SERVICE MANUAL

PEGSON-TELSMITH
Gyrasphere Crushers

SIZES:

36S, 367S, 36FC
48S, 489S, 48FC

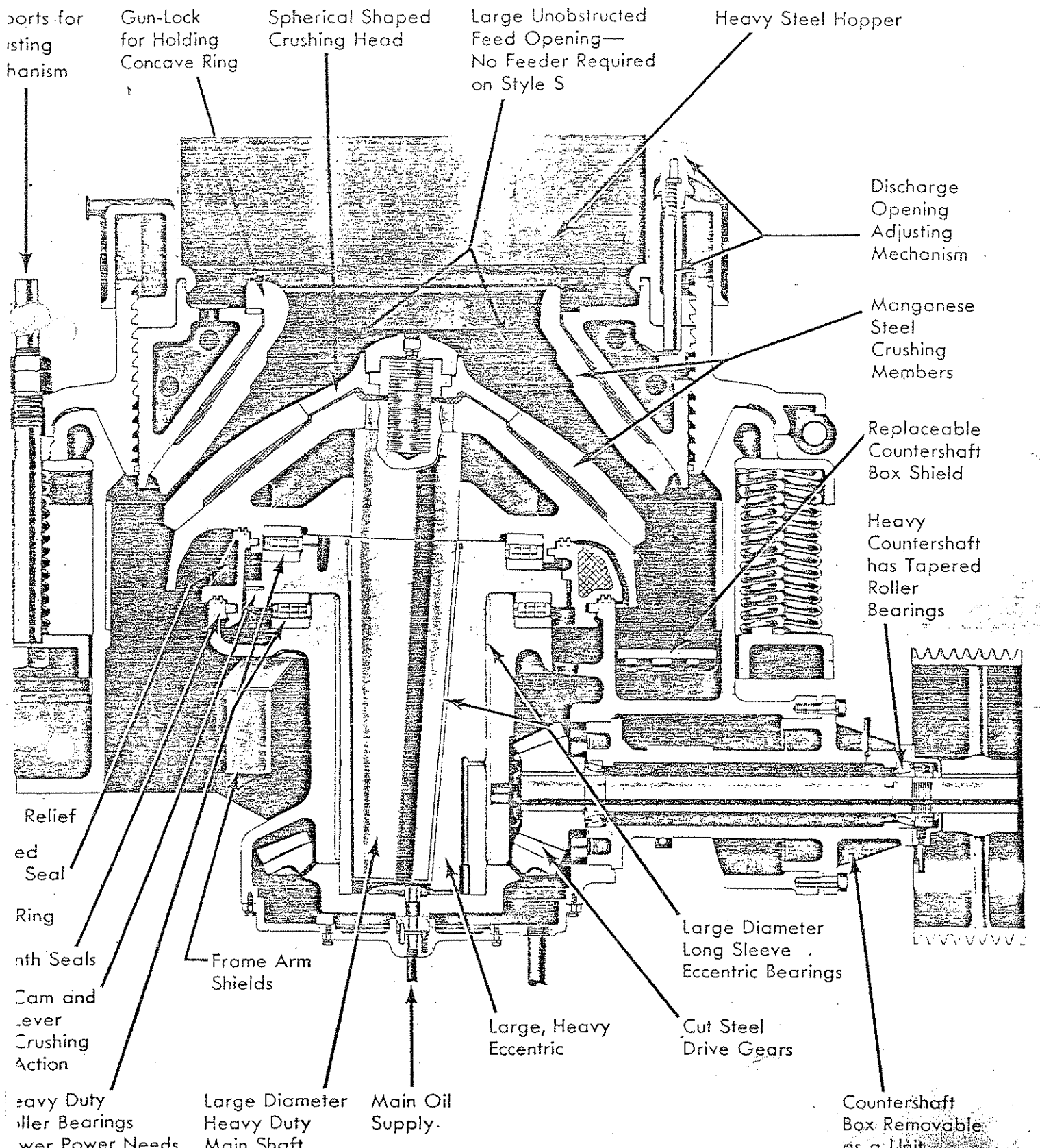
ACSA. ACEROS CUYANOS
TE 0261 4984318/4982188
ING. ROITMAN 0261 156522307
MENDOZA

PEGSON LIMITED COALVILLE, LEICS., ENGLAND
Telephone: Coalville 3322 (10 lines) (Member of the Bentley Group) Telegrams & Cables: Pegson, Coalville
London Office: IDDESLEIGH HOUSE, CAXTON STREET, LONDON, W.I.
Telephone: Abbey 2373
Scottish Office: 7, LISTER ROAD, HILLINGTON INDUSTRIAL ESTATE, GLASGOW
Telephone: Halfway 1800

INDEX

NOTE American threads used throughout

YLE S GYRASPHERE



GENERAL INSTRUCTIONS

The Pegson-Telsmith Gyrasphere is a gyratory reduction crusher of the spring relief type. The very best materials and skilled workmanship have been employed in its construction and with proper attention to installation, operation and maintenance the machine will give long efficient service.

There are two types of Gyrasphere, the style S for standard crushing and the style FC for heavy duty fine crushing. The style of the machine is indicated on the Gyrasphere nameplate. The instructions given in this book apply to both styles S and FC unless specifically captioned otherwise.

Before putting the Gyrasphere into operation, attention should be paid to the following points:

1. Check that all nuts and bolts on the machine are tight.
2. Check the setting of the Gyrasphere discharge opening.
3. Check that the oil piping is tight and is properly connected.
4. Fill the oil tank with the correct grade of oil to the proper level.
5. Start the crusher, remove the oil tank cap and check that oil is returning through the large pipe; also check the speed and direction of rotation of the flywheel.
6. Allow the machine to run light for several hours periodically checking that all parts are functioning correctly.

Every Gyrasphere is fully assembled and shop-tested before despatch to ensure that all parts, including the oiling system, are in perfect working order. However, as these tests cannot be carried out under actual load conditions it is recommended that the machine is run-in, at correct working speed, as follows: 50% of capacity for one full day; 75% of capacity for the second day; at rated capacity thereafter.

The sectional drawings at the rear of the book identify the parts referred to in the instructions. When ordering replacement parts, the numbers used should always be prefixed by the drawing reference indicated and be sure to quote the Gyrasphere size and style, the machine number stamped on the nameplate, and the part name.

1. FOUNDATIONS AND CHUTES

The Gyrasphere should be mounted on a substantial foundation as shown on the plan furnished with the machine. The standard plan, which also shows the necessary clearances for the dismantling of parts, is for standard concrete plinths but, where a conveyor is being employed, a foundation plan is available, on request, showing the crusher mounted on a steel underframe to allow walking access down one side of the conveyor. After the crusher has been placed on the foundations, it should be **levelled transversely and longitudinally in relation to the countershaft.** Grout between the frame and the foundation to ensure perfect bearing.

Since crushed material drops vertically through the bottom of the frame, the discharge arrangement can be directly on to a conveyor passing under the crusher or into a chute to direct the product from beneath the crusher to a bucket elevator or similar conveying mechanism. If a discharge chute is used, the slope must not be less than 45° and of design and material which allows free flow of the crushed product. Where flat-bottom boxes are used they must be installed at such a depth beneath the Gyrasphere to ensure that crushed product, when piled to angle of repose, will not reach the base of the crusher.

Note: **Serious damage will result if faulty chutes or discharge systems allow crushed material to build up to the Gyrasphere crushing head.**

For feed chutes and arrangements see paragraph 2.

2. FEED ARRANGEMENTS

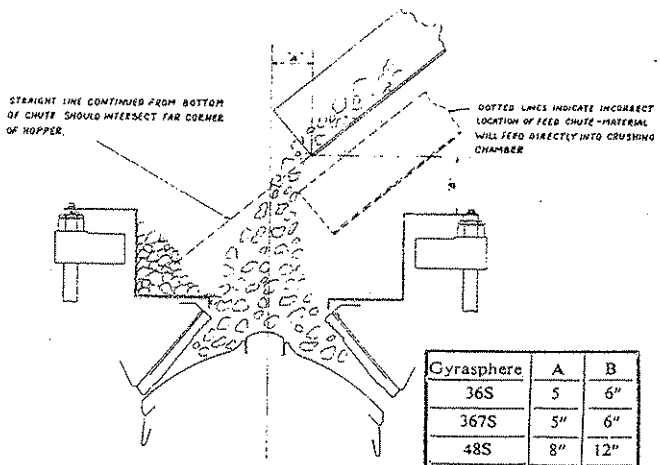
It is recommended that the feed chute to the Gyrasphere is constructed so that the end which extends over the crusher can be unbolted and removed. This will provide easy access when renewal of the manganese wearing surfaces is required. Correct feeding instructions for the style S and style FC Gyraspheres, which are of different head construction, are given below:

A. Style S Gyraspheres

The feed should be arranged to flow into the feed hopper so that the crushing load is evenly distributed within the bowl. Ensure that the bottom edge of the feed chute is several inches above the hopper to allow for the rise and fall of the hopper when the concave is adjusted. The end of the feed chute can terminate at the opening of the hopper; an imaginary line at 40° to 45° from this end should intersect the bottom far corner of the hopper. See Fig. 1.

The feed should be free from all fines, i.e., it should not contain material smaller than the size of the discharge opening or than the size of desired product. Fines in the feed produce a packing action in the crushing bowl; this

FEED CHUTE ARRANGEMENTS FOR STYLE S GYRASPHERES



Gyrasphere	A	B
36S	5	6"
367S	5"	6"
48S	8"	12"
489S	8"	12"

Figure 1

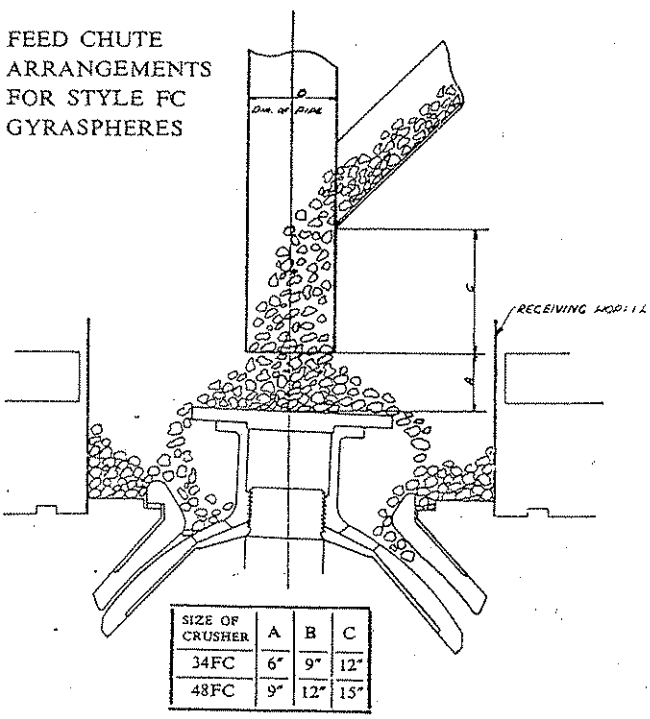
increases horsepower consumption, causes a higher rate of wear on the crushing members and gives rise to greater maintenance costs.

Although the Gyrasphere is designed to operate under choke feed, no advantage is gained by extending the hopper higher than that furnished with the machine; the feed should be introduced at a rate which the machine is capable of crushing.

B. Style FC Gyraspheres

The style FC Gyrasphere is equipped with a feed distributing plate above the head. This prevents feed from entering the crushing chamber at high velocity and also distributes material evenly round the entire circumference of the crushing chamber top opening. When installing feed chutes or feed conveyors a short piece of pipe should be used as a medium for accepting feed and depositing it centrally on the distributing plate. This pipe should be set at sufficient distance above the plate to prevent it acting as a metering device as the FC Gyrasphere can operate under choke feed conditions (except in cases of extreme fine crushing or where material has severe packing tendencies). See Fig. 2.

FEED CHUTE ARRANGEMENTS FOR STYLE FC GYRASPHERES



SIZE OF CRUSHER	A	B	C
34FC	6"	9"	12"
48FC	9"	12"	15"

Figure 2

The feed should be free from all fines, i.e., it should not contain material smaller than the size of the discharge opening or than the size of desired product. Fines in the feed produce a packing action in the crushing bowl; this increases horsepower consumption, causes a higher rate of wear on the crushing members and gives rise to greater maintenance costs.

See Fig. 5 and table (paragraph 5) for feed openings applicable to the style S and style FC Gyraspheres.

3. OILING SYSTEM

A. Assembly

Prior to despatch all oil pipes are removed from the Gyrasphere and neatly stored in the top of the oil tank. Before reassembling make sure that the pipes and tank are clean by washing in petrol or blowing through with compressed air. For correct fitting procedure, refer to the arrangement drawing of the oiling system at the rear of the book; also see oil flow diagram, Fig. 3.

It should be noted that when the machine leaves the Works blanking-off plugs are fitted at the oil feed and return points on the Gyrasphere; these must be removed to allow connection of the feed and return pipes. To facilitate identification the pipes are colour-coded to their respective connections. Ensure that all fittings are absolutely tight, particularly those in the suction line between the pump and oil tank, and when installing the tank check that there is a slope of at least 2° in the main return pipe from the crusher to the tank—oil return is by gravity and sufficient downward pitch is necessary to ensure continuous free flow regardless of oil viscosity.

See instructions under paragraph 3D if oil alarm system is purchased with the Gyrasphere.

See instructions under paragraph 3E for positioning of oil pump cover in relation to direction of rotation.

