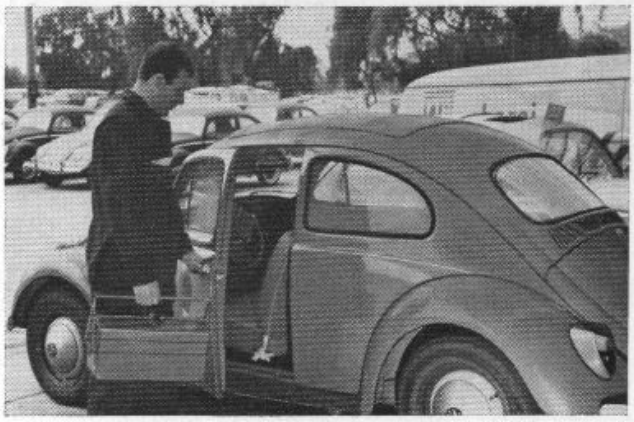
LOOK
LISTEN
DO IT BETTER

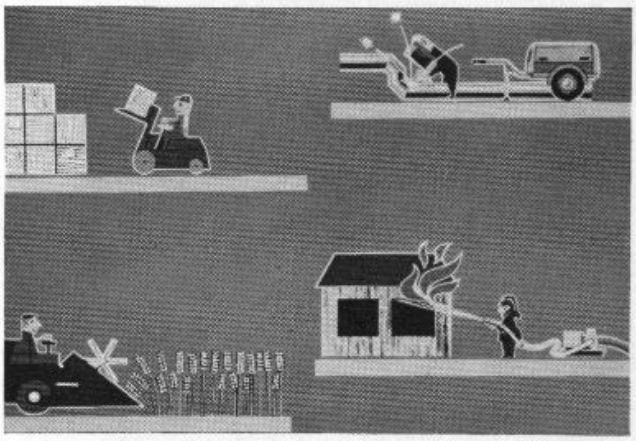
VW Industrial Engines

Slide Series № 22

22/1 One of these days you may be faced with the task of carrying out maintenance or repair work on an industrial engine. The engine may be brought into the workshop or you may have to go out and do the job on the spot like this mechanic is going to do. In either case, this slide series will help you considerably.



22/2 All the machines shown here are driven by VW industrial engines. These few examples give you an idea of the large range of uses to which our engines are put.

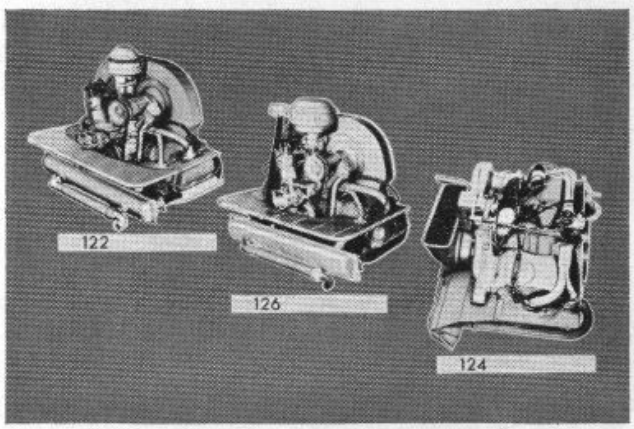


22/3 These three normal versions of the industrial engine are based on the vehicle engine which you already know well.

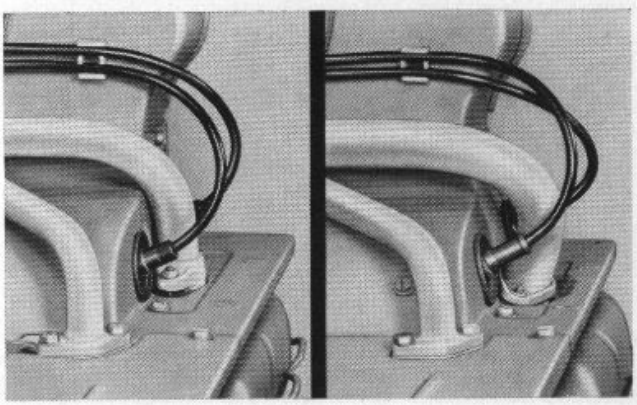
The Type 124, in the right, is based on the single carburetor engine of the Volkswagen 1500.

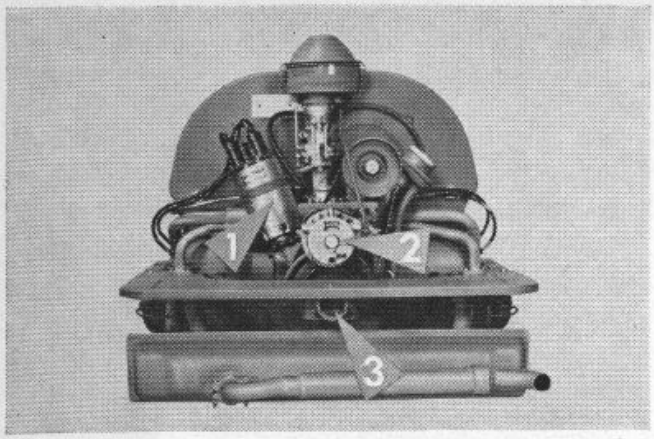
The Type 126, in the center, is based on the 1.5 liter Transporter engine.

Almost the same in appearance is the Type 122 on the left. This engine was developed from the VW 1200 engine. The main external difference between the last two engines is —



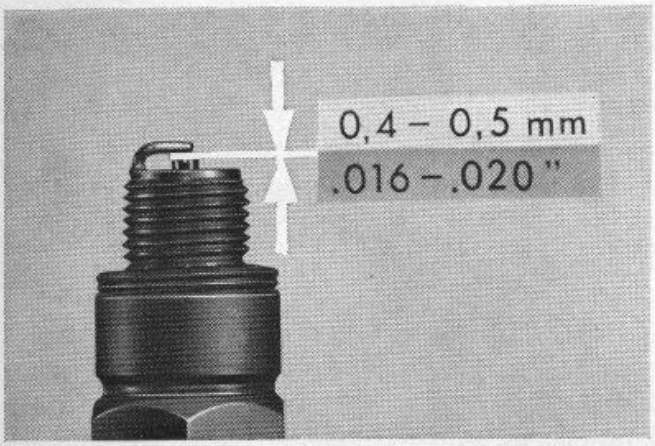
22/4 the way the intake pipes are connected to the cylinder head. Here you can see the difference. The 122 engine on the left and the 126 on the right.





