MAINTENANCE MANUAL

BÖLKOW JUNIOR

BO 208 C

BÖLKOW-APPARATEBAU GMBH

S. NO. 567-680

BÖLKOW
GESELLSCHAFT MIT
BESCHRÄNKTER HAFTUNG
OTTOBRUNN
BEI MÜNCHEN

MAINTENANCE MANUAL
BÖLKOW BO 208 C JUNIOR

KIM 62E-3/65

This Maintenance Manual is a translation of

"WARTUNGS-HANDBUCH BÖLKOW BO 208 C JUNIOR"

THIS MANUAL CONTAINS SERVICE AND MAINTENANCE INSTRUCTIONS FOR THE BÖLKOW BO 208 C JUNIOR. IT IS DIVIDED INTO SEVEN SECTIONS.

For further detailed information on components such as engine, propeller, etc. refer to Manufacturer s pertinent publications.

AMENDMENTS

The portion of the text affected by the changes is indicated by a vertical line in the outer margin of the page.

Amendment		Number of	Amendment incorporated		Remarks
No.	Date	Pages	Date	Name	
1	Oct. 1965		Oct. 1965	BÖLKOW GMBH	
2	Aug. 1966	14	Aug. 1966	BÖLKOW GMBH	Only from serial number 595
3	Jan. 1967	5	Jan. 1967	BÖLKOW GMBH	
4	July 1968	10	Dec. 1968	BÖLKOW GMBH	
5	Jan. 1969	2	Jan. 1969	Messerschmitt-Bölkow GmbH	

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LIST OF ILLUSTRATIONS

ALPHABETICAL INDEX

+ Indicates Illustration

SECTION I

SERVICING

TECHNICAL DATA

Span		26 ft. 4 in.
Length		19 ft.
Height		6 ft. 6 in.
Wing Incidence		1°
Sweep		3°
Dihedral		1°
Wheel Track		6 ft. 4 in.
Tyres		low pressure, tubeless
Size	Nosewheel:	5.00 x 5 1.4
	Main wheels:	5.50 x 5 1.5
Pressure	Main wheels:	22.76 psi
	Nosewheel:	20 psi
Fuel Capacity		22 Imp. Gal. = 26.4 US Gal. =100 l
Usable		21.4 Imp. Gal. = 25.7 US Gal. =97,5 l
Fuel Grade		80/87 Octane Rating Aviation Fuel
Oil Sump Capacity		4.2 Imp. Qts. = 5 US = 4,7 l
Minimum		1.7 Imp. Qts. = 2 US = 1,9 l

RECOMMENDED OIL GRADES

Outside Air Temperature below 40°F — SAE 30 = AVIATION OIL 65

Outside Air Temperature above 40°F — SAE 50 = AVIATION OIL 100

For detailed information see Engine and Airplane Flight Manuals.
Where oil grades SAE 20 and 40 as recommended by the manufacturer, are not obtainable, following oils may be used generally:

winter - SAE 40 = Aviation Oil 80
summer - SAE 50 = Aviation Oil 100

AVIATION OIL 65 Equivalents:

BP Aviation Oil 65
Aero Shell Oil 65
Canadian 3 GP / 60 a
NATO 0-113
US MIL-L-6082 B Grade 1065

AVIATION OIL 80 Equivalents:

BP Aviation Oil 80
Aero Shell Oil 80
Esso Aviation Oil 80
US MIL-0-6082
NATO 0-115
British D. ENG. R. D. 2472 A/0
RAF 34 A/9100552
Canadian 3 GP / 80 a

AVIATION OIL 100 Equivalents:

BP Aviation Oil 100	R.A.F. 34 A/9100554
Aero Shell Oil 100	Canadian 3 GP/100 b A M 1
E s s o Aviation Oil 100	NATO 0-117
British D. ENG. R. D. 2472 B/O	US MIL-L-6082 B
	MIL-L-6082 B Grade 1100

Engine	Rolls Royce O-200 A or	100 HP
	Continental O-200 A	100 HP

Hydraulic Brake Fluid — US MIL-H-5606 A

Equivalents:

BP Aerohydraulic 1

Esso Aviation Univis J. 43

Aero Shell Fluid 4

British DTD - 585

NATO H-515

Lubricants (see Lubrication Chart)

Grease — MIL G. 3278 A

Equivalents:

BP Aero Grease 31	NATO G-350
Esso Beacon 325	RAF 34 B/100512 and 100513
Aero Shell Grease 11	British DTD 825 A

Oil — US MIL-L-7870

Equivalents:

BP Aero Special Oil 4	NATO 0-142
Aero Shell Fluid 3	

Molycote M 55 or equivalent

Exterior Finish

High-grade Aviation paint Herbol FL (Nitro)

GENERAL MAINTENANCE INSTRUCTIONS

NOTE

Safety of operation and airworthiness condition of an airplane essentially depend on the care of all component parts. The airplane is only considered airworthy, if it is maintained and operated in accordance with the provisions of the Maintenance and Operating Handbooks.

In addition to periodic inspections certain parts may require service at more frequent intervals, depending upon such factors as use of the airplane, operation under extreme weather conditions, field conditions, parking or hangarage, etc. At locations subject to blowing sand or dust, for instance, filters may require daily cleaning, while near salt water areas special attention should be given to proper preservation and surface protection. Cleaning and care must be applied in such a way that the qualities of material, finish and preservative are not affected.

NOTE

Do not use methylated spirit or benzol-base substances for cleaning purposes.

Before cleaning the airplane, remove dust. Do not use rough dusters, because they might damage the paintwork and surface finish. Remove caked dirt or mud with cold or moderately warm water to which mild soap powder has been added. Dry the airplane by means of a sponge and a wash-leather.

The plexiglass canopy should be washed only with a mild solution of soap in warm water or one of the special cleansing agents such as

"Plexipol" and "Plexiklar". Any other treatment with glass cleaner, anti-ice fluid, methylated spirit, gasoline, etc., would cause scatching and deteriorate the visibility. Minor scratches can be filled in by waxing the plexiglass with commercial wax. Rubbing the surface of the plastic with a dry cloth builds up an electrostatic charge that attracts dust particles. For the same reason caution is advised when the canvas covers are used.

The painted exterior surfaces of the airplane should be waxed and polished at regular intervals depending upon the environment and use of the plane after an initial curing period of 30 days has been allowed for. Use a good automotive wax; we recommend Herbol-Polish FL 500l. When cleaning and waxing the fuselage be sure to keep the opening for the static port (left forward fuselage side wall) free from wax and dirt.

Oil and fuel on surfaces should be washed at once. Repair damaged parts of the painted surface resulting from gasoline spillage with paint as soon as possible. Bare metallic surfaces require surface protection and are to be treated with suitable varnish and preservatives. Wipe the propeller regularly with an oily cloth to remove dirt and bug stains. Smooth small nicks with a file or sand paper. The tyres should be protected from fuel, oil and grease as they have an adverse effect on rubber.

When jacking the airplane use the steps and tail skid as jacking points. Use proper tools for removal of nuts and screws and check for possible damage. Remove shavings and dirt and apply a thin coat of graphite.

When disconnecting tubes and hoses particularly from instruments, plug openings with caps. Make sure all access panels and filler caps are fastened securely.

Refuel tank to full capacity after the last flight of the day to avoid condensation.

For maintenance and inspection of components such as engine, propeller, instruments etc. refer to manuals and instructions published by the respective manufacturers.

NOTE

When working on the airplane, observe the general safety rules to avoid all possible hazards, in particular:

Ventilate the interior of the airplane sufficiently, when conducting maintenance work on the aircraft's electrical system.

Switch off the aircraft's electrical system and other current sources when using gasoline for cleaning purposes or when working with other inflammable substances.

When working in the fuselage, especially when working on the fuel system, it is vital that the battery be removed first.

Do not enter the airplane with an open flame nor use it near the airplane.

Be careful when placing a tool anywhere in the airplane. Do not place tools where they might fall into inaccessible places. Tools left behind in the aircraft may well block the controls and become the cause of an accident.

It is good practice to count all tools before starting to use them and make sure they are complete after work is finished.

Keep outside the propeller track when turning the propeller.

Before turning the propeller make sure the airplane is safe from moving if the engine should start accidentally, which may happen if both magnetos are not securely shortcircuited.

Turning the ignition switch OFF does not suffice if the magneto breaker covers have been removed from one or both magnetos or if the short circuit lead is not installed.

Complete details and specified instructions for maintenance, adjustment and assembly of the engine are given in:

MAINTENANCE AND OVERHAUL MANUAL
Form No. A-C40, 7-62
OPERATIONS MANUAL AND SERVICE
MAINTENANCE INSTRUCTIONS
Form No. B-AC40, 7-62

of Continental Motors Corporation for Continental-built O-200-A engines.

For Rolls-Royce-built O-200-A engines refer to both C90 and O-200 OPERATING AND FIELD INSTRUCTIONS T. S. D. Publication 2041 of Rolls-Royce Ltd. and MAINTENANCE AND OVERHAUL MANUAL, Form No. A-C40 of Continental Motors Corporation as applicable.

As far as maintenance instructions for the engine are given in this manual they are compiled from the publications listed above.

Where doubt exists reference should be made to the Manuals published in the original language with the exception of "Table of Torque Tightening Limits" and page 24 item 14 of B-AC40.

NOTE

When replacing parts of this airplane or its appliances only original spare parts in accordance with Spare Parts List Bölkow BO 208 C Junior or applicable spare parts catalogues of the manufacturer shall be used.

PREFLIGHT INSPEKTION

1) Remove tie-down equipment, rudder control locks and pitot tube cover.
2) Check correct movement and full range travel of all flight controls including flaps.
3) Check fuel and oil quantity, top up if necessary.
4) Empty free water from filter bowl and Pitot tube system.
5) Examine air filter for cleanliness and condition.
6) Check engine cowlings and fasteners for tightness and security.
7) Check cockpit canopy hood for secure fastening and windows for unobstructed visibility.
8) Check tyre condition and inflation.
9) Check brakes for function.
10) Inspect wheel fairings inside for dirt, ice or snow.
11) Inspect airplane for foreign objects.

POSTFLIGHT CHECK

1) All switches OFF.
2) Inspect airplane for possible external damage.
3) Malfunctions or items found unsatisfactory during the course of the flight should be recorded in the maintenance log.
4) Refill fuel and oil.

STORAGE AND PREPARATION FOR USE AFTER STORAGE

If it is intended to store the airplane for an extended period of time, perform the following:

1) Thorough inside and outside cleaning.
2) Drain all fuel from lines, tank and carburetter.
3) Renew surface polish.

4) Rub propeller blades with an oily cloth.
5) Remove battery, clean and coat posts with a film of acid-free grease.
6) Lubricate fittings.
7) Lock rudders.
8) Jack up the airplane.
9) Deflate tyres.
10) Install a cover over the entire airplane, if this is not possible, cover up cockpit canopy and engine.
11) Preserve engine and propeller as described in the manufacturers' instructions.

Short Term Storage

12) When the airplane stands idle for more than a week, once a week start engine and keep running until an oil temperature of 40°C (104°F) is obtained. This is done in order to renew the oil film along the cylinder walls. At locations of extreme humidity or large daily temperature variations it is advisable to repeat this procedure more frequently.

Preservation of Engine for Extended Storage

If the airplane will be standing idle for more than a month and the procedure outlined under para. 12) above will not be performed regularly, preserve the engine as follows:

1) Drain oil sump and re-install drain plug.
2) Fill oil sump with a suitable mixture, containing two parts engine lubricating oil and one part corrosion preventive compound.
3) Warm up engine until an oil temperature of not more than 40°C (104°F) is obtained.

4) Stop engine and remove air filter.
5) Fill a spray gun with a clean mixture as described under item 2) of this chapter.
6) Restart engine and spray preservative oil mixture into air intake until a dense fog is issuing from the exhaust pipe.
7) Stop engine while spraying process is still in progress.
8) Remove spark plugs.
9) Rotate propeller and spray mixture through upper spark plug openings into all cylinders.
10) Spray each cylinder, its walls and valves after stopping propeller and do not turn propeller thereafter, or it might lead to an "oil shock" which would buckle the crankshaft. Place a sign in a conspicuous place (propeller and instrument panel) to avoid the propeller being turned accidentally:

WARNING

ENGINE is preserved. Do not turn propeller.

11) Install dehydrator plugs (Protex plugs filled with silica gel crystals) in all spark plug holes and install protective caps or wrappings on ignition cable terminals.
12) Remove rocker covers and spray rocker box parts with the corrosion preventive mixture. Re-install all covers.
13) Drain the mixture from the oil sump and re-install the plug.
14) Close the crankcase breather with a rubber or other tight fitting plug.
15) Place a small bag of silica gel in the entrance to the air intake housing and seal the entrance completely with waterproof paper or tape.

The warning placed on the instrument panel should list all parts to be removed or installed before engine operation is resumed.

Inspection during Storage

Airplanes and engines which have been prepared for storage should be inspected at least every 30 days, and the preservatives renewed if necessary.

1) Clean airframe if dirty and apply a new coating of wax polish.
2) Keep tyres clean of fuel and lubrication.
3) Examine cylinder walls for coverage with corrosion preventive mixture and repeat treatment if necessary.
4) Replace dehydrators and silica gel bag.

Preparation for Use after Storage

If the corrosion preventive compound has not left any dangerous deposits, engine and airplane may be placed in service after the following steps have been taken:

1) Remove corrosion preventive compound from airframe.
2) Install recharged battery.
3) Lubricate in accordance with Lubrication Chart.
4) Remove closures from the air intake and the crankcase breather. Make sure that no material is left in the openings.
5) Re-install clean air filter.
6) Remove dehydrator plugs from cylinders. Make sure that no foreign matter is left, in case a dehydrator plug has been broken.

7) Drain oil sump. Fill the oil sump with the proper seasonal grade of oil.

8) Turn the propeller several revolutions to free the cylinders of excess oil and to determine that valves are operating freely. If any valves stick in their guides lubricate their stems with a mixture of oil and gasoline and turn the propeller until they operate freely.

9) Install clean spark plugs and gaskets. Remove wrappings from cable terminals and connect the cables to the spark plugs.

10) Inflate tyres to prescribed pressure.

11) Perform daily inspection and preflight inspection.

12) Proceed with functional test and check out airplane during flight.

OIL CHANGE

Change engine oil, depending on use of airplane and climate, after every 20 to 30 hours of operation unless more frequent oil changes will be advisable. (See below). The oil drain plug is located on the lower side of the sump. When replacing the plug put in a new gasket.

Place a clean container under the sump and drain the oil after warming up the engine to obtain a temperature of approx. 40°C (104°F).

Check oil for dilution and particles. If metallic particles are present in the drained oil or oil screen, the engine is in need of major overhaul.

Remove oil screen, clean it in unleaded gasoline and replace it, putting in a serviceable gasket.

SERVICING OF AIR FILTER

Prematurely worn engine parts, especially on the piston rings, have necessitated engine overhaul before the regularly scheduled time. Investigations of these engines have shown in almost all cases that dirt had entered via the carburetter and accummulated in the engine causing malfunctions.

To avoid deficiencies the following steps should be taken:

1. During pre-flight inspection examine air filter for condition and cleanness. If the filter is damaged or deformed, replace it. Clean the filter when it is dirty. In extremely sandy or dusty areas daily cleaning may be necessary. (This may also apply to fuel strainers and oil filters.) Check if filter and suction inlet are securely attached to prevent dust particles from entering the carburetter.

2. Engine warm-up and run-up should be restricted to the minimum required period and not be performed on dusty and sandy ground. If possible a hardened site should be used for such operations.

3. To avoid the passage of unfiltered and dusty air into the carburetter, carburetter air heat should not be used while on the ground, unless there is imminent danger of icing. If due to ambient air temperature and humidity carburetter icing is likely to occur, it is sufficient to use carburetter heat momentarily at full engine power just prior to take-off. Carburetter heat should only be used during taxying and take-off under s e v e r e icing conditions.
   If an inspection reveals that the filter is dry or dirty, perform the following:

a) Remove filter and gasket. Thoroughly wash the filter in petroleum solvent. Make certain all dirt is removed from the filter and that the filter is in serviceable condition.

b) Dry the filter at room temperature making certain it is thoroughly dry before proceeding with the next step.

c) Immerse the filter element in the recommended grade of engine oil for a period of five minutes.

d) After removal of excessive oil from the filter, reinstall in the aircraft using a serviceable gasket.

> CAUTION
>
> Do not clean the filter by use of pressurized air and do not attempt to shake off loose dirt by rapping on a hard, flat surface.

SERVICING THE BATTERY

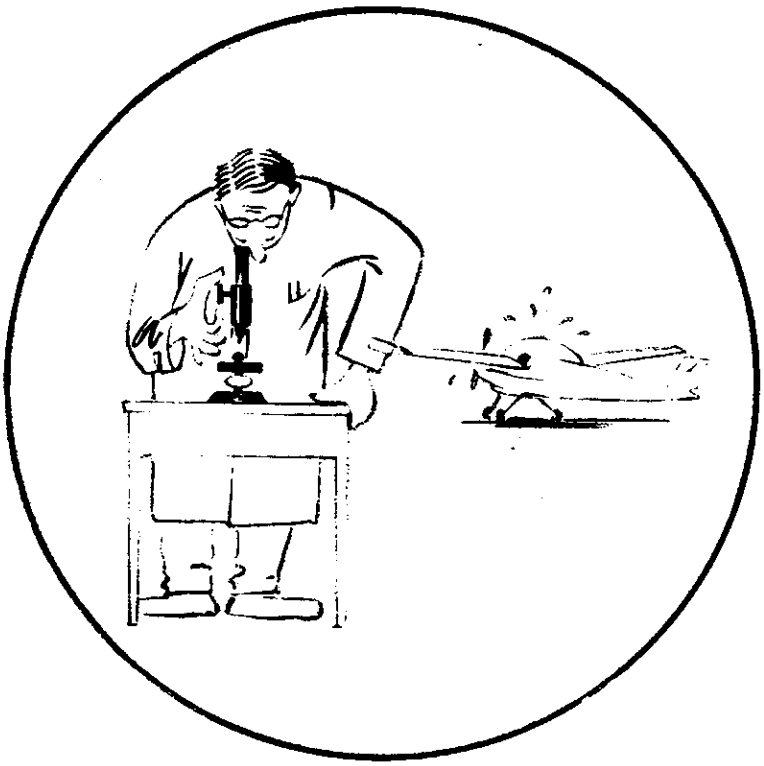
Inspect electrolyte level of battery at least once a month, more frequently during the summer and, if necessary, add distilled water until the plates are submerged. Batteries removed from or remaining in inactive airplanes should be recharged at approximately six-week intervals and electrolyte examined.

REPAIR INSTRUCTIONS

On account of the simple construction of the "Junior" and the usage of commercial aeronautical material, no special repair instructions are necessary. If necessary, proceed in accordance with FAR 43 or FAA, Advisory Circular AC No. 43.13-1.

SECTION II

PERIODIC INSPECTIONS



DAILY MAINTENANCE

This inspection should be performed after the last flight of the day.

1) Eliminate possible defects observed during flight.

2) Inspect the airplane for external damage.

3) Inspect propeller for external damage and security.

4) Inspect fuel and oil system and engine for leaks; plug leaks, clean and remove excess oil.

5) Check engine controls for full range travel and freedom of movement.

6) Inspect spark plugs and cables for tight fit.

7) Inspect starter and generator cables, ignition switch wiring for condition and proper fit.

8) Inspect engine mount, especially rubber blocks, for condition and proper fit.

9) Inspect exhaust system and jackets for cracks, burn-out and proper fit.

10) Inspect engine accessories, controls and baffle plates - the latter for cracks - for general condition and tight fit.

11) Visually inspect the complete engine for loose or missing screws, nuts, bolts and safety-wiring.

12) Drain free water from filter bowl and pitot tube. Remove and clean if necessary.

13) Check oil supply, top up if necessary.

14) Fill fuel tanks to capacity. Make sure tank vent in fuel cap is not clogged.

15) Examine air filter for condition and cleanliness. Clean if found dirty, replace of damaged or deformed.

16) Inspect landing gear, especially for condition of tyres, air pressure, position marks and condition of the spring suspension of the nose gear shock absorber. Inspect cleanliness of the wheel fairings inside (in case attached).

17) Carefully check engine mounts, landing gear and wing attachments as well as the nose gear and especially the outer tube of nose gear after hard landings.

18) Check condition and tight fit of hydraulic lines on struts of main gear.

19) Inspect pitot tube for damage or bending and static port and pitot tube openings for unobstructed air passage.

20) Check engine cowlings for possible cracks and tight fit.

21) Inspect plexiglass canopy for cleanliness and scratches. Check for proper funktion of locks and hinge connections.

22) Check controls and flaps for safetying, free travel, proper deflections and play.

23) Inspect mounting of safety belts and seats.

24) Depending on use of the airplane lubricate and/or preserve in accordance with lubrication chart or as dictated by local or climatic conditions.

25) Inspect airplane' s interior for foreign objects.

NOTE

To inflate tyres use the filler needle supplied at delivery. The needle should be coated with a thin film of glycerin. Before inserting the needle make sure opening is free from dust and dirt. Blow out dirt with compressed air. Avoid the use of pointed tools for cleaning, as these could damage the valve.

ENGINE - FIRST FIFTY HOUR INSPECTION

Inspect each engine after the first 50 hours of operation, whether new, re-manufactured or overhauled, giving particular attention to the checks outlined below. The purpose of this inspection is to detect and correct leaks at gaskets, after they will have taken up a permanent compression or set, and looseness of certain other parts, that may have become less tight than when initially installed.

1) Remove spinner. Inspect propeller for tightness and security of securing bolts, condition and track of blades (maximum within 1/8 inch) (3.2 mm).
2) Check the torque tightness of the cylinder base nuts and engine mounting screws.
3) Check cylinder baffles for cracks and fit on cylinder fins.
4) Check tightness of oil sump retaining nuts to take up gasket set.

5) Check torque tightness of studs and retaining nuts on accessories and crankcase cover. Tighten all nuts and bolts to take up gasket set. Tighten starter retaining bolts and nuts, as necessary. Do not tighten excessively.

6) Check tightness of pushrod housing adapter studs after removal of palnuts. Tighten as necessary and replace palnuts.

7) Check tightness of hose clamps on intake pipes and pushrod housing rubber connectors. Do not tighten excessively.

8) Check retaining nuts of carburetter and air intake duct for tightness. Tighten as necessary to take up gasket set.

9) Examine air filter for condition and cleanliness.

10) Check exhaust manifolds for condition and tight fit.

11) Check heated air ducts for condition and tight fit.

12) Check ignition cables, elbows and spark plugs for tight fit.

13) Tighten rocker cover retaining screws.

14) Check ignition timing.

All wire-safetying, palnuts, slotted nuts, shim discs, toothed spring washers or split-pins removed prior to inspection should be carefully replaced after completion of checks.

100-HOUR PERIODIC INSPECTION

This inspection should be made to coincide with a regular oil change. Repeat the DAILY and FIRST FIFTY HOUR MAINTENANCE CHECKS. Prior to this inspection ascertain that all known discrepancies have been corrected.

A ENGINE

1) Remove engine cowling, clean and check for cracks.

2) Start and warm up the engine to obtain an oil temperature of 104°F (40°C). During this period, check all engine instruments to detect fluctuations or other abnormal indications. Test operation of all engine controls, and observe engine response. Restrict running to the minimum time necessary for warm-up and instrument checks. In warm weather prolonged running for tests should be performed in flight.

3) Immediately after warm-up stop the engine. Place a clean container under the sump. Remove the drain plug and allow the old oil to drain completely. Examine the drained oil for dilution and deposits. If the oil screen contains heavy sludge deposits or if the oil is highly diluted more frequent oil changes will be advisable. If many or large metallic particles are found on the screen or in the drained oil (except machinings in new engines) the engine is in need of overhaul.

4) Remove oil screen, clean in unleaded gasoline and replace it, putting in a serviceable gasket; tighten the cap securely and install lockwire. Replace the oil temperature capillary. Replace oil drain plug, putting in a serviceable gasket. Refill the sump with fresh oil of specified viscosity grade to the gauge "FULL" mark. Examine entire oil system for leaks.

5) Remove spinner, check propeller for visible defects. Remove nicks by file and use fine emery paper cloth for finishing. Clean propeller blades and wipe with an oily cloth. Check torque tightness of propeller securing bolts (3.45 mkp, 300 in lb.) Check proper track within 1/8 inch. (maximum 3.2 mm).

