SECTION 7

WING FLAP CONTROL SYSTEM

TABLE OF CONTENTS

7-1. WING FLAP CONTROL SYSTEM. (Refer to figure 7-1.)

7-2. DESCRIPTION. The wing flap control system is comprised of an electric motor and transmission assembly, drive pulleys, push-pull rods, cables and a follow-up control. Power from the motor and transmission assembly is transmitted to the flaps by a system of drive pulleys, cables and push-pull rods. Electrical power to the motor is controlled by two microswitches mounted on a floating arm assembly, by a camming lever and a follow-up control. As the flap control lever is moved to the desired flap setting, the attached cam trips one of the microswitches, activating the flap motor. As the flaps move to the position selected, the floating arm is rotated by the follow-up control until the active microswitch clears the cam breaking the circuit and stopping the motor. To reverse flap direction, the control lever is moved in the opposite direction causing the cam to trip the second microswitch which reverses the flap motor. The follow-up control moves the cam until it is clear of the second switch, shutting off the flap motor. Limit switches on flap actuator assembly prevent over-travel of the flaps in the full UP or DOWN positions.

7-3. OPERATIONAL CHECK.

a. Operate flaps through their full range of travel observing for uneven travel or jumpy motion, binding or lost motion. Ensure flaps are moving together through their full range of travel.

b. Check for positive shut-off of motor at flap travel extremes to prevent damage to actuator assembly.

c. Check flaps for sluggishness in operation. In flight at 100 mph, indicated airspeed, flaps should fully extend in approximately 9 seconds and retract in approximately 5 seconds. On the ground, with engine running, the flaps should extend or retract in approximately 6 seconds.

d. With flaps full UP, mount an inclinometer on one flap and set to 0°. Lower flaps to full DOWN position and check flap angle as specified in figure 1-1. Check approximate mid-range percentage setting against degrees as indicated on inclinometer. Repeat the same procedure for the opposite flap.

NOTE

An inclinometer for measuring control surface travel is available from the Cessna Service Parts Center. Refer to figure 6-4.

e. Remove access plates adjacent to flap drive pulleys and attempt to rock pulleys to check for bearing wear.

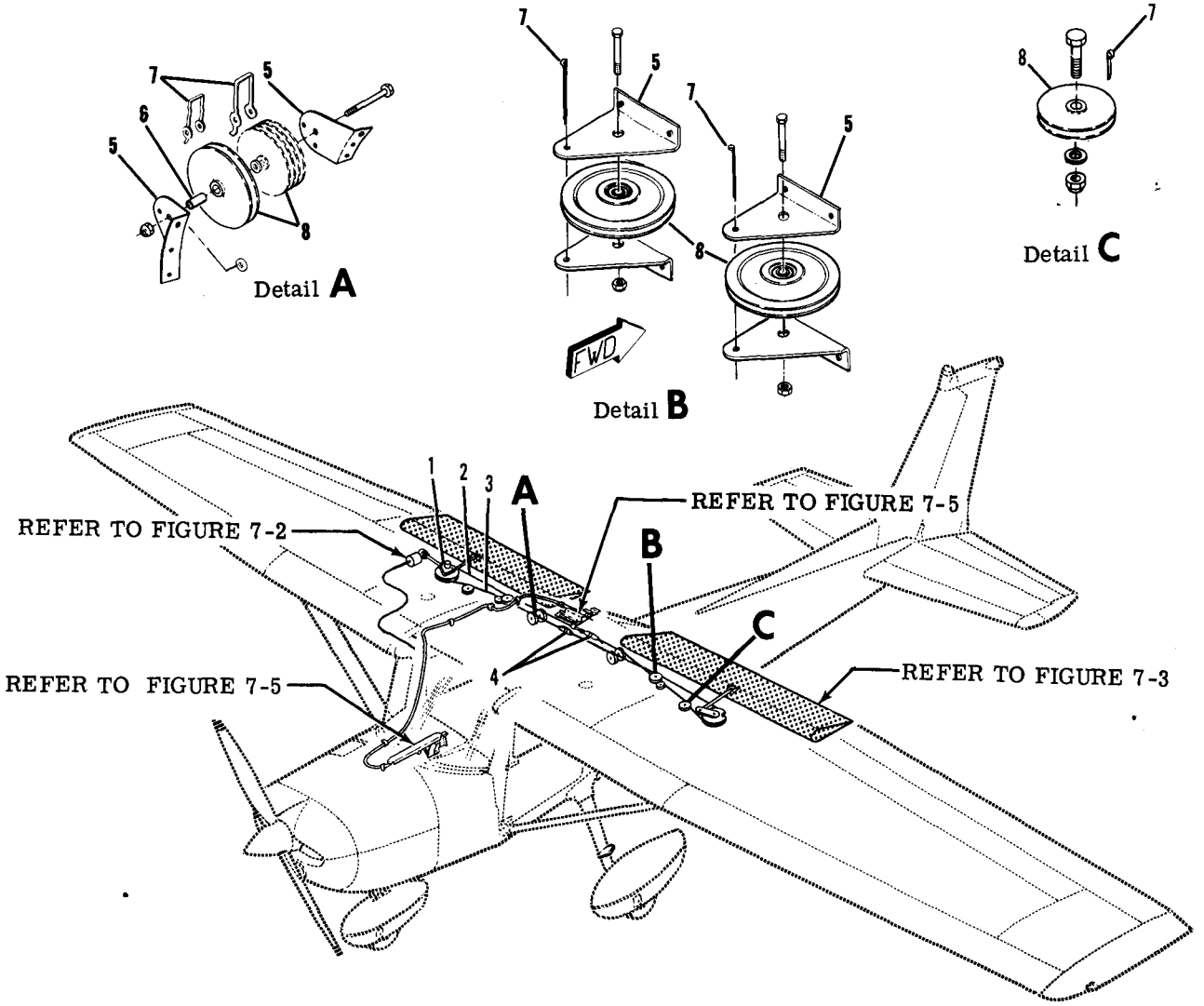
f. Inspect flap rollers and tracks for evidence of binding or defective parts.