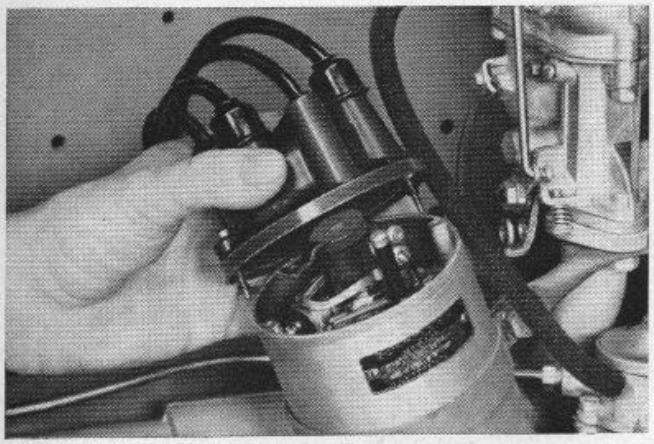
22/5 Industrial engines and vehicle engines differ in two or three important parts. These parts are shown here on the normal 122 engine:

The magneto (1)
The governor (2) and
The starting handle bracket (3)

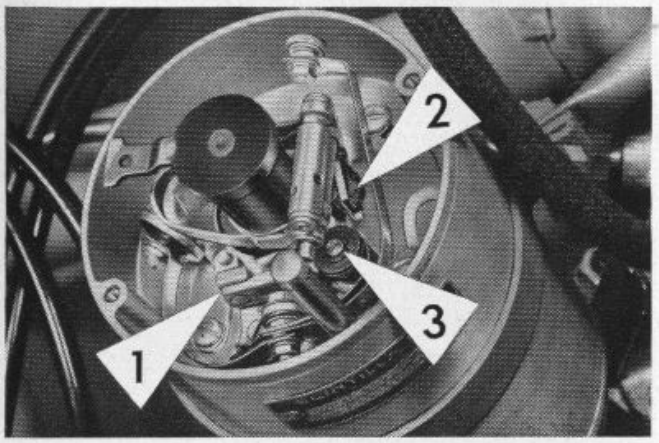


22/6 Before we start with the magneto, there is one point we must mention:

In order to ensure that the engine starts easily at the low cranking speed, the plug gaps on engines with magnetos should never be set to more than 0.4 to 0.5 mm.



22/7 This is the magneto. A glance under the cap shows you that the layout of rotor, breaker contacts and condenser is roughly the same as in a distributor. The big difference with the magneto is that it not only distributes the ignition voltage, it also produces it. That is why the engine can be started by hand without external electricity.

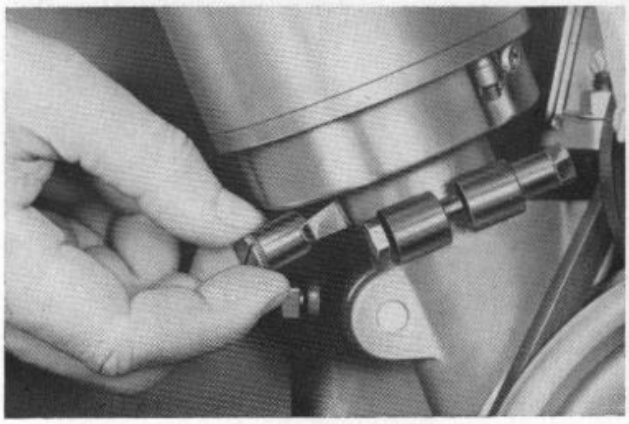


22/8 Maintenance of the magneto is confined to checking the breaker contacts (1) and applying small quantities of fresh grease to the cam lubricating felt (2). Check at the same time that the breaker arm moves easily. If in doubt put a few drops of oil on mounting pivot (3).

When lubricating the magneto, take care to prevent grease getting on to the points as otherwise the ignition will give trouble.

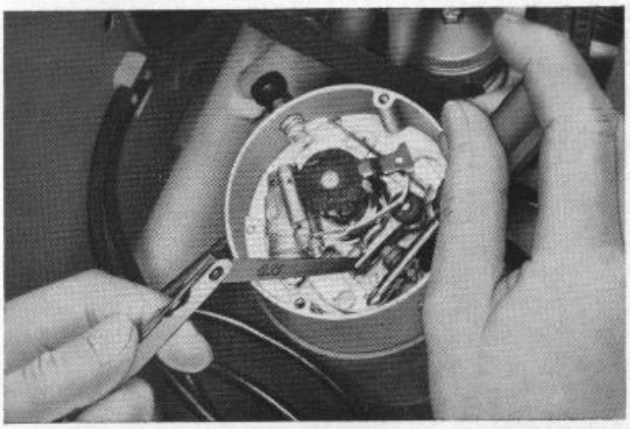
22/9 Another important point: lots of old magnetos have a grease cap as shown here. Every 50 running hours, during the maintenance check, this cap must be given a maximum of two turns to the right. If the magneto is lubricated too often or too much grease forced in, the excess grease will spread about inside the magneto and may interfere with the operation of the centrifugal advance mechanism so that the engine runs retarded all the time. This would, in turn, cause overheating.

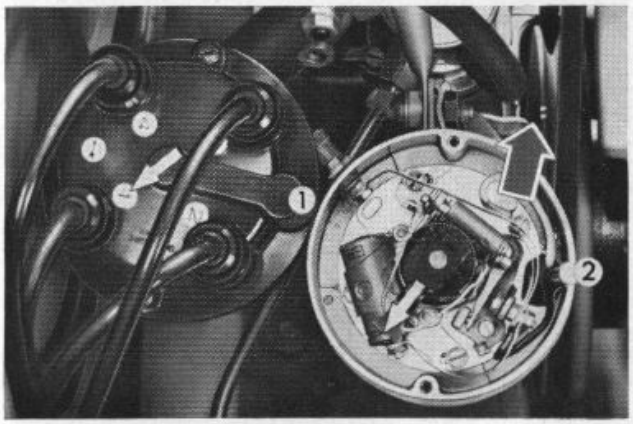
The new type of magneto does not require greasing and the grease cap has been discontinued.



22/10 The breaker contacts of the magneto are set in the same way as those in the vehicle distributor. The only difference is in the clearance which is 0.3 to 0.4 mm on the magneto.

As you know from vehicle practice, the ignition timing must be checked when the points have been reset as an alteration of 0.1 mm in the points gap alters the firing point by 3°. This also applies to magneto ignition.

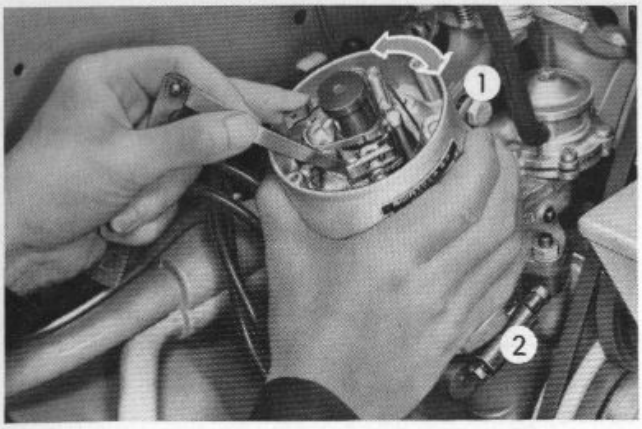




22/11 Check the ignition timing and rectify as necessary. The timing on the 122 and 126 engines must be set to 7.5° before TDC and on the 124 engine it is set to 10° before TDC. The rule about setting the ignition when the oil temperature is not above 50° C also applies to the industrial engine.

Note the following when setting the timing: When the left-hand mark on the crankshaft pulley is in line with the crankcase joint as shown by the thick arrow the rotor arm must point towards the electrode for No. 1 cylinder in the magneto cap. This is shown by the two thin arrows. The numbers 1 and 2 mark the high-tension connection to the central electrode in the cap.

On the 124 engine the ignition timing is set in the same way as on the 1500 vehicle engine.



