

1 gallon
Shay
19 min
held for Co if needed

(taken by Mr. McLean 12/22/41, for the company)

GPG-PWC/lcg
ABERDEEN PROVING GROUND, MD.,
NOVEMBER 8, 1940.

ONE HUNDRED AND FORTY-THIRD PARTIAL REPORT ON FUNCTIONING
AND MECHANICAL TEST OF MACHINE GUNS AND MACHINE GUN ACCESSORIES

AND

REPORT OF DEMONSTRATION OF MADSEN 7 MM MACHINE GUN AND 20
MM ANTI-TANK AND ANTI-AIRCRAFT GUN

ORDNANCE PROGRAM NO. 5082

DATES OF TEST: October 23, 1940.

1. AUTHORITY FOR TEST: O.O. 472.93/329
A.P.G. 472.5/458

2. OBJECT OF TEST: To afford the Madsen Company opportunity to demonstrate to Ordnance Department the uses and functioning of the 7 mm light machine gun and 20 mm automatic, anti-tank and anti-aircraft gun.

3. MATERIAL USED IN TEST:

a. Material Undergoing Test consisted of:

- 1 - light machine gun, Madsen, 7 mm, No. 20332, with bipod mount.
- 2 - spare barrels (with barrel extensions) for above
- 1 - tripod mount, for light machine gun
- 12 - magazines, 32-round capacity, for light machine gun

RETURN TO TECHNICAL STAFF.
FIRING RECORD FILE.

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329
143rd Report

- 2 - pouches, for magazines
- 480 - rounds, Mauser, 7 mm ball ammunition

- 1 - gun, Madsen, 20 mm, automatic, anti-tank and anti-aircraft
- 1 - mount, Universal, for anti-tank and anti-aircraft fire (with wheels for travelling)
- 1 - mount, F-5, light field, for anti-tank fire
- 1 - side car, for 20 mm gun
- 1 - motorcycle, "Nimbus", for transporting 20 mm gun
- 2 - magazines, drum 15-round capacity
- 14 - rounds, 20 mm, Madsen, A.P.T.
- 12 - rounds, 20 mm, Madsen, A.P.E.S.
- 2 - rounds, 20 mm, Madsen, E.S.
- 2 - rounds, 20 mm, Madsen, I.S.
- 1 - round, 20 mm, Madsen, E.S.T.
- 14 - rounds, 20 mm, Madsen, S-2
- 22 - rounds, 20 mm, Madsen, T-2

For other accessories exhibited, see attached list of items received.

b. Other material used in the test (in addition to the usual range facilities) consisted of

- 1 - armor plate, 1-1/2", face-hardened, Disston plate 13, heat 18042, Brinell face 627-627. Ballistic limit with 37 mm T8, 1945 f.s.

- 1 - armor plate, 1", face-hardened, Disston, heat 826, Brinell face 601-601
Ballistic limit with 37 mm M39 shot, 1889 f.s.
- 1 - armor plate, 1-1/2", homogeneous, Carnegie, No. 96685A, Brinell 223.
Ballistic limit with 37 mm T8 shot, 1554 f.s.
- 5 - gallons gas, 100 octane
- 4 - cans, 5-gallon, domestic, oil
- 2 - plates, aluminum, 36"x36"x1/8"
- 1 - plate, aluminum, 36"x36"x.016"
- 1 - tank, light, M2A4, No. 84

4. DETAILS OF TEST: Present at the demonstration were:

Mr. E. Nyholm	Madsen Company
Mr. Jensen	" "
Mr. Johnsen	" "
Capt. H. A. Quinn	Ordnance Department
Lt. H. A. McKerral	" "
Lt. H. L. McCormick	" "
Capt. Mesick	" "
Lt. Col. S. L. McCroskey,	C. A. C.
Lt. Col. R. W. Beasley,	F. A.
Lt. Col. G. A. Schlieker,	Infantry
Lt. Col. C. W. Legette	
Major J. H. Strother	
Lt. J. R. Burton	
Lt. D. B. Willets	
Lt. W. R. Brown	Ordnance Department
Mr. Yocum	" "
Brig. Gen. J. B. Rose	" "
Col. W. B. Hardigg	" "
Lt. Col. J. F. Kahle,	C. A. C.
Major C. F. Colson,	Infantry
Lt. Col. Campbell,	F. A.

A. Madsen 7 mm Light Machine Gun

The Madsen Company representatives first explained the parts of the gun and its functioning.

It is a recoil-operated, magazine-fed light machine gun using Mauser 7 mm ammunition. It may be fired from the shoulder or on a bipod which is an integral part of the gun, or from a separate tripod mount.

Magazine capacity is 32 rounds. There is no semi-automatic feature. The cyclic rate of fire is between 500 and 600 rounds per minute and this rate is not adjustable. Ejection is towards the bottom.

A safety is provided. When the trigger is released during full automatic fire, there is nothing in the chamber but there is one round in the feedway which must be removed before the gun is safe. For this reason an additional stop is provided to allow discharge of this cartridge. If this round is not removed, it will fire when the trigger is pulled.

The gun is air-cooled. Each barrel may be fired continuously for 250 rounds before it must be cooled. Barrels are changed from the rear. A complete barrel and bolt assembly must be replaced each time. It is not practical to detach the barrel from the bolt assembly in the field. This requires shop facilities.

Ordinarily, two extra barrels are carried with the gun, and a special asbestos-lined carrying case is provided to hold hot barrels.

In the hands of an experienced gunner, a barrel may be changed in approximately 12 seconds.

Photographs Nos. 41924, 41925, 41926 and 41927 show four views of this gun. Photograph No. 41928 shows the gun broken in the manner necessary to change barrels. Photograph No. 41929 shows the barrel with the bolt mechanism disassembled as far as is possible in the field with ordinary tools.

Mr. Johnsen of the Madsen Company then showed the observers the tripod mount. This is shown in Photographs Nos. 41908 and 41909. It is fully adjustable. Traverse is graduated in mils. There is provided a remote control trigger of the cable type. The gun is secured to the mount at both the barrel and the stock, and provision is made to absorb recoil by means of a spring.

For anti-aircraft fire, the stock may be detached, and with the front leg of the mount folded up, the gunner may use the mount in a vertical position as a bipod to permit full traverse.

The demonstrator then showed that the gun and mount are light enough for one man to carry a short distance from one firing position to another. The gun weighs 21-1/2 pounds without the magazine and the mount weighs 30 pounds. There is a hinged handle on the barrel of the gun to aid in carrying.

The bipod mount is attached to the gun, and when not in use, the legs may be folded together against the barrel. A stock rest is also provided. Photograph No. 41930 shows the gun in this firing position.

Firing was first done from the tripod mount. One magazine was fired in short bursts and two magazines were fired fully automatic.

The next firing was done from the bipod mount with the stock held against the gunner's shoulder. Six magazines were fired fully automatic. The gun did not climb. Considerable vibration was transmitted to the gunner.

At this point the barrel was changed. Attention was invited to the fact that the bolt mechanism was cool enough to be held in the bare hands.

Two magazines were then fired fully automatic from the shoulder at an elevation of +30 degrees and one magazine fired from the hip with the shooter walking forward.

The gun was replaced on the tripod mount in anti-aircraft position and ~~three~~ magazines fired at +60° elevation.

No malfunctions occurred.

All of this firing was done by Mr. Johnsen of the Madsen Company.

B. Madsen 20 mm Anti-tank and Anti-aircraft Gun

The Madsen Company representatives first demonstrated to the observers the several different methods of mounting the 20 mm gun in firing and traveling positions. These included:

a. The gun on its light field mount F5. This is a low slung tripod mount with recoil-absorbing mechanism. For transporting the gun on this mount, wheels are

attached to the mount and the whole is drawn by the gun crew. Copies of photographs of this mount are attached (Nos. 41904 and 41911);

b. The gun on the Universal Mount F7, which permits both anti-tank and anti-aircraft fire and which has, as a part of it, a recoil-absorbing mechanism similar to that on the light field mount F5. The gun is fixed to this mount by being fitted to the recoil mechanism which is pivoted to the cradle of the mount, and the cradle, in turn, pivots on the body of the mount. Photograph No. 41907 shows the gun on this mount in the anti-tank position and No. 41900 in the anti-aircraft position. By folding the three outriggers, attaching wheels, and locking the gun in position, the mount is made ready for traveling (Photographs Nos. 41906 and 41910);

c. The gun attached to the light field mount F5 and mounted on the side car of the motorcycle for long distance transport over roads. The gun can be fired from the motorcycle mounting, although it is not adequately stable for accurate firing in this position.

The gun itself is a recoil-operated, magazine fed, pivot block type, which fires either fully or semi-automatic. Rounds are chambered by a rammer which operates on cam action during the cycle of the gun. The block is pivoted at its rear end to the barrel extension and during recoil a lug on the right side of the block, acting on cam surfaces in the receiver, raises the forward end of the block to clear the barrel breech and permit ejection. At the end of recoil the forward end of the block drops below the breech, bringing a curved surface on its left side into alignment with the next round to be fed. The cartridge is forced against this surface by the magazine follower and as counter-recoil begins, the rammer pushes it forward and into the chamber. During the last few millimeters of counter-recoil the block is raised by cam action and brought to the closed position.

This type of block action requires that there be a large headspace in order that the face of the block will clear the breech as it pivots. Accordingly the cartridge cases have a thick rim and head to withstand the pressures on the unsupported part of the case.

In design and principle of operation this 20 mm gun is similar to the 23 mm Madsen aircraft cannon previously tested at the Proving Ground. (Fourth Partial Report on Ordnance Program 5383).

A later and more critical examination of the gun led to the belief that it might be difficult to manufacture in quantity because of its many curved and cammed surfaces, some of which depend on close tolerances for successful operation.