The oil tanks supplied with the machines are fitted with cooling coils in the suction end of the tank. Atmospheric temperature will usually determine the need for oil cooling but if the temperature of the return oil stays

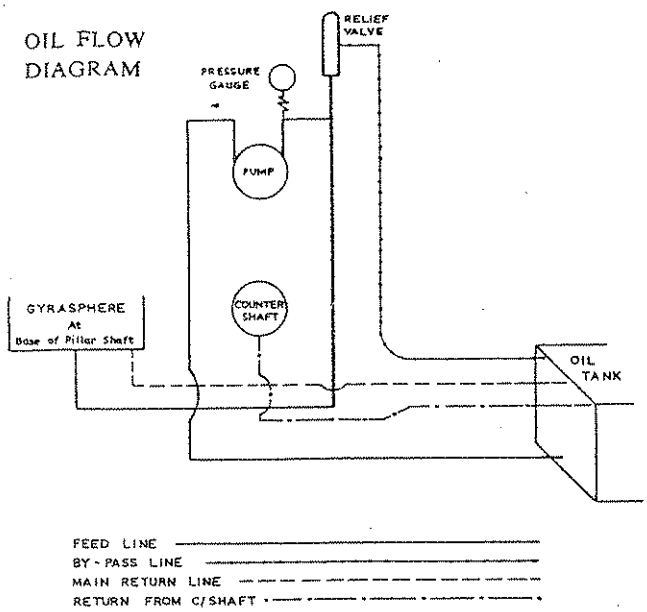


Figure 3

below 70°C the coils need not be used. Pipe nipples from the coils project through the side of the tank and these should be connected to a water flow of three to five gallons per minute in the case of cold water or 10 gallons per minute if the cooling water is more than 20°C.

B. Grade of Oil

Use Shell Trocus 68 or Mobil Vactra Heavy Oil. Alternatively, an SAE No. 40 oil may be used for operation in temperatures of 5°C and above, or an SAE No. 30 oil in temperatures below 5°C. **Do not use heavy black oil sometimes sold as crusher oil.** See also paragraph 3G in cases where oil is thermostatically pre-heated.

C. Operation—*refer to drawing of Oiling System at rear of book.*

Lubrication is carried out by the pump feeding oil from the storage tank to the crusher bearings at a volume sufficient to maintain adequate oil pressure in the machine. An automatic pressure relief valve (3F7), installed in the feed line between the pump and crusher, returns surplus oil to the tank whilst a pressure gauge (3F9), which connects into the tee on the discharge side of the pump, provides an immediate check on oil pressure during operation. (Note: Should excessive vibration be present it is advisable to mount the gauge independently of the crusher with a suitable flexible pipe connection). The countershaft bearings are automatically force-fed by the pump, oil being returned to the tank through the small pipe connected to the base of the countershaft box. Oil from the main crusher bearings returns to the tank through the large pipe. The oil tank is fitted with a cap (3F1) which can be removed for inspection of the returning oil and for checking the oil temperature. It also contains a filtering unit and, where applicable, cooling coils.

To operate the oiling system, fill the tank with oil and check that it is registering to the level shown on the oil gauge (3F3) on the end of the tank; remove the tank cap (3F1) and start the Gyrasphere. If the oil level on the suction side of the tank does not lower after one minute's operation, stop the crusher and remove the plug from the top of the tee on the suction side of the pump; prime the pump with oil and screw the plug back tight. If the pump still fails to operate after priming, it is probably assembled incorrectly—see direction of rotation, paragraph 3E. When functioning properly oil will be seen returning freely to the tank from the main return pipe and from the countershaft return line. It should be noted that before despatch the pump is adjusted and the automatic relief valve set so that the correct amount of oil is pumped into the crusher. **Do not change the setting of the valve unless the gauge shows a pressure exceeding 20 lb./sq.in.** If the relief valve has to be reset proceed as follows: Remove the top cap from the valve and loosen the locknut on the exposed screw; turn the screw to the right to increase the pressure or to the left to reduce the pressure; lock screw in position and replace the cap.

N.B. This operation should be carried out with cool oil and when the crusher is running idle, under which conditions the pressure should not exceed 20 lb./sq.in. As the oil warms up during operation the pressure will decrease due to the lower resistance of the thinner oil; this decrease is in order unless the pressure drops below 5 lb./sq.in. when the cause should be found and corrected at once.

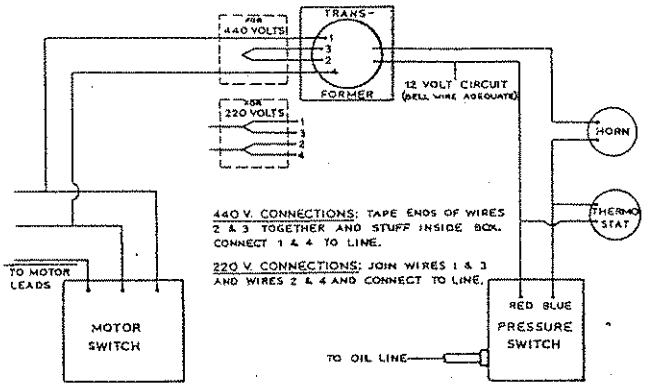
During crushing service, check the temperature of the return oil regularly. Under normal conditions a rise up to 10°C above atmospheric temperature is safe. Under severe crushing conditions the return oil temperature may register as high as 70°C. Above this figure, and in cases of sudden temperature rises, it is dangerous; the cause may be due to excessive packing, inadequate lubrication, a mechanical defect or, in the case of water-cooled systems, insufficient cooling. Stop the feed to the crusher and remedy the fault before the bearings and other parts are damaged.

Important. Always make sure that oil is returning to the tank through the pipes from the crusher main bearings and countershaft bearings before starting to crush material.

D. Oil Alarm System (supplied as optional extra)

If desired, Gyraspheres can be supplied at nominal cost with an alarm system which will set off a horn should the return oil temperature exceed 70°C or the oil

supply fail. The system comprises a low oil pressure switch, a high temperature thermostat, a horn and a 440 v. or 220 v. to 12 v. transformer which is hooked across the line between the motor and the switch. The switch, thermostat and horn are 12 volt units and should be connected to the 12 v. side of the transformer by bell wire. See Fig. 4 for wiring diagram; also arrangement drawing of the oiling system at rear of book for location of the pressure switch and thermostat in the oiling system.



OIL ALARM WIRING DIAGRAM

Figure 4

When the motor switch is closed for start up, the horn will blow and will continue to sound until the oil pressure reaches 5 lb./sq.in. Should the horn sound during subsequent operation stop the feed to the crusher at once as this indicates that the oil temperature has exceeded 70°C or that the pressure has dropped below 5 lb./sq.in. Investigate the cause and remedy before damage occurs.

E. Direction of Rotation

36S and 48S Gyraspheres: These machines are designed to operate either clockwise or counter-clockwise. If the crusher drive pulley is to rotate clockwise (looking on the pulley end), the depressed portion of the oil pump cover (2F4) must be directly at the bottom. For counter-clockwise rotation the depressed portion must be directly at the top. See illustration on arrangement drawing of oiling system at rear of book. To change the position of the oil pump cover (2F4), remove the cover cap screws (2F5) and rotate the pump cover through 180° in either direction; replace the cap screws and tighten firmly.

367S and 489S Gyraspheres: Standard rotation for these machines is counter-clockwise; the depressed portion of the oil pump cover (2F4) must be directly at the top. When it is desired to reverse the direction of rotation in order to obtain maximum wear from the bevel gear and pinion, it is recommended that the operation be carried out when replacing the concave ring—see paragraph 14B. The concave ring is refitted with its locking lugs driven on to the taper wedges in the opposite direction, i.e. looking down on the top of the crusher, the concave ring lugs should be turned counter-clockwise after passing through the slots in the support bowl; the taper wedges are then fitted and the concave ring sledged up in this direction. The oil pump cover must be turned through 180°, as described for the 36S and 48S machines, to maintain correct direction of oil flow.

36FC and 48FC Gyraspheres: These machines are designed for counter-clockwise operation only; the depressed portion of the oil pump cover (2F4) must be directly at the top. The left-hand thread mantle nut and the self-locking concave ring are automatically self-tightening in this direction. Clockwise rotation must not be attempted as it will cause these parts to work loose.

F. Changing Filter Bags and Oil

Remove the filter tray (4F4) from the oil tank once every working month, taking care not to spill the grit and dirt which settles on the tray bottom into the filter bag rings. The tray should be left elevated above the tank for the bags to drain. After draining remove the bags (4F1), with rings (4F2) and springs (4F3) intact, from the tray and pour out the dirty oil and sediment. Turn the bags inside out and wash thoroughly clean with petrol—it is recommended that a spare set of bags, rings and springs is held so that this changeover can be quickly made and the dirty filter bags cleaned later.

Change the oil in the tank every 600 working hours, or sooner if it becomes contaminated with dirt and water. Clean the piping and the oil tank at the same time.

When starting the crusher again, frequently check the oil temperature by removing the tank cap (3F1) and placing a thermometer in the oil returning to the tank.

G. Cold Weather Operation

When the machine is exposed to very cold or freezing conditions, heat the oil tank and the oil pipes before starting. Do not commence crushing until the Gyrasphere has run empty for 15 minutes and until the oil flows freely.

Thermostatically controlled heating elements in the oil tank will allow an SAE No. 40 oil to be used under all conditions. Suitable immersion-type heaters can be supplied, at nominal cost, on request.

Our recommendations for electrical heaters used in Macoma Oils are 8—12 watts per square inch.

4. SPEED OF GYRASPHERES

The correct countershaft speeds for the style S and style FC Gyraspheres are given in the following table. Verify that the machine is running at its correct speed by checking with a tachometer after installation of the Gyrasphere has been completed. Speed variations of 3% are permissible and will not affect the efficient operation of the crushers.

Size and Style of Gyrasphere	36S, 367S and 36FC	48S, 489S and 48FC
Countershaft Speed	600 r.p.m.	525 r.p.m.
Dia. and Face of Pulley ..	28″ × 12″	36″ × 15″

For direction of rotation see paragraph 3E. Unless otherwise specified, the machines are arranged for counter-clockwise running (looking on the pulley end) when despatched from the Works.

5. SETTING AND ADJUSTMENT OF DISCHARGE OPENING

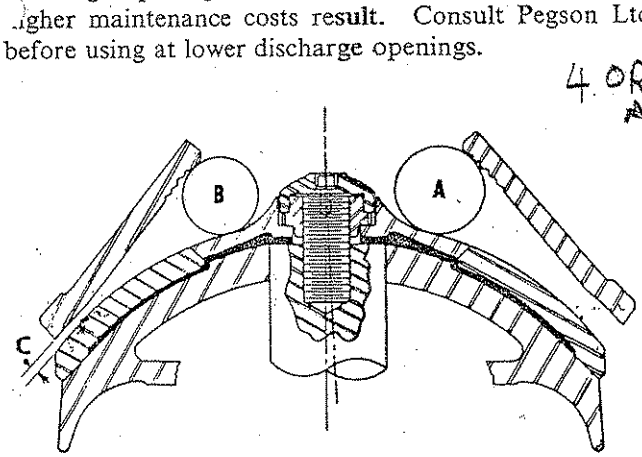
The discharge openings of the Gyraspheres are measured on the closed side at the bottom annulus between the head and the concave ring. In Fig. 5 below, the discharge openings are indicated by 'C' and 'F' respectively for the style S and style FC machines; measurement of the feed openings (A, B, D and E) is also shown.

When setting the machine it is advisable to have the discharge opening slightly smaller than the screen opening that is to gauge the size of the finished product. For example, if a product passing a ½ in. clear square opening is required, the discharge opening of the crusher should be approx. ⅜ in.

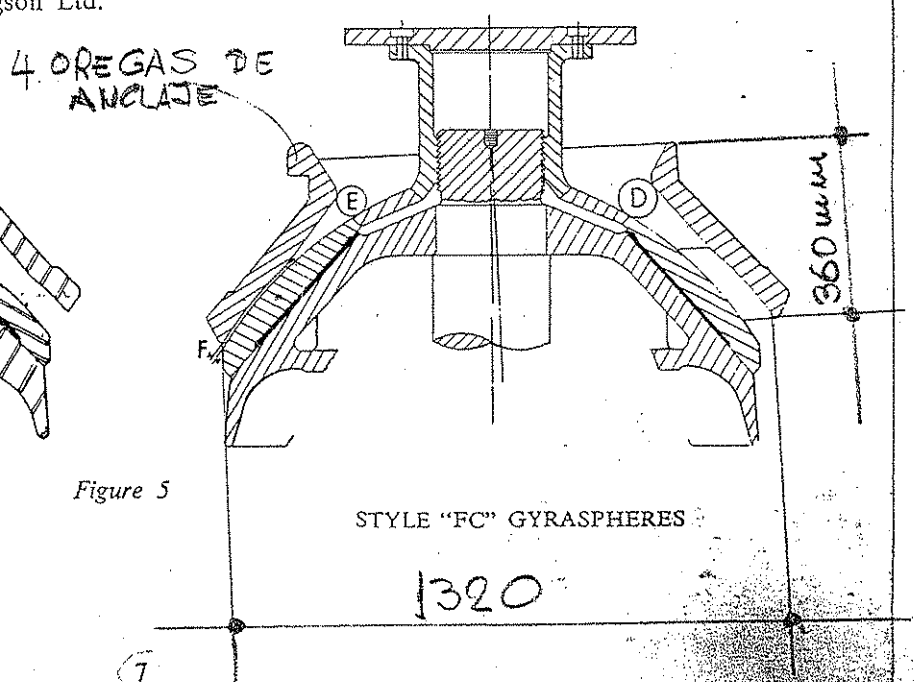
To adjust the discharge opening (Fig. 6): It is not necessary to have the machine working when adjusting the discharge opening; in fact it is far safer to carry out the work with the crusher stopped. Loosen the adjusting screws (1B4) and with the aid of the lever (3B5) rotate the adjusting collar (1A3 or 1B3). If the wedge ring (1B7) and collar threads are seized tight due to the machine being operated at one setting for a long period, the adjusting mechanism can be released by crushing a few rocks with the adjusting screws loosened. The lugs in which the lever engages are equi-spaced around the adjusting collar and on the 36in. Gyraspheres there are 64 in number; on the 48in. Gyraspheres there are 82. For every 34 of the lugs engaged the discharge opening changes ¼ in. Clockwise rotation decreases the opening, counter-clockwise rotation increases it. After making the adjustment **tighten the screws (1B4) evenly** to ensure that the wedge ring (1B7) is forced up squarely to give perfect contact. Check the lower edge of the adjusting collar—where the seal retainer (2B1) is bolted—and ascertain that it is parallel to one of the grooved lines cut round the main frame (1B1). These lines are cut at ¼ in. intervals and provide a ready evaluation of the vertical adjustment that has taken place. (N.B. The extent of this vertical movement must not be construed as the extent to which the discharge opening has been changed.) **If the adjusting collar is not parallel, the concave bowl will also be out of parallel and this will cause the crusher to have an uneven discharge opening and produce an irregular product.**

Size and Style of Gyrasphere	36S		367S	36FC			48S		489S	48FC		
Type of Bowl	Coarse	Med.	Coarse	Coarse	Med.	Fine	Coarse	Med.	Coarse	Coarse	Med.	Fine
Feed Opening— Open Side 'A' or 'D'	5½″	4½″	7″	3″	2″	1¾″	7½″	5½″	10″	3″	3″	2″
Closed Side 'B' or 'E'	4⅜″	3¾″	6½″	2″	1⅛″	⅜″	6¾″	4½″	9″	2⅞″	1⅞″	½″
Recommended Minimum Discharge Opening 'C' or 'F'	½″	⅜″	¾″	1/16″	¼″	3/16″	¾″	½″	1″	⅜″	½″	¼″

Whilst some crushing operations may allow smaller discharge openings than shown it is usually found that higher maintenance costs result. Consult Pegson Ltd. before using at lower discharge openings.



