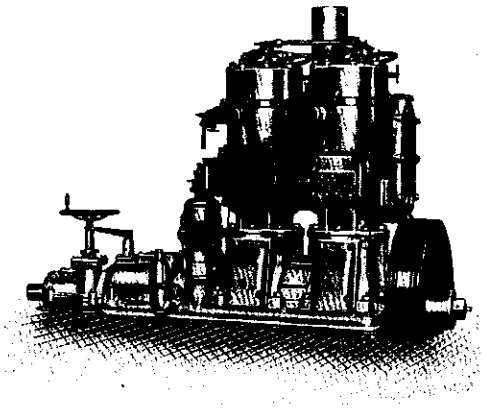
# INSTRUCTION BOOK

FOR

# Hundested Marine Engines

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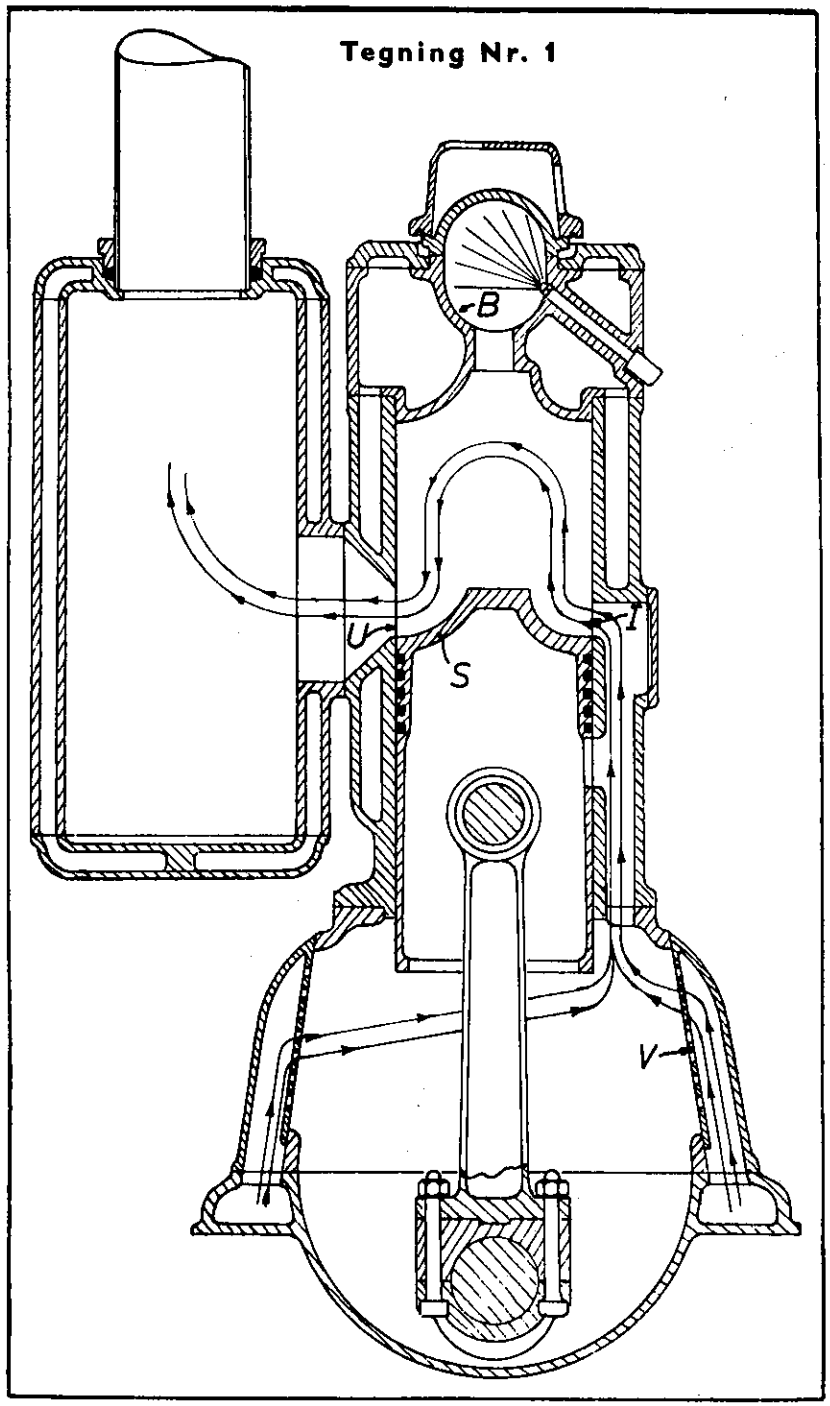


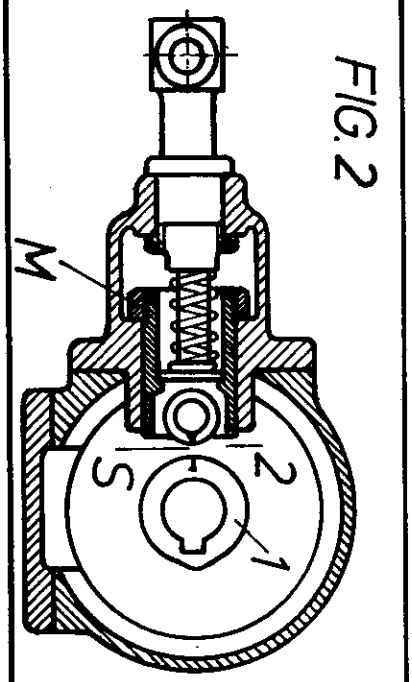



FIG. 2

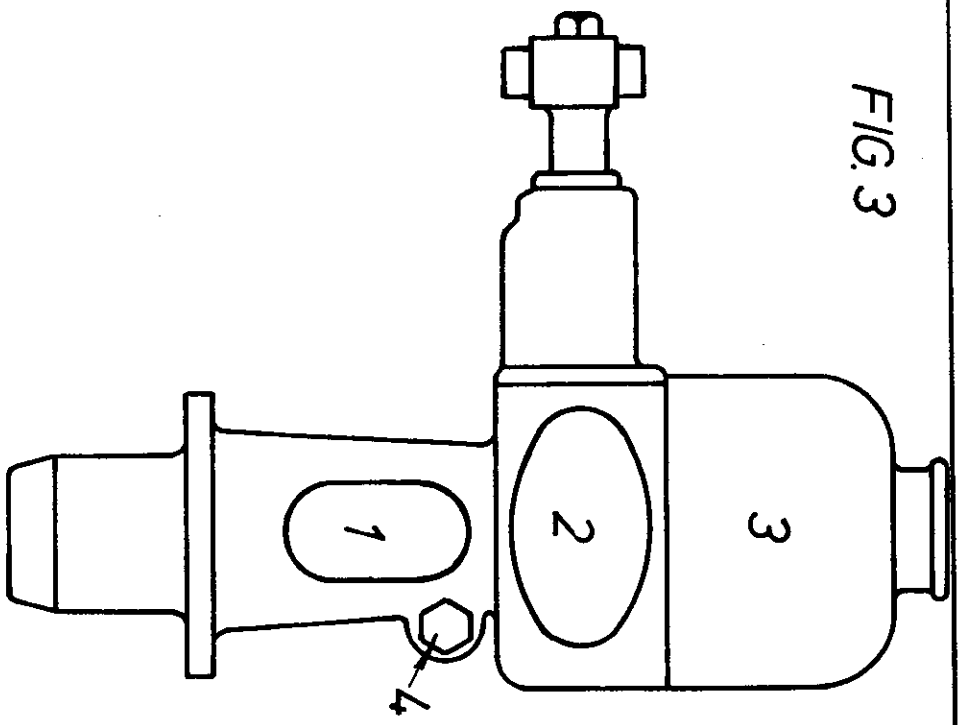
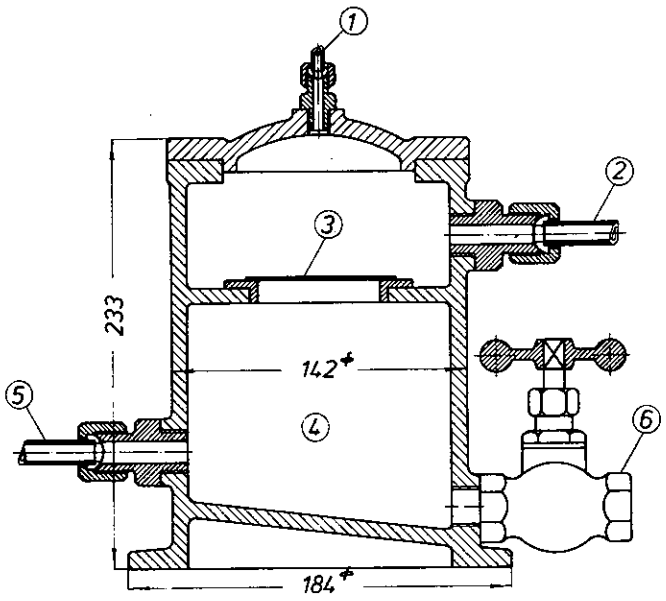



FIG. 3

# Filter og vandsamler.
# Filter and syphon box.

Fig. 6




1 Luftafgang føres så højt op i båden som muligt.
The airoutlet has to be led as high in the ship as possible.

2 Afgang til råoliepumpe.
Outlet for fuelpump.

3 Filter.

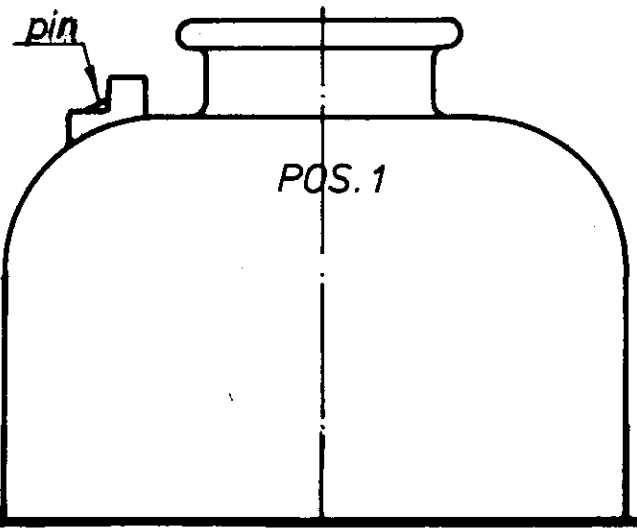
4 Slam og vandsamler.
Sludge and syphon box.