6) With ignition switch "OFF" and throttle fully open test the compression in all cylinders. Uniformly low compression will usually indicate the need of overhaul. Low compression in one or two cylinders may be caused by defective valve lifters, sticking or warped valves or scored valve stems.

7) Remove rocker covers together with cylinder baffles and inspect all parts within each rocker box for breakage, wear and full lubrication. Inspect cylinder baffles for cracks.

8) Remove all spark plugs and observe valve lift (use mirror) while the propeller is turned slowly.

9) Replace rocker covers putting in new gaskets and tighten retaining screws evenly. Re-install cylinder baffles. When replacing the rocker covers be sure to place washers in recess of covers before re-installing cylinder baffles.

10) Remove magneto contact-breaker covers. Wipe any oil from breaker housings. Clean contact-breaker points and inspect for pitting or burning (indicating a defective condenser). For contact-breaker point adjustments and necessary replacement of parts refer to Section X of "Maintenance and Overhaul Manual" of Continental Motors Corporation, Form No. A-C 40 for Continental-built O-200 A engines. O-200 A engines built by Rolls-Royce shall be adjusted in accordance with pages 23 and 25 of "C90 and O-200 Operating and Field Instructions" published by Rolls-Royce Ltd.

11) Check ignition timing (28° B. T. C.) and magneto timing. When finished replace the breaker covers.

12) Clean spark plugs. Check and adjust electrode gaps to 0.015 - 0.018 inch. Test plugs in dry compressed air at 100 psi. pressure. Apply a thin coat of graphite and install with serviceable gaskets. Tighten all plugs to specified torque (300 - 360 lb. in.).

13) Examine cylinder head fins for breakage or cracks.

14) Inspect all spark plug cables for condition of insulation, attachment and fit of brackets, condition of elbows and security of terminals. Reconnect cables to spark plugs.

15) Inspect all electrical wiring and magneto switch wire for firm attachment, proper support and condition of insulation.

16) Inspect all ducting and attaching parts in the induction system including air intake ducts, air filter, carburetter air heat, carburetter and cylinder elbows for condition and attachment. Remove and service the air filter. Replace if damaged or deformed.

17) Inspect exhaust manifold and pipe jackets for security, proper connection and burn-outs.

18) Inspect air and heating ducts for condition and security. Check function of cabin air heat control flap.

19) Test operation of all engine controls and inspect for proper travel and condition.

20) Remove baggage compartment walls and inspect fuel tank for possible leaks and security of mounting.

21) Remove drain plug and drain all fuel from tank. Remove line from fuel line coupling and clean screen located inside coupling. When finished re-install fuel line and replace drain plug. Check tank vent for free passage.

22) Check fuel lines and fuel shut-off valve for condition and function. Remove fuel filter bowl. Empty and clean bowl and screen and re-assemble parts, replacing new gasket. Renew gasket of auxiliary fuel pump.

23) Remove drain plug from bottom of float chamber. Remove and clean strainer and replace. Remove and clean screen at fuel pump. When finished renew all wire-safetying which had to be removed.

24) Service fuel tank. During servicing check reading of fuel gauge and function of fuel warning light. Open fuel shut-off valve after fuel has been serviced and examine the entire fuel system for possible leaks.

25) Check torque tightness of nuts for engine mount bolts. (180 - 190 lb. in). Check rubber elements of engine mount for cracks and deterioration.

26) Test adjustment of starter lever, correct if necessary.

27) Inspect starter and generator for tight fit on flanges and proper mounting. Replace gasket on generator if oil leakage is evident. Thoroughly inspect starter for cracks or external damage, check nuts and screws for proper torque. Wipe off any oil found on starter pinion shaft. When replacing oil seal on starter pinion shaft install specified seal only.

28) Inspect firewall for cracks.

29) Thoroughly wash and dry engine and firewall and examine for leaks after post-inspection flight.

B FUSELAGE AND CABIN

Inspect:

1) Skin and frame for damage - as caused by loose stones or debris - deformation, cracks and loose rivets.

2) Paint, lettering and finish for condition.

3) Steps and tail skid for security and condition.

4) Drain ports for free passage and access panels for positive locking.

5) Cabin and plexiglass canopy for cleanliness. Plexiglass for crazing and scratches. Seats, safety belts and canopy strut for condition and security.

6) Holding bolts of vertical stabilizer (tail bulkhead 9) for security.

INSPECT:

C WINGS

1) Remove tips.
2) Check surfaces and tips for damage - as caused by loose stones - cracks and loose rivets.
3) Condition of paint, lettering and surface finish.
4) Access plates for positive locking.
5) Navigation lights for security and cracked glass.
6) Bearings and attachment fittings between wings and struts for security and condition. Wing struts for security, damage or deformation. Fuselage attachment fittings of struts for cracks, deformation, loose rivets, bearings for security.

D CONTROLS

1) Control surfaces and flaps for correct rigging and proper travel. Re-align if necessary. (Refer to Section IV).
2) Tightness of aileron (26 $\pm$ 2 pounds) and rudder (13 $\pm$ 2 pounds) cables for proper tension, re-adjust if necessary.
3) Cables for broken wire and security, turnbuckles for safetying.
4) Bearings and parts of aileron control system at outer wing section for security and general condition.
5) Adjustable elevator and aileron stops at foot of control stick for security of lock nuts.
6) Control surfaces and trim tabs for free travel and positive deflection. Flap mechanism for proper function and flaps for positive deflection.
7) Elevator push-pull rod and bearings in fuselage for security, condition and wear. Condition and free rotation of pulleys. Preserve control cables when necessary.

INSPECT:

8) Control rods near tail-end and bellcranks located behind bulkhead No.3 and bulkhead No.9 for condition and security.

9) Inspect trim friction control for proper spring tension. Proper alignment of bellcrank located inside tail-unit, as measured between centre of bulkhead No. 9 and centre of control cable attachment at bellcrank must be 28 mm (slightly less than 1 1/8 inches)*, with trim lever in neutral position. Friction control spring at bellcrank shall be adjusted by either tightening or loosening the retaining nut until a force 4.4 lb is obtained, as required for movement of the trim lever from its neutral position.

10) All control surfaces, especially elevator and flaps for damage as caused by stones or debris, loose rivets and cracks, surfaces for condition of paint, evidence of corrosion and hinges and bearings for security.

11) At the annual inspection or when discrepancies are found the rudder control system's friction should be checked at the attachment fitting of stabilizer strut and nosewheel strut assembly with stabilizer strut removed.
The maximum frictional force should not exceed 6.60 pounds.

12) The control system should be lubricated per chart and if necessary a new preservation should be applied to control rods and cables.

13) Re-install wing tips.

E LANDING GEAR

1) Check tyres, wheel hubs and cantilever steel main legs for wear and damage. Check tyre inflation. Apply a thin coat of glycerin to the filler needle before inserting. Remove dirt from filler valve carefully. It is best to use compressed air.

* see illustration on page 82

2) Inspect wheel bearing play and check, if hub thru-bolts (86 in. lbs.) and axle nut on nosewheel (130 in. lbs.) are tightened to proper torque. Tighten axle nuts of main wheels allowing for proper coasting of wheels. If wheels are frequently exposed to mud, water, snow and ice remove bearing cones, clean and repack with wheel bearing grease (Repeat at intervals not exceeding 200 hours).

3) After removing the fairing from the cantilever legs but without removing the tapered steel rods (main landing gear), inspect Teflon bushings for condition.

4) Brake linings and brake discs on main wheels for excessive wear or damage. The two guide bolts (item 28, p. 64) on which the attachment flange (item 30) is sliding should be sparingly lubricated with Molycote M 55 after the two hexagon nuts (item 29) have been backed off. Be sure to keep lubricant away from brake linings or brake disc. If, between inspections, drag noise during braking is obvious, correct by lubricating the guide bolts.

5) Master cylinder of brake system and brake lines for leaks and damage. Check level of hydraulic fluid in brake master cylinder. Refill if necessary.

6) Check brakes for proper function. Toothed segment and brake handle for condition. If necessary bleed system.

7) Nosewheel steering and spring-loaded nosewheel strut for function. Nosewheel strut, torque links, fork and captive cable for condition. Nosewheel strut attachment bolts (four) on fuselage structure for safetying and cotterpin of thru-bolt for security. Unscrew the shock absorber at its lower support, inspect for possible leaks and test shock absorber action (resistance when compressed) by hand. Defective shock absorbers should be replaced by new ones. Lubricate the nosewheel.

8) All nuts of the nosewheel assembly for tightness and security, rods, linkage and stabilizer strut for condition.

F EQUIPMENT

1) Instruments and instrument wiring and lines for security and condition. Check altimeter (QFE) and rate of climb indicator (zero line) for accuracy, turn and bank indicator for proper operation. Magnetic compass for accuracy, compensate the compass if necessary.

2) Battery for condition and charge, proper fluid and electrolyte for proper concentration of acid. Terminals for cleanliness (coat with petroleum jelly), vents for conditions and freedom of passage.

3) Electrical system for function, electrical wiring for security and proper insulation as far as access can be had (electrical indicators, generator control light, fuel warning light, auxiliary fuel pump, flap actuator, navigation lights, radio equipment).

4) Pitot tube and static port for unobstructed passage. Pitot tube for proper alignment, security, and possible damage.
Pitot and static systems for leaks, lines for security.

5) Drain water from pitot system (push cap at lower wing strut attachment fitting aside until the opening in the rube is revealed). Replace the cap after draining.

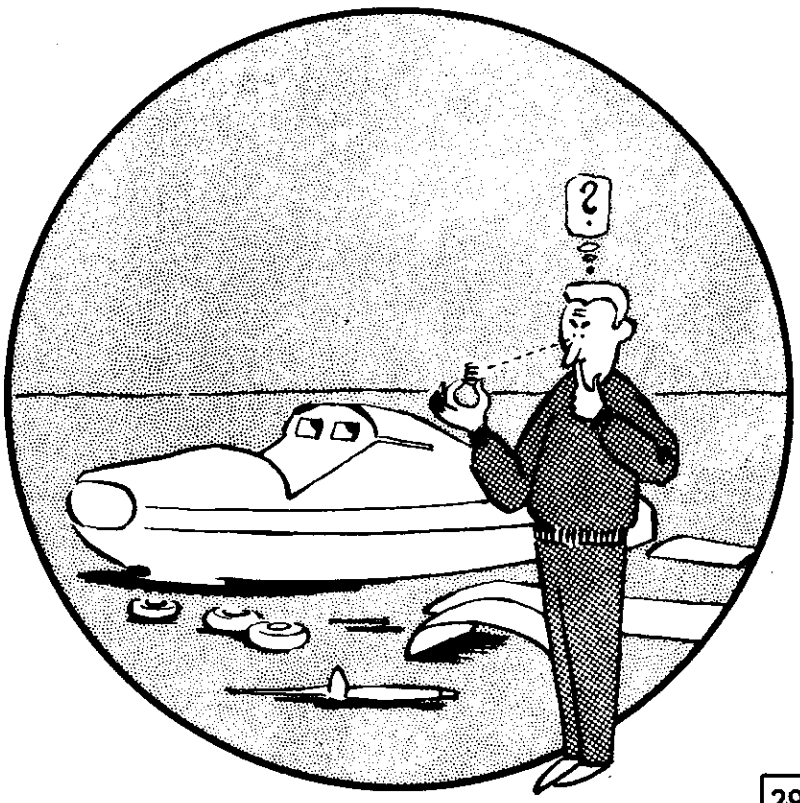
6) Stall warning sensing unit for freedom of vane and proper operation.

7) Cabin door lock for proper function.

Inspection is completed if parts are properly replaced. Examine airplane for foreign objects and perform port-inspection flight.

SECTION III

ASSEMBLY AND DISASSEMBLY



A. REMOVAL OF WING ASSEMBLY AND WING STRUTS

1. Support wings, fully extend landing flaps and remove baggage compartment.
2. Disconnect static pressure line (to fuselage) on LH wing strut from line fitting at fuselage.
3. Disconnect aileron control cables from turnbuckles and pulleys. Tag end of each cable for identification.
4. Remove wing struts.
5. Remove wing attachment bolts proceeding from rear to front attachment.
6. Move wings slightly sideways.
7. Disconnect wiring for navigation lights and stall warning system.

B. REMOVAL OF CONTROL SURFACES AND FLAPS

a) Rudder

1. Remove tip cap from rudder and remove upper tail fairing.
2. Disconnect control cables inside fuselage.
3. Remove upper and lower rudder attachment bolts and remove rudder surface.

b) Elevator and Trim

1. Remove fairings from tail unit.
2. Remove trim control rod.
3. Remove elevator control rod.
4. Remove elevator attachment bolt and remove rudder.

c) Aileron

1. Remove wing tip caps and wiring of navigation lights.
2. Disconnect aileron control rod at each wing root.
3. Remove safetying of piano hinges and hinge pin, remove aileron.

d) Landing Flaps

1. Extend landing flaps.
2. Remove safetying of piano hinges and hinge pin.
3. Remove flaps (pull slightly aft and laterally outward).

C. REMOVAL OF PROPELLER

1. Remove spinner.
2. Remove propeller hub nuts.
3. Remove propeller, clean propeller hub.

   The propeller shall be placed in a horizontal position.

   During assembly tighten bolts diagonally.

   Tightening torque 300 in. lb.

   Check blade track (maximum 3.2 mm or 1/8 in.).

D. REMOVAL OF ENGINE

1. Support tail unit.
2. Remove engine cowls completely.
3. Remove propeller.
4. Disconnect all lines, control linkage and Bowden controls.
5. Attach hoist to lug of engine and take up slack.
6. Remove attachment bolts from engine mount.
7. Hoist engine and place on suitable stand.

E. REMOVAL OF NOSEWHEEL

1. Use tail support ballast to hold down the tail.
2. Remove lower engine cowling.
3. Disconnect steering rods.
4. Disconnect stabilizer strut attachment, remove stabilizer strut.
5. Remove four bolts of strut attachment to firewall.
6. Remove nosewheel assembly.

F. REMOVAL OF MAIN LANDING GEAR

1. Jack up airplane.
2. Remove seats and baggage compartment.
3. Remove strut fairings.
4. Disconnect brake line at brake cylinder, remove line from landing gear.
5. Remove attachment bolts of tapered steel rods at No. 3 frame.
6. Remove tapered steel rods.

Bleed brakes after re-assembly.

Assemble major assembly groups A through F in reversed sequence of disassembly. An inspection by a maintenance inspector is required after completion of assembling operations.
All screws and nuts shall be tightened in accordance with prescribed tightening torque limits (see page 33 and 34) and lock wired and safetied as required.

MAXIMUM TIGHTENING TORQUE

Except where otherwise specified (see following page) the tightening torque limits listed below are given for Standard American screws.

Description	Thread Diameter		Tightening Torque	
	inch	mm	in. /lb.	mkp
AN 3	3/16	4.76	26	0.30
AN 4	1/4	6.35	67	0.77
AN 5	5/16	7.94	135	1.55
AN 526 No. 6	0.138	3.50	2.5	0.03
AN 526 No. 8	0.164	4.16	6	0.07
AN 526 No. 10	0.190	4.82	11	0.13
AN 526 No. 1/4	1/4	6.35	28	0.32
MS - 20006	3/8	9.52	187	2.15
NAS 333	3/16	4.76	26	0.30

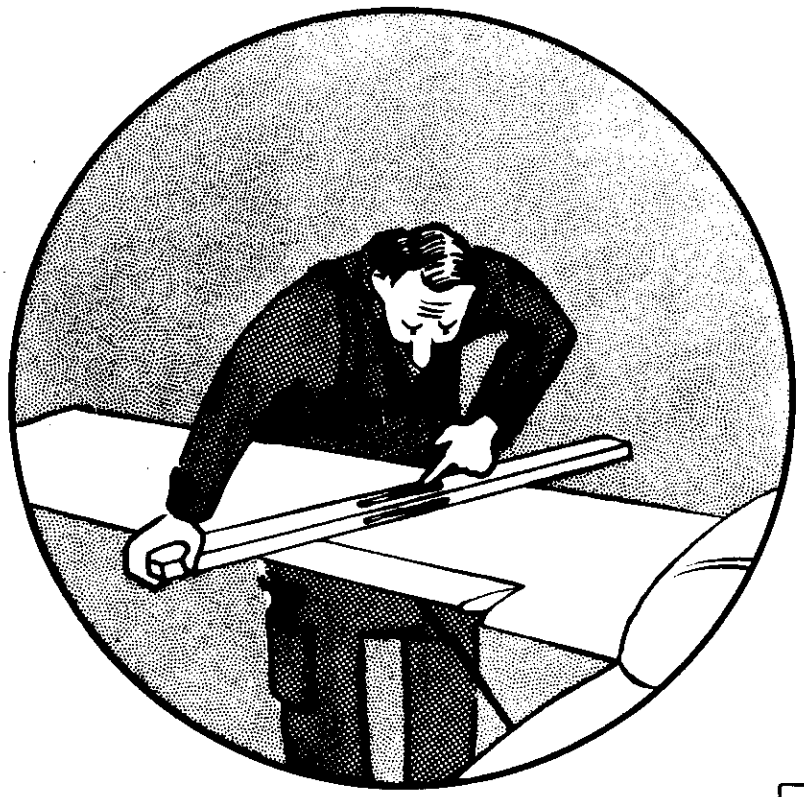
TORQUE LIMITS

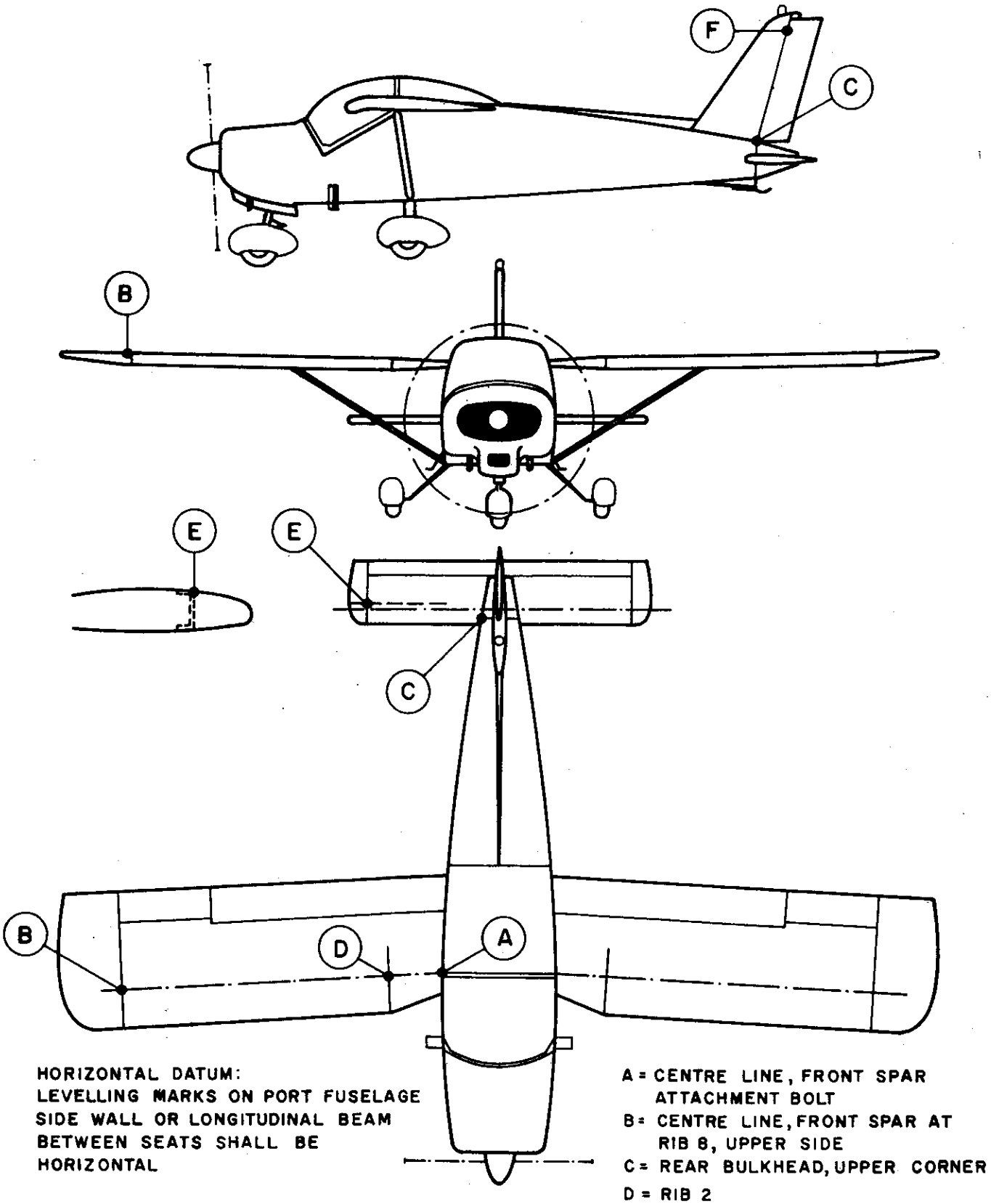
On no account should the following torque limits be exceeded. For further engine torque tightening limits consult Continental "Maintenance and Overhaul Manual" A-C40 for Continental-built engines and "C 90 and O-200 Operating and Field Instructions" TSD Publication 2041 for Rolls-Royce-built engines.

Description	Thread inch	Diameter mm	Tightening Torque in. lb.	mkp
Spark Plugs		18	300-360	3.45 - 4.15
Propeller Hub Nuts	3/8	9.52	300	3.45
Engine Mounting Bolts, Base	3/8	9.52	180-190	2.15
Engine Mounting Screws, Top	3/8	9.52	180-190	2.15
Precision Screws, Engine Mounting Top		6.00	55	0.64
Castellated Nut, Engine Mounting Attachment (located behind firewall)	5/16	7.94	135	1.55
Wheel Hub Nuts	1/4	6.35	87	1.00
Wheel Axle Nuts	5/16	7.94	130	1.5
Precision Screws Wing Struts, upper and lower fittings		6.00	55	0.64
Lock Nut, Elevator Connecting Rod, Tail	1/4	6.35	67	0.77 max.
Wing Attachment Bolt, Rear		8.00	max. 0.36	0.05

SECTION IV

RIGGING





HORIZONTAL DATUM:
LEVELLING MARKS ON PORT FUSELAGE SIDE WALL OR LONGITUDINAL BEAM BETWEEN SEATS SHALL BE HORIZONTAL

A = CENTRE LINE, FRONT SPAR ATTACHMENT BOLT
B = CENTRE LINE, FRONT SPAR AT RIB 8, UPPER SIDE
C = REAR BULKHEAD, UPPER CORNER
D = RIB 2
E = ELEVATOR SPAR, FORWARD TIP
F = FIN, TOP SPAR

(DIMENSIONS: SEE OVERLEAF)

LEVELLING CHART

DIMENSIONAL CHECK REPORT

Inspection	Check point	Design value	Tolerance
Diagonal	B - C	+)	± 0.59 inch (15 mm)
Forward Sweep	BB - A	6 inch	± 0.39 inch (10 mm)
Dihedral	Forward tip		
	Front spar	1 degree	± 0.5 degree
Incidence	B and D	1 degree	± 0.5 degree
Fin - Elevator	E - F	+)	± 0.39 inch (10 mm)
Engine axis 4 degrees down, 1.5 degree right.			

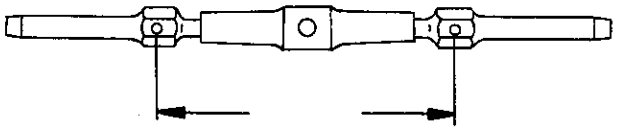
+) No entry for this dimension. Tolerance accounts for differences obtained when comparing LH- and RH-side measurements.