STYLE "S" GYRASPHERES



STYLE "FC" GYRASPHERES

Figure 5

After adjusting the opening it is advisable to check and re-tighten the screws (1B4), if necessary, when the Gyrasphere has been crushing for 30 minutes. This will take up any play that may have resulted between the adjusting screws and wedge ring as the parts become perfectly seated.

The threads of the adjusting mechanism are greased prior to despatch. This will be sufficient for approximately six months operation after which a light grease or heavy oil similar to 600W should be added through the plugged holes around the upper part of the adjusting collar—see Fig. 6.

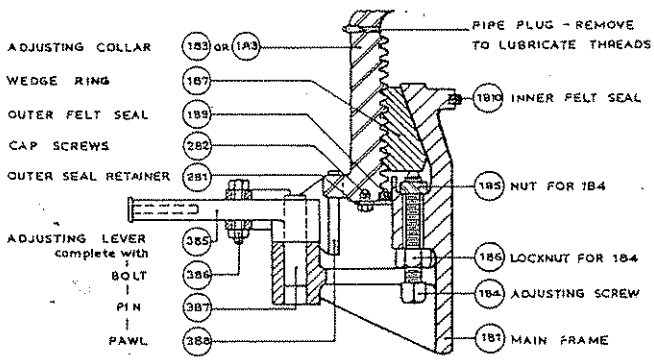


Figure 6.

ADJUSTMENT OF DISCHARGE OPENING

Note: A simple way of checking the discharge opening after making an adjustment is to drop a piece of lead into the rotating Gyrasphere head (e.g., for checking a ½ in. setting, use lead approx. 1 in. thick). After the lead has passed through the machine, take a caliper reading of its most compressed section and this will indicate the discharge opening on the closed side.

6. SPRING RELIEF ACTION AND ADJUSTMENT

The Gyraspheres are equipped with springs (3A4 or 3B4) to hold the concave support bowl (3A9, 3B9 or 3C9) in its normal position under normal operating conditions. When an uncrushable object enters the machine or when excessive packing of material occurs within the crushing chamber, the springs act as a safety device by allowing the bowl to lift away from the sphere head (6A7 or 5B1). The spring compression is adjusted prior to despatch for normal crushing operation; this compression is ¾ in. and the spring lengths are as follows:

Gyrasphere	36S		36FC, 367S	48S, 48FC, 489S
Type of Bowl	M	C	M or C	M or C
Free Length of Springs	16″	15½″	15¼″	20″
Normal Compressed Length	15¼″	14¾″	14¾″	19¼″

M=Medium C=Coarse

Continuous jumping of the concave support bowl, when the springs are in correct compression, indicates that there is some fault in the crushing conditions. **This should be traced and remedied at once.** The most common faults are: intermittent feeding, an improperly-installed feed chute, excessive fines or dirt in the feed, or failure to distribute the feed evenly round the feed opening.

Insufficient spring compression will, of course, also cause continuous jumping of the bowl. To increase the compression, tighten the main tension bolt nuts (3A2 or 3B2) evenly and approximately ⅛ in. at a time until the bowl movement has been eliminated; sledge up the locknuts (3A3 or 3B3). **Note: Do not tighten the auxiliary tension bolt nuts (3A12 or 3B12); these must not be allowed to take spring tension during crushing operations.**

To dismantle the spring assembly, see paragraph 8A, B or C and to reassemble, paragraph 16.

7. THRUST ROD LOCKING ARRANGEMENT

A. 36S and 48S Gyraspheres

The concave support bowl (3A9) is held in place relative to the adjusting collar (1A3) by thrust rods—shown at 'C' in Fig. 7. These rods engage in the horizontal holes in lugs 'A' and bracket 'B'; the former are mounted over the tension bolts (3A1) and are held by set

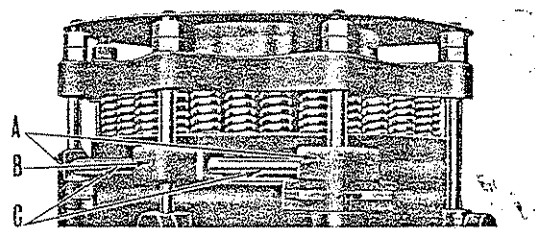


Figure 7

screws whilst the latter is cast integral with the concave support bowl. The thrust rods 'C' should fit between the lugs with a minimum of end play and the vertical hole in bracket 'B' should be out of contact with the tension bolt (3A1). If the thrust rod should embed deeper into the horizontal openings and such contact occurs, either replace the rod with one of the proper length or insert a steel disc in the horizontal opening to compensate for end play.

B. 36FC, 367S, 48FC and 489S Gyraspheres

The concave support bowl (3B9) is held in place relative to the adjusting collar (1B3) by thrust rods—shown at 'C' in Fig. 8. These rods engage in the hori-

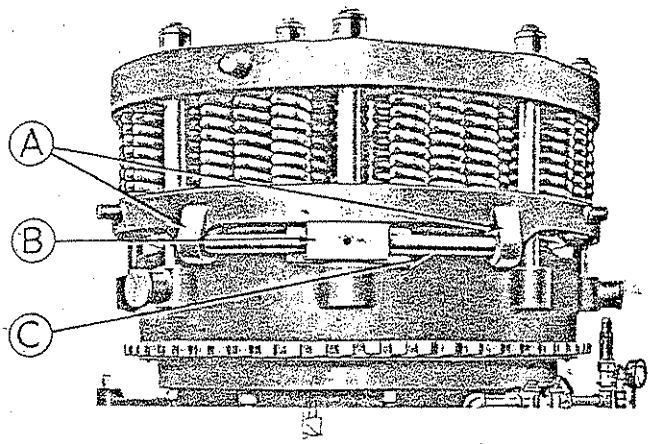


Figure 8

zontal holes in lugs 'A' and bracket 'B'; the former are cast integral with the concave support bowl whilst the latter is mounted over the tension bolt (3B1) and held by a set screw. The thrust rods 'C' should fit between the lugs with a minimum of end play and the vertical holes in the concave support bowl should be out of contact with the tension bolts (3B1). If the thrust rod should embed deeper into the horizontal openings and such contact occurs, either replace the rod with one of the proper length or insert a steel disc in the horizontal opening to compensate for end play.

8. DISMANTLING GYRASPHERE

A. Style 36FC and 48FC Gyraspheres—*see Fig. A at rear of book.*

Lift out the receiving hopper (9B6) which is spigot-mounted on the machine. Tighten down the nuts (3B12) on the auxiliary tension bolts (3B11) until there is no upward thrust on the main tension bolts then remove the nuts (3B2 and 3B3) from the main tension bolts; the concave support bowl (3B9) and spring assembly (3B4) can now be withdrawn as a complete unit. (To dismantle the spring assembly, remove the auxiliary tension bolt nuts, lift off the upper retaining ring and take out the springs.) Remove the distributor plate bolts (4B4), lift out the distributor plate (4B3) and insert the eyebolt supplied with the machine into the top of the main shaft (5B2). Lift the head and shaft unit complete and proceed as described in section D overleaf.

B. Style 36S and 48S Gyraspheres—*see Fig. B at rear of book*

Remove the cap screws (7A7) and lift out the receiving hopper (7A6). The spring assembly (3A4) and concave support bowl (3A9) can then be withdrawn as a complete unit as indicated in section A above. However, if it is intended to replace the concave ring (paragraph 14A) the operation will be simplified by first dismantling the spring assembly. To do this, remove the nuts from the main and auxiliary tension bolts (3A1 and 3A11), lift off

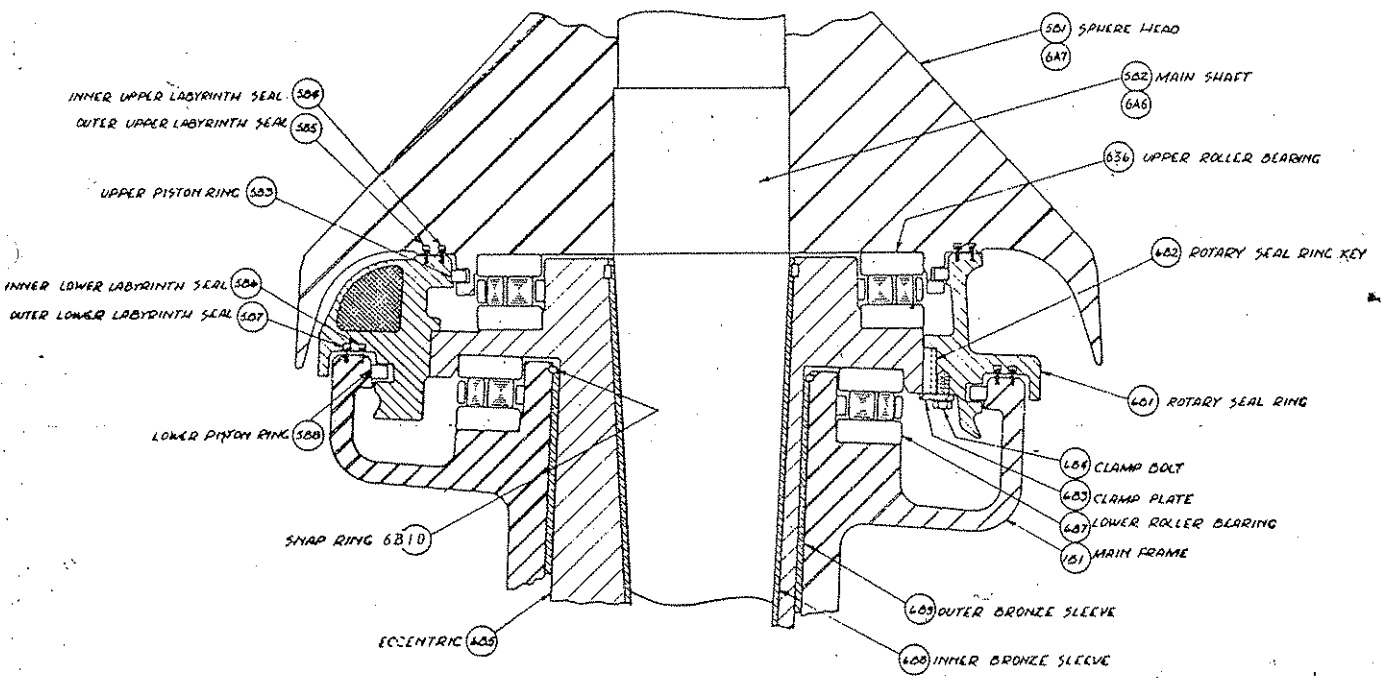


Figure 9

ARRANGEMENT OF ECCENTRIC UNIT (TOP)

the retaining ring (2A7), take out the springs (3A4) and then withdraw the concave support bowl (3A9). After removing the springs and bowl, the mantle stud cap screw (9A10) should be taken off and the eyebolt, provided with the machine, inserted in the tapped hole in the mantle stud (7A5). Lift the head and shaft unit complete and proceed as described in section D opposite.

C. **Style 367S and 489S Gyraspheres**—*see Fig. C at rear of book.*

Remove the cap screws (7A7) and take off the receiving hopper (7A6). Note: The receiving hopper on the 367S machine is spigot-mounted and can be lifted out. Tighten down the nuts (3B12) on the auxiliary tension bolts (3B11) until there is no upward thrust on the main tension bolts then remove the nuts (3B2 and 3B3) from the main tension bolts; the concave support bowl (3C9) and spring assembly (3B4) can now be withdrawn as a complete unit. (To dismantle the spring assembly, remove the auxiliary tension bolt nuts, lift off the upper retaining ring and take out the springs.) Remove the mantle stud cap screw (9A10) and insert the eyebolt provided with the machine into the tapped hole in the mantle stud (7A5). Lift the head and shaft unit complete and proceed as follows.

