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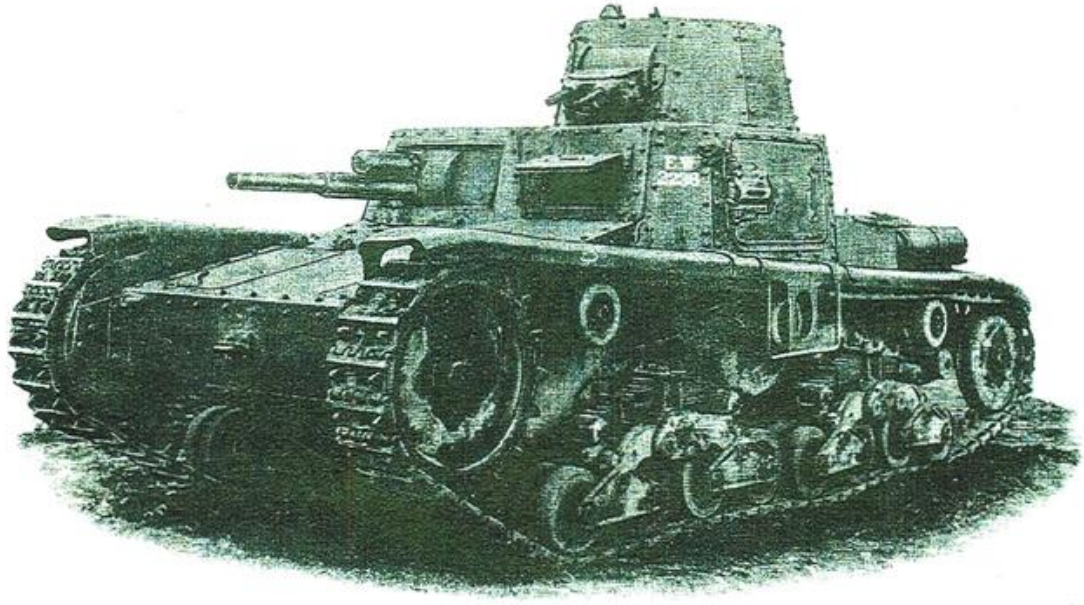
Preliminary Report No. 11

ITALIAN TANK

M. 11/39



School of Tank Technology
Egham

March 1943

FOREWORD

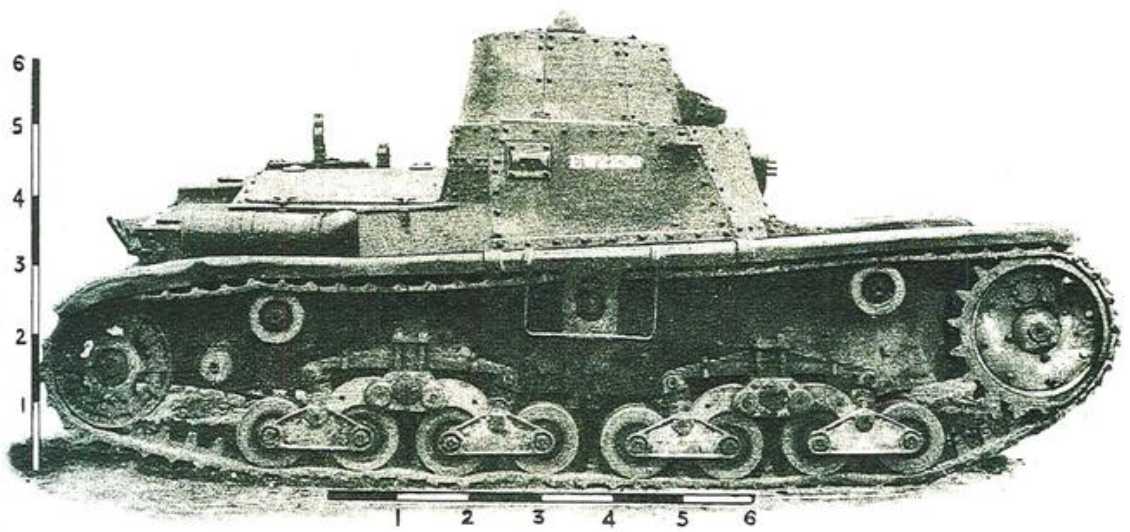
From an enemy publication it appears that the M.11/39 was developed by Ansaldo for street fighting in the Spanish Civil War.

The design has many features which make it unsuitable for modern requirements. The basic armour is thin, and the main armament has limited traverse only, the 3.7 cm. gun being an old Vickers design. Mechanically, however, the tank has many features to recommend it.

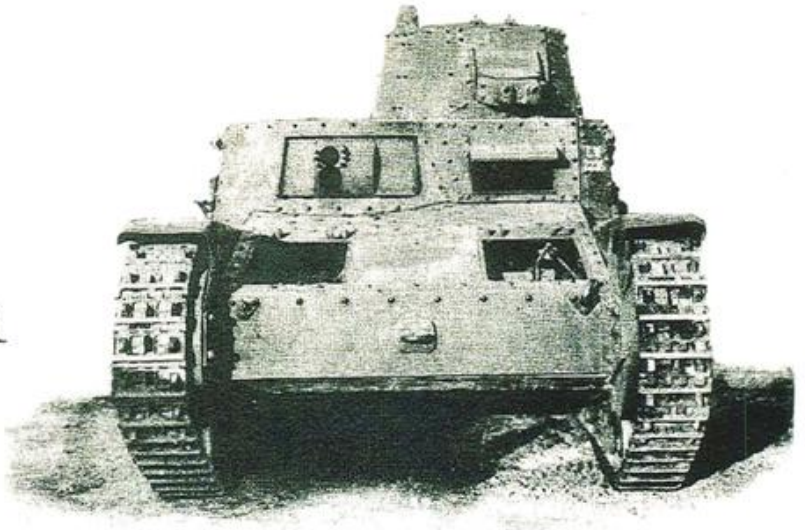
The compact "V" type Diesel engine is a good feature, although the tank would appear to be underpowered. M.I.10 Technical Summaries quote the horse power as 105. We have communicated with Mr. Ricardo, who in peacetime was consulting engineer to the Fiat Company (the engine is a product of S.P.A. who are a subsidiary of Fiat), and he informs us that the engine incorporates a Comet head. He is of the opinion that it has probably been developed to give in the region of 150 B.H.P. (maximum).

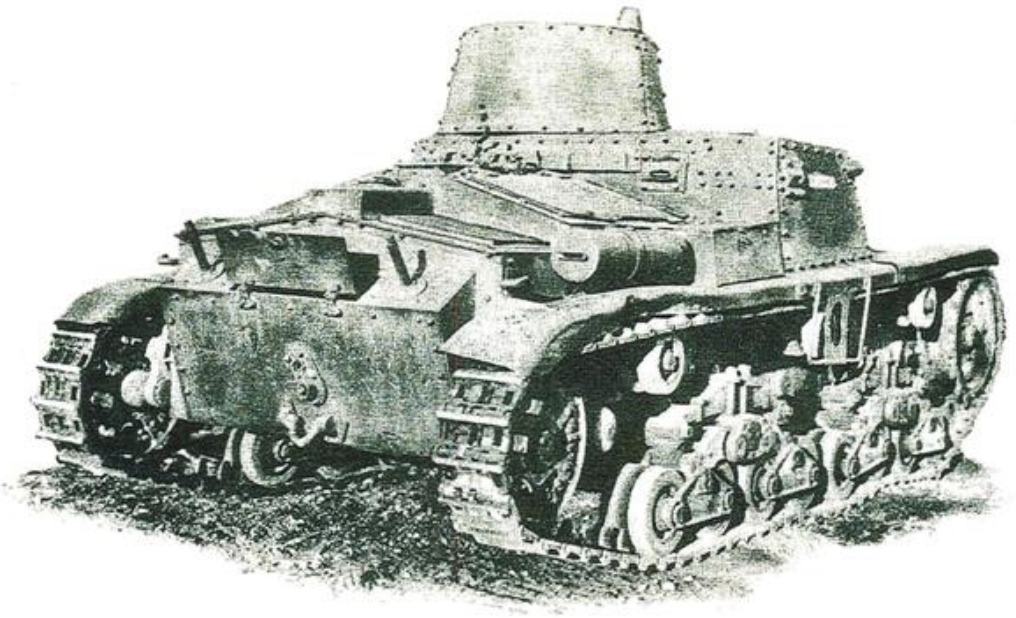
If there is sufficient interest it is proposed to make a more detailed investigation of this, and any other available Italian engines, when opportunity permits.

