SERVICE AND MAINTENANCE

MANUAL

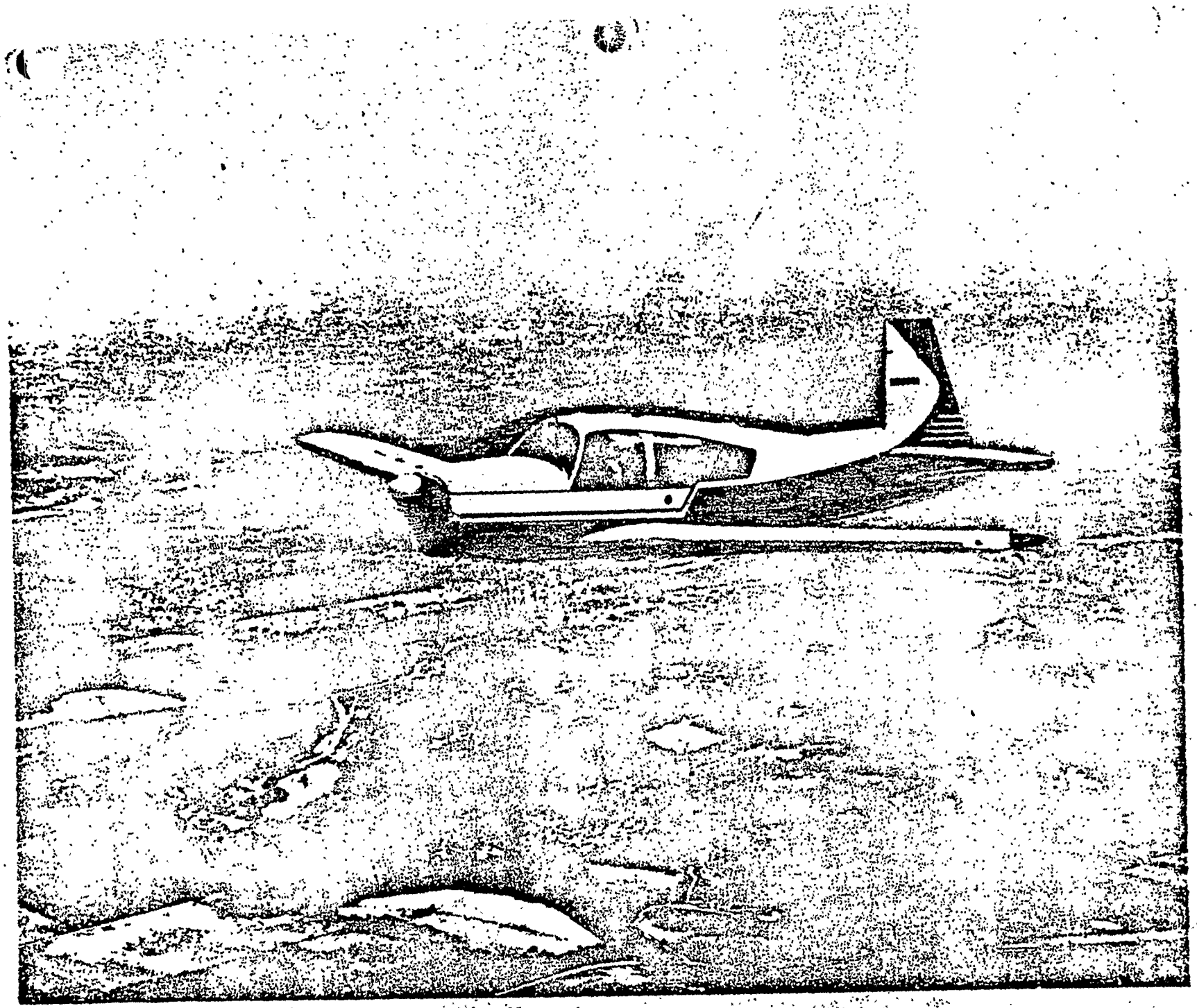
M 20 B

MOONEY AIRCRAFT, INC.

LOUIS SCHREINER FIELD

KERRVILLE, TEXAS

15 JUNE 1961



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Section 1

INTRODUCTION

A. GENERAL

This manual contains service and maintenance information for the **MOONEY M 20B** Aircraft which was designed and manufactured as a high performance, low maintenance, versatile aircraft for the personal and business aviation field.

B. SCOPE OF THIS MANUAL

Sections two and ten comprise the service part of this handbook, whereas the remaining sections comprise the maintenance instructions. The service instructions include ground handling, servicing, and periodic inspections. The maintenance instructions for each system include trouble-shooting, removal and installation of components, corrective maintenance and testing; each major system of the aircraft is covered in a separate section. Only qualified personnel should perform the operations described in this manual.

The description of the aircraft included in this section is limited to general information. Refer to the "Owners Operating Manual" for a more detailed description of the aircraft. Table 1 lists the leading particulars and principal dimensions.

Table 1 LEADING PARTICULARS AND PRINCIPAL DIMENSIONS

1. ENGINE

Model	0-360-AID
Type Certificate	286
Rated Horsepower	180
Rated Speed, rpm	2700 rpm
Cruise speed (Economy)	2350 rpm
Cruise speed (performance)	2450 rpm
Fuel consumption (economy cruise)	9 gph
Oil Consumption (performance cruise)	0.80 qt.
Propeller drive ratio	1.1
Propeller shaft rotation	Clockwise
Bore	5.125 in.
Stroke	4.375 in.
Displacement	361.0 cubic in.
Compression Ratio	8.50:1
Dry weight (with starter & generator)	286
Height	24.59 in.
Width	33.57 in.
Length	29.81 in.
Oil, SAE numbers:	
above 40° F (4.4° C)	SAE 50
Between 40° F (4.4°C) and 10° F (-12.2° C)	SAE 30
Below 10° F (-12.2° C)	SAE 20
Oil Sump Capacity	8 qts.
Fuel, Aviation grade (minimum)	91-96
Carburetor, Marvel-Schebler	MA 4-5
Magneto, Bendix Scintilla (2)	S4LN-204 (Right) S4LN-200 (Left)
Magneto Timing	25 degrees BTC
Magneto Point Setting	.018 ± .006
Spark Plug Gap Setting (Shielded)	.015 to .018
Tachometer drive, ratio to crankshaft	0.5:1
Firing order	1-3-2-4
Tachometer drive rotation	Clockwise
Starter drive, ratio to crankshaft	13.55:1
Starter drive rotation	Counterclockwise
Starter, Delco-Remy	12V 1109689
Generator drive, ratio to crankshaft	1.91:1
Generator drive rotation	Clockwise
Generator, Delco-Remy	12V 50 Amp 1101915
Generator voltage regulator, Delco Remy	1119224
A-N Vacuum Pump Drive, ratio to crankshaft	1.30:1
A-N Vacuum Pump Drive Rotation	Counterclockwise
Propeller governor drive	AN 20010 type XX
Fuel Pump drive	Plunger

2. OVERALL

Wing Span	35 ft. 0 in.
Length	23 ft. 2 in.
Height	8 ft. 4½ in.
Clearance, Propeller tips	10¼ in. Approx.

Table 1 LEADING PARTICULARS AND PRINCIPAL DIMENSIONS

3. CONTROL SURFACES

Aileron Travel	Up	12½° to 17°
	Down	8° ± 1°
	Neutral or Static	0° to 2° Down
Flap Travel	Full Down	21½° ± 1°
	Intermediate Down	11° ± 1°
	Neutral or Up	0° ± 1°
Elevator Travel	Up	24° ± 1°
	Down	10½° ± 1°
	Trim Full Nose Up	-18° to -20°
Rudder	Right	18° ± 1°
	Left	18° ± 1°

4. LANDING GEAR

Type	Manually Retracted
Thread	9 feet ¾ inches
Main Wheel Type	Cleveland Air Products
Main Tire	6 Ply, 6:00 x 6
Main Tire Pressure	24 to 30 Pounds
Brake Type	Cleveland Hydraulic
Fluid Required	Hydraulic, 3580
Nose Wheel Type	Goodyear Products
Nose Tire	4 ply, 500x5
Nose Tire Pressure	24 to 30 Pounds

5. PROPELLER

Manufacturer	McCauley
Type	Constant Speed
Hub	2D36C14
Blade	78KM-4
Diameter	74 Inches
Control Governor	Woodward
Blade Angle, Low	12.7° ± .2°
Blade Angle, High	27.5° ± .5°

6. TANK CAPACITIES

Main Fuel Cells (2)	48 Gallons
Engine Oil Sump	8 Quarts

7. WINGS

Span	35 Feet 0 Inches
Length of Flap, Trailing Edge	10 Feet 8 Inches
Length of Airleron, Trailing Edge	5 Feet 3¼ Inches
Dihedral, Leading Edge	5° 30 Minutes
Incidence	2° 30 Minutes

LEADING PARTICULARS AND PRINCIPAL DIMENSIONS

8. EMPENNAGE

Vertical Fin Area	7.9 Square Feet
Rudder Area	5.01 Square Feet
Horizontal Stabilizer Area	21.5 Square Feet
Elevator Area	12.0 Square Feet

9. WING AREAS

Wings (total area less flaps and ailerons)	167 Square Feet
Total Aileron Area	11.2 Square Feet
Total Flap Area	17.2 Square Feet

DESCRIPTION

The ***MOONEY M 20B*** is a four place, low wing monoplane of metal construction. It is powered by a 180 horsepower Lycoming 0-360-AID engine and is equipped with an all metal McCauley constant speed propeller. Conventional type controls are provided with rudder pedals and control wheels. Entrance to the cabin is made through the cabin door located on the right side of the airplane. The front seat backs fold forward to allow passenger entry to the rear seats. The baggage compartment is aft of the rear seat and an outside baggage door is located aft of the cabin door. The baggage compartment is accessible from the rear seat during flight.

1. ENGINE

   The Lycoming 0-360-AID engine is rated at 180 HP at 2700 RPM and is mounted on dynafocal engine mounts to dynamically balance the engine during flight and to reduce the transmission of vibration to the cabin

2. WING

   The *Mooney M 20B* uses a laminar-flow wing. This wing reduces drag, improves aerodynamic efficiency over standard airfoils, and yet retains very docile slow-flight and stall characteristics.

3. FUSELAGE

   The fuselage tailcone section is of monocoque construction. Aluminum skin, dipped in zinc-chromate primer for corrosion protection, is riveted to heat-treated aluminum bulkheads to form the tail cone section. Extruded aluminum stringers add longitudinal strength to the tail cone.

4. EMPENNAGE

   The tail empennage is constructed on optically aligned jigs that insure uniformity and close tolerance fit for all parts.

5. IGNITION

   This engine utilizes the latest ignition system which gives quicker, easier starts and longer ignition life.

6. PROPELLER

   A 74 inch McCauley all metal constant speed propeller provides a low pitch setting for maximum take-off power and automatic pitch changing controlled by an engine mounted governor for maximum efficiency at cruising speeds.

7. MOVABLE CONTROL SURFACES AND FLIGHT CONTROLS

The ailerons, elevator, and rudder are of all metal construction. They are jig-built using hinges of machined extrusions. The control system requires very little maintenance, and provides superior control-feel, because torque tubes, rather than the conventional cable system, are used to actuate the controls.

8. BRAKE SYSTEM

The MOONEY M 20B uses Cleveland Disc-Type hydraulic brakes.

9. LANDING GEAR

The landing gear is unique in that it is manually retracted by the pilot. Gear-assist springs in the wings, aided by bungee-type springs in the fuselage, make the manual operation of the gear quite simple.

10. FUEL SYSTEM

The fuel system consists of 24 gallon fuel cells located in the front portion of each wing. These cells are formed by sealing off, through the use of a special sealing compound, a portion of the wing.

11. INSTRUMENT PANEL

The instrument panel has been scientifically designed to provide functional location of all flight, radio, and engine instrument groups.

12. HEATER AND DEFROSTER SYSTEM

Cabin heat is supplied by a heater muff which transmits air heated by conduction from the engine exhaust manifold.

13. VENTILATION SYSTEM

Four individual airline-type adjustable vents are located in the center of the cabin roof to provide fresh air for each passenger.

14. FORWARD VENT SYSTEM

Two vents under the instrument panel provide a second source of fresh air for the cabin.

SECTION

2

HANDLING AND SERVICING

SECTION II

HANDLING AND SERVICING

A. GENERAL

This section provides ground handling and servicing instructions.

B. ACCESS PROVISIONS

Figure 1 shows the location and identity of the access panels and plates that provide access for purposes of service and maintenance.

C. GROUND HANDLING

The following instructions are recommended to avoid damage to the airplane during ground operations. If improperly handled, extensive damage to the airplane and its equipment may result. The airplane may be taxied as required for normal maneuvers. Brakes or rudder pedals may be used for turning. If a towbar is used, one man may move the airplane providing it is on a fairly smooth level surface. Points where pushing the airplane are permitted are leading edge of the wing, wing tips, and the inboard position of the propeller blades adjacent to the propeller hub.

1. HOISTING

When it is desired to raise the airplane off the ground to check operations of the landing gear, it is suggested it be done in the following manner. By using jack points provided, outboard of each main gear, it is possible to use standard aircraft jacks to raise the main gear off the ground. By using a rope sling and chain hoist it is possible to raise the nose gear clear of the ground and then the retraction mechanism can be checked and serviced in the usual manner. (See Figure 2).

2. LEVELING

Longitudinal leveling is determined by placing a spirit level on the door sill parallel to the thrust line (Fig. 3). Adjustments may be made by increasing or decreasing air pressure in the nose wheel tire when the airplane is on the ground or on a set of scales for weighing.

3. WEIGHING

Position a scale in front of each of the three wheels. Place a ramp on each scale and tow the aircraft up onto the scales. Remove the ramps and proceed to weigh the aircraft. (Fig. 4).

4. MOORING

When mooring the *Mooney M 20B*, the following method is recommended. Place chocks fore and aft of each main wheel. Stakes may then be driven in the ground outboard of each main gear, approximately three feet, and at the tail skid location. Tie down rings are provided, two feet outboard of each main gear, at the jack point. A tiedown ring is also provided at the tail skid location.

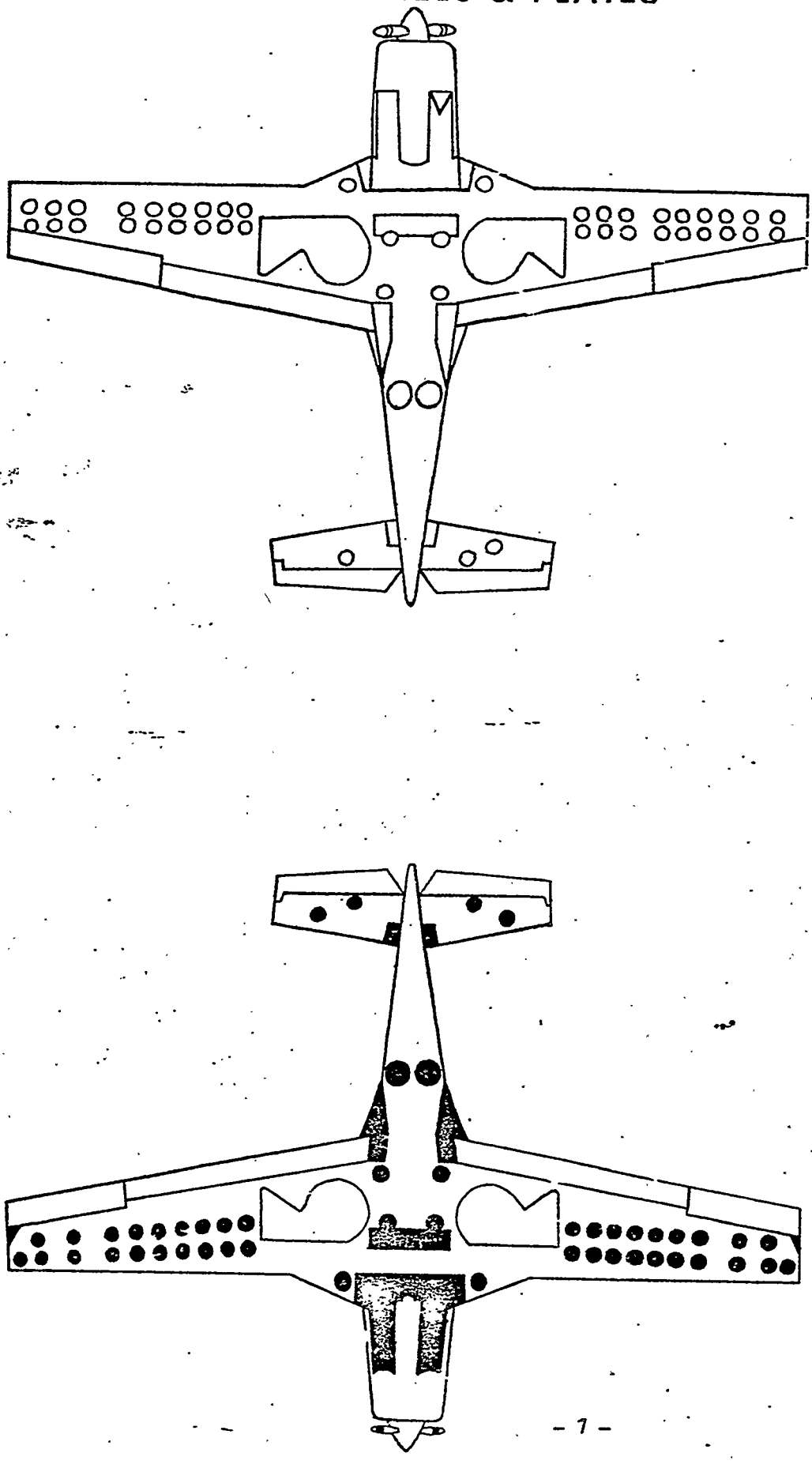
5. TOWING

A suitable towbar is provided as standard equipment with each airplane. The lower bar of the towbar is placed through the gear spindle upper crossmember (See Figure 5). Care must be exercised that the nose gear is not rotated past its normal swivel angles.

(Note: Check to see that park brake is off before towing airplane.)