7-4. TROUBLE SHOOTING.

NOTE

Due to remedy procedures in the following trouble shooting chart it may be necessary to re-rig system, refer to paragraphs 7-16 and 7-20.

TROUBLE	PROBABLE CAUSE	REMEDY
BOTH FLAPS FAIL TO MOVE.	Popped circuit breaker.	Reset and check continuity.
	Defective switch.	Place jumper across switch. Replace if defective.
	Defective motor.	Remove and bench test motor. Replace if defective.
	Broken or disconnected wires.	Run a continuity check. Connect or repair wiring.
	Defective or disconnected transmission.	Connect or replace transmission.
	Defective limit switch.	Check continuity of switches. Replace switches found defective.
BINDING IN SYSTEM AS FLAPS ARE RAISED AND LOWERED.	Cables not riding on pulleys.	Check visually. Route cables correctly over pulleys.
	Bind in drive pulleys.	Check drive pulleys in motion. Replace drive pulleys found defective.
	Broken or binding pulleys.	Check pulleys for free rotation or breaks. Replace defective pulleys.
	Frayed cable.	Check visually. Replace defective cable.
	Flaps binding on tracks.	Observe flap tracks and rollers. Replace defective parts.
LEFT FLAP FAILS TO MOVE.	Disconnected or broken cable.	Check cable tension. Connect or replace cable.
	Disconnected push-pull rod.	Check visually. Attach push-pull rod.
INCORRECT FLAP TRAVEL.	Incorrect rigging.	Refer to paragraph 7-16 and 7-20.
	Defective operating switch.	Check continuity of switches. Replace switches found defective.
FLAPS FAIL TO RETRACT.	Defective or disconnected flaps UP operating switch.	Check continuity of switch. Connect or replace limit switch.
FLAPS FAIL TO EXTEND.	Defective or disconnected flaps DOWN operating switch.	Check continuity of switch. Connect or replace limit switch.



1. Drive Pulley
2. Direct Cable
3. Retract Cable
4. Turnbuckle
5. Bracket
6. Bushing
7. Cable Guard
8. Pulley
9, Follow-Up Control

CAUTION

MAINTAIN PROPER CONTROL CABLE TENSION.

CABLE TENSION:
30 LBS ± 10 LBS (AT AVERAGE TEMPERATURE FOR THE AREA.)
REFER TO FIGURE 1-1 FOR TRAVELS.

Figure 7-1. Wing Flap Control System

7-5. FLAP MOTOR AND TRANSMISSION ASSEMBLY.

7-6. REMOVAL AND INSTALLATION (Refer to figure 7-2.)

a. Run flaps to full DOWN position.
b. Disconnect battery ground cable and insulate terminal as a safety precaution.
c. Remove access plates beneath flap motor and transmission assembly in right wing.

NOTE

Flap motor (10), transmission (8), hinge assembly (11) and actuating tube (5) are removed from the aircraft as a unit.

d. Remove bolt (21) securing actuating tube (5) to drive pulley (14).
e. Screw actuating tube (5) in toward transmission (8) as far as possible by hand.
f. Remove bolt (1) securing flap motor hinge (11) to wing. Retain brass washer between hinge and wing structure for use on reinstallation.
g. Disconnect motor electrical leads at quick-disconnects.
h. Disconnect wiring at limit switches (29 and 32).
i. Carefully work assembly from wing through access opening.
j. Reverse preceding steps for reinstallation. If hinge assembly (11) was removed from the transmission (8) for any reason, ensure that short end of hinge is reinstalled toward the top.
k. Complete operational check as outlined in paragraph 7-3 and rerig system in accordance with paragraph 7-16.

