CLASSIFICATION

N.B.C. 35

MINISTÈRE DE L'AIR

SERVICE DU MATÉRIEL

NOTICE TECHNIQUE POUR MOTEUR RENAULT 4P

(Approuvée par D. M. N° 32.036 STA/Mo du 17 Février 1947)

ÉDITION 1948

NOMBRE D'EXEMPLAIRES : 750

FOREWARD

The service mannal for Renault 4P engines is in 4 sections

VOLUME I

SECTION 1 Characteristics
SECTION 2 Description

VOLUME II

SECTION 3 Operation and maintenance
SECTION 4 Dissasembly. ~~Rebuilding~~ Rebuilding and repairs

In the presence of the many versions of 4P engines, the text will be based upon the first of the types, 4P01

Notice of the operational differences between the 4P01 and the 4P03 and 4P05 Types is shown in the text. (see the principal characteristic differences can be seen in the table on Pg 22)

1° That which relates to all types is keyed to the right

2 In the left margin a comment is made when a section of the text refers to engines, or parts which do not apply to the 4P01 ~~car~~ engine

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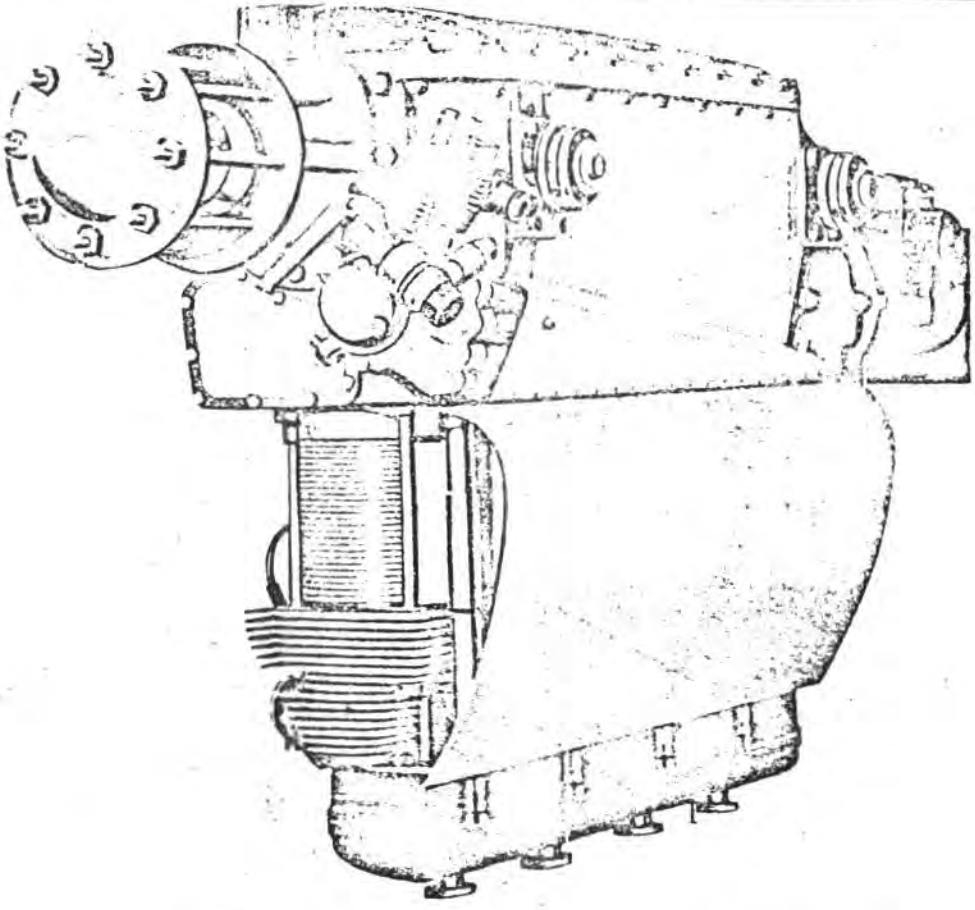

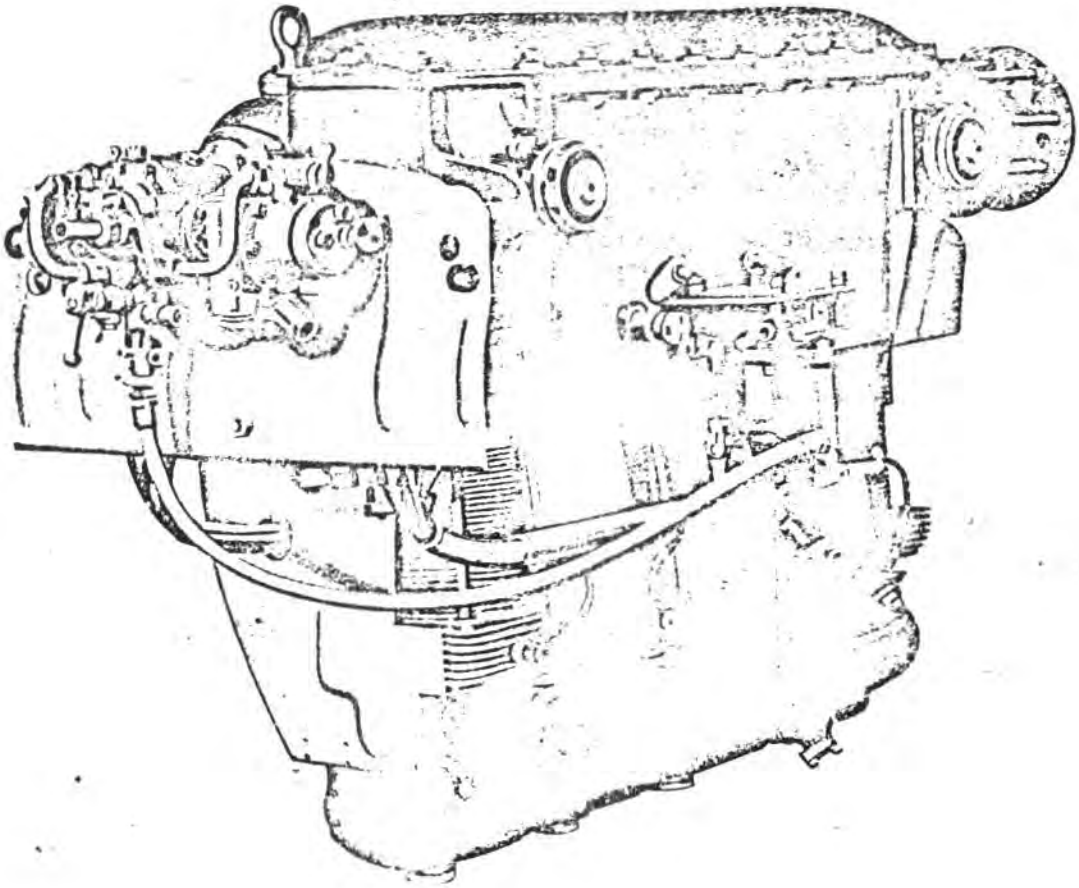

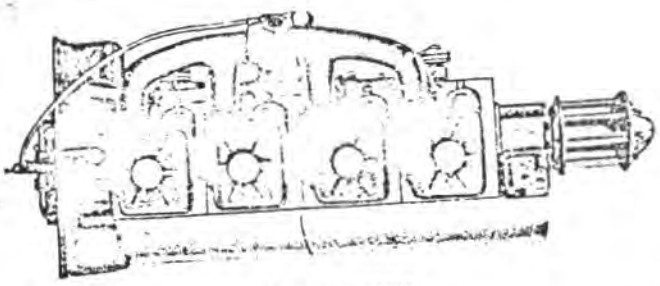

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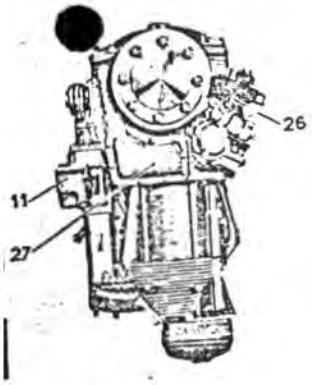

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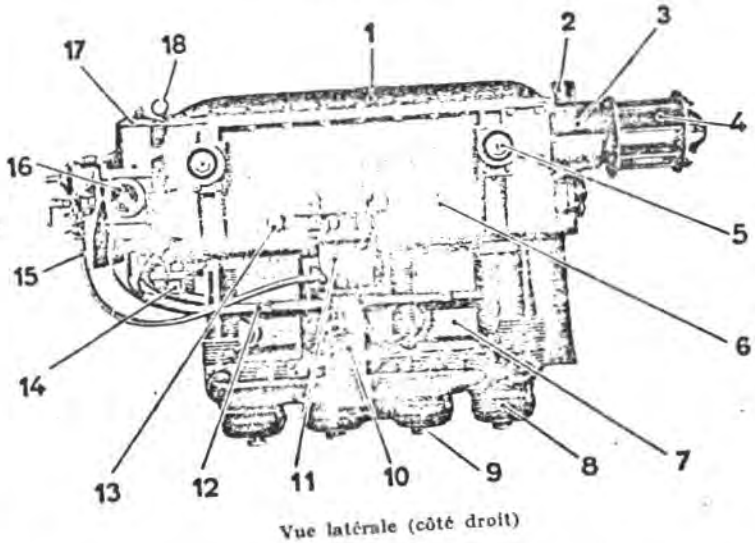
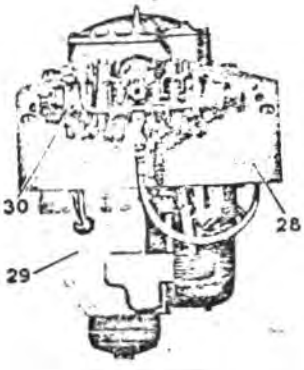


Vue latérale (côté droit)



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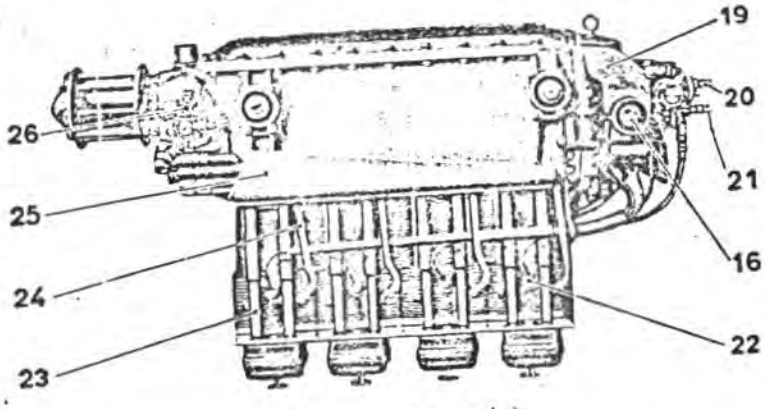

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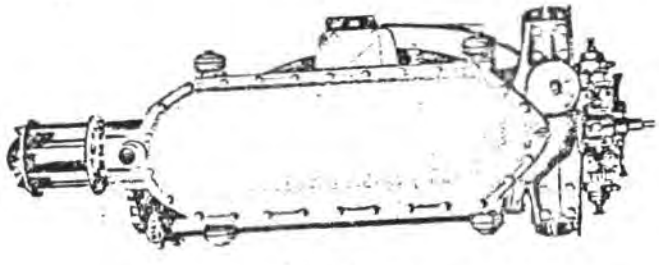


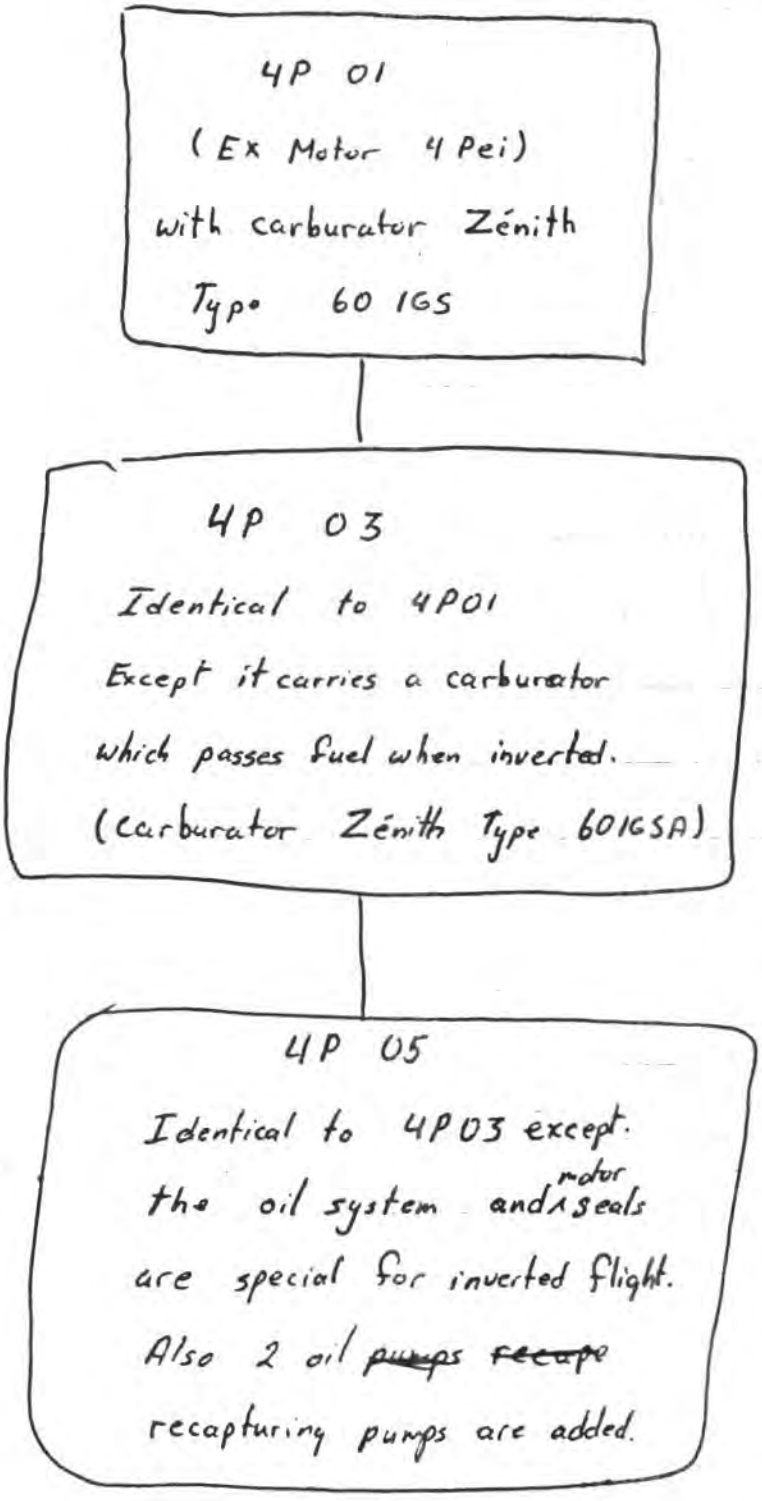
Vue de dessus

FIG. 2 — VUES DU MOTEUR

Names of Parts (References)

1 Upper Crankcase Cover
2 Air Screen, Air Valve
3 forward Bearing Case (thrust bearing)
4 Propeller Hub
5 Motor Mount.
6 Crank Case
7 Air deflector
8 Rocker Covers
9 Rocker Cover securing thumb nut.
10 Intake Manifold.
11 Carbureator
12 Ignition Harness Tube (Shield along engine)
13 Oil pressure sender (Sensor)
14 Return oil connector.
15 Carblureator fuel Line
16 Magneto
17 oil filter. (Strainer ~~cover~~ to it)
18 Lifting ring.
19 drive train (auxilliarys) case
20 Tackometer drive ~~coupling~~ gear.
21 fuel shut off.
22 Spark Plug.
23 Push rod protective tube.
24 Air Starter tubes (to cylinders)
25 Protective shield for Starter air pipes
26 Air Compressor & distributor "Unit"
27 Forward Sump Cover
28 Steel magneto Shield.
29 Steel air Baffle (duct)
30 fuel pumps

Designation of the motors 4 Cylinders 120 x 140



Chapter 1

Characteristics of Renault Aviation Engines

Type 4 P.

Characteristics of Construction.

4P 01 - 03 - 05 4 Cycle Engine.

4 Cylinder inline - inverted.

2 Values per cylinder.

Air Cooled.

Tapered ~~on~~ propeller hub shaft.

Positive direction of rotation (clockwise)

Bore	120 mm	4.724 inches
Stroke	140 mm	5.518.
Cylinder total (all 4 Cylinders)	6,33 dm³	386 in³
Volumetric yield.	5,75	

Total Weight ~~Pressure~~ ~~obtained~~ according to § B 1 of the norm (Standard) AIR 2001 4P01, 4P03 } 147 kg

4P05 151 kg

With the propeller-hub added: 4 kg.

demmentions	~~Bored~~ width	480 mm
	hight.	708 mm
	Length.	1280 mm
	Length	1300 mm (with vaccume pump drive)

Midship frame : 0 m². 265

direction of rotation & cylinder numbering.

CHAPITRE I

CARACTÉRISTIQUES DES MOTEURS D'AVIATION RENAULT TYPES 4 P

CARACTÉRISTIQUES DE CONSTRUCTION

4 P 01-03-05 Moteur à 4 temps :

4 cylindres en ligne, inversés
2 soupapes par cylindre.
Refroidissement par air.
Arbre porte-hélice à cône.
Sens de rotation positif.

Alésage	120 mm.
Course	140 mm.
Cylindrée totale	6,33 dm³
Rapport volumétrique	5,75
Poids suivant § B 1 de la norme AIR 2001	4 P 01 } 147 kg 4 P 03 } 4 P 05 : 151 kg

Pour le moyeu d'hélice ajouter : 4 kg.

Encombrement { Largeur 480 mm. / Hauteur 708 mm. / Longueur 1280 mm. / Longueur 1300 mm. (Munis de l'entraînement de pompe à vide).

Maître couple : 0 m², 265.

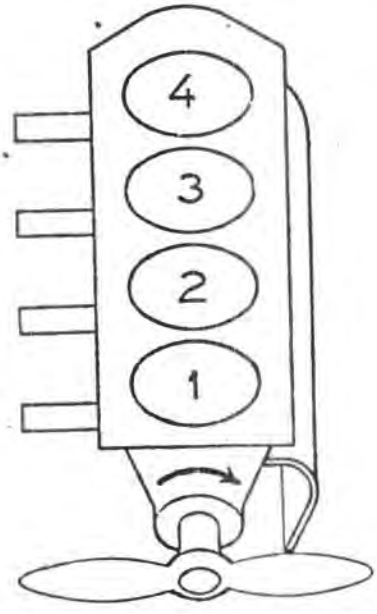


FIG. 3 — SENS DE ROTATION DU MOTEUR ET NUMÉROTAGE DES CYLINDRES

I 1 24 RENAULT 41° NBC 35

Running Characteristics

Normal Operation	Horsepower	RPM
Nominal	140	2400
Take OFF	145	2430
Cruise	108	2100
Top Speed	-	2520

1° Distribution (Timing)

Adjustments with play of 0.74 mm with a warm engine

- Intake
  - Advance opening — 14° BTDC
  - Retarded closing — 64° After BDC
- Exhaust
  - Advanced opening — 64° BTDC
  - Retarded closing — 14° After TDC

Valve gap (play) when cold 0.3 mm (set after other adjustments)
(zero point three millimetres)

2° Supply systems

Fuel used — 80 octane

Fuel use
- Nominal @ sea level — 250 g/ch.h
- Normal cruise — 245 g/ch.h

Consumption per hour
- Normal cruise @ 2100 rpm 32 Litres/hour
- Nominal operation @ 2400 rpm 47 Litres/hour

a) Fuel Pumps

2 Rotary pumps AM, Type 00 (#1 positive rotation #2 negative rotation)

Speed of rotation 7/15 crankshaft speed

Fuel pressure (in g/cm² and Pièces)

one pump — 210 g/cm² (210 pz) approx.

Both pumps — 225 g/cm² (225 pz) approx

Less than full throttle { using 1 pump — 205 g/cm² (205 pz) about
using 2 pumps — 225 g/cm² (225 pz) about.

b) Carburator

the Carburator

- For motor 4P01

Zenith-Stromberg type 60 IGS

For motors 4P03 and 4P05

Zenith-Stromberg type 60 IGS A

(See adjustments page 141)

(Intake manifold is heated by engine exhaust)

3° Ignition

2 magnetos S.E.V with automatic advance, Type DA4 with inverse (reverse) rotation. 35° adv.

Firing order 13-4-2 Spark plugs B.G. 2TA.

4° Lubrication.

Oils { mineral oil viscosite — 1100
for cold days viscosite — 1,120

hourly consumption { normal cruise — 1 Liter/hour
nominal use — 1.5 Liters/hour.

The oil pressure pump draws from the reservoir (sump), it is made of 2 pinion gears with 10 teeth width 15 mm

the return pump (from the two sumps) is made of 3 pinion gears of 10 teeth ea. width 21.5

Oil pressure	normal	3 kg/cm² (3hpz)
	maximum (cold start)	3.5 kg/cm² (3.5 hpz)
	Minnimum at 2400 RPM	2 kg/cm² (2 hpz)

Maximum oil temperatures for ~~entering~~ the engine ~~(outlet)~~

in cruise	60° C
Maximum at full throttle	75°C
Exceptional : during take off & climb	90° C.

4P05

One auxilliary oil pump, located in the crankcase cover permits the normal functioning of the oil system while in inverse flight.

Fig 4

Total Revolutions (turns)

Speed

½

Fuel Pump 7/15 crankshaft RPM

Magneto 1/1 Crankshaft RPM
Impulse Coupling (Declic)
~~Bectic~~, Left side (from front Looking back)

Fig 4 direction of rotation, and their speeds

5° Auxilliary (accessory) ~~Controls~~. drives — Speed of rotation

Tachometer drive	½ of crankshaft.
Compressor - distributer (Air Equipment, Type VIET #63 bis)	1/2 of crankshaft
Vacuum pump (Air Equipment Type 21.170 ~~to~~ Supplied by aircraft builder)	1/1 with cr

Pompe de pression de l'huile provenant du réservoir, constituée par deux pignons de 10 dents. Largeur . . . . . 15 mm.

Pompe double de vidange, constituée par trois pignons de 10 dents. Largeur 21,5 mm.

Pression d'huile
- normale. . . . . 3 kg/cm² (3 hpz)
- maximum (départ à froid) . . . . . 3,5 kg/cm² (3,5 hpz)
- minimum à 2400 tr/mn . . . . . 2 kg/cm² (2 hpz)

Températures maxima à l'entrée du moteur :

En croisière . . . . . 60°
Maxima plein gaz . . . . . 75°
Exceptionnelle : au décollage et montée. . . . . 90°

4 P 05

Une pompe à huile auxiliaire qui se trouve dans le couvercle supérieur de carter, permet le fonctionnement normal du graissage au cours du vol inversé.

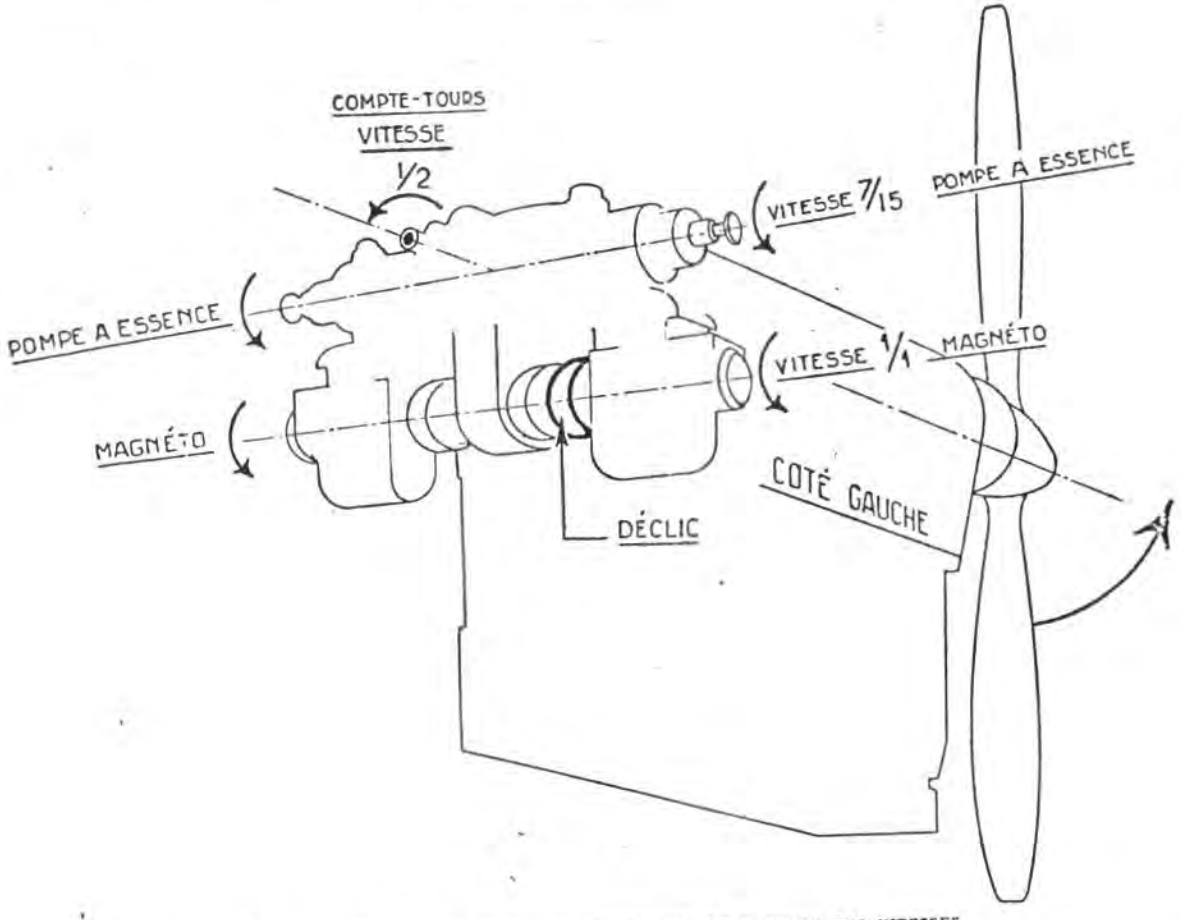


FIG. 4 — SENS DE ROTATION DES ACCESSOIRES ET RAPPORT DES VITESSES

5° COMMANDES AUXILIAIRES

	Rapport des vitesses
Commande de tachymètre	1/2
Compresseur distributeur (Air-Équipement, type VIET n° 63 *bis*).	1/2
Pompe à vide (Air-Équipement, type 21.170, fournie par l'avionneur). . . .	1/1

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CHARACTERISTICS ON THE GROUND (AT SEA LEVEL)

	SPEED			Intake Pressure (PZ)		Power		Specific Consumpt	
	R/S	RPS	RPM	g/cm²	mm Hg	kW	Horse Power	mg/kJ	g/ch
Extra power required for take off	255	40.5	2430	98	735	107	145	100	26
nominal power	251	40	2400	96	720	103	140	95	25
Cruise	243	38.7	2320	92	690	93	126	93	24

Using the graphs

I) Determining the rotational speed and intake pressure needed to obtain the desired power at a given altitude.

1° 76 kW (103 HP) @ 2500 meters → A → 235 r/s (37 RPS, or 2244 RPM) 74 g/cm² (555 mm Hg)

2° 68 kw (92 HP) @ 1700 meters → B → 218 r/s (34.7 RPS, or 2082 RPM) 74 g/cm² (547 mm Hg)

II) Determining the power needed to reach a known altitude with a given RPM and intake pressure.

Example: 1100 meters, 205 r/s (32.6 RPS, 1958 RPM) 82 g/cm² (615 mm Hg)

Sea level graph: 205 r/s (32.6 RPS, 1958 RPM) 82 g/cm² (615 mm Hg) gives The point "E" which transposes to E 1 on the 0 altitude of The altitude graph.

