WESTFALIA SEPARATOR

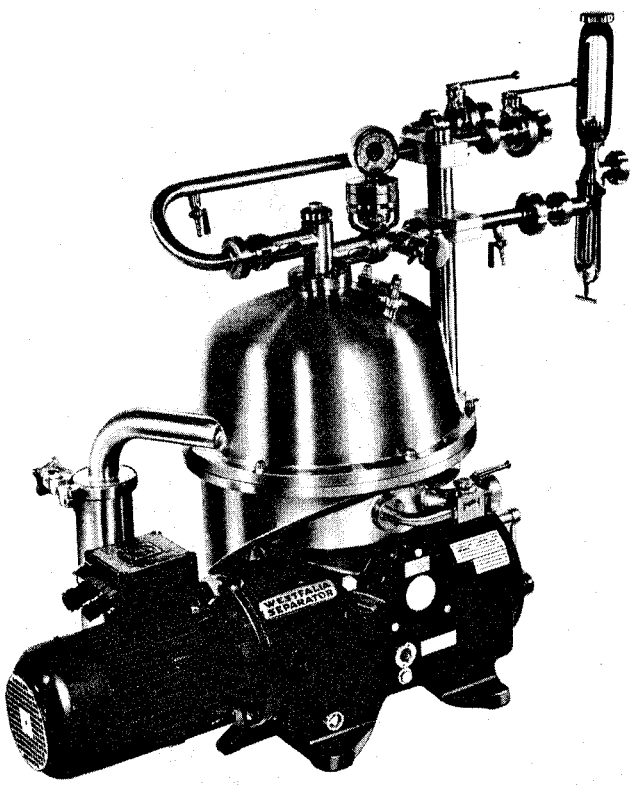
MACHINERY WORLD

Quark Separator
with de-sludging feature and
peripheral nozzles

Model KNA 3-06-076

Serial # 1679 669

NO. 1185-9001-000



The WESTFALIA Separator is a high-speed centrifuge which works reliably, provided that it is operated and looked after in accordance with our Operating Instructions.

The bowl speed has been rated so as to ensure the operating safety of the separator. It depends on the densities of the centrifugally dry solids and of the clarified liquid. If the densities exceed those shown on the name-plate of the separator, check with the factory or with authorized representatives for detailed information, since in the majority of such cases the bowl speed will have to be reduced by changing the drive parts.

When assembling the bowl, strictly adhere to the instructions of this working manual, to avoid undue unbalance **which may result in heavy damage.**

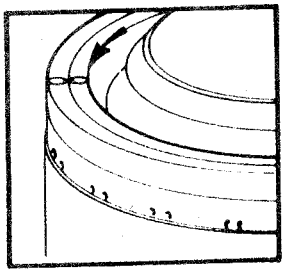
Corrosive liquids and liquids containing abrasive solids, particularly when being processed at high temperatures, may attack the bowl material after quite a short period of operation, resulting in impaired safety. To obviate the danger arising from impaired safety, keep a regular check on all bowl components.
Special attention must be given to the threads of the bowl bottom and of the bowl lock ring as well as to the area between the sludge ejection ports in the bowl bottom.

We, therefore, recommend in your own interest to have your separator inspected by WESTFALIA service engineers at regular intervals. Such inspections will keep your separator working reliably and prevent undesirable shut-downs.

If bowl repair proves necessary, please advise us in time. We shall then check with you how to avoid interruption of operation.

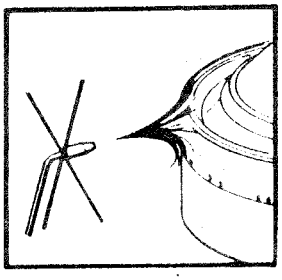
The forces resulting from the high speed rotation of the bowl put great strain on the bowl material. To avoid the risk of impaired operating safety be sure to strictly adhere to the instructions of this manual regarding assembly, starting, shutting down and maintenance of the separator.

- **Do NOT loosen any part of the separator or of the feed and discharge connections before the bowl has stopped completely.**



- Be sure to tighten bowl lock ring thorougly; the "O" marks on bowl bottom and on bowl lock ring must be in line with each other.

- Be sure to fasten hood, feed and discharge housing, and centripetal pump firmly.
- Before starting the separator, check if all nozzles are open (see sect. 4.1.3, item 3).
- To avoid nozzle clogging, install a strainer in the product feed line (see sect. 5.2.1).
- Before feeding the liquid to be processed, close the bowl hydraulically and check bowl on leakage (see section 6.2).
- Stop product supply before each complete de-sludging.
- When strong vibrations occur, shut down the separator immediately. Do not de-sludge bowl. If the bowl leaks, open water supply valve all the way.



- Never use blow-torch on bowl parts or expose them to heat of open flame.
- Every two months, check bowl parts on corrosion and erosion - especially the bowl lock ring and the spaces between the solids ejection ports in the bowl bottom.

  Check threaded area of lock ring at least once a year.

- Be sure to strictly adhere to the instructions of the "Lubrication and Maintenance Schedule" (see page 9/1).

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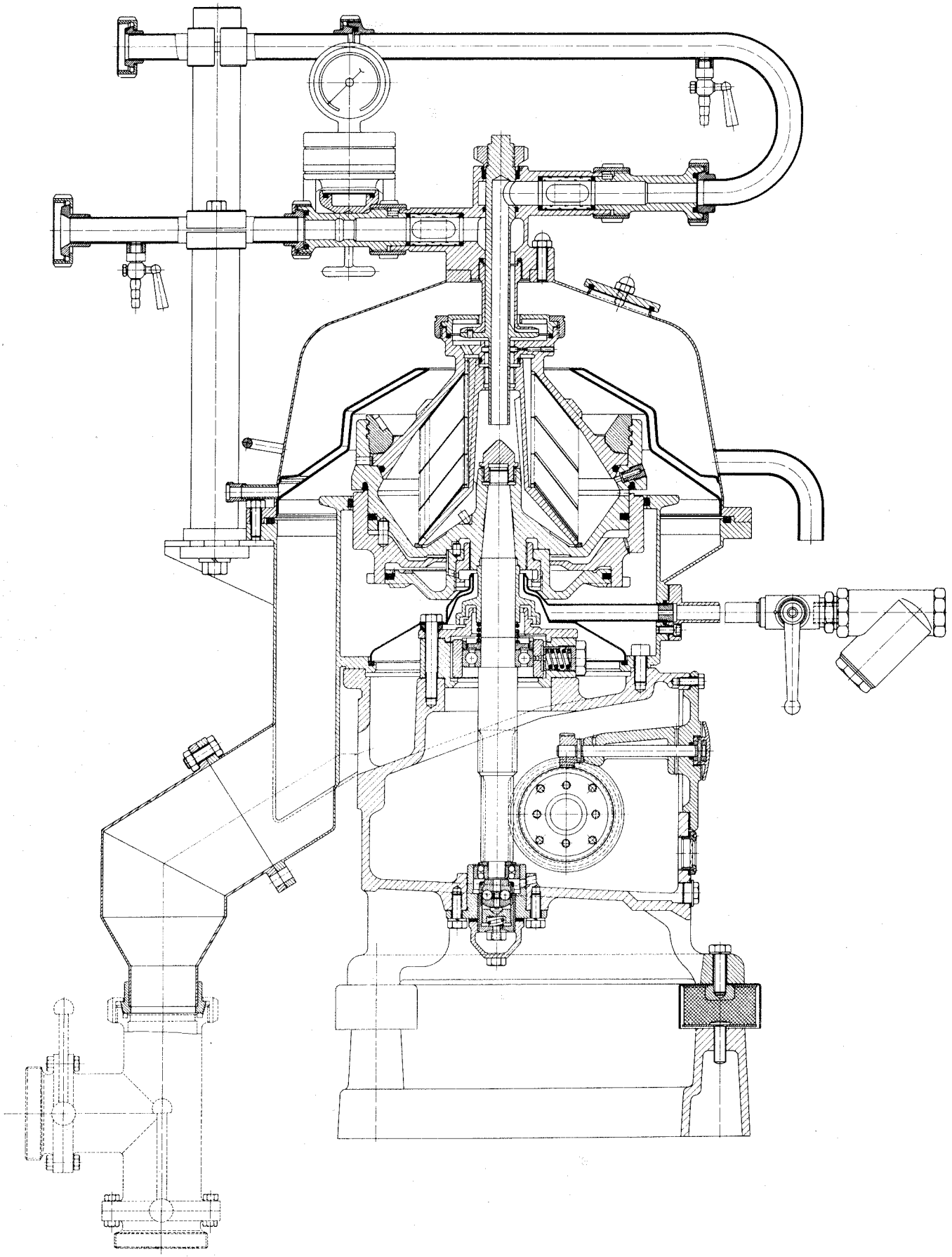
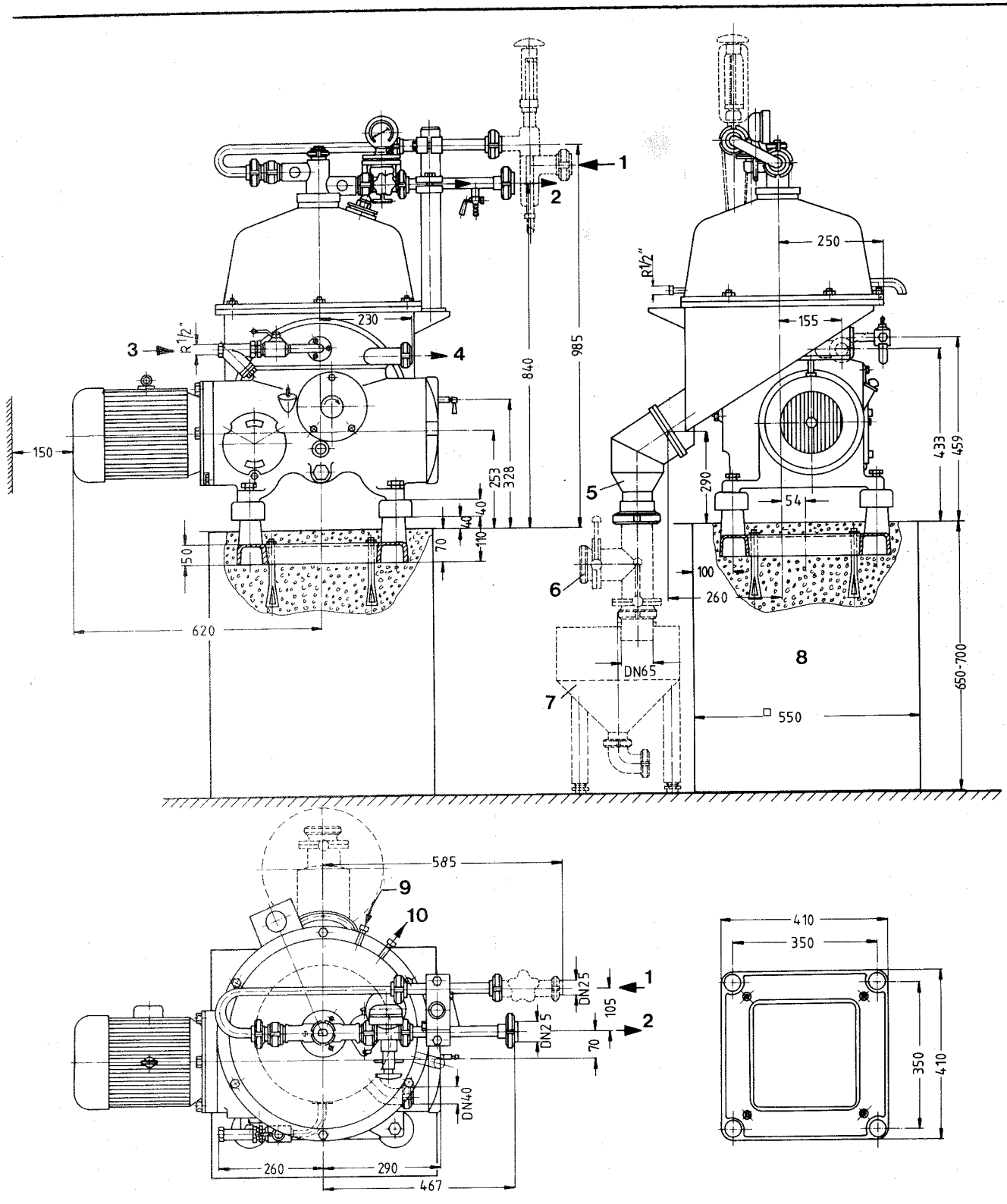
Sectional view of the separator



Dimensioned drawing



1 Feed of coagulated skimmilk
2 Whey discharge
3 Operating-water feed
4 Operating-water discharge
5 Quark outlet
6 Two-flap valves } on special order
7 Quark catcher }
8 Brick foundation
9 Ice-water feed (max. 400 litres, 2 bar)
10 Ice-water discharge

1. Installation

When installing the separator, make sure that sufficient room is available (at least 300 mm) to mount and remove the motor and to remove the horizontal drive shaft which is to be pulled out towards the brake side of the frame.

Take care that the foundation of the separator cannot receive any vibrations from other machines. Foreign vibrations can damage the ball bearings.

Do NOT install a shut-off valve in the frame drain and do NOT connect this outlet to a piping system. The operating water must be able to discharge freely into a sewer or sludge tank, e.g. via a funnel. Otherwise it will rise into the upper section of the frame, resulting in slowing down of the bowl. It can also seep down through the neck bearing into the bearing housing, thus causing damage to the bearings.

The inner diameter of the operating-water supply line shall be 1/2" if the line is up to 3 m long; if it is longer than 3 m, the inner diameter shall be 3/4". The pressure in this line should be at least 1.5 bar and not more than 3 bar.

It is recommended that a second shut-off valve be installed in the operating-water supply line. This is to protect the machine during standstill against inrush of water caused by unintended opening of the shut-off valve.

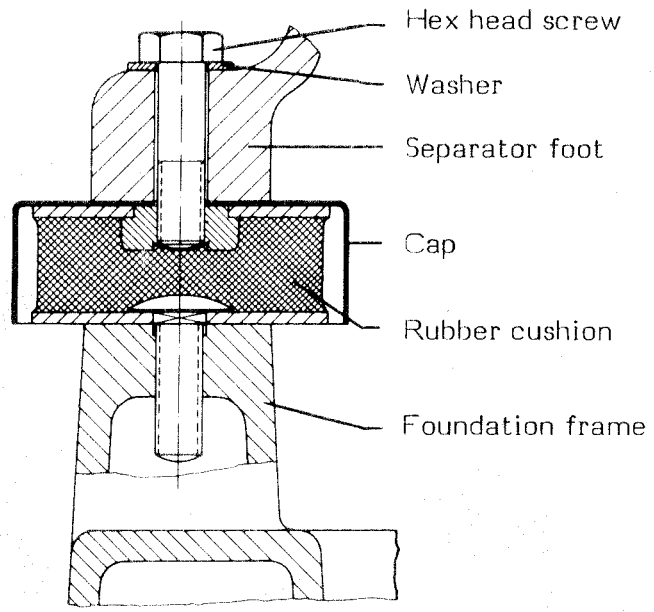


Fig. 1/1
Fastening the separator to the foundation frame

Embed the foundation frame in the floor so that the mounting blocks of the frame protrude from the floor. Make sure that the mounting blocks are **absolutely level.** The foundation frame must be firmly anchored with anchor bolts and with poured concrete.

After the concrete has set, the separator has to be fastened to the foundation frame as shown in fig. 1/1. To absorb vibrations, a rubber cushion has to be put between each separator foot and mounting block.

2.1. Lubrication of bearings and gear parts

All bearings and gear parts are splash lubricated from a central oil bath.

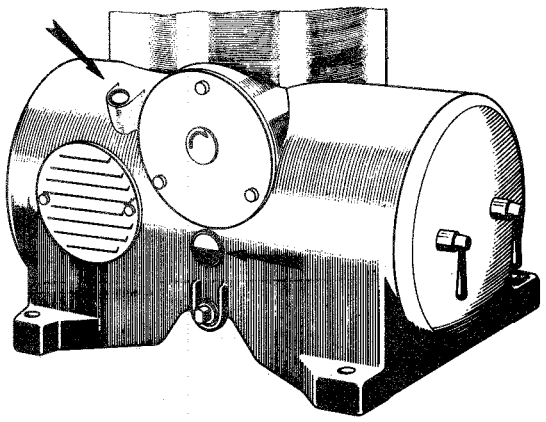


Fig. 2/1

Oil level

Before the initial start-up of the separator fill gear chamber with oil until oil level is slightly above middle of sight glass. About 1.2 litre of oil are required for one filling.
During operation oil level must never be allowed to sink below middle of sight glass; refill oil when necessary.

Oil check

Check oil level once a week.
Check from time to time if oil contains water. To do this, loosen oil drain screw and allow a small amount of oil to drain. If the oil shows a milky colouring (emulsification) an immediate oil change becomes necessary.

Oil change

Make first oil change after about 250 operating hours; then change oil every 750 operating hours. However be sure not to wait longer than 6 months to change the oil.

Each time when carrying out oil change, thoroughly clean gear chamber and flush with thin-bodied oil, prior to filling in new oil. Remove all metal particles from inner walls and corners of the gear chamber. Do NOT use fluffy cleaning rags or cotton waste. The sight glass should also be cleaned, as a layer of oil will probably have deposited on the inner side of the glass and this is easily mistaken for the oil level.

Lubricating oil

As lubricating oil use only a gear oil designated

CLP 100 (according to DIN 51502)

or designated

CC 100 (according to ISO/DIS 3498).

The lubricating oil shall meet the following requirements:

1) Viscosity: 100 $\pm$ 10 mm^2/s (cSt) at 40° C
2) Addivites:
   a) additives giving increased protection against corrosion and increased resistance to aging, - with properties preventing corrosion on steel according to DIN 51355/B, degree of corrosion 0. Corrosive effect on copper according to DIN 51759/100 A3, degree of corrosion 1.
   b) additives for decreasing wear and increasing the load-carrying capacity. The "FZG" gear rig test according to DIN 51354 as well as the test according to A 16.6/90, load grade $>$ 12, must have been passed.
3) Demulsifying behaviour according to DIN 51599: $<$ 60 minutes.

The gear oil designated "Separator lubricating oil CLP 100" which has been extensively investigated by us meets the above requirements and should preferably be used. For the order number refer to page 20/1 of the parts list.

2.2. Lubrication of threads and contact surfaces on bowl parts

Before assembling the bowl apply a thin film of one of the lubricants specified below to threads and contact surfaces of bowl bottom, bowl top, lock rings, etc.

For separators operating in the food processing industry we recommend to use the following lubricants:

Molykote D	(white paste; apply sparingly),
Molykote DX	(white paste; may be used in excess),
Klüber Grease KSB 8	(may be used in excess).

For separators operating in the chemical industry we suggest to use molybdenum disulfide pastes, e.g.

Molykote G or Molykote G Rapid.

Besides the above mentioned lubricants, other pastes or greases with the same properties may also be used.

2.3. Lubrication of the motor bearings

For lubrication of the motor bearings, refer to the instruction of the motor manufacturer (see motor plate).

3.1. General

The separator is powered by a 4 kW three-phase AC flange-type motor, type B5. The motor power is rated to cover the high acceleration current.

3.2. How to fit the motor

The motor is to be fastened to the separator by means of a flange. Appropriate flanges and clutch drivers are available for all standard flange-type motors, type B5.

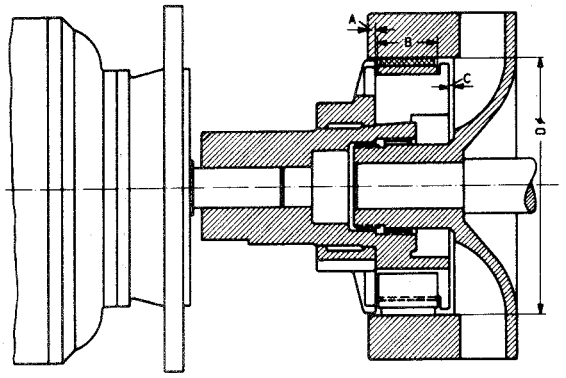


Fig. 3/1a

Position of the clutch driver in ring of clutch drum.

Dimensions in mm					
Fig. 3/1a				Fig. 3/1b	
A	B	C	D	E	d
3,5	33	4±0.5	140	M10	7

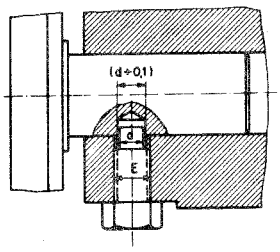


Fig. 3/1b

Fastening the clutch driver on the motor shaft.

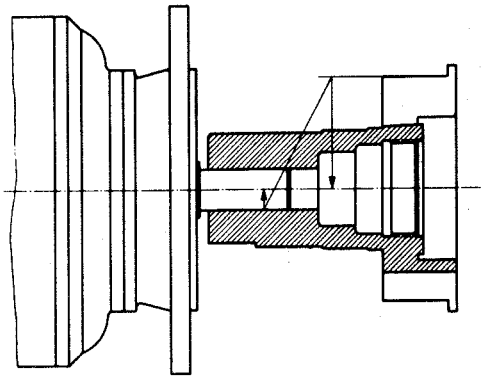


Fig. 3/1c

Tolerance between axis of clutch driver and axis of motor shaft.

The motor power is transmitted to the worm wheel shaft of the separator via a centrifugal clutch. For proper functioning of the centrifugal clutch fit the clutch driver onto the motor shaft end as shown in Fig. 3/1a and 3/1b in such a manner that, after mounting the motor, the clutch shoes rest with their entire widths against the ring of the clutch drum (see fig. 3/1a).

For fitting the clutch shoes refer to sect. 8.4.3.

Fasten clutch driver to motor shaft by screwing the hex head screw all the way in (see fig. 3/1b). Make sure that the screwhead rests tightly against recessed surface.

After fastening the clutch driver, check tolerance between axis of clutch driver and axis of motor shaft. The deviation of tolerance must not exceed 0.05 mm (see fig. 3/1c).

3.3. Motor connection

The motor is started via a motor control either across-the-line or in star-delta connection. In case of star-delta starting, change-over from star to delta connection has to take place after 4 to 6 seconds.

Motor protection is ensured by PTC resistor type temperature feelers incorporated in the winding of the motor. These temperature feelers have to be connected to an appropriate tripping device.

External voltage higher than 2.5 volts must not be applied to the terminals of the temperature feelers.
When testing for continuity, do **not** use a test lamp but only an ohmmeter.

The measuring circuit line (between tripping device and motor) has to be laid separate from other lines.

Dimensioning of switches, wiring and fuses must **not** be based on the rated current, but on the starting current which reaches approx. 1.5 - 1.8 the value of the rated current.

If the separator is controlled by an automatic timing unit, the timing unit must be electrically interlocked with the motor control in such a manner that failure of the drive motor inevitably leads to closing of the automatic product feed valve. (Refer also to Instruction Manual for the Timing Unit).

3.4. Direction of rotation of the bowl

The bowl must turn in clockwise direction when looked at from above. The direction of rotation of the bowl is correct when the revolution indicator disc (fig. 3/3) turns in clockwise direction. If it turns in anti-clockwise direction (incorrect), reverse direction of rotation by interchanging two lead-in wires.

3.5. Speed and starting time of the bowl

The bowl speed has been rated so as to ensure the operating safety of the separator. It depends on the densities of the centrifugally dry solids and of the clarified liquid.

The bowl speed and the maximum permissible densities are shown on the name-plate of the separator.

If densities exceed those shown on the name-plate, the gear must be changed to reduce the bowl speed. In such cases, be sure to check with the factory.

The part-numbers of the gear parts marked with *** in the List of Parts depend on the motor speed as well as on the bowl speed as seen on the name-plate of the separator. For the part-numbers of the gear parts which correspond to the motor speed and bowl speed of your separator refer to the list on page 18/1.

If the bowl speed has been changed in the site by exchanging the gear parts and consequently differs from that shown on the name-plate of the separator, orders for new gear parts should state the number stamped on the part to be replaced as well as model and serial-no. of the separator concerned. Correct delivery cannot be ensured unless the order quotes these data.

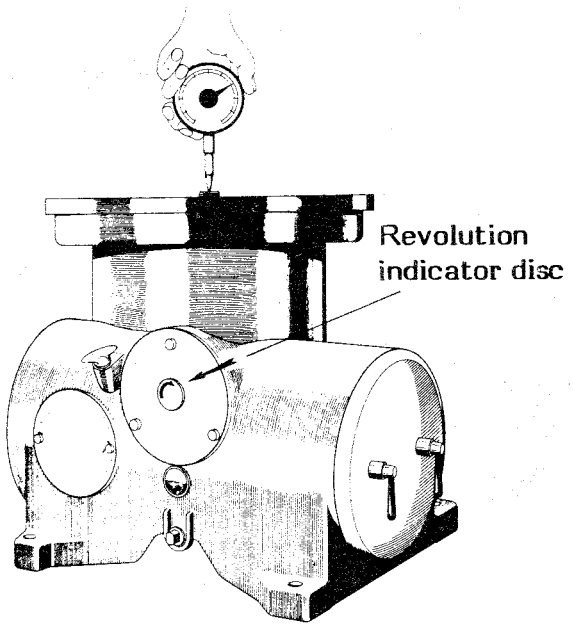


Fig. 3/3

Checking the spindle speed with a hand tachometer

Prior to the first start of the separator and after exchanging the gear parts, check the number of revolutions of the spindle (= rpm of the bowl) with a hand tachometer, before installing the bowl (fig. 3/3).

The **revolution indicator disc** serves to indicate whether the bowl is rotating and in which direction (see 3.4). It also allows to check the operating speed of the bowl.

The bowl is up to full speed when the revolution indicator disc makes the following revolutions:

65 rpm at a motor speed of 1455 rpm,

78 rpm at a motor speed of 1745 rpm.

