

The Degtyarev light machine-gun

Official adoption of the Maxim-Tokarev did not reduce the importance of developing a new model: like any converted system, the MT could only partially satisfy combat requirements.

Amongst the most important conditions imposed by contemporaneous combat experience was the need to enhance the mobility of light machine-guns until they could be carried in the skirmish line to increase the power of attacking units. To satisfy these demands, the light machine-gun, like the infantry rifle, had to be capable of firing from any position (standing, prone, moving); instantly ready for action; and capable of firing long bursts. Requirements such as these could be satisfied only by utilising the latest advances made by the small-arms industry. The credit for designing the first weapon of this type in the Soviet Union is due to Vasilii Alexeevich Degtyarev (1880-1949), born in Tula

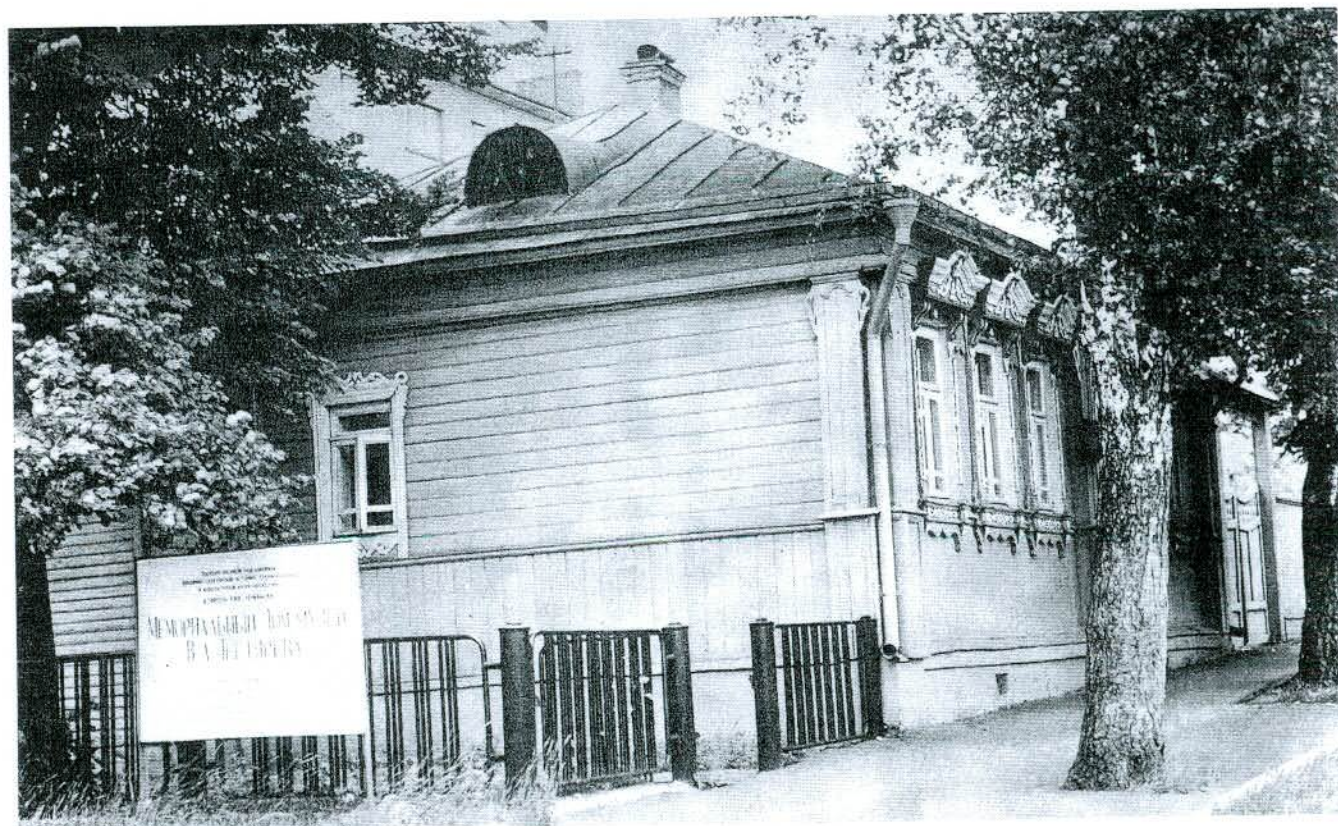


Vasilii A. Degtyarev 1904

into a long-established family of gunsmiths.

When he was eleven years old, Degtyarev began working in the Tula ordnance factory. Drafted in 1901, he was sent to a workshop in the Oranienbaum officers school. After demobilisation in 1906, Degtyarev participated under the direction of Vladimir Fedorov in the manufacture of an automatic rifle. The prototypes were made in the workshops attached to the small arms testing range of the Oranienbaum school, after which work continued in the ordnance factory in Sestroretsk.

Vasilii Degtyarev began his independent design activity in 1916, developing an automatic carbine in which the basic design elements incorporated in his subsequent automatic weapons were outlined. Taking a decisive step away from barrel-recoil operation, all but universal at that time, Degtyarev fitted his carbine with a gas piston. The



Home of V.A. Degtyarev as a museum in Kovrov.

breech was locked by displacing lugs on the sides of the bolt into the walls of the receiver. The trigger mechanism allowed single shots or continuous fire to be selected at will. The return spring was located around a guide rod in the receiver lid, acting on the bolt through its cranked tip. Cartridges fed from an integral five-round magazine. Designed around a 6.5mm cartridge, the Degtyarev carbine weighed only 3.86kg - which at that time represented a considerable achievement.

During the Civil War, Vasilii Degtyarev helped to organize production of the Fedorov Avtomat in the Kovrov factory and then, in collaboration with Vladimir Fedorov, worked to create light and aircraft machine-guns on the basis of the original machine rifle. In 1927, however, the Degtyarev light machine-gun (DP) was adopted as equipment for the Red Army. This

provided the basis for the DA and DA-2 aircraft guns, in addition to the DT tank pattern. Contemporaneously, the inventor created an automatic rifle which successfully passed several firing-range trials.

In 1929-32, Degtyarev designed a selection of submachine-guns, the best of which, adopted in 1934 as an expedient, was improved and finally perfected as the PPD of 1940. The 12.7mm DK heavy machine-gun, initially submitted in 1930, was made in quantity from 1933 on the Kolesnikov universal mount; improved in 1938 by Georgiy Shpagin, the resulting DShK was widely used for anti-aircraft defence.