Altitude graph: 205 r/s (32.6 RPS, 1958 RPM) 82 g/cm² (615 mm Hg) gives the point E_2. On the line E_1-E_2 we determine The point "W" at 1100 m and a power of 72 kw (98 hP)

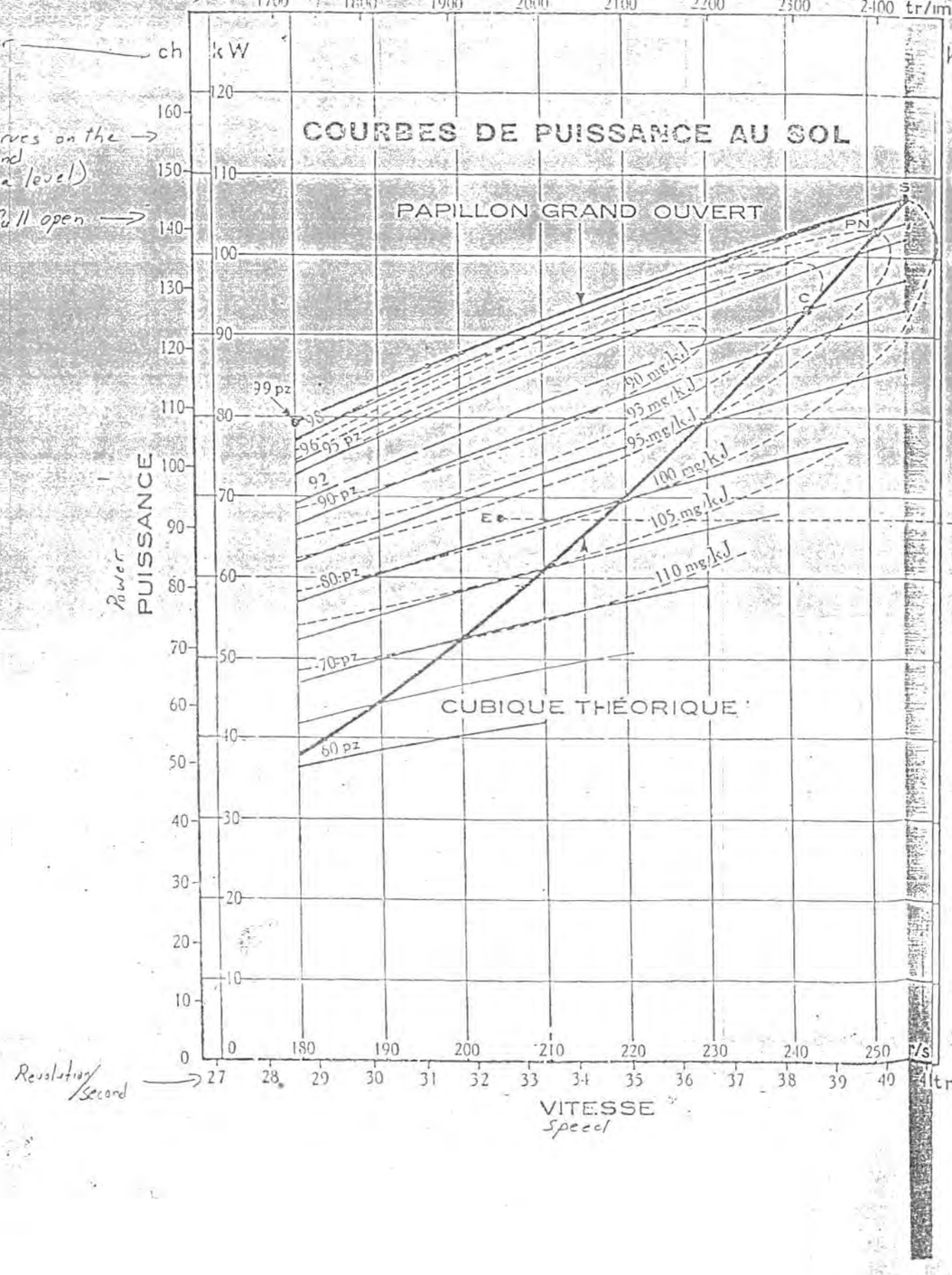
7

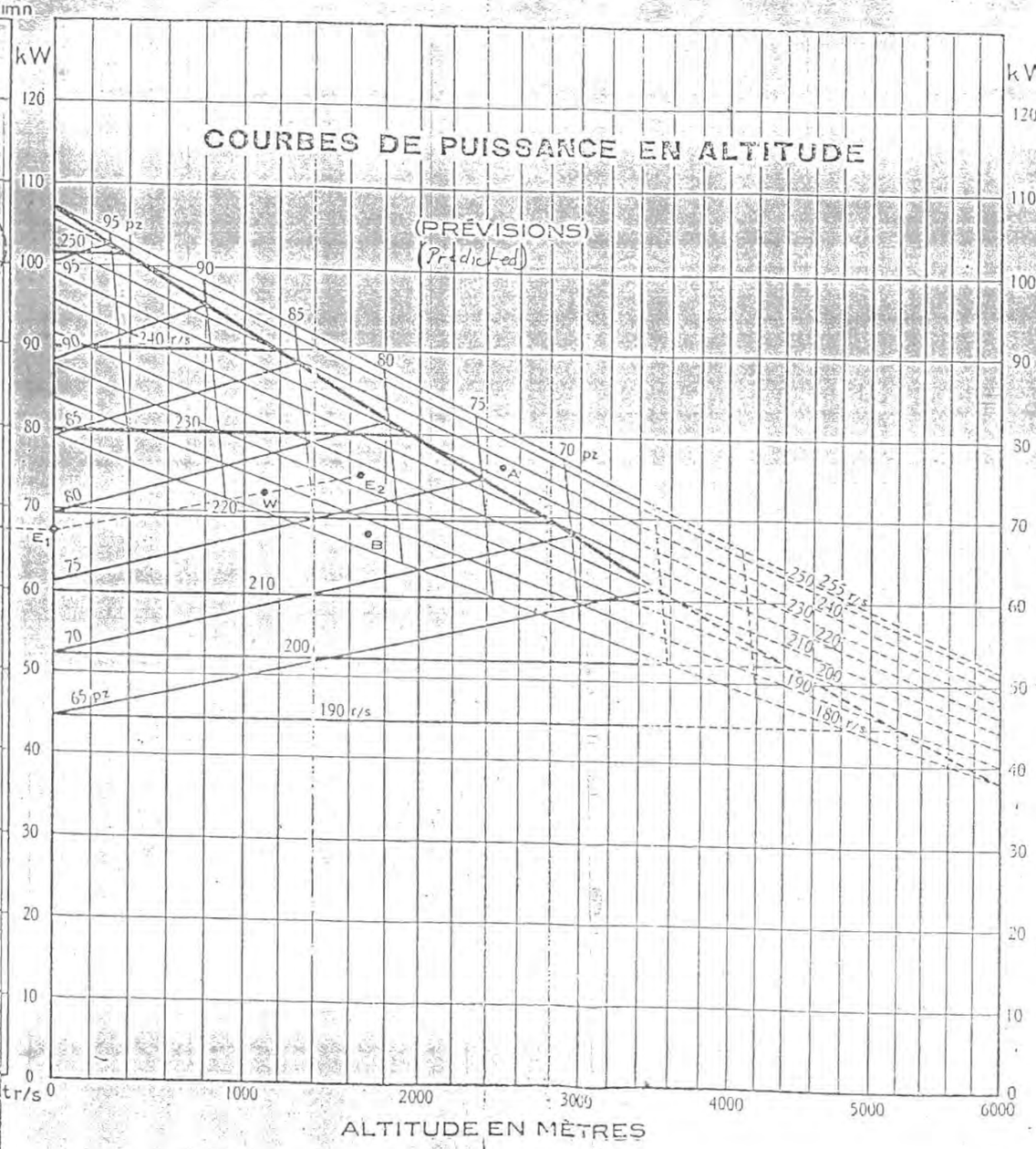
RPM →

Horsepower — ch

Power Curves on the Ground (at Sea level)

Throttle full open →





CLASSIFICATION
N.B.C. 35

MINISTÈRE DE L'AIR
SERVICE
DU MATÉRIEL

NOTICE TECHNIQUE POUR MOTEUR RENAULT 4P

TOME I

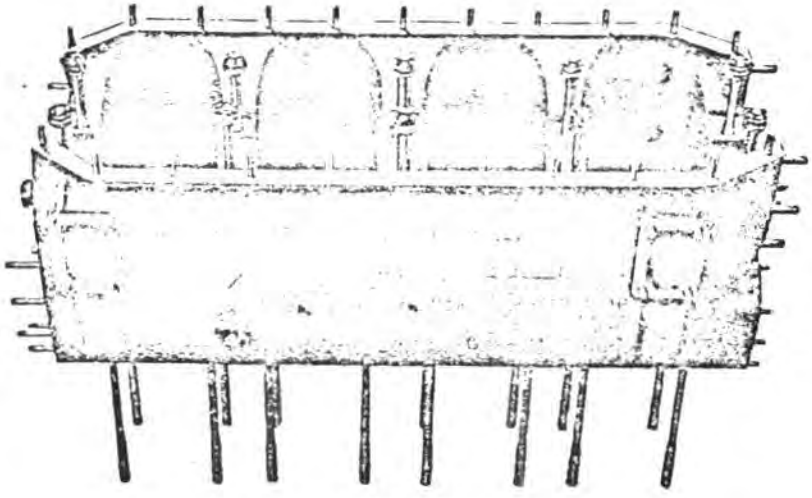
FASCICULE 2

DESCRIPTION

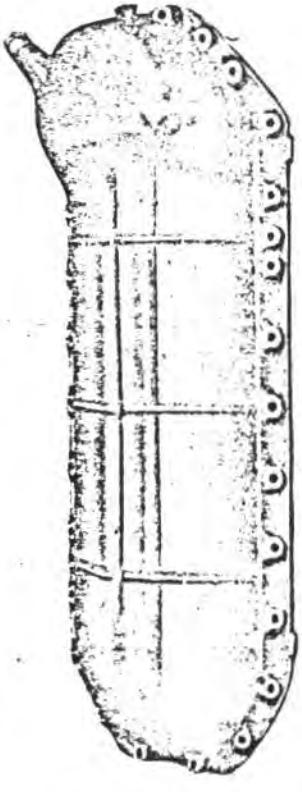
(Approuvée par D. M. N° 32.036 STA/Mo du 17 Février 1947)

EDITION 1948

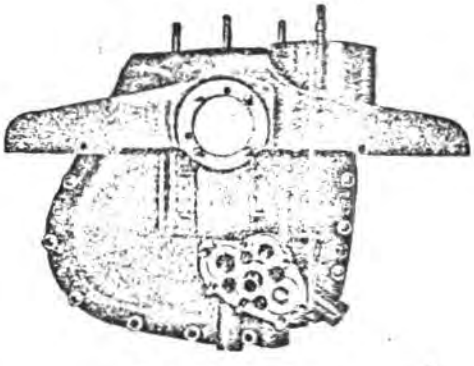
NOMBRE D'EXEMPLAIRES : 750



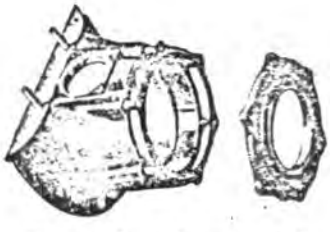
Carter moteur
Main Case



Couvercle de carter pour moteur 4 P 05
Crankcase cover for 4P05 engine



Carter de distribution
Accessory gear case



Support de roulement avant
Front bearing Support

Couvercle de carter pour moteurs 4 P 01 et 4 P 03
Crankcase cover for engines 4P03 and 4P01

FIG. 6 — VUES DES CARTERS ET DES COUVERCLES

Chapter II

General Discription of Engine Parts

Crank Case

The crankcase is made of an aluminum alloy.

The three transverse partitions are cast in one piece in the interior of the case, supported by with the front & rear sections, The five ~~half bearings~~ in line half bearings insure a rigidity to the entire assembly.

At The extreem front, a small aluminum (duraluminum) gearcase opening. The Bearing near the propeller (thrust Bearing) is a ~~sixth~~ sixth bearing.

The five Bearing top halfs are in Duraluminum, and their position is secured by Studs & nu

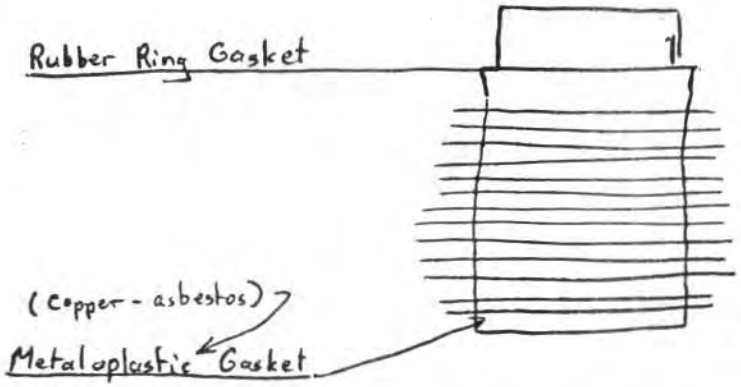
The rear ~~of the cover~~ crankcase housing, forms a box holding the gear drive train, supports the magnetoes, the oil pumps, and is made of magneseum; it is fastened to the crankcase, and crankcase cover with studs & nuts. It accepts the supports & drive connecti to the fuel pumps & tachometer, and contains the fuel shut off valve.

The crankcase cover is also of magnesium, it accepts the top of the main crankcase, and is placed an ~~at the~~ last with studds & nuts

Each cylinder is imbeded in the lower face of the crank case, and held there by studs which pass through the heads, and assure the tightness of the cylinder & cylinder heads in the crank case.

Cylinders.

Separately machined, The cylinders are of special steels, carrying small cooling fins on the outside. four lines of ~~partial notches (cracks, or slots)~~ noches in the fins and ~~the flanges~~ base support flanges of the cylinder in the crankcase are to permi the supporting studs to pass.



The seal of the cylenders when mounted, is obtained with a rubber ring between the cylinder & crankcase, and a metalo-plastic gasket between the cylinder & cylinder head.

CHAPITRE II

DESCRIPTION GÉNÉRALE DES ORGANES DU MOTEUR

CARTER

Le carter du moteur est en alliage d'aluminium.

Les trois cloisons transversales venues de fonderie à l'intérieur du carter, soutiennent avec les parties avant et arrière, les cinq demi-paliers de la ligne d'arbre et assurent une grande rigidité de l'ensemble.

A l'extrémité avant, un petit carter en duralumin porte le roulement butée d'hélice et constitue un sixième palier.

Les cinq chapeaux de palier sont en duralumin et leur fixation est assurée par goujons et écrous.

Le couvercle arrière formant boîte de distribution, support des magnétos et de pompes à huile, est en magnésium ; il est fixé au carter principal et au couvercle supérieur au moyen de goujons et écrous. Il reçoit les supports et commandes de pompes à essence et de tachymètre, ainsi que le robinet d'essence.

Le couvercle de carter est également en magnésium, il recouvre la partie supérieure du carter principal et est fixé à ce dernier à l'aide de goujons et écrous.

Chaque cylindre est encastré dans la face inférieure du carter, et fixé au moyen de quatre goujons qui traversent la culasse et assurent le serrage de l'ensemble culasse-cylindre sur le carter.

CYLINDRES

Usinés séparément, les cylindres en acier spécial portent extérieurement des ailettes de refroidissement prises dans la masse. Quatre séries d'encoches pratiquées dans les ailettes et dans les collerettes d'appui des cylindres sur le carter, permettent le passage des goujons de fixation.

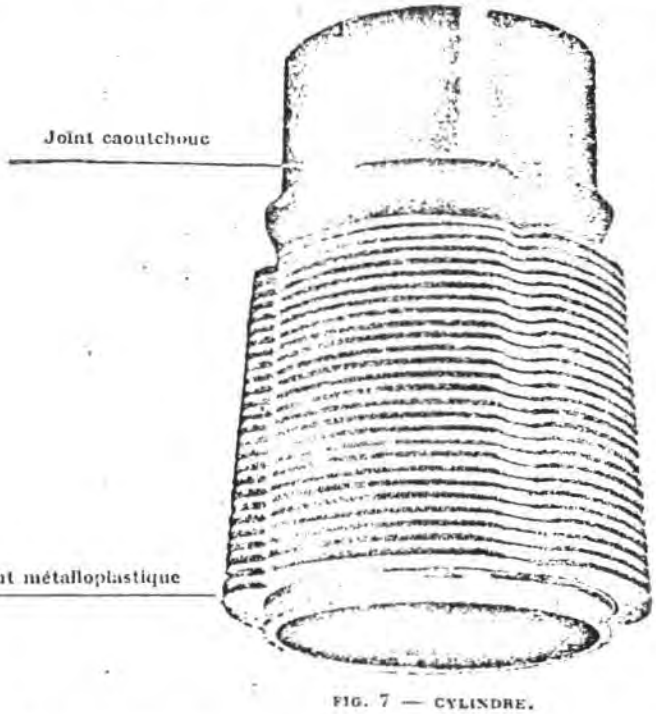


FIG. 7 — CYLINDRE.

L'étanchéité des cylindres lors du montage, est obtenue entre cylindre et carter-moteur par interposition d'un joint caoutchouc et entre cylindre et culasse à l'aide d'un joint métalloplastique.

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Cylinder Heads

The cylinder heads are of an aluminum alloy, and are cooled with fins cast into the heads. Each one contains pressed fittings.. Two valve guide of bronze for the intake and exhaust valves, also with three bronze sleves screwed in when hot to accept the two spark plugs, and the check valve for the AIR-EQUIPMENT typ VIET starter. Two valve seats of special steel, are fitted when hot (these pieces are never to be replaced).

Spark Plug hole

Overflow tube

Side of cylinder head opposite carburator opening for Starter

Cylinder head Side near Carburat

~~Carburetor~~ Cylinder head view with racker arms.

Fig 8 Cylinder heads.

The rocker case, made of sheet metal is mounted tightly against the ~~point where joint with the~~ joint of the valve guides ~~enlarge to a~~ flange enter the flange of the guides & the exterior face of the cylinder head. The racker arms support is fitted in the racker cover and is secured ~~by~~ to the cylinder head by ~~Bolts running through~~ Cast threads studs screwed on Thread two ~~studs~~ small pillars, of which one ~~supports~~ is supported upon the case to the air starter check valve. The other to the cylinder head by a ~~screw~~ bolt ~~set in a~~ screwed into a bronze sleeve set in the cylinde head.

The rockers oscillate on ? pointers around a fixed axcel, held in place by two hollow rocker supports. The assembly of rockers, supports, valve springs rest in the sheet meta rocker case which is closed with a cover which is kept air tight by interposition in the join The tight application of the cover is maintained by the tightening of a thumb screw (nut) The openings for intake & exhaust open on the side of the cylinder head

Four studs are use to ~~support~~ join (connect) the intake manifold. Three Studs are used to secure the exhaust pipes

CULASSES

Les culasses sont en alliage d'aluminium et le refroidissement en est assuré par des ailettes venues de fonderie. Elles comportent chacune, emmanchés à la presse, deux guides de soupape en bronze spécial pour les soupapes d'admission et d'échappement, ainsi que trois douilles en bronze vissées à chaud pour le logement des deux bougies et du corps de clapet de démarrage AIR-ÉQUIPEMENT type VIET. Deux sièges de soupape en acier spécial sont emmanchés à chaud. *Ces pièces ne peuvent être remplacées.*

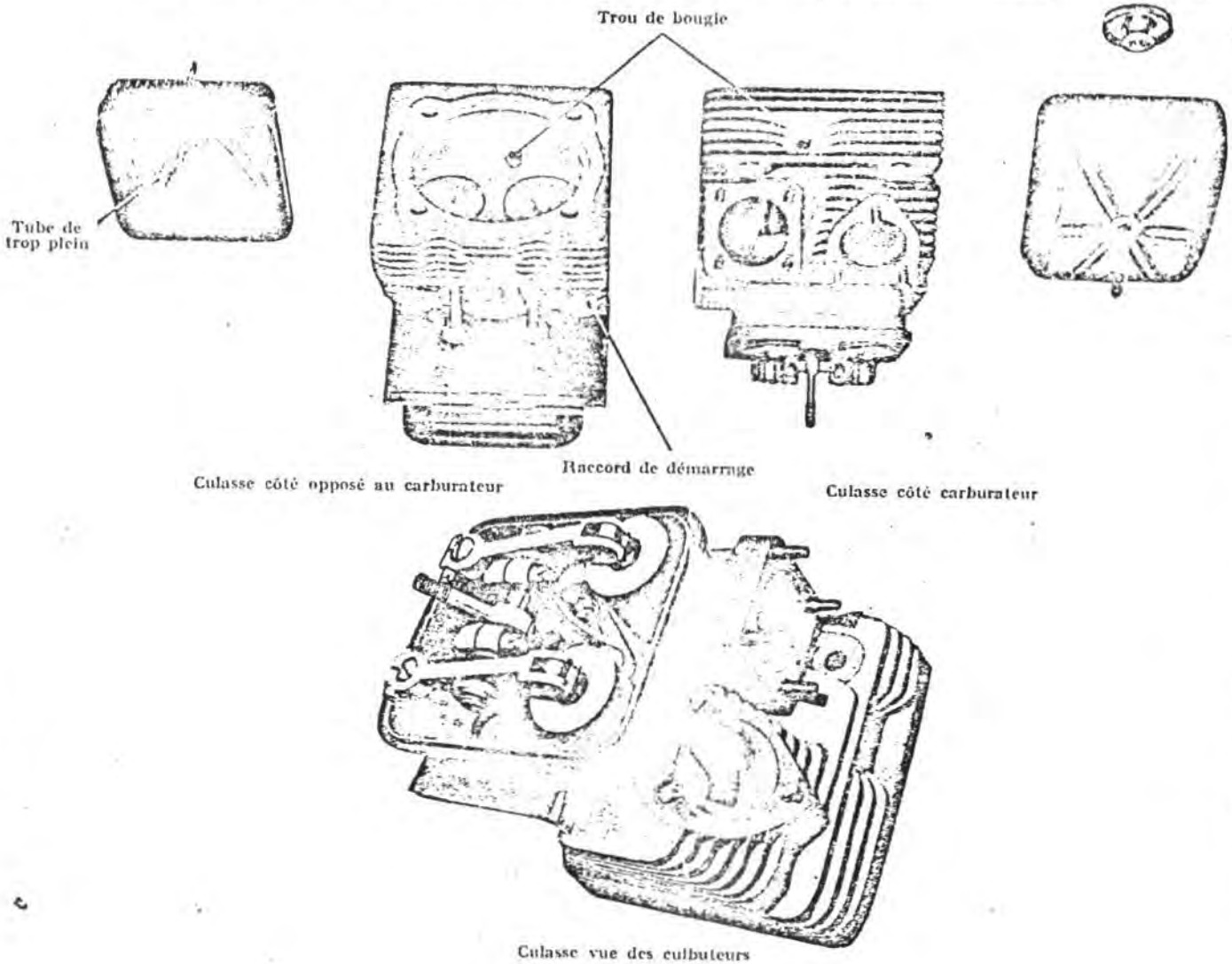


FIG. 8 — CULASSES

Le carter des culbuteurs, en tôle, se trouve serré au moment de l'emmanchement des guides de soupapes entre la collerette de ces guides et la face extérieure de la culasse. Le support des culbuteurs est placé dans ce carter et fixé à la culasse et au moyen d'écrous vissés sur deux colonnettes, dont l'une prend appui sur le corps de clapet d'air comprimé de démarrage, l'autre sur la culasse elle-même, et par une vis fixée dans une bague bronze vissée dans la culasse.

Les culbuteurs oscillent sur aiguilles autour d'un axe maintenu fixe dans les deux alésages du support des culbuteurs. L'ensemble, culbuteurs, supports, ressorts de soupapes, se trouve dans le carter tôle qui est fermé par un couvercle dont l'étanchéité est assurée par interposition d'un joint. L'application énergique de ce couvercle est obtenue par serrage d'un écrou moleté. Les orifices d'admission et d'échappement débouchent côte à côte sur la même face de la culasse. Quatre goujons permettent la fixation du collecteur d'admission. Trois goujons assurent la fixation de la pipe d'échappement.

Piston

Of A high resistance (strength) aluminum alloy, the pistons are drop forged. The bottom of the interior part of the piston is ribbed between the two ~~openings~~ Embossments provided for the length of the connecting rod pin (axel). Each ~~opening goes through the~~ Embossment is pierced by two holes to assure lubrication to ~~lubricate~~ the connecting rod ~~axel~~ pin (axe). ~~The latter the interior which dual tapering cavity is fitted with friction & held in place by two stop rings embedded~~ in the circular gouges carefully cut in the pistons

The Latter, the interior which has a tapered groove to both ends, is equiped with friction lubrication, and is held in place by two stop rings embeded in the circular gouges cut in the pistons

Piston, (Interior view) connecting rod pin, stop ring, piston rings.

Piston, Exterior view.

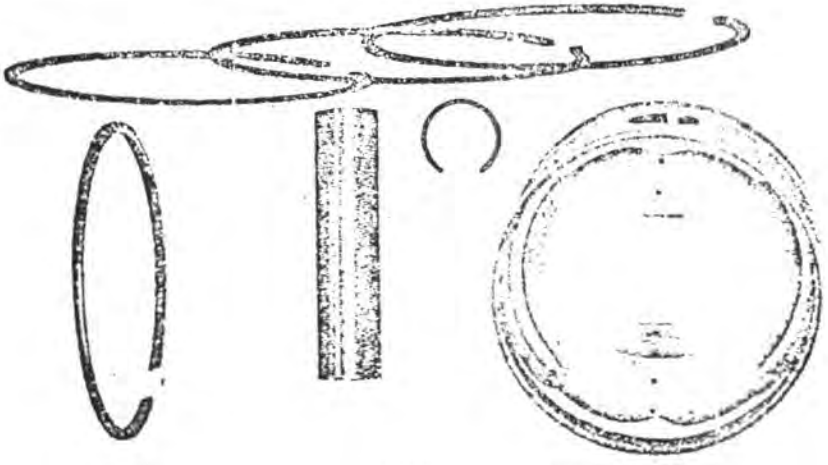
Fig 9 Pistons.

On the outside, The piston has a flat bottom & 4 grooves to recieve the rings to assure the ~~oil openings comes to oil~~ oil tightness. The rings are in echelons (order) of the functions they serve, Starting at the (top) head of the piston:

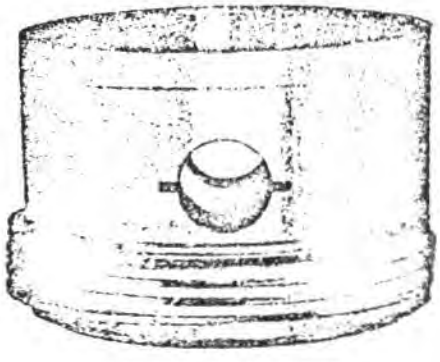
- The compression ring.
- 2 circular tapering rings of which one is cut to the right, the other to the left. The two rings are marked with an engraved O in one face of the ~~ring~~ ring near the ~~cut~~ (cut) opening. The engraved Side (face), corresponds to the narrower part of the tapered ~~ring~~ ring, ~~for~~ is to be placed in a manner (The groove) to be guided near the head of the piston
- The oil ring has the appearance of a ring (throat) ~~pierced~~ pierced with holes. The lower throat (ring) of the piston, where the oil ring is lodged, is perforated in each ~~groove~~ section near the sides of the embossing (for the Connecting rod pin). A second series of holes which allows an equal flow from inside to outside ~~of the~~ or reverse of the piston, is drilled through the throat (ring) from a small depth immediately below the oil ring allowing excess oil to return to the interior of the

PISTONS

En alliage d'aluminium à grande résistance, les pistons sont obtenus par matriçage. Le fond de la partie intérieure du piston est nervuré entre les deux bossages prévus pour le logement de l'axe. Chaque bossage est percé de deux trous assurant le graissage de l'axe de piston. Ce dernier, à évidement intérieur bicônique, est monté à frottement gras et maintenu en place par deux joncs d'arrêt encastrés dans des gorges circulaires ménagées dans le piston.