There is in existence, according to the Madsen Company representatives, a newer model Universal Mounting than the one which was used in this test. The description of this newer mount lists the following improvements:

- a. New disk wheels are now furnished with bullet-proof tires.
- b. The mount has been equipped with knuckle joints to absorb shock when traveling (see Photograph No. 41910).
- c. The cable trigger mechanism has been replaced by a rigid mechanical trigger.
- d. The mount is provided with arm rests for the gunner.
- e. The handles of the mount are placed at an angle instead of being perpendicular to the sides.
- f. The recoil tubes and springs are protected by synthetic rubber covers.
- g. The outriggers of the mount have been made adjustable in height.

It is this newer mount which appears in the photographs left by the Madsen representatives, copies of which are attached.

After the representatives had explained and demonstrated the uses and functioning of the gun and mounts, the following firing was done:

(1) Armor Plate Firings: To determine the efficacy of the two types of armor piercing ammunition for the 20 mm gun, firing was conducted against three samples of plate. Both types of ammunition, solid armor piercing with tracer and armor piercing with explosive charge, failed to completely penetrate the first sample - 1-1/2-inch Disston face-hardened plate (ballistic limit with 37 m/m T8 Shot - 1945 f.s.).

Both types succeeded in completely penetrating the second sample - 1-inch Disston, face-hardened plate (ballistic limit with 37 mm M39 Shot 1889 f.s.), at both normal and 20° incidence.

Both types succeeded in completely penetrating the third sample - 1-1/2-inch Carnegie, homogeneous plate (ballistic limit with 37 mm T8 Shot 1554 f.s.), at normal and 20° incidence but both failed to do so at 25° incidence.

The Madsen representatives were not present at these armor plate firings.

(2) Velocity: Average muzzle velocities for the A.P.T. and A.P.E.S., determined during armor plate firing, are as follows:

A.P.T. Ammunition - 2689 f.s. average muzzle velocity

A.P.E.S. Ammunition - 2716 f.s. average muzzle velocity

(3) Accuracy: Ten rounds were fired, single shot, from the Universal mount at a target at 300-yard range. Fifteen rounds were then fired fully automatic. Results are as follows:

Single Shot

Mean Radius	-	6.27"
" Vertical	-	4.67"
" Horizontal	-	3.14"
Extreme Vertical	-	16.80"
" Horizontal	-	11.13"
" Spread	-	16.85"

Fully Automatic

Mean Radius	-	18.77"
" Vertical	-	17.87"
" Horizontal	-	4.74"
Extreme Vertical	-	74.05"
" Horizontal	-	27.70"
" Spread	-	75.80"

(4) Incendiary Action: Two incendiary shells were fired at four cans containing gasoline.

The first shell, after passing through a 1/4-inch steel plate (according to the Madsen representatives some such resistance is required to function the shell) caused a five-gallon can containing an explosive mixture of gasoline and air to explode and rip the can. A second can placed behind the first one, and containing five gallons of gasoline was burst and the gasoline ignited. A ball of flame, about twenty feet in diameter, could be seen for about one second and then subsided, pools of gasoline continuing to burn on the ground.

The second shell after passing through the 1/4-inch plate caused two cans, containing 2 cc. of gasoline each, to explode. The second of these two was not a violent explosion.

(5) Fragmentation: Two explosive, nose-fuzed, shell were fired at aluminum bursting screens to determine the functioning and fragmentation. Both functioned on .016" thick aluminum. The cone in which fragments were distributed was approximately 30°. The limit of penetration of these fragments was not determined but on the first shot 28 fragments penetrated two 1/8-inch thick aluminum plates placed 3 feet and 8 feet behind the bursting screen.

(6) Anti-aircraft Fire: Ten rounds were fired fully automatic at an elevation of approximately 50°. Functioning was satisfactory.

(7) Cyclic Rates: At approximately 0° elevation a fifteen-round burst from the 20 mm gun was clocked at 220 shots per minute.

At approximately 50° elevation a ten-round burst was clocked at 174 shots per minute.

(8) Self-Destroying Tracer Shell: One self-destroying tracer shell was fired at approximately 45° elevation. The explosion of this shell in the air could be heard a few seconds after firing.

(9) Firing Against Light Tank M2A2: Five rounds of each type of armor piercing ammunition were fired singly against the left side of Light Tank M2A2 to determine effect of fragmentation within the tank. Dummy crew members were installed in the tank before firing.

Four hits, two on the turret and two on the sponson were scored with the A.P.T. ammunition. All four completely penetrated the left side of the tank. Fragments were liberally distributed over three of the four

dummies, one of these being cut into two sections by a concentration of fragments. The fourth dummy, the bow gunner, was untouched by the fragments. It is believed that the greater number of these fragments were from the sheet aluminum with which the interior walls of this tank are lined.

On a previous firing against this tank with the 37 mm M51 A.P. shot, the aluminum fragmented in a similar manner.

One hit was scored with the A.P.E.S. ammunition on the lower part of the hull. Fragmentation was similar to, but not as great as, that resulting from the previous four hits. Three A.P. explosive shell hit the left rear bogie and damaged one volute spring. The damage was not sufficient to have stopped the tank, had it been running. One shell hit and penetrated the left turret. Fragmentation was similar to that on hits with the solid A. P. shot.

All firing except that against armor plate was done by Mr. Johnsen of the Madsen Company.

Armor plate firing was done by Proving Ground personnel.

Detailed results of all firing will be found on the attached firing record.

Copies of photographs left by Mr. Nyholm, showing the 20 mm gun in various positions on its different mounts, are attached (Nos. 41899 - 41911 inclusive).

Photographs of the gun disassembled and of the bursting screens and gasoline cans used in the demonstration are also attached (Nos. 41835-41838, 41889-41897).

On all firings the gun and ammunition functioned satisfactorily.

5. OTHER OBSERVATIONS:

- a. Weight of A.P.T. projectile - 2250 grains (approx.)
Weight of A.P.E.S. projectile - 2070 grains (approx.)
Weight of complete round - 3/4 lb. (approx.)
- b. The A.P.E.S. projectile has no fuze, but consists of an armor piercing shell with black powder (presumably) filler, and solid base plug to close the rear end of the shell. Supposedly, the shell is functioned by the heat incident to impact with armor plate.
- c. Form factor for A.P.E.S. - .94 rel. to G.
Form factor for A.P.T. - .97 rel. to G.

d. Duration of trace could not be determined because the intensity of the trace light was insufficient to permit it to be followed to the end.

e. A small igniter charge is located below the propellant powder charge and adjacent to the primer of the Madsen ammunition.

6. CONCLUSIONS:

a. That the 7 m/m Madsen Light Machine Gun functions smoothly from the bipod and tripod mounts or from the shoulder at elevations from 0 to +60°.

b. That it is light and easily handled.

c. That it endures prolonged fire well under good conditions.

d. That this gun and tripod mount might present manufacturing difficulties if they were to be produced in quantity.

e. That the armor piercing ammunition for the 20 mm Madsen anti-tank gun cannot be expected to penetrate good quality 1-1/2-inch face-hardened armor plate at 100-yard range; but it may be expected to penetrate 1-1/2-inch homogeneous plate at the same range and at normal and 20° incidence.

f. That, with respect to armor piercing characteristics, the Madsen 20 mm anti-tank gun and ammunition are inferior to the Solothurn 20 mm anti-tank gun and ammunition previously tested at the Proving Ground, since the latter can be expected to penetrate good quality 1-1/2-inch face-hardened plate at 100-yard range.

g. That the 20 mm Madsen in single fire and automatic fire from the Universal mounting is a reasonably accurate gun.

h. That the incendiary action of the incendiary shell is good.

i. That the 20 mm Madsen gun might be difficult to produce in quantity because of the many curved surfaces of its component parts.

j. That the aluminum used as lining on the interior of the walls of the M2A2 Tank constitutes a hazard by virtue of its readiness to fragment when struck by a projectile which has penetrated the tank armor.

7. RECOMMENDATIONS:

a. That because of its relatively inferior armor piercing characteristics the 20 mm Madsen gun be considered unsatisfactory as a prospective anti-tank weapon.

b. That because of the complicated shapes of many of the component parts, the question of their manufacturability be investigated before consideration is given to any gun operating on this system.

APPROVED: J. B. Rose,
Brig. General, U.S.A.,
Commanding.

BY: *W. B. Hardigg*
Wm. B. Hardigg,
Colonel, Ord. Dept.,
Officer in charge of
Proof Department.

G. G. Eddy
G. G. Eddy,
Major, Ord. Dept.,
Chief Proof Officer,
Arms & Ammunition Div. *GH*

G. P. Grant
G. P. Grant,
1st Lt., Ord. Res.
Proof Officer.

P. W. Constance
P. W. Constance,
2d Lt., Ord. Res.,
Proof Officer.

- Inclosure #1 - Firing Record for 7 mm Madsen Gun
- Inclosure #2 - Firing Record for 20 mm Madsen Gun
- Inclosure #3 - Photographs A.F.G. 41924, 41930, 41810, 41811, 41835-41838, 41869-41871, and 41889-41897.
- Inclosure #4 - Copies of photographs made by Madsen Company, Nos. 41899 to 41911 inclusive.
- Inclosure #5 - List of items received.

INCLOSURE NO. 1

FIRING RECORD

TEST OF 7 M/M MADSEN LIGHT MACHINE GUN No. 20332

FUNCTION FIRINGS

<u>Date</u> 1940	<u>Magazine</u> <u>No.</u>	<u>Time</u>	<u>Type of Fire</u>	<u>Remarks</u>
10/23	1	11:30	Fired short bursts from tripod mount.	O. K.
	2	11:31	Fired automatic from tripod mount.	O. K.
	3	11:32	do	O. K.
	4	11:40	Fired automatic from bipod.	O. K.
	5	11:41	do	O. K.
	6	11:42	do	O. K.
	7	11:43	do	O. K.
	8	11:43	do	O. K.
	9	11:44	do	O. K.
	10	11:45	Fired at 30° elevation from shoulder	O. K.
	11	11:46	do	O. K.
	12	11:47	Fired from hip walking forward.	O. K.
	13	11:48	Fired at +60° with mount in A.A. position..	O. K.
	14	11:49	do	O. K.
	15	11:50	Fired with A. A. sights, same position.	O. K.