It will be noted that in addition to the orthodox electric starter, an inertia starter is incorporated. This is in common with German practice, but in this case provision is made for starting externally and from the fighting compartment. It is our opinion that this latter feature might with advantage be incorporated in our own designs.

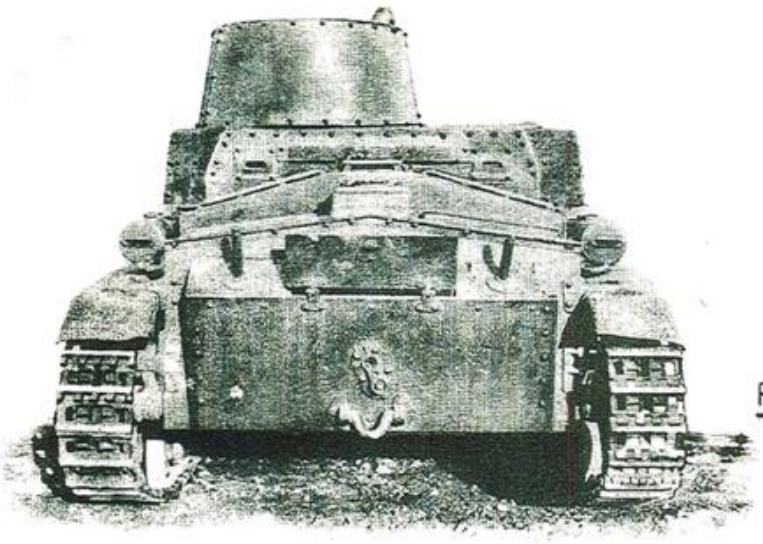


FRONT VIEW





THREE-QUARTER REAR VIEW



REAR VIEW

PRELIMINARY REPORT

ON

ITALIAN TANK M.11/39

EXAMINED AT FARNBOROUGH (D.T.D. No. 2236) March, 1943.

EXAMINERS: MAJOR J.D. BARNES, R.T.R., and MR. D.M. PEARCE. B.A. (Cantab)

D.T.D. PROJECT NO. V.7011.

1. TYPE Italian Tank - M.11/39

2. IDENTIFICATION MARKINGS

Traces of cross at rear of turret.

3. GENERAL CONDITION

The tank is a non-runner, and fire has occurred in the fighting compartment which has resulted in almost complete destruction of aluminium components, notably the gearbox and power traverse mechanism.

All internal components and fittings which have escaped damage by fire have, through lengthy exposure, become so corroded as to become quite unserviceable and inoperative.

The crankshaft has broken with subsequent damage to crankcase.

The tracks, suspension units, idlers and sprockets are in good condition and show little signs of wear.

There is no apparent damage to armour by "hits".

4. WEIGHT

Owing to the damaged and deficient condition it was not considered worth while weighing.

M.I.10 Tech. Summary No.49 - 21/7/41 quotes approximate weight of 11 tons.

5. SPEED Not tested.

6. CREW Three: Commander
Driver
Gunner

7. DIMENSIONS

Length	15' 6½"
Width	7' 1½"
Height	7' 4½"
Clearance	1' 2½"
Ground Contact	8' 11¼"
Track Centres	6' 1⅜"

8. ARMAMENT

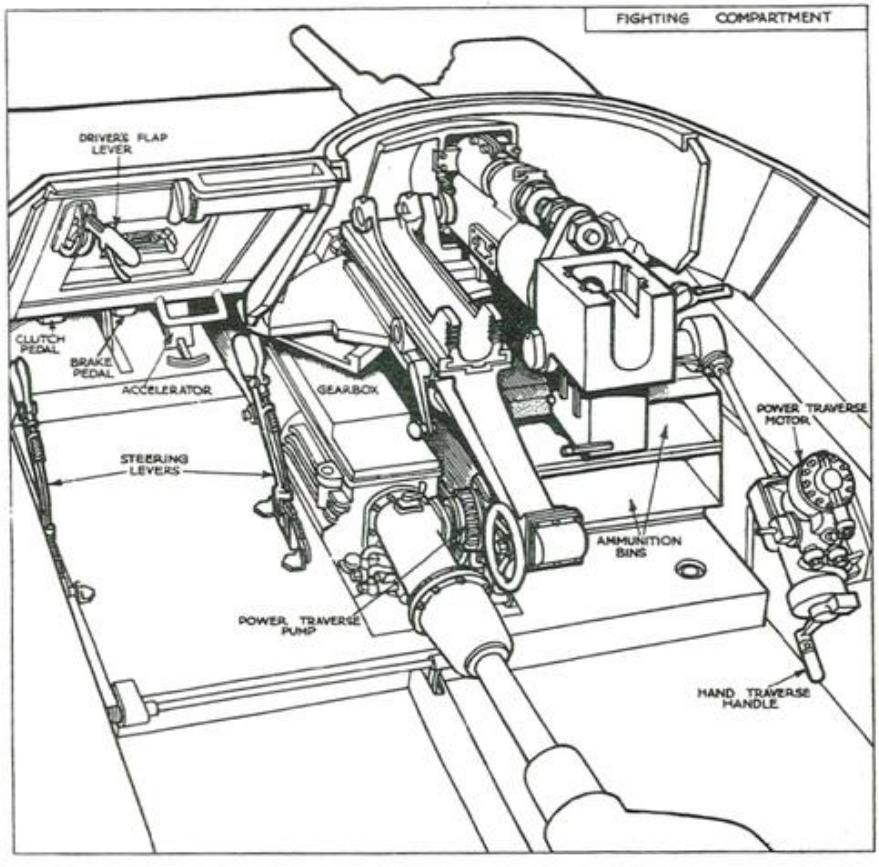


FIG.1

Main Armament

One 3.7 cm. semi-automatic Vickers-Terni mounted in off side superstructure.

The piece is marked:

Spezia. 1918 M^{a} 14711 NF. 2239 S.56 Peso Kg 95
(weight 95 kg.)

This gun is of comparatively low velocity. The breech mechanism is of the falling wedge type, the breech ring being integral with the barrel.

A single hydro-spring buffer is mounted above the gun (See Fig.1)

Sighting

An aperture is provided for telescopic sight which is deficient. An open sight is also provided on the buffer graduated at

500, 1000, 1500, 2000 metres.

The V notches are off set presumably to allow for drift.

Traverse

By reason of its location in the superstructure the gun has a limited traverse only. Owing to the rusted condition of the mounting it is impossible to quote amount of traverse.

Both hand and power traverse are provided. Hand traverse is operated by a crank handle to the right of the gunner, driving through a universally jointed shaft and bevel gears to the traverse rack. The power traverse is hydraulically operated by pump driven off the rear of the gearbox. The pump drive is engaged and disengaged by a control lever situated on the pump. The hydraulic motor forms one unit with the hand traverse gear, and incorporates a control valve. The oil tank is situated on the floor on the off side of the fighting compartment below the ammunition bins.