Degtyarev also designed a mounted (medium) machine-gun in 1930, officially adopted in 1939 as the DS but ultimately unsuccessful. The 14.5mm PTRD anti-tank rifle, developed in the

first months of the Great Patriotic War, began to reach the Red Army in 1942, and a light machine-gun for the M43 intermediate cartridge appeared in 1944.

The weapons designed by Vasilii Degtyarev played a vital part in strengthening the armed forces of the USSR during a critical period in its ordnance history. To mark his outstanding design activity, the inventor rose to the rank of army major-general. Degtyarev became a Hero of Socialist Labour and received a doctorate of technical sciences; he was USSR State Prize Laureate four times. His decorations included three Orders of Lenin, Orders of Suvorov (first and second class), an Order of the Red Banner of Labour, an Order of the Red Star, and numerous medals.

Degtyarev began work on his light machine-gun in 1923, working on his



V.A. Degtyarev and his brother P.A. Degtyarev in Kovrov 1930.

own initiative as his efforts were not initially supported by the artillery administration - which, underestimating the importance of light machine-guns, considered weapons of this type to be no more than a temporary phenomenon. The leading role, so the artillerists believed, would always belong to the more powerful and more perfect mounted machine-gun.[30]

On 22nd July 1924, a commission under the direction of Nikolay Kuybishev, chairman of the Red Army Small Arms Committee, tested the Degtyarev light infantry machine-gun. The report praised "the outstanding originality of the idea, the great operational reliability and fire rapidity, and the simple handling of Comrade Degtyarev's system".[31]

Shortly afterwards, Vladimir Fedorov and Vasilii Degtyarev were summoned to meet the vice-chairman of the Revolutionary Military Council of the USSR, Mikhail Frunze, who was also deputy People's Commissar on Military and Naval Matters.

The meeting was of exceptional importance to the development of automatic weapons in the USSR. Frunze was already acquainted with the particulars of Degtyarev's design, considering it exactly the weapon the Red Army needed. Having drawn attention to the urgent need to finish the prototype, he prom-

ised the inventor every possible assistance.

In 1957, I asked Vladimir Fedorov to recall the conversation. 'M.V. Frunze was not only an expert who brilliantly understood and praised good weapons,' Fedorov remembered, 'he could also foresee their development far ahead, and, like no other officer I had ever encountered, could discuss with us designers all facets of the international situation, the tasks we were facing, the difficulties we had, or the potential of our military industry. He knew about everyone involved with small arms and had a good idea of their potential.' Speaking at the Third Congress of the Councils of the USSR, in 1925, Frunze himself said that '...we have many inventors, some of them geniuses. So we have a tremendous creative potential... Our misfortune is not that we cannot invent something new, nor that we do not have some secret or other, but that we cannot always make use of what we have owing to the conditions of our finance and industry. If our economy improves, I am sure we will not only be equal to foreign countries in matters of research activity, but far ahead of them. We already have some most valuable inventions to strengthen our Red Army to an extent that was previously unknown'.[32]

The results of the meeting between

Frunze, Fedorov and Degtyarev rapidly became apparent. The Artillery Committee, which had previously treated the light machine-gun with contempt, proposed to the administration of the Weapon and Machine-Gun Trust that all attention be 'turned toward the Degtyarev light machine-gun in view of the necessity to complete work...in the shortest time possible. The competition to develop automatic rifles is also an urgent job; however, this work must be undertaken only after that on the Degtyarev light machine-gun'.[33]

Final development of the infantry light machine-gun was completed by Vasilii Degtyarev in 1926. It was greatly assisted by the direct participation of Vladimir Fedorov, who understood the importance of completing the work and helped Degtyarev to gather a small group of specialists. Each among this group was eager to make a contribution to the project. Calculations were made and separate parts drawn by designers Gavriil Markov, Pavel Ivanov, Ivan Dolgushev and Evgeniy Aleksandrovich. Degtyarev was permanently assisted by Georgiy Shpagin and Sergey Simonov, together with fitters Aleksei Kuznetsov, David Uraznov, Yakov Sukhanov, Ivan Bezrukov, Iosif Solovev, Pavel Dmitriev and Nikolay Efimov.



M.V. Frunze with gun designers V.A. Degtyarev and V.G. Fedorov 1924.

Technological characteristics of selected Soviet small-arms

Model	Production time, hours	No. of tolerance measurements	No. of operations
M.1910 Maxim heavy machine-gun - its mount	700 170	1054 361	2488 726
Experimental Fedorov-Degtyarev 7.62mm light machine-gun - its bipod	210 14	835 10	1005 67
Degtyarev 7.62mm light machine-gun - its bipod	130 14	250 10	486 67
M.1891 7.62mm Mosin-Nagant rifle	42	812	1446
M.1895 7.62mm revolver	30	562	823

The prototype Degtyarev light machine-gun was gas operated, its breech being locked by two retractable lugs placed symmetrically in the bolt. A striker-type firing mechanism was used, and the trigger system was restricted to automatic fire. Cartridges fed from a pan magazine containing 49 rounds (later reduced to 47) mounted on top of the receiver. Expended cartridge cases were withdrawn from the chamber by an extractor mounted in the bolt, then expelled by a deflected fixed inside the receiver. The tangent-curve sight was graduated to 1,500 metres. A bipod, effectually designed and ideally placed, gave the light machine-gun good stability. Consequently, its fire was accurate and dense.

At the time of its introduction, the Degtyarev light machine-gun, a completely new model, possessed many advantages over all others in its class. It was also exceptionally simple: to make the Maxim-Tokarev, based on the established Maxim, the Tula factory required 2,080 working patterns, 944 control patterns, 1,158 tool-sets and 400 measuring devices in addition to the existing ones. The corresponding figures for the Degtyarev were 800, 250, 400 and 400.[34] The simplicity of design had resulted from the ingenious construction of the firing and locking mechanisms, comprising a few simple parts so well designed and so well positioned on the bolt carrier that some of them (e.g., the bolt carrier itself and the firing pin) could perform several functions simultaneously.

Interesting data revealing the ease with which the Degtyarev light machine-gun could be made were re-

lated by Vladimir Fedorov in a report made to the chairman of the Artillery Committee in 1926.