INCLOSURE NO. 2

FIRING RECORD

TEST OF 20 MM ANTI-TANK AND ANTI-AIRCRAFT MADSEN GUN NO. 1303

ARMOR PLATE FIRINGS

1923/40

<u>Rds.</u>	<u>Time</u>	<u>Inci- dence</u>	<u>Ammuni- tion</u>	<u>Muzzle Velocity</u>	<u>Striking Velocity</u>	<u>Mount Used</u>	<u>Result</u>
Disston Plate 13, Heat 18042, 1-1/2" face-hardened. Brinell: Face 627-627. Ballistic limit with 37 mm - 1945 f.s.							
1	9:02	Normal	A.P.T.	2674	2594	Light Field Mount F5	Partial
2	9:10	"	"	2785	2605	"	"
3	9:18	"	A.P.E. S.	Lost	Lost	"	"
Disston Plate, 1" face-hardened, Heat 826. Brinell: Face 601-601, Back 341-388. Ballistic limit with 37 mm M39 - 1889 f.s.							
4	9:31	Normal	A.P.T.	2680	2500	Light Field Mount F5	Complete, 1-3/8"x1-1/4"
5	9:35	"	"	2703	2523	"	Complete, 1-1/4"x1"
6	9:42	"	A.P.E.S.	2679	2496	do	Complete, 1-1/4"x1-1/8"
7	9:44	20°	A.P.T.	2664	2484	do	Complete, 1-1/8"x7/8"
8	10:00	"	A.P.E.S.	2683	2500	do	Complete, 1"x13/16"

INCLOSURE NO. 2 (CONT'D)

FIRING RECORD (CONT'D)

TEST OF 20 MM ANTI-TANK AND ANTI-AIRCRAFT MADSEN GUN NO. 1303

ARMOR PLATE FIRINGS

<u>Rds.</u>	<u>Time</u>	<u>Inci- dence</u>	<u>Ammuni- tion</u>	<u>Muzzle Velocity</u>	<u>Striking Velocity</u>	<u>Mount Used</u>	<u>Result</u>
Carnegie 1-1/2" homogeneous Plate 96685A Brinell 223. Ballistic Limit with 37 m/m - 1554 f.s.							
9	10:12	Normal	A.P.T.	2666	2486	Light Field Mount	Complete 3/4"x3/4"
10	10:20	"	A.P.E.S.	2704	2523	F5	Complete 3/4"x3/4"
11	10:35	20°	A.P.T.	2657	2477	do	Complete 3/4"x3/4"
12	10:40	"	A.P.E.S.	2742	2559	do	Complete 3/4"x7/8"
13	10:50	25°	A.P.T.	2682	2502	do	Partial, slight bulge.
14	10:55	"	A.P.E.S.	2774	2591	do	Partial, slight bulge, cracking started.

TARGET FIRINGS

<u>Rds.</u>	<u>Time</u>	<u>Rate of Fire</u>	<u>Cyclic Rate</u>	<u>Ammuni- tion</u>	<u>Mount</u>	<u>Functioning</u>
15	1:30	Single	-	T2	M5	Satisfactory
16 to 25	1:40 1:41	Single	-	S2	Universal	do
26 to 40	1:50	Automatic	220	4 - S2 11 - T2	"	do

INCLOSURE NO. 2 (CONT'D)

FIRING RECORD (CONT'D)

TEST OF 20 MM ANTI-TANK AND ANTI-AIRCRAFT MADSEN GUN NO. 1303

FIRING AGAINST GAS TANKS

Two 5-gallon cans were placed in line. The first of these contained 2 c.c. of 100-octane gasoline; the second contained 5 gallons. In front of the two cans was placed a 1/4-inch steel plate to cause the incendiary shell to explode.

<u>Rds.</u>	<u>Time</u>	<u>Rate of Fire</u>	<u>Cyclic Rate</u>	<u>Ammunition</u>	<u>Mount</u>	<u>Functioning</u>
41	2:14	Single	-	I.S.	Universal	Shell functioned after passing thru 1/4-inch plate, and ignited gasoline in both cans. The first exploded and can was torn apart. The second exploded more violently and flames of burning gasoline extended twenty feet or more in all directions.

Using two cans, each with 2 c.c. of gasoline

42	2:32	Single	-	I.S.	Universal	Both cans exploded. Explosion in the second can was not sufficiently violent to tear can apart.
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FIRING EXPLOSIVE SHELL AT BURSTING SCREENS

(First screen - .016" aluminum; second and third - 1/8" aluminum)

43	2:36	Single	-	E.S.	Universal	Shell exploded at first screen and scattered fragments over entire area of second, placed 3 feet behind first. Some of these fragments penetrated second screen and were scattered over area of third screen, and of these fragments 28 completely penetrated the third. Cone of fragments approximately 30°.
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44	2:45	Single	-	E.S.	Universal	Similar to Round 43.
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INCLOSURE NO. 2 (CONT'D)

FIRING RECORD (CONT'D)

TEST OF 20 MM ANTI-TANK AND ANTI-AIRCRAFT MADSEN GUN NO. 1303

<u>Rds.</u>	<u>Time</u>	<u>Rate of Fire</u>	<u>Cyclic Rate</u>	<u>Ammuni- tion</u>	<u>Mount</u>	<u>Functioning</u>
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FIRING AT APPROXIMATELY 50° ELEVATION

45 to 54	2:48	Auto- matic	174	T2	Universal	Satisfactory. Tracers could barely be seen
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FIRING ONE SELF-DESTROYING TRACER TO DETERMINE FUNCTIONING

55	2:55	Single	-	E.S.T.	Universal	Shell exploded in air a few seconds after firing.
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FIRING AGAINST LIGHT TANK M2A2

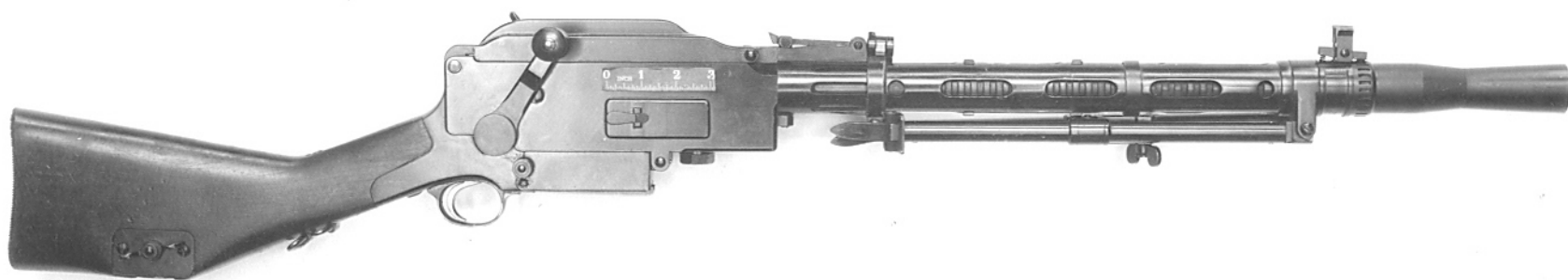
56 to 60	3:10	Semi- Auto- matic	-	A.P.T.	Universal	Found four hits on tank.. All four penetrated one side of tank. Fragments were spattered on three of four dummy crew mem- bers. These fragments appeared to have come mainly from the aluminum with which the inside of this tank is walled.
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61 to 65	3:30	Semi- Auto- matic	-	A.P.E.S.	Universal	Found five hits on tank, four of which penetrated hull. The fifth hit left rear bogie and damaged one volute spring. Fragmentation not as great as on rounds 56 to 60.
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INCLOSURE NO. 3

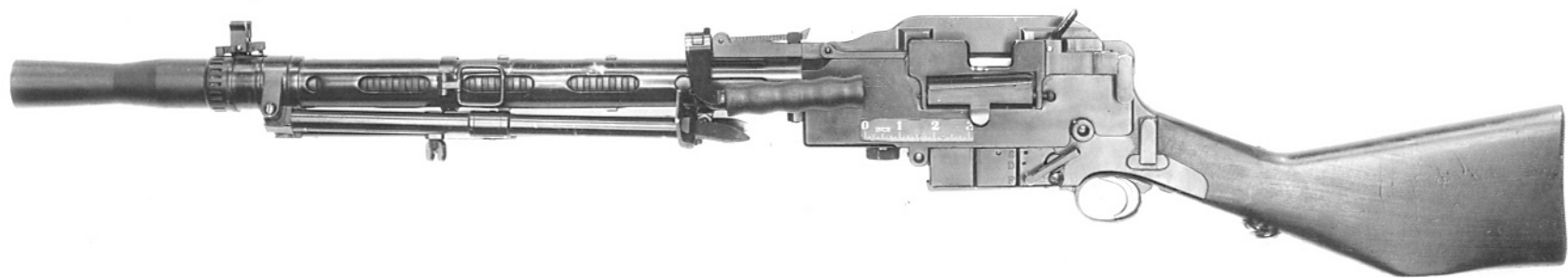
PHOTOGRAPHS A. P. G. 41924-41930, 41810, 41811,
41835-41838, 41869-41871 and 41889-41897.

18



41924 10-28-40 [ABERDEEN PROVING GROUND]
Right side view Madsen 7 mm light machine gun.

Ordnance Dep't.



41925

10-28-40

ABERDEEN PROVING GROUND

Ordnance Dep't.

Left side view Madsen 7 mm light machine gun.



