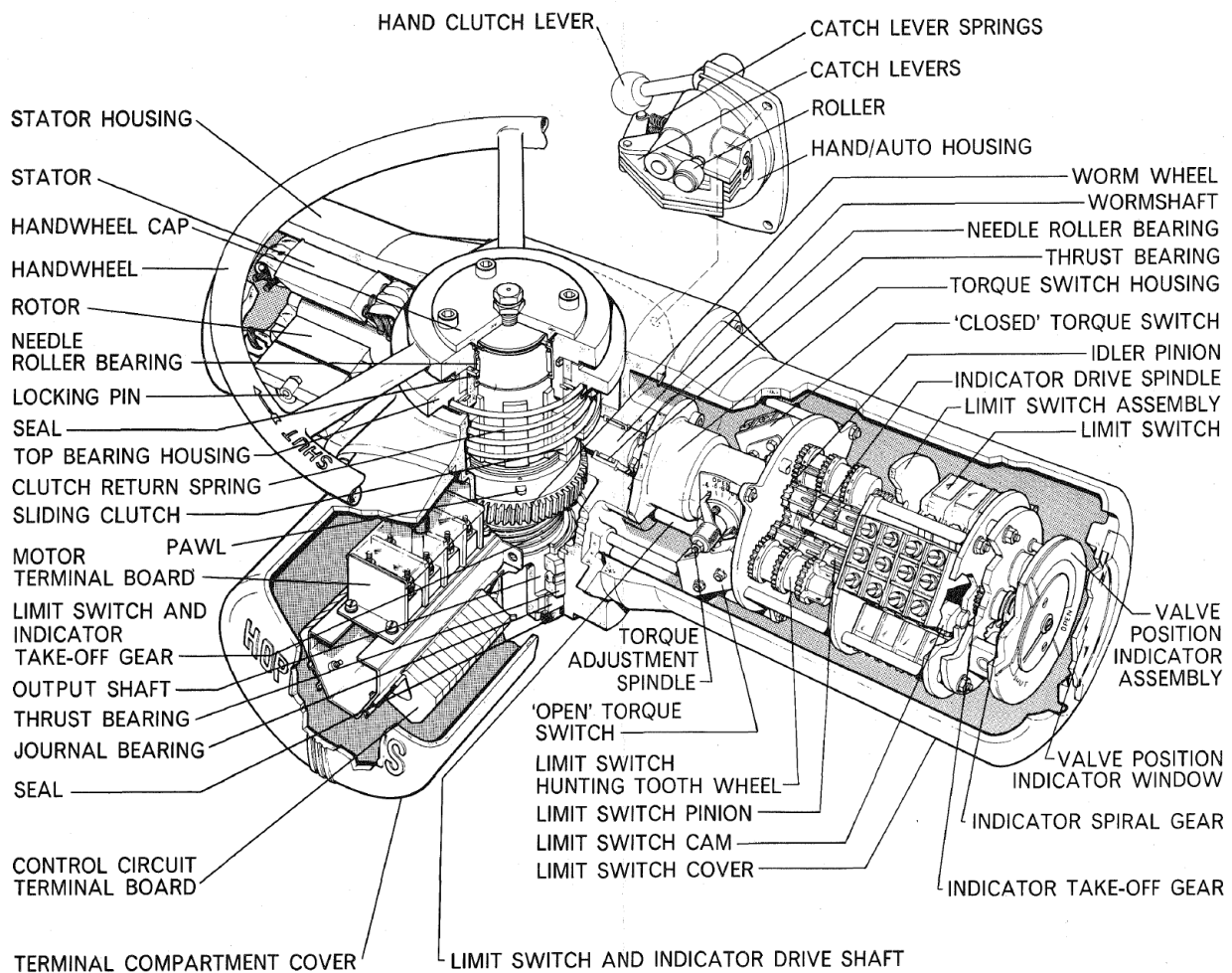


Standard Operating & Maintenance Instructions

Hopkinsons Fig 9151 Issue pre 1980 VALVE ACTUATOR



CUT AWAY OF FIG 9151 VALVE ACTUATOR

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Hopkinsons Fig 9151 (pre 1980)

VALVE ACTUATOR

Section 1

1.1 GENERAL

The actuator consists of a rotor stator unit driving an output shaft through a single stage worm reduction, which incorporates an automatic mechanical device for changing the drive from manual to power. The actuator includes a valve travel limit switch unit and a torque switch unit and is of totally enclosed weatherproof construction, suitable for mounting at any angle or inverted.

1.2 MOTOR AND GEAR TRAIN

A.C. 3 phase motors are of squirrel cage rotor stator design. Class 'F' insulation is provided as standard and the motors are 20 minute rated. The windings are terminated on stud type terminals in actuator terminal box.

The stator is mounted in a housing forming an integral part of the actuator housing and the rotor is mounted directly onto the wormshaft which is mounted on "packed for life" grease lubricated needle roller bearings.