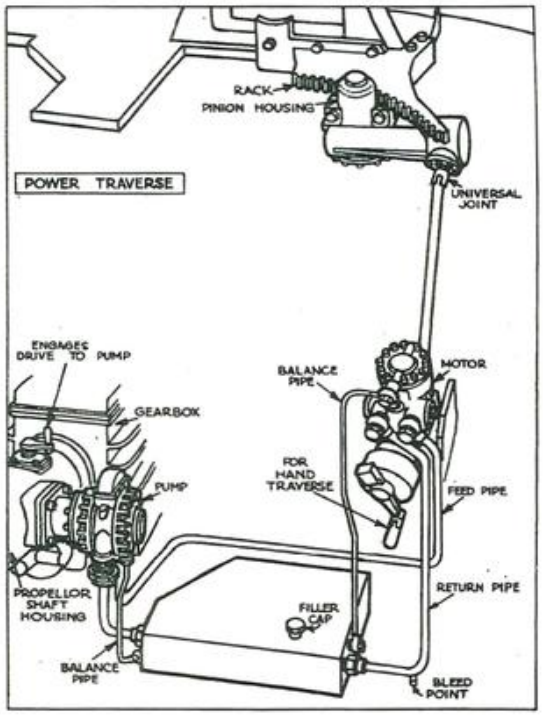


FIG.2.

Elevation is effected by a hand wheel mounted to the left of gunner operating through bevel gears and a worm and rack.

The mechanism is damaged.
(See Fig.2)

Firing

By foot pedal. Several components of this mechanism are deficient.

Machine Guns

Provision is made for two M.G's co-axially mounted in the small turret. The commander fires the M.G's. Both guns are deficient.

Traverse. All round turret traverse is provided, actuated through gears by a crank handle on right of the commander/machine gunner. Additional limited traverse is permitted by the gimbal mounting (shoulder controlled).

Elevation. Shoulder control.

Sighting. By telescope (deficient).

The ranges of elevation of all guns, and the limited traverse of the M.G's are not ascertainable owing to their damaged and rusty condition.

9. AMMUNITION CARRIED

No positive information can be given as some containers may be deficient. There are two boxes, however, situated below the 3.7 cm. gun. These boxes are considerably damaged by fire and possibly by explosion of rounds. They measure approximately 2' 3" long, 1' 7½" wide, and 7½" deep.
(See Fig.1)

10. OBSERVATION

Hull. No vision devices are provided in the hull.

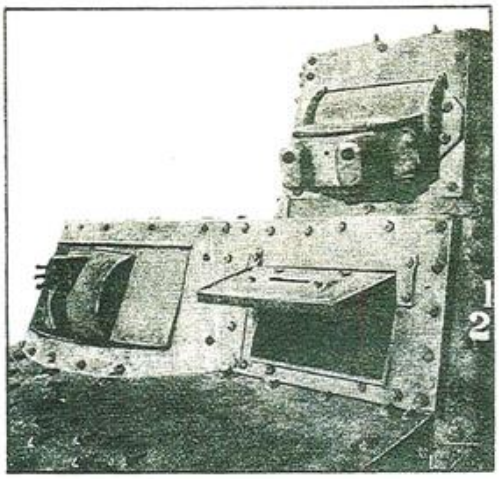


FIG.3.

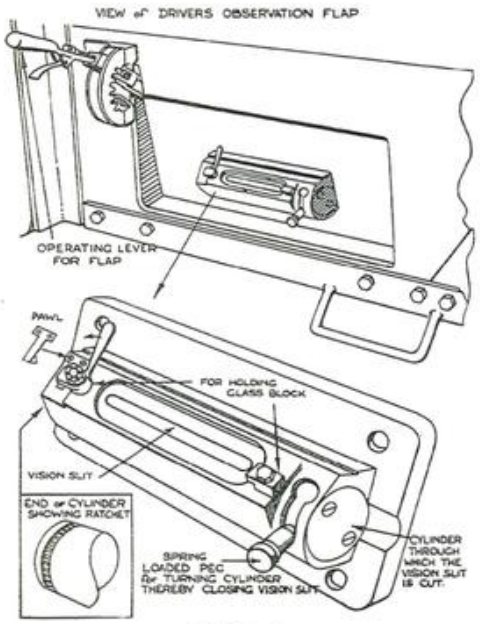


FIG.4.

Superstructure. There is a hinged vision flap measuring 11¾" x 8½" in front of the driver. The flap is hinged at the top, opens outwards and is operated by a lever incorporating a spring loaded pawl. The pawl engages a quadrant allowing seven positions of opening. The flap has a slit measuring 7/16" x 4⅜" which can be completely closed by a roller type shutter. Behind the slit there is provision for a detachable glass block (deficient). (See Figs. 3 and 4.)

In the superstructure above the driver is a mounting for an episcope (deficient) with an aperture of 3" x 8¾". This opening can be closed by a roller shutter if the episcope is not in use. Provision is made for the episcope to tilt in the mounting.

Three further vision slits are provided in the superstructure for the crew, one in the offside and two in the rear. All are of similar construction and have slits measuring 1⅜" x 2¾", and are fitted with roller type shutters.

Turret. The commander/machine gunner's vision is provided by a periscope (deficient), the housing for which is mounted in the roof of the turret on the off side, in a domed housing.

11. ARMOUR

Full details of armour thicknesses and angles of plate are given on Page 5 and plate appended.

The general construction is of bolted plates. Hexagonal conical countersunk bolts are used throughout. The hull and superstructure are composed of flat plates entirely, whereas some use has been made of plate forming in the turret. No cast armour has been employed.

On the near-side of the turret the top plate has split radially and a repair has been effected by welding. The side plate immediately under this defect is also fractured in two places, and the entire top edge of this plate has been welded to the top plate. There is no evidence of a hit on the defective plates and the fracture would appear to be due to abnormal stresses set up in manufacture.

Hull and Superstructure

The general construction and dimensions are shown in the drawings. The only feature of particular interest is the stowage box at the rear. This is of triangular section formed by a bulkhead behind the radiators, and the upper and lower tail plates.

Turret

Of horse-shoe plan with toe to rear and is off-set from the centre line of the superstructure 12" to the near-side.

Dimensions (Internal)

Front to rear (top)	3' 2¼"
" " " (bottom)	3' 7 "
Width (top)	3' 0 "
" (bottom)	3' 6½"
Turret ring (Inside diameter)	2' 10½"
Height (from floor to roof of turret)	5' 7½"

ARMOUR DATA

	BASIC	EXTRA	ANGLE
A. Cupola Top	No cupola fitted		
B. " Front and sides			
C. Turret top, front	7 mm.		90°(Horizontal)
D. " " rear	-		-
E. " sides	14 mm.		10°
F. " rear	14 mm.		10°
G. " front	30 mm.		10°
H. Gun mantlet	30 mm.		10°
J. Front vertical Plate	30 mm.		10°
K. " glacis plate	14 mm.		76°
L. " nose plate	30 mm.		0° (Vertical)
N. Side superstructure	14 mm.		6°
P. Side Hull plate	15 mm.		0° (Vertical)
Q. Top front plate	8 mm.		90°(Horizontal)
R. " rear "	8 mm.		86°
S. Engine cover plate (top)	6 mm.		73°
" " " (lower)	6 mm.		81°
T. Observation cover plate	30 mm.		-
U. Belly plate (front)	10 mm.		85°
" " (middle)	10 mm.		90°(Horizontal)
W. Tail plate (upper)	14 mm.		55°
" " (lower)	14 mm		19°
X. Skirting plates	Not fitted		

(The "Angle of Plate" given is the angle between the plate surface and the vertical, which is equal to the "Angle of Impact" for horizontal attack).

12. ACCESS DOORS AND ESCAPE HATCHES

A lid is provided in the turret roof. It follows the contour of the turret roof and is concentric with it. It is hinged at the front and measures 1' 10⅞" wide and 1' 11⅞" from front to rear. It is formed with ½" lip which locates over a splash ring screwed to turret roof, and is of 7 mm. plate. Three latches are provided to secure the cover when closed, two of which may be operated from inside or outside of the vehicle, whilst the third operates only from the inside.