SURFACE DEFLECTIONS

Surface	Theoretical deflections	
Aileron	Left up	25 degrees $\pm$ 1° 12 degrees $\pm$ 1°
	Right up	25 degrees $\pm$ 1° 12 degrees $\pm$ 1°
	down	
Rudder	Left	20 degrees $\pm$ 2°
	Right	20 degrees $\pm$ 2°
Elevator	up	18 degrees $\pm$ 1°
	down	9 degrees $\pm$ 1°
Elevator tab(Travel of trailing edge in inches) Recorded with elevator up - 18° neutral 0° down + 9°	Noseheavy: Trim lever forward 2 inches	elevator up + 1.81 $\pm$ 0.16 elevator neutral - 0.08 $\pm$ 0.16 elevator down - 1.38 $\pm$ 0.16
	Trim lever neutral:	elevator up + 1.49 $\pm$ 0.16 elevator neutral - 0.47 $\pm$ 0.16 elevator down - 1.96 $\pm$ 0.16
	Tailheavy: Trim lever aft 2 inches	elevator up + 1.02 $\pm$ 0.16 elevator neutral - 1.10 $\pm$ 0.16 elevator down - 2.71 $\pm$ 0.16
Flaps		0 to 35° $\pm$ 1°

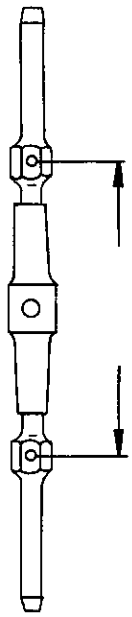
Rigging of elevator and aileron surfaces is done by setting adjustment screws controlling freedom of stick movement. For proper rigging of the rudder adjust turnbuckles connecting the ends of the rudder control cables.

RIGGING OF AILERONS

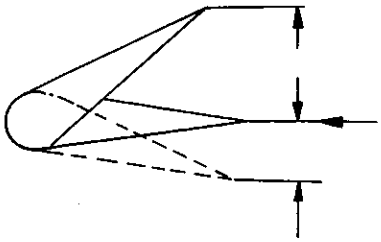


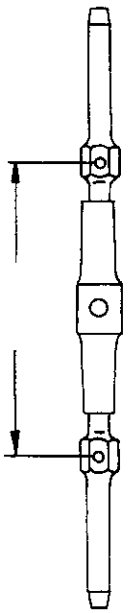
Centre Turnbuckle

With wing flaps retracted and turnbuckles adjusted correctly the following aileron deflections must be obtained:



l. h. turnbuckle





r. h. turnbuckle

The above dimensions were established by the manufacturer after final assembly of the a/c and are included in this manual to facilitate the re-rigging of ailerons if disassembly has become necessary.

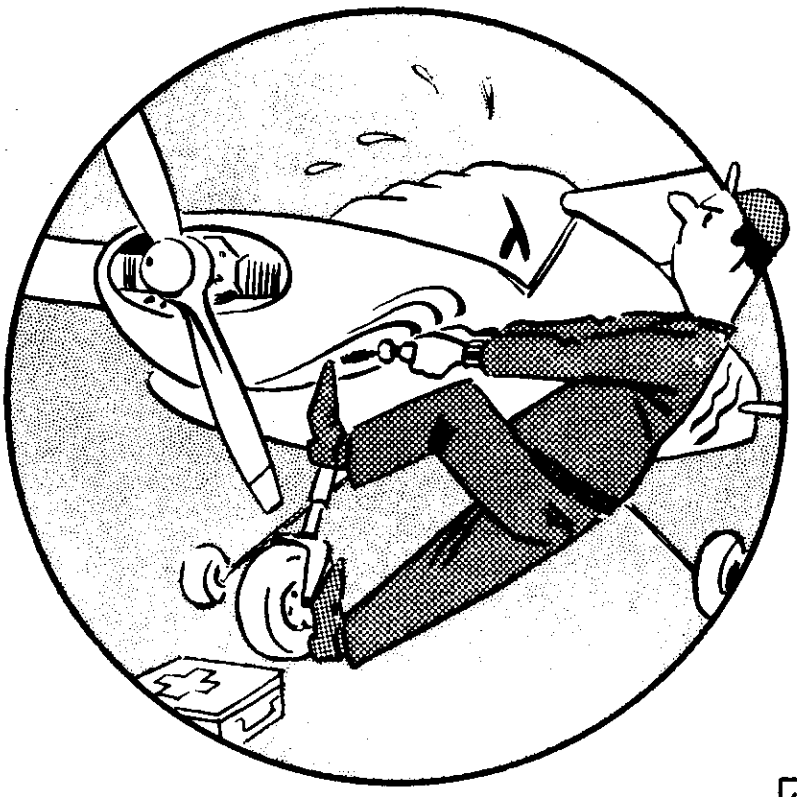
For reassembling the wings the following should be noted:

1. Aileron control cables should not be crossed but must be routed parallel from rib 8 through the wing root rib. The two long cables from the wings must be routed into the fuselage forward of the deflecting pulleys, pushed through the nylon bushings located on the fuel tank support and connected up by means of the centre turnbuckle. The two shorter cables are run over the pulleys aft of bulkhead 3 and are connected to the push-pull cables by using l. h. and r. h. turnbuckles respectively.
2. The electric wires for navigation lights and stall warning unit are marked corresponding to the marks on the receptacles.
3. The wing struts must not be assembled before the wings are attached to the fuselage.

The dimensions given in the above drawing are applicable for aircraft Serial No. ....., Registration .....

SECTION V

ENGINE TROUBLES AND THEIR REMEDIES



ENGINE TROUBLES AND THEIR REMEDIES

General: Experience has proven that the best method of "trouble-shooting" is to decide on the various possible causes of a given trouble and then eliminate these causes one by one, beginning with the most probable.
The following chart describes some of the more common engine troubles, their causes and their remedies.

1) Failure of the engine to start.

a) Lack of fuel.
Fill tank.

b) Insufficient priming (weak explosions).
Repeat starting procedure with more priming by 2 or 3 strokes with the throttle.

c) Overpriming or flooding.
(black smoke issuing from the exhaust pipe)
Turn ignition switch OFF, throttle wide open and pull the propeller through several revolutions in the reverse direction to normal rotation.

d) Cold oil.
Turn ignition switch OFF, pull the propeller through several revolutions, if possible by hand or else by means of the starter. In extremely cold weather drain the engine oil and pre-heat until a temperature of 40°C / 104°F is obtained.

e) Engine too hot.
Repeat starting procedure with throttle in idling position, if necessary allow engine to cool off.

f) Weak battery.

Recharge battery.

g) Spark plugs fouled.

Remove and clean. Inspect gaps and reset if necessary to 0.015 in. - 0.018 in.

h) Breaks in the insulation of the ignition wiring and possible shorting.

Check ignition wiring, replace defective cables. Tape faulty insulation.

i) Incorrect starter adjustment.

Readjust shift lever screw.

j) Fuel does not reach carburetter.

Ensure vent hole in the fuel tank cap and vent line are unobstructed. Blow out supply line. Inspect shut off valve, replace if necessary. Clean filters.

k) Carburetter float and needle valve stuck shut or jets plugged.

Remove carburetter and clean.

l) Magneto breaker points fouled.

Remove oil from breaker.

m) Magneto breaker points burned.

Replace breaker points and condenser.

n) Magnetos incorrectly timed to engine.

Check and correct timing to engine. (28° before TDC)

o) Magneto incorrectly timed internally.

Align for correct magneto timing.

2) Irregular idling.

a) Incorrect idle mixture adjustment.

Correct idle mixture. (normally drive adjustment screw home, then give 1 or 1 1/4 turn in opposite direction).

b) Spark plugs fouled.

Remove and clean.

c) Leak in air induction system.

Tighten loose joints, replace damaged parts.

d) Carburetter idle air bleed or carburetter idle jet plugged.

Disassemble and clean.

3) Rough running.

a) Detonation.

Use specified fuel. Keep cylinder head temperature below specified maximum.

b) Fouled spark plugs.

Remove and clean. Inspect and set gap clearances.

c) Defective spark plug cables.

Test for breakdown at high voltage, if necessary renew.

d) Engine mounting bolts loose.

Tighten nuts to 180 - 190 in. lbs.

e) Propeller out of balance.

Remove and inspect and - if necessary - replace propeller.

f) Cracked magneto distributor.

Overhaul magneto. Check for very fine cracks in block.

g) Defective valve lifter.

Remove and test hydraulic unit. Replace if worn. Adjust valve linkage clearance with the hydraulic unit completely deflated. If more than one valve lifter has been removed, make certain that individual parts are re-assembled in their original position.

h) Warped valves.

Replace. Grind seats.

i) Scored valve stems.

Replace valves and guides.

j) Worn cam lobe.

Overhaul engine.

k) Defective piston rings.

Replace piston rings.

4) Poor acceleration.

a) Engine not warm enough.

Continue warm-up.

b) Air filter plugged.

Remove and clean filter.

c) Water in fuel.

Drain sediment trap and carburetter.

d) Idle mixture too lean.

Readjust.

e) Defective throttle control.

Check for proper movement, correct adjustment for possible damage. Replace worn parts.

f) Plugged idling jet.

Clean carburetter and jets.

g) Leak in air induction system.

Check all supply lines of the induction system for damage and loose joints and inspect throttle shaft bearings. Tighten connections and replace worn parts.

5) Low power.

a) Ice forming on carburetter throttle valve.

Apply full carburetter air heat.

b) Plugged air filter.

Remove and clean.

c) Carburetter air heat valve not closing fully.

Remove filter, inspect valve, straighten plate.

d) Fuel flow restricted.

Inspect tank vents and shut off valve.
Clean sediment bowl, strainer and carburetter screen. Blow out fuel supply line.

e) Defective ignition cable.

Test for high voltage leaks. Inspect for breaks in the insulation. Replace worn cables.

f) Propeller blades warped or incorrect propeller installed.

Replace propeller. Use specified propeller model.

g) Scored valve stems.

Replace valves and guides.

h) Warped valves.

Replace valves. Grind seats.

i) Defective magneto.

Overhaul magneto.

j) Worn cylinders, pistons and/or piston rings.

Overhaul engine.

6) Low oil pressure.

a) Low oil supply.

Replenish.

b) Low oil viscosity.

Drain sump. Refill with correct grade.

c) Defective oil pressure gauge.

Test gauge, and replace or repair.

d) Plugged oil screen.

Remove and clean.

e) Dirt on oil pressure relief valve seat.

Remove and clean plunger and seat. Change oil.

f) Oil pressure relief valve seat worn.

Overhaul engine. Refinish valve seat.

g) Oil pressure relief valve plunger sticking.

Remove cap and plunger. Clean parts.

h) Oil pump suction tube screen plugged. Leaking suction tube.

Remove sump and clean screen. Replace suction tube.

i) Engine bearings worn.

Overhaul engine.

j) Internal oil leak.

Overhaul engine.

k) Cracked crankcase cover casting or defective oil pump.

Overhaul engine.

7) High oil temperature.

a) Low oil supply.

Replenish.

b) Dirty or diluted oil.

Drain sump and fill with fresh oil of proper grade.

c) Prolonged ground operation at high speed.

Avoid prolonged running on the ground either by warm-up shortly followed by take-off or shut down engine.

d) Excessive rate of climb.

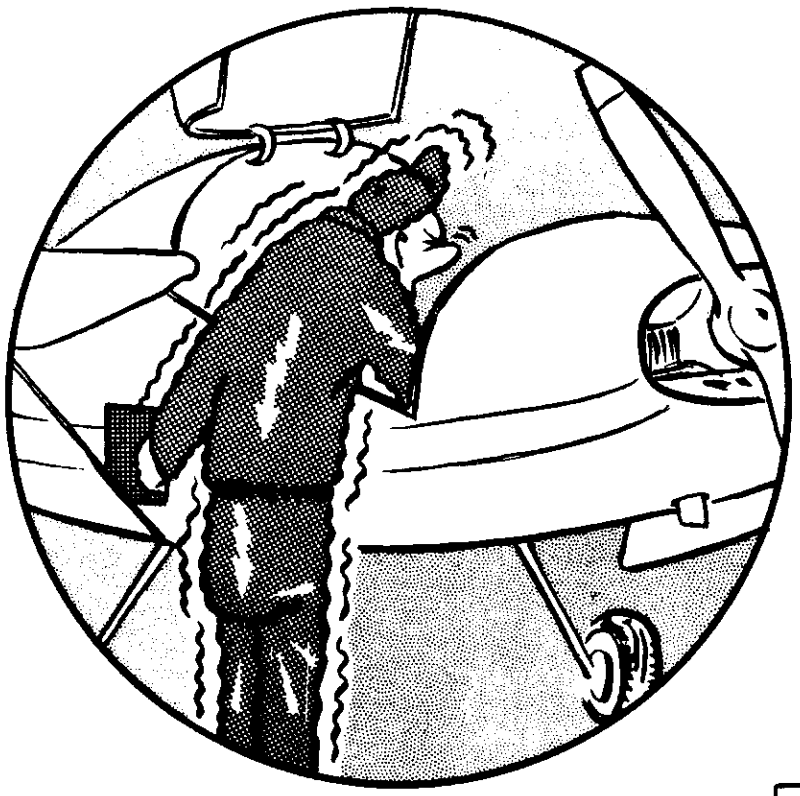
Avoid low airspeed combined with high angle of climb.

e) Excessively lean fuel mixtures.

For proper operation of mixture control refer to Operator's Handbook.

SECTION VI

ELECTRICAL SYSTEM



ELECTRICAL SYSTEM

When the engine ist not running, electrical power for the system ist supplied by a 12V battery (P 1) with the negative terminal grounded (fuselage). The battery capacity is 25-ampere hours for 5-hour rate.

The two-pole Master Switch (P 5), when turned on, connects the winding of the battery power relay (P 4) to ground. The relay connects the starter switch (at starter K 1) and aircraft bus bar to the positive battery terminal. The second pole of the master switch connects the generator (P 2) field (F) to the regulator (P 3) (F). Thus the master switch (P 5), when turned off, disconnects the power supply from the battery and the generator.

Upon pulling the starter handle with the master switch (P 5) ON, the starter motor (K 1) is running.

The Ignition Switch (J 1) has no connection with the electrical power system. To start the engine turn the master switch (P 5) ON, ignition switch (J 1) to BOTH (Magnetos 1 + 2) and then pull the starter handle. The starter is cranking the engine as long as the handle is pulled. If the handle is released, power is no longer admitted to the starter.

When the engine is running the 12 V DC Generator (P 2) with an output of 240 watt (20 ampere) supplies the electrical system with power and charges the battery by control of the regulator (P 3).

A red Generator Control Light (P 6) at the panel is used to guard generator functions. The red light goes out (at approx. 1000 rpm) if the generator is supplying power to the system. The generator together with the control light is only functionning when the master switch (P 5) is turned on.

In addition hereto an Ammeter (P 7) is installed, which operates as follows:
With inoperative engine and turned on load the needle in the left (-)section indicates that current is drawn from the accumulator (generator control light glows).

With operative engine (generator control light dark) and fully loaded accumulator the needle is on zero or on the right (+)section when the generator charges the battery.
When the needle is deflected to the left section below zero with running engine (generator control light comes on), that trouble is caused by the generator or the regulator.
In such a case, the flight may be continued without concern, because ignition does not depend on generator or battery.
However, electrical devices, which are not essentially necessary should be turned off and the fault be repaired before the next take-off.

All load circuits are connected through terminal "B" of the regulator (P 3) to the generator (P 2) and to the battery (P 1). Power is admitted to the load circuits only if the master switch (P 5) is turned on.

The switches for all load circuits are push-button-type circuit breakers. They act in a twofold way. As push-to-lock switches they turn on the equipment when pressed in and turn it off when pulled out. They are also used for automatic overload protection, i. e. they automatically turn off load circuits if the system is overloaded or a short circuit occurs (the button pops out). The circuit breakers employ thermal tripping.

All engine instruments (E 2, E 4, E 6, E 8), the fuel warning light (E 12) which lights up, if fuel is consumed to a reserve of 10 l (2, 2 Imp. Gal.), and the stall warning indicator (C 1) are connected to the E 1 Circuit Breaker. Press button of circuit breaker E 1 before starting the engine. Also press Q 1 button for the emergency fuel pump (Q 2), which operates electromagnetically. The L 1 button is used to turn on the navigations lights (L 2, L 3, L 4). All other equipment and instruments are switched on by individual circuit breakers. They should be operated as needed. Power to the circuit is admitted via terminal B of the regulator (P 4), by actuating circuit breaker (C 3) (10 amps.). The flaps are operated by a three-position toggle switch (C 4) located to the left of the flap position indicator in the centre of the instrument panel, and are operated as follows:

To lower the flaps press the switch down.

To retract the flaps push the switch upward.

The electrically operated Flap Control System is an integrated unit incorporating the motor (C 9), transmission gear, limit switches (C 7, C 8) and condensers (C 5, C 6). This system is mounted on a platform and installed aft of the fuel tank on the upper frame section, and can be replaced as a unit. Electrical connection to the three-position toggle switch is by a releasing plug connector (V 7).

The limit switches (C 7, C 8) and a mechanical slipping clutch in the transmission gear guard the unit against flap travel beyond the stops. The sensing unit for the Cylinder Head Temperature gauge operates by a thermocouple (E 11) installed with the sparking plug of the no. 2 cylinder. This unit has no connection to the 12 V power system and has no switch. It is part of the optional equipment.

The entire electrical system is designed for a 65 per cent load on the generator output when all available instruments and equipment are in operation. With a running engine and operating generator no electrical power is taken from the battery. The battery has a capacity to supply power for two hours if the generator should fail (red generator control light comes on in flight), provided that the battery is fully charged and in good condition. The starter, whenever used should be operated momentarily to avoid battery exhaustion.

Installation and wiring of the electrical system is of single-pole type with negative ground. The entire system is shielded. All wires used are special aviation wires. Connections are either by crimped ring-type tags or by Faston-type receptacles (on terminal blocks). Connections between fuselage to wing and wing to tip are quick disconnect-type for ease of disassembly. Each wire carries a printed code number identical with codes listed in the wiring diagram. The last two digits of the code indicate wire sizes in cross-sectional area (AN) (American Wire Gage).

These wire sections are also listed in the installation diagram. Ground between engine and structure is provided by a ground strap with a cross-sectional area of 0.34 sq. in. (22 mm^2) (AN 4).

All necessary wiring for optional electrical instruments, such as VHF radio and turn and bank indicator, supplied by request, is installed in the standard Junior model, eliminating the need for further wiring.

Coding key of instruments

All electrical instruments carry a code number consisting of a circuit function letter and wire number.

The following circuit function letters are used:

C	Stall warning system and flap control system	L	Lighting
E	Engine instruments	P	D. C. power system
F	Flight instruments	Q	Fuel system
J	Ignition system	R	Radio
K	Starter	V	Terminal block

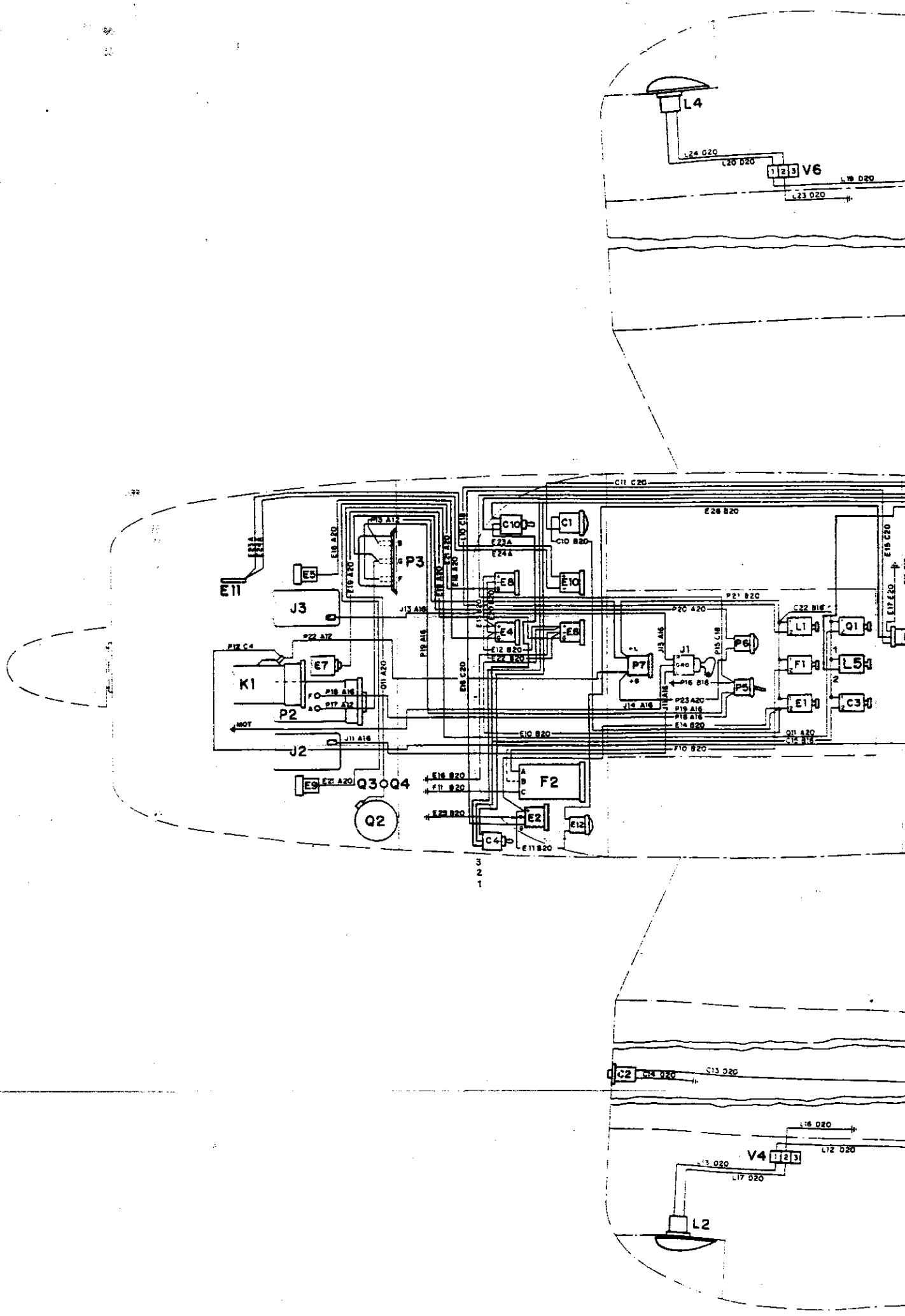
Code numbers are also listed on the particular instrument and at panel location of resp. system and are used throughout diagrams and List of Electrical Instruments, (see overleaf).

