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Installation and assembly instructions for the HSR range of horizontal bearing assemblies.

1. Introduction

The following notes provide installation and assembly instructions for the HSR range of horizontal bearing assemblies. Reference should be made to the specific contract drawings and the operating data sheet for the operational information and specific features, which may be provided.

2. General Information

The standard *GB* Bearings HSR unit is a horizontal journal bearing of split construction, with plain thrust faces for shaft location. It is air cooled, lubricated with an oil pickup ring dipping into a built-in sump. The units are fitted with floating labyrinth seals at each end. The assemblies are supported on an end flange **(Fig 1)**, a centre flange **(Fig 1)**, a base mount **(Fig 1).**

The following features can be incorporated in the design to meet particular requirements.

- External Pressure Lubrication
- Axial Thrust Features
- Additional Sealing
- Insulation
- Hydrostatic Jacking
- Water Cooling
- Instrumentation

HSR bearing assemblies consist of cast iron upper and lower casings into which a bearing shell lined with *GB* Bearings tin based whitemetal, is fitted. The spherical seating assists alignment at assembly.

Tapped holes (BSP parallel thread) for connecting the thermosensors, oil inlet and the oil level sight window are provided on either side of the casing to facilitate left hand or right hand side connections. The sump oil drain plug is positioned towards the outboard side. For external circulating oil lubrication, the oil outlet pipe is fitted in place of a sight window.

For transportation, the HSR units are fitted with lifting eyebolts and are despatched without lubricant. The oil ring, machine seals, end seals and bearings are packed separately.

In the case of self-contained bearing assemblies, the oil is delivered to the bearing from the oil sump by means of an oil-pickup ring partly submerged in the oil sump. The ring is driven by shaft rotation. An oil ring is a precision instrument, vital for bearing function and must be handled with care.

With an external oil supply, the oil level in the sump is controlled by a weir plate fitted in the oil outlet pipe. The oil pick-up ring can be retained to ensure that the oil still reaches the bearing in the event of a failure in the external supply or during run down. When the oil ring is retained, it is essential that the oil level has reached the sight glass level before starting.

Standard HSR assemblies have plain thrust faces for shaft location. Plain thrust faces can take small axial loads. For higher axial loads, bi-directional taperland thrust faces or tilting thrust pads (bi-directional rotation) are offered as alternative designs.

It is advisable to change the lubricating oil after 5000 operating hours, or annually in the case of self-contained bearings. If there are frequent start/stops or high oil temperatures then the required oil change interval is shorter. For external circulating oil systems consult the oil company / supplier for oil change intervals. The recommended oil filtration is 20 microns or better.

3. Installation

3.1 Cleanliness

To obtain the most reliable performance from these bearings, noting that for self-contained operation there is no filtration system for the lubricant, it is necessary to observe high engineering cleanliness standards. The interior of the casing, the bearing housing and the oil passages must be perfectly clean. Lint free cleaning cloth should be used at all times. It is advisable that all closures be completed without delay.

3.2 Assembly

The bearings are designed for ease of assembly. The bearing shells are “match marked” for correct assembly. Check that the casing interior, the spherical seating surfaces and the bearing bore are clean and there has not been any visible damage during transit. Insulated assemblies have the PTFE insulation bonded onto the casing spherical seating. It should be kept clean and care must be taken to avoid any damage.

A general procedure is described below:

- Commence installation by positioning the bottom half of the casing onto the machine bed plate. Apply a little oil to the spherical surfaces then fit the lower bearing shell into the casing. Freely coat the bearing surfaces and the shaft with clean lubricating oil.

  Partially lower the shaft, taking special care to avoid any damage to the thrust faces if bearing assembly is of the locating type. When the shaft is about 2mm away from the bearing bore the lower casing should be precisely aligned. Good alignment is essential for satisfactory bearing and seal function.

  Lower the shaft to rest onto the bearing. Fine alignment of the bearing bore relative to the shaft axis can now be made with a slight tap using a hide mallet.

  A feeler gauge, of half of the bearing clearance, should be used to measure the gap between the bearing and shaft at the four respective corners. **(Fig 2)**.

  Please note that at this stage the bearing sleeve clamping bolts are discarded; these bolts are used for machining and transport purposes only. Bearing sleeves do not need to be bolted together on the assembly.