22/12 As there is no electricity available when checking the magneto timing and a test lamp with its DC current would destroy the magnetic field of the permanent magnets it is best to use a 0.05 mm feeler blade or a piece of clean metal foil of the same thickness.

When you have turned the crankshaft and the rotor arm to the position described, loosen the clip (1) and the clamp (2). Then turn the magneto clockwise until the points are closed and the feeler held between the points. Now turn the magneto slowly in the opposite direction until the feeler can just be pulled out. To cut out the radial play in the magneto drive, press the rotor arm lightly as shown here.

Do not forget that the ignition timing must not be altered when using super fuels.

22/13 Identification plates nearly always look very complicated like this one. Let us see what these symbols mean.

The top line (1) is the general designation of the magneto. The figures on the second row (2) give the beginning and end of the advance range. It begins with 0° at 400 rpm and ends at 12½° at 1750 rpm. The speeds are for the magneto shaft. The figure "1900" behind the diagonal stroke is the "cut-out speed" of the adjustable speed limiter which is fitted to every magneto. This means that the speed limiter cuts the ignition circuit at 1900 magneto shaft rpm or 3800 crankshaft rpm.

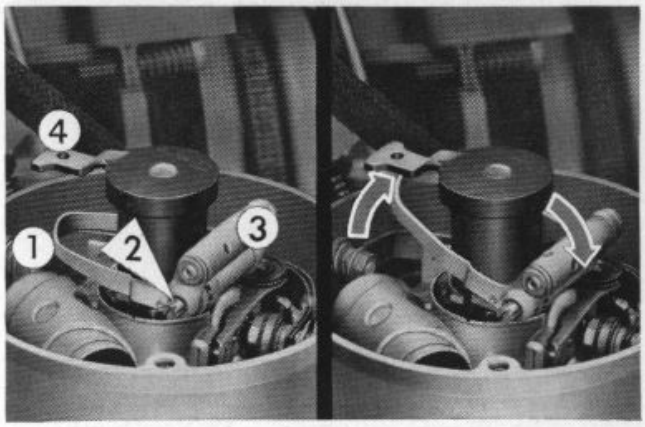
If the cut-out speed is altered, stamp the new speed figures in the space (2) behind the "1900". This also applies when a new magneto is installed and set to the same cut-out speed as the old magneto.

The figures to be stamped on can be found in a list in the Industrial Engine Workshop Manual.

22/14 The speed limiter keeps the speed within the permissible limits and protects engine and machine against damage due to over-revving.

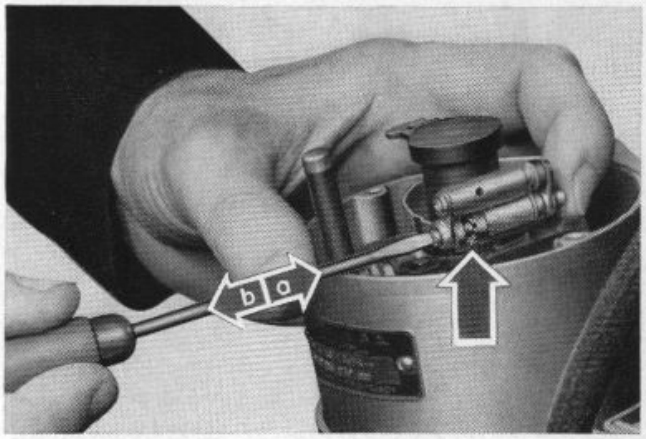
The speed limiter works as follows:

The spring loaded bow (1) is fitted with an adjustable weight (3) above the pivot point of the bow (2). If the magneto speed exceeds the speed set on the limiter, 1900 rpm (3800 crankshaft rpm) for example, the weight starts to move outwards under centrifugal force. This moves the bow upwards until it contacts the electrode in the rotor arm (4) and short circuits the ignition current to ground. The ignition system ceases to work and the engine speed drops immediately. As the speed drops, the spring tension returns the bow to its normal position.



22/15 The basic setting of the speed limiter starts with the rough adjustment of the return spring. To do this, push the small ratchet on the sliding spindle, indicated by vertical arrow, in direction "a" with a screwdriver. Turn the spindle to the left to increase the cut-out speed and to the right to reduce it. Then press the spindle back in direction "b" with the finger, until the ratchet engages again.

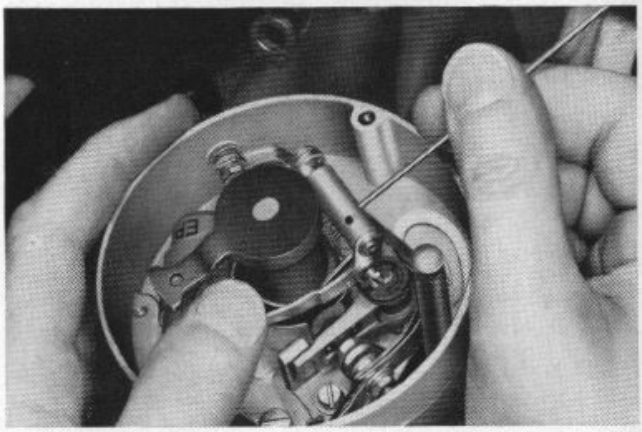
The sliding spindle and the weight with the eccentric mounting for the return spring ends make it possible to set the cut-out speed to between 800 and 2000 magneto shaft rpm.

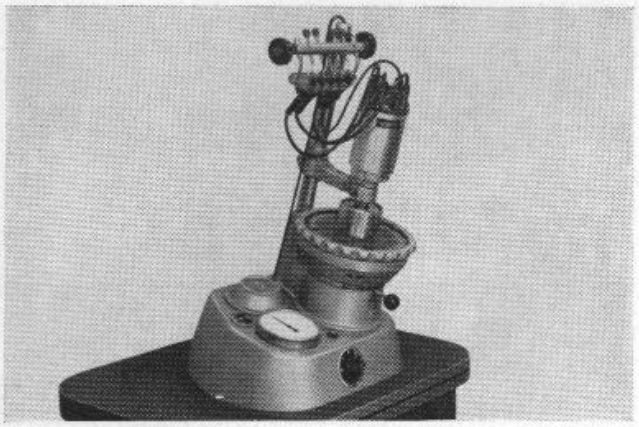


22/16 The cut-out speed can only be adjusted in stages with the rough setting just described. The fine adjustment is done as follows:

Insert a thin steel rod into one of the holes in the centrifugal weight and turn it. You can now increase or decrease the tension of the return spring ends as necessary until the required cut-out speed is obtained.

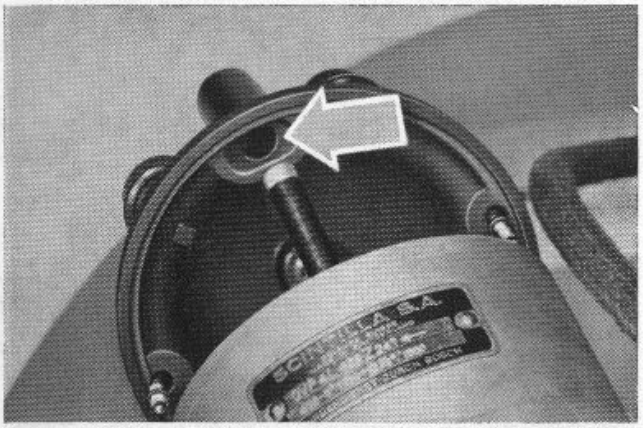
If an engine is not giving sufficient power you can sometimes save yourself a lot of searching and work by checking the adjustment of the speed limiter first.