Piston (vue intérieure), axe, joncs, segments



Piston, vue extérieure

FIG. 9 — PISTONS

Extérieurement le piston a un fond plat et quatre gorges reçoivent les segments destinés à assurer l'étanchéité. Ces segments sont échelonnés de la façon suivante, en partant de la tête du piston :

— un segment d'étanchéité cylindrique ;

— deux segments cylindro-côniques dont les coupes sont l'une à droite et l'autre à gauche. Ces deux segments sont marqués d'un O gravé sur une face du segment près de la coupe. La face ainsi gravée, correspondant à la face la plus étroite du segment cônique, doit être placée de manière à se trouver dirigée vers la tête du piston ;

— un segment râclo-graisseur muni extérieurement d'une gorge percée de trous. La gorge inférieure du piston où se loge ce segment est elle-même perforée sur chaque secteur qui se trouve de chaque côté du bossage. Une deuxième série de trous qui permet également la communication entre l'extérieur et l'intérieur du piston, est percée dans une gorge de faible profondeur, immédiatement au-dessous du segment râclo-graisseur, ce qui permet à l'huile en excédent de retourner à l'intérieur du piston.

~~piston~~. Connecting Rods

The connecting rods are of duraluminum in an I shape. The (big end) tops of the connecting rods have two half bearings of antifriction bresses. The X channels permit lubrication when they are mounted on the cranks of the crankshaft.

The half bearings of the connecting rod body are held in place by a cylindrical pin, wheras the (crank head - big end) half-bearings of the top (cap) of the connecting rod is held in place by a flat pin which inters twice into ~~the~~ an incision in the ~~half~~ Split bearing, permitting the latter to oscillate while setting it and putting it in correctly.

Fig 10 Connecting rod with bearings

The assembly of connecting rod and cap (top) ~~is~~ are connected by two bolts & castle nuts.

The foot of the connecting rod recieves a brass sleeve through which the (crosshead or small end) connecting rod pin passes. This sleeve is fitted with force into the connecting rod foot, and is held in place by a pin; It ~~alone~~ has internal grooves for lubricating the connecting rod pin. A hole at the end (bottom) of the connecting rod passes through the casing and sleeve and is alligned with the lubricating Grooves.

Crankshaft.

Of high resistance steel. stamped & treated, The crankshaft is a single piece. The bearings and cranks are hollow, as well as the tapered part which recieves the propeller hub which is held in place with a key screwed into the length of the taper. A safety wired nut holds the ~~forward~~ bearing which acts like a turbine to return oil. The bearing is mounted on a pollished section of the crankshaft, and rests against a flange

Figure 11 crankshaft

The lubricating oil enters the crank shaft through the bearings, but whereas bearings 1, 3 and 5 are simply lubricated, Bearings 2 and 4 respectively supply connecting rods 1, 2 and 3, 4 by intervening passages which join the grooves (hollowing) of the crank and the crank ~~shaft~~pin. These graves are kept tight (sealed) by the two bushings (connical rings of which the crests face in opposite directions) held in place by the support bolts & nuts. The bushings are of two different diameters: The larger ones ~~bfacing~~ facing the open surfaces, and the smaller ones the crank pin. These ~~joints~~ fittings are between the bushings & openings. The passages to the fifth bearing ~~allow~~ (involves) internal grooves which support and drive the pinion gear which drives the idler in the drive train ~~which drives~~ and the magneto gear (the accessory drive train)

BIELLES

Les bielles en duralumin matricé sont à section en I. Les têtes de bielles sont munies de deux demi-coussinets en laiton régulé. Des rainures en forme de X en permettent le graissage lorsqu'elles sont montées sur les manetons du vilebrequin.

Le demi-coussinet du corps de bielle est maintenu en place par un ergot cylindrique, tandis que le demi-coussinet de chapeau de bielle est maintenu par un ergot plat qui rentre dans la boutonnière du demi-coussinet, permettant à ce dernier d'osciller lors du montage et de se placer correctement.

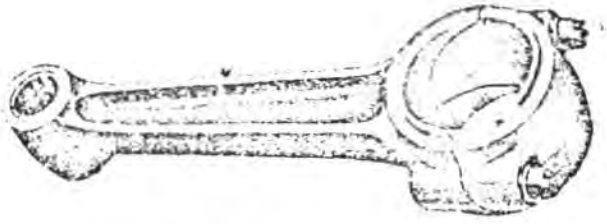


FIG. 10 — BIELLE AVEC COUSSINETS

L'assemblage du corps de bielle et du chapeau est réalisé par deux boulons de bielles.

Le pied de bielle reçoit une bague en bronze dans laquelle vient se loger l'axe de piston. Cette bague, emmanchée à force dans le pied de bielle, est fixée par un ergot ; elle comporte intérieurement des rainures permettant le graissage de l'axe de piston. Un trou situé à l'extrémité du corps de pied de bielle traverse également la bague et alimente ses rainures.

VILEBREQUIN

En acier à haute résistance, estampé et traité, le vilebrequin est entièrement usiné. Les portées et les manetons sont évidés intérieurement, ainsi que la partie avant cônique recevant le moyeu d'hélice qui est maintenu en place par une clavette maintenue par une vis dans son logement sur le cône. Un filetage reçoit l'écrou de blocage du roulement qui forme également turbine de retour d'huile. Le roulement est engagé sur une partie lisse du vilebrequin et vient s'appuyer sur une collerette.

FIG. 11 — VILEBREQUIN

L'huile de graissage arrive au vilebrequin par les paliers, mais tandis que les paliers 1-3 et 5 sont simplement graissés, les paliers 2 et 4 alimentent respectivement les bielles 1-2 et 3-4 par l'intermédiaire des canaux qui relient les évidements des bras et des tourillons. Ces évidements sont rendus étanches par le montage de deux bouchons (rondelles côniques dont les sommets sont opposés) maintenus en place par des tiges de fixation et leurs écrous. Les bouchons sont de deux diamètres différents ; les plus grands obstruent les faces des portées et les plus petits, les faces des manetons. Des joints sont interposés entre les bouchons et orifices. L'évidement de la cinquième portée comporte des cannelures intérieures qui servent à l'entraînement et à la fixation du pignon de commande qui entraîne le pignon intermédiaire de distribution et la roue de commande des magnétos.

Chapter III

Discription of valve train (Intake & Exhaust timing)

Cam shaft.

The camshaft made of stamped steel, in a single piece, and runs the full length of the interior of the engine. The forward end ~~pacesits~~ consists ~~a supports~~ the drive for the ~~air~~ compressor AIR · EQUIPMENT, plus The first bearing, immediatly behind which are the drive cams for the exhaust valve and intake valve of the first cylinder, behind the second ~~cyline~~ bearing The cams of the exhaust and intake valves of the second cylinder, etc. The extreme other end of the cam shaft consists of a plate which permits the coupling with the drive gear with five bolts. The lubricating oil which comes from the crankshaft fifth bearing enters the corresponding camshaft bearing by a 5mm hole: it leads to the interior of the camshaft whose ends are blocked by bushings ~~in the~~ forced in place (pressure fittings), and is distributed to bearings 1.2.3.4 by holes 15/10 opening in each of the corresponding bearings, with small oil baths (pools) in the center. The first four cam shaft bearings are permanently fixed with pins into the duraluminum of the crankase and the last camshaft bearing is a split bearing.

Rocker Arms & Their Controlls

To assure the proper fit between the base of the tappets and the rocker arms, The push rods are made from a tube of appropriate length which have ball joints presed onto each end.

The rockers arms are of drop forged steel. Mounted on a shaft (~~needles~~), they oscillate around a ~~fixed~~ hollow axel fixed in The rocker arm support, and are separated from each other by the support, each on between two washers (roundels). Between the two support arms, The axcel holds a threaded rod Through its eye which is used to secure the rocker cover.

The lateral play on the axel is limited on one end by the rocker support, and the other by fitting a clip ring in ~~a~~ grooves ~~around~~ cut around the axel near its ends.

CHAPITRE III

DESCRIPTION DES ORGANES DE DISTRIBUTION

ARBRE A CAMES

L'arbre à cames en acier estampé, est entièrement usiné et percé intérieurement sur toute sa longueur. La partie avant comporte une denture d'entraînement pour le compresseur Air-Équipement, puis la première portée suivie immédiatement de la came de commande de la soupape d'échappement, la came de commande de la soupape d'admission du premier cylindre, de la deuxième portée, des cames de commande des soupapes d'échappement et d'admission du deuxième cylindre, etc... L'extrémité arrière de l'arbre à cames est constituée par un plateau qui permet son accouplement avec la roue de distribution au moyen de cinq boulons. L'huile de graissage venant du cinquième palier du vilebrequin arrive au palier correspondant de l'arbre à cames, par un trou de 5 mm. ; elle est amenée à l'intérieur de l'arbre à cames, dont les extrémités sont obstruées par des bouchons lisses emmanchés à force, et distribuée aux paliers 1-2-3-4 par des trous de 15/10 débouchant sur chacune des portées correspondantes au centre de petits bains d'huile.

Ces portées de l'arbre à cames tourillonnent dans les bagues en duralumin fixées à demeure, dans le carter pour les quatre premiers paliers, et dans les deux demi-coussinets d'arbre à cames pour le palier arrière.

CULBUTEURS ET LEURS COMMANDES

Assurant la liaison entre les pieds de poussoirs et les culbuteurs, les tiges de commande des culbuteurs sont constituées par un tube de longueur appropriée, recevant à chaque extrémité des pièces emmanchées à force et terminées par des rotules.

Les culbuteurs sont en acier matricé. Montés sur aiguilles, ils oscillent autour d'un axe creux fixé

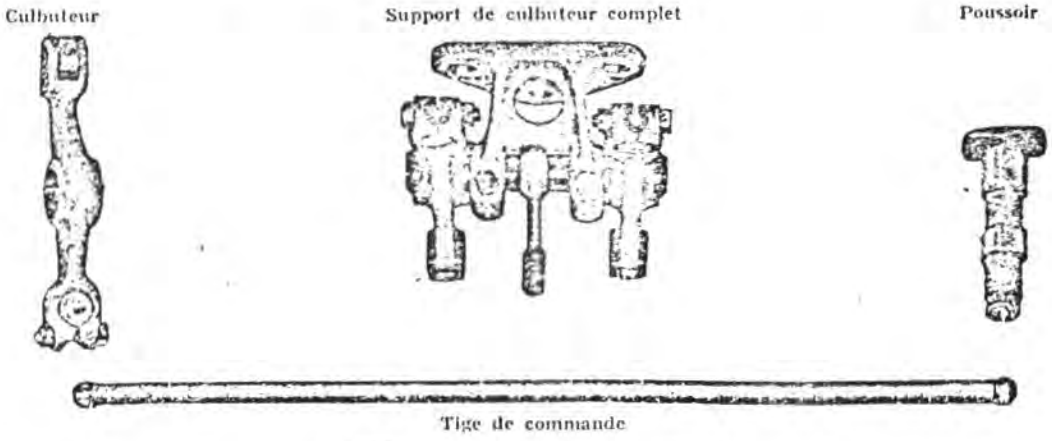


FIG. 12 — ENSEMBLE DE LA CULBUTERIE

dans le support de culbuteurs et sont disposés de part et d'autre de ce support, chacun entre deux rondelles. Entre les deux bras du support, l'axe reçoit une tige filetée à œil, qui permet la fixation du couvercle de carter.

Le jeu latéral sur l'axe est limité d'un côté par le support de culbuteur lui-même, et de l'autre par un jonc prenant sa position en serrant dans une gorge réservée à cet effet, sur le diamètre extérieur de chaque extrémité de l'axe.

The arms of the rockers which press on the valves have an opening with a roller which turns about an axel riveted to the extreem ends of the arm; a central embossing (pin) ? is pierced (drilled) through, boared out & pollished, forming a cage for pins (needles) of oscilation, and the other end recieves a regulating screw in which takes up the ball joint Soccet of the rocker arm. The holes in the axel let oil from ~~the~~ inside the covers ~~enclosure~~ pass from the interior of the axel to the rocker arms.

Valves

Made of a high heat resistant steel, The intake and exhaust valves are entirely machined & pollished. They each have ~~numbers stating~~ numerous ~~their~~ different ~~positions~~ points.

- The bell shaped grooving (hollowing out) is more noticeable (accented) in the intake valve Than the exhaust valve.

Exhaust

Intake.

Fig 13 Valves

- The diameter of the head to the intake valve is larger than that of the exhaust valve
- The seat of the exhaust valve recives a contribution of weld of "Stellite" before ~~grinding~~ being ground.

Ways they are Common (similar)

- The springs are secured against a stepped cap holding the two concentric ~~air~~ springs, whic assures the return of the valves to their seats. This cap is held in place by the insertion of the two halves of the ~~half~~ retaining rings into the conical section of the cap, and the grooved tail on the valve
- The addition of "Stellite" to the edges of the tail of the Valve stem.

Le bras du culbuteur qui commande la soupape, porte un galet qui tourillonne sur un axe rivé à ses extrémités ; un bossage central est percé d'un alésage lisse formant cage des aiguilles d'oscillation, et l'autre extrémité reçoit une vis de réglage dans laquelle prend appui la rotule de la tige de commande des culbuteurs. Des trous percés dans l'axe permettent le passage de l'intérieur de cet axe vers les culbuteurs, de l'huile qui se trouve dans le carter.

SOUPAPES

En acier à haute résistance à chaud, les soupapes d'admission et d'échappement sont entièrement usinées et polies. Elles présentent un certain nombre de points différents :

— l'évidement de la tête en forme de tulipe, qui est plus accentué sur la soupape d'admission que sur la soupape d'échappement ;

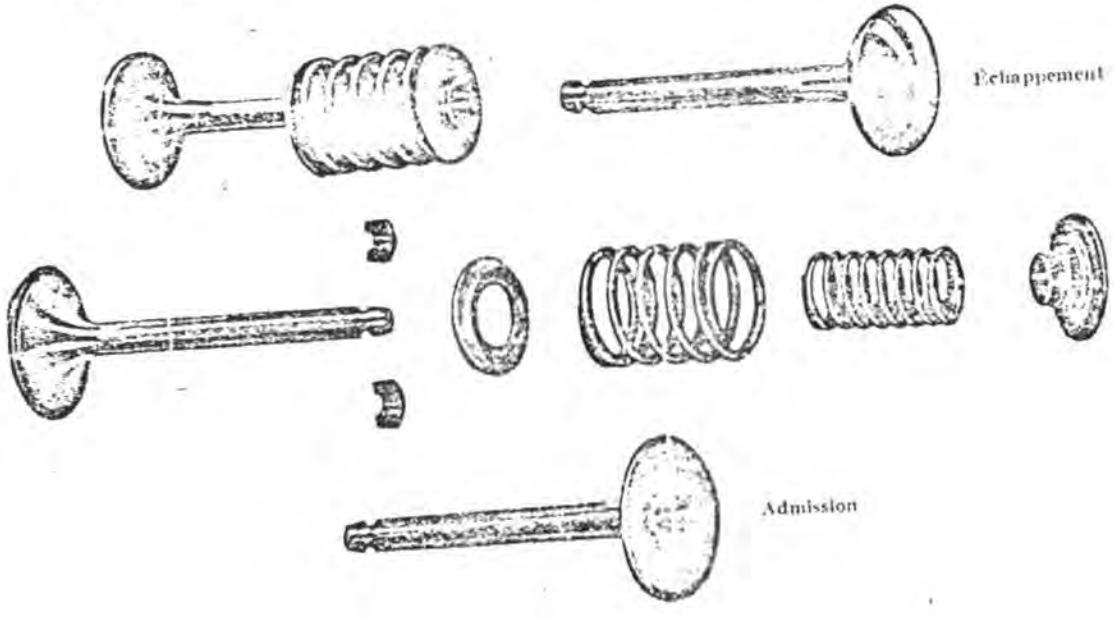


FIG. 13 — SOUPAPES

— le diamètre de la tête de la soupape d'admission, qui est plus grand que celui de la soupape d'échappement ;

— la portée de la soupape d'échappement qui reçoit un apport à l'autogène de « stellite » avant sa rectification.

Elles ont de commun :

— la fixation des ressorts qui s'effectue par une calotte à fonds étagés sur lesquels prennent appui les ressorts concentriques qui assurent le rappel des soupapes sur leurs sièges. Cette calotte présente en son centre, une cuvette cônique dans laquelle se trouvent bloquées les deux demi-bagues d'appui, enserrant l'évidement de la queue de soupape ;

— l'apport de « stellite » à l'extrémité de la queue de soupape.

Chapter IV

Description of lubrication Systems.

POMPS

The general lubrication of the engine is assured by two gear pumps, placed side by side, applied to the rear face of the ~~drive train~~ accessory geardrive case

The pressure pump, made from two meshing wide toothed pinion gears (15 mm wide), forcing oil under pressure into the different lines. The pressure is held constant with a discharge valve, which ~~set~~ opens at 3 kg pressure. The oil released by the overpressure valve returns to the rear sump; This oil not being used to lubricate the engine.

The pump for emptying the two sumps consists of three ~~inter~~ meshing wide toothed gears (21.5 mm wi which draw on the front & rear sumps the lubricating oil, and force it back through the radiator (if there is one) and into the resevoir.

Each pump is driven by ~~one~~ a ~~of the~~ gears ~~which also drives the~~ on a common shaft to all of the pumps;

? The three other pinion (gears) are held in (mounted) loosley (not on gear shafts)

The assembly is mounted, in an magnesium case closed with a cover plate. The pump casting is secured to the gear drive (accessory train) case with 8 botts. The holes drilled into the housings in the casting are the intake, and outlet ports for the oil, connecting with the The piping in the casing of the gear chamber (drive train case)

LUBRICATION SYSTEM.

Oil in the resevoir passes into the circulation pump, then to the filter strainer where it is made safe for ~~the~~ engine lubrication

There is a main oil line ~~electric~~

? ~~A lineup of main distributors (conduits) on the~~ oil

(— on the first bearing, which is near The Thrust bearing and The compressor distributor Air Equipment Type VIET;

— around The other bearings of The crankshaft. In The four bearings The discharge

is limited by the adjustments in their fitting (the tolerances)

- near a tube, going through ~~the~~ a hole in the partition of the crankcase, which makes up the fith bearing, and holds the fith bearing of the camshaft. From here it escape Through the holes drilled in each bearing, and is collected, depending upon the position of the engine, either in the front sump or rear sump, from whic the double sump pump recove

It is by the splashing of oil that lubricates the cylinders, the bases of the connecting rods, and connecting rod pins, the tappets, and drive train gears.

With a small derivation (hole) an oil spray (jet) is sprayed on the hellical teeth of the magneto drive.

The ~~to~~ breather valve, in the forward end (nose) supported by ~~above~~ the thrust bearing, permits The equalization of pressures inside ~~the~~ of the engine

The rocker covers are refilled with oil at the time of "each Rising" (of pistons) in the crankcase assuring ~~them~~ their lubrication. An overflow tube passes through, and is fixed in the cover to assure proper overflow of excess oil (being supplied through the push rod tubes). On the left side of the crank case is the oil pressure sendor (manometer), tapping into the main oil line.

Engines equiped with vaccume pumps.

On certain Motors, an exterior ~~pipe~~ pipe line branching from the specially hollowed tube of the filter permits the lubrication of the gears which drive the vaccume pump.

Motors 4P 05

On some engines, a supplementary derivation, made possible with exterior piping, lubricated in normal flight, an auxilliary recirculating oil pump is located in the rear sump of the crankcase cover.

The division of this pipe is in the hollow type of the strainer filter; its entrance is secured on a nossel which opens into the pump drive axel. The oil arrives at the gears and rings of the pinion gears through holes near the bottom of the teeth

The two stage auxilliary pump consists of the double play of two gears with large teeth. (large crossection)

In inverse flight, they suck in from the front and rear sumps in the crankcase cover, The oil having been used for lubricating, and return it through the radiator (if there is one) Then into the reservoir.

The suction from the rear sump is made through an fixed opening in The crankcase cover.

A felt packing is formed into the bollow of each cover to the rocke arm cases

In normal flight it is impregnated with oil and retains some oil in invese flight, which assures the lubrication of the rockers while in this position

The equilibrium of pressures is obtained by allowing the air inside the crankcase to flow freely out. (or outside air in). The venting to free (outside) air is possible with the removing of the stopper (Bushing) in the front of the crankshaft, and by mounting a special stop bushing running through a row of hols.

Tightnes (oil tightness)

Special precautions are needed to keep the engines oil tight while in inverted flight.

To gain this, on puts on the push rod tubes:

- on the interior a ~~rubber gasget is placed~~ (the tube is treated with rubber) at each end, and on the joint between tubes.

- on the outside a rubber sleeve is placed over the fitting of the tubes, ~~The~~ ps in the support cups and also, a third sleeve assures the seal ~~of the recovery~~ by recovering (overlapping) the tubes inside and out.

Chapter V

Discription of Cooling.

The cowling made by the aircraft company, in accord with the builder, provides for The entrance of air ~~which~~ through an opening through a ~~sheet~~? corridor allong the length of the engine, and as tall as the cylinders and heads

The deflectors are held (on the side opposite the air corridor) so as to force the air around the cooling fins on the cylinders and heads before leaving to the rear of the engine ~~by the~~ Through the large openings in the cowl.

Side view Front view

Fig 14 Assembly of cooling system.

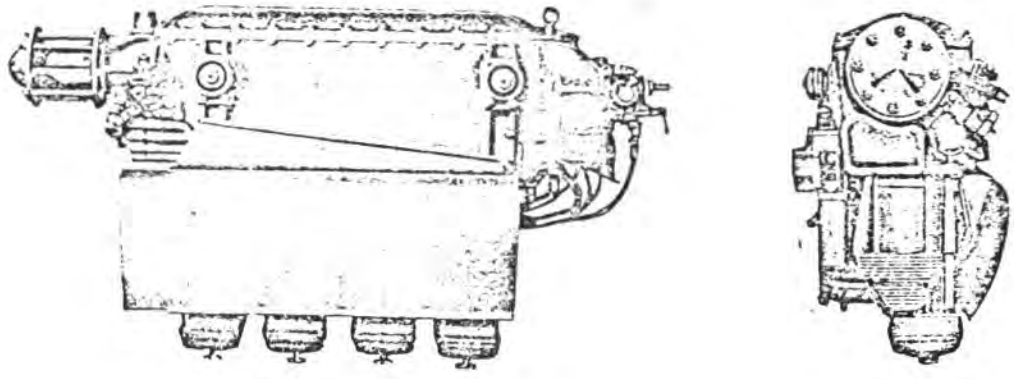
Fig 15 drawing (schematic) of cooling system

CHAPITRE V

DESCRIPTION DU REFROIDISSEMENT

Le capotage exécuté par l'avionneur, en accord avec le constructeur, prévoit une entrée d'air qui débouche face au couloir longeant le moteur, à hauteur des cylindres et culasses.

Des déflecteurs sont disposés (côté opposé au couloir d'air) de manière à ce que l'air contourne les ailettes des cylindres et culasses avant de sortir à l'arrière du moteur par de larges ouvertures ménagées dans le capotage.



Vue latérale Vue de face

FIG. 14 — ENSEMBLE DU REFROIDISSEMENT

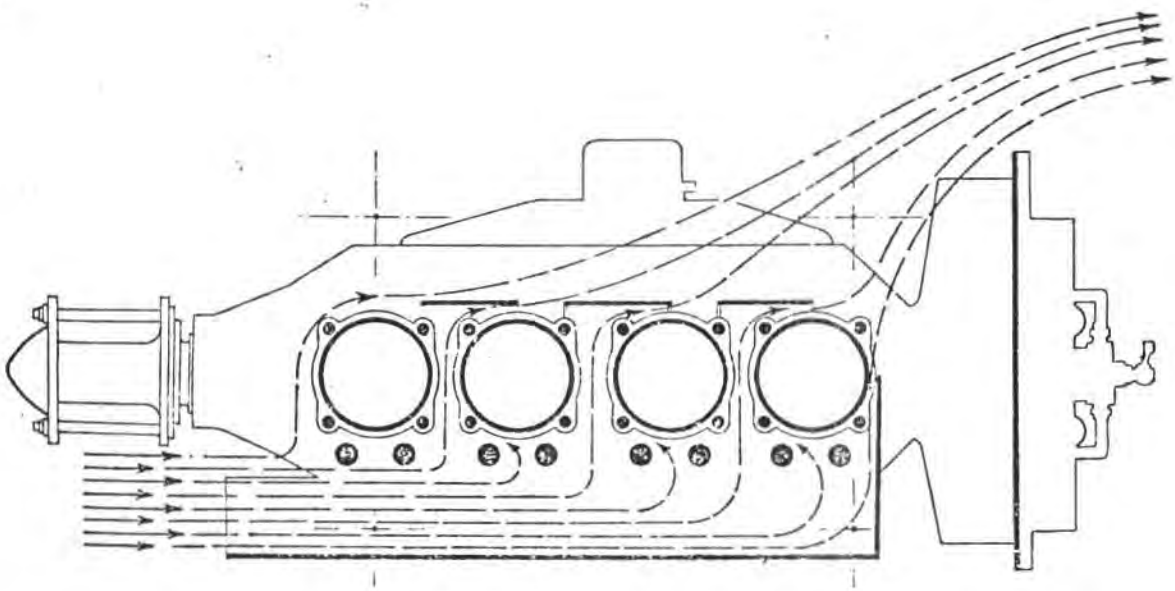
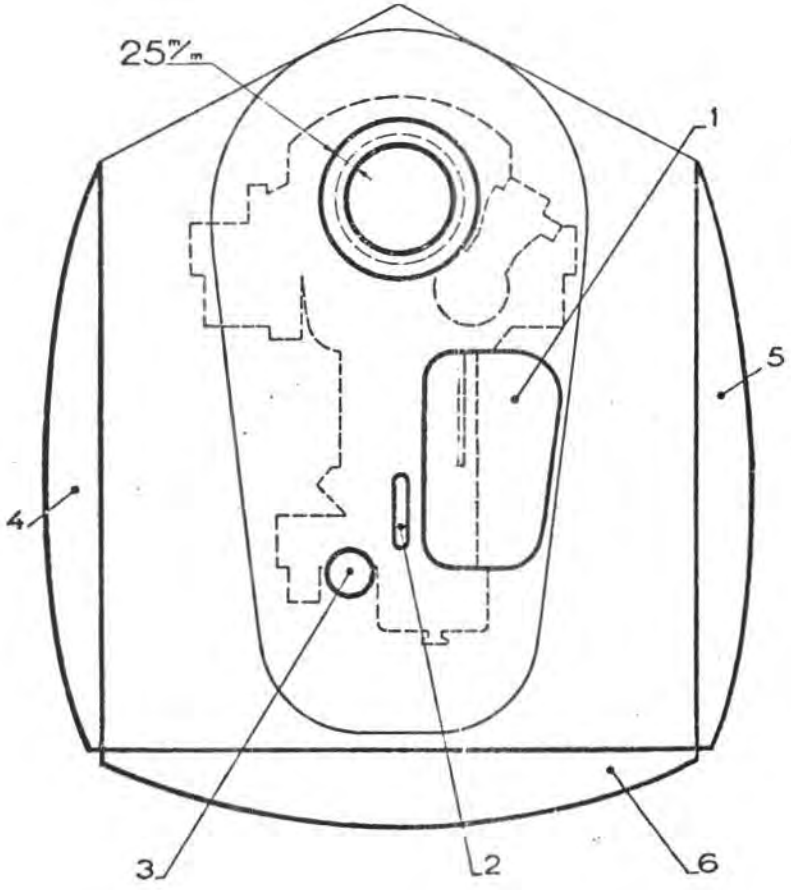


FIG. 15 — SCHÉMA DU REFROIDISSEMENT



1. — 500 cm²
2. — 28 cm²
3. — 15 cm²
4. — 150 cm²
5. — 150 cm²
6. — 400 cm²

FIG. 16 — SCHÉMA DES ORIFICES DE REFROIDISSEMENT

Layout of cooling openings

CHAPTER VI

DESCRIPTION OF THE AUXILLIARY DRIVES

CONNECTION OF THE TACHOMETER

The connection to the tachometer is on the rear of the engine. The gearing is included in the ~~piece~~ part which supports the fuel cutoff valve. The drive gear, turning at the speed of the crankshaft, the gear to the tachometer shaft turns at ½ the crankshaft spe

Vaccume Pump

The vaccume pump is mounted on a bracket fixed to the rear crankcase housing.