It is evident from table above that the time needed to make one Degtyarev, was forty per cent less than that for a Fedorov-Degtyarev machine-gun based on the 1916-type Fedorov Avtomat. The Degtyarev model also required half as many pattern measurements and machining operations as a revolver, and a third as many as an infantry rifle.

The machine-gun had another important advantage: simple stripping and reassembly secured by the design of the bolt carrier. All the important parts of the machine-gun could be removed with the bolt carrier. To increase operational reliability under differing conditions, when necessary, a special regulator on the gas chamber could change the volume of propellant gas acting on the gas piston.

At the time the Degtyarev was being perfected, Steyr-Werke, Vickers and Colt all offered their machine-guns to the Soviet government by way of the 'Scotexac' trading company.[35] The Artillery Committee opined that 'in view of the fact that these models are outdated in regard to their simplicity and ballistics, and also that our factories can produce much better weaponry, the proposed contracts should be declined'.[36] This view was shared by the supreme commander of Soviet armed forces, Sergey Kamenev, who wrote that 'We have designed a new Russian machine-gun which equals the most modern European ones'.[37]

However, despite the theoretical advantages of the new Degtyarev

weapon, its destiny had to be decided by practical testing. The first firing-range tests of the Degtyarev were undertaken in September 1926, when two guns were tested with about five thousand rounds. Owing to breakages in extractors and firing pins, sensitivity to dust, and the absence of spare parts, testing was suspended and the weapons were returned to the inventor.

During the course of trials held in November 1926, about 20,000 shots were fired from each of the two prototype light machine-guns. After every three hundred shots, the guns were immersed in water to cool them; after every 600, their chambers and bolt carriers were lubricated. To investigate the influence of lubrication on operation of the breech mechanism, one gun fired 2,646 shots with no lubrication at all: no stoppages were observed. Barrel endurance was determined by firing twelve 49-round magazines (588 rounds) without cooling, but no stripping of the rifling was observed. About sixty stoppages occurred during the firing of 40,000 rounds during the trials, most being caused by faulty extraction, misfires, feed failures and jams. Three bolt carriers, two recoil springs and two bolt handles had broken, and a selection of minor deficiencies had been revealed: rivets failed, the back-plate latch and the pin connecting the gas-piston head to its body worked loose, the riveted barrel spacer came apart, and the casing bolt unscrewed.

However, although failures of particular parts had occurred during the tests and suitable changes or reinforcements were required, it was clear that



Vasily Degtyarev and prototype of DP light machine-gun.

small irregularities would not undermine the efficacy of the new system.

On 29th December 1926, the Artillery Committee noted that, after a discussion of the test undergone 'by the two aforementioned specimens of the Degtyarev light machine-gun, the...committee decided that these results - although generally satisfactory - indicate the necessity to strengthen some parts and refine the entire pattern, owing to the breakages and stoppages observed when firing'. [38]

The machine-guns were returned to Vasily Degtyarev so that their deficiencies could be eliminated. The final tests were scheduled for 10th January 1927.

Degtyarev was forced to introduce changes in the design of his machine gun to overcome its faults; the bolt was strengthened, the bolt handle and ejection-port ribs were thickened, and the shape of the firing pin was altered.

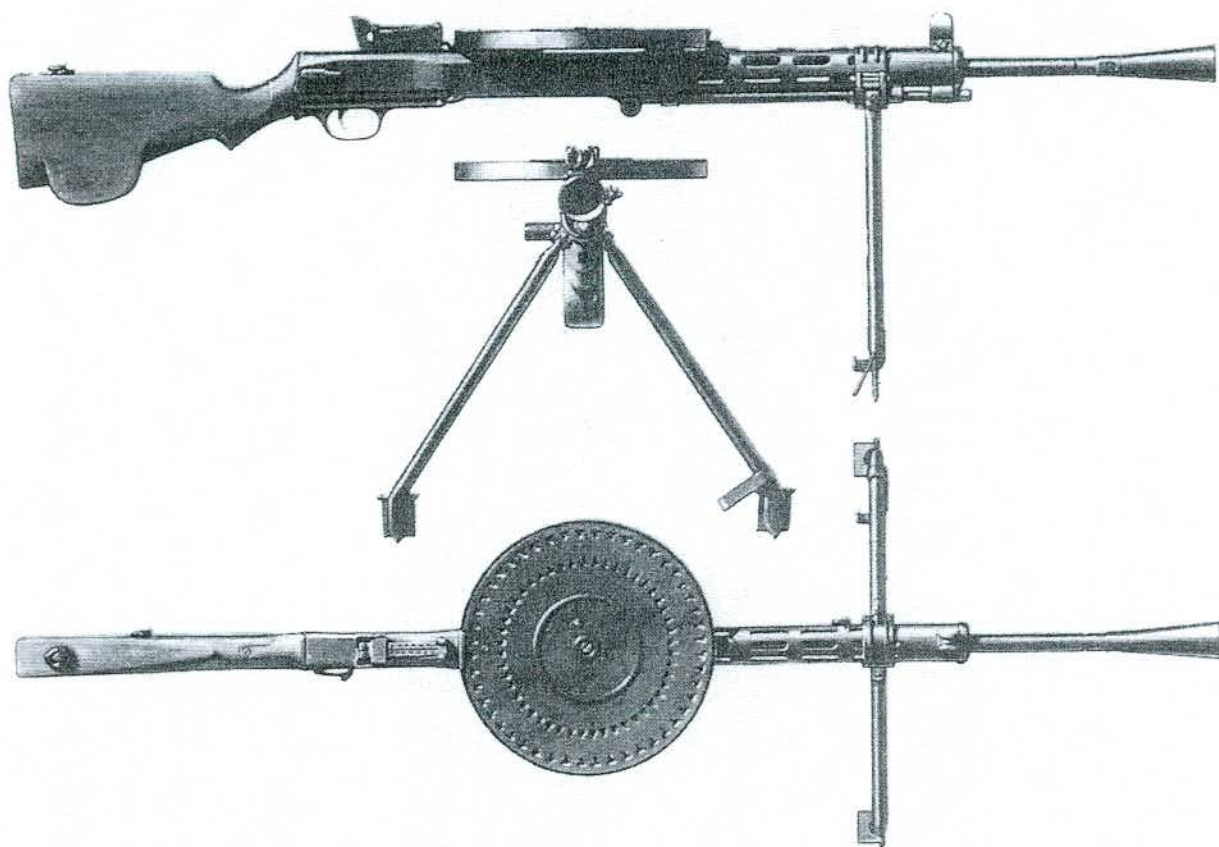
Major parts that had been considered to be too weak - e.g., the bolt carrier, the extractor and the gas-piston rod - were thereafter made of nickel-chrome steel.