The output shaft bearings are located in the main housing and the output shaft assembly incorporates a lost motion, or hammer blow device which allows the motor to run up to speed before transmitting full torque to the valve.

1.3 TORQUE LIMITING DEVICE

The wormshaft of the actuator is capable of axial movement against a Belleville washer spring pack.

The design of the spring pack is such that a limited deflection is permitted allowing axial movement of the wormshaft in either direction corresponding to 40% to 120% output torque of the actuator in the opening or closing direction.

1.4 MANUAL OPERATION

The actuator is equipped with a handwheel to operate the valve in event of power failure. The handwheel is easily engaged with the output shaft by moving the hand/auto lever from right to left and at the same time slowly turning the handwheel.

An automatic device is incorporated which transfers the drive from manual to power immediately the motor starts to rotate. As the sliding clutch is withdrawn completely from manual before engaging power drive the operator is ensured complete safety should the actuator be started during hand operation.

The sliding clutch is mounted on the splined output shaft and a compression spring ensures that the dog teeth on the underside are fully in mesh with the dog teeth on the top side of the wormwheel, thus transmitting the drive from the wormshaft to the wormwheel, from the wormwheel to the sliding clutch via the dog teeth lost motion device and from the sliding clutch to the output shaft. The hand/auto lever operates a lever and roller which makes contact with the sliding clutch in order to lift it out of engagement with the wormwheel and into engagement with the dog teeth on the handwheel.

The hand/auto lever is maintained in the hand position by 2 spring loaded catch levers.

To return to power operation the motor is energised and as the wormshaft rotates the wormwheel, 2 pawls fitted into the wormwheel strike the 2 spring loaded catch levers which release the hand/auto lever allowing it and the sliding clutch to return to the auto position.

1.5 LIMIT SWITCH ASSEMBLY

The standard limit switch assembly comprises 3 - 'open' position and 2 - 'close' position micro switches, each bank of switches being simultaneously operated by a cam on the pinion shaft of a hunting tooth gear train.

An intermediate position bank is fitted when required providing 2 or 4 microswitches operated simultaneously by a cam on the pinion shaft of an additional hunting tooth gear train.

The hunting tooth gear trains are so arranged that each bank is independently adjustable to provide any limit switch setting from zero to 100, actuator turns, i.e. valve fully closed to fully opened, with the 'intermediate' bank set at any position between the open and close limits, the accuracy of the settings being 0.1 actuator turns.

Each hunting tooth gear train consists of pinion shaft with a cam pinned to the non-driving end, 3 pinions on the shaft within the bottom and middle limit switch plates and a drive pinion in mesh with the compound gear train coupled to the limit switch drive spindle. The 3 pinions within the plates are in mesh with 3 spur wheels each of which embodies a positive drive to a hunting tooth gear mounted on the spurwheel boss. The faces of the hunting tooth gear and spurwheel are formed to permit drive in any of 10 positions corresponding to the numerals on the hunting tooth gear flange, the spur wheels being mounted on a hunting tooth spindle. The spur wheel has a pentagonal spigot and the hunting tooth gear has a double pentagonal recess. A spring on the hunting tooth spindle keeps the spur wheel and the hunting tooth gear locked together in the normal driving or set position but permits them to be separated for initial setting.

1.6 LIMIT SWITCH AND INDICATOR UNIT ASSEMBLY

The limit switch and indicator units are mounted on plates which embody an indicator take-off spindle and a limit switch drive spindle.

The complete assembly is fitted to the end of the actuator, opposite to the the motor, the cross pin of the limit switch take off spindle and a slot in the limit switch drive spindle forming the coupling for the gear drive from the actuator output shaft.

1.7 TORQUE SWITCH ASSEMBLY

The actuator is fitted with a torque switch assembly which incorporates 'open' and 'close' torque switches which are fitted with adjusting features easily set to limit the actuator torque in increments of 20% within the indicated range. The torque switch assembly is spigot mounted on the actuator housing and the open and close pinions are engaged with the drive sleeve fitted on the end of the wormshaft. Torque indication in terms of axial displacement of the wormshaft is transmitted via the pinions to the 'open' and 'close' torque switch operating spindles. Withdrawal of operating spindle by means of knurled knob permits the adjusting pointer to be set in any 5 positions from 0.4 to 1.2 (40% - 120%) output torque. The operating spindles are spring loaded and therefore are held in position after re-engaging with drive sleeve. The switch is normally tripped with circuit closed and retained in this position by the switch lever and torsion spring. The switch is re-set and the circuit opened at the set torque figure by the action of the cam attached to the pinion spindle.

1.8 CONTINUOUS INDICATOR UNIT (WHEN FITTED)

The indicator unit consists of two plates separated by pillars, input and output spindles, change gears, spur gears, index plates, pointer and pointer spindle. An indicator unit supplied with an actuator includes change gears of the correct ratio for the number of output turns of the actuator and no adjustment is required other than setting the pointer to correspond to the position of the valve.

Section 2

2.1 LIMIT SWITCH

The limit switch assembly of an actuator fitted direct onto a valve is set for the correct number of turns before despatch and should not be disturbed.