It creates the necessary vaccume to operate the instruments on board. The vaccume is held constant by a regulating value built into the pump and the instruments. The value is adjusted (set up) to conserve a sufficient vaccum throughout the system: it is ~~regulated~~ adjustible in flight with a value (cut off)

A guage permits ~~the~~ a continuous ~~value~~ reading of the vaccume in the ~~motor~~ cut off c

Chapter VII

Supply of Fuel & Carburation

The supply of fuel to the carburator is automatically insured by the two ~~auto~~ Self regulating rotary pumps AM #00 placed each side of a support secured onto the rear crankcase housing.

I. Fuel pumps #00 (See Plate VIII & see AM)

Each pump is mounted directly to the motor using a similar flange. It is driven by a shaft running through the center of the flange.

The various volumes are provided by the sucking and back pressure produced by the rotation of a shaft supporting paddles (turbine fins), ~~from~~ which an eccentric axcel is in contact with the pump beddy.

The pump body is comprised of : one single mobile (movable) wall (partition), on ~~Segment~~ (Floati~~c~~ Sprui piston, , The suction & backpressure (sectrum) part of the pump, and another section with a spring-regulating action. When the backpressure reaches a determined level, the ~~Is~~ ~~Sprung~~ ~~ston~~ sprung piston is compressed and moves The movable partition, which creates in the interior of the pump a limiting diversion to exit the extra fuel.

Fig 17 Fuel Pump AM #00

Discription

This display (discription) includes essentially the pump proper, and the regulating mechanism

a) Pomp~~a~~ - The pump consists of a caseing (26) inside of which is the shaft supporting the paddles (2) from which the head is turned inside the off centerd case By ~~the~~ a connection to the shaft. The release nut (24) is continually rubbed in its fitting in a manner which causes it to automatically recapture the play caused by parts rubbing

One oil chamber is brought into the casing (26). It connects with the rear of the bearing and a hole (25) found in the face of the mounting flange, which ~~holds the oil~~ takes in the oi

A bushing (1) closes the chamber

The casing contains intake check valves, as well as identical ones for the output

The fuel being drawn in passes through a filter (31) which is held in the casing by a bushing bolt.)(33) A piece of sprung wire is used to keep the bushing from loosening.

The incoming fuel reaches the division point where the fluid passes into flexible supply pipes

The shaft (2) of the pump, has, at its end, a groove cut to recieve the key of the drive line from the engine. further in are grooves (22) to circulate the oil

CHAPITRE VII

ALIMENTATION EN ESSENCE ET CARBURATION

L'alimentation du carburateur en essence est assurée automatiquement par deux pompes autorégulatrices rotatives AM n° 00 placés de part et d'autre d'un support fixé sur le couvercle arrière.

I — POMPES A ESSENCE n° 00 (*Voir planche VIII et notice AM*)

Chaque pompe est montée directement sur le moteur à l'aide d'une bride standard. Elle est entraînée par un arbre placé au centre de cette bride.

Les variations volumétriques provoquant l'aspiration et le refoulement sont produites par la rotation d'un arbre porte-palettes, dont l'axe est excentré par rapport au corps de pompe.

Le corps de pompe comprend : une paroi mobile solidaire ; un piston élastique, soumis, d'une part à la pression de refoulement de la pompe, et d'autre part à l'action d'un ressort réglable. Lorsque la pression de refoulement atteint un taux déterminé, le piston élastique se comprime et écarte la paroi mobile, ce qui crée à l'intérieur du corps de pompe une dérivation limitant le débit.

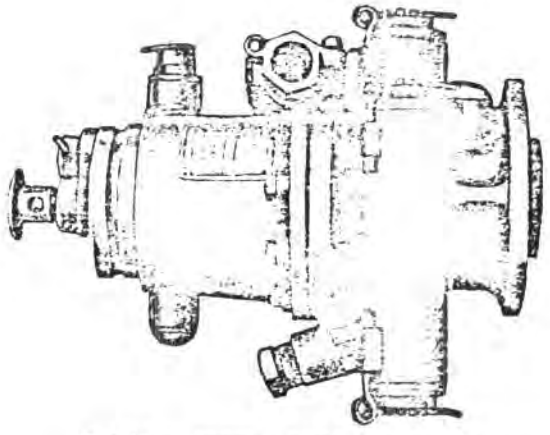


FIG. 17 — POMPE A ESSENCE AM. N° 00

Description

Cet appareil comprend essentiellement la pompe proprement dite et le mécanisme réalisant l'autorégulation.

a) **Pompe.** — La pompe comprend un carter (26), à l'intérieur duquel se trouve l'arbre porte-palettes (2), dont la tête tourne à l'intérieur du corps excentré par rapport à l'arbre. L'écrou (24) agit constamment sur un joint, de manière à rattraper automatiquement le jeu des parties frottantes.

Une chambre d'huile est aménagée dans le carter (26). Elle communique avec l'arrière du coussinet et avec un trou (25) de prise d'huile prévu sur la face de bride de montage.

Un bouchon (1) ferme cette chambre.

Le carter comprend les boîtes à clapets d'aspiration et de refoulement constituées d'éléments identiques.

L'aspiration s'opère au travers d'un filtre (31) logé dans une cavité fermée par un bouchon (33). Un frein en corde à piano s'oppose au desserrage de ce bouchon.

L'arrivée et le départ du liquide s'opèrent par les tubulures munies de raccords orientables.

L'arbre (2) de la pompe présente, à son extrémité, une fente destinée à recevoir le tournevis de la prise de mouvement du moteur; il porte en outre une gorge (22) destinée à faire circuler l'huile.

b) Automatic regulation mechanism – The mechanism is in the casing (5) assembled onto the pump case (26) with the aid of pins, and held with ~~the~~ flange

The mechanism is composed of an elastic (flexible-spring) piston (7) of which ~~one~~ one end is bound by a tube (13) to the flange (16). The other end of the piston is ~~to~~ connected by an intermediate section to the cap of the piston (4), through the rod (9) which is driven by the auto regulator (17

With the aid of a screw (8) fitted ~~furnished~~ from the outside ~~of~~ with a knurled ~~nut~~ knob, one can change (modify) the ~~amount~~ of compression (pressure) on the spring (12).

On the end of the rod (9) the ~~button~~ priming knob. (11)

~~The case The base on top~~ The part of the case facing up is a threaded boss (hump) accepting a grease fitting (cup) (6) and the part ~~which~~ underneath is another hole (boss) filled with a drain bushing (14) (screw).

Regulation.

Do not modify the output pressure, it is permanently set.

II Carburator (see notice ZENITH)

Special attention must be taken for aviation engine. The ~~A~~ carburators ZENITH-STROMBERG, down draft have the same body for the types 60 IGS and 60 IGS A.

The principal parts of the carburator 60 IGS are as follows.

1° In the float chamber, a constant level of fuel is maintained, permitting the correct mixture (supply), even in steep climbs (angles of attack).

1 Fuel fill connection

6 Float valve axel

11 Mixture control lever

13 Main mixture adjustment screw

21 Idle mixture adjustment Screw

23 Idle ~~speed~~ Throttle chamber adjustment lever

37 Acceleration pump & richness control lever

46 butterfly (throttle) stop (Idle speed stop)

51 Choke control lever

58 Bushing to the pump jets

? 78 Bushing (bolt) over the mixture jet.

85 bolts to secure the cover of the carburato

91 Bolt (Bushing) to the fuel filter

92 Bushing (bolt) to the choke jet (starter)

96 Butterfly axel (throttle shaft)

99 Bushing over main jet.

120 Fuel cut off control lever (Etouffoir)

Fig 18 Exterior views of the carburator Zenith 60 IGS.

2° An Atomising System, assuring the proper mixture carburated at all speeds (of engin
It is automatically obtained with a device containing an "emersed jet" and an air tube carying
air and mixing it to create a fuel air "emulsion".

? 5° The idle, and higher speed settings (all settings) are combined in using the main jet

4° The mixture cut off "Étouffoir" cuts off the idle mixture operated by the pilot

b) **Mécanisme auto-régulateur.** — Ce mécanisme est logé dans un carter (15), assemblé au carter de la pompe (26) à l'aide de boulons avec interposition d'un joint.

Le mécanisme comporte un piston élastique (7) dont une extrémité est reliée par le tube (13) à l'embase (16). L'autre extrémité du piston est montée, par l'intermédiaire de la calotte du piston (4), sur la tige (9) portant l'obturateur d'auto-régulation (17).

A l'aide d'une vis (8) munie à l'extérieur d'un bouton moleté, on peut modifier le taux de compression du ressort (12).

En bout de la tige (9) est monté le bouton (11) d'amorçage.

Le carter présente à la partie supérieure un bossage fileté recevant un graisseur (6) et, à la partie inférieure, un autre bossage muni d'un bouchon de vidange (14).

Réglage

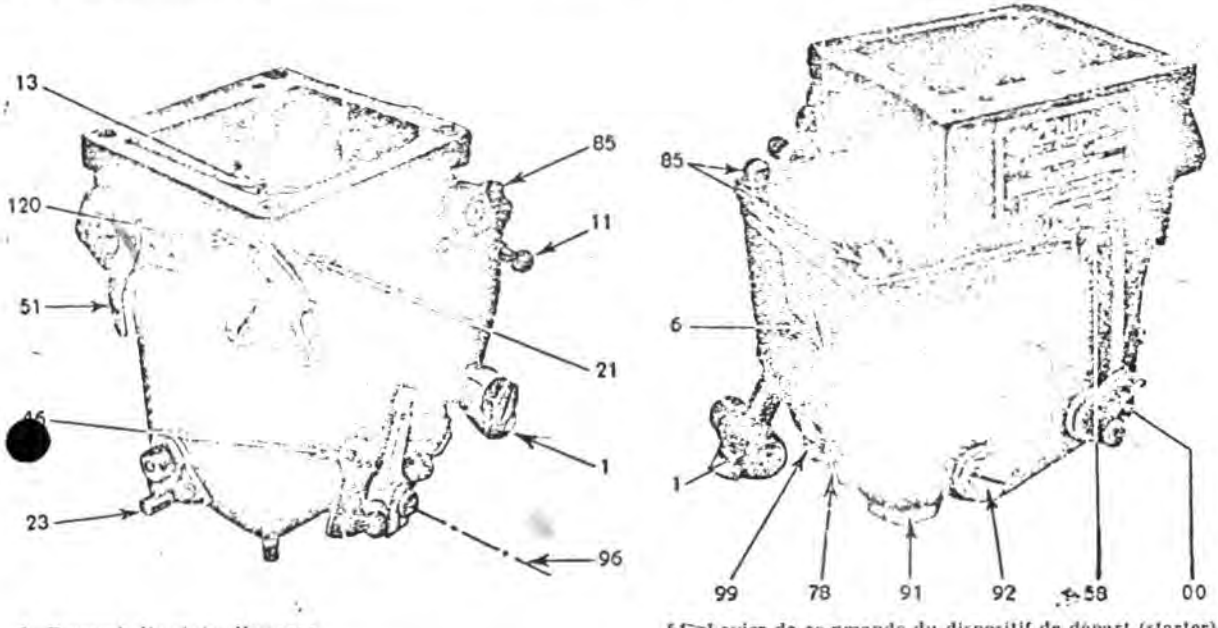
Ne pas modifier la pression de refoulement réglée une fois pour toutes.

II — CARBURATEUR (*Voir notice ZENITH*)

Spécialement étudiés pour les moteurs d'aviation, les carburateurs ZÉNITH-STROMBERG inversés, sont à simple corps, des types 60 IGS et 60 IGSA.

Les organes principaux du carburateur 60 IGS sont les suivants :

1° Une cuve à niveau d'essence constant, permettant une alimentation correcte, même dans les cas de fortes inclinaisons ;



1. Raccord d'arrivée d'essence.
6. Axe d'articulation du flotteur.
11. Levier de commande du correcteur altimétrique.
13. Vis de calibrage d'air d'émulsion principale.
21. Vis calibrée d'air d'émulsion du ralenti.
23. Manette de réglage du boisseau de ralenti.
37. Levier de commande de la pompe d'accélération et de l'enrichisseur.
46. Butée du papillon (réglage de vitesse du ralenti).
51. Levier de commande du dispositif de départ (starter).
58. Bouchon du gicleur de pompe.
78. Bouchon du gicleur d'enrichisseur.
85. Vis d'assemblage corps-couvercle.
91. Bouchon du filtre d'essence.
92. Bouchon du gicleur de starter.
96. Axe du papillon.
99. Bouchon du gicleur principal.
120. Levier de commande du piston d'étouffoir.

FIG. 18 — VUES EXTÉRIEURES DU CARBURATEUR « ZÉNITH » 60 IGS

2° Un système pulvérisateur, assurant une bonne homogénéité du mélange carburé à tous les régimes. L'automaticité étant obtenue par le dispositif du « gicleur noyé » avec émulsion par air pris en dérivation dans la manche à air ;

3° Un circuit de ralenti et de progression des régimes se combinant avec le système de pulvérisateur principal ;

4° Un dispositif d'arrêt du moteur (étouffoir), agissant par obturation totale du circuit de ralenti, sur commande à volonté du pilote ;

5° A choke for starting the engine (starter) provides a richer mixture for cold starting

6° An excelleration pump connected to the throttle, assures smooth operation between thrott settings

7° A pilot operated mixture control assures the proper mixture at the different altitudes

8° A butterfly value (throttle) changes the engine speed by regulating the amount of air-fuel mixture which enters the cylinders.

The different parts of the carburator are shown in figure 18.

Discription & Functions.

Fuel entering the float chamber.

Fuel enters into the the carburator through a moveable fitting (1), and is held in place with a bango bolt.

The fuel then enters a filter, which separates any impurities and then passes to the needle value (4)

Fig 19 Entrance of fuel, and float Chamber.

The systen to keep the fuel level constant consists of a float (2) racking around on axel(6 which controls a needle value (5). The seat(4) to the needle is screwed into the float chamber of the carburator, the top part guiding the pointer (needle), the bottom section regulating the fuel in flow, the regulation is caused by the partial and total interaction with the needle

The float chamber is vented through a tubing (canal) (8) A ball value (7) is placed in the mouth of the canal (8) in the float chamber to stop fuel from running out the vent while in inverted flight.

NBC 35 Renault 4P I. 2. 43

Device for ~~automatic~~ Vaporising the Fuel

Principle

The main role of the carburator: mix the correct amounts of air and fuel for the engine. and a secondary role: vaporise the fuel to make it volitile (explosive)

The most simple carburator consists of a float chamber to keep a constant fuel l[redacted], feeding a jet placed in the interior of the mixing throat at the entrance to the intake manifold.

More has been learned about carburetors, it is good to set up for median speeds, which ? give ~~much~~ plenty of fuel for high speeds, and less at low speeds. It is a result of the flow ? of the air and the fuel which is not the same, due to the different natures of the two.

The carburetors ZENITH-STROMBERG works with an arrangement of an submerged jet assuring automatic operation

5° Un dispositif de départ du moteur (starter), provoquant un enrichissement du mélange pour les départs à froid ;

6° Une pompe d'accélération solidaire du papillon, assurant de bonnes reprises ;

7° Un correcteur altimétrique, commandé par le pilote, permettant de corriger les variations de richesse du mélange carburé, en fonction de l'altitude ;

8° Un papillon de réglage de la vitesse du moteur, agissant par dosage de la quantité du mélange air-essence admis dans les cylindres.

Les différents organes de ce carburateur sont indiqués figure 18.

DESCRIPTION ET FONCTIONNEMENT

Arrivée d'essence et cuve à niveau constant *(fig. 19)*

L'arrivée d'essence placée à la partie inférieure du carburateur, est constituée par un raccord orientable (1), fixé par un axe fileté sur le corps du carburateur.

L'essence arrive au filtre (3) qui retient les impuretés et passe ensuite au siège de pointeau (4).

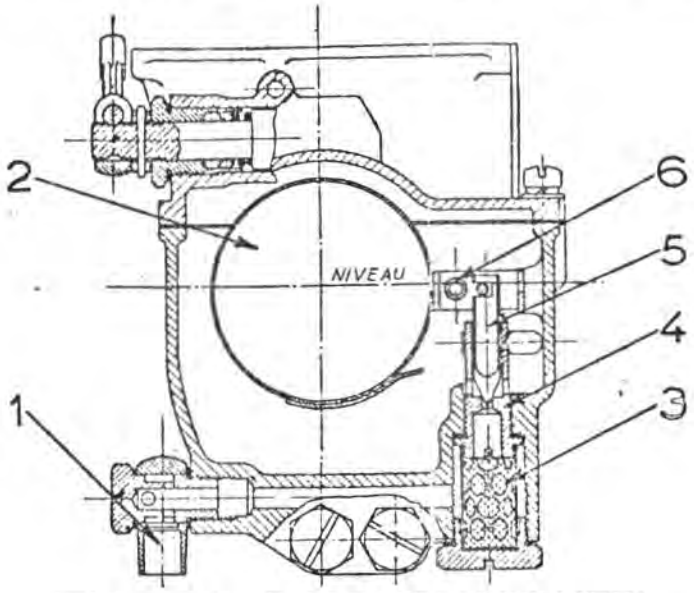


FIG. 19 — ARRIVÉE D'ESSENCE ET CUVE A NIVEAU CONSTANT

Le système à niveau constant se compose d'un flotteur (2) oscillant autour d'un axe (6) et venant commander un pointeau (5). Le siège de pointeau (4) est vissé dans la cuve du carburateur, la partie supérieure sert de guide au pointeau, la partie inférieure porte le calibrage d'arrivée d'essence, calibrage qui est obturé soit partiellement, soit totalement par le pointeau.

La cuve est mise en communication avec la manche à air pour équilibrage de la pression d'air, par un canal (8). Un clapet à bille (7) a été placé dans la cuve, au débouché du canal (8) *(fig. 22)* de la mise à l'air libre pour éviter que l'essence s'écoule vers la prise d'air dans la position inversée.

DISPOSITIF D'AUTOMATICITÉ ET DE PULVÉRISATION

Principe

Le carburateur a un rôle principal : doser la quantité d'essence en fonction de la quantité d'air aspirée par le moteur, et un rôle secondaire : pulvériser l'essence pour préparer sa volatilisation.

Le type le plus simple de carburateur à giclage se composerait d'un niveau constant d'essence alimentant un gicleur placé à l'intérieur d'un diffuseur, dans l'entrée de la canalisation d'aspiration du moteur.

L'expérience a montré qu'un tel carburateur, s'il est bien réglé pour une vitesse moyenne, donne trop d'essence aux grandes vitesses et pas assez aux petites. Cela tient à ce que les lois d'écoulement de l'air et de l'essence ne sont pas analogues à cause de la nature différente de ces deux éléments.

Les carburateurs ZÉNITH-STROMBERG sont réalisés avec la disposition classique du gicleur

In this arrangement, the jet or ~~orifice~~ calibrated orifice is placed in the float chamber, below the fuel level in a tube in which the vaporising takes place, ~~where~~ Air is brought down in another tube (Fig 20) In this fashion, as soon as the air enters the fuel, the engine is no longer drawing pure fuel but a mixture of fuel and air. Theory and experience (Figure 21) shows ~~which arrangement~~ a similar arrangement working automatically, ~~So to speak~~ It follows that the atomiser tube ends in the form of an intak manifold, creating a venturi, The quantity of fuel drawn into the submerged atomiser tube will be proportional, at all speeds, to the quantity of air drawn through the venturi.

Figure 20 Principal Figure 21 actual.

One can vary it automatically, ~~as~~ to form various diameters for the entrance of air to the Submerged jets (mixing tube), Further, the entrance for the air is small with respect to the holes into the ~~em~~ mixture tube. Also the proportion of fuel in the air is augmented by increase in the speed of airflow.

The principle described is illustrated in figures 20 & 21, and is ~~shown~~ done in the following manner

From the float chamber, fuel passes ~~th~~ through the ~~carburator~~ (~~calfustre-breuille~~) mixture control (9) and the main jet ~~Gicleur~~ (10) (fig 25) before arriving at the emulsifier (12) (fig 22)

fuel passing through the main jet, enters into the central emulsifier tube (12) (Fig 22) Through a callibrated hole, (13) air passes through a cannul (14) in the main mixture conduit (~~emu~~ (emusifier) passing the atamising holes (15) and is mixed with the fuel before it exits through the two lateral holes (16) of the diffuser (17) (Throat) a little bit below (? The body ?

Figure 22 Main mixing vessel (Emulsews) and idle ~~valve~~ jet

Idle

That which is shown in Figures 20 and 21 is not all that is necessary for the proper carburation at all engine speeds, The movement of air in the venturi doesn't create an sufficient vaccume to draw the fuel up to the exit holes of the vaporising tube

noyé pour assurer l'automaticité. Dans cette disposition, le gicleur ou orifice calibré est placé dans la cuve, plus bas que le niveau d'essence et prolongé par un tube dans lequel se fait l'aspiration mais où l'air pénètre au-dessous du niveau par un petit tube auxiliaire *(fig. 20)*. De cette façon, à partir de l'endroit où l'air pénètre, il n'est plus aspiré d'essence pure mais une émulsion d'air et d'essence.

La théorie et l'expérience *(fig. 21)* montrent qu'une semblable disposition donne l'automaticité, c'est-à-dire que si le tube du gicleur aboutit dans une conduite d'aspiration d'air en forme de venturi, la quantité d'essence aspirée dans le tube du gicleur noyé sera proportionnelle, à toutes les vitesses, à la quantité d'air aspirée à travers le venturi.

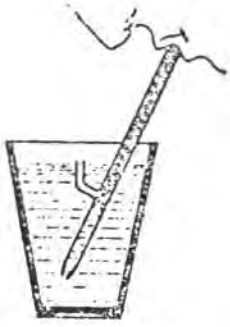


FIG. 20 — PRINCIPE

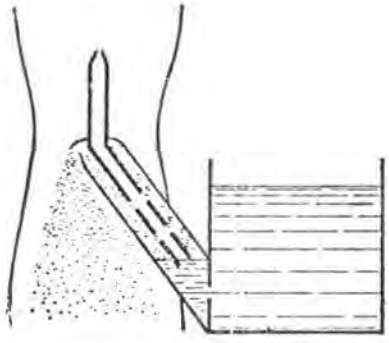


FIG. 21 — RÉALISATION

On peut faire varier l'automaticité en faisant varier le diamètre de l'entrée d'air dans le tube du gicleur noyé (ou tube d'émulsion) ; plus l'entrée d'air est petite par rapport au diamètre des trous de sortie d'émulsion, plus la proportion d'essence dans l'air tend à augmenter pour une augmentation de vitesse d'écoulement de l'air.

Le principe exposé ci-dessus et illustré figures 20 et 21 est réalisé de la façon suivante :

De la cuve à niveau constant, l'essence passe par le correcteur (9) et le gicleur principal (10) *(fig. 25)* avant d'arriver à l'émulseur en (12) *(fig. 22)*.

L'essence débitée par le gicleur se rend au tube émulseur central en (12) *(fig. 22)*. Par la vis de calibrage (13) l'air d'émulsion principale arrive dans un canal (14), passe par les trous de dénoyage (15) et vient émulsionner l'essence avant sa sortie par les deux trous latéraux (16), au centre du diffuseur (17) et un peu au-dessous de son corset.

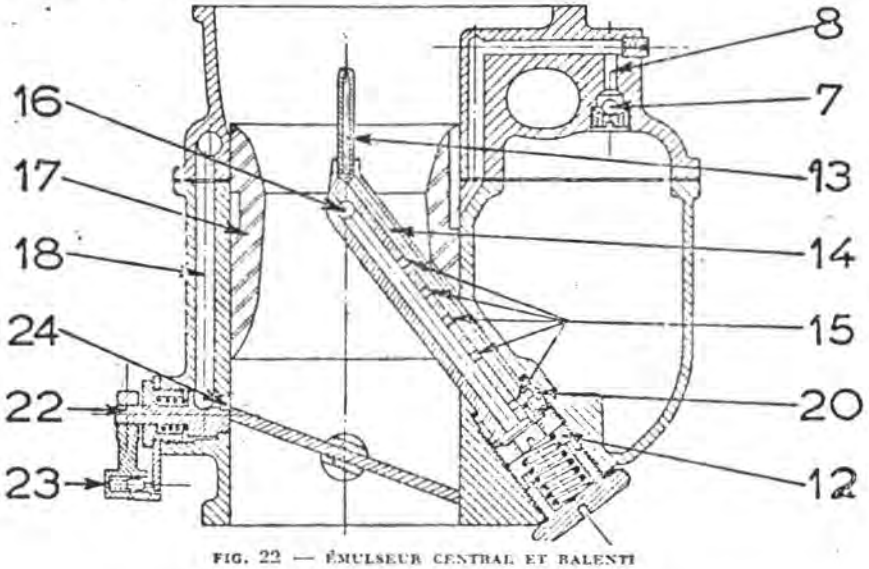


FIG. 22 — ÉMULSEUR CENTRAL ET RALENTI

Ralenti

La disposition des figures 20 et 21 ne répond pas à toutes les nécessités de la bonne carburation parce qu'à faible vitesse, le courant d'air dans le venturi ne crée pas une dépression suffisante pour faire monter l'essence jusqu'aux trous de sortie du tube principal d'émulsion.

The application of a pipe (conduit) next to the preceding arrangement, an auxilliary system; The "Idle system"

At low speeds, there is a high vaccume below the throttle valve, which is closed. As a recorse to ensure the proper intake mixture, an idle system (jet) is used, requiring the high vaccume.

The canal (tube) for the idle system (19) (figures 22 & 23) draws (opens), near the throttle valve. The fuel through the jet (10) (figure 25) which doesnt vaporise through the main vaporizing tube.

The canal consists of an idle jet (19, Figure 23) which at low speeds only, passes an amount of fuel (dose) which has already gone through the main jet (10) and then through the base of the vaporising tube, (12, Figure 22) by an angular canal (pipe) (20).

A callibrating screw (21 Figure 23) sets the proper quantity of air for a proper mixture at idle.

The idle throttle (22 Figure 22) is controlled by a lever (23) set permanently in such a position to keep a constant vaccume in the Idle system by the rotating Idle throttle. a countersunk hole, following the adjusting of the idle mixture.

The speed of the engine is regulated by a stop screw mounted on a lever (46) This stop is to obtain an amount of opening of the throttle valve needed to get the proper idle.

Engine stopping device (Etouffoir) (Idle mixture cut off)

In some cases, for security, one wishes to Stop the engine instantly. It is the purpose of the "Etouffoir" (stranglers) apparatus which permits the total cut off of the normal Idle system. (Figure 23)

Positions with the system open Positions with the system closed.

1

Figure 23 Aparatus for stopping the engine (ETouffoir)

A piston (25) contains bores to complete the idle system. With its displacement to the right, the tube (18) is blocked off, as is the fuel jet (19). The conical (cleck) valve (26) opens a passage, into the ~~canal~~ Idle canal, for air in the Idle system to enter the ventalation opening (2 The free flow between the idle jet, and a region of air pressure which is practically the same as is in the float chamber, decreases (kills) the vaccume, ~~is made possible~~ in the atomiser by opening a Through air passage with the slide valve (25). The intention to stop the engine isn't assured if the throllle valve (Butterfly valve) is not previously closed. (the vaporiser not primed (started))

Choke Mechanism (Starter)

The richness of the mixture when starting, especially when it is cold, must be richer than during the normal idle setting due to inevitable condensation in the pipes, and the vaporiser is less efficient since the pipe walls as well as the fuel are cold.