On 17th-21st January 1927, the commission appointed by the Artillery Committee tested the two light machine-guns in the Tula factory. Twenty thousand rounds were fired from each gun, one recording a stoppage rate of 0.5 per cent and the other merely 0.3 per cent. The heating effects produced during protracted shooting burned the gas-chamber tubes in both Degtyarevs, and the extractor hooks had been destroyed; in addition, the extractor spring of the second specimen tore away and the recoil spring had failed.

Summarising the test results allowed a conclusion that 'Taking into account the percentage of stoppages (0.3-0.5%) and...that 40,000 shots had been fired

during this test, the amount of sundry breakages was minimal. As their character, as explained above, does not raise concerns about the durability of the machine-gun, the commission considers it possible to accept these two machine-guns as a pattern for production. However, the commission considers it necessary to draw attention to the fact that in the course of the tests the machine-guns needed minor adjustments arising from the stoppages. In order to simplify production of the machine-gun and make it more convenient to handle, the design bureau should be ordered to conduct special research in these directions. Perhaps a retarder can be introduced to slow the unlocking of the bolt to ease extraction of empty cartridge-case'. [39]

As a result of the trials, the Artillery Committee commissioned a batch of a hundred Degtyarev light machine-guns incorporating the following design changes:



DP light machine gun.

- the gas chamber tube was to be threaded;
- the gas chamber was to be moved 8mm forward;
- the barrel was to be attached directly to the receiver, eliminating a latch;
- the cam on the rear of the extractor was to be omitted to strengthen the bolt;
- the edges of the firing-pin hole were to be rounded;
- and a rapid-pitch thread was to be cut in the gas piston to facilitate removal of the return spring.

On 26th March 1927, the Artillery Committee adopted the 'Provisional technical requirements for Degtyarev light-machine guns'. All guns had to correspond with the pattern tested in January 1927. The metal had to be flawless, without holes or cracks, and the inner surfaces were to be free of burrs. The muzzle was to be perpendicular to the bore, rounded inside and out, with neither scratches nor dents.

Special requirements were to be met by the chamber and its accordance with the dimensions of the three-line (7.62mm) cartridge.

The technical requirements laid emphasis on the interchangeability of components; all machine-guns were to be examined to ensure that dimensions and tolerances were maintained, then test-fired to check that reliability and the strength of the bolt met the appropriate standards. The shooting sessions were to be undertaken with regular cartridges (ten single shots and 100 fired automatically) and two special high-pressure proving rounds. In the course of trials with the standard cartridges, any breakage during single-shot fire - or irregular operation during automatic fire - meant that the gun had to be returned for adjustment. Breakdowns or stoppages necessitating partial stripping to clear them were not permitted. The only permissible stoppages had to be due to faulty cartridges or eliminated by operating the

cocking handle.

Should at least one breakdown occur in the hundred shots, or more than one stoppage that could not be attributed to ammunition, 200 additional rounds were to be fired from the same machine-gun; no more than two more easily eliminated stoppages were allowed. The minimum chamber pressure permissible during the high-pressure tests was 3,200 atmospheres. After each proving cartridge had been fired, the machine-gun was carefully examined; if no flaws were obvious, ten standard rounds were fired automatically.

Two high-pressure proving cartridges were also fired from four per cent of all spare barrels, bulging or similar damage being prohibited. If one or more barrel in each batch developed these flaws, two proving cartridges were fired from every barrel - each subsequently being examined separately.

The accuracy of one in ten of all the light machine-guns was determined by firing ten single shots at a target 100 paces distant. The 50 per cent dispersion radius could not to exceed 6cm. The test was repeated if any barrel failed to meet the requirement, whereafter, if the barrel being tested still failed, all the machine-guns and barrels in the batch were tested individually.

To ensure interchangeability of spare parts, two per cent of the machine-guns under test fired a hundred cartridges apiece automatically. Only those spare parts that caused no stoppages or operating failures were approved.[40]

The scientifically-substantiated technical requirements governing the acceptance and production of the first officially approved Soviet automatic weapon, the Degtyarev light machine-gun, played an important role in supplying troops with

small arms of high quality. They also laid the foundation for the high requirements to be met by all subsequent small arms. Of course, such stringent requirements were difficult to meet at the time when Soviet industry was still backward. Many factories had nothing but obsolescent or worn-out machinery, no indigenous machine-tool industry existed, and there was neither funding nor opportunity to import machinery from abroad. Working practices had been lost, whilst skilled workers, technicians and engineers were hard to find.

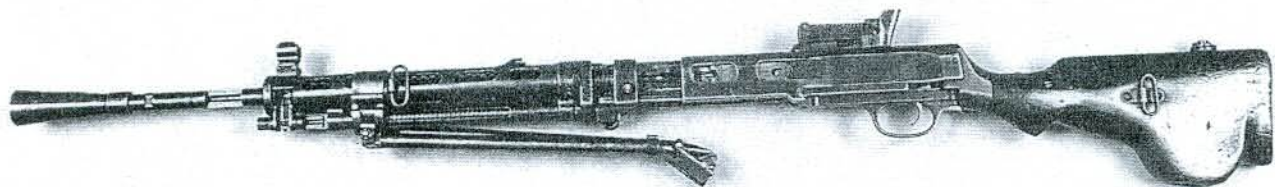
Comparative testing was undertaken in the summer of 1927 with the 1918-pattern German Dreyse, Degtyarev and Maxim-Tokarev light machine-guns. The tests were attended by the Deputy People's Commissar for Military and Naval Affairs, Sergey Kamenev, who wrote on 24th June 1927 to his superior, Kliment Voroshilov: 'Yesterday, in my presence,

the Dreyse machine-gun for the 3-line cartridge was tested. The tests were conducted in parallel, the Dreyse model being compared with our Degtyarev machine-gun and the lightened Tokarev-Maxim model. The comparison yielded the following results: the best was clearly our Degtyarev machine-gun, followed by the Dreyse and - in third place - the Tokarev-Maxim model. It is now evident that we have outdone the Germans, as our Degtyarev machine-gun is far better than their Dreyse'. [41]

However, before it could be delivered in quantity to the troops, the new machine-gun still had to pass a variety of tests. The chief of the Soviet artillery, Marshal Nikolay Voronov, wrote that "It is not by chance that a prominent foreign engineer, having observed our [firing-range] testing, exclaimed 'Well, we can now say that if a model has passed Russian tests, it will survive any war'..."[42]



Vasily Degtyarev inspecting soldiers with DP light machine-guns.