In addition to the turret roof door previously described there is an opening in the superstructure top plate on the off-side measuring 1' 6" x 1' 11¼" with a hinged lipped cover fitted with three latches of similar pattern to those in the turret hatch cover.

The glacis plate has two doors covering apertures measuring 1' 3" x 2' 1½" giving easy access to the main and steering brake adjusters and to final drive shafts and universal joints. A feature of these doors is that they may be opened by the driver, when conditions permit, to afford ventilation.

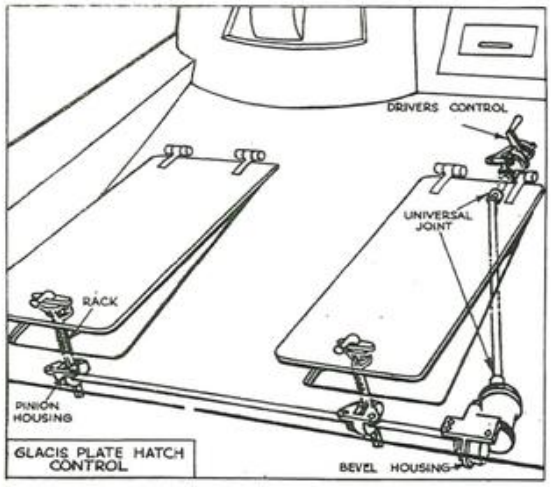


FIG.5

They are operated by a hand-crank situated in the driving compartment, the movement being transmitted through a small bevel box to a rack and pinion for each cover.
(See Fig.5.)

There are two hinged access doors over the engine, each in the form of a trapezium and measuring 1' 8" x 2' 0" x 2' 11". They have lipped edges locating over splash fillets on the engine cover plate. These doors are locked by two levers situated on the rear bulkhead of the fighting compartment.

In the belly plate at the rear of the tank is an access plate, secured by hexagon head set screws, giving access to the water pump.

13. SUSPENSION

No. of weight carrying wheels - 8 each side.
No. of suspension assemblies - 2 " "

Wheel

Type:	-	Solid Twin rubber tyred.
Diameter:	-	12" (over tyres)
Tyre Make	-	Pirelli
" Size	-	310 x 76 x 200

Top Roller

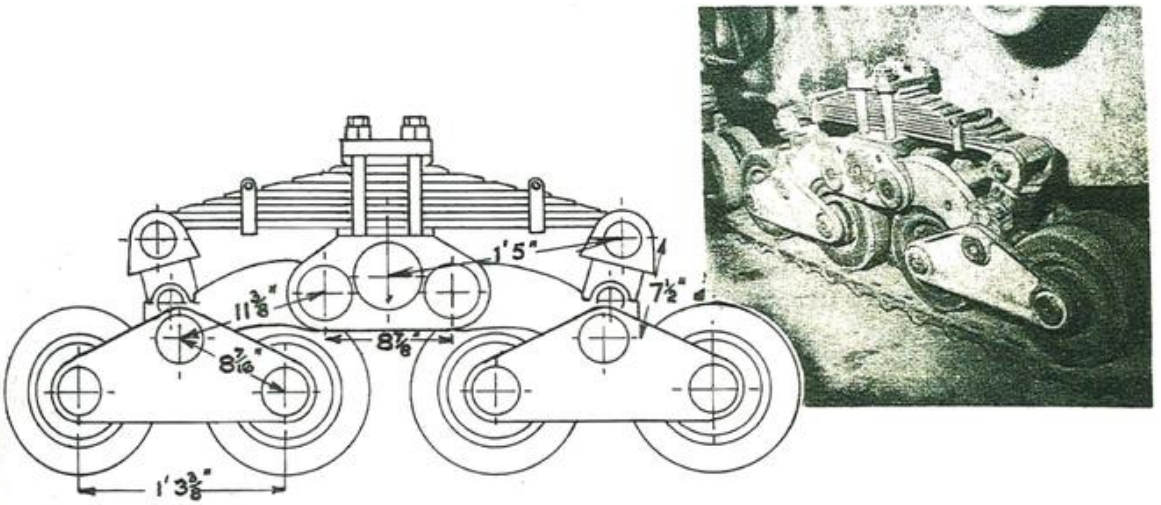
No. each side	-	3
Type	-	Twin rubber tyred
Diameter	-	9½" (over tyres)
Tyre Make	-	Pirelli
" Size	-	69 per 154

Spring

Laminated ½ elliptic - 10 leaves.

Shock Absorbers

Not fitted.



SUSPENSION UNIT.

FIG.6

Description of suspension assembly.

The assembly is of the four-wheeled articulated type utilizing a semi-elliptic laminated spring. This spring is pivoted at its centre on a trunnion situated centrally above the wheels. Each end of the spring is supported by a pair of wheels through a short link. Each pair of wheels is mounted in a cradle, which articulates freely about a point situated vertically below the point of attachment of the end of the spring. This cradle is linked to the trunnion by a box section radius arm pivoted on the trunnion. The whole assembly can articulate freely about the trunnion mounting. No limiting stops are provided for the articulation of the whole assembly, but individual wheel movement is restricted. (See Fig.6.)

14. TRACKS

Type:	Single pin - 4/5 lugs.
Material:	Stamped-Magnetic
Pitch of link:	5"
Width of link:	10¼"
Shoes per track	80
Weight of link (including pin and retaining cap)	13 lbs. 5 oz.
Diameter of pin:	16 mm.

Method of Pin retention:

Convex cap flattened by blow to locate in annular groove in the outer lug. The pin is retained in the inner lug by a shoulder.

The condition of the track is particularly good. It is notable that the design necessitates a considerable number of machining operations. (See Fig.7.)

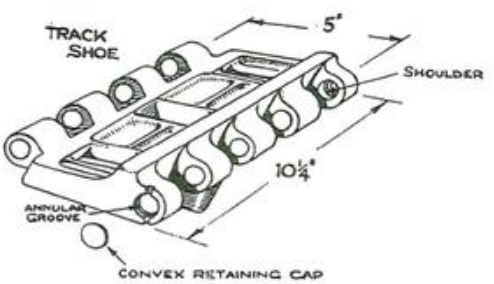
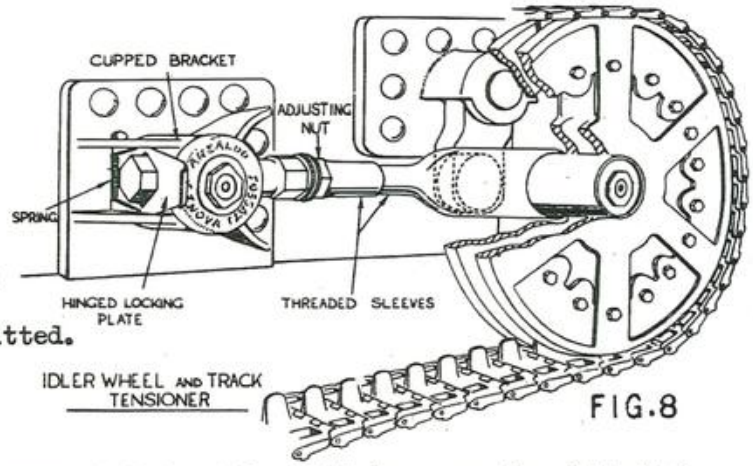


FIG.7

Idler Wheel

Construction:
Two piece-bolted.
Rim:
No rubber tyre fitted.
Diameter: $21\frac{9}{16}$"



IDLER WHEEL AND TRACK TENSIONER

FIG.8

Track Adjustment

The idler wheel is suspended from the hull by a crank. Attached to this crank is a draw bolt which cannot rotate and on to which is screwed a barrel nut. One end of the barrel nut forms the internal member of a ball and socket assembly, which may be rotated by a spanner for adjustment. The external member of the ball mounting is attached to the hull. The adjustment is retained by a hinged locking plate locating on a hexagonal boss on the ball. (See Fig.8.)