These considerations have led to the provision of a special aparatus (deuce) for starting (figure 24) consisting of a small auxilliary carburator independent of the main one

A ~~Throttle~~ choke valve (50) is operated by a lever (51) connected to the cockpit with a flexible cable. ~~When in~~ the position "Fermé" (closed) ~~the engine (carburator) functions normally, in the position "Ouvert" (open)~~ is for normal running, the position "Ouvert" (open) is for cold starts.

When the ~~Throttle~~ choke valve is in the "Ouvert" position a canal in the large section (49), opening further down-

La pratique a conduit à ajouter à la précédente disposition un circuit auxiliaire: le « Circuit de ralenti ».

Aux régimes de faible puissance il existe une forte dépression en aval du papillon alors presque fermé. On a recours pour assurer l'alimentation du moteur au « Circuit de ralenti » en utilisant cette forte dépression.

Le canal de ralenti (18) *(fig. 22 et 23)* entraîne vers le papillon l'essence du gicleur (10) *(fig. 25)* qui ne peut être aspirée par le tube principal d'émulsion.

Ce canal comporte un gicleur de ralenti (19) *(fig. 23)* qui, aux faibles vitesses seulement, dose l'essence débitée par le jet calibré principal (10) et prise en (12) *(fig. 22)* par la gorge annulaire (20).

Une vis calibrée (21) *(fig. 23)* dose la quantité d'air pour émulsionner l'essence au ralenti.

Le petit boisseau (22) *(fig. 22)* commandé par le levier (23) permet de faire varier la dépression sur le circuit de ralenti, par la rotation d'une fraisure (24) et, par suite, de régler la richesse du ralenti.

La vitesse du moteur est réglée par une vis butée, montée sur le levier (46). Cette butée fait obtenir une ouverture du papillon plus ou moins grande selon le régime désiré.

DISPOSITIF D'ARRET DU MOTEUR (Étouffoir)

Dans certains cas et pour des raisons de sécurité, on peut avoir besoin de l'arrêt instantané du moteur. C'est le but du dispositif d'étouffoir qui permet de couper totalement le circuit normal du ralenti *(fig. 23)*, par manœuvre du levier.

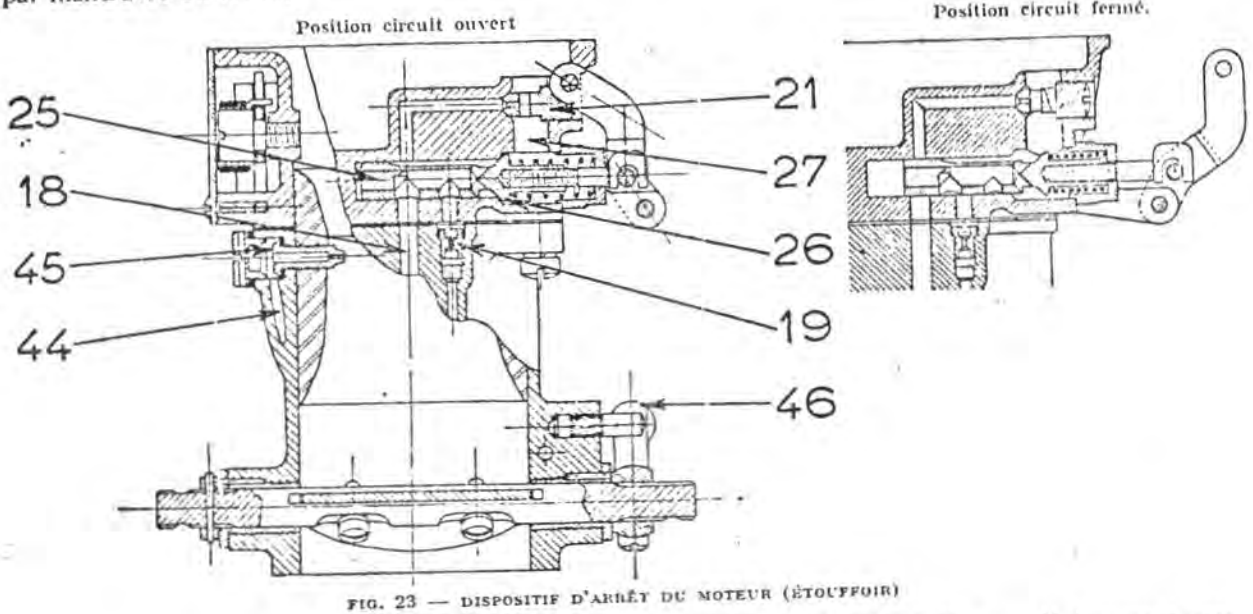


FIG. 23 — DISPOSITIF D'ARRÊT DU MOTEUR (ÉTOUFFOIR)

Un piston (25) comprend des perçages faisant partie du circuit de ralenti. Par son déplacement vers la droite, le canal (18) sera obturé ainsi que la sortie d'essence du gicleur (19). Le cône clapet (26) livrera passage, vers le canal de ralenti, à l'air pris dans la prise d'air en (27). Cette mise en communication du gicleur de ralenti avec une région où la pression d'air est pratiquement la même que dans la cuve, supprime la dépression qui peut subsister sur ce gicleur par suite d'une mauvaise étanchéité possible du tiroir (25). Bien entendu l'arrêt n'est sûr que si le papillon est préalablement fermé (émulseur non amorcé).

DISPOSITIF DE DÉPART (Starter)

La richesse du mélange au départ, surtout par temps froid, doit être plus grande qu'en marche normale sur le ralenti, pour tenir compte des condensations inévitables dans les tubulures et d'une vaporisation moins complète du combustible due au fait que les parois de la tubulure d'admission sont froides.

Ces considérations ont conduit à prévoir un dispositif spécial pour le départ *(fig. 24)* constituant un petit carburateur auxiliaire indépendant du carburateur proprement dit.

Un boisseau (50) est actionné par un levier (51), relié au poste de pilotage par un câble flexible. On passe de la position « Fermé » en marche normale à la position « Ouvert » pour le départ à froid.

Lorsque le boisseau est à la position « Ouvert », un canal de forte section (49), débouchant en aval

below the butterfly valve, is connected with a ~~with~~ free flow of air through an orifice (c) and draws on fuel through the jet (47). The jet has two calibrated holes," a "and "b". They control the passage of fuel from the float chamber and a reserve well. This reserve produces an over rich mixture on the first intake strokes, the well draining rapidly, because The jet (b) ~~Jet~~ is passing fuel because of ~~under~~ the great vaccume under the butterfly valve, and the jet (a) limiting the total amount of fuel that can enter the well. Air ~~entering~~ entering the hole (d) creates a mixture with the fuel which comes through the jet (47)

When the engine is warm, one should close the choke (starter)

The choke is permanently adjusted, in any case, it should not need to be reset (readjusted)

~~Operation~~ Closed Position Open Position Cutaway x x'

Figure 24 Choke mechanism (Starter)

MIXTURE CONTROL

It is known that, everything else being equal (the same), the mixture drawn into the engine becomes richer with the higher altitude as a function of the decreased air density. To maintain its proportions The proper mixture, and keep ~~it~~ in line while climbing one must reduce the amount of fuel along with the ~~amount~~ amount of air pressure.

The fuel reduction is controlled by the pilot who operates the mixture control device. (figure 25)

Figure 25 Mixture control

du papillon, communique avec la prise d'air par un orifice (c) et aspire par un canal (75) l'essence débitée par le gicleur (47). Ce gicleur (47) comporte deux trous calibrés a et b. Ils contrôlent le débit d'essence entre la cuve et un puits (48) formant réserve. Cette réserve produit un surenrichissement dès les premières aspirations, le dénoyage s'opère rapidement, le gicleur (b) débitant sous la grande dépression qui règne en aval du papillon, le gicleur (a) limitant la valeur du débit maximum. Le trou d'air (d) émulsionne l'essence débitée par le gicleur (47).

Dès que le moteur est chaud, on referme le starter.

Le starter est réglé une fois pour toutes, en aucun cas il n'y aura lieu d'en retoucher le réglage.

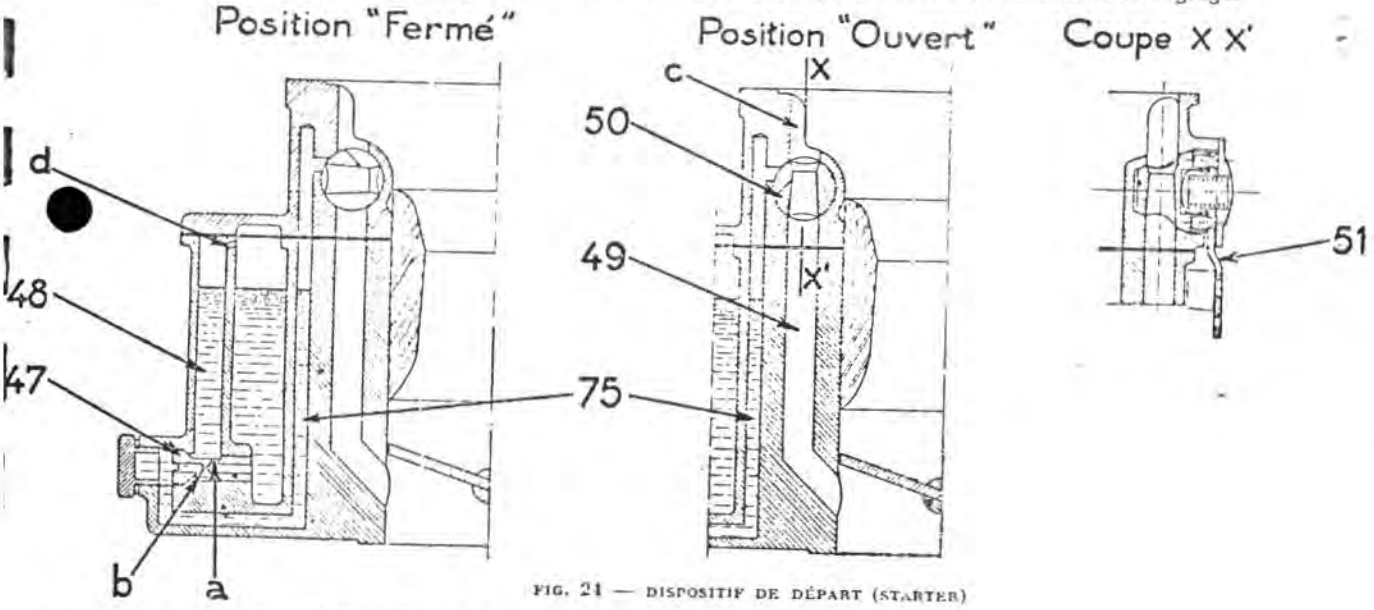


FIG. 24 — DISPOSITIF DE DÉPART (STARTER)

CORRECTEUR ALTIMÉTRIQUE

Il est connu que, toutes choses égales par ailleurs, le mélange gazeux aspiré par le moteur s'enrichit quand l'altitude croît, c'est-à-dire en fonction de la diminution de densité de l'air. Pour maintenir le mélange en proportions convenables on doit, en montée, réduire le débit d'essence parallèlement à la diminution de la pression atmosphérique.

Cette réduction du débit d'essence est faite par le pilote qui dispose de la commande du dispositif de correction *(fig. 25)*.

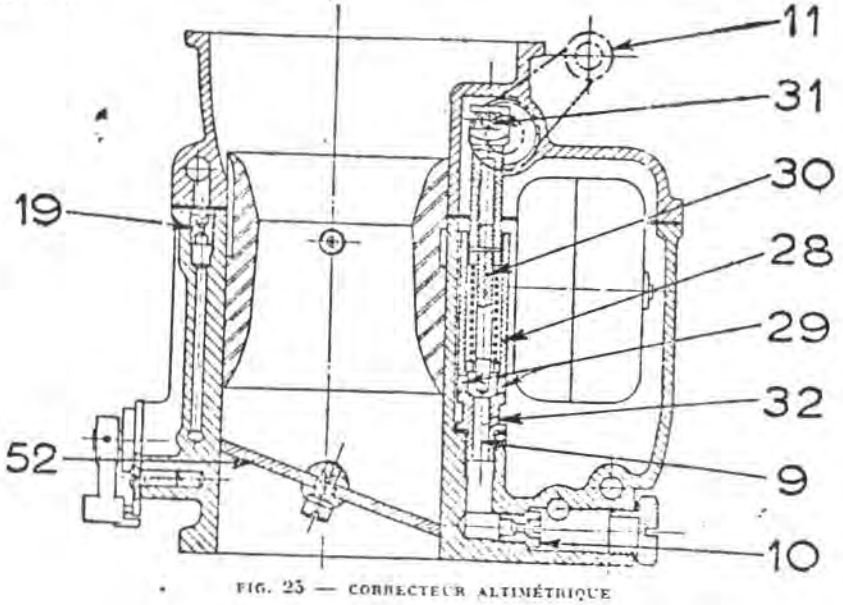


FIG. 25 — CORRECTEUR ALTIMÉTRIQUE

The correction is made directly in the main fuel system, by decreasing the size of the opening in the main jet (10). The seat (28) contains two holes for fuel to enter (29) and one for fuel to exit (9), and is screwed into the block of the carburator (the base of the casing). Inside the seat, a needle valve (30) of special profile, is pushed into the hole (9) by the rotation of an excentric (31).

This excentric is secured to the same axel as the control crank (lever) (11) which is connected to the pilot's control.

A hole (32) limits the Leanness of the mixture when the needle valve (30) is fully seated in the hole (9)

The profile of the needle valve has been set in such a manner as to keep the correct amount of correction (mixture) with the changes in the pilots control lever. (allowing full tra

ACCELLERATION PUMP

The difference in the air density and fuel density at ~~the~~ The time when the throttle is opened quickly, a delay is found in the increas of fuel supply with the increased air supply creates the need to inject fuel with a mechanical system called an "Acceleration pump." (Figure 26)

Figure 26 Acceleration pump.

The pump is composed of the following:

1° A bell shaped cylinder (36) is controlled by the movement of the butterfly valve throu an intermidiary lever (37) pushing on a push rod (38), a rocker arm (40) which pushes on the pump shaft (tube) (39)

2° A piston (41) is pushed over (allong) an ~~axel~~ axle (42)

The piston has constant pressure near its top by a spring (43) which holds it against the head of the hollow axle.

This head carries the holes for passage to the interior of the axle and ~~flame~~ from the piston. Through the canal (44) to the pump jet (45, Figure 23) which regulates the ammount of fuel used each time (depending on the ammount of throttle travel

When one closes the throttle The cylinder (Bell) of the pump is returned upwards and refills with fuel which passes from the fleat chamber between the gaps between the piston and (bell) cylinder. When one opens the throttle quickly, The cylinder (bell) slips down words forcing the ~~cy~~ piston down, opening the holes in the ~~axle~~ head of the axle, forcing fuel into the canal (44) and through the pump jet (45). The pump action continues after the cylinder has stepped, since the piston continues to return to its orrigional position due to the return spring, (43) closing the holes in the axel

INCREASING THE POWER.

If one wishes the proper richness to suit operations at full throttle (a richness a little more than needed for the power setting, to avoid overheating the engine while in the air) it is difficult to get an richness at all speeds of cruse, which is eccenomical, and will support the engine in inverted flight.

La correction se fait directement sur l'essence du circuit principal, par diminution de la section de passage vers le gicleur (10).

Le siège (28) comprend deux trous d'entrée d'essence (29) et un trou de sortie (9), cette pièce est vissée, bloquée sur le corps du carburateur. A l'intérieur de ce siège, se déplace une aiguille (30), de profil spécial, qui obture le trou (9) par la rotation de l'excentrique (31).

Cet excentrique est fixé sur le même axe que le levier de commande (11) relié au poste de pilotage.

Un trou (32) limite l'appauvrissement lorsque l'aiguille (30) obture complètement le trou (9).

Le profil de l'aiguille a été déterminé de telle sorte que les pourcentages de correction soient proportionnels aux déplacements angulaires de la manette pilote.

POMPE DE REPRISE

La différence de densité de l'air et de l'essence provoque au moment des reprises brusques, un retard de débit d'essence par rapport au débit de l'air et oblige à fournir un appoint d'essence par un système mécanique appelé « pompe de reprise » *(fig. 26)*.

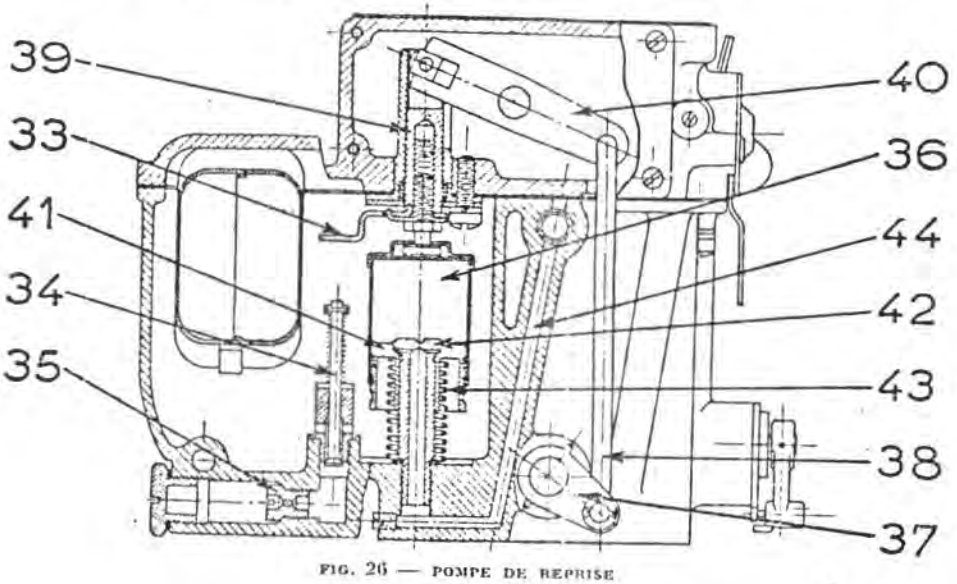


FIG. 26 — POMPE DE REPRISE

La pompe proprement dite se compose :

1° D'une cloche (36) commandée par le mouvement du papillon par l'intermédiaire du levier (37), de la bielle (38), du balancier (40), du poussoir ou tige de pompe (39) ;

2° D'un piston (41) pouvant coulisser sur un axe (42) ;

Ce piston est constamment poussé vers le haut par un ressort (43) et vient s'appuyer sur la tête de l'axe creux (42).

Cette tête porte des trous communiquant avec l'intérieur de l'axe et de là, par un canal (44), au gicleur de pompe (45) *(fig. 23)* qui règle la quantité d'essence utilisée aux reprises.

Lorsqu'on referme le papillon, la cloche de pompe, en remontant, se remplit normalement d'essence prise dans la cuve par le jeu existant entre le piston et la cloche. Lorsqu'on ouvre brusquement le papillon des gaz, la cloche s'abaisse, l'essence refoule le piston et peut pénétrer par les trous de la tête de l'axe dans le canal (44) du gicleur de pompe (45). L'action de la pompe se prolonge après le mouvement de la cloche jusqu'à ce que le piston ait fini de remonter sous l'action du ressort (43), et vienne buter sur la tête de l'axe de pompe obturant ainsi les trous de refoulement.

ENRICHISSEUR DE PUISSANCE

Si on veut réaliser la richesse qui convient au fonctionnement « plein gaz » (richesse un peu supérieure à celle strictement nécessaire pour obtenir la puissance de façon à éviter l'échauffement des différents organes, surtout dans le cas de moteur à air), il est difficile de réaliser aux régimes de croisière la richesse la plus économique que peut supporter le moteur et inversement.

Le carburateur type 60 IGS possède un perfectionnement qui a consisté à adjoindre aux organes décrits précédemment un dispositif d'enrichissement de puissance *(fig. 26)* comportant un gicleur (35) qui, en parallèle avec le gicleur principal (10) *(fig. 25)* peut alimenter l'émulseur en même temps que lui.

Le gicleur principal peut avoir ainsi une dimension plus faible et donner le réglage de croisière le plus économique compatible avec la tenue des organes moteur. Au « plein gaz », on retrouve une richesse suffisante grâce à l'entrée en action du gicleur d'enrichisseur.

La tige de pompe (39) *(fig. 26)* qui est liée aux mouvements du papillon, entraîne dans ses déplacements la palette (33).

Avant que le papillon arrive à sa pleine ouverture, la palette appuie sur la queue de la soupape (34) *(fig. 26)* livrant passage à l'essence vers le gicleur d'enrichisseur (35).

L'essence débitée par ce gicleur est canalisée vers le tube d'émulsion principal en (12) *(fig. 22)*.

Le profil de l'aiguille et le point de début d'ouverture sont déterminés une fois pour toutes.

POUR LES MOTEURS 4 P 03 et 4 P 05

Dispositif de vol inversé : Carburateur 60 IGSA *(fig. 27 et 28)*.

Les carburateurs dont l'indication du type est affecté de l'indice A, sont munis d'un dispositif permettant le vol inversé. Ce dispositif se compose essentiellement d'un siège spécial (121) qui, dans sa partie supérieure, est identique au siège (4) de série, mais qui comporte à sa partie inférieure un guide dans lequel coulisse librement le clapet mobile (122). Un bouchon (123) sur lequel repose normalement le clapet mobile (122) ferme la base du guide.

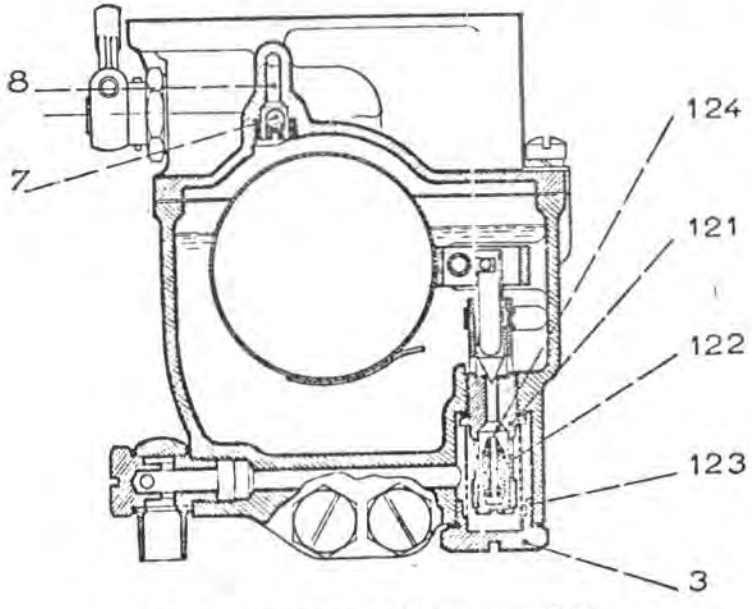


FIG. 27 — FONCTIONNEMENT EN VOL NORMAL

Le clapet qui affecte la forme d'un pointeau à section carrée est percé suivant son axe d'un orifice calibré (124).

Fonctionnement

En position normale *(fig. 27)*, le clapet mobile (122) repose sur le bouchon (123) et il n'intervient pas dans le circuit d'alimentation d'essence qui s'effectue de la façon habituelle par le siège d'arrivée d'essence contrôlé par le pointeau (5).

Au contraire, lorsque l'avion passe en vol inversé *(fig. 28)* le clapet mobile (122) par son propre poids vient obturer le siège (121) tandis que le poin-

The carburator type 60 IGS has an ~~perfection~~ improvement which consists of the joining of parts previously described in the power mixture mechanism (figure 26) allowing a jet (35) which is in parralell with the main jet (10 figure 25) to provide a mixture the same as norm

The main jet ~~also has a shutter~~ in this (manner) way has a small opening set up to regulate the most efficient mixture for cruise with proper engine operation. At full power, the required richness is sufficiently provided by the "richness jet"

The pump rod (39 figure 26) which is operated by movements of the throttle valve, is attached to, and moves the arm (33)

After the Throttle has opened pased a given point, the arm presses on the top of the value (34 Figure 26) allowing fuel to flow to the richness jet (35)

The fuel passing Through this jet goes Throug a tube to the ~~tube~~ of the main vaporising tube (12 Figure 22)

The profile of the needle and the size of the seat opening are permanently set.

For Engines 4P05 and 4P03

Equipment for Inverted flight: Carburator 60 IGSA (Figures 27 & 28)

Carburators of this type are identified by the leter "A", and include equipment allowing inverted flight. This mechanism is essentially composed of a special seat (value) (121) which in the upper section is identical to the float value seat (4) ~~but~~ but which, in the lower section is a guide in which a free sliding, movable value (122). A bolt (bushing) (123) on which the movable value normally rests, closes the base of the guide.

Figure 27 Functioning (positions) in normal flight.

The value which is shaped like a pointer, is ~~bored~~ bored out down its center to a specified calibration (an orifice of specific ~~size~~ size). (124)

Operation

In the normal position (Figure 27) the movable valve (122) rests on the bolt (123), and doesn't intervene with the fuel intake system; which is controlled by the needle valve (5).

On the contrairy, when the airplane passes into inverted flight (figure 28) the movable valve (12 by its own weight, slides into the seat (121), whereas the needle valve (5)

controlled by the float (2) completely disengages (is completely removed) from the orifice it previously controlled. The amount of fuel passing is now controlled by the diameter of the hole through the center of movable valve, and the pressure created by the fuel pumps (220 g/cm²). The diameter of the orifice is determined for the correct function of the engine at "P G" (Full Gas) (Cruise) Full or cruise throttle. It follows therefore that at speeds less than "P G" the mixture will be too rich.

On will notice that in the inverted position the ball (7) obstructs the canal (8) which vents the float chamber., This is to prevent the carburator (fuel) from draining. It should be noted that this discription is limited: To insure a flight with the right amount of fuel, for small variations in engine speeds, particularly at full throttle the changing from normal to inverted flight should be done in a rapid manuver. It does not allow flying on the side, or in an aileron roll.

Figure 28 Operation in inverted flight.

Dismantling and Maintenance.

Fuel Intrance Filter.

Every thirty hours, clean the filter (3)

In replacing it, engage the filter in the groove in the lower edge of the needle valve seat. Put the bolt (Bushing) back into the socket, and Safety wire it. (Brake it)

24 mm wrench

For Carburetor IGSA equiped on the 4P03305 Every 30 hours, dismount the filter bolt (3), un screw the bolt (bushing) (123), and check for the free movement of the inverted flight needle valve (122)

#10 screwdriver

Carefully clean the valve housing with an injection of pressurised air or fuel.

Replace the valve (122) The blocking bolt (bushing) (123).

#10 Screwdriver

Verify That The sliding valve is free.

Engage The filter in the groove in the bottom of the needle valve seat, screw in the filter bolt (bushing) (3) in its socket; Safety stop it.

24 mm wrench

See figure 27 & 28

teau (5) sollicité par le flotteur (2) dégage complètement l'orifice qu'il contrôlait précédemment. Le debit est alors défini par le diamètre du trou central (124) du mobile et la pression de la pompe d'alimentation (220 g/cm2). Le diamètre de l'orifice a été déterminé pour que le fonctionnement du moteur soit correct au régime de PG. Il s'ensuit que l'automaticité de l'appareil n'est plus assurée et que pour les régimes inférieurs au PG le mélange s'enrichit.