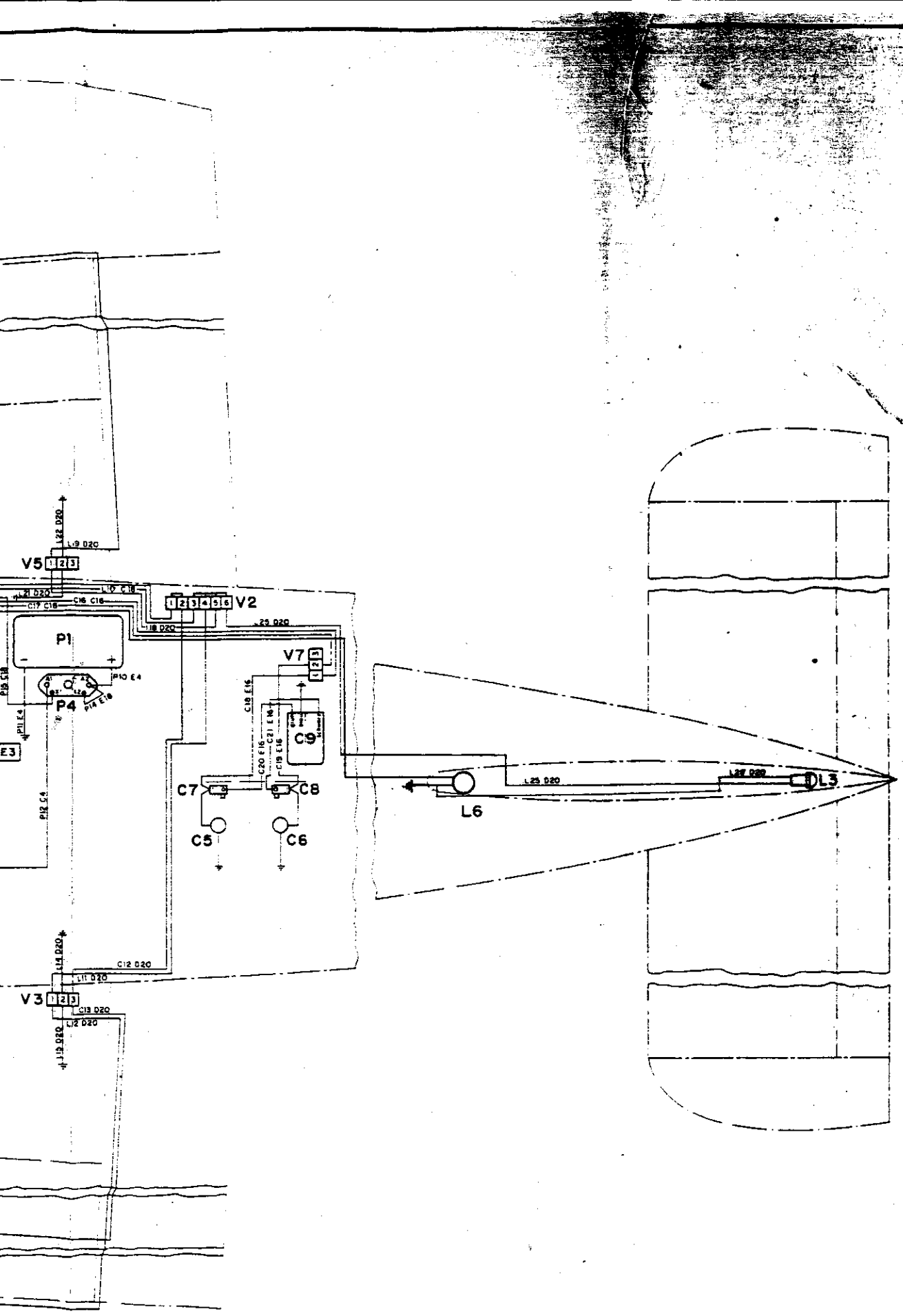
ELECTRICAL INSTRUMENTS

CODE	DESCRIPTION	LOCATION
C 1	Stall Warning Indicator (audio signal)	rear of instrument panel, on right-hand side
C 2	Stall Warning Transmitter	port wing
C 3	Circuit Breaker, Flap Control System (10 Amps.) (7.5 Amps. as from serial no.681)	circuit breaker panel
C 4	Three-position Toggle-Switch	instrument panel
C 5	Condenser Limit Switch	fuselage
C 6	Condenser Limit Switch	fuselage
C 7	Limit Switch Flap Control System	fuselage
C 8	Limit Switch Flap Control System	fuselage
C 9	12V 40 Watt DC motor, Flap Control System	fuselage
C 10	Three-position toggle switch, Flap Control System	instrument panel
E 1	Circuit Breaker, Engine Instruments (3 Amps.)	circuit breaker panel
E 2	Fuel Quantity Indicator	instrument panel
E 3	Fuel Quantity Transmitter	fuel tank
E 4	Oil Pressure Gauge 0-5 kg/cm^2 = 0-60 psi	instrument panel
E 5	Oil Pressure Transmitter	in front of firewall right side
E 6	Oil Temperature Gauge 30-120 ^{o}C = 75 ^{o} - 225 ^{o}F	instrument panel
E 7	Oil Temperatur Transmitter	engine

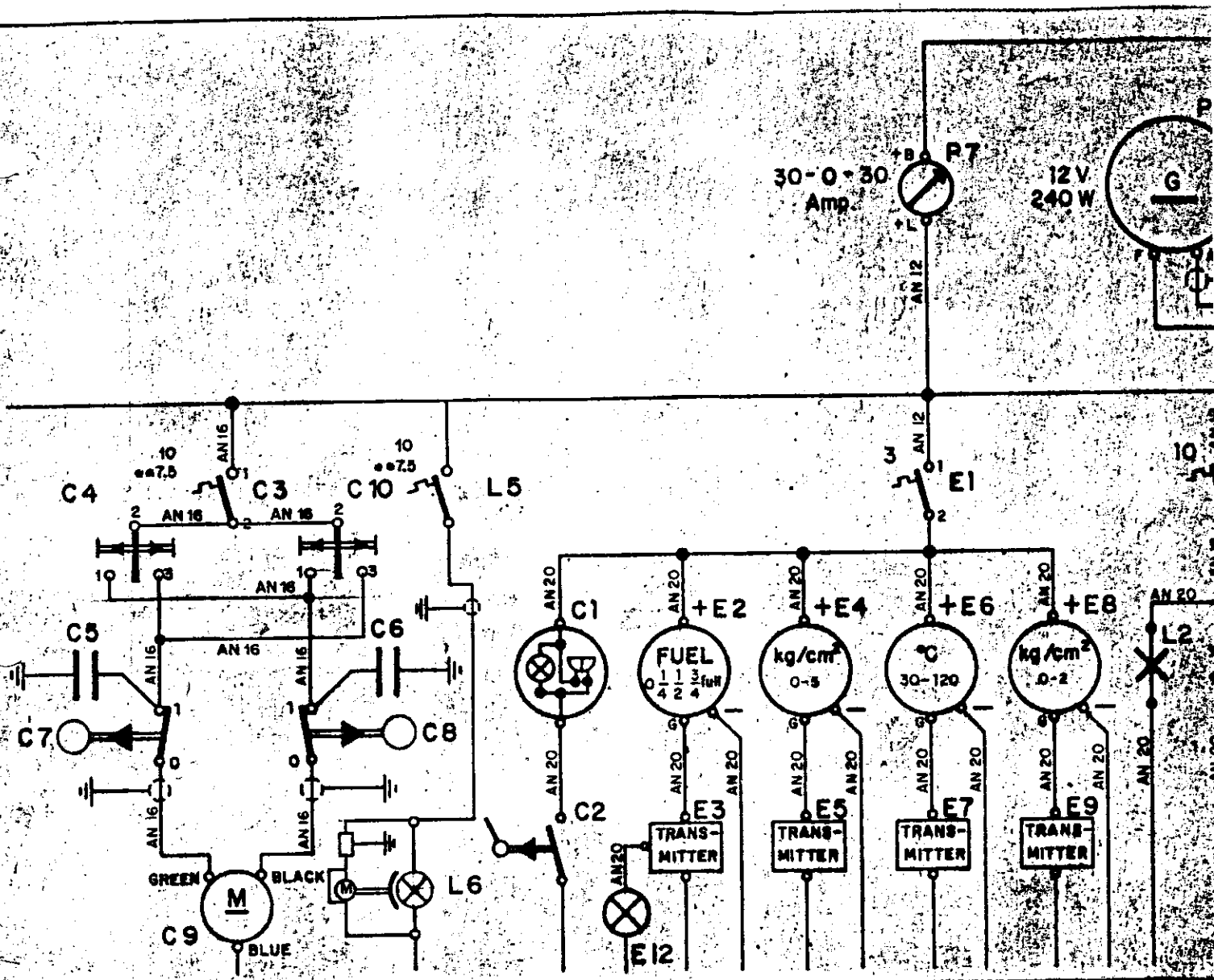
CODE	DESCRIPTION	LOCATION
E 8	Fuel Pressure Gauge ($0-2\ kg/cm^2$)	instrument panel
E 9	Fuel Pressure Transmitter	firewall, left side
E 10	Cylinder Head Temperature Indicator	instrument panel
E 11	Thermocouple	engine
E 12	Fuel Warning Light	instrument panel
F 1	Circuit Breaker, Turn and Bank (3 Amp.)	circuit breaker panel
F 2	Turn and Bank Indicator	instrument panel
J 1	Ignition Switch	circuit breaker panel
J 2	Magneto, left	engine
J 3	Magneto, right	engine
K 1	Starter	engine
L 1	Circuit Breaker, Navigation Lights (10 Amps.) (7.5 Amps.) as from serial no. 681	circuit breaker panel
L 2	Navigation Light, red	port wing
L 3	Navigation Light, white	fin/rudder
L 4	Navigation Light, green	starboard wing
L 5	Circuit Breaker Anti-collision Light (7.5 Amps.)	circuit breaker panel
L 6	Anti-collision Light	horizontal stabilizer
P 1	Battery, 12 V, 25 Ah	fuselage
P 2	Generator, 12 V, 240 W	engine
P 3	Voltage Regulator	in front of the firewall, right side
P 4	Battery Relay	battery installation
P 5	Master Switch, 2 pole	circuit breaker panel

CODE	DESCRIPTION	LOCATION
P 6	Generator Control Light, red	circuit breaker panel
P 7	Ammeter	circuit breaker panel
Q 1	Circuit Breaker, 3 Amps., Emergency Fuel Pump	circuit breaker panel
Q 2	Emergency Fuel Pump	firewall, left side
Q 3	Connector, Fuel Pump	firewall, left side
Q 4	Connector, Fuel Pump	firewall, left side
R 1	Circuit Breaker, 10 Amps. VHF Radio	circuit breaker panel
R 2	Power Supply Unit, VHF Radio	fuselage
R 3	Transmitter-Receiver	instrument panel
R 4	Antenna	fuselage
R 5	Connector, Power Supply	power unit
R 6	Plug	power unit (R7)
R 7	Receptacle	power unit
R 8	Plug	transmitter-receiver (R 9)
R 9	Receptacle	transmitter-receiver
R 10	Plug	power unit (R 11)
R 11	Receptacle	power unit
R 12	Receptacle	cabin, 2nd frame
R 13	Press-to-talk Button	control stick
R 14	Plug	antenna
R 15	Plug	transmitter-receiver
R 16	Resistor	terminal strip, main bulkhead no. 3
R 17	Speaker	main bulkhead no. 3


L4
L24 020
L20 020
V6
L18 020
L23 020
C11 020
E26 B20
C10
C1
E23A
E24A
C10 B20
E11
E5
P3
E8
E10
J3
P21 B20
P20 A20
C22 B16
L1
Q1
E4
E6
P6
P7
J1
F1
L5
K1
E7
P5
E1
C3
P2
P23 A20
P19 A16
P18 A16
E14 B20
MOT
J2
E10 B20
F10 B20
E9
Q3 Q4
F2
E16 B20
F11 B20
E25 B20
E2
E12
Q2
C4
E11 B20
C2
C14 020
C13 020
L16 020
L12 020
V4
L13 020
L17 020
L2



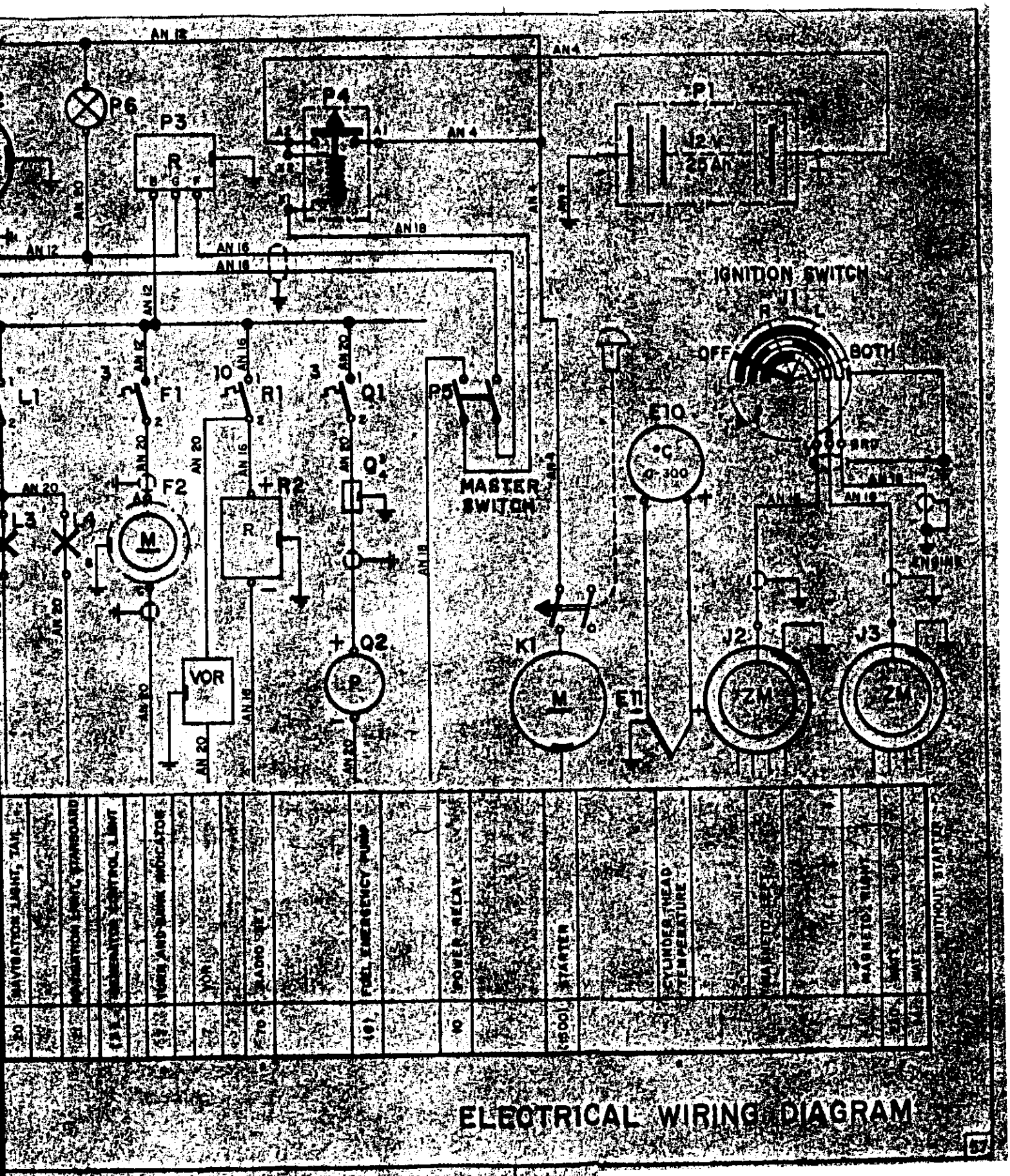
ELECTRICAL AIRCRAFT SYSTEM INSTALLATION DIAGRAM



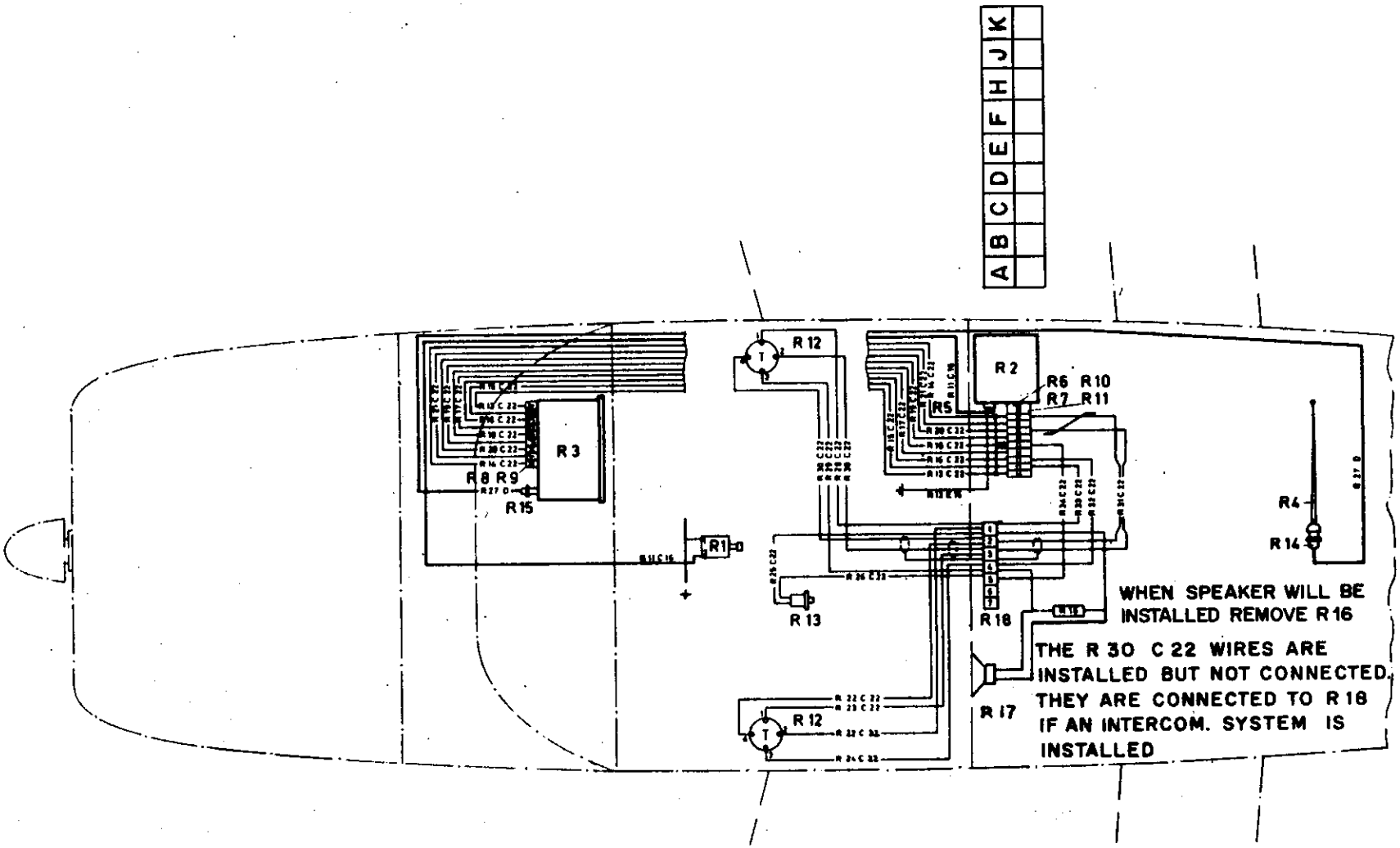
LANDING FLAP SYSTEM		ANTI-COLLISION LIGHT		STALL WARNING SYSTEM		FUEL WARNING LIGHT		FUEL QUANTITY		OIL PRESSURE		AMMETER	OIL TEMPERATURE		FUEL PRESSURE		NAVIGATION LIGHT PORT	
(75)		70		(10)		(3)		1		1			1		1		(2)	