Driving Sprocket

A double type driving sprocket situated at the front of the tank.
P.C.D.: $28\frac{3}{4}$"

15. ENGINE

The engine is mounted at the rear of the tank, the flywheel end forward and the timing gears and main auxiliaries at the rear. It is mounted on two channel section longitudinally disposed members. (See Fig.9.)

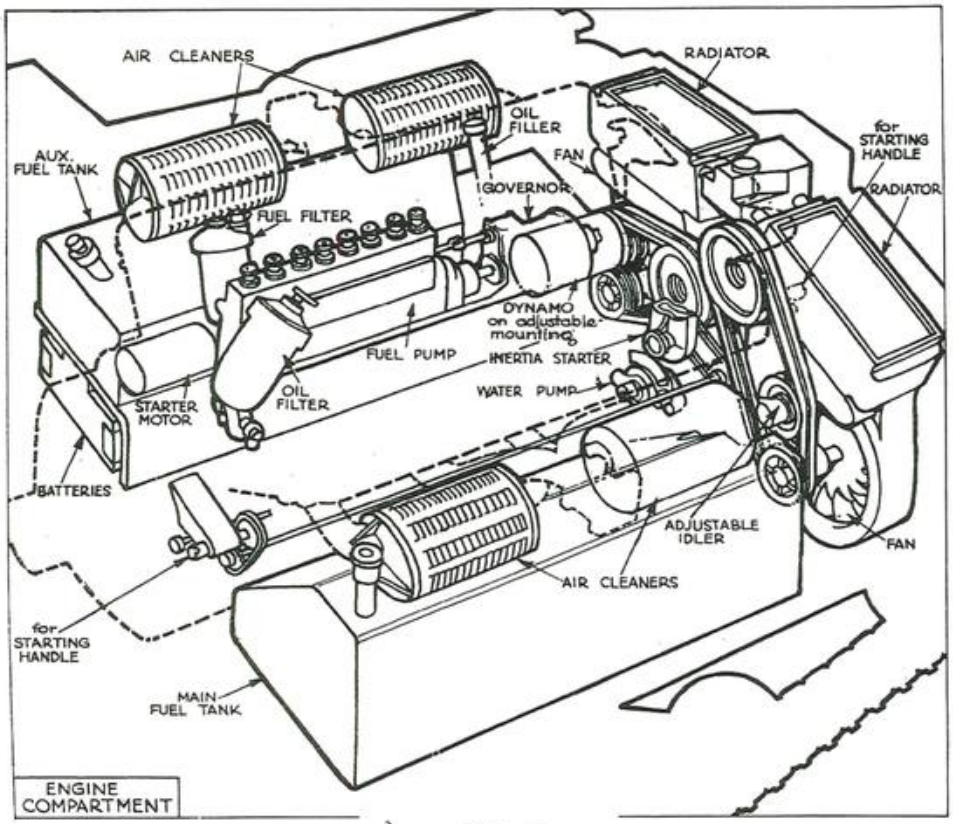


FIG.9

Maker: S.P.A.

Type: Compression ignition. 90° Vee 8-cylinder. Integral aluminium cylinder blocks and crankcase. Detachable cylinder heads.
All auxiliary drives are taken from the rear timing case.

Valves: Two per cylinder. In line. Push rod operated by a single camshaft centrally disposed between the cylinder banks. Single valve springs.

Fuel Pumps: A single Bosch type unit marked "FIAT." Centrally disposed between cylinder banks on the front. The pump is driven in tandem through the governor from the timing case. Owing to the damaged condition of the power unit it is not possible to give details of the low pressure fuel pump, though it is probable that it was mounted on the end of the injector pump.

Injectors: Bosch standard type - made in Germany.

Fuel Filter: Fabric element type.

Fuel Tanks: Two fuel tanks are situated in engine compartment. The main tank on the near-side has a capacity of approx. 33 gallons and the filler is in the engine compartment. The off-side tank is a reserve, is mounted above the battery box and has a capacity of approx. $8\frac{1}{2}$ gallons. The filler cap of this tank is accessible from the fighting compartment.

The fuel tap is mounted on the near-side of the rear bulkhead in the fighting compartment, and provides for supply from either or both tanks.

Air-Cleaners: Four "dry" pattern filters of cylindrical design, two per bank mounted each side of the engine above the fuel tanks.

Starting Equipment:

Heater plugs are fitted to all cylinders, the current being supplied from one cell of the main battery.

Two electric starters, engaging ring gear on flywheel, are mounted on off-side of engine.

An inertia starter marked "FIAT" and manufactured under Marelli-Eclipse licence is mounted on the rear of the crankshaft. It may be operated either through the tail plate of the tank by a crank-handle and a press button engagement, or alternatively, in a similar manner from inside the fighting compartment. The remote control for the latter operation consists of a shaft on the near-side of the engine coupled to the starter via roller chains and sprockets.

Exhaust System: The exhaust manifold of each bank converges to an elbow pipe protruding through the engine cover side plate. The elbow is heavily protected by a B.P. cover. Cylindrical silencers are mounted horizontally to the rear above each track guard.

Dynamo: A single 24V dynamo is mounted on the off-side of the engine and is driven by a twin triangulated Vee belt which also drives the off-side fan.

Battery: Make: Marelli.
Four 6V units coupled in series, situated on the off-side beneath the reserve fuel tank.

Cooling: Water, forced circulation and fans.

Radiators:

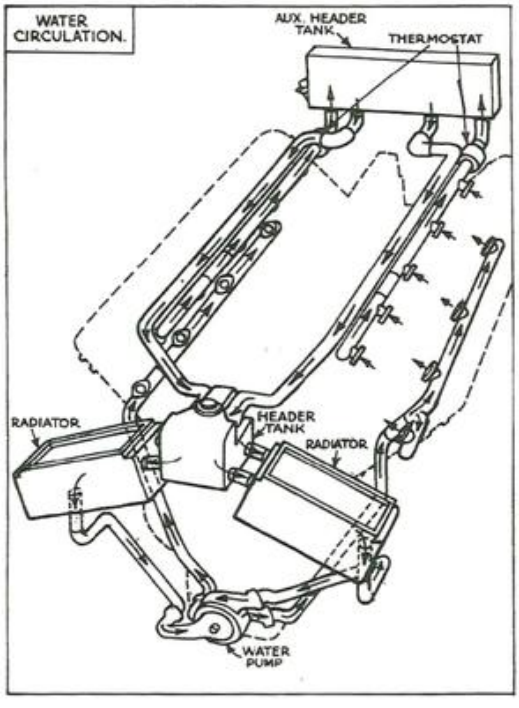


FIG. 10

Two film type mounted above the fans at rear of engine. 81° to the vertical and coupled by a cast aluminium header tank mounted centrally. The filler cap is centrally disposed and is accessible through a screwed B.P. cap in the top armour. There is an additional header tank (approximately 2 gallons capacity) provided with filler cap mounted on the rear bulkhead of the fighting compartment and above the level of the engine and radiators. (See Fig.10)

Water Pump: A single impellor type pump mounted low down on the near side of the timing case. The pump has a separate inlet and outlet for each radiator and cylinder bank.
Access to the pump gland is made through a removable plate in the belly.

Thermostats: A thermostat is interposed in the connection from each bank to the auxiliary header tank.

Circulation: Water is delivered from the pump to the head of each bank below the ports and returns from the opposite sides of the heads through the thermostats to the auxiliary header tank. From this tank it is returned to the main header tank via two pipes. Delivery to the pump is taken via a pipe from the bottom of each radiator.