5 Tilførsel fra råolietank.
Inlet from fuel tank.

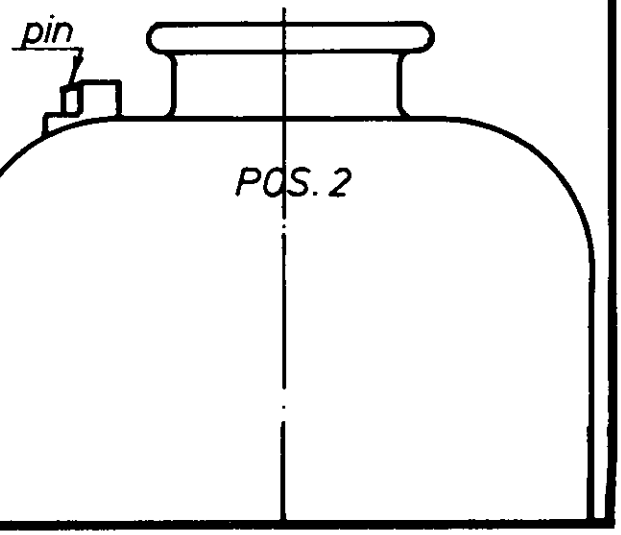
6 Aftapning af vand og slam en gang om ugen.
Outlet for water and sludge once a week.

# LOAD INDICATOR. DRWG NO. 4

OVERLOAD:
Pin at bottom for a short period only.



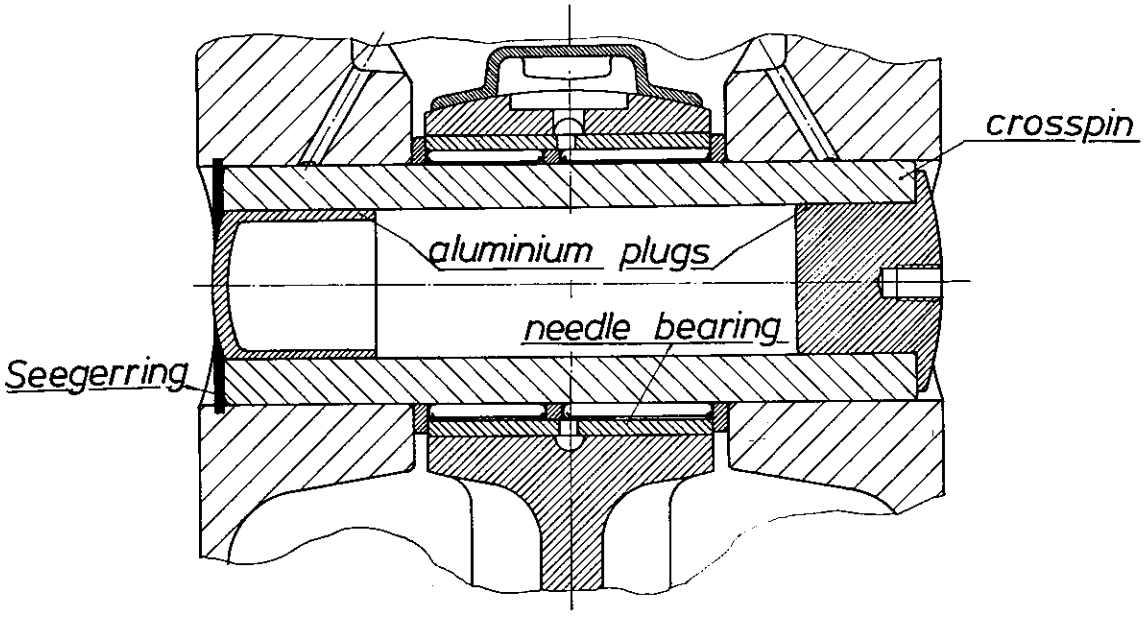

NORMAL LOAD:
Pin coincides with the upper edge of guide.



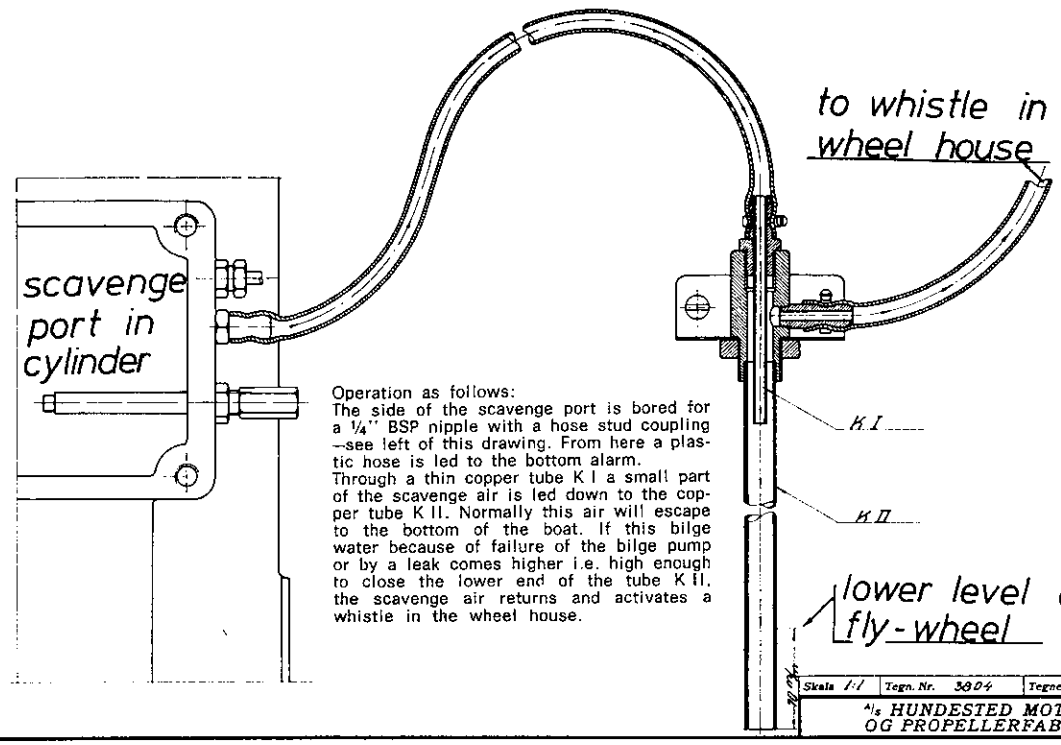

## ASSEMBLY OF CROSSBEARING IN PISTON.

old type with Seegerring

new design without Seegerring



# BOTTOM ALARM

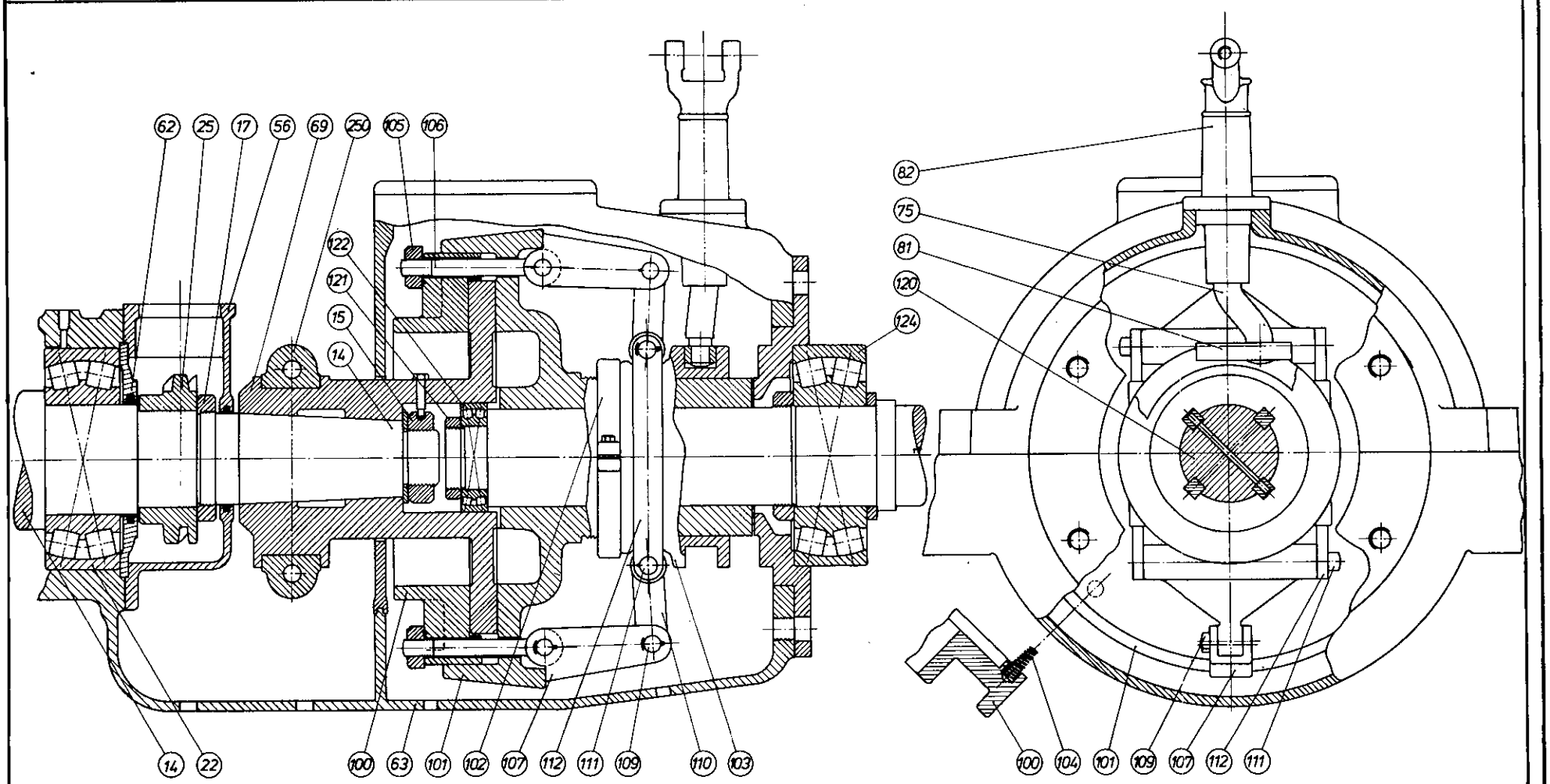



Operation as follows:
The side of the scavenge port is bored for a 1/4" BSP nipple with a hose stud coupling –see left of this drawing. From here a plastic hose is led to the bottom alarm.
Through a thin copper tube K I a small part of the scavenge air is led down to the copper tube K II. Normally this air will escape to the bottom of the boat. If this bilge water because of failure of the bilge pump or by a leak comes higher i.e. high enough to close the lower end of the tube K II, the scavenge air returns and activates a whistle in the wheel house.

| Skala 1:1 | Tegn. Nr. 3804 | Tegnet d. 7/8 - 67 |
|---|---|---|

A/s HUNDESTED MOTOR- OG PROPELLERFABRIK

# CLUTCH ARRANGEMENT. drwg. no. 10




The numbers refer to the spare part catalogue.