Speed variations up to 3 % are permissible.

The **starting time** of the bowl ranges between 3 and 4 minutes, depending on number and condition of the clutch shoes used.

Make sure that the bowl reaches its rated speed (as per name-plate of separator) within the starting time and that this speed is maintained during operation (see 10.1.1 - 10.1.3).

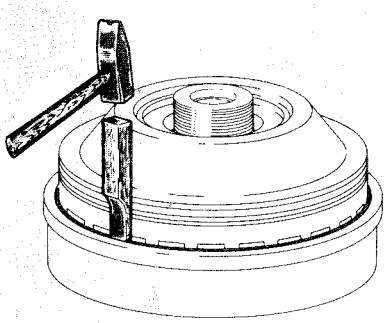


Fig. 4/2a

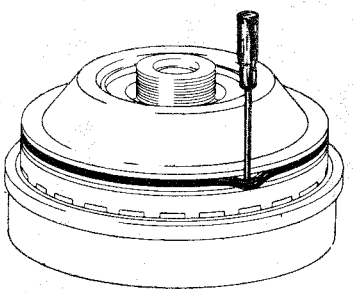


Fig. 4/2b

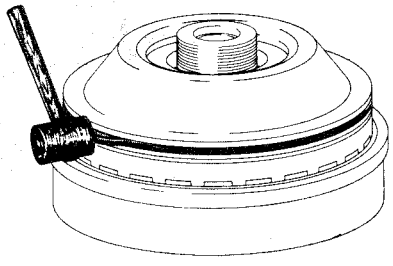


Fig. 4/2c

1) Thoroughly clean groove in bowl bottom for gasket 255.
Wipe gasket dry and insert it into groove of bowl bottom. Then place a piece of wood on gasket and hammer gasket into the groove so that it fits in evenly all around. See fig. 4/2a.

In order to make certain that the gasket is properly placed in the groove, proceed as follows after the separator has been completely assembled:

a) Block off all air circulation by closing solids run-off and feed and discharge pipes. The operating-water outlet on the frame must NOT be closed.

b) Turn on separator and let run for about 3 hours without feeding operating water. Bowl will warm up to about 90°C through air friction.

c) Close bowl by briefly opening the valve in the operating-water supply line several times in succession. The gasket, which has become pliable through the heat of the bowl, will become firmly pressed into the anchor grooves.

d) Let bowl run closed an additional 15 minutes while feeding cold water at a low flow rate. **Important:** Before first solids ejection, be sure solids-run off has been reopened.

2) Thoroughly clean groove in bowl bottom for gasket 267 and rub in a thin layer of neutral grease (one with no harmfull effect on the feed liquid).

In case the gasket is new and a bit too small, stretch it out equally all the way around until its perimeter is approximately equal to the perimeter of the groove.

Put gasket into its groove.
Then put a screwdriver under the gasket and run it around the bowl bottom two or three times (fig. 4/2b).
(This equalizes the gasket fitting all the way around and makes for best sealing during operation).
Then tap the gasket back into the groove with a rubber hammer (fig. 4/2c).

Important Hints

- Before assembling the bowl, make sure that all guide and sliding surfaces as well as the threaded areas of the bowl parts are clean.
- When assembling the bowl parts, make sure that the "O" marks of all parts are aligned.
- Before inserting gaskets, check them for wear. Make sure that grooves for gaskets and gaskets are clean and that gaskets are in perfect condition. Be careful not to twist the gaskets while inserting them and check to be sure that they fit properly in their grooves.
- If the plant has several separators, be sure not to interchange parts of different bowls, since each bowl has been balanced with its component parts. The main parts of the bowl are marked with the last three digits of the Serial-Number of the Separator.

4.1. Assembly of the bowl

4.1.1. Assembling the lower bowl parts

The lower bowl parts are assembled in the order shown in fig. 4/1, i.e. in a position inverted with regard to service position.

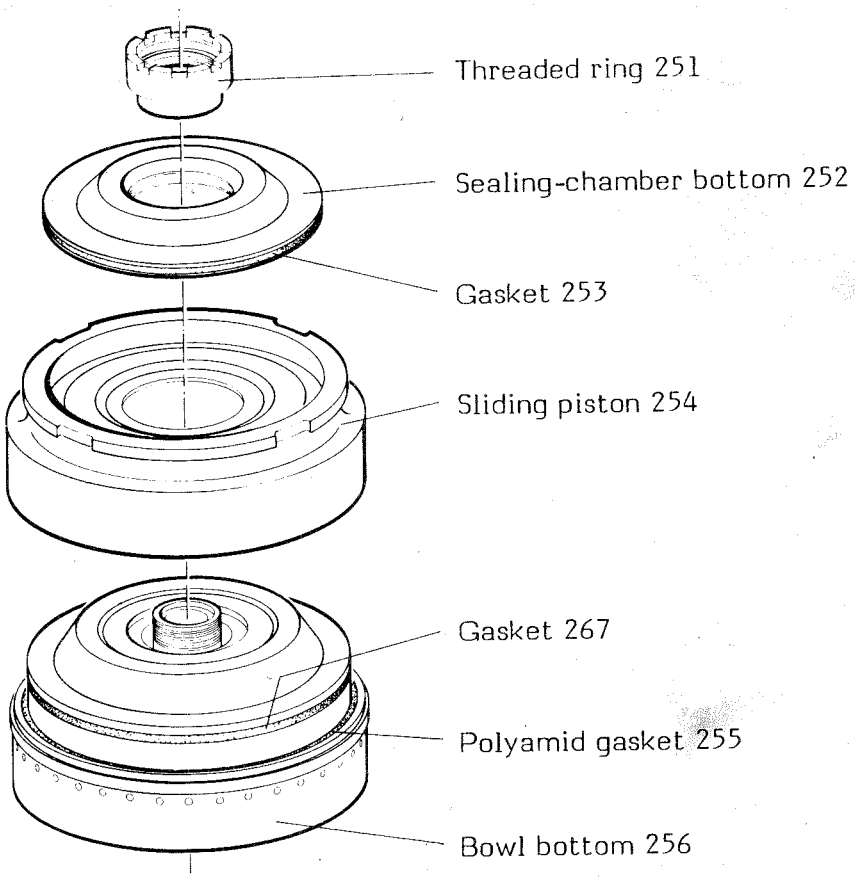


Fig. 4/1

Exploded view of lower bowl parts

4. Bowl, - Feed and Discharge Connections

4.1.1. Assembling the Lower Bowl Parts

If the bowl is taken apart for some reason (e.g. for cleaning purposes) and the gasket is not changed or taken out, then it should be lifted out in one place with a small screwdriver to allow water which has collected behind the gasket to flow out. The gasket should then be tapped back into the groove with a rubber hammer. This will make the job of re-inserting the sliding piston much easier.
The same procedure should be followed with gasket 253 in the sealing-chamber bottom.

3) Grease contact surfaces of sliding piston 254 (see 2.2).

Before installing the sliding piston, heat its outer surface with hot water or steam for about 5 minutes. **Never use any other sources of heat, e. g. blow torch or welding torch.**
Then place the sliding piston onto bowl bottom, by hand. The "O" marks of both parts must be in line with each other. The sliding piston is properly mounted when its sealing edge rests on gasket 255.

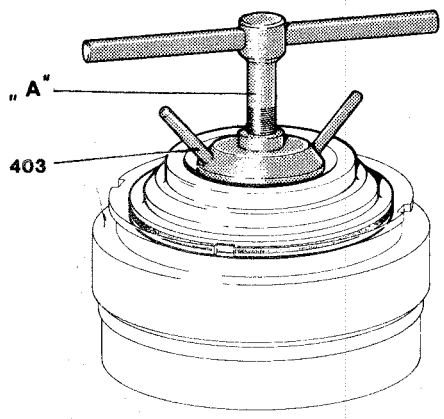


Fig. 4/3a

4) Put gasket 253 into groove of sealing-chamber bottom 252. Proceed by the same method as for gasket 267 (see para. 2).

5) Grease guide surfaces of sealing-chamber bottom (see 2.2). By means of jack 403 install sealing-chamber bottom in sliding piston (fig. 4/3a).
By turning jackscrew "A" in counter-clockwise direction, the sealing-chamber bottom will gradually sink into the sliding piston. Be sure arresting pin of sealing-chamber bottom catches into hole of bowl bottom. The "O" marks of both parts must be in line with each other.

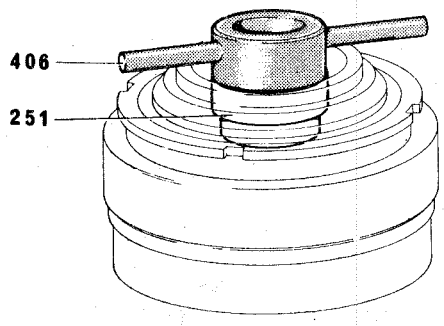


Fig. 4/3b

6) Grease threaded areas and contact surfaces on bowl bottom, threaded ring 251, and sliding piston (see 2.2). Then screw threaded ring, by hand, on to bowl bottom **(right-hand thread)** and tighten it with annular wrench 406 (fig. 4/3b) until "O" marks on sealing-chamber bottom and threaded ring are aligned.

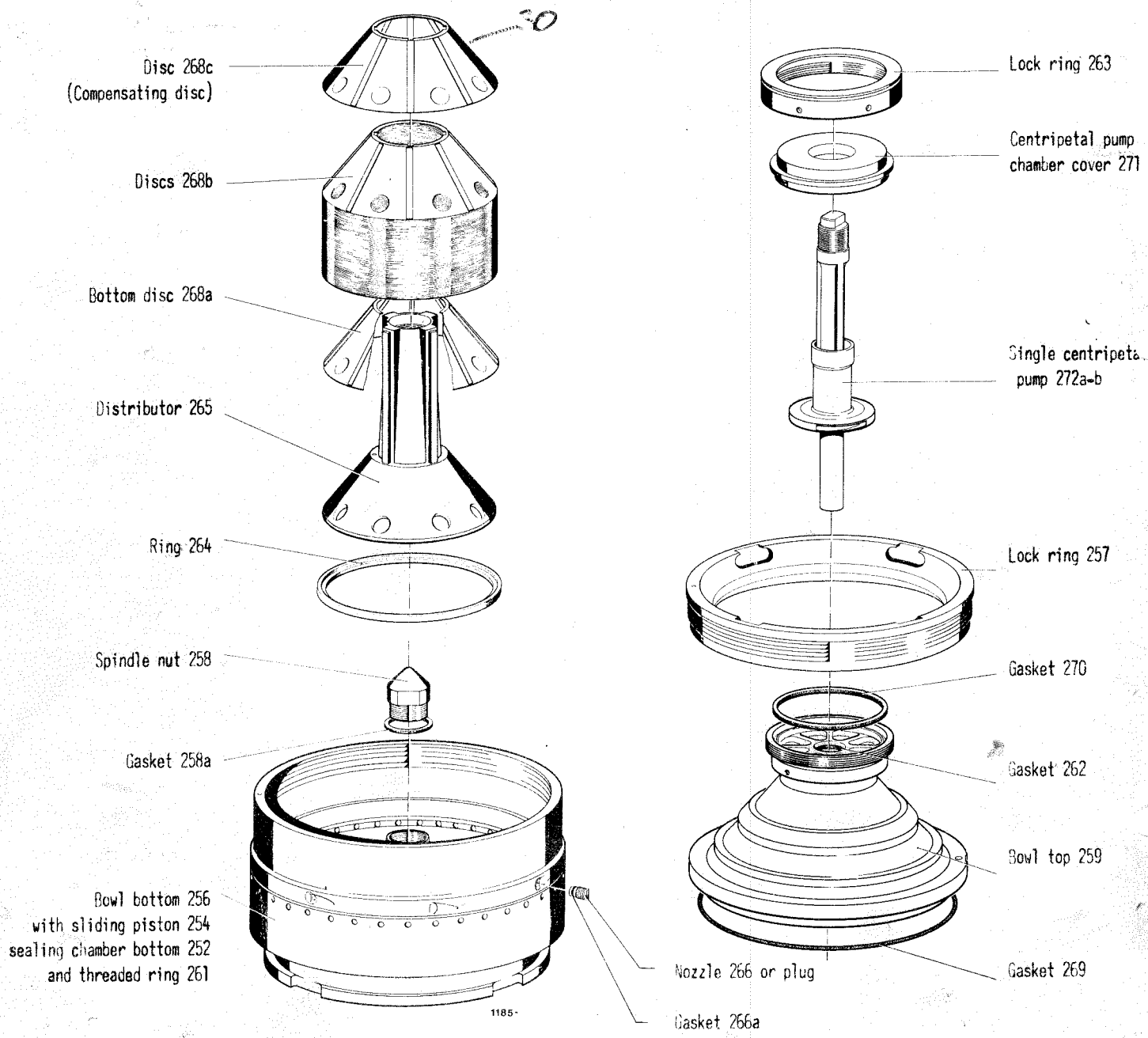


Fig. 4/4

Exploded view of the bowl

4.1.2. Assembling the upper bowl parts

1) Oil the upper part of the spindle (thread, cone and cylindrical guide surface for spindle cap). It must be possible to move the spindle cap easily up and down on the spindle. Then **clean and wipe dry the conical part of the spindle with a smooth rag.** Carefully clean the inside of the bowl hub as well to assure proper fitting.

2) Use jack 405 to place bowl bottom 256 together with sliding piston sealing-chamber bottom and threaded ring onto the spindle.

3) Screw on spindle nut 258 (with fitted-on gasket 258a) and tighten it firmly with a wrench. Note that the spindle nut has left-hand thread.

4) Put ring 264 into bowl bottom.

5) Stack discs 268a-c onto neck of distributor 265 in numerical order, beginning with No. 1.

   The compensating discs 268c (with thin spacers) are only used when one or two discs with an overall thickness less than that of the normal disc (with thick spacers) are required to obtain the necessary pressure in the disc stack. They are included in the set of spare parts unless they are already fitted in the bowl.

6) Use device 424 to place distributor together with disc set into bowl bottom. Make sure that arresting pin of distributor fits into groove of bowl bottom. Watch for "O" mark alignment.

7) Insert gaskets 269, 262 and 270 into the grooves of bowl top 259.

8) Grease the guide surfaces of bowl top and bowl bottom.

   Screw small lock ring 263 onto bowl top and with the aid of lifting tongs 402 place bowl top so into bowl bottom that arresting pin of bowl bottom fits into groove of bowl top. The "O" marks of both parts must be in line with each other. Then remove small lock ring.

9) Thoroughly clean, wipe dry and grease (see 2.2) threaded areas and guide surfaces of bowl bottom and bowl lock ring 257 as well as the sliding surfaces of bowl top and of lock ring. Screw bowl lock ring into bowl bottom, by hand **(left-hand thread).** Then tighten lock ring with annular wrench 401, by giving a few blows with mallet 413 against wrench handle until "O" marks on lock ring and on bowl bottom are in line with each other.

10) Install centripetal pump 272a-b.

11) Install centripetal pump chamber cover 275.

12) Clean, wipe dry and grease (see 2.2) threads on upper part of bowl top and in lock ring 263. Then screw on lock ring tightly, using hook wrench 407 **(left-hand thread).**

13) Check to see if bowl can be turned by hand.

4.1.3. Installation of the nozzles

1) Make sure that all the nozzle bores are open and that the nozzle gaskets 266a are in good condition.

2) Use screw driver 426 to screw nozzles 266 into bowl bottom. Front surfaces of nozzles must be flush with outer wall of bowl bottom **(do NOT screw in any further!)**. The slots in the nozzles will then be in vertical position and the discharge openings are directed backwards.

3) Before starting the separator, it is recommended to fill the bowl with a small amount of water in order to see if each nozzle discharges a uniform, solid jet of water. Uneven jets prove that the nozzles are clogged or worn or damaged and must, therefore, be cleaned or replaced.

PROCEEDING AS 3 ABOVE WILL PREVENT BOWL STARTING
DO NOT UNDER ANY CIRCUMSTANCES FOLLOW THESE INSTRUCTIONS
190687. PLB

4.2. Assembling the feed and discharge connections (fig. 15/1)

1) Install hood and fasten with hex head screws.

2) Check to see if gaskets in feed and discharge housing 72 are in good condition and if they are properly placed in their grooves. Mount feed and discharge housing and fasten with cap nuts.

3) Apply a thin film of grease to threads of centripetal pump and of grooved nut 84. Screw grooved nut on to centripetal pump **(left-hand thread)** and tighten firmly.

4) Fit bend 78 into feed line and valve connection 85 into discharge line. Then tighten screw couplings firmly.

5) Connect the feed and discharge lines for ice water.

4.3. Removing the feed and discharge connections, Dismantling the bowl

IMPORTANT: Do NOT loosen any part of the separator or of the feed and discharge connections before the bowl has stopped completely.

For removal and dismantling proceed in reverse order of assembly (see 4.1 and 4.2). The following should be kept in mind:

Handle bowl parts with care.
Be sure to replace gaskets when worn. Before opening the bowl be sure to release brake by turning handle clockwise.

In case the bowl lock ring is stuck in the bowl bottom (e.g. after too long an operating time) heat up bowl bottom in the area of bowl lock ring with hot water or steam. **Do NOT use any other sources of heat.**

Normally the lower bowl parts such as bowl bottom, sliding piston, sealing-chamber bottom and threaded ring (see fig. 4/1) need only to be dismantled when new gaskets have to be inserted. Removal of sliding piston is facilitated by giving some oil into annular gap between bowl bottom and sliding piston to achieve better sliding of the gaskets. Let oil soak in for about 15 minutes. Then place assembly of lower bowl parts upside down on a stand and dismantle as follows:

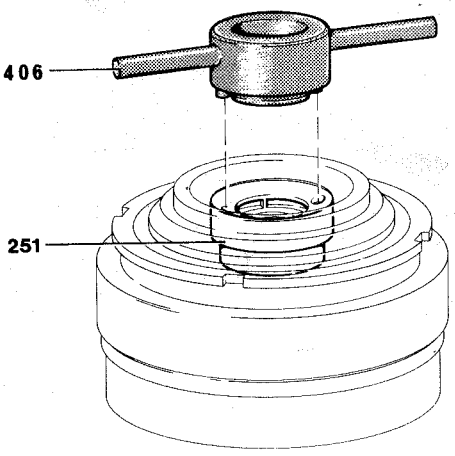


Fig. 4/7a

Use annular wrench 406 to unscrew threaded ring 251.

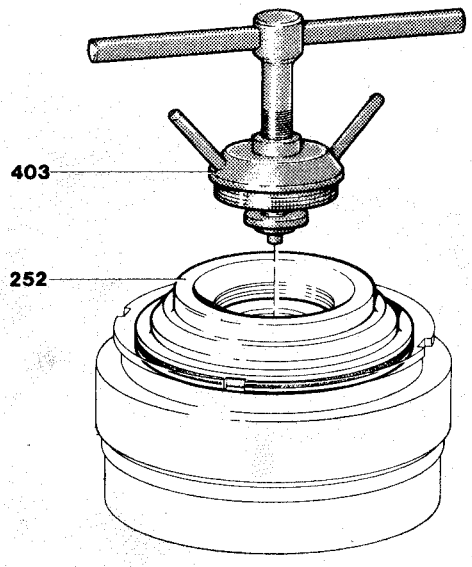


Fig. 4/7b

With the aid of jack 403 remove sealing-chamber bottom 252 from bowl bottom.

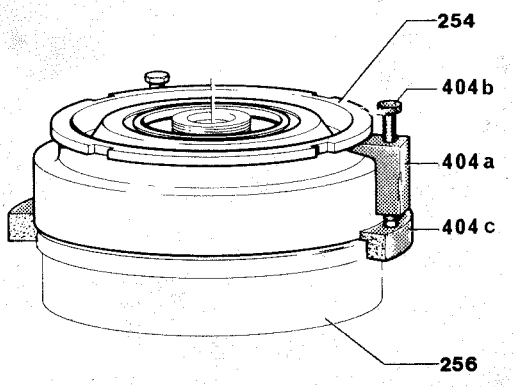


Fig. 4/7c

With the aid of device 404a-c remove sliding piston 254 from the bowl bottom in the following manner:
Place clamp ring 404c on the rim of bowl bottom. Fit claws 404a - equally distributed - under the rim of sliding piston and tighten hex head screws, alternately and evenly. By doing this, the sliding piston will gradually come off so that it is possible to lift it off by hand.

4.4. Removing Polyamid gasket from bowl bottom

1) Heat up gasket with hot water or steam (70 - 100°C) for about 10 minutes.

Fig. 4/8a

Fig. 4/8b

2) Use chisel 425 to cut a small triangular piece out of the gasket.

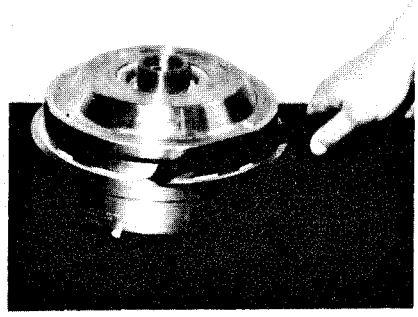


Fig. 4/8c

Fig. 4/8d

3) Press gasket out of its groove.

5.1. Operating principles of the bowl

The coagulated skimmilk enters the bowl through inlet A, flows into the distributor space then through holes in the distributor base into the rising channels of disc stack D where it is equally distributed in the spaces between the discs. In the disc spaces the coagulated skimmilk is separated into whey and quark due to centrifugal force.

The whey flows towards the center of the bowl from where it is discharged through outlet B, foamfree and under pressure, by means of centripetal pump C.

The quark accumulates in sediment holding space E from where it is continuously discharged through nozzles K into the concentrate collector from which it slides over a discharge chute into the quark catcher. A positive displacement pump conveys the quark from the catcher to a tubular cooler.

In addition to discharging the concentrate continuously through the nozzles, the bowl is capable of performing total emptyings, initiated by hand by means of timing unit S. Ejection of solids by way of total emptyings through ejection gap G are accomplished with the aid of a sliding piston F which is lowered and raised hydraulically (see "Functioning of the hydraulic system of the bowl", sect. 5.3).

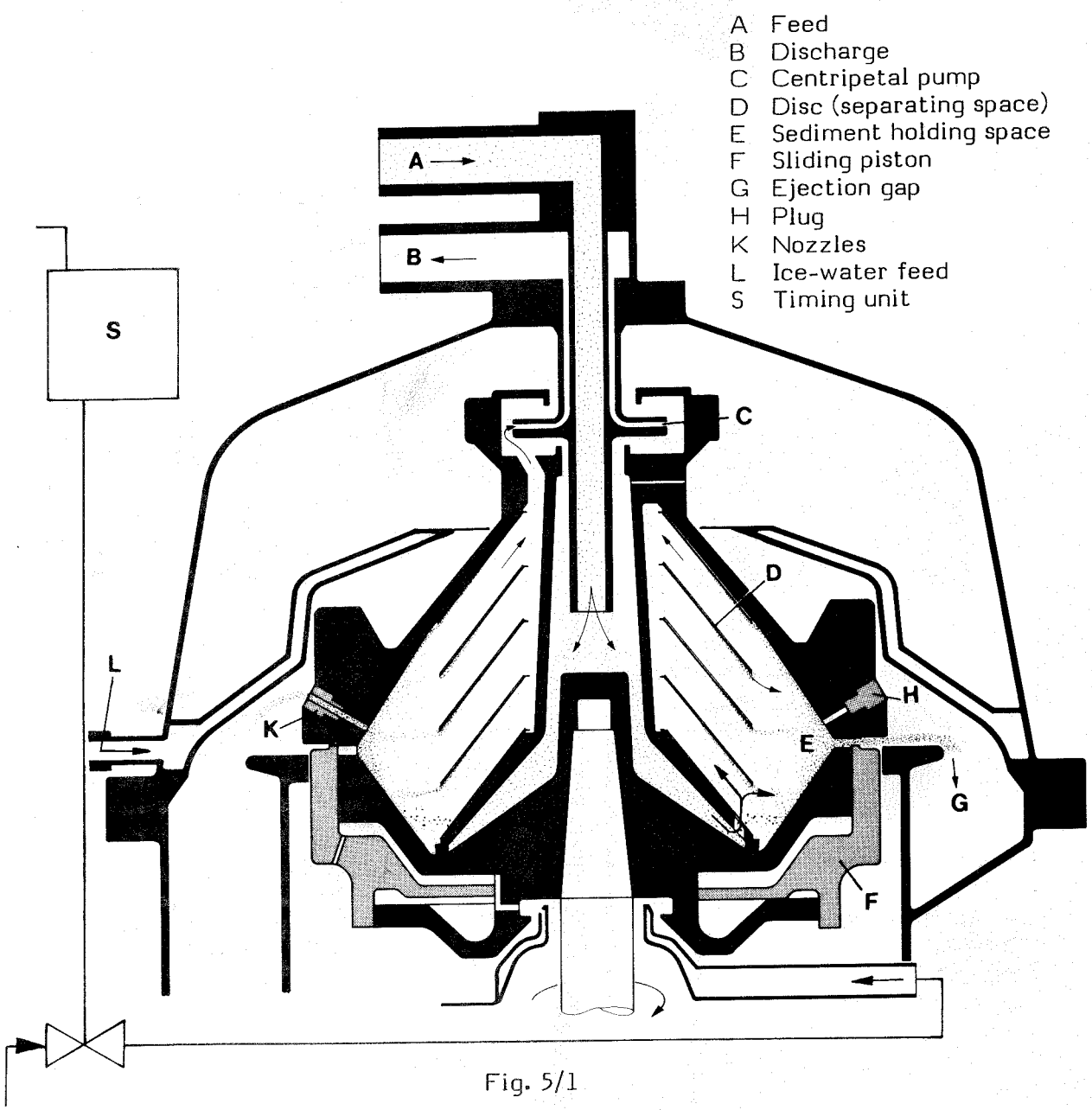


Fig. 5/1

5.2. Determining the size and number of nozzles

The quark concentrated in the bowl is continuously discharged through 4 nozzles with a diameter of 0.4 mm.