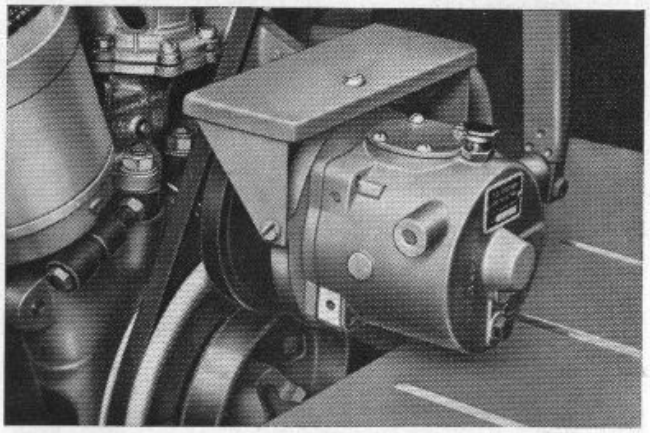


22/17 Industrial engines do not normally have rev counters or a means of measuring the speed.

The speed limiter can only be set properly on an engine stand or on a distributor test stand as shown here.



22/18 When installing the cap on the magneto, always ensure that the high tension cable projecting from the housing enters the hole in the cap properly. Otherwise the engine will not start and there is a risk of the high-tension cable being damaged by the rotor arm even at cranking speed. This would give rise to extensive repairs on the magneto.



22/19 This is the governor which we shall deal with next. The governor is fitted to keep the engine speed steady independent of engine load. This takes place as follows:

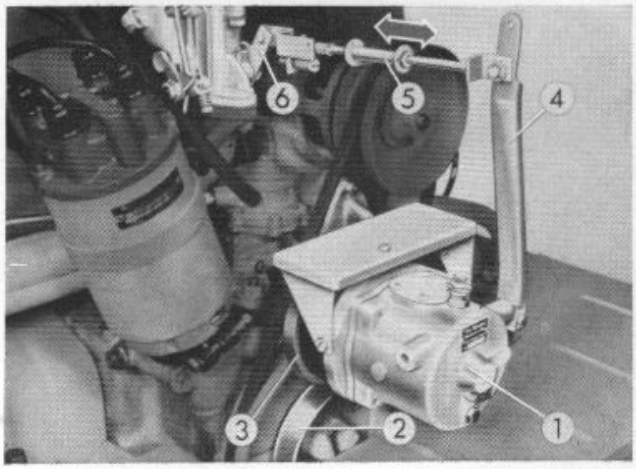
Every time the load is taken off the engine the speed rises at first. However, according to the governor accuracy, which is determined by the jets used or the carburetor type, the speed should not rise more than 5 or 8 % above the nominal full load speed.

When a load is applied to the engine, the speed drops again but it should settle at the nominal governor speed after not more than 6 seconds. The governor operation thus takes place within a relatively small range.

This is the main difference between the governor and the speed limiter. The one keeps the engine speed within a certain range and the other limits the maximum speed by cutting out the ignition. The governor and speed limiter are, therefore, both essential.

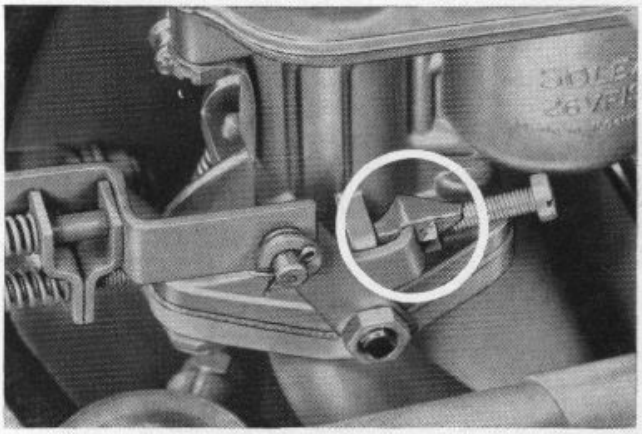
22/20 This picture shows you how the governor works. The governor (1) is attached to the generator bracket and driven by a pulley (2) and a rubber coated friction wheel (3). As the speed increases, the weights inside the governor are forced apart by centrifugal force and this moves the governor lever (4). The operating rod (5) transmits this movement to the throttle valve lever (6) and the throttle valve in the carburetor.

At this point we should like to warn you about restricting the linkage in any way. The governor can only work properly if the linkage moves freely.



22/21 After working on the engine and throttle valve lever, always check the governor operating rod setting. Start by checking the throttle valve stop screw. The screw must contact the stop when engine is giving its nominal output and running at the pre-set speed.

As the stop screw is set at the factory and then locked and sealed, it should not be interfered with unless absolutely necessary. If it is necessary to alter the adjustment at any time, read the instructions in the industrial engine workshop manual.

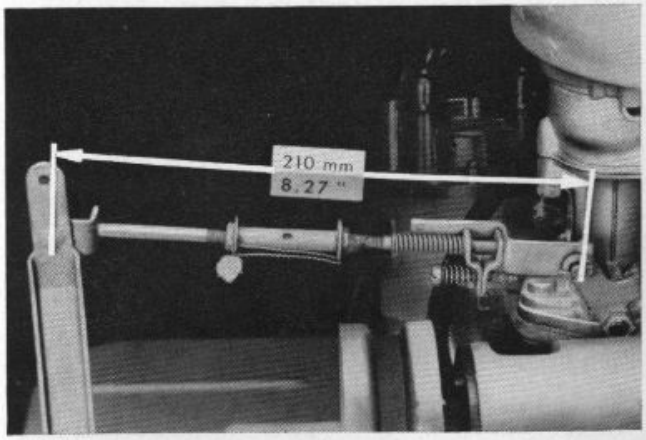


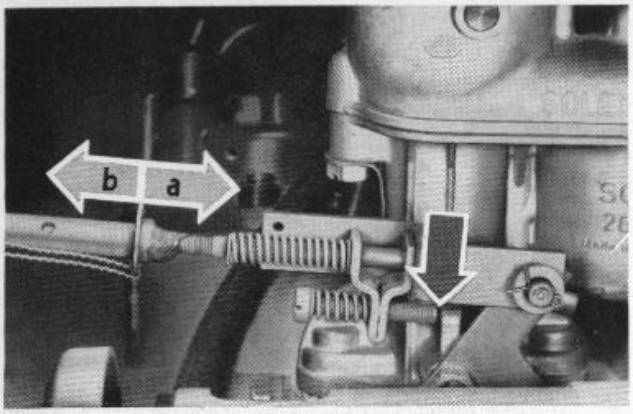
22/22 The length of the operating rod can be adjusted with the threaded sleeve in the center. As you can see, the sleeve is also sealed with paint and even has a proper lead seal. This means that the setting of the rod should not normally be altered.

When it is necessary to alter the length, the rod should first be set to the basic length. This is 210 mm on the 122 and 126 engines and is measured between the centers of the two holes for the pins. On the 124 engines, the measurement between the two ball socket centers should be 325 mm.

The final adjustment of the rod to the nominal speed takes place with the engine running but without load.

When the rod has been set properly, the sleeve must be sealed again.