## FUNCTION AND ADJUSTING OF HUNDESTED CLUTCH

By turning the crank lever 75, the sliding sleeve 103 by means of the square block 81, is moved to and fro on the clutch neck. To engage 103 is led forward, until it is stopped by the adjusting nut 102. By this movement the arm 110 is raised slightly past the vertical position. By this the aft end of the arms 107 are pressed out. Due to the shape of 107 with a neck marked N on the drawing, there is a very hard pull on the bolt 106. This bolt has on the fore end a nut 105 resting on the disc 100. By the pull in 105 no. 100 is tightened hard to the fixed disc 69. The neck N of 107 simultaneously presses the clutch flange 101 forward against 69. That is the surfaces of 101 and 100 are pressed hard to the surfaces of 69. Through friction the propeller is thus coupled to the engine.

It is necessary to take care that the adjusting nut is so placed on the neck of the coupling that the arm 110 will go as little as possible over vertical position, because a further forward movement of the sliding sleeve will cause two things: first the coupling pressure achieved in the vertical position will be slackened off due to the arm's forward slanting position, second the clutch will be difficult to disengage. The ring 102 is quite simple to adjust, because it is threaded to the clutch neck. One side of it is split with a screw S, which can be loosened. When the right position of 102 is found, the screw S is tightened again.

It is important that the coupling crank, the rod to the wheel house and the clutch handle are completely free when the propeller is engaged. Don't sit on or lean to the clutch handle, as this will wear out the square block 81 and the groove in 103.

## NORMAL AFTER ADJUSTMENT OF CLUTCH

Adjustment of the clutch is carried out by taking a round steel bar and turning the nuts 105. On the reverse of these are circumferential holes, which fit to a ball marked K in the disc 100. Due to the springs, which press the disc and the clutch flange apart, when the propeller is disengaged, you will feel, when turning the nut, a sharp stroke everytime the ball passes one of the holes. The ball and the holes will lock the nut in the desired position. This is when the handle in the wheel house can engage without too much effort. Try with one movement on both nuts. If an intermediate position should be required, it may be obtained with only one movement on the one nut, as within certain limits the clutch will balance the tension from the one bolt to the other.

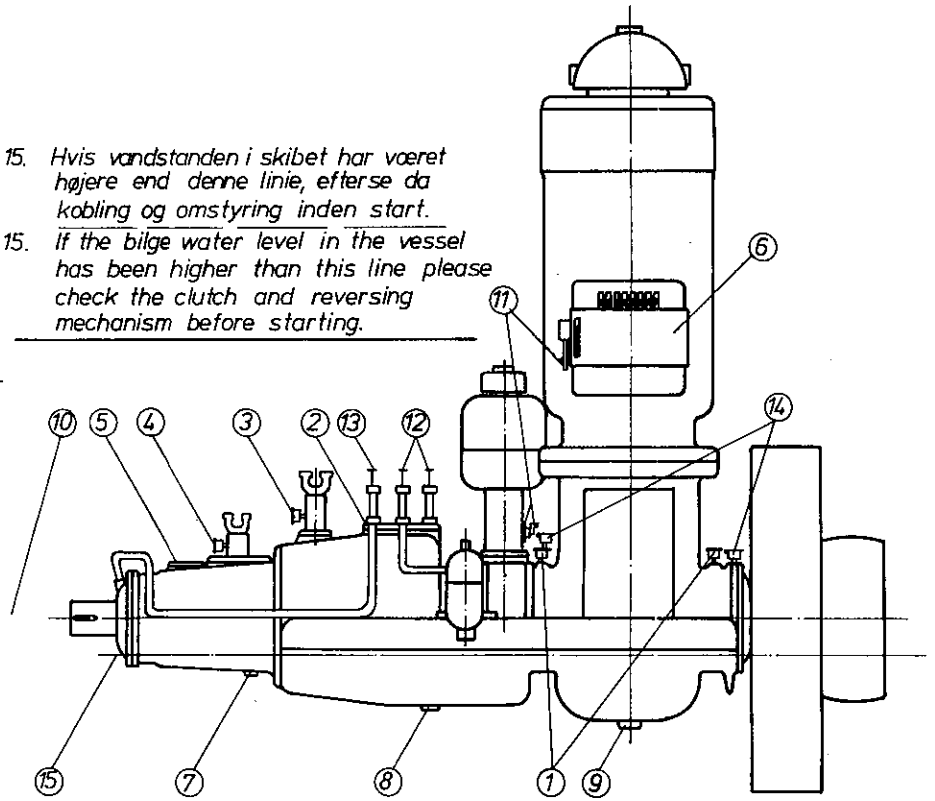
Even if, through a displacement of the toggle 112, a certain self alignment takes place (especially if the clutch has been dismantled) it should be checked that the space marked M between the arm and the rounding in the sliding sleeve are about equal on both sides.

# SMØRESKEMA - LUBRICATION SCHEME.

1. ¼ omdrejning ved start. 1 fedtkop skal vare ca. 1 måned.
1. ¼ turn by start. 1 grease cup to last approx. 1 month.
2. Kobling ca. ¼ l olie en gang om ugen. Hver fjerde gang vandopløselig olie.
2. Clutch approx. ¼ liter oil once a week. Every fourth time water soluble oil must be used.
3. ½ omdrejning ved igangsætning.
3. ½ turn on starting.
4. 1 omdrejning ved igangsætning.
4. 1 turn on starting.
5. Påfyldning af olie indtil det store snekkehjul ved drejning af omstyringen dypper i olien. Halvdelen af denne skal være vandopløselig f.eks. Vacuum Soluble Oil W. eller Shell Dromus B.
5. Fill with oil until the big worm wheel by turning of the reversing mechanism dips into the oil. Half has to be water soluble for instance Vacuum Soluble Oil W. or Shell Dromus B.
6. Vedrørende indstilling og pasning af smøreapparat. Se instruktionsbogen
6. For adjustment and care of the lubricator, Please see in the instruction book.
7-8. Aftapning for omstyring og kobling - såfremt aftapning er besværlig, bruges den medfølgende oliesprøjte.
7-8. Draining for reversing mechanism and clutch - when draining is difficult please use the oil gun supplied.
9. Aftapning for krumtaphus. Se instruktionsbogen
9. Draining of crankcase. Please see in the instruction book.
10. Stævnrøret smøres hver time. Husk det kræver smøring ligesom ethvert andet leje. Brug vandopløselig stævnrørsfedt.
10. The stern tube has to be lubricated every hour. Remember it requires lubricating like any other bearings. Use water soluble stern tube grease.
11. Smøretrækket gives nogle dråber ved start og tilses jævnligt.
11. Lubricator drive some drops on starting and has to be checked frequently.
12. Fedtkopperne til vandpumperne: ½ omdrejning ved start og ½ omdrejning i timen. Brug stævnrørsfedt.
12. The grease cups on the water pumps: ½ turn on starting and ½ turn an hour. Use stern tube grease.
13. Fedtkoppen til tryklejet: ½ omdrejning ved start. Brug stævnrørsfedt.
13. Grease cup to the thrust bearing: ½ turn on starting. Use stern tube grease.
14. Oliekopperne på hovedlejerne fyldes ved start.
14. The oil cups on the main bearings have to be filled on starting.

15. Hvis vandstanden i skibet har været højere end denne linie, efterse da kobling og omstyring inden start.
15. If the bilge water level in the vessel has been higher than this line please check the clutch and reversing mechanism before starting.

Sættes op på maskinskoddet.
To be placed on the engine-room bulkhead.