* OPTIONAL EQUIPMENT

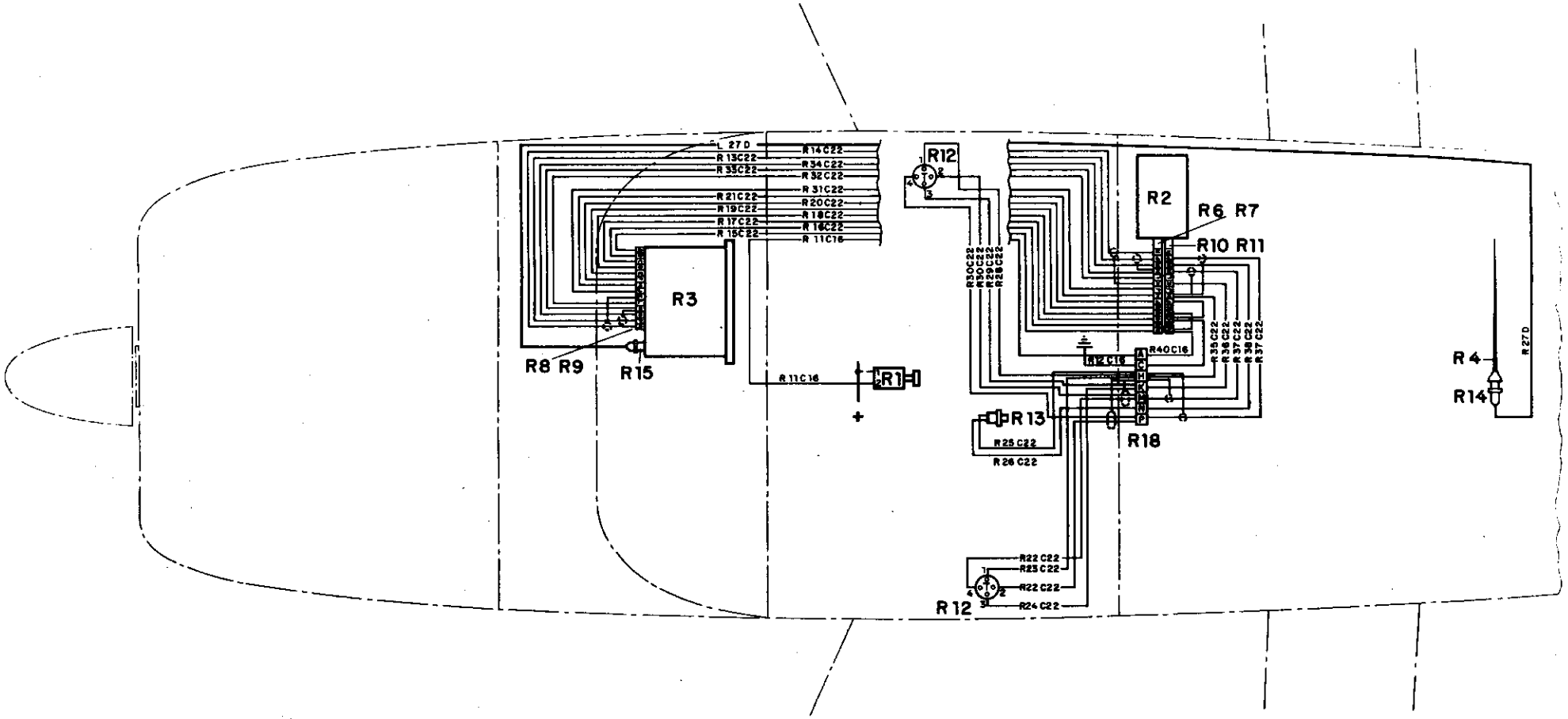
* * SERIAL NO. 681 FROM



ELECTRICAL WIRING DIAGRAM



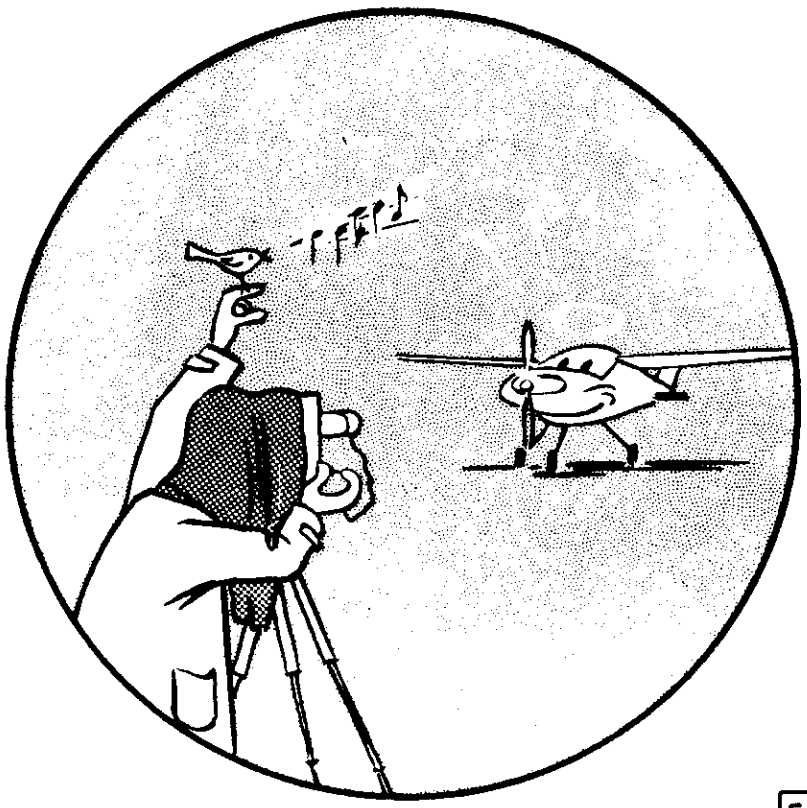
VHF RADIO WIRING DIAGRAM AR 12 M

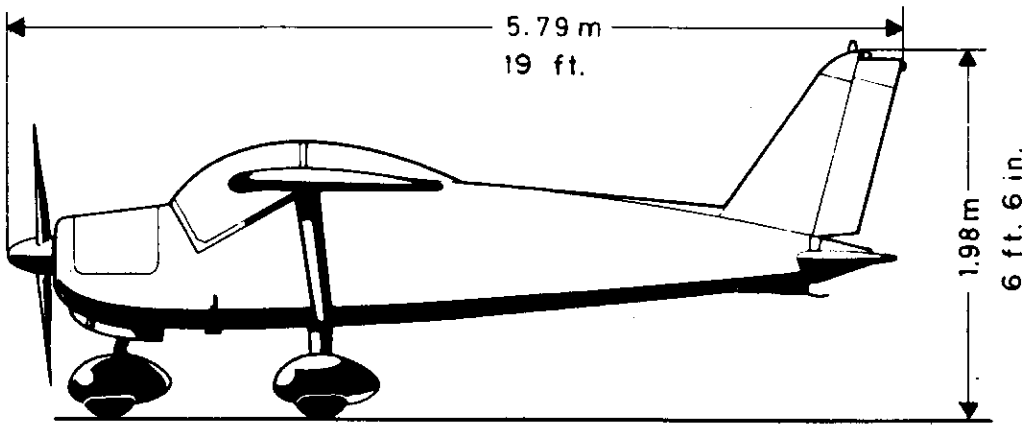


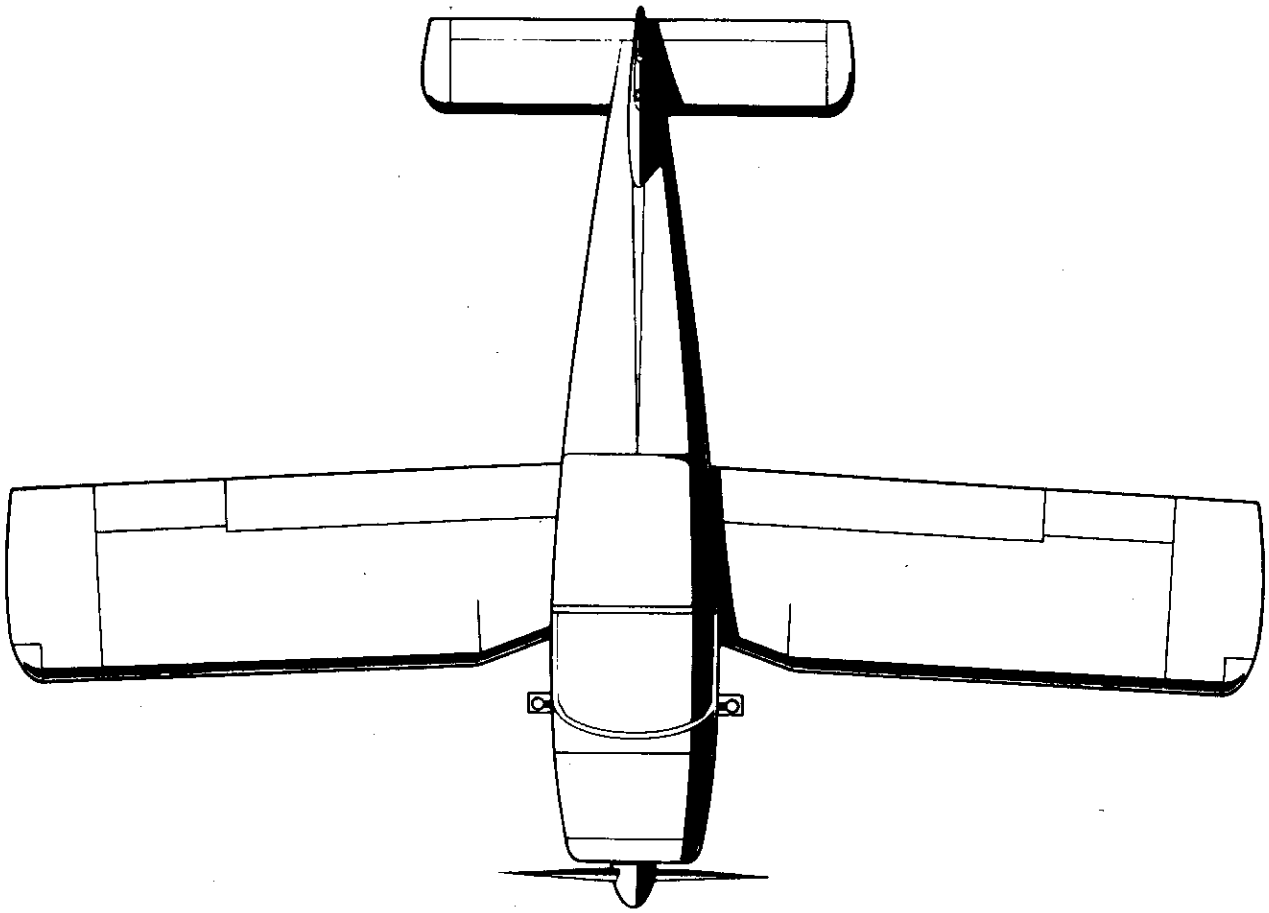
VHF RADIO WIRING DIAGRAM AR 380

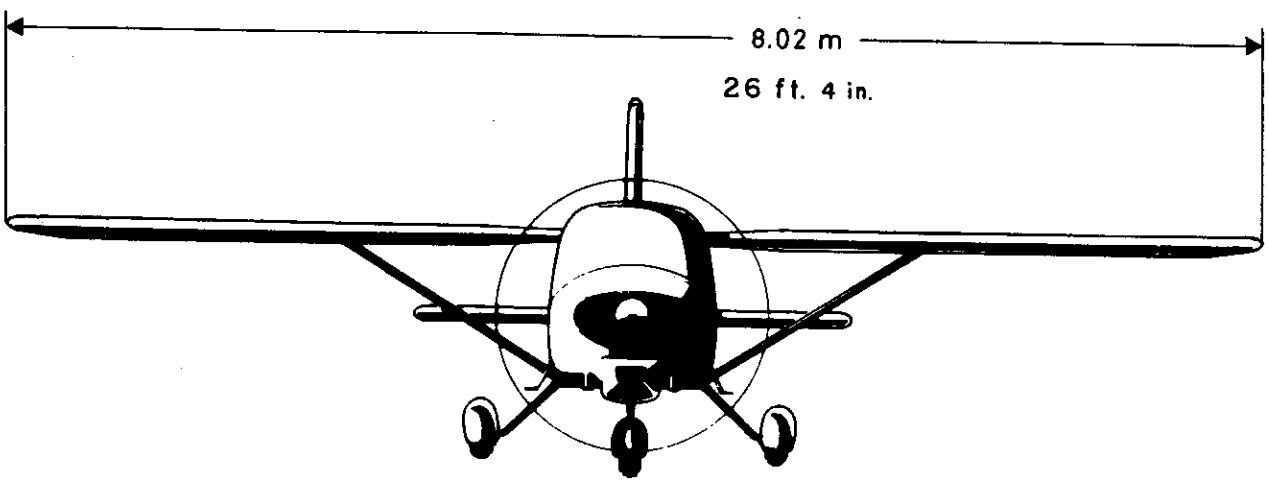
SECTION VII

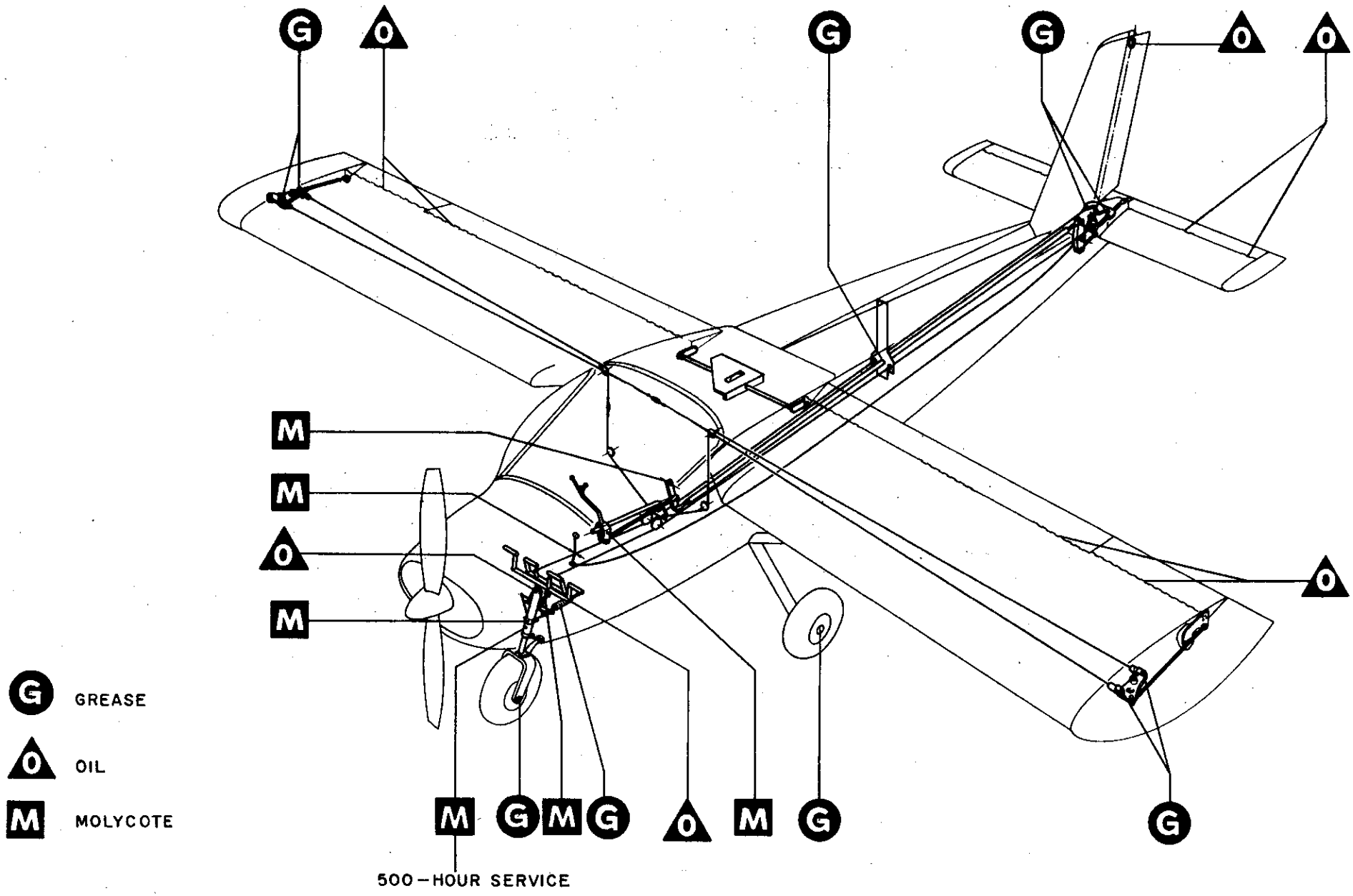
ILLUSTRATIONS




5.79 m
19 ft.
1.98 m
6 ft. 6 in.




8.02 m
26 ft. 4 in.

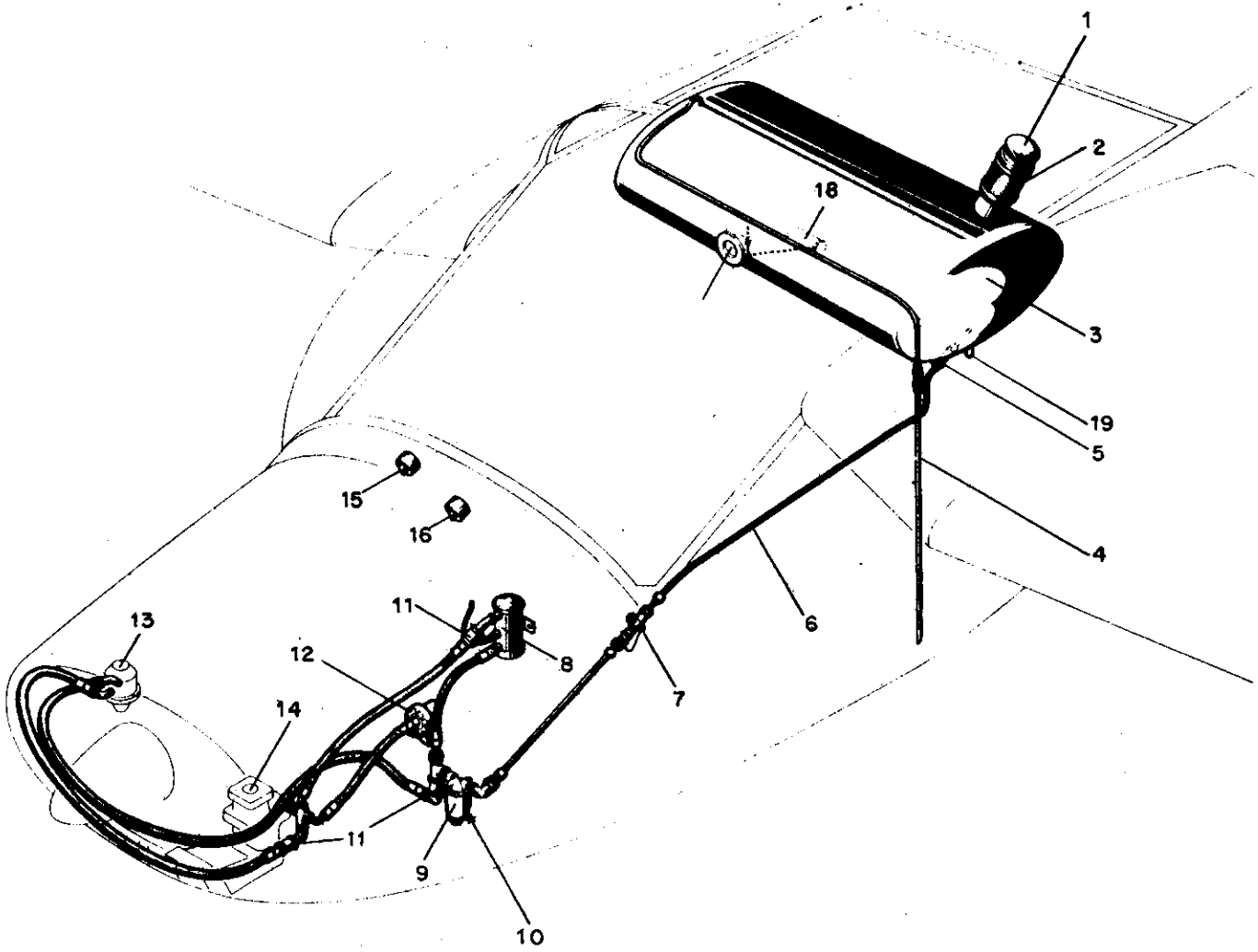


G GREASE

O OIL

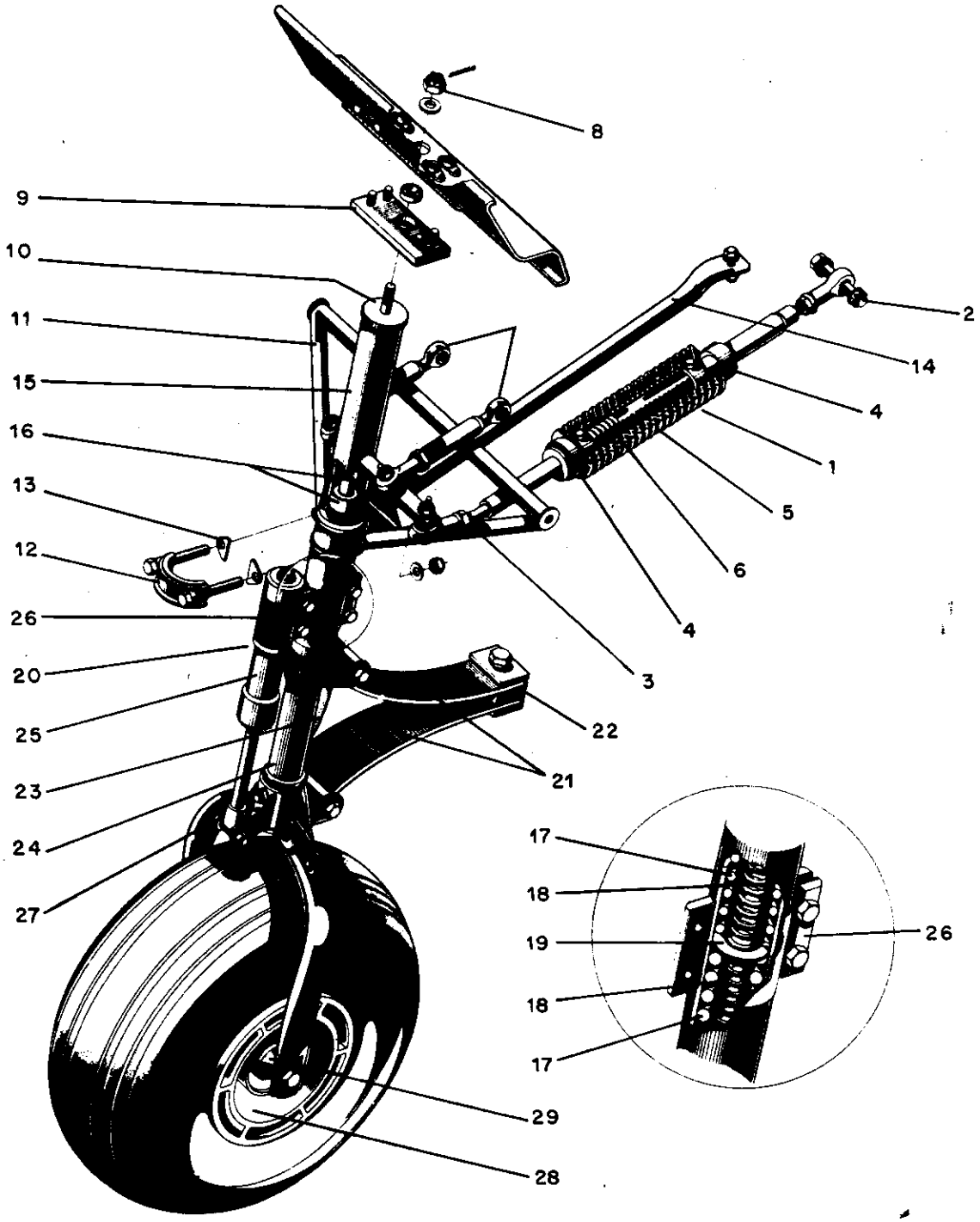
M MOLYCOTE

LUBRICATION CHART



1 FILLER CAP
2 FILLER NECK
3 FUEL TANK
4 FUEL TANK VENT LINE
5 FINGER STRAINER
6 LINE, TANK TO VALVE
7 FUEL SHUT-OFF VALVE
8 FUEL EMERGENCY PUMP
9 SEDIMENT BOWL
10 DRAIN VALVE
11 NON-RETURN VALVES
12 FUEL PRESSURE TRANSMITTER
13 FUEL PUMP
14 CARBURETTER
15 FUEL PRESSURE GAUGE
16 FUEL QUANTITY GAUGE
17 FUEL QUANTITY TRANSMITTER
18 FLOAT
19 SUMP DRAIN PLUG

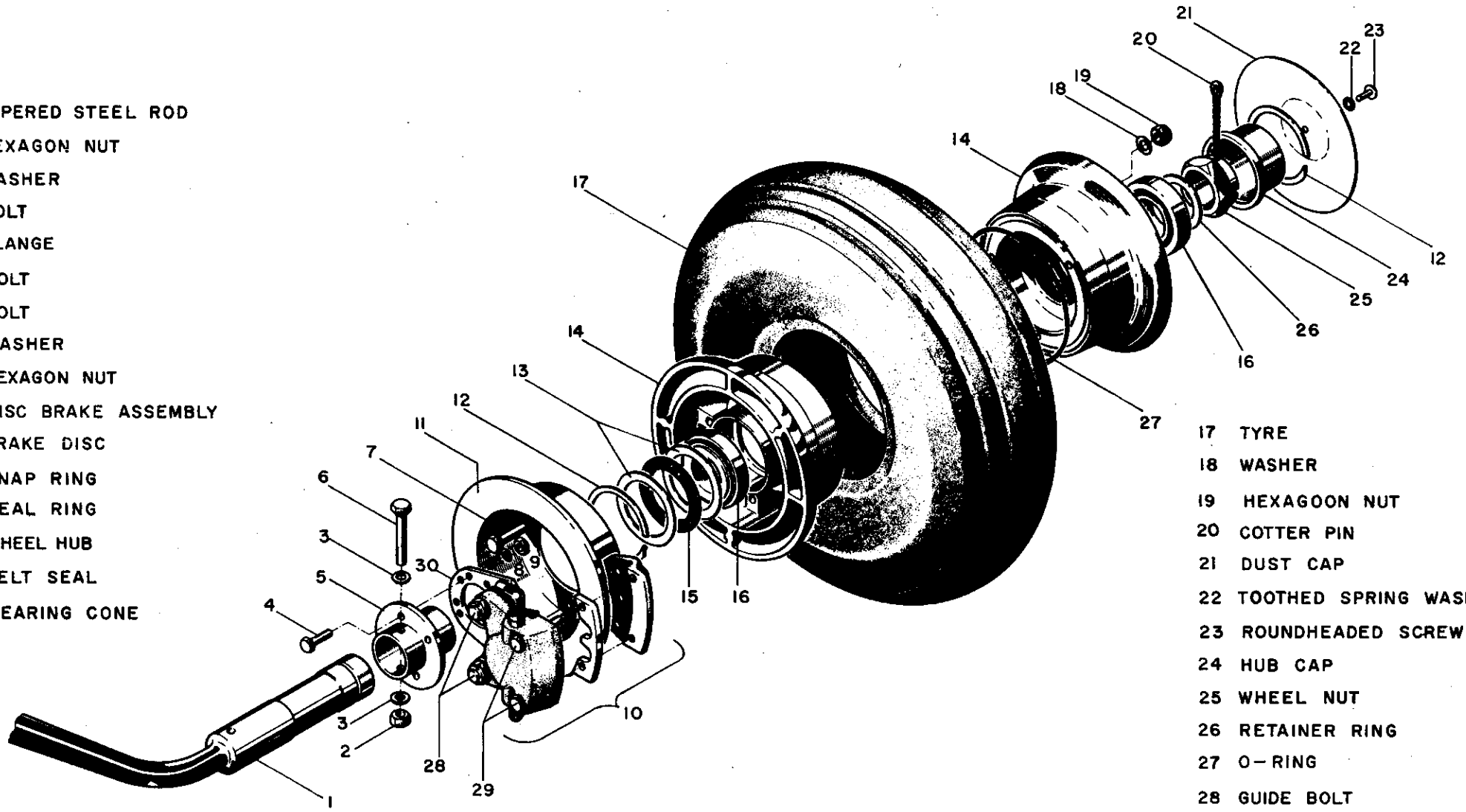
FUEL SYSTEM



1 STABILIZER STRUT
2 ATTACHMENT BOLT, STRUT TO FUSELAGE
3 NUT, ADJUSTMENT
4 CLAMP, BOOT
5 BOOT
6 SPRING
7 STEERING RODS
8 CASTLE NUT, UPPER ATTACHMENT
9 STRUT ATTACHMENT BRACKET
10 JURID TYPE FRICTION PLATE
11 BRACKET
12 STRUT FITTING
13 WASHER
14 SUPPORT STRUT
15 UPPER STRUT
16 FRICTION DAMPING
17 OUTER SPRING
18 INNER SPRING
19 SPACER
20 LUBRICATING POINT (UPPER STRUT)
21 TORQUE LINK ASSEMBLY
22 SHIM
23 CAPTIVE CABLE
24 LOWER STRUT AND WHEEL FORK
25 HYDRAULIC DAMPER
26 CLAMP, HYDRAULIC DAMPER TO STRUT
27 ATTACHMENT BOLT
28 WHEEL HUB
29 AXLE AND WHEEL BEARING