Fans and Fandrive:

Two radial flow fans mounted at the rear of the engine beneath each radiator. The fans are belt driven in opposite directions by two double groove pulleys on the timing case. Both drives are triangulated, the off-side incorporating the dynamo which serves as a tensioner, the near-side having an independent tensioning pulley.
Air is taken from the fighting compartment via the engine compartment to the fans and expelled through louvres in the rear top cover plates. An additional intake is situated centrally in the engine cover. (See Fig.11)

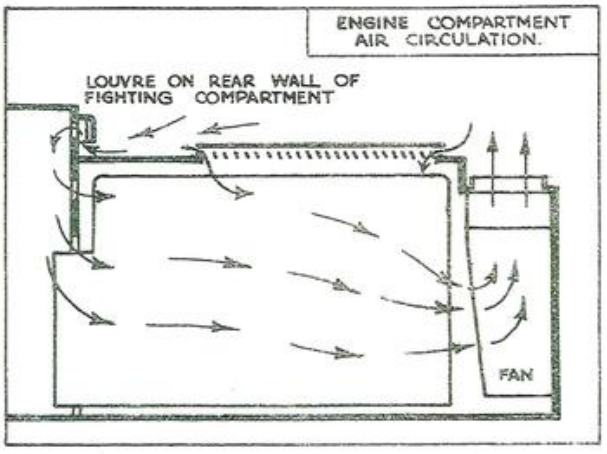


FIG.11

Lubrication: There is no evidence of an external oil cooler. A single hand-operated filter of Auto-Kleen type is mounted on the near-side cylinder bank. It may be operated by remote control from the fighting compartment.

16. TRANSMISSION

Clutch and Propeller Shaft:

The drive is taken from the engine via a plate clutch mounted on the flywheel through a short propeller shaft to the gearbox. The propeller shaft passes through the fighting compartment approx. 13" above the floor level and incorporates two laminated steel disc couplings.

Gearbox: The gearbox is mounted centrally forward in the fighting compartment on the off-side of the driver. Owing to the extensive damage by fire it is not possible to give a detailed description, but the gearbox is of the crash type with four forward speeds and one reverse. A high/low gear is incorporated in the forward part of the box. The top cover and all controls have been destroyed by fire or are deficient. An oil filler cap is situated at the rear of the box on the left and incorporates a dipstick. Oil is supplied to the gear box and steering unit by a gear driven pump mounted on the rear of the box, beneath the hydraulic power traverse pump. (See Fig.1.)

Bevel Drive and Steering Units

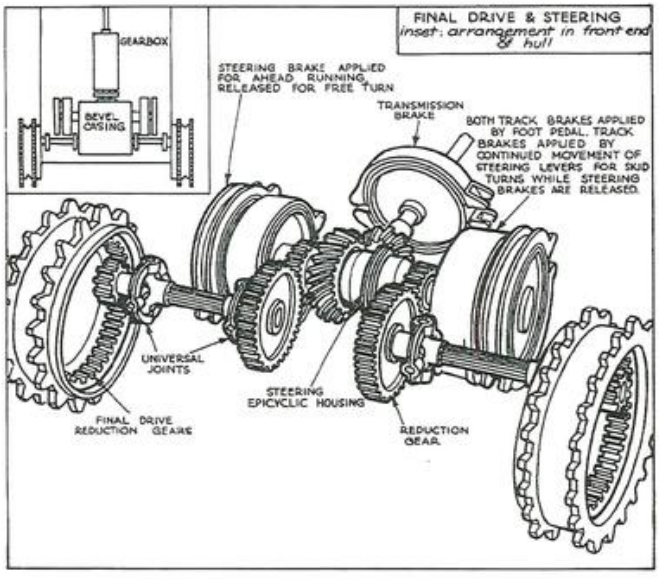


FIG.12

The drive is taken forward from the gearbox to the steering unit via a short shaft incorporating a universal joint and an external contracting transmission brake. This brake is operated by a lever to the right of the driver. On the outer diameter of the universal joint is cut a coarse ratchet and whilst there is no evidence of an engaging pawl, it is suggested that this is probably a "hill-holding" device. A small hand lever to the right of the driver and mounted on the side of the gearbox, the function of which is not clear, may be the means of its engagement.

The bevel drive and steering gears form a single unit. It is impossible to give precise details without completely dismantling, but epicyclic clutch and brake steering is apparently employed.

Drive is transmitted to the cross shaft carrying the steering gear by a pair of helical bevels. The bevel on the cross shaft is coupled to the annuli of the two epicyclic trains, these forming a composite unit. The output shafts are driven by the planet wheels of their respective epicyclics and each shaft drives through spur reduction gears to a forward cross shaft and thence to the final drive. An extension of each primary output shaft carries an external contracting brake assembly which provides for a skid turn. Alongside this brake assembly is a similar brake assembly of lighter construction mounted on a shaft which passes through the centre of the primary output shaft to the sun wheel of its respective epicyclic. This brake is normally held in the "on" position. The brake is released to effect a free turn, further movement of the steering lever applying the skid brake. The bevel gears, epicyclics and primary spur reduction gears are all housed in a single large casing. Brake cooling is assisted by hemispherical cups on the brake drums. (See Fig.12 and 13.)

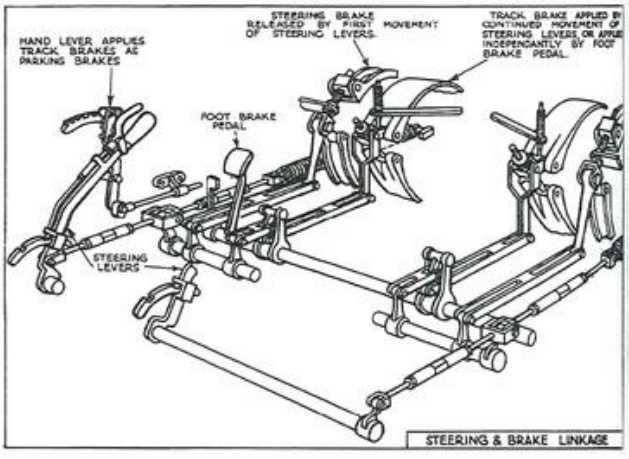


FIG.13

Final Drive.

The final output shafts each drive through a pair of universal joints to a pinion engaging an internally toothed final drive gear which is integral with the driving sprocket. (See Fig.12.)

17. INSTRUMENTS AND CONTROLS

Driver's controls and instruments

Steering levers to the left and right operating through mechanical linkage to brakes.
Clutch - - left
Foot brake - - centre.
A hand lever comprising a quadrant and ratchet engages with a stop on the foot-brake cross-shaft and provides a means of holding on the foot-brake. A normal type parking brake-lever is situated on the right of the driver and operates the transmission brake.
Accelerator - - right
Hand throttle on left of driver.
Gear shift lever on top of gearbox (deficient)
All other controls and instruments are deficient.
The flexible drive for the speedometer is taken from the offside final output shaft
(See Figs. 13 and 14)

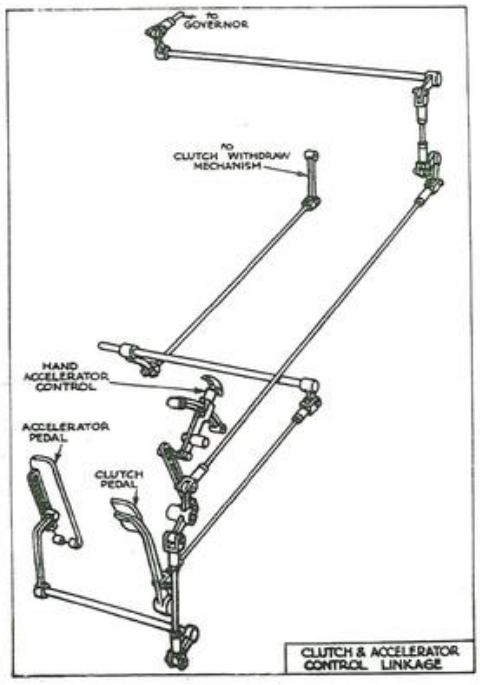


FIG. 14

Fighting Compartment

Fuel tap on rear bulkhead.
A fuel "cut-off" press button is also mounted on the bulkhead and engages the rack of the fuel pump.
As all electrical system has suffered extensively from fire, it is not possible to give a detailed description.