# SMØRESKEMA - LUBRICATION SCHEME.

1. ¼ omdrejning ved start. 1 fedtkop skal vare ca. 1 måned.
1. ¼ turn by start. 1 grease cup to last approx. 1 month.
2. Kobling ca. ¼ l olie en gang om ugen. Hver fjerde gang vandopløselig olie.
2. Clutch approx. ¼ liter oil once a week. Every fourth time water soluble oil must be used.
3. ½ omdrejning ved igangsætning.
3. ½ turn on starting.
4. 1 omdrejning ved igangsætning.
4. 1 turn on starting.
5. Påfyldning af olie indtil det store snekkehjul ved drejning af omstyringen dypper i olien. Halvdelen af denne skal være vandopløselig f.eks. Vacuum Soluble Oil W. eller Sheel Dromus B.
5. Fill with oil until the big worm wheel by turning of the reversing mechanism dips into the oil. Half has to be water soluble for instance Vacuum Soluble Oil W. or Shell Dromus B.
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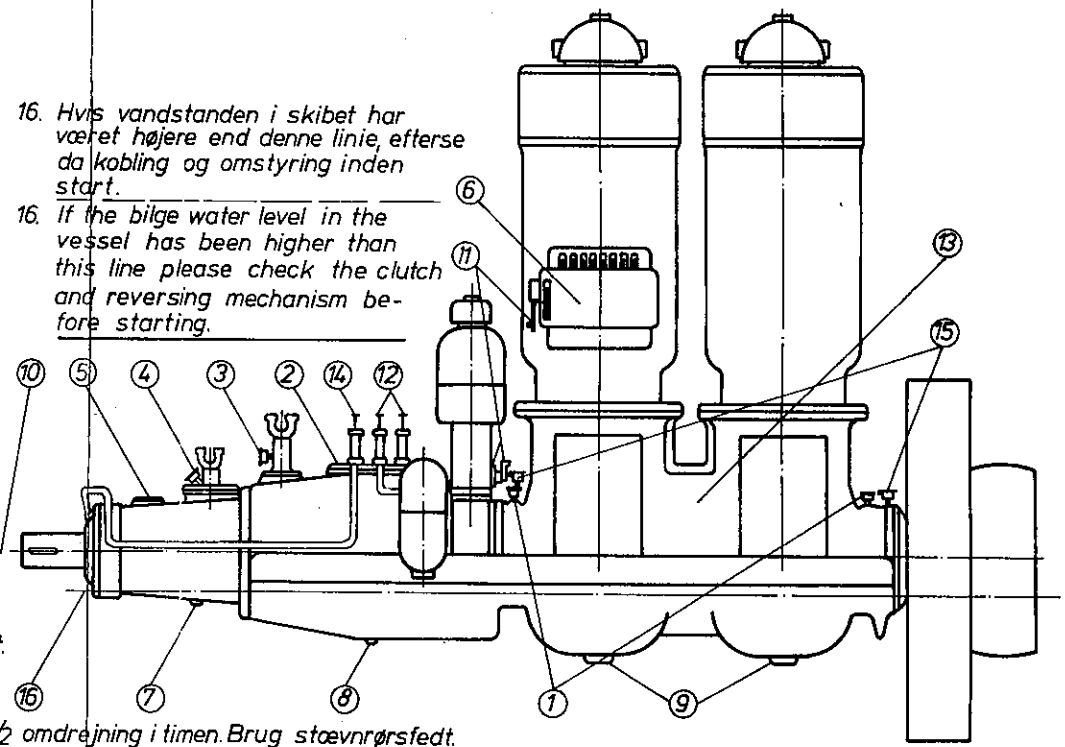
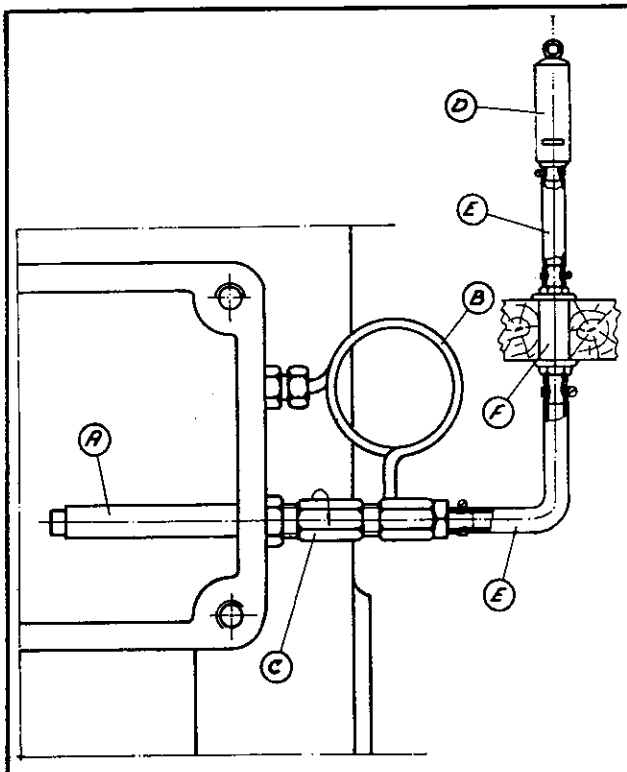
9. Aftapning for krumtaphus. Se instruktionsbogen
9. Draining of crankcase. Please see in the instruction book.
10. Stævnrøret smøres hver time. Husk det kræver smøring ligesom ethvert andet leje. Brug vandopløselig stævnrørsfedt.
10. The stern tube has to be lubricated every hour. Remember it requires lubricating like any other bearings. Use water soluble stern tube grease.
11. Smøretrækket gives nogle dråber ved start og tilses jævnligt.
11. Lubricator drive some drops on starting and has to be checked frequently.
12. Fedtkopperne til vandpumperne: ½ omdrejning ved start og ½ omdrejning i timen. Brug stævnrørsfedt.
12. The grease cups on the water pumps: ½ turn on starting and ½ turn an hour. Use stern tube grease.
13. Hvis midterlejet ikke smøres fra smøreapparatet, hældes ¼ l olie i en gang om ugen.
13. If the middle bearing is not lubricated from the lubricator pour in ¼ liter oil once a week.
14. Fedtkoppen til tryklejet: ½ omdrejning ved start. Brug stævnrørsfedt.
14. Grease cup to the thrust bearing: ½ turn on starting. Use stern tube grease.
15. Oliekopperne på hovedlejerne fyldes ved start.
15. The oil cups on the main bearings have to be filled on starting.

Sættes op på maskinskoddet.
To be placed on the engine-room bulkhead.

16. Hvis vandstanden i skibet har været højere end denne linie, efterse da kobling og omstyring inden start.
16. If the bilge water level in the vessel has been higher than this line please check the clutch and reversing mechanism before starting.