Pedestal type actuators and actuators for fitting direct on to valves at site are despatched with each switch bank set at 50.0 turns so that any mal-operation of the handwheel before the actuator is coupled or fitted to the valve should not disturb the correct relationship of cams to rollers. After coupling or fitting the actuator to the valve remove the limit switch cover. Hand operate the valve to the full shut position, and observe that the limit switch cams are in the correct re-set position. Maximum cam throw to operate switches 72° clockwise for open or intermediate, anti-clockwise for close. If for any reason the cam is in any other position, the correct position is easily attained by separating the spur wheel and the hunting tooth wheel which registers multiples of 10. Turn the hunting tooth wheel in a clockwise or anti-clockwise direction until the correct cam position is obtained and re-engage with spurwheel. This should be carried out without disturbing the remaining digits. After noting the actual number of turns indicated on the 'close' bank hand operate the valve in the open direction 0.3 turns of the limit switch counter mechanism to the nearest 0.1 turn which will give a complete number in a straight line, in line with the pinion and hunting tooth spindles. Reset the 'close' bank to 000 turns (in line) and re-engage each spur wheel and hunting tooth gear. Now set the 'intermediate' and 'open' banks to the correct number of actuator output shaft turns from zero at which these switches are required to trip.

2.2 COMMISSIONING PEDESTAL UNITS

First ascertain that the valve is in the full shut position i.e. the stop is resting on the lower shoulder of the valve pillars. Connect the valve and unit mechanically by the extension spindle supplied taking care not to move the valve from the full shut position and also ensure that the universal forks on the intermediate shaft are in line and not at 90° to each other.

2.3 COMMISSIONING DIRECT MOUNTED ACTUATORS

Valves which are to be fitted with direct mounted actuators at site are fitted with a circular adaptor plate secured to the valve by the pillar nuts.

If a standard hand operated valve is to be motorised by means of a direct mounted actuator, remove the existing handwheel, gearing (when fitted) sleeve and bridge, leaving the valve pillars and spindle only for application of the actuator. Remove the circular adaptor plate from the base of the actuator and fit this item on the valve pillar ends and secure by means of the existing pillar nuts. Do not remove any covers at this stage but engage manual operation in preparation for fitting to the valve.

Sling the actuator by means of overhead tackle and carefully lining up the actuator with the valve spindle axially and radially, lower the actuator on to the valve until the output shaft begins to engage the valve spindle. Rotate the handwheel in the opening direction, and, at the same

time, gradually lower the actuator until the base face or distance pieces is/are flush with the top face of the adaptor flange. Fit the nuts to the mounting studs and secure.

2.4 MECHANICAL VALVE POSITION INDICATOR (WHEN FITTED)

Set the pointer to the 'shut' index of the scale with the valve in the full shut position after setting the limit switch, and adjust index plates if necessary.

2.5 ALTERNATING CURRENT

For A. C. 2 and 3 phase.

It is very important to ascertain that the direction of travel of the valve corresponds to the 'open' and the 'close' button of the controller.

Carefully check the direction of travel of the valve with the movement of the controller by having the **valve in mid-position**. Then press the 'open' or 'close' operating button and immediately after that stop the actuator and ascertain whether the valve has moved to correspond to the button which was operated. If the valve has travelled in the opposite direction, reverse any two of the supply leads in the contactor.

2.6 LUBRICATION

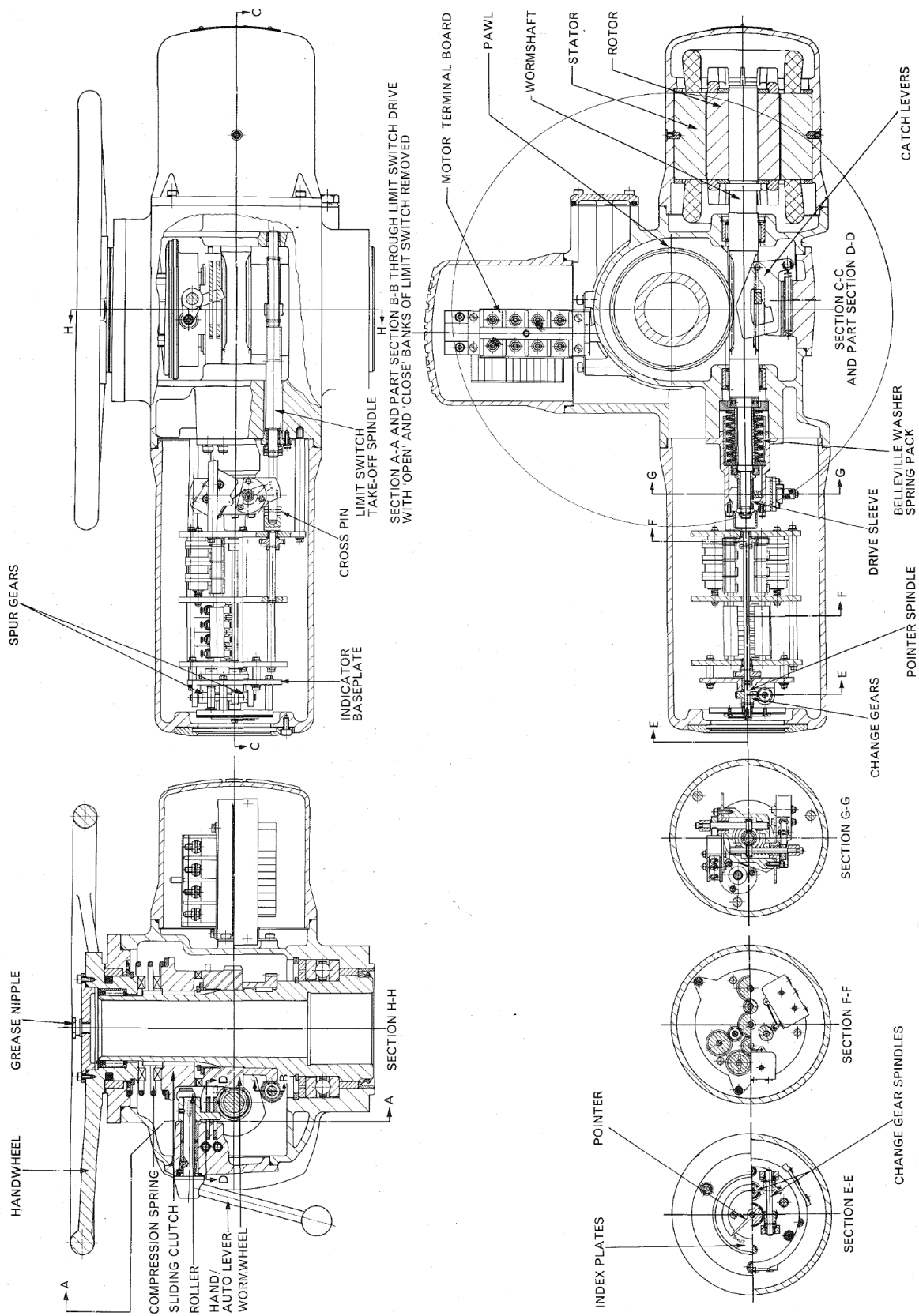
The actuator requires the minimum of lubrication as the bearings are packed for life. Actuators for mounting direct on to a valve are fitted with a grease gun nipple for valve stem lubrication. When an actuator is fitted to a valve at site, the latter nipple should be fully charged when commissioning, with the valve in the full open position, and not excessively lubricated during service with the valve full shut. It is advisable to lubricate sparingly the brass drive gearing and bearings on the Limit Switch Assembly.

RECOMMENDED LUBRICANTS:

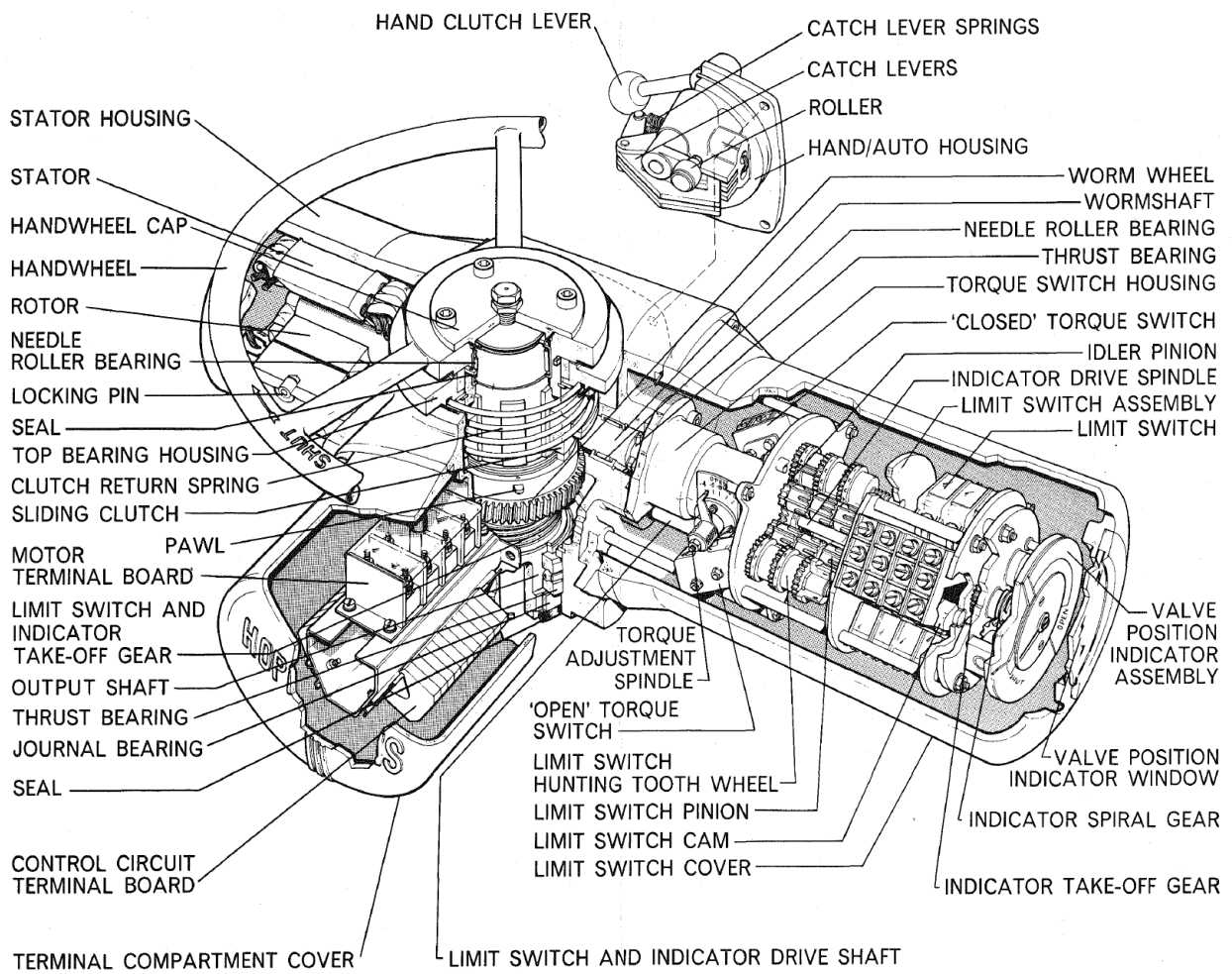
SHELL ALVANIA GREASE No.3 - Grease gun nipple