On remarquera que dans la position inversée, la bille (7) obture le canal (8) de mise à l'air de cuve, ce qui évite l'écoulement du carburant vers la prise d'air. Il faut noter également que le dispositif décrit a un but limité : **assurer un vol sur le dos correct, pour de faibles variations de régime en partant du plein gaz, le passage en position inversée étant obtenu par une manœuvre rapide. Il ne peut en aucun cas permettre le vol en tranche, ni le tonneau lent.**

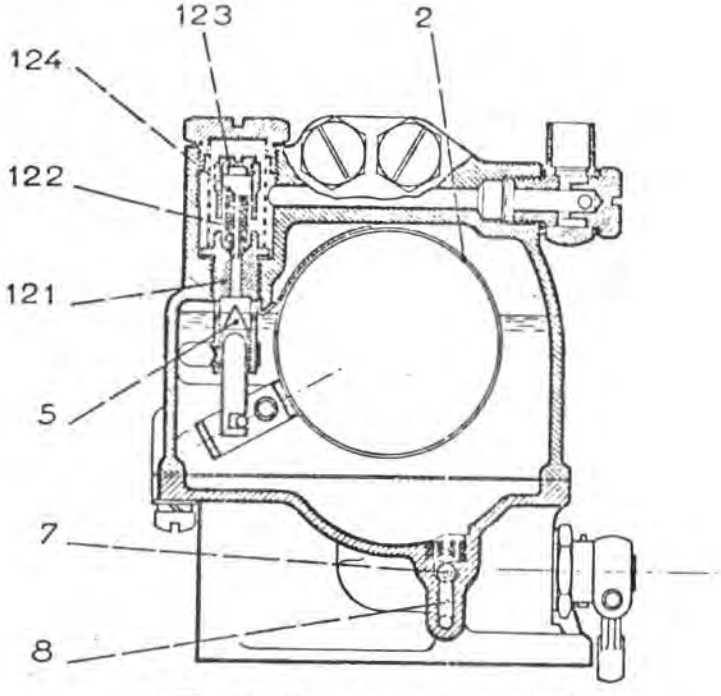


FIG. 28 — FONCTIONNEMENT EN VOL INVERSÉ

DÉMONTAGE ET ENTRETIEN

Filtre d'arrivée d'essence :

— Toutes les 30 heures, nettoyage du filtre (3).
Au remontage, engager le filtre sur le guidage inférieur du siège de pointeau (4).

— Bloquer le bouchon sur le joint et freiner. . . . . Clé de 24

Pour carburateur 60 IGSA équipant les 4 P 03-05

Toutes les 30 heures, démonter le bouchon de filtre (3), dévisser le bouchon (123) et dégager le clapet de vol inversé (122) . . . . . Tournevis de 10

Nettoyer soigneusement le logement du clapet par injection d'essence ou d'air sous pression ;

Remettre en place le clapet (122), bloquer le bouchon (123).

Vérifier que le clapet se déplace librement . . . . . Tournevis de 10

Engager le filtre sur le guidage inférieur du siège de pointeau, bloquer le bouchon filtre (3) sur son joint ; freiner. . Clé de 24

Voir fig. 27 et 28.

Gets

- Parts to check and cleane:
- Main Jet (10) — 13.004 M.
- Enrichening Jet (35) — Zenith wrench (1
  Age doesn't cause a detericoration of the seal ~~(...)~~ of the jet in its seat, allowing it to be remounted.
- Remount the ~~bat~~ Jet cap bolts, and safty wire them — 16 mm wrench.
- Choke jet. (47):
  When rephounting ~~tighten its socket, and safty it (the butterfly in place)~~ tighten the retaining bolt, and safety it. — 16 mm wrench.
- Idle Jet (19) accessible by removing the carburator cover (top) from the main casting. — #6 screwdriver.

Acceleration pump jet. (45)
When remounting, put in cover bolt, and safety it. — #6 screwdriver

Disassembling the Carburator Cover from the main float casting.

- Remove the safety wire
- Unscrew the six retaining screws — # 10 screwdriver.
- Disconnect the Acceleration pump push rod by removing the cotter pin and washer from the push rod at the throttle crank end.
- Slide the push rod out of the slot in the crank arm when the throttle is in the full open position.
- Separate the cover from the ~~float~~ float chamber, being careful not to damage the centering pins between the joining pieces.
- The fuel pump bell cylinder, vent, and mixture control needle come out with the cover.:
- The fuel pump bell cylinder is held in place by a flange which is slid laterally into an enclosure in the top of the cylender
- When remounting place the return spring of the mixture control needle in the needle guide (28):
- Slide the Acceleration pump bell cylinder onto the flange of the operating shaft lower the cover while checking that the mixture control needle is in its seat (guide) and the acceleration pump cylindor is on the piston;
- replace the six retaining screws and safety wire them.
  Remount the Acceleration pump push rod, replace the washer, and insert the cotter pin. — # 10 screwdriver

Float Level

- Check the free travel of the float and needle valve, also check the valve for wear.
- Make shre the valve seat is properly safetied. If changing these parts see the chapter on operational adjustments, and measurements for the float level.

Mixture Control.

- Unscrew the nut on the control shaft (~~axle~~ axle)
- Pull the ~~axle~~ axle strait out. To replace the cork (gasget) on the axle, unpin the stop, marking its position on the axle, so that it can be ~~replaced~~ positioned in the same place upon reasembly:
- Take out the bolt and spring.

When remounting, ~~engage~~ place the head (~~top~~ needleend) of the mixture control needle in its guideway, with the back of the ~~fork groove near the basset hole of the float chamber~~ side control fork near the float chamber wall; start to screw on the bolt, with the eccentric pin partially engaged in the slot of the mixture control needle: Try to turn the shaft 180° to bring the back of the fork near the float wall. Secure the mechanism, Safty wire the locking ~~screw~~ nut.

21 mm extra thin socket required.

Pump Control (drive)

- Unscrew The four screws which secure the plate over The rocker arm — #10 screwdrive
- Check for ware on the rods, ~~and~~ rokerarm, and bearings (fittings)
- Grease or oil The mechanism. Replace the plate, and secure The 4 screws and Safety them. — #16 screwdrive
- In The float chamber, ~~be sure~~ The pump axle (42) should be completely blocked
- Make certain That The piston slides freely over The axle, and That play is normal.

Vaporiser

- Do not dismount it. See that The supporting screw is properly blocked (safetyed) on The spherical washer
- Clean by injecting fuel or air under pressure.

Idle Throttle Chamber

- Unscrew The screws securing The assembly. — Flat wrench 17
- Remove the Throttle ~~chamber~~, cleaning it and its housing;
- Carefully remount it in The ~~position initially~~ same position prior to reveral.
- Safety the two screws.

Choke.

- ~~Unscr~~(remove) The two screws which support The assembly — #10 Screwdrive
- Remove The Throlle chamber, The spring and control lever
- Carefully clean The Throlle unit and its housing:
- grease or oil it, and remount it.
- Safety The two ~~securing~~ screws.

Idle cut off.

- Remove The two screws which support The assembly — #10 screwdri
- ?. Remove The piston ~~from the~~ and ~~extention~~ 3 fer by pulling strait out, so as not to bend The piston stem
- Carefully clean The piston and its housing.
- Grease or oil it.
- Remount.

Power mixture richener. (avoid dismantling)

- place The screw-driver on The seat of The valve (34) and unscrew it — Special Zenith Screwdrive

- Inject air or fuel under pressure in the housing and valve seat.
- Remount tightly.
- Check for free travel of the needle, and a quick return to its ~~position~~ proper position.

Chapter VIII
Ignition

Magneto Controlls

The dual ignition is generated by the two magnetoes, located on either side of the rear crankcase housing. The left magneto is equiped with a "declic" permitting the Propping of the engine

The magnetoes are driven by a helical gear on a magneto shaft, and another on the end of the crankshaft.

The magneto driveshaft is coupled to the magnetos with an elastic coupling.

Magnetos SEV Type 211 without "Déclic" and 210 with "déclic"

The magneto is of the type with a fixed induction coil, and revolving magnet. The primary current is interupted by the points with each lobe of the cam. These interuptions are carried through the primary contacts. ~~A condenser~~

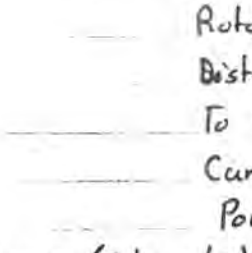


Figure 29 Drawing (Schematic) of a magneto.

A condenser absorbs the overflow current, and prevents the sparking (arking across points) caused by the self induction. The current energized in the secondary winding passes through a strip of carbon turning past the contacts on the magneto cap and on to the spark plugs in the following firing order 1, 3, 4, 2.

Magnetic Rotor Assembly. (figure 41)

The magnetic rotor consists of essentially the following parts.

- drive shaft (27)
- drive gear (28)
- Advance (29)
- Magnet (30)
- breaker cams (31)

The assembly all rotates on the same shaft.

The variation in flux is obtained by rotating a cylindrical magnet which has plates at the extremities which carry the flux out to the sides.

The breaker cam turns with the magnetic rotor, and is situated at the end of the rotor shaft.

The rotor is supported by the magneto drive axle, around which it is able to turn

CHAPITRE VIII

ALLUMAGE

COMMANDE DES MAGNÉTOS

L'allumage double se fait par deux magnétos disposées de part et d'autre du couvercle AR. La magnéto gauche est munie d'un dispositif à déclic qui facilite le lancement du moteur.

Les magnétos sont entraînées par un pignon de commande en prise avec le pignon de renvoi fixé en bout du vilebrequin.

L'arbre de commande transmet son mouvement à la magnéto par un accouplement élastique.

MAGNÉTOS S. E. V. TYPES 211 SANS DÉCLIC ET 210 AVEC DÉCLIC

La magnéto est du type à induit fixe et aimant tournant. Le courant primaire est interrompu par le levier de rupture, à chaque bossage de la came. Les ruptures se produisent entre les contacts primaires.

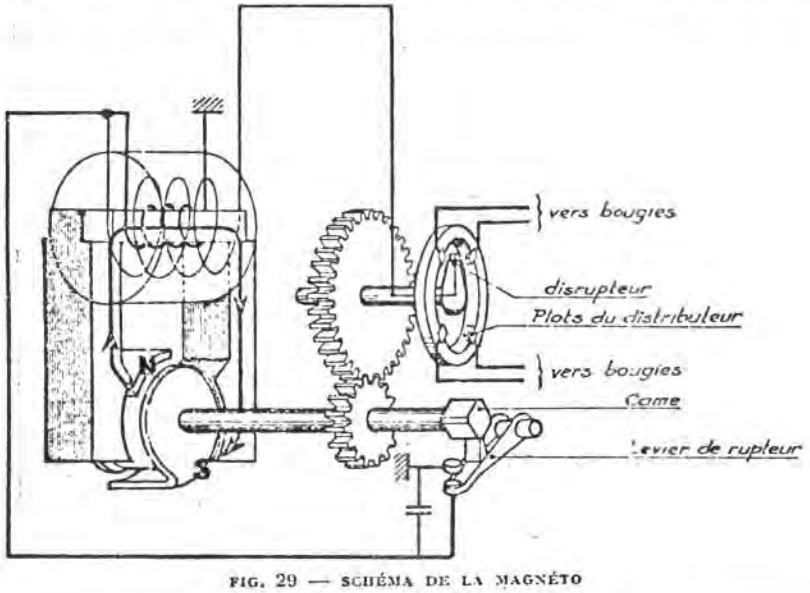


FIG. 29 — SCHÉMA DE LA MAGNÉTO

Un condensateur absorbe l'extra-courant et évite les étincelles dues à la self-induction. Le courant engendré dans l'enroulement secondaire arrive au charbon tournant du porte disrupteur et est conduit aux bougies dans l'ordre d'allumage suivant : 1-3-4-2.

ROTOR COMPLET *(fig. 41)*

Le rotor est composé essentiellement des organes suivants :

— Axe de commande (27) ;
— Pignon de distribution (28) ;
— Régulateur d'avance (29) ;
— Aimant (30) ;
— Came de rupture (31) ;

l'ensemble se trouvant sur le même axe de rotation.

La variation du flux est obtenue par la rotation de l'aimant de forme cylindrique tubulaire, et ses épanouissements fixés aux extrémités répartissent convenablement le flux.

La came du rupteur tourne avec le rotor et est centrée et fixée à son extrémité.

Le rotor est supporté par l'axe de commande de la magnéto, autour duquel il peut tourner d'une

a small amount, a result of of an automatic advance mechanism, secured to the magneto drive shaft, which changes the angular phase.

The automatic advance consists of two flyweights rotating on separate axes, which are pushed outwards by centrifical force. The flyweights are held to the rotor with pins, extending from the extremities of the flyweights, which engage in inclined slots in the rotor.

Two opposing return springs, creating an equillibrium with the effects of centrifical forces, result in the proper advance required at all times.

This mechanism permits ~~the~~ an automatic angular shift of 25°

This shift doesn't influence the induced opening - no connection between the breaker points and the magnetic field (poles), The cam, however, is always fixed to the rotor. The magneto always gives a full spark, which is particularly important when starting.

Distribution

The distribution of high voltage to the points in the distributor is done with a distributor rotor ~~f~~ured to the distributor drive gear.

Stationary parts

The fixed magnetic circuit is encased in an Aluminum housing, and is arranged so that the Magnetic field carriers (on the rotor) pass by creating a succession of alternating polarities. This curcuit carries the magnetic flux through the coil, which is ~~wraped~~ wound around the fixed magnetic curcuit.

The housing contains the rear thrust bearing, as well as that of the main drive shaft.

Coil (figure 32)

The coil is a strong single unit, which is verry accessible. Both the high, and low voltage coils are wraped around the magnetic core, and are encased in an insulating material which will also hinder deterioration.

The coil demonstrates without intervention regardless of what happens to the other parts of the magnetos, any demagnitization is not a problem.

A single connection is made outside the coil directly with the condenser, and the points. The condenser is located in front of the coil, and is connected with the coil through the bolt sticking out the right end.

Points (figure 33)

The points are fixed in place, and are controlled by a cam turning with the rotor.

Its function is to provide proper voltages at all speeds of the engine.

It comprises of a rigid plate (14) supporting the pin around which the half of the points which is moved by the cam, pivots, This continually lubricated, with a lubrication shield being employed to keep the points free of oil. The result is a longer lasting unit, noticeable by the frequency of re adjusting required.

The point aparatus is secured in place. It contains special equipment to keep it from being altered by the vibrations of the engine (even at high speeds of the cam)

It consists of a lever with a contact, which oscillates on an axle (pin) which is driven by a cam through a post on the lever. The fixed contact is supported on the fixed plate ? The two contacts are platinum.... .

Distributor

The distributor Cap consists of two symetrical pieces of a high quality insulating material which are held on the Magneto body with a strap (2 pieces of steel tightened at the top with a nut & bolt)

Electrical distribution is made with a rotor.

Maintenance to the distributor .

The contact screws must always be in their proper position Avoid oil from getting on these contacts, which is caused by excessive lubrication.

Such a deposite would cause irregularities in operation (misfiring). Combustion of the oil on the contacts causes them to wear rapidly.

Platinum contacts

When cleaning the points, never use rags, or emery paper: only a smooth file should be used. It is recomended not to...

Magneto without "Déctic"
DA 4
211

Magneto with "Dectic"
DA 4
210

Fire Wall

Shielded Ignition Switch.

Shielded ~~prim~~ low Voltage Wires

Position when running
Position when Stoped.

Figure 30 Drawing of Ignition circuit within airplane

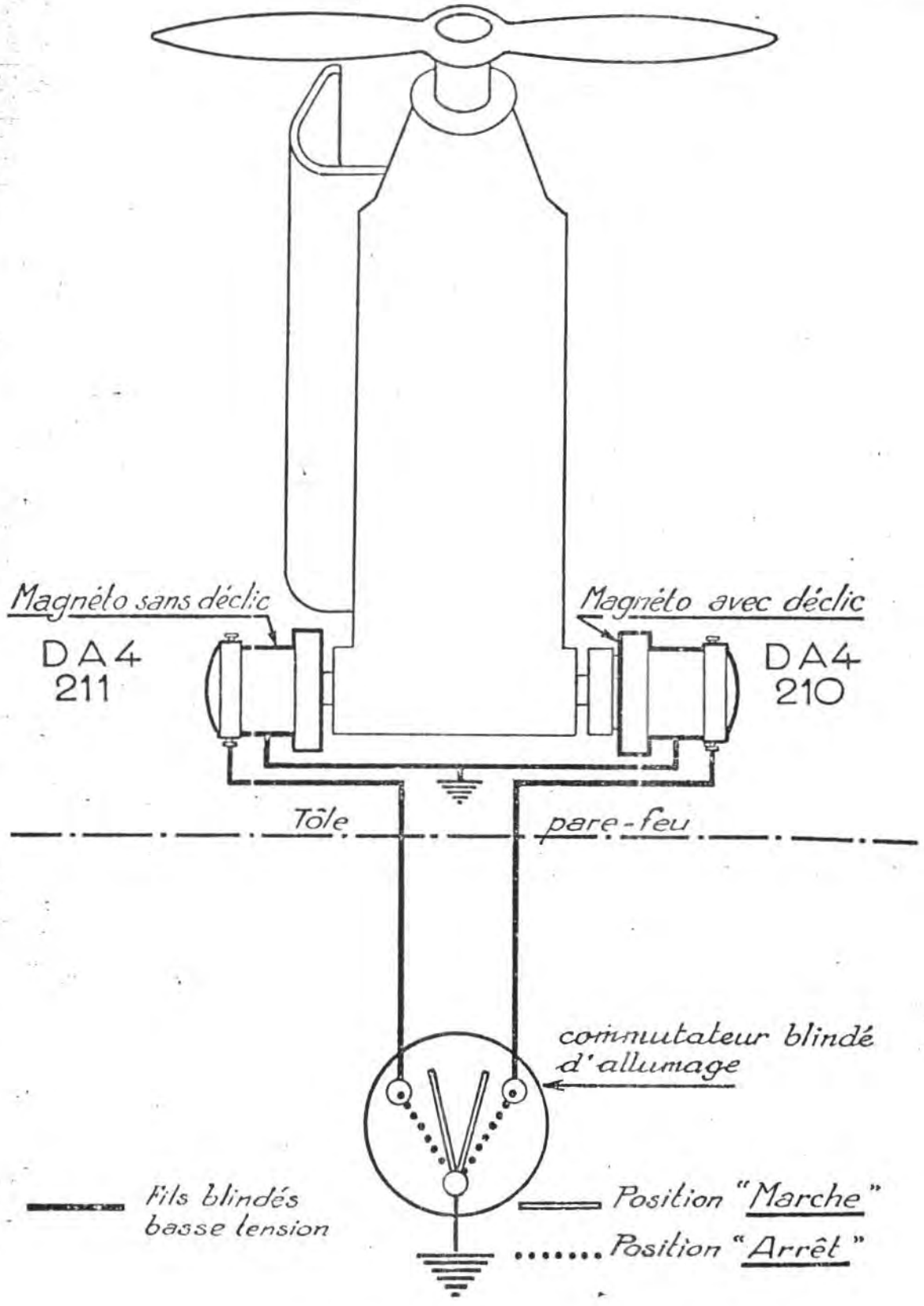


FIG. 30 — SCHÉMA DU CIRCUIT D'ALLUMAGE SUR AVION

overuse the file, otherwise, in leiw of a simple cleaning, ~~an~~ accelerated wear will be the result. In the same sence, a file ~~too rude~~ course will give the same result.

Comment – When Starting only use the magneto with the "declic" it is retarded 11° in relference to the other one.

~~By~~ Consequently, When starting ground the magneto without "declic" with the magneto switch in the cockpit, but open the ground (Switch on) to the magneto without the "declic", ~~then~~ when the engine is running.

Description and Operation of The "Declic" (The Magneto ~~thereof~~ impulse mechanism.

The magneto to the Left is equipped with an impulse mechanism to facilitate easy starting. A Tubular casing is driven by the engine. It is bound (connected) to the magneto shaft with a spring. On this shaft, a plate is keyed supporting two catches (rachets). When the tails of the catches (rachets) rests against the sholder of the stationery case, the magneto shaft is immobilized, the casing continues to turn, and winds up the spring.

The Casing has two pieces which disengage the catches (rachets) from the ~~shoulder~~ shoulder. The spring quickly unwinds, turning the magneto shaft at a high speed, at the same time that the second catch (rachet) comes up against the shoulder. This very high speed allows one to get a very hot spark.

When the engine turns at a sufficient speed, the catches are held against the case by centrifical force, and turn freely, without catching the shoulder.

The system is driven by the spring, when not in the starting (low speed) mode.

To Cut The Ignition.

To kill the ignition, one closes an interrupter (mag switch) of which one lead is connected to the primary terminal on the ~~breaker~~ points, The other to ground. This kills the primary Currant.

The Spark-Arrester (~~Capacitor~~)

Each magneto is equiped with a ~~capacitor~~. spark arestor.

It is set to protect the insulation from dangerous overvoltage, and permits passage of sparks produced by the high tention current, when the secondary circuit is interrupted or has a very high resistance.

Control of the Magnetoes

A special switch (Mag switch) permitts one to use both together, one only, or neither.

Dissasembly & Reassembly.

All parts of the magnetoes are interchangeable. The dissasembly is done in three ~~steps~~ {categories}.

exagérer l'emploi de cette lime sinon, au lieu de procéder à un simple nettoyage, on provoquerait une usure anormale. Dans le même ordre d'idées, une lime d'un grain trop grossier provoquerait une usure prématurée.

Remarque. — Le départ à la main se fait uniquement sur la magnéto munie du déclic, dont l'étincelle jaillit en retard de 11° par rapport à celle de la magnéto sans déclic.

En conséquence, à la mise en marche, couper l'autre magnéto par le contact multiple disposé sur la planche de bord de l'avion, et remettre également le contact sur la magnéto sans déclic, dès que le moteur est mis en marche.

DESCRIPTION ET FONCTIONNEMENT DU LANCEUR

La magnéto de gauche est munie d'un système à déclic remplaçant la magnéto de départ et assurant des départs faciles. Une douille est entraînée par le moteur. Elle est reliée à l'axe de la magnéto par un ressort. Sur cet axe, est claveté un plateau portant deux cliquets. Lorsque la queue de ces cliquets bute contre l'épaulement du boîtier fixe, l'axe de la magnéto est immobilisé, la douille continue à tourner. et le ressort est bandé.

La douille présente deux segments qui dégagent les cliquets de la butée. Le ressort se détend brusquement, entraînant l'axe de la magnéto à une vitesse élevée, jusqu'au moment où le second cliquet vient buter contre l'épaulement. Cette grande vitesse instantanée de rotation permet d'obtenir des étincelles très chaudes.

Lorsque le moteur tourne à une vitesse suffisante, les cliquets sont appliqués par la force centrifuge contre la douille et tournent librement, sans accrocher l'épaulement.

Ce système fonctionne comme un entraînement élastique, en dehors de la période de démarrage.

POUR COUPER L'ALLUMAGE

Pour arrêter tout allumage, on ferme un interrupteur dont l'un des pôles est relié à la borne primaire de la boîte du rupteur et l'autre à la masse : le courant primaire se trouve ainsi coupé.

PARAFOUDRE

Un parafoudre est prévu sur chaque magnéto.

Il sert à protéger les isolants contre les surtensions dangereuses, en permettant le passage des étincelles produites par le courant à haute tension, lorsque le circuit secondaire se trouve interrompu ou présente une résistance exagérée.

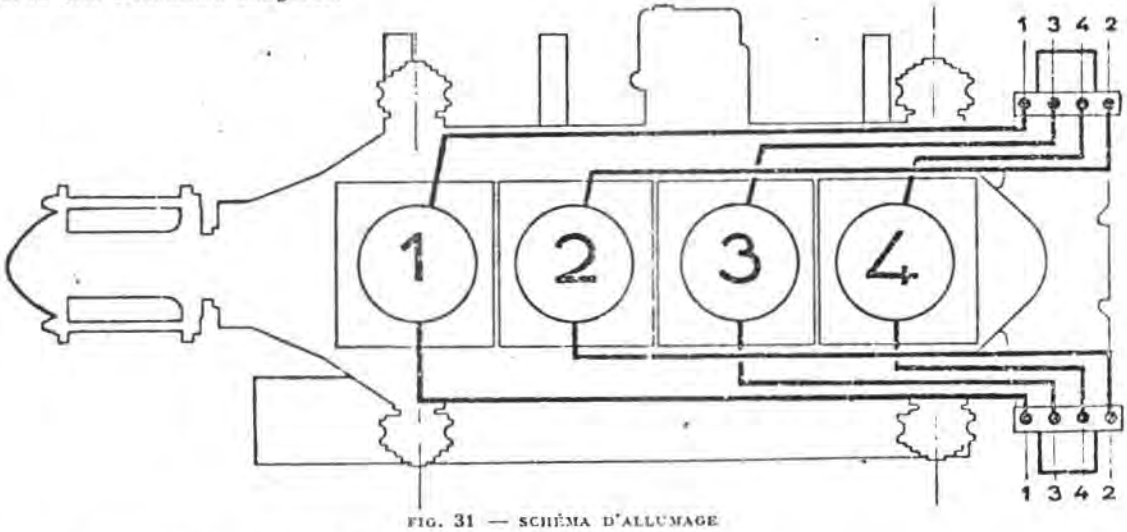


FIG. 31 — SCHÉMA D'ALLUMAGE

UTILISATION DES MAGNÉTOS

Un commutateur spécial permet de mettre les deux magnétos en action, ou une seule, ou aucune.

DÉMONTAGE ET REMONTAGE

Tous les éléments de ces magnétos sont interchangeables. Les démontages sont classés en trois catégories :

Fig 32 Dissassembling the distributor.

Fig 34. Dissassembling the points & their mounting plate.