41926

10-28-40

ABERDEEN PROVING GROUND

Ordnance Dep't.

Top view Madsen 7 mm light machine gun.



41927

10-28-40

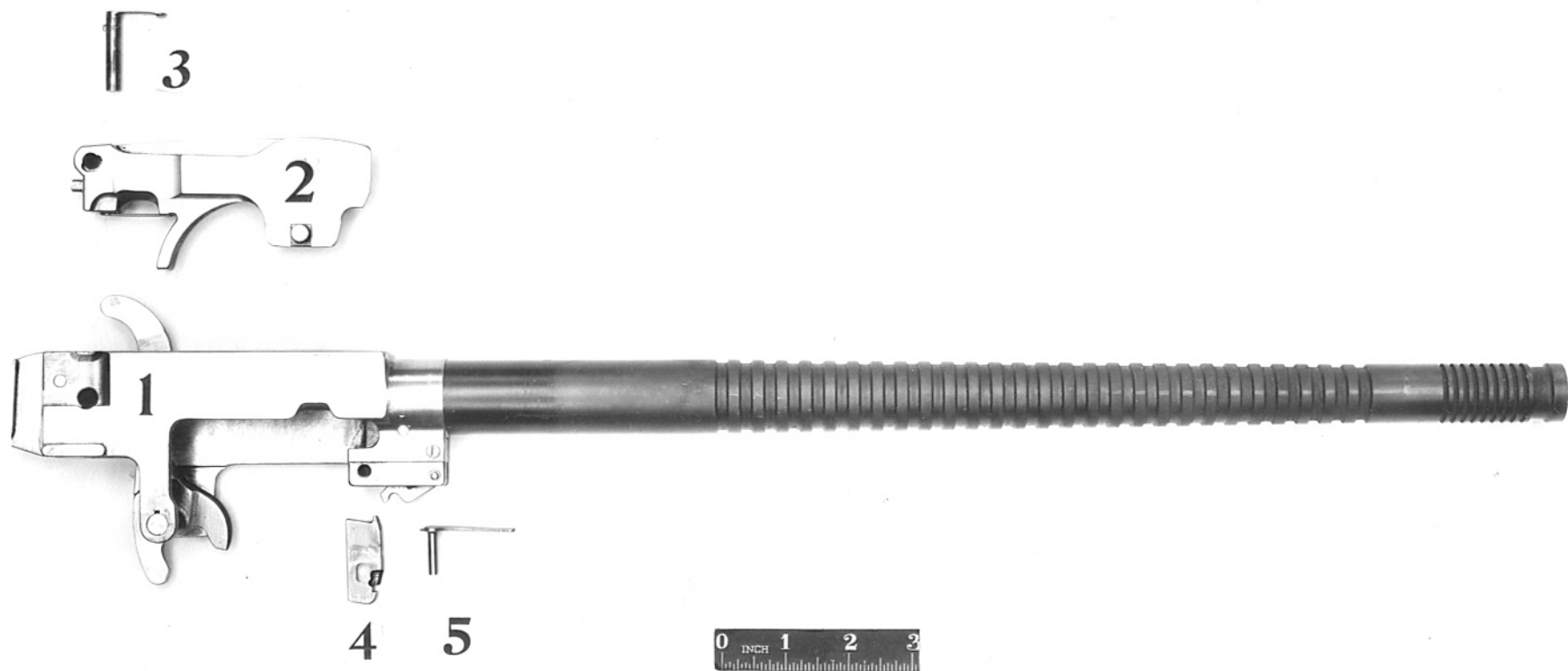
ABERDEEN PROVING GROUND

Ordnance Dep't.

Bottom view Madsen 7 mm light machine gun.



41928 10-28-40 [ABERDEEN PROVING GROUND] Ordnance Dep't.
Barrel and bolt assembly separated from Madsen 7 mm light machine gun.



41929

10-28-40

ABERDEEN PROVING GROUND

Ordnance Dep't.

Bolt disassembled. Madsen 7 mm light machine gun.



41930 10-28-40 ABERDEEN PROVING GROUND Ordnance Dep't.
Madsen 7 mm light machine gun on bipod and stock rest.



41810

10-22-40

ABERDEEN PROVING GROUND

Ordnance Dep't.

Three-quarter front view of Tank M2A2 before firing with 20 mm Madsen Anti-tank Gun.



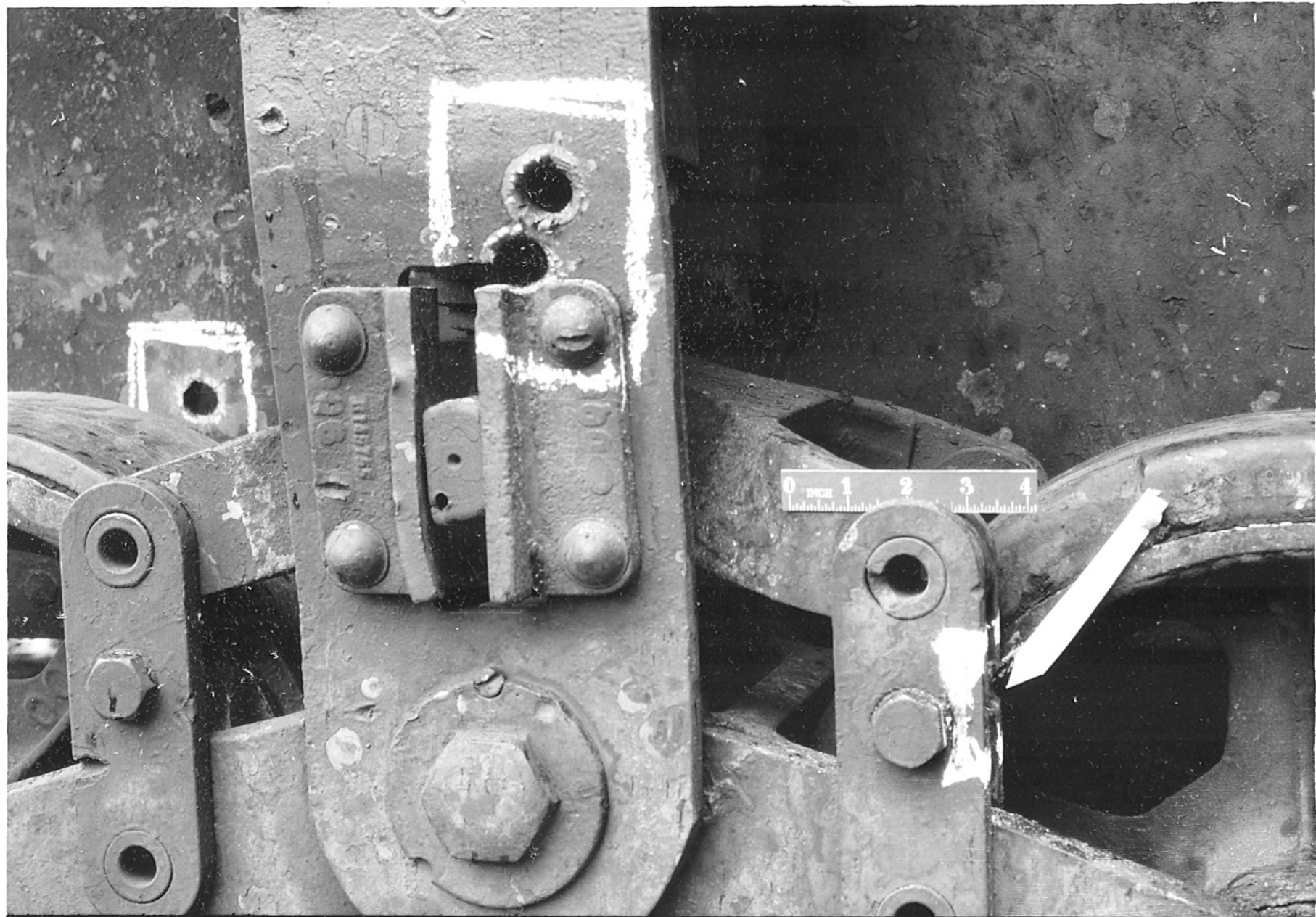
41811

10-22-40

ABERDEEN PROVING GROUND

Ordnance Dep't.

Left side view of Tank M2A2 before firing with 20 mm Madsen Anti-tank Gun.



41869 10-25-40 [ABERDEEN PROVING GROUND] Ordnance Dep't.
Four rounds 20 mm Madsen APES against left rear bogie assembly and side plate of Light Tank M2A2.



41870

10-25-40

ABERDEEN PROVING GROUND

Ordnance Dep't.

Penetrations made by 20 mm Madsen, 4 rounds APT and 1 round APFS, in Light Tank M2A2.



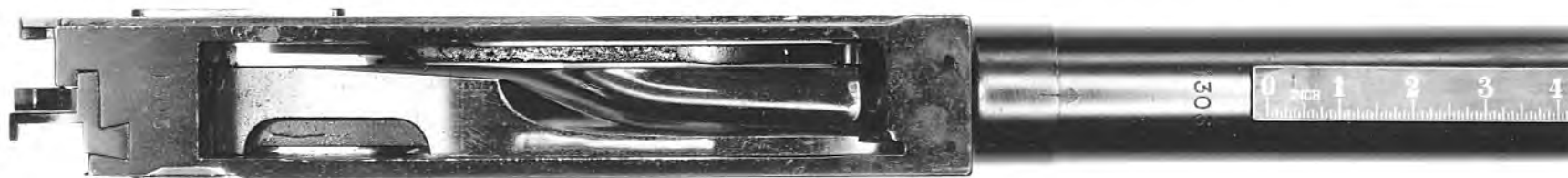
41889

10-28-40

ABERDEEN PROVING GROUND

Ordnance Dep't.

Barrel extension, bolt and rammer of 20 mm Madsen anti-tank gun #1303. Right side view.