Cut-away demonstrational model of DP light machine-gun.

A typical test of the Degtyarev machine-gun was conducted on 5th-7th September 1927, when about 14,000 rounds were fired from one specimen and 8,526 from another. The testing committee noted that 'results of the recent tests show that separate parts and assemblies of this machine-gun are in need of additional perfection and research in the factory design bureau. In addition, the clearance between the tube and the gas piston and the diameter of the regulator holes must be adjusted: this must be applied retrospectively to the first batch, which has already been made'. [43]

As the bolt carrier had broken twice during the test, Vasily Degtyarev suggested that it could be strengthened by narrowing the slot for the trigger and introducing radial ribs in the rear part of the groove in which the locking-lugs moved. His suggestion was reinforced by the Kovrov machine-gun factory, which was responsible for adjusting the weapons. 'This change is greatly desirable for the system', the factory representative wrote to the Artillery Committee, 'because it does not involve redesigning the parts touching the bolt carrier yet improves the strength of the carrier itself'. [44]

On 5th October 1927, the Artillery Committee approved the design change, noting that 'strengthening the carrier of the existing Degtyarev machine-gun is useful; the designer's intention to simplify it cannot be opposed, particularly as the factory is sure that [the change] will not affect the production methods'. [45]

The design of the new Soviet infantry machine-gun was perfected by rigorous testing. Changes were made to enhance the reliability of many sub-assemblies and, on 12th November 1927, the military representative was presented with the first ten Degtyarev light machine-guns to be completed; early in January 1928, the last of the initial

hundred-gun order was finished. The weapons were sent for searching examination on the firing range and in the hands of the troops, with the expectation that flaws requiring final changes in the system would be revealed.

Intent on providing the Red Army with Degtyarev light machine-guns as soon as possible, the Revolutionary Military Council issued permission to order 2,500 additional weapons in the 1927/28 financial year. Manufacture was to start immediately, without waiting for the results of troop trials, on the understanding that full interchangeability would not be demanded if achieving it delayed deliveries. Organisation of a production line began immediately in the Kovrov factory.

However, even the most severe firing-range tests cannot be the basis for a final decision. Experience dating back to the development of the first magazine rifles - and especially the earliest automatic weapons - had shown that mass production should always have been preceded by large-scale field trials, regardless of firing-range results. Field trials often revealed deficiencies that could not be disclosed under the artificial environment of a range-test. The decision to begin series production of the Degtyarev light machine-gun, even though field trials were still being undertaken, was a remarkable act of faith in the basic weapon. It was also somewhat unavoidable; otherwise, the Red Army would be left without light machine-guns at a critical period. [46]

On 21st December 1927, two machine-guns from the new batch were tested in temperatures of -30 Celsius. One fired 1,500 rounds with neither cooling nor lubrication, whilst the second gun fired five hundred times. Mindful that the number of stoppages had been insignificant, the testing committee recommended adoption of the Degtyarev light machine-gun under the

designation 'Degtyareva pekhotniy' (DP, 'Degtyarev Infantry'). Sixty guns were subsequently tested in a variety of military districts and military schools, being greeted with universal enthusiasm.

Even though trials were stretching into infinity, the fate of the Degtyarev light machine-gun had already been determined; soon, the weapons began reaching the men of the Red Army in great quantity. In addition to the 2,500 ordered in 1927/28, 6,500 more were required in 1928/29 - 4,000 infantry, 2,000 aircraft and 500 tank guns. [47]

Special attention was paid during the course of manufacture to the interchangeability of parts. On 15th June 1928, the deputy chairman of the Revolutionary Military Council, Iosif Unshlicht, convened a special meeting with representatives of the Chief Military Industry Directorate. The conference was to discuss the possibility of accelerating production of machine-guns with interchangeable parts. The deadline for the organisation of this type of production was set for 1929 or, at the latest, early 1930. [48]

The tremendous effort applied to the programme increased the durability of the Degtyarev machine-gun. The heat treatment applied to the most important components was changed, and the parts themselves were often made of the best steel. From 25th March to 2nd April 1930, acting under orders from the Director of Armament of the Red Army, a commission headed by Deputy Director of Armament Nikolay Efimov tested thirteen machine-guns in an effort to define critical limits for the durability of the Degtyarev and its components. This factor determined the requisite quantities of spare parts and compared the durability of the machine-guns against time.

Shooting was undertaken in two basic modes. Some machine-guns fired

bursts of 8-10 rounds, being allowed to cool after every third magazine, while others fired bursts of 10-15 rounds with cooling after every fifth magazine. The guns were all lubricated after 1,500 rounds had been fired, then cleaned, examined and tested for accuracy after 3,000. No fewer than 573,700 rounds were fired during the trials, totals per gun ranging from 33,000 to 69,000.

On 29th May 1930, Vladimir Fedorov wrote that 'By now, machine-gun durability has been increased to 75,000-100,000 rounds, and that of the parts most prone to breakage (firing pins and extractors) to 25,000-30,000. An average of 10,000 was formerly considered completely adequate for this [type of] weapon'.[49]

Vasily Degtyarev's long-cherished dream of becoming a designer had come true. Noting his personal contribution to the vitally important work to create a light machine-gun, the first Soviet automatic weapon constructed to defend the

country, Kliment Voroshilov said in a speech to the Moscow garrison: 'the machine-gun problem has been solved principally by constructor Degtyarev, together with other designers. Our army is now greatly indebted to him'.[50]

By the time of Voroshilov's speech, the DP had become a cornerstone of the armament structure of the Red Army, and production satisfied demand. However, the rate was subsequently allowed to drop, preventing the formation of appropriate mobilisation stores. A noticeable decline in production in the first six months of 1941 - a period of transition to newer models - was particularly serious.

