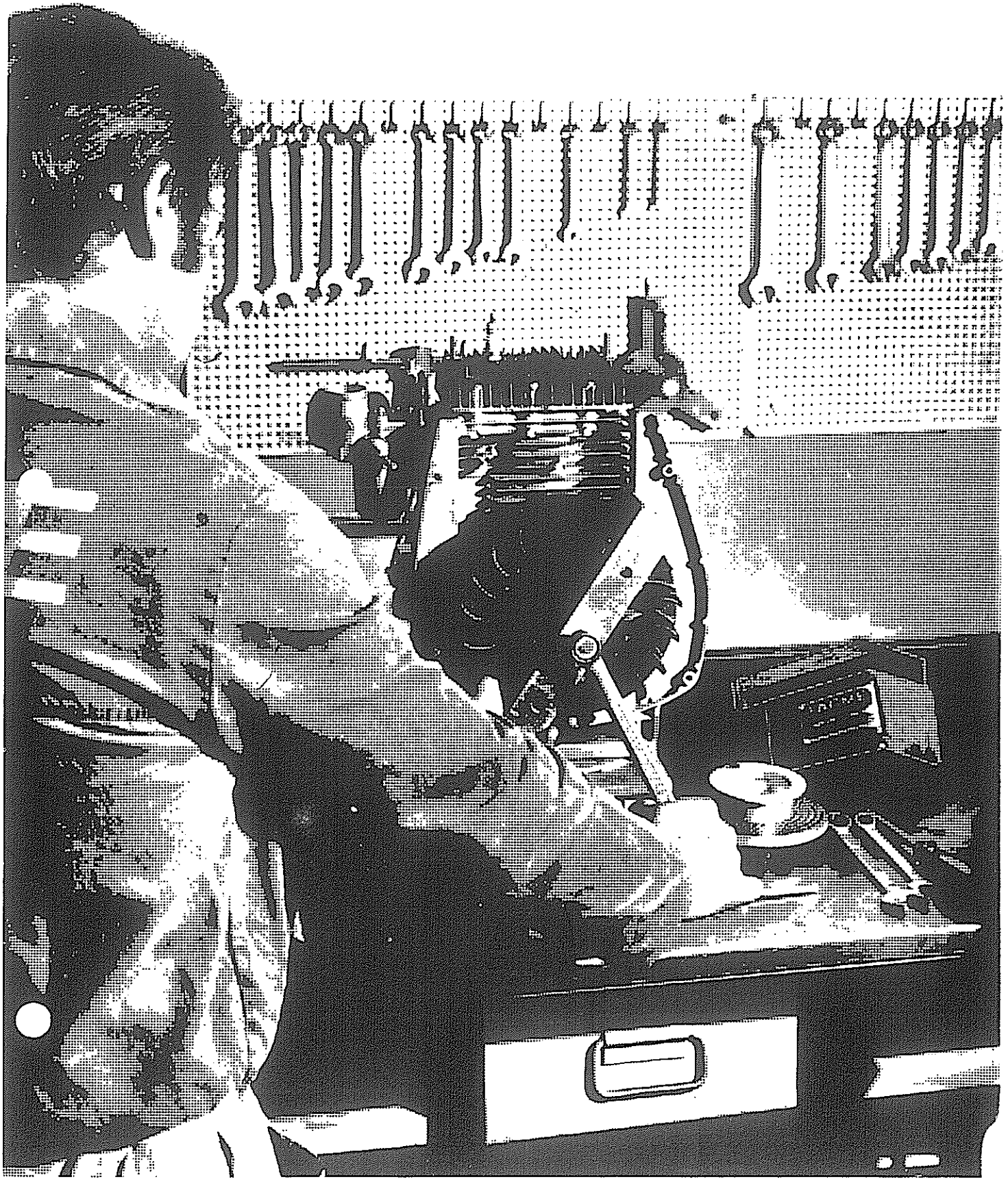
ACME motori

workshop manual

SPARK IGNITION ENGINES SERIES A 180 - A 220



FOREWORD

This Manual contains all the instructions for repairing A 180 - A 220 series engines. The engine type can be identified from the ACME engine plate fixed to the air cooling shroud on te right side of the engine as you face the engine from the starter or flywheel end. The engine serial number is stamped into the block near the plate. This Manual is up to date and your satisfaction with this product will be assured directly in relationship to the attention you give to rcommendations and suggestions contained herein:

- always use proper tools to avoid damage to engine parts;
- use only plastic hammers to disassemble coupled parts;
- mark parts to facilitate reassembly;
- separate various parts in groups and place (temporarily) nuts and bolts in their proper location when disassembling;
- when reassembling, thoroughly clean and lubricate each part and install new gaskets. Do not use gasket cement on any gasket.

ENGINE OIL: Always use a high quality oil. Each time you fuel the engine, check the oil (with the engine in a level position). Bring the oil level up to full, however small the amount of oil necessary to do so. Stay strictly with the manufacturers recommendations of lubricants.

ENGINE STOPPING: When stopping an engine with electric starter, always use the key switch. If the key is left in the ON position, the battery will be drained of its power in the same manner your car battery would go flat if the ignition key was left ON.

A FEW OTHER HINTS: The engines with electric starter, are equipped with a charging coil. If the battery is accidently discharged, start the engine with rope; the battery will recharge.
Proper engine running-in will reward you with many extra engine horse power hours. Do not overload the engine at any time during the first ten hours of operation.

USE GENUINE ACME SPARE PARTS ONLY.

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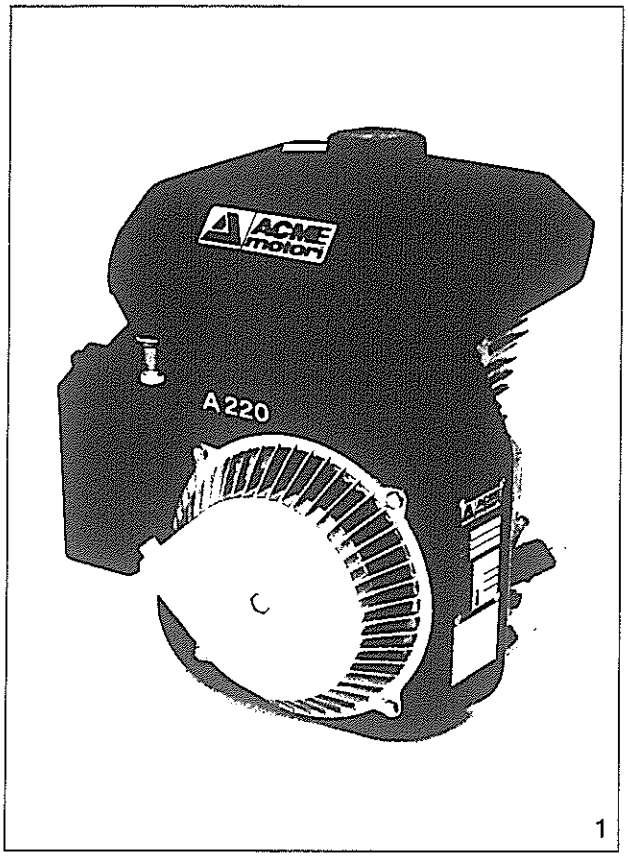

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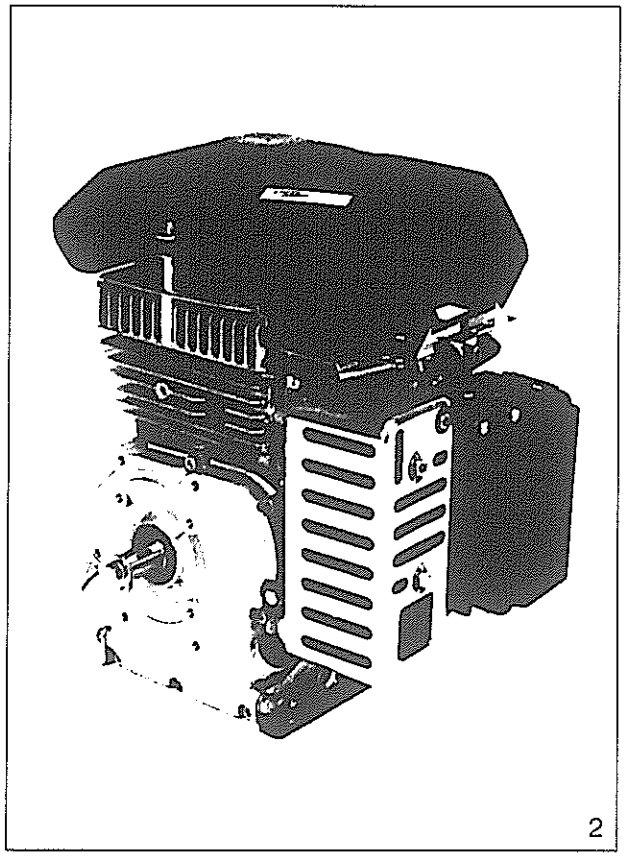
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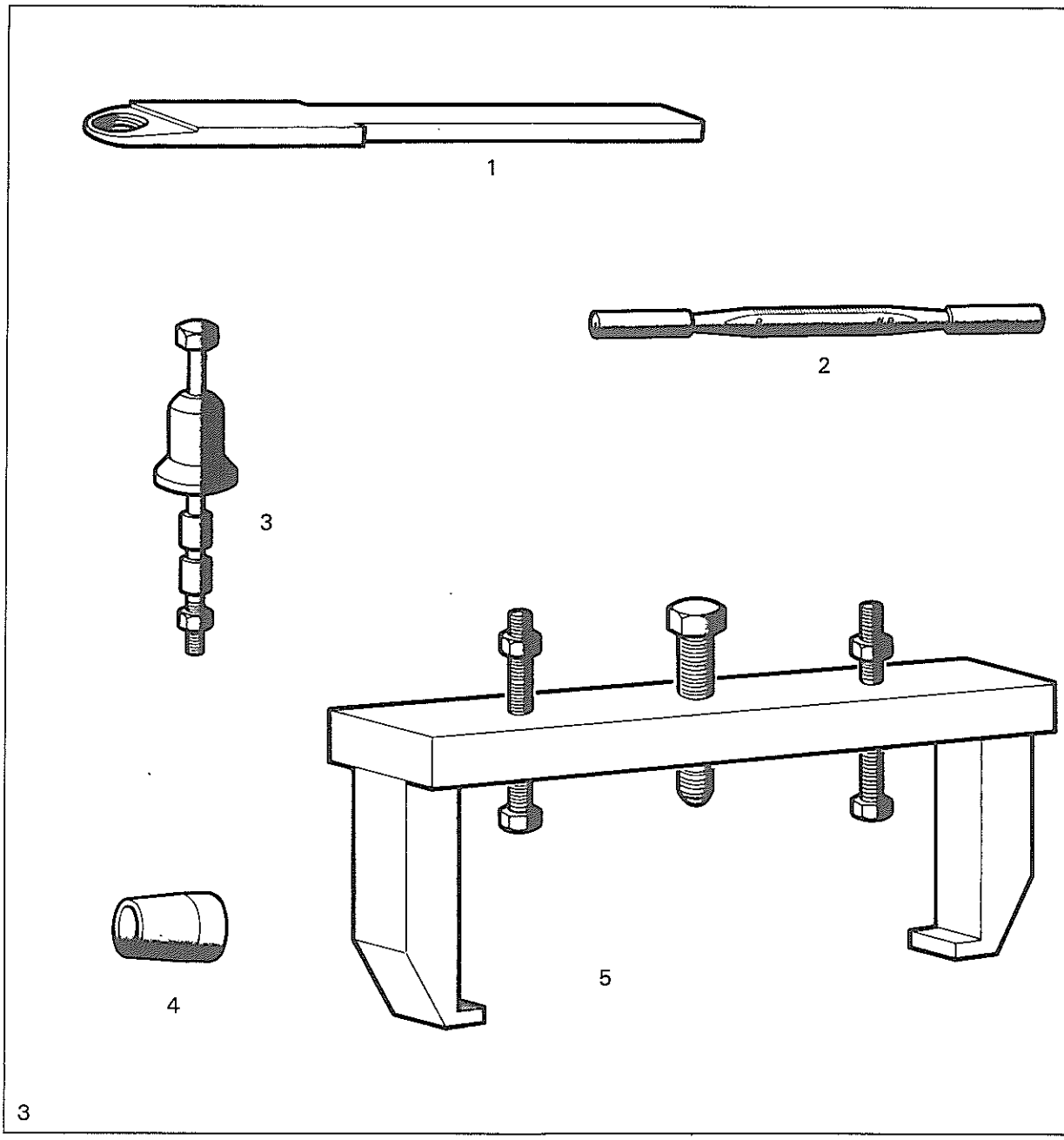
1 TECHNICAL FEATURES

ENGINE TYPE	DISPLACEMENT		BORE		STROKE		COMPRESSION RATIO	STANDARD R.P.M.
	cm³	cu. in	mm	in	mm	in		
A 180 B	179	10.92	65	2.56	54	2.13	6.17:1	3,600
A 180 P	179	10.92	65	2.56	54	2.13	4.49:1	3,600
A 220 B	220	13.43	72	2.83	54	2.13	6.17:1	3,600
A 220 P	220	13.43	72	2.83	54	2.13	4.45:1	3,600



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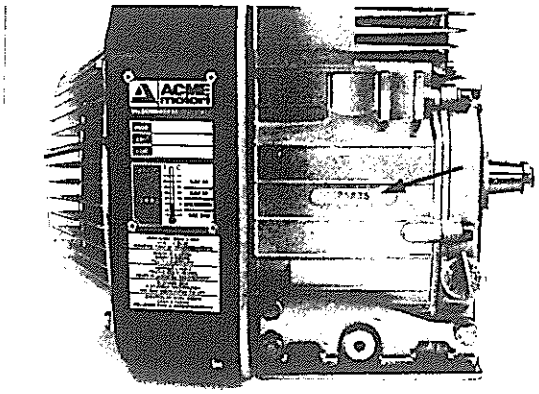
2 SPECIAL TOOLS

POS. NO.	TOOL NO.	DESCRIPTION
1	365110	VALVE SPRING EXTRACTOR
2	365048	VALVE GUIDE CHECK TOOL
3	365109	VALVE GUIDE PULLER
4	365152	OIL SEAL INSTALLATION CONE
5	365113	ENGINE FLYWHEEL AND TIMING COVER PULLER

3 ENGINE DISMANTLING

3.1 ENGINE IDENTIFICATION

The engine type can be identified from the ACME engine plate fixed to the air cooling shroud on the right side of the engine as you face the engine from the starter or flywheel side. The engine serial number is stamped into the block approximately three inches to the rear of the plate (fig. 4).



