

**1. Design**

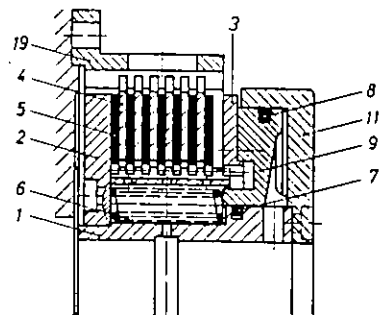


Fig. 1

Bl. 1266

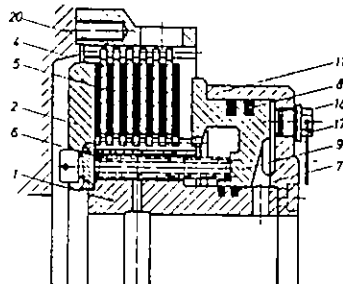


Fig. 2

Bl. 1267

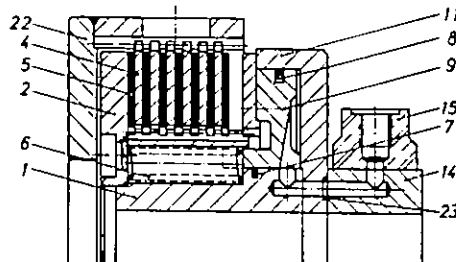


Fig. 3

Bl. 1268

Single clutch with normal piston  
oil inlet through clutch shaft.

Single clutch with normal piston  
and external oil inlet.

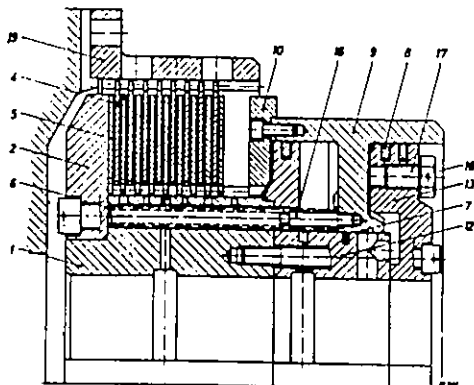


Fig. 4

Bl. 941

Single clutch with double piston for high speeds.  
Oil inlet through clutch shaft.

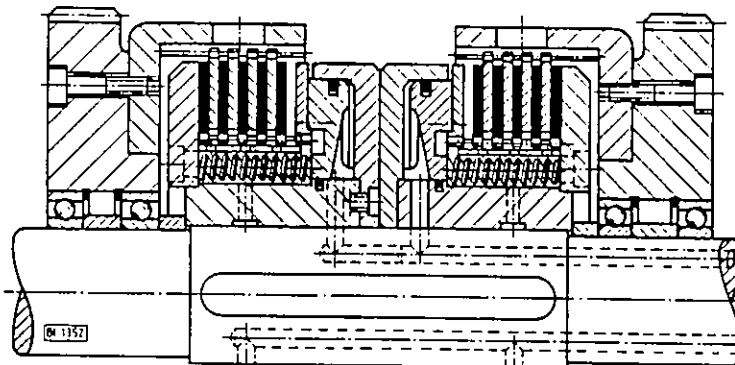


Fig. 5

Two single clutches on one shaft as double clutch.

- 1 Hub
- 2 Stop plate
- 3 Pressure plate
- 4 Outer plate
- 5 Inner plate
- 6 Pressure spring

- 7 Piston ring, inner
- 8 Piston ring, outer
- 9 Piston
- 10 Pressure plate (piston side)
- 11 Cylinder

- 12 Cylinder wall, inner
- 13 Cylinder wall, outer
- 14 Conduit ring
- 15 Oil inlet ring
- 16 Spring retaining bolt
- 17 Plug

- 18 Seal
- 19 Flange housing
- 20 Ring housing
- 21 Hub housing
- 22 Cup housing
- 23 U-seal

**2. Description**

2.1 The plate pack (4/5) is compressed by oil acting on the piston (9) under pressure. The friction between the outer and inner plates (4/5) forms a positive connection between the housing (19 to 22) and the hub (1). When the pressure is released, the springs (6) return to their original position, exhausting the oil from the cylinder.

When the clutch is idling, the remaining oil exerts an axial force on the piston, due to the centrifugal force. If this force exceeds the spring force, then a single-piston clutch will automatically engage (fig. 1, 2, 3, 5). This, then, is the determining factor for maximum speeds of rotation.

2.2 On clutches with a double piston (fig. 4) oil is fed into both sides of the piston. Oil fed into the outer cylinder acts on the piston, compressing the plate pack and hence forming a positive connection as in 2.1 above.