The diameter and number of nozzles to be fitted depend on the feed rate (i. e. amount of liquid supplied per unit of time), on the percentage of dry matter in the coagulated skimmilk and on the desired percentage of dry matter in the low-fat quark.
A homogenous quark can only be obtained when the feed rate and the solids content in the feed liquid remain constant.

If the concentrate is too thin, increase the feed rate; if necessary, use nozzles with a smaller diameter.

If the concentrate is too thick and the discharging whey looks turbid, reduce the feed rate. If the whey then still contains separable albumin, nozzles with a smaller diameter will have to be installed.

The following table is based on quark with a solids content of 18 % (dry substance).

Table of nozzle outputs

Feed rate litres/h	Nozzle output (quark) kg/h	Nozzle diameter mm
900	200	4 nozzles x 0.4

Depending on local conditions, slight variations from the above mentioned values can occur, since the feed rate - quark output ratio depends on the solids content of the coagulated skimmilk and on the desired solids content of the quark.

IMPORTANT: Make sure that the nozzles are equally distributed in the bowl. Nozzles with the same diameter must always be arranged opposite each other. Likewise, the plugs (blind nozzles) must be arranged opposite each other.

5.2.1. Pre-straining of the feed liquid

To avoid nozzle clogging, strainers have to be installed ahead of the separator:

for product supply use a tubular strainer 50 mesh/1",
for water supply use a tubular strainer 70 mesh/1".

5.3. Functioning of the hydraulic system of the bowl

The operating liquid (normally water) fed into the bowl and rotating with it, develops high centrifugal pressure. This pressure is used to operate sliding piston F which closes and opens the bowl. The sliding piston F rotates at the same angular velocity as the other bowl parts, but unlike the other bowl parts it can be moved axially.

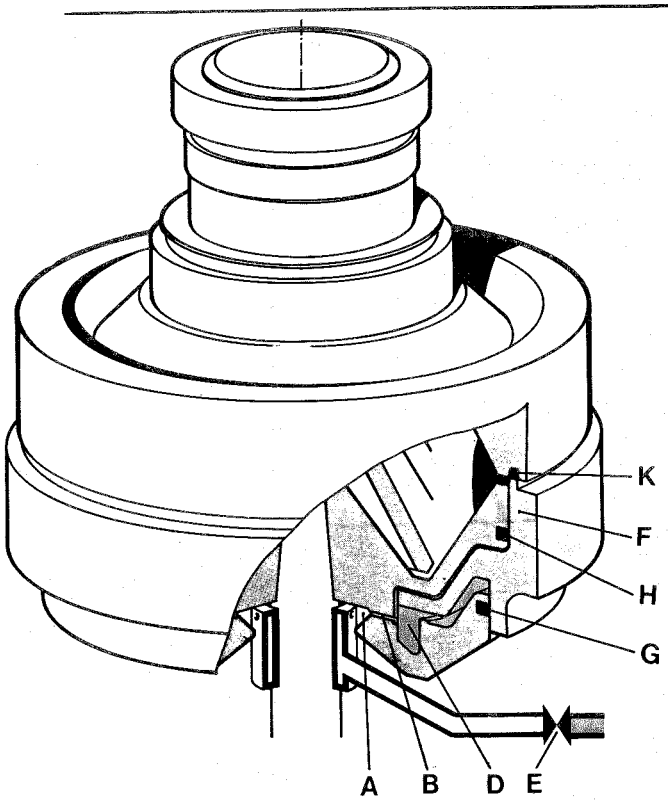


Fig. 5/2
Bowl, closed

Sealing of the bowl: After the bowl has reached its rated speed, the operating-liquid valve E is briefly opened several times in succession. The operating-liquid flows into injection chamber A and from there, through four holes B, into the sealing chamber D beneath the sliding piston.

The liquid pressure prevailing in the sealing chamber raises the sliding piston and presses it against bowl gasket K, thus sealing the bowl. Through centrifugal force, gasket G in the sealing chamber bottom seals off the sealing chamber and gasket H in the bowl bottom seals off opening chamber M and the centrifugation room.
Separation can now begin.

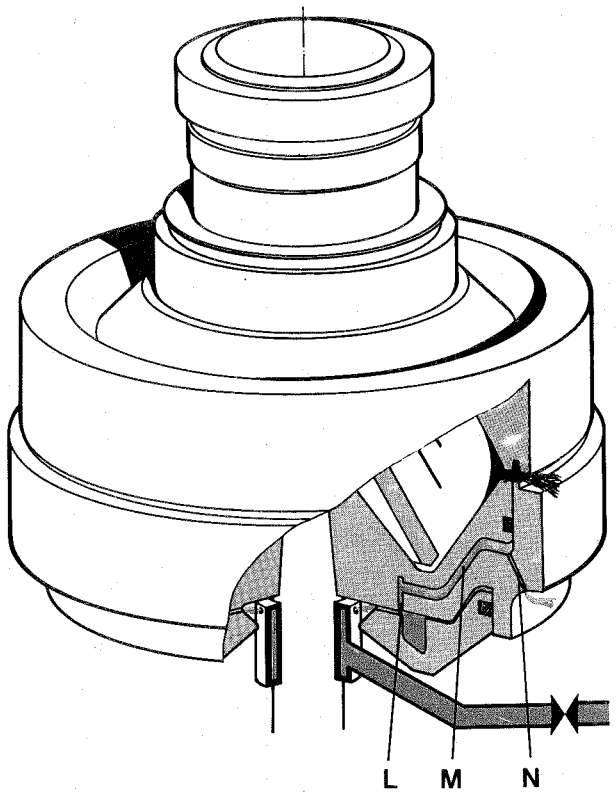


Fig. 5/3
Bowl, open

Opening of the bowl (solids ejection): When the sludge space of the bowl is filled with solids, operating-liquid valve E is opened. The operating-liquid is injected into chamber A, from where it flows into sealing chamber D. When the sealing chamber is filled, the liquid flows on into opening chamber M.

A small portion of the operating-liquid leaves the opening chamber through discharge nozzle N whose diameter has been selected so as to ensure that the amount of discharging liquid is less than the amount of liquid entering the chamber. Since the effective area of the sliding piston in the opening chamber is larger than that in the sealing chamber, the opening pressure resulting from the effective area and the liquid pressure, exceeds the sealing pressure and pushes the piston down. This opens the discharge ports in the bowl bottom for solids ejection.

Re-sealing of the bowl: After solids ejection, the operating-liquid supply is shut off again. The liquid contained in the opening chamber is ejected through discharge nozzle N. As the liquid level recedes, the opening pressure acting on the upper side of the sliding piston quickly declines. When the opening pressure has become smaller than the sealing pressure acting on the underside of the piston, the latter is pushed upwards, thus re-sealing the centrifugation room. The separation process can now recommence.

5.4. Operating-water connection (fig. 14/2)

The inner diameter of the operating-water supply line shall be 1/2" if the line is up to 3 m long; if it is longer than 3 m, the inner diameter shall be 3/4". The pressure in this line should be at least 1.5 bar and not more than 3.0 bar. During partial de-sludgings pressure fluctuations must not exceed 0.2 bar. Consumption of operating water is approx. 1.5 litre for each total de-sludging and 0.25 - 0.3 litre for each partial de-sludging procedure.
The operating-water connection is provided with a water-pressure reducer by means of which the line pressure is to be throttled to approx. 2 bar. Pressure adjustment should be made while solenoid valve is open.
The operating water must be clean and should meet the following specifications:

Hardness:	$\leq 22^{\circ}$ English hardness at separating temperatures of up to 40 °C
	$\leq 7^{\circ}$ English hardness at separating temperatures exceeding 40 °C
Chlorine ions:	$\leq$ 100 mg/litre
pH value:	6.5 to 7.5

It is recommended to clean the strainer of the water pressure reducer from time to time by putting it for a short while into diluted vinegar or hydrochloric acid. Before re-installing the strainer, flush it thoroughly with water.

5.4.1. Solenoid valves for operating water and for * flush water for hood

The solenoid valves incorporated in the operating-water system are 2/2-way straight-flow diaphragm valves with internal piloting.
The solenoid valve for operating water is equipped with a manual operator (override) for test purposes.
The solenoid coil is entirely embedded in Epoxy resin which ensures protection against moisture, good dissipation of heat, and perfect electrical insulation. The valves are fully tropicalized.

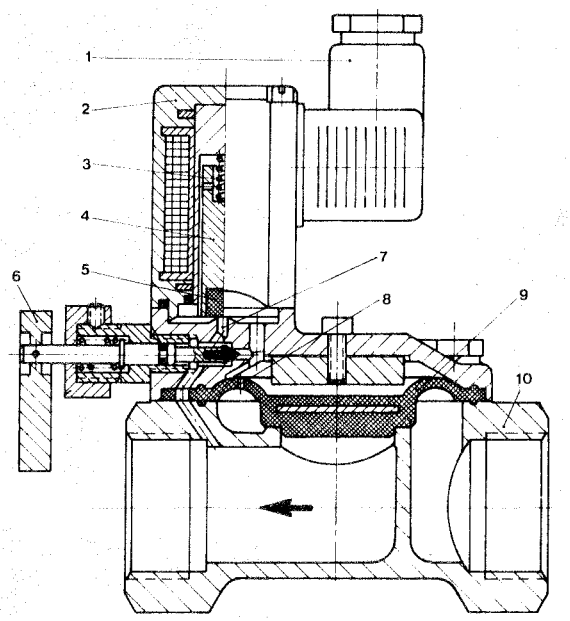


Fig. 5/4

1 Coupler socket
2 Solenoid head
3 Cylindrical pressure spring
4 Solenoid core
5 Plug (pilot valve)
6 Manual operator (override)
7 Outlet hole
8 Inlet hole
9 Diaphragm
10 Valve housing

* on special order only.

Operating principles

When the valve is closed (de-energized), the upper side and the underside of the diaphragm are exposed to the water line pressure, because water can flow from the valve inlet side through a small hole in the diaphragm into the chamber above the diaphragm. As the area exposed to the water line pressure on the upper side of the diaphragm is larger than the area exposed to the same pressure on the underside, the diaphram is kept pressed against the valve seating.

Upon energization of the solenoid coil, the plug which is integrally vulcanized in the solenoid core is lifted from the seating of the pilot valve thus opening a duct between the space above the diaphragm and the discharge side of the diaphragm valve. As this duct is larger in diameter than the small hole on the inlet side, the water can flow faster out of the space above the diaphragm than it flows into it. Thus the water pressure above the diaphragm drops so that the diaphragm is lifted by the pressure acting on its underside; the valve is opened.

If the energizing current is disconnected, the spring will drive the solenoid core downwards and the pilot valve will close. Consequently, the water pressure above the diaphragm builds up again so that the diaphragm is pressed against the valve seating; the valve is closed.

Maintenance

The solenoid valves do not require special maintenance. However, care should be taken that the coupler socket is always screwed tightly to the solenoid head to ensure perfect sealing action of the gasket.

Locating electric troubles

If it has been found that the control cabinet functions properly and that voltage is present at the valve terminals of the terminal strip while the corresponding time function element is operating, the trouble will have to be ascribed either to a defective solenoid coil, or to open circuit between terminal strip and valve, or to poor connection.

In the event of a defective solenoid coil, the solenoid head can be removed from the valve. To do this, remove first the coupler socket (loosen screw and pull out the socket), then loosen the fillister head screws.

Since the solenoid coil is entirely embedded in the solenoid head, the complete solenoid head (No. 0018-3710-800, see page 14/4) has to be replaced.

Technical data

Solenoid valve	Type	40 A / 2451 for operating water	40 A / 122 for flush water
Part - Number		0018-3712-600	0018-3710-600
Pipe connection	R	1"	1/2"
Voltage	V	220 ~	220 ~
Frequency	Hz	50/60	50/60
Optional voltages	V	24 ~ 115 ~ 24 DC	24 ~ 115 ~ 24 DC
Power consumption: pull-in	VA	approx. 20	approx. 20
(AC operation) operation	VA	approx. 16	approx. 16
(DC operation)	W	approx. 12	approx. 12
Duty cycle	%	100	100
Frequency of operations	/h	1,000	1,000
Type of enclosure	IP	65	65
Pressure range	bar	0.5 - 10	0.5 - 10
Temperature: medium	°C	+90	+90
ambient	°C	+35	+35
Cable entry	Pg	9	9

5.5. Timing unit

Total de-sludgings of the bowl during product run are normally initiated manually by pressing push button **"De-sludging"** on timing unit TA 2 S.

Before total de-sludgings, change over from product run to water run and set the two-flap valves in the quark outlet to cleaning solution discharge.

Fig. 5/6
Timing unit TA 2 S

Setting the timing relay "Separation"

To prevent the timing unit from automatically initiating time-dependent total de-sludgings, the timing relay "Separation" has to be set to the longest possible running time of 30 hours. The elapsed separating time is indicated by a red pointer.

Setting the timing relay "De-sludging"

Adjustment time: approx. 5 seconds.

The timing relay "De-sludging" determines the time of operating-water injection for one bowl opening procedure (= total de-sludging time). The total de-sludging time depends on the operating-water pressure and the amount of ejected solids. The operating-water pressure must be kept constant to make sure that always about the same amounts of solids are ejected.
The exact time of total de-sludging has to be found out by observing the solids ejection and evaluating the ejected solids while the machine is operating.

For further details of the timing unit refer to the instruction manual for timing unit TA 2 S.

5.6. Procedure

5.6.1. Preparing the skimmilk

The renneting tanks are to be filled with pasteurized milk. Make sure that during a short-time pasteurization (40 seconds) the temperature does not exceed 74° C since otherwise the whey discharging from the separator will contain albumin.

A good quality quark can only be obtained from a properly treated skimmilk. For renneting, the skimmilk should have a temperature of at least 30° C.

Normally 0.5 - 1 % starter and 1 cm^3 of liquid rennet (concentration 1 : 10,000) are added per 100 litres of skimmilk

or

0.5 - 1 % starter and 1 gramme of dry rennet dissolved in 0.25 litre of water (concentration 1 : 100,000) per 1,000 litres of skimmilk.

After 16 to 18 hours, when the desired coagulation has taken place, the acidity of the whey will be 25 - 28° SH which corresponds to a pH-value of 4.5 - 4.4. About 15 minutes before beginning of separation the coagulated skimmilk is efficiently stirred by means of an agitator. During separation, the agitators in the tanks must be kept working to ensure that the content of dry matter in the quark remains constant.

The separating temperature should be at least 28 - 30° C.

5.6.2. Calculation of the quark yield

According to the well known formula which is used to determine the cream volume when separating milk, the percentage of quark with reference to the coagulated skimmilk can be found out as follows:

$$Q = \frac{100\,(T_{MM} - T_{MO})}{T_{MQ} - T_{MO}}$$

T_{MM} = dry matter of coagulated skimmilk (%)

T_{MO} = dry matter in discharging whey (%)

T_{MQ} = dry matter in low-fat quark (%)

Example:

When T_{MM} = 8.6 %, T_{MO} = 6.1 %, T_{MQ} = 18 %, 100 litres of skimmilk will yield the following amount of quark:

$$Q = 100\,\frac{8.6 - 6.1}{18 - 6.1} = 20.95\ \%$$

If 100 litres of skimmilk are required to obtain 20.95 kg of quark with 18 % of dry matter then $\frac{100}{20.95}$ = 4.77 kg of skimmilk are necessary to produce 1 kg of quark with 18 % of dry matter.

The actual percentage of dry matter depends on the conditions prevailing in each dairy. Therefore, **the above example cannot be set as a rule.**

Amount of skimmilk required to produce 1 kg of quark based on the percentage of dry matter in the quark

Percentage of dry substance in the quark	Amount of skimmilk (kg) necessary to produce 1 kg of quark Standard Process	Amount of skimmilk (kg) necessary to produce 1 kg of quark Thermo Process
17.0	4.19	3.79
17.5	4.38	3.98
18.0	4.77	4.37
18.5	4.85	4.45
19.0	5.05	4.65
19.5	5.23	4.83
20.0	5.43	5.03
20.5	5.62	5.22
21.0	5.80	5.40
21.5	6.02	5.62
22.0	6.20	5.80
22.5	6.38	5.98
23.0	6.57	6.17
23.5	6.76	6.36
24.0	6.98	6.58

The values in the above table show that the skimmilk consumption per 1 kg of quark depends on the content of dry matter in the quark.

In addition to determining the yield theoretically, the actual amount of coagulated skimmilk and the actual amount of the quark produced should be measured percisely. Approximation of theoretically and practically obtained values will only be achieved by high accuracy of measurement.

6.1. Before starting the separator

check to be sure that

- the correct nozzles (see 5.2) are installed in the bowl,
- all nozzles are open (see sect. 4.1.3, No. 3),
- timing relays on timing unit are properly adjusted (see 5.5.),
- oil level is slightly above middle of sight glass,
- brake is released by turning the handle clockwise,
- the separator is properly assembled (see if hex head screws of hood, cap nuts on discharge and grooved nut 84 on centripetal pump are tightened securely),
- manual shut-off valves for product and water are closed and rapid-closing valve for operating water is open.

6.2. Starting the separator

- Switch on the motor. If strong vibrations occur, stop the separator and check if bowl is clean and correctly assembled.

- Switch on the timing unit as soon as the bowl has reached its rated speed which is after about 4 minutes.

- Close the bowl hydraulically by repeatedly actuating push button **"De-sludging"** on the timing unit.

- Switch the two-flap valves in the quark outlet to position "cleaning solution discharge".

- Open water valve and adjust it so that a small amount of water discharges from the whey outlet.

- Disinfect pipe lines from tank to separator and flush them with water.

- Feed ice water to cooling chamber of separator hood at a rate of 200 - 300 litres/h. Maximum feed pressure: 2 bar.

- Switch on the feed pump. Open the product valve and close the water valve simultaneously.

  Adjust the product valve to obtain a suitable throughput (observe flowmeter).

- As soon as the discharging quark has the desired dry substance content, switch two-flap valves in quark outlet to position "quark catcher".

- Adjust counter pressure in whey discharge line as follows: Throttle valve until slight overflow occurs on the overflow pipe of the hood. The pressure indicated by the pressure gauge the moment overflow occurs, is considered as maximum pressure. Then re-open whey valve until a pressure is obtained which is by 0.3 - 0.5 bar lower than the maximum pressure. This discharge pressure must be kept during separation.

  The discharging whey must be clear and should be free of undissolved albumin. If it still contains albumin, reduce the throughput capacity.

- When after some time of operation (approx. 2 - 5 hours) the discharging whey becomes turbid (see through sight glass in discharge line) two or three total emptyings must be performed in order to clean the bowl (see 6.3).

- Sudden increase in concentration of the discharging product indicates that one or several nozzles are clogged. In this case, stop the separator (see sect. 6.5) and clean the nozzles.

6.3. Total de-sludging of the bowl

- Before each total de-sludging switch over from product run to water run:
  - Stop feed pump.
  - Close product valve and simultaneously open water valve.
  - Switch two-flap valves in quark outlet over to position "cleaning solution discharge".
- Accomplish total de-sludging by actuating the push button "De-sludging" on the timing unit. The protein segments which have formed between the nozzles during separation are abruptly ejected.
  Normally, the total de-sludging will have to be repeated 2 times at intervals of 30 seconds.
- Then switch over from water run to product run; the separation process can recommence.

6.4. CIP cleaning

6.4.1. General

The separator is included in the CIP cycle of the pasteurizers. The alkaline solution used in dairies for cleaning the pasteurizers is also adequate for the separator. To avoid corrosion it is recommended to use only approved cleansing agents. Never use cleansing agents containing chlorine as the chlorine will attack stainless steel bowl parts, resulting in impaired operating reliability.

6.4.2. CIP procedure

Upon completion of separation open the water valve and change over the two-flap valves in the quark outlet to the position "cleaning solution discharge". Then accomplish 2 or 3 total de-sludgings of the bowl by actuating the push button "De-sludging" on the timing unit at intervals of 30 seconds.

When the quark catcher is pumped empty, set up the separator for CIP cleaning: Switch over the two-flap valves. Close the ice-water supply to the hood. Throttle the whey discharge valve so that slight overflow occurs. Keep the valve throttled during the whole cleaning process. This way the hood and the outer bowl walls will be thoroughly cleaned, too.

Recommended cleaning program:

1) Flushing with alkaline solution,
2) Flushing with water,
3) Flushing with acid solution,
4) Flushing with water.

IMPORTANT: Each program step is finished up by a total de-sludging procedure which is to be initiated manually by actuating the push button "De-sludging" on timing unit TA 2 S or by actuating the hand lever on the solenoid valve for operating water for 5 seconds.

Before each total de-sludging the feed to the separator must be shut off.

6.5. Stopping the separator

- Perform CIP cleaning (see sect. 6.4).
- Switch off the timing unit.
- Switch off the motor.
- Apply brake by turning handle anti-clockwise.
  ATTENTION: **Do NOT loosen any part of the separator before the bowl has stopped completely.**

  Note that the bowl has not stopped before the revolution indicator disc (fig. 3/3) has ceased rotating.
- Close main shut-off valve in operating-water line.
- If dismantling of the bowl is intended, it should be done immediately after stopping of the bowl when the contact surfaces of the bowl parts are still wet.

7.1. Cleaning the bowl

Self-cleaning bowls need not be taken apart for cleaning at the end of a run, unless the nature of the separated solids makes bowl dismantling for thorough cleaning necessary. Experience will show how often the bowl has to be dismantled.

During the first few months of operation, the lock rings should be removed every two weeks for greasing the threads, to prevent seizing. Later on, the greasing intervals may be extended. However **the bowl should be dismantled at least every two months** for thorough cleaning of the inner bowl parts.

Never use metal scrapers or metal brushes for cleaning the discs and bowl parts.

Remove gaskets from the bowl parts and clean grooves and gaskets to prevent corrosion. Replace damaged gaskets. Swollen gaskets should be left to dry at a warm place so that they can regain their original dimensions and can be re-used.

The gaskets in bowl bottom and sealing-chamber bottom whose edges have been frayed through abrasion, can be re-used after grinding off the edges with an emery wheel. When grinding, be careful not to damage the sealing surfaces.

Special care should be taken in cleaning the small orifices in threaded ring and sliding piston for feed and discharge of operating water (fig. 10/1) to ensure trouble-free performance of the de-sludging process.

To prevent clogging of the nozzles when re-starting the separator, make sure that all nozzles are open and that no solids are left in the bowl.

Clean and wipe dry guide surfaces and threads of bowl parts and grease them (see 2.2). Spindle cone and inside of bowl hub should be oiled and then **wiped clean and dry with a smooth rag.**

Re-assemble bowl immediately after cleaning.

7.2. Cleaning the operating-water feeding system

The strainer in the water pressure reducer (fig. 14/4) and the small holes in the operating-water feeding device should be cleaned every 3 - 6 months.

7.3. Cleaning the gear chamber

When changing oil, clean gear chamber thoroughly with kerosene. Be sure to remove all metal particles from walls and corners. Do NOT use fluffy cleaning rags or cotton waste.

7.4. Cleaning prior to a long-term shut-down of the separator

Prior to a long-term shut-down, clean the separator thoroughly (see 7.1). The clean bowl parts and all unvarnished machine parts should be wiped dry and greased to avoid corrosion. The clean grease-coated bowl should be kept in a dry place.

To prevent gaskets from getting brittle, keep them in a cool and dry room, protected from dust and light.

Drain the lubricating oil and fill gear chamber with corrosion-preventing oil, e.g. SHELL Ensis Oil 30. Oil level must be up to middle of sight glass. Let separator run without bowl for approx. 10 minutes to make sure that all gear parts are coated with the corrosion-preventing oil. Then drain the oil. Oil upper end of spindle by hand.

Check water shut-off devices for leakage. If necessary, remove connecting piping between faulty shut-off device and separator to avoid damage which may be caused by drip water.

Stop operating-water supply at the branch point of the water mains to prevent inrush of water into the separator, caused by unintended opening of the shut-off valve.

Before re-starting the separator, fill gear chamber with the lubricating oil specified on page 2/1. Oil level must be slightly above middle of sight glass. Then let the separator run without bowl for 10 minutes.

8.1. Removing the vertical gear parts

After dismantling the upper bowl parts unscrew spindle nut **(left-hand thread).** Use jack 405 to remove bowl bottom from the spindle cone and to lift the whole assembly out of the frame.