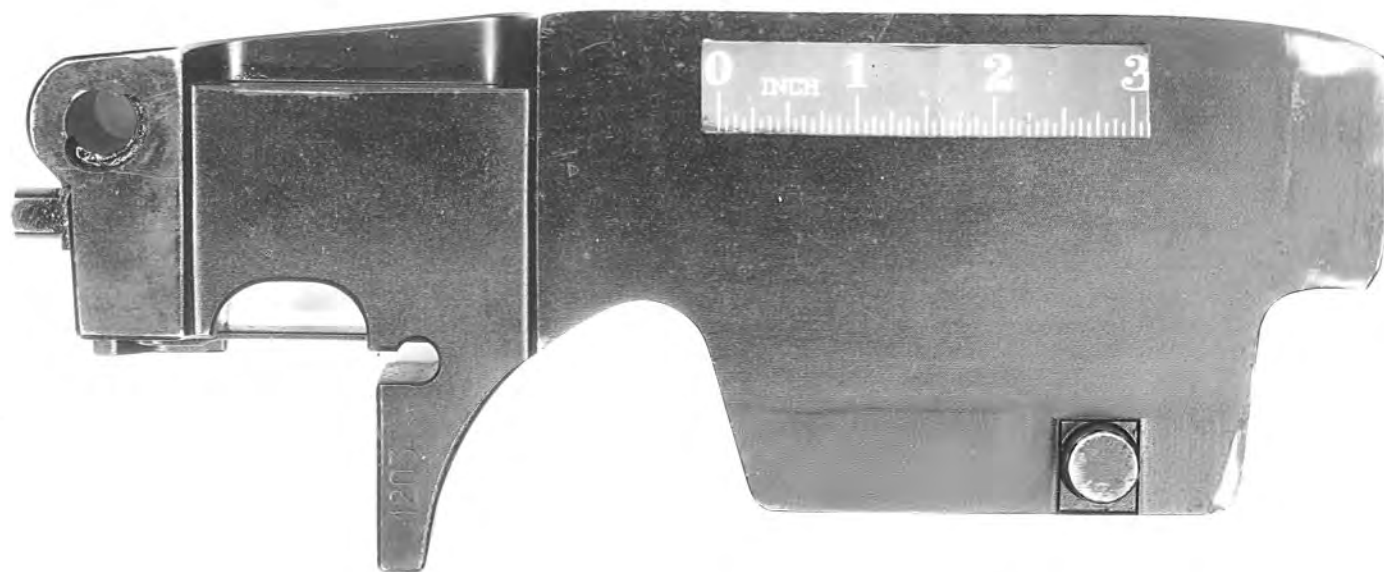
41890

10-28-40

ABERDEEN PROVING GROUND

Ordnance Dep't.

Barrel extension, bolt and rammer of 20 mm Madsen anti-tank gun #1303. Top view.



41891 10-28-40 ABERDEEN PROVING GROUND Ordnance Dep't.
Right side view of bolt of 20 mm Madsen anti-tank gun.



41892 10-28-40 ABERDEEN PROVING GROUND Ordnance Dep't.
Left side view of bolt of 20 mm Madsen anti-tank gun.



41893

10-28-40

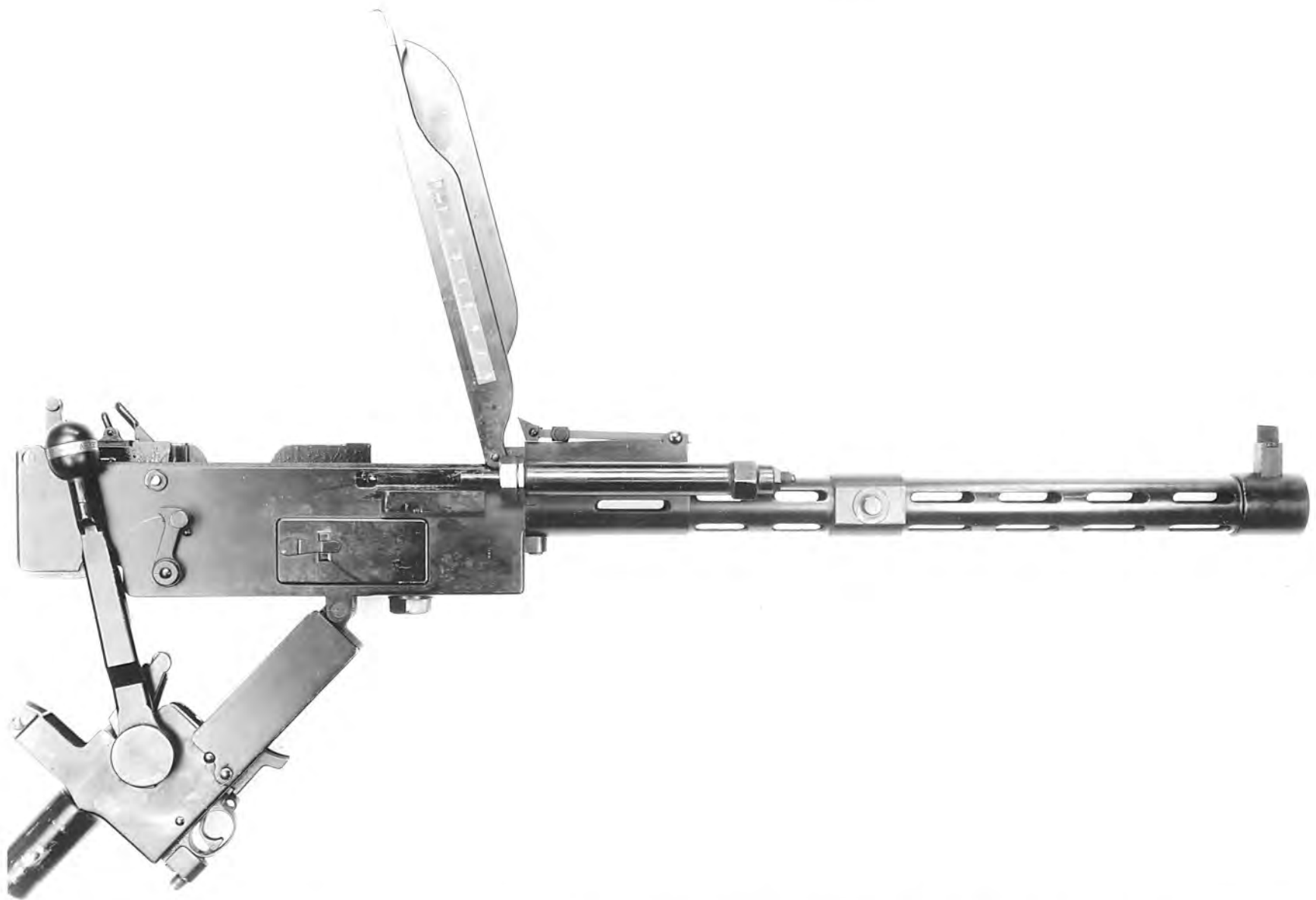
ABERDEEN PROVING GROUND

Ordnance Dep't.

Top view of bolt of 20 mm Madsen anti-tank gun.



41894 10-28-40 ABERDEEN PROVING GROUND Ordnance Dep't.
Bottom view of bolt of 20 mm Madsen anti-tank gun.



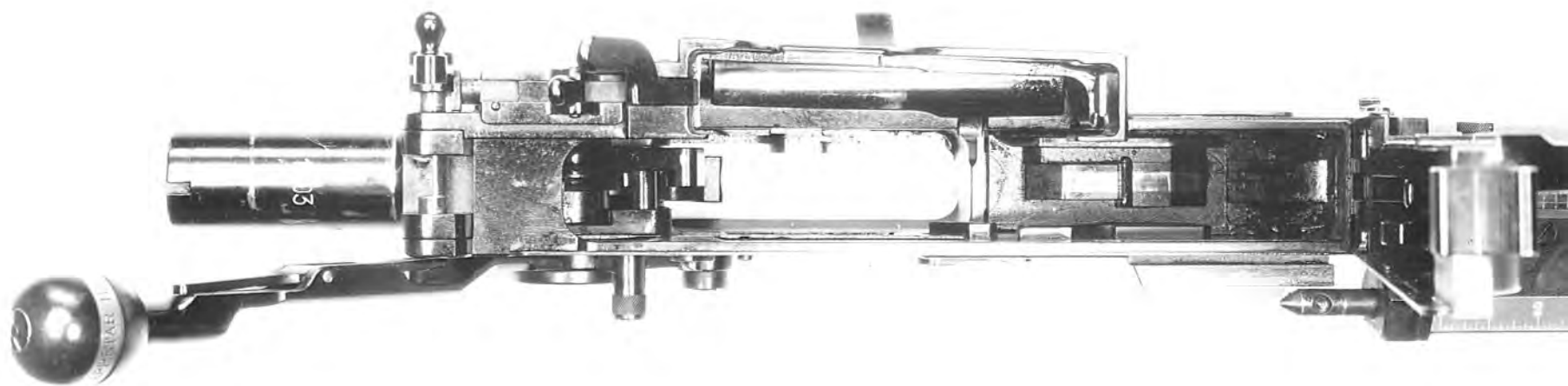
41895

10-28-40

ABERDEEN PROVING GROUND

Ordnance Dep't.

Right side view of receiver of 20 mm Madsen anti-tank gun, with cover and back plate opened.