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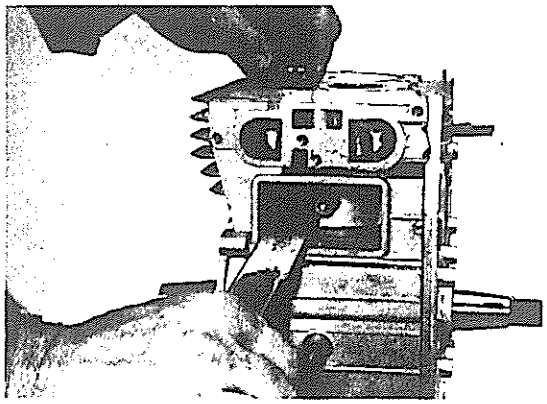
3.2 VALVES DISASSEMBLING

After removing the cup containing the shims for valve clearance adjustment and after positioning the piston on the T.D.C., use the tool no. 1 page 4 as shown at fig. 5. Should it be difficult, turn the lower cap until the slot on such cap faces the inside (see fig. 46 pag. 17).



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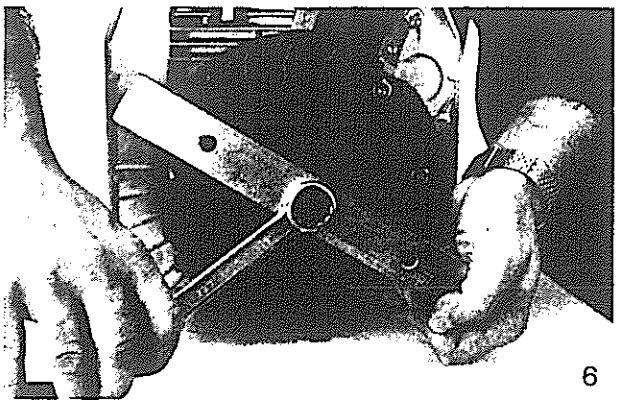
3.3 FLYWHEEL REMOVAL

Use the puller no. 5 page 4, after removing nut, washer, pulley and guard (fig. 6).



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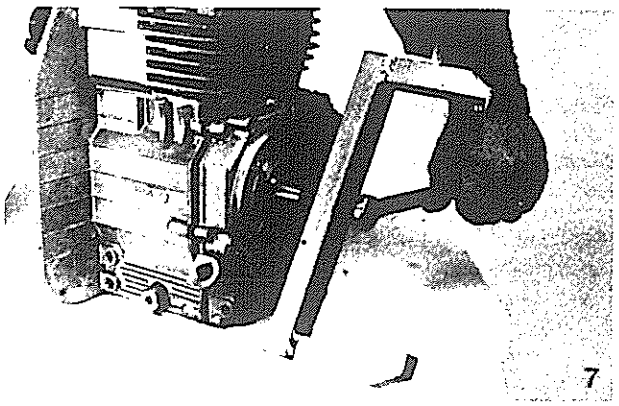
3.4 TIMING COVER REMOVAL

Use the puller no. 5 page 4, positioning the central screw on the opposite side to that used to pull the flywheel out and tightening the other two screws in the threaded holes on the cover (fig. 7).

3.5 GOVERNOR GEAR

Remove the clamp and take out both pins of the flyweights; take the flyweights and the cap out of their seat. After removing the retaining ring, the gear can be taken out of the pivot.



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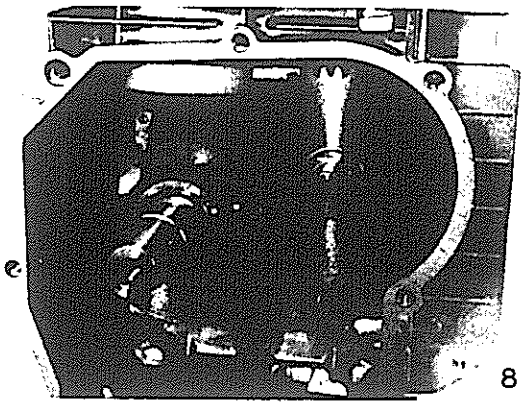
3.6 CAMSHAFT REMOVAL

Remove the cup with the shims for valve clearance adjustment and rotate the crankshaft until the marks on the camshaft gear and on the crankshaft gear are in correspondence (fig. 8).

N.B.: The tappets will then release from their guides.



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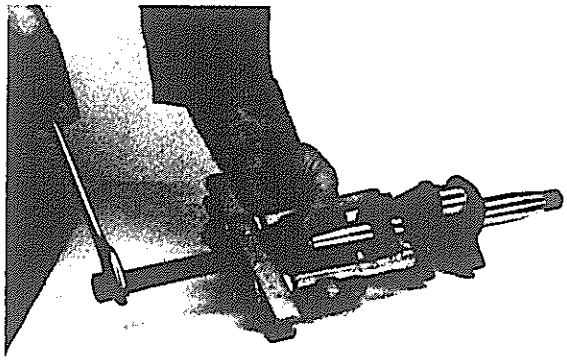
3.7 CRANKSHAFT GEAR REMOVAL

Use a universal puller with 2 or 3 fingers (fig. 9).



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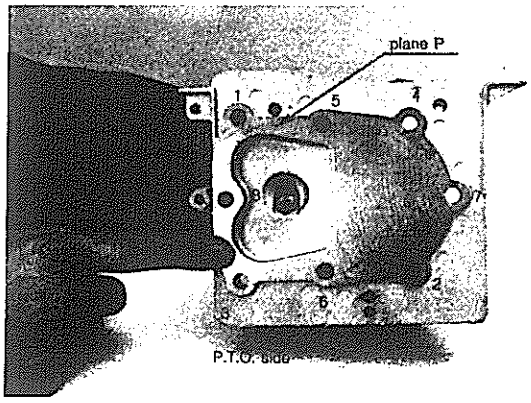
4 CHECKS AND OVERHAULS

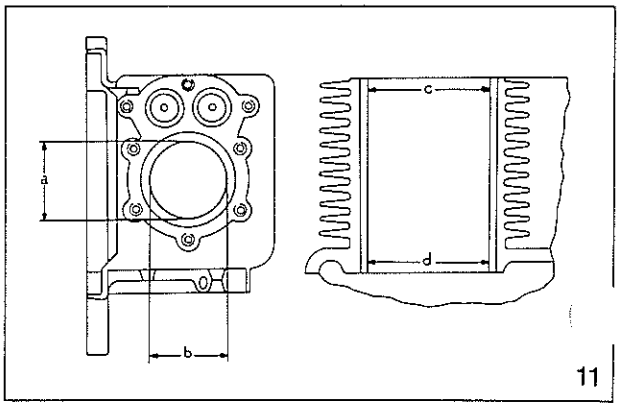
4.1 CYLINDER HEAD AND CYLINDER

The cylinder head is made of aluminium alloy and therefore the head should not be loosened when the engine is hot. Removal of a hot cylinder head can result in warping of the cylinder head. Any trouble occurring on plane P of the head (fig. 10), should be removed by milling the head surface.
Maximum flatness tollerance in between:

0.3/0.5 mm	**0.012/0.020 inches**



To obtain clean removal of carbon deposits, soak the head in gasoline (petrol) or Diesel fuel for three or four hours.
The cylinder sleeve is made of special cast iron (perlite) and is inserted into the engine block during pressure die casting. In dealing with cylinder wear, there are two oversize possibilities. Accurately gauge the extent of wear. Should the cylinder wear measure less than **0.06 mm (0.0024 inches)**, change piston rings (see table 9 page 26).



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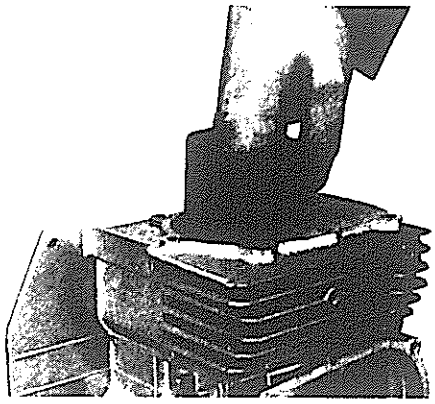
To facilitate quick and proper seating of the new piston rings, hand hone the cylinder with emery cloth (80-100 fine) soaked in Diesel fuel (fig. 12).
A rough surface should be obtained, as per fig. 13 below.

To avoid breakage of new piston rings, remove with sandpaper any ring groove which might have formed at the top of the cylinder (zone A, fig. 13).
After the above operations, wash thoroughly with kerosene or Diesel fuel.
Should maximum wear be over 0,06 mm and roundness an taper be in excess of indicated value, recondition cylinder as per Table 9 page 26.

CAUTION: When grinding comply with working tolerance that should be or between:

mm	**+0.020 0**	**inches**	**+0.0008 0**

from nominal diameter of the cylinder bore.



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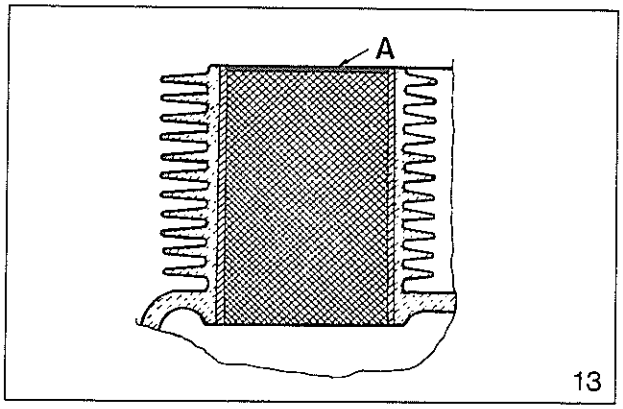

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4.2 VALVE GUIDES, VALVES SPRINGS AND TAPPETS

Original as well as replacement valve guides are made of special perlitic cast iron (intake) and bronze (exhaust) and are inserted into the engine block. To check wear between valve and guide, use a go no-go internal gauge n. 2 page 4 (fig. 14).

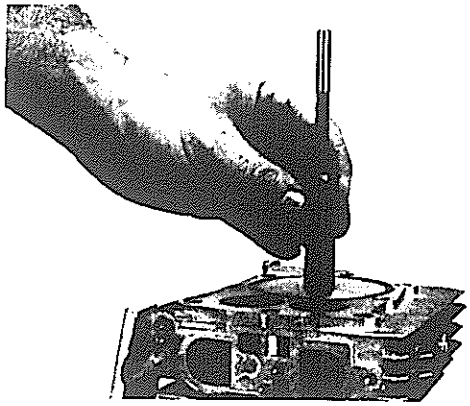
Internal valve guides diameter after assembly in the engine:

min.	**7.015 mm**	**0.2762 in**
max.	**7.025 mm**	**0.2766 in**

ACME valve guides gauge diameter:

go	**7.000 mm**	**0.2756 in**
no-go	**7.097 mm**	**0.2794 in**

Should clearance exceed, replace with new guides using puller no. 3 pag. 4 (fig. 15), after removing the lower split ring.



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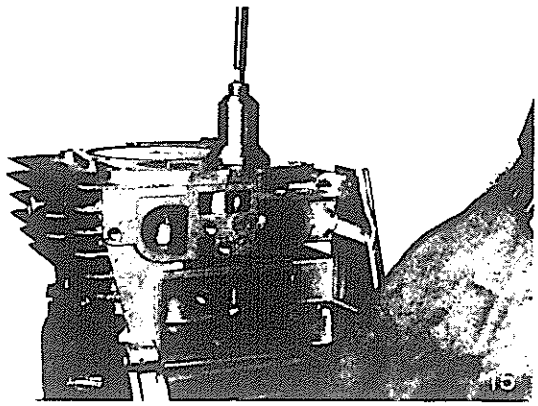

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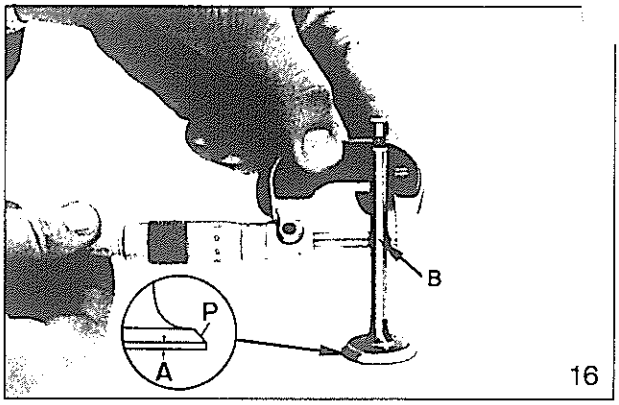
Valve condition is checked according to A and B values indicated in fig. 16.