7-7. REPAIR. Repair consists of replacement of motor, transmission, coupling, actuating tube and associated hardware. Bearings in hinge assembly may also be replaced. Lubricate as outlined in Section 2.

7-8. DRIVE PULLEYS. (Refer to figure 7-2.)

7-9. REMOVAL AND INSTALLATION.
a. Remove access plate adjacent to drive pulley (14) in right wing.
b. Unzip or remove headliner as necessary for access to turnbuckles (index 4, figure 7-1), remove safety wire and loosen turnbuckles.
c. Remove bolt (20) securing flap push-pull rod (15) to drive pulley (14) and lower RIGHT flap gently.
d. Remove bolt (21) securing actuating tube (5) to drive pulley (14) and lower LEFT flap gently. Retain bushing.
e. Remove cable locks (13) securing control cables to drive pulley (14). Tag cables for reference on reinstallation.
f. Remove bolt (12) attaching drive pulley (14) to wing structure.
g. Using care, remove drive pulley through access opening, being careful not to drop bushing. Retain brass washer between drive pulley and wing structure for use on reinstallation. Tape open ends of drive pulley after removal to protect bearings.
h. To remove left wing drive pulley, use this same procedure omitting step "d."
i. Reverse the preceding steps for reinstallation. Rig system in accordance with paragraph 7-16, safety turnbuckles and reinstall all items removed for access.

7-10. REPAIR. Repair is limited to replacement of bearings. Cracked, bent or excessively worn drive pulleys must be replaced. Lubricate bearings as outlined in Section 2.

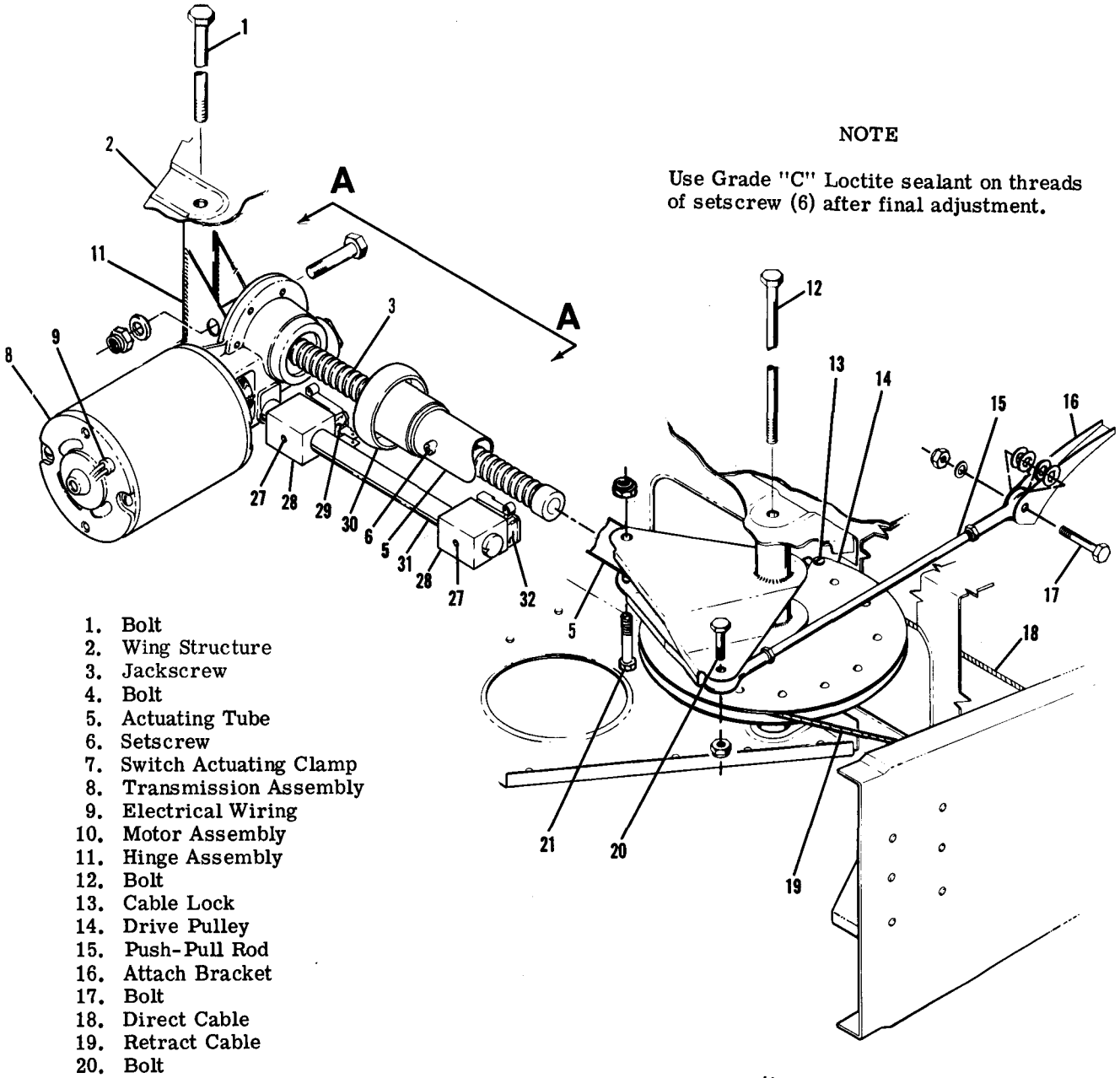
7-11. FLAPS. (Refer to figure 7-3.)