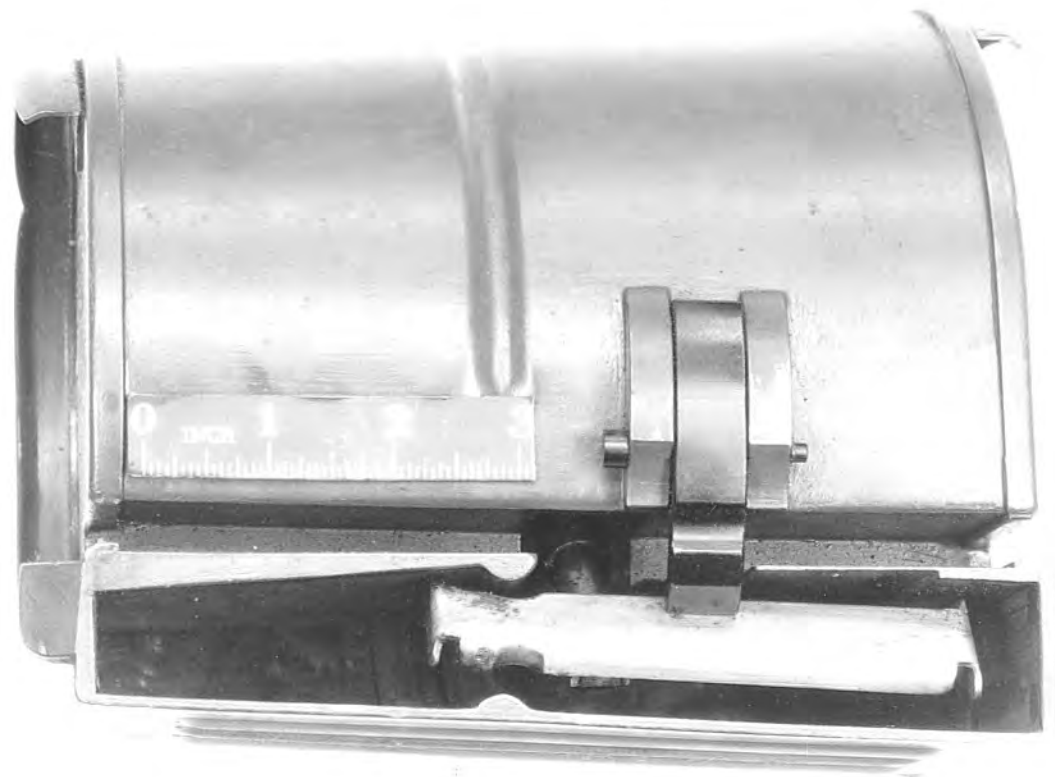
41896

10-28-40

ABERDEEN PROVING GROUND

Ordnance Dep't.

Top view of interior of receiver of 20 mm Madsen anti-tank gun. Bolt and barrel exterior removed.



41897 10-28-40 [ABERDEEN PROVING GROUND] Ordnance Dep't.
Drum magazine 15 rd. capacity, for 20 mm Madsen, anti-tank gun.

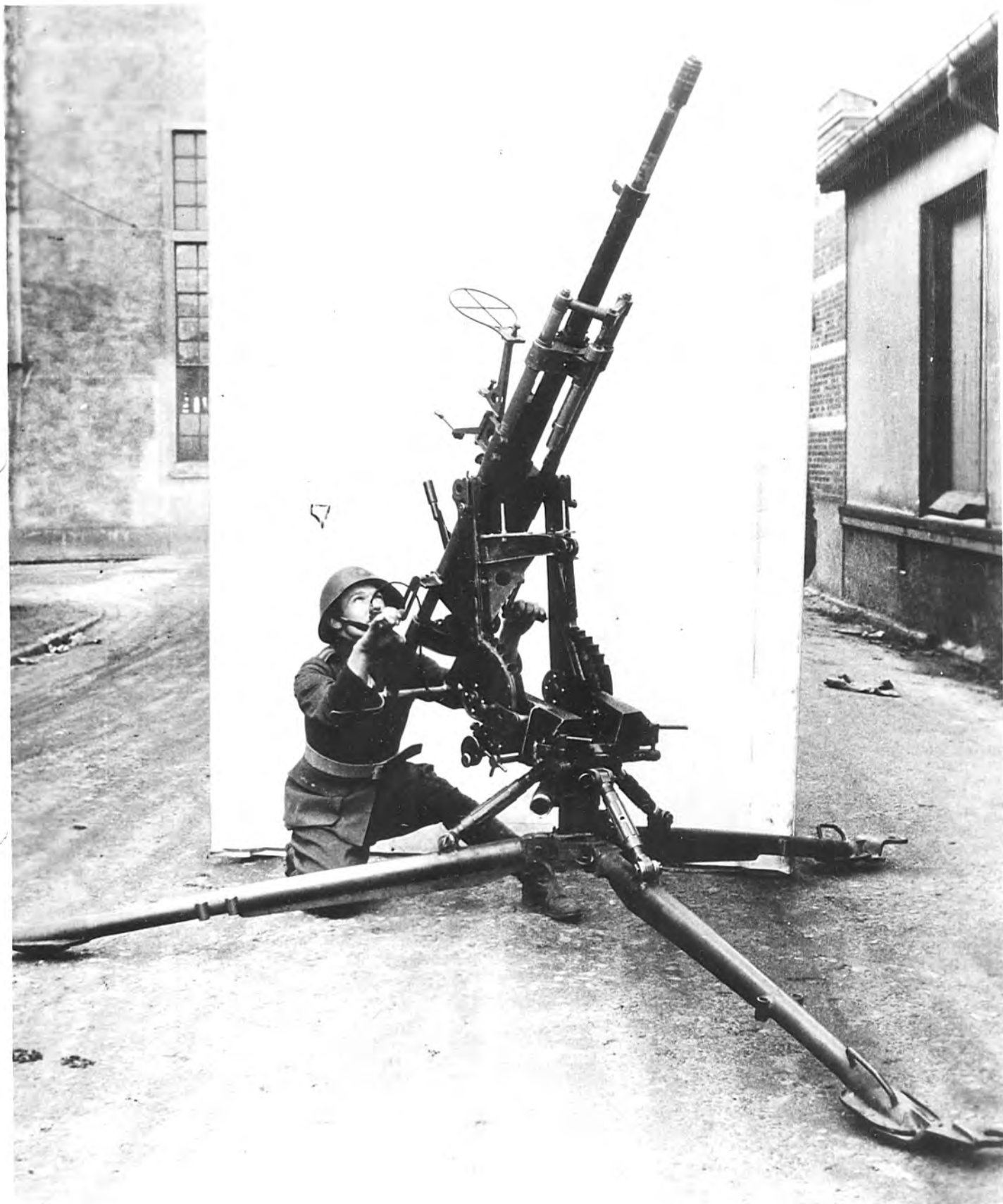
INCLOSURE NO. 4

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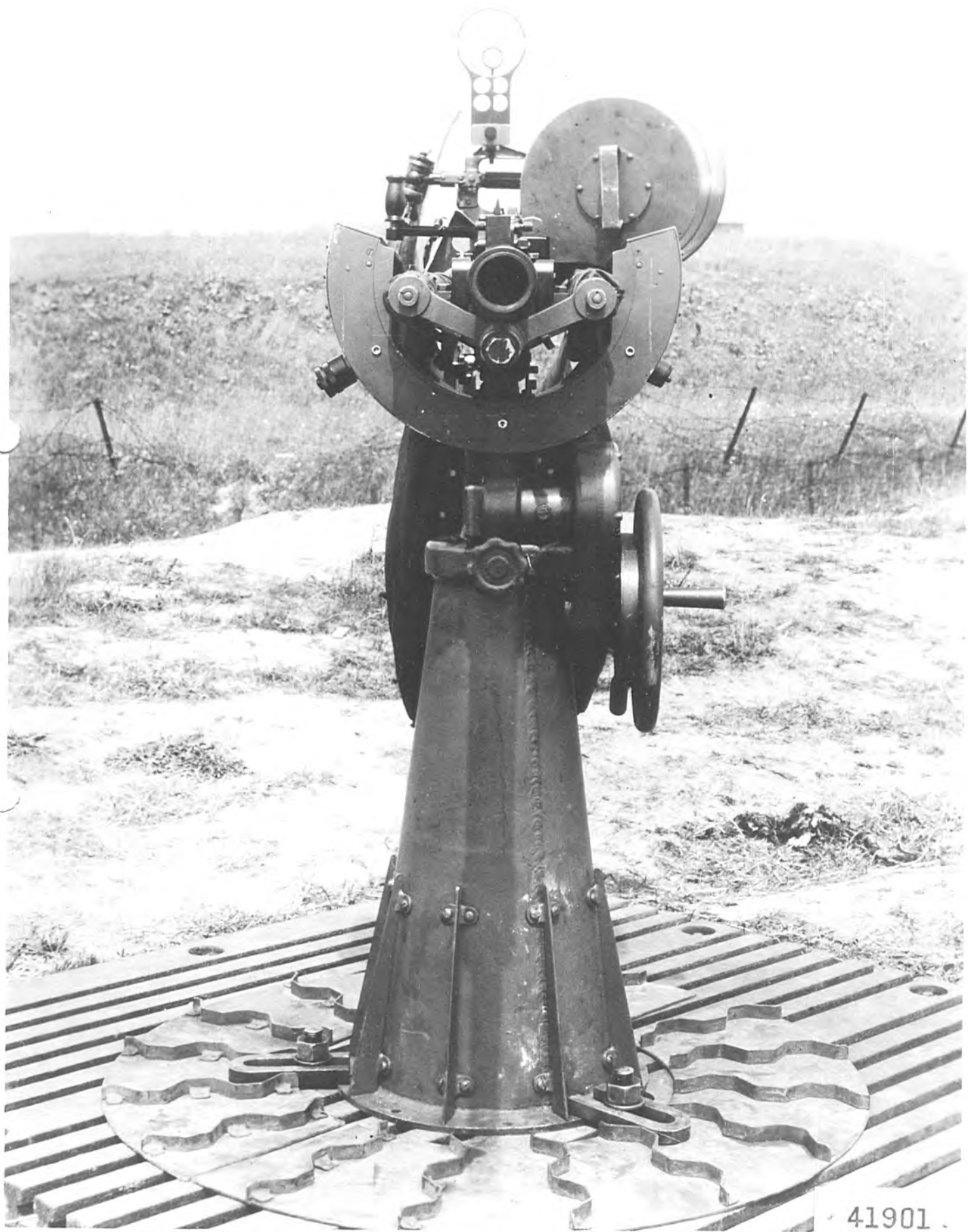
19