With A not less than **0.5 mm (0.020 in)** and B falling within the limits shown below, it is possible to repair the valve by grinding track P at 45°.

VALVES NOMINAL DIAMETERS B					
Exhaust valve			Inlet valve		
max.	6.970 mm	0.2744 in	max.	6.970 mm	0.2744 in
min.	6.955 mm	0.2738 in	min.	6.955 mm	0.2738 in



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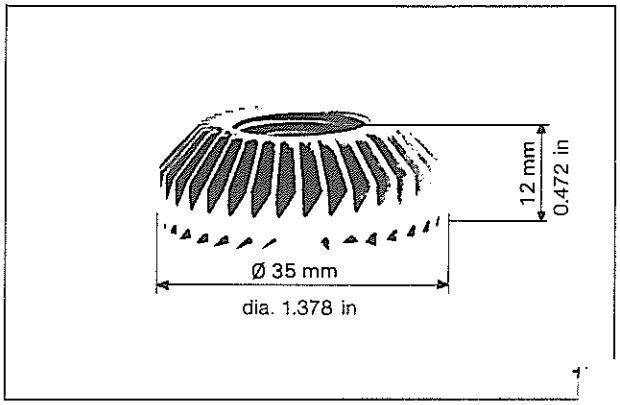
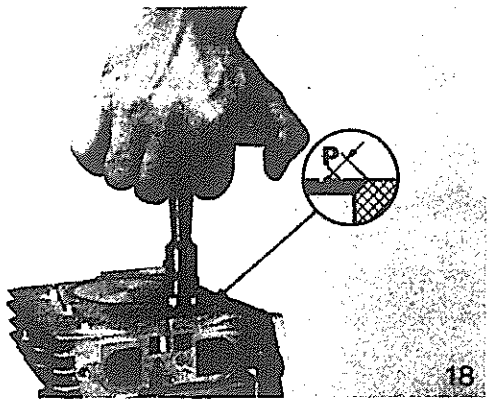
Valve seats are made of special cast iron of high nickel content to make them more heat resistant.
Seats are formed with an integral lip, which locks them permanently into the block during pressure die casting.
To regrind use a conical 45° valve grinding tool (fig. 17).



Due to prolonged use of the engine, tapping of valves on seats at high temperature hardnes track P (fig. 18) and makes hand grinding impossible.
It is therefore necessary to remove the hardened layer with a 45° grinding tool, employing a mechanical grinder.



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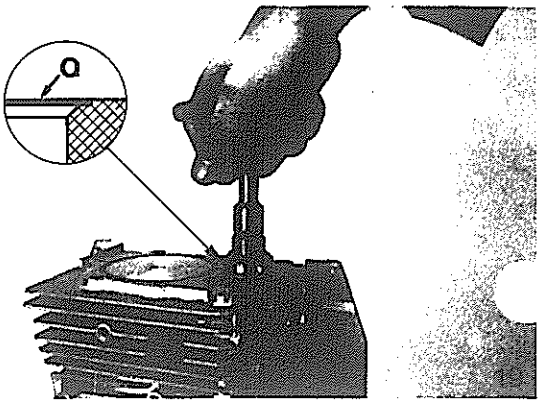
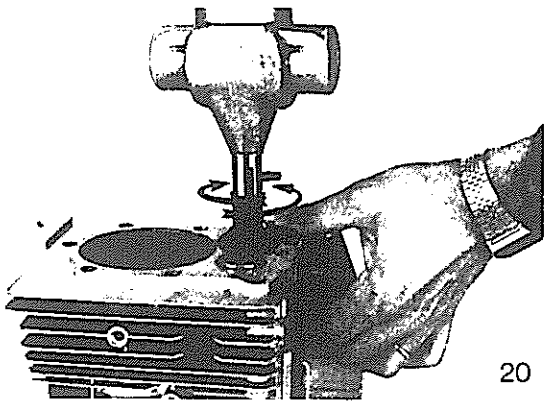
The final ajustment can be made by hand with the above illustrated hand grinder. Valve seat regrinding implies widening of track P. Should P be wider than 2 mm (0.079 in), lower plane Q (fig. 19) till P is **from 1.2 to 1.3 mm (from 0.047 to 0.051 in).**



Final adjustment of valves on the seats must be made by using fine grained emery paste and by rotating the valve with pressure, utilizing an alternate rotary movement, until a perfect «seating» is obtained between the two surfaces (fig. 20).

Next wash the valve and seat thoroughly with kerosene or gasoline to remove any lapping compound or swarf.



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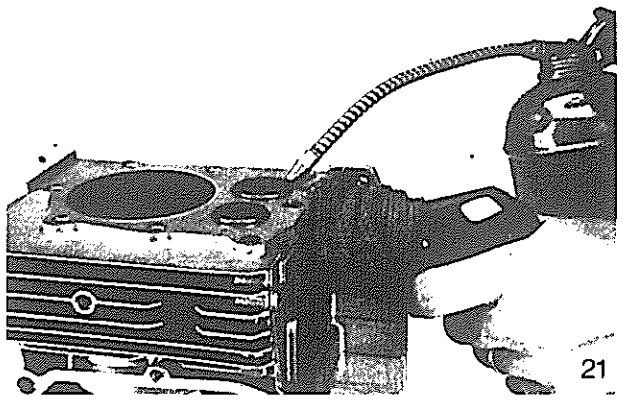
To check the seal between valve and seat after grinding, proceed as follow:

1) Mount the valve on the crankcase with spring and stop cap;
2) Pour some oil drops around the valve head.
3) Blow compressed air in the duct, making sure to plug the sides of the duct to avoid air leaks (fig. 21).

If air infiltration occurs in the form of bubbles between seat and valve, dismantle the valve and re-grind the seat.
The seal can also be checked by pushing the valve upwards and letting it fall freely down on to its seat. If the rebound which takes place is considerable and uniform as the valve is rotated, it means that a good fit has been made. If not, continue to re-grind in order to achieve the conditions described.
Change spring if H is lower than 31 mm (1.22 in); 34 mm (1.34 in) is measuremente of new spring (fig. 22).
Make sure that the max play between tappet and guide is 0.037 mm (0.0015 in) and no scratches can be seen on the stem and on the head in touch with the camshaft. In the negative replace the tappets.



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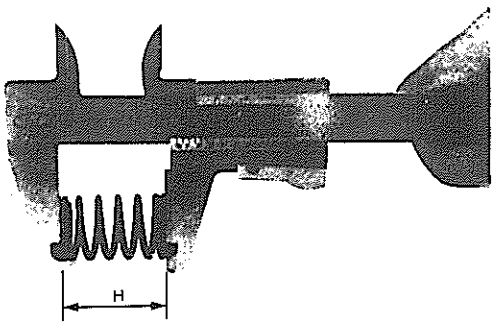

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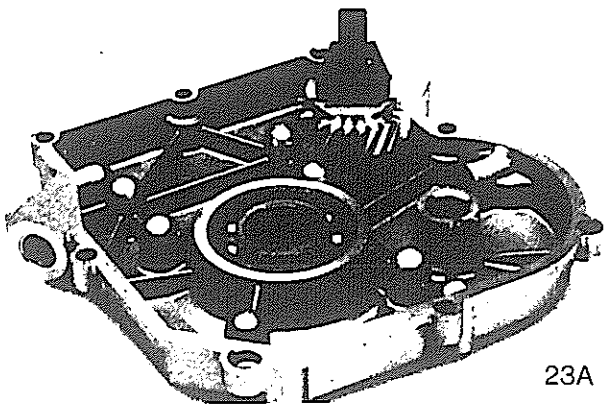
4.3 SPEED GOVERNOR

Flyweight type (fig. 23A-23B).
Check that the gear rotates freely on its pivot and make sure that the flyweights come out easily of their seats.

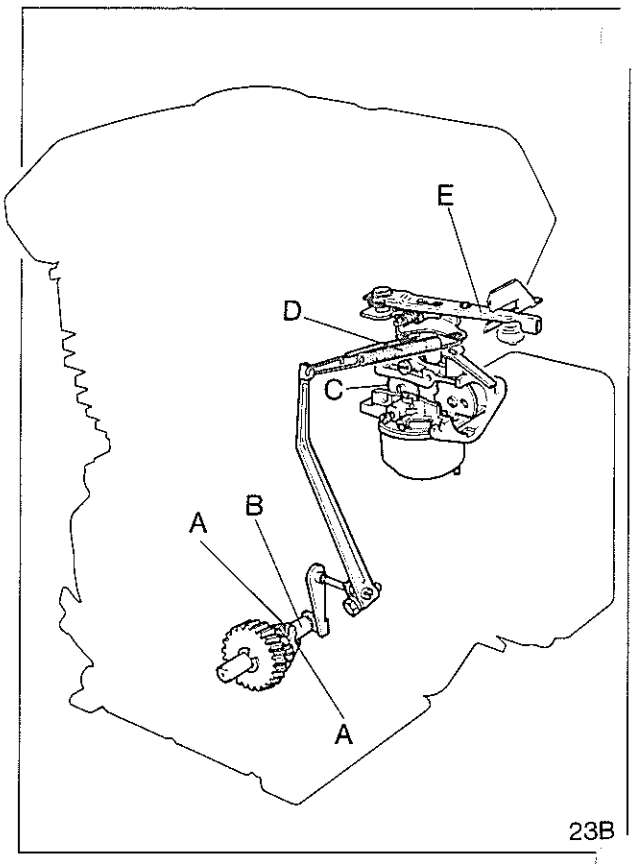


23A

The two **A** flyweights, pulled outward by centrifugal force, push **B** cap axially and this cap by means of a series of levers opens the carburetor throttle plate **C**. The spring **D**, put under tension by the accelerator **E**, works against the action of the centrifugal force.
Every position of the accelerator lever corresponds to a load variation on the spring and therefore to a situation of balance between the tension of the spring and the centrifugal force of the flyweights at different RPMs.
The cap plane on which the flyweights act should be smooth and ortogonal to the guide hole.
The play between the cap and its pivot should be

0.17 / 0.24 mm	0.005/0.009 inches

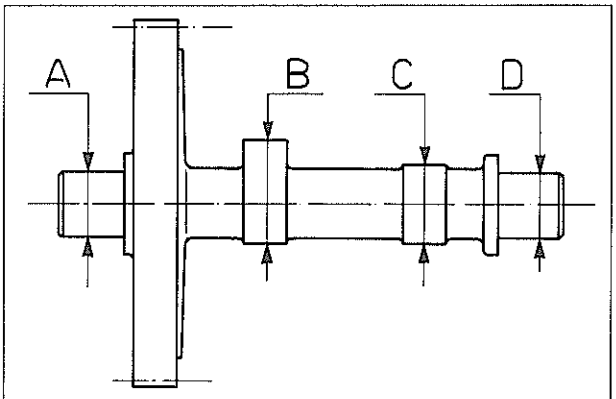
In case of excessive play replace cap.



23B

4.4 CAMSHAFT

Make sure that the cam lobes, the pivots and the gear show no signs of wear or scratches. Any light marks or scratches can be trued by using some extremely fine grain files and finished by emery cloth of the same kind.
The value of the cam lobe and the journal dimensions of the camshaft are specified at table of fig. 24.
The gear is helical-toothed to reduce the noise and add strength.
The exhaust cam has a lobe which delays the closing of the valve at low R.P.M. and makes the engine start easier, thus eliminating any possible counterstroke.
This device is standard on all engines, allowing the application of recoil starter also on those engines which originally were rope start, with no extra modification.