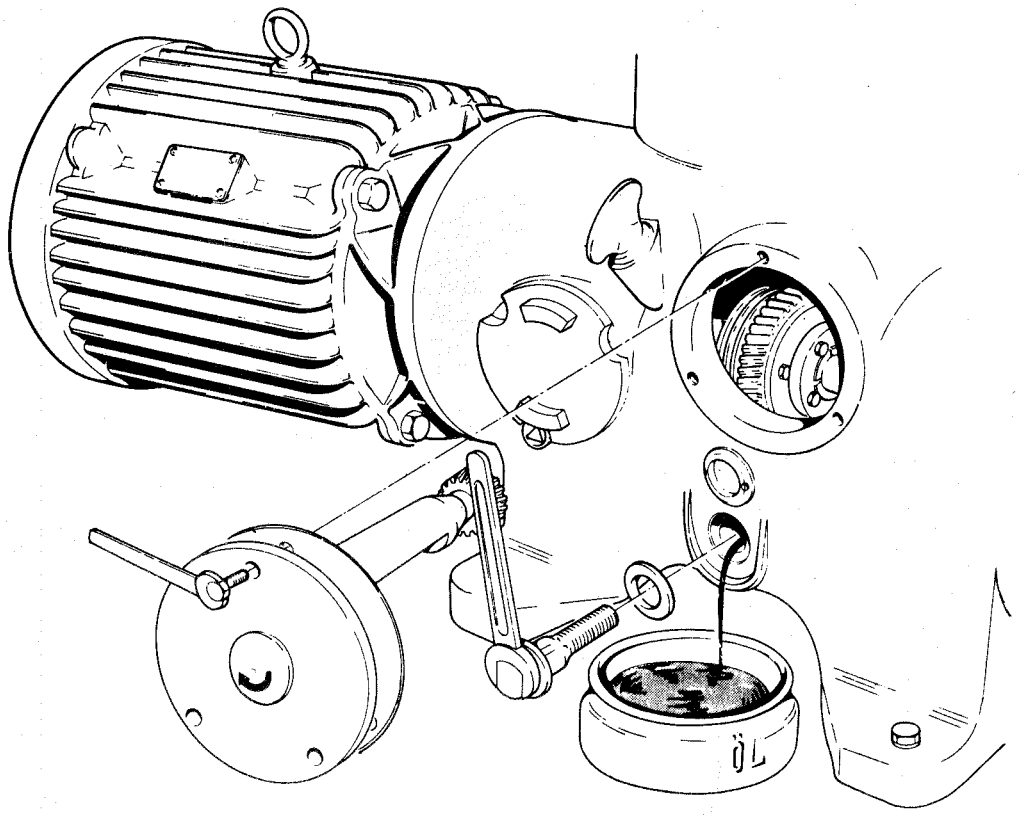


Fig. 8/1a

Undo oil drain screw and let oil drain into oil pan.

Unscrew hex head screws of revolution indicator housing.

Remove the housing.

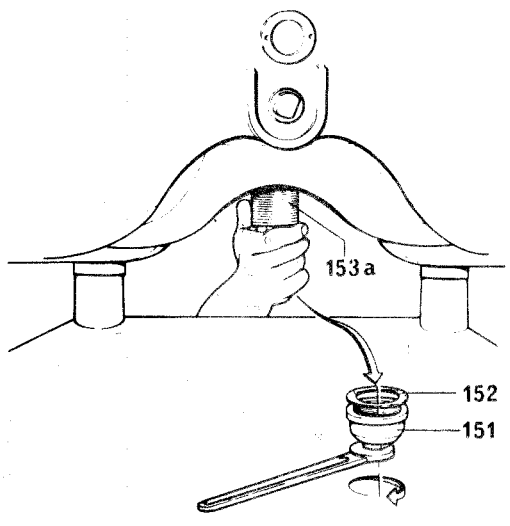


Fig. 8/1b

Unscrew bottom bearing cap 151 and remove gasket 152.

Unscrew bottom bearing threaded piece 153a and remove it together with the other parts of bottom bearing.

If bottom bearing housing 156 (fig. 16/1) has to be replaced, straighten tab washers 155 and unscrew hex head screws 154. Then take two hex head screws and screw them into two opposite tapholes of the housing. By doing this, the housing will come out of the lower section of the frame.

Unscrew hex head screws 159s and remove operating-liquid feeding device 39, spindle cap 158h, neck bearing protection cap 159m and spindle spring 158g.

Screw spindle nut 258 onto worm spindle, by hand. Then pull out worm spindle together with neck bearing bridge.
IMPORTANT: Be sure not to damage gaskets 159k and 159a; if necessary, install new gaskets.

Detach neck bearing bridge from worm spindle by turning spindle upside down and tapping it on a piece of wood (see fig. 8/2b).

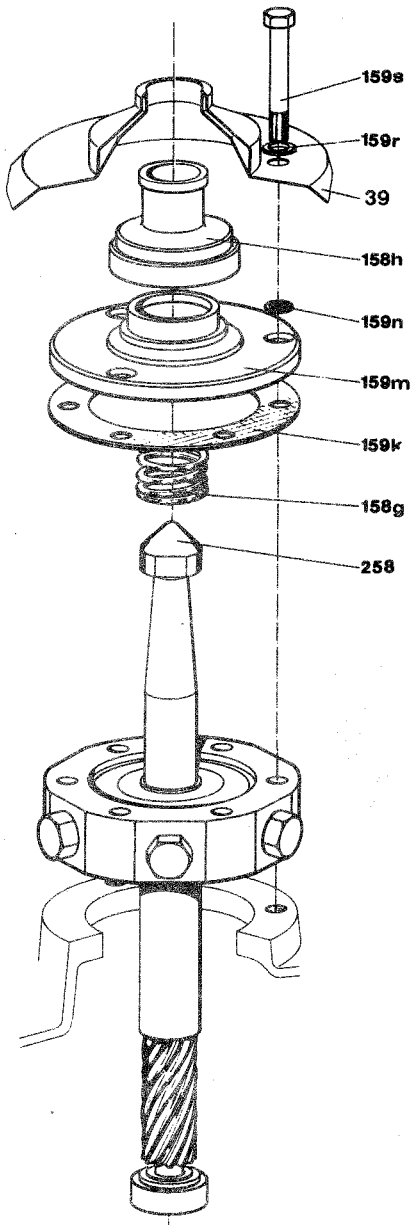


Fig. 8/2a

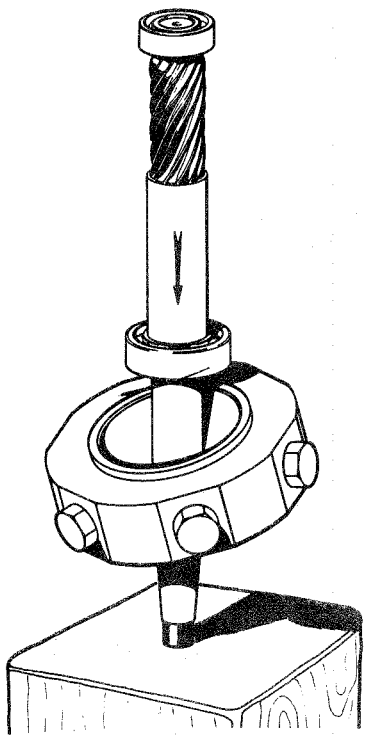


Fig. 8/2b

8.2. Assembling the vertical gear parts

When assembling the vertical gear parts proceed in reverse order of removal (see 8.1) and according to the instructions given below (see 8.2.1 - 8.2.3).

8.2.1. Important hints

Before assembling clean gear chamber thoroughly (see 7.3).

For reasons of safety, replace ball bearings on worm wheel shaft and on worm spindle every 5,000 operating hours.

Check ball bearings of worm spindle before re-fitting.
IMPORTANT: Only the high precision ball bearings listed in this manual may be used.

Heat ball bearings as well as ball bearing protection rings in approx. 80°C oil, before fitting them on the spindle.

It must be possible to install the worm spindle, with ball bearings attached, without having to hit on the upper spindle end, and to move the built-in spindle axially by hand. If this is not the case, smooth the inside of the bottom bearing housing with a very fine emery cloth.

When replacing the worm spindle 158c, the worm wheel assembly with clamp plates, 208, should be replaced at the same time, since this part, also worn down to some extent, would cause premature wear to the new worm spindle.

When installing the neck bearing bridge assembly 159b-g, check to be sure that gaskets 159a and 159k are in good condition.

IMPORTANT: After re-assembly of the vertical gear parts, check bowl height for possible re-adjustment (see 8.3).

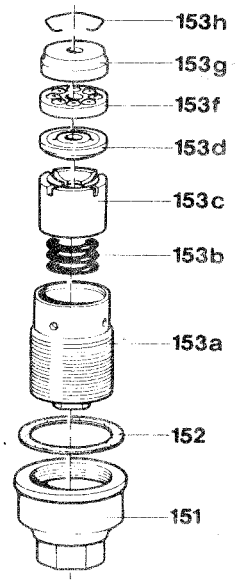


Fig. 8/3

8.2.2. Assembling the bottom bearing

Thoroughly clean all constituent parts of bottom bearing 153a-h.

Fit pressure spring 153b into bottom bearing pressure piece 153c.

Put bottom bearing pressure piece with inserted pressure spring into bottom bearing threaded piece 153a.

Put set of bottom bearing running parts into bottom bearing threaded piece:
Bottom bearing pressure disc 153d,
Ball cage 153f,
Bottom bearing running disc 153g.

Insert snap ring 153h in bottom bearing threaded piece.

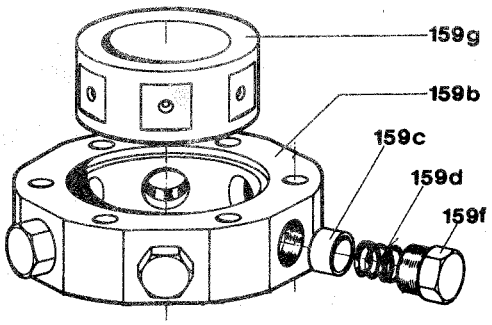


Fig. 8/4a

8.2.3. Assembling the neck bearing bridge

The upper ball bearing of the worm spindle is contained in pressure ring 159g which is held by six radially arranged, evenly distributed springs 159d.

Insert pressure ring in neck bearing bridge 159b in such a manner that the six recesses of the pressure ring face the six tapholes of the neck bearing bridge.

Grease spring pistons 159c thoroughly, put neck bearing springs 159d into spring pistons and slip threaded plugs 159f on spring pistons.

Screw threaded plugs with spring pistons and neck bearing springs into tapholes of neck bearing bridge and tighten them.

8.3. Re-adjustment of bowl height

The bowl height has been adjusted at the factory prior to shipment of the separator. It must be checked for possible re-adjustment after re-assembling the vertical gear parts, after exchanging the bowl or the centripetal pump, and as soon as the centripetal pump shows grinding marks.

Correct bowl height adjustment can only be made when the bowl is properly closed, i.e. when the "O" marks of bowl lock ring and of bowl bottom are aligned.

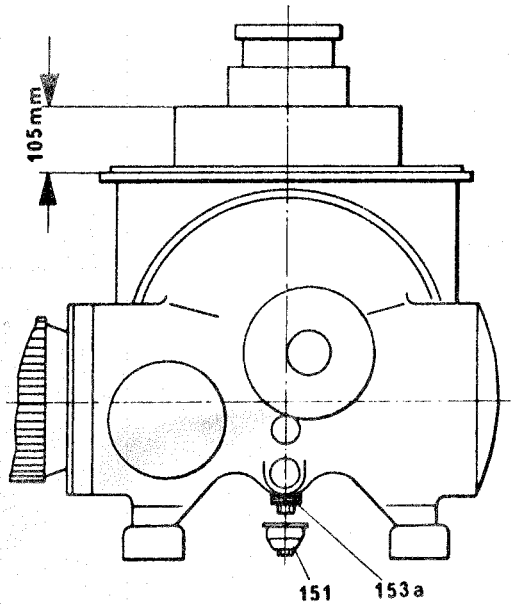


Fig. 8/5a

The bowl height is properly adjusted if there is a clearance of 105 mm between upper edge of sediment collector and upper edge of bowl lock ring (fig. 8/5a).

Check also whether the centripetal pump has proper clearance in the pump chamber (approx. 4 mm above and below).
To do this, loosen Allen screws on feed and discharge housing 72 of completely assembled machine and raise feed and discharge housing together with centripetal pump and nut 84 to limit (thus bringing centripetal pump against pump chamber cover).

The centripetal pump has equal clearance in the pump chamber when there is a clearance of 3 to 4 mm between upper edge of hood and contact surface of feed and discharge housing (fig. 8/5b).

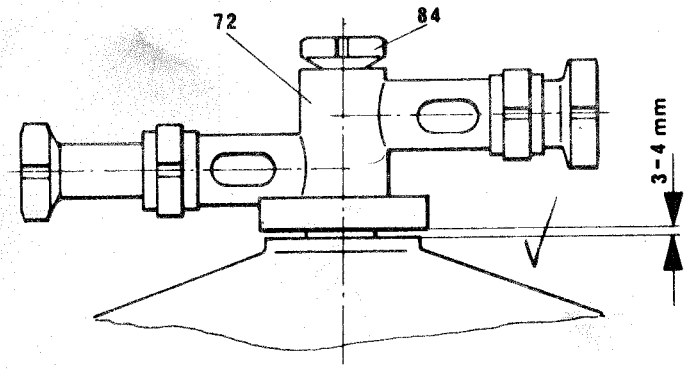


Fig. 8/5b

If the distance does not conform to this measurement, remove bottom bearing cap 151 and re-adjust bowl height by turning bottom bearing threaded piece 153. A full turn of the bottom bearing threaded piece to the right or to the left raises or lowers the bowl by 1.5 mm.

ATTENTION: Under no circumstances should the bowl be placed so high that the upper ball bearing is exposed to axial stress since this would result in uneven running of the separator and in premature wear of the ball bearing. It is, therefore, recommended that, upon adjustment, the bottom bearing threaded piece be turned **counter-clockwise** by half a turn to lower the bowl by 3/4 mm. By this means, axial stress on the upper ball bearing will be eliminated.

After adjusting to proper bowl height, replace bottom bearing cap with gasket and tighten it firmly.

8.4. The Centrifugal Clutch

8.4.1. General

The centrifugal clutch **gradually** brings the bowl up to its rated speed, elimating premature wear on gear parts and motor. The acceleration time can be controlled by the number of clutch shoes used.

When fewer clutch shoes are used, the friction moment will be lower, the starting time longer, and wear on gear parts and motor less. Two, three, four or six clutch shoes must be used, depending on the motor power to be transmitted.
The clutch shoes are to be fitted - **evenly distributed** - into the clutch driver (see 8.4.3).
Note that the driving effect of new clutch shoes will improve after several starts.

Smoking of the clutch during the first few starts is quite normal and will disappear after a short time of operation.

If the bowl comes up to rated speed as per name-plate of separator in less than 3 minutes, the motor will pull too high a starting current. This condition can be easily overcome by reducing the number of clutch shoes to four, three or two. Be sure to keep the shoes evenly distributed (fig. 8/7a).

Check condition of clutch shoes from time to time. Make sure to replace the clutch shoes before their linings are worn down to the rivet heads, to avoid damage to the contact surface of the ring of the clutch drum. Such damage would result in premature wear of the clutch shoe linings. To avoid unbalance, **all** the clutch shoes have to be replaced as soon as one of their linings is worn. Never replace clutch shoes separately.

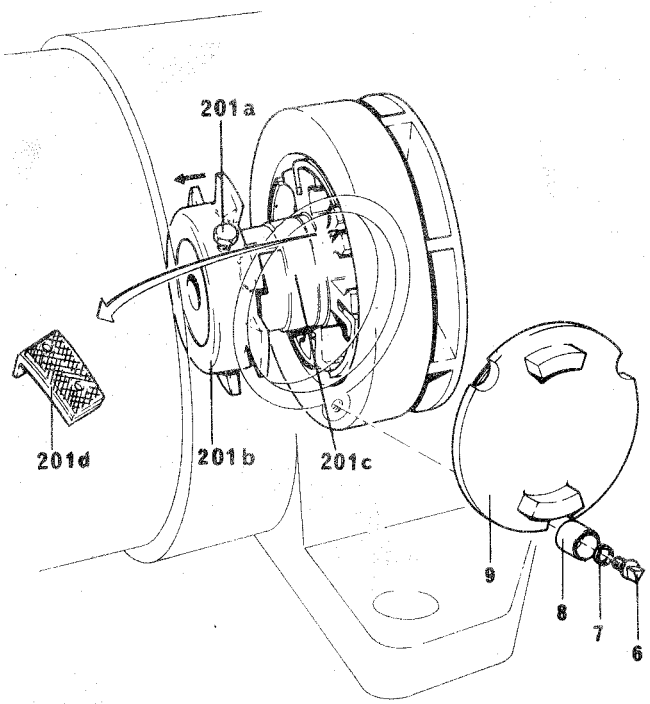


Fig. 8/6

8.4.2. Removing the clutch shoes

Remove triangular screw 6 and cover 9.

Use socket wrench 421 to loosen screw 201a.

Push clutch cover 201b towards motor side.

Pull out clutch shoes 201d towards motor side.

8.4.3. Fitting the clutch shoes

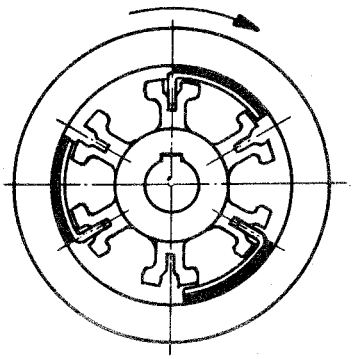


Fig. 8/7a
Clutch driver with clutch shoes (seen from motor side)

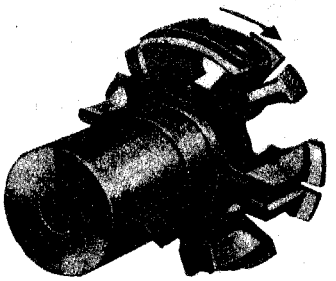


Fig. 8/7b
Clutch driver with one clutch shoe

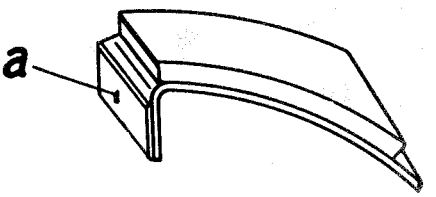


Fig. 8/7c
Clutch shoe

Put clutch shoes 201d (two, three, four or six shoes) - evenly distributed - in slits of clutch driver 201c in such a manner that they will be **pushed** by the driver and NOT pulled. See figs. 8/7a-c. Make sure the shoes fit loosely in the slits of the clutch driver.

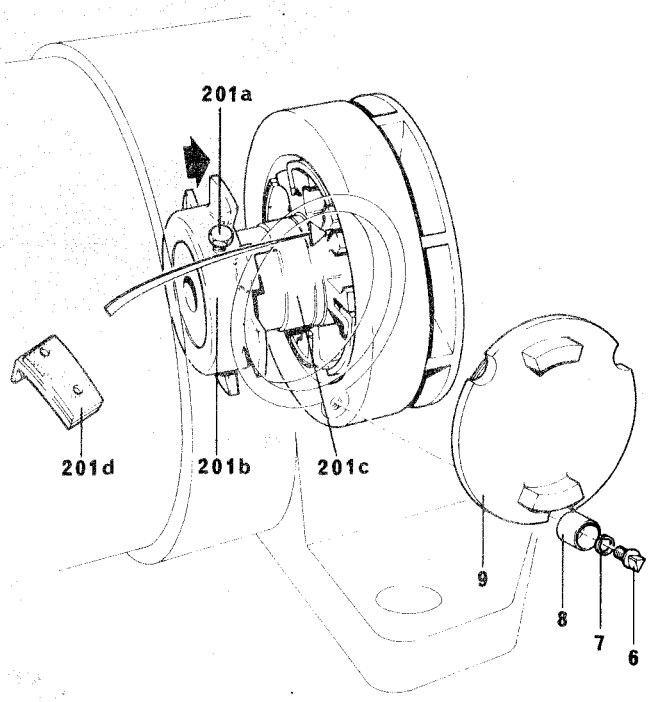


Fig. 8/7d

Push clutch cover 201b forward until it rests **on** the centering rim of clutch driver 201c and NOT before it.

Tighten hex head screw 201a in clutch cover, using socket wrench 421.

Screw cover 9 into lower section of frame and arrest it by means of screw 6, cap 8 and lock washer 7.

In case the clutch emits disturbing noises during the acceleration period, apply a very thin coat of molybdenum disulfide paste to lips "a" of the clutch shoes (fig. 8/7c). If too much paste is applied, there is the chance that some might be thrown by centrifugal force on the friction surfaces, leading to clutch slippage.

8.5. Removing the horizontal gear parts

8.5.1. Removing the motor

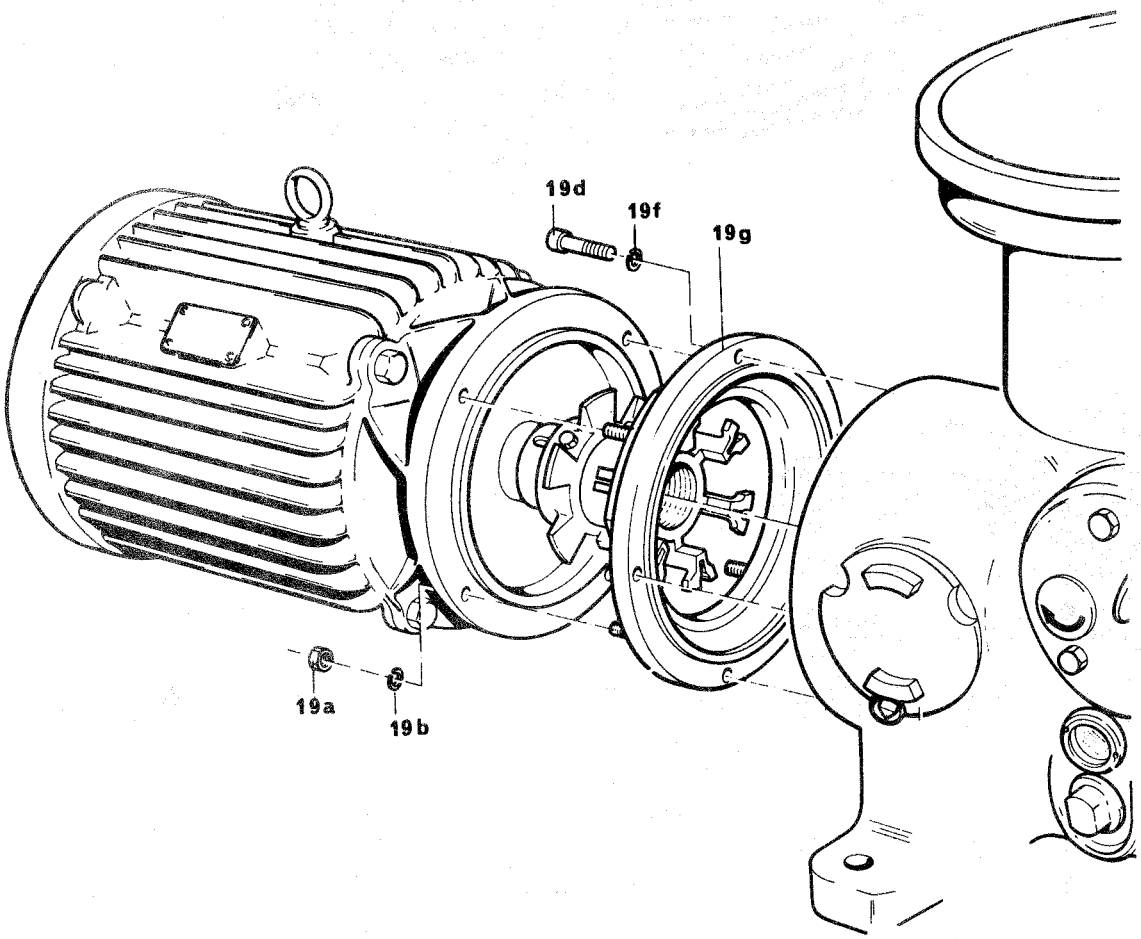


Fig. 8/8

Remove lead-in wires from motor terminals.

Take out clutch shoes (see 8.4.2).

Remove hexagon nuts 19a from motor flange and take off lock washers 19b.

Remove motor together with clutch driver 201c.

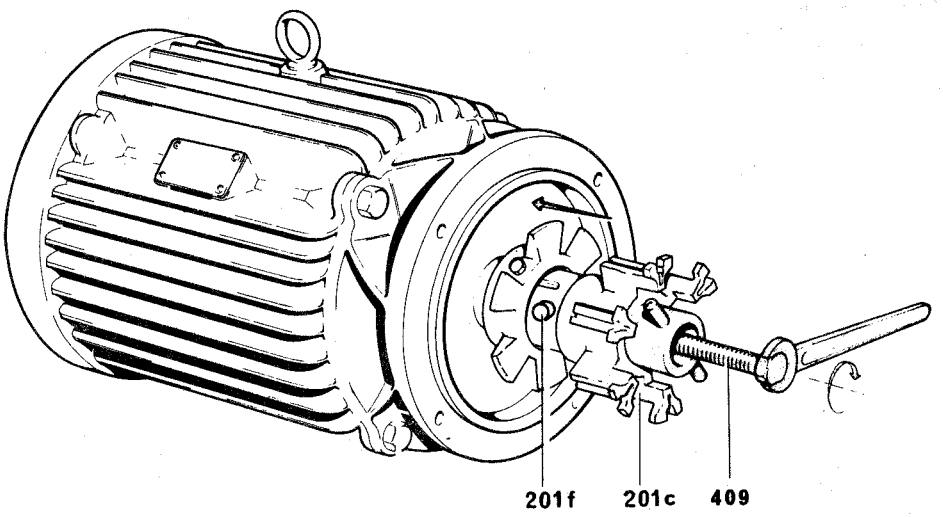


Fig. 8/9a

Use wrench 421 to loosen hex head screw 201f in clutch driver.

By means of pulling device 409 remove clutch driver from motor shaft end.

8.5.2. Removing the centrifugal clutch

Remove the motor (see 8.5.1).

Unscrew hex head screws 19d and remove flange 19g (see fig. 8/8).

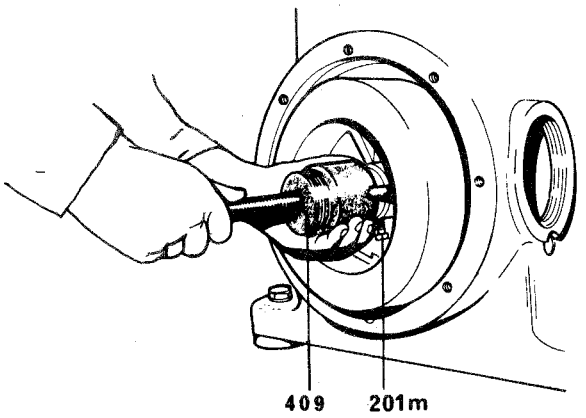


Fig. 8/9b

Loosen hex head screw 201m which is found in the hub of clutch drum 201h.