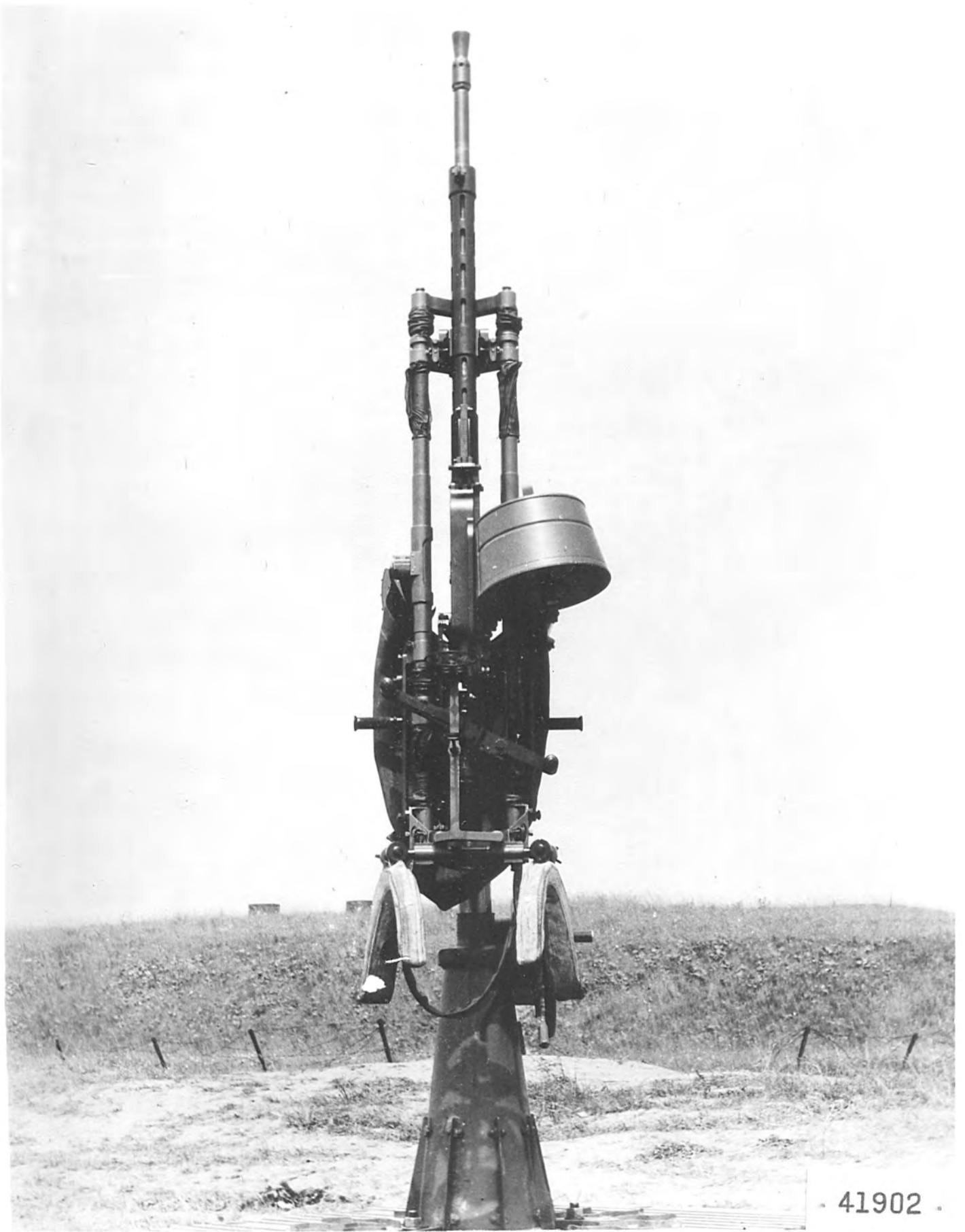
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41901



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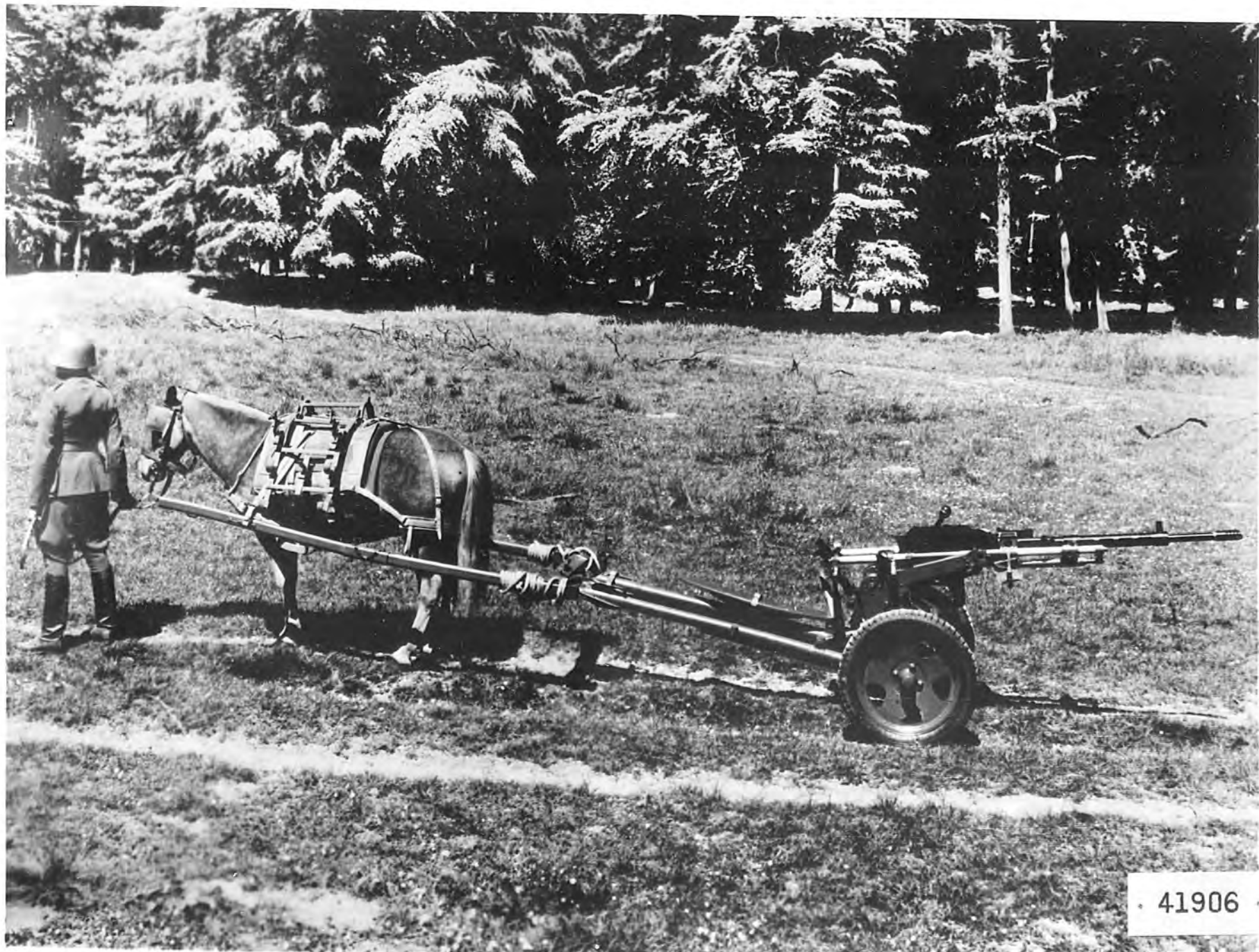
41903