  The oil ring is installed next **(Fig 3)**. It is a vital component especially when the bearing is only ring lubricated. It requires special care in handling and fitting. The top bearing shell can now be fitted, ensuring that the identification numbers top and bottom are the same and on the same side. Incorrect fitting can lead to serious damage. Oil rings should be free t rotate on the shaft.

  Then fit the seals **(Fig 4).**

  The casing cap is fitted next. The joint faces of the casing should be coated with a non-hardening jointing compound such a Hylomar PL32 or Curil.T.

  Before fitting ensure that the identification marks on the casing cap and the lowercasing match and that the bearing locating dowel lines up without any restriction. The cap bolts must be tightened securely, as per the torque table. At this stage any instrumentation that may be required can be fitted.

The sight window at the top of the casing can be used to fill the bearing with the prescribed lubricating oil.

3.3 Seals (Fig 4)

Different seals or sealing arrangements can be fitted to suit the application and the protection requirements. The standard arrangements are **(Fig 4)**:

- Floating Labyrinth seals IP44
- Floating Labyrinth seals with IP55 or IP56
- Rigid (fixed) Labyrinth seal – IP54
- Flinger
- Machine seal

These floating type seals can freely move in their housings, thus they can cope with shaft radial displacements. The seal is of reinforced plastic material / phenolic resin, in halves, held together by a coiled garter spring with looped ends.

After the bearing has been mounted and aligned with the machine frame or the foundation, fit the seals. Fit the seal bottom half first, identified by the oil drain back slot, into the bottom casing half. Then fit the top half, fit the opened garter spring behind the seal into the groove **(Fig 4)**, tension it and lock with the looped ends. The complete seal should be free to rotate on the shaft.

Rotate the seal so that the lug on the outside diameter of the seal locates in the seal housing at the horizontal, the seal split line being horizontal, with the drain back oil hole at the bottom. Prior to final assembly, apply a thin coat of non-hardening seal compound on the sides of the outer shoulder of the seal. This should prevent excess oil escaping from behind the seals.

DMC/Aluminium baffles provide additional protection **(IP55)**. To fit the baffle, position it so that it just touches the underside of the stationary shaft then tighten the fixing screws. A rotating shaft will ‘lift’ due to the oil film thus eliminating the bottom contact.

Rigid Labyrinth Seals

These are aluminium alloy material, non-contact, flange mounted end seals with dual labyrinths used for ‘higher’ speed applications. The seals are fitted after the bearing has been aligned.

The seals are fitted to the bearing casing by pressing them gently on the static shaft from underneath, and then lowering the seal to a gap of a quarter of the bearing's clearance, by using

feeler gauges. The bolts can now be tightened, ensuring that the side clearances are equal. Under running conditions the shaft 'lifts' due to the oil film further reducing the possibility of any contact between the shaft and the seals. Thus there should not be any wear of the seals.

Machine Seals

Machine seals of aluminium alloy material are fitted at the inboard end of the bearing assemblies to prevent oil mist being drawn out of the bearings due to the creation of partial vacuum inside the machine. Machines seals for the centre flange assemblies only, are in halves. The space between it and the assembly is ventilated to outside atmosphere with two air-balanced pipes.

The clearance gap between the shaft and the machine seal can be closed, if required, by fitting greased packing into the machine seal.

Machine seals for end flange assembly are in one piece. Assembly of this seal is over the shaft, and is bolted to the machine frame at the inboard side of the bearing, prior to fitting the bearing casing.

3.4 Oil Ring (Fig 3)

Handle the brass oil ring with extreme care. A distorted or damaged oil ring will not function satisfactorily, endangering the bearing performance.

To separate the ring in two halves, undo the screws gently tapping on a screw at each end to release the ring halves from the locating dowels. Then carefully separate the two halves. When the ring is assembled on the shaft, the joint screws must be tightly fastened. Any steps at the joints must be avoided. Any edges should be carefully removed to ensure smooth running of the ring. Subsequent dismantling / assembling of the ring must be handled carefully, as above, to avoid any distortion of the ring.

3.5 Insulation

Where the shaft needs to be insulated electrically from the bearing mountings, the HSR assembly can be fitted with insulation.

The PTFE insulation is bonded onto the spherical seating of the cast iron casing.

Care should be taken to ensure the PTFE surface is free of any dust or swarf contamination and is not damaged or torn in any way. It should be clean and smooth. The PTFE surface may be cleaned with clean mineral oil. Mating surfaces of the steel bearing assembly must also be clean and free from any burns or swarf contamination, as these will damage the PTFE.