7-12. REMOVAL AND INSTALLATION.
a. Run flaps to full DOWN position.
b. Remove access plates (1) from top leading edge of flap.
c. Disconnect push-pull rod (6) at flap bracket (7).
d. Remove bolts (5) at each flap track. As flap is removed from wing, all washers, rollers and bushings will fall free. Retain these for reinstallation.
e. Reverse the preceding steps for reinstallation. If push-pull rod (6) adjustment is not disturbed, rerigging of system should not be necessary. Check flap travel and rig in accordance with paragraph 7-16, if necessary.

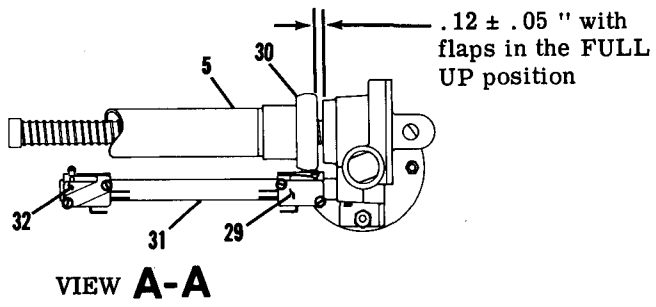
7-13. REPAIR. Flap repair may be accomplished in accordance with instructions outlined in Section 18.

7-14. CABLES AND PULLEYS. (Refer to figure 7-1.)

7-15. REMOVAL AND INSTALLATION.
a. Remove access plates, fairings, headliner and upholstery as necessary for access.
b. If the direct cable (2) is to be removed, disconnect clamp (index 19, figure 7-5) from bellcrank (index 15, figure 7-5).
c. Remove safety wire, relieve cable tension, disconnect turnbuckles (4) and carefully lower LEFT flap.
d. Disconnect cables at drive pulleys, remove



1. Bolt
2. Wing Structure
3. Jackscrew
4. Bolt
5. Actuating Tube
6. Setscrew
7. Switch Actuating Clamp
8. Transmission Assembly
9. Electrical Wiring
10. Motor Assembly
11. Hinge Assembly
12. Bolt
13. Cable Lock
14. Drive Pulley
15. Push-Pull Rod
16. Attach Bracket
17. Bolt
18. Direct Cable
19. Retract Cable
20. Bolt
21. Bolt
22. Snubber
23. Bracket
24. Spacer
25. Shim
26. Screw
27. Set Screw
28. Switch Adjustment Block
29. Up-Limit Switch
30. Switch Actuating Collar
31. Support
32. Down-Limit Switch