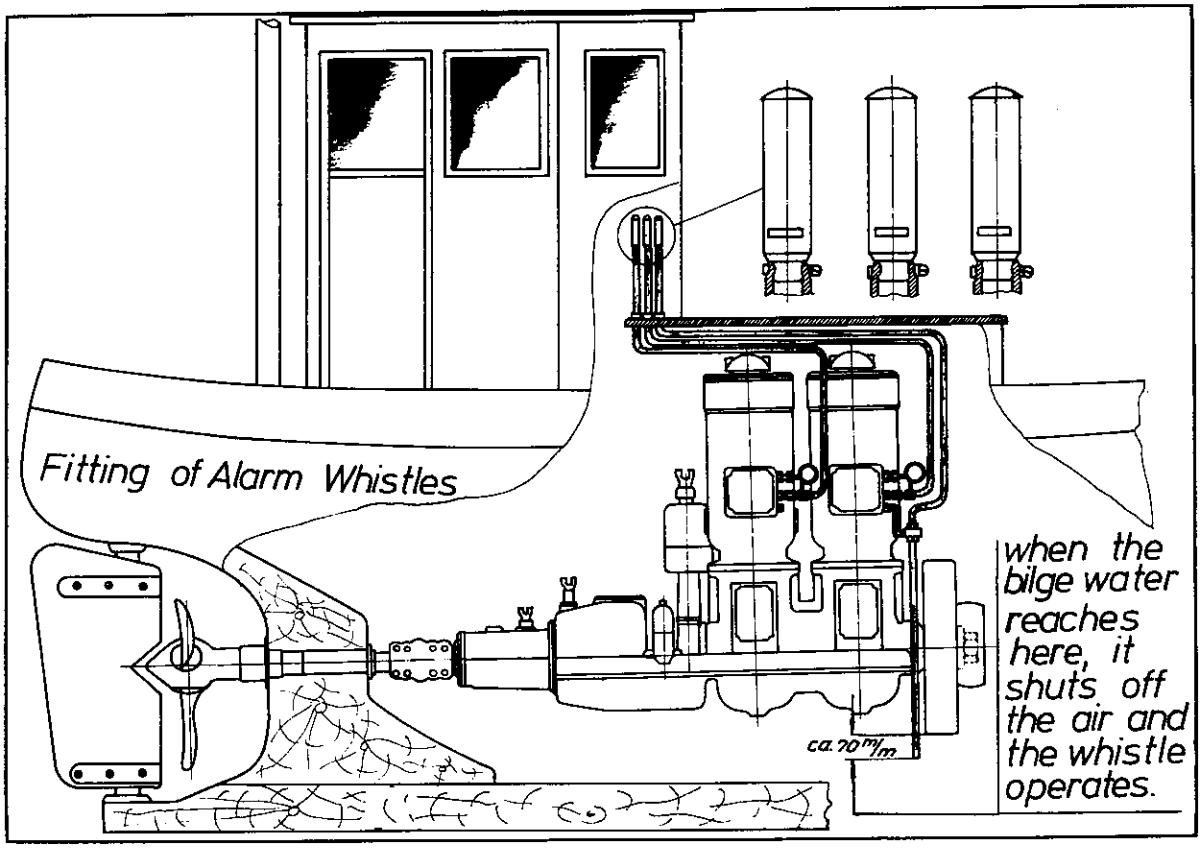

# Alarmtermostat.

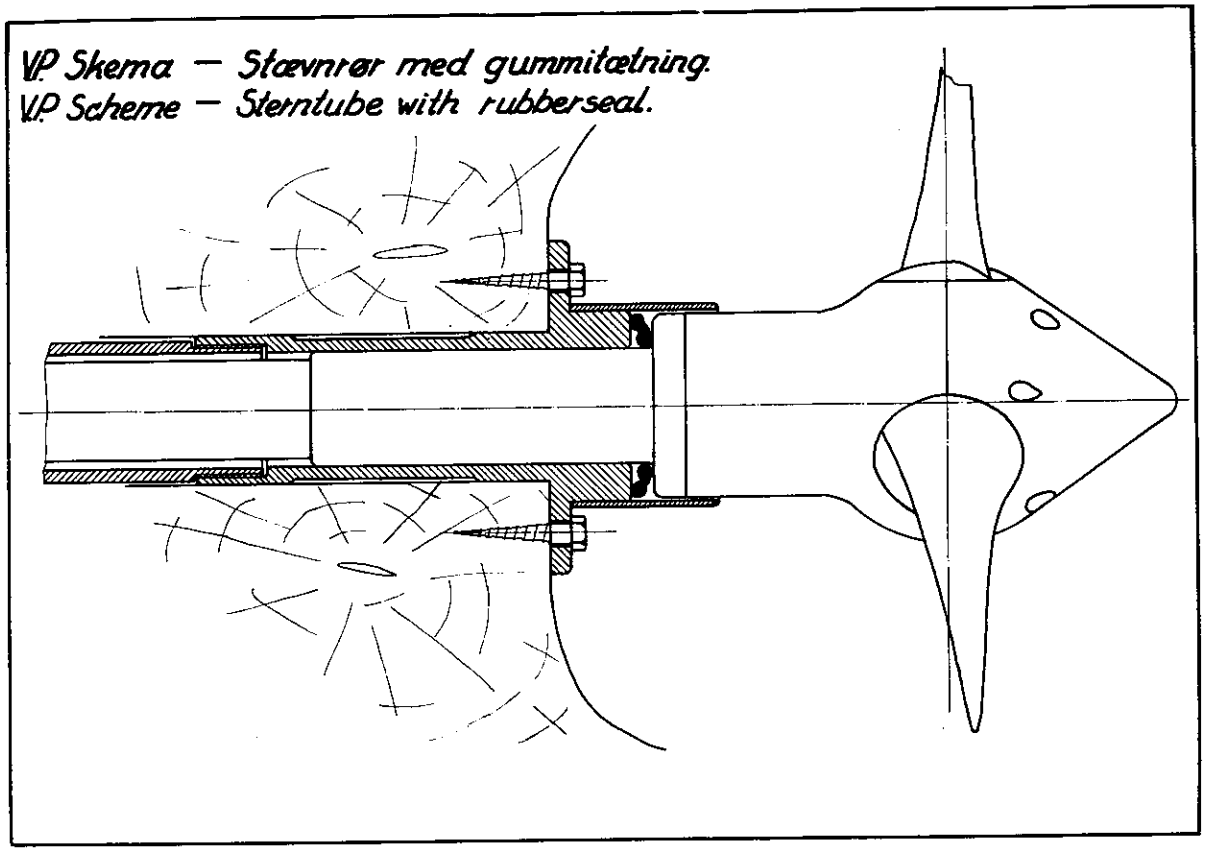
In the scavenge channel a built-in thermostat element "A" is controlled by the working temperature. When this rises too much either by failure of the cooling water system or a heated crank shaft, the thermostat opens a valve so that the scavenge air will get through to the whistle "D" via the tube "B" and via connection "E" and junction "F".

To obtain proper operation nut "C" must be carefully adjusted after several hours full load running to the point where the whistle cuts out. Turning the nut "C" in the direction shown by the arrow will raise the temperature at which the whistle sounds and vice versa.

In a country such as this, where there is a great difference in the air temperature summer and winter, adjustment should be made to counteract this.

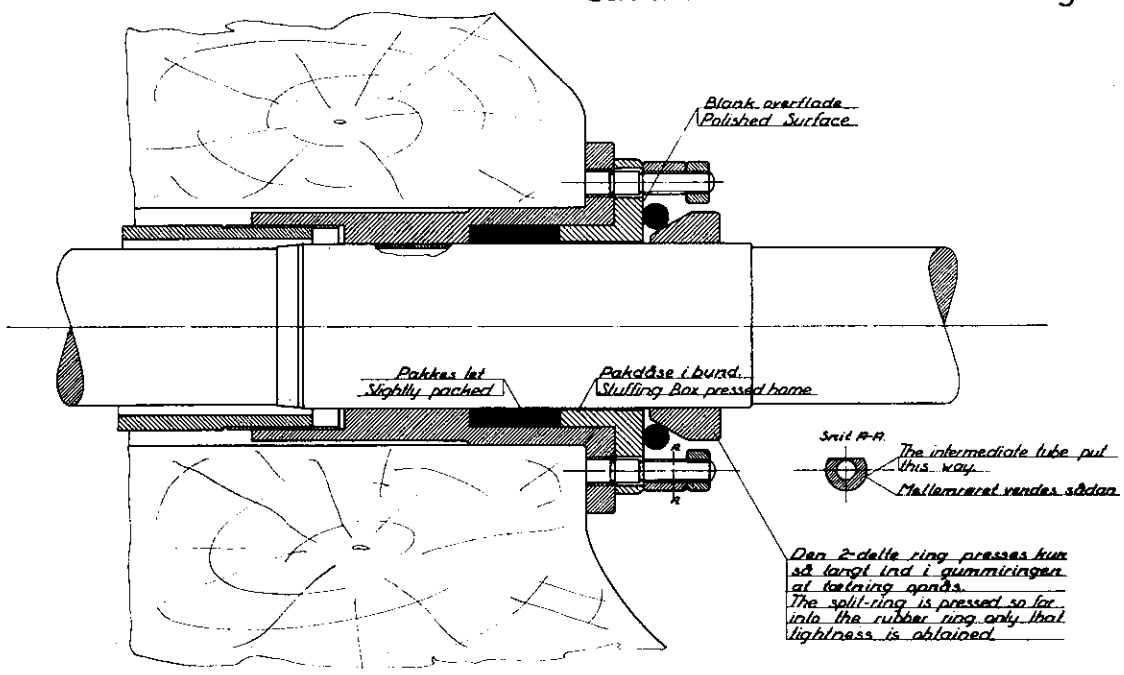
It is very important, if the whistle sounds, to examine the cooling water and the crank shaft bearing, before setting "C" to a higher temperature.


Fitting of Alarm Whistles
when the bilge water reaches here, it shuts off the air and the whistle operates.
ca. 70 m/m

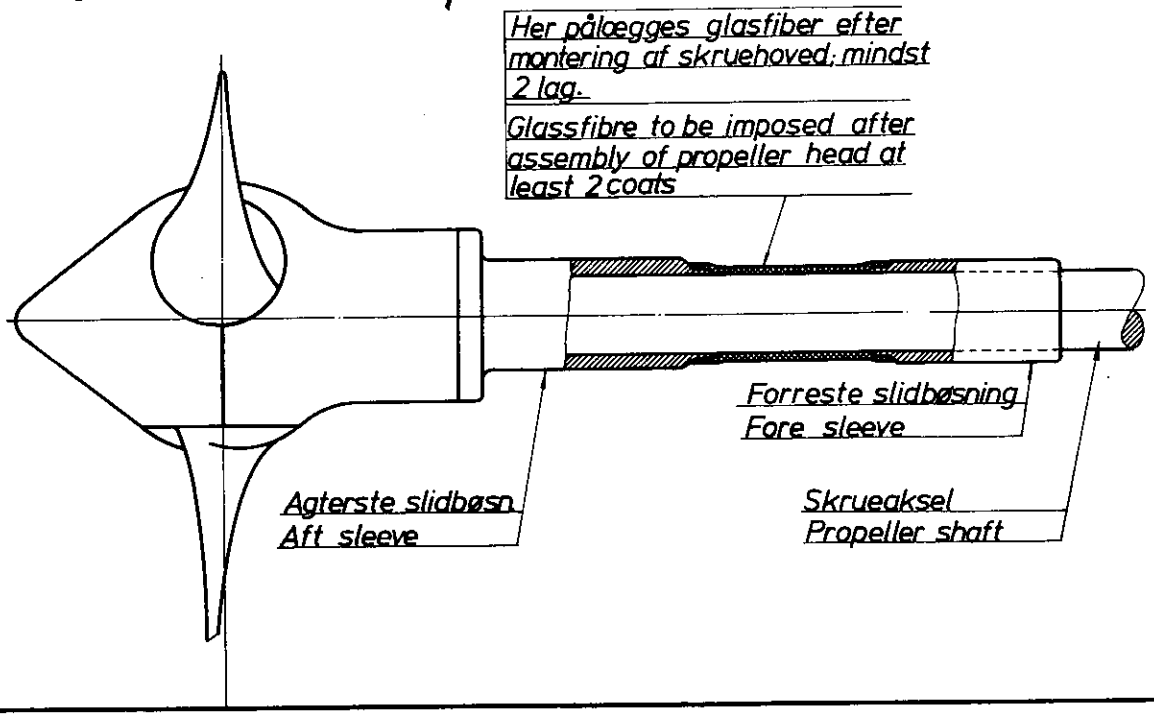

V.P. Skema – Stævnrør med gummitætning.
V.P. Scheme – Sterntube with rubberseal.

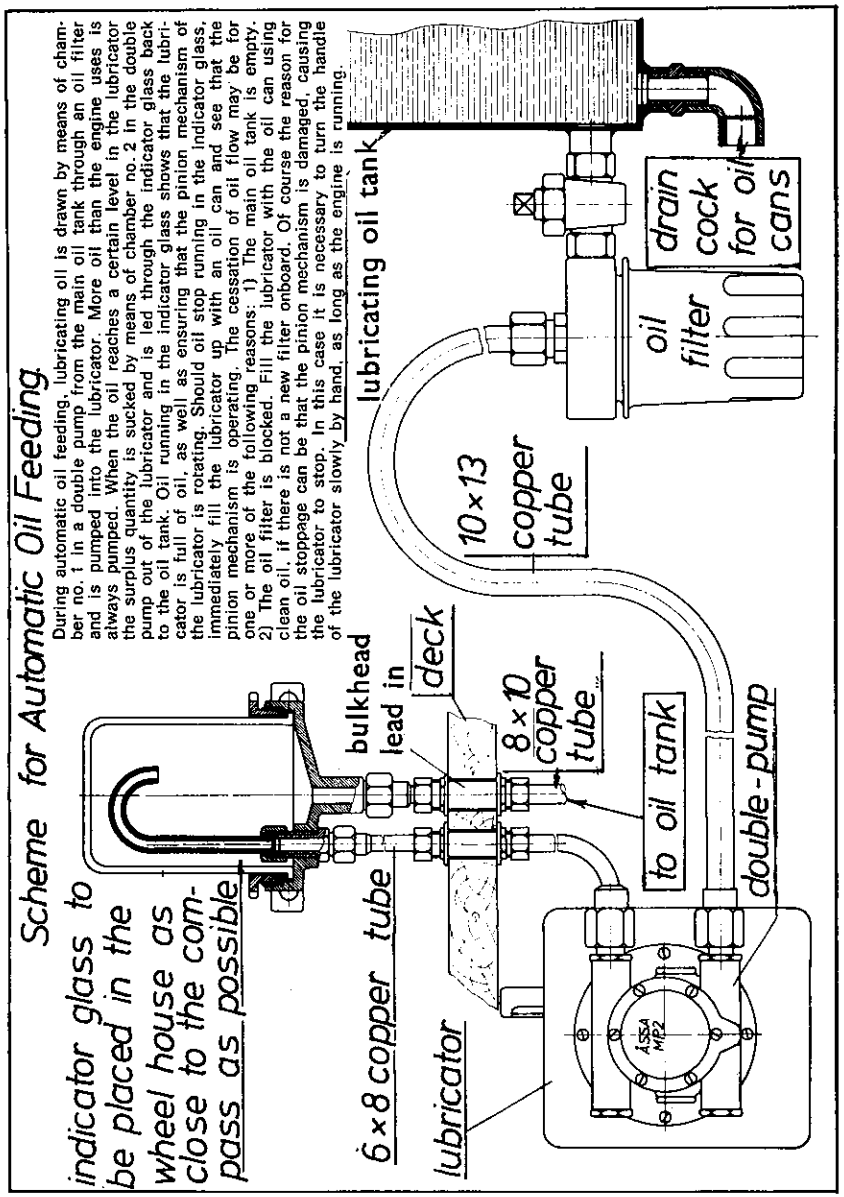
## Skema for V.P. - Stævnrørstætning.