An insulated bearing assembly can be supplied with an earthing cable, which is then connected to the motor frame.

3.6 Hydrostatic Jacking (Fig 5)

For heavy loads at start up or slow speed barring, bearing assemblies are fitted with hydrostatic jacking. High-pressure oil is introduced into the bearing bore, through jacking pockets. The shaft is 'lifted' and can turn without metal to metal contact, preventing any wear.

As the jacking oil is supplied at high pressure, external pipework should be arranged according to safety regulations.

Jacking connections are normally supplied loose and should be fitted in accordance with the contract drawing. Prior to fitting these connections it is essential that the bearing shell be correctly assembled with the casing top and the anti-rotation pin at the top of the shell.

GB Bearings will advise on the design of the oil jacking system.

3.7 Instrumentation

All HSR assemblies have tappings for fitting thermosensors to monitor bearing and oil sump temperatures.

Additional facility for fitting accelerometers on the casings and proximity probes, two at 90º, on the casings or on the baffles can be provided.

4. Operating Conditions

The bearings are designed for hydrodynamic operation using clean mineral-based oil. Bearing operating data, including the design bearing clearances and oil grade, are listed on the *GB* Bearings performance data sheet, which is supplied with the initial enquiry or the order for the HSR units.

Before starting, check that the bearing is filled with the prescribed lubricating oil to the correct level. This is at mid-way of the oil sight

window. If the bearing is fitted with water cooling, external lubrication or hydrostatic jacking then these supply systems must be switched on before the machine is started.

If, after installation or after some operational tie, unacceptable vibration levels or a sudden increase in bearing temperature is detected, then the machine should be stopped immediately and the bearing examined. If damage is found then it should be investigated. It should however be noted that on start up the temperature will rise rapidly in the first 30-45 minutes, until stabilised.

The maximum safe operating temperature depends on the design and application and can vary from as low as 50ºC up to 120ºC. The actual running temperature itself is not an indication of the safe operating conditions but the stability or otherwise of the running temperature is a useful guide. A bearing which normally runs at 55ºC which suddenly rises to 65ºC should be of concern, whereas a bearing operating steadily at 90ºC can be quite safe and normal if designed for such conditions.

It is therefore important to establish the actual temperature of the unit under operating conditions. Set the temperature alarm and trip switches as follows:

- Alarm: 10ºC above operating temperature
- Trip: 10ºC above alarm temperature

5. Recommended Spares

- Bearing shells
- Floating seals
- Oil ring

6. Storage

All machined surfaces should be coated with appropriate oil or other anti-corrosive substance. The atmospheric conditions and length of storage should be taken into account when making this selection. If stored with the shaft in position for a short period of time, the shaft should be similarly coated.

For an insulated assembly do not apply any anti-corrosive substance to the PTFE or its surrounding areas, including the spherical mating surfaces as it can attack the PTFE bond. Simply apply clean mineral oil.

If the unit is to be stored for a long period of time, with the rotor in position, it is advisable that the bearings be replaced with dummy or wooden bearings.

Care should be taken to avoid storing in humid or corrosive atmospheres. Suitable protection should be provided.

7. Transportation

The oil ring must be removed during transportation. Suitable precautions should therefore be taken to ensure that the oil ring is replaced before the units are used again.

If the bearings are to be transported over long distances or rough terrain with the rotor in position, then it is advisable to replace the bearings with dummy or wooden bearings.

The bearings should be visually inspected when they arrive on site before the machine is run. In the event of any damage, *GB* Bearings should be consulted.

It should be noted that the bearing units are protected and packaged sufficiently well by the *GB* Bearings works ensuring that they arrive at the customer in good condition. This standard of protection and packaging, however, might not be adequate for transportation or the long-term storage by the customer.

