Vinten

TELEVISION
CAMERA PEDESTAL
(CENTRE STEERING)

OPERATORS HANDBOOK

W. VINTEN LIMITED
[illegible] North Circular Road, Cricklewood, London, N.W.2.
Telephone : GLAdstone 6373-5

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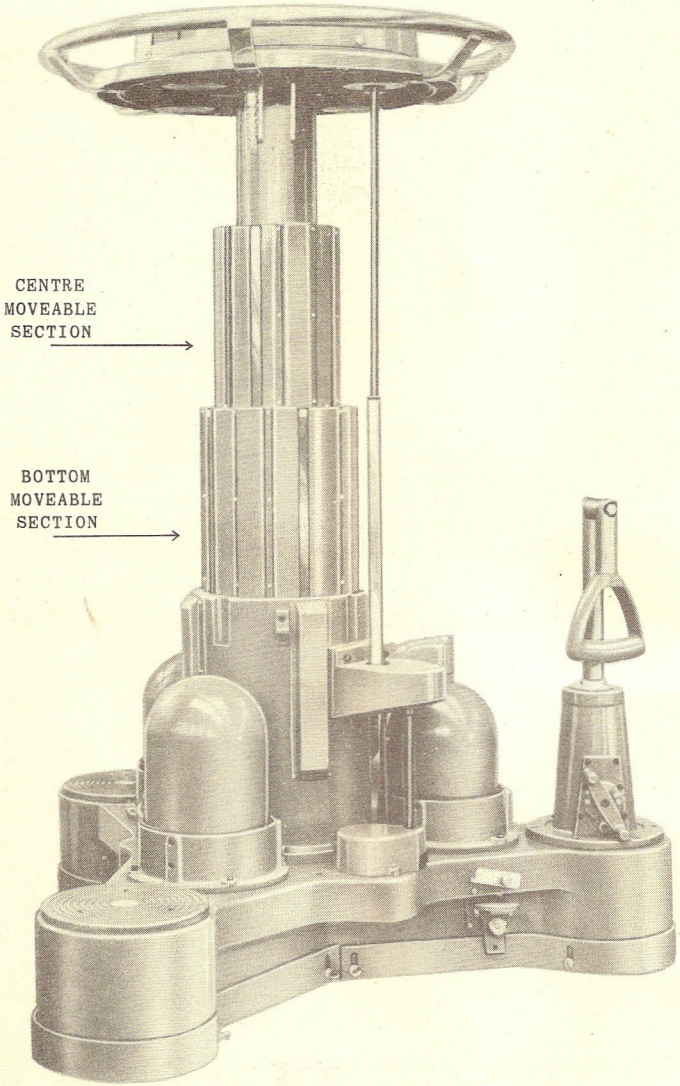

Fig. 1.

GENERAL DESCRIPTION

The Vinten Television Hydro-Pneumatic Pedestal has been designed to fill the special requirements of a television studio camera mounting. It is built to the highest standards and makes possible not only smooth dolly or "crabbing" shots but also the raising and lowering of the camera during transmission. This latter feature is obtained by a novel system which eliminates springs or counterbalance weights and is completely reliable.

Fig.1 shows the pedestal extended to its full height. The camera is supported by a three-section telescopic standard; this encloses a hydraulic ram, connected in a closed circuit which includes an accumulator. The latter is pressurized by nitrogen carried in metal storage bottles and the effect of the system is to counterbalance the weight of the moving parts and camera. When raising or lowering the camera, therefore, the manual effort applied need only overcome friction and this is reduced to a remarkably low value by the use of ball races between all moving parts.

The pedestal may be locked at any height by use of a foot control valve.

In order to obtain precise balance, provision is made for adding compensating weights up to a maximum of 60 lbs. (27 kgs.) should a camera be used which is lighter than the "standard" load of 190 lbs. (86 kgs.). Cameras within the weight range of 100 to 250 lbs. (45.36 to 113.35 kgs.) may also be balanced by varying the gas pressure within the system. Heavy loads up to 500 lbs. (226.7 kgs.) may be supported by fitting a special ram assembly.

All the loads quoted above are additional to the weight of the pan and tilt head, which is assumed to be 46 lbs. (21 kgs.).

The base is provided with three sets of rubber-tyred wheels. They are rotatable through 360° by means of a centre wheel to permit "crabbing". Alternatively, using the tiller only, one set of wheels may be controlled and the others fixed to give a true steering action.

Maximum height (without pan and tilt head)	56 ins. (1.42m)
Minimum height (" " " " ")	26 ins. (0.66m)
Maximum width of base	41 ins. (1.02m)
Minimum width of base	33 ins. (.82m)

WEIGHT

Pedestal weight (without balance weights)	367 lbs. (165 kgs.)
Balance weights	60 lbs. (27 kgs.)
Total all up weight	427 lbs. (192 kgs.)

OPERATING INSTRUCTIONS

IMPORTANT: IT IS ESSENTIAL THAT THE CORRECT SEQUENCE OF OPERATION - AS DETAILED BELOW - SHOULD BE OBSERVED WHEN PUTTING A NEW PEDESTAL INTO SERVICE.

SETTING UP PROCEDURE

The system pressure is normally set by the manufacturers at 725 lbs. sq.inch (50.97 kgs.cm^2) but this value might be changed before dispatch should the pedestal be specifically ordered for equipment differing significantly in weight from the "Standard" load of 190 lbs. (86 kgs.).

As supplied the pedestal is complete with lead weights to a total of 59 lbs. (27 kgs.) made up as follows:-

4 weights at 9 lbs. (4.1 kgs.)
4 weights at 4½ lbs. (2.04 kgs.)
5 weights at 1 lb. (.45 kg.)

ATTACHING THE HEAD

Vinten types

Any type of Vinten heavy duty head may be fitted simply by placing the head in position, locating the four holes and securing by the bolts provided. It is preferable to do this with the pedestal close to the bottom of its travel and secured by the safety pip-pin (J Fig.2). When in this position (Fig.2) it may be that the two centre sections of the column are close up under the steering wheel assembly. If so, release the foot valve and using your fingers slide the sections down. It will then be very much easier to insert the four fixing bolts.

NOTE. Without the weight of the head and a camera it is DANGEROUS to remove the safety pip-pin because if the foot-valve is operated the column will rise rapidly and with considerable force to its maximum height.

Centre-screw types

If the head to be fitted is of the centre-screw type then the nut must be inserted beneath the base-plate. This operation is simple but greater care must be taken because the safety pip-pin must be removed.

Proceed as follows:-

With the pip-pin still in position, remove the two small countersunk screws and lift out the steel adaptor ring from the centre of the platform.

With two persons, one either side, press down on the steering ring and at the same time depress the foot valve. Press down so that the pip-pin is about half an inch (12 mm.) below its safety stop. Release the foot valve and the downward pressure on the steering wheel and check that the column does not tend to rise. Loosen the four countersunk screws with a hexagon key. Remove the pip-pin. Remove the four screws and gently lift the steering assembly by means of the steering wheel. Take care that it is lifted squarely so that no strain is put on the telescopic steering rod which must be able to extend as the assembly is raised.

Raising it 2 to 3 inches (5 to 7.5 cm.) will enable an assistant to insert the centre-fixing nut between the four lugs at the top of the column. Lower the assembly back to its original position and replace the four screws and the pip-pin.

The head can now be placed in position and the fixing nut screwed on to the spigot. If it is difficult to turn the nut when the pedestal is in this position it may be raised by removing the pip-pin, carefully depressing the foot valve and with two people to control its speed allowing it to rise to a convenient height. When the foot valve is released the column will remain in the selected position.