A mm (in)		B mm (in)		C mm (in)		D mm (in)	
min	max	min	max	min	max	min	max
14,973 (0.589)	14,984 (0.590)	23,275 (0.916)	23,325 (0.918)	17,575 (0.962)	17,625 (0.964)	14,973 (0.589)	14,984 (0.590)

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4.5 OIL SEAL RINGS

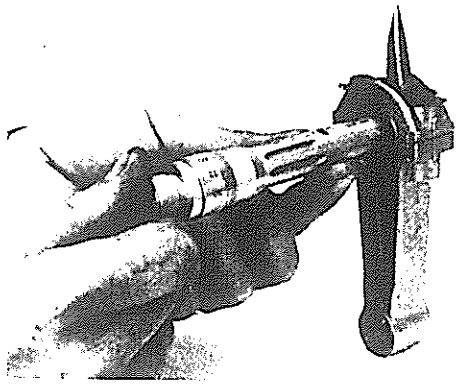
Check the inner surface of the seal rings for hardening or scratches where the seal touches the crankshaft. If hardened or scratched, replace with new seals with the following dimensions:

OIL SEALS DIMENSIONS	
Dimensions	Code
∅ 25 x 40 x 7 mm (dia. 0.90 x 1.57 x 0.28 in)	054126

4.6 MAIN BEARINGS

The crankshaft is supported on both sides by ball bearings with the characteristics indicated in the following table:

FLYWHEEL & P.T.O. SIDE		
Type	Dimensions	Code
Balls 6205	∅ 25 x 52 x 15 mm (dia. 0.98 x 2.05 x 0.59 in)	304102



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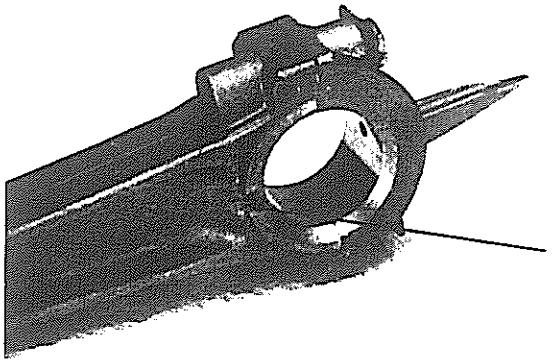
4.7 CONNECTING ROD

The connecting rod is made of a special die-cast aluminium alloy without «big end» and «small end» bearings. In case of wear or siezure, replace the whole connecting rod with another one with reduced head hole. Two reductions are allowed and, in case of crank journal grindings, consult the table 10 page 26.
The maximum wear of the connecting rod «big end» hole is (fig. 25):

mm 0.10	0.004 in



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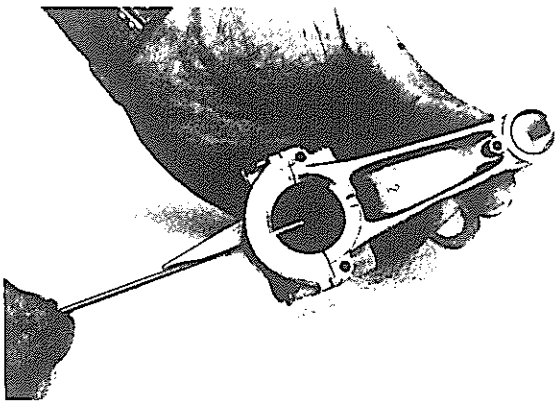
On the shoulders of the connecting rod «big end» there are grooves that assure a greater lubrication of the journal and the bearing (fig. 26). On the connecting rod cap there is a little scoop for the splash lubrication (fig. 27).

The fitting tolerance between «small end» hole and piston pin must be:

max 0.022 mm min 0.006 mm	max 0.0009 in min 0.0002 in



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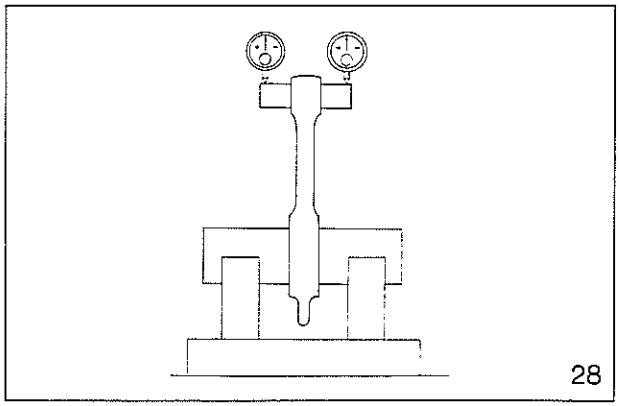
To check connecting rod axis, proceed as follows:

1) Fit pin in «small end» hole and a calibrated pin in «big end» hole.
2) Place big pin ends on two guage blocks laying on a surface plate (fig. 28).
3) Using a column gauge, be certain that the difference between the two pin ends does not exceed 0.05 mm (0.002 in). If in excess of 0.05 mm, square the connecting rod, or replace it (fig. 28).

Should the connecting rod axis not be parallel, proceed as follows (using a small press);

a) Place connecting rod on two blocks and make sure it is perfectly levelled with the press plane.
b) Press gently on connecting rod stem until values coincide with those indicated under paragraph 3.



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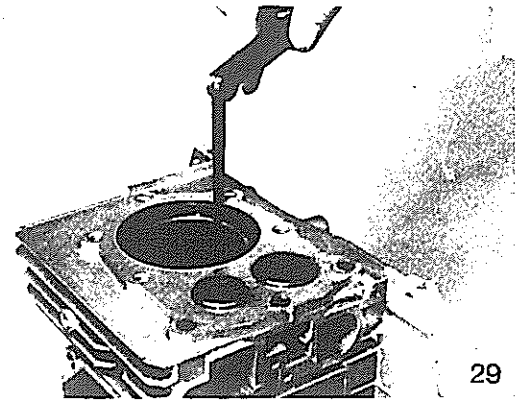
4.8 PISTON RINGS AND PISTON

To check the piston rings wear, insert the rings in the cylinder and gauge the gap between ring ends (fig. 29) which should be between:

0.25/0.45 mm (0.0098/0.0177 in)	for compression rings
0.20/0.35 mm (0.0098/0.0177 in)	for scraper ring

If the cylinder does not require reconditioning, replace the rings with others of the same type.
Make sure that the piston skirt shows no deep scratches and no seizure. Make sure that the pin hole has no ovalization exceeding 0.10 mm. If so, replace both piston and piston pin. After disassemblying the piston rings and eliminating the carbon deposits, make sure that they run freely in the grooves and that their vertical clearance (fig. 30) is:

1st compression ring	A = 0.05 mm (0.000197 in)
2nd compression ring	B = 0.05 mm (0.000197 in)
Scraper ring	C = 0.05 mm (0.000197 in)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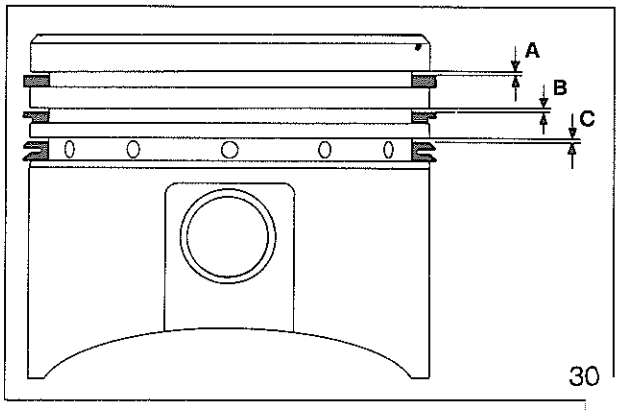

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4.9 CRANKSHAFT

Check that the main journals and the crank pin have no scratches or traces of any seizure.
Any possible light scratches or marks should be trued by means of a very fine grain file and finished by an emery cloth of the same kind.
Cones, key seats and threads should not be warped and should show no marks.
With the crankshaft perfectly clean, using a micrometer, check wear and ovality of the journals and of the crank pin, at two different positions, perpendicular to each other (fig. 31).
If wears exceed 0.05 mm (0.00197 in) grind the crank pin as table 10 pag. 26.

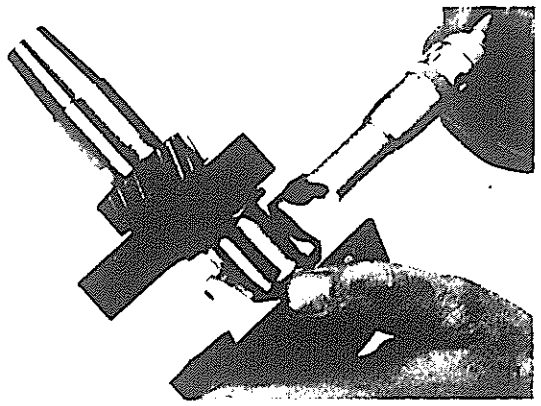
N.B.: When grinding the crank pin, keep a working tolerance of

max	mm	0.000	in	0.00000
min		—0.011		—0.00043

The diameter of the main journals should be

max	mm 25	+0.015	in 0.98425	+0.00059
min		+0.002		+0.00008

and it cannot be ground. Should the measured dimensions not correspond to the above, replace the crankshaft.
Make sure that there are no scratches in correspondance with the oil seal rings. If any, they should be eliminated with a very fine emery cloth.



4.10 CARBURETOR

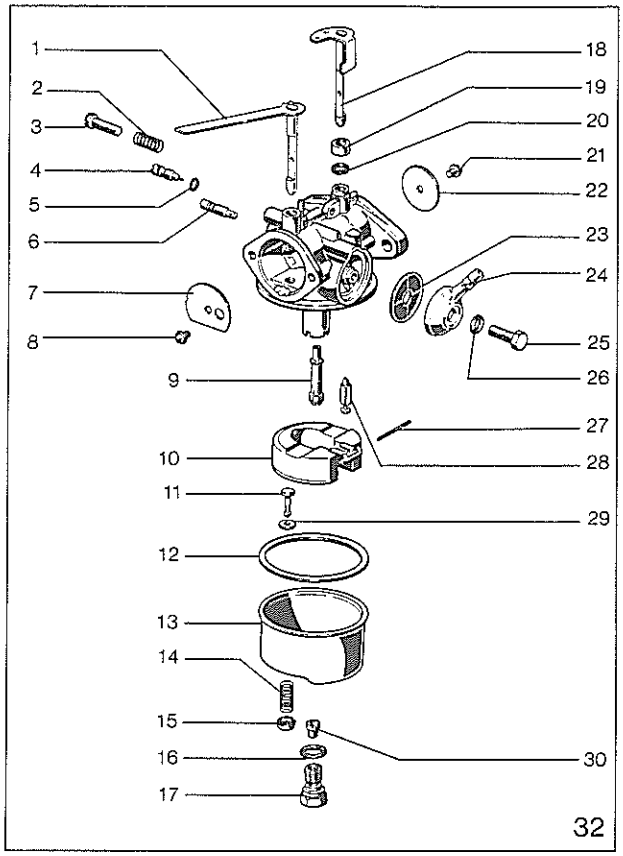
Parts shown at fig. 32
1) Lever - 2) Spring - 3) Idling R.P.M. adjusting screw - 4) Idling mixture adjusting screw - 5) Gasket - 6) Idle jet - 7) Choke plate - 8) Screw - 9) Atomizer - 10) Float - 11) Push-button - 12) Gasket - 13) Float chamber - 14) Spring - 15) Drain push-button - 16) Washer - 17) Plug - 18) Lever - 19) Cap - 20) Gasket - 21) Screw - 22) Throttle - 23) Filter element - 24) Eyelet - 25) Screw - 26) Washer - 27) Float pin - 28) Needle valve - 29) Gasket - 30) Main jet.

Carburetors characteristics
(dry air filter STD)

Engine type	Fuel Feeding	Carb. mod.	dia. diff. mm	dia. throttle mm	dia. needle valve mm	Main jet	Idle jet	Code
A 180 B	gasoline	FHCD 20/16	16	20	1,2	95	35	155142
A 180 P	kerosene	FHCD 20/13	13	20	1,2	98	35	155144
A 220 B	gasoline	FHCD 20/16	16	20	1,2	98	35	155138
A 220 P	kerosene	FHCD 20/16	16	20	1,2	100	35	155140

To carry out any cleaning or checking, please proceed as follows:

— disassemble the carburetor completely and wash its components carefully, using gasoline or kerosene. Never use any metal points cleaning jets, holes or calibrated channels, but only compressed air;
— check the seal of the needle valve and see that it runs freely in its seat; replace it if not;
— make sure that the float is not damaged and that it moves freely;
— make sure that the throttle rod rotates freely in the whole area where it can be used, and that the play between the rod and its seat is not excessive, as it might let some air in;
— make sure that the choke plate is not worn and that its rotation is complete and free;
— make sure that the fuel filter and the atomizer are not damaged or dirty.



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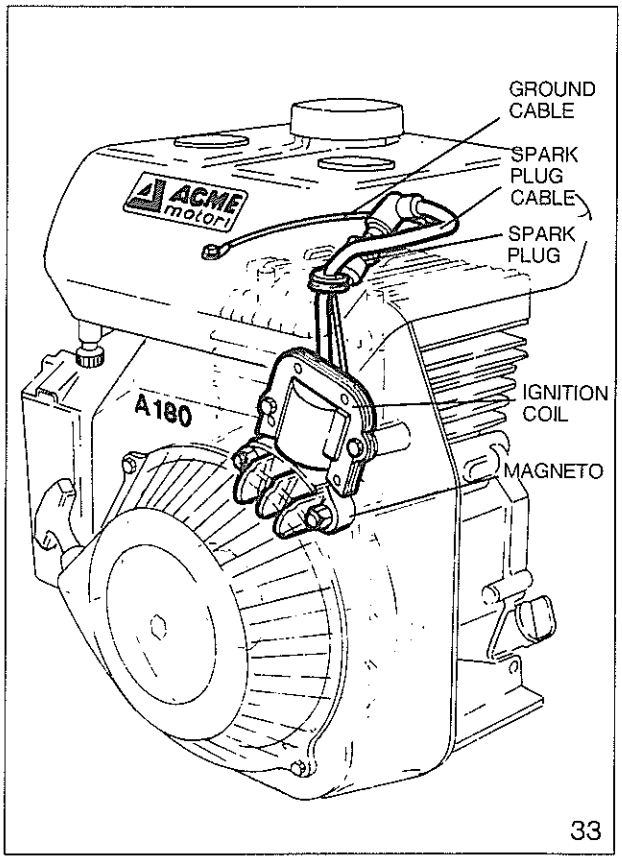


33

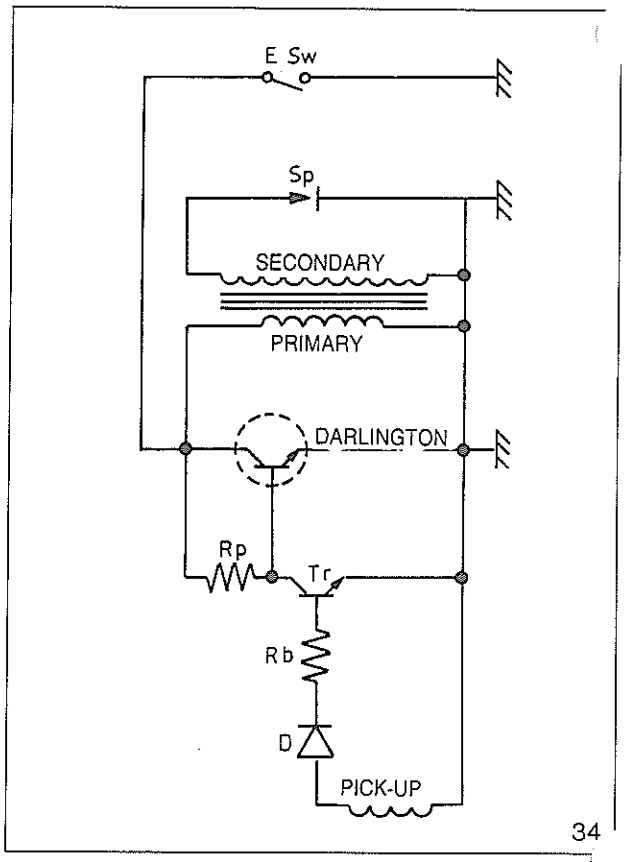
4.11 IGNITION

Inductive type electronic ignition with high performances which make engine starting much easier.
This system is designed for a higher degree of quality in each of the features listed below:

— no maintenace required as there are no moving parts;
— resistant to moisture, water and dust;
— high durability as there no parts subject to deterioration due to mechanical wear;
— stable working and efficieny;
— simple costruction as the number of components in the ignition system has been considerably reduced.