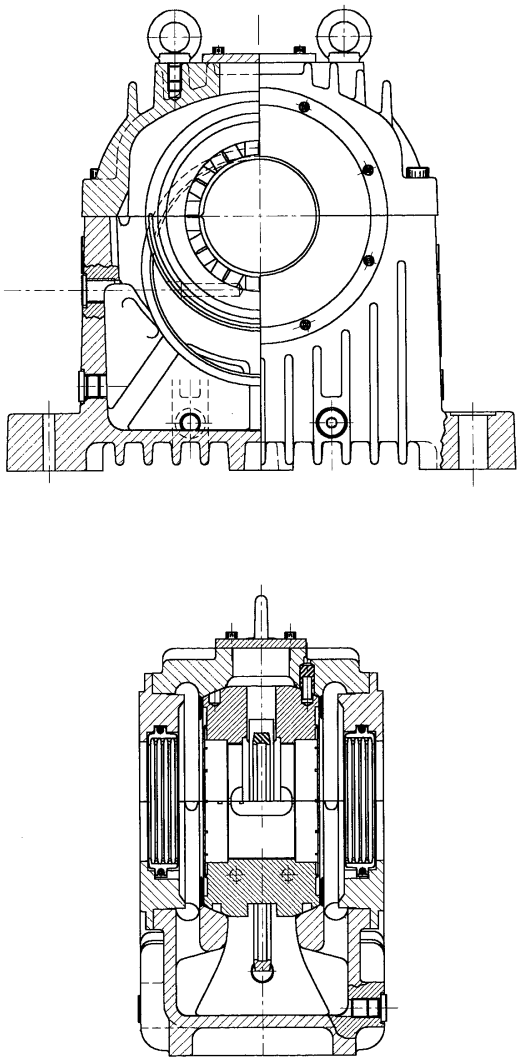
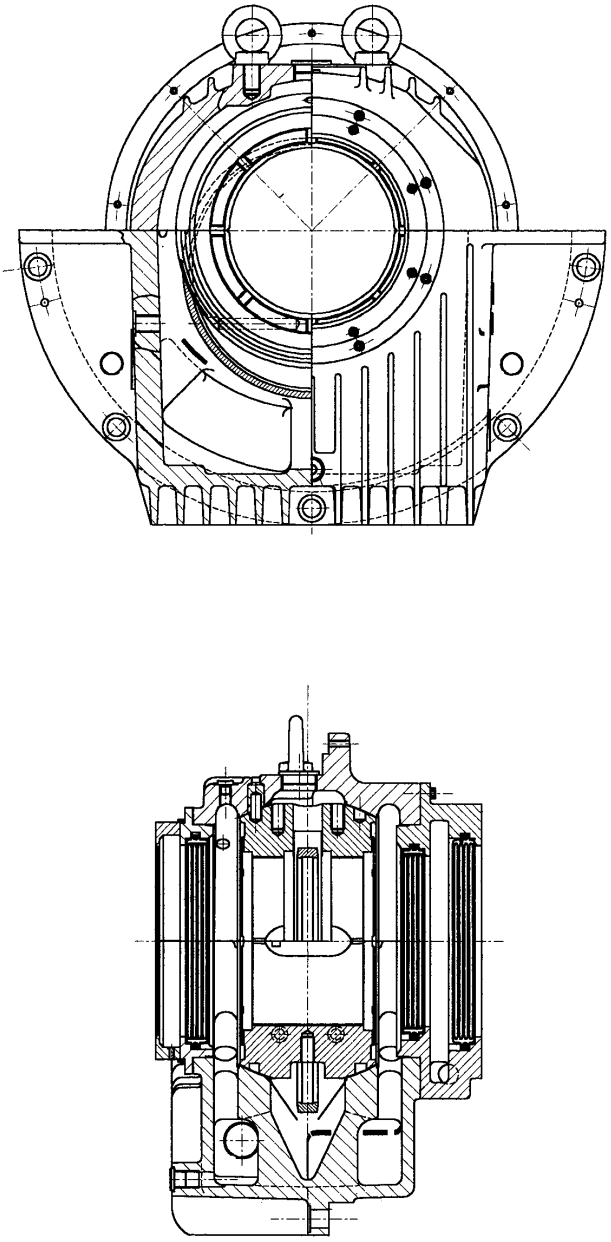


Fig. 1



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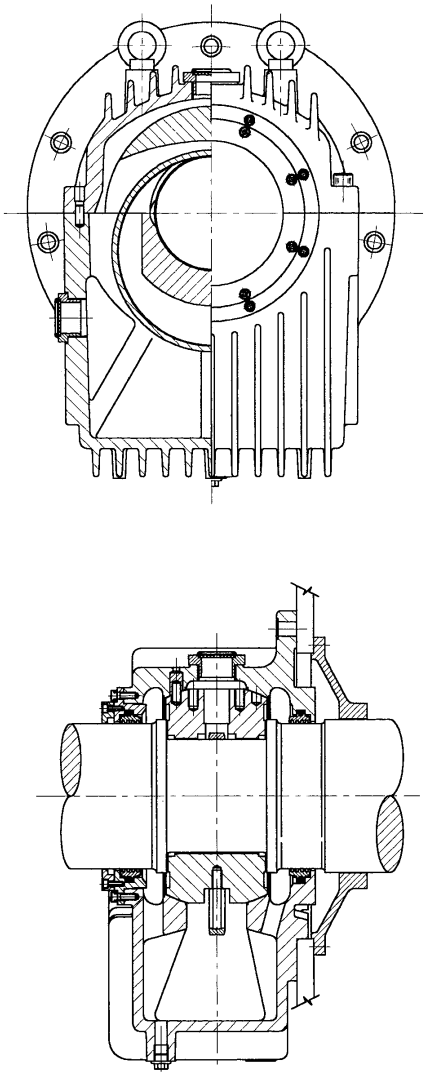

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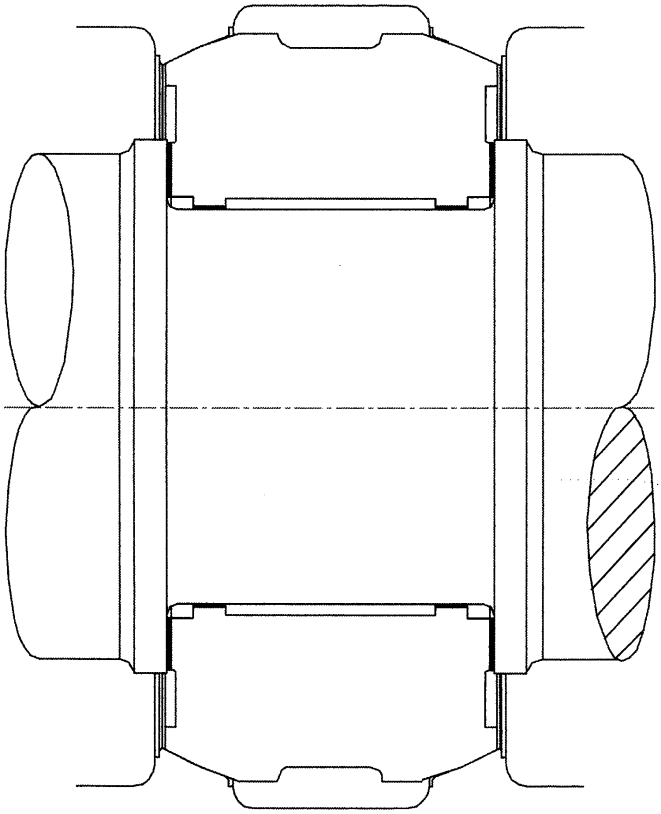


View on joint face - bottom half

Fig. 2

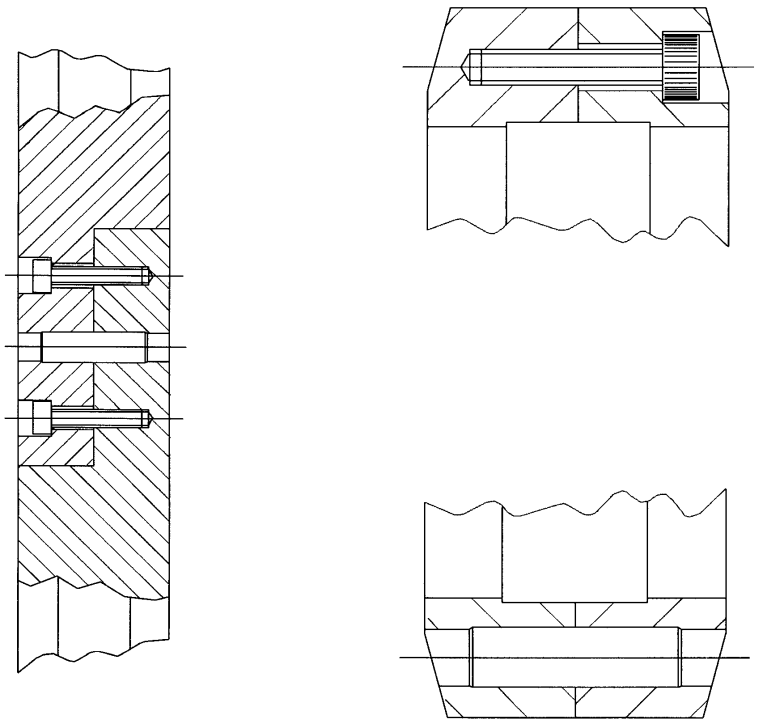
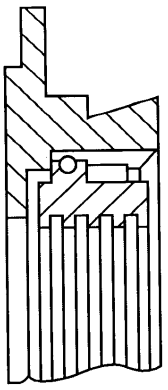
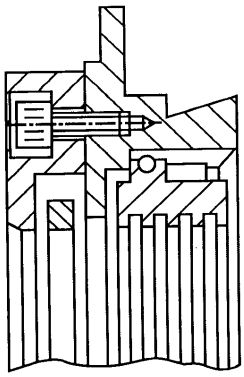