D. **Style 36FC, 36S, 367S, 48FC, 48S and 489S Gyraspheres**—*see Figs. 9 and 10.*

When the head and shaft unit is being withdrawn, the upper race of the upper roller bearing (6B6) will often adhere to the underside of the head (5B1 or 6A7) due to oil suction. To prevent damage by the race dropping off on to the rollers, clean boards should be placed on top of the rollers as soon as the head has been raised high enough to allow this. Sometimes the race will not detach itself during lifting in which case it may be brought away with the head but precautions must be taken against injury to personnel or parts in the event of the oil suction breaking during lifting or handling. To remove the race from the head, apply light heat to break the oil seal.

The roller assembly of the upper bearing is now exposed in the machine and this should be lifted out, followed by the lower race of the bearing (6B6). Wrap the roller assembly and races in clean rags and store in a dry place for protection until machine is reassembled.

Before the eccentric (6B5) can be removed from the crusher, the main drive gear (7B1) must be released from the bottom of the eccentric—see Fig. 10. Disconnect the oil feed pipe at the bottom of the crusher, remove the drain plug in cover plate (7B6) and drain off any oil that may be present; plug the pipe ends to keep out dirt.

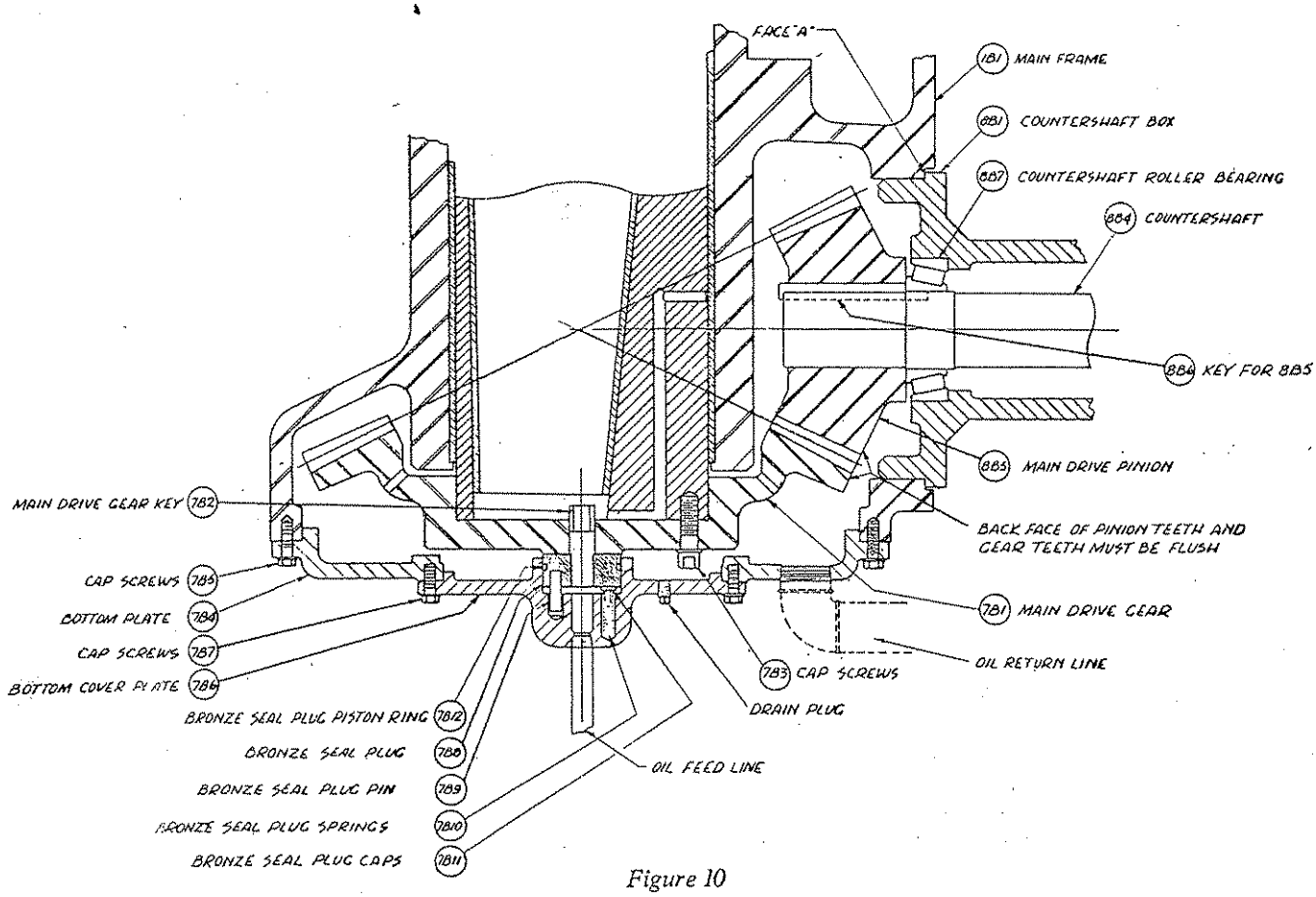


Figure 10

ARRANGEMENT OF ECCENTRIC UNIT (BOTTOM)

the retaining ring (2A7), take out the springs (3A4) and then withdraw the concave support bowl (3A9). After removing the springs and bowl, the mantle stud cap screw (9A10) should be taken off and the eyebolt, provided with the machine, inserted in the tapped hole in the mantle stud (7A5). Lift the head and shaft unit complete and proceed as described in section D opposite.

C. Style 367S and 489S Gyraspheres—*see Fig. C at rear of book.*

Remove the cap screws (7A7) and take off the receiving hopper (7A6). Note: The receiving hopper on the 367S machine is spigot-mounted and can be lifted out. Tighten down the nuts (3B12) on the auxiliary tension bolts (3B11) until there is no upward thrust on the main tension bolts then remove the nuts (3B2 and 3B3) from the main tension bolts; the concave support bowl (3C9) and spring assembly (3B4) can now be withdrawn as a complete unit. (To dismantle the spring assembly, remove the auxiliary tension bolt nuts, lift off the upper retaining ring and take out the springs.) Remove the mantle stud cap screw (9A10) and insert the eyebolt provided with the machine into the tapped hole in the mantle stud (7A5). Lift the head and shaft unit complete and proceed as follows.

D. Style 36FC, 36S, 367S, 48FC, 48S and 489S Gyraspheres—*see Figs. 9 and 10.*

When the head and shaft unit is being withdrawn, the upper race of the upper roller bearing (6B6) will often adhere to the underside of the head (5B1 or 6A7) due to oil suction. To prevent damage by the race dropping off on to the rollers, clean boards should be placed on top of the rollers as soon as the head has been raised high enough to allow this. Sometimes the race will not detach itself during lifting in which case it may be brought away with the head but precautions must be taken against injury to personnel or parts in the event of the oil suction breaking during lifting or handling. To remove the race from the head, apply light heat to break the oil seal.

The roller assembly of the upper bearing is now exposed in the machine and this should be lifted out, followed by the lower race of the bearing (6B6). Wrap the roller assembly and races in clean rags and store in a dry place for protection until machine is reassembled.

Before the eccentric (6B5) can be removed from the crusher, the main drive gear (7B1) must be released from the bottom of the eccentric—see Fig. 10. Disconnect the oil feed pipe at the bottom of the crusher, remove the drain plug in cover plate (7B6) and drain off any oil that may be present; plug the pipe ends to keep out dirt.

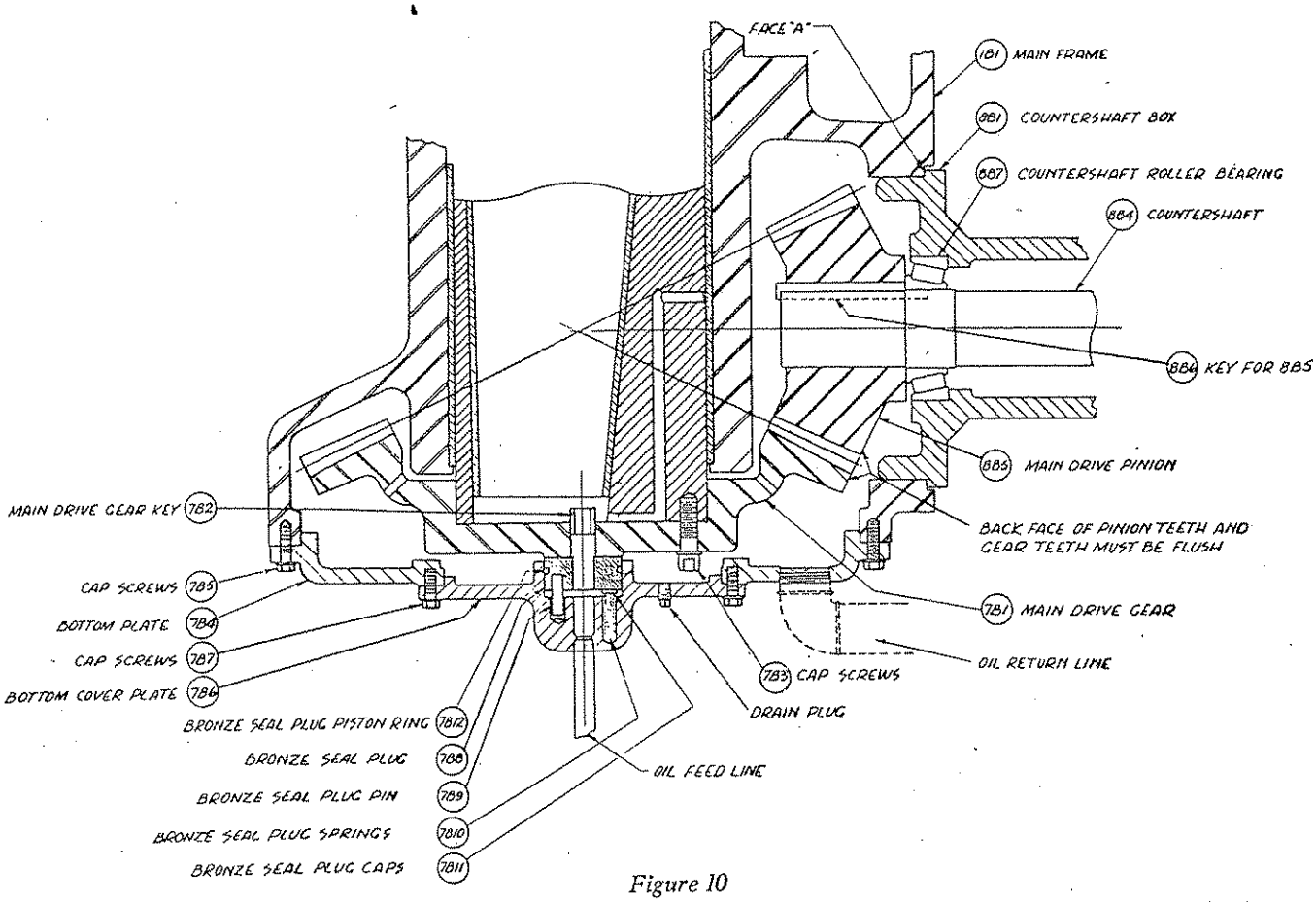


Figure 10

ARRANGEMENT OF ECCENTRIC UNIT (BOTTOM)

Unscrew the cap screws (7B7) and remove the cover plate (7B6) by inserting screws in the tapped holes provided for this purpose; the oil seal plug assembly will come away with the cover plate. The hollow-head caps screws (7B3) which attach the main drive gear (7B1) to the bottom of the eccentric are now exposed and, after removing these, the eyebolts provided with the Gyrasphere can be screwed into the holes at the top of the eccentric for lifting purposes. When the eccentric is raised, the main drive gear (7B1) will remain in the gear case squarely supported by the machined pads on the bottom plate (7B4).

During withdrawal of the eccentric, the upper race of the lower roller bearing (6B7) will tend to stick to the underside of the eccentric and the same precautions must be taken, as described for the upper race of the upper bearing. Remove the roller assembly and lower race of bearing (6B7) and wrap with clean rags for protection until machine is reassembled.

The rotary seal ring (6B1) will come away with the eccentric. It is attached by means of clamp bolts (6B4) and clamp plates (6B3) and rotates with the eccentric through a steel key (6B2). Removal of the ring is unnecessary as it has no wearing parts or surfaces but, if so desired, it can be inspected by unscrewing the clamp bolts and lifting the ring off the eccentric. A portion of the ring is hollowed and filled with lead; this serves as counterweight to balance the eccentric action of the head and provide smooth running.

The bottom plate (7B4) is usually left intact unless the main drive gear is to be replaced. To remove the plate disconnect the main oil return line, support the plate and gear, then remove cap screws (7B5) and lower off. The support may be in the form of a crane hook lowered through the centre of the machine and carrying a bar which will span the opening of the bottom plate; alternatively timber staging can be used beneath the machine of sufficient strength to withstand the unit weight of the heavy gear and bottom plate.

The adjusting collar (1A3 or 1B3) need not be removed from the crusher but, if it is desired to do so, proceed as follows: *(See Fig. 6)*. Remove caps screws (2B2) from the outer seal retainer (2B1) which will allow the latter to drop. Take out the felt seal (1B9) now exposed and turn the adjusting collar counter-clockwise to remove. If dismantling is carried out to this stage, it is recommended that the condition of the inner felt seal (1B10) is checked although, normally, this part only needs renewing after many years service. The seal should stand sufficiently proud to rub against the deflector ring (2B3) thus preventing dust entering the adjusting threads; renew the felt if worn.

The countershaft is removed from the crusher as a complete unit—*refer to drawing of Oiling System and Figs. A, B or C at rear of book.* Withdraw the flywheel (9B1) from the countershaft (8B4) and disconnect all oil lines to the machine; plug the ends of the lines with rag to keep clean. Loosen the main frame clamping bolts (9B4) and remove the countershaft box bolts (8B13). On the face carrying the countershaft box bolts are two tapped holes; insert set-pins in these and tighten up to slowly withdraw the countershaft unit. If the countershaft unit has not been removed for a number of years it may be difficult to extract with set-pins only; in this case, drive wedges into the slots where the clamping bolts (9B4) are located to open up the crusher frame bore and so allow the set-pins to pull the countershaft unit away. When the countershaft box (8B1) is about 1 in. away from the crusher frame, support the unit by means of a cable and crane hook; the unit may then be withdrawn until it is clear of the crusher frame.