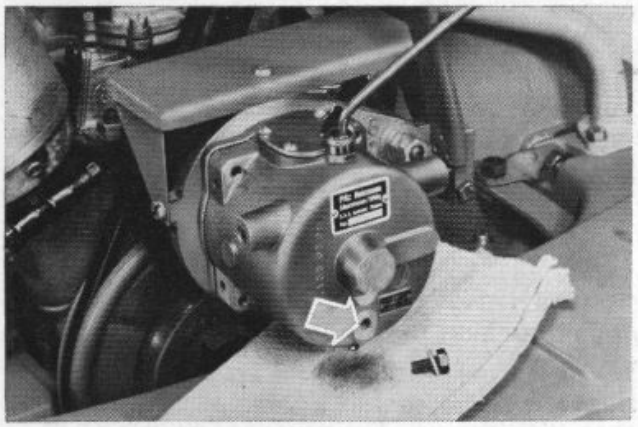
22/23 The engine can only give the preset speed and output if the rod is adjusted correctly. This setting also ensures that the governor works properly and without speed variation. The spring loaded damping stop shown here, also has a lot to do with smooth engine running.

What causes this speed variation?

When the load on the engine drops, the speed rises straight away. The governor then cuts in and presses the rod in direction "a" to reduce the speed. As the load increases again the speed also has to increase. This speed regulation should, as already mentioned, not take longer than 6 seconds. This speed increase and decrease causes the governor rod to move to and fro. If this to and fro movement continues for more than 6 seconds, the so-called "surging" occurs.

This uncontrolled governor operation can be eliminated by adjusting the damping stop correctly. This is done by running the engine without load and steadying the surging governor by holding the rod. Then turn the adjusting screw in until the end is 0.5 mm (.020") from the stop in the carburetor as shown by the arrow on the right.

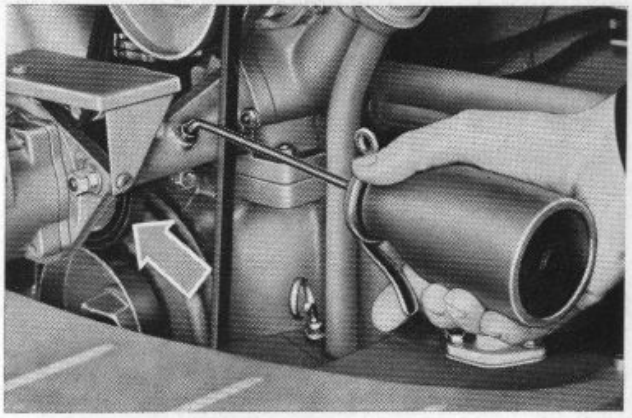
To run the engine at idling speed, press the rod in direction "a" until the spring pressure of the damping stop has been overcome and the rod contacts the fixed stop. Arrow "b" shows the normal operating direction.



22/24 The governor requires very little maintenance. Every 50 running hours the plug must be removed and the oil level checked as shown by arrow. If necessary, the oil is topped up through the cap until the oil is up to the lower edge of the hole. Please ensure that the level hole and oiler are closed properly.

22/25 This is how the spring loaded governor mounting is lubricated. Take care to keep oil off the rubber-coated friction wheel.

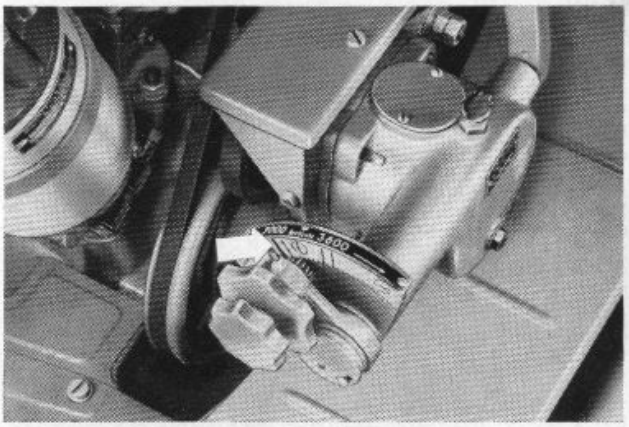
If oil does get on to the wheel it must be cleaned off thoroughly as otherwise the wheel will slip and the governor will not work properly.



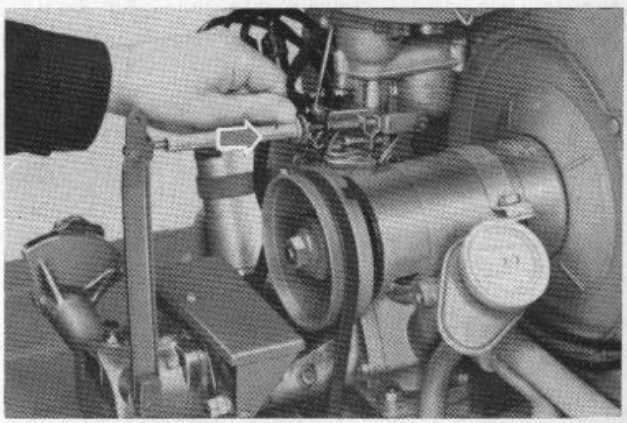
22/26 VW industrial engines which drive generators often have the type of governor shown here. This governor has a tension spring balance and is known as a "variable speed governor". With this governor, it is possible to set the engine speed to 3000 or 3600 rpm according to whether a generator frequency of 50 or 60 cycles is required. Both these speeds are marked on the upper edge of the toothed segment.

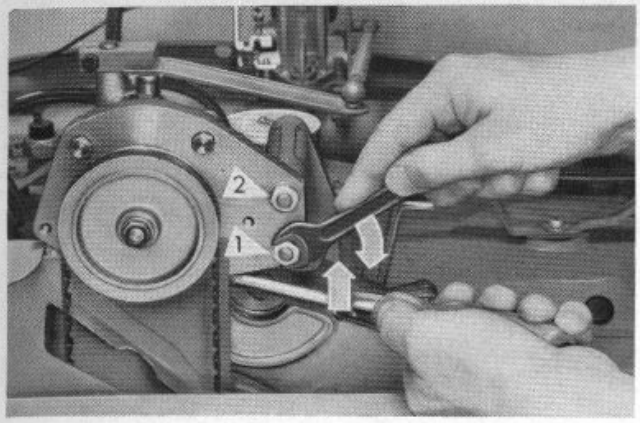
The governor is adjusted to 3000 rpm initially. Check first that the engine gives its nominal output at 3600 rpm by moving the indicator to this speed. Then switch back to 3000 rpm as marked here by the arrow and adjust the governor as already described.

The 3600 rpm position is not marked as the governor will work automatically at this speed if the basic setting at 3000 rpm is correct. Furthermore, it is often necessary to alter the regulating speed with the fine adjustment on the governor in order to compensate for slight generator frequency variations.



22/27 There is also a further difference on the variable speed governor. Due to the design of this governor, the governor lever can only be moved by the centrifugal weights and not by hand. To make it possible to run the engine at idling speed, the operating rod is fitted with a spring loaded link, shown here lightly colored, which you push in the direction of the arrow.