The first indigenous Soviet light machine-gun instantly aroused the interest of foreign authorities. Even though rarely quick to praise, they saw a weapon so good that its designer - little known at that time - was eventually nicknamed the 'Russian Maxim'. However, only after many years had

passed (and many other weapons had been approved) did Western inventors honour the self-taught Soviet designer Vasily Degtyarev as an equal. Typical of the praise accorded in later years was an article in the *American Rifleman*, which stated that 'typical of the improvements which might have some importance for would-be riflemen could be considered the efficient system of the breech-locking applied in the Degtyarev light machine-gun, and its further perfection. It is so absolutely simple that the cleverness of its designer cannot yet be entirely fathomed'.[51]

Soviet designers have created many original small arms, evidence being provided by the first one - the Degtyarev light machine-gun of 1927. But originality has never been their only aim. It was one way amongst many to achieve perfection, making the weapon stable, reliable, simple and easy to make, so that it could meet the highest tactical and technical requirements.

The Simonov light machine-gun

Preoccupied by the work on the Degtyarev machine-gun, the Kovrov factory staff did not notice a light shining in one of the workshops long after the working day had finished. Working eagerly, making and then carefully finishing components himself, Sergey Simonov was busily developing a gun of his own. A highly skilled specialist by that time, he was also a brilliant machinist.

The Simonov light machine-gun had much in common with the inventor's automatic rifle. It shared the same simplicity of design; the same wish to avoid existing solutions; and the same quest for new paths. Anxious to eliminate the deficiencies of his original rifle, Simonov created a machine-gun without a single threaded connection: even the barrel was joined to the receiver with a movable rectangular cotter, a novelty that was later to be used by many other inventors. The simple receiver - another novelty - required neither casting nor stamping, yet eliminated the need for external finishing. All inner recesses (e.g., the bolt-locking plug and the piston-rod chamber) were simple cylinders and could be made simply by turning or drilling. The bolt was also an easily-made cylinder, whilst the trigger mechanism (unlike that of the rifle) permitted single

shots or continuous fire to be selected at will. The closed pan magazine was placed on top of the receiver to protect the feed mechanism against dust or moisture.

Other novelties were intended to improve the handling characteristics; the magazine, for example, could be replaced with one hand. Fired cases were expelled through a port on the front right side of the receiver, not only allowing the machine-gun to be supported from below but also improving firing comfort.[52]

Though the innovative Simonov machine-gun promised numerous advantages over its rivals, neither simplicity of design nor ease of manufacture could guarantee reliability. Small-arms history is littered with guns that met every requirement imaginable, passed tests of all types, but proved to be a disaster in service. Knowing that it was impossible to predict how the Simonov machine-gun would behave without lengthy effort-consuming trials, the authorities realised that additional delays in adopting a light machine-gun were not only senseless but could well become criminal: should a war begin, the Red Army would be left without a weapon whose importance could not be doubted.

Though mindful that the Degtyarev

light machine-gun had already gained general approval, met all tactical and technical requirements, and had demonstrated its superiority to foreign systems in the course of comparative testing, the Artillery Committee resolved on 26th September 1927 to allow the Kovrov machine-gun factory to finance the final stage of Sergey Simonov's work. Simultaneously, however, the resolution noted that there was then no 'likelihood of solving the problem related to the light machine-gun in any way other than [adoption of] the Degtyarev pattern'.[53]

Simonov realised that additional work on his light machine-gun would simply waste effort, time and money. Then directing the assembly workshop producing Degtyarev machine-guns, Simonov contented himself with increasing production of the gun of his rival - even though he could never forget his favourite activity, designing new small arms. Though many obstacles were placed in his way, his natural talent and dedicated work ultimately brought great success.

Sergey Simonov could not know at that time that only three of the many weapons he designed would be officially adopted, though he understood that even a single approved model signified enormous success. Many talented designers were not so lucky.

Modified Degtyarev light machine-guns

Even though the DP had been adopted officially, development work did not stop. Changes made by Degtyarev in the basic design resulted in the creation of modified patterns.

The 1931-pattern light machine-gun lacked the barrel casing. The gas cham-

ber was moved towards the breech until it lay directly ahead of the receiver, shortening the piston rod. As there was no longer a suitable place ahead of the bolt carrier, the return spring was moved into a tube threaded into the back plate of the receiver to project backward above

the butt. The trigger mechanism gained a safety lever on its right side, and the rear part of the firing pin was elongated to double as the return-spring guide rod.

The gas chamber of the 1934 version was moved to the muzzle, necessitating an elongated gas piston.



Degtyarev light machine-gun 1931 pattern.

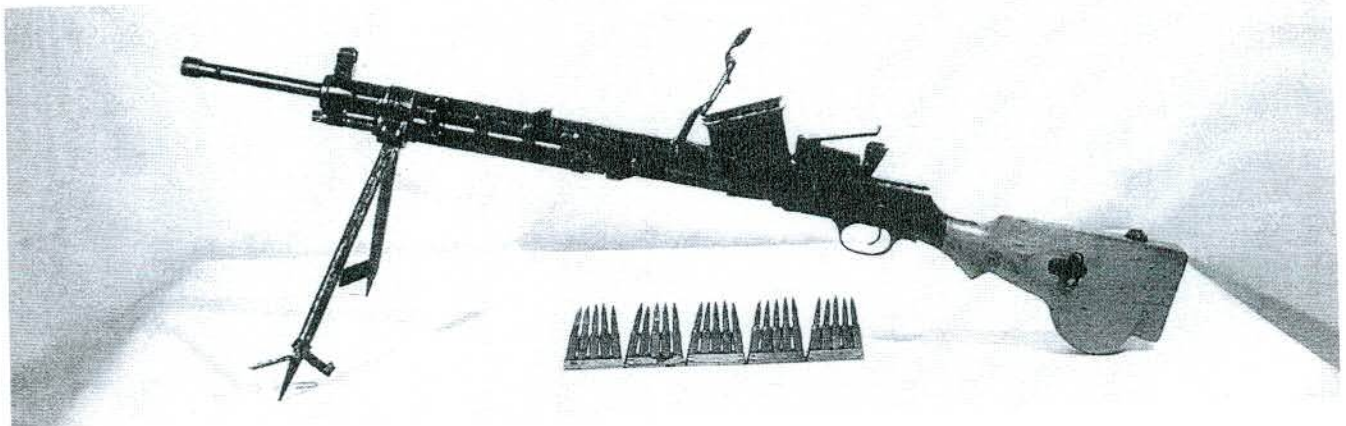
The 1938-pattern light machine-gun embodied several notable design changes. The detachable magazine was replaced with a special hopper on the left side of the receiver, attached with the same latch that had held the original pan. Loose cartridges were fed into the hopper from above and pressed

downward by a strong spring. They were then propelled into the feed aperture by a lever mounted in the reinforced left wall of the hopper.