Fig 33 Removing The Cover

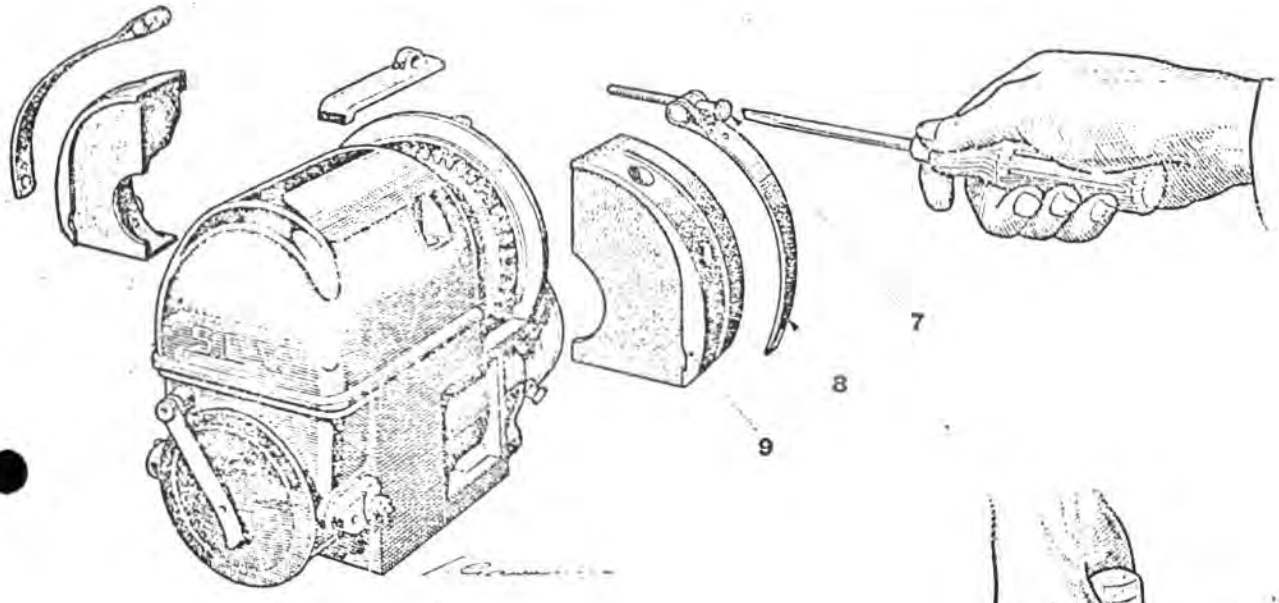


FIG. 32 — DÉMONTAGE DU DISTRIBUTEUR

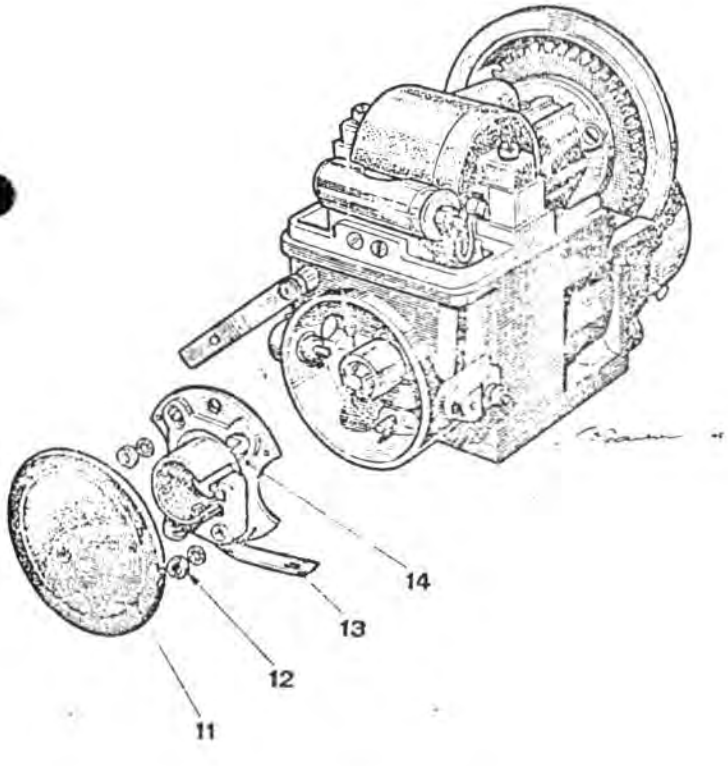


FIG. 31 — DÉMONTAGE DU RUPTEUR ET DE SON PLATEAU

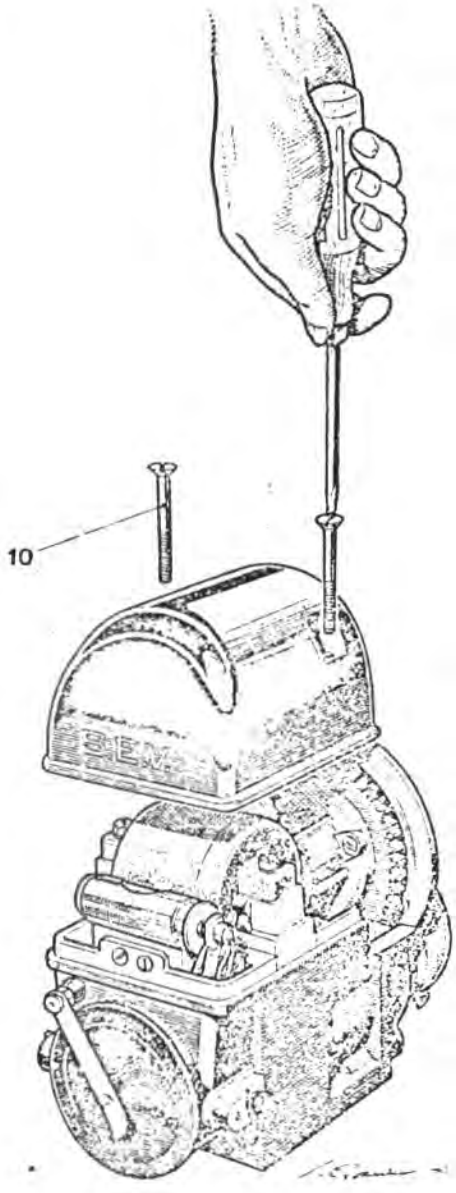


FIG. 33 — DÉMONTAGE DU CAPOT

N.B.C. 35 Renault 4R X. 2. 57

1° The required distance disassembly which aids in the maintenance, and permits the repair of small problems (damage)
2° The disassembly to avoid such that problems which would cause an accident would result.
3° The prohibited disassembly which would otherwise cause immediate, failure, or shock the parts useful life.

The required disassemblies are:
a) dist. Remove the Cover
b) Remove the distributor (cap)
c) Remove the points and their mounting plate.
d) Remove the Coil.
e) Remove the Capacitor
f) Remove the distributor support.
g) Remove the impulse mechanism
h) Open the impulse mechanism Casing.

The disassemblys to avoid:
a) Removing the Forward wheel (gear)
b) Removing the timing gear (distributor gear)
c) Removing the rotor

The disassemblies not to be made.
a) dismounting the automatic advancer
b) disassembling the magnetic core
c) opening the coil casing (box)

The dismantling cannot be done without the following tools:
5 m.m Screw driver
7 m.m Screw driver
Split Screwdriver
12 m.m wrench (" in wrench)
S.E.V wrench " Fig. 212

I. Authorized (Required) disassemblies
a) Removing distributor cap. (Fig 32) 5 m.m Screwdriver
- unscrew and remove the screw of strap (clamp) (7)
- Lift up the strap (8)
- Remove the 2 half distributor caps (9) by pulling (them)
b) Removing The Casing (Fig 32) 7 m.m Screwdriver
- Unscrew The screws (10)
- Remove The casing (cover)

Reassembly :

Proceedure the same but the reverse order of dissasembly.

c) Disassembly of points and supporting bracket. (fig 34)

- Remove the cap. (11)
- Remove the nut which secures the point spring.
- Unscrew & remove the ~~screw~~ nut to the condenser terminal
- Remove the washers to the 2 bolts, and ~~remove the~~ lift out the connections which are made.
- Unscrew and pull out the 2 screws that secure the supporting bracket
- Remove the lock washers
- Disingage the points spring (13) from its terminal (post)
- Pull out the point support plate.

Split screwdriver

~~S E U 170 212 Screwd~~

S E U. 170. 212 wren

Fig 35 Removing The Coil.

Fig 36 Removing the Condenser

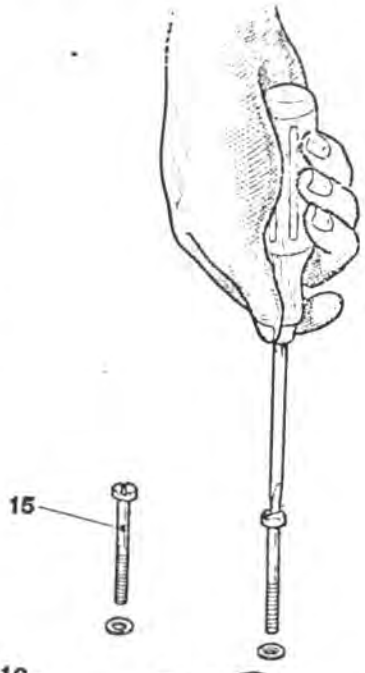


FIG. 35 — DÉMONTAGE DE LA BOBINE

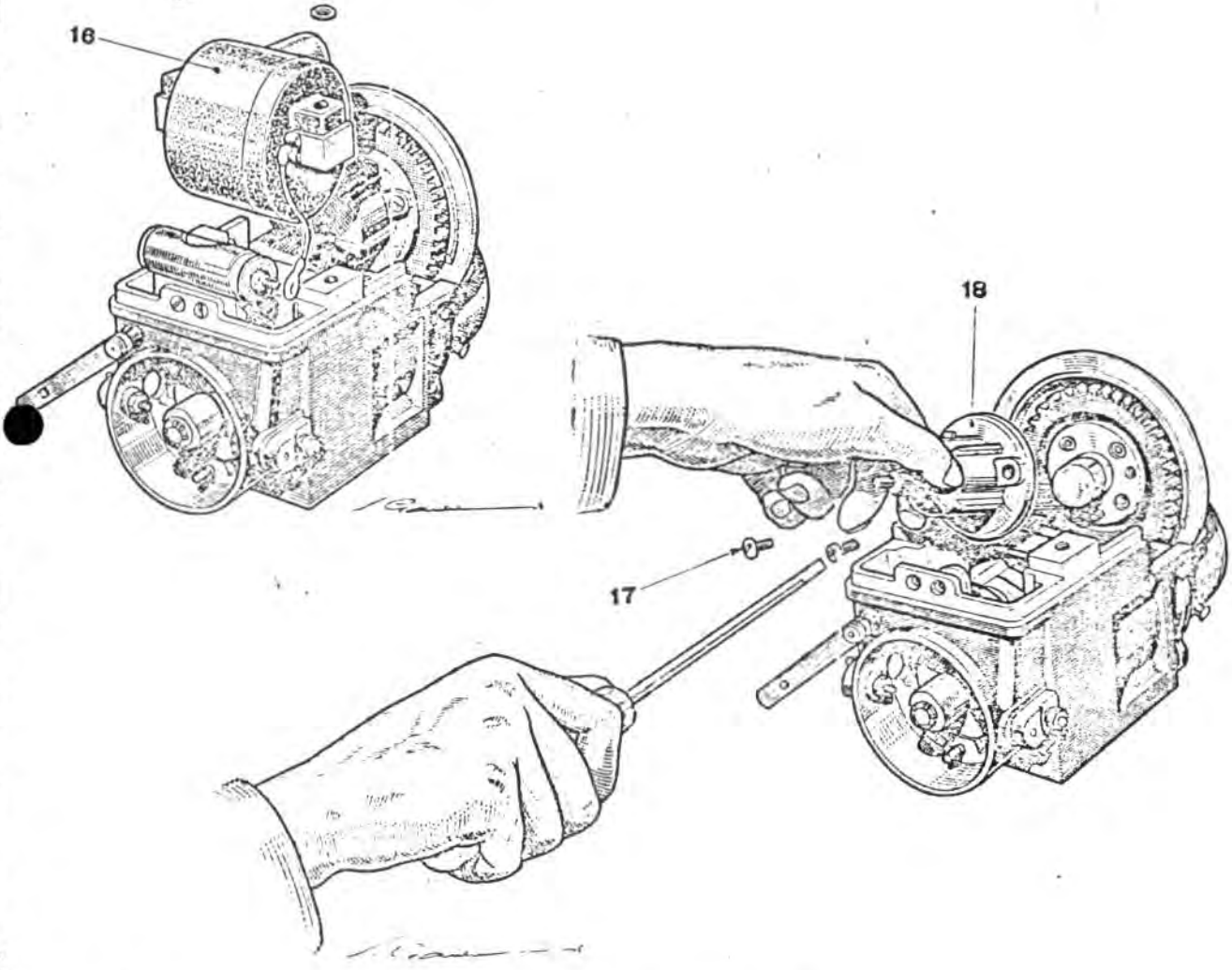


FIG. 36 — DÉMONTAGE DU CONDENSATEUR

Fig 37 Removing the disrupter support. (distributor rotor)

Fig 38 Removing the impulse and forward gear (wheel) case

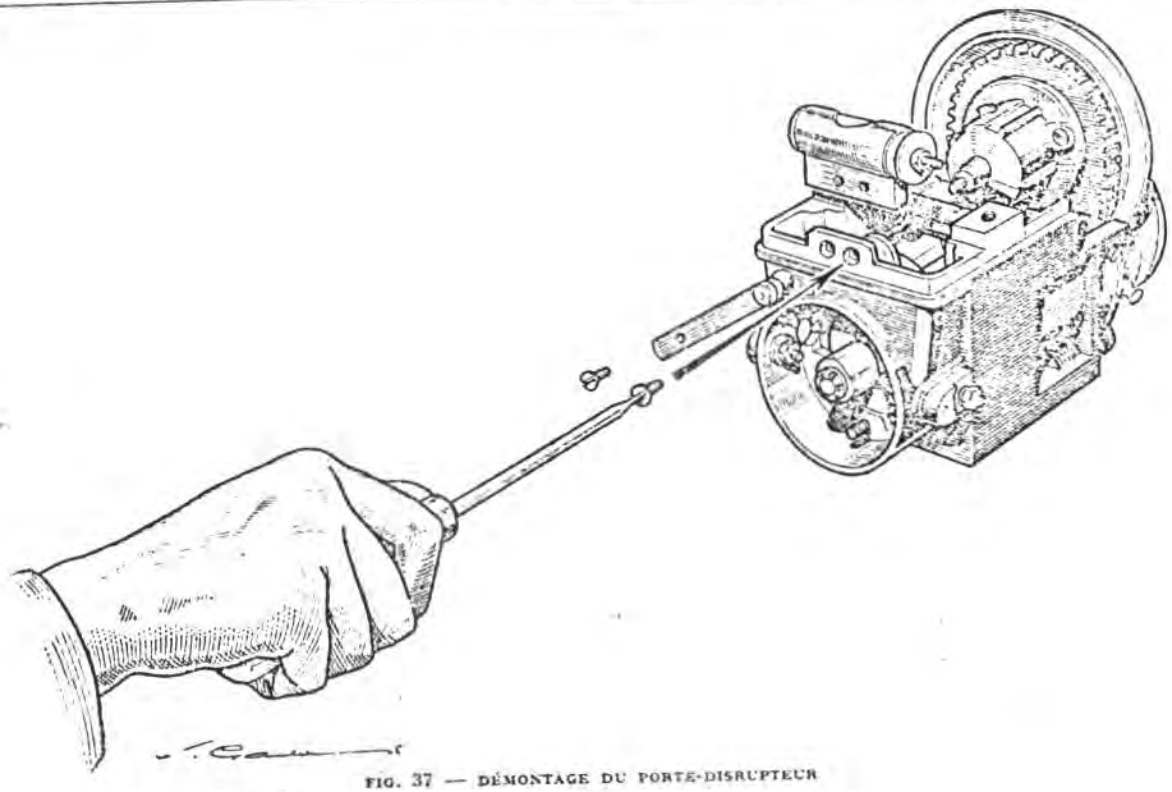


FIG. 37 — DÉMONTAGE DU PORTE-DISRUPTEUR

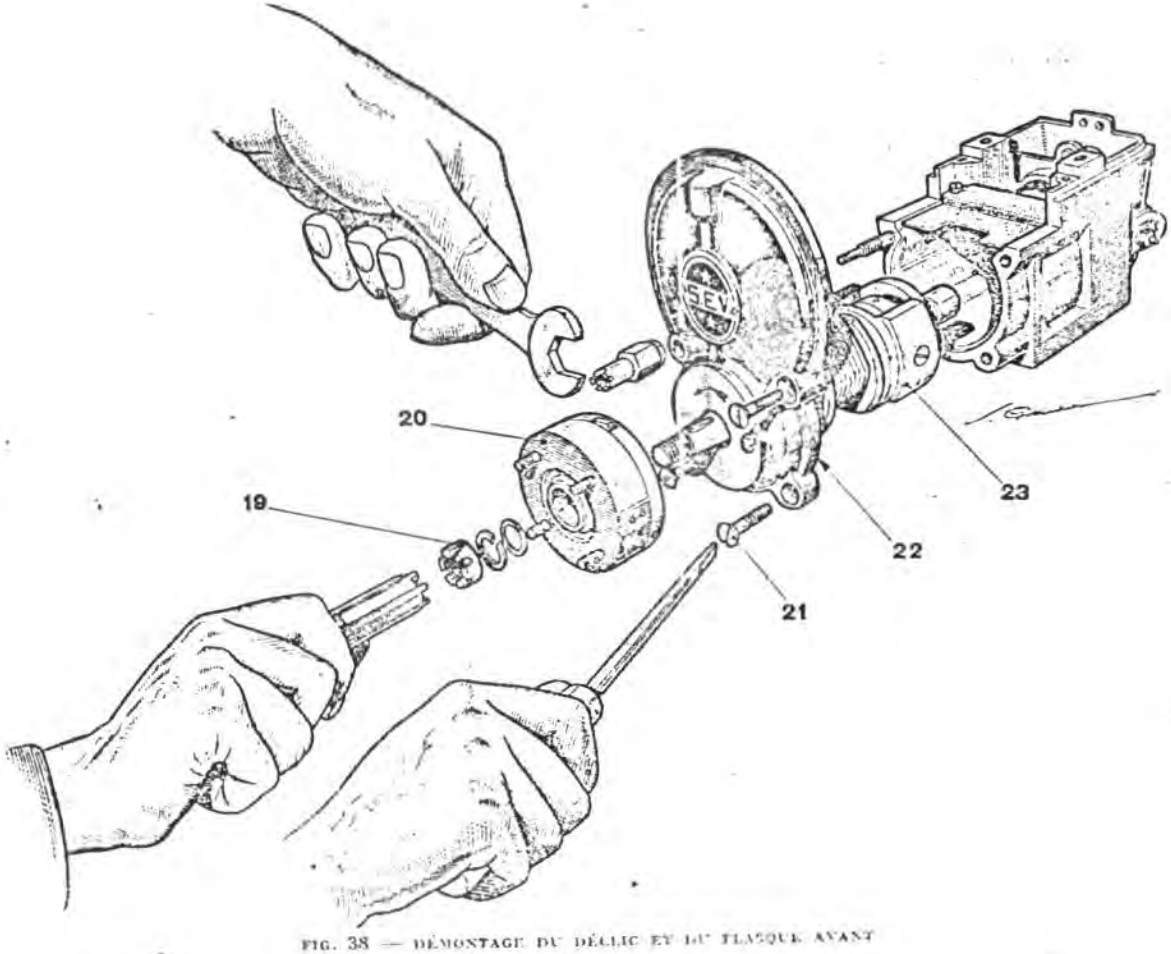


FIG. 38 — DÉMONTAGE DU DÉCLIC ET DE LA PLAQUE AVANT

Reassembly:

Proceed the same as disassembly, except in the reverse order

IMPORTANT. A hole cut through the point support plate engages with a centering pin which secures the position of the points. The setting is variable and can be moved to touch either the Centering pin or the hole. All of The points are interchangeable; The position of the regulating slot (hole) is pre set at the factory, and should not be reset, regardless of the position of the points.

All S.E.V., Model D.A.4 Points are ~~inter replaceable~~ interchangeable without adjustments other than the contacts (gap)

d) Removing the Coil (Fig 35)

- Remove the nut which secures the primary (rear) lead to the condenser — 52.867 wrench
- Unscrew & remove the two screws which secure the coil (15) — 7mm Screwdriv
- Remove the coil (16)

IMPORTANT. Be careful not to let the screws or washers fall into the magneto case. They should be counted ~~op~~ after dissesembly, and after reassembly. The play between poles on the rotor is very fragile, and the less that is allowed to fall on them (into the magneto housing) will result in a reduced amount of permanent damage.

Reassembly. - The same but in the Reverse order of disassembly.

e) Removal of the Condenser (fig 36)

- Remove the two supporting screws — 5mm Screwdriver
- Remove the nut which secures the primary wire — S.E.V 52.867 wr

f) Removal of The disrupter Support (distributor rotor) (Fig 37)

- After removing the coil, remove the two ~~Capacitor~~ support ~~screw~~ screws (17) — 7mm Screwdriver
- pull out the distributor rotor (18)

Reassembly

- Proceed as above except in Reverse order

G) disassembly of the impulse (declic) (fig 38)

- Remove the castle nut (19) from the drive shaft. — S E V 60.587 wren
- Drive the entire impulse casing off (20) (a tappered shaft with a Woodruff key)

Reassembly

- Proceed the same as above but in the reverse order.

h) Opening the impulse Mechanism. (Fig 39 & 40)

- With 2 screwdrivers, remove the steel retaining ring from the boss in the top of the declic container
- Using Caution, support the bronze hub of the impulse in a ~~vise~~ vise.
- pull on the steel casing gently rocking it back and forth.
- disengage the impulse spring.

5 & 7mm Screwdriver

Reassembly:

- Place the spring in the steel case such that it winds in the direction oposite to that of the pointers (rachet pauls)
- Engage the spring in the channel (groove) in the hub. With the 5mm Screwdriver, cock (turn wind) the spring about 60° to catch ~~its~~ on the outer edge ~~on the peg~~ of the bearing of the case. With the same screwdriver place the outside edge of the spring on the casing peg such that the spring stays taught on both halves of the case. (This will allow the spring to remain caught during the operation.

Fig 40 dissassembled case to impulse mechanism

Fig 38 Opening the case to the impulse mechanism

Fig 41 dissassembling the distributor Gear and rotor

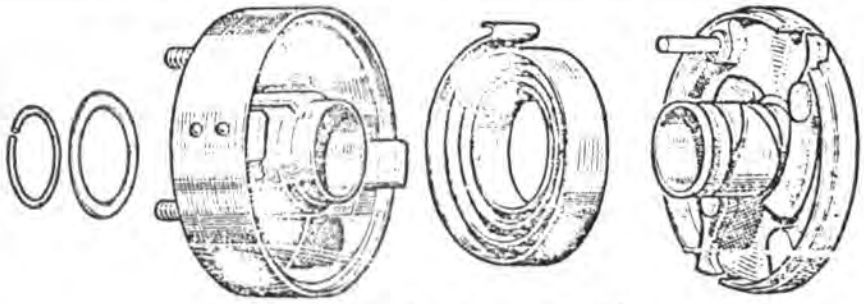


FIG. 40 — BOITIER DE DÉCLIC DÉMONTÉ

FIG. 39 — OUVERTURE DU BOITIER DE DÉCLIC

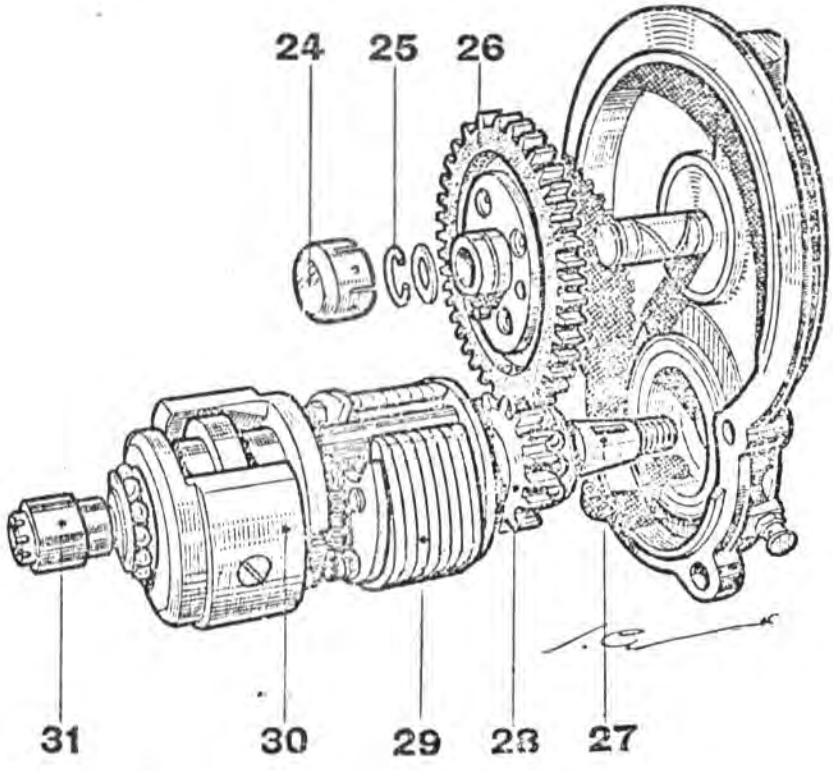


FIG. 41 — DÉMONTAGE DE LA ROUE DE DISTRIBUTION ET DU ROTOR

- Hold the bronze bushing (box) in your left hand, the casing (box) in your right;
- Place (engage) the bushing in the casing;
- Place the bushing spring pin (peg) into the outside rounded end of the spring, inserting it 3 to 4 mm only
- Wind the spring by turning the bushing counter clockwise, and the casing clockwise a few degrees.
- During this operation, hold the pieces horizontally and keep the racket pauls outside.
- Press the casing onto the bushing until the groove for the retaining ring is outside the steel casing.
- Check to see that the two rocket pauls of the impulse mechanism are completely free.
- Replace the steel washer on the bushing, and then the retaining ring (clip)

II DISSASEMBLIES TO BE AVOIDED.

a) Dissasembling the forward gear case (fig. 38)

- Remove the 4 retaining screws (21) — 7mm Screwdriver
- Remove the casing (22)
- Pull out the rotor (23) while pushing on the cam, NEVER PULL ON DRIVE SHAFT OR DESTRUCTION of THE AUTOMATIC ADVANCE MAY RESULT ASSEMBLY.

- Proceed as in dissasembly but in the reverse direction.

b) Dissasembling the Distributor Gear. (fig 41)

- Remove the aluminum cap (24) which covers the retaining ring of the distributor gear on the bushing
- Remove the retaining ring (25) — 5 & 7mm Screwdriver
- Remove the washers which regulate the gear play;
- Remove the gear (26)

Reassembly.

- Proceed the same, but in reverse order of dissasembly, noting that there are markings on the pinion (indent on tooth), and a marking on the gear (red point on 2 ~~the~~ teeth). These markings should be lined up.

III FORBIDEN DISSASEMBLIES

The dismantling of the automatic advance ~~is forbidden since it is likely to~~ and magnet is not to be performed since it will lessen the strength of the magnet. This demagnitization will impair the proper function of the magneto with a lower spark voltage being the result.

There is another more serious risk, which is important. The new nickel-Aluminum magnet of S.E.V. magnetoes requires a ~~machine~~ gousing (magnitizing) machine of high strength (high tollerance) The machine used in the repair shop must have a ~~stron~~ capability of 5 kw (kilowatts) One shouldn't use a machine which gives ~~an~~ ~~an~~ a fraction less than the required amount of power.

If, after a partial demagnitization, one remagnitizes it with a machine not having enough strength, one will find a demagnitization greter than the orrigional.

As a result of having dissasembled the rotor, one must have access to a magnitizing machine of sufficient power. In any case, if one doesn't have this machine (60 000 Ampere turns), and if the dissasembly is inevitable, it is better, after reassembling, not to use a machine of lower power.

CHECKS FOR PROPER OPERATION

Articles necesary for different checks consists of:

- 1 high voltage spark gap with 4 sets of tips of suitable capacity
- 1 test stand with a variable speed control to drive the magneto from 50 to 5000 RPM.

1° Test runs.

The spark gap should be set at 10 mm

The test includes: four hours opperation at 4000 RPM, finnished off with a period of 5 minutes at 5000 RPM.

During the entire test, one should not have either a missfire nor abnormal sparks on the breaker points.

A 5 minute test at 4000 RPM should be run at a closer than normal ~~spark gap~~ contact gap of 2 tenths of a mm, and then move the contacts to the abnormal gap of 6/10 mm

With these two extreem gap spacings, ~~It can't be~~ is not possible at rates of 400 RPM There should not be any misfires at 4000 RPM with a spark gap of 10 mm ~~between~~.

2° Slower Tests

With the spark gap set at 6 mm, The speed of the magneto set at 60 RPM. There should not be any missfireing.

3° Still Tests

Withe the ground terminal electrically bound to the frome of the magneto, no sparks should pass between the gap.

SPARK PLUGS BG 2 TA

These non shielded plugs consist of three outside terminals ~~and~~ around a central electro

There characteristics are as follows:

- a base diameter of 12 mm, with a pitch (thread) of 125;
- length of threaded section is 8.5 mm.;
- The connections in the spark plug are of copper.
- The spark gap (.3 minimum - .4 Maximum) should be checked every. 50 hours with the aid of feeler gauges

Chapter IX

Dissasembly.

COMPRESSOR - DISTRIBUTOR AIR-EQUIPMENT TYPE "VIET"

Principal of Operation.

The installation of the starter consists of a piston compressor driven by the engine, a delivery pipe, a pressure regulator, an air reservoir, a return feed pipe (tank to distributor), a quick opening valve, a distributor, tubing connecting the distributor ports to each cylinder, and an air check valve mounted in each cylinder head.

Upon opening the starter valve air is directed by the distributor to each cylinder at the point when it should be firing.

The entrance of compressed air, under these condition, creates enough rotational movement to start the engine.

Figure 42 Forward View of compressor-distributor "Air Equipment"

DESCription of The Differrent Parts

The compressor, distributor, and starter valve are grouped in a single unit mounted to the engine

The cylender, complete with cooling fins, and automatic valves in the top for intake and exhast, where the air is pushed through to the regulator and reservoir.