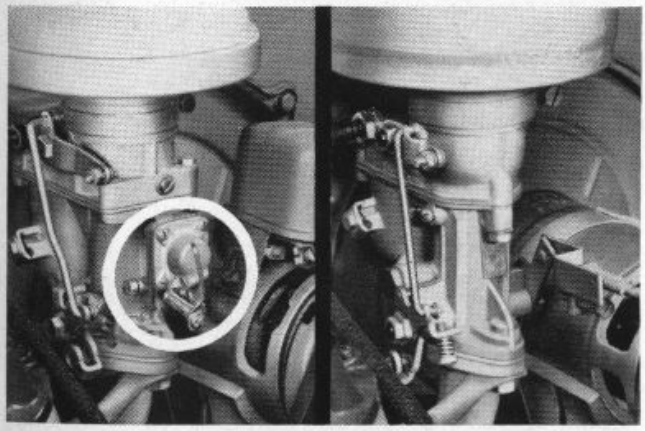


22/28 Owing to the distance between the crankshaft and the governor shaft, the governor on the 124 engine is driven by a toothed belt instead of a friction wheel.

The belt must be tensioned properly. This is done as follows:

Loosen the two nuts (1 and 2) on the bracket. Tension the belt by inserting a strong screwdriver between fan housing and bracket and levering up. Tighten bottom nut (1) first and then the top nut (2). The belt tension is correct when the belt can be depressed about 10 mm in the center by pressing lightly with the thumb.

Apart from minor alterations due to the housing being turned 45°, this governor is the same as the type used on the 122 and 126 engines.



22/29 It is essential to remember that only carburetors without accelerator pumps may be used for industrial engines with governors. This SOLEX carburetor of the VFIS series, shown on right here, must not be subsequently replaced by a carburetor with accelerator pump for two reasons.

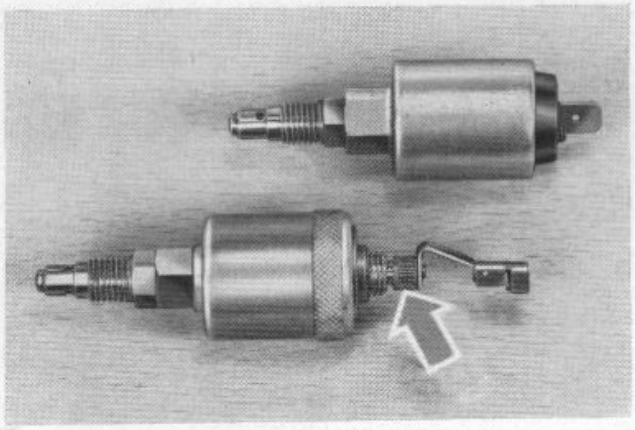
Firstly, the required governor accuracy cannot be obtained with PCI or PHN carburetors and secondly the governor force is insufficient to overcome the pressure of the spring on the connecting link, in the circle, for the accelerator pump. The engine would only run slowly.

Please note that the carburetors have different jets according to industrial engine type even though the carburetor designation may be the same.

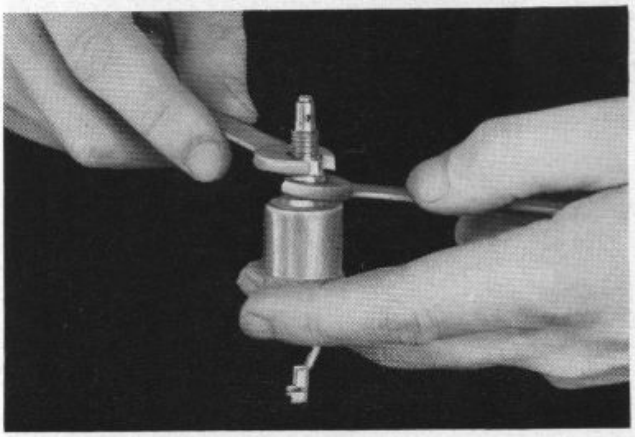
22/30 All the 124 and 126 engines are fitted with a cut-off valve for the pilot jet as a standard part. On the 122 engine, the valve is only fitted on request. On engines with battery ignition, the body of the valve, shown at top here, is the same as is used for the vehicle engine. This valve is also operated when the ignition is switched off and on. On engines with magneto ignition, a hand operated valve is used — shown here at the bottom — which we shall now deal with.

Before starting the engine, check that the cut-off needle is withdrawn and the pilot jet thus open. When switching the engine off, push the short circuit button and close the cut-off valve at the same time.

If the mechanical remote control does not work properly, you can open the valve by turning the small knurled screw indicated by the arrow, to the left.



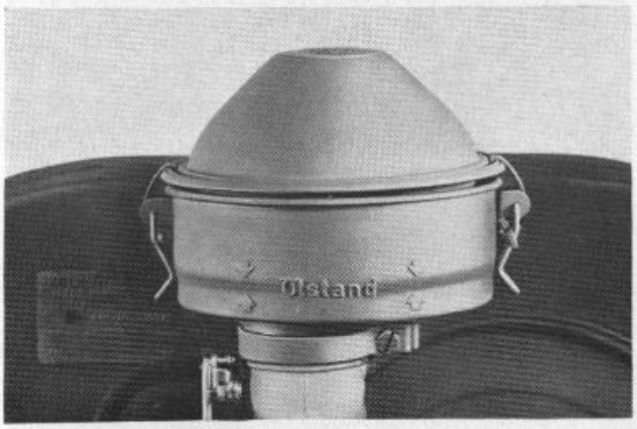
22/31 The pilot jet can be screwed off the valve body for cleaning purposes. Use two wrenches as shown here. Do not clamp the valve in a vice under any circumstances as this will make the needle stiff in operation.

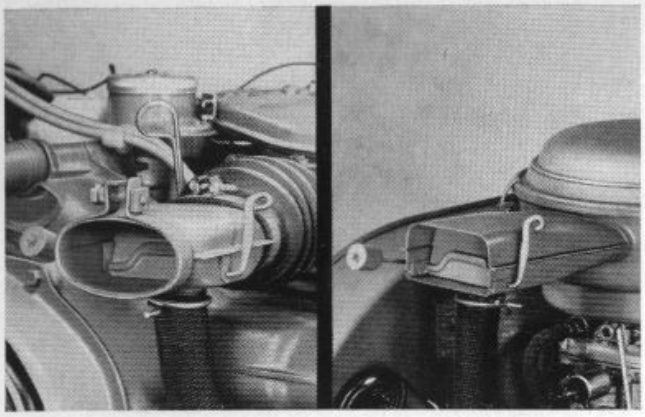


22/32 According to the conditions in which the engine has to operate, the industrial engines are fitted with various types of air cleaner.

The one shown here is used for the normal 122 engine. The instructions for checking the lower part and cleaning as necessary are the same as on the vehicle. You should ensure that this operation is carried out more often if the engine is working in very dusty conditions.

The cleaner shown here was used as a wet air cleaner on former portable fire pumps to prevent the oil running out when the engine is tilted. Please remember that oil must never be put in such cleaners.