Figure 1

ACCESS PANELS & PLATES



JACKING ARRANGEMENT

Figure 2

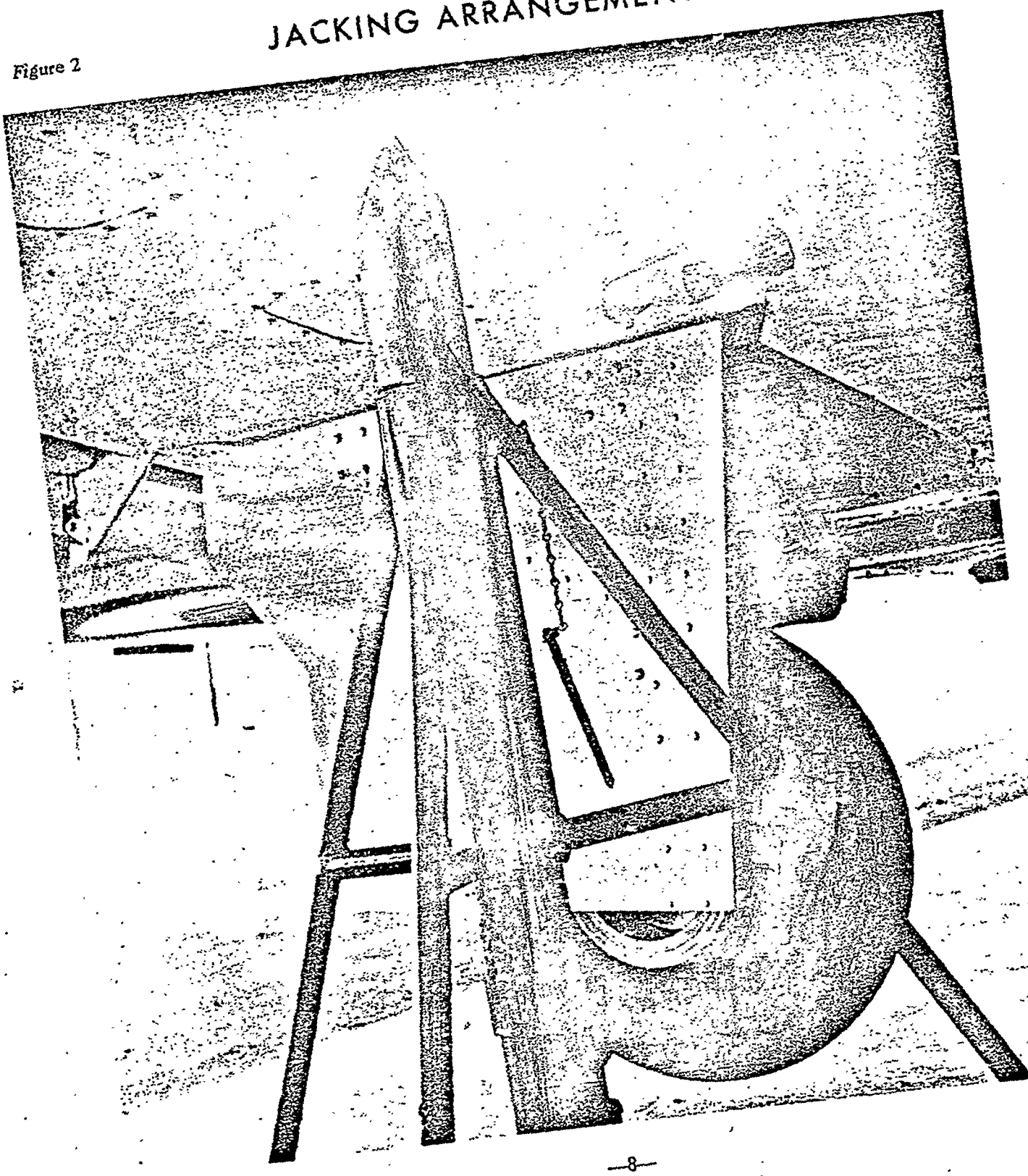


Figure 3

LEVELING THE AIRCRAFT

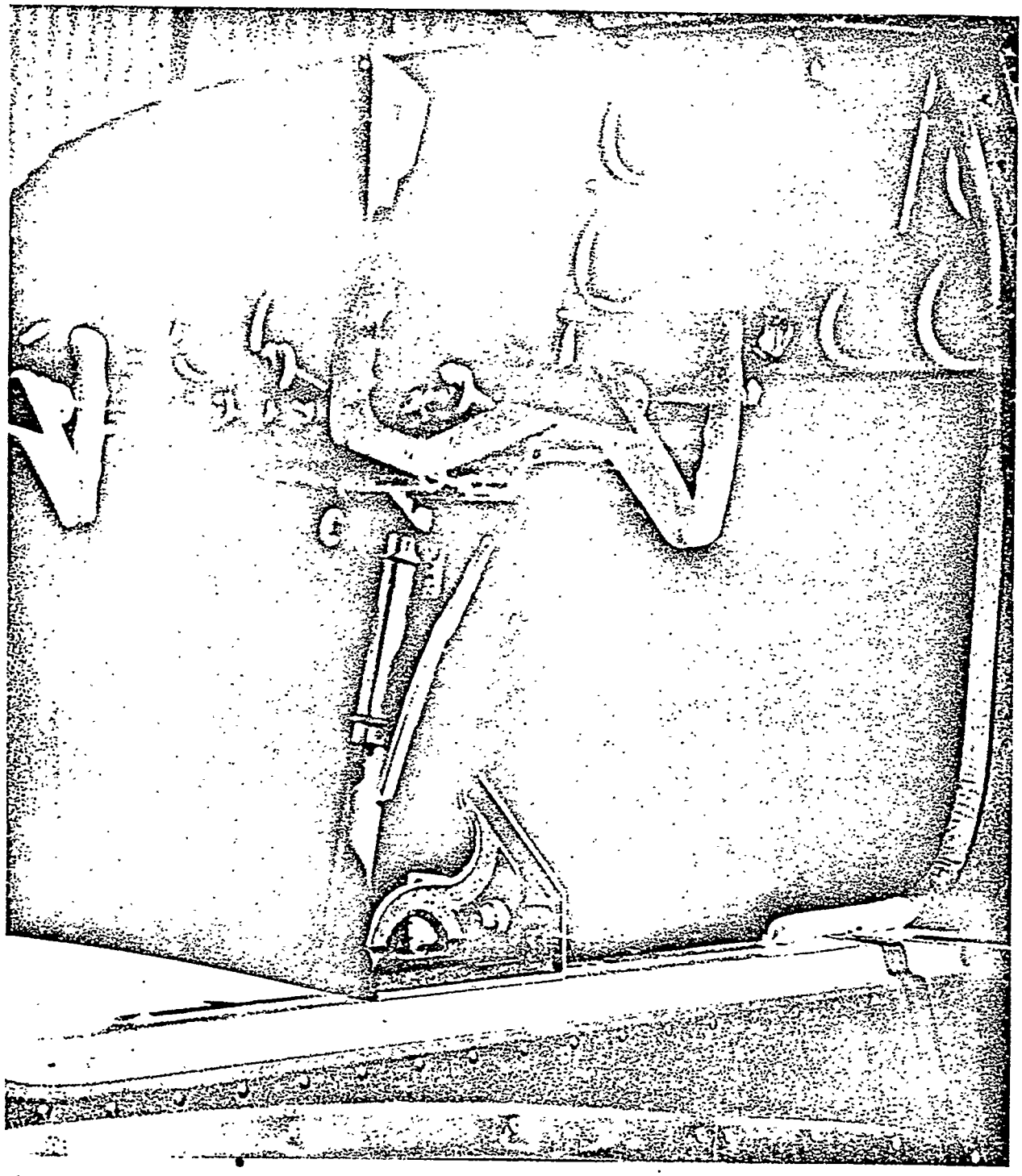


Figure 4

WEIGHING THE AIRCRAFT

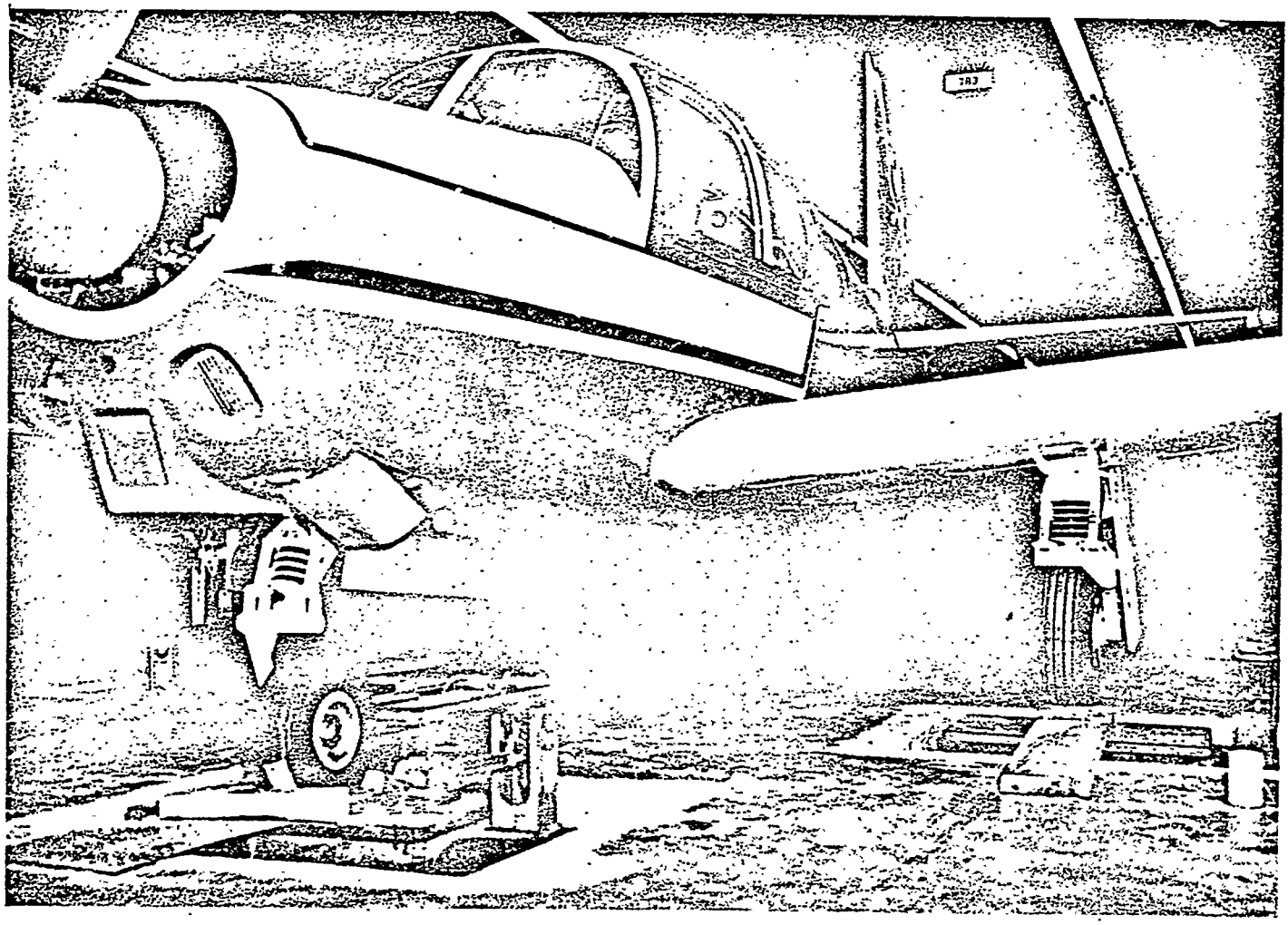
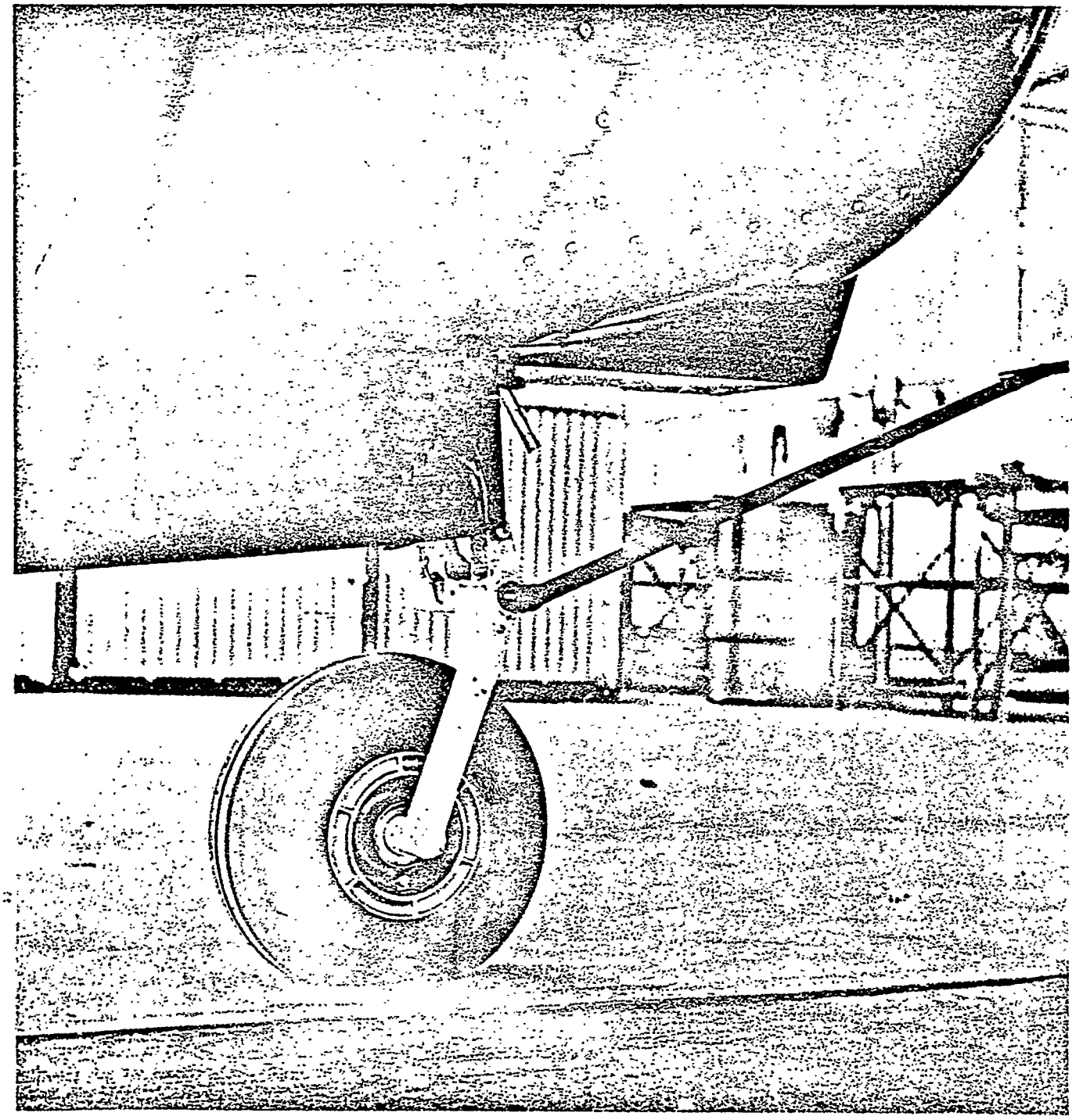


Figure 5

ATTACHMENT OF NOSE WHEEL STEERING BAR



D. SERVICING

1. FUEL SYSTEM

a. Filling The Fuel Cells.

Each wing intragal fuel cell has a capacity of 24 U. S. gallons and is accessible for filling by lifting a dzus fastened door and removing the expansion type gas cap. A scupper box drain is provided to drain off any gasoline spilled outside the filler neck opening. The fuel cell drain is located on the inboard corner under each wing. This is the lowest point of each fuel cell.

b. Fuel Strainer.

The fuel strainer (Figure 6) is located in the nosewheel well. It is equipped with an easy drain valve and should be checked for water or dirt accumulations and drained regularly.

c. Draining Fuel System.

Drain the fuel from the system by removing the flush drain from the bottom of the fuel selector valve. (Note: the fuel selector valve must be turned on the tank being drained).

2. LUBE OIL SYSTEM

a. Filling Engine Sump.

Fill the engine sump with the lubricating oil specified in Table 1.

b. Draining Engine Sump.

The engine sump can easily be drained by means of the oil quick drain that is installed in each *Mooney M 20B* airplane as standard equipment.

3. BRAKE SYSTEM

a. Filling Brake Cylinder Reservoir.

The brake cylinder reservoir (Figure 7) must be filled with the brake fluid specified in Table 1. It should be checked at every 100 hour inspection and replenished when necessary. After initial installation, the Cleveland Disc Brakes require no adjustment whatever, during the service life of the brake lining. (Caution: Do not fill reservoir while parking brake is set.)

b. Draining the Brake System.

To drain the brake system, open the brake bleeder valve on the brake discs and slowly pump the brakes until all the fluid runs out. The brake system can be cleaned by flushing out with denatured alcohol.

E. LUBRICATION

Refer to the Lubrication Chart (Figure 8) for instructions regarding the location, time intervals, and types of lubricants used. Grease fittings are provided on the nose gear and the main gear. Bearings used in bell cranks, hinge points, and rod-ends are of the sealed type and do not require periodic lubrication. Avoid excessive application of lubricants. Excess lubricant on exterior surfaces of bearings tends to attract dirt and grit, and may lead to malfunction of the unit.

Where a reservoir is not provided around a bearing, apply the lubricant sparingly

Figure 6

FUEL STRAINER DRAIN

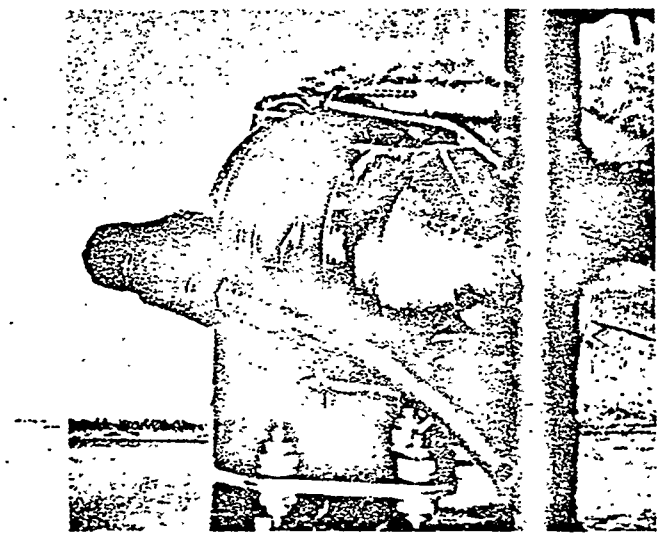


Figure 7 **BRAKE CYLINDER RESERVOIR**

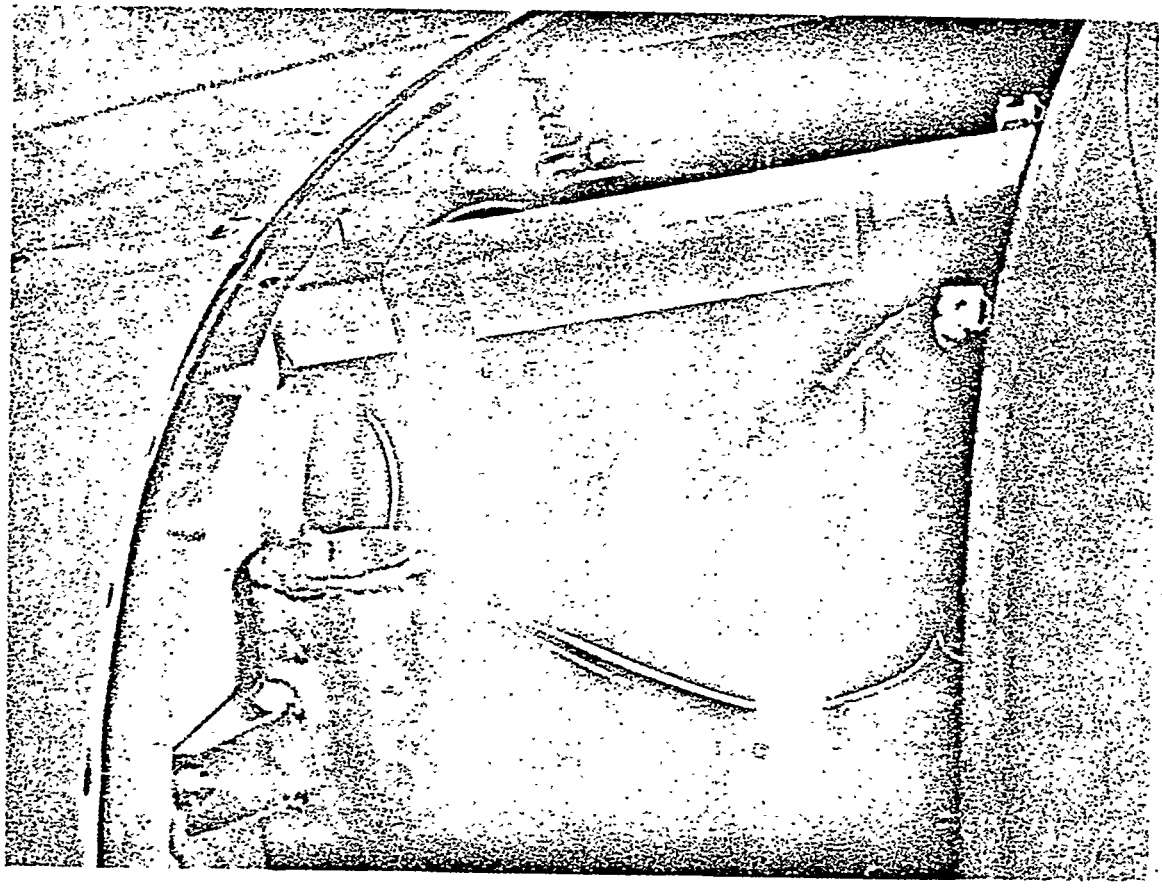


Figure 8 LUBRICATION CHART FOR MOONEY M 20B

HOURS

Trim system 250

Control Column 100

Brake reservoir, maintain fluid level indicated on the side of reservoir 50

Rudder control system.....100

Front seat adjustment.....100

Nose wheel steering 100

Starter bendix 25

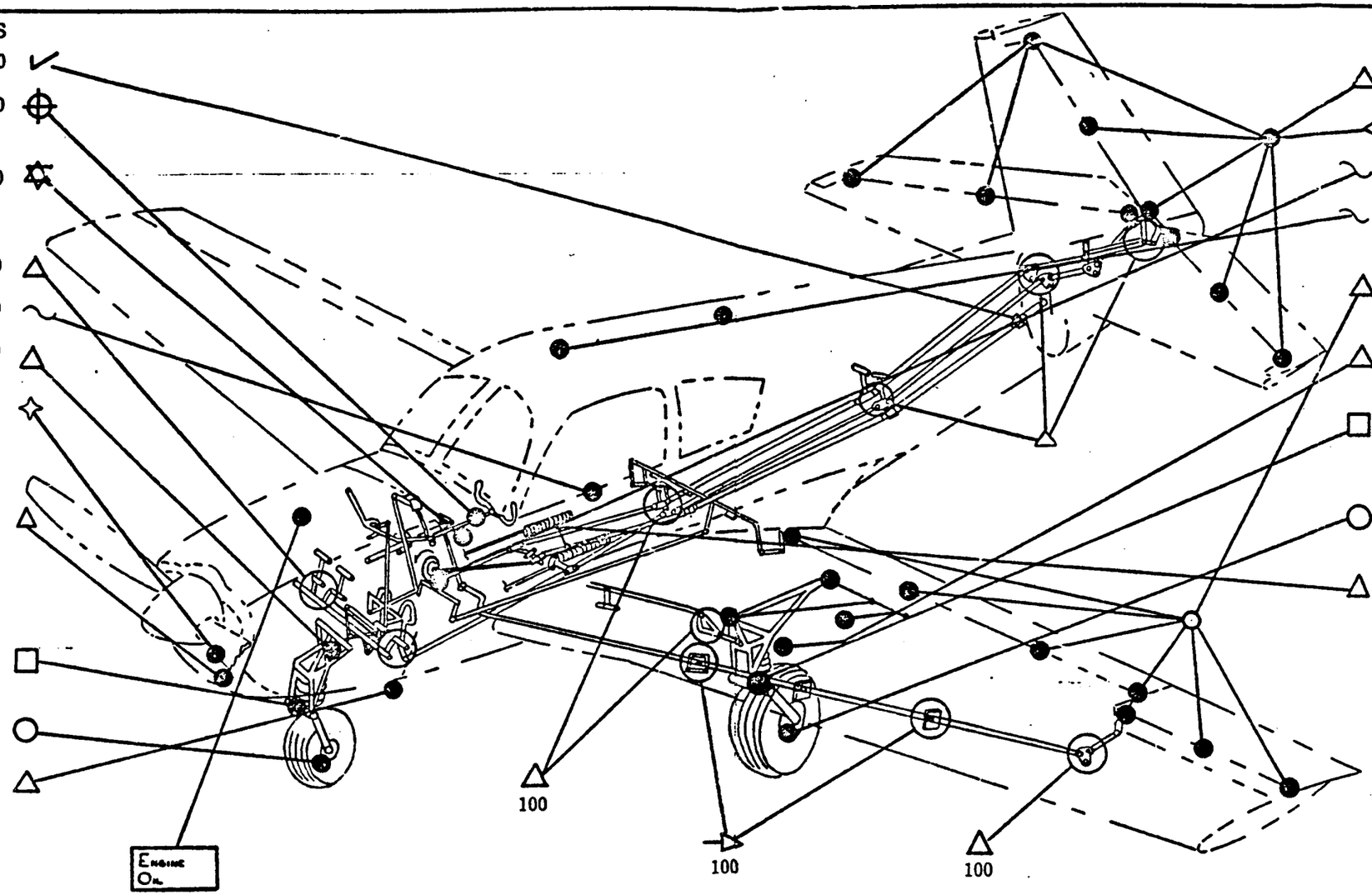
Carburetor air filter, use SAE-60 oil, to reoil..... 25

Propeller—See note 6 for McCauley propeller.

Nosegear grease fittings, 4 total 100

Nose wheel bearing.....100

Hinges—Nose wheel Door, 2 total.



HOURS

100 Rudder hinges and horn

100 Stabilizer hinges

100 Adjustment mechanism

100 Baggage door and main door and latches

100 Aileron and flap hinges, bellcrank right and left

100 Hinges—Main gear doors, 2 each

100 Main landing gear grease fittings right and left 5 each

100 Main wheel bearings right and left.

100 Landing gear retraction system

50 Engine oil tank, drain and refill. (Non-detergent) 8 qt.

NOTES

1. Fuel system — The following points require regular servicing.
   A. Fuel pump strainer—
   B. Carburetor screen—
   C. Filter bowl—
   D. Quick drain unit.
2. Miscellaneous — During routine maintenance checks, apply lubrication to miscellaneous linkages.
3. Do not use a hydraulic fluid with a castor oil or ester base.
4. Do not over-lubricate pedestal controls.
5. Battery — Check battery fluid level, and battery condition every 25 hours.
6. McCauley propellers are prelubricated and need no lubrication until disassembled.
7. Do not apply lubricant to rubber parts.
8. Remove all excess grease from grease fittings.

LEGEND

OIL—NON-DETERGENT

SAE 50 above 40° air temp.

SAE 30 above 10° and below 40° temp.

SAE 20 below 10° air temp.

LEGEND

△	MIL-L-7870	Oil—General Purpose low temp. lubrication
□	MIL-L-7711	Grease—lubrication—general purpose aircraft
○	MIL-L-3545	Grease—lubrication high temperature
✓	MIL-G-3278	Grease—aircraft and instruments
✡	MIL-O-5606	Hydraulic fluid (Red)
✧	Graphite and kerosene	
⊳	Graphite and MIL-G-3278 grease	
⊕	Powdered graphite	
~	Door Ease or equiv.	

and wipe off any excess. Remove wheel bearings from the wheel hub and clean thoroughly wtih a suitable solvent. When repacking with grease, be sure the lubricant enters the space between the rollers and the retainer ring. Do not pack the grease into the wheel hub.

Whenever specific instructions for lubrication of mechanisms requiring lubrication are not available, observe the following precautions:

1. Apply oil sparingly, never more than enough to coat the bearing surfaces.

2. Squeeze the magneto cam foller felts at regular inspection periods. If oil appears on the fingers, do not add oil. If the felt is dry, moisten with light oil. Be careful not to add too much oil, because the excess will be thrown off during operation and will cause pitting and burning of the magneto points.

The engine manufacturer does not recommend oils by brand names. Use a quality brand Aviation Grade Oil of the proper seasonal viscosity! However, it has been observed that the best overall results are obtained from non-detergent oils. The proper grades of oil are listed below.

Figure 9 RECOMMENDED LUBRICATION OILS

Aviation Grade Oil	Average Ambient Air Temperature	Oil Inlet Temperatures	
		Desired	Maximum
SAE 50	Above 40° F (4° C)	180 F (82° C)	245° F (118° C)
SAE 30	Below 40° F (4° C)	170° F (77° C)	220° F (104° C)
SAE 20	Below 10° F (-12° C)	160° F (71° C)	200° F (93° C)

SECTION

3

POWER PLANT

SECTION III

POWER PLANT

A. GENERAL

The *MOONEY M 20B* is powered by the famous Lycoming 0-360-AID, high compression engine. It is rated at 180 horsepower at 2700 RPM and uses dynafocal engine mounts to dynamically balance the engine in flight and to reduce transmission of vibration to the cabin. It is the newest version of this type engine and incorporates the following improvements:

1. New-type cylinders which have tapered bores and are nitrided for extra hardness.
2. New pistons, compression and oil-scraper rings for longer engine life.
3. 180 degree oil temperature thermostat to provide optimum oil temperature in all conditions of flight and to give better vaporization of the fuel-air mixture in the intake manifold.

This engine utilizes the latest ignition system which gives quicker, easier starts and longer ignition life. It consists of the following:

1. Two bendix magnetos, the left magneto being equipped with a set of retard breaker points.
2. A starting vibrator, located on the upper fire wall, and which furnishes a shower of sparks for starting.
3. A switch which combines both ignition and starting functions.
4. Shielded spark plugs and ignition harnesses to suppress radio noises.

The Lycoming 0-360-AID engine has an 8.5 to 1 compression ratio and requires 91/96 octane fuel. It also uses a McCauley 2D36C14 Constant Speed Propeller. For further detailed information on the engine or the propeller refer to the Manufacturer's applicable publications.

B. TROUBLESHOOTING

Troubles peculiar to the Mooney Power Plant are listed in Table 2 along with their probable causes and suggested remedies. When troubleshooting this engine, we recommend that the magneto primary circuit be grounded before performing checks on the ignition system.

Table 2 ENGINE TROUBLESHOOTING

TROUBLE	CAUSE	REMEDY
Failure of engine to start.	Lack of Fuel	Check fuel systems for leaks. Fill fuel tank. Clean dirty lines, strainers, or fuel cocks.
	Underpriming	Prime with 2 or 3 strokes of throttle.
	Overpriming	Open throttle and unload engine by turning in counterclockwise direction.
	Incorrect throttle setting.	Open throttle to one tenth of its range.
	Defective Spark Plugs.	Clean and adjust or replace.
	Defective ignition wire.	Check with electric tester and replace any defective wires.
	Defective Battery.	Replace with charged battery.
	Improper operation of breaker points.	Check internal magneto breaker point timing of magneto.
	Water in Carburetor.	Drain Carburetor and Fuel Line.
	Internal Failure.	Check oil sump strainer for metal particles. If found, complete overhaul of engine may be indicated.
Failure of engine to idle properly.	Incorrect carburetor idle adjustment.	Adjust throttle stop to obtain correct idle.
	Idle mixture.	Adjust Mixture — refer to adjustments of this section.
	Leak in the induction system.	Tighten all connections in the induction system. Replace any parts that are defective
	Low cylinder compression.	Check condition of piston rings and valve seats.
	Faulty ignition system.	Check entire ignition system.
Low power and uneven running.	Mixture too rich; indicated by sluggish engine operation, red exhaust flame at night. Extreme cases indicated by black smoke from exhaust.	Readjustment of carburetor by authorized personnel is indicated.

ENGINE TROUBLESHOOTING *(Continued)*

TROUBLE	CAUSE	REMEDY
	Mixture too lean: indicated by overheating or back-firing	Check fuel lines for dirt or other restrictions. Check fuel supply.
	Leaks in induction system.	Tighten all connections. Replace defective parts.
	Defective Spark Plugs.	Clean or replace spark plugs.
	Poor Fuel.	Fill Tank with fuel of recommended grade.
	Magneto breaker points not working properly.	Clean points. Check internal timing of magnetos.
	Defective ignition wire.	Check wire with electeric tester. Replace defective wire.
	Improper ignition timing.	Check magnetos for timing and synchronization.
	Defective spark plug Terminal connectors.	Replace connectors on spark plug wire.
Failure of engine to develop full power.	Throttle lever out of adjustment.	Adjust throttle lever.
	Leak in induction system.	Tighten all connections, and replace defective parts.
	Restriction in carburetor air scoop.	Examine air scoop and remove restrictions.
	Improper fuel.	Fill tank with recommended fuel.
	Faulty ignition	Tighten all connections. Check system with tester. Check ignition timing.
Rough Engine.	Cracked engine mount.	Replace or repair mount.
	Unbalanced propeller.	Remove propeller and have it checked for balance.
	Defective mounting bushings.	Install new mounting bushings.
	Malfunctioning engine.	Check entire engine.
Low Oil Pressure.	Insufficient oil.	Check oil supply.
	Leak in suction line or pressure line.	Check gasket between accessory housing and crankcase.
	Dirty oil strainers.	Remove and clean oil strainers.

ENGINE TROUBLESHOOTING *(Continued)*

TROUBLE	CAUSE	REMEDY
	High oil temperature.	See "High Oil Temperature" in "trouble" column.
	Defective Pressure gage.	Replace gage.
	Stoppage in oil pump intake passage.	Check line for obstructions. Clean suction strainer.
High Oil Temperature.	Insufficient air cooling.	Check air inlet and outlet for deformation or obstruction.
	Insufficient oil supply.	Fill oil sump to proper level.
	Low grade of oil.	Replace with oil conforming to specifications.
	Clogged oil lines or strainers.	Remove and clean oil strainers.
	Excessive blow-by.	Usually caused by worn or stuck rings. Complete overhaul required.
	Failing or failed bearing.	Examine sump for metal particle. If found, overhaul of engine is indicated.
	Improper engine operation.	Check entire engine.
	Defective Temperature gage.	Replace gage.
Excessive oil consumption.	Low grade of oil.	Fill tank with oil conforming to specifications
	Failed or failing bearings.	Check sump for metal particles and, if found, overhaul engine
	Worn piston rings.	Install new rings.
	Incorrect installation of piston rings.	Install new rings.
Cold weather difficulties.	Cold oil.	Move aircraft into a heated hanger. Heat oil.
	Inaccurate pressure readings.	Extreme readings up to approximately 100 do not necessarily indicate malfunctioning.
	Overpriming	Rotate crankshaft in counterclockwise direction with throttle "Full Open" and ignition switch "Off".
	Weak Battery	Install fully charged battery.