BALANCING

On delivery of a new pedestal it should be checked to ensure that it is correctly adjusted for the load to be carried. This must be done as follows:-

(1) The camera together with all its normal accessories should be mounted on the head.

(2) Remove weight tray cover and all but two 4½ lb. (2.04 kg.) weights.

(3) Remove pip-pins, and slowly depress one of the two foot pedals 'G'. Should the head tend to rise, it is necessary to reduce the system pressure as described below.

(4) In order to adjust the system pressure it is necessary to employ the Vinten charging equipment. This comprises a combined pressure-gauge and bleed valve built in one unit with a connection suitable for the bulkhead Schrader valve, and a flexible hose for connection to a cylinder of compressed nitrogen. The pressure gauge is capable of rotation and is coupled through a gland to a screw mechanism which advances or retracts a pin within the Schrader valve connection. It is ESSENTIAL that the pin be retracted by turning the pressure gauge fully anticlockwise before fitting the charging unit to the pedestal connection.

To reduce the system pressure the procedure is as follows:-

(a) Seal off the hose connection with the blanking nut. With the blanking cap removed from the Schrader valve, the pressure gauge should be turned fully anticlockwise.

(b) The unit is then connected by the union nut to the Schrader valve on the pedestal.

(c) The pressure gauge should be turned SLOWLY clockwise (thus advancing the centre pin and opening the Schrader valve) until a reading is shown on the dial. This reading shows the existing system pressure.

(d) The knurled hand wheel of the bleed valve should be cautiously unscrewed, permitting nitrogen to leak from the system. When the camera is in balance the knurled hand wheel should be screwed home.

(e) The pressure should not be reduced beyond 470 lbs. sq.in. (215 kgs. sq.cm.). If at this pressure the head still has a tendency to rise, weight should be added until the correct balance is achieved.

(f) The pressure gauge should then be rotated fully anticlockwise to close the Schrader valve, after which the unit may be uncoupled from the pedestal. Check that the Schrader valve is seated fully home and is not leaking.

(g) Replace blanking nut and tighten lightly with a spanner.

(5) If the pedestal, as received, tends to sink under the weight of the camera and head it is necessary to charge the system to a higher pressure and the procedure is as follows:-

(a) With the blanking nut removed from the Schrader valve, the pressure gauge should be rotated fully anticlockwise.

(b) The flexible hose should be connected to the side connection in place of the blanking cap, and coupled to a cylinder of nitrogen.

(c) The charging unit should be connected by the union nut to the Schrader valve, and the pressure gauge turned SLOWLY clockwise to open the valve, when a reading will be shown on the dial, indicating the existing system pressure.

(d) The main cylinder valve may then be opened slowly permitting the system pressure (as shown by the gauge) to build up to the pressure required to balance the camera.

(e) For efficient working of the pedestal a pressure greater than 725 lbs. sq.in. (50.97 kgs.cm^2) should not be used.

(f) The main cylinder valve may then be closed, the pressure gauge rotated fully anticlockwise and the equipment disconnected. The dust cap should be replaced on the hose connection and also on the Schrader valve. Under (2) above it will be noted that the camera and other equipment should be initially balanced with two 4½ lb. (2.04 kgs.) weights in the tray, so that small items of additional equipment, different lenses, etc., may be fitted subsequently up to a total weight of 9 lbs. (4.1 kgs.) and compensated by removal of these weights as necessary. Larger items of ancillary equipment such as artists' prompting devices may occasionally be attached to cameras. Should it be anticipated that these may be required in the future, additional weights to a suitable value may be added before balancing the pedestal. Attachment of such an item can then be simply effected at any time, equivalent weights being removed whenever the component is attached.

(g) After balancing, or on changing to a camera of a different weight, it may be found that there are small differences in the movement of the separate sections of the column. An adjustment is provided so that a smooth change from one section to another can be achieved.

When adjustment is required, remove the ball-race covers (Fig.3) from the centre and bottom moveable sections (Fig.1). Several lead weights will be seen, they are attached by a small screw. These weights should be removed or added to as required.

The full compliment is three either side of the bottom section and two either side of the centre section.

STEERING CONTROL

The Vinten pedestal has been designed to permit crabbing, as normally used while the camera is on shot, but has the added facility of a true steering movement.

It is possible to move the pedestal and camera very rapidly to a new position, to line it up and to revert to crabbing before the camera is again required.

STEERING CHANGE-OVER

To change the steering mechanism from crabbing to steering the uppermost knob of the clutch bar F should be depressed and the tiller swung through an arc until the two red marks are in line. A slight pause should be made in this position to allow the mechanism to change-over. It should be noted that it is unnecessary to line the red marks before depressing the clutch bar. Altering the position of the clutch bar loads the mechanism so that the change-over will take place when the red marks are in line.

When the pedestal is set for crabbing, the three sets of wheels are locked together with the crabbing wheel, the direction of track being indicated by the line of the tiller or by the indicators on the crabbing steering wheel (it is advisable to fold down the tiller arm when using crabbing steering). The crabbing wheel may be used to alter direction whilst tracking, its location enabling all adjustments to be easily carried out without interfering with the operation of the camera. When the pedestal is set for steering the tiller steers only its local set of wheels; the other two sets of wheels and the crabbing wheel being straightened by lining-up the red indicators with the steering tiller.

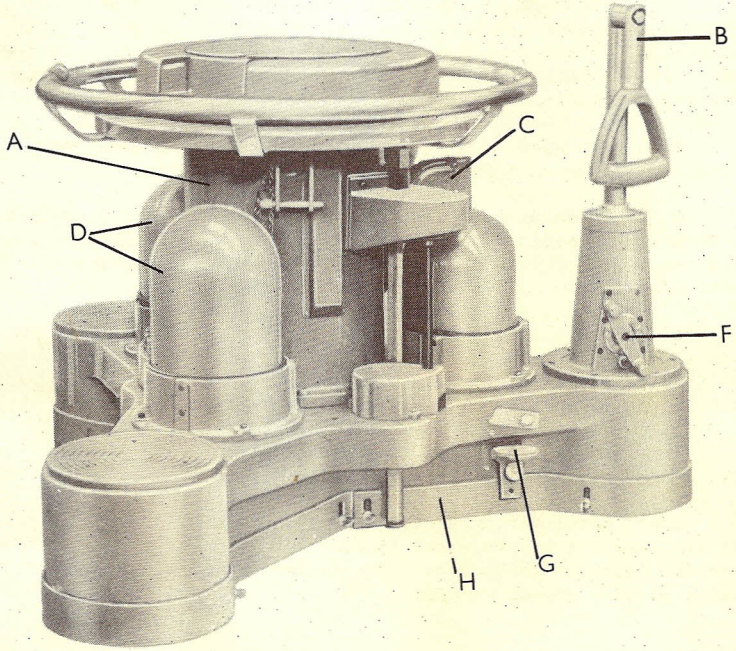

Fig. 2.

CONSTRUCTION

The pedestal may be divided into 5 main parts:-

(1) The base

(2) The telescopic standard

(3) The ram assembly

(4) The hydraulic system

and (5) The steering gear.

THE BASE

This consists of a robust casting in light alloy having generally a deep inverted-U section and stiffened by internal webs. It is basically triangular in plan and supported by a set of wheels at each corner.

The space within the casting contains the valves and piping of the hydraulic system and the steering gear. A large central well receives the lowest section of the telescopic standard.

The exterior of the base is shown in Fig. 2. It is provided with a circular machined face around the central well to which is bolted a flange on the lowest section of the telescopic standard (A).

A boxed bracket, situated on the latter section of the standard, contains the crabbing wheel steering gears and associated bearings and bushes.

The corners of the base are enlarged to cylindrical form to provide clearance for the three sets of wheels. The tiller (B) is mounted directly on one of these circular housings. The remaining space on this arm of the base is occupied by the hydraulic accumulator (C).

Similar positions on the other two arms of the base are occupied by two nitrogen storage cylinders (D).

On one side of the base the crabbing wheel driving shaft enters a housing containing the steering gears, associated ball races, and the chain sprocket which transmits the steering motions to the three sets of wheels.

A lever (F) at the base of the steering shaft housing enables the steering movements from the tiller to control either the one or the three sets of wheels: in the former case the remaining wheels are locked in one position automatically.

Foot pedals (G) project through both sides of the base beneath the accumulator and enable the pedestal to be locked at any height.

Sheet metal cable guards (H) are fitted around the lower edge of the base and are retained by wing nuts passing through vertically slotted holes in the guards. The latter are thus fully adjustable for a minimum ground clearance.

STANDARD

This comprises four main parts, each being a basically cylindrical member. The tubes are stepped in size to telescope one within the other.

The lowest portion, which is static, is bolted rigidly to the base by means of nine bolts. Four pairs of ball races are disposed around this section, 90° apart. Each pair of ball races is arranged one race near the top and one near the centre of the section, this arrangement being shown in Fig. 3. Each bearing consists of one ball race (A) mounted on a short horizontal shaft (B) which is clamped over reduced diameters by two split clamping blocks (C). These blocks are each attached to the main cylindrical casting by two socket head bolts (D). A third socket head bolt (E) is used to compress the block and thus secure the shaft. A hole is cut into the main casting to provide clearance for each bearing.

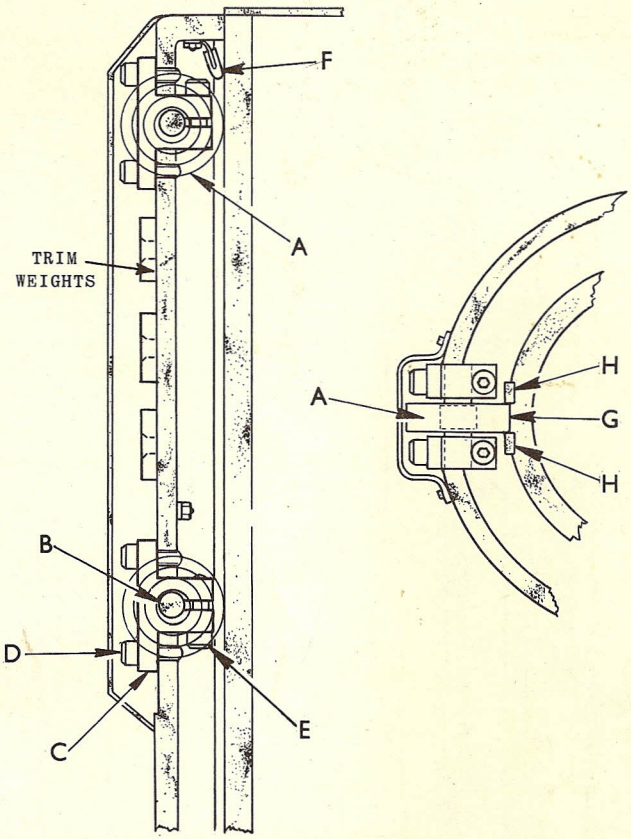

Fig.3.

Two pairs of ball races are arranged to be adjustable and take up any clearance across their individual planes of support. These adjustable bearings have the same construction as the non-adjustable pairs except that the shaft (B) has an eccentric centre portion enabling the ball race to be advanced when the shaft is turned. Fig.3 illustrates an adjustable bearing.

A sheet metal dust guard (F) covers each pair of bearings and is retained by small cheese-head screws tapped into the main casting. It is easily removed for access to the bearings.

Each vertically disposed pair of bearings in the largest section of the standard bears against a flat track (G) machined along the side of the next smaller section. Rotary movement between sections is prevented by rectangular rails (H) set into screws tapped into the casting. These rails exactly embrace the width of the ball races and prevent any transverse movement. Only one track between any pair of sections is provided with these guide rails.

A steel spring is attached above each bearing assembly and presses a felt pad against the machined track adjacent to it. This pad maintains a clean dust-free surface on the track, which is essential to maintain low rolling friction.

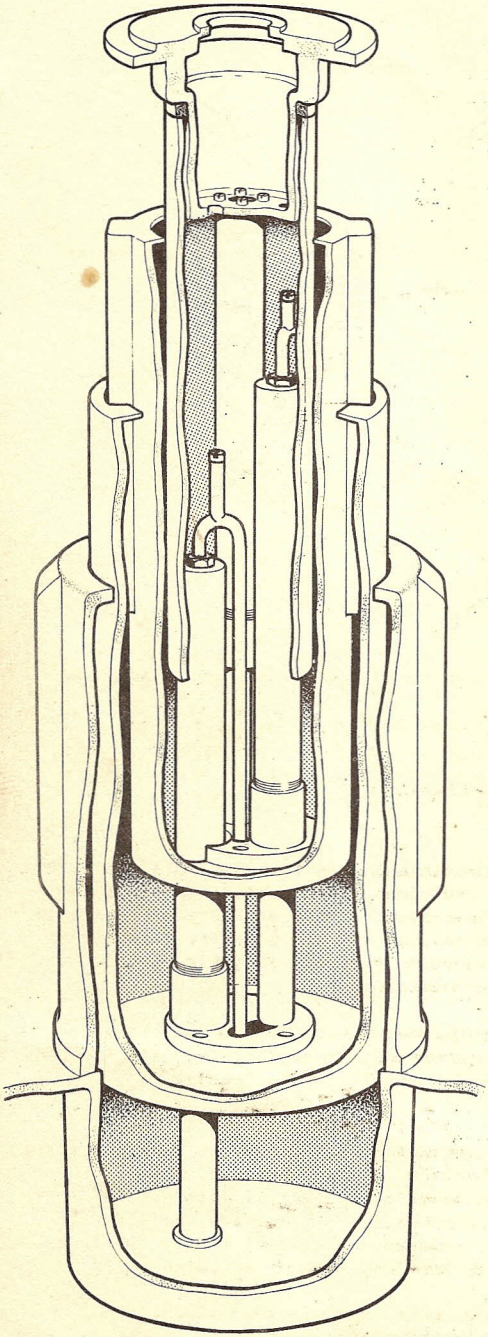

Fig. 4.

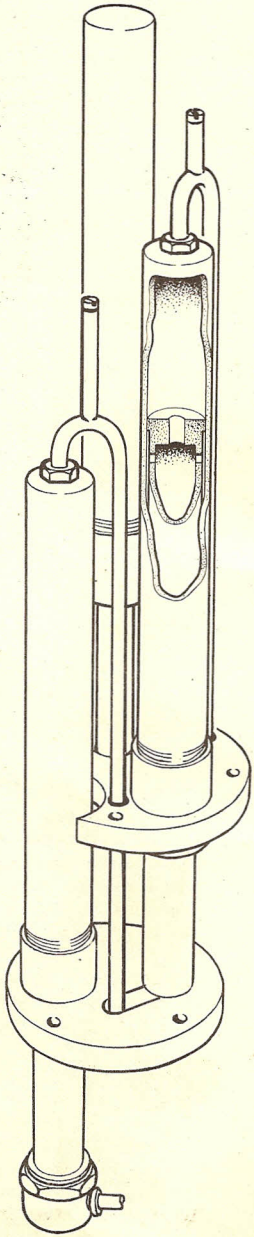

Fig. 5.

This method of support is repeated between each pair of adjacent sections, so that each may move vertically inside the next for rather more than half its length. The overall movement of the top (smallest) section is 32 inches (81.3 cm.).

The four sets of bearings in each section are identical to those in the other sections but it will be seen (Fig.1) that the bearings for each section are orientated at 45° to those in the adjacent section.

Fig.4 shows diagrammatically the layout of the ram assembly within the sections of the standard. The bottoms of the two larger sections have fitted end plates which are cut away to clear the hydraulic rams. Appropriate stages in the ram assembly pick up on these two end plates, while the fixed part of the ram assembly is attached to the base casting.

The remaining part of the ram is attached to a casting at the top of the upper (smallest) tube. This top casting is fitted with an adaptor on the underside to accept the top of the ram assembly, and supports an assembly which has provision for carrying the load (both camera gear and counterbalance weights).

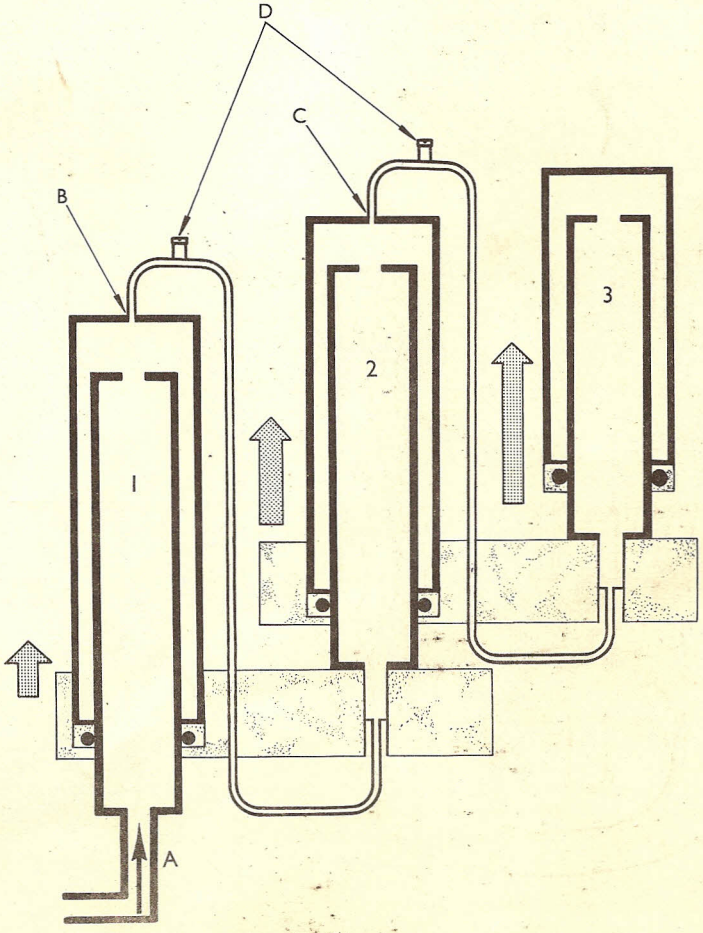

Fig.6.

The vertical movement of each section is limited at top and bottom of its travel by two spring stop units at the bottom of each section. The spring stop comprises a metal block riveted to the wall of the tube and drilled vertically to take a sliding pin. The pin is between each head and the fixed block is a spiral spring. The spring units come into contact with fixed stops on the next section at the limits of movement and thus eliminate any jarring action which might otherwise occur without resilient stops.

RAM ASSEMBLY

This unit is made up from three virtually identical rams disposed in a triangular arrangement, as shown in the simplified diagram of Fig.5. The two moving platforms are each attached by 4 bolts to the end plate of the appropriate section of the standard.

Fig.6 is a functional diagram of the assembly showing the rams side by side for clarity. It will be seen that hydraulic fluid enters through orifice (A) and passes into the body of ram No.1.

A hydraulic pipeline, leaving the top of the lower ram cylinder (No.1) at B, conveys fluid pressure to the base orifice of No.2 ram. Similarly, fluid pressure passes to No.3 ram via the pipeline connecting the top of the intermediate ram cylinder (C) to the base of the final stage ram. Bleeder nipples (D) are provided on both hydraulic pipelines to enable air locks to be relieved.

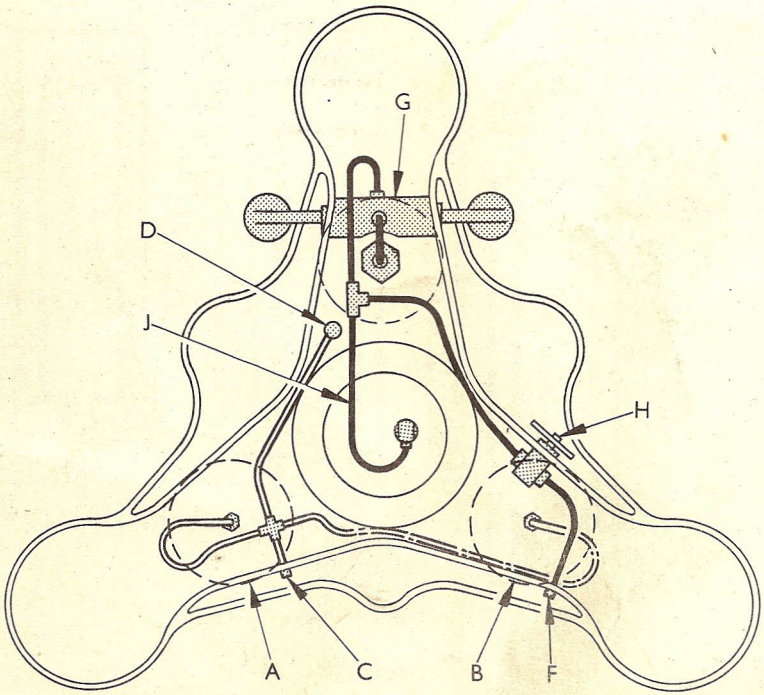

Fig.7.

HYDRAULIC SYSTEM

The components of the hydraulic system are disposed principally within the base casting. Fig.7 is a simplified diagram of the system viewed from below.

The two nitrogen bottles (A and B) project through the top surface of the base and are connected to a four-way adaptor. From this four-way adaptor a short pipe leads to an external connection (C) fitted with a non-return valve. A charging line may be coupled to the external valve to maintain gas pressure in the system.

The remaining pipe from the four-way adaptor passes through the base casting at D and communicates with the top of the accumulator, thus pressurizing the hydraulic fluid in the lower part. A neoprene diaphragm separates the gas and the fluid.

A short pipe from the accumulator connects to the control valve G. From the control valve another pipe connects directly to the ram assembly. Inserted into this pipe is a T junction, which connects via the shut-off valve H to the bulkhead connection F.

The control valve is a spring-loaded component operated by a pedal. When this is depressed the valve offers no restriction to fluid flow, but release of a pedal moves the valve shuttle so as to close a port and thus prevent flow. This locks the rams, and therefore the pedestal head at any desired height. Two pedals are fitted, one on each side of the base casting, each one acting on one end of the shuttle valve. The pedals may be held in the depressed position by means of a simple lock.

As an added refinement, there is a variable screw adjustment built into each pedal to restrict the oil flow (if desired) and thereby increase the resistance to vertical movement of the pedestal head.

STEERING GEAR

The pedestal is supported on three pairs of steerable wheels, situated one pair at each corner. The wheels are employed in pairs so that both must rotate when the pair is turned through a steering angle.

This prevents any possibility of tyre squeal when steering movements are made, even when the pedestal is stationary.

Fig.8 shows the steering mechanism within the base, viewed from below.

Each wheel unit (A) comprises two free running wheels mounted on an axle pivoted about its centre.

Each wheel is split to embrace a solid rubber tyre, the two parts of the wheel being clamped together by six nuts and bolts. The hub is mounted on a pair of ball races carried on one end of a shouldered axle. A pin at the centre of the axle, between the two wheels, is carried in a fork (B) and permits the axle to adopt its own angle so that the load is always evenly distributed between both wheels.

The fork is integral with a vertical pivot. This is a short steel shaft carried by two ball races in a housing bolted to a boss cast into the base.

The upper ends of the steering pivots carry sprocket wheels linked together by a roller chain (C). Near the centre of the base the chain is supported by idler sprockets (D and E) carried on ball races.

The two sprockets (E) are carried on eccentrically mounted pins held to the base by clamping rings. Releasing these rings permits the chain to be rotated to adjust chain tension.

On one side of the base the chain engages with the steering sprocket (F). This sprocket is carried on a short vertical shaft running in ball races situated in a housing bolted to the base casting.

The upper end of the shaft terminates in a gear wheel which engages with a smaller gear driven from the crabbing wheel via a reduction gear unit.

The centre crabbing unit (Fig.9) which has been incorporated to enable the wheels to be readily and easily set for crabbing from the camera operating position, consists of an internally toothed gear ring which is screwed to the crabbing ring assembly and in permanent engagement with a spur gear (A). Radial and lateral support for the gear ring is provided by three rollers (B) which are mounted on the weight tray and disposed at 90^{o} to one another. These rollers each of which runs in two ball races, act against bearing surfaces machined on each side of the teeth on the gear ring. Any slight wear on the roller faces may be taken up by adjusting the position of the rollers on the eccentric shaft (Inset-Fig.9).

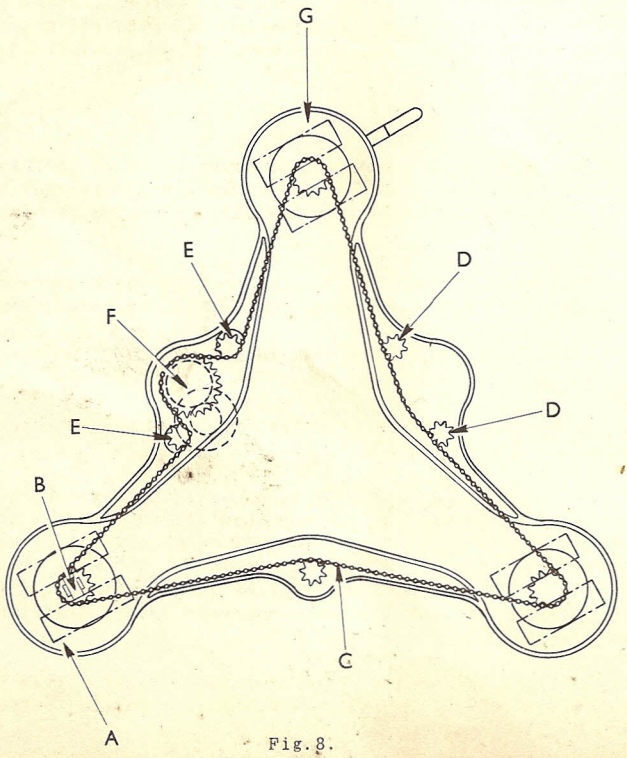

Fig.8.

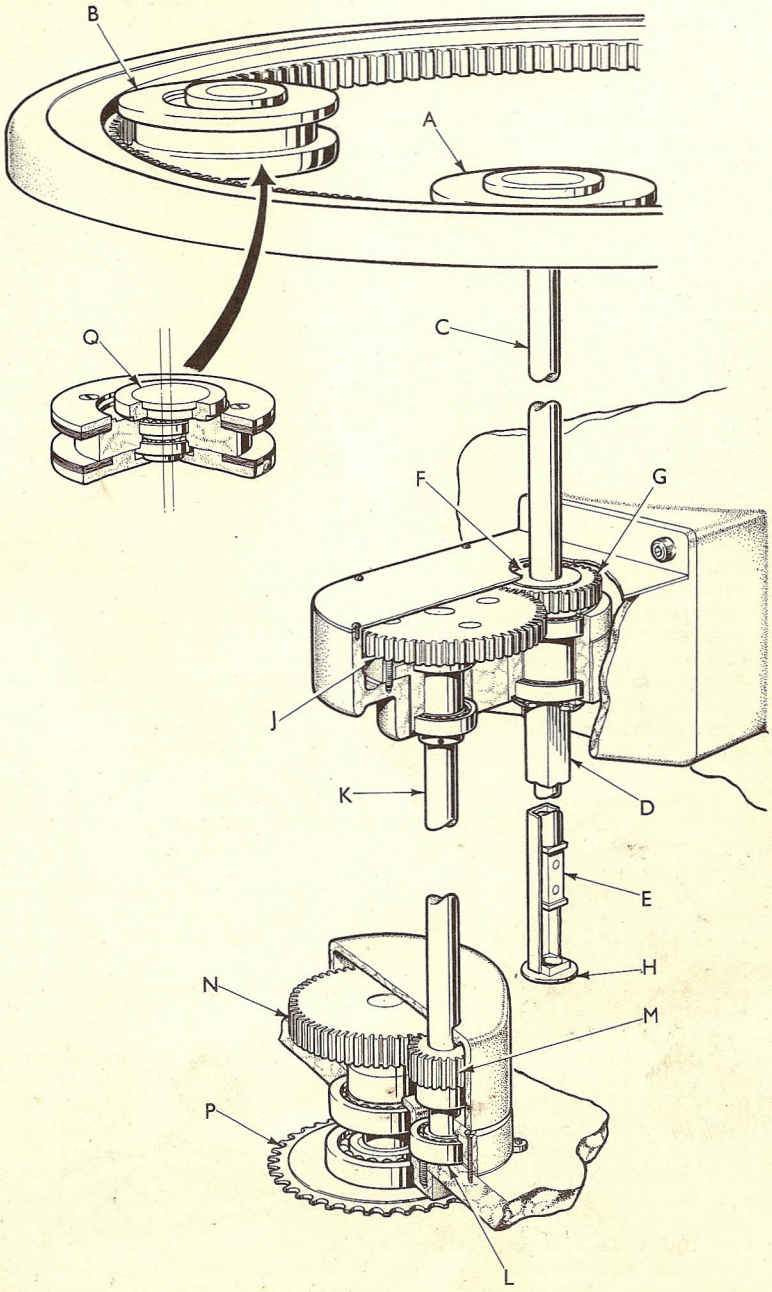

Fig. 9.

When the crabbing ring is turned the spur gear rotates and the drive is transmitted through a vertical driving shaft of circular cross-section (C). The lower end of this shaft is a sliding fit in a driving tube of square cross-section (D) housed in the boxed bracket situated on the lower section of the standard. Brazed and screwed to the lower end of the driving shaft, a barrel (E), of similar external cross section to the bore of the tube, transmits the drive from shaft to tube.

To make allowance for the various vertical heights of the pedestal, the arrangement of the driving shaft and tube forms a two stage telescopic effect. It will be seen that, when the pedestal is in the process of being elevated, the driving shaft rises from the tube progressively until the barrel makes contact with the driving tube upper end cap (F). From this point further elevation of the pedestal is compensated for by corresponding movements of the tube, which is free to slide vertically within its associated gear pinion (G), until the maximum pedestal height has been reached. When the pedestal is depressed the driving shaft lowers first until the barrel makes contact with the driving tube lower end cap (H) whereupon the tube telescopes until the pedestal is fully lowered.

It is emphasised that crabbing motions may still be transmitted to the wheels by the crabbing ring whilst the pedestal is being elevated and depressed.

The rotation of the tube, transmitted from the shaft, turns a gear pinion (G) the P.T.F.E. lined bore of which mates with the outer faces of the tube. This gear is in permanent mesh with a further pinion (J) keyed to a layshaft (K). Both gear pinions are mounted in twin ball races and housed within the boxed bracket. The vertical layshaft, the lower end of which is carried in a double row ball race (L) held in a housing clamped to the base casting, transmits the drive to another gear pinion (M) which, keyed to the layshaft, meshes with the sprocket shaft gear (N) mentioned in an earlier paragraph.

The resulting movement of the sprocket (P) transmitted to the roller chain turns the three sets of wheels to any desired position for crabbing.

The wheel unit (G - Fig.8) is supported by a steering pivot which is surmounted by a clutch mechanism. This is enclosed within a cast housing clamped to the base casting by a bolted ring.

Fig.10 shows the tiller steering components and clutch in a simplified form.

The tiller (A) is hinged to the top of the vertical steering shaft (B) supported by a bearing (C) at the top of the housing. A lever (D) is pivoted through a cover plate on the housing, and can rotate a cam through approximately 90°. The cam engages with a flanged sleeve capable of sliding axially over the steering shaft. This axial movement is conveyed via a spring system to a cross pin passing through slots in the wall of the hollow steering shaft.

Internally the cross pin engages with a push rod (E). At its lower end the rod carries a second cross pin transferring movement outside the steering shaft to a clutch disc. The disc carries two pins. Below the disc the pins pass through holes in a sprocket (F) loose on the shaft; below the sprocket are two corresponding holes in a static flange of the bearing housing (G).

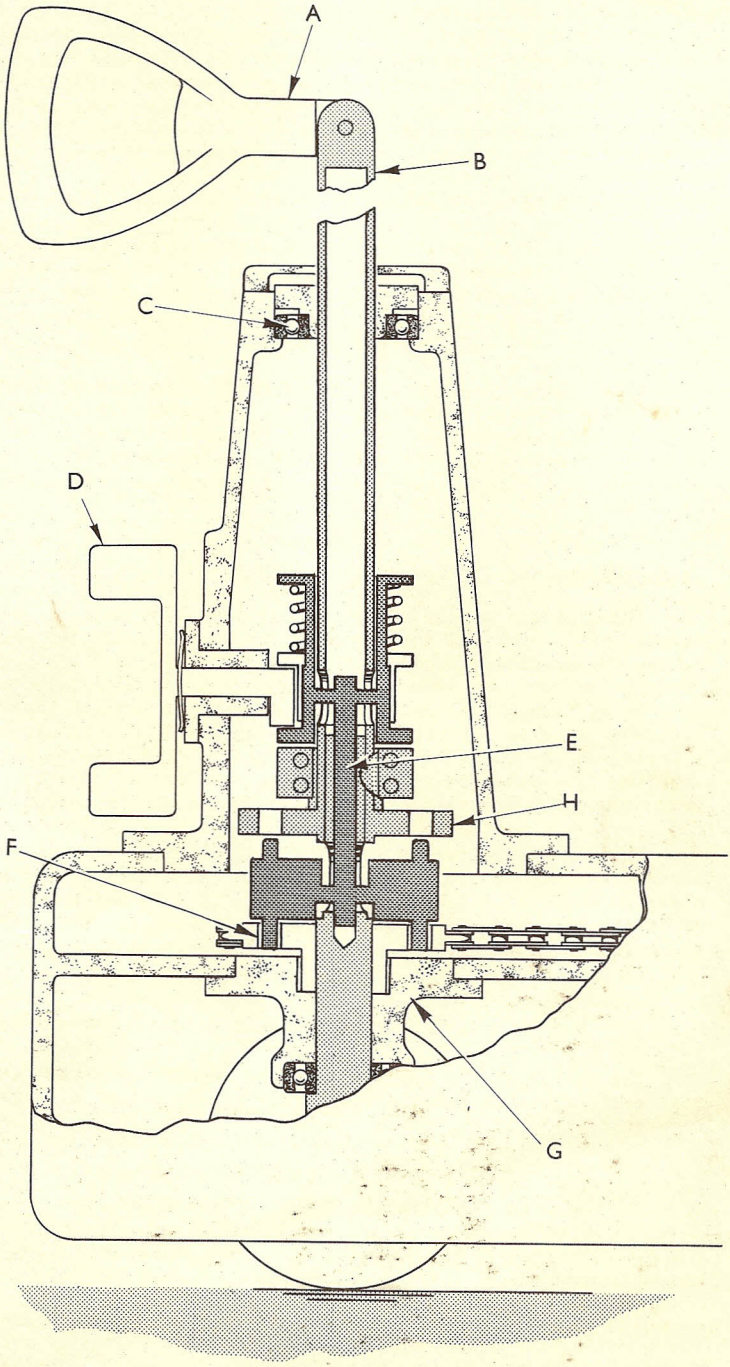

Fig. 10.

By means of the lever (D) the clutch disc and pins may be shifted to two positions. In the lower position the pins lock the sprocket wheel to the fixed bearing housing thus clamping the chain and the other two wheel units in one of two positions 180° apart, and therefore effectively identical. At the same time, the local wheel unit can be directly controlled by the tiller; this position thus provides the required conditions for true steering.

In the upper position of the clutch the pins disengage from the fixed holes and lock the sprocket to a disc (H) above it. This disc is fixed to the tiller steering shaft and has the effect of locking the three sets of wheels together. It follows therefore that under these circumstances, rotary movements of the crabbing steering ring are conveyed ultimately to each set of wheels to set up the conditions for crabbing.

It will be seen that the clutch can engage only at two specific positions. Generally, therefore, when the lever (D) is moved the pins will not immediately engage and energy is stored in the compressed spring; as the steering gear is moved a position occurs where the pins pick up their holes and the clutch inner assembly moves home.

ADJUSTMENT OF THE CLUTCH LEVER POSITION

The clutch and steering shaft housing is capable of rotation through 360°, enabling the clutch lever to be brought to the most favourable operating position.

To do this the steering should be centralized, so that the reference mark on the shaft collar is opposite the red datum line, after which the clamping ring at the base of the housing should be loosened by slackening off the holding-down bolts. The housing may then be rotated to suit the operator, and the bolts retightened.

The red datum line on the top of the housing will then be incorrectly set. To compensate for this the collar around the steering shaft should be loosened and rotated to a new position, where the reference mark is once again opposite the red datum line. The collar must then be clamped in position on the shaft.

SERVICING

The design of the pedestal and its robust construction ensure that maintenance is reduced to a minimum. In normal use the work required is likely to be limited to

(1) Adjustment of steering gear chain tension

and (2) Maintaining the system pressure.

CHAIN ADJUSTMENT

After a period of use the roller chain may become slightly stretched. This can be checked by feeling the amount of free transverse movement possible in the centre of the span of chain lying between either wheel unit and the single idler sprocket. This should not exceed ¾ inch (18 mm.) total movement. To ensure that the maximum slack is determined this check should be carried out while slightly rocking the steering tiller back and forth.

To adjust chain tension, first release the eccentric adjuster sprocket pins by slackening the four flush cheese head clamping screws adjacent to the eccentric adjuster. These adjusters, which are slotted to suit a screw-driver, are located either side of the lowest section of the crabbing steering unit. The nuts securing the non-adjustable idler sprockets on the other side of the base should NOT be touched.

Having slackened off the clamp screws slightly, the slotted adjuster between them can be rotated by a screw-driver; the screws must not be completely removed.

When the rotation of the adjuster has taken up the slack in the chain, it should be held in position by the screw-driver while the clamping screws are firmly retightened.

Only one sprocket need be adjusted at a time.

SYSTEM PRESSURE

The complete system (both gas and fluid) forms a closed circuit and in normal use should maintain its pressure for many months. Ultimately it may be found that the pedestal requires more effort to raise than to lower, indicating a lack of balance caused by reduced pressure. The system must then be topped up.

The procedure for re-charging the nitrogen system is detailed under 'Operating Instructions' which also describes the method of reducing nitrogen pressure in the system, in both cases using the special charging equipment supplied by W. Vinten Ltd.

In certain circumstances it might be necessary to top up the oil in the hydraulic system. The correct method of using the Vinten Hand Pump equipment is also given in the 'Operating Instructions'.

DISMANTLING

Should it ever become necessary to gain access to the mechanism of the pedestal it is likely that the first operation would be the separation of the standard assembly from the base. Either part may then be conveniently dealt with individually.

Removing the Standard Assembly

(1) Insert pip-pins.

(2) Remove the camera and gear.

(3) Remove the weight covers and weights.

(4) Ensure that the foot valve is in the closed position, remove the coupling to the ram and allow the free oil to drain out.

(5) Withdraw the taper pin securing the crabbing ring spur gear to the crabbing steering driving shaft.

(6) After removing the pip-pins; the weight tray, crabbing ring, spur gear and roller assemblies may be removed.

(7) Unbolt the steering gear housing situated on the base and slide the housing up the layshaft.

(8) Remove the taper pin securing the lower gear pinion, to the layshaft and unscrew the layshaft bearing clamping ring. This is necessary so that, when the standard is removed, the layshaft may be freely withdrawn from its gear pinion and ball race.

(9) The standard and steering shaft assembly may now be removed complete from the base by first unscrewing the nine $\frac{3}{16}$ inch B.S.F. cap screws which pass through the standard flange. The outer tube is first removed and then the three inner tubes may be removed as an assembly.

NOTE:- When removing the outer tube care should be taken to ensure that the layshaft withdraws freely from its lower gear pinion and double row ball race. It may be necessary to tap either component lightly to facilitate removal. Excessive force, however, should not be used. The gear pinion, clamping ring, housing, ball race and screws, which have been removed from the base and layshaft, should now be stored pending reassembly.

Dismantling the Telescopic Standard

Before dismantling the telescopic standard the boxed bracket containing the intermediate gears for the driving shaft and layshaft should be removed from the lower section of the standard by releasing the four securing cap screws. The centre steering shaft and layshaft assembly may then be removed complete and dismantled as a separate unit as detailed in a later paragraph.

Having removed this assembly the procedure for dismantling the telescopic standard is as follows:-

(1) Unscrew four $\frac{3}{16}$ inch B.S.F. countersunk screws and lift off the pedestal head complete with location spigot.

(2) Unscrew eight 2 B.A. cheese head screws and remove the top column casting; this will come away complete with the ram locating member.

(3) Remove the end plate from the bottom of the outer tube by unscrewing eight 2 B.A. cheese head screws which secure these parts together. Four ¼ inch B.S.F. cap screws should be removed to detach the end plate from the ram assembly.

(4) The end plate may now be removed from the centre tube by unscrewing eight 2 B.A. cheese head screws. The ram assembly can then be removed from the standard.

(5) The tubes may now be separated by withdrawing them one from another in a rearward direction.

Each tube may be dismantled in a similar fashion. To do this, proceed as follows:-

(1) Unscrew the sixteen 6 B.A. cheese head screws which retain each outer cover, and detach covers.

(2) Remove the top covers from the outer and centre tubes by unscrewing eight 2 B.A. cheese head screws in each.

(3) Detach the wiper pads above each bearing assembly by unscrewing two 6 B.A. countersunk screws and nuts in each.

(4) The bearing assemblies should then be removed by unscrewing two ¼ inch B.S.F. cap screws holding each bracket. The brackets will come away complete with spindles and ball races.

(5) To remove the bracket, unscrew the ¼ inch B.S.F. cap screws, and thus release the spindle. The packing washers may then be removed and the spindles driven out from the ball races.

When dismantling the standard assembly, the positions of the ball races should be noted so that the bearings can be correctly reassembled later. This refers particularly to the position of the static and adjustable (eccentrically mounted) bearings.

Dismantling the Base

(1) Unscrew the $\frac{5}{16}$ inch B.S.F. lock nut and remove the handle pivot screw, the spring washer, distance piece, the Tufnol friction washer and the tiller handle.

(2) Remove the indicator by unscrewing one 4 B.A. grub screw.

(3) Turn the complete base on its side, with the tiller steering shaft uppermost.

(4) Unscrew one 2 B.A. grub screw, withdraw each axle pivot and remove each pair of wheels complete with axles.

(5) The wheels may be removed from the axles by unscrewing a hexagon headed screw (½ inch B.S.F.) and withdrawing each wheel from its axle. The wheels can then be split by removing the $\frac{5}{16}$ inch B.S.F. hexagon headed bolts, thus permitting removal of the tyres. Bearings may now be removed from the hubs by driving out with a soft metal punch.

(6) Remove the cap from the tiller steering shaft housing by unscrewing three 2 B.A. cap head screws. Remove the bearing bush by unscrewing one 2 B.A. cap screw.

(7) Remove the foot lever (clutch) from the tiller steering shaft housing by withdrawing it complete with its bearing and cover plate. Six 2 B.A. countersunk screws retain this plate.

(8) Unscrew six ¼ inch B.S.F. countersunk screws, detach the clamp ring around the base of the tiller steering gear housing and detach the housing from the base.

(9) Remove the circular cover plates from above the other two wheel units by unscrewing three ¼ inch B.S.F. cap head screws from each plate.

(10) Detach the spring link from the chain and withdraw the chain from the base, clearing it carefully from each sprocket.

(11) The clutch assembly can be removed complete by unscrewing six ¼ inch B.S.F. cap head screws from beneath the base and by withdrawing the tiller steering shaft from the base.

(12) The other two wheel pivot shafts and forks may then be removed in a similar fashion to (11) above.

(13) The two chain adjustment sprockets should next be removed. Unscrewing four 4 B.A. cheese head screws on the top of the base releases each clamping ring thus permitting the sprockets and shafts to be detached. The sprocket, ball races and clamp ring may be removed from each shaft by springing open the spring clip on the shaft.

(14) The three small (non-adjustable) sprockets can be removed by unscrewing the $\frac{3}{8}$ inch B.S.F. hexagon nuts on top of the base and withdrawing the shafts (together with sprockets) from below.

(15) The sprockets and ball races may be removed from the shafts by springing open the spring clips as detailed for (13) above.

(16) The crabbing steering sprocket shaft gear should be removed by withdrawing the taper pin and sliding the gear off the shaft. The crabbing steering sprocket shaft and its housing may then be removed complete by releasing four ¼ inch B.S.F. cap screws securing the housing to the base.

(17) Unscrew four ¼ inch cap screws and detach the split clamp; withdraw the sprocket, and drive out the steering shaft. Detach the circlip and remove the ball race.

(18) Remove each wheel fork assembly by releasing six ¼ inch B.S.F. cap screws and dismantle in a fashion similar to (17) above.

The clutch assembly may now be dismantled, as follows:-

(1) The $\frac{3}{16}$ inch diameter pin should be driven out from the clutch sleeve ring.

(2) Unscrew four ¼ inch cap screws and release the split clamp; remove the Woodruff key.

(3) Release the clutch plate by unscrewing four 2 B.A. cap screws. Withdraw the steering shaft and housing until the cross pin is visible above the clutch body, and remove the cross pin. Withdraw the steering shaft complete with the housing, distance piece, sprocket and clutch body. These parts can then be simply removed leaving the steering shaft in its housing. The shaft can then be driven out of the housing.

(4) Remove clutch rod complete with end pieces. The end pieces should be removed only when necessary.

(5) The driving flange may be removed from the steering shaft followed by the clutch sleeve with washer and spring, and the clutch sleeve ring.

Dismantling the Crabbing Steering Gear

Having removed the crabbing steering gear together with the boxed bracket from the pedestal as outlined in earlier paragraphs, the procedure for dismantling the crabbing steering assembly is as follows:-

(1) Remove the plate covering the upper face of the bracket.

(2) Remove the small cap blanking the lower end of the driving tube and withdraw both the circular cross-section driving shaft, and the driving tube.

(3) Spring open the circlips retaining the ball races on both layshaft and driving tube assemblies and remove the taper pin retaining the layshaft in its housing.

(4) The layshaft gear pinion and driving tube gear pinion assemblies may then be removed by driving out with a soft metal punch from below. The dismantling procedure for the latter assemblies is obvious and requires no description. Care should be taken, however, to prevent damage to the gear teeth or the function of the mechanism may be impaired.

(5) Release the countersunk screws securing the clamp ring on the adjustable layshaft liner and remove the clamp ring and liner.

(6) Release the countersunk screws securing the driving tube liner to the bracket and remove the liner.

NOTE:- It cannot be too strongly emphasised that, unless stated, excessive force should not be employed in dismantling any part of the pedestal.

When reassembling the pedestal generally reverse the operations detailed in all sections above.

After replacing the steering gear it is necessary to ensure that the wheel units are aligned one with the other, and that the crabbing steering gear and tiller are also lined up correctly with the wheels. In all cases, the procedure is the same - the relevant split clamps on the steering shafts are loosened by slacking off the clamp bolts, and the shafts correctly orientated relative to each other.

HYDRAULIC SYSTEM

The hydraulic circuit is a closed system, and only in the event of damage resulting in a leak should the oil require topping up. Any loss of oil would result in a restricted range of travel by the moving part, the maximum extension being reduced.

To top up the oil system the procedure is as follows:-

(a) The reservoir of the hand pump unit is filled with an approved hydraulic oil, and the cap removed from the oil connection on the side of the pedestal.

(b) The hand pump delivery connection is coupled to the pedestal oil connection.

(c) Shut-off valve should be fully opened.

(d) The hand pump should first be given a few strokes after which the bleed valve on the pump may be opened, by-passing oil back to the reservoir, and with it the trapped air from the connecting pipes. Bubbles should be seen to rise into the reservoir.

(e) After allowing the system to settle, the bleeding process is repeated to release any remaining air.

(f) The hand pump may then be operated, and oil pumped into the system until the full travel of the pedestal is once more obtained.

(g) Finally, the shut-off valve should be closed, the pump connection uncoupled, and the pedestal connection cap replaced, care being taken to include the sealing washer.

In the unlikely eventuality of air becoming trapped in the hydraulic pipe-lines connecting the first, second and third stage rams, bleeding may be effected by releasing the sealing cap on the third section ram cylinder and the bleed nipple situated on each pipe-line.

WARNING -- before carrying out any major work on the components of the hydraulic system it is desirable to drain either the fluid or nitrogen circuit, or both.

To drain the hydraulic fluid open all valves and permit the oil to drain via the topping-up unit.

To discharge the nitrogen system fit the charging gauge and follow the instructions given for reducing pressure.

All connections and joints in the gas or fluid systems may be broken (as servicing may require) in an obvious manner. They must be well tightened on reassembly (see (6) under Refilling and Recharging the system).

REMOVING HYDRAULIC COMPONENTS

The accumulator fits within a ring on the base and may be lifted out after breaking the nitrogen connection at the top and the fluid connection at the bottom.

The two nitrogen storage bottles are removed in a similar manner, but require the breaking of only one connection to the bottom of each.

In general the various valves may be removed by breaking their connections, unscrewing the retaining bolts and withdrawing the components from the walls of the base.

To dismantle the foot-operated valve assembly proceed as follows:-

(1) Unscrew the $\frac{5}{8}$ inch hexagon lock nuts and remove the bolts. The foot pedals may then be detached.

(2) Remove the hexagon headed bolts, distance pieces and springs from each end of the valve unit.

(3) Release the retaining collars by unscrewing two 2 B.A. countersunk screws on the side walls of the base; the valve body will then come away with the retaining collars in place, one on either end. Remove these collars.

(4) Unscrew the 4 B.A. cheese head screws to free the glands.

(5) Withdraw the valve piston carefully.

(6) Withdraw the oil seals from the valve body.

REFILLING AND RECHARGING THE SYSTEM

The nitrogen and the oil system are separate and it will be realised that work may be carried out on one without discharging the other.

The complete procedure for filling and charging the system is detailed below; a major service of this type is unlikely ever to be required in normal use, but study of the principles involved should also facilitate carrying out less extensive operations.

To fill and charge the system

(1) Ensure that the pip-pins are in position.

(2) The complete pedestal should be inverted and the three arms of the base rested upon suitable supports.

(3) After connecting the hand pump unit as described under topping-up procedure, approximately one quart of the approved hydraulic oil is pumped into the system.

(4) The gas system is charged to approximately 200 lbs. sq.inch., (14.06 kgs.cm^2). The release valve on the pump is then unscrewed, permitting oil to flow back through the pump into the tank. This must be continued until no more oil flows by which time any air trapped in the system or pump circuit will have been carried away.

(5) A further half pint of oil is then pumped in.

(6) A close check is then made of all hydraulic system connections to ensure that neither nitrogen nor oil is leaking. In this connection it should be observed (where new components have been fitted) that the Ermeto couplings on the shut-off valve should be tightened up solid. The Wade couplings employed for the nitrogen circuit joints should be screwed up finger tight and then given another 1½ turns. The Enots couplings on the oil circuit should be firmly tightened. The leakage check should be carried out at this stage, and if the joints are satisfactory a further half turn should be given. When it is required simply to remake old joints, they should be screwed up finger tight and then given a further half turn.

Increase nitrogen pressure to 725 p.s.i. (50.97 kgs.cm^2).

(7) The shut-off valve should now be closed.

(8) The pedestal should be reversed to its normal position.

(9) Remove head spigot and felt disc to reveal three bleed screws on top of each ram.

(10) Each of these should be loosened in turn, whereby the fluid pressure on the ram assembly should drive out the trapped air.

(11) The bleed screws should be well tightened when this process is complete.

(12) Replace felt disc and camera head spigot.

(13) The normal load can then be added to the pedestal.

(14) The hand pump should then be used to top up the system with oil, if the full range of movement is not obtained.

NOTE:- The oil used in the hydraulic system has been specially compounded for the pedestal and reduces friction to a minimum. The pedestal must therefore always be refilled or topped-up with this fluid; in an emergency it is possible to use normal types of hydraulic oil, such as the following:-

AERO SHELL
FLUID 4
(D.T.D. 585).

GENERAL NOTE

When reassembling the pedestal after dismantling, ball races should be grease packed, and grease may be applied to the steering chain and to the plain bearings in the steering system. In NO case should grease or oil be applied to the flat tracks on the telescopic standard sections, and care should be taken to remove any oil or grease which may have been transferred to them accidentally.

C I N E M A T O G R A P H E X P O R T L T D

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