The reason for this modification is clearly understood for following episode.

On the very eve of war, however,

the fate of the Soviet light machine-gun hang in the balance. A representative of the military headquarters informed Stalin that light machine-guns captured from the Japanese during the Khalkhin Gol battles overcame the Degtyarev in all respects.



Degtyarev light machine-gun 1938 pattern with Japanese style feeding system.

The peculiar feed system of the Japanese weapons was considered to be a great advantage. Cartridges were held under the pressure of a spring-loaded lid in a hopper on the left side of the receiver. When the hopper had been emptied, the firer simply depressed the spring with his hand and dropped new cartridges into place. However, the smallest handling error - lack of experience, or simply attempting to load in an uncomfortable position - could make the lid snap shut, bruising or even amputating fingers.

Stalin told Boris Vannikov to clarify the problem. During a sitting of the People's Commissariat of Armament, where the Japanese trophy had been displayed, the military commanders expressed a favourable opinion of it. The head of the Chief Artillery Directorate, Marshal Grigory Kulik, sided with the command-

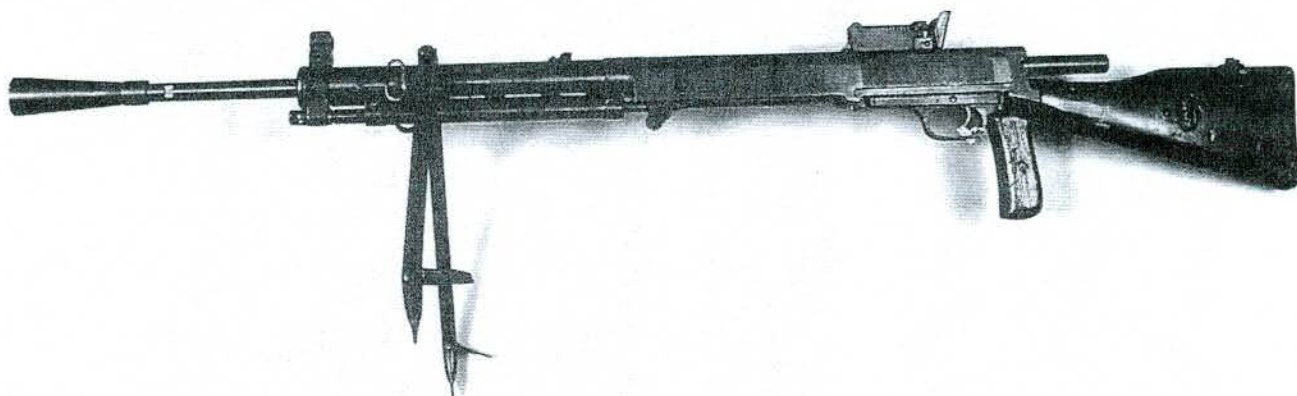
ers and even suggested that the Degtyarev light machine-gun should be replaced with the Japanese model. Military industry representatives objected to this course of action, stressing that the Japanese weapon chambered 6.5mm semi-rim cartridges of a type that was not produced in the USSR. Creating a new machine-gun with a Japanese-style hopper feed, adapted for the 7.62mm Soviet cartridge, would not only require development time but also add weight to the system. In addition, the magazine of the Japanese machine gun was dangerous under combat conditions and would inevitably cause injuries to the soldiers if mass conscription occurred.

However, nothing in these arguments could change the military minds. Then, supported by Kliment Voroshilov (who was chairing the conference), Vannikov

lay down, opened the hopper lid and put a thick pencil across the edge of the magazine wall. When released, the lid cut the pencil in two. Marshal Semen Budyonny, sitting in the front row, immediately remarked 'let those who like this thing fight with it; I would never go to war with something like this'. The future of the Degtyarev light machine-gun was finally assured.

'It must be considered,' wrote Vladimir Novikov in his memoirs, 'that we would have made a huge mistake had we discarded the DP only two years before the war and embarked on the design of a completely different light machine-gun for a new cartridge'. [54] However, the mere fact that the replacement of the DP was mooted as late as 1939 was by no means an exceptional case in ordnance history.

The modernised DP light machine-gun 1944, DPM



Military service soon showed that changes could be made in the basic DP-27 to increasing the durability of its parts.

It is more of a mystery why fifteen years should pass before the Degtyarev was provided with improvements that had been obvious from the first moment it had appeared in service. Ironically, the changes were finally made in the desperate days of the Great Patriotic War.

Positioning the recoil spring directly beneath the barrel proved mistaken; adversely affected by heat radiating from the barrel, the spring lost its power and ultimately failed to operate. The flaw was corrected by transferring the recoil spring to the receiver, something that had been tried ex-

perimentally as early as 1931 (see above). The trigger mechanism was improved and strengthened, to prevent accidental automatic fire, whilst the automatic safety catch was replaced with a thumb lever on the right side of the receiver. Introducing a pistol grip and re-shaping the butt improved the consistency of aimed fire.

The new non-detachable bipod - which could no longer be lost - could rotate around a longitudinal axis to facilitate levelling the gun before firing commenced. Ballistic performance and operating characteristics remained unchanged. The modernisation programme was supervised by Vasily Degtyarev himself, assisted by Aleksandr Belyaev and Aleksandr Skvortsov (to whom some of the improve-

ments should be credited); they were supported by fitters Aleksey Dubynin and Petr Polyakov.[55]

On 29th August 1944, the People's Commissar of Armament, Dmitry Ustinov, and the head of the Chief Artillery Directorate, Nikolay Yakovlev, presented the modernised weapon to the State Defence Committee for approval.[56] The committee approved the changes in design, designating the new gun 'Degtyareva pekhotniy modernizirovanniy' (DPM, 'Degtyarev infantry, modernised').

As the result of these improvements, the reliability, stability, handling characteristics and accuracy of the DPM were significantly better than those of the preceding DP.

The Degtyarev at war



Russian soldiers cleaning their DP during WW II.

When the Great Patriotic war began, the Degtyarev light machine-guns had been the basic support weapon of the Soviet infantrymen for almost fifteen years, allowing them to exterminate enemy manpower and suppress hostile fire at distances as great as 800 metres. They were mighty weapons in the hands of men fighting at Lake Khasan and the Khalkhin-Gol river, then at the Fronts during the war.

In July 1944, for example, a group of soldiers from the 415th infantry regiment of the 1st (Brestskoy) infantry division, commanded by machine-gunner Nikolay Mikhailovich Dyakonov, was amongst the first groups to cross the Bug river to occupy an important hill on its western bank. Robust German counter-attacks attempted to push the interlopers

back into the river, but for two days, until the main forces arrived, the spirited resistance of a handful of Soviet riflemen could not be broken. The fire of the DP performed the duties of a barricade, preventing Germans regaining the hill and contributing greatly to their two hundred dead.

For his bravery, Nikolay Dyakonov was awarded the title of Hero of Soviet Union, and his machine-gun was sent for perpetual exhibition in the Central Museum of the Armed Forces of the USSR.

Though the Degtyarev infantry machine-guns were at least the equal of their foreign contemporaries, even the DPM could not fully meet the requirements for light machine-guns that became evident during the Second World War. The manoeuvrability of in-

dividual units was constantly improving, whereas the comparatively large size and high weight of the DP or DPM reduced their utility. These disadvantages were principally due to the pan magazine, which weighed 1.64kg. The design of the magazine had been influenced by the protruding rim of the regular rifle cartridge, which caused excessive rim-over-rim jams in conventional box magazines.[57] The small capacity of even the large-diameter pan magazine limited the practical rate of fire and prevented the lengthy bursts that were especially important during an offensive, when light machine-guns had to compensate for the absence of cumbersome heavy weapons which could not support rapidly-moving infantrymen.

Several attempts were made to



DP light machine-gun on motorcycle side-car.



DP light machine-gun in action. Note correct position of left hand while firing.

increase the fire-rate of the DP during the Great Patriotic War. In 1942, for example, fitters Dubynin and Polyakov devised a universal feed block accepting the regular Maxim-type fabric belt. The major components of the block were made of cold-stamped thin metal sheets. Vasilii Degtyarev also developed

belt-feed systems, presenting two differing prototypes in 1943.

Unfortunately, belt-fed Degtyarevs weighed 10-11kg and the pendant belt made running with the weapon difficult. The advantages of belt feed in light machine-gun design were not apparent at that time. 'The belt feed for the light machine-gun', read

a firing-range report of 20th January 1945, 'is a serious problem requiring profound investigation. Until now, the question of the best way of feeding machine-guns with cartridges, from a belt or a magazine, has not been answered'. [58]

Wartime light machine-guns, 1942-4

In addition to perfecting the DP, Soviet designers expended much effort on the design of new weapons. In 1942, a competition was announced for the development of a 7.62mm light machine-gun to an extremely demanding specification. Vasilii Degtyarev, Sergey Simonov, Mikhail Kalashnikov and others participated in this endeavour.

Degtyarev presented two gas operated machine-guns, locked by displacing the bolt upward.

The barrels of both guns could be replaced with ease.

One gun fed from a metal-link belt, the cartridges being transferred to the feedway by pawls on the follower travelling in curved slots cut in the receiver. The cartridge was withdrawn from the belt by a swinging lever fixed to the bolt carrier. The barrel was retained with a wedge-key controlled by a special operating handle acting through a cam. The metal back-plate, attached to the butt,

engaged vertical slots on the back of the receiver and was locked in place with a wedge. Inserted through a hole in the butt, the recoil spring was locked by a guide rod with special locating studs. The trigger mechanism, contained in the combination trigger guard/pistol grip, allowed single shots or automatic fire to be selected at will. The tangent-curve back, graduated to a maximum range of 1,300 metres, could be adjusted laterally to correct aim.



DP machine-gun 1943 belt-fed variation.

The other Degtyarev machine-gun fed from a detachable box magazine on top of the receiver, the sights being offset to the left. The barrel was held in the receiver by a lateral wedge. The trigger mechanism was combined with a

safety lever, to guard against accidental shots, but was restricted to automatic fire. The return spring and its guide rod were carried on the trigger frame, which was inserted into slots cut in the receiver and held in place by the

wedged-in back plate. To improve portability, the weapon was provided with a metal stock that could be folded on the march. The cam-shaped back sight was graduated to a range of 1,500 metres.



Experimental Simonov light machine-gun.

The Simonov 7.62mm light machine-gun also embodied a gas-piston system, but the gas vent lay on the top of the barrel together with the tube containing the piston and piston-rod assembly. The breech

was locked by tipping the bolt downwards. Cartridges fed from a twenty-round detachable box magazine inserted into the receiver from below. The return spring and its guide rod were held in the receiver

lid by a lateral wedge. The barrel could not be detached from the receiver, though a collapsible metal stock reduced bulk on the march. The tangent-curve back sight was graduated to a range of 1,500 metres.



Experimental Kalashnikov light machine-gun 1943.

The Kalashnikov 7.62mm light machine-gun was operated by allowing the barrel to recoil a short distance. The breech was locked by the interaction of a swinging lever with an operating cam. The trigger mechanism, restricted to automatic fire, carried a safety lever on its left side. The primer was hit by a massive striker, propelled by the recoil spring; the striker was cocked after the bolt had been locked, but while the receiver/barrel assembly was still moving forward. Premature shots were prevented by an automatic

safety lever in the front part of the bolt, which kept the striker cocked until the receiver, barrel and locked bolt had reached the limit of their forward movement. Cartridges were fed from a detachable two-row box magazine containing 15 rounds, inserted into the receiver casing from below, whilst the folding frame-type back sight was graduated for five ranges between 200 and 900 metres.

Testing showed that it was extremely difficult to design an effective light machine-gun, chambered for the 7.62mm rifle cartridge, that

weighed less than 7kg, had a practical rate of fire below 100 shots per minute, plus acceptable accuracy, good reliability and excellent endurance. The competition committee recommended that a batch of Simonov machine-guns should be made. The weight of the weapon was close enough to 7kg to satisfy all tactical and technical requirements, but subsequent tests showed that the guns were not reliable or durable enough to be acceptable, nor were they particularly accurate. Another disadvantage of the Simonov lay in its small-capacity magazine.