9. REPLACING PINION AND ROLLER BEARINGS ON COUNTERSHAFT

—see Fig. A, B or C at rear of book.

Withdraw the countershaft unit from the crusher main frame as described in the preceding paragraph. Remove the pump housing (1F5) from the countershaft box (8B1) and loosen off the set screws on the pump drive gear (1F1)—the opening previously covered by the pump housing will give access to the screws. Remove the oil guard (8B12) and, after loosening the clamp bolt (8B11) and removing the lock screw (8B9), unscrew the adjusting nut (8B8). With the aid of a babbitt hammer or hard wood block commence to drive out the countershaft (8B4) from the flywheel side. After the countershaft has been driven through the box approximately 6 in. the inner race of the outer bearing (8B7) will become loose and can be withdrawn from the shaft. As the shaft is drawn through the box, the pump drive gear should be slid along it and eventually removed through the top opening in the box.

The main drive pinion (8B5) is pressed on to the end of the countershaft and is held in place by a steel taper-key (8B6)—see Fig. 10. To replace the pinion proceed as follows: Spot-weld the end of the key to the face of the pinion so that the key comes away with the pinion and does not wedge in tighter as the countershaft is pushed out. Heat the pinion evenly with a torch and press out the countershaft. When the pinion is removed the key can be knocked out for re-use. The new pinion can be pressed on to the countershaft or, if a press is not available, the pinion should be heated and the countershaft driven in. When carrying out this operation **make sure that the keyways in the pinion and in the end of the countershaft are perfectly in line.** The taper-key should then be sledged in tightly. If the old key is re-used and the head drives flush with the face of the pinion it is not tight enough; remove the key, by driving from the back of the pinion with a bent bar or drift, and insert a thin shim in the bottom of the countershaft keyway; this will cause the key to tighten before being driven too far in.

To replace the countershaft roller bearings (8B7) first remove the inner bearing inner race—next to the pinion—by wedging off or, if of no value, cut free with a torch; the inner race of the outer bearing will come loose when withdrawing the shaft. The outer races of the bearings can be removed from the countershaft box (8B1) by means of a bar. When fitting the new outer races check that the faces and bores of the countershaft box have no burrs or defects then drive the races in place with a hard wood block ensuring that they contact the shoulders squarely. Before fitting the new inner bearing inner race, heat the race in oil to a temperature of 90°C approx. Stand the shaft up on the pinion end and fit the heated race in place against the pinion. Lower the countershaft box over the shaft, at the same time inserting the pump drive gear (1F1) on to the shaft through the side opening of the box. Heat and fit the outer bearing inner race, positioning correctly on the countershaft. Replace the locking plate (8B10), registering its recess with the small L-shaped anchor key fitting in the groove cut on the shaft adjacent to the bearing, and tighten up the adjusting nut (8B8) to a position where the rollers are snug but do not bind. The lock screw (8B9) can then be fitted and the clamp bolt (8B11) tightened up. Bolt the oil guard (8B12) in place. Check that the pump drive gear (1F1) is properly spaced inside the countershaft box, tighten up the set screws in the countersunk holes in the shaft and wire the screws in place. Refit the pump housing (1F5) on the countershaft box.

The complete countershaft unit can now be returned to the crusher main frame and pulled up tightly with the countershaft box bolts (8B13). After fitting, check that the pinion is in correct mesh with the main drive gear as described in the following paragraph.

10. REPLACING MAIN DRIVE GEAR—*see Fig. 10.*

The crusher is driven through a cut steel gear engaging with the countershaft pinion. For smooth operation the gear should have slightly perceptible back-lash at all positions of the eccentric which can be tested at each point by turning the flywheel through two revolutions. If the parts have become worn or damaged, the pinion should be replaced as described in paragraph 9. To replace the drive gear proceed as follows:

Disconnect the oil feed line where it is fitted to the cover plate (7B6) and plug end with rags to keep clean; likewise, disconnect oil return line and plug up. Take off the cover plate cap screws (7B7) together with the cover plate (7B6). Remove the main drive gear cap screws (7B3) and allow the drive gear (7B1) to drop until it rests on the pads on the bottom plate (7B4). Support the plate and gear—by crane hook if the head and eccentric units have been removed, if not, by timbers beneath the crusher—release the bottom plate cap screws (7B5) and lower off the plate and gear. Remove the gear, take out the key (7B2) and fit same in keyway of the new gear. Make sure that the new gear is quite clean then hoist it into position on the bottom of the eccentric (6B5). Insert the main drive gear cap screws (7B3) and draw the gear up to the eccentric tightly. If the countershaft unit carrying the pinion has been removed, return it to the crusher frame and pull up tightly with bolts (8B13).

Before replacing the bottom plate (7B4) **check that the gear and pinion are in correct mesh.** The back faces of the gear and pinion teeth can be seen by looking up through the opening in the bottom of the main frame. These faces must be flush and even as shown in Fig. 10. If the back face of the pinion is deeper than that of the gear, the mesh is too tight. This can be corrected by inserting shims between the countershaft box and main frame bore, indicated at face 'A' on Fig. 10; the countershaft unit should be partially withdrawn from the frame to enable the shims to be inserted. When the back faces of the gear and pinion teeth are in proper alignment check for correct back-lash as mentioned above.

Clean the bottom plate (7B4), raise into position and secure in place with cap screws (7B5). Refit the cover plate (7B6) and reconnect the oil feed and return lines.

11. BABBITTING AND BACKING

Babbitting

Before carrying out the babbitting operations referred to in paragraphs 12 and 15 make sure that the surfaces to be metalled are free from moisture—if not, the hot metal may generate steam and cause an explosion. Apply a light coat of oil to the surfaces and to the clay pouring gates. Wear protective clothing and take the usual precautionary measures when handling and pouring the hot metal.

Backing

The mantle and concave ring are backed with Pegbond, a non-metallic agent which gives greater impact protection than zinc and is far easier and safer to apply. When re-backing the parts, as referred to in paragraphs 13 and 14, the following procedure should be adopted:

(i) Clean and set up the parts to be backed ensuring that all holes, joints, etc., are sealed off and that threaded parts are protected. To prevent pouring difficulties in cold weather, warm the parts to above 18°C also the contents of the two tins marked (A) and (B).

(ii) Insert the stirring rod supplied with the kit into an electric drill and stir the contents of the large tin (A). Move the rod round the sides and bottom of the tin to ensure maximum stirring.

(iii) When the contents have been thoroughly agitated, continue to stir, and pour in the contents of small tin (B). Mixing must continue until the ingredients become uniform pink in colour.

Note: At this stage hardening starts to take place rapidly. *Pour without delay.*

(iv) Pour the Pegbond into the opening between the crusher parts by means of a clay pouring gate and continue pouring until the aperture is filled to the correct level or the contents of the tin are used.

(v) If more Pegbond is needed, repeat (ii), (iii) and (iv).

(vi) Reassemble the parts in the Gyrasphere by which time the Pegbond will have hardened sufficiently for the machine to be returned to service.

Note: When mixing and applying Pegbond, carry out the work in a well-ventilated area and protect the hands with rubber gloves. Should any come into contact with the skin, remove the material with soap and water before it can harden. If it should enter the eyes, bathe them immediately in clean running water. If it is spilled on clothing, thoroughly wash articles before re-use.

Pegbond is supplied in kits of 21 lb. (after mixing). The numbers of kits required for backing Gyrasphere parts are:

Gyrasphere Type	36S	367S	36FC	48S	489S	48FC
Mantle	2	2	2	5	5	2
Concave Ring	2	2	2	4	4	4

After babbitting or re-backing parts, it is recommended that the new surfaces be run-in by operating the Gyrasphere at 50% load for the first day, 75% load the second day and full crushing load thereafter.

12. REPLACING BRONZE SLEEVE BEARINGS—*see Fig. 9, also paragraph 11.*

Access to the bronze sleeve bearings can be obtained after removal of the head and shaft unit and the eccentric unit as described in paragraph 8.

The outer sleeve (6B9) is held in position by vertical babbitt keys and is prevented from rising by a snap ring (6B10) fitting in the groove on the upper frame bore above the sleeve. Remove the snap ring and with a cold chisel cut the outer sleeve down one of the vertical keyways over its full depth; this will collapse the sleeve and it can then be withdrawn from the bore through the top of the frame. Check that the bore is clean and free from burrs and insert the new outer sleeve taking care that the sleeve keyways correspond with those in the bore. Stop up the keyways at the bottom with clay, make clay pouring gates at the top and pour in babbitt. After cooling, remove any excess babbitt with a small chisel and replace the snap ring in the horizontal groove.

The inner sleeve (6B8) is held in position by vertical babbitt keys and by a horizontal babbitt-filled groove near the top of the sleeve. Remove this babbitt ring by chiselling through, remove the top of the sleeve thus cut off, and clean out the babbitt groove machined in the eccentric (6B5). The remainder of the sleeve can then be collapsed and withdrawn by chiselling down one of the vertical keyways. When fitting the new inner sleeve check that the eccentric bore is clean and that the sleeve is in its correct position: a vertical slot extends from the sleeve base to within a few inches of its top; **this slot acts as an oil duct and must be on the same side as the flat on the outside of the eccentric (6B5);** also make sure that the keyways in the sleeve and the eccentric are in alignment. Because of the slot it is necessary to expand the sleeve, after positioning, to give it full contact with the eccentric bore. To do this insert a wood plug, approximately 6 in. deep, into the lower part of the sleeve and drive down until correct expansion has been obtained. Clay up the bottoms of the vertical keyways, make pouring gates and pour in babbitt; this will flow into the horizontal ring as well as the vertical keyways. After cooling remove the plug, clay and excess babbitt.

13. REPLACING MANTLES ON SPHERE HEAD

A. Style S Gyraspheres—*See Fig. 11*

Withdraw the complete head unit assembly from the Gyrasphere, as described in paragraph 8, remove the lifting bolt and take out the stud cap (9A9) thereby exposing the mantle nut (9A16). Fit the wrench supplied with the machine over the nut and sledge in an anti-clockwise direction. If the nut cannot be moved—this sometimes occurs due to the ductility of manganese under long, heavy pounding causing a binding effect between the mantle and nut—an acetylene torch should be used to continue the dismantling. Start half way down the upper mantle (9A11) and cut a groove through and latitudinally round it, being careful not to penetrate the sphere head (6A7) beneath. After the cut has been made, a few blows with a heavy sledge on the upper mantle will loosen this part and so relieve the strain on the mantle nut. It will now be possible to unscrew the nut following which the upper and lower mantles can be lifted off. Remove any pieces of old backing which may have adhered to the sphere head and clean the surface thoroughly with a wire brush. **Apply a thin coat of oil to the head**—this is important otherwise the new backing will seal itself to the head, possibly to so great a degree that the head and mantle will be found virtually inseparable when future dismantling is required.

Before fitting the new lower mantle inspect the ground surface, inside the mantle bottom, and the finished surface on the sphere head which it contacts. Any burrs or rough spots should be smoothed down with a file. Clean the insides of the new lower and upper mantles with a wire brush.

Place the lower mantle (9A12) on the sphere head (6A7) turning it to a position where the grooves inside the mantle correspond with those on the head. The underside of the upper mantle (9A11) has retaining lugs; mark the positions of these on the outside surface for guidance and fit the mantle so that the lugs sit in the corresponding slots in the lower mantle. Fill the area round the mantle stud (7A5) with clay to a depth of approximately ½ in.—see Fig. 11; this filling prevents backing liquid flowing beyond the mantles and contacting the stud threads. Screw the mantle nut (9A16) on to the mantle stud and tighten firmly with the wrench and sledge. In order to ensure that all parts are properly seated and that the assembly is tight, hit the upper and lower mantles a few times with the sledge then repeat the tightening operation on the mantle nut. When the nut is fully driven home, make sure that one of the lugs on its periphery is directly in line with one of the openings on the top of the upper mantle; otherwise it will not be possible to fit the stud cap (9A9) later.

that it contains lugs internally and round its base; these rings of lugs are arranged so that in one case only is a lug and a space in direct alignment. Mark this position on the stud cap and align with the similar lug/space matching of the mantle nut and upper mantle. Place the stud cap over the mantle nut, making sure that it is engaging properly, and tighten down by means of the cap screw (9A10).

B. Style FC Gyraspheres—*See Fig. 12.*

Withdraw the complete head unit assembly from the Gyrasphere, as described in paragraph 8, and remove the lifting bolt. Fasten a heavy steel bar across the top of the mantle nut (4B5), securing by bolts through the holes normally occupied by the distributor plate bolts (4B4), and sledge the bar in a clockwise direction. **Note: The nut has a left-hand thread.** If the nut cannot be moved—this sometimes occurs due to the ductility of manganese under long, heavy pounding causing a binding effect between the mantle and nut—an acetylene torch should be used to continue dismantling. Start half way down the upper mantle (4B6) and cut a groove through and latitudinally round it, being careful not to penetrate the sphere head (5B1) beneath. After the cut has been made, a few blows with a heavy sledge on the upper mantle will

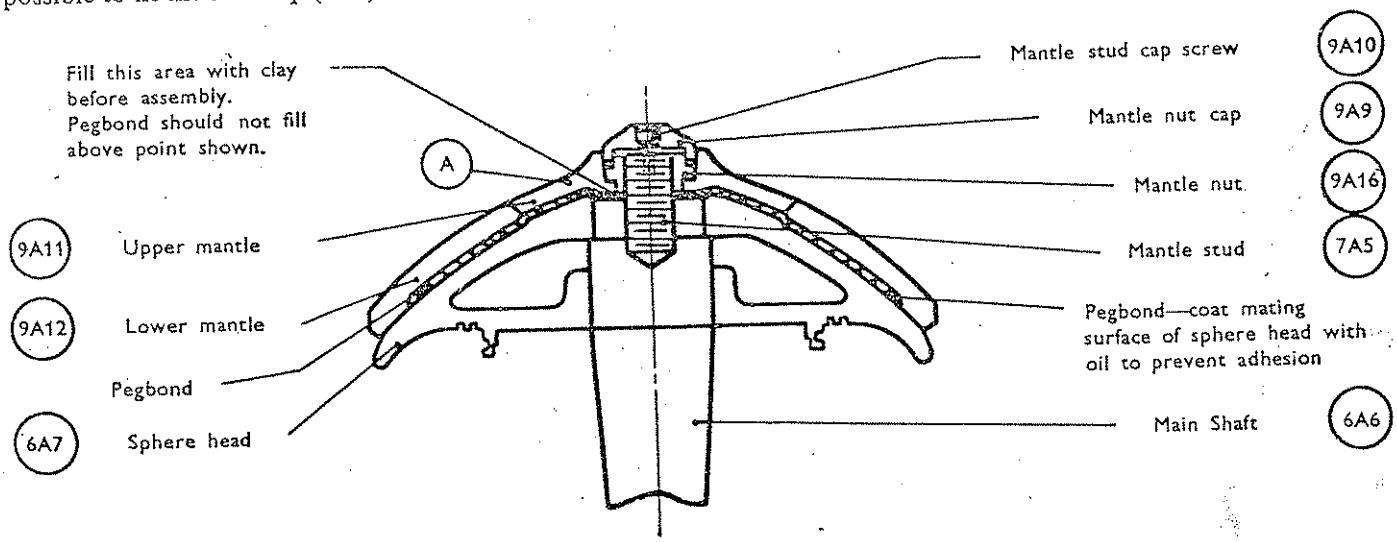


Figure 11

HEAD AND MANTLE ASSEMBLY—STYLE S GYRASPHERES

The complete head unit should now be turned over so that the shaft is projecting upwards. Make clay pouring gates at two of the openings between the bottom of the lower mantle and the sphere head and pour in Pegbond backing—see paragraph 11.

The stud cap (9A9) and cap screw (9A10) are fitted after the head unit has been returned to the Gyrasphere—see paragraph 16 to carry out this—as the tapped hole which takes the cap screw is first used to accommodate the lifting bolt. When fitting the stud cap, it will be seen loosen this part and so relieve the strain on the mantle nut. It will now be possible to unscrew the nut following which the upper and lower mantles can be lifted off.

Remove any pieces of old backing which may have adhered to the sphere head and clean the surface thoroughly with a wire brush. **Apply a thin coat of oil to the head**—this is important otherwise the new backing will seal itself to the head, possibly to so great a degree that the head and mantle will be found virtually inseparable when future dismantling is required.

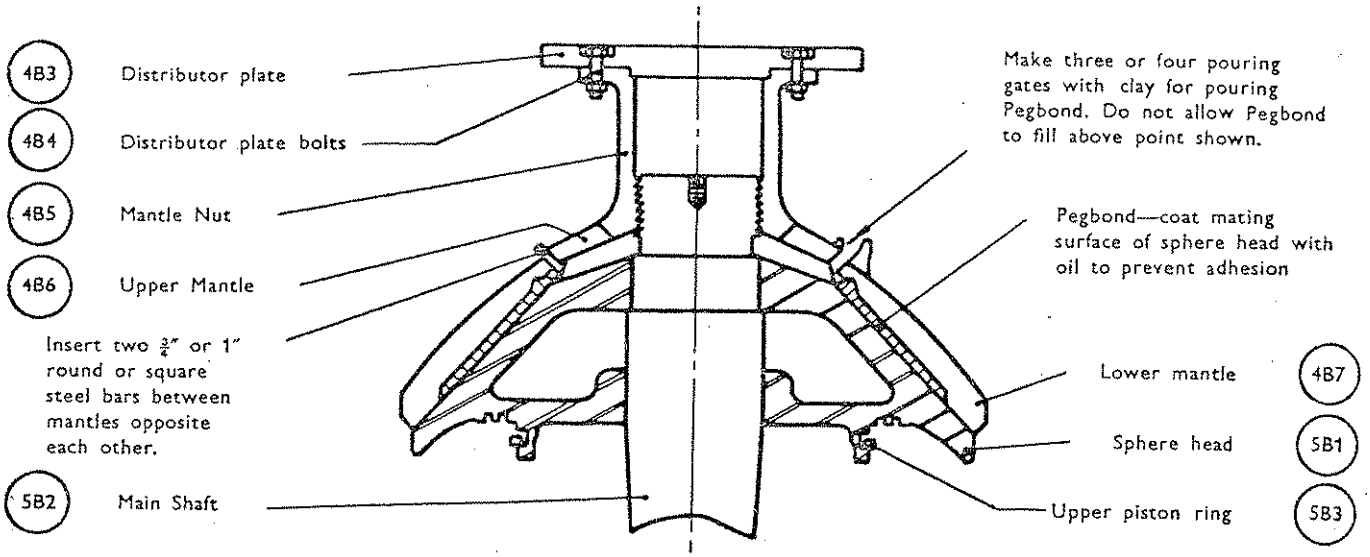


Figure 12

HEAD AND MANTLE ASSEMBLY—STYLE F.C. GYRASPHERES

Before fitting the new lower mantle inspect the ground surface, inside the mantle bottom, and the finished surface on the sphere head which it contacts. Any burrs or rough spots should be smoothed down with a file. Clean the insides of the new lower and upper mantles with a wire brush.

Place the lower mantle (4B7) on the sphere head (5B1) turning it to a position where the grooves inside the mantle correspond with those on the head. Fit the upper mantle (4B6) checking that the two semi-circular corings at the bottom are in line with those in the top of the lower mantle. Replace the mantle nut (4B5) and tighten down to ensure that the mantles are properly seated. The mantle nut should then be loosened off sufficiently to allow the upper mantle to be raised and two ¾ in. or 1 in. thick steel bars inserted in the space between the mantles. Locate the bars on opposite sides to give even pressure and tighten down the mantle nut firmly. Make three or four pouring gates at the cavity round the top of the lower mantle and pour in Pegbond backing—see paragraph 11. The backing should be poured until is approximately 1 in. below the top of the lower mantle; it must not be allowed to rise as high as the lace which mates with the upper mantle. After the backing has hardened, slacken the mantle nut and remove the two steel bars; check that the semi-circular corings in the mantles are in alignment then tighten down the mantle nut. When the nut has been driven fully home, pour Pegbond into the two holes formed by the semi-circular corings thus keying the upper and lower mantles.

The wrench bar may now be removed from the mantle nut and the lifting bolt inserted in the top of the main shaft to return the head unit to the Gyrasphere—see paragraph 16. When the unit is in place, remove the lifting bolt and fit the distributor plate (4B3) by means of the bolts (4B4).

14. REPLACING CONCAVE RING

Remove the concave support bowl (3A9, 3B9 or 3C9) from the Gyrasphere as described in paragraph 8, section A, B or C. In the case of the 36FC, 367S, 48FC and 489S machines, the concave ring (4B1) can be replaced without dismantling the spring assembly from the bowl. In the case of the 36S and 48S machines it is recommended that the spring assembly be dismantled to simplify fitting of the ring (4A4).

A. 36S and 48S Gyraspheres—*see Fig. 13*

Bolt Type: Remove the concave ring nuts (4A3) with the wrench supplied with the machine and take off the steel washers (4A6). Set the concave support bowl (3A9) on blocks and drive the concave ring (4A4) down by means of a sledge until it falls away from the bowl. Turn the bowl over, remove any pieces of old backing which may have adhered to it and thoroughly clean the surface with a wire brush. Apply a thin coat of oil to the bowl surface—this is important otherwise the new backing will seal itself to the bowl, possibly to so great a degree that the concave bowl and ring will be found virtually inseparable when future dismantling is required.

Check the ground surface on the lower edge of the new concave ring and the machined surface on the lower edge of the concave support bowl. Any burrs or rough spots should be filed smooth.

Suspend the new concave ring over the support bowl. Before lowering, insert the wood packers which are

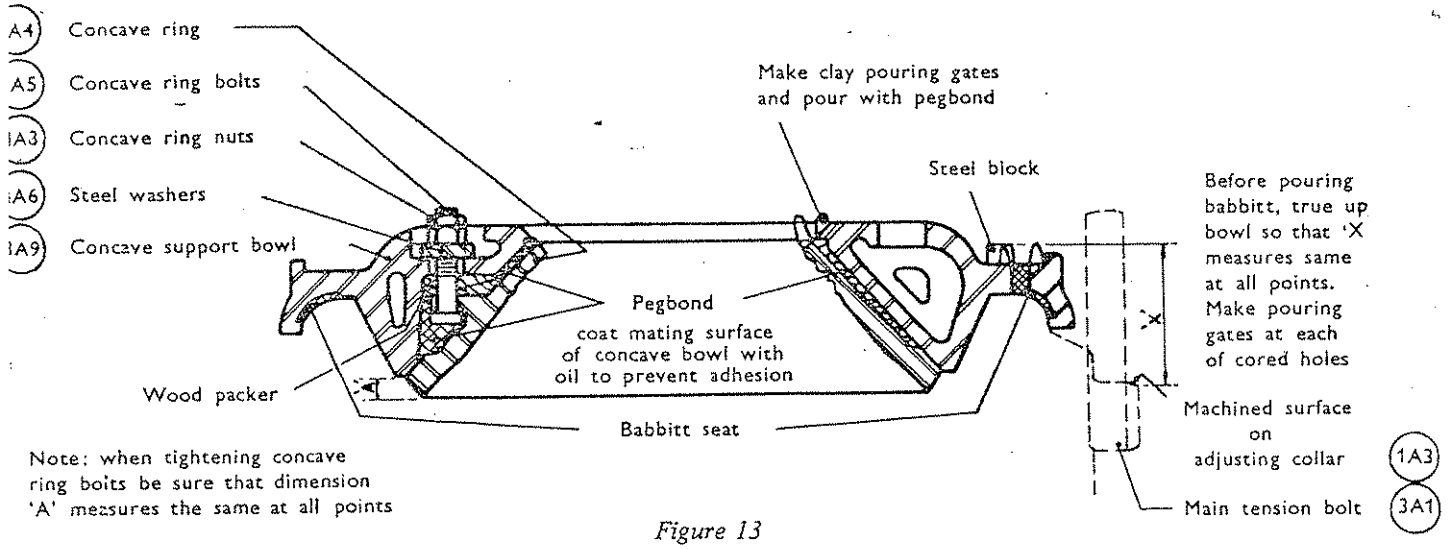


Figure 13

CONCAVE RING AND BOWL (BOLT TYPE)

pre-cut to shape and thickness into the pockets in the bowl and fit the bolts (4A5) into the concave ring. Lower the ring so that the bolts pass through the corresponding holes in the packers and the bowl; fit the steel washers (4A6) and ring nuts (4A3) to the ends of the bolts and tighten up. Turn over the complete bowl/ring assembly. Re-tighten the nuts evenly so that the ring is drawn up into the bowl centrally, checking this by measuring dimension 'A'—across the bottom edges of the bowl and ring, Fig. 13—and ensuring that the measurement is the same at different points around the lower edge; sledge the nuts firmly home. Make two or three pouring gates at the top of the concave ring and pour with Pegbond—see paragraph 11.

Return the concave bowl to the Gyrasphere as described in paragraph 16.

B. 36FC, 367S, 48FC and 489S Gyraspheres—*see Fig. 14*

Self-Locking Type: The concave ring (4A1 or 4B1) is held in place in the concave support bowl (3B9 or 3C9) by a self-tightening gunlock. The simplest way of removing the old concave ring is to support the bowl under its outer flange on blocks, extract the dowels adjacent to the taper wedges (4A2 or 4B2) and burn off the concave ring lugs with an acetylene torch; the ring can then be driven down and out of the bowl with a sledge.

Remove any pieces of old backing which may have adhered to the bowl and thoroughly clean the surface with a wire brush. **Apply a thin coat of oil to the bowl surface**—this is important otherwise the new backing will seal itself to the bowl, possibly to so great a degree that the concave bowl and ring will be found virtually inseparable when future dismantling is required. Check the ground surface on the lower edge of the new concave ring and the machined surface on the lower edge of the concave support bowl. Any burrs or rough spots should be filed smooth.

Raise the bowl sufficiently to allow the new concave ring to be placed beneath and support the ring on blocks. Lower the bowl on to the ring, positioning so that the lugs on the ring pass through the slots in the bowl. **Turn the ring clockwise so that the lugs rest on the bowl to the right of the slots.** (On the 367S and 489S machines only, reverse rotation of the Gyrasphere is permissible—see paragraph 3E—and if this is required the ring is turned counter-clockwise so that the lugs are to the left of the slots.) Fit the taper wedges with the thick ends adjacent

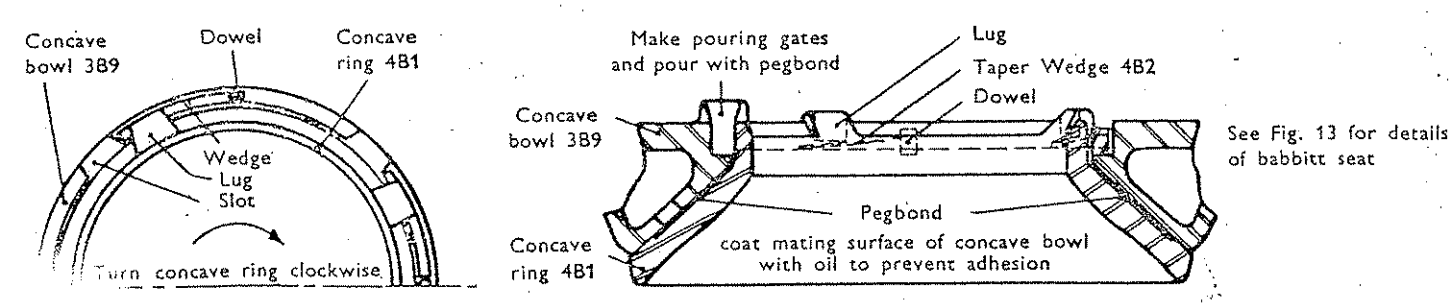


Figure 14

CONCAVE RING AND BOWL (SELF LOCKING TYPE)

to the dowel holes and drive in the dowels. Make sure that the wedges are fitted so that the concave ring is central to the concave support bowl, then sledge the ring thus driving the lugs firmly on to the wedges; continue sledging until the lower machined surfaces of the ring and bowl are in tight engagement. Form pouring gates at the top of the concave ring and pour with Pegbond—see paragraph 11.

Return the concave support bowl to the Gyrasphere as described in paragraph 16.

15. BABBITTING CONCAVE BOWL SEAT

In addition to the taper fit, the concave support bowl (3A9, 3B9 or 3C9) rests on the adjusting collar (1A3 or 1B3) on a babbitted seat—see Fig. 13. Under normal operating conditions the seat will last for many years. When re-babbitting is necessary a lateral movement will be perceived between the bowl and the collar. Note: Failure to re-babbitt at this time can result in excessive wear on the bowl and collar tapers which will necessitate building up the tapers with weld and re-machining to size.

Take the concave support bowl out of the Gyrasphere as described in paragraph 8, section A, B or C and by means of an acetylene torch remove all the old babbitt, particularly from the cored anchor and pouring holes. Replace the bowl on the adjusting collar and ensure that it is seating evenly. To check this, place a steel block on the bowl and measure dimension 'X' as shown in Fig. 13; the measurement should be the same when taken at various points around the bowl.

To permit the taper fit, there is a circumferential clearance between the lip of the bowl and the adjusting collar. In order to prevent babbitt flowing out of this clearance, blank off with soft clay from underneath, alternatively with thick string, tied to one of the lifting lugs and tightly wound two or three times round and into the clearance. Make pouring gates at each of the cored holes in the concave support bowl and pour with babbitt—see paragraph 11; pour quickly and simultaneously at two or more gates, topping up the remaining gates as necessary. After cooling remove the clay, string and excess babbitt; lift the bowl out of the collar and check that the babbitt has run evenly. Apply a coat of grease to the babbitt seat and the taper surface and return the bowl to the Gyrasphere as described in paragraph 16.

16. REASSEMBLING GYRASPHERE

When reassembling the Gyrasphere, the parts should be returned to the machine in reverse order to which they were removed, starting at the bottom and working upwards. If the countershaft assembly, bottom plate (7B4) and main drive gear (7B1) have been removed, these should be replaced first—see paragraphs 9 and 10. **Do not refit the cover plate (7B6) at this stage.**

The lower roller bearing (6B7) is fitted next but first ensure that this is thoroughly clean by washing in petrol and blowing through the roller pockets with compressed air. Set the lower race of the bearing on the crusher main frame as shown in Fig. 9, then the bronze cage containing the rollers. (Note: The cage has raised pads on one side only and these should face downwards in contact with the lower race); pour clean oil on to the rollers, then fit the upper race.

If the rotary seal ring (6B1) has been removed from the eccentric (6B5) it should now be returned to same and fastened in place by means of the clamp plates (6B3) and clamp bolts (6B4). Inspect the two grooves on the underside of the rotary seal ring and clean out all dirt. Check the lower labyrinth seals (5B6 and 5B7) which register with these grooves and which are fitted in the crusher main frame—see Fig. 9. If the seals are worn they should be replaced in the following manner: Clean out old material from the two grooves in the crusher frame and apply a coat of shellac to one of the grooves. Each seal consists of two sets of bakelite strips per groove. Take one strip, brush on shellac and press it into the coated groove; continue in this way taking care that each strip end butts up squarely to its neighbour; before fitting the last strip, measure and cut to size exactly as it is unlikely that the strip can be removed intact once pressed into the groove. Fit the second set of strips in the same groove likewise, but with the joints staggered to the first set; if they are too tight to go in without being damaged by the edge of the groove, they may be lightly ground. Repeat the process for the two sets of bakelite strips for the second groove, again staggering the joints so that those in adjacent sets and grooves do not coincide. The upper labyrinth seals (5B4 and 5B5) are also formed from bakelite strips and are replaced in the same manner. In this case, the strips are inserted in the two grooves at the top of the rotary seal ring (6B1) and register with the grooves on the underside of the sphere head (5B1 or 6A7).

The eccentric unit (6B5) complete with rotary seal ring (6B1) should now be positioned over the crusher, checking at this time that the lower piston ring (5B8) is correctly aligned—the ring should be located centrally and protrude evenly from the seal ring otherwise it will not correctly enter the corresponding bore in the crusher and the eccentric will fail to lower sufficiently. Rotate the eccentric until the keyway in its bottom face is in the same relative position as the main drive gear key (7B2). The unit may then be lowered. To register the keyway with the key, it may be necessary to move the eccentric to and fro, otherwise, to move the main drive gear (7B1) slightly by working through the opening in the bottom

plate (7B4). When the unit is in place, tighten the main drive gear up to the eccentric by means of the cap screws (7B3). Make sure that a lock washer is used with each screw and tighten the latter firmly with a wrench and hammer.

The cover plate (7B6) may now be returned to the machine but, before doing so, inspect the bronze seal plug assembly which it incorporates. This assembly contains a seal plug (7B8) equipped with a piston ring (7B12) which fits the bore in the cover—see Fig. 10. Springs (7B10) keep the plug tight up against the bottom face of the main drive gear (7B1) such that when oil pumps through the centre hole of the plug it flows through the hole in the gear and key and into the crusher; oil is prevented from escaping round the plug by the piston ring. To avoid the plug rotating with the drive gear, it is anchored to the cover plate by means of a pin (7B9). Check that all these seal parts are clean and in good condition, then refit the cover plate to the bottom plate (7B4) by means of the cap screws (7B7).

Clean and fit the upper roller bearing (6B6), as described above for the lower bearing (6B7), setting it on the upper face of the eccentric (6B5) as shown in Fig. 9.

Clean out the grooves in the bottom face of the sphere head (5B1 or 6A7) and remove any burrs on the main shaft (5B2 or 6A6) with a file, polishing down with emery cloth. Lift the head/shaft unit (Fig. 11 or 12) over the crusher and check that the upper piston ring (5B3) in the underside of the head is centrally located to enter the rotary seal ring (6B1). Lower the unit into place. To check that it is seating correctly, hold the drive pulley, thus preventing the countershaft and eccentric from rotating, and turn the head by hand; if it turns freely, installation is correct; if it is difficult to turn, the piston ring has not entered the seal ring bore properly—raise the head and relocate the ring. When the unit is correctly installed, remove the lifting bolt and, in the case of style FC Gyraspheres, fit the distributor plate (4B3) with the bolts (4B4); in the case of style S machines, refit the mantle stud cap (9A9) and the cap screw (9A10).

At this stage the crusher should be given a test run to check that all parts fitted so far have been assembled correctly and that the oiling system is functioning properly. Full details of the oiling system will be found under paragraph 3 and its arrangement is shown on the drawing at the rear of this book.

If the adjusting collar (1A3 or 1B3) has been removed, wash the threads and those of the wedge ring (1B7) with petrol and coat with grease. The collar may then be screwed down clockwise on the ring to the correct position relative to the discharge opening—see paragraph 5. Refit the outer felt seal (1B9) by pushing into the counterbore at the bottom of the collar and check that it is in contact with the main frame to prevent ingress of dust to the threads. Bolt the outer seal retaining ring (1B2) in place by means of the cap screws (2B2).

Before replacing the concave bowl (3A9 or 3B9)—together with the concave ring, Fig. 13 or 14—the bowl should be refitted with the spring assembly: set the springs (3A4 or 3B4) on the upper face of the bowl taking care that they are grouped correctly over the spigots provided; fit the auxiliary tension bolts (3A11 or 3B11) into the bowl and lower the spring retaining ring (2A7 or 2B7) over the bolts ensuring that the ribbed compartments in the underside of the ring are in line with the groups of springs; when the ring is resting evenly on all the springs, fit the auxiliary tension bolt nuts (3A12 or 3B12) and tighten down sufficiently to keep the assembly intact for lifting. The assembly is now returned to the machine by lowering over the main tension bolts (3A1 or 3B1) and on to the adjusting collar (1A3 or 1B3); during lowering, push the thrust rods 'C' through the lugs 'A' and into the bracket 'B'—see Fig. 7 or 8—so that the rods secure the bowl in place as it reaches its final position. Loosely fit the main tension bolt nuts (3A2 or 3B2) and slacken off the auxiliary tension bolt nuts to a point where they have no compressive effect on the springs. Proceed to tighten the main tension bolt nuts evenly with a wrench and continue until the springs have been compressed $\frac{3}{4}$ in.—see paragraph 6 for measurements of springs. When this compression has been obtained, screw on the main tension bolt locknuts (3A3 or 3B3) and tighten down firmly. **Note: The auxiliary tension bolts and nuts must never be allowed to take any spring tension during crushing operations. Make sure the nuts are adequately slackened off before and after adjusting the springs.**

The style S machines are fitted with a receiving hopper (7A6). Replace this and tighten down by means of the cap screws (7A7).

Assembly of the Gyrasphere is now complete and, after checking the points listed under General Instructions, may be put back into service. Note: Because the sphere head is mounted on the eccentric with a roller bearing in between, it will rotate with the eccentric when the crusher is running idle but will stop once sufficient rock is fed into the bowl.

17. SPARE PARTS

When ordering spare parts, always quote the part numbers and names as given on the sectional drawings at the rear of this book. Also give the machine size, style and serial number as stamped on the nameplate.

As a ready reference to your Gyrasphere Crusher, record the details given on the machine nameplate here:

Size and Style .....

Serial No. .....

5C-WN1263 (1980)

Ref. 409/23A

Before fitting the new lower mantle inspect the ground surface, inside the mantle bottom, and the finished surface on the sphere head which it contacts. Any burrs or rough spots should be smoothed down with a file. Clean the insides of the new lower and upper mantles with a wire brush.

Place the lower mantle (9A12) on the sphere head (6A7) turning it to a position where the grooves inside the mantle correspond with those on the head. The underside of the upper mantle (9A11) has retaining lugs; mark the positions of these on the outside surface for guidance and fit the mantle so that the lugs sit in the corresponding slots in the lower mantle. Fill the area round the mantle stud (7A5) with clay to a depth of approximately ½ in.—see Fig. 11; this filling prevents backing liquid flowing beyond the mantles and contacting the stud threads. Screw the mantle nut (9A16) on to the mantle stud and tighten firmly with the wrench and sledge. In order to ensure that all parts are properly located and that the assembly is tight, hit the upper and lower mantles a few times with the sledge then repeat the tightening operation on the mantle nut. When the nut is fully driven home, make sure that one of the lugs on its periphery is directly in line with one of the openings on the top of the upper mantle; otherwise it will not be possible to fit the stud cap (9A9) later.

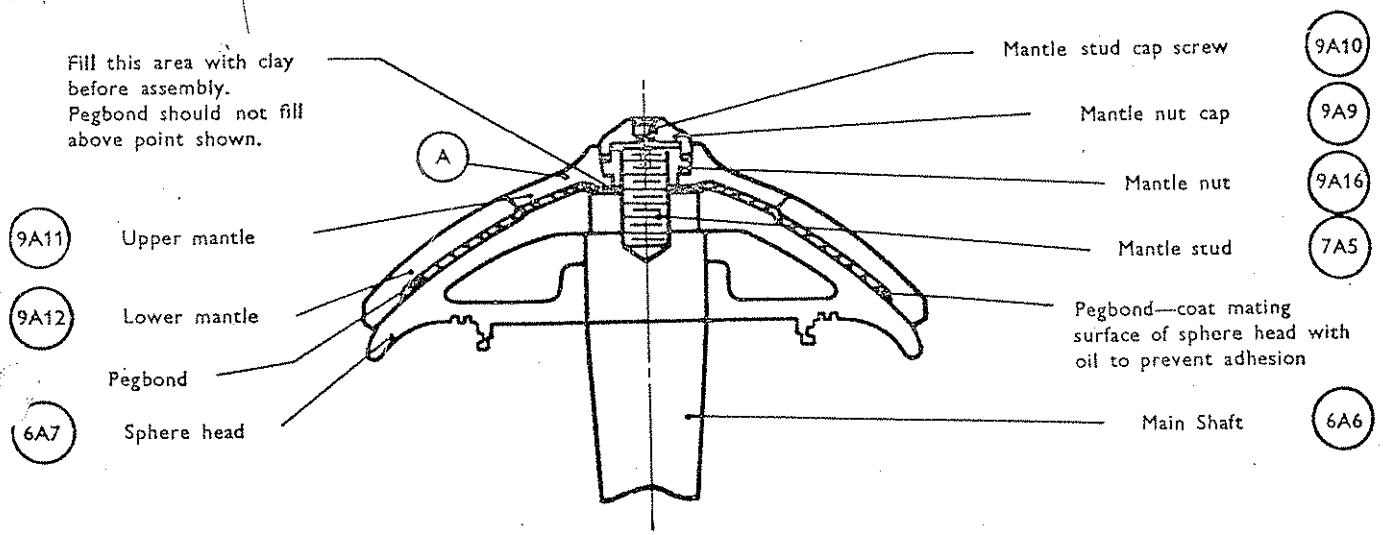


Figure 11

HEAD AND MANTLE ASSEMBLY—STYLE S GYRASPHERES

The complete head unit should now be turned over so that the shaft is projecting upwards. Make clay pouring gates at two of the openings between the bottom of the lower mantle and the sphere head and pour in Pegbond backing—see paragraph 11.