18. COMMUNICATION

No indication.

19. OUTSIDE STOWAGE

Two $1\frac{3}{8}$" diameter steel rods mounted vertically on the upper tail plate form brackets for spare wheels. A rectangular sheet metal box is mounted on each track guard alongside the engine compartment.
A stowage compartment formed by the two tail plates is described in Para. 11.
A bracket that would appear to carry a circular container is mounted forward on the near side track guard.

20. RECOGNITION POINTS

Two suspension assemblies each side with small bogie wheels.
A high mounted forward driving sprocket and a low tensioner wheel gives the track assembly an appearance of tapering to the rear.
Three top rollers. Large numbers of bolts used in armour construction. Low flat glacis plate. Unusually small turret carrying M.G's only, off-set to near side. The 3.7 cm. gun mounted low down in off-side superstructure. The rear view is unusual by reason of penthouse design of engine covers.

21. VULNERABLE POINTS

Whilst the suspension is of robust construction it is completely exposed. By reason of the four-wheeled articulation, damage to one wheel may possibly put the tank out of action.

The side, tail, and top armour is particularly light having only 14 mm. basis.

Air Intakes and Outlets

Air is taken through a long single B.P. louvre in the rear superstructure into the fighting compartment. Attack directed here may be effective. An additional air intake situated in the top engine cover is protected by a B.P. cover, and fire directed here may also be effective.

The air is expelled through louvres in the rear engine cover plates and these are of light construction. S.A. fire might possibly damage radiators.

22. TOWING ATTACHMENTS

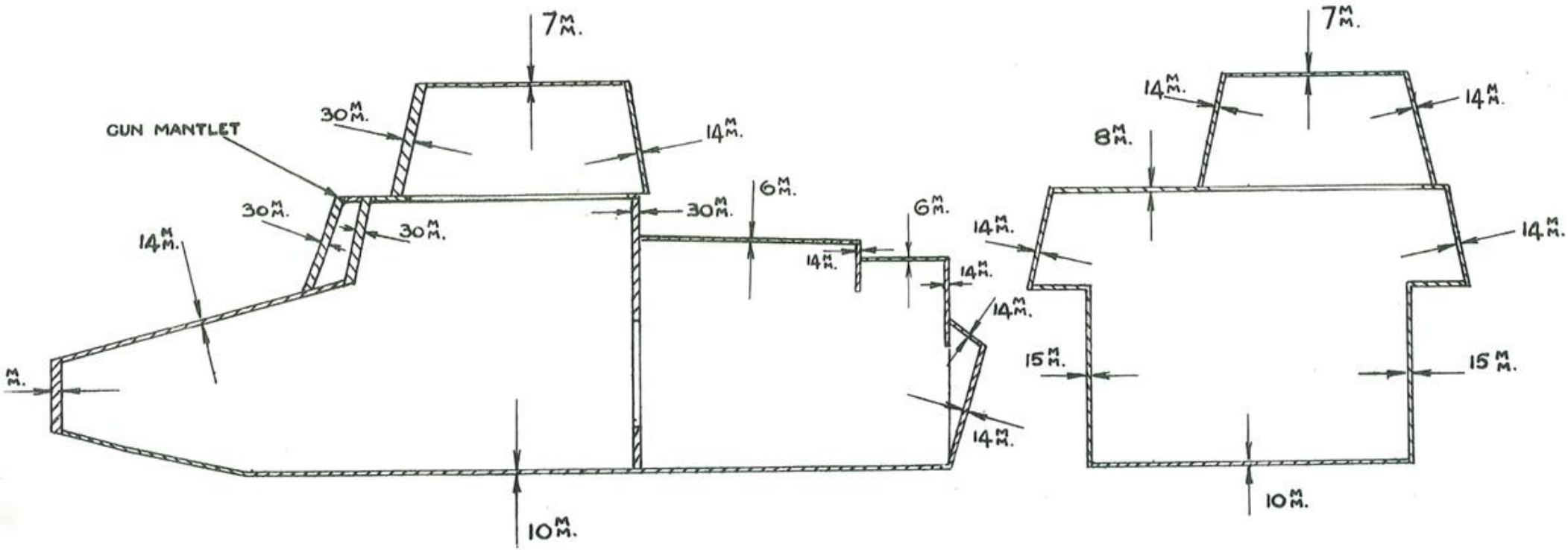
Towing hooks are fitted on each side of the nose plate. In the centre there is also a towing eye.

Towing hooks are provided on each hull side plate at the rear and a towing loop is fitted to the centre of the lower tail plate.

23. SPECIAL EQUIPMENT

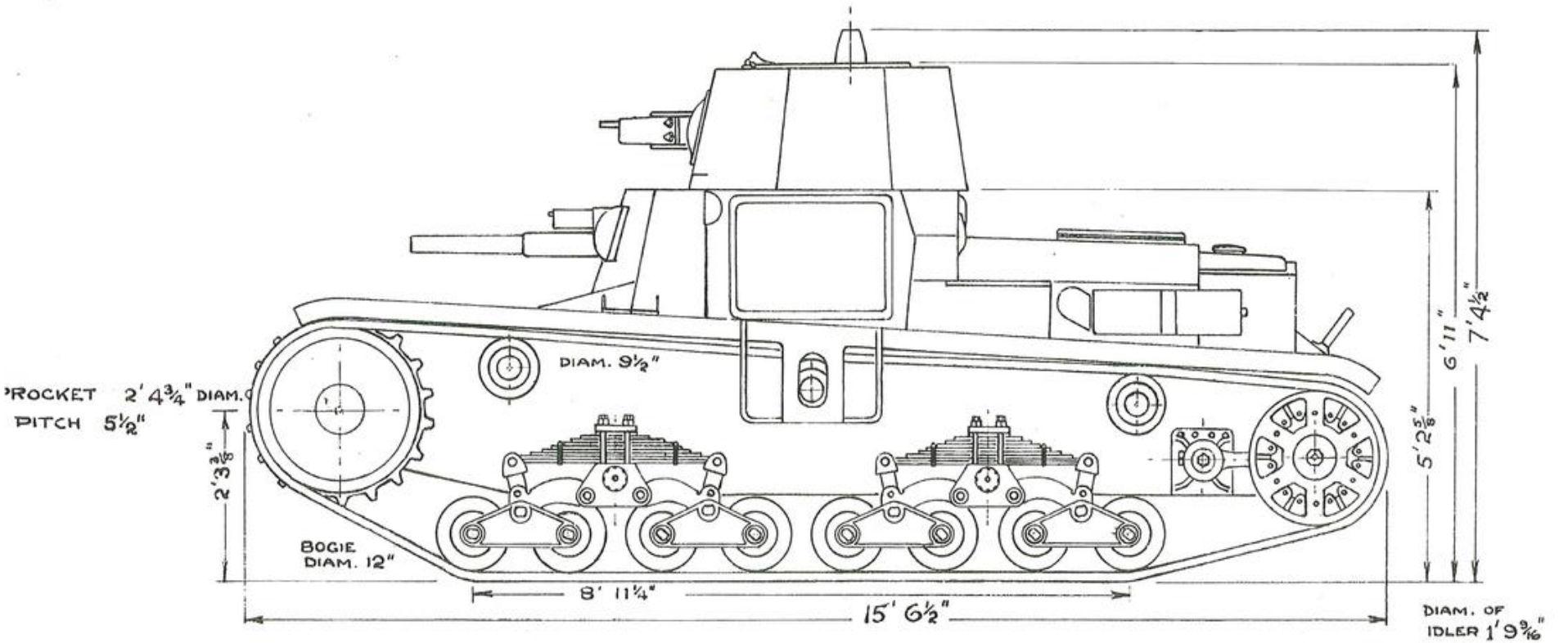
Provision is made for mounting headlaps on the near and off-side front superstructure.