Hereunder please find the operating principles of the ACME electronic ignition (fig. 33-34).

The inductive type electronic ignition reflects the operation of the breaker points system; however, in this case, the mobile contact interrupting the current in the primary winding is replaced by one or many transistors in «DARLINGTON» connection, which are usually closed (conduction) and are opened (lock) by a pick-up device followed by a small transistor. The «DARLINGTON» connection must open at peak current flow through the primary winding to have the highest efficiency, as it happens for the conventional breaker points ignition.
When a current is induced in th pick-up device, after being rectified by the diode D, it causes conduction in the transistor Tr, which takes to ground the «DARLINGTON» base, which is therefore interdicted, provoking a sudden variation of current circulating in the primary winding from peak to zero, with consequent extravoltage to the secondary winding, provoking the spark in the Sp spark plug.



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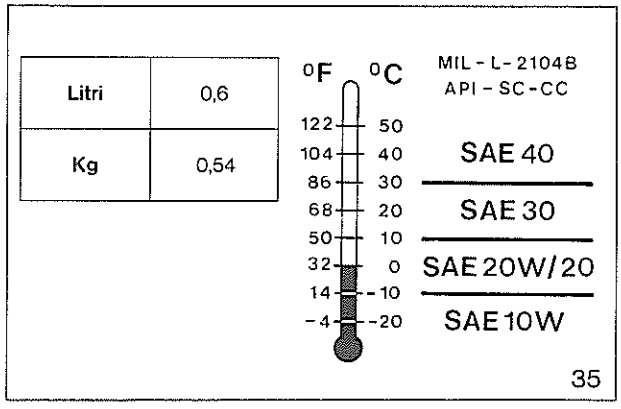
4.12 LUBRICATION

Lubrication of the internal engine parts is splash type. An oil jet is lifted and guided towards the piston crown by an oil dipper in the big end of the connecting rod. The oil reaches the tappets, valve springs, and caps in mist form, driven by upcoming air along the tappets at each stroke of the piston in the cylinder.
The diaphragm in the breather maintains the correct pressure inside the crankcase and prevents oil leakage and any dirt from getting in.
Before starting the engine, make sure that the sump is filled with clean oil per the table in fig. 35.

Litri	0,6
Kg	0,54



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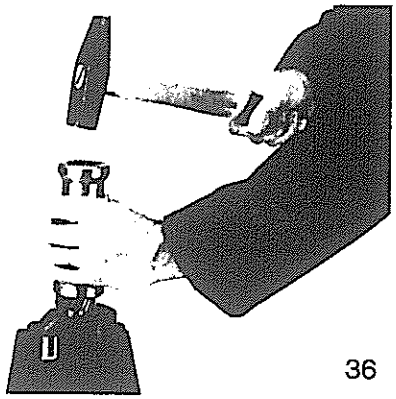
5 ENGINE ASSEMBLY

5.1 CRANKSHAFT

To assemble the crankshaft on the crankcase correctly, proceed as follows:

1) Pre-heat crankcase and timing cover from 70° to 80°C (190°F to 210°F) and fit bearings in their casing.
2) Pre-heat crankshaft gear by placing in oil bath 80° to 90°C (210 to 230°F) for a few minutes.
3) Fit gear key in crakshaft key-way and then place gear on shaft (fig. 36).
4) Fit crankshaft in engine crankcase using a plastic hammer (fig. 37), placing a wedge between the two crankshaft counterweights in order to avoid damage to the crankshaft.
5) Fit oil seals on both crankcase and timing cover; place protection cone on shaft end to prevent scratching or otherwise damaging oil seals.



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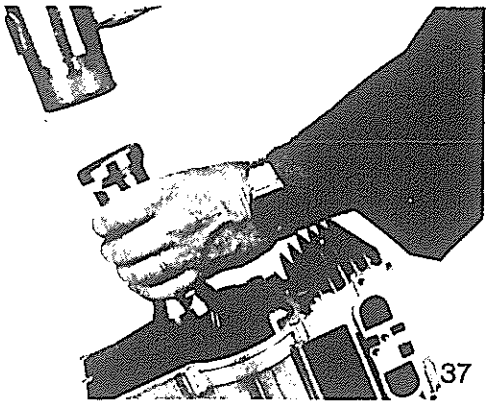
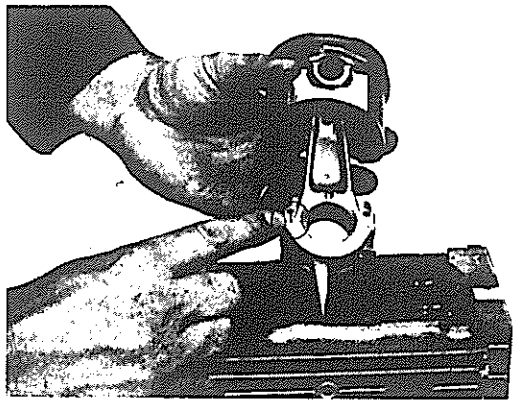


37

5.2 PISTON AND CONNECTING ROD

The piston and the connecting rod have to be mounted as follows; by keeping the arrow forged on top of the piston turned to the left, the connecting rod should be mounted with the reference notches on the connecting rod big end toward the assembler (fig. 38 and 39).
The piston pin should be mounted without preheating the piston, but pressing it by hand. The lock it by the stop rings.
After inserting the rings into the proper grooves on the piston and before fitting piston into cylinder, equally place rings at 120° angle to one another (1/3 way each around piston circumference).
The scraper ring (the thicker ring with perforations) fits in the bottom groove and the two compression rings fit in middle and top grooves (fig. 39).
The installation of piston into cylinder is facilitated by using a ring compression tool.



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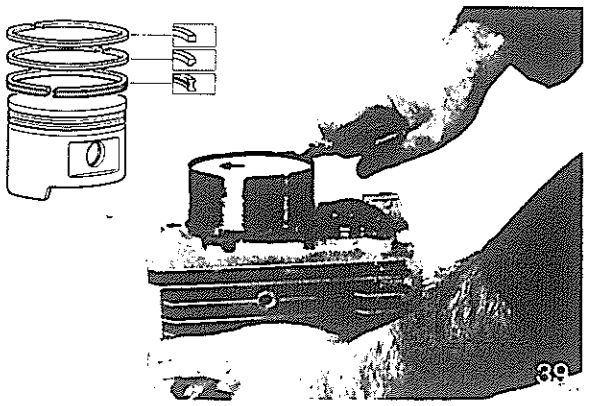

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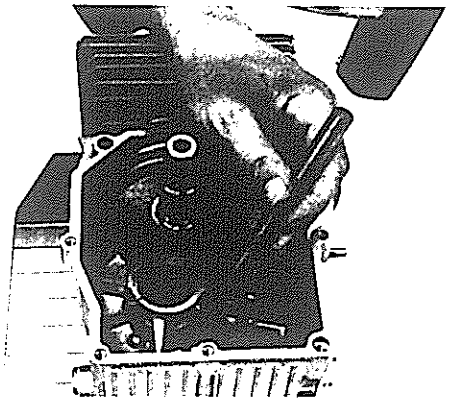
5.3 CONNECTING ROD AND CRANKSHAFT CONNECTION

There is only one way to assemble connecting rod and cap (fig. 38). It is necessary that the two marks on connecting rod stem and cap correspond. When fitting connecting rod on crankshaft, the marks face toward timing cover.
After assemblying the connecting rod, tighten the screws, by using torque wrench at a value of

11.8 Nm (1.2 Kgm) (8.7 ft-lbs)

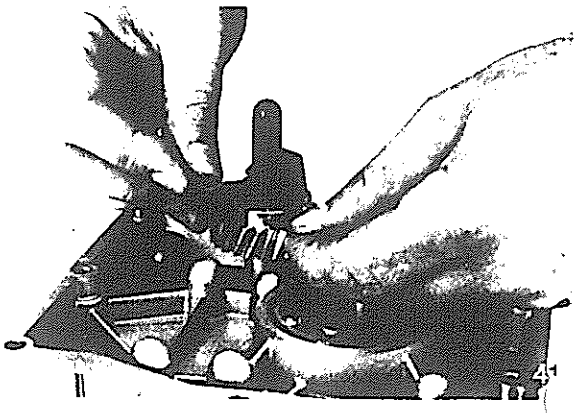
Bend locking tab washer at both cap screw heads (fig. 40).



40

5.4 SPEED GOVERNOR

After assembling the gear on the pivot fixed to the timing cover, lock it by the retaining ring. Then assemble the push rod and the flyweights with their own pins, locking them by the clamp (fig. 41). Insert the inner lever of the governor In the crankcase, locking it by the two retaining rings (fig. 42). For any explanation as to the governor working, see par. 4.3 page 9.



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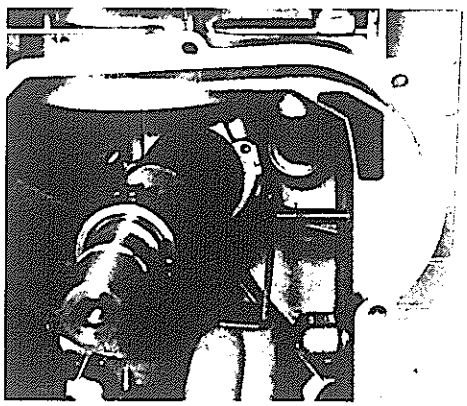
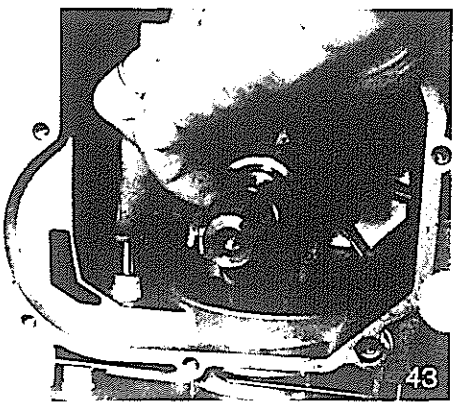


42

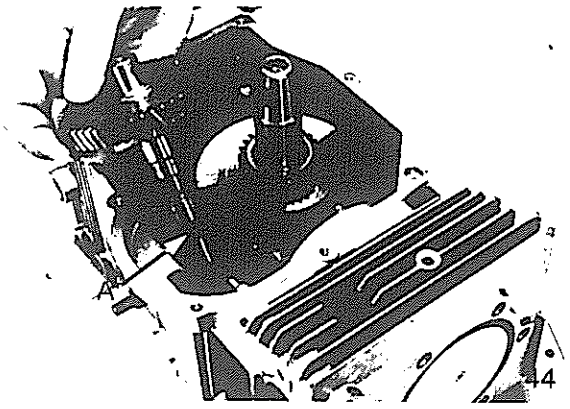
5.5 CAMSHAFT

To insert the camshaft in its seat in the engine block, proceed as follows:
a) fit the tappets in proper casings (fig. 43).



43

b) fit the camshaft with bevel A (fig. 44) placed parallel to the tappets;
c) rotate the carkshaft until the piston reaches the T.D.C. point, to make the marks stamped in the gears coincide (fig. 8). In this way the timing will be correct.

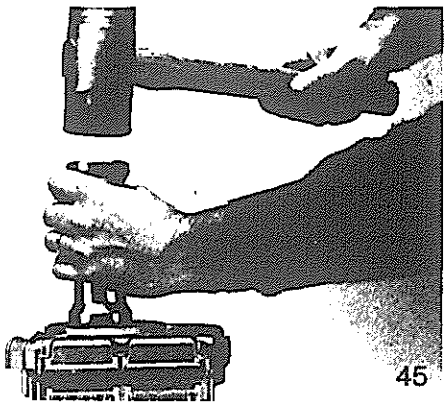

44

5.6 TIMING COVER

After assemblying the gear and the governor units, as shown at par. 5.4 page 16, proceed as follows:

a) apply the protection cone no. 6 page 3 to the shaft end;
b) mount the timing cover, with the proper gasket between the surfaces (fig. 45).