C. ENGINE REMOVAL

1. Remove the Propeller.
2. Remove the Side Cowls.
3. Remove the Top Cowl.
4. Remove the Bottom Cowl.
   a. disconnect both cables from battery.
   b. remove carburetor air filter duct (6179) by removing wraplock.
   c. landing light wires (2).
   d. Oil radiator (4 bolts).
   e. brace rods (connected to firewall.
   f. cowl flap control rods.
   g. fuel pump blast tube.
   h. alternate air source duct.
   i. hot air overboard duct (2 clamps.
5. Disconnect the following:
   a. tachometer drive shaft.
   b. oil temperature bulb.
   c. oil pressure line.
   d. fuel pressure line.
   e. manifold pressure line.
   f. cylinder head temperature gage thermocouple line.
6. Disconnect the following controls:
   a. throttle control.
   b. propeller governor control.
   c. carburetor hot air control.
   d. mixture control.
   e. cowl flap control and spring.
7. Disconnect ignition switch wires from magnetos (GROUND MAGNETOS).
8. Disconnect the engine ground strap.
9. Disconnect all the voltage regulator wires.
10. Disconnect cabin heater duct (2 places).
11. Disconnect 2 generator wires and 1 starter wire.
12. Disconnect both mufflers, tail pipes, and support springs.
13. Remove top engine baffle to expose hoisting hook and attach an "A" frame type hoist or other suitable hoist to the engine hoisting hook and relieve the tension on the engine mount.
14. Disconnect the main fuel line from the firewall to the fuel pump.
15. Disconnect four bolts from the engine mounts at firewall and slide engine forward slowly and carefully to check if any wires or cables are still connected to engine. (If it is desirable to remove the mount from the engine, it can be accomplished easier at this time).

D. PROPELLER REMOVAL

1. Remove propeller spinner by taking 10 screws, washers and spacers.
2. Remove 6 bolts and washers from propeller flange and gently remove propeller from the engine shaft (When the propeller is removed from the engine crank shaft there will be a small amount of oil that will run out of the propeller hub and crank shaft.
3. Carefully remove the "O" Ring from the engine shaft.

E. INSTALLATION OF ENGINE

1. Hoist engine even with attach points on fuselage and slowly secure to firewall (use a circular tightening sequence).
   NOTE: Experience has proven that it is much easier to remove and reinstall this engine with the mount attached to it.
2. Connect the main fuel line from the firewall to the fuel pump.
3. Disconnect the "A" frame from the hoist point and remove.
4. Install mufflers, support springs, and tail pipes.
5. Connect generator wires (2) and starter wire (1).
6. Connect Engine ground strap, voltage regulator wires, top engine baffle.
7. Connect cabin heater duct (2 places).
8. Connect ignition switch wires on magnetos.
9. Connect the following:
   a. Tachometer drive shaft.
   b. Cylinder head temperature gage thermocouple line.
   c. Manifold pressure line.
   d. Fuel pressure line.
   e. Oil pressure line.
   f. Oil temperature bulb.
10. Connect the following controls:
    a. Throttle control.
    b. Propeller control.
    c. Mixture control.
    d. Carburetor hot air control.
    e. Cowl flap control and spring.

    (After connecting these controls, move them several times from the cabin to ascertain that they move freely through the full arc of their travel. Adjust all controls to provide the same degree of resistance to the pilot's setting.)
11. Install the bottom cowl.
    a. Connect bottom cowl brace rods to firewall.
    b. Connect the radiator to bottom cowl (4 screws).
    c. Connect the carburetor air filter duct (6179) with wraplock.
    d. Connect the hot air overboard duct.
    e. Connect the alternate air source duct.
    f. Connect the fuel pump blast tubes.
    g. Connect the cowl flap control rods and springs.
    h. Connect the landing light wires (2).
    i. Connect both battery cables.
12. Replace the top cowl and secure it to the bottom cowl.
13. Replace the side cowls.
14. Reinstall the propeller.

F. INSTALLATION OF PROPELLER

1. Clean and check the mating surfaces of the propeller hub flange and the crankshaft flange.
2. Install the "O" ring seal in the propeller hub counterbore and lubricate it liberally with clean lubricating oil.
3. Line up the arrow on the hub flange outer diameter with the short bushing in the crankshaft flange.
4. Engage the crankshaft pilot in the propeller hub and push the propeller hub straight back until the crankshaft bushings enter the holes in the propeller hub flange.
5. Avoid twisting and shaking of propeller as much as possible, as damage to the "O" ring could result and oil leakage will follow.
6. Using McCauley propeller mounting bolts only, with special shouldered washers, tighten 6 bolts to the torque recommended by manufacturer.

PROPELLER TORQUE LIMITS		
Part Number	Nomenclature	Torque Limits
McCauley	Mounting Bolts	55 to 65 Ft. Lbs.

G. ADJUSTMENTS

1. CARBURETOR IDLE MIXTURE.

a. Perform the standard engine starting procedure and operate the engine for at least two minutes to warm it up properly.

b. Reduce the throttle to obtain a tachometer reading of approximately 550 RPM.

c. Turn the idle adjusting screw, located near the rear of the carburetor, clockwise, thinning the fuel mixture. Continue to do this until the engine begins to run roughly, at which the engine speed will decrease.

d. Turn the screw counterclockwise until the engine runs smoothly again and continue to turn the screw in the same direction until the engine begins to run roughly once more. At this point the fuel mixture will be too rich and engine speed will decrease again.

e. Now advance the screw to the midway position between the lean and rich fuel mixture; the RPM of the engine will reach a maximum speed for idle mixture settings.

2. ENGINE IDLING SPEED

a. With engine running and side cowling off, pull back the throttle control lever until it is completely aft and in the closed position. Observe the tachometer for the engine speed.

b. Adjust the idle adjustment screw to obtain from 550 to 600 RPM by rotating it clockwise to increase the speed of the engine and counterclockwise to decrease the engine speed. The screw is located on the throttle arm.

NOTE: One complete revolution of the carburetor idle screw provides a variation of approximately 100 RPM in idling speed.

SECTION

4

STRUCTURE

SECTION IV

STRUCTURE

A. GENERAL

Figures 10, 11, and 12 identify the types of skin structure used on the MOONEY M 20 B. No structural repairs are recommended without contacting the manufacturer. However, minor repairs such as patching the skin, welding, etc., may be made in accordance with the regulations set forth in Civil Aeronautics Manual 18. Skin repairs must result in a surface which is as strong as, or stronger than, the original skin. However, flexibility must be retained so that the surrounding areas will not receive extra stress.

B. REMOVAL OF WING COMPONENTS

The major subassemblies of the wing may be removed individually or the wing may be removed as a unit. To remove a wing, a fuselage supporting cradle is required.

1. REMOVAL OF WING.

   a. Remove wing root fairings, all wing inspection panels, and the bottom fuselage access panels.

   b. Drain the gas from the wing to be removed.

   c. Drain brake lines and reservoir. Disconnect at wing main spar.

   d. Remove front and rear seats. Remove 4 inspection plates under rear seat area.

   e. Set the airplane on jacks (on jack points).

   f. Set "A" frame on propeller.

   g. Remove the following:

      1. Two landing gear assist springs (5047-3).

      2. Flap tubes (7097 and 7098).

      3. Aileron Tubes (two 7246).

      4. Trim Link Tubes (7218-13 or 7218-7 (serial 1751 and on) and 7218-8).

      5. Main gear retraction tubes (5242).

6. Rudder tubes (7244).
7. Elevator Tube (7243).
8. Elevator and Rudder 3rd Link (7101) (two tubes).
9. Remove floorboard braces (3937-9, 3937-10, 3937-11).
10. Seat Rail Bracket (3939-7, 3939-8 Six bolts) (3941 two bolts).
11. Stringer assembly doubler (3977-7).
12. Fourteen bolts from "Z" rail.
13. Sixteen Attach bolts (AN 3-5A).
14. Gas lines and wires from wing root.
15. Airspeed indicator linc, Pitot lines, heated pitot lines if used.
16. Front mating bolts (two AN 6-16A).
17. Rear mating bolts (two AN 4-15A and two AN 4-17A).
18. Two tension Bolts (7H-16A).

NOTE: Have suitable cradle ready for fuselage before accomplishing last three steps of wing removal.

2. REMOVAL OF WING FLAP

a. Remove wing flap cover plate at wing root (7274).
b. Disconnect the flap actuating link (7100).
c. Remove hinge bolts (4).
d. Pull the flap straight back off the wing.

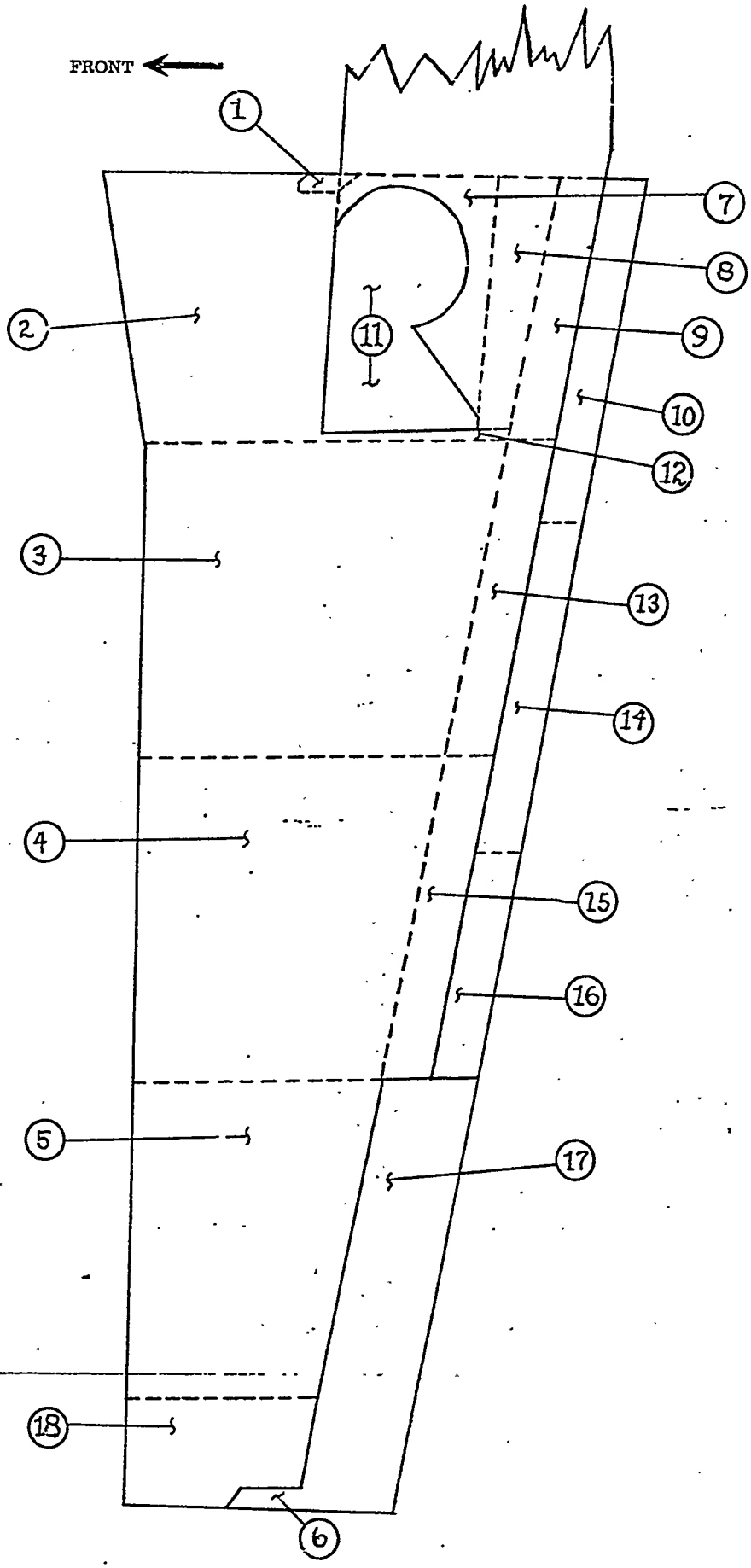
3. REMOVAL OF AILERON

a. Disconnect the Aileron control tube (7241) at the inboard aileron hinge (2177 or 2178).
b. Remove three hinge bolts.
c. Pull the aileron straight off the wing.

C. INSTALLATION OF WING COMPONENTS

1. Installation of Wing.
Installation of the wing assembly is a direct reversal of removal.
2. Installation of Flap.
Installation of the flap assembly is a direct reversal of removal.
3. Installation of Aileron.
Installation of Aileron assembly is a direct reversal of removal.

Figure 10 AIRCRAFT WING SKIN CHART



RIGHT BOTTOM WING SHOWING

NO.	THICKNESS	MATERIAL
1.	0.063	2024 T-3 CLAD
2.	0.050*	2024 T-4 CLAD
3.	0.040	2024 T-3 CLAD
4.	0.032	2024 T-3 CLAD
5.	0.025	2024 T-3 CLAD
6.	0.032*	2024 T-4 CLAD
7.	0.032**	2024 T-3 CLAD
8.	0.040	2024 T-3 CLAD
9.	0.025	2024 T-3 CLAD
10.	0.025***	2024 T-3 CLAD
11.	0.040****	2024 T-3 CLAD
12.	0.032	2024 T-3 CLAD
13.	0.025	2024 T-3 CLAD
14.	0.020*****	2024 T-3 CLAD
15.	0.025	2024 T-3 CLAD
16.	0.020*****	2024 T-3 CLAD
17.	0.020*****	2024 T-3 CLAD
18.	0.025	2024 T-3 CLAD

* Heat Treated to T-4 Condition after forming.

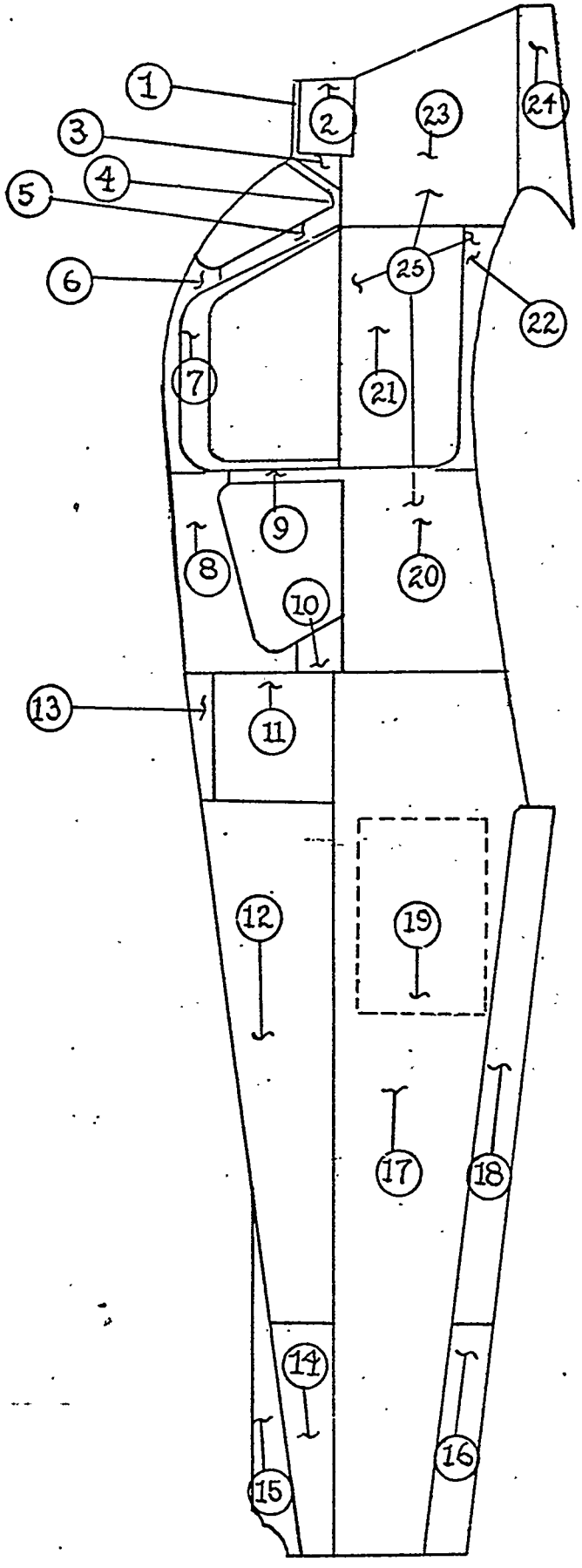
** Aircraft s/n 1852; s/n 1940 & on use 0.025 material.

*** 0.020 thickness on bottom side of flap.

**** Top of wing only.

***** Same thickness on both sides.

Figure 11 AIRCRAFT FUSELAGE SKIN CHART



NO.	THICKNESS	MATERIAL
1.	0.025	2024 T-3 CLAD
2.	0.020	2024 T-3 CLAD
3.	0.032	2024-0*
4.	0.040	3003-0
5.	0.025	24 ST**
6.	0.025	24 ST**
7.*****	0.025***	24 ST**
8.	0.025	24 ST**
9.	0.025	2024 T-3***
10.	0.025	2024 T-3 CLAD
11.*****	0.025	2024 T-3 CLAD
12.	0.020	2024 T-3 CLAD
13.******	0.020	2024 T-3 CLAD
14.	0.020	2024 T-3 CLAD
15.	0.025	2024 T-3 CLAD
16.	0.020	2024 T-3 CLAD
17.	0.032	2024 T-3 CLAD
18.	0.025	2024 T-3 CLAD
19.******	0.032	2024 T-3 CLAD
20.*****	0.025	2024 T-3 CLAD
21.	0.032	24 ST**
22.*****	0.025	2024 T-3 CLAD
23.	0.025	2024 T-3 CLAD
24.	0.025	2024 T-3 CLAD
25.******	0.025	2024 T-3 CLAD

* Heat Treat to T-4 condition after forming.

** After forming.

*** Or 0.032 can be used.

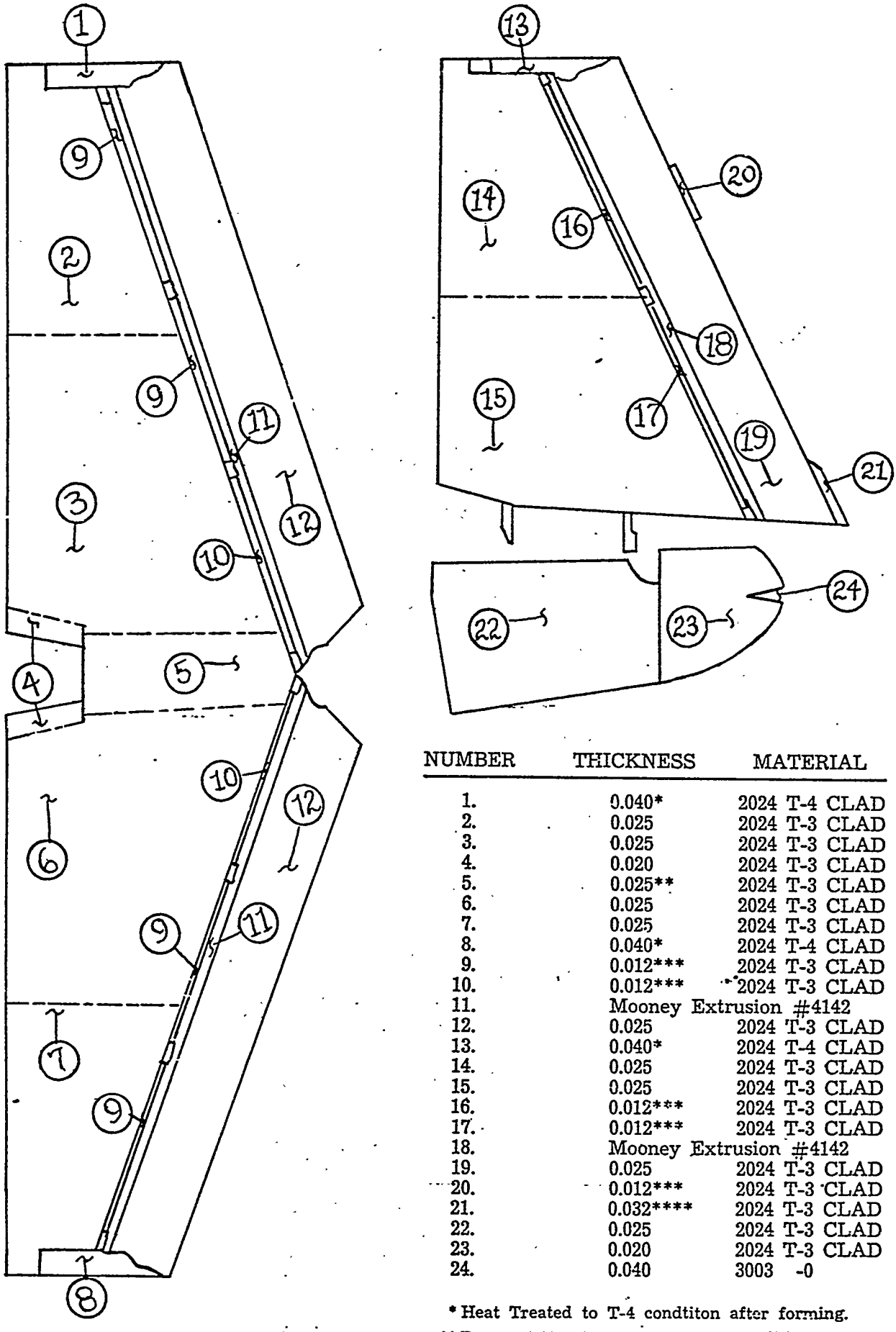
**** Use 24 ST material on right side.

***** Right side only.

****** Left side only.

RIGHT SIDE OF FUSELAGE SHOWING

Figure 12 AIRCRAFT TAIL SURFACES SKIN CHART



NUMBER	THICKNESS	MATERIAL
1.	0.040*	2024 T-4 CLAD
2.	0.025	2024 T-3 CLAD
3.	0.025	2024 T-3 CLAD
4.	0.020	2024 T-3 CLAD
5.	0.025**	2024 T-3 CLAD
6.	0.025	2024 T-3 CLAD
7.	0.025	2024 T-3 CLAD
8.	0.040*	2024 T-4 CLAD
9.	0.012***	2024 T-3 CLAD
10.	0.012***	2024 T-3 CLAD
11.	Mooney Extrusion #4142	
12.	0.025	2024 T-3 CLAD
13.	0.040*	2024 T-4 CLAD
14.	0.025	2024 T-3 CLAD
15.	0.025	2024 T-3 CLAD
16.	0.012***	2024 T-3 CLAD
17.	0.012***	2024 T-3 CLAD
18.	Mooney Extrusion #4142	
19.	0.025	2024 T-3 CLAD
20.	0.012***	2024 T-3 CLAD
21.	0.032****	2024 T-3 CLAD
22.	0.025	2024 T-3 CLAD
23.	0.020	2024 T-3 CLAD
24.	0.040	3003 -0

* Heat Treated to T-4 condtiton after forming.

** Bottom 0.025 2024-O, H.T. to T-4 condition.

*** 0.016 may be used as alternate.

**** A/C 1852, 1940 & on use 0.025 material.

SECTION

5

LANDING GEAR AND BRAKE SYSTEM

SECTION V

LANDING GEAR AND BRAKE SYSTEM

A. GENERAL

The landing gear is a tricycle type gear. It is constructed of heavy, chrome-molydenum tubular steel, heat treated for greater stength and resistance to wear. Neoprene rubber discs of great resiliency absorb the shock of normal taxiing and landing. The Cleveland Wheels used on the main tires are made of magnesium castings and the six-ply tires are made by Goodyear. The main gear has a nine-foot tread, which makes taxiing a simple orperation; and because of the wide gear-tread and the aircraft's low center of gravity, taxiing or landing in strong cross-winds presents no problem, even to the novice pilot. The attaching points of the main gear are in metal bushings embedded in the gear-mounting box and attached to the spars. The nose wheel is mounted to the cabin's tubular-steel frame instead of the engine mount. The main gear wheels are equipped with hydraulic brakes. The nose wheel rudder pedal mechanism is equipped with a centering bungee located under the left front floorboard.

B. REMOVAL OF LANDING GEARS

1. Main Gear.
   a. Place aircraft on jacks. (Refer to Section IIc).
   b. Unlock and move gear handle aft a short distance. Disconnect the gear doors, brake lines, and the retraction tube.
   c. Retract gear all the way.
   d. Remove the wing gear assist sping. (Special tool No. 8186 available at factory).
   e. Extend gear to about 3 or 4 inches from down lock position and secure it or have someone hold it in this position.
   f. Remove two bolts from retracting truss bracket (5028).
   g. Remove six bolts from rear landing gear at attachment bracket (2257).
   h. Slide out rear part of Bearing (2257) sideways.
   i. Slide front part of bearing (2257) aft and remove.
   j. Slide gear assembly aft slightly until clear of front bearing and carefully take out of wing.

2. Nose Gear.
   a. Set aircraft on jacks (Refer to Section IIc).
   b. Remove exhaust cavities (3150).
   c. Remove bolt on aft end of retracting link (5032).

d. Partially retract nose gear by hand and remove bolt from nose gear steering horn.

e. Bend flange of firewall to clear bolts of support truss (5015-5).

f. Remove right and left bolts of support truss (5015-5).

g. Carefully remove nose gear assembly.