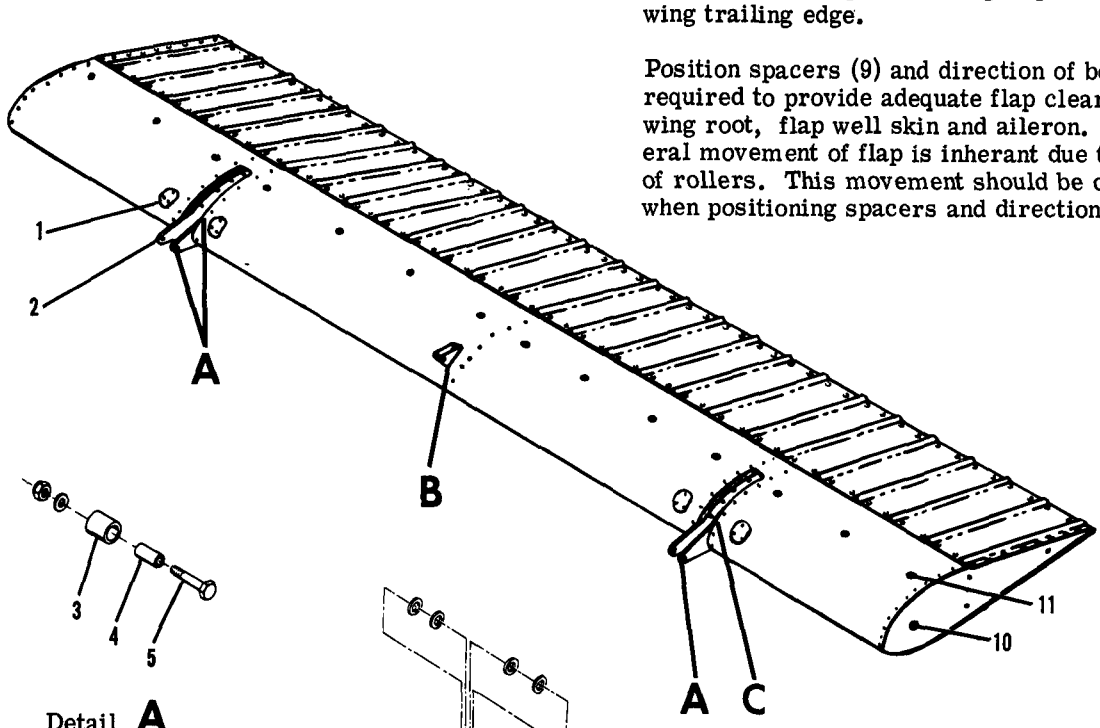
VIEW **A-A**

Figure 7-2. Flap Motor and Transmission Installation

NOTE

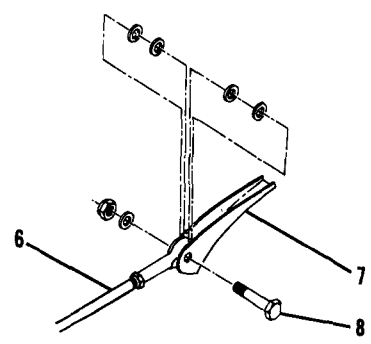
Bushings (4), rollers (3) and spacers (9) are first positioned through slots in flap tracks, then are secured to the flap roller supports (2) with attaching bolts, washers and nuts. Nylon plug buttons (11) prevent wing flap from chafing wing trailing edge.

Position spacers (9) and direction of bolts (5) as required to provide adequate flap clearance at wing root, flap well skin and aileron. Some lateral movement of flap is inherant due to the width of rollers. This movement should be considered when positioning spacers and direction of bolts.

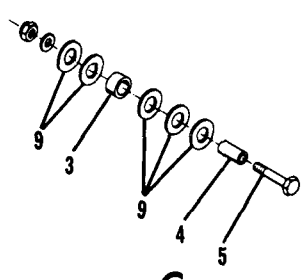


Detail A

INBOARD



Detail B



Detail C

OUTBOARD

1. Access Plate
2. Flap Support
3. Roller Assembly
4. Bushing
5. Bolt
6. Push-Pull Rod
7. Flap Bracket
8. Bolt
9. Spacer
10. Plug Button
11. Nylon Plug Button