41904

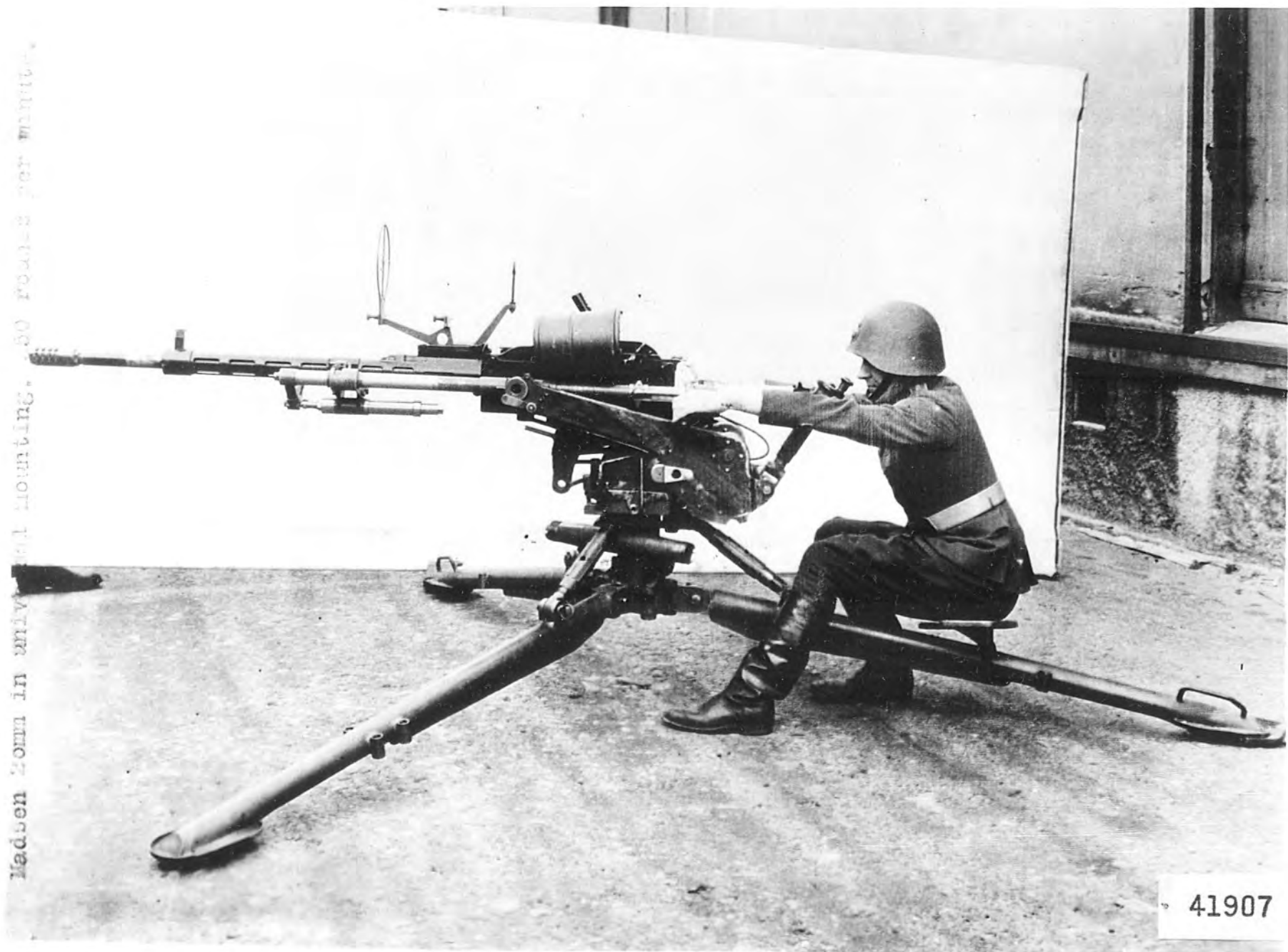


41905



41906

Medden 20mm in universal mounting. 50 rounds per minute.



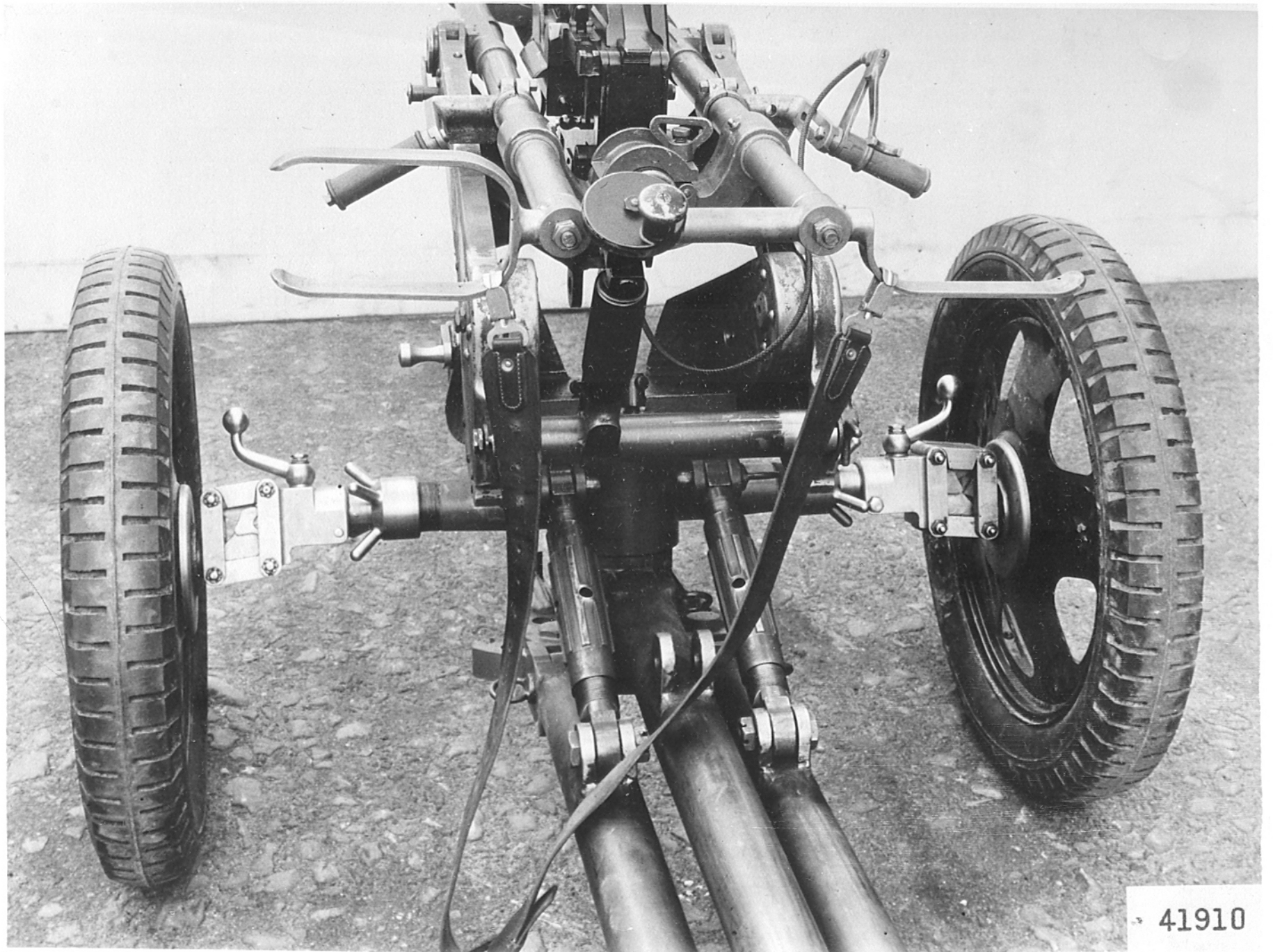
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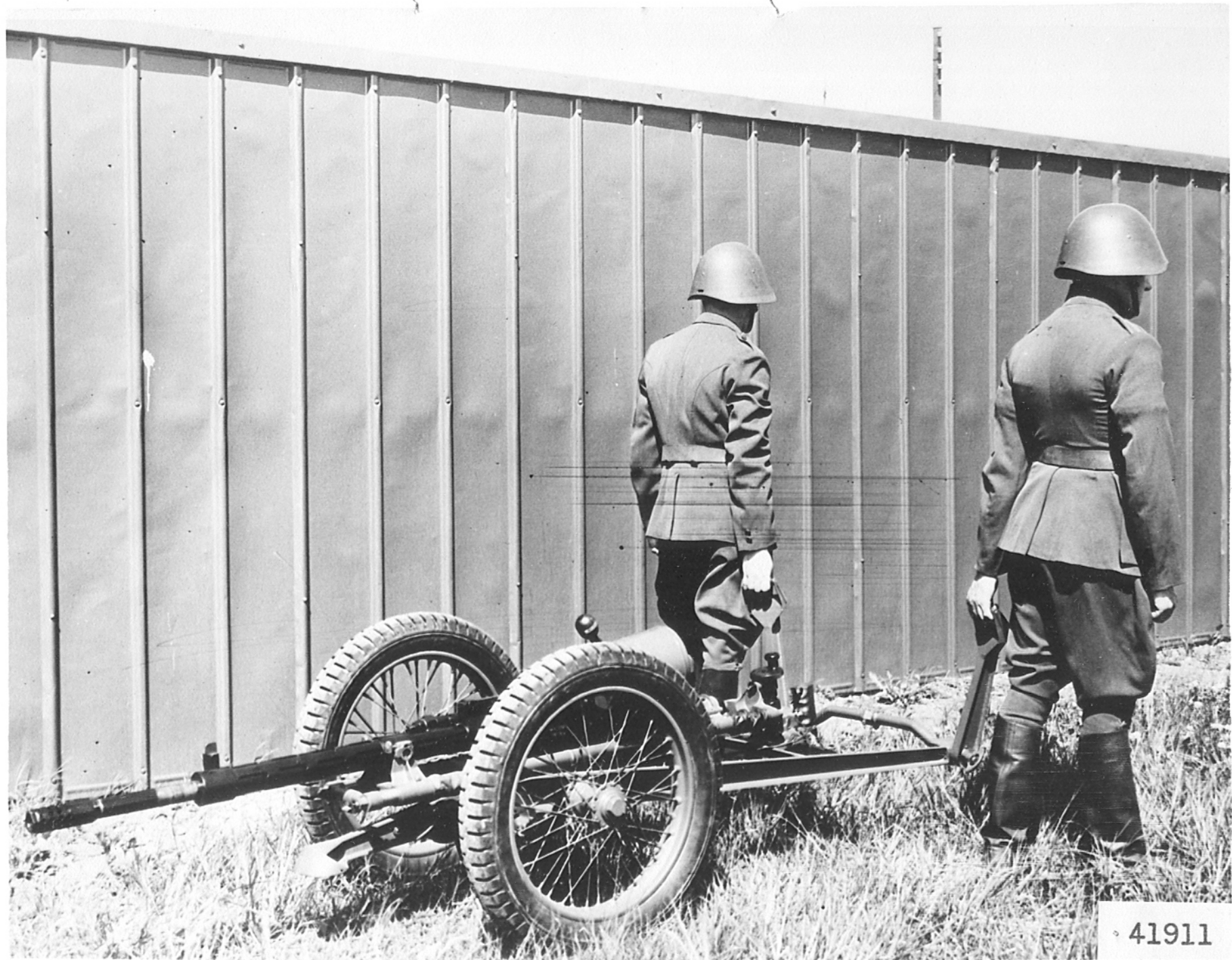
41908



41909



41910



41911