N.B.: During the assembly, take care that the governor gear can couple with the camshaft gear correctly. Do not force the insertion of the cover if you are not sure that the coupling is correct, as the governor gear might be seriously damaged.
The two longer screws have to be fitted to the upper right and to the lower left positions.

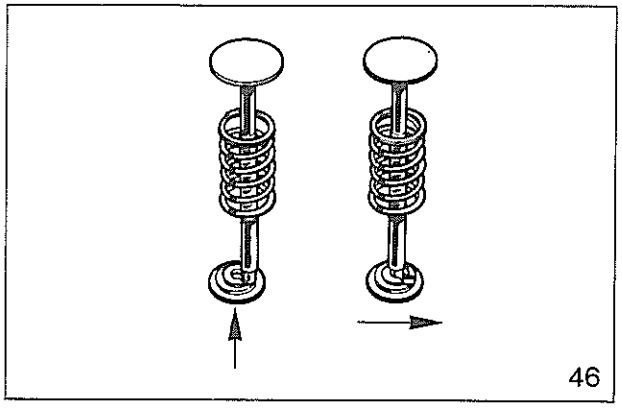

45

5.7 VALVES

Make sure that between the valve stem and the valve guide there is a play according to the following table:

INTAKE	0.020 / 0.045 mm (0.00079/0.00177 in)
EXHAUST	0.045 / 0.070 mm (0.00177/0.00276 in)

Mount the valves proceeding as follows:
a) insert between the spring and the surface plane on the engine block the upper plate; insert the spring equipped with the lower plate for valve locking;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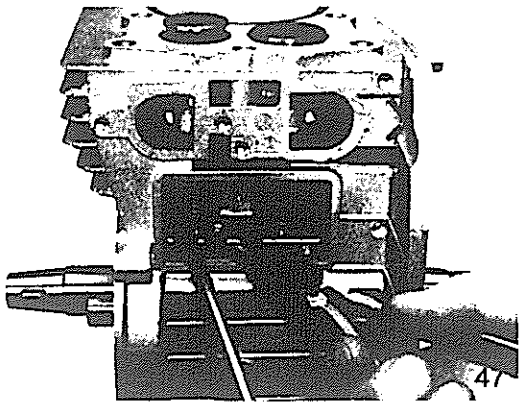
b) insert the valves into their seats, by locking them in their lower part by the lower plates, using the tool no. 3 page 3 as indicated in the fig. 46;
c) insert between the lower end of the valve stem and tappets the shim-holding cup for valve clearance adjustment (fig. 47).

N.B.: The shims for valve clearance adjustment are available in two thicknesses:

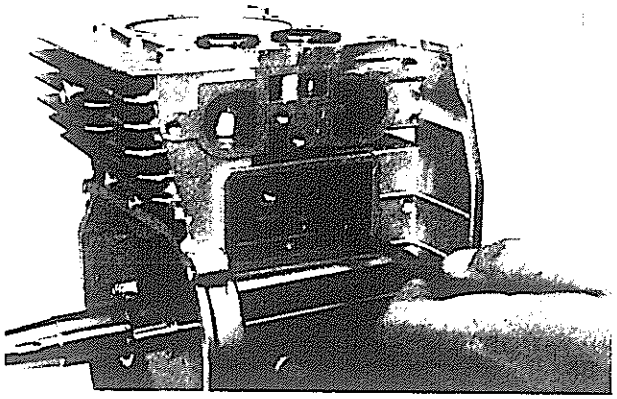
mm 0.1	**0.004 in**
mm 0.2	**0.008 in**


47

d) check that the valve clearance between valve and tappet is (piston at T.D.C.):

0.10 / 0.15 mm (0.004/0.006 in)

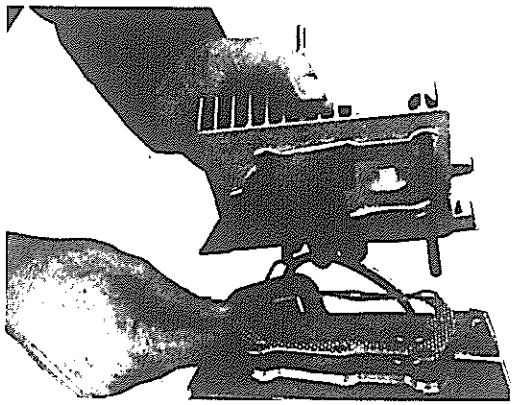
for both valves with cold engine (fig. 48).
The clearance should be adjusted by varying the number of shims in the cup.



5.8 CYLINDER HEAD

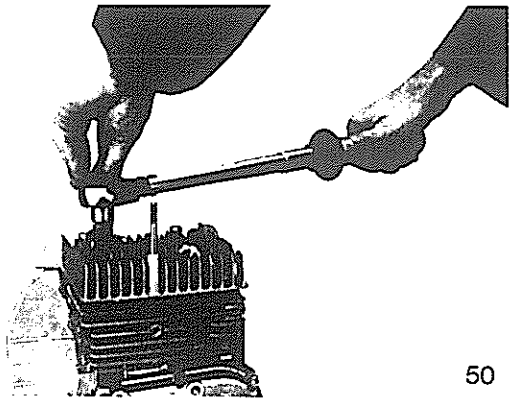
A head gasket must be fitted between the head and the cylinder (fig. 49). Do not use sealer or gasket cement. Each head bolt should be tightened gradually and progressively in the order shown in fig. 10 page 6, by a torque wrench (fig. 50) at a value of

24.5 Nm (2.5 kgm) (18.1 Ft-lbs)



49

N.B.: The two longest screws should be mounted on the side of inlet and exhaust ducts (pos. 1 and 3 fig. 10 page 6).



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5.9 COIL AND MAGNETO

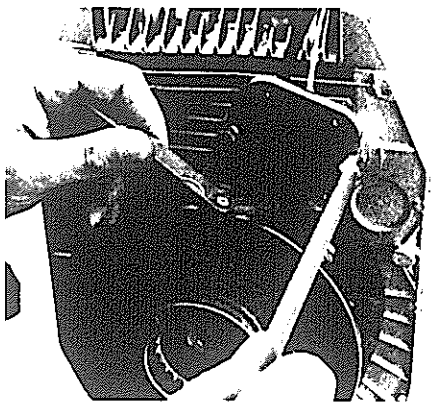
Proceed as follows:

a) mount the coil on the engine block without tightening the screws;

b) mount the flywheel, after checking the integrity of the magneto and the validity of its fixing on the flywheel;

c) use the feeler gauge positioned between the coil and the magneto to adjust the correct value of the air gap at **0.40 / 0.45 mm (0.016/0.018 in).** Then locking the coil by tightening the screws at a value of

11.8 Nm (1.2 kgm) (8.7 ft-lbs) (fig. 51).



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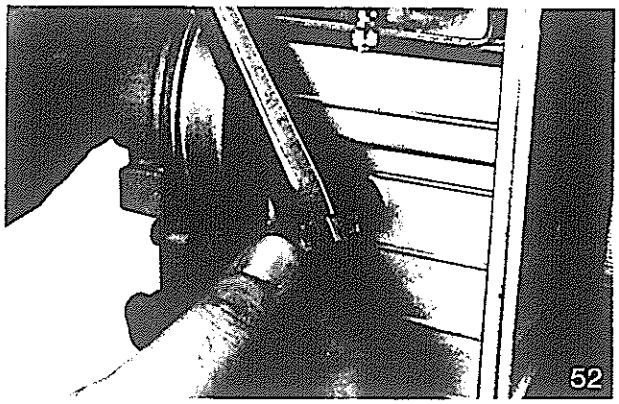
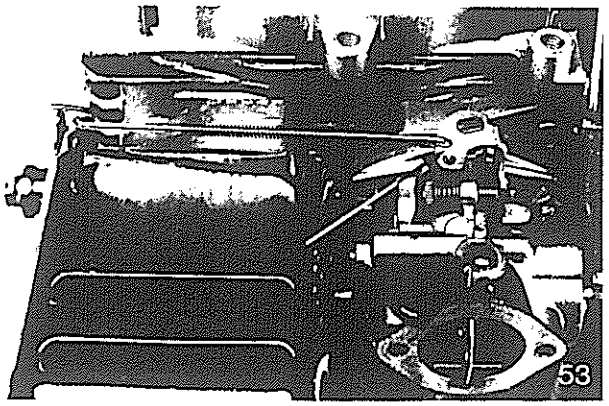
5.10 GOVERNOR LEVERS CONNECTIONS

Proceed as follows:

a) connect the outer lever of the governor to the pivot of the inner lever coming out of the crankcase without tightening the locking screw completely (fig. 52);

b) mount the carburetor on the crankcase, by inserting the spacer and both gaskets. Connect the outer lever of the governor to the trottle rod of the carburetor by means of the relevant tie-rod, to the ends of which the spring to take up slack is hooked; both the tie-rod and the spring to take up slack must be connected to the hole nearest the throttle rod (fig. 53).

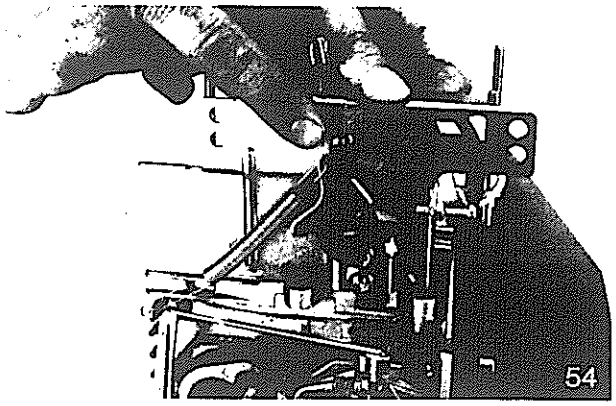

52


53

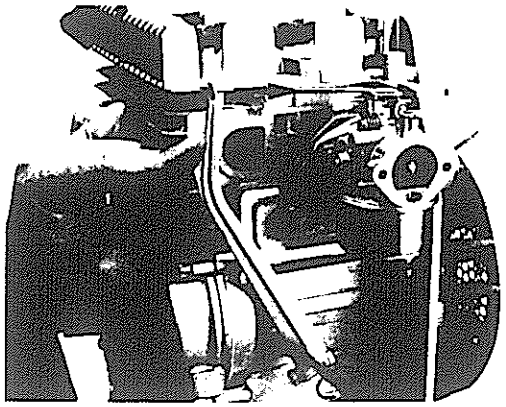
5.11 GOVERNING SYSTEM ADJUSTMENT

Proceed as follow:

a) Insert the top of a screw-driver in the notch on the head of the pivot of the inner lever of the governor, which comes out of the crankcase and rotate it clockwise, holding it in its position of end of stroke. At the same time, by the other hand position the accelerator throttle on its max. opening (fig. 55);


54

b) by keeping the positions of the point a), tighten the locking screw of the outer lever of the governor on the pivot of the inner lever coming out of the crankase (fig. 56).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6 ENGINE TEST

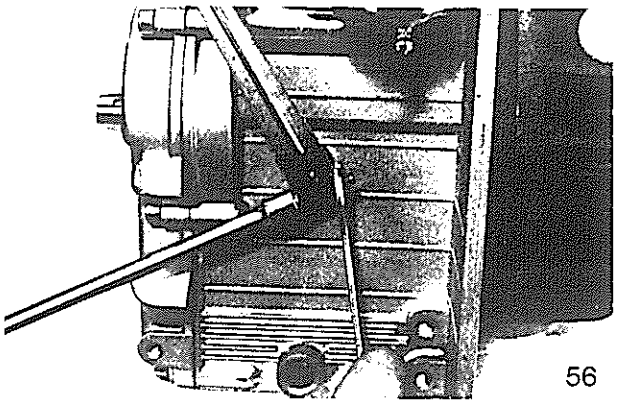
Fix the engine on a base or on the machine. Check the oil level in the sump (and in the air filter if oil bath type) and the fuel level in the tank.

6.1 ROPE OR RECOIL STARTING

a) Cold.
Close the choke or position it in the middle and position the accelerator approx. at its half stroke. Give the rope a determined pull, after winding the rope on the pulley in case of rope starting. As soon the engine is started, open the choke (fig. 57).

N.B.: The engines working with kerosene feeding should be starded on gasoline, by turning the tap to the «gasoline» position. A few minutes after starting, the tap can then turned to the «kerosene» position.

b) Hot.
Do not touch the choke: simply position the accelerator at its minimum or half stroke. Give the rope a determined pull, after winding the rope on the pulley in case of rope starting.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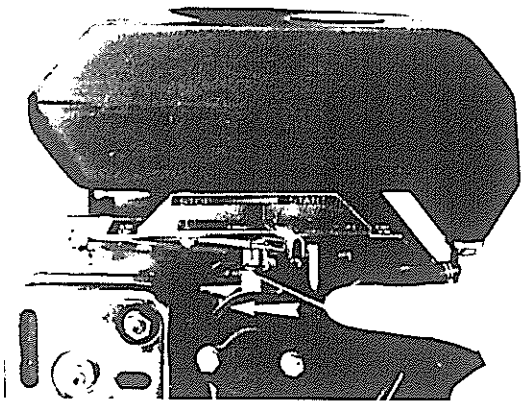
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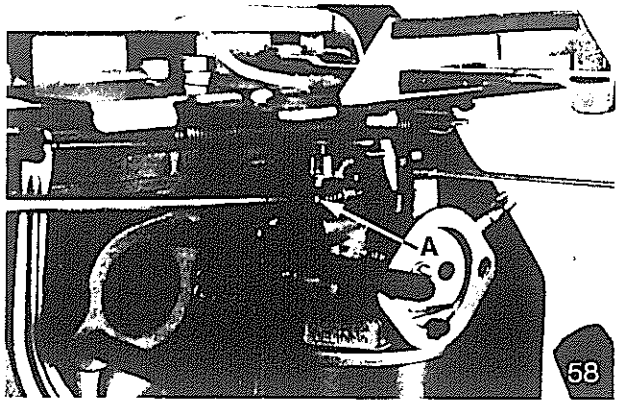
6.2 ELECTRIC STARTING

Before using the key or the push-button for starting, make sure that all connections are positive, expecially those relevant to the rectifier with ground and battery. **The rectifier can be damaged in a few seconds if it is not connected to the system (including battery), while engine is running.**
As to the hot or cold starting procedures, see pos. 6.1.