ITALIAN TANK M - 11/39



ARMOUR PLATE

ITALIAN TANK M 11/39



SIDE VIEW

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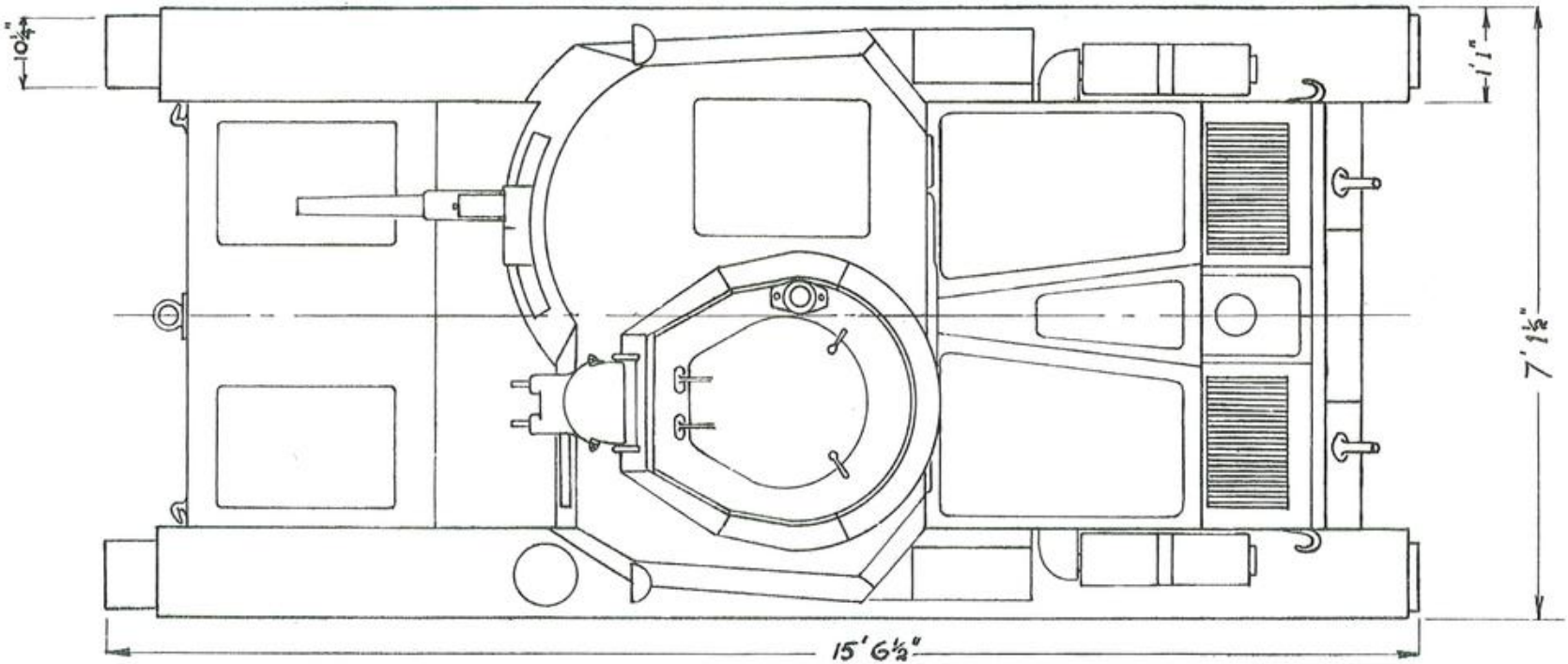
	C.G.P. 3/43
F7	S.T.T 8/5/1

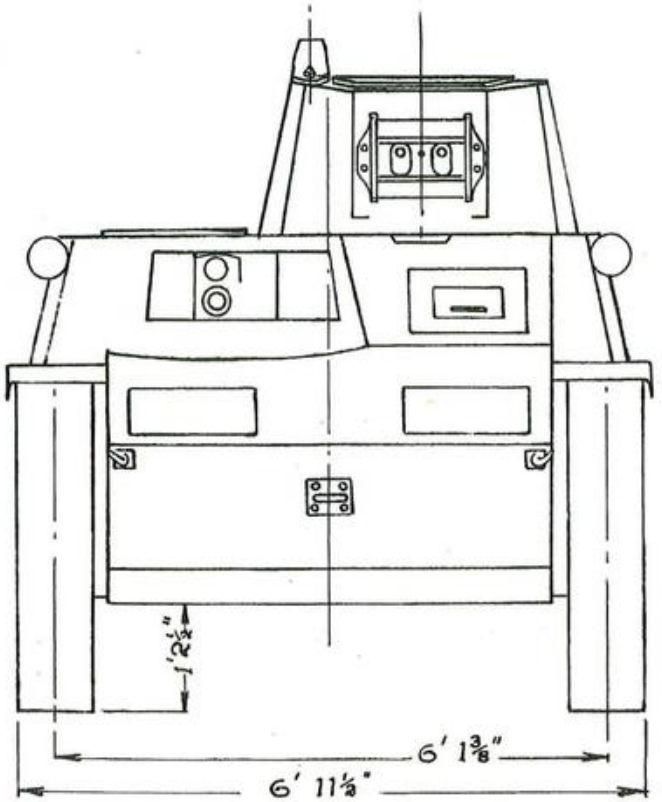
ITALIAN TANK M 11/39



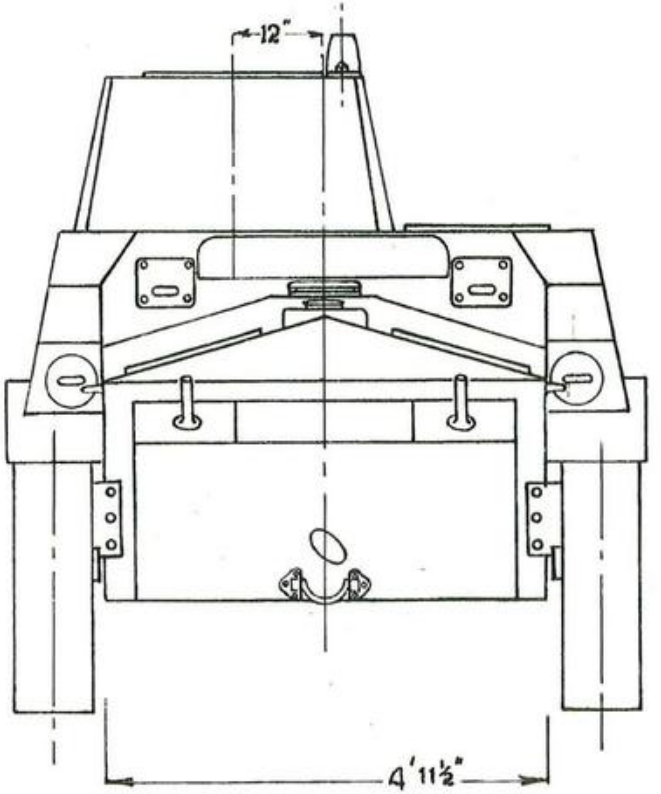
PLAN

ITALIAN TANK 11/39	
Drg. No. 217	
C.G.P. 3/43	
F7	S.T.T. 8/5/1

ITALIAN TANK M 11/39



FRONT VIEW



REAR VIEW

	ITALIAN TANK 11/39
	Drg No. 215
	C.G.P. 3/43
F7	S.T.T. 8/51