The inner cylinder receives a constant supply of lubricating oil. Since the piston surface areas are equal, the centrifugal effect on the two piston faces act in opposite directions. Thus, when the outer cylinder is exhausted, the inner cylinder is at 0.5-1 bar (gauge) and this, together with the effect of the springs, will disengage the unit.

**2.3 Marine clutches**

These clutches function exactly as those described above. They are, however, fitted with an emergency engagement feature, have an increased number of cooling oil holes in the hub and outlet slits in the housing and have reduced play on the plate tooth profile. All external screws are wired for safety, and the outer plates have both spiral grooving and radial slots.

Standard clutches can also be supplied to order with emergency engagement and wired screws.

## 2.4 Emergency engagement

When the hydraulic system fails, the screwed plugs (17) are removed from the cylinder and replaced by longer hex-headed (jacking) screws. Tightening these screws pushes the piston forward, compressing the plate pack and providing the positive connection in the usual way.

## 2.5 Seals

Hydraulic clutches are fitted with metal seals (piston rings) which have a small thrust clearance, reducing the leakage flowrate to a minimum.

## 2.6 Plate pack

The plate pack consists of alternate inner and outer plates. The surface of the steel inner plates is sinusoidal. The outer plates are sintered on both faces. The plate facings have spiral grooves and radial slots to improve oil flow and, hence, heat dissipation. This gives a longer friction surface life even on soft engagements.

## 2.7 Securing the screw

On marine clutches, all external screws are wired. The remaining screws are secured with Loctite 270.

2.8 The oil inlet hole is normally positioned at 180° to the hub keyway. If two keys are required, the keyways should be at 120°. An oiling groove is provided in the hub for the cooling oil. For exact positioning of the oil inlet holes and grooves, please refer to the appropriate Ortlinghaus drawings.

## 3. Spare parts

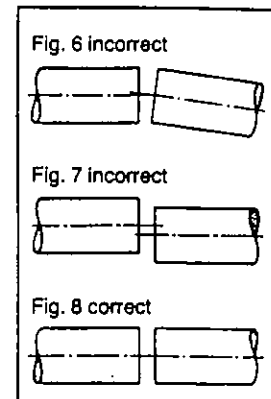
When ordering spare parts, please ensure that both the model number of the spare part and the «fabrik» number of the clutch (located on the hub or housing) are given.

Please avoid confusion by placing orders in writing or by telex (see fig. 1 for spare part numbers).

## 4. Incorporation

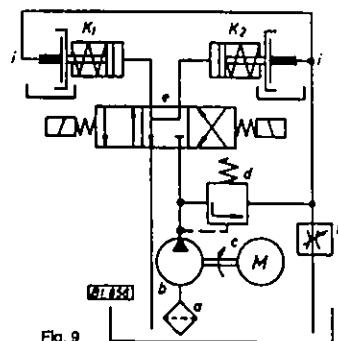
Bearings should be positioned as close to the clutch as possible. If the clutch is to be mounted on a split shaft arrangement, a central bearing should be fitted within the length of the clutch. Accurate alignment of the shafts is most important (figs. 6-8). The hub should be fitted firmly to the shaft and secured against axial movement. The housing should turn easily when the clutch is idling, but must also be secured axially.

In order to keep the oil leakage to a minimum, the recommended fits should be adhered to, (h6 or k6 on the shaft, H7 on the hub), and the oil grooves and holes should be positioned to the Ortlinghaus drawings. Oilways must be cleaned when fitting and re-assembling the clutch. Filters incorporated into the oil circuit must keep the oil clean to prevent damage both to the control elements and to the clutch.



## 5. Control (see figs. 9, 10, 11)

- |                  |                           |  |
|------------------|---------------------------|--|
| a Filter         | d Press. regulating valve | h Check valve  |
| b Pump           | e Multi-way valve         | i Lubricating oil feed for K <sub>1</sub> , K <sub>2</sub> clutch cylinder |
| c Electric motor | f Adjustable throttle     | l Accumulator  |
|                  | g Throttle                |  |



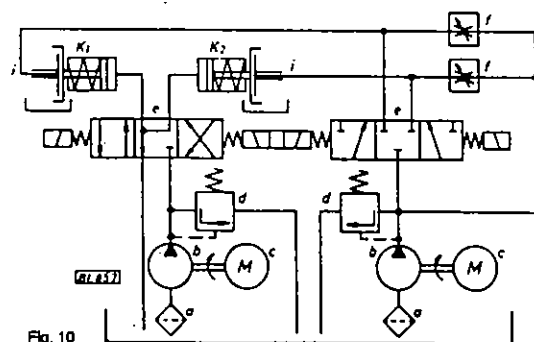
### 5.1 Standard control system

Fig. 9 shows the principles of the standard control system. Oil is drawn from the oil tank through a fine mesh filter (a) to the gear pump (b). The oil is then fed under pressure to the control valve (e). When the clutch is engaged excess oil flows through the pressure regulating valve (d) to the cooling oil inlet (i). The cooling oil flowrate can be regulated by the adjustable throttle valve (f).