Use pulling device 409 to withdraw clutch drum from worm wheel shaft end, on motor side. Then remove clutch drum by hand.

8.5.3. Removing the worm wheel shaft and the worm wheel

Remove motor (see 8.5.1).

Remove flange (see fig. 8/8).

Loosen oil drain screw and let oil drain into oil pan (fig. 8/1a).

Remove revolution indicator housing (fig. 8/1a).

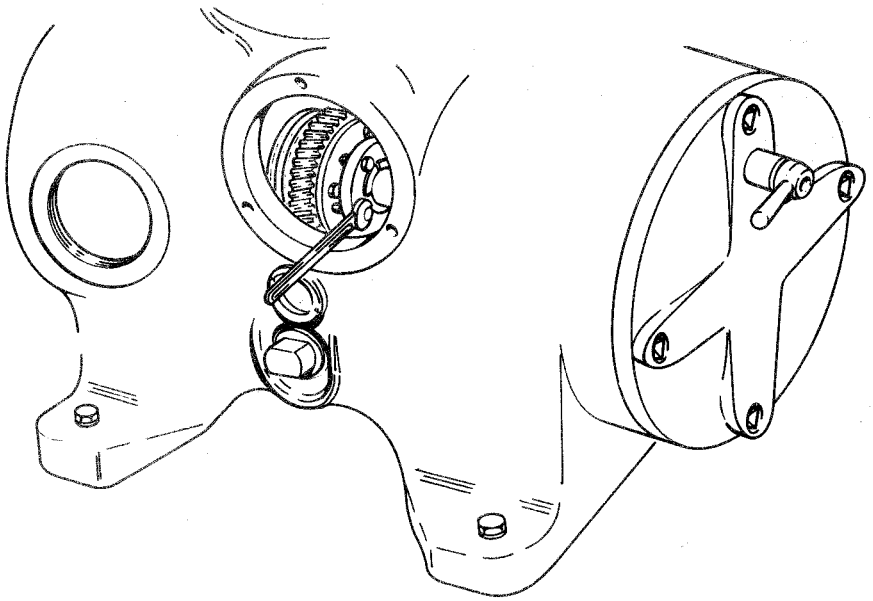


Fig. 8/10a

Loosen hex head screws 208h in clamp plates of worm wheel. While doing so, hold clutch drum to prevent worm wheel shaft from rotating.

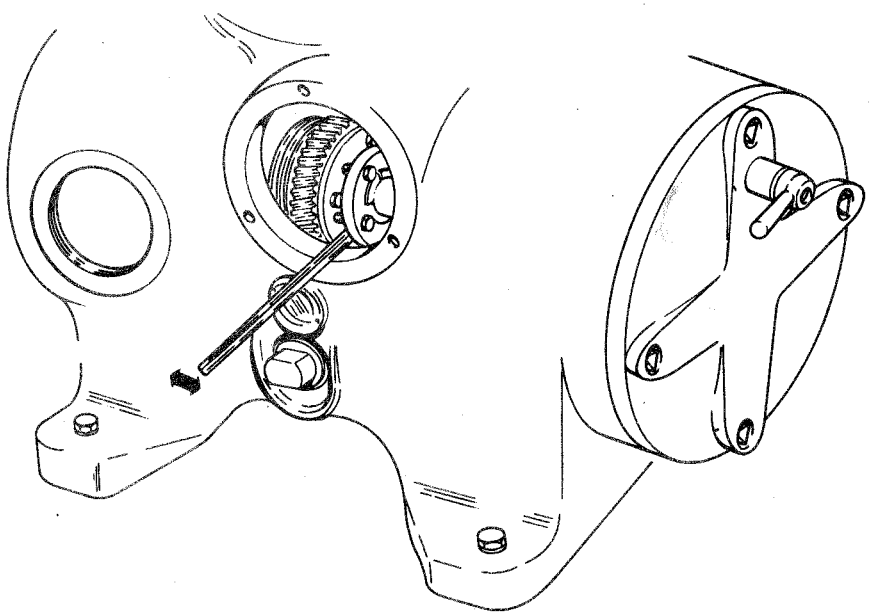


Fig. 8/10b

Loosen clamp plates 208a and 208g so that worm wheel can be moved on worm wheel shaft.

Loosen hex head screw 201m in hub of clutch drum.

Use pulling device 409 to withdraw clutch drum 201h from worm wheel shaft end, on motor side. Then remove clutch drum by hand (fig. 8/9b).

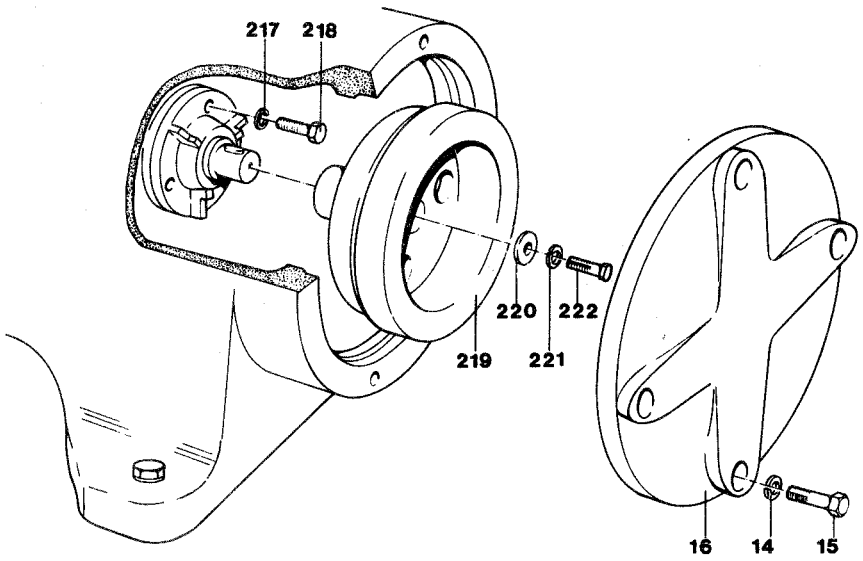


Fig. 8/11a

Undo triangular screws 15 and remove cover 16.

Undo hex head screw 222 and remove lock washer 221 and centering disc 220.

Remove brake drum 219 by hand.

Use socket wrench to unscrew hex head screws 218 holding the bearing cover.

Remove key 209 from shaft end (fig. 8/11b).

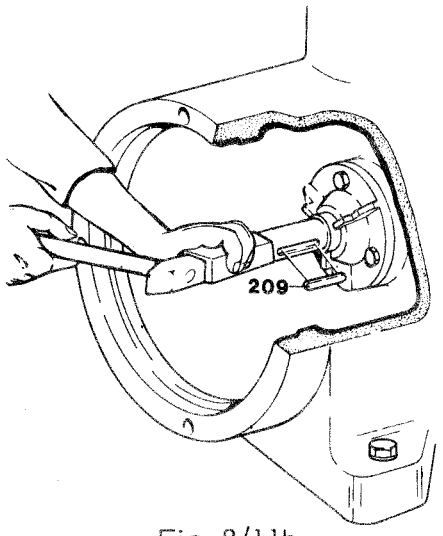


Fig. 8/11b

Place a piece of hard wood against worm wheel shaft end and hit it with a hammer to drive out shaft towards brake side.
When shaft has completely loosened from ball bearing on motor side, remove shaft by hand. While doing so, hold worm wheel to prevent damage to gear teeth.

Take worm wheel assembly with clamp plates out of the gear chamber.

8.6. Assembling the horizontal gear parts

For assembly proceed in reverse order of removal (see sect. 8.5). The following should be kept in mind:

For reasons of safety, replace ball bearings of worm wheel shaft and of worm spindle every 5,000 operating hours.

The worm wheel with clamp plates, 208, has been balanced in the factory as a complete assembly. To avoid unbalance, clamp plates 208a and 208g must, therefore, NOT be rotated on the wheelbody 208d, and parts 208a-d and 208g must NOT be replaced individually.

When mounting the worm wheel assembly with clamp plates push the worm wheel towards brake side until it rests against shoulder of worm wheel shaft 210. This ensures correct positioning of the toothed rim with reference to the worm spindle.

The worm wheel must be firmly clamped to the worm wheel shaft, accomplished by tightening screws 208h in both clamp plates. Tighten screws cosswise, by single turns, to make sure clamp plates are drawn together evenly.

IMPORTANT: When toothed rim 208c is worn and needs replacement, the entire worm wheel assembly with clamp plates, 208, must be replaced. It is recommended that worm spindle 158c be replaced at the same time, since this part, also worn down to some extent, would cause premature wear to the new toothed rim.

After mounting new gear parts, install the bowl and adjust to correct height (see 8.3).

Fill gear chamber with oil as specified in sect. 2. Oil level must be slightly above middle of sight glass.

Check spindle speed with a hand tachometer (see 3.5) and check direction of rotation of the bowl (see 3.4).

To run in new gear parts (worm wheel, worm spindle), let separator run - without bowl - for about one hour. During this time, switch motor on and off several times.

Servicing Program	Lubricant	Operating hours 250	750	1500	3000	5000	MAINTENANCE	Every week	3 month	6 month	year	2 years
Lubrication Chart	Lubricant	▨					First oil change after initial start-up.					
	O						Check oil level.	▨				
	O		▨				Oil change and thorough cleaning of the gear chamber.			▨		
	O			▨			Lubrication of hand-operated parts, such as brake bolts, etc.			▨		
	MF	when disassembling					Grease sliding surfaces and threads of essential parts of the self-cleaning bowl.	when disassembling				
	F				▨		Pack motor bearings with grease.				▨	
	Cleaning		when necessary				Clean filter in operating-water pressure reducer.		when necessary			
				▨			Clean gear chamber (oil change).			▨		
					▨		Remove bottom bearing and clean all parts thoroughly.				▨	
		when necessary					Remove bowl and clean interior of upper section of frame.	when necessary				
		when necessary					Dismantle bowl and clean all bores, nozzles and chambers of the hydraulic system.	when necessary				
	Inspection			▨			Remove bowl gaskets. Clean gaskets and grooves and check grooves for corrosion.			▨		
				▨			Check starting time. Check clutch linings for wear.			▨		
				▨			Check brake linings for wear.			▨		
				▨			Inspect neck bearing springs and spring pistons.			▨		
					▨		After having removed the revolution indicator housing, check gearing of worm drive.				▨	
					▨		Check spindle speed (bowl speed).				▨	
	Replacement				▨		Replace clutch shoes.					
						▨	Replace ball bearings on spindle					
						▨	Replace ball bearings on worm wheel shaft.					

Abbreviations:
O = Lubricating oil
MF = Lubricating grease containing MoS_2
F = Roller and ball bearing grease

10.1. General

Troubles	Causes	Remedies
10.1.1. The bowl does not come up to rated speed or takes too long to do so (see 3.5).	Brake is on.	Release brake by turning handle clockwise.
	Motor is incorrectly connected.	See wiring diagram.
	Friction surfaces of clutch shoes are oily.	Wipe friction surfaces dry. Do NOT use benzine, nor trichlorethylene, nor any other solvent.
	Linings of clutch shoes are worn.	Replace clutch shoes (see 8.4.2 and 8.4.3).
	Insufficient number of clutch shoes.	Add one or two clutch shoes (see 8.4.1 and 8.4.3).
	Bowl is too high or too low and, therefore, rubs against centripetal pump.	Adjust to proper bowl height (see 8.3).
	Liquid or sludge has collected in the sediment collector, resulting in slowing-down of the bowl.	Check frame drain; liquid must run out freely (see sect. 1). Clean sediment collector underneath the bowl.
	Clamp plates are not tight; worm wheel slips on shaft.	Tighten long hex head screws on worm wheel evenly and **firmly.** Tighten crosswise, by single turns.
	Product feed valve is open.	Close product feed valve.
10.1.2. The bowl speed drops during operation.	Friction surfaces of clutch shoes are oily.	Wipe friction surfaces dry. Do NOT use benzine, nor trichlorethylene, nor any other solvent.
	Motor speed drops during operation.	Inspect motor and line voltage.
	Nozzle bores are worn out, or nozzles are leaky due to damaged gaskets.	Install new nozzles. Replace the gaskets.

Troubles	Causes	Remedies
10.1.3. The bowl comes up to rated speed too quickly (in less than 3 minutes). Motor pulls too high a starting current.	Too many clutch shoes are used. Note that the driving effect of new clutch shoes will improve after several starts.	Reduce number of clutch shoes to four or three or two. Make sure shoes are equally distributed (see 8.4.1 and 8.4.3).
10.1.4. Uneven run of the separator.	Separated solids have deposited unevenly in the bowl (see also 10.2.5).	Stop separator and apply brake. Close product feed valve. Do NOT de-sludge the bowl, since de-sludging would increase vibrations occurring during slowing-down of the bowl. If the bowl leaks, open water feed valve all the way. Clean the bowl (see 7.1).
	One or several nozzles are clogged. The separated solids have deposited unevenly in the bowl.	Carry out a total de-sludging with subsequent flush de-sludging. If separator continues to run unevenly, open water-supply line all the way. Stop the separator, apply the brake, and clean the bowl.
	Sediment of very solid structure has hardened as a result of too long a retention time in the bowl.	Perform total de-sludgings at shorter intervals, - if necessary with subsequent flush de-sludgings.
	Bowl is not properly assembled or, if plant has several separators, parts of different bowls may have been interchanged.	Assemble bowl properly (see 4.1).
	Tension of disc stack has slackened.	Make sure bowl lock ring is screwed on tightly (see 4.1.2, page 9). Check disc count. If necessary, add spare disc or compensating disc.
	Bowl is damaged and, therefore, out of balance.	Send bowl to factory or authorized factory repair shop. Do NOT attempt to make your own repairs. Never weld or solder. Bowl is made of heat-treated steels.

Troubles	Causes	Remedies
10.1.4. Uneven run of the separator. (cont'd)	Neck bearing springs are weak or broken.	Replace all six neck bearing springs.
	Pressure spring in bottom bearing is broken. Bowl is found to be about 2 mm too low in the frame.	Install new pressure spring (see 8.2.2). Adjust to proper bowl height (see sect. 8.3).
	Ball bearings are worn.	Replace damaged bearings. **IMPORTANT:** When replacing, use only the high precision ball bearings as specified in the Parts List.
	Gear parts are in bad condition as a result of	Clean gear chamber thoroughly (see 7.3).
	1. normal wear,	Replace damaged gear parts (see 8.2 and 8.6).
	2. premature wear caused by: a) lack of oil b) oil of too low a viscosity, in general, recognized by blue tempering colour of gear parts	Change oil (see chapt. 2). If necessary, change oil more often.
	c) metal abrasives present in the lubricating oil due to the following possible causes: viscosity of oil is too low, oil has not been changed in time, gear chamber has not been cleaned,	
	d) replacement of one gear part only, instead of both parts.	
	e) inrush of water because automatic valves for operating-water had been open for a longer period after shut-down of the separator.	Regarding **inrush of water,** the following should be kept in mind: Make sure manual shut-off valve ahead of the operating-water connection is always closed during shut-down of the separator.

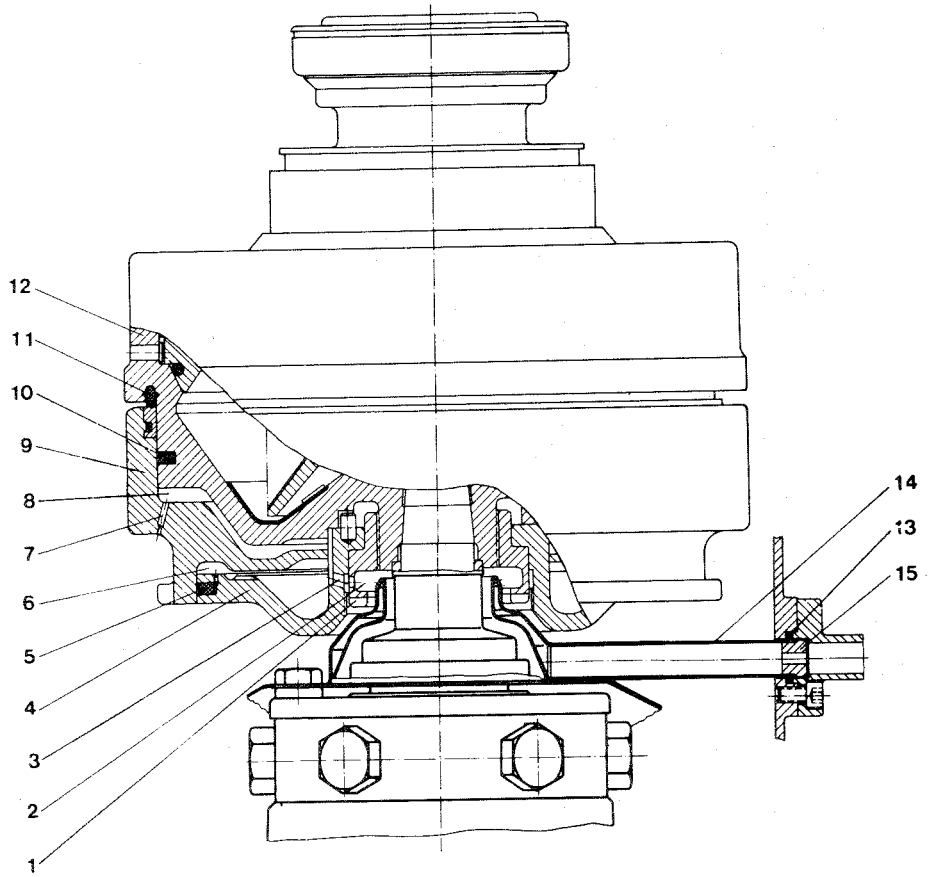
10.2. Bowl performance (see fig. 10/1)

Troubles	Causes	Remedies
10.2.1. The bowl does not close.	Orifices 3 in threaded ring and sealing chamber bottom - leading from injection chamber to sealing chamber - are clogged or the injection chamber is soiled.	Remove bowl bottom (see 4.3). Clean orifices and injection chamber.
	Orifice 7 in sliding piston, through which the opening water discharges, is clogged.	Remove sliding piston (see 4.3). Clean orifice. Be sure not to enlarge diameter of orifice (1.2 mm) while cleaning.
	Sludge has deposited at the periphery of the opening chamber. This prevents the piston from rising to its highest position and sealing off the centrifugation room.	Dismantle the bowl (see 4.3). Clean the opening chamber. If necessary, replace gasket 10. Check operating-water for impurities.
	Gasket 5 in sealing-chamber bottom is damaged or its edges have been frayed through the up- and down movement of the sliding piston.	Replace damaged gasket. If, however, only the edges of the gasket are frayed and the gasket is not damaged otherwise, it can be re-used after grinding off the edges with an emery wheel.
10.2.2. The bowl does not close properly.	Gasket 5 in sealing-chamber bottom or gasket 10 in bowl bottom does not seal properly.	Make sure gasket is stretched out enough. Before fitting in gaskets, **lightly** lubricate the groove in sealing-chamber bottom or, respectively, in bowl bottom (see 4.1.1 No. 2).
	Gasket 11 in bowl bottom is damaged.	Replace gasket.
	Sealing edge of sliding piston is damaged.	Re-turn sealing edge very lightly as soon as traces of erosion are to be seen. Be sure not to remove more than 2.5 mm of the material.
	Shut-off valve for operating water does not close properly.	Install a new shut-off valve.

Troubles	Causes	Remedies
10.2.3. The bowl does not open at all or not completely.	The operating-water pressure is too low or fluctuates too much due to tapping water for other purposes.	Check line pressure; if necessary, assemble operating-water line separately to avoid fluctuations of pressure.
	Strainer in water-pressure reducer of operating-water line is clogged.	Clean strainer.
	Gasket 13 in operating-water line is damaged. Part of the operating water seeps away.	Replace gasket.
	The inner diameter of the operating-water line has become too small due to dirt accumulation or damage.	Clean or replace operating-water line.
	Dry dirt or rubber particles have settled between bowl bottom and sliding piston or between sliding piston and sealing-chamber bottom.	Clean bowl parts. See 7.1. Round off edges on gaskets. Replace damaged gaskets. Grease contact surfaces.
	The sealing chamber is soiled.	Dismantle bowl (see 4.3) and clean sealing chamber.
10.2.4. Partial de-sludgings are irregular.	Operating-water pressure fluctuates.	Pressure fluctuations should not exceed 0.2 bar: If necessary, install a separate operating-water line or install a tank (approx. 50 - 100 litres) with pressure-controlled pump. The operating-water pressure should range between 1.5 and 3 bar.
	Orifice plate 15 has not been installed.	Install orifice plate.
	The inner diameter of orifice plate 15 is too large for the existing operating-water pressure. Opening and closing of the bowl takes place so quickly that any small change in water pressure causes an irregularity in partial de-sludging.	Solder up hole of orifice plate and drill in a new hole. I.D. of orifice plate should be dimensioned so as to ensure perfect partial de-sludgings and to allow, in addition, quick and efficient complete de-sludgings. A partial de-sludging will then take 1 - 2 seconds.

Troubles	Causes	Remedies
10.2.5. The bowl does not de-sludge completely.	The bowl has been closed too early. Solid particles which could not be ejected, have gradually accumulated and hardened through the long time of centrifugation.	Clean bowl thoroughly (see 7.1). Leave operating-water valve open for about 10 seconds. If necessary, finish up by flush-water de-sludging procedures (see 5.2).
	Discharge nozzle 7 in sliding piston, through which the water leaves the opening chamber, has become too large due to cleaning or erosion. The sliding piston moves down too slowly; part of the sludge remains in the bowl.	Reduce diameter of nozzle bore to 1.2 mm. This is done by drilling up the nozzle bore to 4 mm, then closing it by driving in a pin and boring it to proper diameter; or re-tap nozzle bore to size.
10.2.6. Gasket 11 in bowl bottom wears off too fast.	Bowl has been closed too early. Solids have become lodged between top of piston and gasket in bowl bottom.	Extend opening time of operating-water valve.
	The product contains abrasive solids.	Be sure to pre-strain product before feeding it to separator.
10.2.7. The bowl does not close or open properly after a long-term shutdown of the separator.	The bowl has not been cleaned thoroughly before the long-term shutdown of the separator. Scale has deposited between sealing-chamber bottom and sliding piston or between sliding piston and bowl bottom.	Before dismantling the bowl, dissolve the scale with citric acid. Then take bowl apart and clean the parts thoroughly. See 7.1.

Bowl and operating-water feed assembly shown with regard to possible operating troubles (refer to sect. 10.2)



1 Threaded ring
2 Injection chamber
3 Feed channel
4 Sealing-chamber bottom
5 Gasket in sealing-chamber bottom
6 Sealing chamber
7 Discharge nozzle
8 Opening chamber
9 Sliding piston
10 Gasket in bowl bottom
11 Polyamid gasket in bowl bottom
12 Bowl bottom
13 Gasket in operating-water line
14 Operating-water supply line
15 Orifice plate

Fig. 10/1

The **operating-water pressure** should be at least 1.5 bar and should not exceed 3 bar.

By means of pressure reducing valve adjust operating-water pressure to 2 ar (the solenoid valve being open).

For partial de-sludgings be sure to maintain equal operating-water pressure.

Pressure fluctuations up to 0.2 bar are permissible.

I.D. of operating-water line: 1/2" when up to 3 m long
3/4" when longer than 3 m.

Required amount of operating-water: 2 l/10 s at a pressure of 2 bar.

In case of a pressure other than 2 bar the amount of operating-water can be controlled by using an orifice plate 15 with an adequate I.D.

LIST OF PARTS

IMPORTANT!

When ordering parts, please state the following:

1) Model 2) Serial-No.	of the Separator: Both designations are shown on the name-plate of the separator. The Serial-No. also appears on the rim of the sediment collector.
3) Description 4) Part-No.	of the part to be replaced: For details refer to List of Parts. The Part-No. is also shown on all major parts.
5) Bowl Serial-No.	(only required when ordering bowl parts): The Bowl Serial-No. appears, in large figures, on bowl lock ring and on bowl bottom.