The lubrication IS provided by ~~engine~~ engine circulation. The ~~oil~~ engine oil lubricates the mechanical parts, and then returns to the engine case (block)

CHAPITRE IX

DÉMARRAGE
COMPRESSEUR-DISTRIBUTEUR AIR-ÉQUIPEMENT TYPE "VIET"

PRINCIPE DE FONCTIONNEMENT

L'installation du démarreur comprend un compresseur volumétrique à piston mû par le moteur, une conduite de refoulement, un régulateur automatique de pression, une bouteille d'accumulation d'air comprimé, une conduite de retour, un robinet à ouverture brusque, un distributeur, des tubes reliant le distributeur à chaque cylindre et un clapet d'entrée d'air monté sur chaque culasse.

En ouvrant le robinet, l'air pénètre successivement, par l'effet du distributeur, dans chaque cylindre au moment où ses organes sont disposés au temps « explosion ».

L'admission, dans ces conditions, de l'air comprimé provoque une rotation du moteur suffisante pour en assurer le lancement.

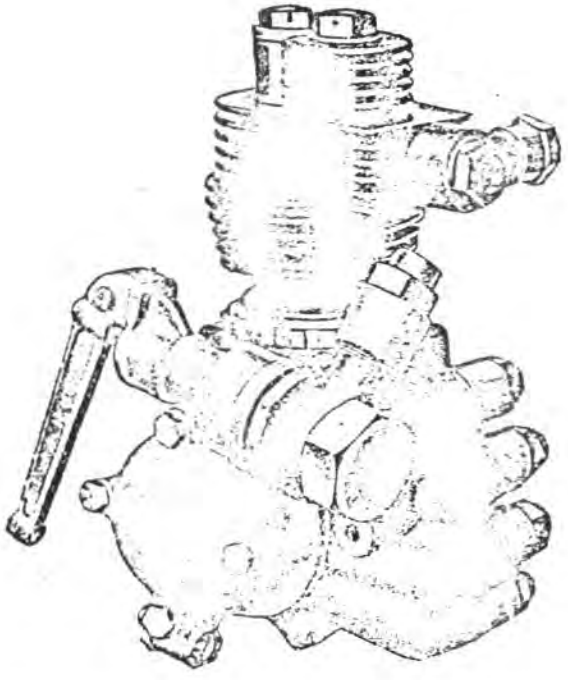


FIG. 42 — VUE AVANT DU COMPRESSEUR-DISTRIBUTEUR « AIR-ÉQUIPEMENT »

DESCRIPTION DES DIFFÉRENTS ORGANES

Le compresseur, le distributeur et le robinet sont groupés en un seul appareil fixé sur le moteur.

Le cylindre, muni d'ailettes de refroidissement, porte à sa partie supérieure les clapets automatiques d'aspiration et de refoulement ainsi que le raccord destiné à l'évacuation de l'air vers le régulateur et le réservoir.

Le graissage est prévu par circulation. L'huile venant du moteur graisse les parties mécaniques et retourne dans le carter du moteur.

The compressor is directly driven by the cam shaft, the speed is therefore half that of the engine.

The air is compressed to 30 Hpz

Fig. 43 Rear View of the compressor - Distributor "Air Equipment"

The distributor plate is also driven by the camshaft, within a ground aluminum piece with holes corresponding to each cylinder, ~~in the~~ arranged in their firing order.

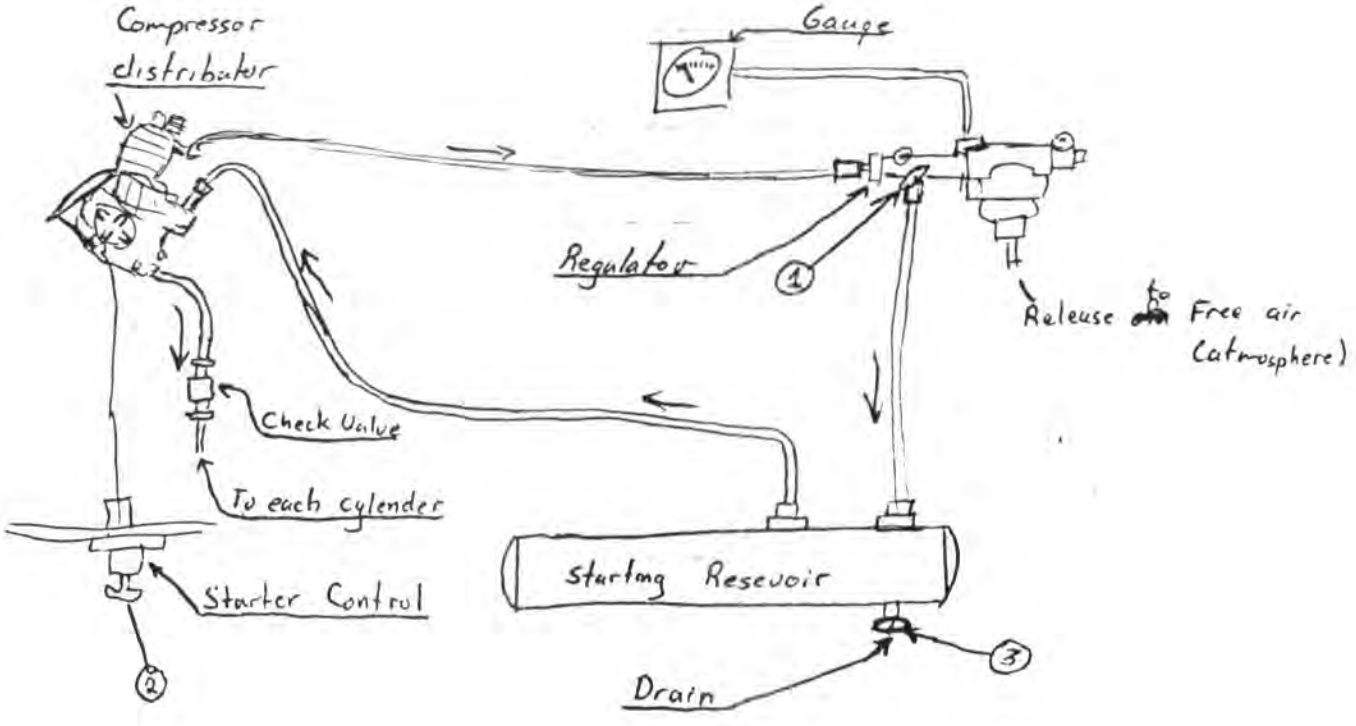


Fig 44 drawing of installation of starter on the airplane.

Le compresseur est entraîné directement par l'arbre à cames ; sa vitesse est donc la moitié de celle du moteur.

L'air aspiré est comprimé à 30 hpz.

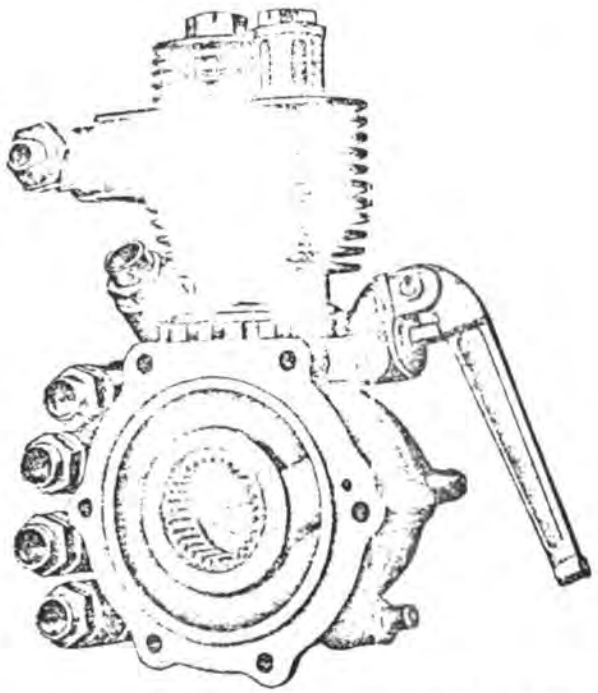


FIG. 43 — VUE ARRIÈRE DU COMPRESSEUR-DISTRIBUTEUR « AIR-ÉQUIPEMENT »

Le distributeur comporte un plateau entraîné également par l'arbre à cames, se déplaçant sur une glace en aluminium percée de trous correspondant à chacun des cylindres dans l'ordre d'allumage.

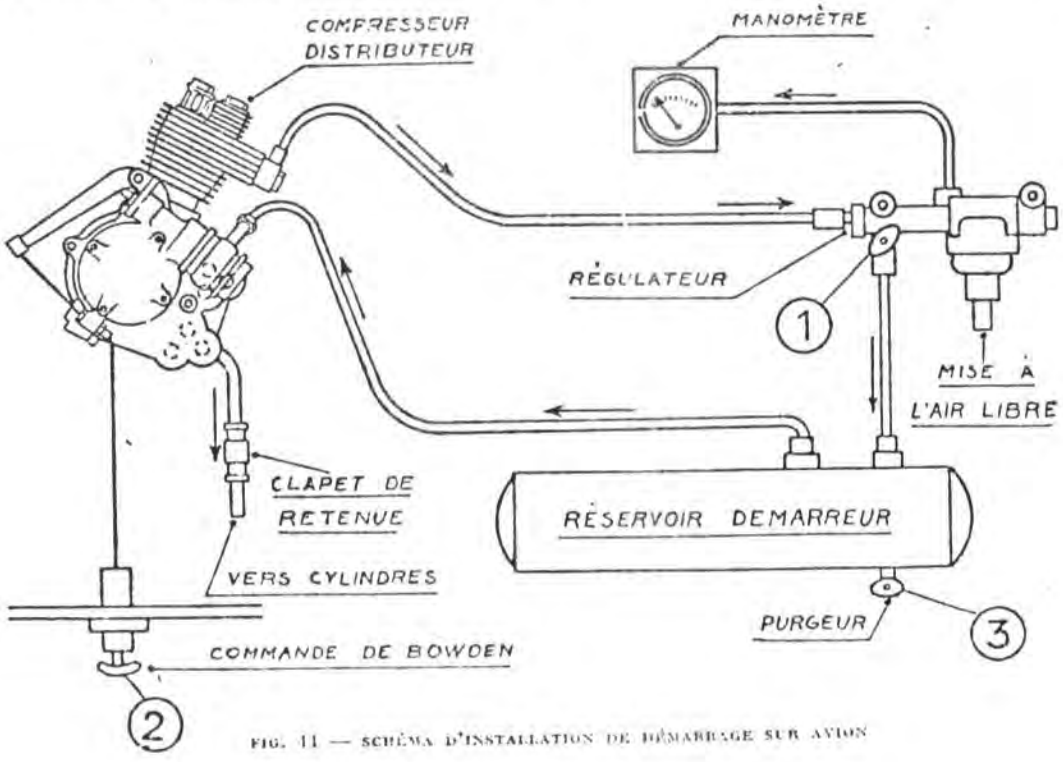


FIG. 11 — SCHÉMA D'INSTALLATION DE DÉMARRAGE SUR AVION

The plate, pierced with one port (slot), sucessively uncovers (passes over) the hole in the ground serface corresponding to a cylender in the firing position, permmitting the passage of compressed air from the resevoir.

The regulater automatically limits the pressure in the starting resevoir to 30 hpz, releasing any more to the atmosphere. The regulater starts the cycle when the pressure drops more than ~~the~~ 5 hpz in the resevoir

The resevoir has a drain cock for blowing off any condensed water (it should be drained every 30 hours)

Every starter installation should be done with care. There shouldn't be any leakes at any joints or fittings

An unsuffisiont pressure, or leak in pressure when stopped indicates that leakes exist. Check the installation. A convinient way is to use soapy water, and spread it with a paint brush on ~~the~~ all parts. Bubles will appear at the leaks. After the tests, rinse with water and carefully wipe all pieces which had been soaped.

~~To start the engine~~
To start, ~~(starting)~~ ~~When leaving~~: open the needle valve (1) for the resevoir.
See that
~~Be assure that~~ the resevoir is under pressure, and the following operations are effective: Open the fuel, pump the carbureator to prime engine; gas, contact, advance

Release the starter handle (2) and pull it all the way out. As the engine starts running, secure the handle in its orrigional position.

After the flight: close the needle valve (1)

Every 30 hours, drain the resevoir of condensation through the drain cock (3)

CHAPTER X

Mounting Engine on the Airplane

To install the engine in the aircraft, it is imperative that all controls, linkages, and plumbing are in their correct positions (Checking all clearances to ensure the full travel of controls to the: throttle, ~~starter~~ The choke mixture, idle cutout, the starter, and the fuel selector valve).

Securing the Engine in the Frame

The engine is suspended (secured) to the frame with saddles and "U" bolts on support brac

Oil Circulation.

The intake and output oil hoses must have a minimum diameter of 22 mm.

The capacity of the reservoir is a function of the desired range, but it must account for the calculation of this capacity of which 4 litres are necessary in the engine for the proper operation of the lubrication system. Under Threat of ~~d~~maging the engine one should never let the oil run less than The 4 litres minimum.

Cooling

The air intake faicing must not have a smaller cross section than the air duct, which will assure the proper cooling of the engine (see pg. 39)

Carburator Controls.

The fuel ~~selector valve~~ (throttle) control must be very free: having been disconnected The Throttle must open freely., ~~and close in case a throttle control brakes~~ breaks ~~The engine~~ in case the throttle controls break, the engine will go to full speed and not to idle.

CHAPTER XI

USE

PUTTING A NEW OR STOCK ENGINE IN SERVICE

- Remove the protective grease, and rust inhibitors which cover possible areas of rust.
- At all joints on the engine remove the protective plates, the drying plugs, the closure caps, and make certain that no foreign matter is in any fillings or pipes
- lubricate the fuel pumps and the magnetoes with liquid mineral oil.
- Put in place the oil and fuel circuits - hook up the plumbing.
- Connect the controls and electrical circuitry.
- Check for the seal of the needle (float valve) valve in the carburator. Should it leak, flooding The engine when leaving could produce serious mechanical accidents.
- If the intake is faulty, check to see that there is proper operation of the float chamber (carburator) check (ball) value is free, and hasn't been blacked during handling, transport, or storage.
- Check to see that the intake manifold drain pipe is well mounted and passes fuel, making certain it isn't blocked
- Dismount the rocker covers. Fill them with oil, level with the drain in the center, and remount.
- Fill reservoir with 5 to 10 Litres of oil - Prefferably warm
- To obtain an emmediate circulation of oil, it is sufficient, with the spark plugs out, to turn the crankshaft in the direction of rotation a few times.
- Disconnect the oil pressure gauge and check to see that the tubing is full (good in the case where the gauge is connected directly to the engine oil system, but not when it is connected through a relay system (ultimate fitted)

- Check for the proper connections of the ground wires, and verify the off "Coupé" position of the switch.
- Check the spark plugs before installing them.
- Start the engine following the instructions in the paragraph "Starting the engine" (Pages 71 and Operate the engine at 800 to 1200 RPM until the temperature of oil leaving the engine reaches 75°, however without staying at the same point for more than 20 minutes.
- Stop the engine and drain the oil (resevoir, radiator, & pluming). Clean the filter.
- Refill with the proper oil
- Make the first oil change - and clean the oil filter carefully after 10 hours of operation.

IMPORTANT

After an engine replacement, required by an ~~accident, has been made as~~ accidental poluting of the oil, one must, before installing a new engine, completely clean

- the oil resevoir
- The radiator (if one exists)
- The connections and fittings - all accessories

STARTING THE ENGINE

IMPORTANT RECOMMENDATION: After a prolonged rest, and before trying to start the engine, it is essential to hand pull the propeller through 4 full revolutions or less

This precaution is to guarantee the free operation of the pistons in the cylenders in which oil or gas can accumulate. Should the drain in the intake manifold become blocked, fuel can accumulate in the cylinder

An attempt to start the engine under these conditions will cause the cylender head to shatter (crack), the connecting rod to buckle.

If an unusual resistance is felt, the spark plugs should be removed to let the fuel or oil out.

PREPARATION BEFORE FLIGHT

- Face the airplane into the wind
- Check to see the plane is full of oil and gas
- Check the pressure of the starter (18 kg/cm² in summer minimum, 20-30 kg/cm² in winte
- Open the valves in the fuel and oil tanks (reseoirs)
- Open the fuel cutoff valve "(coupe feu)"
- Check that the idle cut out is off (open)
- Connect the on board wiring
- Start the fuel pumps by working the on board primer on the pumps until a pressure of at least 200 g/cm² is reached.

STARTING PROCEEDURE

The two Cases (procedures)

With 2 People	With 1 Person
Cold Start	
- The aid requests Switch off and Idle, and the operator will check	Pull on the ~~starter~~ choke
a) That the throttle is reduced (Idle)	
b) That the switch is off, after which he will respond "Idle and switch off."	
- The operator will pull the ~~starter~~ choke and operate the Throttle lever., (pump it)	Operate the Throttle ~~control~~ lever (pump it)
which operates the fuel pump, with the result of increasing the mixture in the manifold. This operation is stopped when excess fuel flows out the intake manifold drain.	
- during this time the aide should be pulling the prop through in the normal operating direction.	The operator should secure the throttle control in a minimum position, and make sure the switch is off.
	He should continue turning the prop until fuel flows out the manifold drain pipe.
The throttle should be set at idle by	
The operator	The operator should climb in
One should make certain no one is in the path of the propeller, and yell "Clear"	
- Switch on	
- Pull on the starter, which will turn the engine over	

STARTING WHEN WARM

Use the same operation except without the choke.

IMPORTANT OBSERVATIONS: Never pull on the starter more than 4 to 5 seconds If the engine doesn't start, repeat the operation, which will avoid draining the reservoir of air without starting the engine, and thus producing condensation on the spark plugs.

If the engine fires only once on each attempt, it is a sign of an overly rich mixture. In this case turn the switch off, open the throttle, and turn the prop in the normal direction by hand as fast as possible, and continue as with a normal hot start.

If the engine starts, and then stops a few revolutions later, repeat the operation and give it a little more gas.

When it is cold (10° or under) and the engine is cold, proceed with the opperation with minimum throttle and the choke fully ~~open~~ extended.

Never touch the propeller when the engine is warm and the switch is close

In the exceptional case of starting by hand, the switch is set for magneto Number 1 for starting, and both after the engine is running.

WARMING THE ENGINE

After the engine has started, idle it at 800 RPM.

Keep it at this speed or higher to keep from fouling the plugs.

Check to see that the oil pressure comes up within about 10 seconds, if not, stop the engine and check for the problem.

Turn off the choke when carbon (black smoke) appears out the stacks (one minute after starting if the smoke isn't seen)

Increase the speed to 1200 RPM to allow the oil temperature reach 40°C for oil leaving the engine, and 30°C for entering.

STANDING TEST (The Runup)

After the oil temperature has reached 40°c at the exit of the engine, increse the RPM to 1800, and go through the following procedures:

1) Checking the Magnetoes

Check independently each magneto. The engine should not show any unusual vibrations, and there shouldn't be a variation of more than 50 RPM between each singular magneto, and the two combined.

2) Check the on board gages and instruments

Oil pressure: 3 kg/cm² ± .5 (3 ± .5 hpz)

Fuel pressure 220 g/cm² ± 10g (22 ± 1 pz)

Make a quick check of ~~fuel supplies~~ full throttle, and make certain that yours engine speeds correspond with the type of propeller in use.

the length of each full throttle check should not be more than 10 seconds

TUNING THE ENGINE

One shouldn't in principle modify the factory settings ("dial readings"). Do not expect the settings to be exact, but they should be within the previously listed tollerances. To get these measurements use equipment callibrated to standards, and not the on board equipment.

If the idle speed needs adjustment, do so with the idle stop screw, and not the air adjustment (mixture) screw (see page 45)

OPERATION IN FLIGHT

ON TAKE OFF : Give it full throttle for take off.

IN FLIGHT : Reduce the throttle as soon as ~~the proper~~ a safe altitude is reached.

- Reduce to a crusing altitude when the flight altitude is reached.

GENERAL FLIGHT STRUCTURES

- Watch the oil pressure to be certain it doesn't go below .1 kg/cm² (1 HPz)
- Watch the oil temperature and see that it doesn't go above 90°c leaving the engine
- Make certain the fuel pressure stays above 200 g/cm² (20 pz)
- Do not attempt to correct the ~~attitude~~ mixture before reaching 1500 meters.

If a change of altitude is made, going below 1500 meters do not forget to move the mixture to full rich. The carburated mixture ~~changes~~ becomes richer as the altitude increases, as such the mixture becomes too rich, resulting in decreased engine power.

Operating (Use of) The Mixture Control.

The mixture control is to be used with much prudence. The premature leaning, the forgetting to enrichen during a descent, creates a very ~~poor~~ mixture which will damage the valves and pistons, and cause the engine to overheat. As a correction over 1500 Meters, watch the tachometer, slowly ~~pull~~ operate the mixture control until the tachometer shows a decrease in RPM, quickly enrichen the fuel mixture and bring the mixture control back towards the ~~front~~ rich side so as to be more towards a rich mixture, than the poor lean one

STOPPING THE ENGINE AFTER A FLIGHT

- Let the engine idle for 30 seconds

It is recommended that one use the "Etouffoir" (Mixture cut off), especially after prolonged running on the ground, since this will diminish the probability of cooling problems resulting from dieseling.

- After the engine has stopped - turn of the magnetoes, and electricals
- Close the fuel valve ("Coupe Feu)
- Close the fuel and oil valves

PERIODIC CHECKS

AFTER EACH FLIGHT

- Clean all parts which have had oil oze onto, or had been splattered with oil (cylinders, pipes, exhaust, etc.)
- Check the condition of the cowl fasteners
- Check the spark plug leads, and make certain the plugs are tight.

EVERY 12½ HOURS of OPERATION

- Clean the fuel filters, and reservoir drain plugs, if it has them.
- Check the propellor locking pins (screws)

EVERY 25 HOURS OF OPERATION

- Blow out (drain) the compressed air reservoir.
- Clean the oil filter strainer
- Check all hoses and pipes for wear or decay (fuel, oil, air)
- Check the oil level in the case of the fuel pumps (see page 75)
- Make sure the intake and exhaust manifolds are secure. See that there arent any cracks in either one.

EVERY 50 HOURS.

- Check and clean the spark plugs (gap of .4 mm.) (see page 76)
- Check the platinum screws of the magnetoes (.4mm gap) (See page 75): Clean the casing of the points
- Check all of the ignition system.
- Clean the carburator (float chamber, jets, filter) (see page 75)
- lubricate the control rods
- Check the play between the rocker rollers and the valves (3/10mm when cold) with the #28 gauge
- Adjust the ~~screw~~ play by using the adjustment screw (See page 131)
- Check the compression on a cold engine, as follows:
  1) remouve the spark plugs from all but the cylinder being tested
  2) open the throttle fully (full throttle)
  3) Check the compression by turning the propeller in the normal direction.
  4) Remouve the spark plugs of the cylinder being tested, and install the ones of the following cylinder.
- Drain the oil from the fuel pump casings (sump)
- Drain (change) the oil
- Clean the oil and fuel filters.

EVERY 150 Hours

- dismantle the engine.

STORAGE

- If the engine isn't used in regular service, it should be turned over about 15 minutes per week to stop the effects of corosion caused by condensation.

CHAPTER XII

RUNNING MAINTENANCE

MAINTAINING THE MAGNETOES

Put a few drops of liquid paraffin in the oiler on the top of the gear case.

- Check the points housing for any dirt: make sure the points strike on the platinum contacts, and that they are clean and well gapped. Do not put oil onto the contacts, This causes the platinum to wear very quickly and causes the ignition to miss fire.

Inspect the point gap.

Clean the contacts with gasoline if they have any oil on them.

Let the gasoline evaporate before starting the engine. Should the contacts become fouled, clean them with a very fine file (platinum points) or an abrasive stone (grind stone) (tungsten contacts)

MAINTAINING THE CARBURATOR

The maintainence consists of cleaning the fuel filter (entrance to carburator). Oil the control shafts to the acceleration pump and the throttle.

Make sure all screws and bolts are tight, and the safety wires are in fact.

Make sure all joints are tight, and don't leak.

Avoid contact with moisture which will cause the alluminum to oxdize. Clean the carburator of gas frequently. If the jets are cloged, clean them with gas, and blow them clean; Never use a piece of wire.

Never block the hole in a jet to make it smaller. Do not repair a float; if it is fuel logged (pierced), replace it.

FUEL PUMPS (Maintainence and lubrication)

The casing housing the regulator of the fuel pump must be maintained at least

half full of mineral oil

Drain the ~~casing~~ sump, clean it thoroughly and then fill it with fresh oil

The intake filter should be kept perfectly clean and in good condition. In remounting, make certain the filter spring is in place, and that the filter gasket (seal) is properly placed

To get into the values, unscrew the ~~stopper~~ (plug), remove (pick up) the spring, disse the valve bearing, the claw? and the ~~stop~~ check valve. To reassemble, be sure to put the parts in their correct places. The plugs must be put in ~~with~~ tightly.

On other occasions, especially when the pumps are being put into service for the first time, the hoses between the filter and the pump can contain impurities, it is good to check this, and clean it out.

After a fair amount of operation, the time between filter checks can be lengthened

Clean frequently the reservoirs on the test stands pumps ~~as well as the filter canisters~~ supply the benches with filter drain offs.

If, accidentally, a fuel ~~engine~~ pump on the engine takes in water, one must run it with fuel for several minutes to get rid of any fuel which may have accumulated in the joints, plumbing, pump casing or regulator

UF

SPARK PLUGS

Check the gap and make sure it is no wider than 0.4 MM. Make certain the outer electrode is in good condition.

Thouroughly clean the electrodes, make sure there are no carbon deposits.

FILTERS

Clean the fuel pump filters, the oil strainer filter, and the drain valves on the reservoir, if there are any.

OVERHAULING THE ENGINE

The need to overhaul is noticed by.

1) a decrease in engine RPM.

2) Poor compression in one or more cylinders.

3) a greater consumption of oil or a drop in oil pressure.

Before deciding to rebuild the engine, one must make the following operations

- Check the travel between the throttle lever in the cockpit, and on the carburator. They should be the same.

- Check the condition of the platinum screws (points) their gap setting (0.4 MM) and the gap in the spark plugs (0.4 mm).

- Check the cleanness of the oil and fuel filters.

- Check the on board instruments.

After having done the above, if the engine doesn't respond properly. Then an overhaul should be conducted.

STORING THE ENGINE.

When not using the engine for a long period (more than 1 month). or when working on the engine, follow the following proceedures

STORING AN ENGINE LUBRICATED WITH MINERAL OIL

With the engine very hot, drain the rear sump, and connect the oil lines with a reservoir containing the proper DE 100 oil (aviation oil), Then, having filled the fuel lines with white fuel, containing neither alcohol, or benzol, turn over the engine at about 1000 RPM for 10 minutes

In order to clean out the fuel from the fuel pumps, and the carburator, stop the engine by running it out of fuel, and then close the drain.

Take off the rocker covers, drain and clean out the oil, and put them back in place.

Clean the sump

Take out the spark plugs, fill the cylinders with oil (the piston at bottom dead center) and turn the engine over. Screw in the place of the spark plugs, ~~the~~ plugs with a dehydrating agent.

All parts which can oxidise should be coated with a "rust" preventative coating and openings should be blocked off with plates, wood plugs, or cellophane.

Protective plates should be put on:

- Air entrances to the carburator

- Exhaust and intake openings, if the manifolds and pipes aren't in place.

Plugs or caps (cellophane) on the:

- Air valve - blow off
- Air Compressor A-E
- Valves and pumps (AM)
- Vacuum pump
- Oil couplings
- Tachometer drive connection

The crankshaft cone on which the propeller hub mounts should be encased in an oil impregnated paper and secured with wire.

To store the accessories, see the sections concerning them

STORING THE FUEL PUMPS

If the engine is left idle for a number of months, run 2 to 3 cm^3 of mineral oil into the fuel pumps. To do this, remove the exit valve (check valve), force out the fuel by moving the primer lever, and pour oil on the valve (check valve) while working the primer. Replace the check valve

When putting it back in use, when starting the pumps, the fuel will dilute the small amount of oil in the pumps.

~~The engine is then ready~~ With the engine ready, resting on a frame equipped with "U" bolts on which are secured steel and felt washers which keep the engine on its frame by means of its supports