### Scheme for V.P. - Stern Tube Sealing




## Beskyttelse af skrueaksel mellem slidbøsn
## Protection of Propeller Shaft between Sleeves






## Engine Function.

The Hundested engine is two stroke, which means there is an explosion in the combustion chamber every time the piston passes its deadpoint whereas with the four stroke engine there is an explosion every second revolution. Thus it follows that the two stroke engine is smoother and more vibration free and the power is achieved with far less stress on the bearings, cylinderwalls etc.

Section drawing no. 1 shows the piston in its lower position. The cylinder is filled with air, which is compressed by the upwards movement of the piston and fresh air is sucked to the crankhouse through the air valves V. When the piston approaches its deadpoint a certain amount of atomized fuel controlled by the governor is injected into the combustion chamber B. Here it is ignited by an internal glowtube and the exploded gas forces the piston down in the cylinder. When the piston approaches its lower position it opens channel U, so that the exhaust gas escapes into the silencer.

When the pressure in the cylinder has dropped below the pressure of the fresh air which the piston has compressed in the crankhouse by its downward movement, the channel J opens and the cylinder is now filled with fresh air and the rest of the burnt gas is driven out through the silencer.

The piston is now in its lower position, the engine has turned one revolution and the cycle described above is repeated as long as the engine is running.

## Starting the Engine.

When starting the engine first time, the fuel tank is filled with fuel and the fuel tap on the pipe line to the filter opened.

The coupling of the pipe from the filter to the fuel pump is loosened at the suction valve and the fuel is bled until no air bubbles appear. The coupling is tightened again and the pressure valve is disconnected from the pump and filled with fuel.

The pressure valve is reconnected and the pump operated until the fuel flows regularly and without air. The pressure valve is reconnected but not at the injector. Hand pump again until fuel without air comes out of the upper end of the pipe. Then the pipe and injector are connected, the handpump operated until resistance

is observed when the fuel comes through the atomiser. The atomiser itself can be tested either by removing the coldstart or by taking out the injector and connecting it to the pipe outside the engine. By heavy hand pumping the fuel should be atomised to a regular mist and there must be no excess dripping. If drips appear it shows that there is air somewhere in the system or there is a leak in the injector valves.

The lubricator is filled with a good cylinder oil which is the same summer and winter, i.e. Viscosity 12—14.

All the pipes should be loosened where they connect to the engine and then must be turned until all pipes are filled.

After these are re-connected turn the handle about 25 times to make sure that oil has reached everywhere. The clutch and reverse gear housing should be filled with oil until the clutch flange and the large reversing wheel dip in the oil. Fill all grease cups for sterntube, thrust bearing, cooling water and bilge pump, reverse and clutch operation bearings and main bearings. The roller on the fuel pump housing and the pistons for the cooling and the bilge water pump should be lubricated with oil. The seacock connection to the cooling water pump to be opened up and checked.

For the larger engines it is necessary to start by air. The air bottle therefore must be pumped to 7—8 atmospheres either by a foot pump or from an air bottle.

**Never load the engine with oxygen!**

As the engine will blow up with risk to life. When air starting the engine is turned until the piston reaches the air valve and is a little over deadcentre. The compression cock is then shut—prime with the hand pump and the starting air is led to the cylinder by momentarily pressing the starthandle and then closing the valve again. It is important to keep the handle well back when the engine ignites or some power from the explosion will be lost through the air valve to the air bottle. After the engine is started, the air bottle is recharged to 12 atmos. by adjusting the small hand wheel below the air valve. If the hand wheel is opened too much the engine will stop but opening it too little extends the time taken to recharge



the bottle. The air valve and the valve on the air bottle must be closed carefully on completion. It is desirable to check the hand wheel on the valve for tightness about a quarter of an hour after charging. The starting spindle is warmed up by the exploded gas and is therefore expanded.

If it is a fuel with a high flame point, low calorific value, or other disabilities it might be necessary to engage the propeller immediately after starting at low revolutions, to keep the combustion chamber warm. For fuel with the above mentioned characteristics it is inadvisable to stop the engine after a long period of idling, full load for a short while will clean piston and cylinder to facilitate easy starting next time. For engines with coldstart, starting by means of a cartridge is done by pressing a cartridge into the holder and igniting it. When the cartridge is burning well the cartridge and holder are screwed into the coldstart. After allowing half a minute for warming up the internal ignition pipe give a heavy pumpstroke with the fuel pump. It is desirable not to pump before the engine has started turning because the residue from the cartridge together with a too heavy injection might cause failure to fire. In the event of cold starting without cartridges the internal ignition pipe should be taken out and heated red with a blowlamp, then put quickly into the combustion chamber and the engine started immediately either by hand or air.

When the engine is started check that there is sufficient cooling water and that the lubricator is functioning. If the engine stops through failure in the cooling water system it should not be started again after the fault is traced before half an hour, because cold water on hot cast iron will cause cracking. The reason for cooling water failure can be: 1) The seacock is not open. 2) The bottom strainer blocked by ice, jelly-fish, seaweed or other impurities. 3) The valves or springs in the cooling water pump out of order.

When on the slipway the strainer should be removed and cleaned and barnacles and growth under the strainer or in the entrance to the seacock cleaned away. It often happens that barnacles loosen whilst the boat is on the slip and when the cooling water pump starts working, can foul the valves. The result can be cracked cylinder covers or similar serious trouble.

After docking the cooling water air dome should be removed and the valves and springs checked. Many accidents with cracked

cylinder covers will be avoided.

While running, the supply of oil to the engine from the lubricator should be frequently adjusted. Check with the lubrication table which is supplied with every engine. The drain cock from the crankcase should always be slightly open to avoid accumulation of oil in the crank case. This could enter the cylinder with the scavenge air and cause carbonising and damage to piston rings. Excess oil from the crankcase can also escape unburnt through the engine into the silencer and from there through the exhaustpipe. Undrained oil can cause engine overspeed which could demolish engine and vessel. Therefore—check that drain pipe and cock are not blocked.

The cocks on the fuel tanks must always be sited so that water or other impurities do not accumulate in the tank, but are lead to the filter where they can be drained. Clear the filter frequently to avoid inconvenient stops.

The Hundested engine is unlike most other engines which are locked to a certain power, and should therefore never be run maximum for long periods. We feel that this reserve, which can be used in emergency, is a good thing, but it is expected that it will not be used the detriment of the engine by overrunning it for hours.

When the engine is installed the pitch indicator should be marked at a maximum that will leave 6-8 mm of normal governor adjustment travel. It is checked during running by the removal of the oval cover 2 (drawing no. 3) aft on the governor. For engines with load indicator the load can be read direct by the little pin on top of the governor housing. If the speed is required to be increased, this should be done by decreasing pitch a little before putting more revs on. As the engine RPM can be controlled through the governor up or down over a wide range, it will normally be sufficient to reduce the RPM if the vessel requires to decrease speed. Only for special purposes should it be necessary to decrease pitch.

For bigger engines the pitch indicator should be marked zero pitch—this indicates a neutral position neither ahead nor astern. The indicator is also marked with a suitable astern pitch for manoeuvring. Except in an emergency the change from ahead to astern should not be made without disengaging.



**Bad starting.**

1) There might be water in the fuel. The draincock on the filter to be opened frequently to drain water.

2) The ignition device is not hot enough.

3) The fuel strainer or the pipes might be blocked.

4) Air in the injection system.

5) The atomiser might be blocked, if so the fuel pump will be hard to operate.

6) The fuel pump piston is stuck. Remember never to tighten up the pump. The nut on the neck of the pump must be tightened only by hand.

7) The airvalves are too stiff (only after a long stop period). If the airvalves have failed this can be clearly heard when the engine is running.

8) The piston rings have pitched. (There is no compression in the engine).

9. The gasket between the cylinder cover and cylinder is blown. (There is no compression in the engine). If the engine does start, smoke will come out of the water delivery pipe.

10) There is a hole in the cylinder cover or somewhere in the combustion chamber (same symptons as under point 9).

**The engine smokes.**

1) The atomising is bad. The reason for this might be that the atomiser is worn that means that the bore is far too large. The worm has slid out of the atomiser.

The grooves in the worm are partly blocked.

The valves in the injector or fuel pump leak.

The fuel cam is worn, so that pumping is too slow.

2) The engine is wrongly adjusted. For smaller engines the injection should be at top dead centre for larger engines about five degrees over top dead centre.

3) The engine gets too little scavenge air. The flaps in the air valves are damaged or too stiff. If the engine has been carelessly looked after, there might be too little distance between the flaps and their stoppers.

The piston rings might be pitched so that part of the explosion enters the crankcase and prevents fresh air suction.

The exhaust channel or the exhaust pipe might be sooted up so that the exhaust gas cannot easily escape from the cylinder.

When a cylinder cover is replaced too much distance between the piston and the cover might cause smoking. Without gasket there should not be more than 1,5-2 mm for smaller engines and for bigger engines 2-2,5 mm.