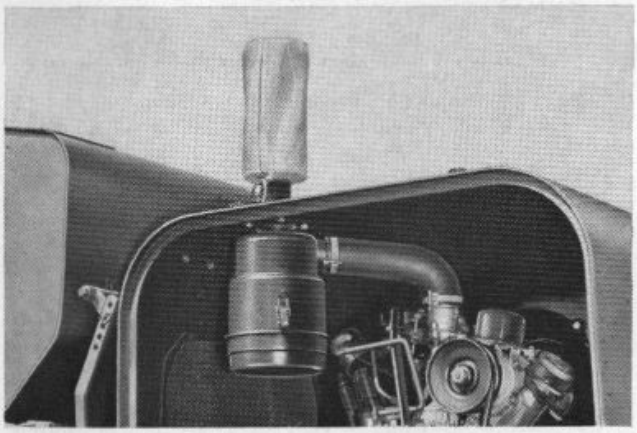
22/33 The air cleaners for the 126 engine on the right and 124 engine on the left are fitted with a carburetor air preheater pipe as on the vehicle engines.

The 122 engine can also be subsequently fitted with this arrangement to prevent the formation of ice in the carburetor.

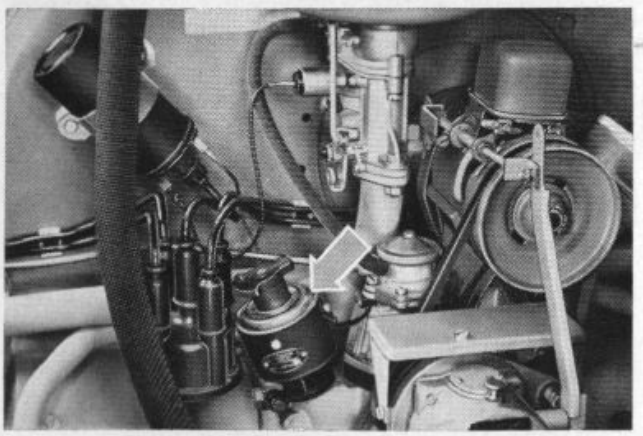
On these cleaners ensure that the warm air control flap moves freely.

22/34 Engines for newer type portable fire pumps are fitted with this sort of cleaner or a similar wet air cleaner.

To clean this type, take it off the carburetor, wash it in benzine and then moisten the gauze with clean engine oil.



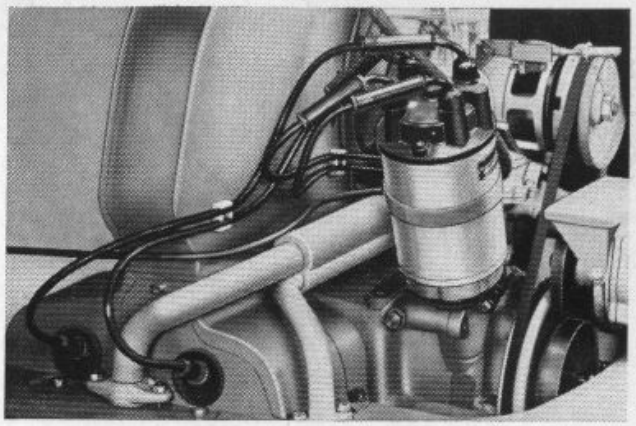
22/35 Many machine manufacturers fit the industrial engine with special air cleaning systems. This picture shows a harvester with a combination of an oil bath air cleaner and a cyclone filter. These cleaners should be serviced as instructed by the manufacturers.



22/36 As you already know, the industrial engine can also be supplied with a battery ignition system as shown in this picture. The maintenance and adjustment of this ignition system is exactly the same as on the vehicle engine. There are, however, one or two additional points as follows: The spark advance of the distributor for the industrial engine is operated by centrifugal force only. All distributors also have a sealing plate as shown by arrow to keep out dust and dirt. Do not forget to install this plate.

In this picture you can also see the suppressed ignition system. It can be recognized by the long caps on the connectors in the distributor cap.

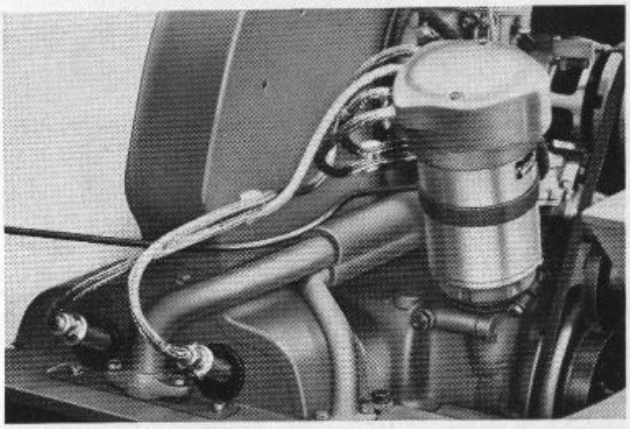
22/37 Here is a view of the suppressed magneto ignition system. As opposed to the vehicle engine with the resistor type cables, the 126 engine is fitted with special suppression parts as standard. These include a suppressed rotor arm, 4 suppression sleeves for the cables and 4 suppressed plug connectors. The 122 engine can also be fitted with this suppression equipment.



22/38 Both ignition systems can be supplied fully suppressed. This type of suppression is mainly for engines which work near radio installations.

You can see clearly the fully screened ignition cables, the suppressed plug connectors and the special screening cap on the magneto. The magneto itself is the same on both normal and suppressed systems.

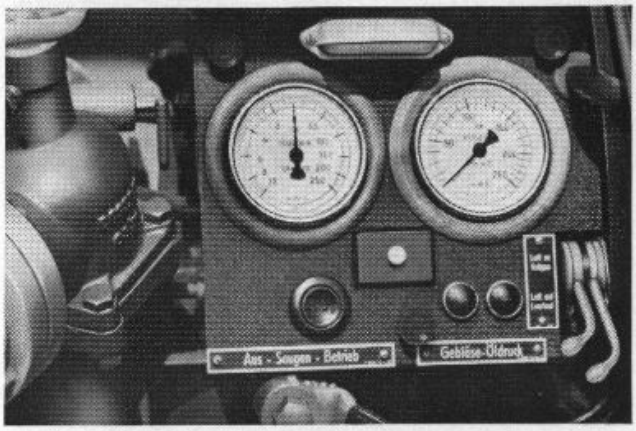
Fully suppressed battery ignition systems have a special distributor and a special coil.



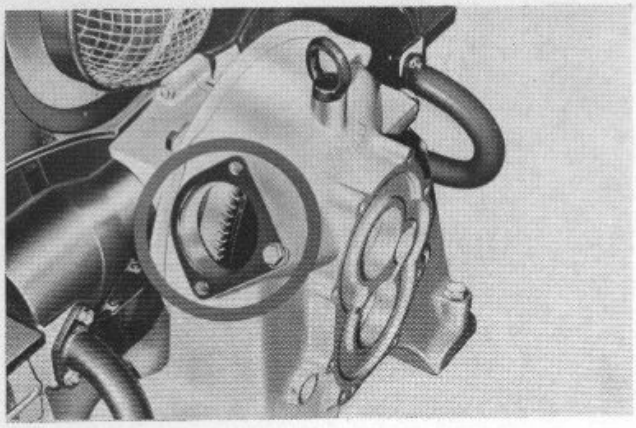
22/39 Engines for portable fire engines are normally fitted with magneto ignition and a generator but without battery. The instrument panels of these pumps have two warning lamps as shown in this picture in the right lower corner. The lamps are marked:

Fan - (green light)
Oil pressure - (red light)

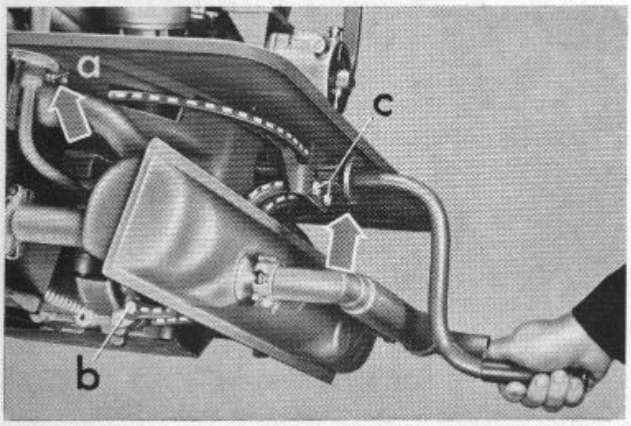
Owing to the absence of the battery, the lights have the opposite meanings to those on the vehicles. The green lamp controls the generator and cooling and deserves special attention. It lights up when the engine is started and remains on all the time the engine is running. If this lamp goes out when the engine is running, it can mean that the belt is broken and that the operation of fan and generator has ceased.