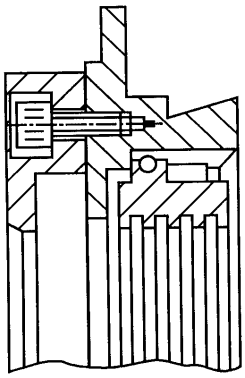
Fig. 3



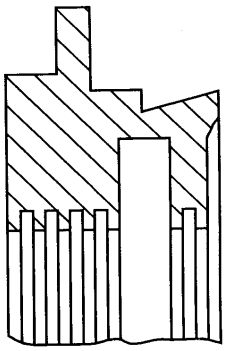
Floating Labyrinth Seal
- Type **SS**
Protection to IP44



Floating Labyrinth Seal
with Baffle - Type **SZ**
Protection to IP56



Floating Labyrinth Seal
- Type **SB**
Protection to IP55



Floating Labyrinth Seal
(Dual System) - Type **SD**
Protection to IP44

Fig. 4

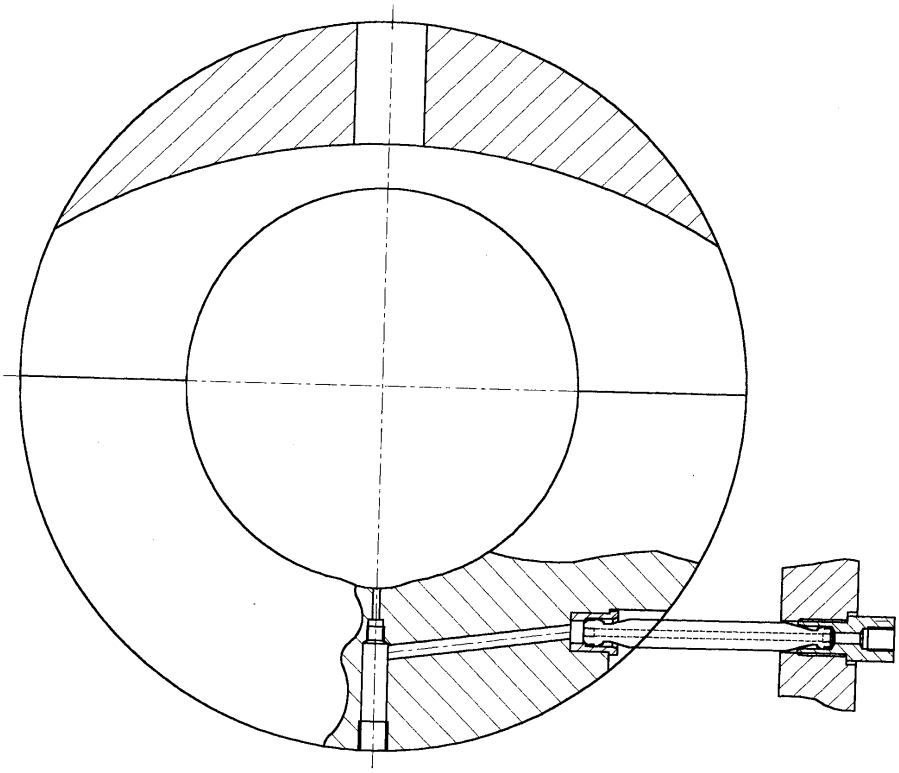


Fig. 5