### The engine gets too hot when coldstarting under load.

The main reason why the internal glow screen gets too hot (this can be recognised by the screen being burned away) is that the space S between the backside of the fuel cam 1 (drawing no. 2) and the little arch shaped ball bearing 2 transmitting the movement to the fuel pump is too small. For bigger engines this space should be 0,5-0,7 mm, for smaller engines 0,3-0,5 mm. The space is adjusted by means of the nut M. Too much space prevents the engine from keeping warm when running idle, and too little space makes the engine get too hot under load and might result in burnt glow tubes and screens.

Too early injection also might give extra heat to the cold start. This is very seldom and can only occur when the governor is wrongly adjusted. Too early injection shows by a rhytmic hard knocking growing in strength as the load increases. If the fuel cam is worn it means that the sharp pumping edge is rounded or gone and will cause extra heat in the combustion chamber.

If the atomiser is worn and atomising faulty the combustion gets very hot.

As a rule finer atomising gives a colder combustion, this doesn't mean that the atomising ought to be too fine because then the engine keeps too cool when idling.

We warn against using atomisers with smaller holes than calculated for each engine size.

These are for:

| | |
|---|---|
| R | 0,8 mm |
| C | 0,8 mm |
| A | 0,9 mm |
| B | 1,0 mm |
| D | 1,1 mm |
| E | 1,1 mm |



| | |
|---|---|
| K | 1,2 mm |
| F | 1,3 mm |
| G | 1,5 mm |
| J | 1,8 mm |
| H | 1,8 mm |

The size of the hole is stamped on the side of the atomiser. Too small holes give an unnecessary pressure on the fuel cam and pumping rollers and can eventually cause defects in these.

Defective air flaps and sooted exhaust channels can also cause bad combustion and heat.

If a cold start leaks where it is tightened to the cylinder the faces must be ground with carborundum powder. In the case of excessive damage the faces must be machined. Take care that no grinding powder comes into the cylinder. Stop the neck hole and clean the combustion chamber afterwards.

Never use a gasket between the cold start and the cylinder cover.

### The engine does not keep warm when idling.

1) The distance between the backside of the fuel cam 1 and the pump roller is too big (see drawing no. 2) so that the idlercam (the lower advanced part of the fuel cam) can no longer actuate the pump roll. The space must be adjusted: Look up under hot combustion.

2) There is a hole somewhere in the combustion chamber or the gasket between the cylinder and cylinder cover is blown so that water comes into the engine. In this case the cooling water will not be steady because it is mixed with explosion gas.

3) The atomiser is partly blocked so that the atomising is too fine or the direction is too much downwards.

4) The fuel has too few calories; very seldom under normal conditions. Try with an old worn atomiser—eventually with an atomiser from a bigger engine.

### 2 cyl. engines.

On 2 cyl. engines it is absolutely necessary that both cylinders get equal fuel in order to keep warm. It is easiest to achieve this by checking that the space between fuel cam and rollers (with a feeler gauge) are absolutely equal. Don't run the engine with too many RPM without load.

## Engine Knocking.

If the engine is timed too early there will be constant knocking increasing with growing load. This is most noticeable from the side of the cylinder cover. In this event the governor ought to be timed lower. Adjustment of the injection timing is done by turning the complete upper part of the governor to the desired position after loosening the binding screw no. 4 in the lower part of the governor. (See drawing no. 3). For smaller engines the injection ought to finish just when the engine is at its deadpoint when the pump roller should be in the middle of the fuel cam. For bigger engines about 5 degrees later. This means that for larger engines when the piston is in its deadcentre the flywheel mark should be turned about 5 cm the same ways as the engine is running to find where the injection should finish.

2) Knocking also can occur by too late injection, but is then irregular because by the late injection there is fuel left which preignites next time the piston moves up. Often this knocking is accompanied by misfires, especially when the engine gets really hot.

3) If a cylinder cover or piston is replaced the knocking can be caused by the piston touching the cylinder cover, when it passes the dead centre. Knocking of this kind sounds when the engine is slowed down after full load. It thereafter will decrease gradually, because the piston after a while cools and contracts. To avoid piston and cylinder cover touching each other, when piston or cover is replaced turn the engine without gasket and check that the piston does not touch the cover: Then ample space is sure to be left for expansion when the gasket is on.

4) Knocking caused by too much space between cylinder and piston (only by older engines or by engines being run with ineffective lubricating oils) can be stopped for a short time by sufficient oil supply to the piston, about 25-50 turns on the lubricator.

5) Knocking in the engine can also be caused by a loose flywheel. This must be fixed very hard with a sledge hammer using the key supplied. The nave is warmed to about 100 centigrades. Don't use too heavy oil to lubricate the cranktaper and the nave, preferably half oil and half fuel.

6) The clutch flange with the water pump eccentric might be loose (very seldom) but only if some obstructions have hit the



propeller or after heavy ice sailing.—Common for all knocking caused by loose parts aft of the engine i.e. loose propeller head, clutch flange, or muff coupling are that they are noticeable with engaged propeller and only when the revs drop under a certain level.

## Fitting of cross bearing in piston.

When fitting the crossbolt in alloy pistons the piston and its surroundings are heated to about 100° centigrade. After the pin is fitted the two alloy plugs are pressed or driven into the hollow cross pin.

When dismantling, the plugs must first be removed with a draw tool, whereafter the piston and the ears are heated to about 100 centigrades.

When replacing the outer ring of the needle bearing the head of the connecting rod is heated to about 100° centigrade. The old outer ring is easily removed and the new one replaced. The replacing of outer ring in steel connecting rods should be done under a press.

## Cleaning of the engine.

After a lengthy period of running or if the piston rings have pitched by poor lubricants or fuel it might be necessary to take the piston out for cleaning.

Fixed piston rings are noticed by lack of compression, and often by a sharp metallic sound from the cylinder like the sound of hammering on a tin basin.

If there are none of above mentioned troubles and the engine is running well it is not necessary to open up the engine. Dismantling unnecessarily is of little use.

Cylinder and silencer should be cleaned every second year of sand and rust in the cooling chambers.

If the vessel has been stranded or sailed for a long time in sandy waters, the cylinder and silencer should be cleaned. The cylinder is cleaned through the two cleaning covers, one on the foreside one on the aft side of each cylinder. The silencer is cleaned by taking the end covers off.

**When the engine has been dismantled it should be turned to assure that everything is correct.**

## Siting of the engine in the vessel.

The engine siting in fishing and cargo vessels is as a rule as far aft as possible. Only in vessels for special purposes, passenger vessels and the like, the engine is sited amidship or even more forward.

The engine ought never to be sited further aft than stated on the installation drawing, and the sterntube should not be longer than necessary. Long sterntubes stiffen the sterngear unnecessarily so that eventual movements in the vessel or engine bearers might cause warm running and in severe cases breaking of intermediate shaft or propeller shaft.

Earlier—especially in bigger vessels where the frames aft are very heavy—it was usual to fasten the internal end af the sterntube onto a frame and then either fill the space between the frame and the stern post with pitch or leave the tube exposed. In most cases it is best to go aft to the stern post or fix a wood block to the stern post to take the fore end of the tube. It could weaken the frame if a hole has to be bored for the propeller shaft. Going aft to the stern post achieves better fastening of the sterntube and more flexibility in the shaft.

Due to troubles which might arise when the intermediate and propeller shaft are misaligned, the engine alignment ought to be checked at least twice a year and immediately if troubles with the stern gear are suspected.

With installations of engines in bigger vessels it is always correct to check the alignment after launching, or, better still, to line up afloat.

The height of the installation centerline is based on the diameters of the flywheel and propeller, keeping in mind that the inclination should not be too steep. Inclinations of more than 50 mm per meter should be avoided.

The flywheel should be at least 30-40 mm clear of frames, bottom floor and keelson.

The same applies to the propeller. Ample space between the tip of the blades and the aperture. This space should not be less than 60-70 mm.

Too little clearance will cause vibrations and bad turbulence. The stern ought to be faired as much as possible above and below the sterntube hole to ease the flow of water to the propeller blades.



The seatings should be of oak and of ample dimensions. Either athwartship or longitudinal bearers may be used depending upon conditions in the vessel—it is preferable to use longitudinal bearers whereever possible. The engine bed supplied is heavily designed so that it will add to the strength of longitudinal bearers.

It is a fundamental rule that the frames should not be weakened by the fitting of longitudinal bearers and it is in such a case that athwartships bearers might provide the best solution.

Athwartship bearers and floors for longitudinal bearers should be taken as high up the shipsides as possible, especially at the fore end of the bearers.

The faces between longitudinal bearers and frames should be as horizontal as possible. This is self explanatory.

The bearer through bolts should be bored through the bottom planking and have large heads to suit the planking.

The bolt heads should be coated with red lead and sealed with a lead plate nailed with copper spikes. Every fourth year the bolts should be drawn and checked for corrosion.

It is better to use bolts of sea resistant material. When bronze bolts are used they should be heavier than normal steel ones.

After the engine is tightened down, the seacock should be sited. Do not make the pipe from the cooling water pump too short and straight. In wooden ships there will always be some flexibility between engine and hull and a pipe which is too stiff will sooner or later crack at the joints.

To avoid blocking of the sea-inlet when sailing in ice this should not be sited too high.

The exhaust-pipe should be as short as possible and without sharp bends.

The exhaust is effectively cooled by the watercooled silencer. It is therefore unnecessary to lag the metal exhaust pipe from the silencer.

The starting pipe should be at least two meters long so that the charging air can be cooled before it reaches the valves of the air-bottle.

The bolts for the seacock should only be of sea resistant material e.g. copper, gunmetal or seabronze. Ordinary brass or the like should never be used.

On the delivery pipe from the cylinder to the silencer is a 3/8" socket. From this socket an 8 mm copper pipe is led to the wheelhouse. If the cooling water fails, steam will escape into the wheelhouse and the engine can be stopped before anything serious happens. Remember not to start the engine again until after 20-30 minutes.

From the top of the filter is lead a 6 mm copper pipe up under the casing. This will automatically ventilate the filter when sailing in rough sea with a nearly empty fuel tank.

### Lubrication of Hundested marine engine.

The lubrication points on the Hundested engine are reduced to a minimum. The drive for the central lubricator and waterpump pistons should be lubricated with an oil can. The grease cups for the waterpump should be turned twice when starting and once every second hour. The controls should be lubricated about once a month. (Remember the universal joint screws). The main bearings to be greased with best ball bearing grease, one quarter turn when starting. One grease cup should last a month. Oil cups to be filled when starting. The middle bearing on 2 cyl. engines should be lubricated with cylinder oil. On engines where this bearing is not piped from the central lubricator a 1/4 liter should be poured in every week.

Into the clutch and the reversing gear for engines with closed mechanical reversing box pour 1/6 to 1/2 a litre oil per week, depending upon engine size. Water soluble oil if available should be used every 3rd-4th time, otherwise cylinder oil. If the water level in the vessel has been so high, that there is a possibility of water in the reversing box or clutch, this water must immediately be removed, either by draining or by sucking it up through the filling covers. In severe cases the clutch and reversing cover must be removed and thorough cleaning done. After the water is removed always fill with water soluble oil. This will absorb residue water and prevent rust on ball and roller bearings.

The grease cups on reversing and clutch control should be turned respectively 1 and 1/2 turn when starting.

The grease cup on the thrust bearing and on open reversings should be turned twice when starting and thereafter one turn every second hour.



There is a grease cup on the propeller shaft which fills the space around the push rod with grease. With a new installation or if the sterngear has been dismantled, this space must be filled with grease. In normal running one grease cupful a week will do. Use watersoluble sterntube grease.

The sterntube should be lubricated frequently—the outer end at least once each hour. Remember that it is a bearing and it requires lubrication as well as other bearings in the engine. If the propeller has hit an underwater obstruction or after heavy ice sailing then check that the blades are undamaged. A bent propeller blade can mean a huge extra load on the sterntube. If forced to sail with a bent propeller blade run with lowest possible revs and well lubricate the sterntube.

Use sterntube grease to fill the propellerhead and the grease cup on the propellershaft. Lubricate well here so that the whole space between pushrod and propeller shaft is filled. The surplus grease then will be pressed into the propellerhead.

Using watersoluble grease in the propellerhead ensures that all internal parts will be lubricated and wrapped in the white emulsion which is formed when a little water enters. The increase of volume will furthermore cause the faces and necks on the propeller blades to be lubricated effectively, because some of the grease mixture is pressed into the propeller head.

The sterntube packing should be of a soft cotton quality, not hemp packing.

The packing should be cut in rings to fit exactly round the propeller shaft. Never make the packing in one long piece, this can twist around the shaft and cause heating. Use a packing which fits easily between the sterntube and the propeller shaft and with new sterntubes tighten the stuffing box only after you see a good deal of grease coming in. Then tighten with care. A small sterntube leak is unimportant—the watersoluble grease copes with it.

The starting valve spindle is lubricated by one turn on the grease cup before starting. Turn the spindle whilst greasing. The central lubricator for piston, cylinder, crankshaftbearing etc. is one of the most important engine components and it needs to be checked continously to avoid engine damage.

It is important to see that the drive is in order and the shaft

turns. It is important to keep an eye on the oil level.

It is important that the oil in the lubricator is of the right quality, waterfree, and without impurities. The oil should have a flamepoint of 210° centigrade and a Viscosity of 12-14.

It is important that the oil reaches every lubrication point as prescribed by the factory.—See the lubrication scheme.

If the engine is installed in an open boat or if the casing over the engine leaks, a screen over the lubricator is recommended. The lid because of its adjusting screws is not watertight. If the flywheel has run in water—look after the lubricator for above mentioned reasons.

The checking of the amount of oil is done in the following way: Count the number of drops per minute when the engine is running full speed. This is the same for all glasses. Multiply this figure by the number of drops falling each time (counted by slow turning of the lubricator when the engine is stopped).

Example: Lubrication of an engine requires 40 drops per minute at full speed 8 drops fall per minute. The adjusting screws on top of the box are regulated so that when the engine is stopped and the lever is slowly turned 5 drops fall each time. 5 multiplied by 8 makes 40 drops per minute. If there is oil assembled in the sight glasses this can be removed when the engine is stopped by draining all oil from the lubricator and thereafter turning the lever until the glasses are empty.

The grease cups for the sterntube are turned twice when starting and thereafter once per hour.

Do your best to keep all lubricants clean. No grease tins without lid. Think what it may cost if a grease channel is blocked.

Carefully clean all old tins which are intended to be used for lubrication oils. Even a little varnish—tar or the like can cause immense engine damage.

As hydraulic gears are very sensitive, used tins should never be used for hydraulic oil.

### Water in Engines.

In all vessels there are some places where water can intrude where it is not wanted. Clutch, reversing, worm gear housings and governor even in the main bearings especially if the water level in



the engine room has been allowed to get too high. As ball and roller bearings can be ruined by water the removal of it has to be taken care of immediately. Check the reversing housing for water with an oil syringe at least once a week. If there is water take it out as far as possible and pour 1/2-1 liter watersoluble oil through the filling cover. This oil is available under the name soluble oil and will absorb the residue of water. There is an advantage in that the mixture of a little water and soluble oil does not rust. If water has entered always check how it occurred and take steps to prevent a recurrence.

The following are some of the causes of water intrusion. 1) The water level has been so high in the vessel that it has intruded along the intermediate shaft.

2) The stuffing boxes on intermediate and propeller shaft are not tightened properly so that they touch each other and form a tube around the push rod so that water coming from the propeller shaft cannot escape through the openings in the muff coupling, but makes its way into the reversing housing. With older engines with bored throw holes in the muff coupling clean grease from them.

3) The water might come from the clutch housing having entered there through too much water in the bilges or from a leaky water pump. Repack the pump or if the pistons are very worn replace them also. In the bottom housing under the water pump 2 drain holes are bored for waste water. Take care that these are not blocked by rags or dirt or else the water will go direct to the clutch. Any water in the clutch to be removed with the oil syringe and 1/2-1 liter soluble oil added.

Water can only enter the fore main bearing if it reaches the level of the crankshaft. It is removed by loosening the fore roller bearing cover and then well lubricating through with watersoluble grease (sterntube grease) which will absorb any remaining water.

For the aft main bearing it will be the same, here the governor must be taken up and the water drawn out of the worm gear housing with the oil syringe. When the water is removed fill with 1/2 a liter soluble oil. Water in the worm gear housing and from there to the aft main bearing also can come through the governor from the wheelhouse, along the rod which adjusts the engine

speed. If this is so the stuffing box on the protection screen is tightened so that any water runs round outside the governor.

Water can also enter the governor from the lubricator. Due to the inclination of the engine any water collected in the box will drain to the after pump which is that giving oil to the governor. Therefore the utmost care must be taken that oil added to the lubricator is waterfree.

In some vessels oil is pumped direct to the lubricator by means of a wing pump. This method is very dangerous, because water from the oil tank can enter the lubricator and from there the engine. If it is necessary to pump oil to the lubricator the suction pipe from the tank must be at least 100 mm from the bottom. Just clear of the bottom is led a pipe to the tap used for filling the oil can. In this way water can be seen and can be thrown away. For existing installations where the suction in the tank cannot be moved higher in the tank a water sump must be fitted under the wing pump with the tap beneath it.

Deck flanges for oil tanks must have an ample bearing face to tighten to the deck, also the pipe from the flange to the tank must be properly tightened at the lower end, which must be packed carefully and tightened in the tank. It is safer to weld the pipe to the tank and leave the upper end free in the deck flange like a water bonnet. This method is preferred even if for installation reasons it is necessary to have a thread connection on the lower end. Oil tanks and vessels always move and if there are two thread connections one sooner or later will loosen and it will not necessarily be the upper one. More often is it the lower thread so that any water running down the filling pipe enters the oil tank and from there gets to the engine bearings.

If the flywheel touches the bilge water and throws it around in the engine room part of the water which hits the lubricator can come through the adjusting screws to the oil.—It is in this case therefore absolutely necessary to drain any water by loosening the plug sited aft on the lubricator.

At least once a week loosen above mentioned plug, drain any water and re-tighten.

If the engine is installed in vessels where the conditions for bottom water and bilge pumps are difficult it is necessary to



protect the lubricator against water from the flywheel. Prolonged water spraying endangers governor, bearings and the aft main bearing. Water reaching the pump which supplies oil to the crankshaft bearing will cause a failure.

As is obvious from the above there are many possibilities for water entrance to parts of a marine engine.

Damage of this nature, besides being expensive can also cause loss of the vessel and constitutes a serious danger to the crew.

Neglecting these safety rules is therefore dangerous negligence.

We are as interested in the economic running of our engines as you are interested in a reasonable production price.

Memorise these good hints carefully.

*Hundested Motorfactory Ltd.*

## Instructions for fitting a spare cylinder head.

To check that there is the necessary space between the piston and cylinder head, the cylinder head is first placed direct on the cylinder without gasket and without fastening.

Then turn the flywheel until the piston is at top dead centre and then move the piston to an fro so that the piston goes up and down in the upper position. During this moving the whole circumference face of the cylinder and cylinder head is checked. If the piston touches the cylinder cover this will lift a little and extra fitting is involved.

To check any touching the piston top is cleaned and then painted with lead which will mark the cylinder head.

If any fitting is required care must be taken that no chips or impurities enter or are left in the cylinder. When everything is satisfactory the piston top is cleaned, the gasket put on and the cylinder head tightened.

The coldstart face is ground carefully to the cylinderhead. For this use abrasive or carborundum stirred in thick oil. If the face of the old coldstart is damaged it must be machined before reassembling. Take good care that these abrasives do not get into the cylinder. Stop the neck hole with rags and remove the rest of the abrasives in the combustion chamber.

**WARNING.**

If the earth of the transmitter is connected with parts of the engine, the propeller shaft and foundation bolts will corrode very quickly.

The earth of the transmitter should be led direct through the bottom of the vessel preferably as far from the engine as possible and connected to an amply dimensioned copper earthplate on the outside of the planking.

We have seen in 2½ months in vessels where the earth was led to the engine the same corrosion on the propeller shaft as compared normally to after 4-5 years.—Remember to lubricate the propeller shaft with ample water soluble sterntube grease.