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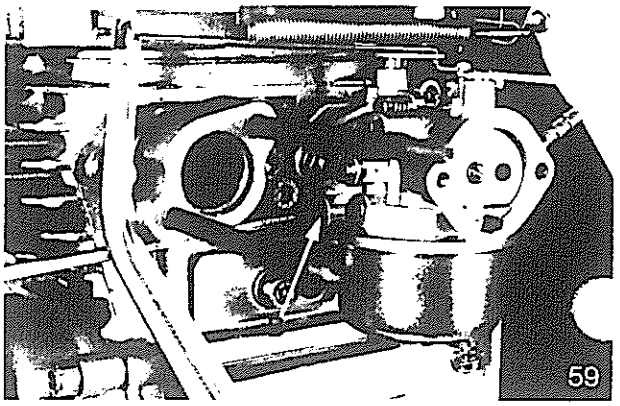
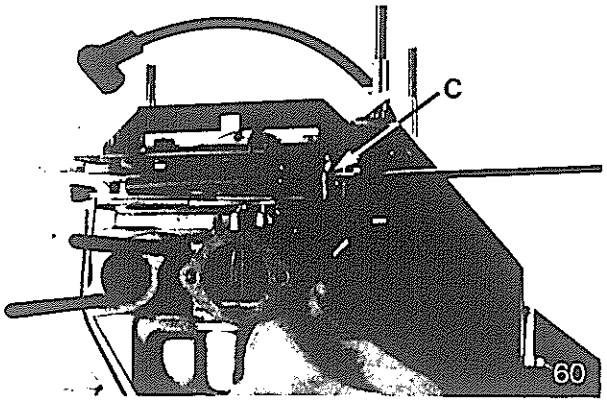
6.3 CARBURETOR AND SPEED ADJUSTMENTS

To carry out these operations, it is necessary to have a R.P.M. counter. Start the engine and let it run for some minutes at 2000 R.P.M. approx. Keep the engine at its slow running and fix it at 1000/1100 R.P.M., by turning the screw A (fig. 58).
Gently tighten the screw B and loosen it slowly of 1 ½ turns (approx.), looking for the position where the engine working is must regular (fig. 59). Such operation is particularly delicate and it is necessary to carry it out many times to be sure to have found the position of max. working evenness. Check the R.P.M. at slow running again, which should be 1000/1100 R.P.M. Then adjust the max. running dipending on the different applications (2400/3000/3600 R.P.M.) by turning the screw C (end of stroke of the lower lever of the accelerator) remembering that the R.P.M. without load should be over 5% approx. as to ther R.P.M. at full load (fig. 60).


59



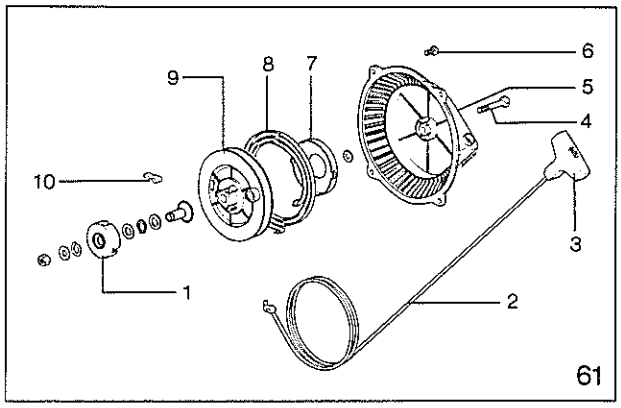
7 ACCESSORIES

7.1 RECOIL STARTER

Description

This is a manual starting device which rewinds the cable on a spring activated disc, after starting.
It can be mounted on all engines equipped with a standard pulley with inner toothing as specified at pos. 4.4 page 10.
Any breakage of the starting unit, will not compromise the engine starting. It can be started manually by a rope, just removing the complete recoil starter from the engine by loosening the screws holding it to the front of the engine (parts 6 of fig. 61).

Parts of fig. 61:
1) Dogs guide housing - 2) Starting cable - 3) Knob - 4) Starter locking screw - 5) Starter support - 6) Screws M6 for starter fixing - 7) Spring cover - 8) Spiral spring - 9) Cable rewind disk - 10) Starter dogs.



Disassembly, checking, overhaul

— Check the cable (2): should it be broken replace it.
— Check that the starter dogs (10) come out when starting.
— To replace the spiral spring (8) in case of breakage, it is supplied complete with cover (7) as an assembly, for simple replacement.
The spring (8) and its cover (7) can be separated from the disk (9), proceeding as follow:
- disassemble the disk from the recoil starter;
- turn the cover (7) counterclockwise by using the two small holes;
- separate the cover from the disk.

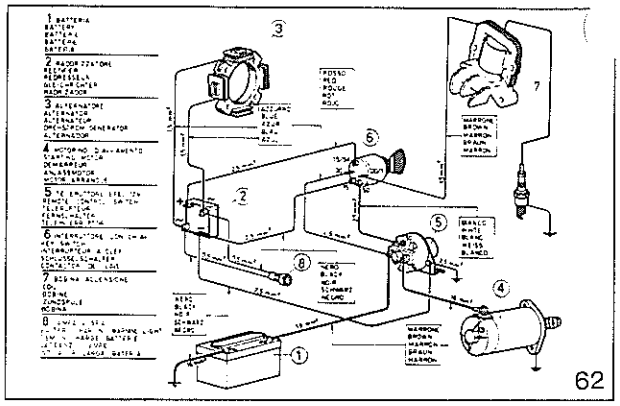
Mounting (or remounting) of recoil starting assembly

Install recoil assembly over starting pulley. Screw down the 4 screws that hold the assembly onto the engine, but **do not tighten** them. Grasp the starter handle and pull the cable approximately 150 mm (6 in), hold tension on the cable, then tighten the 4 screws. By performing this procedure, the starter assembly will be in perfect alignment with the center of the starting pulley.

7.2 ELECTRIC STARTER BY MOTOR

Drawing of the plant (fig. 62)

Parts of the system:
1) Battery - 2) Rectifier - 3) Alternator (startor) - 4) Starting motor - 5) Remote control switch - 6) Starting switch - 7) Ignition coil - 8) Warning light.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Characteristics

Alternator ACME 12V-70 W
Rectifier IR type 26 MB 20 A
Starter SJCE PN1 12 V-0.15 kW
Remote control switch EFEL 12 V-75 A
Recommended battery: capacity 20 Ah.

Electrical system check

Check the cables, the insulation and the connections. Should the system no longer charge the battery, look for the following causes:

— stator windings bonding;
— magnetized ring, mounted on the flywheel, unmagnetized;
— defective rectifier;
— interruption in the battery ground;
— battery polarity inversion.

ALTERNATOR

Fixed armature type, mounted on the engine crankcase, with rotor in the flywheel.
Check the magnetization of the rotor.
The windings of the armature (stator) should not have any loose connections and traces of burning or wires bonding. Replace the stator if defective.
Check by an Ohmmeter that all wires are continuous and the ground insulated.
Check the efficiency of the alternator mounted as follows:

— disconnect the rectifier wires;
— connect a Voltmeter 10 to 30 Volts in alternated current or a tester between them;
— start the engine and check that the voltage reading on the Voltmeter or on the tester corresponds to that of the below indicated table:

RPM	Volts (V)
2,000	13.5/14.5
2,500	17/18
3,000	20.5/22
3,600	25/26

Should the voltage reading be lower, It means that the rotor is no longer magnetized and therefore it is necessary to replace it.

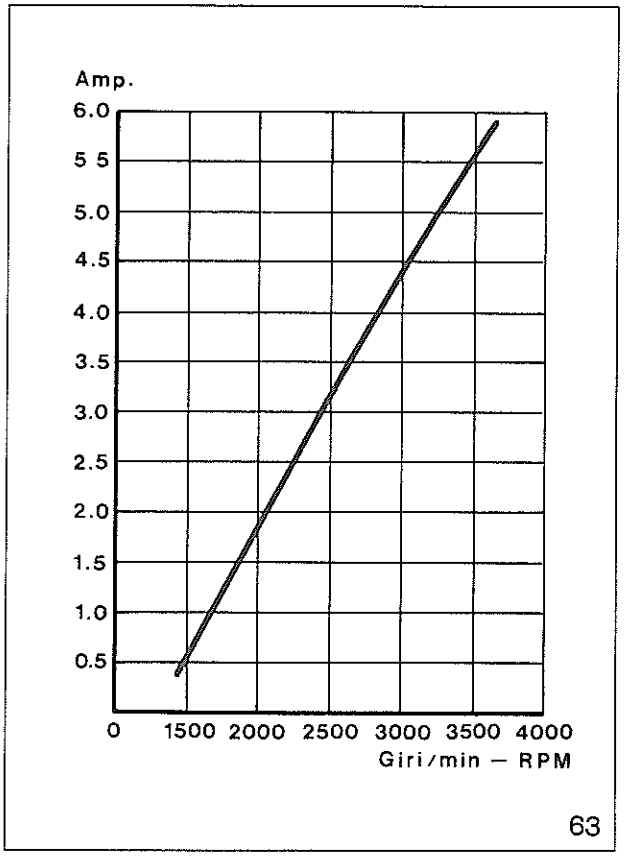
RECTIFIER

The rectifier should be checked as follows:

— check the connections;
— connect an Ampmeter 5A between the positive pole of the battery and the positive terminal of the rectifier;
— connect between the battery poles a Voltmeter 20 V;
— decrease the battery voltage below 13 Volts. This can be done by starting the engine as many times as necessary (with the electric starter), to achieve the less than 13 Volts reading.

The diagram at fig. 63 shows the trend of the current intensity when the engine RPM varies, with constant voltage of the battery 12.5V and room temperature +25°C (+77°F).
If the charge current is zero with battery voltage 12.5V, replace the rectifier and check the charge.
Should the charge remain the same, check the alternator.

CAUTION: The rectifier can be damaged in a few seconds if it is not connect to the system, while engine is running.



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STARTING MOTOR (STARTER)

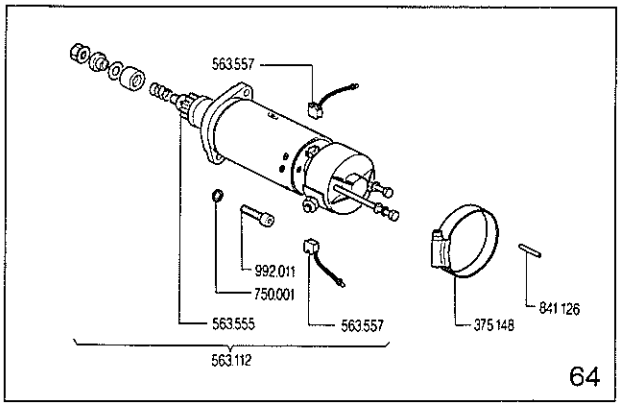
The starter is SJCE type PN1 12V-0.15 kW.
The following fig. 64 shows the parts of the starter.
The ones with code numbers, are available as spare parts.

BATTERY

The recommended battery is 12V with a capacity of 20 Ah.
The battery capacity is according to the room temperature therefore, for low temperatures, batteries of higher capacity are required.
The level of the liquid in the battery should be about 5 mm (0.20 in) above the plates.

STARTING PANEL

The following fig. 65 shows the various positions of the starting key. As to the connections of the wires to the panel, see the fig. 62.
The first position of the key clockwise, activates the battery charging circuit, the second position activates the starter.
When the engine is running, the key has to be at its first position.
When the engine is not running, the key should be in rest position; if it is kept on its first position, the rectifier is damaged and the battery discharged.
The warning light of battery recharge is excluded by the key in its rest position; **it has to be lighted when the engine runs and so the system works correctly. If it switchs off, sommething is wrong in the battery charging system.**



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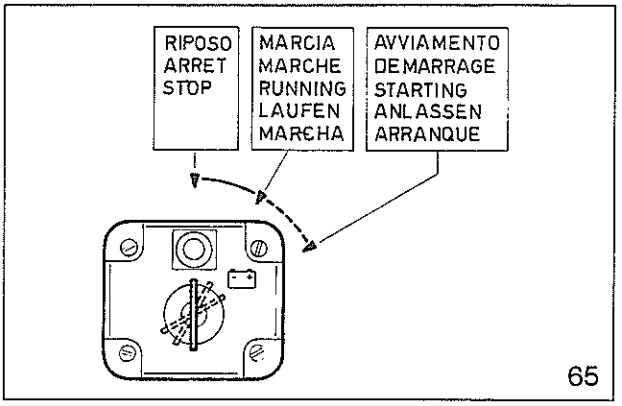

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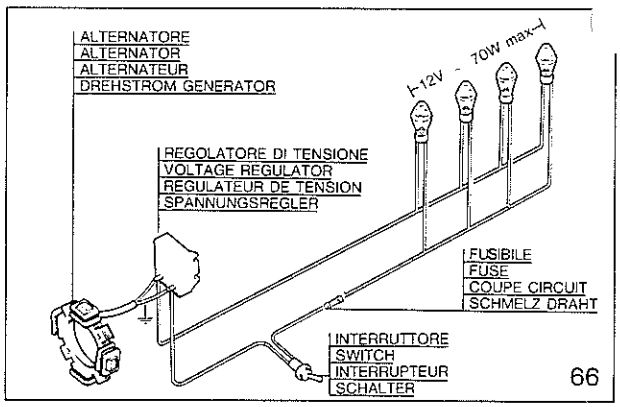
7.3 LIGHTING SYSTEM BY ALTERNATOR

Drawing of the plant (fig. 66)

System check

Apply a load by turning on lights for an absorption of 25 to 70 W, start the engine and bring it to the maximum speed (3,600 RPM); the outler voltage should be approximately 12V.
Insert an Ampmeter with a scale of 5A between the positive pole of the voltage regulator and the switch. Should the charge be equal to zero, replace the voltage regulator and check the charge. Should it be unvaried, check the alternator.