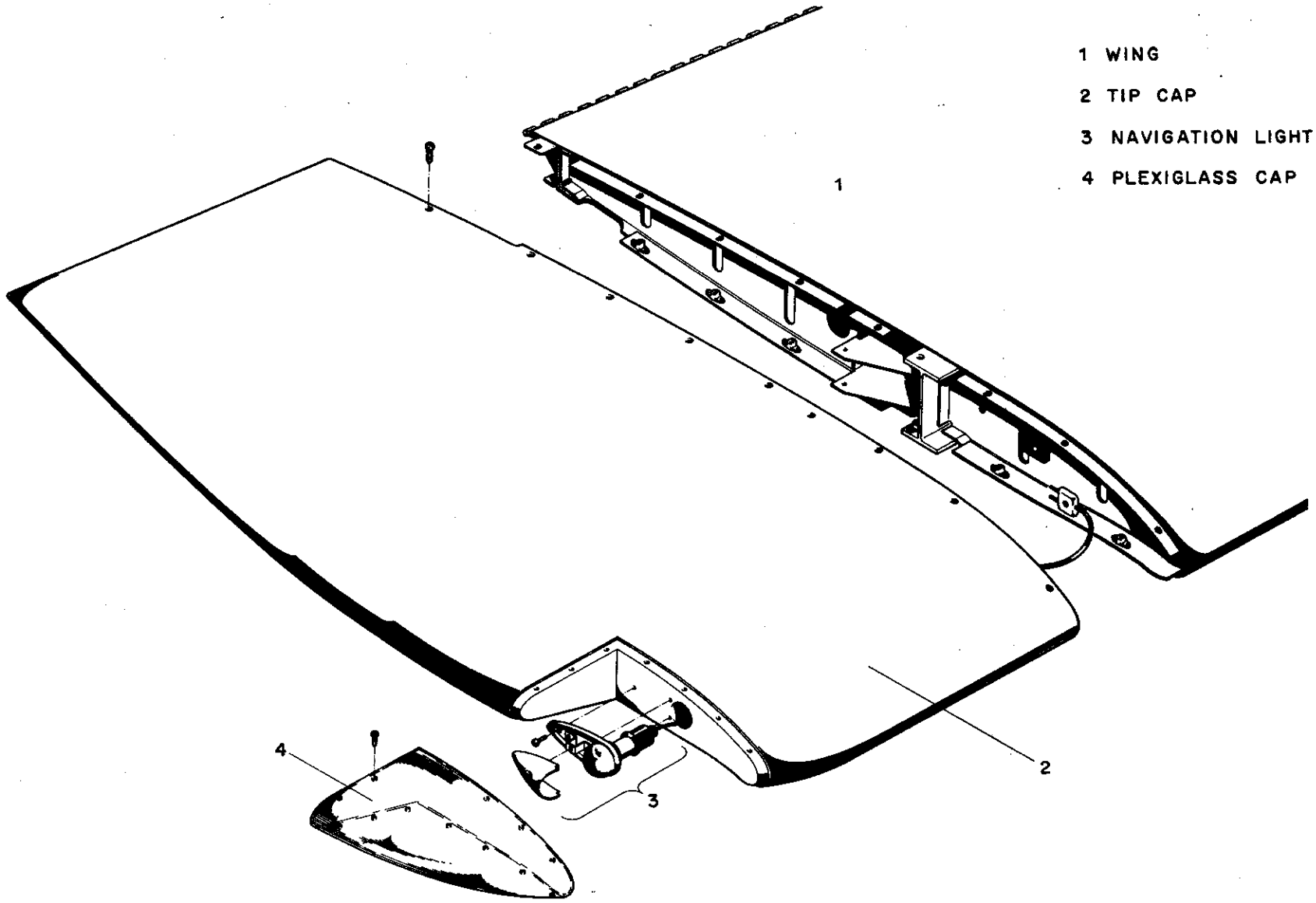
NOSE GEAR AND STABILIZER STRUT

1 TAPERED STEEL ROD
2 HEXAGON NUT
3 WASHER
4 BOLT
5 FLANGE
6 BOLT
7 BOLT
8 WASHER
9 HEXAGON NUT
10 DISC BRAKE ASSEMBLY
11 BRAKE DISC
12 SNAP RING
13 SEAL RING
14 WHEEL HUB
15 FELT SEAL
16 BEARING CONE

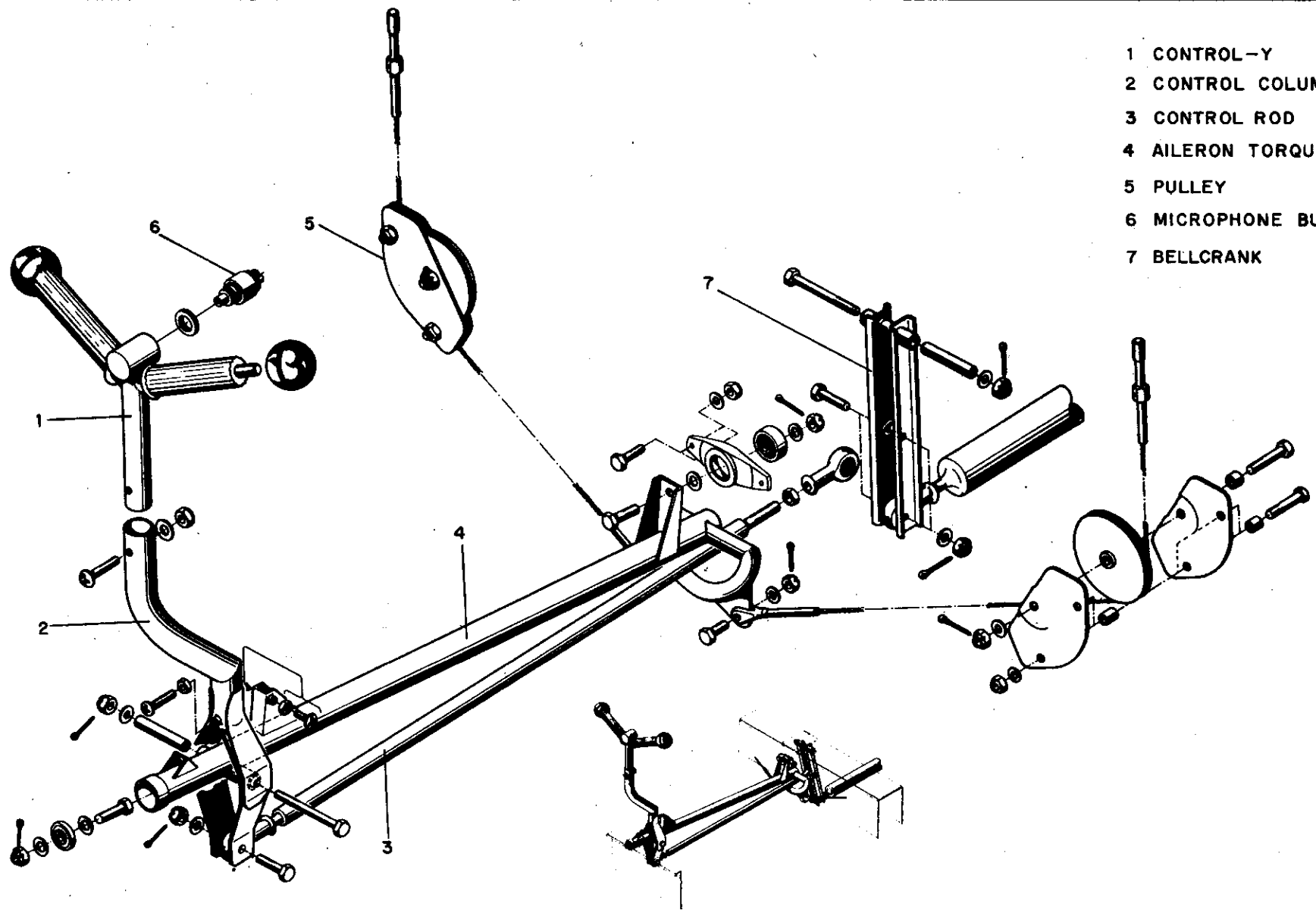


17 TYRE
18 WASHER
19 HEXAGOON NUT
20 COTTER PIN
21 DUST CAP
22 TOOTHED SPRING WASHER
23 ROUNDHEADED SCREW
24 HUB CAP
25 WHEEL NUT
26 RETAINER RING
27 O-RING
28 GUIDE BOLT
29 BOLT
30 ATTACHMENT FLANGE

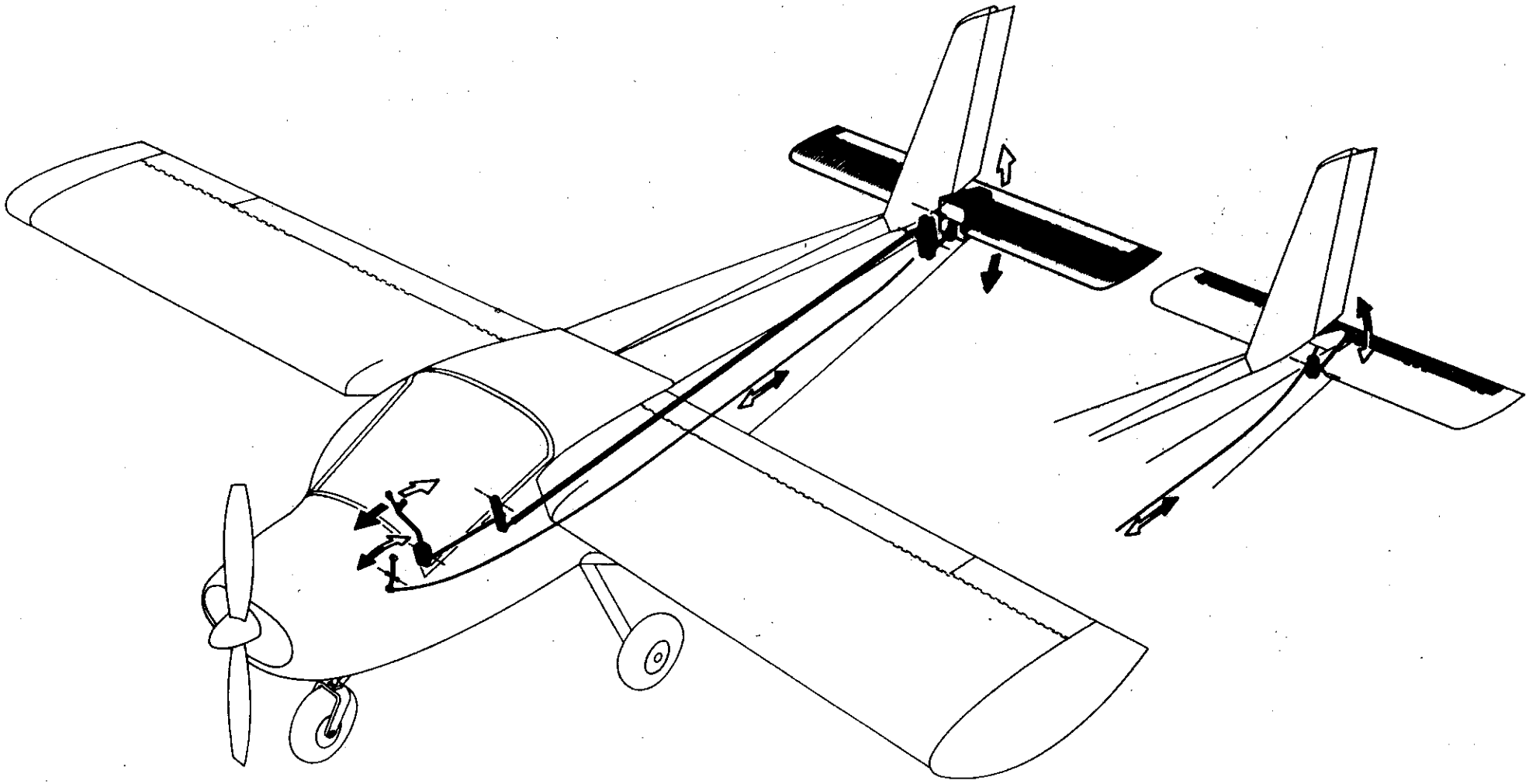
MAIN WHEEL AND BRAKE



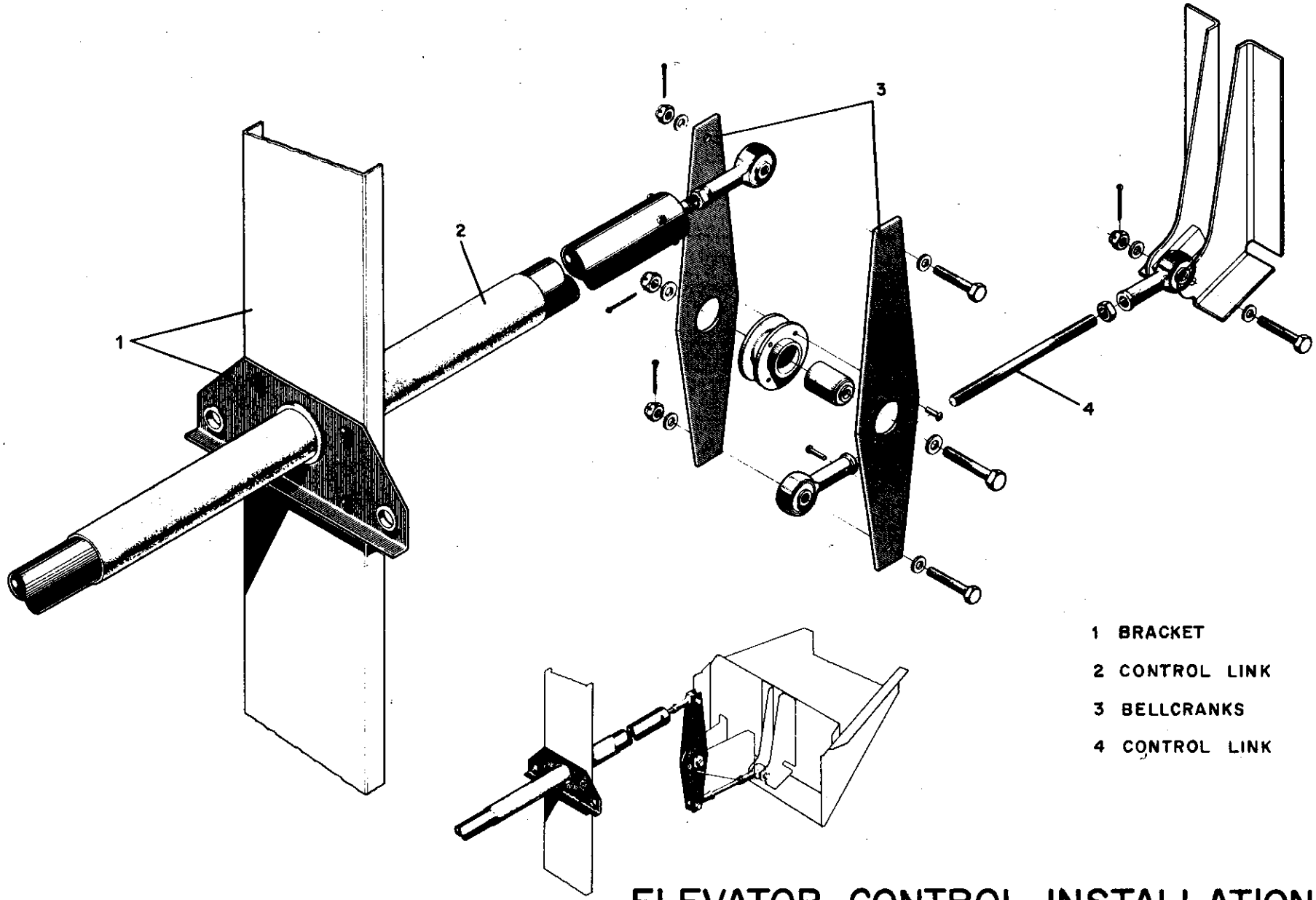
TIP CAP INSTALLATION



ELEVATOR AND AILERON CONTROL SYSTEM

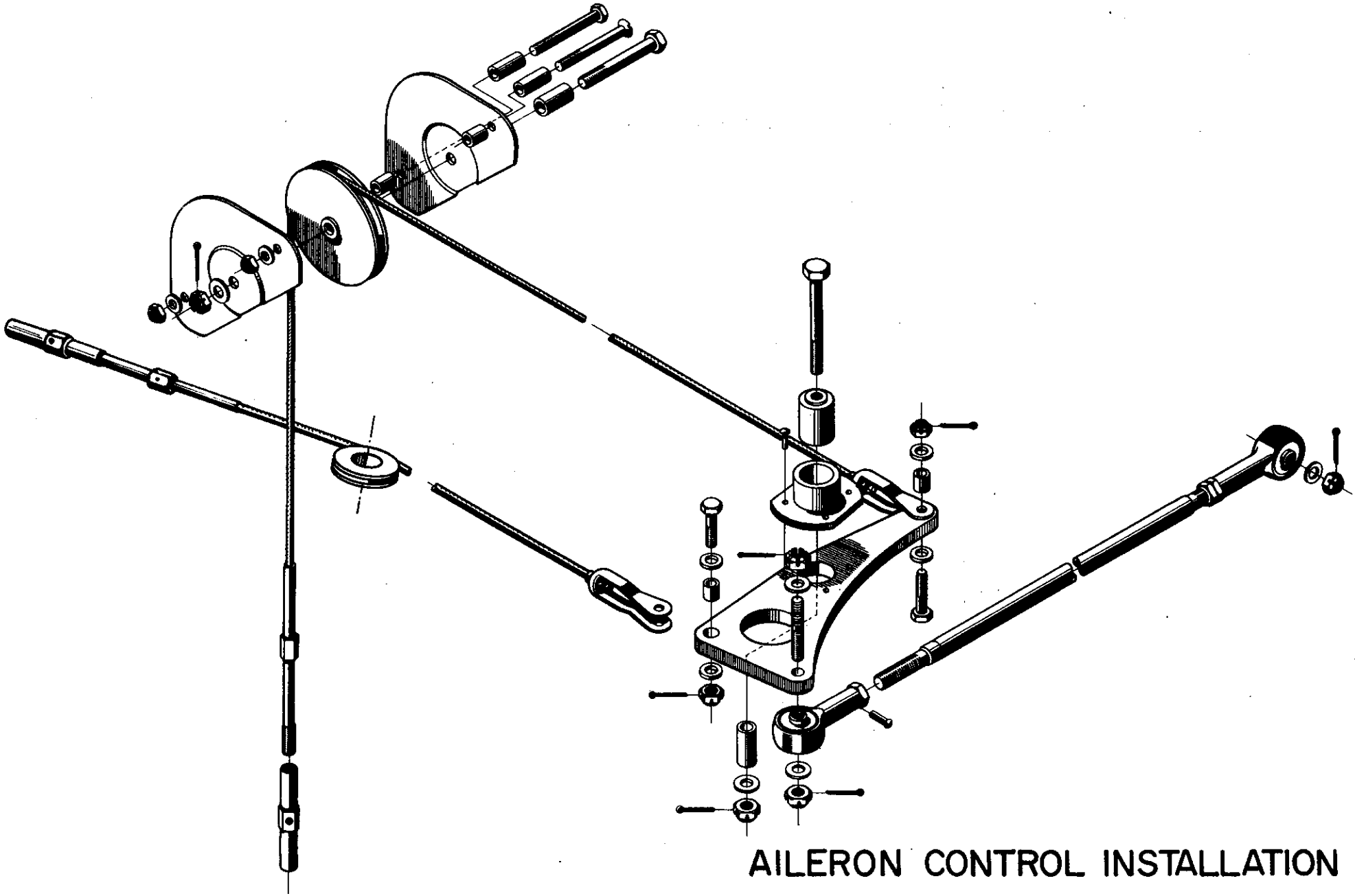


ELEVATOR CONTROL AND TRIM TAB SYSTEM



1 BRACKET
2 CONTROL LINK
3 BELLCRANKS
4 CONTROL LINK

ELEVATOR CONTROL INSTALLATION



AILERON CONTROL INSTALLATION

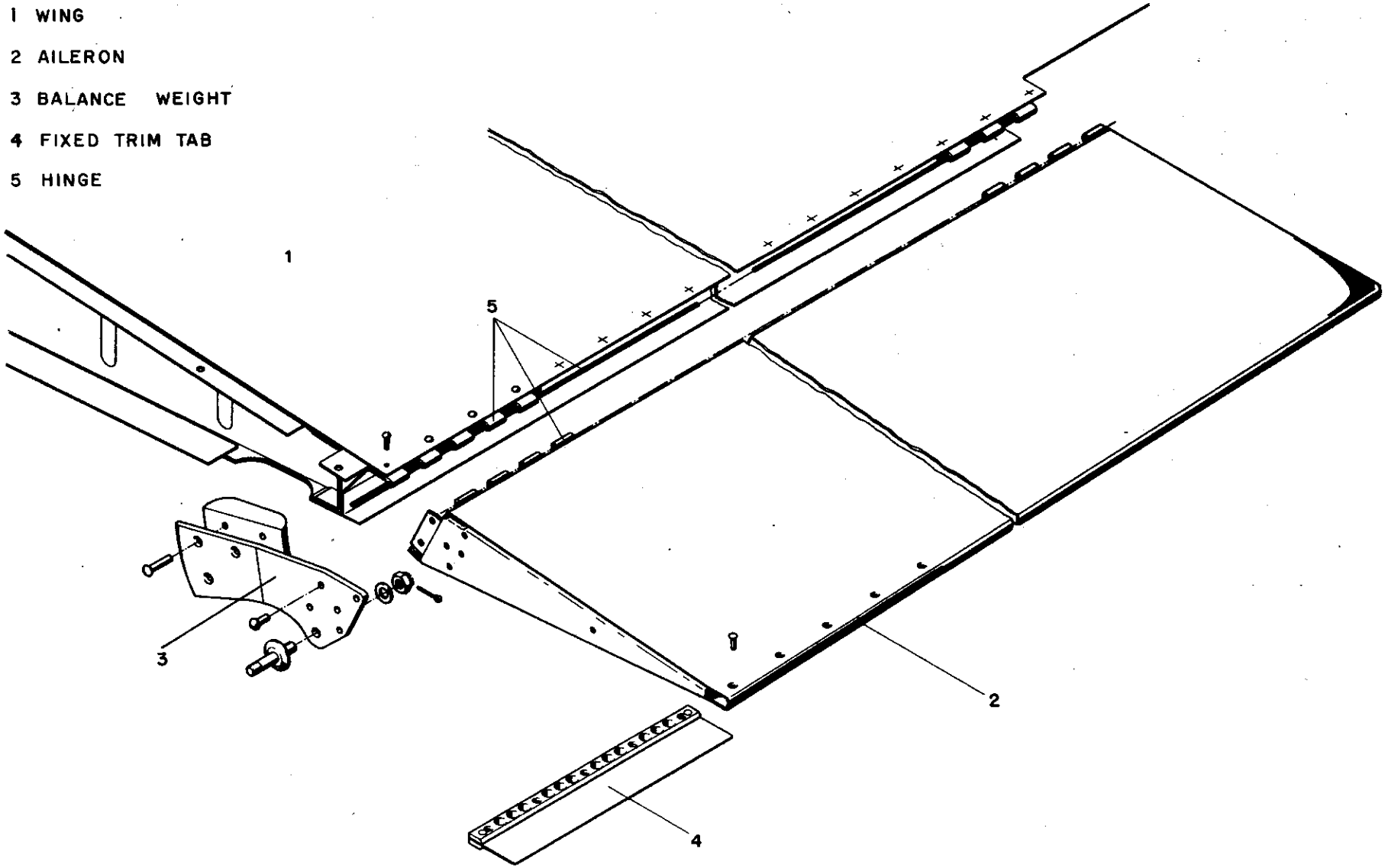
1 WING

2 AILERON

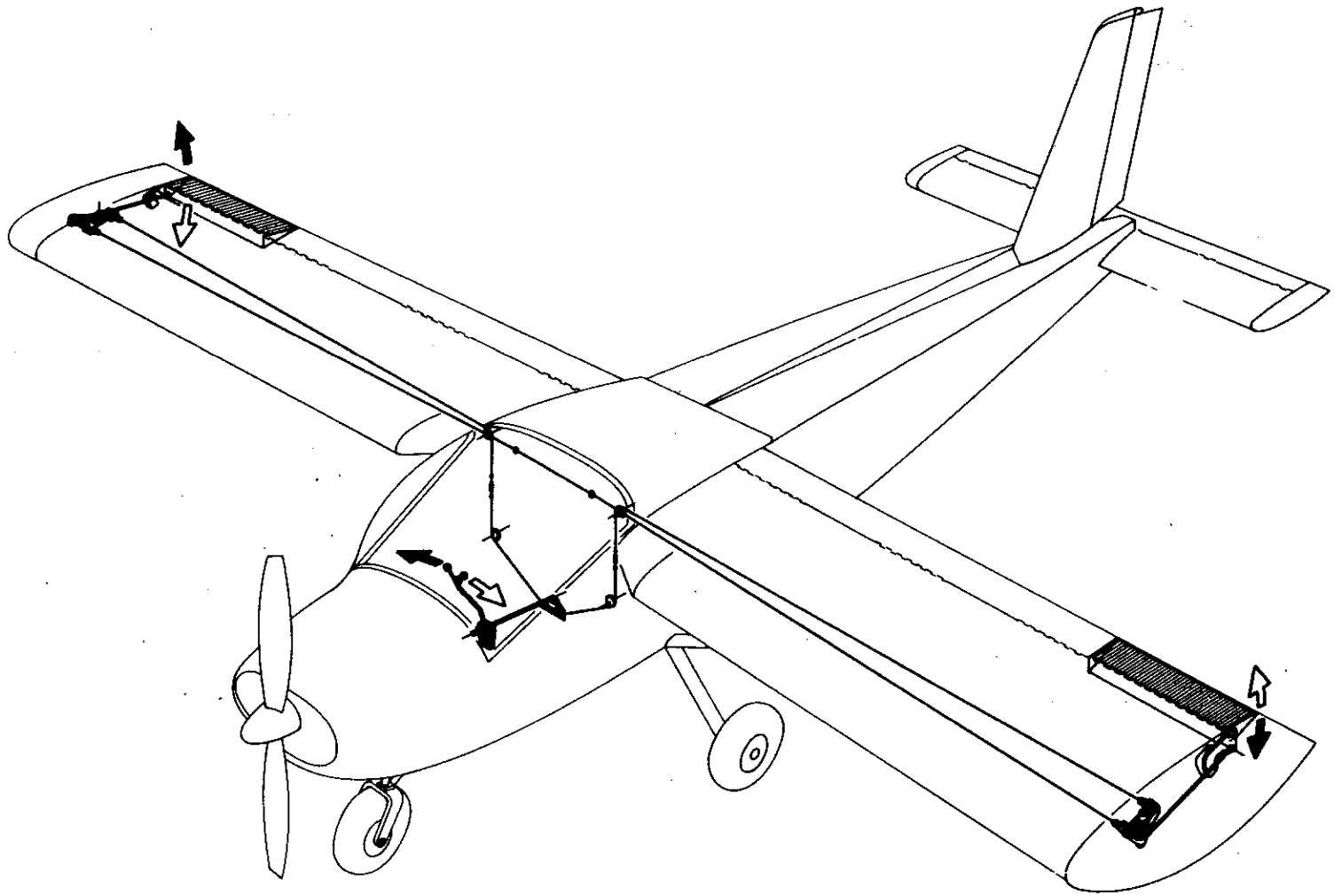
3 BALANCE WEIGHT

4 FIXED TRIM TAB

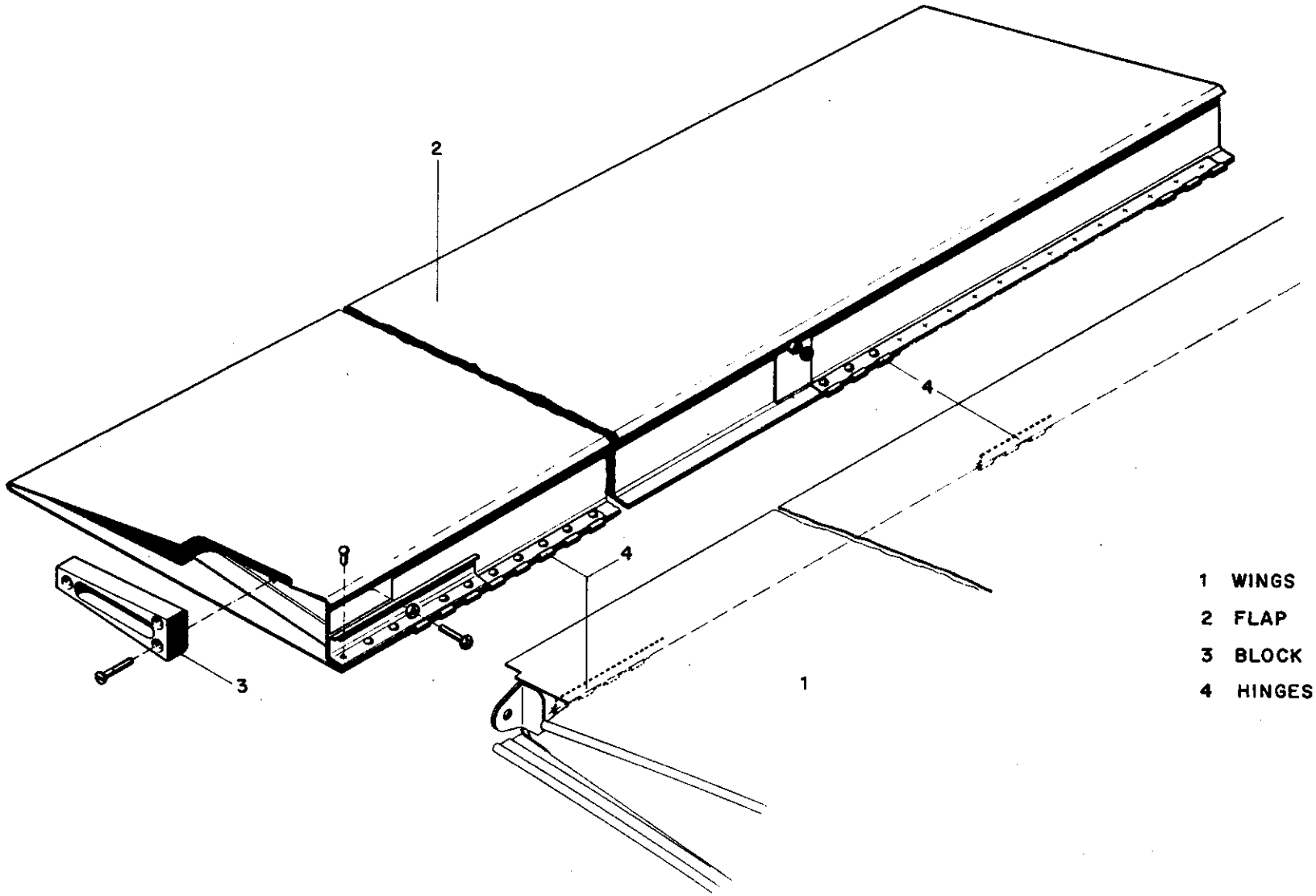
5 HINGE



AILERON INSTALLATION

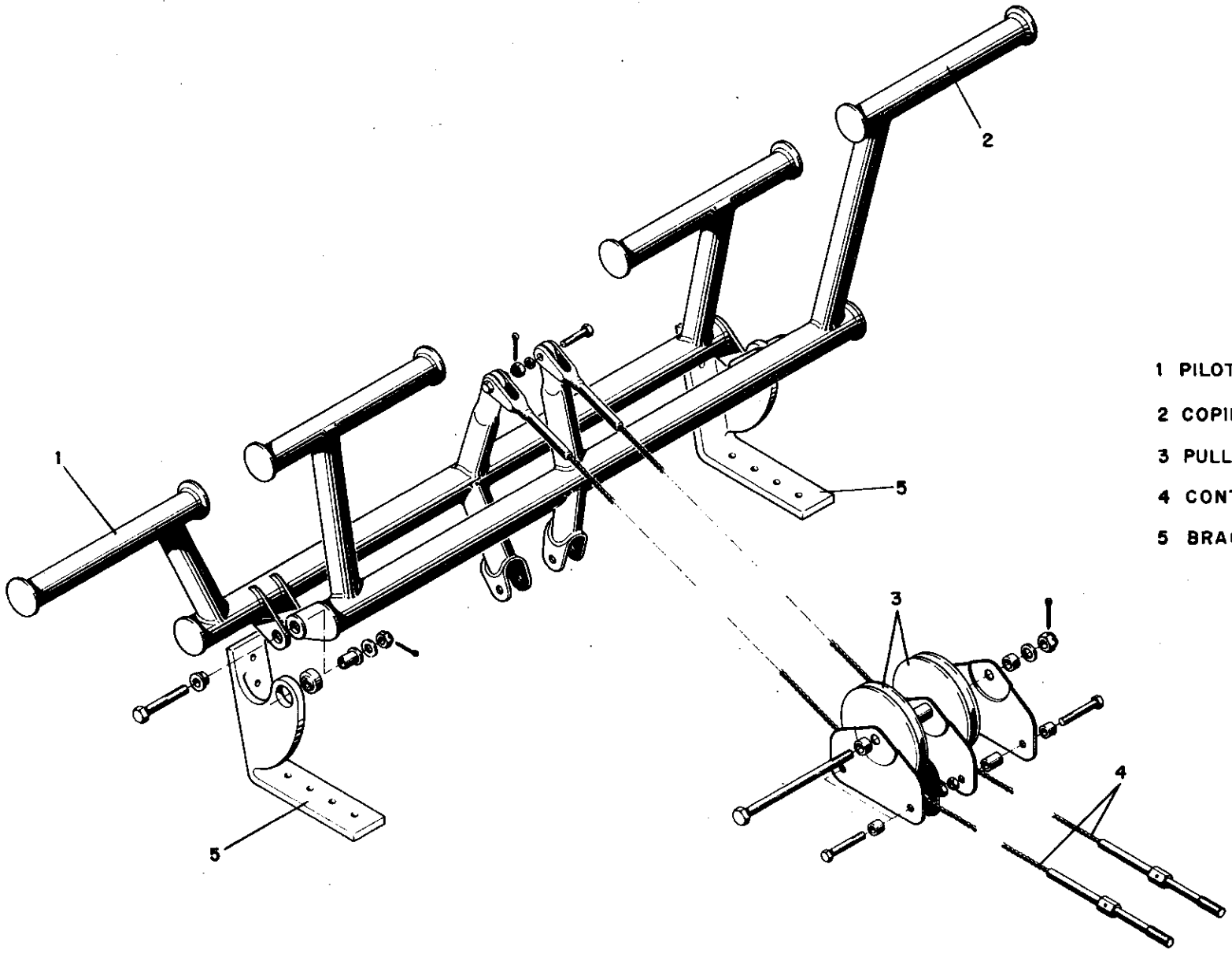


AILERON CONTROL SYSTEM



1 WINGS
2 FLAP
3 BLOCK
4 HINGES

FLAP INSTALLATION



1 PILOT'S RUDDER BAR

2 COPILOT'S RUDDER BAR

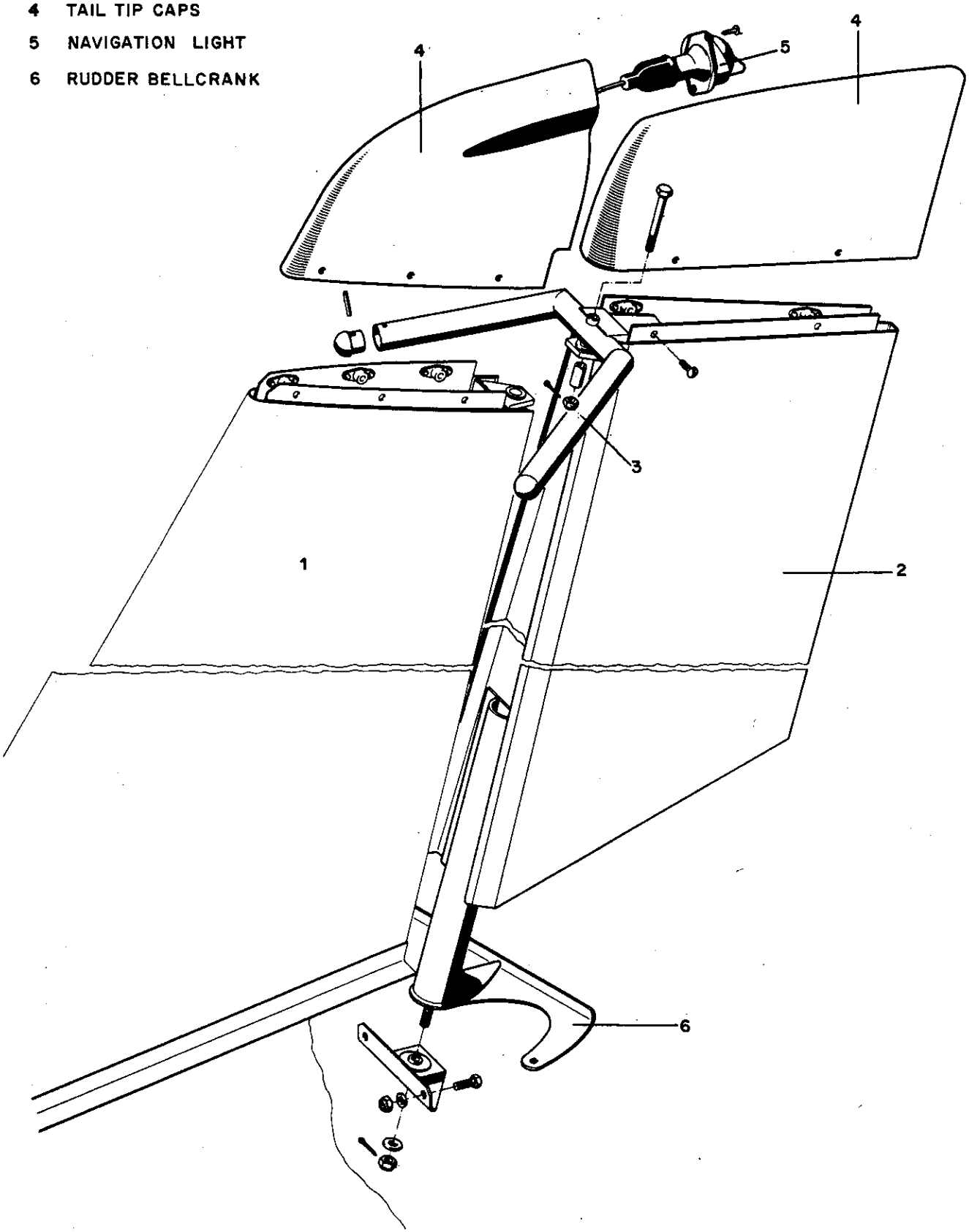
3 PULLEYS

4 CONTROL CABLES

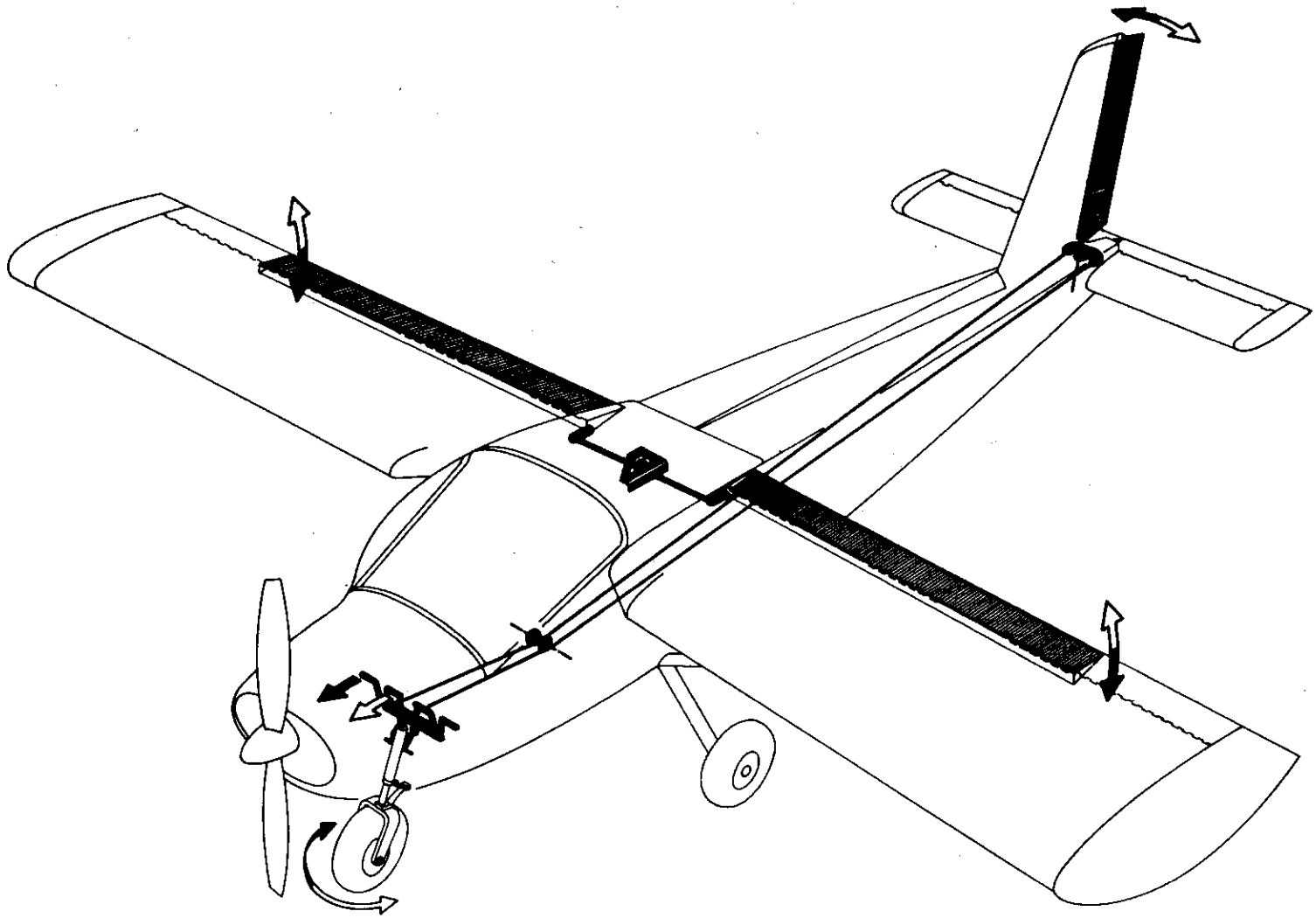
5 BRACKET

RUDDER CONTROL INSTALLATION

1 TAIL FIN
2 RUDDER
3 BALANCE WEIGHT
4 TAIL TIP CAPS
5 NAVIGATION LIGHT
6 RUDDER BELLCRANK

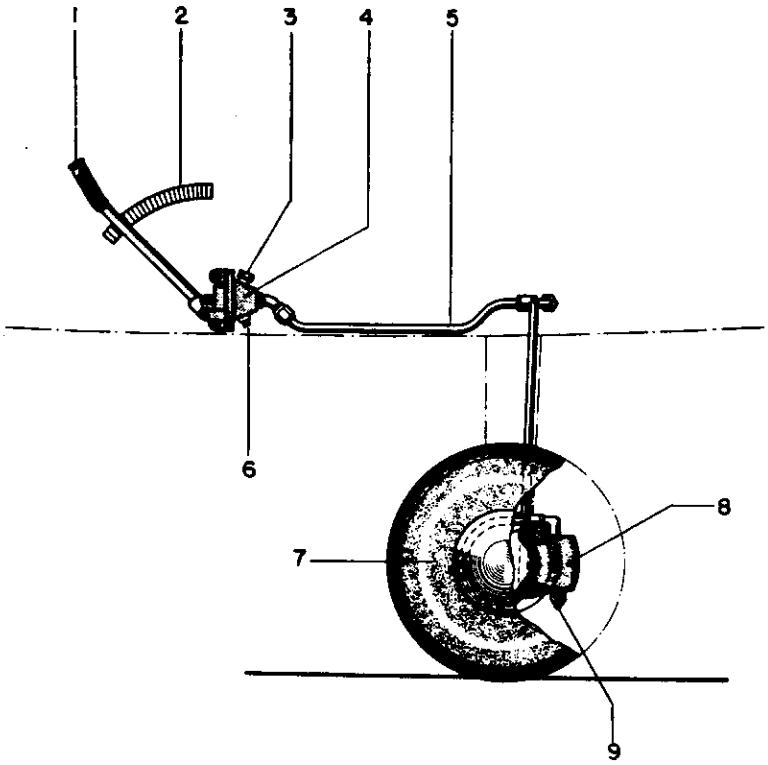


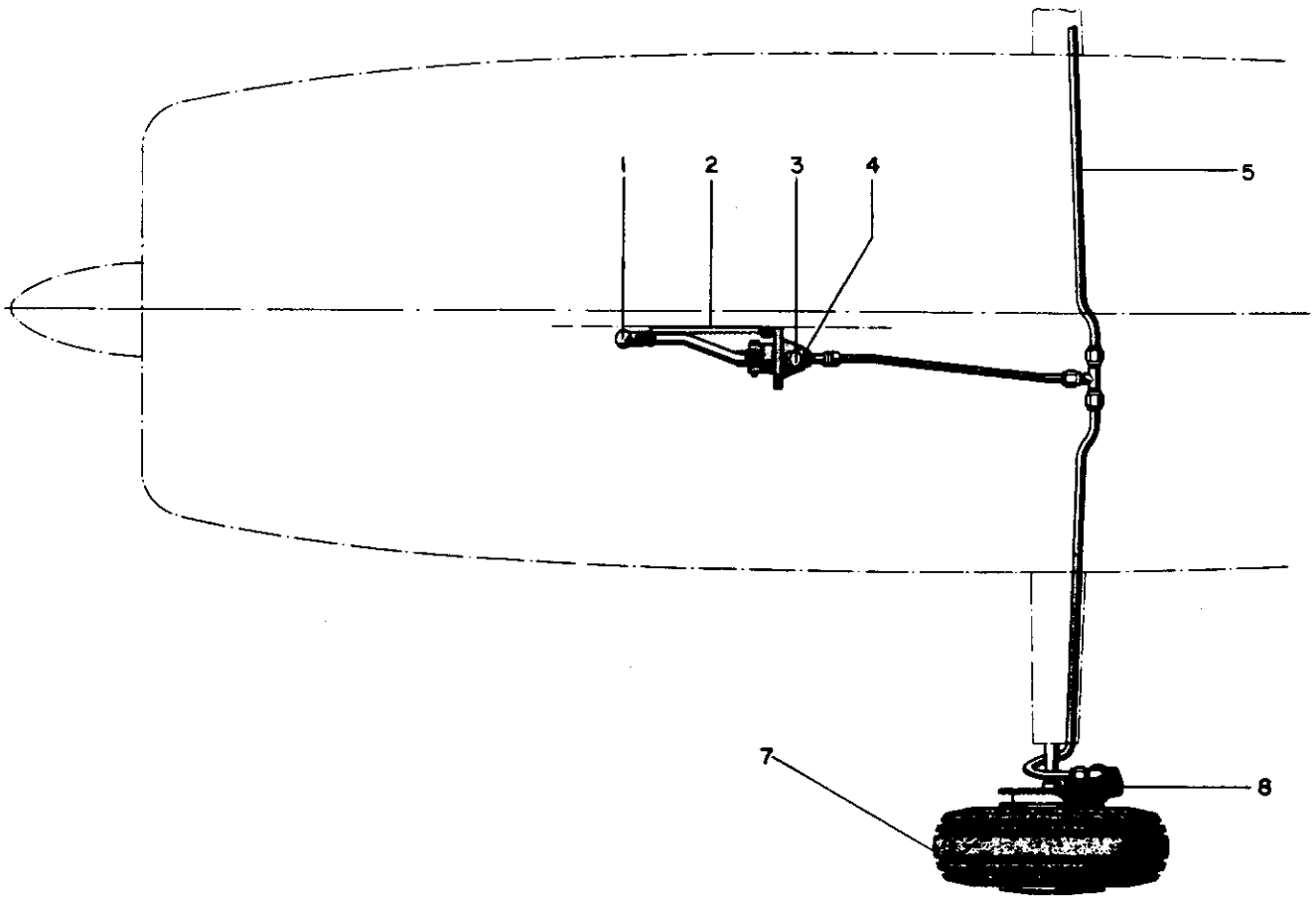
RUDDER INSTALLATION



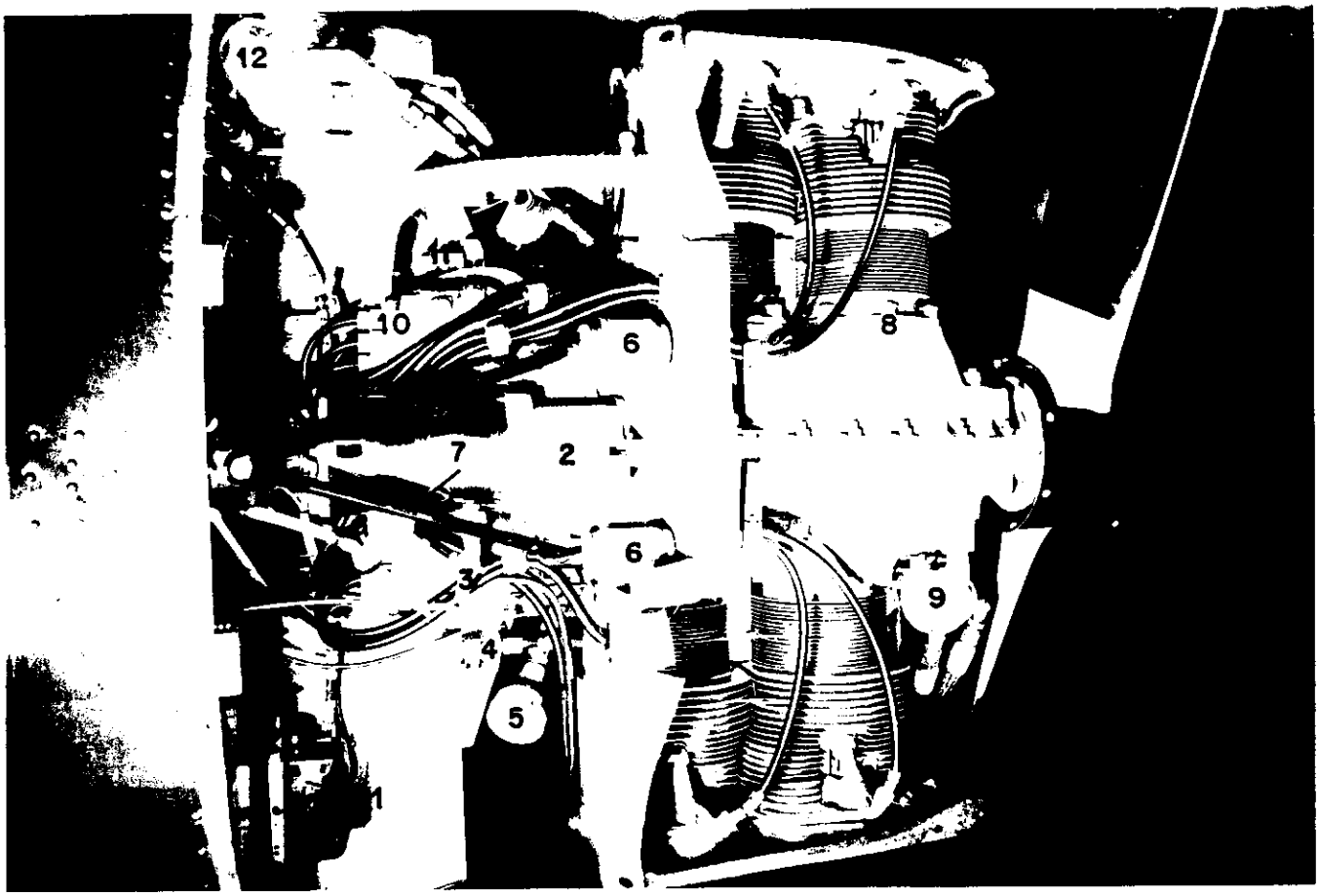
RUDDER AND FLAP CONTROL SYSTEM

1 BRAKE HANDLE
2 TOOTHED SEGMENT
3 FILLER CAP
4 BRAKE MASTER CYLINDER
5 BRAKE LINE
6 DRAIN PLUG
7 MAIN WHEEL
8 DISC BRAKE
9 VENT SCREW



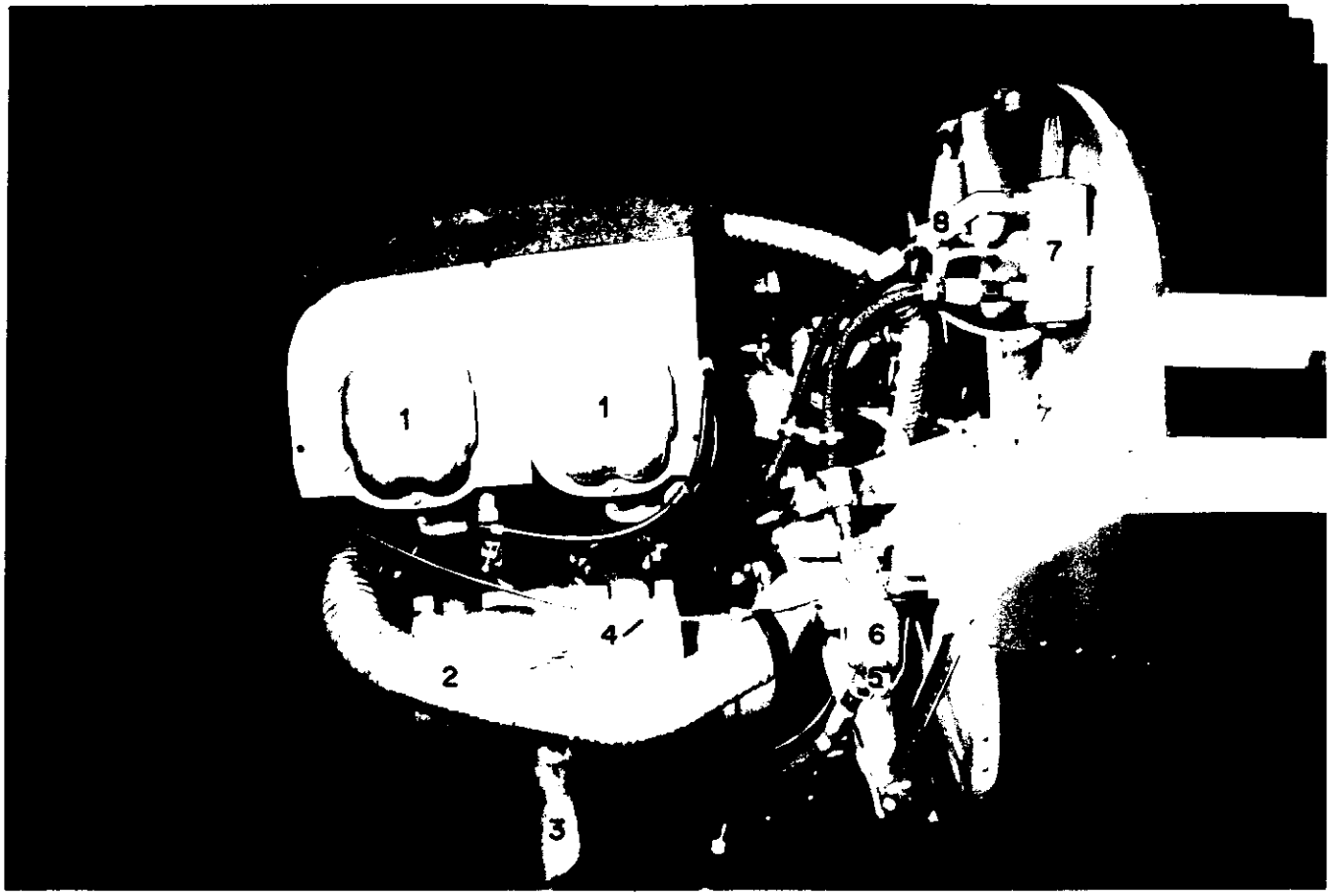


HYDRAULIC BRAKE SYSTEM



1 REGULATOR
2 STARTER
3 STARTER LEVER
4 FUEL PRESSURE TRANSMITTER
5 OIL FILLER NECK
6 ENGINE SUSPENSION
7 ENGINE MOUNTING
8 CYLINDER FLANGE NUTS
9 FUEL PUMP
10 MAGNETO, LEFT
11 OIL PRESSURE TRANSMITTER
12 EMERGENCY FUEL PUMP

ENGINE-TOP VIEW



1 ROCKER COVERS

2 AIR INLET TO CABIN

3 EXHAUST

4 BOWDEN CABLE, CABIN HEATING/VENTILATION

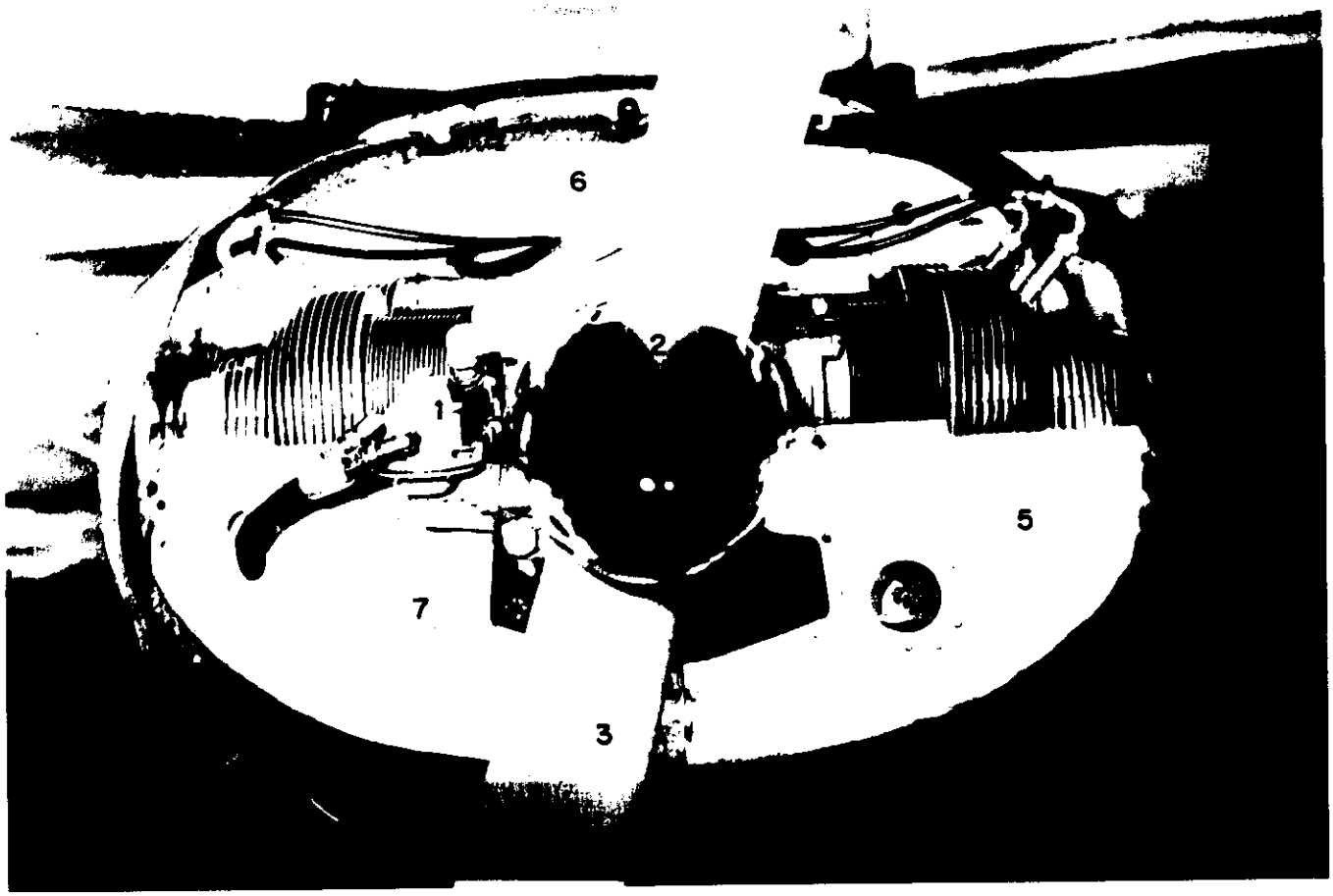
5 FUEL DRAIN VALVE

6 FUEL FILTER

7 FUEL EMERGENCY PUMP

8 NON-RETURN VALVE

ENGINE - LEFT SIDE VIEW



1 FUEL PUMP

2 SPINNER

3 PROPELLER

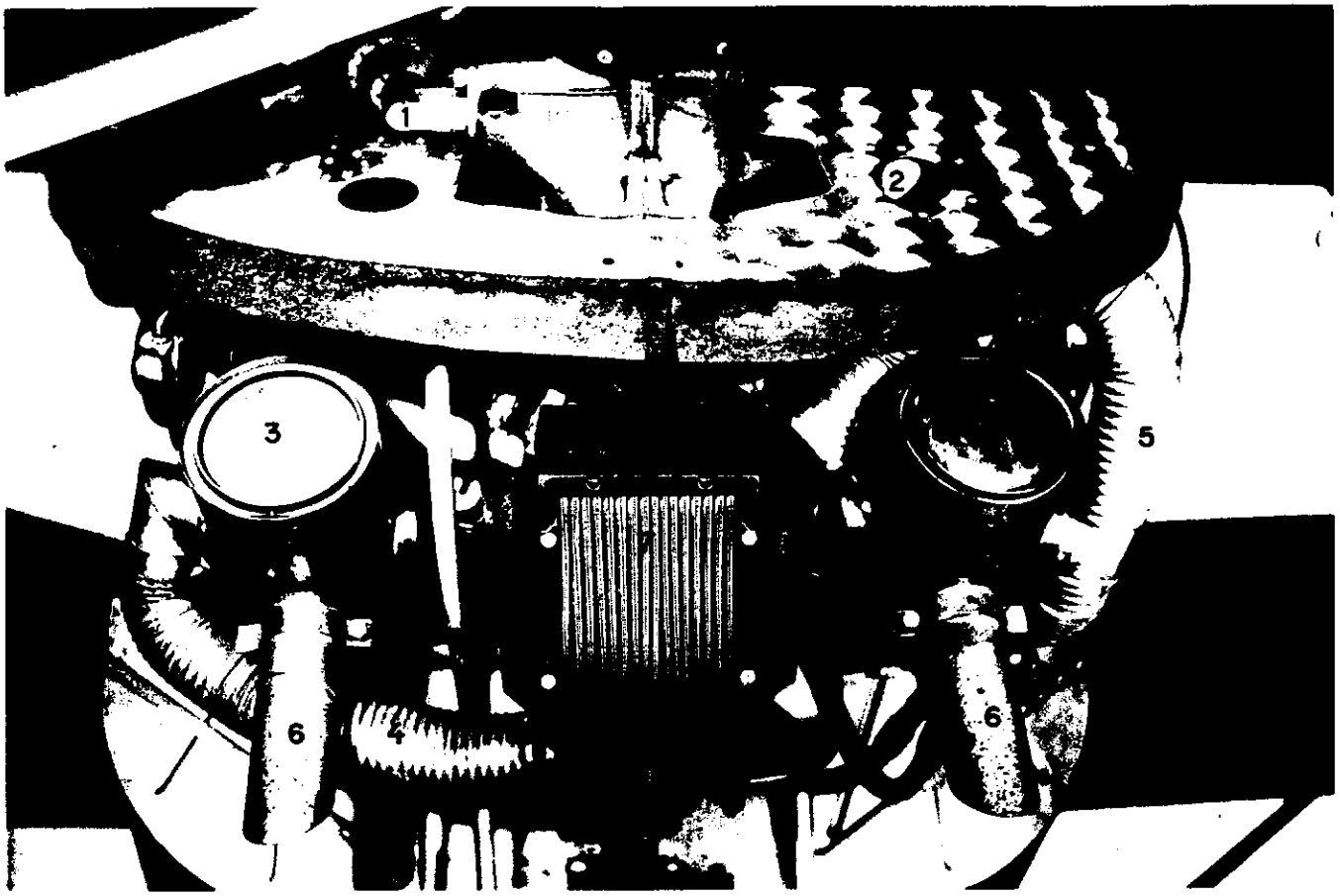
4 AIR INTAKE - CABIN VENTILATION

5 COOLING BAFFLE

6 FIREWALL

7 AIR INTAKE, OIL SUMP COOLING SYSTEM

ENGINE - FRONT VIEW



1 FUEL PUMP

2 CABIN AIR INTAKE

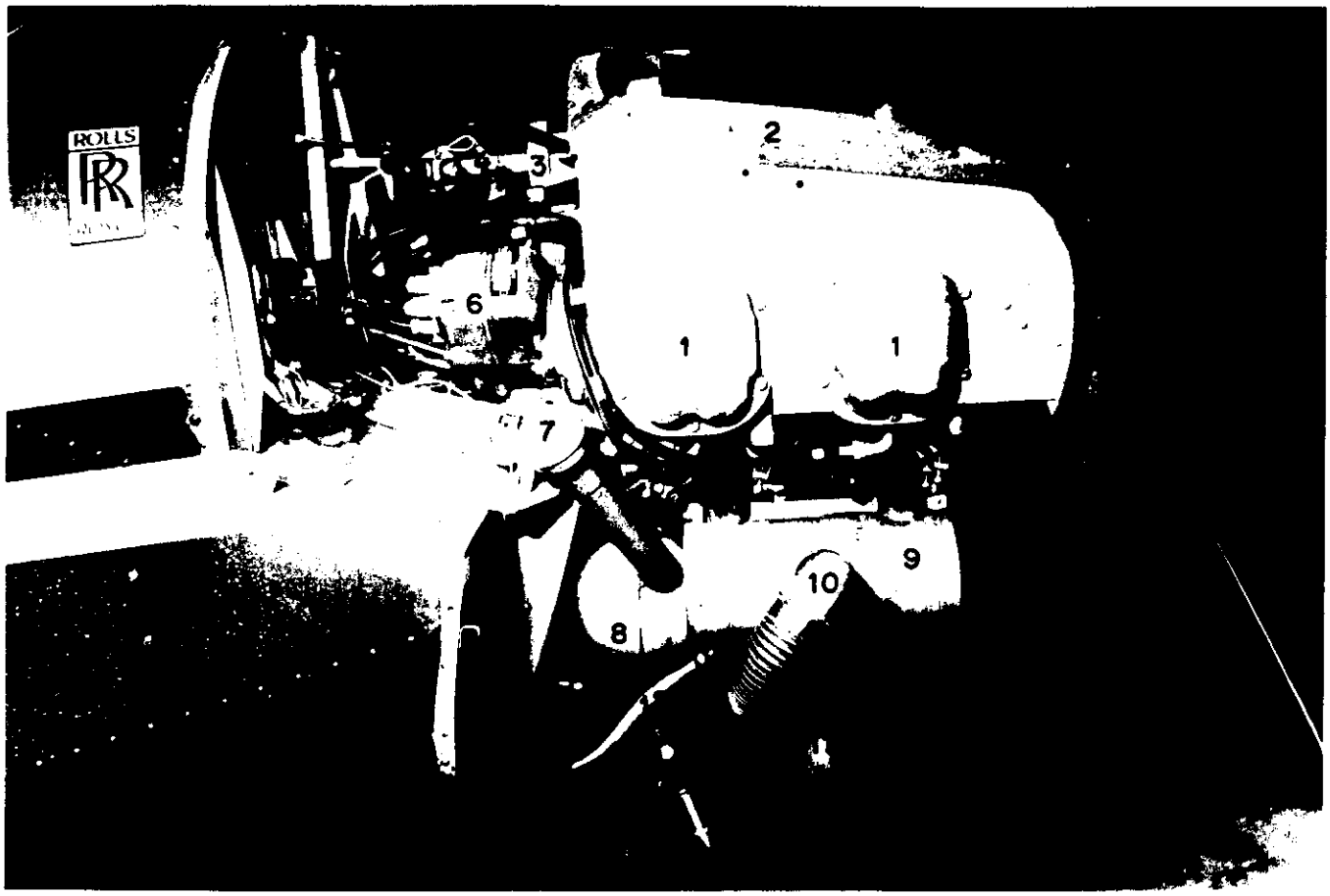
3 EXHAUST MANIFOLD

4 CARBURETTER AIR HEAT DUCT

5 COOL/WARM AIR DUCT FOR CABIN

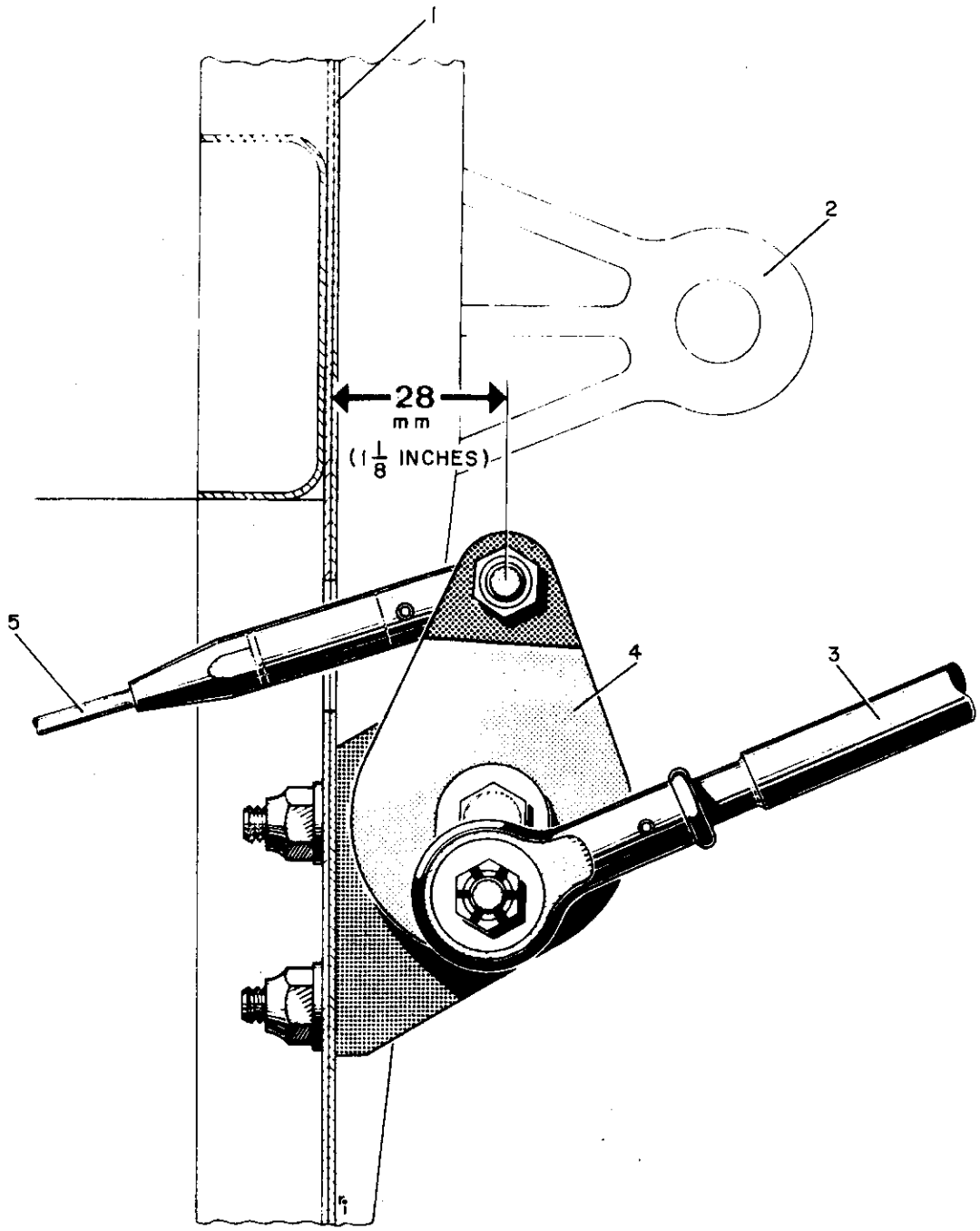
6 EXHAUST

ENGINE - LOWER FRONT VIEW



1 ROCKER COVERS
2 FELT PACKING
3 STARTER
4 STARTER LEVER
5 REGULATOR
6 MAGNETO, RIGHT
7 OIL FILLER NECK/DIP STICK
8 SUMP
9 EXHAUST MANIFOLD
10 CARBURETTER AIR HEAT DUCT
11 EXHAUST
12 CRANKCASE BREATHER PIPE

ENGINE - RIGHT SIDE VIEW



1 FRAME NO.9

2 ELEVATOR BEARING

3 PUSHROD TO THE TRIM FLAP

4 SHIFT LEVER

5 WIRE LINE FROM THE TRIM LEVER

ALIGNMENT OF TRIM CONTROL