### 5.2 Standard control system for clutches with intensive cooling oil flow

In order to dissipate the high energy levels associated with harsh applications, a certain quantity of cooling oil must be supplied to the clutch during each engagement.

The system shown in fig. 10 provides this cooling oil from a separate circuit (compare fig. 9). When the clutch (K<sub>1</sub> or K<sub>2</sub>) is engaged by activating the control valve, the second control valve is activated simultaneously to provide the required oil flow. When idling, the units require a much lower oil supply flowrate. When the solenoid valves are in their central position in fig. 10, both clutches are idling, each receiving a constant flow of oil, which may be regulated by setting the throttle (f). Excess oil is returned to tank via the pressure regulating valve (d).



### 5.3 Control system for soft engagement

The system shown in fig. 11 differs from that in fig 9, in that an oil accumulator has been added. The pump keeps the accumulator full of oil at maximum pressure. When the valve is activated the accumulator empties into the cylinder, bringing the piston quickly across to its engaged position. The soft engagement characteristic is provided by the small volume of compressed gas in the accumulator. Once the cylinder is at working pressure, the accumulator is filled again by the pump.

### 5.4 Control system for delayed response

The system shown in fig. 12 is again based on that in fig. 9, but has a throttle (g) and check valve (h) in parallel in the clutch supply line. The throttle opening can be set to give the desired engagement time. When the unit is disengaged, the oil flows quickly past the (self-opening) check valve (h).

The engagement characteristics can be improved still further by using a valve to control the pressure build-up.

### 5.5 Oil-line dimensions

The oil lines should have the largest practical cross section. In normal gearboxes, piping with 8 to 12 mm I.D. is adequate. The oil return should be kept as short and straight as possible, and must flow directly to tank and must not be used for lubricating any other parts, as this would introduce a back pressure to the line.

## 6. Working fluid

Oils suited for these applications are high-aging corrosion resistant Solvat Raffinates, mineral oil based with non-foaming additives, with a low temperature-viscosity dependence, for example Shell Tellus Oil C68 (68 mm<sup>2</sup>/s at 40° C).

For both high and low speed applications, an oil with a lower viscosity is more suitable, for example Shell Tellus Oil C32 (32 mm<sup>2</sup>/s at 40° C). It is imperative to fit a micro-mesh filter, which should be cleaned at regular intervals.

## 7. Adjustment and maintenance

Adjustment is unnecessary since the action of the piston automatically compensates for plate wear. The plate pack must be renewed when the wear is in excess of the maximum stroke. The first oil change should be made at 500 hours. Subsequent oil changes should occur after 2000 to 3000 working hours. The gearbox should be cleaned carefully.

## 8. The fault-finder

### 8.1 The clutch does not engage fully and slips

#### 8.1.1 Oil pressure is too low

The pressure regulating valve should be adjusted until the clutch engages fully. Please note that when the oil has warmed up, after 1-2 hours of operation, the reduction in oil viscosity gives rise to a slight decrease in pressure, which should be compensated by a further adjustment of the pressure regulating valve. The clutch seals should be examined.

#### 8.1.2 Plate wear has increased the stroke of the clutch. The plate pack should be replaced (see para. 9.3).

#### 8.1.3 If an unsuitable oil is used, the surface pressure may not be sufficient to remove the surface film of oil on the plates. An oil with a lower viscosity should be used. Oils with hypoid additives reduce the coefficient of friction. If any further problems arise, please contact our engineers.

### 8.2 The clutch overheats

#### 8.2.1 Check whether the clutch slips during operation. Increase the oil pressure.

#### 8.2.2 Overheating may originate from the gearbox bearings, or from an insufficient lubricating oil supply.

#### 8.2.3 The oil pressure is set too high

At high pump power requirements, the oil may tend to overheat. Reduce the oil pressure, but ensure that the clutch still engages fully.

#### 8.2.4 Inner oiling

For applications with high engagement frequencies, where large inertias are to be accelerated, or where the clutches are running at high speeds, the plate pack should be cooled by oil supplied through the shaft to the hub (see para 5.2). The required oil quantity is calculated for the given size of clutch in the particular application. If the resulting oil outlet temperature is too high, some form of oil cooling must be provided.