Figure 7-3. Flap Installation

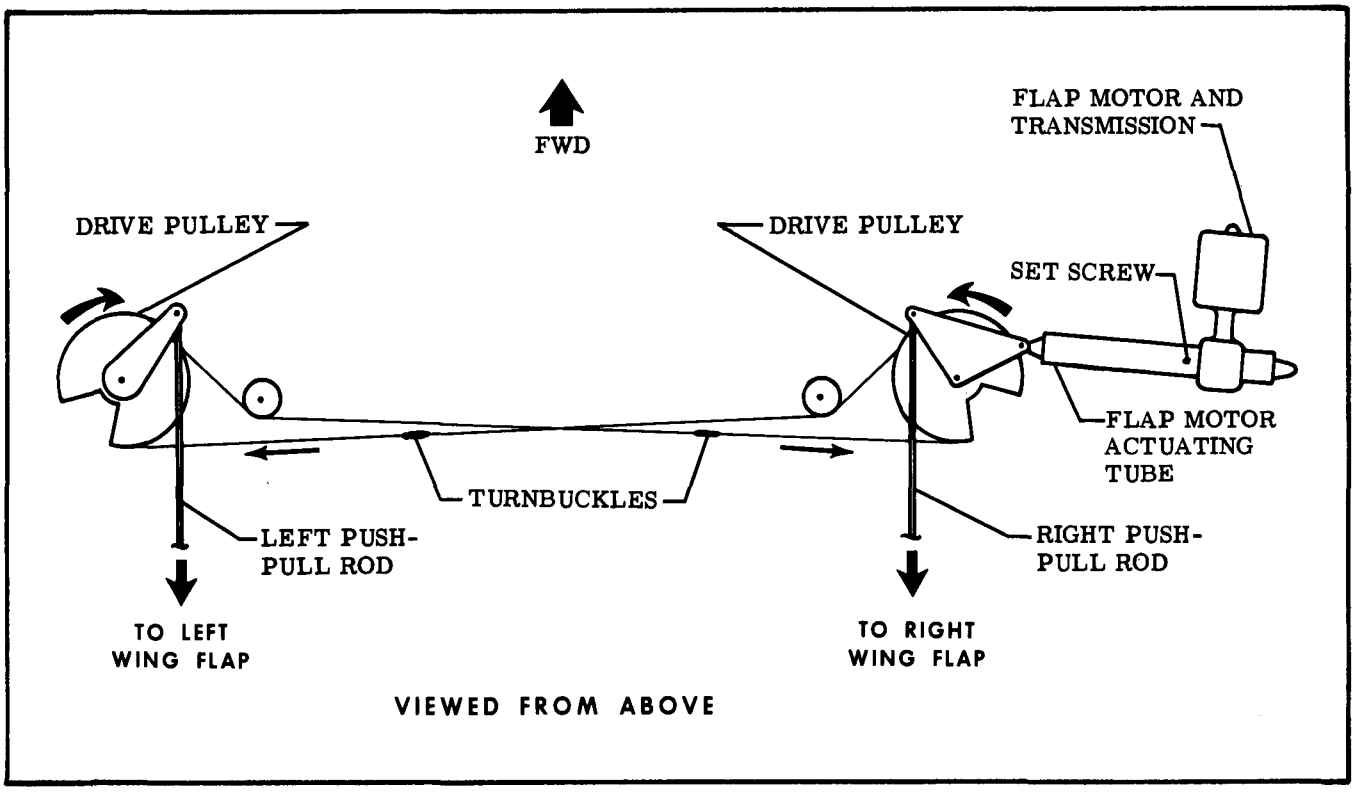


Figure 7-4. Flap System Schematic

cable guards and pulleys as necessary to work cables free of aircraft.

NOTE

To ease routing of cables, a length of wire may be attached to the end of cable being withdrawn from the aircraft. Leave wire in place, routed through structure; then attach the cable being installed and use wire to pull cable into position.

e. Reverse the preceding steps for reinstallation.
f. After cables are routed in position, install pulleys and cable guards. Ensure cables are positioned in pulley grooves before installing guards.
g. Re-rig flap system in accordance with paragraph 7-16 and safety turnbuckles.
h. Re-rig follow-up system in accordance with paragraph 7-19 and reinstall all items removed in step "a."

7-16. RIGGING.

a. (Refer to figure 7-1.) Unzip or remove headliner as necessary for access to turnbuckles (4).
b. With flaps in the full UP position, disconnect follow-up cable (index 1, figure 7-5) by loosening clamp bolt (14).
c. (Refer to figure 7-1.) Remove safety wire, relieve cable tension, disconnect turnbuckles (4) and carefully lower left flap.
d. (Refer to figure 7-2.) Disconnect push-pull rods (15) at drive pulleys (14) in both wings and lower RIGHT flap gently.
e. Disconnect actuating tube (5) from drive pulley (14).

NOTE

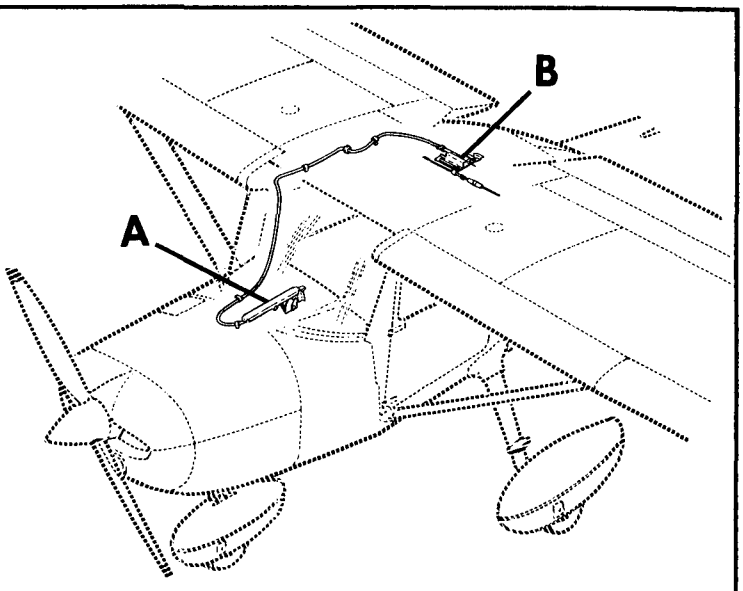
If control cables are not connected to left and right drive pulleys, actuating tube (5) and push-pull rods (15) must be disconnected before installing cables. If drive pulleys (14) are not installed, attach control cables before installing drive pulleys in the wings as illustrated in figure 7-4.

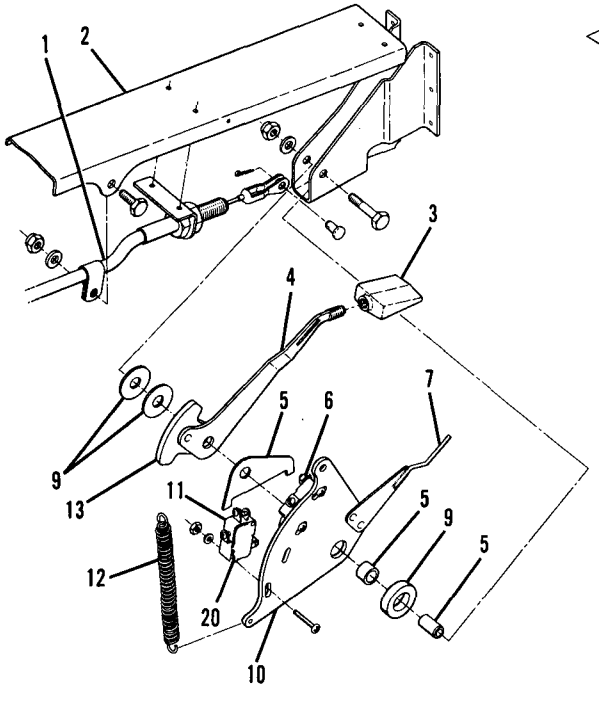
f. Adjust both push-pull rods (15) to 8.83±.12 inches between centers of rod end bearings and tighten locknuts on both ends. Connect push-pull rods to flaps and drive pulleys.

NOTE

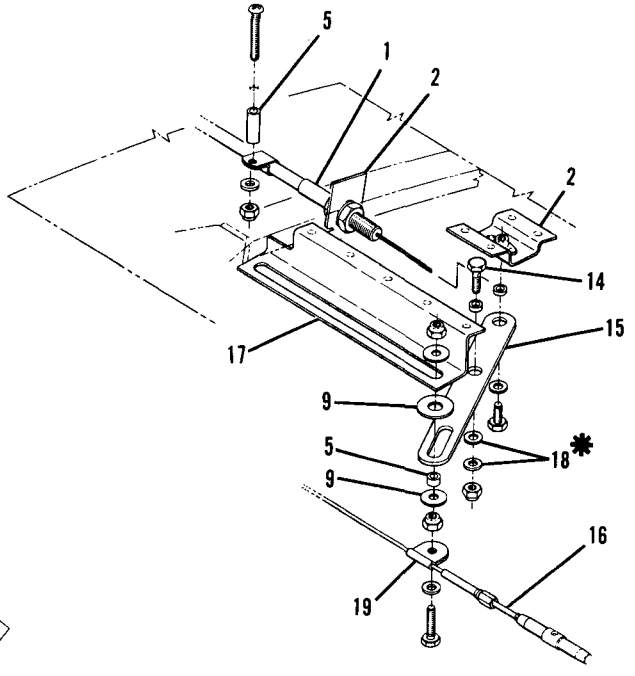
Temporarily connect cables at turnbuckles (index 4, figure 7-1) and test flaps by hand to ensure both flaps extend and retract together. If they will not, the cables are incorrectly attached to the drive pulleys. Ensure that the right drive pulley rotates clockwise when viewed from below, as the flaps are extended. Tag cables for reference and disconnect turnbuckles again.

1. Follow-Up Cable
2. Mounting Bracket
3. Knob
4. Flap Lever
5. Spacer
6. Flaps DOWN operating Switch
7. Position Indicator
8. Bushing
9. Washer
10. Switch Mounting Arm
11. Flaps UP Operating Switch
12. Return Spring
13. Cam
14. Clamp Bolt
15. Bellcrank
16. Flap Cable
17. Guide
18. Clamp Bolt Washers
19. Clamp
20. Insulator





Detail **A**



Detail **B**

* NOTE

Position center cable of flap follow-up (1) between washers (18).

Figure 7-5. Flap Follow-Up and Indicating System

g. (Refer to figure 7-2.) Screw actuating tube (5) IN toward transmission (8) by hand to .12±.05 inches between switch actuating collar (30) and transmission as illustrated in View A-A.

h. Loosen setscrew (6) securing actuating tube (5) to switch actuating collar (30) and hold collar to maintain .12±.05 inch while holding RIGHT flap in the full UP position and adjust actuating tube (5) IN or OUT, as necessary to align with attachment hole in drive pulley (14).

i. Apply Loctite grade CV sealant (or equivalent) to threads of setscrew (6) and torque to 60 pound-inches.

NOTE

If actuating tube (5) is too long to allow attachment to drive pulley after completion of step "h", proceed to step "j".

j. Disconnect push-pull rod (15) at drive pulley (14) to allow connecting actuating tube (5) to drive pulley.

k. Manually hold RIGHT flap in full UP position and readjust push-pull rod (15) to align with attachment hole in drive pulley. Connect push-pull rod and tighten locknuts.

NOTE

The right flap and actuator must be correctly rigged, before cables and left flap can be rigged.

l. With flaps in full UP position, loosen setscrew (27) and slide up limit switch adjustment block (28) on support (31) to just activate switch and shut off electrical power to motor at this position. Tighten setscrew.

m. Manually hold LEFT flap, full UP and connect control cables at turnbuckles (index 4, figure 7-1). Remove reference tags previously installed in step "f".

n. With flaps full UP, adjust turnbuckles to obtain 30±10 pounds tension on cables. Adjust retract cable (19) first.

NOTE

Ensure cables are positioned in pulley grooves and cable ends are positioned correctly at drive pulleys before tightening turnbuckles.

o. Disconnect push-pull rod at left drive pulley. Run motor to extend flaps approximately 20° and check tension on each flap cable. If necessary, readjust turnbuckles to maintain 30±10 pounds tension on each cable and safety turnbuckles.

p. Fully retract right flap. Manually hold left flap in full UP position and readjust push-pull rod to align with attaching hole in drive pulley. Connect push pull rod and tighten locknuts.

NOTE

An inclinometer for measuring control surface travel is available from the Cessna Service Parts Center. Refer to figure 6-4.

q. Mount an inclinometer on RIGHT flap and adjust to 0°.

r. Run flaps to full DOWN position and adjust DOWN limit switch (32) to stop motor and flap at the degree of travel specified in figure 1-1. Repeat check on LEFT flap. Recheck limit switch through several flap cycles.

NOTE

All flap rollers may not bottom in the flap tracks at the travel extremes.

s. Reconnect and rerig the flap follow-up system in accordance with paragraph 7-20. Perform an operational check in accordance with paragraph 7-3, recheck all items for proper safetying and replace items removed for access.

7-17. FLAP FOLLOW-UP AND INDICATING SYSTEM. (Refer to figure 7-5.)

7-18. DESCRIPTION. The flap follow-up and indicating system consists of a sheathed cable assembly one end of which is attached to the flap operating switch mounting arm and the other end is clamped to the flap direct cable above the headliner in the rear cabin area. Motion of the flap cable is transmitted through the follow-up control to the pointer attached to the switch mounting arm, moving the pointer along a scale as the flaps are extended or retracted.

7-19. REMOVAL AND INSTALLATION. Figure 7-5 can be used as a guide to removal and installation of the flap follow-up and indicating system.

7-20. RIGGING. (Refer to figure 7-5.)

a. Flap control system must be rigged in accordance with paragraph 7-16 before flap follow-up control can be rigged.

b. Disconnect spring (12) from switch mounting arm (10).

c. With flaps in full UP position, pull center cable of flap follow-up control (1) (detail b, figure 7-5) to remove slack.

d. Ensure flap lever (4) is in full UP position while indicator (7) has a .03-.06 inch clearance with top of instrument panel cut-out. Secure follow-up cable to bellcrank (15) with clamp bolt (14) while observing note in figure 7-5.

e. Connect spring (12) to switch mounting arm (10).

f. Adjust switches (6) and (11) in slotted holes on mounting arm (10) until cam (13) is centered between switch rollers.

g. Mount on inclinometer on one flap and set to 0° (flaps full UP). Turn master switch ON and move flap lever (4) to 10° flap position.

NOTE

An inclinometer for measuring control surface travel is available from the Cessna Service Parts Center. Refer to figure 6-4.

h. Observe inclinometer reading when flaps stop. Adjust flaps DOWN operating switch (6) in slotted

holes on mounting arm (10) as required to obtain flap travel of 10°±2.

i. Adjust flaps UP operating switch (11) in slotted holes to obtain positive clearance with cam (13) when flaps DOWN operating switch has just opened in the 10° position.

j. Repeat steps h and i for 20° flap position.

k. Run flaps to full DOWN position (40°±2°) and check that flaps DOWN operating switch (6) remains closed as flap motor limit switch (index 32, figure 7-5) stops flaps at 40° position.

l. Check flaps through several cycles, recheck all items removed for security and replace items removed for access.

SHOP NOTES: