstal

One changes (those which had to immediately be included):

1. *design a combination flash hider and grenade launcher*
2. *make the front sight protector stronger*
3. *make the rear sight either flip-up or diopter*
4. *fit a catch or stop on the carrying handle*
5. *change the positions of the change lever detents*
6. *build in a spent case deflector*
7. *replace the metal buttplate with rubber*
8. *simplify the production of the pistol grip*
9. *change the sling attachment points*
10. *make the cocking lever longer*
11. *change the outer shape of the barrel*
12. *change the recoil spring guide*
13. *change the pistol grip attachment pin*
14. *change the buffer system*
15. *change the shape of the buttstock*
16. *change the trigger system safety lever*
17. *make the cocking lever more ergonomic*

218. Left side closeup of the receiver of the above rifle, showing markings on the magazine well.

Compare with fig 12-29: it appears the markings are now roll-stamped rather than being engraved. Note the two *Bundeswehr* acceptance stamps at top left. courtesy FN Herstal

Phase Two - to be included after completion of the trials:

1. *stronger bipod*
2. *special hand protection [handguard]*
3. *more ergonomic shape to the pistol grip unit*
4. *reduced weight*

Phase Three - after some construction and thorough testing:

1. *change the trigger mechanism so cocking is possible with the safety on*
2. *produce a lighter 20-shot magazine*
3. *breech to stay open after last cartridge is fired.*

These three phases of modifications were not introduced all at once. Henk Visser recalls that there were "many small series" produced during this period which incorporate some but not all of the listed modifications.

219. Left side view of STG CETME serial no 1512, also produced in September, 1956, with grenade launcher and grenade sight installed.

The buttstock has been lengthened, but the grenade launcher is still an accessory. courtesy H&K GmbH

220. Right side view of an STG CETME made into an instructional cutaway.

courtesy H&K GmbH, photo by Reiner Herrmann

221. Right and left side views of the pistol grip/trigger group assembly for the early STG CETME, with trigger-guard removed.

The selector lever is located on the right side, with a notch on the shaft on the left side indicating which position the lever is occupying. courtesy H&K GmbH

Chapter Thirteen

The Rocky Road to the G3

The Fight over Wartime Roller-Lock Patents

As the possibility of the STG CETME becoming the next German service rifle steadily gained credence, its potential value increased accordingly. With the entire *Bundeswehr* hungry for arms, it took very little imagination to contemplate the lucrative nature of the impending production contracts.

Thus the question of prior patented ownership of the features of the action concept itself became increasingly important, to the point where it engendered a seemingly endless series of patent disputes during the later 1950s and the 1960s among Heckler & Koch, Mauser, and Rheinmetall.

The first such battles were attempts to establish, in court, just who had been the first to develop and use the semi-rigid roller lock. A brief introduction to this convoluted story, told by Ludwig Vorgrimler, is somewhat confusing, as while the facts concerning the events appear clear, the patent numbers and dates to which he refers do not agree with the available documentation:

> *Mr Johannes Grossfuss of Döbeln, Saxony, was released from Soviet detainment in 1952. Returning to the Federal Republic of Germany, [he] sold all his patent rights for the MG42 and his rights from current re-registrations to Rheinmetall of Düsseldorf. The deadline for patents and all other wartime claims was September 30, 1950, but Mr Grossfuss who had received special recognition, and did not return until the end of 1952 from the Russian prison camp, was allowed to claim all his patents after his return.*
>
> *While the Mauser company during the time up until the end of 1955 was under a French commander and in liquidation, they had, however, an assign, their parent company Industriewerk Karlsruhe, for whom the restriction to protect their rights for the Mauser company did not apply to the same extent as it did for Mr Grossfuss. Of the 200 patents in force at end of the war and the many current applications of the Mauser company, amongst which were also the one for the semi-rigid [roller lock] breech mechanism, only seven of their former patents were upheld, but only those that were not directly connected with weapons, otherwise these would have also become victims of the liquidators' censorship. Following complete disassembly and liquidation at the end of 1955, Mauser suffered the loss of all patents and rights from former applications, and had to witness that all re-applications made by Grossfuss in favour of Messrs Rheinmetall GmbH were successful, which all their appeals in this matter could not prevent.*
>
> *At the time Mauser was working together with the Spanish company [CETME] on the development of a machine gun [discussed below] based on the CETME rifle, and thus heard of Rheinmetall's objections against manufacture in Germany. Therefore a meeting was held among CETME, Heckler & Koch and Mauser-Werke at the end of 1956. During this meeting Mauser offered to manufacture the three breech mechanism parts in question for CETME, resp. Heckler & Koch, at their factory, this after checking the records and statements under oath of several co-workers, who, to a certain extent were recognised as inventors and had been involved in this development from the very beginning, in case no proportional agreement could be reached with Rheinmetall. The company confirmed their offer by depositing a large bond in the amount of DM 50,000 with the court in Rottweil, until a court decision was reached regarding the accuracy of pre-use rights by Mauser. Upon this pre-use right statement for the semi-rigid roller breech mechanism made by Mauser, Rheinmetall, during a meeting on January 12, 1957 in Düsseldorf, referred, for the first time, to the old Grossfuss patent no 955 819 dated September 26, 1939, for the fixed lock breech mechanism for the*

recoil-operated MG42, which, however, had nothing to do with the CETME weapon, and was simply mentioned because of its earlier date, and to fool the less knowledgeable. This proof was extremely far-fetched, and probably would not have held up in a later court fight, otherwise the subsequent patent 933 392 and its additional patent no 976 428 dated June 30, 1944 would not have been granted.

As far as the last patent is concerned, Mauser could have proved prior use even though there was no violation in regard to the CETME rifle. The Mauser company had applied for a patent on February 16, 1944, no AzM 195690 XI 72 h, for a breech mechanism with a double sloping guide piece, which showed already some of the characteristics of patent no 976 428, dated June 30, 1944. This is further proof that Mauser of Oberndorf was already working on the problems of the Sturmgewehr *G3 with the semi-rigid roller breech mechansim, beginning in 1942 up to 1945, and later on further development was continued in Spain, and had not, as an inexpensive solution, been taken over from the MG42V (MG45) . . Furthermore, in the previously mentioned records of the* Bundesarchiv *Freiburg, it clearly documents that the semi-rigid Mauser MkB is mentioned much earlier than the MG42V (MG45), and therefore had to have been developed earlier. The Mauser MkB is first mentioned on April 1, 1944, while in regard to the MG42V, [a note] dated August 30, 1944 reads "no sample available as yet." I can verify all these statements . .*

The Confrontation Begins

The story of how the confrontation over the use of the half-locked roller action began between Heckler & Koch and Rheinmetall is told in a further excerpt from Ludwig Vorgrimler's account. This time the patent number and date to which he refers are correct:

. . After the 400 CETME rifles had passed tests at the Shooting School in Hammelburg, the weapon was to go into production [at Heckler & Koch]. Now Rheinmetall GmbH of Düsseldorf came into the picture for the first time at the end of 1956, and threatened Heckler & Koch and CETME, requiring them to stop and prohibited them from manufacturing the weapon in the Federal Republic of Germany, referring to Mr Grossfuss' patent rights for the MG42, especially to the principal patent no 955 392, registered by Grossfuss in Döbeln on June 25, 1943, which was made public on June 21, 1956 . .

In a memorandum titled "Brief Data on the History of the G3", dated February 7, 1969, Otto Schulze, the former head of the wartime FG42 programme and a seminal force throughout the period of the selection and adoption of the G3 rifle in Germany, confirmed the granting of the Grossfuss roller lock patent in 1943, as follows:

. . The MG42 was the first German weapon design that used rollers to attack the problem of frictional difficulties . . A simplified action was developed to improve on the MG42 and save materials. A patent for the new action was applied for by the Grossfuss firm in Döbeln, Saxony, on June 24, 1943, under number G11355 XI/72 H. Because it was a secret patent, it was first made public in Germany on June 21, 1956, under provision of the first transitional law of August 7, 1949. The MG45 was developed in 1944 through use of this patent. That gun had a roller-locked action, fired on closing, and had a shortened barrel jacket that saved over 3.5kg of material . .

The story is next taken up from the CETME point of view by Werner Heynen, as follows:

. . At the end of 1955, Rheinmetall had shown great interest in the acquisition of the [CETME] production rights. We, however, had to point out that we already had an agreement with H&K, whereupon in April, 1956 H&K and Rheinmetall agreed to co-operate in the production of the CETME weapon in Germany. It was on this agreement that Rheinmetall depended in November, 1956, when they complained that the CETME weapon design infringed on parts of their recently acquired Grossfuss patents. These patents, by the way, went back to the war years, when they were considered as Secret Patents, although they were well known in expert circles (and [were later] used, for example, in the SIG weapon). They had been granted after the war, and were valid only in Germany . .

But then the German firm Rheinmetall, due to certain rights regarding patents, insisted in participating in the production. A proposal was considered whereby the production rights would be handed over to a German working committee, which would produce the first weapons for Germany in conjunction with CETME.

A co-operation with Rheinmetall was welcomed by the Spaniards. In February, 1957, negotiations were held in Düsseldorf, wherein was discussed the possibility of expanding such a co-operative agreement to include the Mauser firm. CETME considered this advisable, because there was a certain family similarity between assault rifles and machine guns. At a second meeting, however, the Mauser firm did not take part. There a visit to Madrid was planned, to consider the fundamentals for a co-operative effort . .

Discussions about the production of a certain number of assault rifles were held at a meeting in Koblenz in April 1957. At the beginning of the co-operation period H&K had pushed for a licensing agreement with CETME, but this did not materialise due to the inability of H&K to meet the CETME demand for an initial payment . .

In April, 1957 an additional conversation took place in Düsseldorf, to discuss the coming co-operative effort, wherein the decision was taken that CETME should be the recipient of the order from the Ministry, and that both German companies were co-operators, responsible particularly for assembly of the weapon in Germany. The Madrid visit took place on May 17, 1957, but the essential condition for further negotiations, namely the creation of contracts between CETME and the "German group" (Rheinmetall and H&K), made no progress. It was for this reason that we informed both companies in June, 1957 that if an agreement could not be arrived at very shortly, we would offer the production rights to the Defence Ministry itself.

Mauser is Odd Man Out

Ludwig Vorgrimler's account concludes with the view from the Mauser side as follows:

. During the meeting in Düsseldorf held on January 12, 1957 [Heynen, above, says it was in February], Mauser representatives first learned that negotiations had been going on between Rheinmetall and Heckler & Koch regarding the G3, which made any further participation in this project by Mauser unneccessary. Especially for financial reasons, Mauser's participation was not wanted. In their combined efforts they finally succeeded in driving this point home with the German authorities and CETME . .

[However] the Mauser company can claim that they, long before any others attempted it, dealt with the problems of the semi-rigid roller breech mechanism, using their own funds and expertise for development and testing, as is proven in documents that are still available today . . Mauser can claim the moral victory to have laid the ground work for the G3 rifle, [which is] not much consolation when others made all the money . .

H&K and Rheinmetall Victorious

Ludwig Vorgrimler recorded the outcome of the epic battle for ownership of the roller lock action as follows:

. . In Germany the government . . awarded Heckler & Koch and Rheinmetall the manufacturing rights for the G3. The contract with Heckler & Koch stated that the company could fight any new applications regarding the G3 rifle, and costs would be borne by the German government.

The Last Word

For his part, Dr Maier steadfastly refused to credit the government's decision concerning the primacy of the Grossfuss roller lock patents. He summed up his long view in his 1995 memoir with the following vindictive comment:

. . In my opinion Mr Grossfuss was a <u>first rate Patent Swindler</u>*. During the postwar years Mr Grossfuss managed to use as many ideas as possible from his competitors and had them patented in his name. He then sold the entire package of patents with profit (and immediately) to the Rheinmetall company.*

The Short-Lived Mauser-CETME MG

Vorgrimler's Return to Mauser

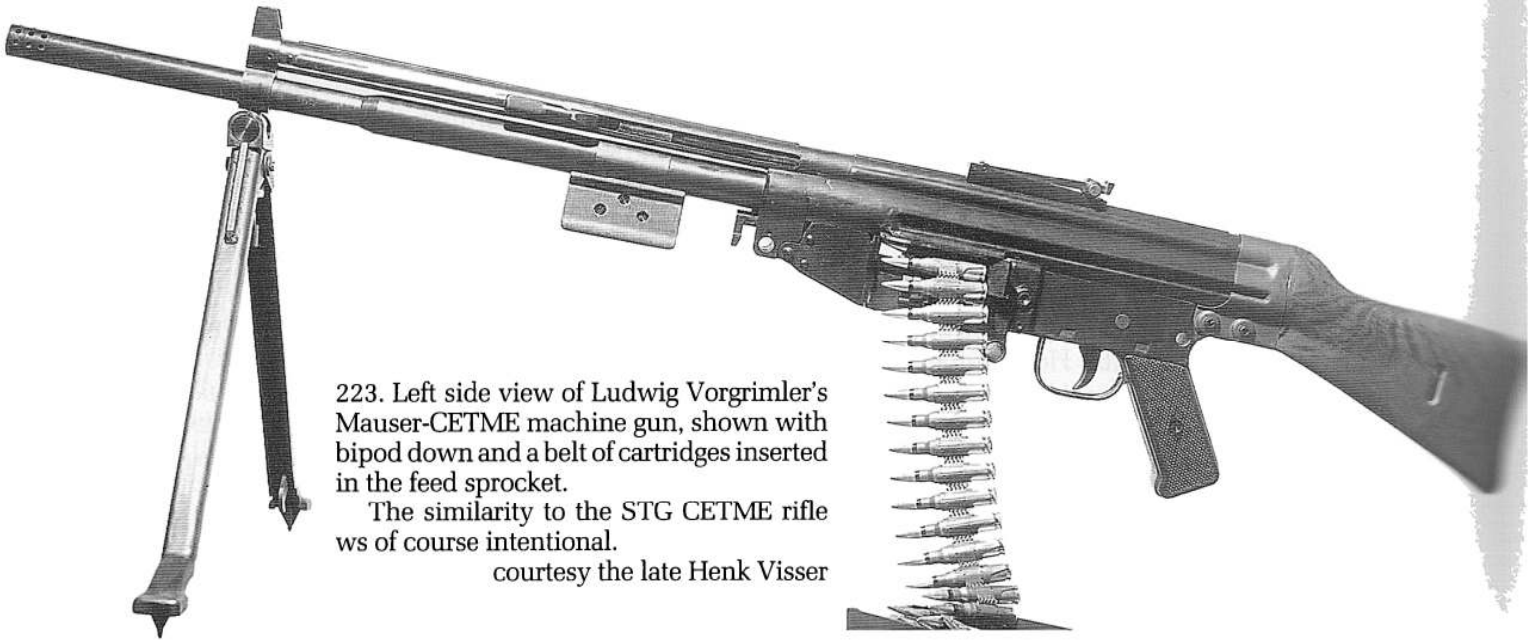
Alex Seidel, a former wartime colleague of Ludwig Vorgrimler's at Mauser, wanted Vorgrimler to come to work with him at Heckler & Koch after he returned to Germany in the summer of 1956. At that time, however, H&K was a small company without an established reputation, and throughout the late 1950s rumours abounded of the problem-plagued CETME programme being dropped, while Mauser was widely predicted to become an important part of postwar German re-armament, just as it had after Hitler had come to power in the 1930s.

In any case, in the words of Werner Heynen, Vorgrimler "was hired away from the [CETME] programme by the firm of Mauser in Oberndorf, and despite an agreement with Heckler & Koch, there was no further trust or co-operation between H&K and the new Mauser-CETME alliance from September 14, 1956."

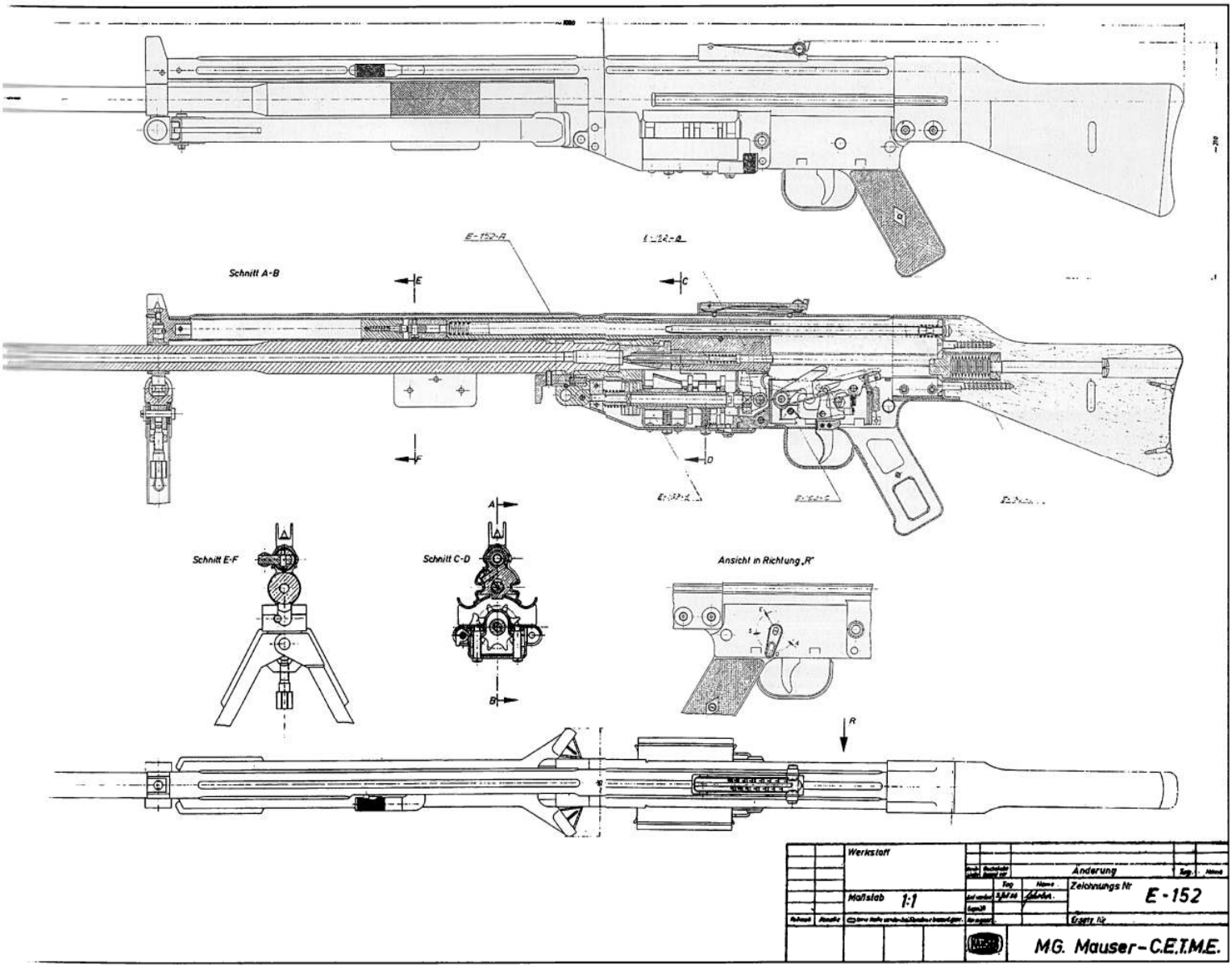
Henk Visser recalls that when Vorgrimler returned to Germany as head of Research and Development, the total executive staff in the Mauser office consisted of two people: Vorgrimler and the firm's postwar director, Dr Dr Dörge.

222 (right). Ludwig Vorgrimler in a photo taken shortly after his return to Germany in 1956.
courtesy Manfred Kersten, *service K*

Vorgrimler Designs the Belt-Fed Mauser-CETME Machine Gun



223. Left side view of Ludwig Vorgrimler's Mauser-CETME machine gun, shown with bipod down and a belt of cartridges inserted in the feed sprocket.
The similarity to the STG CETME rifle ws of course intentional.
courtesy the late Henk Visser



224. Mauser drawing no E-152 titled MG Mauser-CETME dated July 3, 1956, showing various views and sections of Vorgrimler's belt-fed roller lock design.
courtesy the late Henk Visser

...tal of ten Mauser-CETME belt-fed machine guns ...re built as a co-operative project between the two ...mpanies. The basic parameters were similar to ...ose of the CETME Model A—the short buttstock, ...raight pistol grip with chequered plastic grip pan... etc—although the Mauser-CETME was fitted ... a much heavier quick-change barrel dimen...ed at the muzzle for launching grenades, a longer ...t radius with a tangent sight graduated to 1,600 ...es. and a stronger bipod, which closely resem...ed that of the MG34.

The Mauser-CETME machine gun was in...ded as a companion model to the CETME assault rifle, which meant that it had to keep closely to the same basic body configuration, and utilise as many standard components as possible. This turned out to be its downfall, as it resulted in a complicated belt feed system which fed the cartridges in from below the bolt and was subject to component wear and jamming.

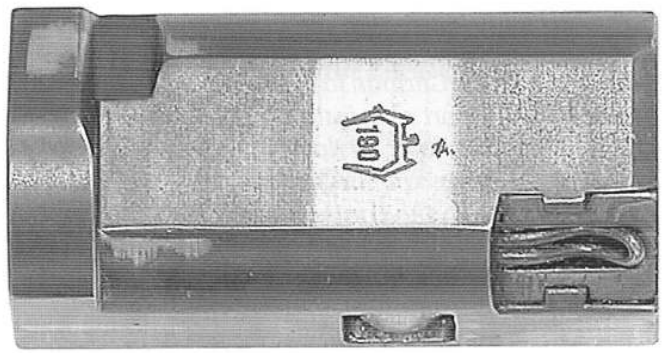
The German government was happy with the MG42, but since Vorgrimler had designed the Mauser-CETME, they felt duty-bound to purchase five of the guns. There was, however, no hope of its adoption in Germany—the Mauser-CETME was never even tested there.

225. Left side closeup of the Mauser-CETME machine gun serial no V-011, showing details of the feed system which fed the belted cartridges into the receiver by means of a sprocket arrangement below the path of the bolt.
courtesy the late Henk Visser

226. Right side closeup of Mauser-CETME machine gun serial no V-011 with grip and feed assemblies lowered.
Note the change lever, with German markings, located on the right side. MoD Pattern Room collection

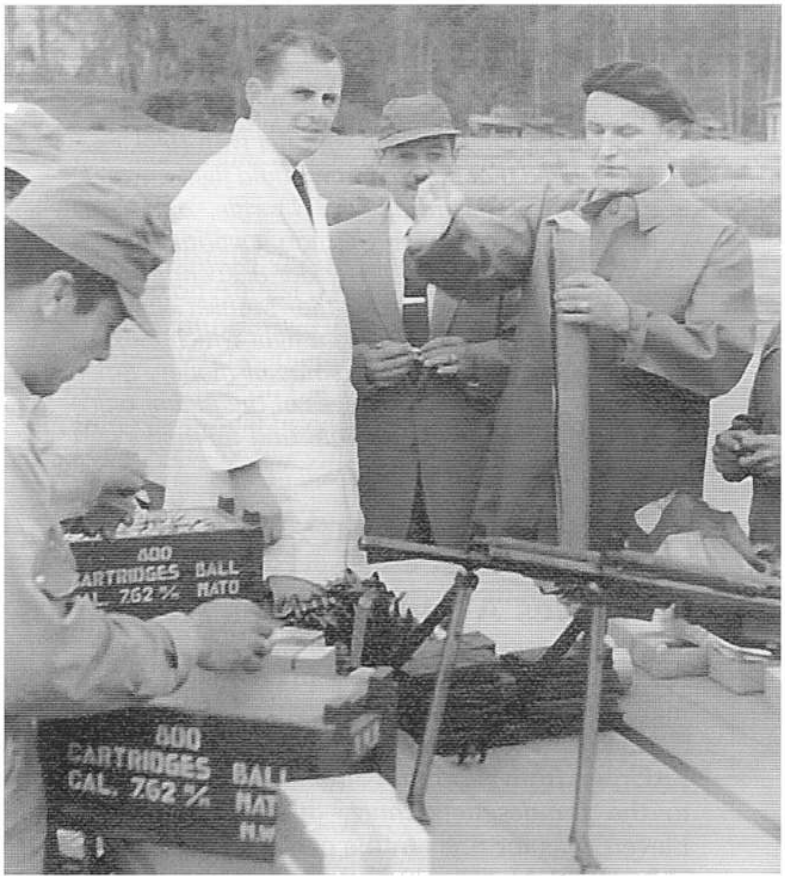
227. Left side closeup of Mauser-CETME machine gun serial no V-011, showing markings.

Henk Visser, who had purchased this example for use in trials, later donated it to the MoD Pattern Room where it resides today. MoD Pattern Room collection



228. Top closeup of the bolt head of the Mauser-CETME machine gun, showing large etched German military acceptance mark. MoD Pattern Room collection

NWM bought the remaining five guns and demonstrated them in Ecuador and for the Dutch Army, where a tendency to violent ejection was noted and caused objections.



229 (right). Henk Visser, left centre, and Ludwig Vorgrimler, right, prepare to demonstrate the Mauser-CETME machine gun in Ecuador.

Note the wooden ammunition crates, each holding 800 rounds of 7.62mm NATO ball in what appear to be 20-round boxes. The partial initials "NW", visible on the lower crate, indicate manufacture by Mr Visser's company, Nederlandsche Wapen- en Munitiefabriek (NWM) of s'Hertogenbosch, Holland. collection of the late Henk Visser, photo courtesy Dan Shea

The Second Great Patent Battle

H&K versus Mauser re the Vorgrimler *Rückprallsperre* (Recoil Lock)

Ludwig Vorgrimler introduces the second series of court battles which continued to plague the fledgling G3 programme in Germany, as follows:

. . When during 1953, 1954 and 1955 the CETME weapon became more popular, the Spanish directors urged me to have all the new innovations patented, which [inventions] included the trigger system and the recoil lock. At the same time there were rumours in Madrid, which were supposed to have come from the German Ministry of Justice, warning all German citizens working abroad to be careful with foreign patent applications, since they could possibly result in lawsuits once they returned

home. Following this our group of ten met with our group leader Mr Heynen, asking him to clarify this matter with the German [authorities], otherwise we would not report any innovations. This problem was cleared up later on during a personal conversation.

According to the contract with CETME at that time concerning the development of a Mauser CETME light machine gun, both partners were bound to report any innovations in their respective countries, Mauser in Germany, CETME in Spain. According to this agreement, and because the Mauser management strongly urged me to do so, I applied for the previously mentioned recoil lock for the MG, being more important than for the G3, at the end of 1956 under patent Az M 32 456/c/72 h/DAS 1 119726 . .

[As noted above], the government had awarded Heckler & Koch and Rheinmetall the manufacturing rights for the G3. The contract with Heckler & Koch stated that the company could fight any new applications regarding the G3 rifle, and costs would be borne by the German government. According to this contract, Heckler & Koch immediately filed suit against the Mauser [patent] application, starting a patent fight which took 10 years and cost enormous sums of money. Since there was a change of judges at the patent office while the trial was going on, and the new court found that mistakes had been made, a settlement was proposed to the opposing parties. The 32-page deposition by Heckler & Koch, dated August 14, 1968, wherein they argued previously published rights to the recoil locking system, was completely rejected. Mauser was awarded the patent, however, they had to agree, upon government request, not to ask for any licensing fees from G3 production, agreeing that they did not have any claims against Germany, even if German production rights were passed on to third parties . .

*Heckler & Koch was asked to retract their objections. Also, Mauser was offered help in getting other contracts. Totally against the advice of our then patent attorney, [*Dr-Ing *Ernst] Maier, in Munich, the Mauser management agreed to this settlement . .*

During the ten-year court battle for patent rights, Heckler & Koch made use of the time to try and circumvent the Mauser patent no 1 119 726 Recoil Locking Mechanism. Mr Koch omitted the locking lever in the breech block carrier, and he and his team developed a locking mass made of heavy [tungsten] granules, DB no 1 242 477/71 d, and put it in the breech block carrier, which was supposed to have the same effect as the Mauser/CETME recoil lock. However, the gravitational force of this mass caused fallback when firing high, thus actually promoting recoil . .

The G1 (FN FAL) in Germany

"Series A" and "Series A2" Rifles Ordered for the *Bundesgrenzschutz*

According to the German researcher Matthias Schörmal who has studied the history of the FAL in Germany, the Germans placed at least four orders for FAL rifles from Fabrique Nationale. The first delivery to the *Bundesgrenzschutz*, discussed in Chapter Eleven, was for rifles in the configuration known at FN as the FAL "Canada", described in German nomenclature as the original "Series A". These were fitted with wooden forends and the original high line of sight. The triggers on these first rifles were not yet fine-tuned as on later BGS rifles.

After the first order for 20 "Series A"rifles without flash hiders, a further 2,000 rifles known as "Series A2" were ordered. These were fitted with the US-type flash hider, which screwed onto the threaded muzzle end of the barrel and was secured by a small screw above.

Troop Trials with the First 100 "Series A2" FAL Rifles

By November, 1955 the first 100 "Series A2" FAL rifles had been received, and on November 23 and 24 a conference was held at the BMI (Ministry of the Interior) in Bonn, where it was decided to conduct an extended six-month troop trial with these 100 rifles. This was obviously rather touchy ground politically, as indicated in the following excerpts from the file notice of the careful conclusions drawn up at this conference, translated by Dieter Handrich:

Lübeck, November 25, 1955/Sat BGS School for Weaponry

Meeting of the heads of department in Bonn on November 23 and 24, 1955

FN Rifle:

100 FN rifles will be handed over to the GSA for a troop trial lasting half a year. It must be emphasised that this is just a trial, and does not mean than the FN rifle will be fielded. (England and Belgium have adopted the rifle already.)

The designation of the weapon is Leichtes automatisches Gewehr Modell FAL FN.

1. *The demands in regard to the weapon are as follows:*
2. *Possibility of a precise shot up to 600m; low weight and low recoil. Single fire, in semi-automatic mode - 5 to 6 rounds; full automatic mode - 20 rounds.*
3. *Manufacturing time for one FN rifle: 25 hours; for the former* Sturmgewehr*: 10 hours.*
4. *The rifle is chambered for the cal 7.62mm Model ss 77 standard cartridge (NATO cartridge, headstamped with a cross).*
5. *The ammunition is delivered in clips, which make loading of the magazine very simple. A German manual for the rifle will be published shortly.*
6. *The FN rifle is a closed [bolt] weapon. It must be emphasised, however, that the FN rifle is not an assault rifle. All tacticians and technicians agree that the term "assault rifle" does not apply to this weapon.*

The order for fielding the FAL was given at some point between November, 1955 and May, 1956—the exact date is not known, because during this period no official notice of its introduction was published.

The next BGS order, placed in September, 1956, was for 4,800 rifles like the "Series A" type, but fitted with the metal handguard and bipod assembly as designed for the *Bundeswehr*, and the new two-piece reactor. The receivers of these rifles were the first to be marked with a unique German designation reading "Gew. Kal. 7.62mm FN". Such rifles were differentiated by being given the designation "Series B". The price for the "Series B" rifles was DM 516.60 each. All of the rifles ordered by the BGS were supplied with a blued finish.

The first list of spare parts for the G1 FAL was published on August 24, 1956. The Weapons School at Hammelburg issued a *Merkblatt für die Gewehr Kal 7.62mm FN* on September 4, and on September 8, 1956, by edict of the Ministry of the Interior, a training pamphlet titled *Merkblatt für die Ausbildung mit die Gewehr Kal 7.62mm FN (FN Gewehr)* was published.

A later report by BGS Major Naujokat, the consultant to the BMI, the date of which is not known, referred to the new FN automatic rifle as the "*FN-Schnellfeuergewehr Kal 7.62mm*".

Later BGS rifles were known as the "Series A/f", with the "f" standing for *formgeändert* (modified). These were "Series A" rifles modified to resemble the "Series C" rifles of the *Bundeswehr*, described below.

The *Bundeswehr* Orders 100,000 "Series "C" FALs

On November 13, 1956, the *Bundeswehr* ordered 100,000 FAL rifles of a new type designated the "Series C". These were produced at FN between April, 1957 and May, 1958, and were supplied with a phosphated finish, a new detachable flash hider grenade launcher and a separate BFA, with the line of sight lowered by 3mm, as requested by Major Otto Schulze. The butts and grips on these rifles, originally made of wood, were later plastic.

The *Bundeswehr* also ordered 5,000 special top covers set up for scope mounting from FN.

A Memorandum Regarding the FN Contract

It appears that, despite voluble protestations from the FN management that the FAL would never be produced under licence in Germany, such an offer was indeed made. This and several other interesting facts are included in a memorandum, signed by German Defence Minister Matthauser, which contains a frank

230. Left and right side views of "Series C" FN FAL rifle serial no 1. This was the pattern for the 100,000 G1 FALs purchased by the *Bundeswehr*. Note the three accessory muzzle attachments at top left: grenade launcher and sight assembly (above the barrel), flash hider, and blank firing adapter (BFA). All were designed to mount over the plain muzzle and attach via the bayonet lug.

Compare with fig 180: note the lowered line of sight and the stamped metal forend with bipod folded.

FN photo 18-6514 (above) and 18-6515 (below) dated January 9, 1957, author's collection.

discussion of the terms of the contract with FN for the 100,000 FAL rifles for the *Bundeswehr*. This document is excerpted as follows, from a translation kindly supplied by Dieter Handrich:

Koblenz, October 15, 1956 XI D 01/00/03018/00/56

Note Re: FN Contract for 100,000 automatic rifles

The terms of the contract were discussed in Koblenz on September 21 - 28 and October 11, 1956. We refer to the recordings of the negotiations dated September 20 and October 2, 1956. The results of the final discussion held on October 10, 1956 are included in the following exposition. The following contract submitted for signing is explained as follows:

1. *Scope of delivery*
2. *Description*
3. *Government approval.*

Regarding the scope of delivery it was checked if a saving could be achieved by renouncing 5,000 regular receiver covers due to the order for 5,000 receiver covers provided with telescopic sight mounts, as laid down in Article 1, no 4. It was agreed that these covers are to be ordered separately in order to prevent the rifles from being transported without covers, due to the highly sensitive telescopic sights [and the fact that] rifles without covers would become subject to dirt [and fouling and] the cost of 10,000 DM for the extra covers compared to the total amount of 44 million DM [is negligible].

The drawings contained in Article 2 are meant as an exact definition of the rifle.

4. *Delivery deadlines*

The listing of cases of force majeure *corresponds with other contracts concluded with foreign countries.*

231. Left side closeup of a cutaway instructional model G1, serial no 089, approximately 100 of which were prepared specifically to order by the FN factory in Herstal and marked "Schnittmodell G1" as shown.
Wolfhart Fritze collection

5. Prices

The splitting up of the price in two instalments is due to intended clauses re the deposit, etc.

The agreed regulation was the result of very difficult negotiations regarding the retail price. the price proviso, and the interest rate to be paid on the deposit. Regarding the retail price, the firm [FN] agreed to state calculation details which indicate in general the required material and cycles of operation, but they refused to present a detailed calculation. Therefore it was necessary to check the adequacy of the price by other means. The BGS for example, according to the contract of September, 1956, paid a price of 516.60 DM. But this average price per rifle referred to a total number of 4,800 rifles. Compared to this the price for the BMVtdg [Defence Ministry] is lower by 65.10 DM per gun for the first 50,000 rifles, and lower by 86.94 DM for the second 50,000 rifles. By replacing the originally intended magazine fillers with slings, another price reduction was achieved . . Besides, the firm in a written statement dated October 9, 1956 has confirmed that only 7% of the rifles sold so far were sold for a cheaper price, and these were sold to the Belgian government. The remaining 93% were sold at the same or a higher price. Under these conditions the suggested prices must be considered really favourable. In addition, the British Ministry of Supply was telephoned by Section XI to ascertain what price they had paid for their order, but the information was refused.

Regarding the price adjustment clause, which is common in international business, it was agreed that the changed price is limited to the second instalment. The clause itself has been changed in favour of BMVtdg because a share of 20% of the total price is not affected by changing factors. The remaining 80% is split up as 60% labour costs and 20% material costs. In regard to the labour costs they are not subject to the actual wages paid by FN at the Herstal

factory (which due to a shortage of labourers are relatively high) but to the average wages in Belgium. A general wage increase affects the price after 6 months.

Prices are in US Dollars - the Germans preferred Belgian Francs, but FN did not agree.

Regarding surety (Articles 10 and 11) the firm's demand as of June 8, 1956 was a deposit of 33% of the total price, which was supposed to be paid when signing the contract. It was agreed, however, that the deposit can be split up in such a way that the second half is payable three months before the second instalment is due. Our demand to receive interest on the deposit was not achieved . .

The cancellation of the contract (Article 12) was limited to the case of bankruptcy only.

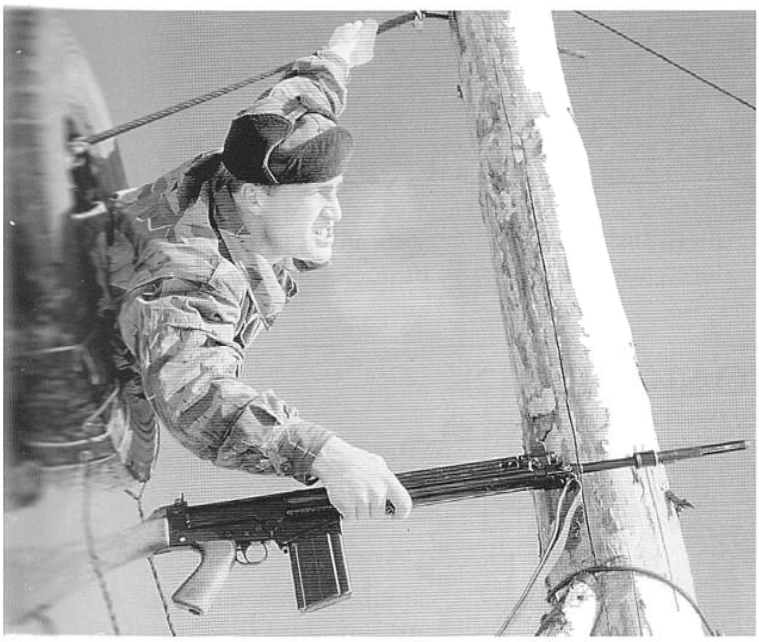
Concerning patent violations and licence regulations (Articles 13 and 14), there are no special remarks regarding patent violations. The firm agreed to construction [of the rifle in Germany] under licence. The terms are favourable. This subject might become important, although it is intended to equip the troops with a different model eventually. Originally the firm requested a restriction to a certain number of weapons, and a licence fee of 5% . .

A Further History of the FAL in Germany

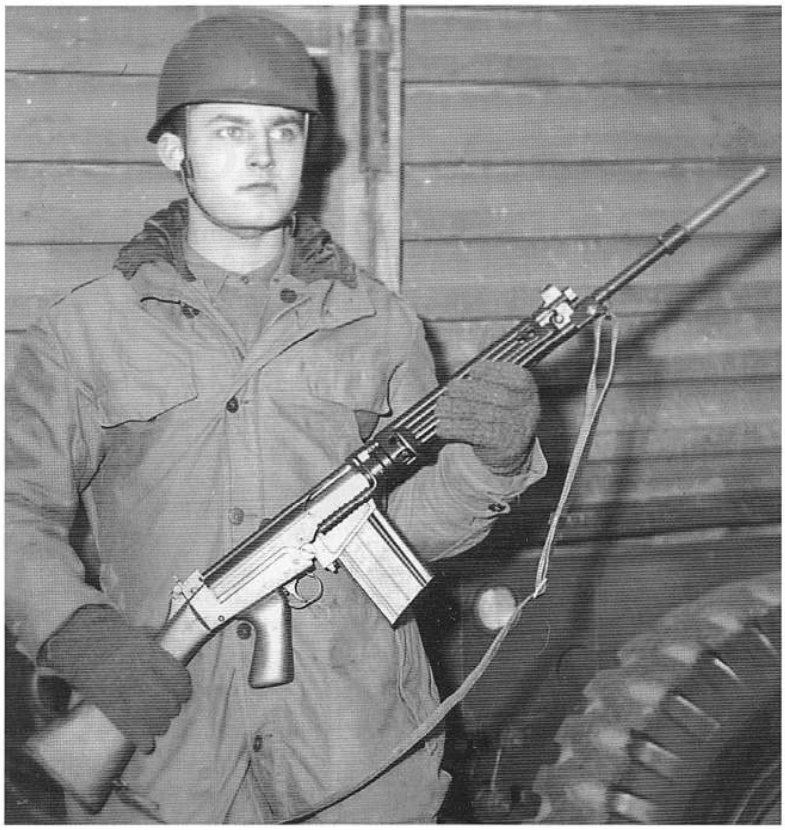
232. A presentation of the grenade launching capability of the G1 FAL rifle to German Chancellor Konrad Adenauer.

The camo-clad officer at right is *Oberst* (Colonel) Wolf Graf Baudissin, who was instrumental in creating *Leitbild der Inneren Führung* (principles for a new German army in a democratic state). He was later promoted to the rank of general. FN photo 13-12764 dated February 22, 1960

233. A *Bundeswehr* unit on exercises. The soldier at left, armed with a G1 FAL with flash hider attached, advances while covering fire is provided by the MG42/59 gunner and another rifleman at right.
© *Informations- und Medienzentrale der Bundeswehr*



234. A soldier emerges from an obstacle course "tunnel" formed by a group of truck tires clutching his brand-new "Series C" G1 FAL with flash hider attached.
© *Informations- und Medienzentrale der Bundeswehr*



235. A German soldier photographed on an exercise in February, 1960, armed with a "Series C" G1 FAL rifle with the BFA fitted. courtesy William B Edwards

During the 1960s the BGS purchased additional numbers of the "Series C" (Army) model FAL from FN (blued, not phosphated), and during the late 1960s they upgraded their early rifles as well as

taking delivery of over 12,000 "Series C" FALs from the *Bundeswehr*, which they overhauled, changing the finish from phosphate to blue in the process.

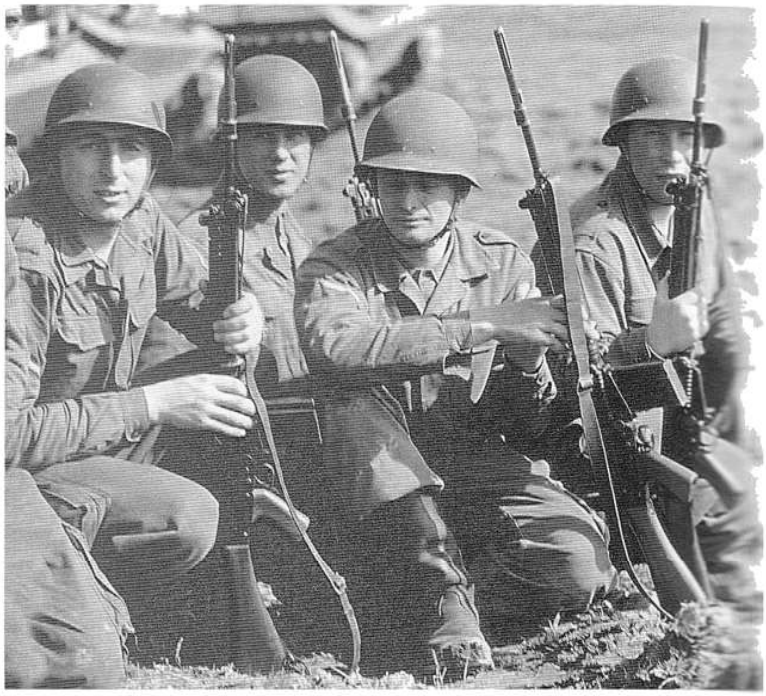
The BGS also retrofitted some rifles to fire plastic blank and training ammunition. These rifles are fitted with a special top cover marked with a "Police Star" and featuring a larger ejection port.

The *Bundeswehr* FAL rifles were known officially for a very short time as the "*Gewehr* DM 1 (*Deutsches Modell* 1)" and later the G1 (*Gewehr* 1), although as noted they were all factory-marked "Gew. Kal. 7.62mm FN". The hundred or so instructional cutaway models ordered from FN were factory roll-stamped "SCHNITTMODELL G1" (fig 231).

FALs were used in the German Army until the mid-1960s, after which they were phased out in favour of the G3. After this the FALs were used by the *Luftwaffe* for guarding airfields and by the Army in competitive rifle matches, during which the self-loading actions were converted to single shot fire by turning the gas plug to the "G" (grenade) position.

The FAL rifle was well accepted by the BGS but not so well by the professional soldiers of the *Bundeswehr*, who perhaps felt more strongly that they should be equipped with German-made rifles.

FALs were last seen in the German Army during the 1970s, although a few are still in use with the BGS and police today.

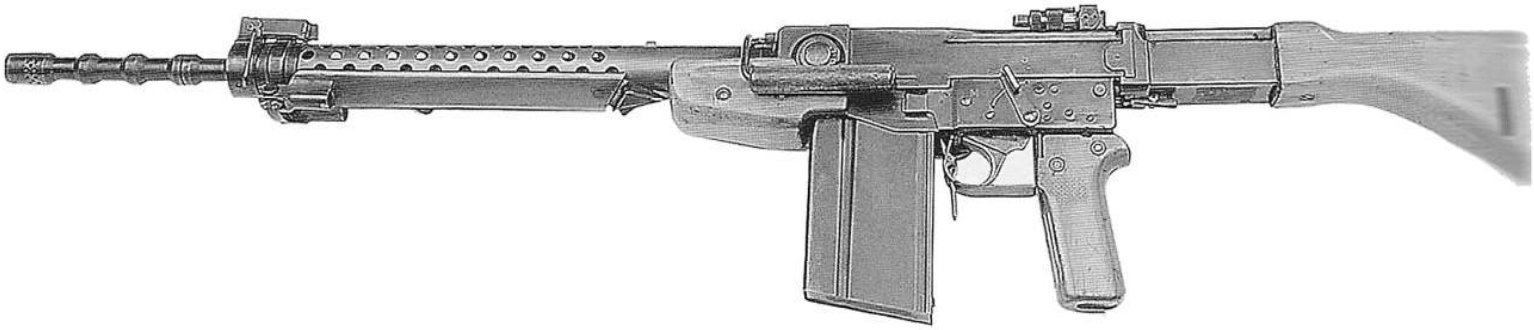


236. *Bundeswehr* troops armed with G1 FAL rifles, at rest. All the rifles shown are fitted with flash hiders.
© *Informations- und Medienzentrale der Bundeswehr*

Trials of the G2 (SIG 510) and G4 (AR-10)

In late 1957, with the less-than-sterling reliability record of the first 400 STG CETME rifles in the troop trials still a source of considerable controversy, small quantities of two other competing designs were ordered and tested by the *Bundeswehr*.

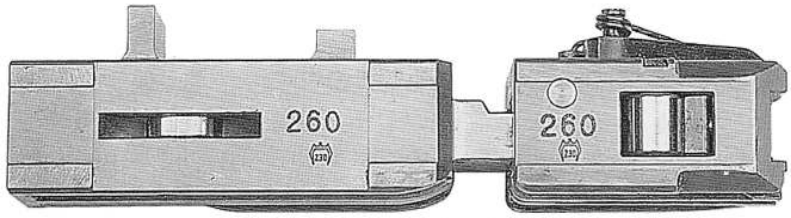
The 7.62mm NATO SIG 510 (G2)



237. Left side view of the Swiss SIG SG510, designed by Rudolf Amsler. As discussed in the text, a quantity of 50 of these rifles, designated the G2, were delivered to the BWB (Federal Office for Defence Technology and Procurement) in Koblenz on December 19, 1957.
photo courtesy Dr Elmar Heinz, Deutsches Waffen Journal

One of these was a 7.62mm NATO calibre variant of the SIG SG510, designed by Rudolf Amsler and adopted by the Swiss Army as the 7.5x55mm *Sturmgewehr* 57, which featured a version of the half-locked roller action descended from that of the experimental Mauser roller-locked MG42 of 1944. The *Materialamt die Bundeswehr* (Army Materiel Office) ordered 50 of these rifles, which they designated the G2. These were delivered to the BWB (Federal Office for Defence Technology and Procurement) in Koblenz on December 19, 1957, forty of them with rubber buttstocks and ten with wooden butts. Unlike the version adopted by the Swiss, the G2 trials rifles were fitted with wooden handguards.

A lengthy series of trials were conducted at the training areas of Hammelburg, the Armoured Corps School at Munster-Lager, and at Meppen, although the heavy weight of the SIG G2, already criticised by Werner Heynen, precluded any further action.



238. Side view of the bolt assembly of the SIG SG510, as procured for trials in Germany and designated the G2.
Note the German military acceptance stamps under the serial numbers on the bolt carrier and bolt head.
photo courtesy Dr Elmar Heinz, Deutsches Waffen Journal

The Armalite AR-10 (G4)

239. Right side closeup of an ArmaLite AR-10 with bipod and sling, manufactured under licence from ArmaLite by Artillerie Inrichtingen of Hembrug-Zaandam, Holland. A total of 140 AR-10s were ordered for German trials in 1957 and 1958, designated as the "G4".
© *Informations- und Medienzentrale der Bundeswehr*

On the other side of the scale was the lightweight 7.62mm NATO calibre ArmaLite AR-10, as manufactured under licence from the US-based ArmaLite Division of the Fairchild Engine and Airplane Corporation by Artillerie Inrichtingen of Hembrug-Zaandam, Holland, and designated by the *Materialamt* as the G4. The first five AR-10 samples were procured in late 1957. Two of these rifles, serial numbers 1010 and 1013, featured in adverse condition tests in Bourges, France, from December 17 to 19, 1957; the serial numbers 1011 and 1012 remained in Germany where they were the subject of a 10,000-round full-auto fire test held in Meppen. Both rifles completed this test with the replacement of only a few minor parts.

While these tests were still in progress a further 400 AR-10 rifles were ordered for short-term troop trials, but this order was cancelled. A further small demonstration was held on February 26, 1958 before Defence Ministry and *Bundesgrenzschutz* officials.

SIDEM International, the German representatives of the AR-10, ordered 135 slightly modi-

fied rifles for troop testing on March 22, 1958, although the official order was delayed until July 1, 1958. These rifles, 100 standard models and 35 fitted with bipods, were delivered to various German weapons schools in late August and early September, 1958, as follows:

- 45 rifles (34 standard and 11 with bipods) to the *Infanterieschule* (Infantry School), Hammelburg;
- 45 rifles (34 standard and 11 with bipods) to the *Panzertruppen-Schule* (Armoured Corps School), Munster-Lager;
- 2 rifles, 1 with bipod, to the *Feldzeugtruppenschule* (Ordnance Troop School), Sonthofen;
- 14 rifles (11 standard and 3 with bipods) to the *Luftlandeschule* (Airborne Force School), Schongau;
- 14 rifles (10 standard and 4 with bipods) to the *Gebirgs- und Winterkampfschule* (Mountain and Winter Combat School), Mittenwald;
- 15 rifles (10 standard and 5 with bipods) to the *Erprobungsstelle* (Proving Ground), Meppen.

The AR-10 (G4) was obviously a much more serious threat to the STG CETME programme than was the overly heavy SIG 510 (G2). Even as the above trials rifles were being delivered, a sniper version and an LMG version were being demonstrated before impressed officials of the Defence Ministry and the *Truppenamt* (Forces Office) on September 1, 1958. The German Army, influenced by Otto Schulze, was very interested in the AR-10 because of its light weight. However the Dutch were clearly not ready for series production, and modifications requested by the *Bundeswehr* could not be incorporated in a timely fashion. SIDEM tried to sell a short carbine model of the AR-10 to the German police, but without success.

240. Left side closeup of ArmaLite AR-10 serial no 00280 designated as the "G4" for German trials.

Note the German acceptance stamp (to the right of the serial number), and the overstamped "S", "E" and "D" markings added to the selector positions.

photo courtesy Dr Elmar Heinz Deutsches Waffen Journal

As far as the Army was concerned, therefore, the field was left by default to the H&K version of the CETME roller-lock rifle, and all that remains of the G4 in Germany today is a handful of sample weapons with German acceptance markings and additional single-letter markings ("S", "D" and "E" alongside the standard SAFE, AUTO and SEMI markings designating the three positions of the selector lever), which are held in the WTS collection in Koblenz.

Back to the STG CETME

All Things to All Men - Briefly

As quoted in Chapter Twelve regarding H&K's efforts to get production of the STG CETME under way, Werner Heynen commented that "It is to the honour of the firm Heckler & Koch that despite all these disturbing circumstances and the back-and-forth of opinions, they steadily followed their course. They never left anything untried, and with all their might they worked for the introduction of the CETME weapon to the *Bundeswehr*, particularly trying to please everyone who had a say in the decision."

A single example of a weapon, built up on an unmarked receiver, obviously constructed with this latter statement in mind, is shown in fig 241. Perhaps the rationale was to weed out the more fanciful

-1. Left and right side views of a post-troop trials STG ETME rifle embodying a number of the requested improvements, along with a few ideas that did not survive. It appears that only one such rifle was ever constructed.

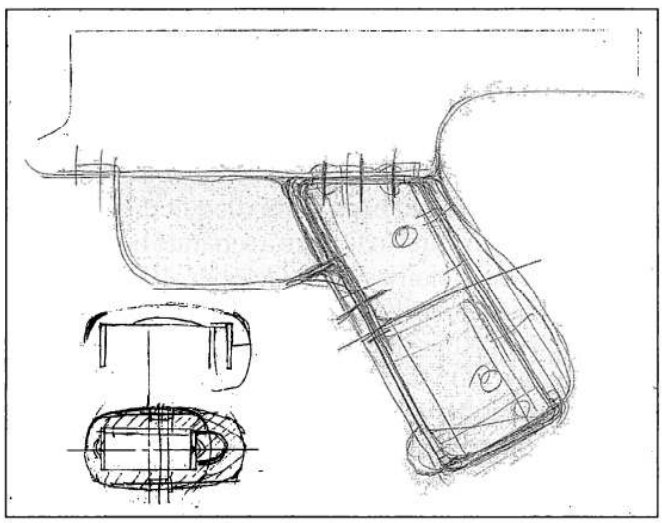
Note (above) the first appearance of the flash hider figured as a grenade launcher; the unusual stamped-metal handguard, which appears to clip onto the cocking handle tube; the modified cocking handle tube with a notch at the rear end to permit the cocking handle to be used to hold the bolt assembly to the rear; a prototype straight 20-round magazine; the left-hand portion of the ambidextrous change lever; and the first attempt at an "orthopedic" grip, following the design of the sketch shown in fig 242. For the first time, the sling location has been moved to the left side, where it was to remain.

The right side view, below, with bipod folded, shows the right-hand portion of the ambidextrous change lever and the then-conventional curved 25-round magazine.

Note the two-position flip rear sight: centred, above, and at the rear, below. Apparently there was a difference of opinion as to just where the sight should be located, and on this model a track was built into the top of the receiver so the sight could be slid into either position.

courtesy Walter Schmid

...gestions once and for all before getting back to the ...rous business of engineering the German version ...he CETME rifle through to adoption in the face of ...number of continuing adversities.



...right). An initial sketch of what was to become the ...opedic" grip. This early pattern was apparently only ...on the rifle shown above.

Matthias Schörmal collection

The STG CETME "Twenty Series"

As *Dipl-Ing* Heynen records, the "final decision" regarding adoption of the STG CETME rested on the success of a sudden-death trial of a small series of twenty STG CETME rifles embodying all the requested modifications:

> *. . The final decision to adopt the CETME was to depend strictly on the successful completion of these modifications, and the testing of 20 sample weapons incorporating them, which weapons were ordered on March 21, 1957.*
>
> *During this very important phase of development there were no permanent CETME representatives in Germany. A time span of three to four months would have been enough to avoid latent tensions among the technical departments of the Defence Ministry, the firm Heckler & Koch and CETME, and worse, between the two Oberndorf companies H&K and Mauser.*
>
> *The sample weapons were delivered in October 1957, and thoroughly tested . .*

Introducing the H&K DM3 (CETME)

243. Left side view of an early "DM3 CETME", serial no 1703, dated March, 1957.

Certain features were retained from the above rifle, such as the flash hider configured for grenade launching and the cocking handle holdopen slot. The stamped metal handguard is the early production version, grooved to accept the folded legs of the bipod, and the combination magazine catch is the first to feature the lower thumb-operated latch.

This first improved version of the smooth wood "orthopedic" grip has a pronounced thumbrest and Henk Visser's design of a slot in the underside of the grip where the grenade sight is stowed. The two-position flip-over rear sight is located at mid-receiver, and the change lever is accessible from the left side only. courtesy H&K GmbH

Up to this point the original 400 STG CETME trials rifles had been produced during the summer of 1956, and the troop trials had been completed in April, 1957. A number of initial modifications had been requested which had been embodied in the "Twenty Series" rifles, the first to feature a separate handguard, which had been delivered in October, 1957.

Ludwig Vorgrimler's account continues with the story of further development of the CETME rifle in Germany, now known as the DM 3 (*Deutsches Modell* 3) as follows:

> *. . The German military officials still wanted some changes made to the weapon, and gave Messrs Heckler & Koch the order 16a/00 W/001/00/8 E in May, 1958 amounting to DM 50,000. Essentially ten changes were requested, among others the ability to cock the rifle when in the safe position . .*
>
> *Nevertheless, recently a soldier from a neighbouring community has been sentenced; he had been on guard duty at the Grafenwöhr firing range when, while cocking his partially loaded and secured weapon, he shot a comrade . .*

A brief description of the DM 3 (CETME) is excerpted from a report produced by Heckler & Koch GmbH dated September 20, 1958, as follows: