# Appendix 9

# PLESSEY, JAGUAR SERIES

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## LIST OF ILLUSTRATIONS

### Introduction

**1.** Plessey linear actuators of the Jaguar series follow the general design described in this Appendix; the machines illustrated are typical of the series, and specific details of individual actuators will be found in A.P.4343D, Vol. 1, Sect. 14. They vary in such details as the working load, the position of the electrical plug, the type of end fittings and the length of travel.

**2.** The actuators of the Jaguar series are designed to provide remotely controlled linear motion against either tensile or compressive loads. Motive power is provided by a small reversible motor driving a lead screw threaded into a plunger mechanism, through a spur gear reduction train and slip clutch. The plunger has a travel range between 0·125 in. minimum and 3 in. maximum,

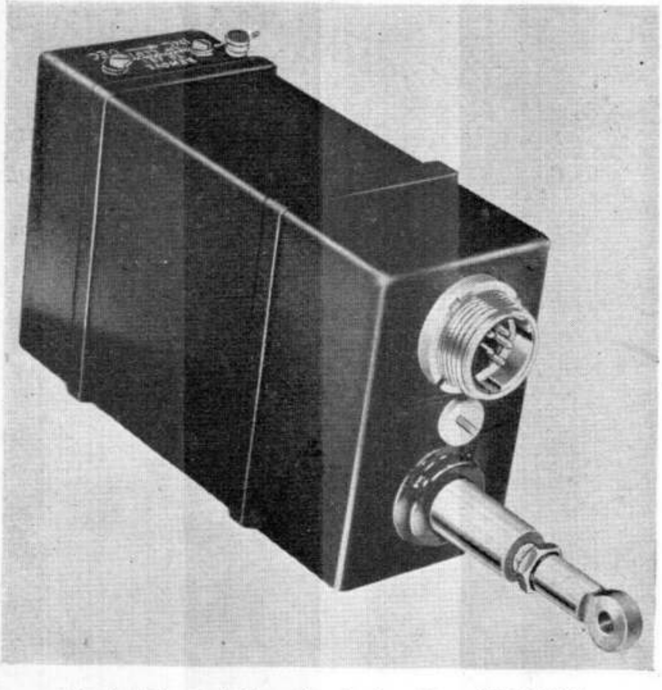

**Fig. 1. General view of actuator, Type CZ53681/1, with plunger extended**

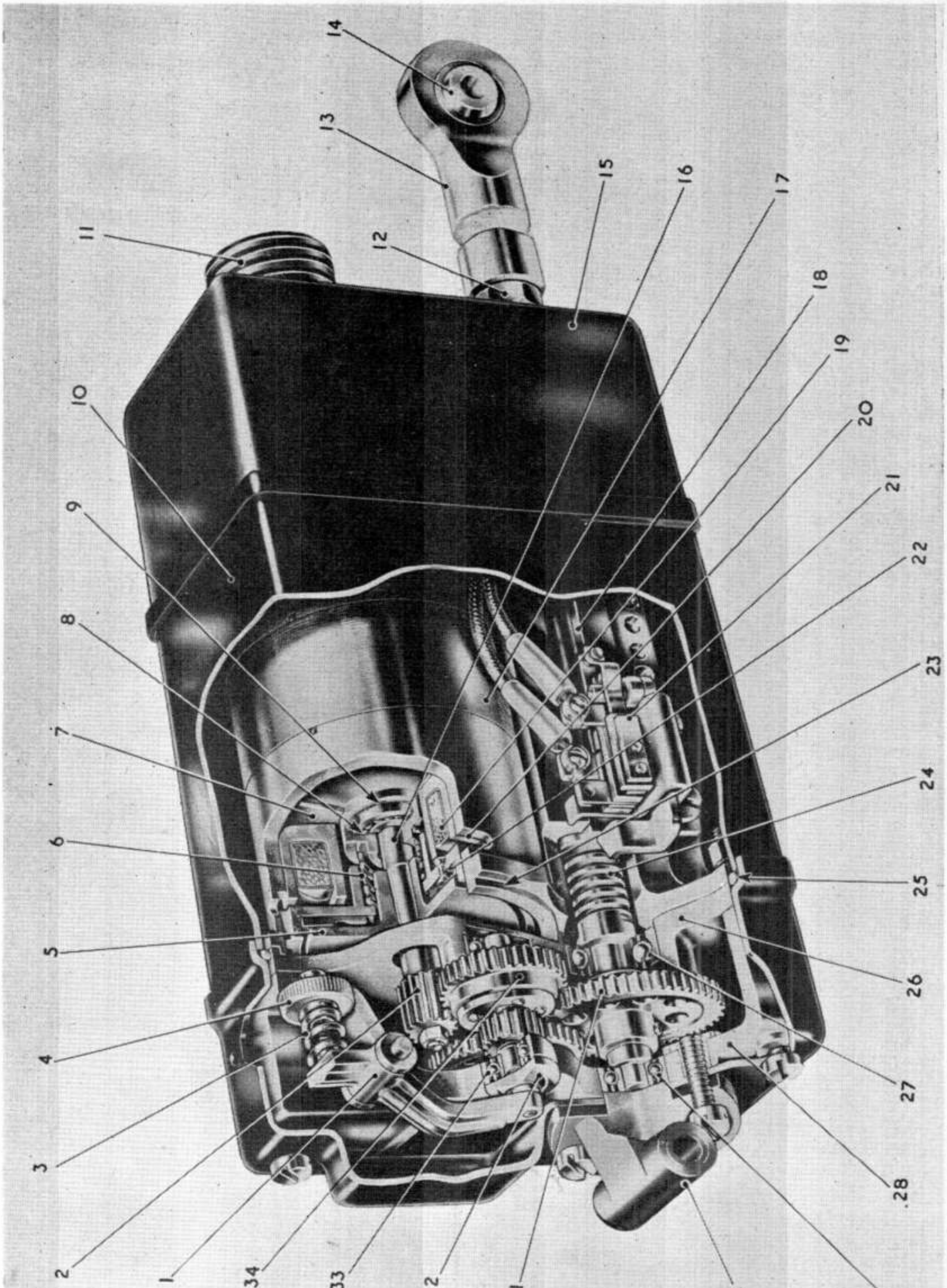

Fig. 2. Sectional view of actuator, Type CZ53681/F

### KEY TO FIG. 2

1 CLUTCH LEVER
2 FIRST (MOTOR) GEAR
3 CLUTCH SPRING
4 CLUTCH ADJUSTING NUT
5 FRICTION PLATE
6 BRAKE RETURN SPRING
7 AIR GAP ADJUSTING SHIM
8 SHIM
9 BRASS CASE
10 SPACER CASE
11 MULTI-POLE PLUG
12 LOCK-NUT
13 PLUNGER END FITTING
14 SELF-ALIGNING JOINT
15 FRONT COVER
16 ARMATURE SHAFT
17 MOTOR
18 PLUNGER HOUSING
19 BRAKE COIL
20 AIR GAP CHECKING SLOT
21 "IN" LIMIT SWITCH
22 BRAKE SHOE ASSEMBLY
23 REGISTER
24 LEAD SCREW
25 SEALING WASHER
26 FRONT COVER (GEARBOX)
27 LEAD SCREW BEARING
28 GEARBOX
29 FINAL GEAR SPIGOT BEARING
30 END FITTING
31 FINAL OR LEAD SCREW GEAR
32 CLUTCH THRUST PAD
33 SPIGOT BEARING
34 SECOND GEAR, CONTAINING CLUTCH

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controlled by adjustable change-over limit switches operated by the plunger itself.

## DESCRIPTION

**3.** A sectional view of the actuator is shown in fig. 2. The motor and plunger housing are mounted parallel to each other on the gearbox casting and enclosed within a spacer case. A rear cover casing houses the gearbox, and has fitted to it the fixed end fitting by which the actuator may be attached to the structure of the installation or aircraft. A front cover casing carries a multi-pole plug for the electrical connections. The end fittings vary according to the function performed by the actuator.

**4.** The linear motion of the plunger is guided by torque reaction ears, formed integrally with the plunger, which travel in longitudinal slots in the plunger housing. The extended and retracted plunger positions are determined by limit switches which are tripped by the plunger ears. This action breaks the motor circuit, and an electro-magnetic brake rapidly stops the motor and controls the selected rest positions.

### Motor

**5.** The motor is of a split-field series wound type, incorporating an electro-magnetic brake, and is designed to operate between 18 and 29 volts (24 volts nominal). The motor housing carries the electro-magnetic brake assembly and the drive end armature bearing. Into this housing spigots the wound yoke assembly which in turn locates the commutator end frame, the commutator bearing and the brush gear. Both bearings are enclosed in brass shields that retain the bearing lubricant.

### Brush gear

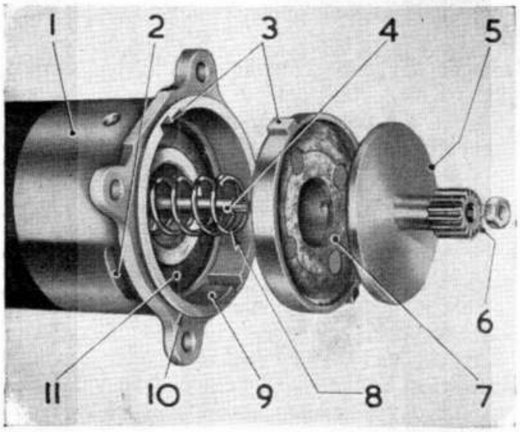
**6.** Two carbon brushes are set in brush boxes on a moulded brush rocker. The assembly is retained by two screws which pass through slots in the rocker and screw into two shaped clamp plates located in a curved track, behind the rocker slots. These slots permit adjustment of the rocker over a range of 22 deg. mechanical to enable equal armature speeds to be obtained in both directions of rotation.

### Motor brake

**7.** The motor brake comprises a brake coil assembly, a brake shoe assembly and a friction plate integral with the pinion gear. In the rest position the brake shoe is in contact with the friction plate through the compressive medium of a coil spring. When the motor is switched on, the brake coils are energized and the brake shoe is withdrawn, against the spring compression, from contact with the friction plate. The armature is thus free to rotate. When the motor current is switched off, the reverse operation takes place, and the coil spring forces the brake shoe against the friction plate, rapidly stopping rotation of the armature shaft, and effectively controlling overrun of the plunger.

### Gearbox

**8.** The gearbox is formed by the rear housing end plate, spacer case and front housing casting, the whole being enclosed in the rear cover casing. The front cover is cast and counterbored to take the main lead screw bearing and the bearing carrying the drive shaft to the gear train. The train is compounded between the motor pinion gear and the final drive gear on the lead screw shaft



1 MOTOR
2 AIR GAP CHECKING SLOT
3 LOCATING EARS AND SLOTS
4 ARMATURE SHAFT
5 FRICTION PLATE
6 ARMATURE GEAR
7 BRAKE SHOE ASSEMBLY
8 RETURN SPRING
9 FRONT COVER
10 MOTOR REGISTER
11 BRAKE COIL

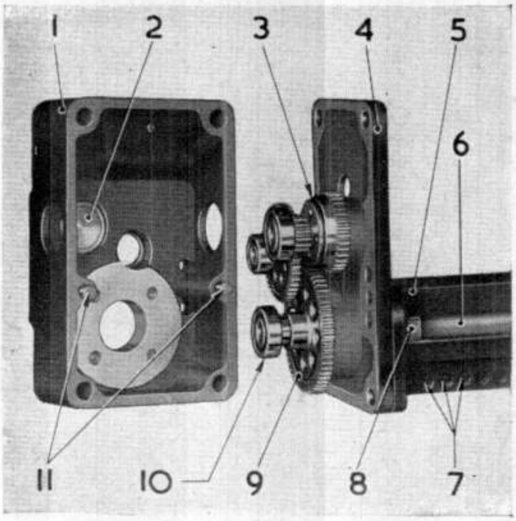
**Fig. 3. Motor brake (exploded)**

by four compound gears. A grease guard assembly forms part of a spacer housing about the motor drive pinion.

### Slip clutch

**9.** The slip clutch is a safety measure to prevent the motor stalling if the actuator is subjected to an excessive load. The clutch assembly comprises a smaller gear driven by a larger gear, which in turn is driven by the pinion drive gear. The larger gear has one face recessed by an internal taper to receive the tapered friction drive wheel.

**10.** Axial movement within the clutch is effected through a lever and spring assembly. One arm of the lever is spring loaded, and applies pressure through the other arm to a pressure disc on the smaller gear bearing which is transmitted to the tapered friction drive wheel. Variation of the spring pressure is made by adjusting a knurled nut in the desired direction as indicated by markings on the gearbox.



1 GEARBOX CASE
2 CLUTCH THRUST PAD
3 SLIP CLUTCH
4 FRONT COVER
5 PLUNGER HOUSING
6 PLUNGER
7 SWITCH FIXING HOLES
8 PLUNGER LUG
9 FINAL, OR LEAD SCREW GEAR
10 FINAL GEAR SPIGOT BEARING
11 DOWEL PINS

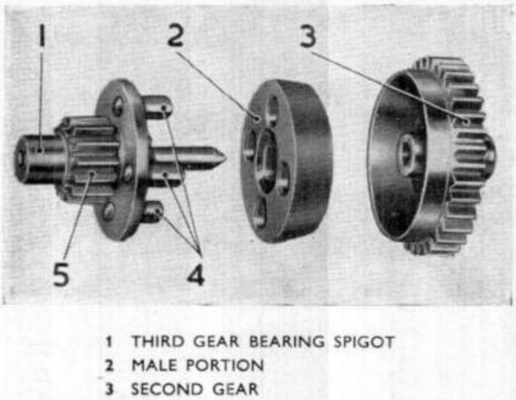
**Fig. 4. Gearbox**

### Lead screw

**11.** The lead screw, positioned in the plunger housing and driven by the final gear, converts the rotary motion of the motor drive into linear movement of the plunger. It is threaded along its main length with a thread which mates with a similar internal thread in the plunger tube.

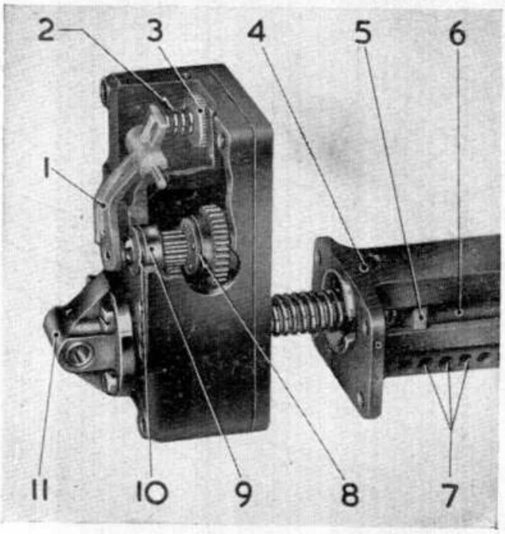
### Plunger

**12.** The plunger is a smooth finished chromium plated tube blanked off at one end



1 THIRD GEAR BEARING SPIGOT
2 MALE PORTION
3 SECOND GEAR
4 DRIVEN PEGS
5 THIRD GEAR

**Fig. 5. Slip clutch (exploded)**



1 CLUTCH LEVER
2 CLUTCH SPRING
3 ADJUSTING NUT
4 PLUNGER HOUSING
5 PLUNGER LUGS
6 PLUNGER
7 SWITCH FIXING HOLES
8 SLIP CLUTCH
9 THIRD GEAR SPIGOT BEARING
10 CLUTCH THRUST PAD
11 REAR FITTING

**Fig. 6. Slip clutch mechanism**

to take the actuator end fitting, and threaded internally for a short distance at the other end with a mating thread for the lead screw. Two torque reaction ears, integral with the plunger, travel in slots in the plunger housing and prevent the plunger rotating with the lead screw.

### Limit switches

**13.** Two snap-action type limit switches are fitted on opposite sides, and near each end, of the plunger housing to control the extended and retracted positions of the plunger. A single-pole change-over arrangement is provided for a remote indicator lamp, if required.

**14.** The switch operating mechanism comprises a spindle on each end of which is an arm. One arm is positioned in the plunger lug slots and is tripped by the ear at a predetermined position. This action swings the other arm and breaks the actuator motor circuit through the switch button.

**15.** The stroke of the plunger is set to its required length by altering the position of the limit switches. Such action should never be taken, however, without the permission of a competent authority, as a special setting rig is required for the purpose in order to obtain the accurate adjustment necessary for the correct functioning of the actuator.

### End fittings

**16.** The type of end fitting to be used on both the fixed end of the actuator, and the end of the plunger, vary according to the function to be performed by the actuator.

## INSTALLATION

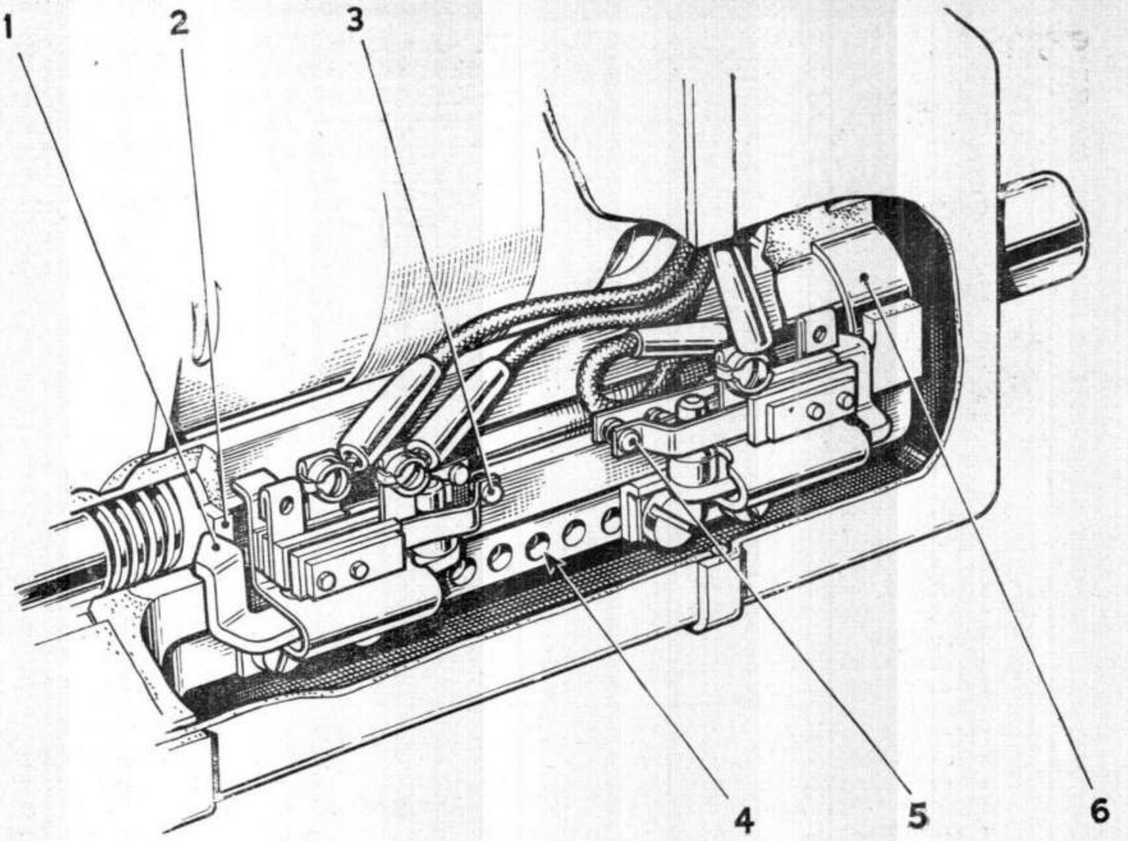
**17.** For details of actuator installations in particular aircraft, reference should be made to the relevant Aircraft Handbook. Upon receipt of a new actuator, or when an actuator is to be re-fitted after servicing, it should be inspected for damage in transit and a functional check made from a 24-volt d.c. supply to establish its satisfactory operation, i.e., time of operation, correct plunger stroke and load.

**18.** Check that the attachments and fittings are able to move freely and that the actuator and its associated load are at the end of their travel before coupling them together. The installation centres must be checked for spacing dimensions as given on the installation drawings.

**19.** To install the actuator, first attach the end fitting of the actuator to the appropriate mounting on the aircraft and fit the pivot fixing bolt, after smearing it lightly with approved grease. Ensure that the bolt is free and not binding, by moving the actuator. Lock the fixing bolt.

**20.** Swing the actuator into the front fitting, checking that the plunger eye enters cleanly and without strain. Binding on the end fittings may cause the actuator to stall and result in failure of the electrical service. Verify that the rear and forward attachments remain aligned with each other throughout the range of their movement.

**21.** The function of the limit switches in determining the stroke of the actuator must not be interfered with by fitting mechanical stops elsewhere on the operating mechanism. Such an arrangement would lead to a stalled condition and electrical failure, and possibly mechanical damage.



1 TRIPPING ARM
2 LUG ON PLUNGER
3 "IN" POINTS
4 FIXING HOLES
5 "OUT" POINTS
6 STEEL BUSH

Fig. 7. Limit switches

## SERVICING

### Lubrication

**22.** As the actuators are lubricated during manufacture, they require no attention during normal service other than the application of a smear of approved grease to the pivot pins at each end of the actuator.

### Brush gear

**23.** The brush gear of the motor is accessible when the plunger end and centre covers of the actuator are removed. The condition of the brushes may be tested with the use of a suitable resistance meter, when an abnormal reading will indicate the presence of brush dust.

**Note . . .**

*During the normal operational life of the actuator no adjustment should be required to the brush spring pressure, nor should it be necessary to renew the brushes. Should such action become necessary, it must only be carried out by qualified personnel acting on competent authority, and when adequate servicing gear is available.*

### Final check

**24.** Check all external screws, and the locknuts on the plunger end fitting, for tightness and security. Ensure that all pivot pins are secure and that the electrical plug and socket connection is tight.

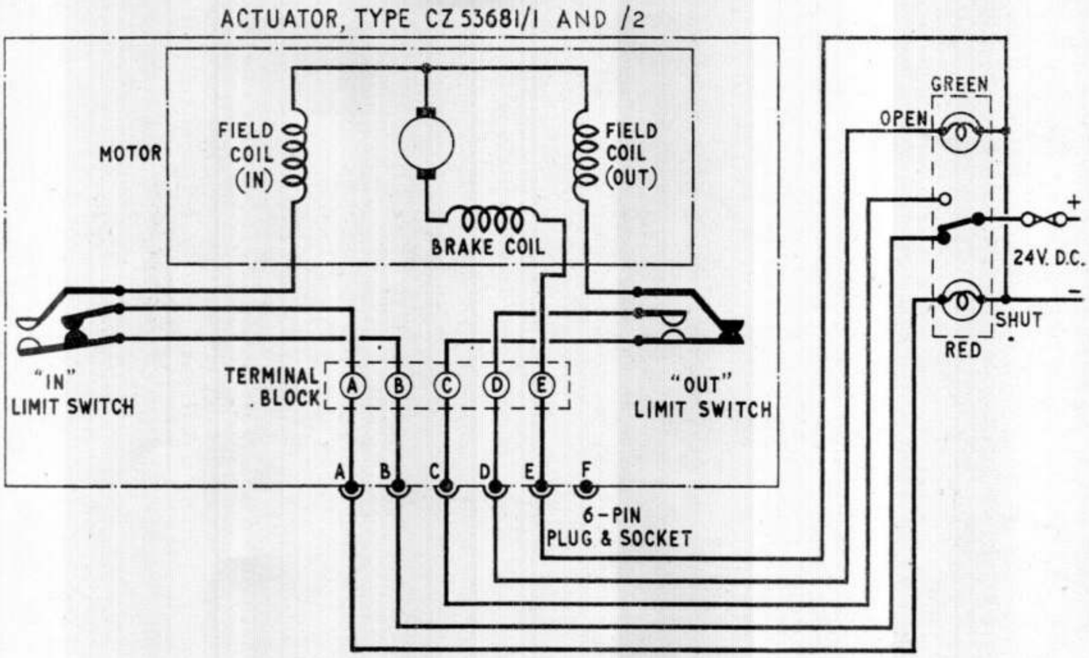


Fig. 8. Circuit diagram, Types CZ53681/1 and /2

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TELEBRIEF
CONNECTIONS
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