SHELL VITREA OIL No. 27 - Gears and moving parts of limit switch and valve position indicator unit.

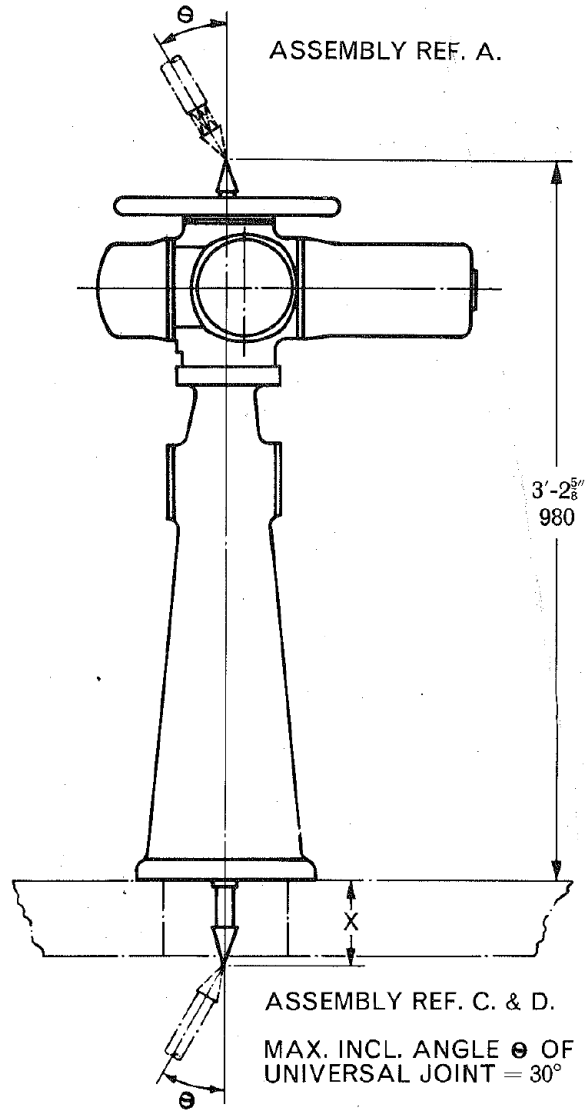
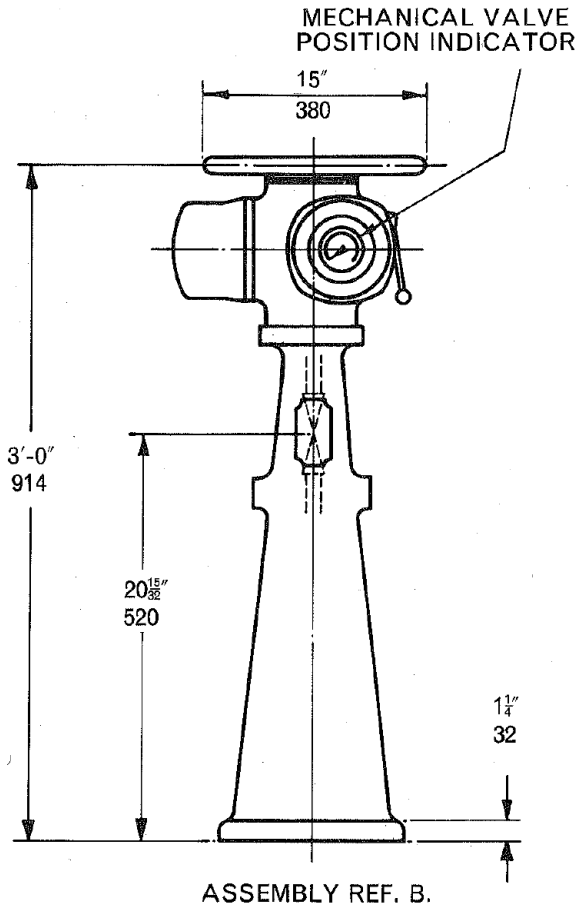
ROCOL MOLYGEAR - Internal power gears pre-lubricated at works sufficient for normal life of actuator. Dependent upon usage and operating conditions.



**SECTION ARRANGEMENT OF FIG. 9151 ACTUATOR
 WITH MECHANICAL VALVE POSITION INDICATOR (OPTIONAL EXTRA)**

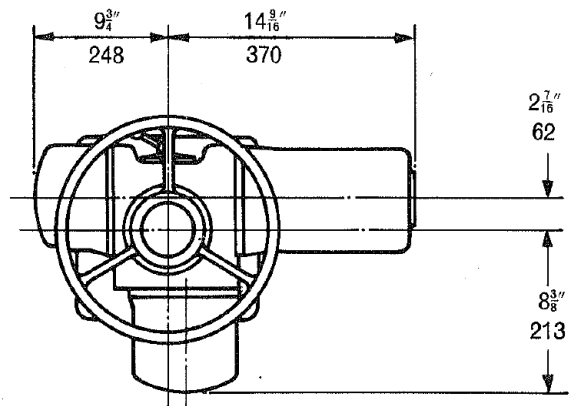
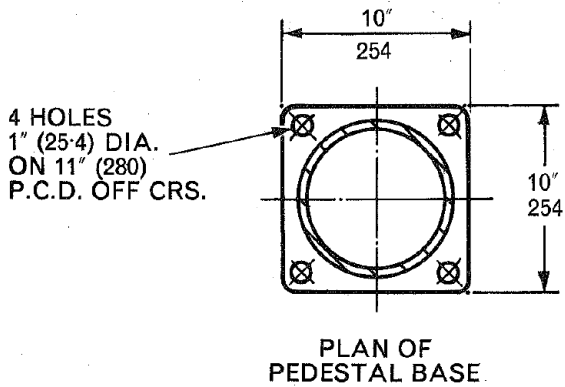


CUT AWAY OF FIG 9151 VALVE ACTUATOR

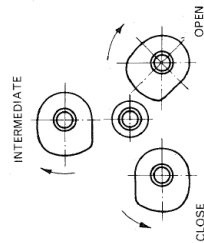
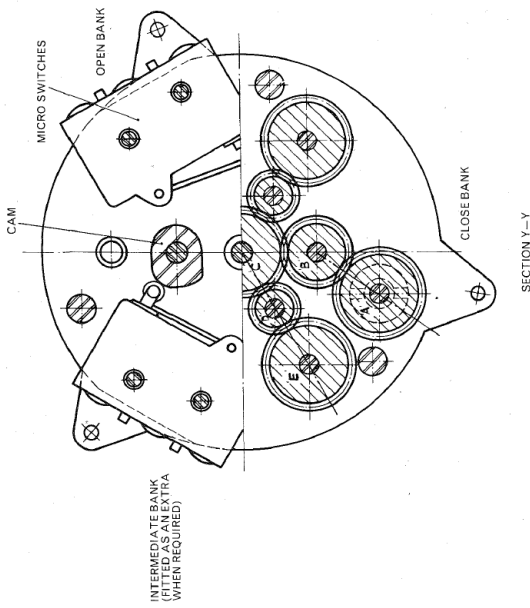


APPROX. WEIGHT 1CWT. 20 lbs 60 KGS.

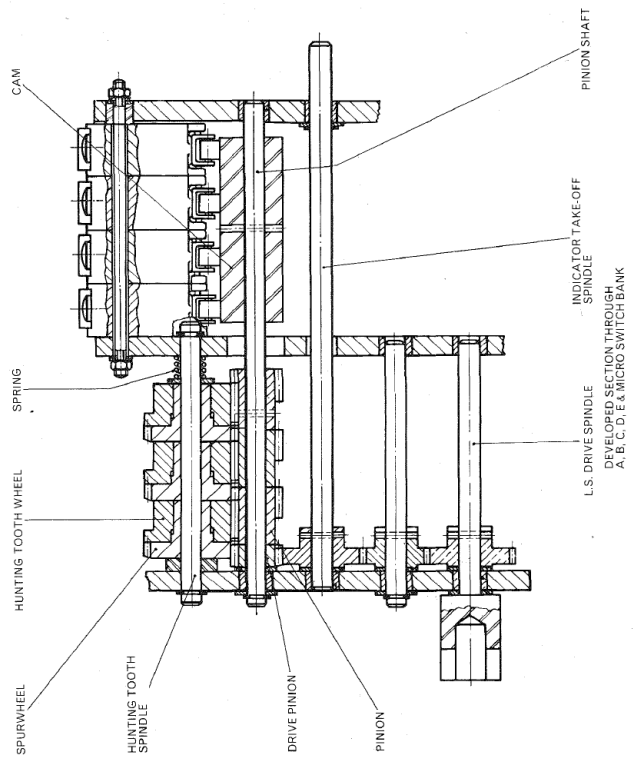
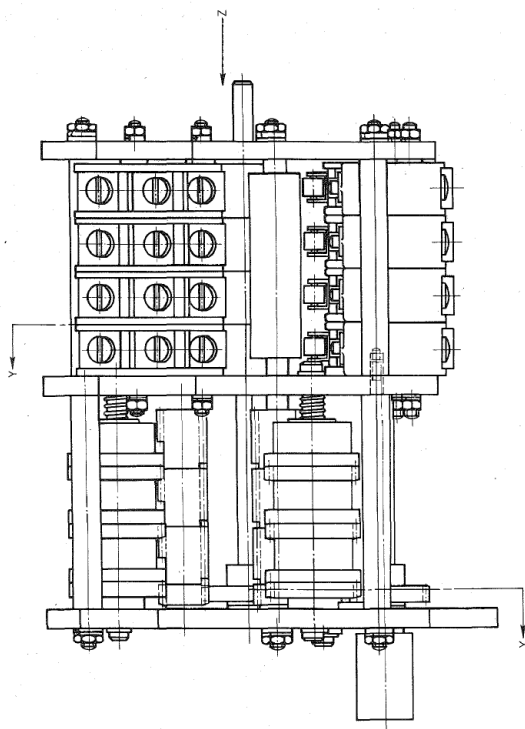
REF	X	FLOOR THICKNESS
C	6' 152.4	UP TO 4 1/2" 114
D	12' 305	ABOVE 4 1/2" 114



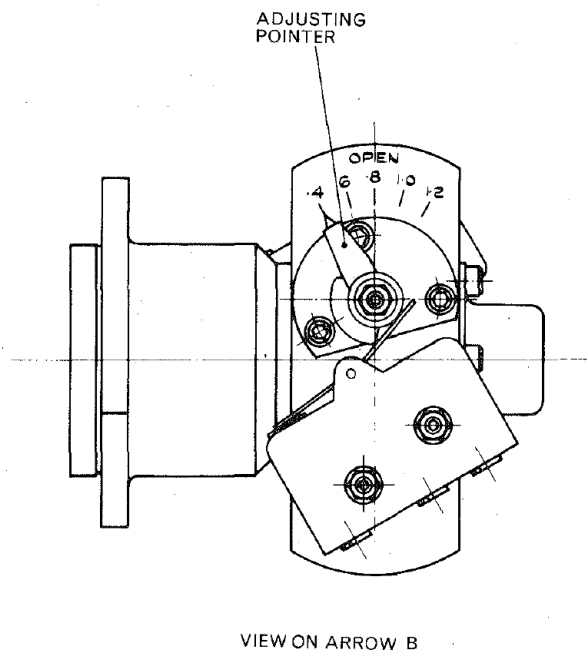
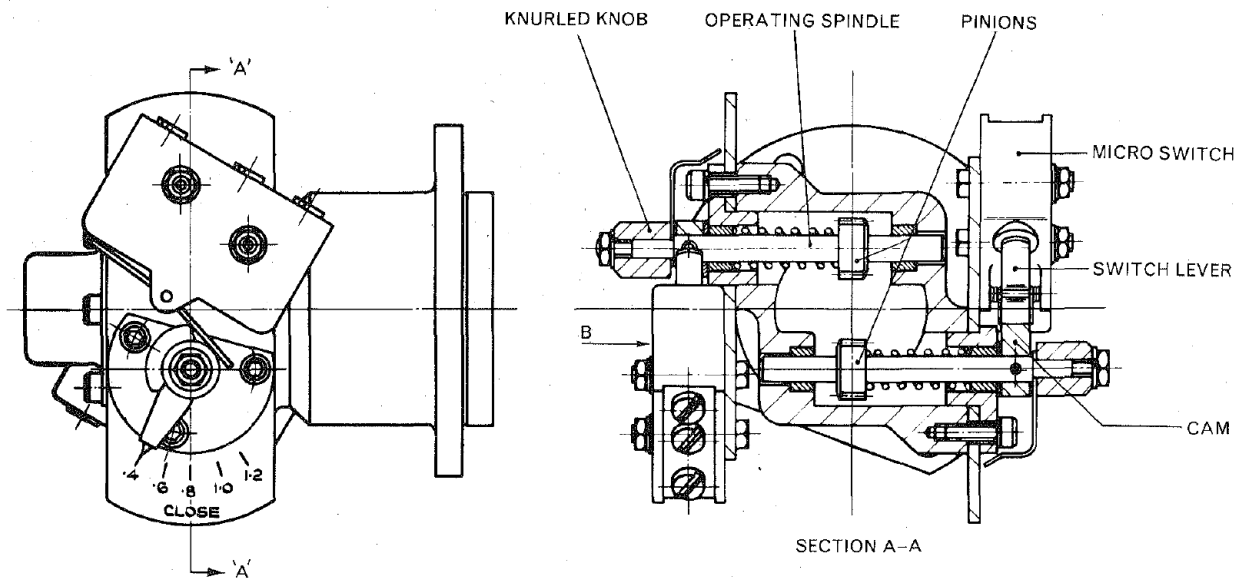
**ARRANGEMENT OF FIG. 9151 ACTUATOR
PEDESTAL MOUNTED**



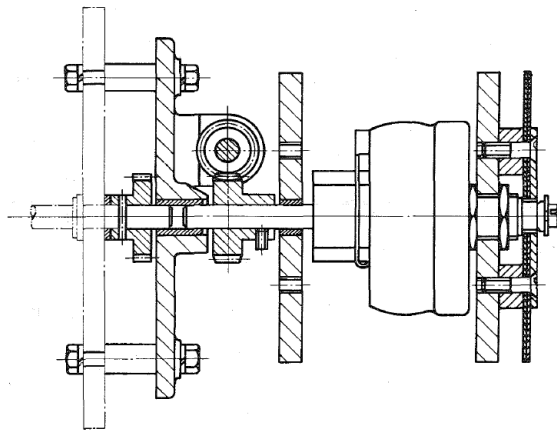
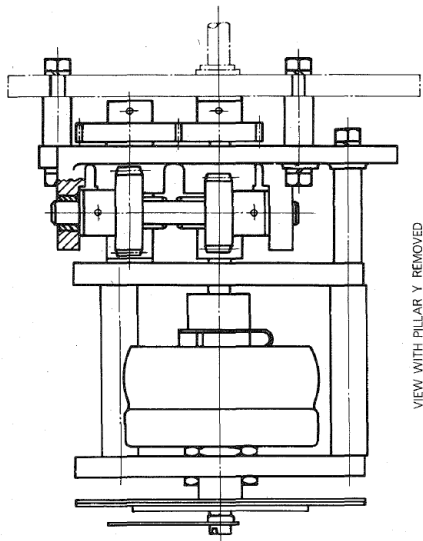
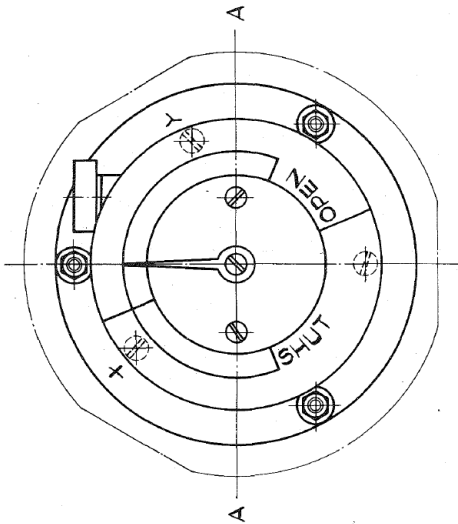
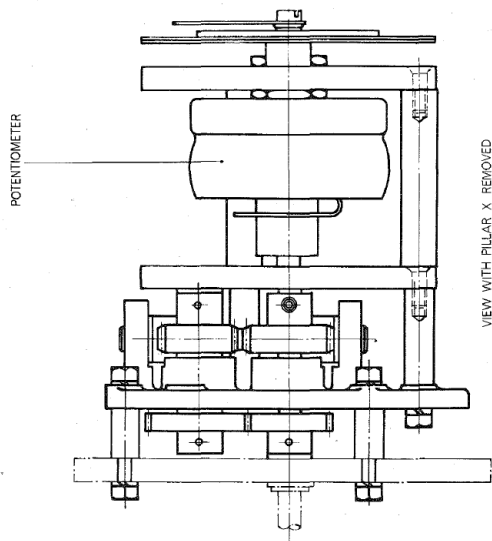
TYPICAL VIEW OF CAMS IN DIRECTION OF ARROW Z WITH MICRO SWITCH TOP PLATE REMOVED.
 NOTE: CLOSE CAM IS TURNED END FOR END RELATIVE TO INTERMEDIATE & OPEN CAMS.
 ARROWS INDICATE DIRECTION OF ROTATION OF CAMS TO OPERATE MICRO SWITCHES.



ARRANGEMENT OF LIMIT SWITCH FOR FIG. 9050 & 9151 ACTUATORS



**TORQUE SWITCH ASSEMBLY FOR
FIG. 9050 & 9151 ACTUATORS**



**ARRANGEMENT OF VALVE POSITION TRANSMITTER
FOR FIG. 9050 & 9151 ACTUATORS**

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