# HASTIE'S

## ELECTRIC HYDRAULIC

## STEERING GEAR

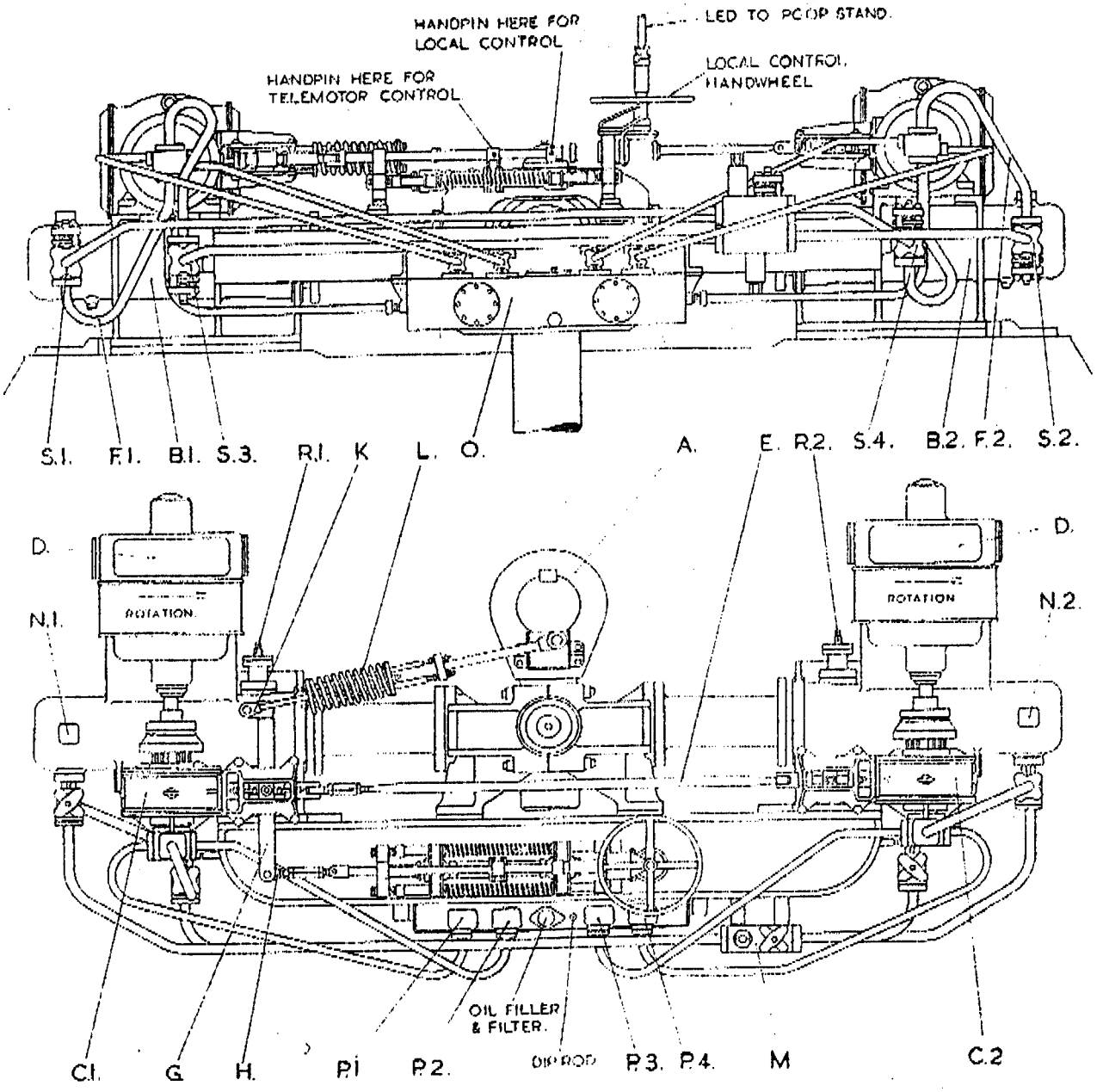
DESCRIPTION AND INSTRUCTIONS FOR
CHARGING, WORKING AND ADJUSTING

JOHN HASTIE & CO., LIMITED
GREENOCK (SCOTLAND)

TELEGRAMS:
"HASTIE, GREENOCK TELEX"

TELEPHONE Nos.:
GREENOCK 22286 (7 lines)

Telex Number 77194
"Answer-back" Code HASTIE GREENOCK




TWO RAM STEERING GEAR.

# DESCRIPTION OF
# TWO RAM GEAR.

**A.**—Tiller fixed to rudderstock.

**B1, B2.**—Hydraulic Cylinders and Rams operating Tiller A by means of a swivel crosshead carried in fork of rams.

**C.**—Hastie Variable Delivery Pump.

**D.**—Electric Motor.

**E.**—Link Connecting Pumps.

**F1, F2.**—Oil pipes leading to cylinders B1 and B2 respectively.

**G.**—Is a floating lever connected at its middle point to the pump control mechanism.

**H.**—Is the connection to Telemotor at one end of floating lever G.

**K.**—Is the connection at the other end of floating lever G to tiller through Spring Link L.

**L.**—Safety Spring Link to prevent damage to control mechanism.
When H is moved by telemotor or local control, it moves floating lever G and pump control mechanism. The pump at once draws oil from one cylinder and discharges it to the other, thus moving the tiller. As the tiller moves, it moves point K of floating lever G through the medium of Spring link L, and in doing so returns the pump to mid-position, at which point delivery of oil ceases, the rudder movement stops and the rudder is held until H is again moved.

**M.**—Bye-pass valve combined with spring loaded double shock valves. The shock valves are set at a pressure which will allow the rudder to give way when it is subjected to severe shock from a heavy sea or other cause. In giving way the rudder moves the pump control mechanism by means of spring link L. In doing this it puts the pump on stroke, so that when the excessive pressure has been relieved, the rudder returns automatically to its former position.

**N1, N2.**—Are air release and pressure gauge shut-off valves.

**O.**—Oil replenishing tank containing non-return suction valves P1, P2, P3, and P4.

**P1, P2, P3, P4.**—Are non-return suction replenishing valves connected to the pump by piping. These valves automatically make up any leakage in the system.

**R1, R2.**—Rudder brakes fitted to hydraulic cylinders B1 and B2 respectively, are normally padlocked in "off" position and must not be used except in an emergency caused by a breakdown of the hydraulic system.
To apply brakes, turn spindles in a clockwise direction by means of the spanner provided, until rudder is brought under control.

**S1, S2, S3, S4.**—Pump shut-off valves are provided for isolating each pump should the occasion arise to overhaul a pump at sea.

# INSTRUCTIONS FOR

# CHARGING, WORKING AND ADJUSTING THE GEAR.

**OIL.** Only best quality oil must be used in the system. The grade of oil varies in accordance with the trade in which the vessel is engaged. The oil should be thoroughly filtered before charging the gear. It should be renewed periodically, and the suction tank O cleaned out when this is done.

**METHOD OF CHARGING.**

(1) Open air cocks N1 and N2 on hydraulic cylinders B1 and B2.

(2) Open bye-pass valve M.

(3) Fill both cylinders completely and replenishing tank O three parts full of oil.

(4) Close air cocks.

(5) Make sure that pump is working freely by pulling round coupling between pump and motor by hand.

**STARTING.**

(1) Connect local control handwheel in steering compartment by means of handpin.

(2) Start electric motor.

(3) Turn local control handwheel in both directions to circulate the oil in the pipes.

(4) Bring pump control mechanism to mid position.

(5) Shut bye-pass valve M.

(6) Turn hand control wheel and open air cock on the hydraulic cylinder into which the oil is being pumped. When all air has been expelled, shut the cock, and carry out the same operation on the other cylinder.

The gear is now ready for steering.

In order to connect the telemotor on the bridge, change handpin to position for Telemotor control.

**NOTES ON WORKING THE GEAR**

When two Pumps are fitted, they are arranged to run either independently or simultaneously. Both Pumps are permanently connected to the telemotor, so that it is possible to switch on either pumping set instantaneously.

Shut-off valves are fitted on the Pumps, but these should only be closed when it is found necessary to overhaul a Pump at sea.

No valves on the system should be closed at sea, except the bye-pass and air release valves.

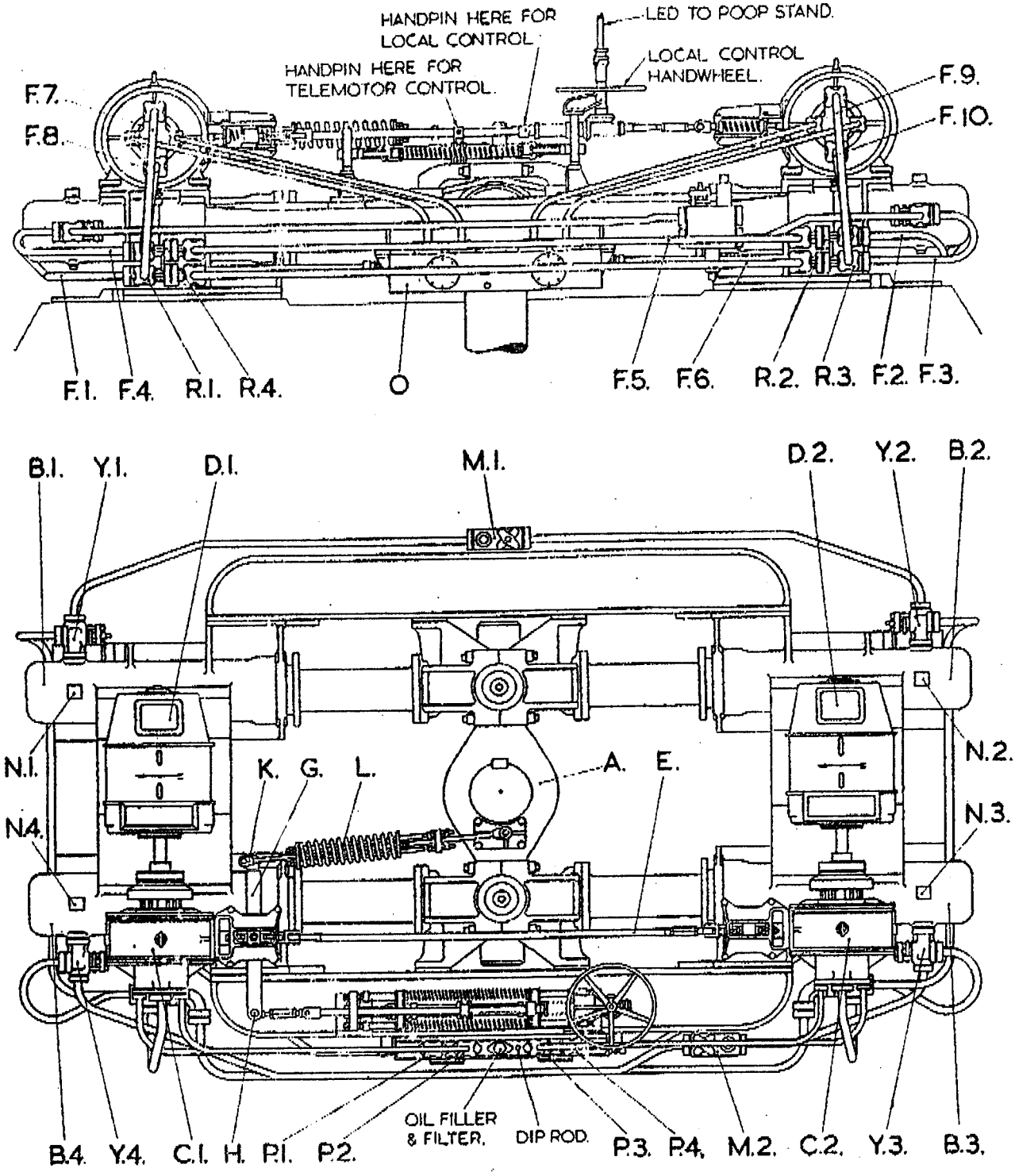
Electric motors are arranged to run clock-wise viewed from commutator end.

After each voyage the coupling between the Pump C and the electric motor D should be pulled round by hand, to make sure that the pump is working freely. If any stiffness be found, the pump should be opened, and all the working parts thoroughly examined. When the pump is opened up, clean the parts with linen cloths. Do not use cotton waste. Before replacing the working parts of the pump, they should be thoroughly washed in paraffin.

The suction valves in the replenishing tank O should be examined from time to time.

The amount of current taken to run the Hastie Variable Delivery pump light should be noted, and a note should also be made of the amount of current taken to put the rudder to an angle of 10 degrees at the normal speed of the vessel. With this data it is a simple matter to check the efficiency of the Gear.

Hydraulic Lip Packing to suit all sizes of rams can be supplied from stock.




FOUR RAM STEERING GEAR.

# DESCRIPTION OF
# FOUR RAM STEERING GEAR.

**NOTE.**—With four ram gears two pumping sets are usually fitted, each set being capable of putting the rudder from hard-over to hard-over at full speed in specified time. One set acts as standby. All four rams must be used exceptional in an emergency. Electric motors are arranged to run clockwise when viewed from commutator end, and can be run simultaneously or independently.

**A.**—Tiller fixed to Rudderstock.

**B1, B2.**—Hydraulic Cylinders and Rams operating Tiller A by means of swivelling
**B3, B4.** crossheads carried in forks of rams.

**C1, C2.**—Hastie Variable Delivery Pumps.

**D1, D2.**—Electric Motors.

**E.**—Link connecting Pumps.

**F1, F2.**—Oil pipes leading from cylinders B1, B2, B3, and B4 respectively to pumps.
**F3, F4.** shut-off valves R1, R2, R3 and R4.

**F5, F6.**—Pipes connecting valves R1 with R3 and R4 with R2.

**F7, F8.**—Oil pipes connecting valves R1, R4, R2, R3 to pumps.

**F9, F10.**

If pump control mechanism is pulled out from pump C1, oil is drawn from cylinders B4 and B2 through pipes F4, and F2 and F5 to valve R4 and thence through pipe F8 to pump C1. At the same time oil is discharged from pump C1 through pipe F7, valve R1 and pipes F1, F6 and F3 to cylinders B1 and B3. If pump control mechanism is pushed in, oil is discharged in opposite direction. A corresponding operation takes place for pump C2.

**G.**—Is a floating lever connected at its middle point to the pump control mechanism of pump C1 and through link E to the pump control mechanism of pump C2.

**H.**—Is the connection to the telemotor at one end of floating lever G.

**K.**—Is the connection at the other end of floating lever G to tiller through spring link L.

**L.**—Safety Spring Link to prevent damage to control mechanism. When H is moved by telemotor or local control, it moves floating lever G and pump control mechanism. The pump at once draws oil from one pair of cylinders and discharges it to the other pair, thus moving the tiller, which moves point K of floating lever G through the medium of spring link L, and in doing so, returns the pump to mid-position at which point delivery of oil ceases, the rudder movement stops and the rudder is held until H is again moved.

**M1, M2.**—Bye-pass valves combined with spring loaded double shock valves. The shock valves are set at a pressure which will allow the rudder to give way when it is subjected to a severe shock from a heavy sea or other causes. In giving way, the rudder moves the pump control mechanism by means of spring link L. In doing this it puts the pumps on stroke so that when the excessive pressure has been relieved the rudder returns automatically to its former position.

**N1, N2.**—Air release and pressure gauge shut-off valves.

**N3, N4.**

**O.**—Oil replenishing tank containing non-return suction valves P1, P2, P3 and P4.

**P1, P2.**—Are non-return suction replenishing valves which automatically make up

**P3, P4.** any leakage. P1, and P2 are connected to pump C1 and P3 and P4 to pump C2.

**R1, R2.**—Are pump shut-off valves. These valves are provided so that either pump

**R3, R4.** can be isolated if required without interfering with the connections to the cylinders.

**Y1, Y2.**—Are cylinder shut-off valves. These valves are arranged so that the

**Y3, Y4.** connections to the pump shut-off valves R1, R2, R3 and R4 can be isolated when required, without interfering with the connections to the shock valves M1 and M2. Either pair of opposing cylinders can thus be isolated without interfering with the working of the other pair of cylinders.

# DESCRIPTION OF
# THE HASTIE VARIABLE DELIVERY PUMP.

The Hastie Variable Delivery Pump is of the rotary plunger type. Its operation will be easily understood from the following short description:—

Figures 1, 2 and 3 show diagrammatically a section through the centre of the pump at right angles to its axis.

AB is the line along which stroke variation takes place.

C is the "Cylinder Body" in which are formed a number of radial cylinders. The cylinder body is coupled to and driven directly by the prime mover employed.

D is the fixed central valve on which the cylinder body revolves, and in which are the suction and delivery ports P and Q, communicating with the outside by passages.

The radial cylinders are fitted with pistons H, through each of which, parallel with the axis of D, is a gudgeon pin G. On these gudgeon pins are slippers J, fitting in an annular groove, and causing the gudgeon pin centres to travel in a circular path E shown on dotted lines; the position of this path can be changed by moving its centre along the line AB.

Suppose the cylinder body to be rotating in the direction of the arrows, and the position of the circular path E to be such that its centre coincides with the centre of D as in Fig. 1; no radial motion is then communicated to the pistons.

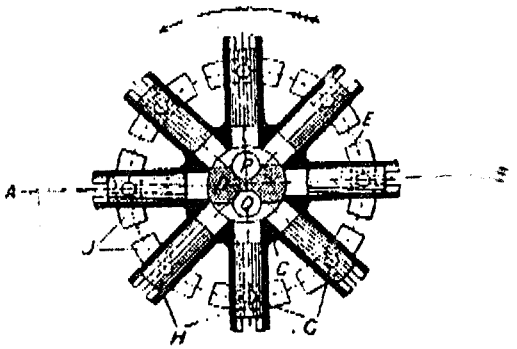


Fig. 1.

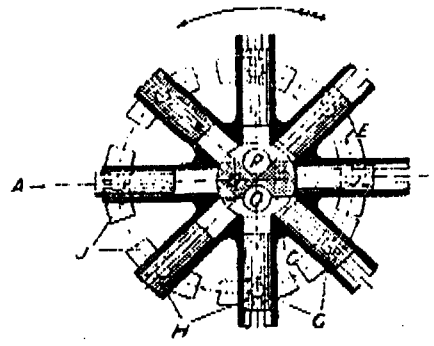


Fig. 2.

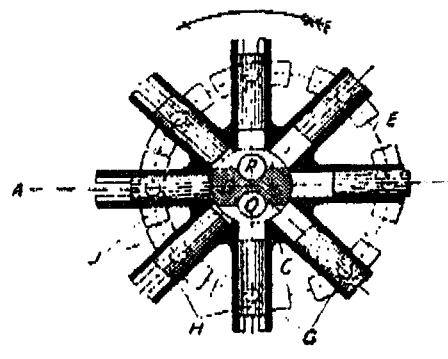


Fig. 3.

If the position of the centre of E be to the left as in Fig. 2, the pistons as they pass above the line AB, recede from D and suck liquid through the port P, whilst the pistons below AB approach D and discharge through port Q.

If the position of the centre of E be to the right as in Fig 3, then the pistons below AB recede from D, so that Q becomes the suction port, and P the delivery port. The flow of liquid is therefore reversed without altering the direction of rotation.

In moving from the position of maximum delivery on one side to that on the other, the discharge is gradually reduced until at the central position it ceases, after which

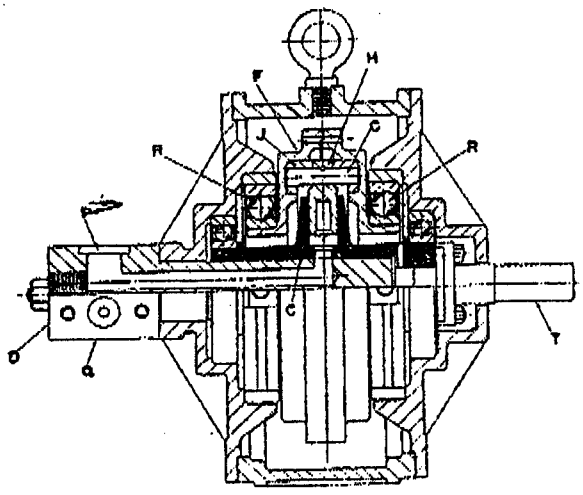



FIG. 4.

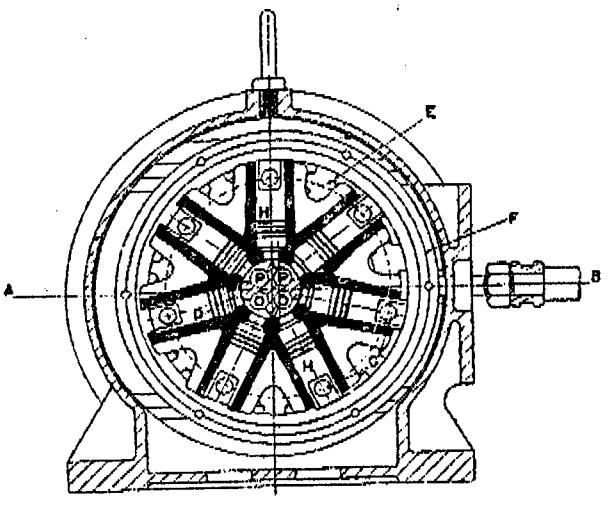



FIG. 5.

it again increases to the maximum, but in the opposite direction the change from full forward to full reverse discharge is made without shock.

The slippers J traverse the whole surface of the path E once in each revolution, and their resistance at high speeds of revolution would be large, even if perfectly lubricated by running in a case full of oil. Further, the oil filling the case would be churned by the rotation of the pump and increase the resistance.

To decrease this resistance and thereby increase the efficiency of the pump the path E is formed as part of a floating ring which runs on bearings. This is made clear in Figs. 4, 5, 6 and 7, views of an actual pump in outline. In these figures the lettering used in the previous figures has been adhered to for similar parts.

It will be seen that two more parts are indicated in these figures, which are

F the floating ring.

R the ball or roller bearings on which this revolves.

The action of the pump is exactly as described previously, the revolving cylinder body C carries the pistons H, their gudgeon pins G and slippers J round with it, the slippers in their turn cause the floating ring F to revolve on the bearings R, the resistance of the slippers in their annular groove being greater than that of the bearings R.

The slippers approach and recede from one another in each revolution by an amount equal to the stroke of the pump, there being no relative motion at the no stroke position.

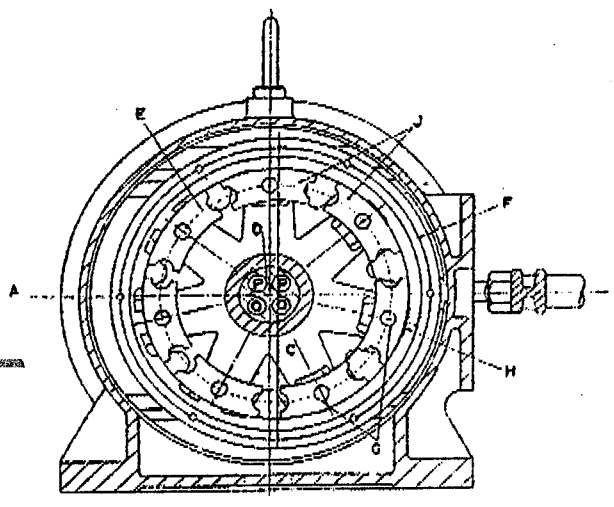



FIG. 6.

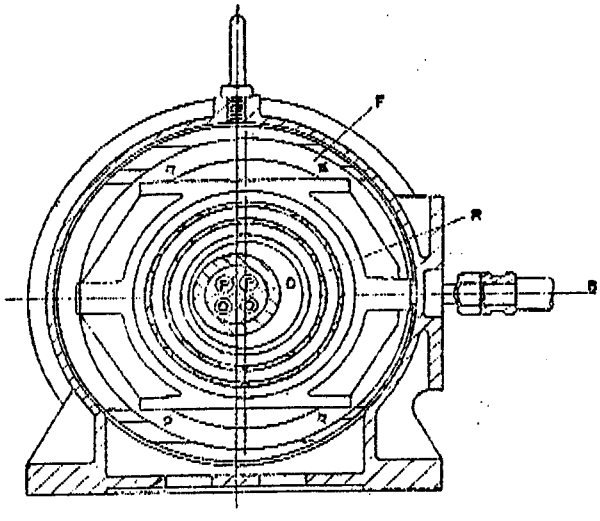



FIG. 7.

The floating ring F is made in the form of a drum, the oil leaking past the pistons is retained by centrifugal force as an annulus to lubricate the slippers and gudgeon pins.

All the forces in the pump being in the plane of rotation, there is no end thrust and a small end float can be allowed.

All the parts are simple, and only those which are cylindrical require making with any great degree of accuracy.

By using oil as the working medium all parts are properly lubricated and no wear takes place.

The following photograph shows all parts of the pump dismantled and separated and shows the simplicity of them all:—

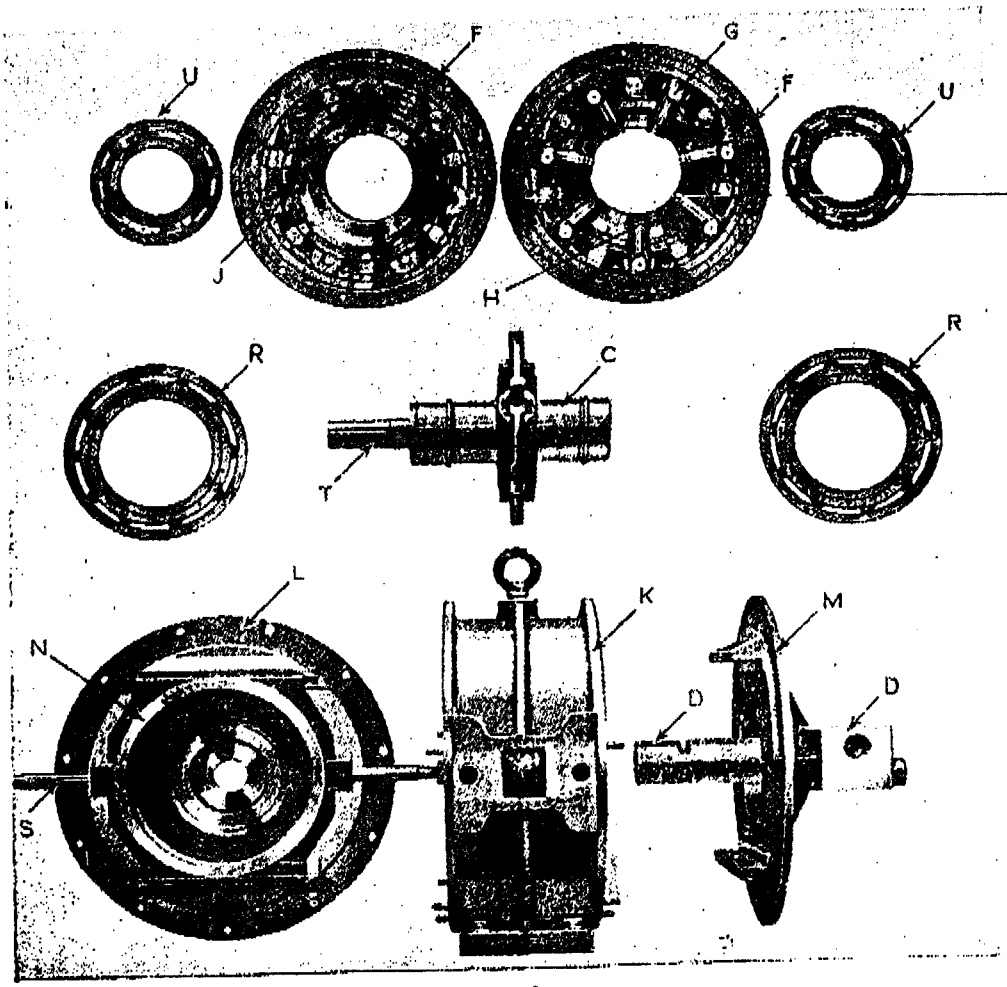



Fig. 8.

C. The Cylinder Body in which the radial cylinders are bored.

D. The Central Valve on which the cylinder body runs.

F. The Floating ring, in halves.

G. The Gudgeon pins fixed in the pistons.

H. The Pistons which work in the radial cylinders.

J. The Slippers fitting in groove in the floating ring and on the gudgeon pins of the pistons.

K. The main case or frame.

L. The front cover and slides in which fit the guides N.

M. The back cover and slides in which fit the guides N.

N. The guides fitting in cover slides and carrying the bearings of the floating ring.

R. The ball or roller bearings of the floating ring.

S. The spindle to alter the stroke by moving the guides in their slides.

T. Driving Shaft.

U. Ball or roller bearings of the cylinder body.

# LIST OF PUMP BEARINGS & THEIR EQUIVALENT SIZES.

As supplied by:—

Messrs The Hoffmann Manufacturing Co. Ltd., Chelmsford, Essex.
Messrs The Skefko Ball Bearing Co. Ltd., Luton, Beds.
Messrs Ransome & Marles Ball Bearing Co. Ltd., Newark-on-Trent.

CYLINDER BODY BEARINGS "U"

| *Size of Pump* | *Hoffman* | *Skefko* | *Ransome and Marles* |
|---|---|---|---|
| H.P.0·75 | L.S.13½ | R.L.S.13 | L.J.1⅝ |
| H.P.1·5 | L.S.16 | R.L.S.18 | L.J.2¼ |
| H.P.3 | L.S.19½ | R.L.S.26 | L.J.3¼ |
| H.P.4·5 | L.S.20 | R.L.S.28 | L.J.3½ |
| H.P.6 | L.S.20½ | R.L.S.30 | L.J.3¾ |
| H.P.9 | L.S.21 | R.L.S.32 | L.J.4E |
| H.P.12 | L.S.22½ | R.L.S.38 | L.J.4¾E |
| L.P.18 | L.S.22½ | R.L.S.38 | L.J.4¾E |
| H.P.18 | L.S.23½ | R.L.S.44 | L.J.5½E |
| L.P.24 | L.S.23½ | R.L.S.44 | L.J.5½E |
| H.P.24 | L.S.24½ | R.L.S.52 | L.J.6½E |
| L.P.36 | L.S.24½ | R.L.S.52 | L.J.6½E |
| H.P.36 | L.S.25½ | R.L.S.60 | L.J.7½E |
| L.P.50 | L.S.25½ | R.L.S.60 | L.J.7½E |
| H.P.48 | L.S.26 | R.L.S.64 | L.J.8E |
| L.P.60 | L.S.26 | R.L.S.64 | L.J.8E |

FLOATING RING BEARINGS "R"

| *Size of Pump* | *Hoffman* | *Skefko* | *Ransome and Marles* |
|---|---|---|---|
| H.P.0·75 | L.S.18 | R.L.S.22 | L.J.2¾ |
| H.P.1·5 | L.S.20½ | R.L.S.30 | L.J.3¾ |
| H.P.3 | L.S.23 | R.L.S.40 | L.J.5E |
| H.P.4·5 | L.S.23½ | R.L.S.44 | L.J.5½E |
| H.P.6 | L.S.23½ | R.L.S.44 | L.J.5½E |
| H.P.9 | L.S.24½ | R.L.S.52 | L.J.6½E |
| H.P.12 | L.S.25½ | R.L.S.60 | L.J.7½E |
| L.P.18 | L.S.25½ | R.L.S.60 | L.J.7½E |
| H.P.18 | L.S.26 | R.L.S.64 | L.J.8E |
| L.P.24 | L.S.26 | R.L.S.64 | L.J.8E |
| H.P.24 | L.S.28 | R.L.S.80 | L.J.10E |
| L.P.36 | L.S.28 | R.L.S.80 | L.J.10E |
| H.P.36 | L.S.29 | R.L.S.88 | L.J.11E |
| L.P.50 | L.S.29 | R.L.S.88 | L.J.11E |
| H.P.48 | L.S.29½ | R.L.S.92 | L.J.11½E |
| L.P.60 | L.S.29½ | R.L.S.92 | L.J.11½E |

# INSTRUCTIONS FOR DISMANTLING THE HASTIE VARIABLE DELIVERY PUMP FOR EXAMINATION OR REPAIR.

(1) Remove pump from soleplate and place it on deck with driving shaft T looking upwards with half coupling removed.

(2) Fit packing under pump to prevent D tube resting on deck.

(3) Remove shaft cover L by means of starting screws.

(4) Remove pump spring control gear.

(5) Remove spindle S by unscrewing (anti-clockwise).

(6) Insert eyebolt in end of driving shaft and lift by means of block and tackle or other suitable device. All the internal working parts will be removed by this operation.

(7) Prise off guide blocks N.

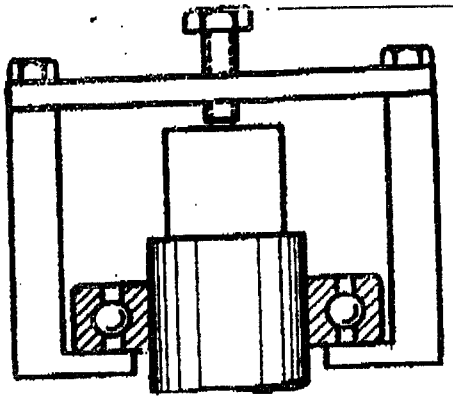
(8) The cylinder body ball race U can now be removed.

(9) Should it be necessary to use force to remove the cylinder body ball race U, three pinch bars may be employed, or withdrawing gear arranged as shown in Fig. 4.

(10) Remove bolts in floating ring F. Care to be taken that nuts, being "Castle" type, are put back on the same bolts.

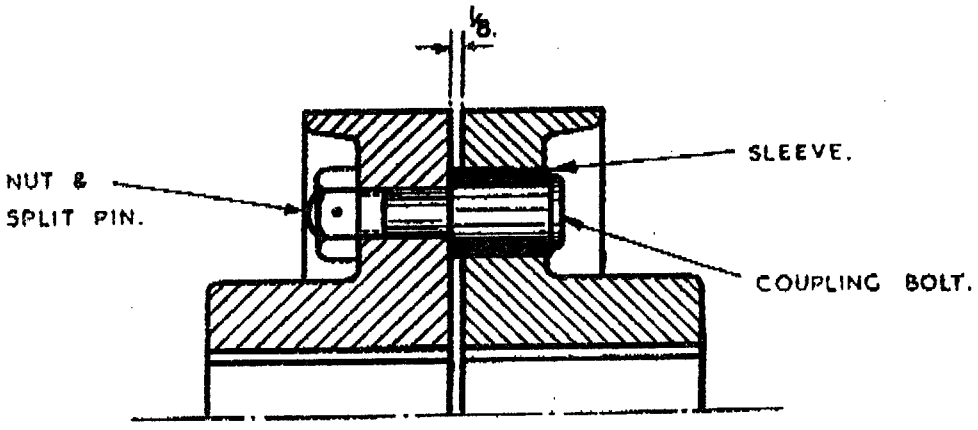
(11) By lifting top half of floating ring F the pistons H and slippers J will be exposed to view.

(12) To withdraw pistons and slippers both halves of floating ring F must be removed.



WITHDRAWING GEAR

# ERECTION INSTRUCTIONS FOR FLEXIBLE COUPLINGS AS SUPPLIED WITH PUMPING UNIT.




Flexible coupling as supplied by J. Hastie & Co. Ltd.

Keep the sleeves free from oil.

Should the engine or pump be removed for overhaul, remove coupling bolts before re-aligning.

As the nuts are secured to the coupling bolts by pins, care must be taken to replace nuts on their corresponding bolts.

# RECOMMENDED OILS FOR CHARGING HASTIES STEERING GEARS.

| | WHERE USED. | | | |
|---|---|---|---|---|
| | STEERING GEARS | HAND & POWER STEERING GEARS. | TELEMOTORS. | LUBRICANTS FOR RUDDER CARRIERS. |
| SUPPLIERS | SYMBOL. | SYMBOL. | SYMBOL. | SYMBOL. |
| SHELL-MEX & B.P. LTD., | SHELL TALPA OIL 30. | SHELL TELLUS OIL 27. | SHELL TELLUS OIL 11. | OIL: SHELL STROMBAS OIL 77.<br>GREASE: SHELL BARBATIA 4 " " 6 |
| POWER PETROLEUM Co.,LTD., | B.P. ENERGOL O.E.175. | B.P. ENERGOL H.L.65 | TELEMOTOR OIL H.L. 40. | OIL: ——<br>GREASE: —— |
| ESSO PETROLEUM Co.,LTD., | TRO-MAR 65. | NUTO H. 44. | NUTO H. 32. | OIL: ——<br>GREASE: BEACON 3. |
| REGENT OIL Co., LTD., | DORO. 30. | REGAL A (R & O) | TELEMOTOR OIL. | OIL: 65T CYLINDER.<br>GREASE 971. |
| CASTROL LIMITED. | I.L.O. HEAVY DR. | HYSPIN 70. | TELEMOTOR OIL LIGHT. | OIL: ——<br>GREASE: SPHEEROL A.P.3. |
| GULF EASTERN COMPANY. | VERITAS V.9. | MECHANISM 39. | MECHANISM 35. | OIL: MARINE OIL 77.<br>GREASE GRAPHITED |
| MARINE INDUSTRIAL LUBRICANTS LTD., | MANCOL 65. | MOROLA 013. | MOROLA ICE FLOW 775. | OIL. MORAX 75.<br>GREASE: MANCOLENE. |
| MOBIL OIL COMPANY LTD., | MOBIL D.T.E. OIL No.3. | MOBIL D.T.E. OIL LIGHT. | VACUUM TELEO OIL. | OIL: ——<br>GREASE: MOBIL GRAPHITED. No.3. |