The generators on these engines can fail due to graphite formation on the commutator if not loaded all the time. This will also cause the green lamp to go out. In these cases check the 9 Ohm series resistance. If this resistance is not fitted, as may be the case on older units it should be installed.



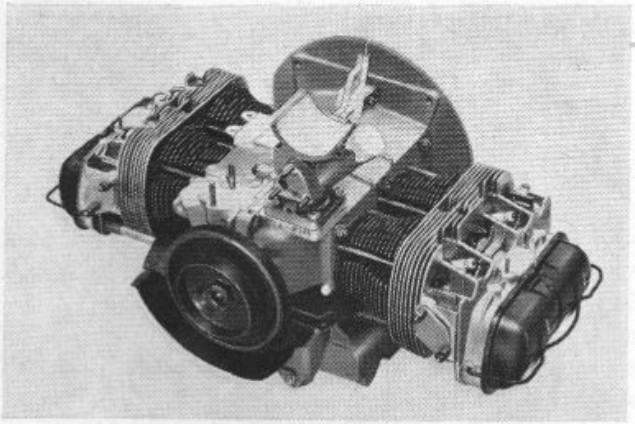
22/40 VW industrial engines can also be supplied with an electric starter. These are available as horizontal or radial types. The radial starter naturally requires a suitably toothed starter ring on the flywheel. The gearbox shown here has a flange, in dark circle, for a radial starter. The starter must be aligned properly with the flywheel with a special setting gauge. Instructions on this operation are given in the industrial engine workshop manual.



22/41 Please note the way the crank handle is being gripped here. This is the proper way to start the engine which has no electric starter. The thumb must be on the same side of the handle as the fingers to avoid injury if the engine should kick back.

This picture also shows the mounting of the cranking bracket. The screws tend to work loose with the vibration of the engine. The bracket must then be centered with the cranking dog on the crankshaft as follows.

Loosen all nuts and bolts marked here on the bracket (c), the exhaust flange (a) and on the crankcase at the bottom (b). Check that all screws have spring washers. Then insert the starting handle in the dog and tighten all the screws and nuts.

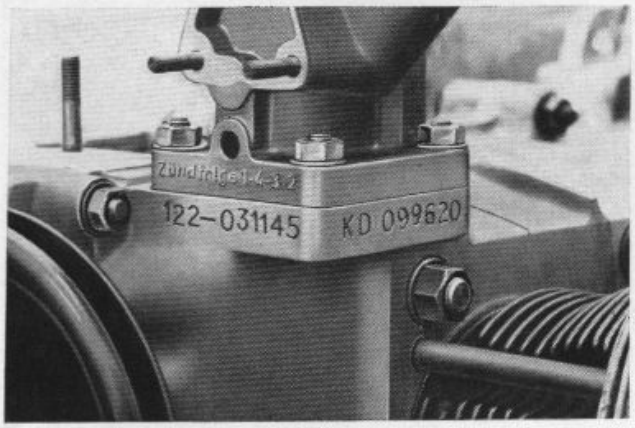


22/42 Exchange industrial engines are supplied as so-called "short engines" because the differences in equipment fitted make it impossible to supply the engine ready to install.

In other respects, the same conditions apply to the exchange of these engines as to vehicle engines.

22/43 Vehicle engines and industrial engines must not be interchanged. Means of identification is supplied by the number stamped into the crankcase which also gives the engine type. Here is a Type 122 engine.

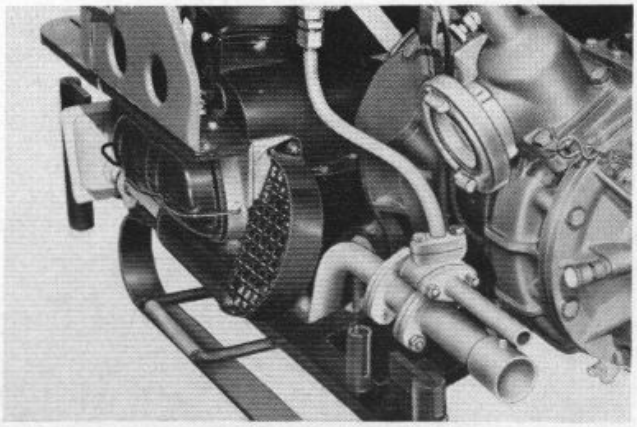
Every Genuine VW Exchange engine has a second number stamped on the right-hand side of the generator flange. This number can have the letters "KD" or "KDI" in front of it.

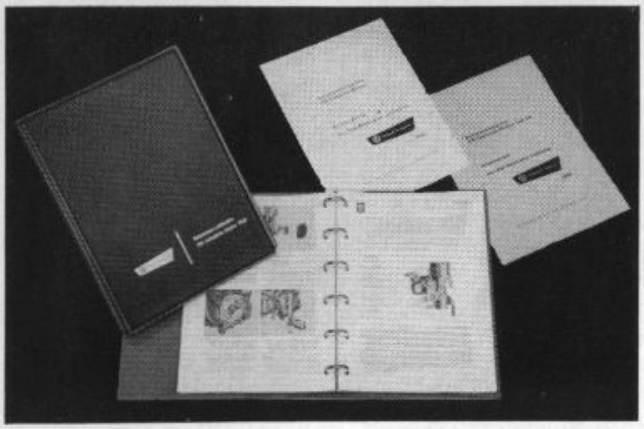


22/44 The short engine is built up with the parts from the old engine, or, where these parts are found to be unfit for further use, by Genuine VW spare parts or exchange parts.

Additional parts fitted by the manufacturer of the machine should also be taken from the old engine. The exhauster device fitted in the modified muffler of a portable fire pump as shown here is an example of this sort of thing. This device is provided to extract the air from the water suction pipes.

If such parts are found to be damaged, new parts must be obtained from the manufacturer of the equipment. In most cases the owner of the machine is responsible for this.





22/45 As you have seen in this slide series, there are only very slight differences between the vehicle engines and the industrial engines which have been developed from them. Remember the hints on maintenance and repair which you have just seen when you have to carry out this work. The publications shown here and the booklet "Look, Listen, do it Better" will help you in this respect.

Always bear in mind that the industrial engine is also a VW product and that the owners rely on rapid and reliable assistance from VW workshops.

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