Better heat dissipation can also be obtained by sensible design of the gearbox casings (e.g. with cooling fins), and by the positioning of the gearbox in a well ventilated position.

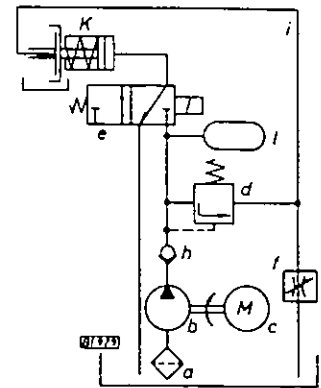


Fig. 11

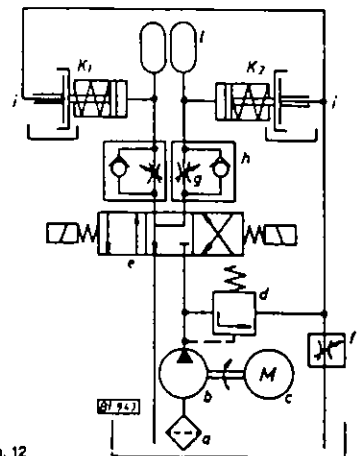


Fig. 12

## 9. Dismantling and assembling the clutch

### 9.1 Removing the clutch from the clutch shaft

If the unit is to be removed from its shaft, 2 or 3 screws are removed from the stop plate or cylinder, and replaced with drawbolts suited to whatever device is to be used for withdrawing the clutch from the shaft.

### 9.2 Renewal of the piston rings (figs. 1, 2 and 4)

Mark the hub and cylinder to assist with re-alignment on assembly. Remove the screws in the cylinder side, the cylinder may then be removed, giving access to the piston and piston rings (note: the piston is under spring pressure on clutches as per fig. 2).

The unit is assembled by reversing the above procedure. The piston rings should be compressed carefully using screwdrivers to allow the piston/cylinder to slide over them. All parts must be thoroughly cleaned before refitting to prevent damage to the piston running surfaces. All keys and dowels should be replaced, and the screws tightened using a torque wrench and secured by wire or Loctite.

### 9.3 Replacing the plate pack and springs

The stop plate is removed, giving direct access to the plate pack and springs. Note: on all hydraulic clutches the stop plate is under spring pressure and should be removed with care!

## 10. Accessories for hydraulically actuated clutches

### 10.1 Oil pump

Gear pumps are used on the majority of applications. A significant proportion of the pumping power is converted into heat at the pressure regulating valve by a throttling effect. Therefore a pump should be chosen which is just sufficiently sized to cover the engaging and cooling requirements of the clutch.

The total oil leakage must also be taken into account when sizing the pump. For application requiring a large pump capacity at low engagement frequency, the use of an automatic double pump should be considered. The small pump is used to maintain engagement pressure, whereas the large pump is used at engagement. An accumulator can be used to give the same effect in some cases.

### 10.2 Oil tank

The oil tank should be large enough to give good heat dissipation from its surface. The quantity of oil in the gearbox is related to the pumping power, and should be at least 2-3 times the delivery rate per minute.

### 10.3 Oil Inlet

When a clutch is supplied with external oil inlet (fig. 3), the conduit ring (14) is screwed to the clutch whilst the oil inlet ring (15) is held stationary by means of a pin or lug, which locates in the hole provided. The oil line should be flexible to prevent misalignment of the inlet ring, and consequent damage to the oil inlet unit.

Oil inlets as shown in fig. 12 are for use at the shaft end, and can be designed to suit any application. The seal is formed by a floating bronze bush, which is secured relative to the housing by a screw. With this design, the oil lines can be attached directly to the inlet parts in the housing.

10.4 All components of the control circuits given in section 5 can be obtained as accessories from most major hydraulics firms. We will be pleased to offer assistance in selecting and designing control systems, should you require it.

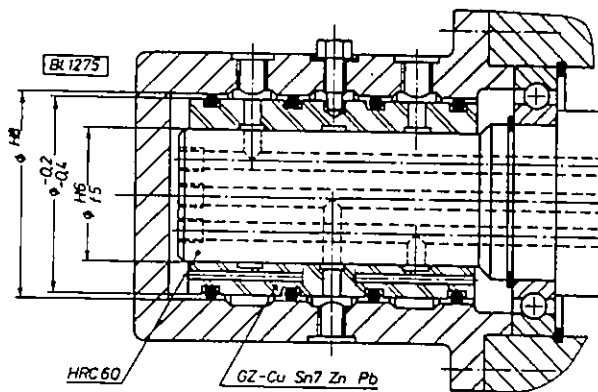


Fig. 13

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