The stud cap (9A9) and cap screw (9A10) are fitted after the head unit has been returned to the Gyrasphere—see paragraph 16 to carry out this—as the tapped hole which takes the cap screw is first used to accommodate the lifting bolt. When fitting the stud cap, it will be seen that it contains lugs internally and round its base; these rings of lugs are arranged so that in one case only is a lug and a space in direct alignment. Mark this position on the stud cap and align with the similar lug/space matching of the mantle nut and upper mantle. Place the stud cap over the mantle nut, making sure that it is engaging properly, and tighten down by means of the cap screw (9A10).

B. Style FC Gyraspheres—*See Fig. 12.*

Withdraw the complete head unit assembly from the Gyrasphere, as described in paragraph 8, and remove the lifting bolt. Fasten a heavy steel bar across the top of the mantle nut (4B5), securing by bolts through the holes normally occupied by the distributor plate bolts (4B4), and sledge the bar in a clockwise direction. **Note: The nut has a left-hand thread.** If the nut cannot be moved—this sometimes occurs due to the ductility of manganese under long, heavy pounding causing a binding effect between the mantle and nut—an acetylene torch should be used to continue dismantling. Start half way down the upper mantle (4B6) and cut a groove through and latitudinally round it, being careful not to penetrate the sphere head (5B1) beneath. After the cut has been made, a few blows with a heavy sledge on the upper mantle will loosen this part and so relieve the strain on the mantle nut. It will now be possible to unscrew the nut following which the upper and lower mantles can be lifted off.

Remove any pieces of old backing which may have adhered to the sphere head and clean the surface thoroughly with a wire brush. **Apply a thin coat of oil to the head**—this is important otherwise the new backing will seal itself to the head, possibly to so great a degree that the head and mantle will be found virtually inseparable when future dismantling is required.

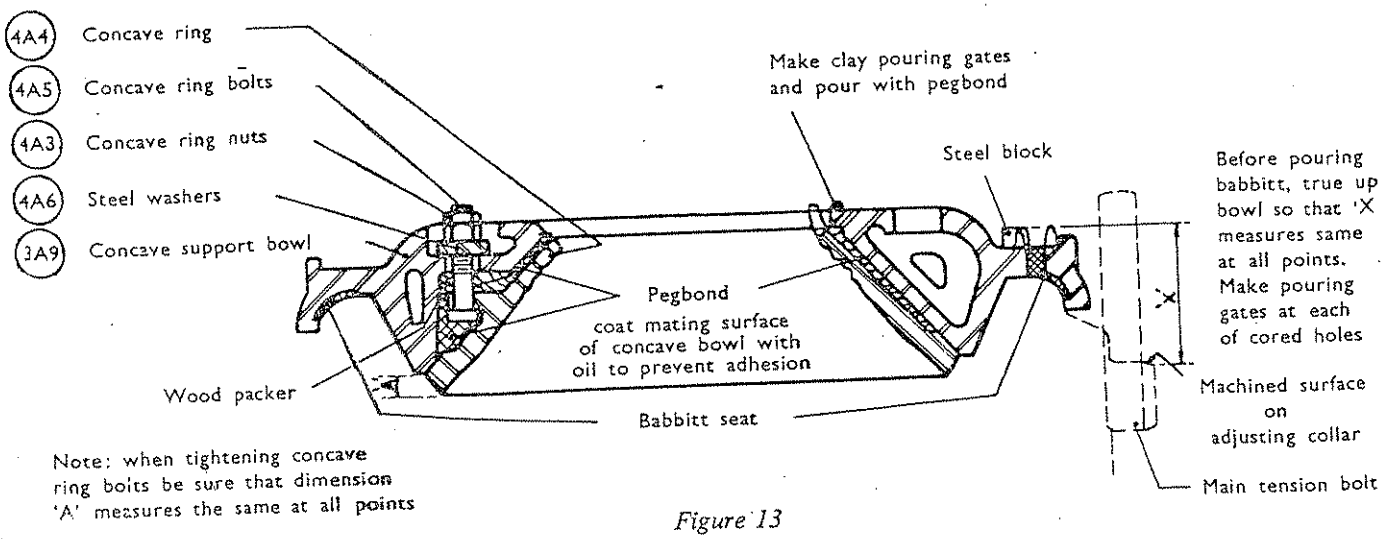


Figure 13

CONCAVE RING AND BOWL (BOLT TYPE)

pre-cut to shape and thickness into the pockets in the bowl and fit the bolts (4A5) into the concave ring. Lower the ring so that the bolts pass through the corresponding holes in the packers and the bowl; fit the steel washers (4A6) and ring nuts (4A3) to the ends of the bolts and tighten up. Turn over the complete bowl/ring assembly. Re-tighten the nuts evenly so that the ring is drawn up into the bowl centrally, checking this by measuring dimension 'A'—across the bottom edges of the bowl and ring, Fig. 13—and ensuring that the measurement is the same at different points around the lower edge; sledge the nuts firmly home. Make two or three pouring gates at the top of the concave ring and pour with Pegbond—see paragraph 11.

Return the concave bowl to the Gyrasphere as described in paragraph 16.

B. 36FC, 367S, 48FC and 489S Gyraspheres—*see Fig. 14*

Self-Locking Type: The concave ring (4A1 or 4B1) is held in place in the concave support bowl (3B9 or 3C9) by a self-tightening gunlock. The simplest way of removing the old concave ring is to support the bowl under its outer flange on blocks, extract the dowels adjacent to the taper wedges (4A2 or 4B2) and burn off the concave ring lugs with an acetylene torch; the ring can then be driven down and out of the bowl with a sledge.

Remove any pieces of old backing which may have adhered to the bowl and thoroughly clean the surface with a wire brush. **Apply a thin coat of oil to the bowl surface**—this is important otherwise the new backing will seal itself to the bowl, possibly to so great a degree that the concave bowl and ring will be found virtually inseparable when future dismantling is required. Check the ground surface on the lower edge of the new concave ring and the machined surface on the lower edge of the concave support bowl. Any burrs or rough spots should be filed smooth.

Raise the bowl sufficiently to allow the new concave ring to be placed beneath and support the ring on blocks. Lower the bowl on to the ring, positioning so that the lugs on the ring pass through the slots in the bowl. **Turn the ring clockwise so that the lugs rest on the bowl to the right of the slots.** (On the 367S and 489S machines only, reverse rotation of the Gyrasphere is permissible—see paragraph 3E—and if this is required the ring is turned counter-clockwise so that the lugs are to the left of the slots.) Fit the taper wedges with the thick ends adjacent

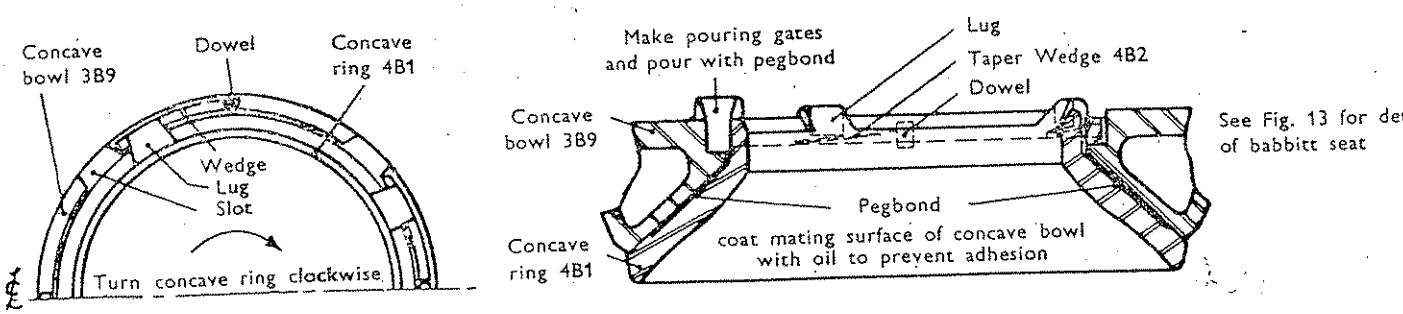


Figure 14

CONCAVE RING AND BOWL (SELF LOCKING TYPE)

	24″S	36″S, 36″7S 48″S, 48″9S	66″S, 66″14S
Sphere Head	6M8	6A7	1H6
Upper Mantle	10M8	9A11	2H5
Lower Mantle	10M9	9A12	2H4
Main Shaft	6M7	6A6	7H1
Mantle Stud	7M6	7A5	6H1
Mantle Nut	10M7	9A16	6H2
Mantle Stud Cap	10M5	9A9	6H3
Mantle Stud Cap Screw	10M6	9A10	6H4

PEGSON LIMITED · ENGINEERS · COALVILLE · LEICESTERSHIRE · ENGLAND
(Member of the Bentley Group)
Telephone: COALVILLE 3322 (10 lines) Cables and Telegrams: PEGSON, COALVILLE
London Office: IDDESLEIGH HOUSE, CAXTON STREET, S.W.1 Telephone: ABBey 2373
Scottish Office 7, LISTER ROAD, HILLINGTON INDUSTRIAL ESTATE, GLASGOW. Telephone HALFWAY 1800

7½c-WN665 (3233)

AMENDED INSTRUCTIONS FOR POURING PEGBOND INTO HEAD ASSEMBLIES OF STYLE 'S' GYRASPHERES

On the Style 'S' Gyraspheres the method of pouring Pegbond between the sphere head and the upper and lower mantles has been changed to allow the operation to be carried out with the head in an upright position. This reduces the handling and lifting of the heavy components to a minimum and so facilitates the replacement of mantles in the field. It also ensures better contact between the sphere head and the lower mantle since the slots, used for pouring when the head is in an inverted position, are eliminated.

The instructions given below should be read in conjunction with the following sections of the standard Instruction Manuals and should be regarded as superseding those paragraphs in the sections which cover the same subject:

24"S Manual: Section 13
36"S, 36"7S, 48"S & 48"9S Manual: Section 13A
66"S & 66"14S Manual: Section 16A

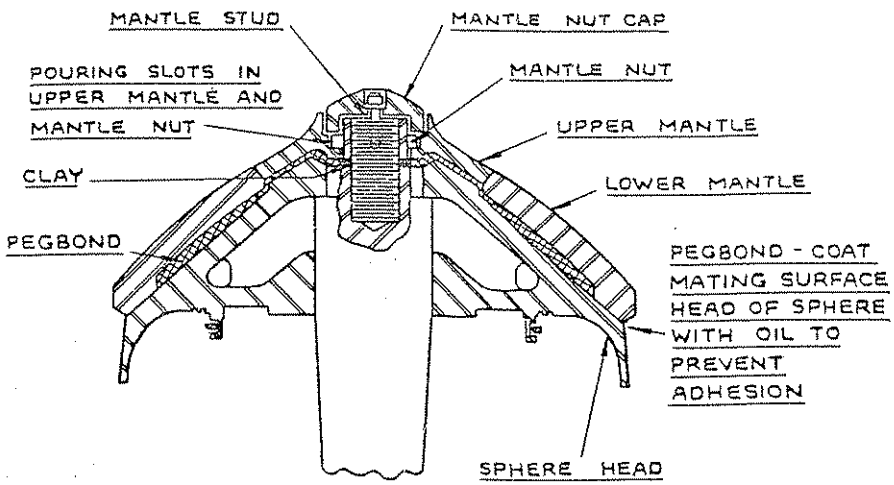


Figure 1
CLAY PACKING AROUND MANTLE STUD

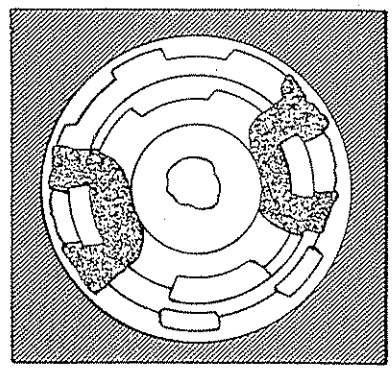


Figure 2
CLAY POURING GATES IN MANTLE STUD

Place the lower mantle on the sphere head turning it to a position where the grooves inside the mantle correspond with those on the head. The underside of the upper mantle has retaining lugs; mark the positions of these on the outside surface for guidance and fit the mantle so that the lugs sit in the corresponding slots in the lower mantle. Fill the portion on top of the main shaft with clay as shown in Fig. 1. Apply a coating of oil to the mantle stud where it extends above the main shaft and also to the mantle nut except where it engages with the nut wrench. Screw the mantle nut on to the mantle stud and tighten firmly with the wrench and sledge. In order to ensure that all parts are properly seated and that the assembly is tight, hit the upper and lower mantles a few times with the sledge then repeat the tightening operation on the mantle nut. The mantle nut incorporates pouring slots and at least one half the width of the slots must match the slots in the upper mantle when the nut is fully home—**do not loosen the mantle nut to achieve this slot alignment.** As tightening progresses, it is advisable to drop the mantle stud cap in place occasionally to check its location and so ensure a proper fit after the backing material has been poured.

Seal with clay the joints between the upper and lower mantles and between the lower mantle and sphere head. Make clay pouring gates around the slots in the mantle nut—see Fig. 2—and pour in the Pegbond backing. Do not fill the cavity beyond the bottom level of the slot in the upper mantle.

After pouring, remove all clay and return the head unit to the crusher, as described in the standard instructions, then refit the mantle stud cap and cap screw.

See overleaf for corresponding part numbers of items referred to in the above instructions