C. REMOVAL AND DISASSEMBLY OF SHOCK DISCS

1. Main Gear.

a. Remove main gear from aircraft (See instructions above).

b. To use the special Mooney Shock disc replacement tool (8400) it will be necessary to remove the landing gear spindle (5018) from the main gear leg (5071).

c. Remove the bolt attaching the spindle (5013) to the shock disc retainer (5013).

d. The remaining assembly is now ready to be fastened to the shock disc replacement tool (8400).

e. Apply pressure to the shock disc retainer (5013) until bolt in collar lines up with hole in the shock disc supporting structure and remove the bolt from the shock disc retaining collar (5131-9) or (5131-8).

f. Release pressure slowly from the shock disc retainer and remove the discs (3CRE-714) that need to be replaced.

g. Install new shock discs on the retainer (5013) and reverse the procedure on steps (e) and (f) above.

3. Nose Gear.

a. Remove nose gear from aircraft (see instructions above).

b. To use the special Mooney shock disc replacement tool (8400) it will be necessary to remove the nose gear sprindle (5070) from the upper gear structure (5074). Also remove the bolt attaching the spindle to the shock disc retainer (5078).

c. The remaining units, Upper gear structure (5074) and shock disc retainer (5078), can now be attached to the shock disc replacement tool (8400).

d. Apply pressure to the retainer so that the bolt holding the Retaining collar (5131-7) can be removed.

e. After removing bolt from collar, release pressure slowly from the shock disc retainer and remove the discs that need to be replaced.

f. Install new shock discs (3CRE-714) on the retainer (5078) and reverse the procedure in steps (d) and (e) above.

D. REASSEMBLY AND INSTALLATION OF LANDING GEAR

Installation of the landing gear is essentially the reversal of removal. On reinstalling the main gears in the airplane, just remember to keep parts from the right and left gears separated. Also, do not attach gear door brakets to gear legs with

sheet metal screws until doors are finally adjusted as explained in the following procedure.

1. Main Gear.

   a. Grease wheel bearings, retraction linkage, and fore and aft bearings which attach to the spar.

   b. Slide front end of gear leg into front bearing; slide bearing plate of rear attachment (2257) over rear end of main gear leg, spotfaced side forward.

   c. Slide rear part of attachment bracket between spar and landing gear.

   d. Line up holes in rear attachment and spar. Attach with six bolts.

   e. Attach retracting truss through retracting bracket (5020) with two bolts and secure with safety wire.

   f. Connect retraction tube (5244) and fully retract gear.

   g. Connect gear assist spring (5098) and lower gear.

   h. Attach gear door links (8051-8052) to brackets (8054) on gear legs. Raise gear to see that there is no bind in door link heim bearings. Door edge should seat evenly all around against wing without excessive distortion where links attach to door. Adjustment may be made by slightly shifting the position of the gear door brackets on the gear leg or by changing the length of the links. This is a preliminary adjustment. Do not attach gear door brackets to gear leg with sheetmetal screws until door adjustment is rechecked after gear is rigged.

2. Nose Gear.

   Installation of the nose gear is a direct reversal of the removal procedure.

E. BRAKE AND WHEEL MAINTENANCE

1. Brake lining inspection and replacement.

   Visually inspect the brake while it is installed on the airplane. No adjustment of brake clearance is necessary. If, after extended service, the brake linings become excessively worn, replace with new linings as follows:

   a. Remove dust cover from wheel.

   b. Remove spindle nut from one side of wheel and two bolts from the other side (2 bolts that hold back brake plate stationary).

   c. Slide wheel out and remove pressure plate that has the worn lining on it.

   d. The linings can easily be replaced by drilling out three rivets from the pressure plate (35-203) and three rivets from the back plate (35-205).

   e. Replace old linings with the new Cleveland 35-204 brake linings and Cleveland 561 rivets. A 561-R Rivet setting kit is available through Mooney Aircraft or your nearest Distributor. This special rivet setting kit should be used as rolling of the rivet is very important to get a tight fit between the rivet and the rivet hole.

2. Wheel Assembly Inspection.

   To inspect the wheel assembly proceed as follows:

   a. Place airplane on jacks.

   b. Remove axle nut and two bolts from back plate (35-205) and slide wheel off.

   c. Inspect the wheel assembly for the following:

      1. Check for bolt failure. Replace any bolts found to be defective.

2. Check the internal diameter of the felt grease seals. Replace the felt grease seal if surface is hard or gritty.

3. Inspect the casting for visible signs of cracks or corrosion. If there are any indications of cracks, the tire and tube should be removed and the wheel disassembled for a closer inspection of the suspicious area.

4. Replace any wheel casting having visible cracks.

F. LANDING GEAR RIGGING PROCEDURE

First, an important feature of the Mooney M 20B gear down locks. The tubes and linkages of the retraction system are designed to hold the overcenter locking mechanism in its overcenter position only. The retraction tubes and linkages will not take the loads imposed upon them if the overcenter locks become disengaged. This can happen in two ways. One, by improper adjustment of the overcenter lock mechanism. Two, by disengaging the retraction handle from its down lock block under the instrument panel which may make it possible for the overcenter linkage to be tripped.

If either of the possibilities stated above should occur, it will probably result in the collapse of the nose gear with subsequent damage to the airplane.

1. Rigging Instructions.

   a. Hoist Airplane and remove access panels shown in figure 13B.

   b. Remove retraction handle (5039) from gear down lock. Tie handle loosely to prevent bungee from forcing it down. In order to prevent damage to retraction tubes, do not move gear legs from outside until step 3 has been accomplished.

   c. Disconnect retraction tubes (5242)(2) and (5085)(2) at point B (fig. 13B). Loosen check nuts on heims on tubes (5242)(2) at point E and on tubes (5085)(2) at point A.

   d. Check nose gear and main gears (2) for any binding at hinge points designated by a star (*) in figure 13B by moving gear legs back and forth by hand. Tubes (5244) may be disconnected at point C during check of main gear if desired. For easy gear retraction, the points indicated should be lubricated in accordance with lubrication chart on page 15.

   e. Place retraction handle (5039) in gear-down lock. Check for and remove any foreign matter between retraction trusses and links at point Z and point S (fig. 13A) and place all gears in the down and lock position. It is recommended that a C-clamp be used at point X and point R (fig. 13A) clamping retraction trusses solidly to retraction links in the full overcenter position.

   f. By turning tubes, adjust retraction tubes (5242)(2) and (5085)(2) so that a 3/16" D bolt can be inserted through retraction lever (5059) and heim bearings at point B (fig. 13B). This will give a zero pre-load in system with the handle in the gear down lock.

   g. By turning tubes, shorten retraction tubes (5085)(2) two turns and lengthen retraction tubes (5242)(2) two to two and one-half turns. Tighten check nuts (4) at points A and E (fig. 13B).

   h. Remove retraction handle (5039) from gear down lock and connect tubes (5242) and tubes (5085). Place retraction handle (5039) in gear down lock.

2. Inspection of System Pre-Load.

   a. Nose Gear (See figure 13A).

      1. Place rigging tool (8442) on retraction link (5032) with sloped edge aft. Hold tool in place against retraction link (5032).

      2. Place finger at point R.

3. Apply force on torque wrench and read torque at instant that point R first begins to move. Movement of retraction truss (5062) may be felt at point R may be seen in area of joint S. Practice this several times before recording torque. Torque should be between 140 and 200 inch pounds.

   NOTE: Take reading on torque wrench when .005 to .010 inch movement is observed at points R and X (figure 13A).

4. After release of force, retraction truss (5062) should snap back to full over-center and should bear tightly against retraction link (5032) at point S. This should be carefully checked by pulling down on retraction truss (5062). If retraction truss (5062) moves down, then the pre-load in tubes (5085) (2) is not sufficient.

b. Main Gear (See figure 13A).

1. Place rigging tool (8444) as shown in figure 13A. Hold in place with thumb at point Y pressing forward.

2. Place finger at point X.

3. Apply force on torque wrench and read torque at instant that point X first begins to move. Movement of retracting truss (5256) may be felt at point X and may be seen in area of joint Z. Practice this several times before recording torque. Torque should be between 275 and 325 inch pounds. The torque should register approximately the same at both main gears.

4. After release of force, retracting truss (5256) should snap back to full over-center and should bear tightly against retracting link (5026) at point Z. This should be carefully checked by pulling down on retracting truss (5256). If retracting truss (5256) moves down, then the pre-load in tubes (5242) (2) is not sufficient.

   CAUTION: Do not attempt to rig the gear to increase or decrease gear up travel.

3. Adjustment of Pre-Load.

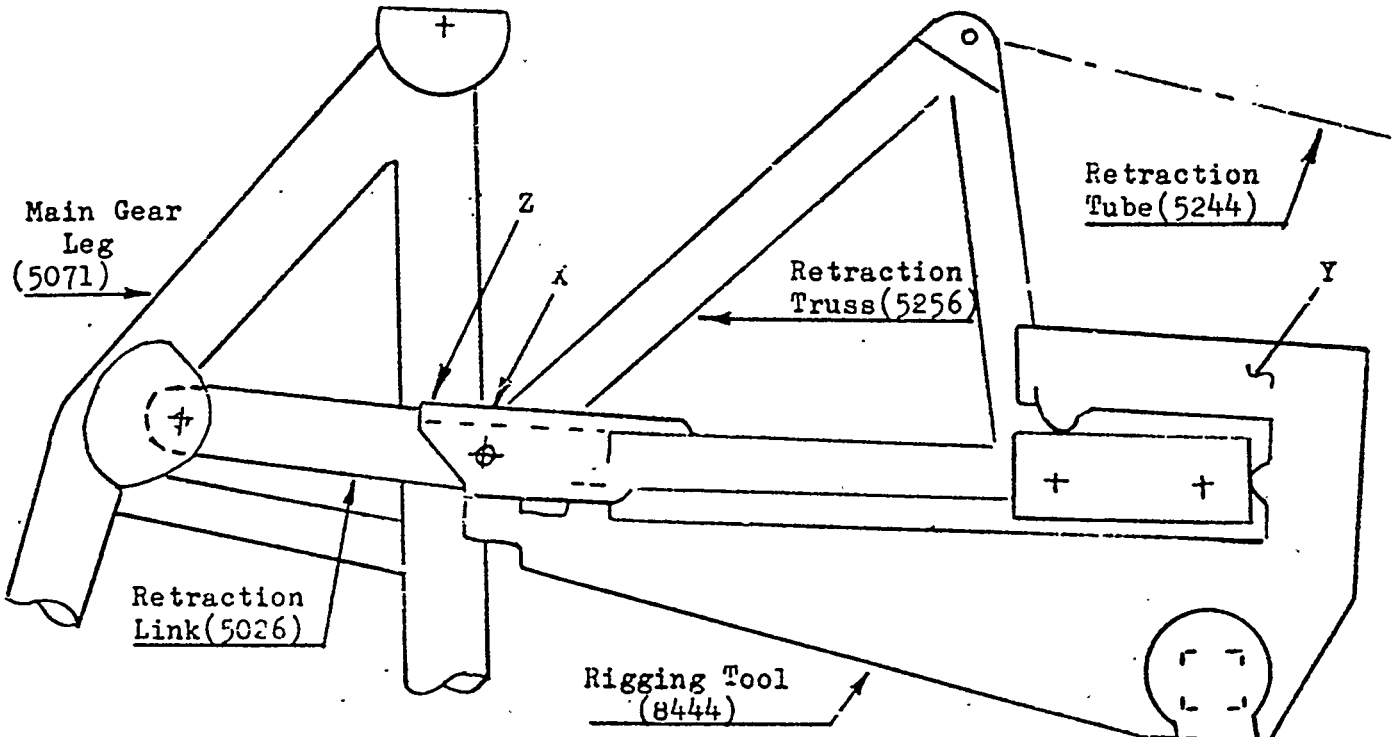
If the torque values do not fall within the limits specified, then the system pre-load should be changed by changing the lengths of retraction tubes (5242) and (5085). This is done by taking a turn on the heim bearings in the proper direction. One-half turn is usually sufficient. Any adjustment made to the nose gear should be made identically to both retraction tubes (5085) since they should carry the same pre-load.

Since the retraction tubes from all gears are attached to the gear retraction lever, a change in pre-load in the retraction tube at one gear can affect the pre-load in the retraction tubes at the remaining gears. Therefore, after an adjustment is made at one gear, the other gears must be rechecked. This process must continue until the proper pre-loads are obtained in the retraction tubes at all gears.

The amount of freedom of the gears (as determined from the check made under item 4 of rigging instructions above) will affect the torque readings. Gear systems with free joints will be adequately rigged when the torque is on the low end of the range while gears that are stiffer may require torque values on the high end of the range for adequate pre-load.

A final check should be made of the force required to place the gear handle (5039) in the gear down lock (gear extended position). If the force required to move the gear handle forward the last 1 to 2 inches is excessive, then the system pre-load may be reduced slightly within the prescribed torque limits. Check for and relieve any bind in the sliding hand grip at the top of the gear lever since a bind at this point may make it difficult to lock the gear handle in place.

NOTE: Gear rigging tools (8442) and (8444) may be obtained at a nominal cost through our dealer organization or directly from Mooney Aircraft, Inc.



VIEW LOOKING FORWARD AT LEFT MAIN GEAR

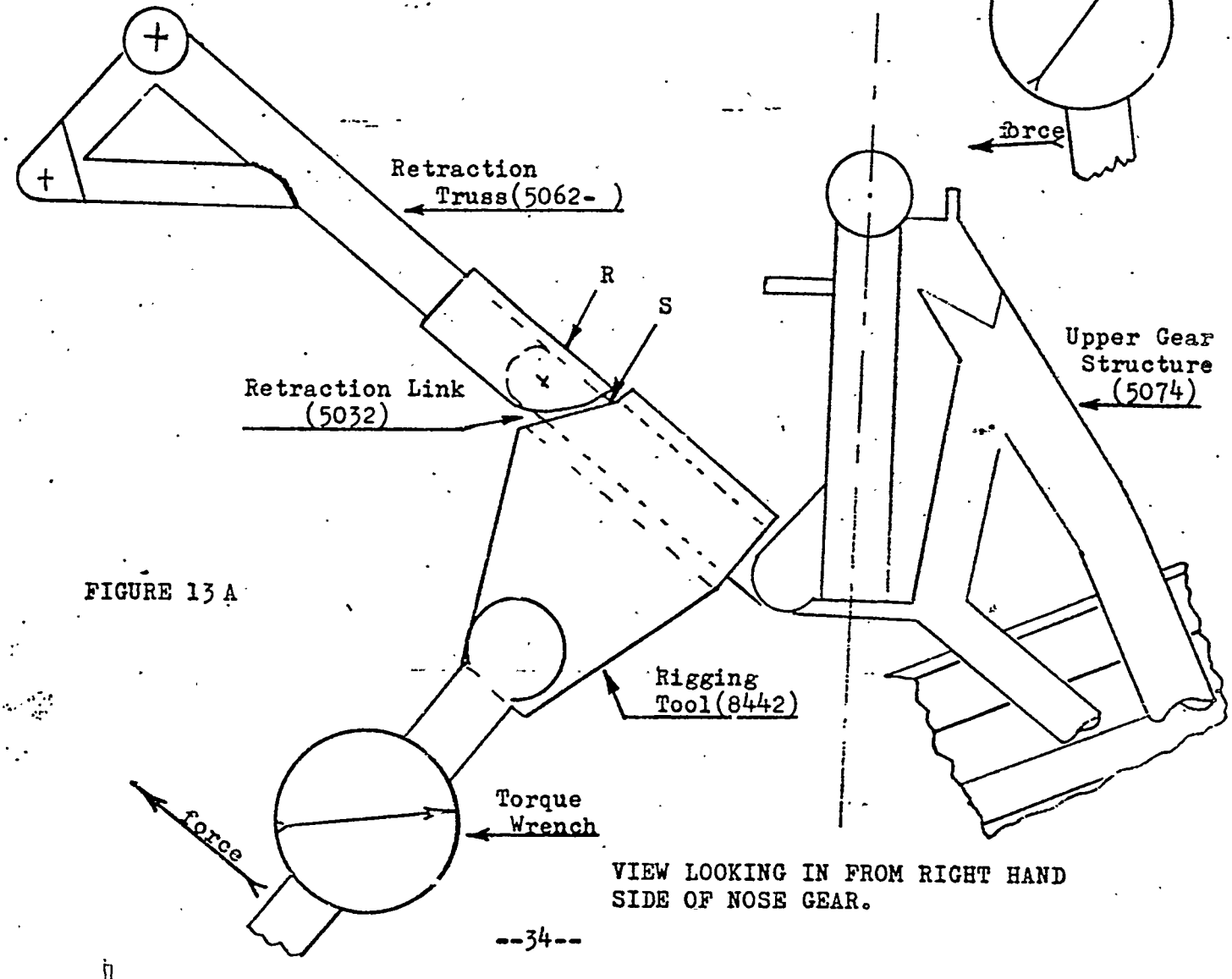
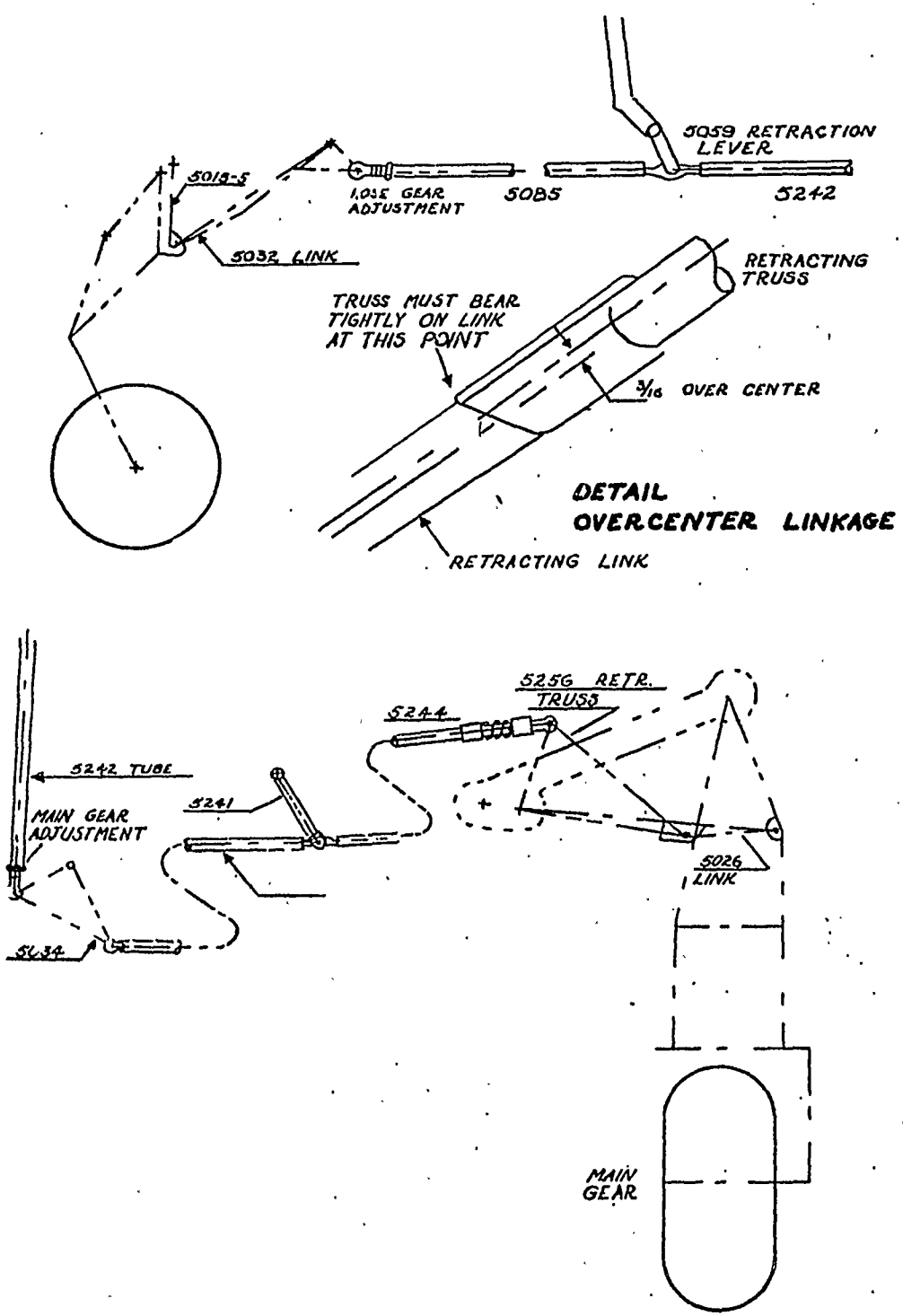
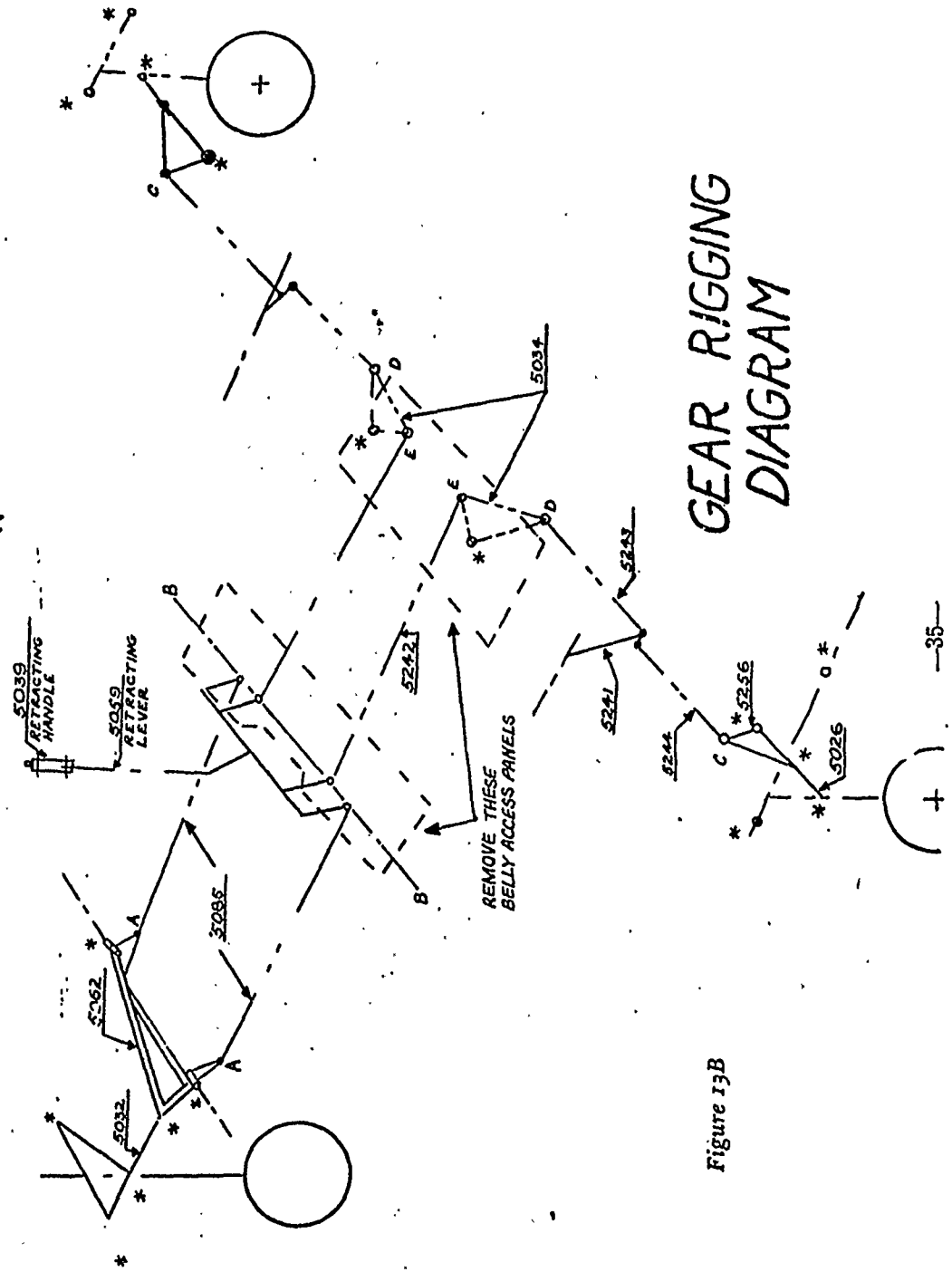


FIGURE 13 A

VIEW LOOKING IN FROM RIGHT HAND SIDE OF NOSE GEAR.





GEAR RIGGING DIAGRAM

Figure 13B

SECTION

6

CONTROL SURFACES

SECTION VI

CONTROL SURFACES

A. GENERAL

The ailerons, elevator, and rudder on the ***MOONEY M 20B*** are of all-metal construction. They are jig-built, using hinges of machined extrusions. The elevator an rudder incorporate an unusual method of construction. The leading-edge spar of these controls consists of a specially designed extrusion that allows flush attachement of the skin. Lead counterweights are provided for dynamic balancing to prevent flutter.

The control system requires very little maintenance and provides superior control-feel, because tubes, rather than the conventional cable system, are used to actuate the controls. Heim bearings are used throughout the control system. These bearings are simple and dependable and require very little maintenance.

B. REMOVAL AND INSTALLATION

1. Removal and installation of Aileron (2200).
   a. Remove control tube (7241) from inboard end of aileron.
   b. Remove bolts, nuts, washers from three attach hinges.
   c. Remove aileron by pulling straight back.
   d. Replacement is accomplished by reversing of above steps.
   e. Rig the ailerons in accordance with factory rigging instructions.

2. Removal and Installation of Rudder (4104).
   a. Remove the rudder control tube (4169) by taking off one bolt, nut, and washer.
   b. Remove bolts, nuts and washers from three attaching hinges.
   c. Remove the rudder by pulling straight back.
   d. Replacement is accomplished by reversing of above steps.
   e. Rig the rudder in accordance with factory rigging instructions.

3. Removal and Installation of Elevators (4103).
   a. Remove control tube (7224-5) and assist bungee (7038-1) by taking off attaching bolts, nuts, and washers on each elevator.
   b. Remove bolts, nuts and washers from four attaching hinges on each elevator.
   c. Remove elevator by pulling straight back.
   d. Replacement is accomplished by reversing above steps.
   e. Rig the elevators in accordance with factory rigging instructions.

4. Removal and Installation of Flaps.
   a. Remove Wing-flap hinge fairing (3979) to expose flap link (7100).
   b. Remove flap link (7100) by taking off one bolt, nut, and washer from flap attachment.
   c. Remove flap by pulling down and out.
   d. Replacement is accomplished by reversing above steps.
   e. Rig the flaps in accordance wi the factory rigging instructions.

C. CONTROL SURFACES GENERAL SPECIFICATIONS

The dimensions and general specifications of the control surfaces of the Mooney M 20 B are as follows:

Wing Span	35 Feet	0 Inches
Length	23 Feet	2 Inches
Height	8 Feet	4½ Inches
Tread	9 Feet	¾ Inches

1. WINGS

Airfoil Section at Root	NACA 63-215
Airfoil Section at Tip	NACA 64-412
Dihedral	5½ Degrees
Wing Area	167 Square Feet
Aileron Area	11.2 Square Feet
Flap Area	17.2 Square Feet

2. EMPENNAGE

Vertical Fin Area	7.9 Square Feet
Rudder Area	5.01 Square Feet
Horizontal Stabilizer Area	21.5 Square Feet
Elevator Area	12.0 Square Feet

3. MOVABLE CONTROL SURFACE TRAVELS

Aileron Travel	Up	12½° to 17°
	Down	8° ± 1°
	Neutral or Static	0° to 2°
Flap Travel	Intermediate Down	11° ± 1°
	Full Down	21½° ± 1°
	Neutral	0° ± 1°
Elevator Travel	Up	24° ± 1°
	Down	10½° ± 1°
Rudder Travel	Right	18° ± 1°
	Left	18° ± 1°

CAUTION: When repainting or repairing the control surfaces, the following limits should not be exceeded:

Elevators: Maximum allowable static unbalance=18.1 inch/lbs. (1.32 lbs. at 12.75 inches from hinge line.)

Ailerons: Maximum allowable static unbalance=9.6 inch/lbs. (.753 lbs. at 12.75 inches from hinge line.)

Rudder: Maximum allowable static unbalance=5.601 inch/lbs. (.4625 lbs. at 12.12 inches from hinge line.)

D. RIGGING AND ADJUSTMENT

1. Aileron Rigging and Adjustment.
   a. Use a straight edge to line up the control wheels. Adjust control tubes (7085) until the control wheels are level.
   b. Adjust control tubes (7084) so that the aileron bellcrank (7067) is located 1/16" to the left of center.
   c. Adjust control tubes (7087) so that the center of the most outboard hole in bellcrank (7263) is 4 and 39/64 inches from the spar web.
   d. Adjust control tubes (7241) so that the ailerons are adjusted from 0° to 2°.

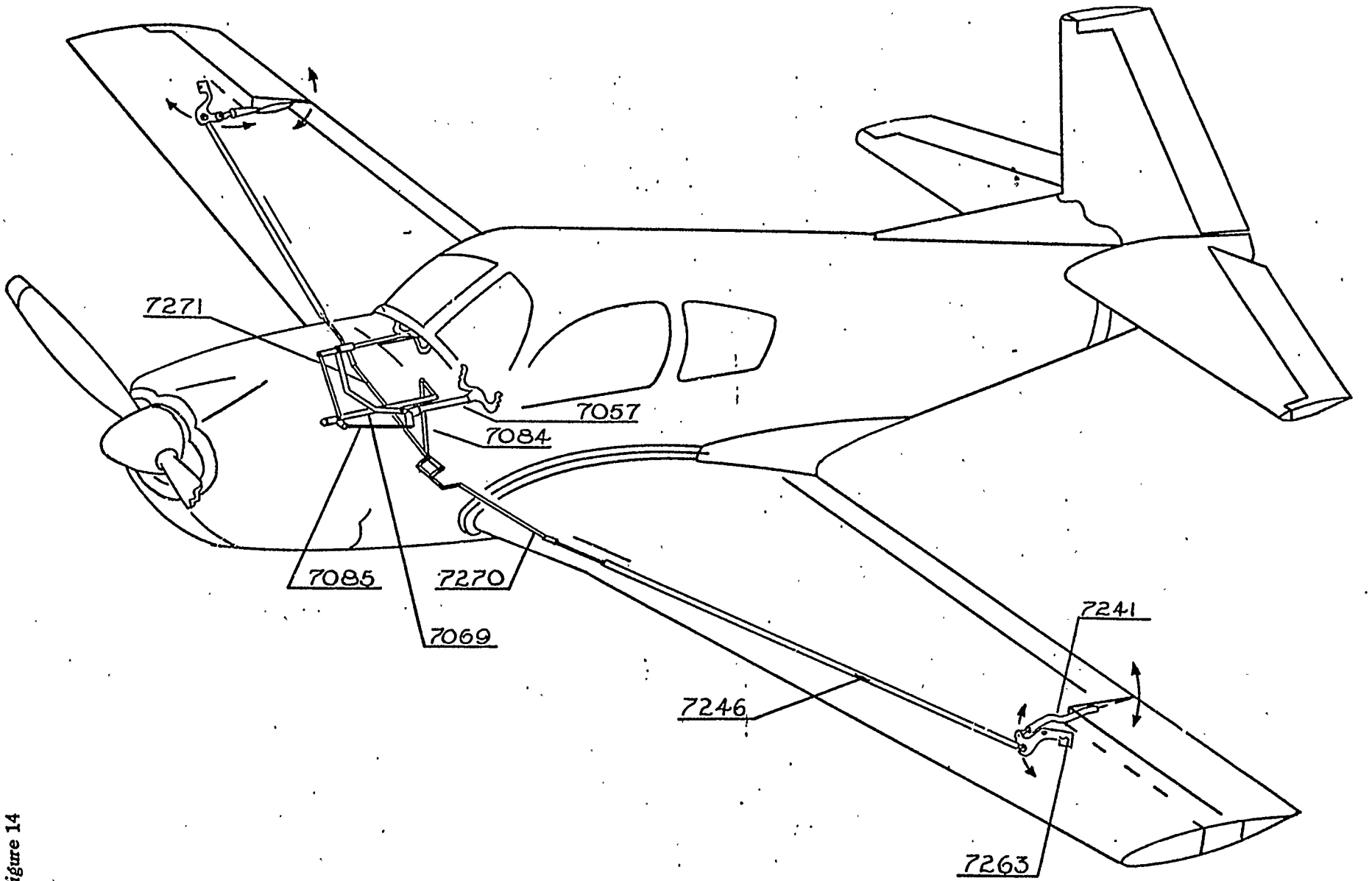
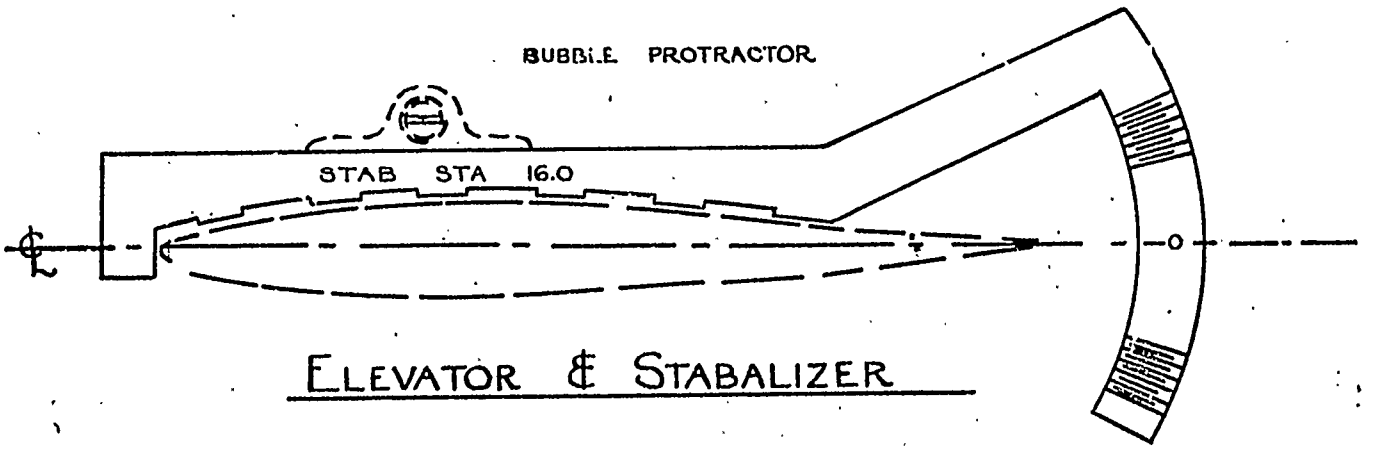
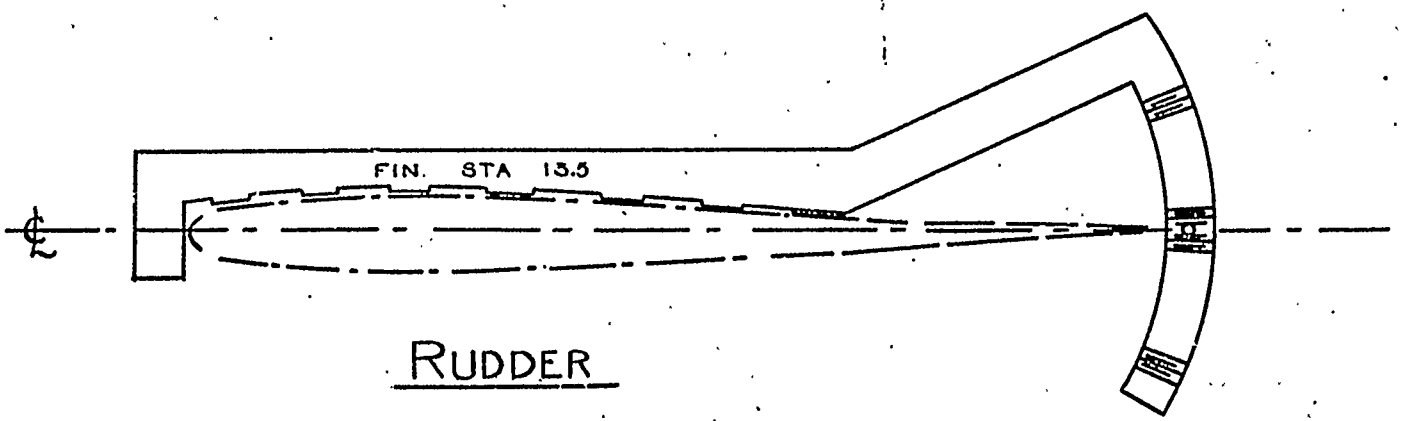


Figure 14

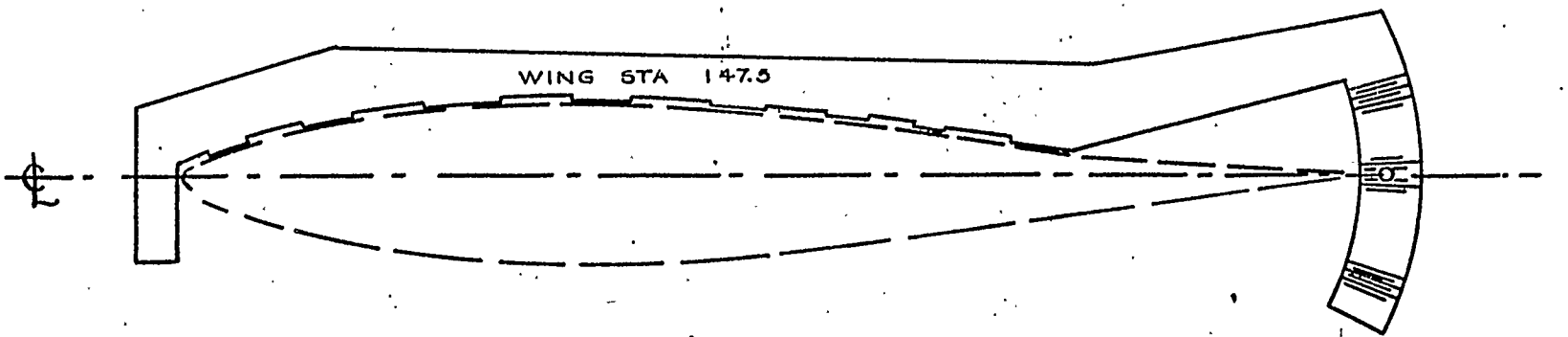
AILERON CONTROL SYSTEM



ELEVATOR & STABALIZER



RUDDER



AILERON

Figure 15

CONTROL TRAVEL JIGS

Droop in the static position. Now, all aileron travels are measured from the static position.

e. The aileron control stops are then adjusted for a down travel of 8° ± 1° and up travel may vary from 12½° to 17°.
f. See Figure 14 for aileron travel jig which is used at wing station 147.75.
g. See Figure 15 for aileron control system drawing.
n. See flap rigging for wing heavy conditions.

2. Trim Rigging and Adjustment.

a. Set stops (5257) at trim wheel (7216) for extreme travel.
b. Adjust screw (7217) at rear bulkheads (sta. 194.0) so that trim travels in excess.
c. Set stops (5257) at trim wheel (7216) to travels as given in control surface specifications.
d. See Figure 16 for trim control system drawing.

3. Flap Rigging And Adjustment.

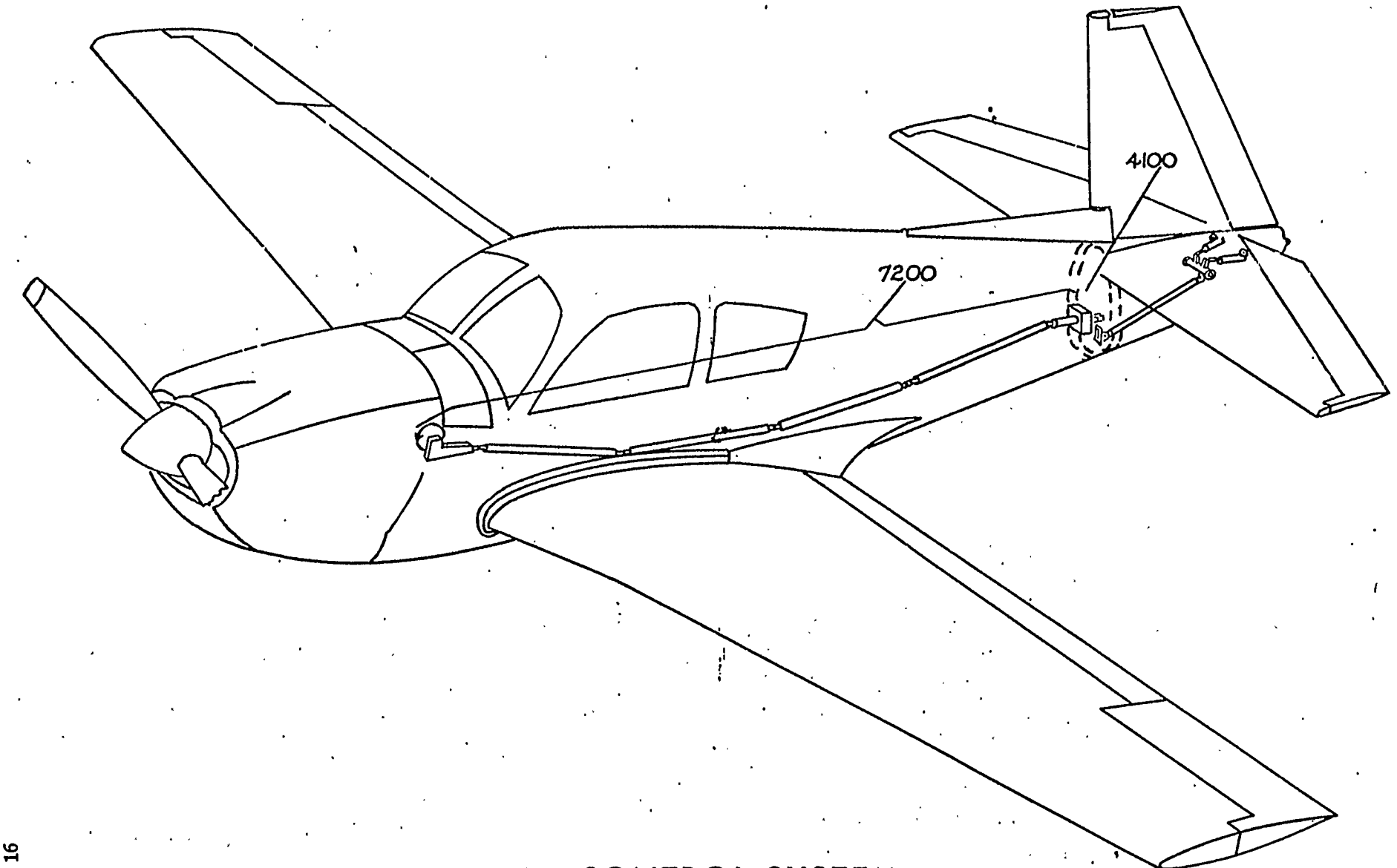
a. Adjust heim bearings on control tube (7100) at both flaps and at flap handle (7224-6) to travels as given in the control surface specifications.
b. See Figure 19 for flap control system drawing.
c. Adj. flap control tubes (7100) for wing heavy conditions.

4. Rudder Riggings and Adjustment.

a. Hoist nose gear (refer to hoisting instructions).
b. Set trim control in neutral.
c. Clamp co-pilot's rudder pedals in neutral.
d. Adjust heim bearing (7114) in nose wheel well to center nose gear. (Note: machined part of heim bearing should be on bottom).
e. Adjust bungee (7038) in left exhaust cavity to neutral.
f. Adjust heim bearing of control tube (7224-1) at main spar and control tube (7224-1) at rear fuselage bulkhead (sta. 194.0) to set rudder at approximately 1° to the right.
g. Unclamp rudder pedal.
h. Set stops (7226-1) (7226-3) of control tube (7224-1) in stinger for rudder travels as given in control surfaces specifications.
i. See Figure 20 for rudder control system drawing.

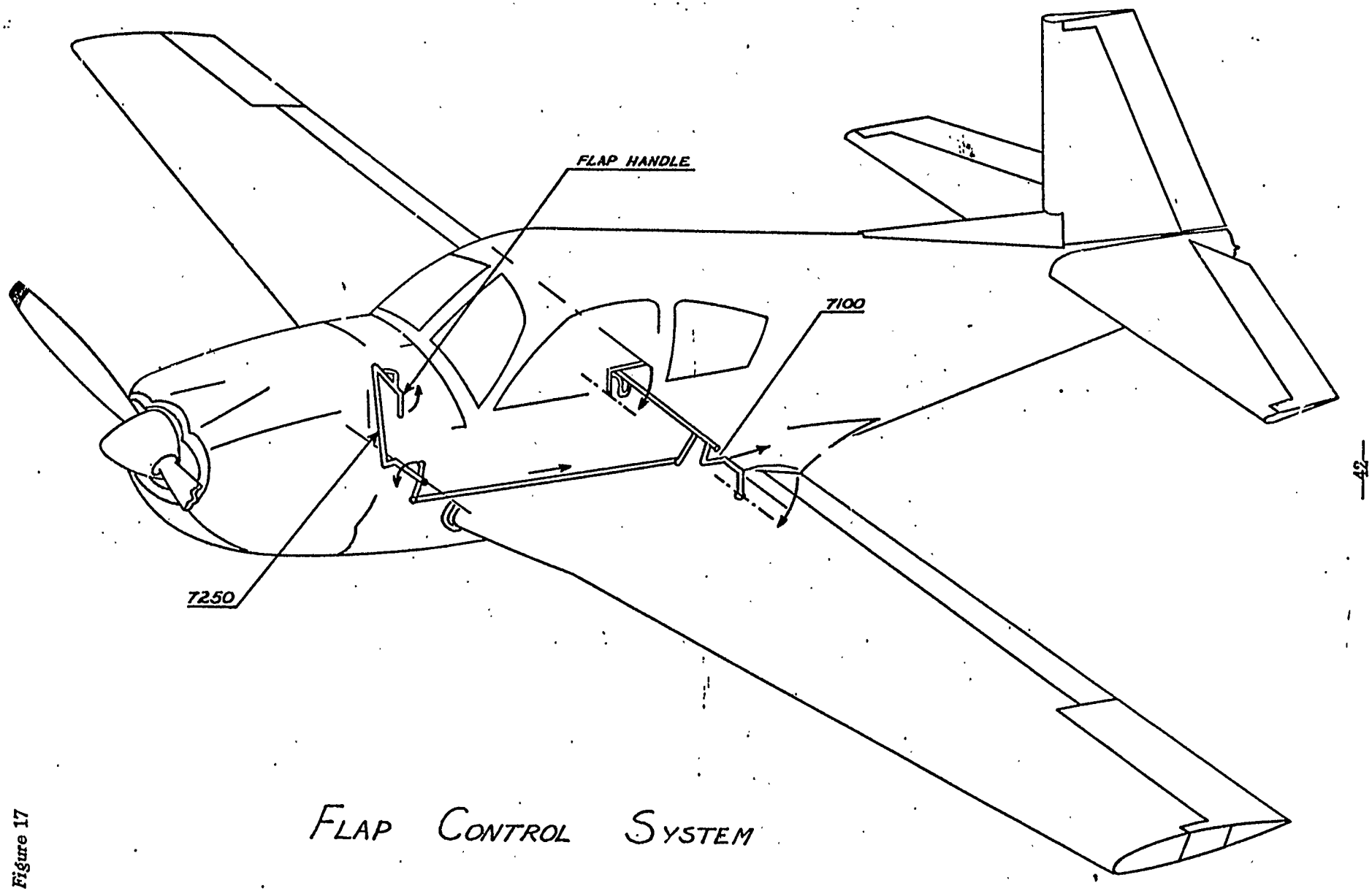
5. Elevator Rigging and Adjustment.

a. Adjust the heim bearing of control tube (7084) at control column (7058) for clearance of control shaft (7057) to firewall, and control column (7058) to fuselage structure.
b. Set trim control (7216) in neutral.
c. Adjust heim bearing of control tube (7224-5) at elevator attachment, and control tube (7224-3) at rear of Bulkhead (sta. 194.0) for excess travel of elevators.
d. Set stops (7226-1) in stinger for travels as given in control travels specifications.
e. Roll trim (7216) to nose up and adjust bungees (7038.1) 18 to 20° up.



TRIM CONTROL SYSTEM

Figure 16



FLAP CONTROL SYSTEM

Figure 17

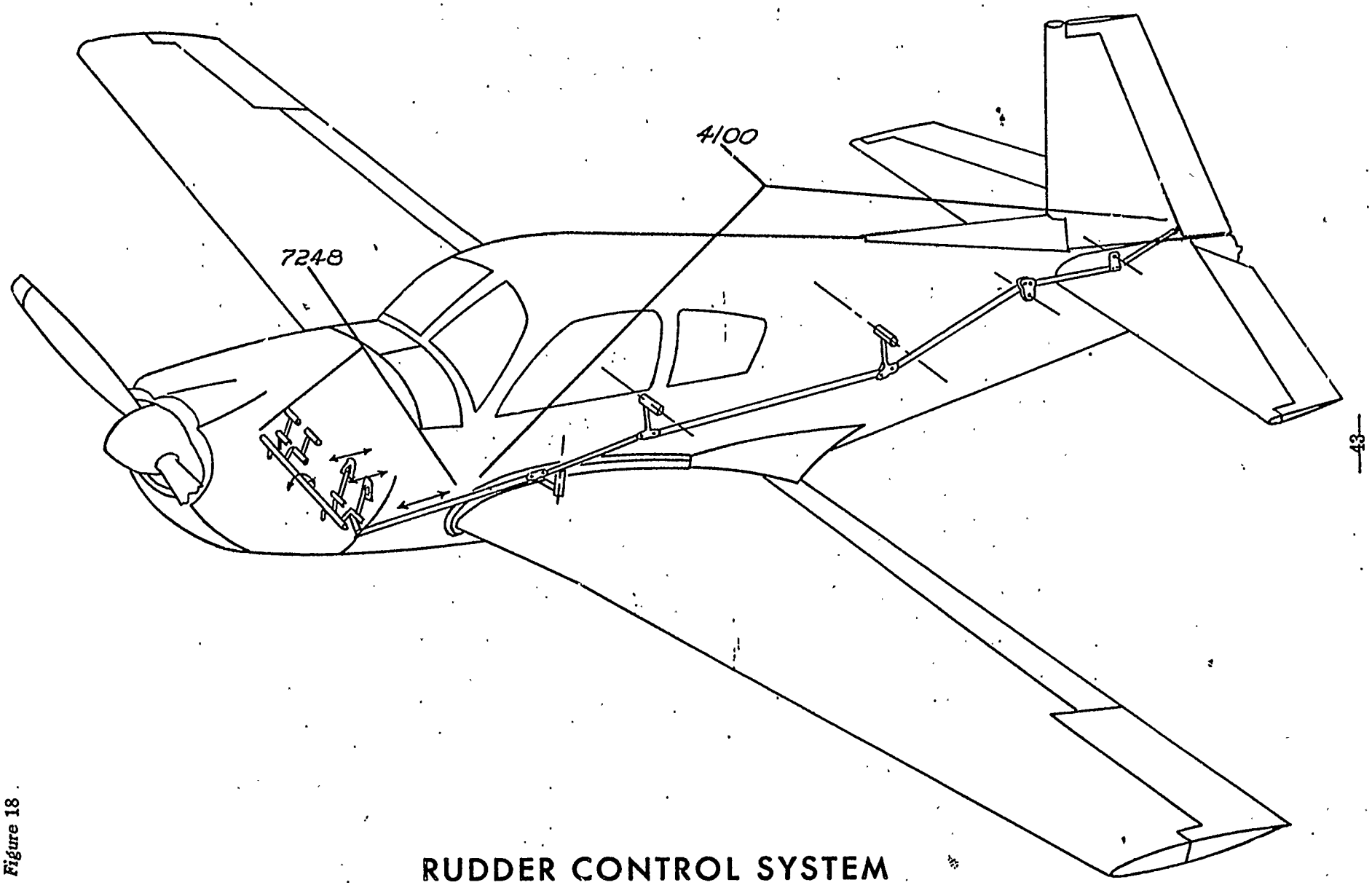


Figure 18

RUDDER CONTROL SYSTEM

Supplement to figures 14, 15, 16, 17, and 18.

CONTROL TRAVELS AND RIGGING INFORMATION FOR MOONEY M 20B

WING FLAPS

Measured from wing chord with travel board at wing station 147.75.

Take off position 0°	Tolerance ± 1°
Approach and landing position 21½°	Tolerance ± 1°

AILERONS

Measured from aileron chord with aileron in the static position with travel board at wing station 147.75.

Down travel, both ailerons + 8° Tolerance ± 1°

Up travel, either aileron, may vary from 12½° to 17° with no additional tolerance.

Static position 0° to 2° down.

RUDDER AND NOSEWHEEL

Measured from fin chord with travel board at fin station 13.5.

Left travel 18°	Tolerance ± 1°
Right travel 18°	Tolerance ± 1°

With rudder pedals in neutral and with trim assist unit (p/n 7038) at zero spring travel, rudder and nosewheel settings are approximately 1° right.

STABILIZER

Measured with thrust line level, (Door sill level).

Maximum positive setting	+ 1° to + 2½°
Maximum negative setting	— 3½° to — 4½°

ELEVATORS

Measured from stabilizer chord with travel board at stabilizer station 16.0 and with stabilizer at 0° thrust line.

Up travel 24°	Tolerance ± 1°
Down travel 10½°	Tolerance ± 1°

ELEVATOR TRIM ASSIST UNITS

With stabilizer set at maximum negative setting to thrust line (—3½°), adjust trim assist units (p/n 7038-1) for elevator up angle of —18° to —20° at the zero spring travel position. With the stabilizer moved to the maximum positive setting (+1½°), the position of the elevators at the zero spring travel position of the trim assist units should be from 0° to +3° down.

ALLOWABLE FREE PLAY LIMITS

Fore and aft allowable movement at stabilizer tip: .12"

Vertical allowable movement at stabilizer tip: .10"

Vertical allowable movement at rudder trailing edge: .08"

SECTION

7

FUEL SYSTEM

SECTION VII

FUEL SYSTEM

A. GENERAL

The fuel system consists of 24 gallon fuel cells located in the front portion of each wing. These cells are formed by sealing off, through the use of a special sealing compound, a portion of the wing. Aluminum fuel lines feed the fuel from the cells to the two way, positive setting selector valve on the floor beneath the pilot's seat. It is then routed through the Bendix electric fuel pump to the gascolator,or sediment bowl, by aluminum lines. From the gascolator, it passes through the firewall to the engine-driven fuel pump, and from there to the carburetor.

There are three flush-type quick drains located in the fuel system. one at the lowest point of each fuel cell, and one beneath the fuel selector valve. A drain cup is provided with each airplane for testing for water or sediment after each refueling or prior to each flight.

B. TROUBLESHOOTING

Troubles peculiar to the ***MOONEY M 20 B*** fuel system are listed in Figure 22 along with their probable causes and suggested remedies. When troubleshooting, check from the power supply to the items affected. If no trouble is found by this method, the trouble probably exists inside individual pieces of equipment; they may then be removed from the aircraft and an identical unit, tested and known to be in good condition installed in its place.

Table 3 FUEL SYSTEM TROUBLESHOOTING

TROUBLE	CAUSE	REMEDY
Fuel gage not indicating.	Broken Wire	Check and repair
	Transmitting unit faulty	Replace
	Float hung in fuel cell	Check and repair.
	Circuit breaker out	Check and reset
Fuel gage indicates full when tanks are not full.	Incomplete ground	Check ground connections at fuel transmitter in tank
No Fuel Pressure Indication	No fuel in tanks	Check and fill tanks
	Defective Fuel Pump	Check pump for proper fuel pressure buildup. Check for obstruction in electric fuel pump screen. Check engine fuel pump diaphragm and check valve
Pressue low or pressure surge	Obstruction in inlet side of pump	Check fuel lines and remove obstructions
	Faulty diaphragm in Engine pump	Replace or rebuild pump. Check fuel lines and repair or tighten

C. REMOVAL AND INSTALLATION OF FUEL PUMPS

1. Electric Fuel Pump.
   a. Remove the electrical lead at the knife disconnect.
   b. Disconnect the inlet and outlet fuel lines.
   c. Remove two fuel pump mounting bolts and carefully remove pump.
   d. Hold the pump manually and turn the cover in a counterclockwise direction and remove core.
   e. Carefully remove the sceen and rinse it in gasoline or kerosene to thoroughly clean it. If screen is badly distored or collapsed, replace it.
   f. Clean fuel pump cover in the same manner as in Step e.
2. Engine Driven Fuel Pump.
   Refer to the appropriate Lycoming overhaul manual for instructions in removal and assembly of the engine driven fuel pump.

D. REMOVAL AND INSTALLATION OF FUEL SELECTOR VALVE

1. Removal.
   a. Remove fuel selector valve handle and pointer (6459). NOTE: Use caution when removing pointer plate as this plate releases the tension of the detent pin and spring.
   b. Remove detent mechanism (6121) carefully.
   c. Remove right and left fuel inlet lines at valve body.
   d. Remove fuel outlet line at valve body.
   e. Remove four screws holding fuel valve assembly to mounting plate (6131-3). Fuel valve assembly can now be removed.
   f. See Figure 20 for illustration of fuel valve assembly.
2. Installation.
   a. Fuel valve installation is essentially the reverse of removal.
   b. Important: Install valve handle and pointer (6459) so that pointer will align with valve core inlet hole.

E. FIELD REPAIR OF FUEL CELLS

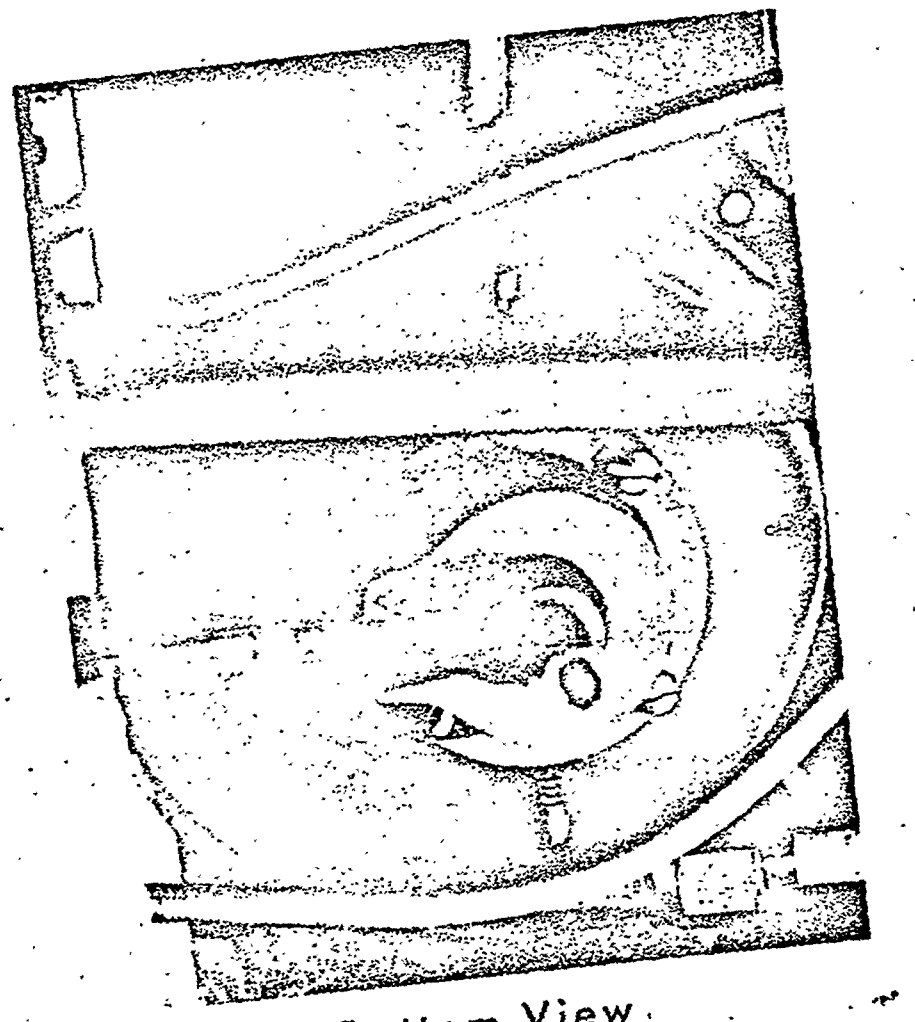
1. General.
   This instruction establishes the procedure to be used in repairing the Mooney *Mooney M 20B* integral fuel tank. Tank repairs should not be attempted until these instructions are read.
2. Approved Materials.
   a. Sealants. (Note: Sealant must meet the U. S. Government specifications as indicated.)

PR 1221-A-½ or A-2	(MIL-S-7502B, Class A)	Brush Coat
PR 1221-B-½ or B-2	(MIL-S-7502B, Class B)	Filleting Compound
PR 1321-B-½ or B-2	(MIL-S-8784A, Class B)	Removable Access Panel
b. PR 1005-L	(MIL-S-4383B)	Protecting Coating

   c. Gloves—Polyethylene.
   d. Approved Metal Cleaning Solvents.
      1. Turco 657 Wipe Sol
      2. The following shop mixed cleaner may be used as an alternate.

Aromatic Petroleum Naptha (Specification TT-N97 Type 1, Grade B)	50 Percent by Volume
Ethyl Acetate (Specification TT-E-751)	20 Percent by Volume
Methylethyl Keytone (Specification TT-M261)	20 Percent by Volume
Isopropyl Alcohol (Specification MIL-F-5566)	10 Percent by Volume

Figure 20



Bottom View

FUEL SELECTOR VALVE

e. Cheese Cloth

f. Turco Leak Detector

g. Methyl Ethyl Keton (thinner for PR 1005-L)

All of the above materials may be obtained from the spare parts department of Mooney Aircraft, Inc., 1712 Water Street, Kerrville, Texas. Sealants may be obtained from the products Research Co., at either of the following addresses: 2919 Empire Avenue, Burbank, California, or 401 Jersey Avenue, Glouchester City, New Jersey.

3. Handling And Mixing Sealant.

a. Sealant Material Characteristics.

1. Application life is the time that the mixed compound remains suitable for application. Application life is always based on standard conditions of 75° F. and 50% relative humidity. For every 10° F rise in temperature, application life is reduced by half, and for every 10° F drop in temperature, application life is doubled. High humidity at the time of mixing shortens the application life.

2 Maximum unopened container storage life is six (6) months at 85° F.

3. Tack free time application life and curing rate of sealants.

PR 1221 SEALANT			
Class A	Tack Free Time Hrs.	Curing Rate Hrs.	Application Time Hrs.
A ½	10	30	½
A 2	24	48	2
A 4	36	72	4
A 8	50	100	8
Class B			
B ½	10	30	½
B 2	24	48	2
B 4	36	72	4
B 8	50	100	8
B 12	60	120	12
	PR 1321 ACCESS DOOR SEALANT		
Class B			
B 2	24	48	2

b. Mixing of Sealants.

1. Hand Mixing.

2. Kits consisting of the proper proportions of base compound and accelerator should be used.

3. Slowly stir, to avoid excessive air entrapment, the accelerator into the base compound and thoroughly mix approximately seven to ten minutes. Be sure to scrape the sides and bottom of the container in order to include all compound in the mixture and to insure uniform blending. Scrape mixing paddle periodically to remove unmixed compound.

4. Take a small amount of sealant from the mixture with a clean aluminum strip and spread the sealant, then visually examine the film of sealant to ascertain if the accelerator is visable in particle form. If particles of accelerator are visible, continue the mixing operation. If course particles of accelerator persist after mixing, the mixed batch and remaining accelerator will be rejected.

5. Put a small amount of sealant in the accelerator container and mix to assure that all the accelerator is mixed into the sealant.

4. Sealant Application Instructions.

The following instructions are for the reapplication of sealant removed in order to repair tank leaks.

A. Brush Sealant.

1. Apply a brush coat of sealant compound PR 1221-A-½ or A-2 over all seams, rivets, nuts, and bolts if removed for repair.

2. A one-inch stiff paint brush is recommended for this operation. Brush strokes should be parallel to seams forcing the sealant into all gaps. Use a circular brush action to deposit an even coat of sealant around rivets, nuts, and bolts. Coat should be approximately 1/32 of an inch thick.

3. Considerable brush action should be used to force sealant into all small crevices to obtain good adhesion. Air pockets trapped under the sealant due to improper application will open up in the form of a hole or void soon after it has been applied. Repair should be made by pressing the sealant in place with a spatula while it is still in the application life state.

4. In cases where the top of a flange is .040 inches or less and where application of a successful fillet would not be clearly defined, apply two brush coats of sealant compound in approximately 1/32 inch thick coats. Allow first coat to cure approximately four hours or until it becomes rubbery before application of the second coat. The second coat should extend ¼ of an inch past the previous coat.

B. Fillet Sealing.

1. General Requirements.

a. Brush coat sealant must be tack free before applying sealant.

b. See Figure 24 for typical fillet size.

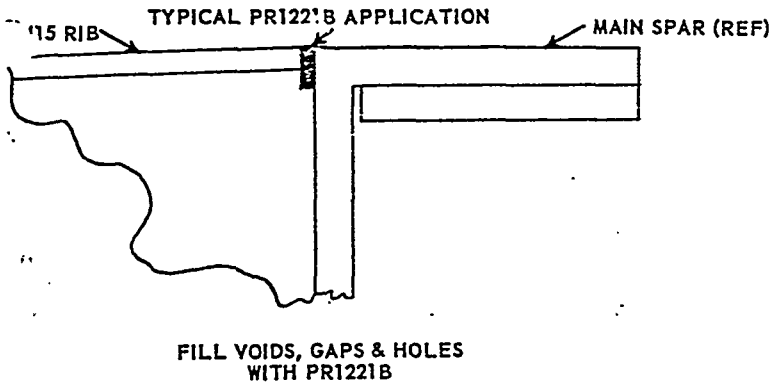
c. Fillet laid on intersection joints shall be joined together to produce a continuous fillet.

d. All difficult and hard to reach areas to be sealed first, to prevent the possibility of their being overlooked or incorrectly sealed.

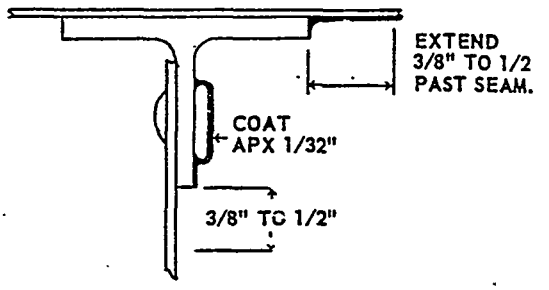
Figure 21

TYPICAL SEALANT APPLICATION

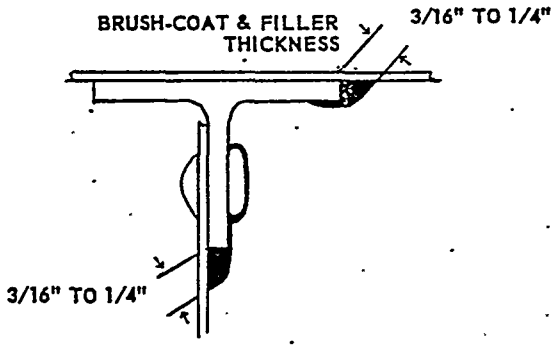
TYPICAL FILLETS FOR FUEL TANK REPAIRS



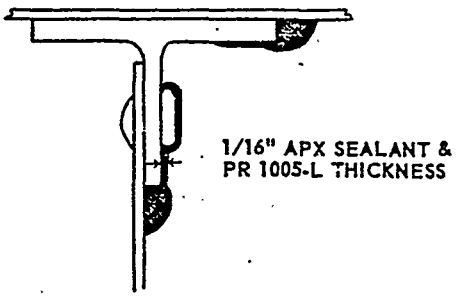
FIRST STEP



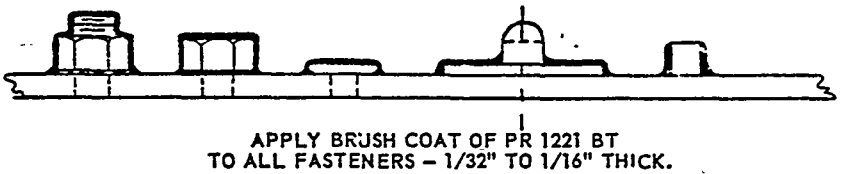
SECOND STEP



THIRD STEP



FOURTH STEP



2. Application of Fillets.
   a. Use a spatula or extrusion gun with ⅛ inch to ¼ inch nozzle openings for applying fillets on edge of all seams.
   b. If gun is used, hold gun perpendicular to seam when applying fillet so that extruded sealant will be packed tightly.
   c. Use a spatula to firmly pack sealant in place, work out air pockets and form each fillet.

C. Protective Coating Procedure (Brush).

1. Brush on a smooth, continuous coat of PR 1005-L over sealant with a paint brush using short even strokes. The film should extend beyond the sealant one inch onto the adjacent metal.
2. Cure top coat twenty minutes at 75° F. or until tack-free.
3. Apply second brush coat of PR 1005-L.
4. Every effort must be taken to obtain a complete bubble-free continuous top coat. Do not try to rebrush over areas during the drying period as this will only cause dragging or will break the continuity of the coating.

D. Removal Panel Sealing.

1. General Requirements.
   a. Clean metal surfaces to be sealed with Turco 657 Wipe Sol.
   b. Cleaned surfaces need dry only a few minutes (5 to 10 Minutes) before application of sealant. Sealant should be applied as soon as possible after cleaning.
   c. Parts should not be stored or handled in any manner which will allow fingerprints, dust, dirt, and other foreign substances to contaminate the surfaces to be sealed after the pre-cleaning operation.
2. Sealant Procedure (Upper Wing surface access panels).
   a. Apply a coat of access door sealant PR 1321, B½ or B-2, to either faying surface using a short stiff bristle brush, spatula or filleting gun. If the gun is used for application, the sealant must be smoothed with a brush or spatula.
   b. Cover the entire faying surface with a sealant coat of sufficient thickness (1/32 to 1/16 inch) to assure extrusion along the edges of the faying surface when the mating parts are assembled.
   c. Assemble parts immediately after application of sealant, tighten screws to obtain as near as possible a metal to metal contact.
   d. After fastener installation, remove the extruded sealment from the wing surface.

5. Description of Leaks.

It is important to make careful periodic fuel tank inspections. These inspections are particularly important in confined areas of the airplane which are not exposed to air stream in flight. Classification of fuel leaks, which occur in both confined areas and open areas, is necessary to differentiate between those leaks which require repair before flight and those which do not constitute a flight hazard. The wetted area around a leak is an indication of the intensity of the leak. All leaks should be marked and the location and intensity of the leak should be recorded.

A. Classification of leaks as to Intensity and to Location.

1. Classification as to Intensity (see Figure 22).

a. Stain is a slow fuel seepage which tends to dry as it is exposed to the air.

b. Seep: A seep is a fuel leak which reappears in a short period of time after being wiped clean.

c. Heavy seep: A fuel leak which appears immediately after being wiped clean.

d. Running Leak: A leak which flows steadily.

2. Classification as to Location.

a. Leaks which do not constitute a flight hazard. If slow seeps, seeps, or heavy seeps occure in open areas such as the surface of the wing, wheel well, which are exposed to the air stream in flight, they need not be repaired before flight providing, the condition causing the leak cannot result in a leak of greater intensity after the flight is in progress. Seeps considered acceptable for flight should be inspected frequently to insure that an increase in intensity does not occur.

b. Leaks which Constitute a Flight Hazard.

1. Running leak and any leak which, in a confined area, is not exposed to the air stream should be repaired before the next flight. (See Figure 23).

6. Leak Detection.

A. External Leak Detection after Fueling.

1. To be able to trace the leak from where it appears on the outer boundary to its true source inside the tank, the exact point where the fuel is escaping from the tank must be determined. Locating the point will help determine on which fitting or seam the true source of the leak may be located.

2. By using an air gun to blow and evaporate fuel from the seams and crevices of the leak area, the exact point where the fuel is escaping from the tank may be more clearly defined.

3. Small seep leaks can be traced with the raw edge of torn paper. The fuzzy edge of torn paper absorbs fluid and gives a good visual indication of the presence of any fuel when brought in contact with suspected leak points.

4. After the leak has been traced to its exterior source and marked drain fuel from tanks.

B. Internal Leak Detection.

1. It is very important that the true source of the interior leak be found in order to make a permanent repair. The fuel tank is a network of seams and fuel may flow through or along a seam,, or from one seam to another and may channel a few inches or several feet to the point where it appears on the external boundary of the tank.

Figure 22

FUEL LEAK CLASSIFICATION

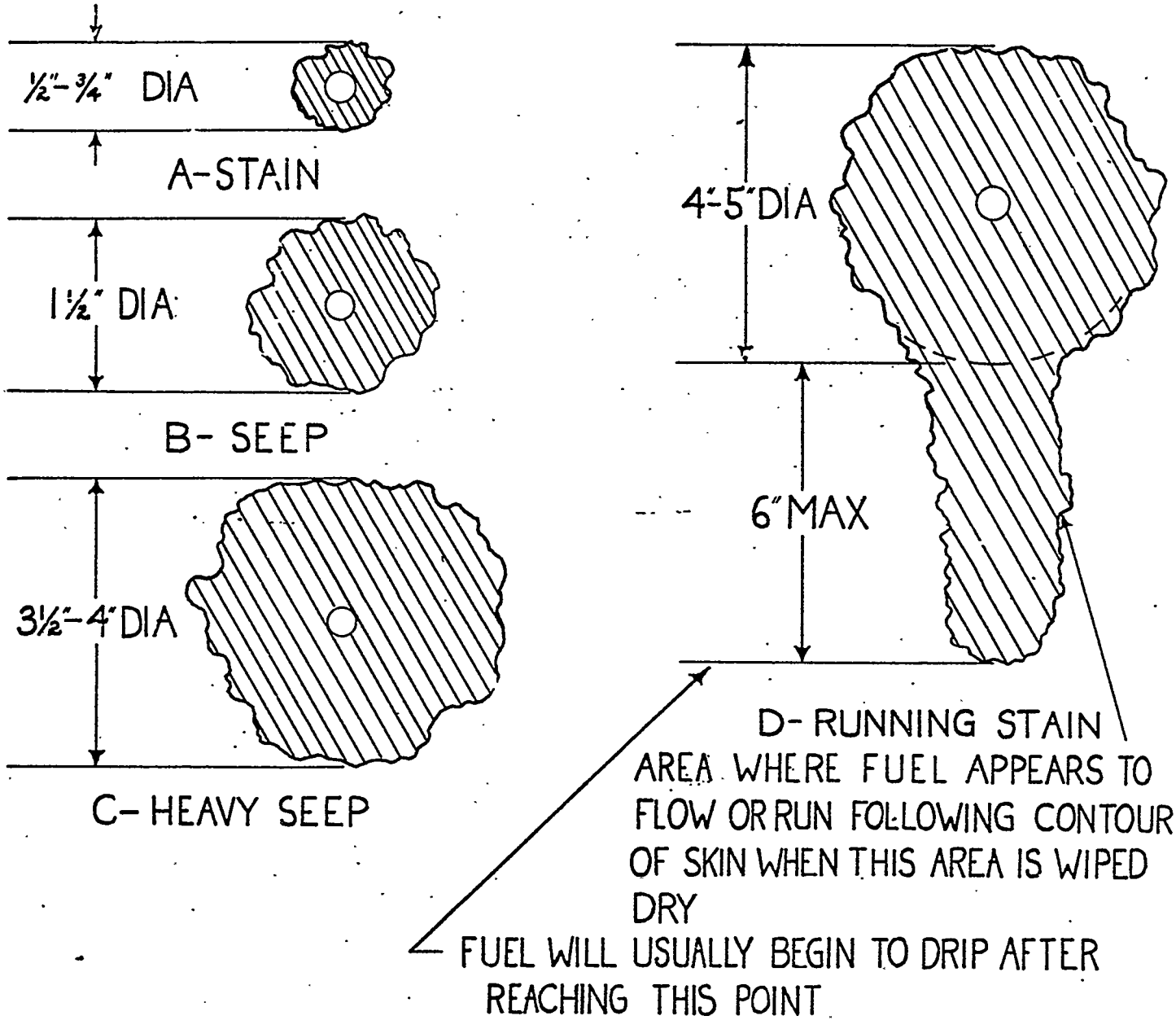
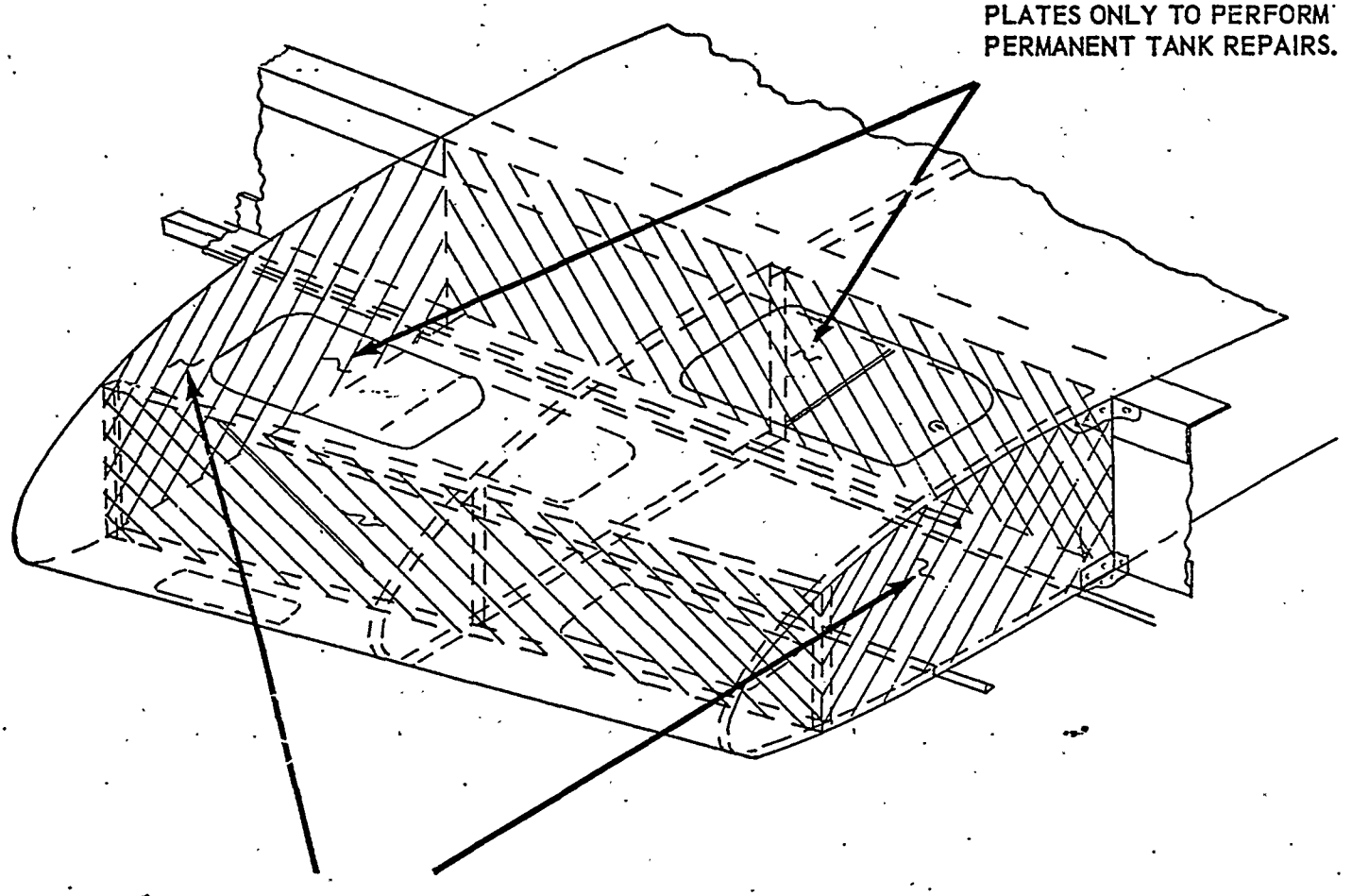


Figure 23 LEAKS WHICH CONSTITUTE A FLIGHT HAZARD



2. Enter the tank through the top inspection plates only (See Figure 23) and inspect the sealant in the general area of the outside leak point. Look first for bare seams, rivets, and bolts in difficult to seal areas. Inspect sealant for blisters, pin holes, cracks, splits, and loss of adhesion. Mark all flaws with masking tape.

3. Try each flaw inside the tank with 20 to 30 PSI air (filtered) line pressure. Hold the air nozzle against the flaw and check closely the outside leak point for sign of fuel.

4. After trying all flaws in this manner, and if no leak source has been discovered, apply bubble fluid to outside of tank and again apply air pressure to flaws inside of tank.

5. See Figure 24 for suggested method of leak detection when leak exists around rivet and after the above method has been unsuccessful.

7. Leak Repair Procedure.

A. Temporary Repair of Fastener Leaks.

1. Generally all leaks located in enclosed areas and running leaks in open areas constitute a flight hazard. Fastener leaks in these catagories may be repaired temporarily by the application of a sealant fillet over the fastener head on the fuel tank exterior.

2. In order for a temporary repair of a leak to be made at a fastener, the following requirement must be met. Structural integrity must exist in the area of the leak.

3. Temporary repair procedure for fastener leaks.

a. Remove enough fuel to drop the level below the leak.

b. Clean the head of the fastener and the adjacent surface with Turco 657 Wipe Sol, or equivalent, and dry thoroughly. Fastener head and adjacent metal must be free from paint, dirt, and oil.

c. Apply ⅛ inch thick coat of PR 1221-B-½ or B-2 over the head and around the fastener.

d. Cure the sealant until firm and rubbery.

e. Refill the tank and carefully examine the repair periodically. If leak reoccures, remove the sealant and either make a new temporary repair or make the permanent repair.

B Permanent Leak Repair.

1. If the leak source is determined to be around a rivet or threaded fastener, the repair procedure shall be restrike the rivet or retorque the fastener to the maximum torque valve permitted. Any one rivet can be restruck only once. If the leak continues, the rivet must be replaced. Repair any sealant damage due to the restriking or retorquing operation.

2. Remove sealant in immediate area of leak source using a sharp non-metalic tool. A chisel shaped formica tool is suggested. Scarf ends of existing sealant so that the new sealant can form a continuous and smooth tie-in.

3. Thoroughly clean repair area using metal cleaning solvent to obtain good adhesion. Wash one small area at a time. Then dry with a clean cloth before the solvent evaporates to prevent redisposition of oil and dirt on the surface. Always pour the solvent on the washing cloth to maintain clean solvent supply.

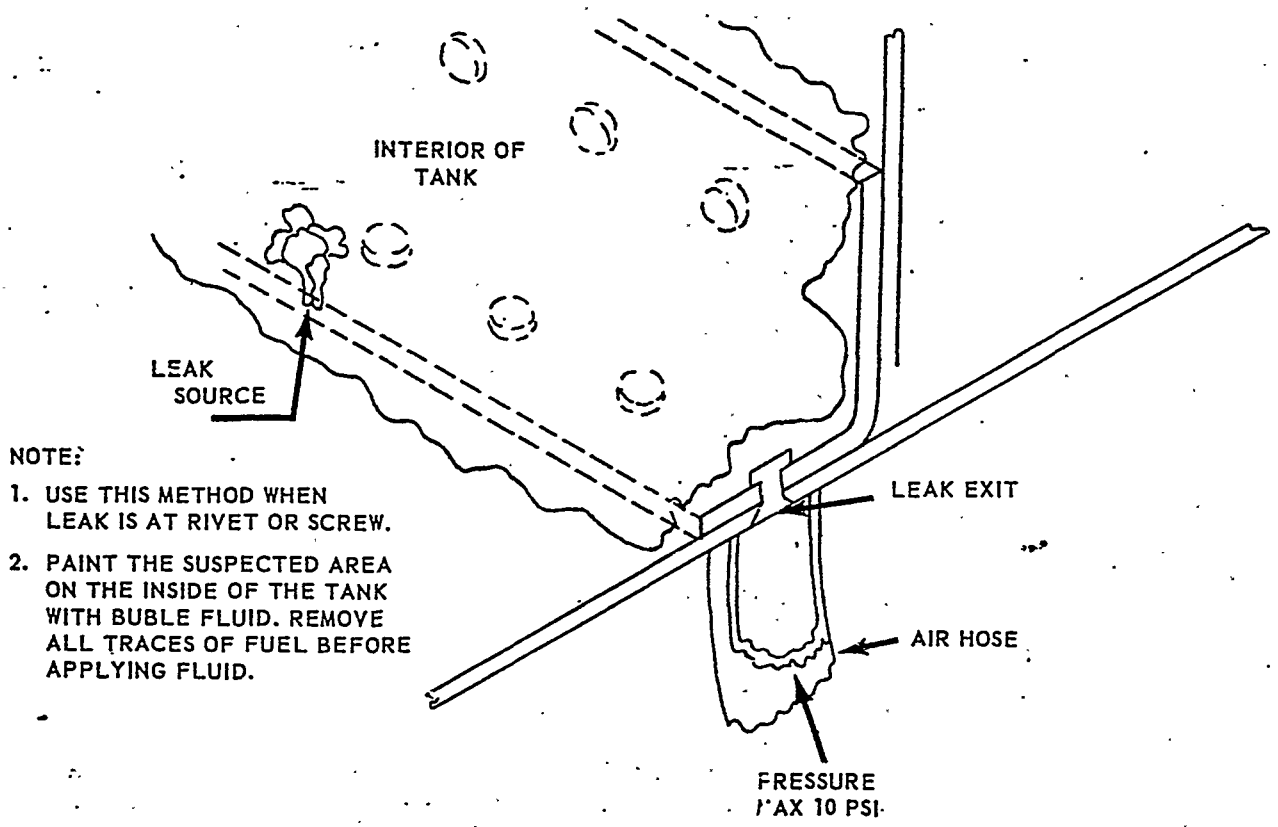
4. Cleaned area must be thoroughly dried by blowing filtered air over the immediate area until there is no possibility of solvent or fuel entrapment under adjacent sealant.

5. Apply sealant as required for repair. (See Figure 21). Repaired fillets must be blended into existing fillets and worked with a filleting tool as was required.

6. Allow all repaired sealant to cure to a tack-free condition and apply two brush coats of PR 1005-L to the repaired area.

Figure 24

TANK LEAK DETECTION



SECTION

8

ELECTRICAL SYSTEM

SECTION VIII

ELECTRICAL SYSTEM

A. GENERAL

The ***MOONEY M 20 B*** uses a twelve-volt electrical system. A fifty amp, heavy duty generator provides plenty of current so that, even if a high electrical load is placed on the system by multiple radios, a rotating beacon, and navigational lights, the heavy-duty thirty-three amp battery will remain at full charge.

The battery is located on the forward left-hand side of the firewall. It is sufficiently close to the engine, so that there is very little voltage drop and more electrical power is available for cold weather starting.

The breaker switches, designed to relieve the electrical system of any over-loads, are located on the lower right-hand side of the co-pilot's instrument panel.

The master switch control for the electrical system is located at the top right-hand side of the radio instrument panel.

B. TROUBLESHOOTING

Troubles peculiar to the ***MOONEY M 20 B*** electrical system are listed on Figure 28 along with their causes and suggested remedies. When troubleshooting, check from the power supply to the item affected. If no trouble is found by this method, the trouble probably exists inside an individual piece of equipment which may then be removed from the airplane and an identical unit or units, tested and known to be good, installed in place.

1. Electrical Switches and Circuit Breakers.

Electrical switches and circuit breakers, located in the lower left and lower right instrument panels, control the navigation and instrument lights, landing light, electric turn and bank indicator, electric fuel pump, and other electrical components. The circuit breakers automatically break the electrical circuit if an overload is applied to the system, thus preventing damage to the electrical wiring. To reset the circuit breakers, simply push in the buttons. Allow sufficient time for cooling before resetting circuit breakers. The time for resetting circuit breakers may vary considerably, depending on the nature of the overload and the temperature.

2. Battery.

The battery is accessible when the left side cowl is removed from the airplane. The battery should be maintained in a charged condition at all times and the water-level checked at regular intervals. A fully charged battery will not freeze and a clean battery presents no hazard. Never add anything but distilled water to the battery. Do not overfill as the water and acid will overflow and possibly stain the belly of the airplane. A hydrometer check should be performed to determine the percent of charge present in the battery (Refer to Table 4). All connections must be clean and tight. If the battery is not up to normal charge, recharge starting with a charging rate of 4 amperes and finishing with 2 amperes.

Note: Quick charges are not recommended.

3. Battery Charging System.

The charging current of the battery depends upon the condition of the battery and the voltage regulator setting. With all loads turned off and the engine running at 2000 RPM or higher, the normal battery charging current is from 5 to 35 amperes.

If the charging current is apparently excessive, note the following:

a. Charging current should slowly drop to 10 amperes or less after 15 to 20 minutes of flight.

b. A very low battery will take longer to show a drop in charging current.

c. Too high a voltage regulator setting will cause excessive charging and excessive loss of water

Measure the voltage with a voltmeter at "Batt" terminal of the voltage regulator. At 80°F, the voltage should be 13.8 to 14.8 volts. This voltage will be higher if the temperature is less than 80°F and lower if the temperature is higher than 80°F.

If the charging is apparently low, note the following:

a. The charging current of a fully charged battery is normally from 1 to 4 ampheres.

b. The regulator should not be considered defective because of a low charging until:

1. A voltmeter check indicates that the voltage at the "Batt" terminal is below requirements given in Step 3C above.

2. A hydrometer check of the battery indicates that the battery is not fully charged. Refer to Table 4 for hydrometer reading Vs Battery Charge Percent.

Table 4 Hydrometer Reading vs. Battery Charge Percent

Hydrometer Reading **	Percent of Charge
1280	100
1250	75
1220	50
1190	25
1160	Very little useful capacity
1130 or below	Discharged

** Based on battery electrotype temperature of 80° F.

If battery electrotype temperature is below 80° F, subtract 4 points for every 10° F from the hydrometer readings. If the battery acid temperature is above above 80° F, add 4 points for every 10° F to the hydrometer reading.

Example:		
	Hydrometer reading	1260
	Battery Electrolyte Temperature	30° F
	Subtract	20
	Correct Reading	1230

Table 5 ELECTRICAL SYSTEM TROUBLESHOOTING

	BATTERY	
TROUBLE	CAUSE	REMEDY
Discharged battery.	Battery worn out.	Replace battery.
	Charging rate not set right.	Reset (Refer Lycoming Manual).
	Discharging rate too great.	Remove load when generator is not charging and reduce use of starter, etc., on ground; use external power whenever possible.
	Standing too long.	Remove and recharge battery.
	Equipment left on accidently.	Remove and recharge battery.
	Impurities in electrolyte.	Replace battery.
	Short circuit ground) in wiring.	Check wiring.
	Broken cell partitions.	Replace battery.
Battery life is short	Insufficient electrolyte.	Maintain electrolyte level.
	Heavy discharge.	Remove loads when generator is not charging.
	Sulfation due to disuse.	Long slow charge for 60-100 hours at ½ regular charging rate.
	Impurities in electrolyte.	Replace battery.
	Low charging rate.	Adjust voltage regulator.
Cracked cell jars.	Hold-down bracket loose.	Replace battery and tighten.
	Frozen battery.	Replace battery.
Compound on top of battery melts.	Charging rate too high.	Reduce charging rate by adjusting voltage regulator.
Electrolyte runs out of vent plugs.	Too much water added to battery and charging rate too high.	Drain and keep at proper level and adjust voltage regulator.
Excessive corrosion inside container.	Spillage from overfilling.	Use care in adding water.
	Vent lines leaking or clogged.	Repair or clean.

TROUBLE	CAUSE	REMEDY
	Charging rate too high.	Adjust voltage regulator.
Battery freezes.	Discharged battery.	Replace battery.
	Water added and battery not charged immediately.	Always recharge battery for ½ hour following addition of water in freezing weather.
Leaking battery jar.	Frozen.	Replace battery.
Battery polarity reversed.	Connected backwards on airplane or charger.	Battery should be slowly discharged completely and then charged correctly and tested.
Battery consumes excessive water.	Charging rate too high (in all cells).	Correct charging rate.
	Cracked jar (one cell only)	Replace battery.
	GENERATOR	
Generator operating within rated speed range but voltage output low.	If the voltage is low, generator is operating on residule magnetism.	Check for loose or high-resistance connections; clean and tighten.
	Loose or high-resistance electrical connections.	Clean and tighten all electrical connections.
	Brushes excessively worn.	When brush wears down to ½ inch, replace with new one. Caution: Do not use abrasives of any description in seating brushes.
	Brushes binding in the brush box.	The brushes should be a free fit without excessive side play in the brush boxes. Binding brushes and brush boxes should be wiped clean with a cloth moistened in Varsol or undoped gasoline.
	Excessive side play of brushes in brush box.	Replace the brushes outlined above.
	Brushes not properly seated.	Reseat brushes as outlined above.
	Low brush spring tension.	Brush spring should bear centrally on top of the brushes, insuring full brush contact with the face of the commutators.
	Dirty commutator.	Clean the commutator with a cloth moistened in Varsol or undoped gasoline.

GENERATOR—Continued

TROUBLE	CAUSE	REMEDY
	Scored or pitted commutator.	Turn down commutator or replace.
	Shorted or open armature coils.	Replace generator or armature.
	Improper operation of voltage regulator.	Adjust regulator.
Generator operating within rated speed range but voltmeter indicates zero.	Wiring not properly connected.	See electrical system wiring diagram.
Generator operating within rated speed range, but voltage output is erratic.	Unstable operation of the voltage regulator. Same as "Generator operating within rated speed range but voltage output low", above.	Replace voltage regulator. Use remedy under "Generator operating within rated speed range but voltage output low", above.
Excessive sparking at generator brushes.	Same as "Generator operating within rated speed range but voltage output low," above.	Use remedy under "Generator operating within rated speed range but voltage output low".
Generator operating within rated speed range but system ammeter reads off scale.	Generator field magnetized in the wrong direction.	Flash field with a jumper wire on regulator between generator and battery.
System ammeter fluctuates excessively when indicating full rated load.	Generating system is overloaded.	Check the system for abnormal loads.
	Improper operation of generator reverse-current relay.	Re adjust to operate properly.
	Loose connections.	Tighten connections.
Burned-out system ammeter or line fuse.	Discharged battery. Defective wiring.	Replace with fully charged battery. Replace all defective wiring.
	STARTER	
Motor fails to operate.	Low battery charge.	Check and recharge if necessary.
	Defective or improper wiring or loose connections.	Refer to electrical wiring diagram and check all wiring.
	Defective starter solenoid or control switch.	Replace faulty unit.

STARTER, *Continued*

TROUBLE	CAUSE	REMEDY
	Binding, worn, or improperly seated brush, or brushes with excessive side play.	Brushes should be a free fit in the brush boxes without excessive side play. Binding brushes and brush boxes should be wiped clean with a gasoline (undoped) moistened cloth. A new brush should be run in until at least 50% seated; however, if facilities are not available for running in brushes, then the brush should be properly seated by inserting a strip of No. .0000 sandpaper between the brush and commutator, with sanded side next to brush. Pull sandpaper in the direction of rotation, being careful to keep it in the same conture as the commutator. Caution: Do not use coarse sandpaper or emery cloth. After seating, clean thoroughly to remove all sand and metal particles to prevent excessive wear. Keep motor bearing free from sand or metal particles.
	Dirty commutator.	If commutator is rough or dirty, smooth and polish with #0000 sandpaper. If too rough and pitted, remove and turn down. Blow out all particles.
	Shorted, grounded, or open armature.	Remove and replace with an armature known to be in good condition.
	Grounded or open field circuit.	Test, repair if possible or replace with a new part.
Low motor and cranking speed	Worn. rough, or improperly lubricated motor or starter gearing.	Disassemble, clean, inspect, and relubricate, replacing ball bearing if worn.
	Same electrical causes as listed under "Motor fails to operate".	Same remedies listed for those troubles.
Excessive arcing of motor brushes.	Binding, worn, or improperly seated brush or brushes with excessive side play.	See information above dealing with this trouble.
	Dirty commutator, rough, pitted or scored.	Clean as outlined above.
Excessive wear and arching of motor brushes.	Rough or scored commutator.	Remove and turn commutator down on lathe.
	Armature assembly not concentric.	Reface commutator.

Table 6

ELECTRICAL EQUIPMENT LIST

ITEM	RATING	MAUFACTURER	MODEL OR PART NO.
Generator	50A	Delco Remy	1101915
Voltage Regulator	50A	Delco Remy	1119224
Circuit Breaker—Generator	50A	Wood	2350
Battery	33A	Rebatt	R33
Switch—Generator	55A		AN 3022-2
Switch—Master	55A		AN 3023-2
Starter		Delco Remy	1109689
Switch—Ignition & Starter		Bendix	10-126690-8
Circuit Breaker—Gear Warning	5A	Klixon	PSM-5N
Light—Gear Warning	.08A	Dialco	VM911-M-3A
Switch—Gear Warning (retr. Handle)		Micro	BZ 7 RWT 80
Switch—Gear Warning (throttle)	25A	Micro	BZ 7 RQIT
Horn—Gear Warning	.7A	Edwards	319
Light—Gear Warning	.08A	Dialco	VM911-M-2A
Circuit Breaker—Fuel Pump	5A	Klixon	PSM-5N
Switch—Fuel Pump	40A	Micro	AN 3021-2 (511TSI-2)
Pump—Fuel Electric	1.5A	Bendix	476087
Circuit Breaker—Fuel Gage	5A	Klixon	PSM-5N
Gage—Fuel Quantity		AC	5643860
Switch—Fuel Gage	40A	Micro	AN 3021-3 (511TSI-3)
Gage Units—Fuel Tank		AC	5641991
Circuit Breaker—Stall Warning	5A	Klixon	PSM-5N
Indicator—Safe Flight (Stall Warning)		Safe Flight	164-R
Pre-stall Warning Switchlift Detector		Safe Flight	164
Circuit Breaker—Turn & Bank	2A	Klixon	PSM-2N
Indicator—Turn & Bank	4.2W	Schwein	NS27200-A1
Circuit Breaker—Nav. Lights	10A	Klixon	PSM-10N
Switch—Navigation Lights	40A	Micro	AN 3021-2 (511TSI-2)
Lights Assembly—Wing	16A	Grimes	A1285
Light Assembly—Tail	1.15A	Grimes	A2064-12
Circuit Breaker—Landing Light	35A	Klixon	PSM-35N
Switch—Landing Light	55A		AN 3021-2
Light—Landing	100W	G E	4537
Circuit Breaker—Panel Lights	5A	Klixon	PSM-5N
Rheostat (25r) Panel Lights		Clarostat	25-25
Light—Panel Assemblies	.63A	Grimes	A1425-R
Lamp—Compass	.08A	G E	330
Lamp—Fuel Selector	.08A	Dialco	83B1310-117
Circuit Breaker—Dome Lights	10A	Klixon	PSM-10N
Lights & Switch Assy., Dome	1.15A	Grimes	B3555A12

Table 6 ELECTRICAL EQUIPMENT LIST *(Continued)*

Ammeter	.60A	A C	1502373
Solenoid—Starter		Delco Remy	1464
Magneto—Left		Bendix	S4LN200
Magneto—Right		Bendix	S4LN204
Vibrator—Starting	3A	Bendix	10-87998-1
Switch—Starter Solenoid Cutout	40A	Micro	AN 3021-2 (511TSI-2)
Voltmeter—Turn & Bank		Weston Electric Inst.	840 (or equivalant).
Cigar Lighter		Dalcamp	4-2272
Circuit Breaker—Heated Pitot	10A	Klixon	D-7270-5-10
Circuit Breaker—Rotating Beacon	10A	Klixon	D-7270-5-10
Circuit Breaker—ADF-29 Radio	2A	Klixon	PSM-2N
Circuit Breaker—ADF-T12 Radio	5A	Klixon	PSM-5N
Fuse & Fuse Retainer	10A	Little Fuse	31101Q & 155020A, 10 Amp.
Loud Speaker		Oxford	46 AMS
Pitot—Optional		Aero Instrument	PH 562-12
Rotating Beacon—Optional		Grimes	G8400-8-12, D7080-1-12.
Radio—Optional			
ADF Radio—Optional			
Receptical—External Power			AN 2552-3A
Solenoid			AC 1464
Connector—Electrical Plug			AN 3106-14S-1S
Indicator-Carb. Air Temp.	1.5A	Richter	C-12
Probe—Temp. Sensing		Richter	B-5
Adaptor—Electrical Accessory to Cable			AN 3057-6

Special Notes to accompany master schematic Drawing of electrical system.

a. All splices AMP knife disconnect or equivalent.

b. All circuit breakers trip-free type.

c. All terminals AN 659 or equivalent or soldered.

d. All cable to conform to Spec MIL-W 5086.

e. All terminal will be of presinsulated type or will be insulated with vinyl tubing or Scotch #33 tape or equivalent.

f. Insulate splices with Scotch #33 electrical tape or equivalent.

g. Leads without dash numbers are furnished with the equipment.

h. Solder will be plastic resin core.

i. Refer to Mooney Drawing #8573 for installation details.

j. "F" indicates ground through frame (no wires).

k. ⋘ indicates knife disconnect.

l. Attach optional equipment wires to power source only if equipment is installed. Insulate terminals with Scotch #33 tape if not connected.

m. Install 49 and 50 circuit breakers only if heated pitot and rotating beacon is installed.

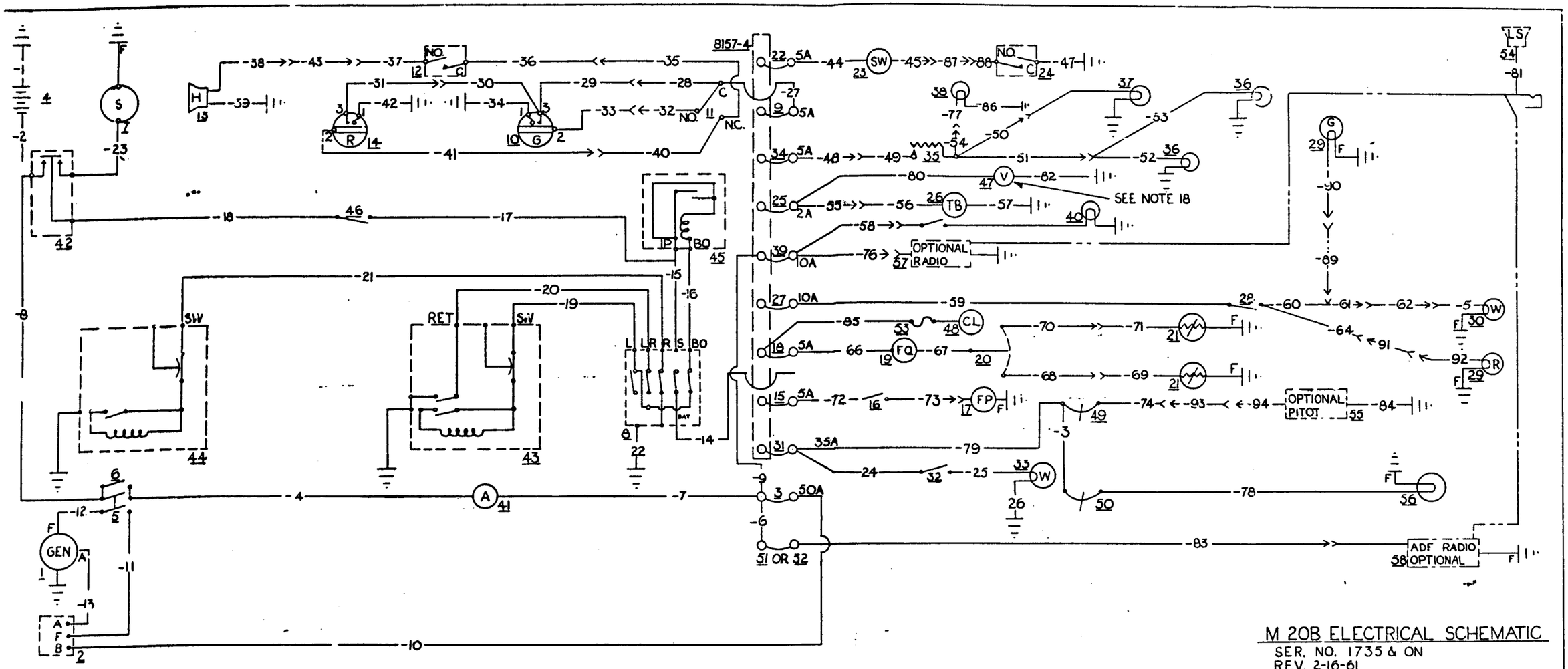
n. Voltmeter 47 and 82 wire installed as optional equipment.

o. Install 3 wire only if rotating beacon and heated pitot are both installed.

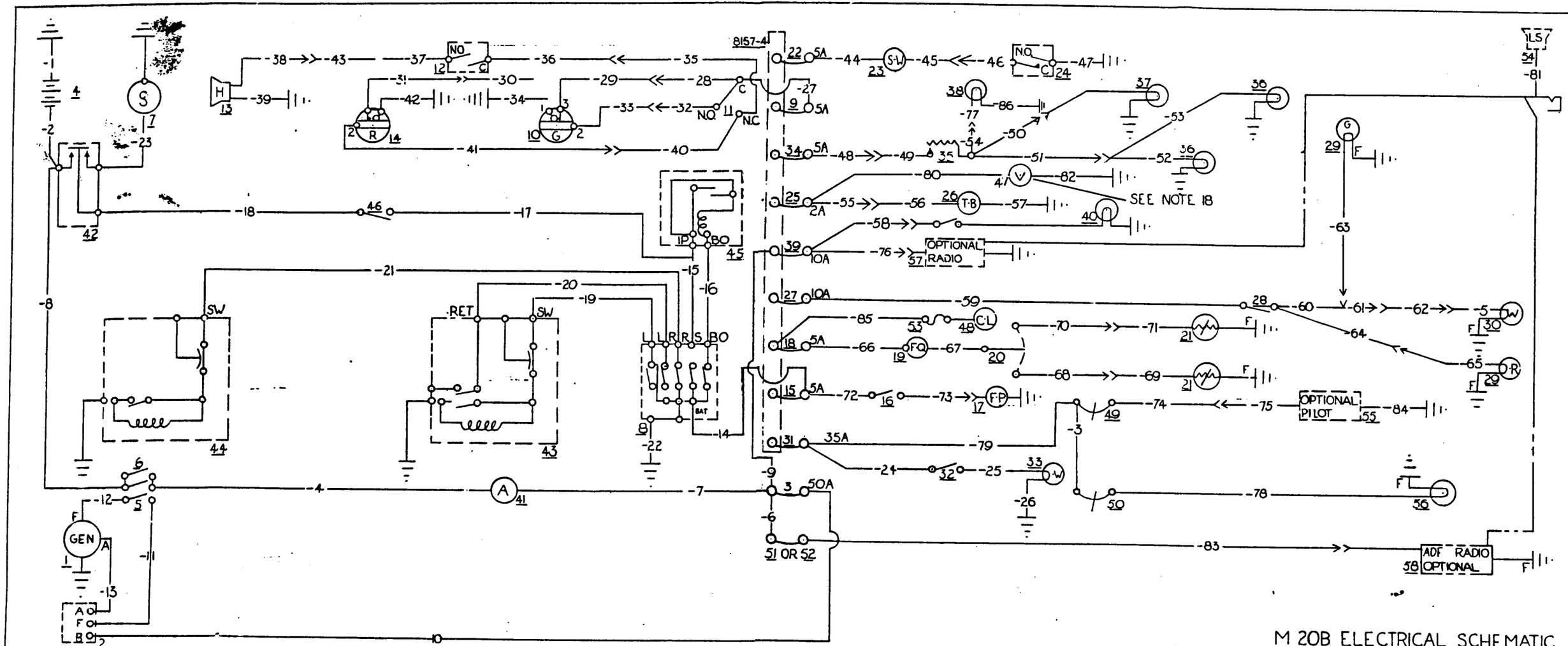
p. Circuit breaker 51 or 52 and wire -6 installed only if ADF is installed.

q. -9 Wire encased full length in 3/8 ID x 3/32 wall vinyl tubing.

r. All aircraft with Turn and Bank Instrument installed must have Voltmeter installed.


8157-4
SEE NOTE 18
OPTIONAL RADIO
OPTIONAL PITOT
ADF RADIO OPTIONAL
SW
RET
SW
GEN
51 OR 52
M 20B ELECTRICAL SCHEMATIC
SER. NO. 1735 & ON
REV. 2-16-61

4.2 FIG 26B

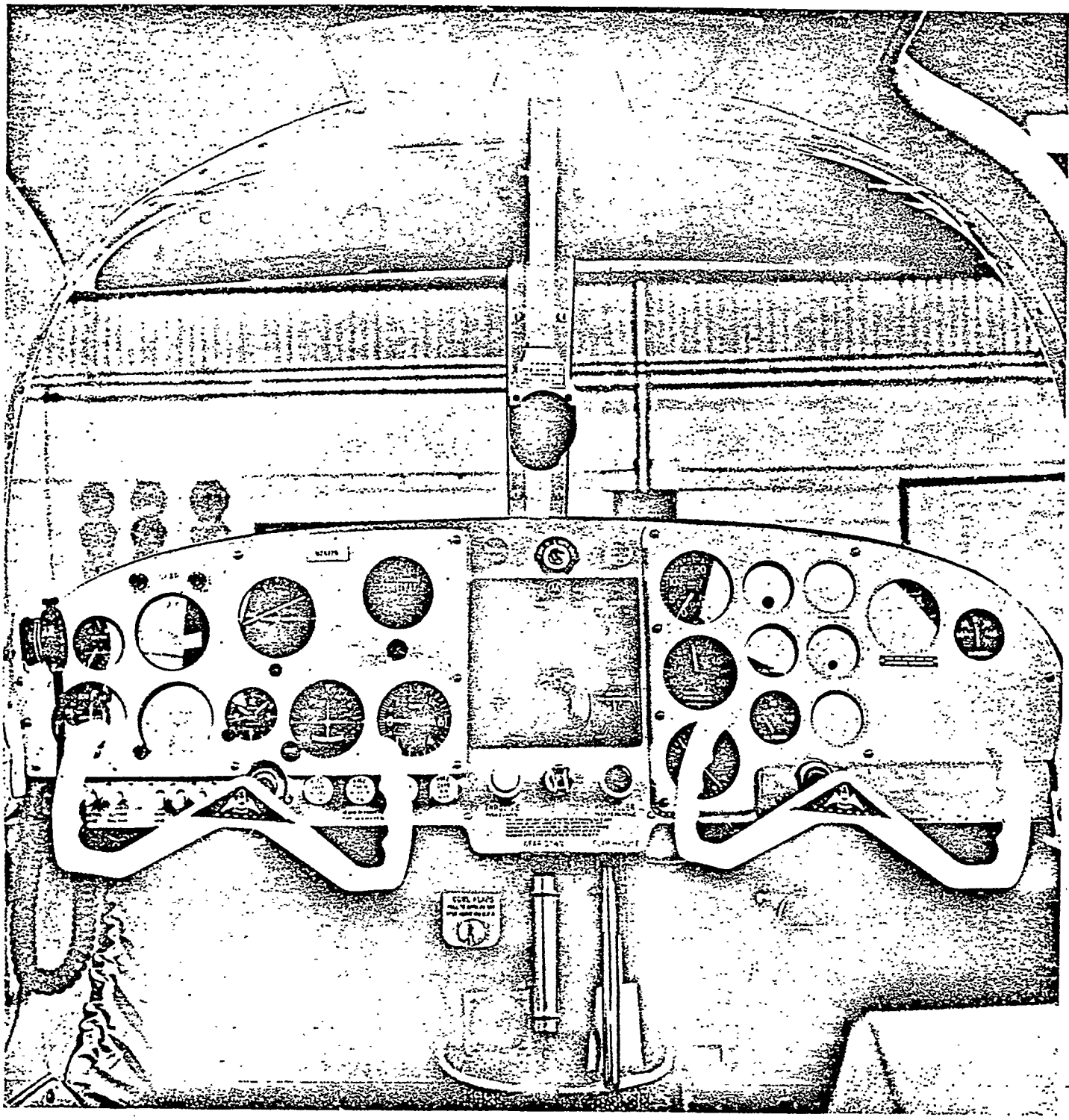


M 20B ELECTRICAL SCHEMATIC
SER 11 1701-1734
REV. 2-16-61

FIG. 26A

Figure 27

INSTRUMENT PANEL



SECTION

9

INSTRUMENTS

SECTION IX

INSTRUMENTS

A. GENERAL

The instrument panel has been scientifically designed to provide functional location of all flight, radio, and engine instrument groups.

All flight instruments are grouped on a shock-mounted panel directly in front of the pilot. They are located in such a manner as to provide maximum efficiency for instrument cross-check, a most important item for good IFR flying.

A radio panel is located in the center of the instrument panel and has sufficient room for two modern radios. A sub-radio is located on the far side of the right instrument panel, should a third radio be desired. All of the engine instruments are grouped on the co-pilot's panel. A brief glance tells the whole story on the engine operation, since all engine instruments are in one location.

B. TROUBLESHOOTING

When troubleshooting instruments containing an electrical power source, check from the power supply to the instrument affected. If no trouble is found by this method, the trouble probably exists inside the individual instrument. The instrument then, should be replaced by an identical instrument, tested and known to be operating properly.

Following, is an instrument troubleshooting table which can be used as a guide for checking out particular instruments.

Table 7 INSTRUMENT TROUBLESHOOTING

TROUBLE	CAUSE	REMEDY
	COMPASS	
Excessive card error.	Compass not properly compensated.	Compensate Instrument.
	External Magnetic Interference.	Locate Magnetic interference and eliminate if possible.
Excessive card oscillation.	Improper mounting on instrument panel.	Align instrument.
	Insufficient Inquid.	Replace instrument.
Card Sluggish.	Weak card magnets.	Replace instrument.
	Excessive pivot friction or broken jewel.	Replace instrument.
	Instrument too heavily compensated.	Remove excess compensation.
Liquid leakage.	Loose bezel screws. Broken cover glass. Defective sealing gaskets.	Replace instrument. Replace instrument. Replace instrument.
Discolored luminous markings or damping liquid.	Age.	Replace instrument.
Defective light.	Burnt out lamp or broken circuit.	Check lamp or continuity of wiring.
	TACHOMETER	
No reading on indicator either permanent or intermittent.	Broken Shaft. Springs weak.	Replace instrument. Replace instrument.
Pointer oscillates excessively.	Rough spot on, or sharp bend in shaft.	Repair or replace.
	Excessive friction in instrument.	Replace instrument.

INSTRUMENT TROUBLESHOOTING (*Continued*)

TROUBLE	CAUSE	REMEDY
	ALTIMETER	
Excess scale error.	Improper calibration adjustment.	Replace instrument.
Excessive pointer oscillation.	Defective mechanism	Replace instrument.
High reading.	Improper venting.	Eliminate leak in static pressure system and check alignment of air-speed tube.
Setting knob is hard to turn.	Wrong lubrication or lack of lubrication.	Replace instrument.
Inner reference marker fails to move when setting knob is rotated.	Out of engagement.	Replace instrument.
Setting knob setscrew loose or missing.	Excessive vibration.	Tighten instrument screw, if loose. Replace instrument, if screw is missing.
Cracked or loose cover glass.	Excessive vibration.	Replace instrument.
Dull or discolored luminous markings.	Age.	Replace instrument.
Barometric scale and refernence markers are out of synchronism with pointers	Shift in mechanism.	Reset pointers.
Barometric scale and refernce markers out of synchronism.	Slippage of mating parts.	Replace instrument.
	AIRSPEED INDICATOR	
Pointers of static instruments do not indicate properly.	Leak in instrument case or in pitot lines.	Check for leak and seal.
Pointer of instrument oscillates.	Leak in instrument case or in pitot lines.	Check for leak and seal.
	HEATED PITOT TUBE (IF USED)	
Tube does not heat or clear itself of ice with swich ON.	Switch circuit breaker out.	Replace or reset

INSTRUMENT TROUBLESHOOTING (*Continued*)

TROUBLE	CAUSE	REMEDY
	Open circuit.	Repair.
	Excessive voltage drop between battery and pitot head.	Check voltage at pitot head.
	Heating element burned out.	Replace pitot head.
	TURN AND BANK INDICATOR	
Pointer fails to respond.	Foreign matter lodged in instrument.	Replace instrument.
	No electric circuit.	Check for voltage at instrument.
Incorrect sensitivity.	Misadjustment of sensitivity spring.	Adjust by means of sensitivity spring screw. If this pulls the pointer from zero, replace instrument.
Pointer does not set on zero.	Gimbal and rotor assembly out of balance.	Replace instrument.
	Pointer incorrectly set on its staff.	Replace instrument.
	Sensitivity adjustment pulls pointer off zero.	Replace instrument.
Vibrating pointer.	Gimbal and rotor assembly out of balance.	Replace instrument.
	Pitted or worn pivots or bearings.	Replace instrument.
In low temperature, pointer fails to respond or does so sluggishly and with insufficient deflection.	Oil has become too thick. Insufficient bearing clearing.	Replace instrument. Replace instrument.
Pointer sluggish in returning to zero and does not set on zero when sationery.	Oil or dirt detween damping pistons and cylinders.	Replace instrument.
	Excessive clearance between rotor and rotor pivots.	Replace instrument.
Ball inclinometer does not center.	Instrument out of alignment on panel.	Correct alignment.

	RATE OF CLIMB INDICATOR	
Pointer does not set on zero.	Aging of diaphragm.	Reset pointer to zero by means of setting knob. Tap instrument while resetting.
Pointer fails to respond.	Obstruction in static line.	Disconnect all instruments connected to static line. Check individual instruments for obstructions in lines.
Pointer oscillates.	Leaks in static line.	Disconnect all instruments connected to the static line. Check individual instruments for leaks. Reconnect instruments to static line and test installation for leaks.
	Defective mechanism.	Replace instrument.
	MANIFOLD PRESSURE INDICATOR	
Excessive error at existing barometric pressure.	Pointer shifted.	Replace instrument.
Excessive error when engine is running.	Line leaking.	Tighten line connections.
Sluggish or jerky pointer movement.	Improper damping adjustment.	Adjust damping screw.
Broken or loose cover glass.	Vibration or excessive pressure.	Replace glass and reseat case.
Dull or discolored luminous markings.	Age.	Replace instrument.
Incorrect reading.	Moisture or oil in line.	Disconnect lines and blow out.
	ENGINE TEMPERATURE GAGE	
Instrument fails to show any reading.	Broken or damaged cappilary. Wiring open.	Check engine unit and wiring to instrument.
Excessive scale error.	Improper calibration adjustment.	Repair or replace.
Pointer fails to move as engine is warmed up.	Broken or damaged capillary or open wiring.	Check engine unit and wiring.
Dull or discolored luminous marking.	Age.	Replace instrument.

INSTRUMENT TROUBLESHOOTING (Continued)

	ENGINE OIL PRESSURE GAGE	
Excessive error at zero.	Pointer loose on shaft. Overpressure or seasoning of bourdon tube.	Replace instrument.
Excessive scale error.	Improper calibration adjustment.	Replace instrument.
Excessive pointer oscillation.	Improper damping or rough relief valve.	Disconnect line and drain. Check for leaks. If trouble persists, clean and adjust relief valve.
Sluggish operation of pointer or pressure fails to build up.	Relief valve open.	Check and clean.
	DIRECTIONAL GYRO INDICATOR (if installed)	
Excessive drift in either direction.	Excessive vibration with amplitude more than .006".	Check shock mounts.
	Insufficient vacuum. If vacuum below 3.75 inches Hg, check for the following: a. Relief valve improperly adjusted. b. Incorrect gage reading. c. Pump failure. d. Vacuum line kinked or leaking.	Check vacuum. a. Adjust. b. Recalibrate. c. Repair or replace. d. Check and repair. Check for collapsed inner wall of hose.
	Defective instrument.	Replace instrument.
Dial spins continuously.	Defective mechanism.	Replace instrument.
	GYRO HORIZON INDICATOR (if installed)	
Bar fails to respond.	Insufficient vacuum.	Check pump and tubing.
Bar does not settle.	Excessive vibration.	Check shock mounts. Replace if necessary.
	Insufficient vacuum.	Check line and pump. Adjust valve.
	Defective instrument.	Replace.
Bar oscillates or shimmies continuously.	Excessive vibration.	Check shock mounts. Replace if necessary.
	Vacuum too high.	Adjust valve.
	Defective mechanism.	Replace instrument.

SECTION

10

INSPECTION

SECTION X

INSPECTION

A. GENERAL

This section provides instructions for conducting routine inspections. Repair or replacement instructions for those components found to be unserviceable at inspection may be found in the section covering the applicable aircraft system. When working on engines, ground the magneto primary circuit or remove all the spark plug leads before performing any checks on the ignition system.

B. PREFLIGHT INSPECTION

This inspection is designed to determine the general condition of the airplane and to detect any damage or maladjustment which might interfere with flight reliability. The following safety procedure instructions must become an integral part of the aircraft owner's operational routine and/or preflight inspection.

The airplane should be virtually inspected to determine any obvious defects or damage of the following:

Wings	Landing Gear
Fuselage	Check Fuel Cells for evidence of leaks
Empennage	Engine Cowling
Control Surfaces	Fuel Tank Filler Caps

Check the operation of the following for full travel and smooth operation:

Ailerons	Rudder	Trim System
Elevators	Wing Flaps	

Check the following electrical equipment for proper operation:

Transmitter and Receiver	Landing Light
Position Lights	Fuel Quantity Gages on both Cells

Check the following Power Plant Items.

Carburetor controls for full travel and free action.

Engine oil for quality and quantity.

Carburetor air filter for cleanliness.

Fuel and oil system for any evidence of leakage.

Ignition wiring for tightness and connections and condition of wire.

Engine in general for any loose or missing nuts, palnuts, and for proper safetying of all plugs.

Magnetos for RPM drop at approximately 1800 RPM. The normal drop from both magnetos to one magneto is not to exceed more than 125 RPM.

Oil pressure (Minimum idle 25 PSI).

Fuel Pressure (2.5 to 3.5 PSI).

Engine for proper tune up (550 to 1860 RPM).

Visually inspect the following parts of the Propeller
Hub. All bolts and nuts for tightness.

Blades Excessive loss of grease from bearings.
If propeller runs rough, check the pitch of the blades (allowable difference ½°), track (allowable difference ⅛°), and balance.

C. 25 Hour Inspection.

This inspection is designed to determine the general condition of the airplane and to detect any damage or maladjustment which might interfere with flight reliability. The following inspection guide is recommended by the factory and should be performed by qualified personnel only.

25 Hour Inspection Guide.

Remove both engine side cowls.
Clean engine and refer to Lycoming's Operator's Manual.
Remove and clean air maze filter. Apply light coat of oil before reinstalling.
Inspect engine compartment for oil or fuel leaks. Check for security and condition of all equipment in accessory section.
Check all wing, fuselage, and tail section for dents or damage.
Check complete airplane for any damage to control surfaces.
Check all instruments for operation, dials for proper markings and placards.
Check static and pressure system of airspeed indicator for leaks or stoppage.
Inspect airplane in general for security of all bolts, nuts, screws, etc.
Check the battery.

D. 50 Hour Inspection Guide.

Accomplish all items on 25 hour inspection and the following:

Engine:
Drain oil, check and clean screens.
Check engine for oil leaks.
Check ignition harness for fray, wear, etc.
Check throttle, carburetor heat, carburetor mixture, and propeller governor control for general condition, travel, and free operation.
Check engine mount and rubber lord mounts.
Check exhaust stacks for general condition.
Check engine baffles for wear or cracks.
Check carburetor air cleaner. Clean per manufacturers instructions.
Check fluid in brake reservoir.
Check battery and cables.
Check cowl for cracks, loose or missing screws, etc.
Remove and clean screen in electric fuel pump.
(Refer to Section 7-C).

Propeller:
Remove spinner and check.
Check propeller for oil leaks and general condition.
Inspect blades for nicks and cracks.
Clean and install spinner.

Cabin:
Check parking brake cylinder for leaks.
Check trim operation.
Check cabin door and pilot window for damage and operation.

Check cabin, navigation, instruments, and landing lights.
Check fuel selector valve for proper operation.

Landing gear:
Check tires for wear and proper inflation (24 to 30 Pounds).
Check for general condition.

Wing:
Check surfaces and tips for damage.
Check ailerons, attachments, bellcranks for damage and operation.
Check flaps and attachments for damage and operation.
Lubricate where necessary in accordance with lubrication chart.

Fuselage and Empennage:
Check stabilizer, fin and rudder surfaces for damage.
Check rudder and elevators for proper attachment.

E. 100 Hour Inspection Guide.

Accomplish all items on 50 hour inspection and the following.

Engine:
Remove engine cowl and clean engine.
Check and/or replace spark plugs as required.
Check magneto points for gap. Reset if necessary (Retime).
Drain carburetor, clean fuel strainers and check fuel system for leaks.
Check vacuum pump (if installed) for operation and condition.
Check condition of flex fuel lines.
Check fuel pumps for operation (engine and Electric).
Flush battery box.
Remove and clean screen in electric fuel pump.
Remove and check exhaust stacks and heater muff.

Propeller:
Rotate blades and check of tightness.
Inspect hub parts visually for cracks.
Check propeller mounting torque (McCauley 55-65 Foot Pounds).
Check spinner and bulkhead for cracks and general condition.

Cabin:
Remove instrument access panels.
Check control wheels.
Check instruments, lines and attachments.
Check upholstery for tears.
Check seats, belts, securing brackets, and bolts.

Landing Gear:
Remove wheels, repack bearings.
Check brake shoes and discs for wear.
Check brake lines.
Check wheels for alignment.
Check gear doors and attachments.
Check nose gear steering control and travels.

Check tire pressure (24 to 30 Pounds).
Lubricate as per chart.
Check and rig gear as per maintenance manual instructions.

Wing:

Remove inspection plates and fairings and check wing for general condition.
Check fuel cells for leaks.
Check wing attach bolts.

Fuselage and Empennage:

Check stabilizer bearings, bungees and horns for damage and operation.
Check rudder, horns, and attachments for damage and operation.
Check trim mechanism.
Check bulkheads and stringers for damage.
Check electrical wiring, loops, loopmounts, antennas.
Check fuel lines, valves and gages for damage and operation.
Lubricate as per chart.

F. Overlimits Inspection.

If the aircraft has been operated so that any of its components have exceeded their maximum operational limits, check with the appropriate manufacturer's manual.

G. Post Inspection Check.

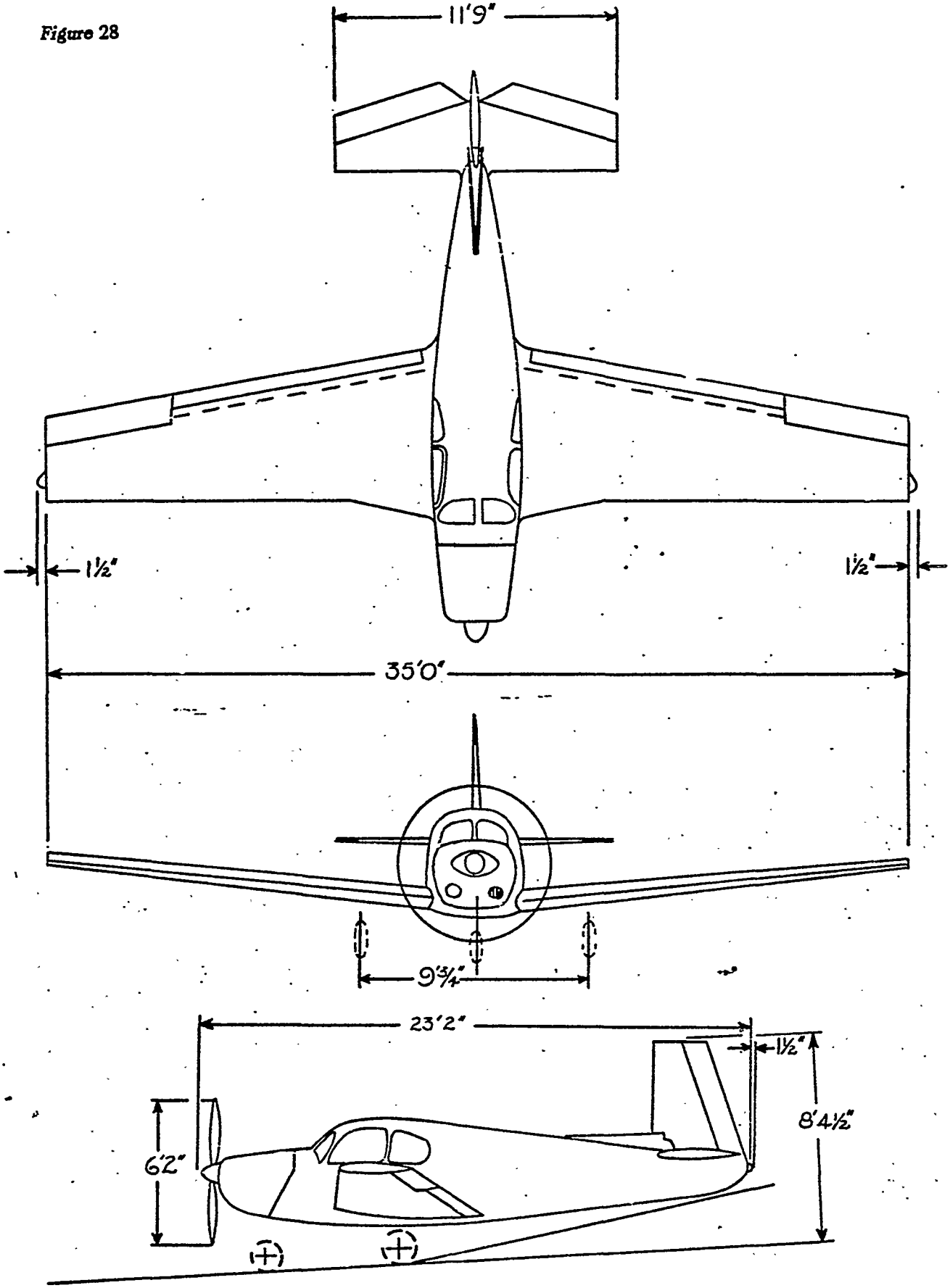
Following the fifty and one hundred hour inspections, start the engine and check the following items for performance:

Check fuel pump and fuel tank selector valve.
Check fuel quantity and pressure gages.
Check oil pressure and temperature gages.
Check generator output.
Check manifold pressure.
Check carburetor heat.
Check parking brake.
Check vacuum gage.
Check gyros for noise and rough operation.
Check cabin heater operation.
Check magneto switch.
Check magneto RPM variation.
Check throttle operation.
Check propeller smoothness.
Check propeller governor action.
Check radio operation.
Check engine idle (650 RPM).

General:

Check that aircraft conforms to FAA Specifications.
Check that FAA Airworthiness Directive's are complied with.
Check that Manufacturers Service Bulletins are complied with.
Check that aircraft papers are in proper order.

Figure 28



THREE VIEW