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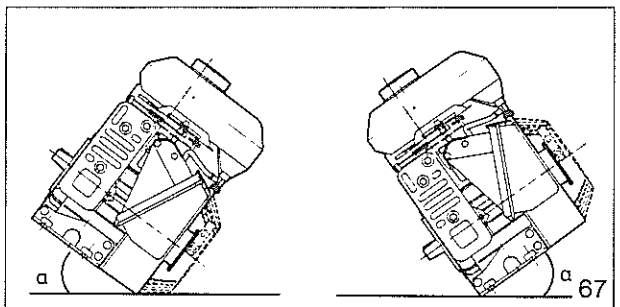
8 INSTALLATION

To install the engine correctly refer to the indicative data indicated below.

8.1 WORKING LIMIT BENDING (fig. 67-68)



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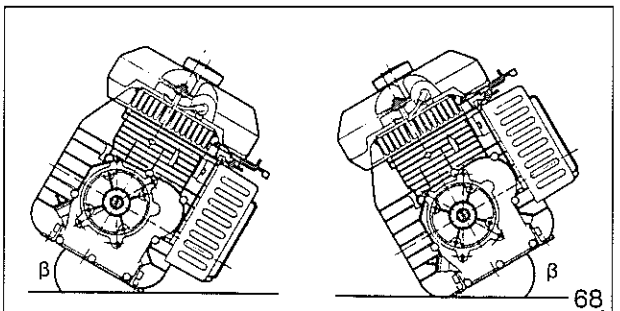
LONGITUDINALLY	
INTERMITTENT SERVICES	α = 40°
CONTINUOUS SERVICES	α = 35°



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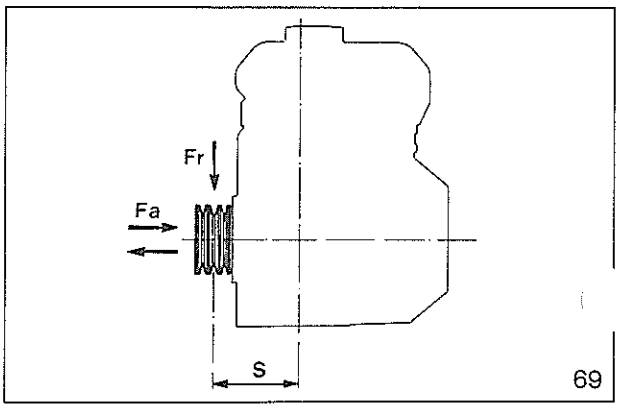
TRANSVERSALLY	
INTERMITTENT SERVICES	β = 35°
CONTINUOUS SERVICES	β = 30°

8.2 AXIAL LOAD RADIAL LOAD AND MAXIMUM OVERHANG

The axial thrust in both senses Fa (fig. 69), must be less than 200 kg (441 Lb).
The maximum radial load Fr (fig. 69), for belt application, is 50 kg (110 Lb), with a max. overhang "S" from the cylinder axle of 135 mm (5.31 in).
Increasing the overhang "S", reduce the load Fr, so that the bending moment (Fr x S) does not increase.



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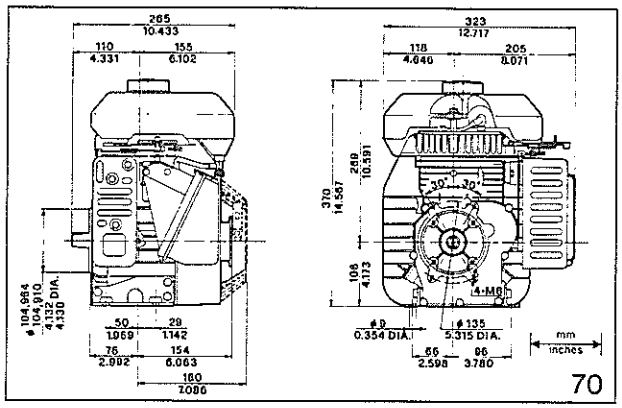
8.3 OVERALL DIMENSIONS (fig. 70)



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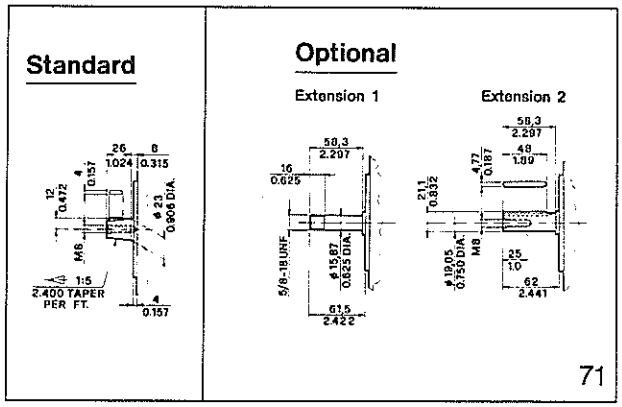
8.4 OPTIONAL P.T.O. AND FLANGES (fig. 71-72)



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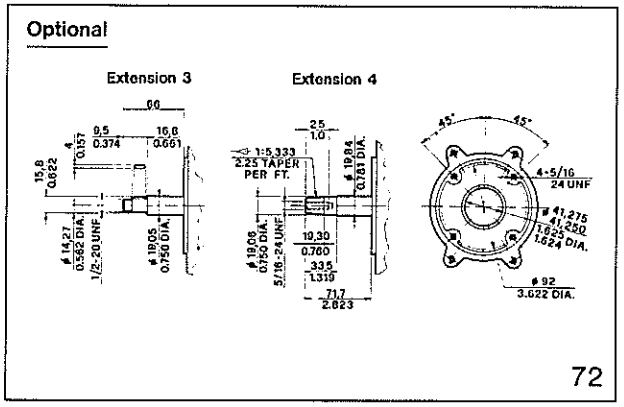

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9 PISTON - CYLINDER OVERSIZE TABLE

ENGINE	NOMINAL			FIRST RE-BORING			SECOND RE-BORING		
	Ø mm	dia. in	Piston code	Ø mm	dia. in	Piston code	Ø mm	dia. in	Piston code
A 180	65 $^{+0.013}_{0}$	2.56 $^{+0.0005}_{0}$	– A3423	65.5 $^{+0.013}_{0}$	2.58 $^{+0.0005}_{0}$	– A3424	66 $^{+0.013}_{0}$	2.60 $^{+0.0005}_{0}$	– A3425
A 220	72 $^{+0.013}_{0}$	2.83 $^{+0.0005}_{0}$	– A3426	72.5 $^{+0.013}_{0}$	2.85 $^{+0.0005}_{0}$	– A3427	73 $^{+0.013}_{0}$	2.87 $^{+0.0005}_{0}$	– A3428

ATTENTION: The code numbers indicated refero to pistons complete with rings and pin.

10 TOLERANCES OF CRANKSHAFT JOURNAL GRINDING

NOMINAL			FIRST GRINDING			SECOND GRINDING		
Ø (mm)	dia. in	Code	Ø (mm)	dia. in	Code	Ø (mm)	dia. in	Code
Min 25.989 Max 26.000	1.0232 1.0236	100.124	Min 25,739 Max 25,750	1.0133 1.0138	100.125	Min 25,489 Max 25,500	1.0035 1.0039	100.126

ATTENTION: Code (Parts) numbers refer to complete connecting rods.

11 CLEARANCES AND ADJUSTMENTS TABLE

POSITION		Min (mm)	Max (mm)	Min (in)	Max (in)
Valve guide and stem	Inlet	0.020	0.045	0.0008	0.0018
	Exhaust	0.045	0.070	0.0018	0.0028
Pin and small end hole of connecting rod		0.006	0.022	0.0002	0.0009
Piston and pin (interference)		0.000	0.008	0.0000	0.0003
Connecting rod bearing and crankshaft journal		0.030	0.049	0.0012	0.0019
Cold valves clearance		0.100	0.150	0.0040	0.0060
Gap between ignition coil and flywheel		0.400	0.450	0.0160	0.0177
Spark plug electrodes gap		0.600	0.800	0.0240	0.0310
Distance between ends of compression rings		0.250	0.450	0.0100	0.0160
Distance between ends of scraper ring (oil ring)		0.200	0.350	0.0079	0.0138

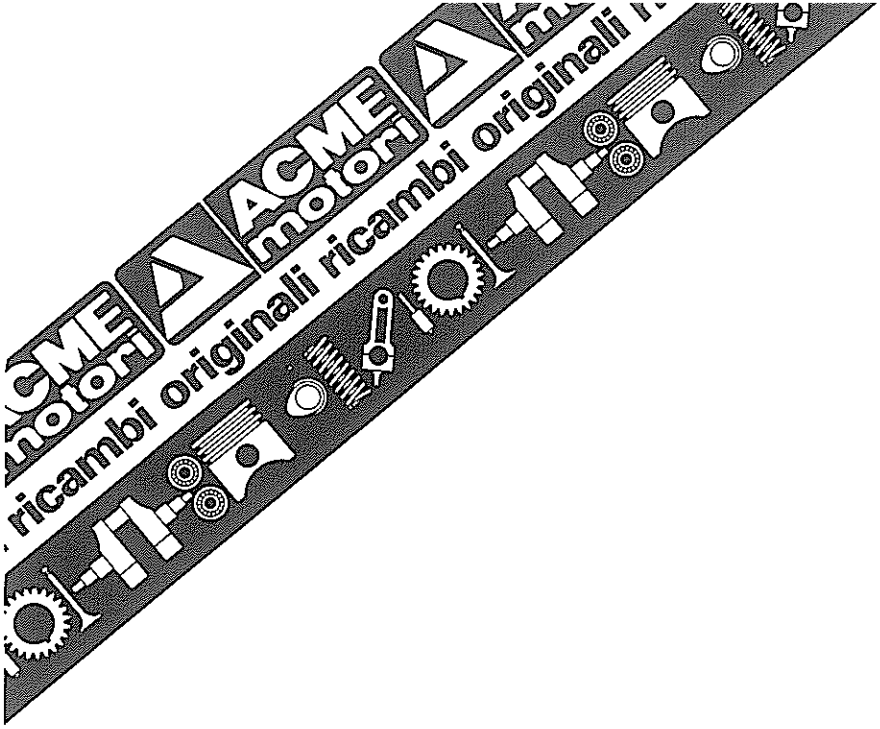
12 TORQUE SETTING

POSITION	Boit Size	Nm	Kgm	Ft-lbs
Timing	M6	11.8	1.2	8.7
Connecting rod cap	M6	11.8	1.2	8.7
Engine head	M8	24.5	2.5	1
Fan cowl	M6	9.8	1.0	7.2
Engine mount	M8	15.7	1.6	11.6
Flywheel	M18 x 1,5	157.0	16.8	115.8
Coil	M6	11.8	1.2	8.7
Breather cover	M6	6.9	0.7	5.1

13 TROUBLE SHOOTING

Listed below are some of the possible causes of engine operating defects.
Carry out simple tests before proceeding with disassembly operations or making substitutions.

POSSIBLE CAUSES	TROUBLE											
	Does not start	Starts and stops	Lacks power	Noisy	White smoke	Dark smoke	Consumes oil	Overheats	Does not accel.	Hunts	Loses oil from breather	Spark plug fails to spark
Tank plug breather clogged		●										
Tap clogged		●	●						●			
Carburetor venting holes osbstructed		●	●				●					
Fuel line plugged up	●		●						●			
Fuel filter clogged		●	●				●		●			
Dirty carburetor			●			●	●					
Carburetor needle valve blocked		●	●							●		
Speed governor rod blocked							●			●		
Empty tank	●											
Grounded spark plug	●											●
Broken spark plug lead	●											●
Defective coil	●	●								●		
Clogged air filter		●	●									
Blocked valves	●	●	●						●			
Worn piston rings			●		●			●		●	●	
Excessive valves play			●	●						●		
Defective oil seals								●			●	
Worn valve guides			●	●		●				●		
Worn governor spring							●			●		
Piston seizure			●		●			●		●		
Loose head locking-nuts	●		●							●		
Low idling		●										



ALWAYS USE ACME ORIGINAL EQUIPMENT REPLACEMENT PARTS

When ordering replacement part, always specify:

- engine model (on plate Fig. 4)
- engine serial number (see Fig. 4)
- make and model of equipment on which engine is mounted (version code on plate Fig. 4)
- part number and description