Part-Numbers ending with letter "L" (e.g. 3158-1021-L) designate parts which are available in different designs for the separator concerned. To ensure correct delivery of these parts, **Model and Serial-No. of the Separator MUST be stated.**

Frame Parts

No.in Fig.	Part - No.	Qty.		Part Description
-	2162-3495-000	1		Revolution indicator assembly (1a-g)
1a	0026-1049-030	2		Cylindrical pin
1b	3117-3497-010	1		Revolution indicator disc
1c	0007-2502-750	1		Gasket 12/3
1d	2162-3493-000	1		Housing
1f	2162-3488-010	1		Shaft
1g	2162-3487-000	1		Worm wheel
2	0019-6903-150	3		Hex head screw M 8x20 DIN 933 - 8.8
3	0004-5228-700	1		Gasket 126/158 x 1
4	0001-0006-640	1		Sight glass
5	0004-5034-760	1		Gasket 34/44 x 1.5
6	0019-8594-100	1		Triangular screw AM 10x16 DIN 22424 - 5.6
7	0026-1337-190	1		Lock washer A 10 DIN 127
8	0026-2280-300	1		Cap B 26 DIN 22423
9	3037-1079-000	1		Cover
10	0019-9117-400	1		Oil drain screw M 22x1.5 DIN 7604
11	0007-1798-550	1		Gasket DIN 7603 - C22x27
-	3205-1020-000	1		Foundation frame assembly (13a-f)
13a	3033-1003-010	1		Foundation frame
13b	0021-3151-750	4		Rubber cushion M 12x75x40
13c	0026-2127-400	4		Cap
13d	0026-1371-400	4		Washer 13 DIN 125
13f	0019-6972-400	4		Hex head screw M 12x40 DIN 933
14	0026-1328-190	4		Lock washer A 12 DIN 127
15	0019-8619-100	4		Triangular screw AM 12x30 DIN 22424 - 5.6
16	3033-1066-010	1		Cover
17	0019-5053-090	1		Threaded pin M 8x16 DIN 553 - 5.8
-	1073-1043-010	1		Brake assembly (18a-g)
18a	0021-3515-300	1		Handle
18b	0004-1872-720	1		Gasket 13/25 x 2
18c	0021-3544-300	1		Brake housing
18d	0006-4338-160	1		Cylindrical pressure spring
18f	1073-1031-020	1		Brake bolt, complete
18g	0021-4100-880	1	*	Brake lining
-	0026-1263-550	2	*	Countersunk rivet 4x15 DIN 661
-	3033-1021-L	1		Flange assembly (19a-g)
19a	0013-0280-400	4		Hexagon nut M 12 DIN 934
19b	0026-1328-190	4		Lock washer A 12 DIN 127
19c	0019-7668-090	4		Stud M 12x35 DIN 939 - 5.6
19d	0019-6970-400	4		Hex head screw M 12x30 DIN 933 - 8.8
19f	0026-1328-190	4		Lock washer A 12 DIN 127
19g	3033-1028-L	1		Flange
20	0019-1741-800	1		Oil fill screw
21	3245-1001-000	1		Lower section of frame

* This part is included in the preceding "complete" part, but it is also available as separate item.

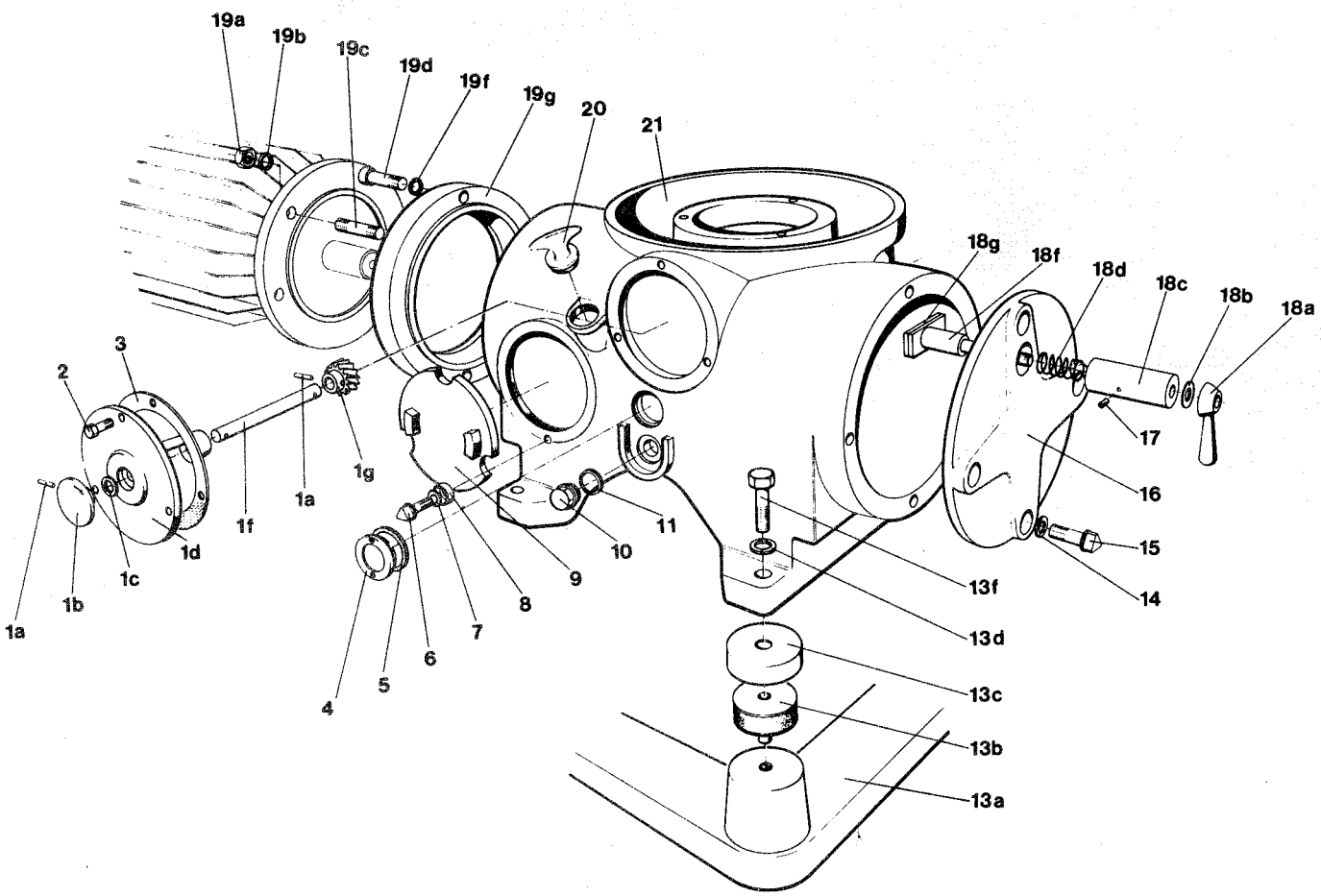

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Fig. 13

Sediment Collector and Hood

No.in Fig.	Part - No.	Qty.	Part Description
30	0019-6120-400	3	Allen screw M 8x16 DIN 912
31	3181-2184-000	1	Bend
32	0007-2507-750	1	Gasket 16/3.5
33	3181-2021-000	1	Orifice plate
34	0019-6164-400	4	Allen screw M 12x25 DIN 912
-	0004-2286-400	4	Gasket 12.7x18x1.5
35	0004-2363-758	1	Packing cord 6x8x850
36	3205-1018-020	1	Sediment collector
37	0004-2364-758	1	Packing cord 8x8x1450
38	0007-2796-840	1	Gasket 298/307x8
39	3205-1219-000	1	Operating-water feed
40	0019-6937-400	6	Hex head screw M 10x30 DIN 933
41a	0019-6971-400	4	Hex head screw M 12x35 DIN 933
41b	0013-0280-400	4	Hexagon nut M 12 DIN 934
41c	1185-1045-000	1	Pipe
41d	0004-2664-830	1	Gasket 130/178x1
-	1185-7759-000	1	Hood, complete (42a-k)
42a	0013-2811-400	2	Coupling nut R 1/2"
42b	0018-1844-400	2	Hose connection 10
42c	0007-2068-850	2	Gasket 10/16x3
42d	1185-7765-000	1	Hood
42f	0013-0405-400	3	Cap nut M10 DIN 1587
42g	0007-2106-820	1	Gasket 65/73x5
42h	8191-1061-010	1	Cover
42k	0013-0405-400	2	Cap nut M10 DIN 1587

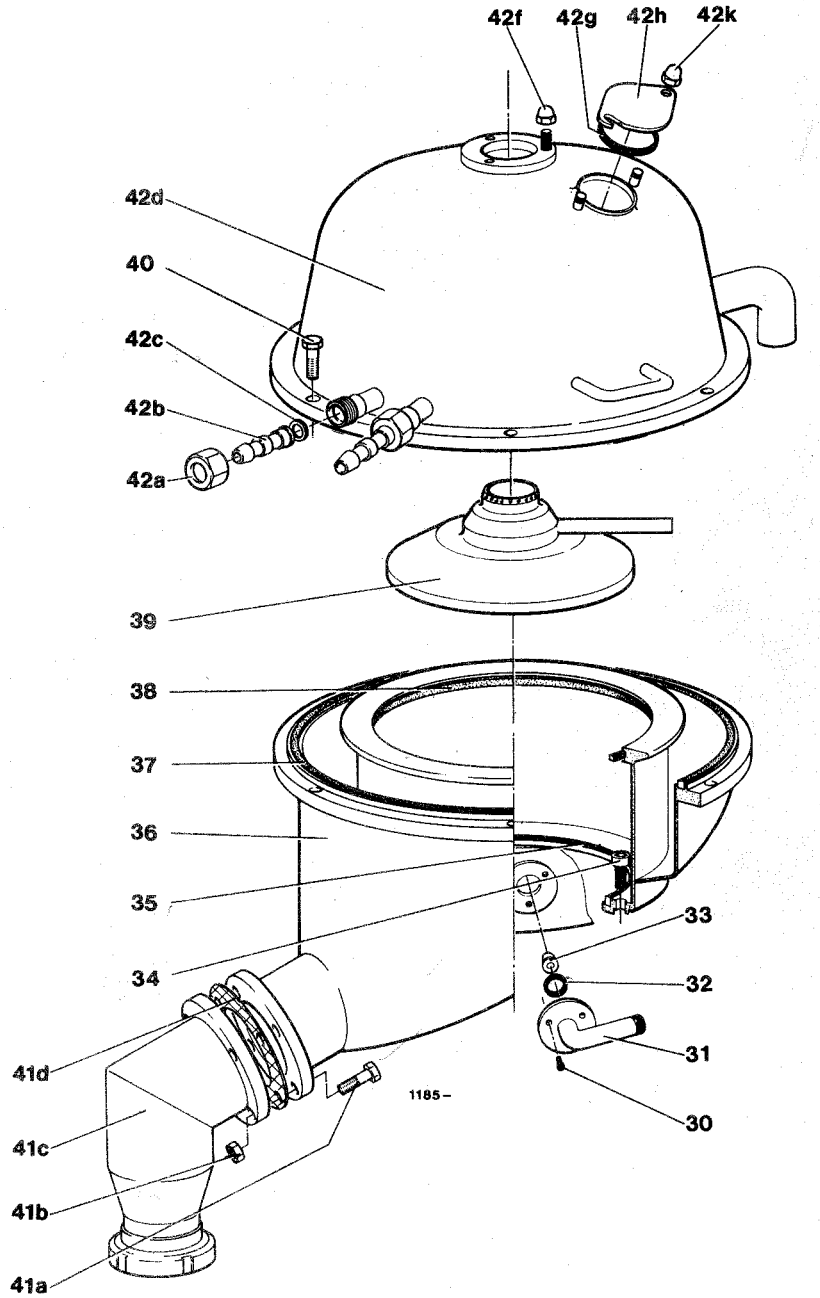
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Fig. 14/1

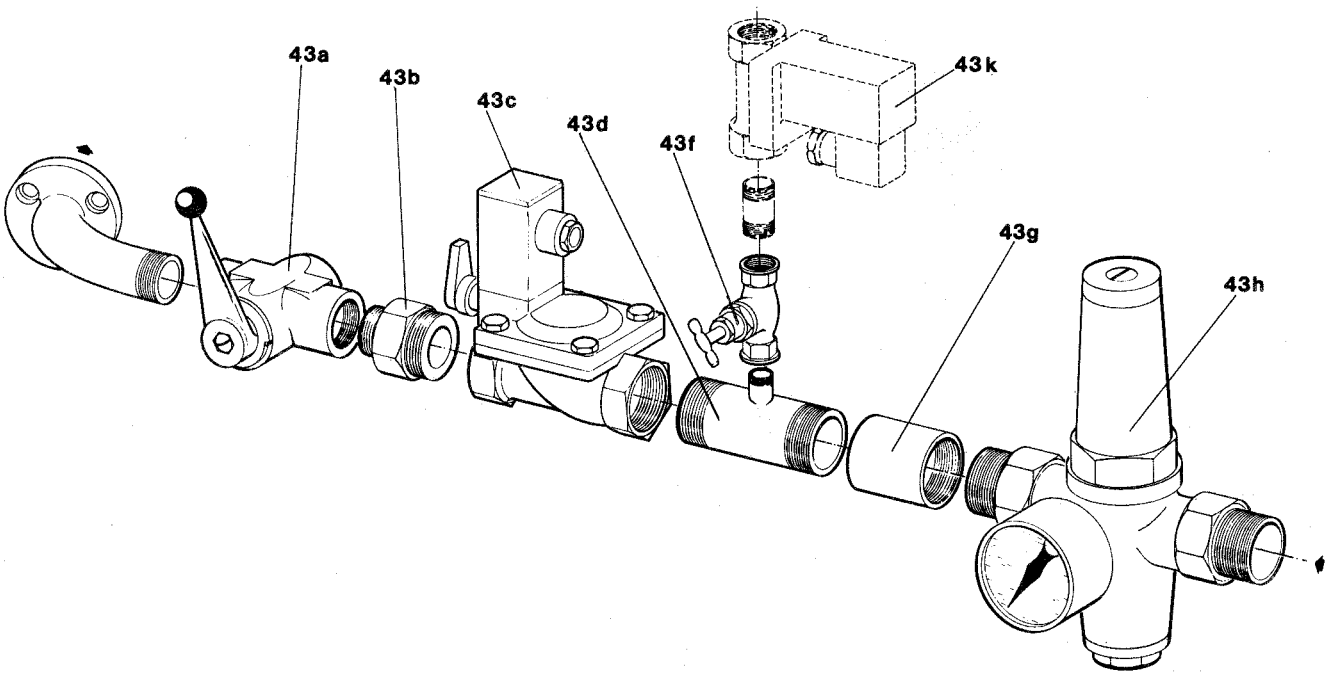

Fig. 14/2

No.in Fig.	Part - No.	Qty.	Part Description
-	8134-2120-020	1	Operating-water connection, complete (43a-h)
43a	0018-1711-640	1	Ball-type valve 20
43b	0018-1778-300	1	Reducing nipple 1", 3/4"
43c	0018-3712-600	1	Solenoid valve 1" (see also page 14/4)
43d	8134-2165-030	1	Connecting piece
43f	0018-1310-640	1	Straight-way valve 1/4" DIN 3512
43f	0018-1312-640	1 **	Straight-way valve 1/2" DIN 3512
43g	0018-0762-400	1	Socket 1"
43h	0018-1741-000	1	Water pressure reducer, complete, 1" (see also page 14/5)
43k	0018-3710-600	1 **	Solenoid valve 1/2" (see also page 14/4)

** for automatic hood flushing only (on special order)

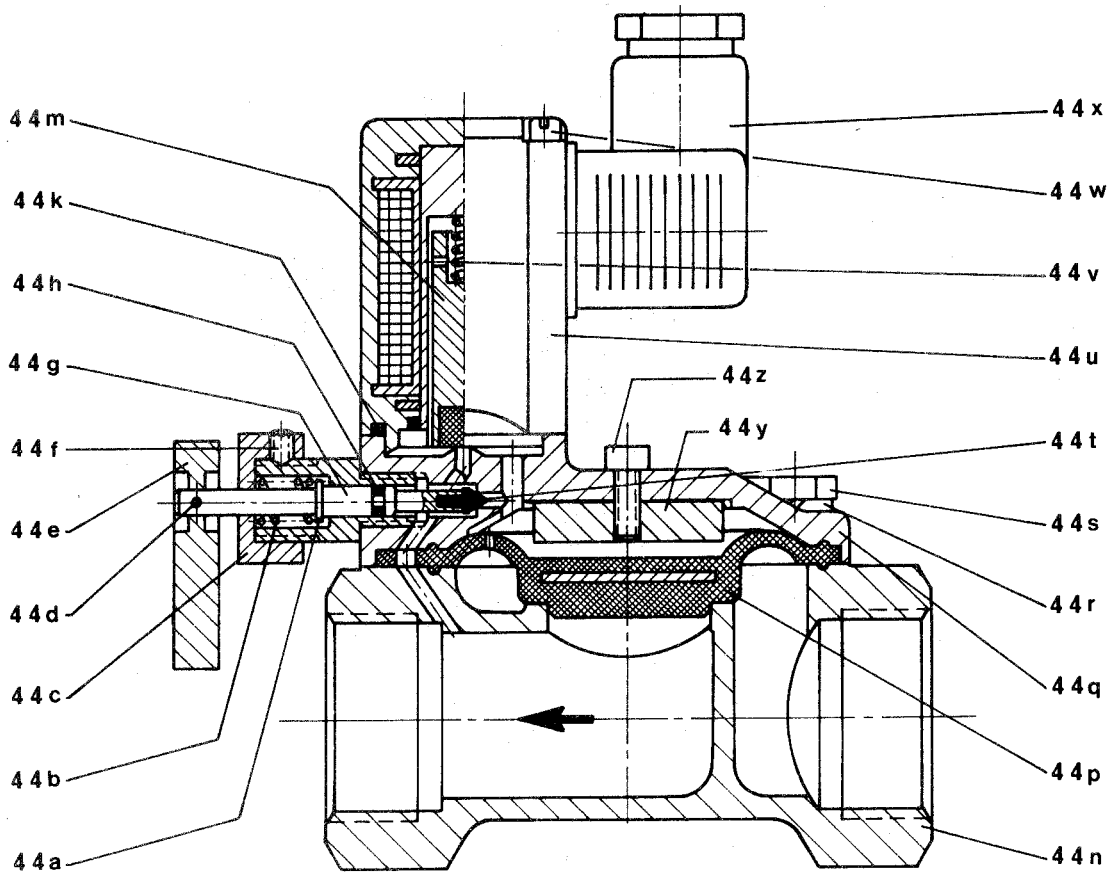

Fig. 14/3

No.in Fig.	Part No. R 1" valve for operating water	Part No. R 1/2" valve for hood flushing water	Qty.	Part Description
-	0018-3712-600	0018-3710-600	1	Solenoid valve assembly (44a-z)
44a	0018-3710-000	-	1	Ring 4W 2271
44b	0006-4084-190	-	1	Pressure spring
44c	0018-3710-010	-	1	Screw part 4W 2273
44d	0026-1557-300	-	1	Cylindrical notched pin 2x14
44e	0018-3710-020	-	1	Lever 4W 2274
44f	0019-3950-400	-	1	Threaded pin M4x4
44g	0018-3710-030	-	1	Valve spindle 4S 1316
44h	0007-1910-750	-	1	Gasket R4x1
44k	0007-1946-750	0007-1946-750	1	Gasket 25 x 1.5
44m	0018-3710-040	0018-3710-040	1	Solenoid core 4M 719
44n	0018-3712-080	0018-3710-080	1	Valve housing
44p	0018-3712-750	0018-3711-750	1	Diaphragm
44q	0018-3712-070	0018-3710-070	1	Valve housing cover
44r	0026-1389-620	-	4	Washer 8.4 DIN 433
44r	-	0026-1322-170	4	Lock washer A5 DIN 127
44s	0019-6903-400	-	4	Hex head screw M8x20 DIN 933
44s	-	0019-6077-400	4	Fillister head screw M4x55 DIN 84
44t	0018-3710-060	-	1	Plug 4D 612
44u	0018-3710-800	0018-3710-800	1	Solenoid head 220 Volts, 50/60 Hz
44v	0006-4079-300	0006-4079-300	1	Cylindrical pressure spring 5/0.75x13.5
44w	0019-2387-400	0019-2387-400	4	Fillister head screw M4x55 DIN 84
44x	0018-3710-050	0018-3710-050	1	Coupler socket
44y	0018-3712-090	-	1	Limiting disc 30x6.5
44z	0019-6077-400	-	1	Allen screw M4x10 DIN 912

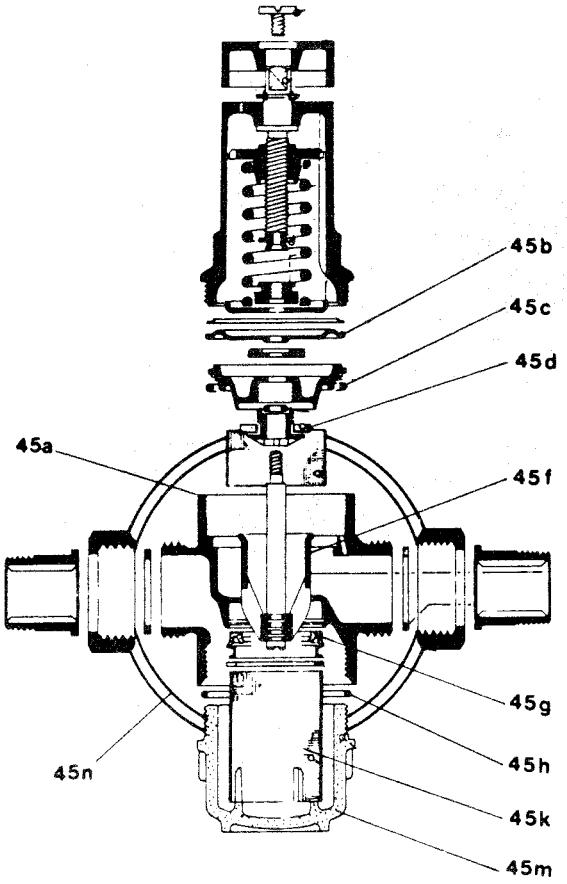

Fig. 14/4

No.in Fig.	Part - No.	Qty.	Part Description
	1"		
-	0018-1741-000	1	Water pressure reducer, complete 1.5 - 6 bar (45a-n)
45a	0018-1741-690	1	Water pressure reducer assembly (45a-m)
45b	0018-1741-750	1	Diaphragm
45c	0007-1907-750	1	Gasket
45d	0018-1741-020	1	Sealing disc
45f	0018-1741-010	1	Nozzle
45g	0004-5738-840	2	Grooved ring
45h	0007-2539-750	1	Gasket
45k	0018-1741-030	1	Strainer with ring
45m	0018-1741-600	1	Plug
45n	0001-0279-600	1	Pressure gauge M63x6 bar, DIN 16040 - R 1/4"

Strainer 45k should be cleaned from time to time, the cleaning intervals being dependent on the degree of impurities contained in the water. To remove the strainer, unscrew plug 45m.

No.in Fig.	Part - No.	Qty.		Part Description
-	3245-2296-030	1		Feed and discharge connections, complete (71-94d)
71	0007-2235-750	1		Gasket 35/43x4
72	3272-2301-010	1		Feed and discharge housing
73	0007-2299-850	4		Gasket 25.5/33.5x4
74	0001 0101 820	2		Cylindrical sight glass 0001 0101 820
75	0013 0370 400	2		Grooved nut 0013 0370 400
76	3015-2178-000	1		Threaded piece
77	0007-2209-750	1		Gasket G 32 DIN 11851
78	3205-2196-030	1		Bend, complete
	0018-1525-400	1	*	Hose cock 1/4
79	0007-2208-750	2		Gasket G 25 DIN 11851
80	0007-2615-750	1		Gasket 30/3.5
81	0007-2246-750	1		Gasket 30/38x4
82	0026-1809-400	1		Washer
83	0026-5549-300	1		Snap ring
84	0013-2676-400	1		Grooved nut Tr 28x3
85	3015-2287-000	1		Valve connection
86	0007-2210-750	1		Gasket G40 DIN 11851
87	8918-2000-300	1		Pressure gauge
88	3245-2166-000	1		Connecting piece, complete
88a	0019-6515-400	1	*	Hex head screw M 10x55 DIN 931
88b	0019-6938-400	1	*	Hex head screw M 10x35 DIN 933
89	3205-2166-010	1		Connecting piece, complete
89a	0019-6938-400	1	*	Hex head screw M 10x35 DIN 933
89b	0019-6515-400	1	*	Hex head screw M 10x55 DIN 931
89c	0018-1525-400	1	*	Hose cock 1/4"
90	0007-2285-750	2		Gasket 22/32x5
91	0026-5508-300	1		Washer
92	0026-1445-300	1		Snap ring
-	1072-2273-020	1		Stuffing box, complete (93a-f)
93a	1072-2279-020	1		Round slide valve
93b	0026-1062-400	1		Cylindrical pin
93c	0019-1590-610	1		Threaded bolt
93d	1072-2284-000	1		Housing
93f	0021-3096-300	1		Handle
-	0018-4034-400	1		Support
94a	0019-7103-400	1		Hex head screw M 20x35 DIN 933
94b	0026-1332-300	1		Lock washer B 20 DIN 127
94c	0026-1991-400	1		Washer
94d	0018-4034-410	1		Support

* This part is included in the preceding "complete" part, but it is also available as separate item.

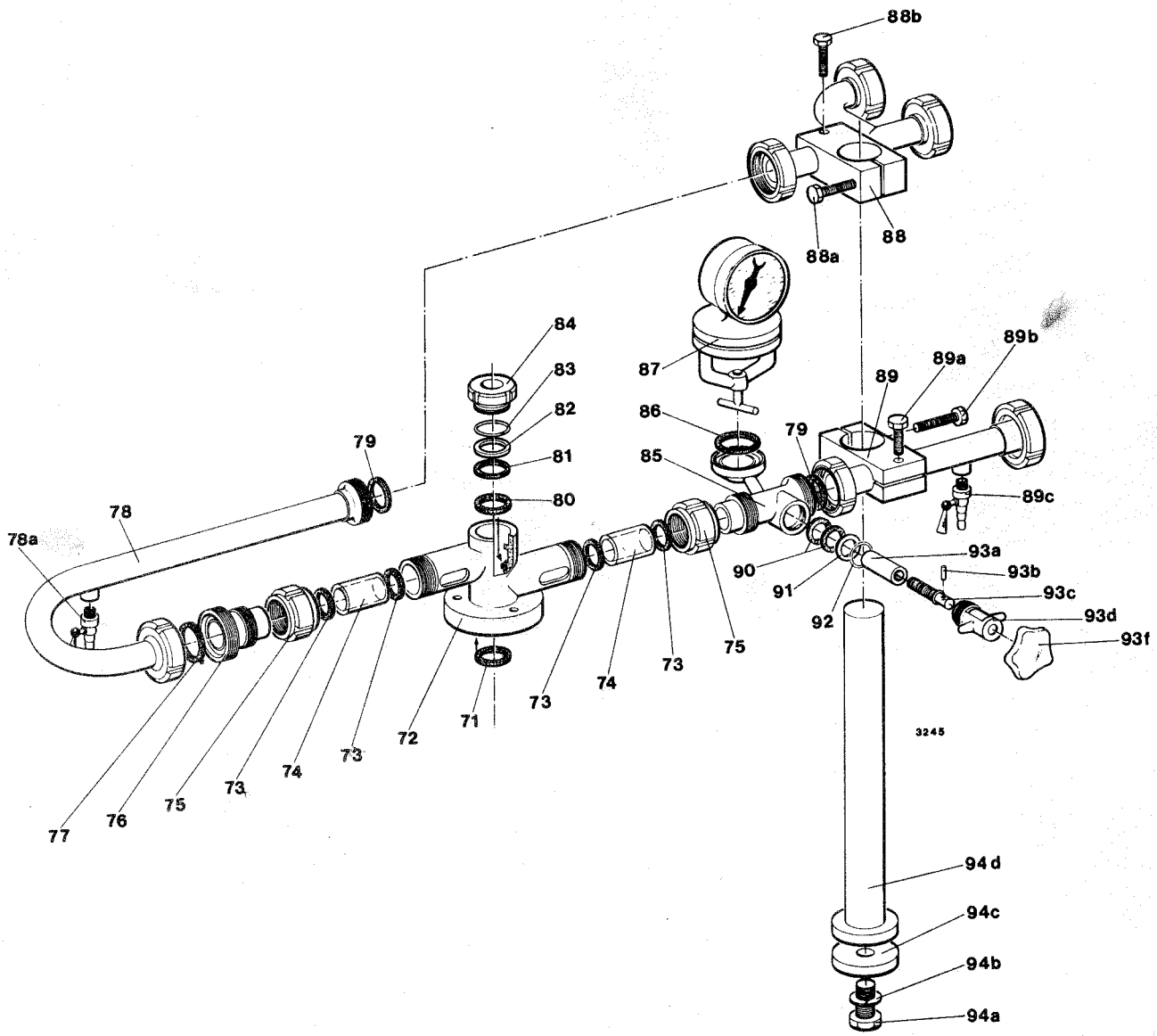
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Fig. 15/1

Measuring range: 700 - 4,000 litres/h

No.in Fig.	Part - No.	Qty.		Part Description
-	8021-2000-090	1		Flowmeter assembly (131a-u)
131a	0007-2210-750	2		Gasket 42/52x5
131b	0013-2846-300	1		Grooved coupling nut F90 DIN 11851
131c	8022-2001-150	1		Inlet cup
131d	8022-2012-000	1		Float cone
131e	0007-2279-750	1		Gasket 56/68x6
131f	8021-2003-120	1		Outlet pipe
131g	0007-2298-750	2		Gasket 13.5/22x10
131h	0026-1375-300	1		Washer
131k	0013-3010-300	1		Nut M 35x1.5
131m	0019-1380-300	1		Threaded sleeve
131n	8020-2002-000	1		Intermediate piece
131p	0001-0083-890	1		Cylindrical sight glass 0001-0083-890
131r	0019-1732-400	1		Handle screw
131s	0019-2478-300	2		Cheese head screw M 4x8 DIN 85
131t	0004-5261-720	2		Gasket 4.8/9x1
131u	8021-2017-000	1		Scale 700 - 4,000 litres/h
131v	0018-3949-400	2	*	Cone connection
131w	0013-2844-300	2	*	Grooved coupling nut
-	3015-9033-010	1	*	Bracket (to support flowmeter)

* On special order only.

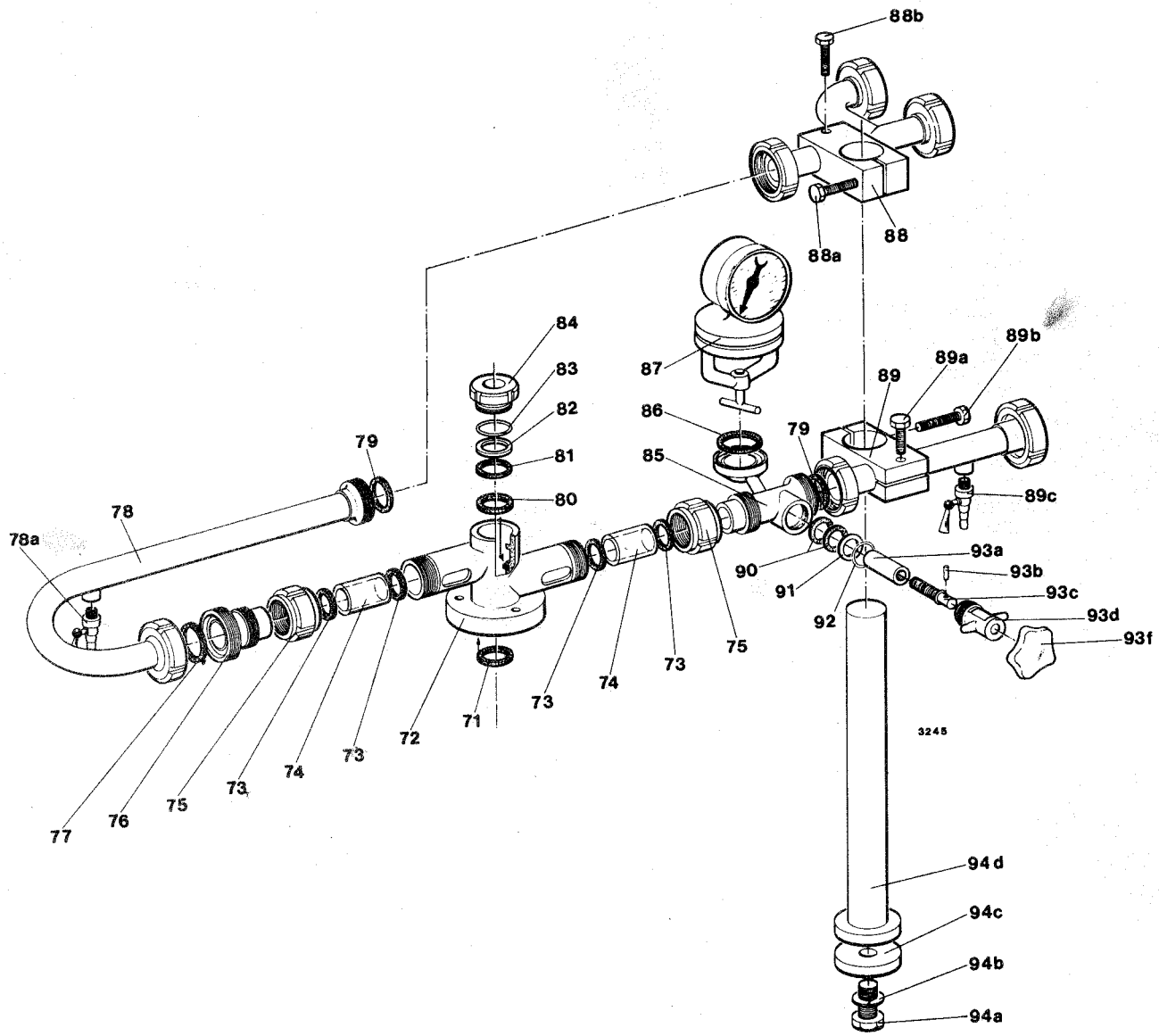
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Fig. 15/1

Measuring range: 700 - 4,000 litres/h

No.in Fig.	Part - No.	Qty.		Part Description
-	8021-2000-090	1		Flowmeter assembly (131a-u)
131a	0007-2210-750	2		Gasket 42/52x5
131b	0013-2846-300	1		Grooved coupling nut F90 DIN 11851
131c	8022-2001-150	1		Inlet cup
131d	8022-2012-000	1		Float cone
131e	0007-2279-750	1		Gasket 56/68x6
131f	8021-2003-120	1		Outlet pipe
131g	0007-2298-750	2		Gasket 13.5/22x10
131h	0026-1375-300	1		Washer
131k	0013-3010-300	1		Nut M 35x1.5
131m	0019-1380-300	1		Threaded sleeve
131n	8020-2002-000	1		Intermediate piece
131p	0001-0083-896	1		Cylindrical sight glass 0001-0083-896
131r	0019-1732-400	1		Handle screw
131s	0019-2478-300	2		Cheese head screw M 4x8 DIN 85
131t	0004-5261-720	2		Gasket 4.8/9x1
131u	8021-2017-000	1		Scale 700 - 4,000 litres/h
131v	0018-3949-400	2	*	Cone connection
131w	0013-2844-300	2	*	Grooved coupling nut
-	3015-9033-010	1	*	Bracket (to support flowmeter)

* On special order only.

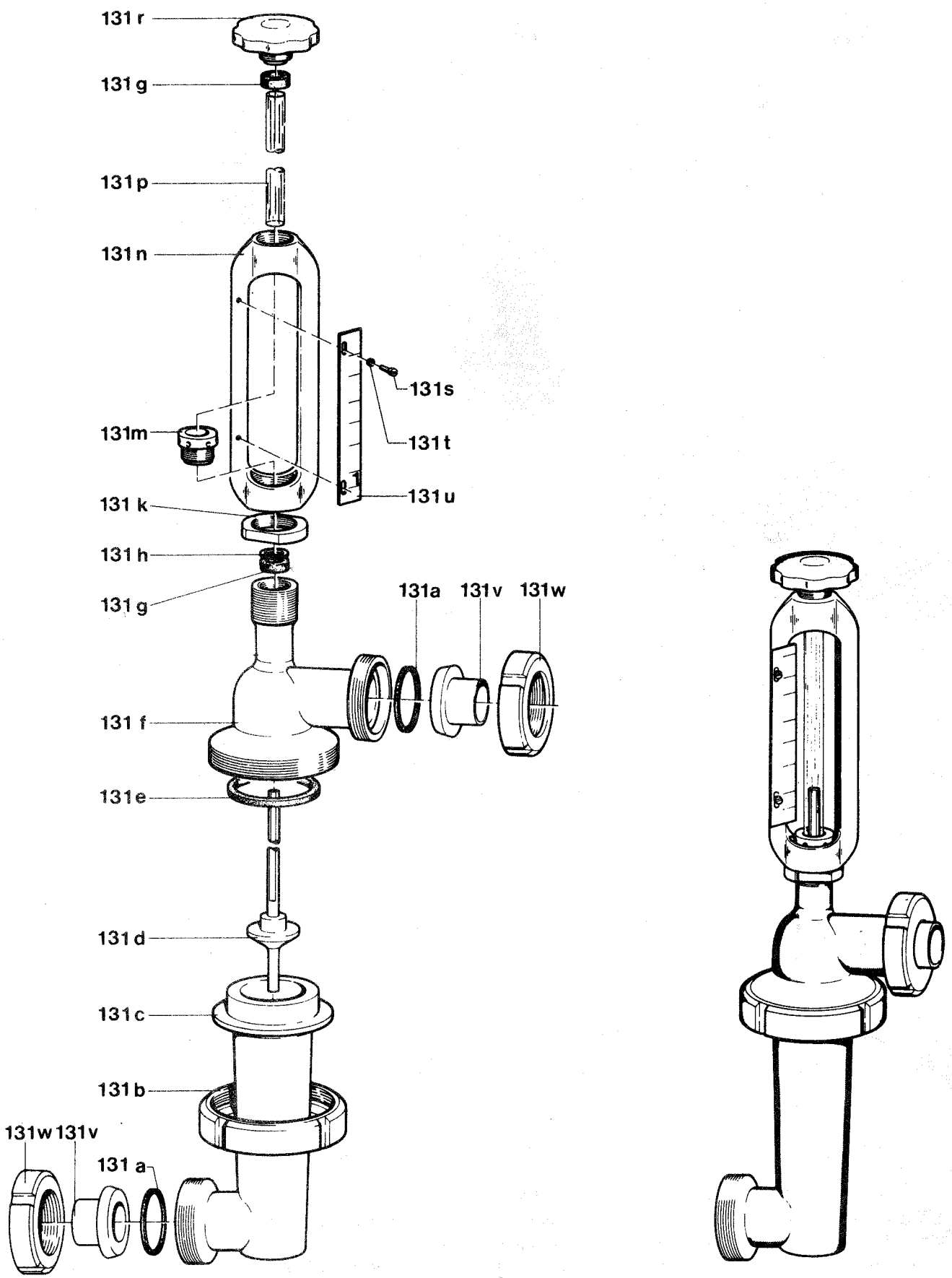
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Fig. 15/2

No.in Fig.	Part - No.	Qty.		Part Description
151	0010-3003-200	1		Bottom bearing cap
152	0004-1891-740	1		Gasket 38/57 x 2
-	0010-3000-000	1		Bottom bearing assembly (153a-h)
153a	0010-3002-000	1		Bottom bearing threaded piece
153b	0006-4209-160	1		Cylindrical pressure spring
153c	0010-3001-200	1		Bottom bearing pressure piece
-	0010-3010-000	1		Set of bottom bearing running parts (153d-g)
153d	-	1	*	Bottom bearing pressure disc
153f	-	1	*	Ball cage
153g	-	1	*	Bottom bearing running disc
153h	0026-1473-170	1		Snap ring
154	0019-6938-150	4		Hex head screw M 10x35 DIN 933 - 8.8
155	0026-1337-190	4		Lock washer A 10 DIN 127
156	3033-1112-010	1		Bottom bearing housing
157	0004-5254-770	1		Gasket 61/102x0.3
-	see page 18/1	1	***	Worm spindle assembly (158a-h)
158a	0011-1303-030	1		Pendulum ball bearing 1303 M/P62 DIN 630
158b	0008-1708-000	1		Ball bearing protection ring
158c	see page 18/1	1	***	Worm spindle
158d	0011-6207-010	1		Grooved ball bearing 6207/P62 DIN 625
158f	0008-3508-000	1		Ball bearing protection ring
158g	0006-4226-160	1		Spindle spring
158h	0008-3501-580	1		Spindle cap
-	0008-3500-230	1		Neck bearing bridge assembly with covering (159a-s)
159a	0004-5002-770	1		Gasket 110/162x0.3
-	0008-3510-220	1		Neck bearing bridge, complete (159b-g)
159b	0008-3506-000	1		Neck bearing bridge
159c	0026-1286-110	6		Spring piston
159d	0006-4375-060	1		Set of neck bearing springs
159f	0019-1420-030	6		Threaded plug
159g	0008-3507-090	1		Pressure ring
159h	0008-3509-000	1		Distance ring
159k	0004-5002-770	1		Gasket 110/162x0.3
159m	0008-3502-070	1		Neck bearing protection cap
159n	0007-2502-750	3		Gasket 12/3
159r	0026-1371-030	3		Washer 13 DIN 125
159s	0019-6541-150	3		Hex head screw M 12x75 DIN 931 - 8.8

* This part is not available as separate item, but only assembled with the parts 153d-g.

*** The design and, hence, the number of this part depends on the motor speed as well as on the bowl speed given on the name-plate of the separator (see table on page 18/1). In case of reduced bowl speed be sure to refer to sect. 3.5.
IMPORTANT: When replacing this part, the worm wheel 208 should be replaced at the same time.

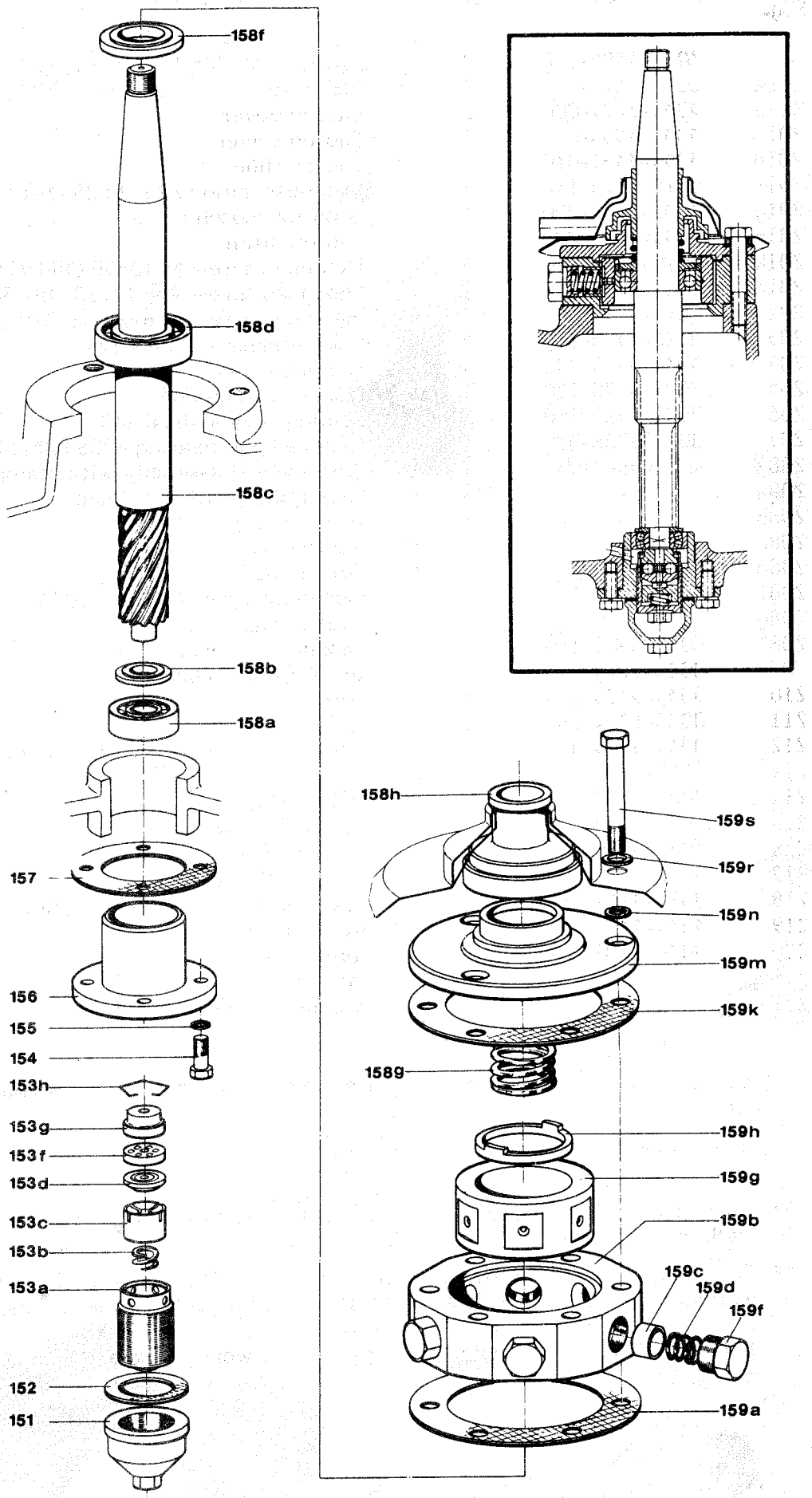
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Fig. 16/1

No.in Fig.	Part - No.	Qty.		Part Description
-	3033-3385-010	1		Centrifugal clutch assembly (201a-m)
201a	0019-5195-150	1		Hex head screw AM 10x25 DIN 561 - 8.8
201b	3033-3479-000	1		Clutch cover
201c	3033-3468-L	1	+)	Clutch driver
201d	3033-3397-010	6	*	Clutch shoe
201f	0019-5194-150	1		Hex head screw AM 10x25 DIN 561 - 8.8
201g	3033-3366-000	1		Ring for clutch drum
201h	3033-3365-000	1		Clutch drum
201k	0019-6941-150	4		Hex head screw M 10x50 DIN 933 - 8.8
201m	0019-5194-150	1		Hex head screw AM 10x20 DIN 561 - 8.8
202	0019-0717-150	3		Hex head screw M 8x22 SZ DIN 933 - 8.8
203	0026-1325-190	3		Lock washer A 8 DIN 127
204	3033-3375-030	1		Bearing cover
205	0004-5370-770	1		Gasket 62/100x0,3
206	0004-5569-750	1		Sealing ring A 30x48x10
207	0011-6206-000	1		Grooved ball bearing 6206 DIN 625
208	see page 18/1	1	***	Worm wheel assembly with clamp plates (208a-h)
208a	-	1	**	Clamp plate with toothing
208b	-	1	**	Pressure ring
208c	-	1	**	Toothed rim
208d	-	1	**	Wheel body
208f	0019-6908-150	4		Hex head screw M 8x35 DIN 933 - 8.8
208g	-	1	**	Clamp plate
208h	0019-6502-150	4		Hex head screw M 8x80 DIN 931 - 8.8
209	0026-1743-160	1		Key A 8x7x40 DIN 6885
210	3033-3400-010	1		Worm wheel shaft
211	0026-1744-160	1		Key A 6x6x35
212	0011-6206-000	1		Grooved ball bearing 6206 DIN 625
213	0013-3011-060	1		Nut
214	0004-5542-750	1		Sealing ring A 28x47x10
215	0004-5350-770	1		Gasket 62/100 x 0.3
216	3033-3375-020	1		Bearing cover
217	0026-1325-190	3		Lock washer A 8 DIN 127
218	0019-0717-150	3		Hex head screw M 8x22 SZ DIN 933 - 8.8
219	3033-3371-000	1		Brake drum
220	0026-1650-000	1		Centering disc
221	0026-1325-190	1		Lock washer A 8 DIN 127
222	0019-6907-150	1		Hex head screw M 8x30 DIN 933 - 8.8

+) When ordering this part, please state diameter of motor shaft end and width of key.

* The number of clutch shoes to be used (2 or 3 or 4 or 6 shoes) depends on the motor size and on the motor speed.

** This part is not available as separate item, but only assembled with the parts 208a-h.

*** The design and, hence, the number of this part depends on the motor speed as well as on the bowl speed as stated on the name-plate of the separator (see table on page 18/1).
IMPORTANT: When replacing this part, the worm spindle 158c should also be replaced.

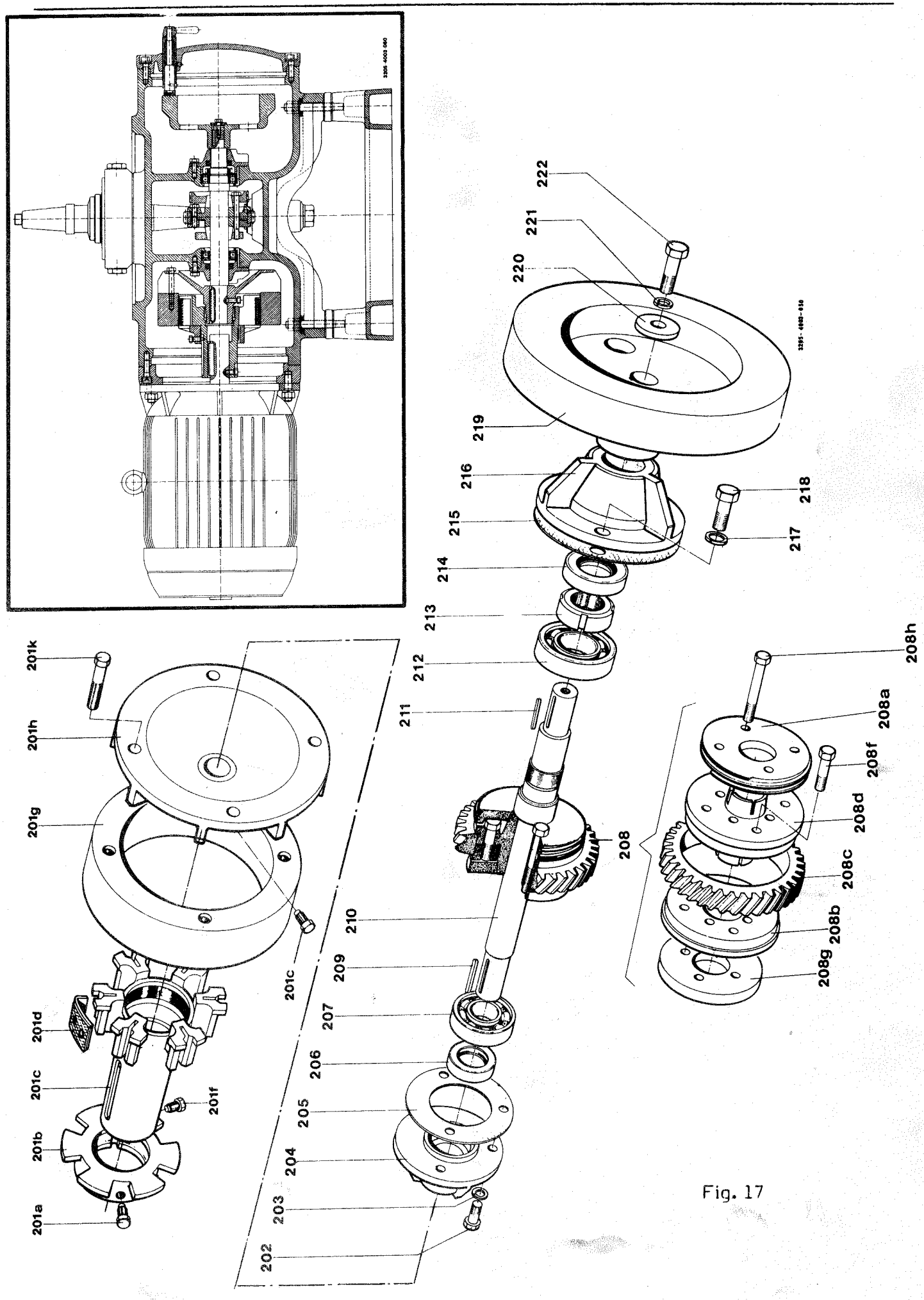
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Fig. 17

No.in Fig.	Fig.	Part Description	Motor speed n = 1455 rpm (50 Hz) Part - No. Bowl speed n = 8520 rpm		Motor speed n = 1745 rpm (60 Hz) Part - No. Bowl speed n = 8510 rpm	
-	16	*** Worm spindle assembly	2162-3429-000		2162-3429-010	
158c	16	*** Worm spindle	3033-3420-010		3033-3420-000	
208	17	*** Worm wheel assembly	2162-3449-000		2162-3449-010	

*** The design and, hence, the number of this part depends on the motor speed as well as on the bowl speed as stated on the name-plate of the separator. In case of reduced bowl speed be sure to refer to sect. 3.5.
IMPORTANT: Worm spindle 158c and worm wheel assembly 208 should always be replaced at the same time.

No.in Fig.	Fig.	Part Description	Motor speed n = 1455 rpm (50 Hz) Part - No. Bowl speed n = 8520 rpm		Motor speed n = 1745 rpm (60 Hz) Part - No. Bowl speed n = 8510 rpm	
-	16	*** Worm spindle assembly	2162-3429-000		2162-3429-010	
158c	16	*** Worm spindle	3033-3420-010		3033-3420-000	
208	17	*** Worm wheel assembly	2162-3449-000		2162-3449-010	

*** The design and, hence, the number of this part depends on the motor speed as well as on the bowl speed as stated on the name-plate of the separator. In case of reduced bowl speed be sure to refer to sect. 3.5.
IMPORTANT: Worm spindle 158c and worm wheel assembly 208 should always be replaced at the same time.

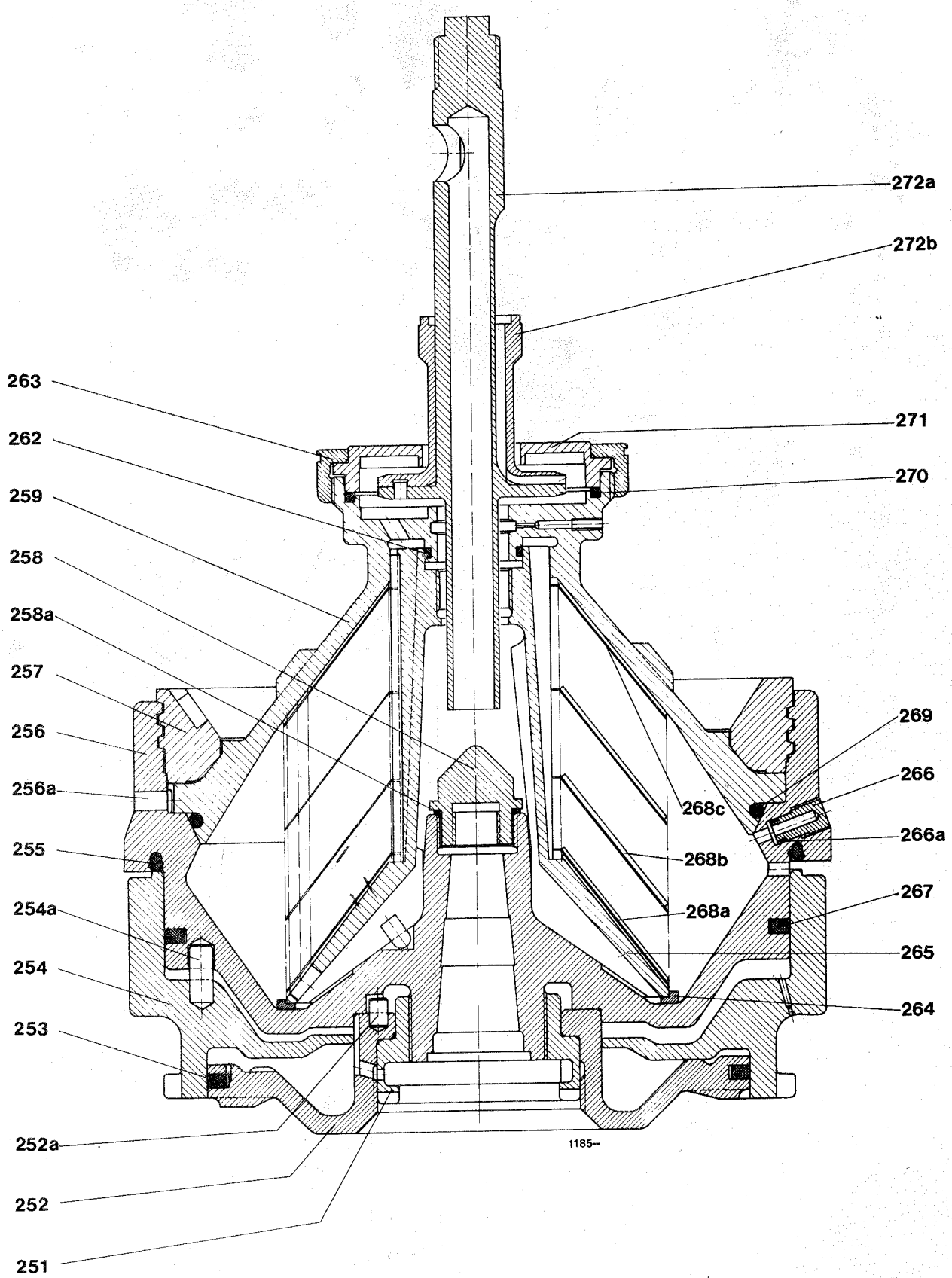
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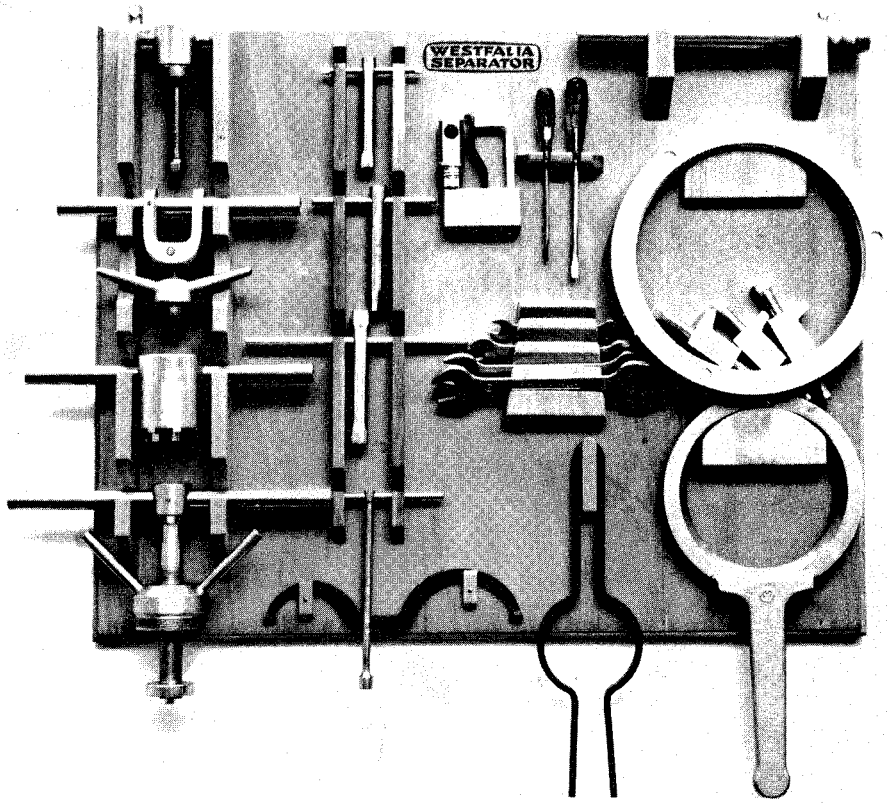
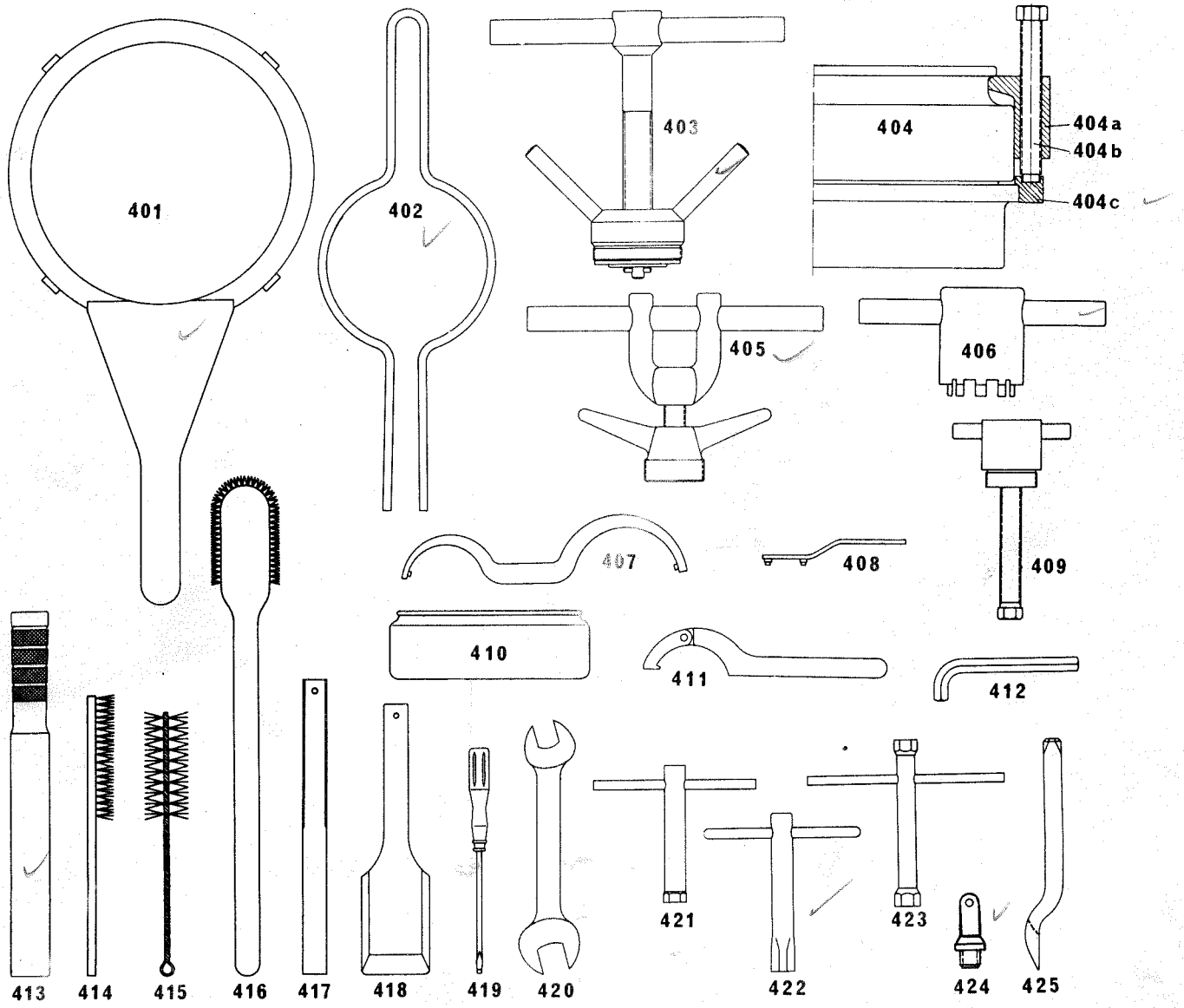
Fig. 19

All the parts mentioned in the packing list furnished with the separator should be found in the packing case.

No.in Fig.	Part - No.	Qty.	Part Description
400	3205-9920-000	1	Tool board (without tools)
401	0003-0354-000	1	Annular wrench (for bowl lock ring)
402	0003-3458-170	1	Lifting tongs (for bowl top)
403	2171-9800-000	1	Jack (for sealing-chamber bottom)
404	3210-9800-000	1	Puller assembly (404a-c) (for sliding piston)
404a	3205-9837-000	3	Claw
404b	0019-5230-150	3	Hex head screw BM 20x160 DIN 561 - 8.8
404c	3210-9882-000	1	Clamp ring
405	3034-9930-000	1	Jack (for bowl bottom)
406	2171-9855-000	1	Wrench (for threaded ring)
407	0003-3685-000	1	Hook wrench (for centripetal pump chamber lock ring)
408	0003-4585-000	1	Wrench (for sight glass)
409	3033-9910-000	1	Pulling device (for clutch)
410	0003-0277-800	1	Oil cup
411	0003-3845-000	1	Pivoted hook wrench 60/90 Ø (for screw coupling NW 25/50
412	0003-3775-320	1	Allen wrench 5 DIN 911
-	0003-3776-320	1	Allen wrench 6 DIN 911
-	0003-3778-320	1	Allen wrench 10 DIN 911
413	0003-0200-000	1	Mallet
414	0003-4690-960	1	Brush 35x125x285 (for discs)
415	0003-4540-960	4	Cylindrical brush 10x40x160
	0003-4544-960	4	Cylindrical brush 15x85x285
	0003-4552-960	1	Cylindrical brush 45x110x270
416	0003-4695-960	1	Brush 70x100x500 (for distributor)
417	0003-0210-950	1	Scraper 25
418	0003-0211-950	1	Scraper 70
419	0003-4636-050	1	Screwdriver 4,5x125
	0003-4637-050	1	Screwdriver 8x150
420	0003-4202-320	1	Double-ended wrench 10x13 DIN 3110
	0003-4205-320	1	Double-ended wrench 17x19 DIN 3110
	0003-4208-320	1	Double-ended wrench 22x27 DIN 3110
	0003-4211-320	1	Double-ended wrench 27x32 DIN 3110
421	0003-4227-030	1	Wrench 13 DIN 659
422	0003-4424-000	1	Triangular socket wrench 10 DIN 22417
	0003-4425-000	1	Triangular socket wrench 12 DIN 22417
423	0003-4253-150	1	Hexagon socket wrench B17x19 DIN 896
424	0802-9839-010	1	Lifting device (for distributor)
425	0003-0215-000	1	Chisel
-	0015-0103-000	1	Tube of Molykote paste DX
-	0015-0003-080	1	2.5-litre can of separator lubricating oil CLP 100

Fig. 20


WESTFALIA
SEPARATOR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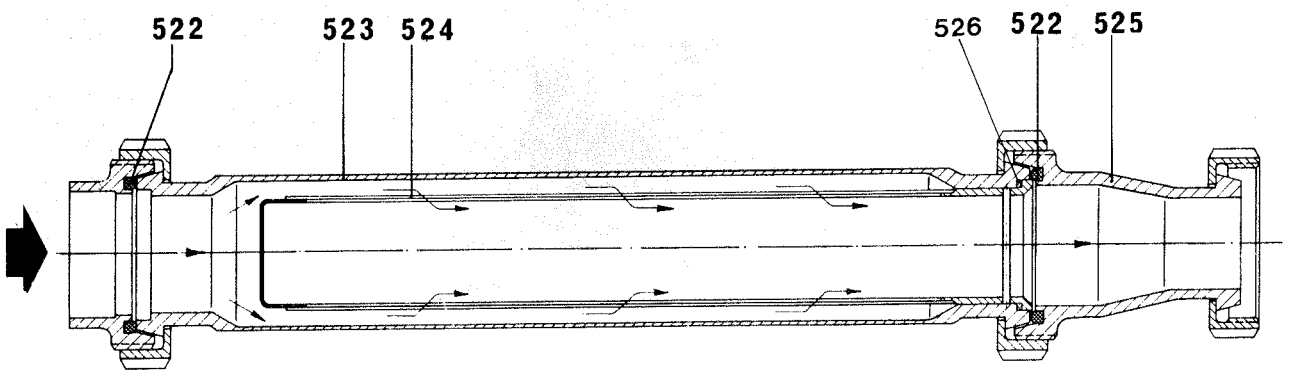


Fig. 21

No.in Fig.	Part - No.		Qty.	Part Description
	50 mesh/1" Product supply	70 mesh/1" Water supply		
-	3157-2330-010	3157-2330-030	1	Tubular strainer, complete (522-526)
522	0007-2211-750	0007-2211-750	2	Gasket G 50 DIN 11851
523	3157-2331-000	3157-2331-000	1	Housing
524	3157-2332-020	3157-2332-030	1	Strainer screen (welded)
525	0018-0515-300	0018-0515-300	1	Reducing socket A 50x40 DIN 11890
526	0007-2257-750	0007-2257-750	1	Gasket 45/2

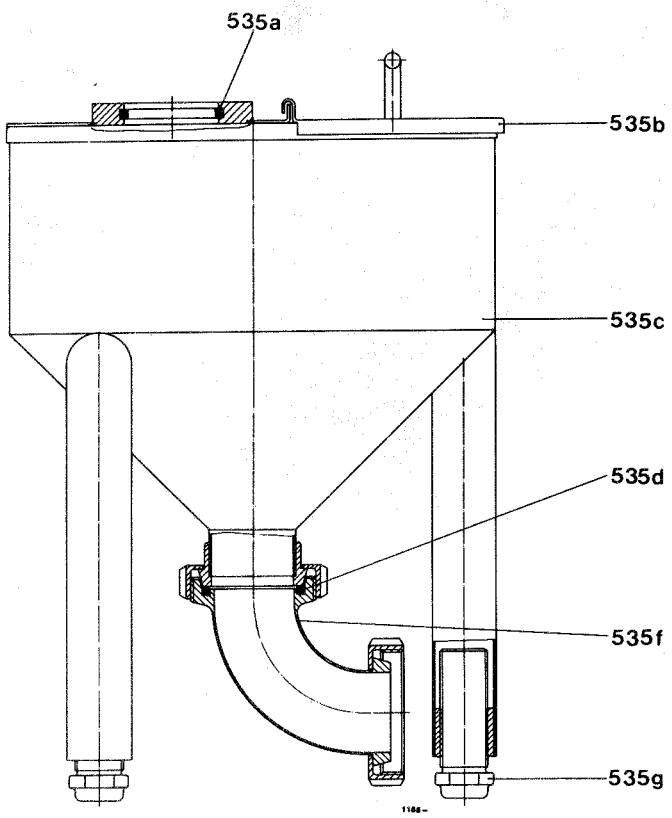


Fig. 22

No.in Fig.	Part - No.	Qty.	Part Description
-	1185-1703-000	1	Quark catcher, complete (535a-g)
535a	0007-2384-830	1	Gasket 55/65x6
535b	1185-1061-000	1	Cover
535c	1185-1702-000	1	Funnel
535d	0007-2211-750	1	Gasket G50 DIN 11851
535f	0018-1626-300	1	Bend N 50 DIN 11851
535g	8222-1106-000	3	Threaded bolt

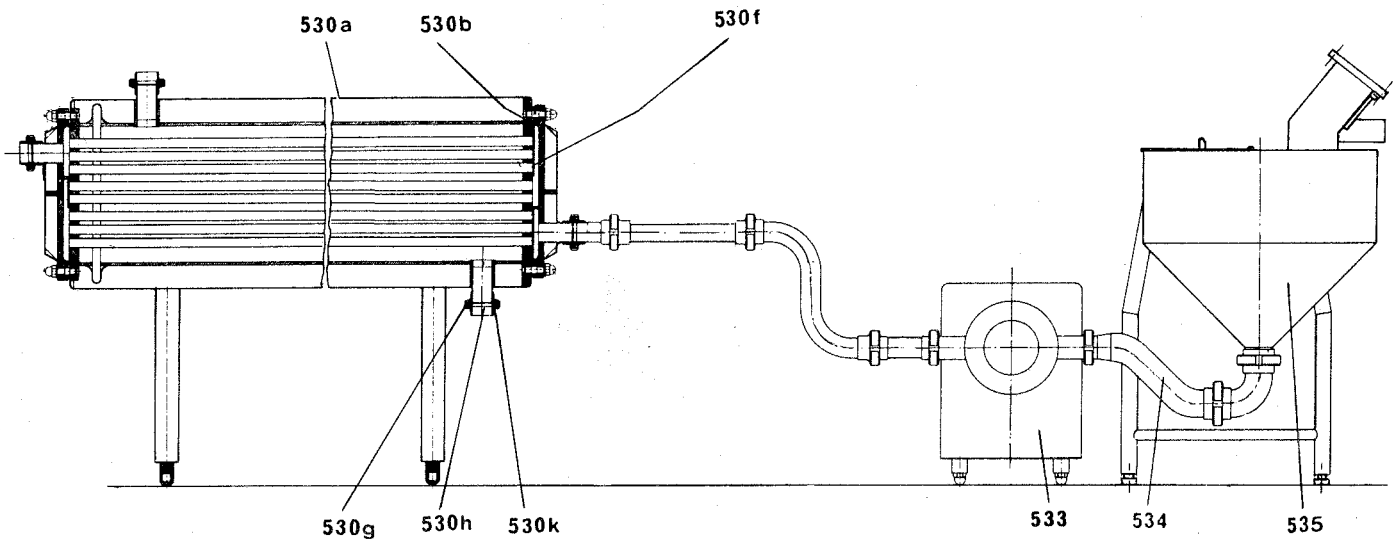
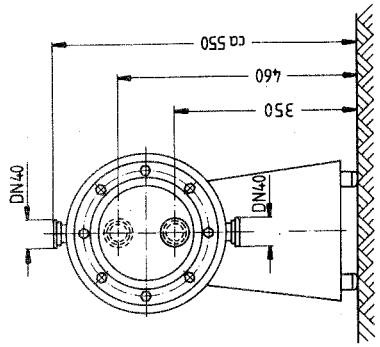
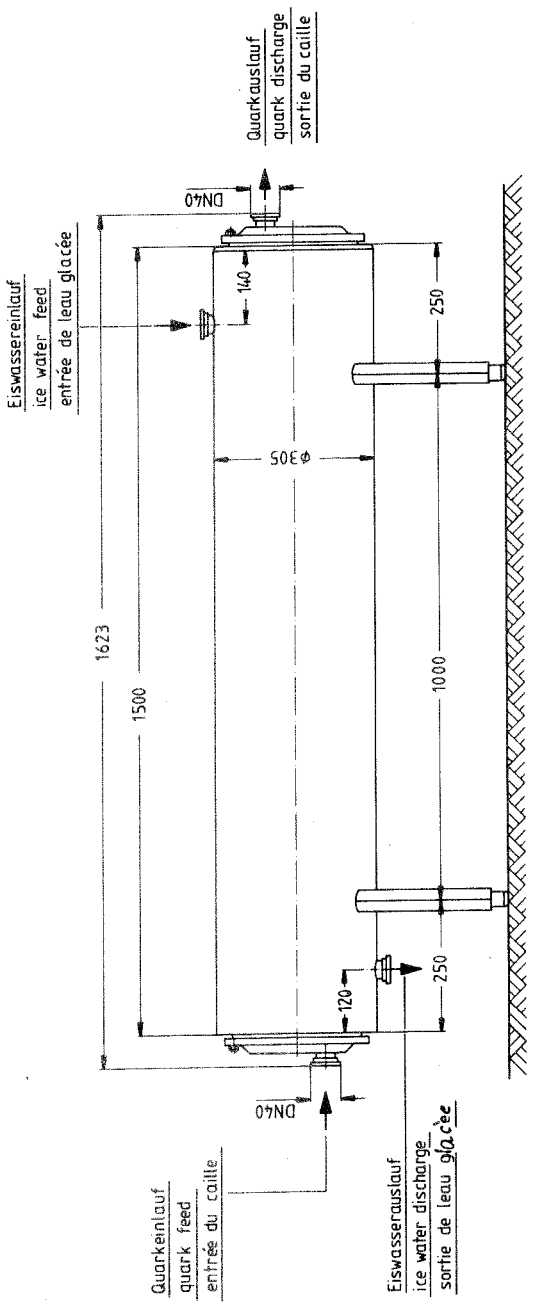


Fig. 23

No.in Fig.	Part - No.	Qty.	Part Description
-	8245-2100-000	1	Quark cooler, complete (530a-k)
530a	8245-2110-000	1	Tubular cooler
530b	0004-5168-750	2	Gasket 178/194x5
530f	8245-2504-L	1	Perforated plate (depending on order)
530g	0013-2844-300	4	Grooved coupling nut NW 40 DIN 11851
530h	0018-3949-300	4	Cone connection DN 40 DIN 11851
530k	0007-2210-750	4	Gasket G 40 DIN 11851
533		1	Positive displacement pump (depending on order)
534	8235-2196-...	1	Bend (depending on order)
535	see page 22	1	Quark catcher (see fig. 22)

ATTENTION: The pipe connections to the suction side of the positive displacement pump must be free of stress and the unions must be absolutely tight, otherwise air might be sucked-in, resulting in improper conveying of the quark (see also instruction manual for positive displacement pump).





Kühler für CIP-Reinigung	cooler for CIP	refroidisseur pour systeme NEP	C 300-3
Kühlmittel: Eiswasser	cooling agent: ice water	moyen de refroidissement: eau glacée	
Eiswasserdurchlauf	capacity of ice water	débit de l'eau glacée	8000 l/h
Eiswassertemperatur	temperature of ice water	température de l'eau glacée	+0,5 bis 1°C
Quarkleistung	quark capacity	rendement en caillé	300 l/h
Durchflußwiderstand	flow resistance	contre-pression	5 bar
Quarkfassungsvermögen	quark holding capacity	capacité en caillé	12 kg
Kühlrohrlänge	length of the cooling pipe	longueur du tuyau de refroidissement	1500 mm
Anzahl der Rohre	number of pipes	nombre des tuyaux	30 Stck.
Durchmesser der Rohre	diameter of the pipes	diamètre des tuyaux	16/18 mm
Isolierschicht: Polyurethan	insulating cover: polyurethan	isolement: polyuréthan	60 mm
Nettogewicht des Kühlers	net weight of the flow cooler	poids net du refroidisseur	180 kg
Reinigungsmitteldurchlauf	throughput of cleaning agent	débit du produit de nettoyage	mind.6000 l/h