# KASPERWING 1-80 MOTORGLIDER
# B—MODEL

## ASSEMBLY AND CONSTRUCTION MANUAL

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**INTRODUCTION:** CONGRATULATIONS! YOU HAVE WAITED LONG AND PATIENTLY FOR YOUR KASPERWING AND BEFORE WE GET INTO THE STEP BY STEP ASSEMBLY INSTRUCTIONS, I WOULD FIRST LIKE TO GIVE YOU A FEW BASIC CONSTRUCTION TIPS. THE PARTS FOR YOUR AIRCRAFT WERE FABRICATED FROM THE HIGHEST QUALITY AIRCRAFT GRADE MATERIALS USING STATE OF THE ART PRODUCTION TECHNIQUES AND PROCEDURES AND WE HAVE GONE TO GREAT EXTREMES DESIGNING THE KASPERWING WITH THE PILOT/BUILDER IN MIND. PLEASE DO NOT ATTEMPT TO MAKE ANY MODIFICATIONS OR DESIGN CHANGES TO YOUR WING WITHOUT FIRST CONSULTING THE FACTORY AS THIS COULD COMPROMISE THE STRUCTURAL OR AERODYNAMIC QUALITIES OF THE WING AND RESULT IN AN UNSAFE AIRCRAFT. IF YOU SHOULD DISCOVER AN PART OR PARTS OF YOUR WING WHICH YOU BELEIVE COULD USE IMPROVEMENT, PLEASE CONTACT US AS WE ARE CONSTANTLY SEARCHING FOR WAYS TO IMPROVE THE DESIGN. GIVE YOUR KASPERWING THE SAME AMOUNT OF RESPECT AND CONSIDERATION YOU WOULD GIVE TO A "PIPER", "CESSNA-150" OR A "BOEING 747", AS IT IS JUST AS MUCH A "REAL AIRPLANE" AND NOT A TOY. MISTAKES IN CONSTRUCTION OR OPERATION CAN HAVE JUST AS SERIOUS CONSEQUENCES AS IN LARGER AIRCRAFT. WHEN ASSEMBLING YOUR WING BE SURE TO USE PROPER TOOLS FOR THE PROPER JOB. NEVER ATTEMPT TO HAMMER OR DRIVE A BOLT OR PART INTO POSITION BY USING FORCE! STOP AND FIND OUT WHAT THE OBSTACLE IS BEFORE PROCEEDING. TRY TO ORGANIZE YOUR TIME AND WORKSPACE PRIOR TO BEGINNING CONSTRUCTION AND HAVE ALL TOOLS AND EQUIPMENT PRESENT BEFORE STARTING WORK. WORK SAFELY AND EFFICIENTLY, NOT SPORADICALLY. IT IS BETTER TO DEVOTE FIVE-EIGHT HOUR PERIODS TO THE JOB THAN SPENDING TEN-FOUR HOUR PERIODS AS YOU WILL TEND TO FORGET LESS BETWEEN EPISODES.

READ THE CONSTRUCTION MANUAL COMPLETELY FROM COVER TO COVER ONCE, IN ORDER TO FAMILIARIZE YOURSELF WITH THE PROJECT AND THEN BEGIN WORKING YOUR WAY THROUGH THE STEPS GLANCING AHEAD A PAGE OR TWO AT A TIME. WORK SLOWLY AND METHODICALLY. DO NOT ATTEMPT TO TAKE SHORT CUTS AS THIS MAY CAUSE YOU MUCH GRIEF AND WASTED TIME. FOLLOW THE SEQUENCE EXACTLY!

INTRODUCTION CONTINUED: IT WILL HELP TO FIND A LARGE OPEN WORKSPACE ABOUT 20'x40', DRY, FLAT AND PREFERABLY INSIDE. IF NONE IS AVAILABLE, IT IS POSSIBLE TO ASSEMBLE THE UNDERCARRIAGE, SPARS, ETC. IN A SMALL LIVING ROOM BUT FOR FINAL ASSEMBLY MORE SPACE IS REQUIRED. BELOW IS A LIST OF THE TOOLS AND ITEMS NEEDED TO COMPLETE CONSTRUCTION:

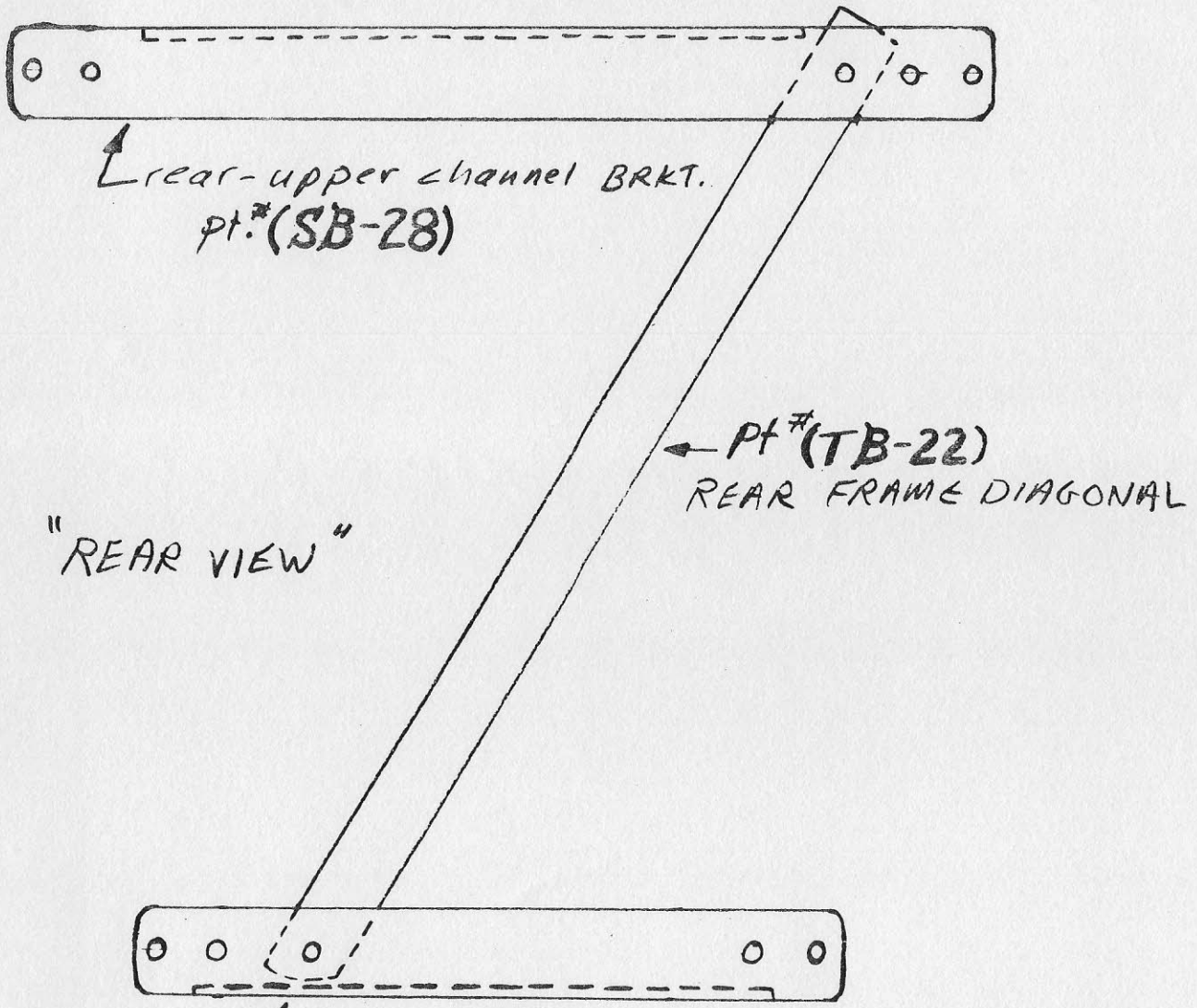
BOX OR OPEN END WRENCHES:
9/16", 1/2", 7/16", 3/8"
1 - 1/4" OR 3/8" DRIVE RATCHET WRENCH
1/4" OR 3/8" DRIVE SOCKETS:
9/16", 1/2", 7/16", 3/8"
1 - SMALL HAMMER OR WOOD MALLET
1 - SHARP CENTER PUNCH
1 - ELECTRIC DRILL MOTOR - 1/4"
DRILL BITS: 1/8", 3/16", 7/32",
1 - TAPE MEASURE RULER
1 - POP RIVET GUN
1 - PAIR PLIERS OR VISE GRIPS.
1 - SET CABLE CUTTERS OR DIKES
1 - HEAT SHRINK GUN OR SOURCE OF OPEN FLAME

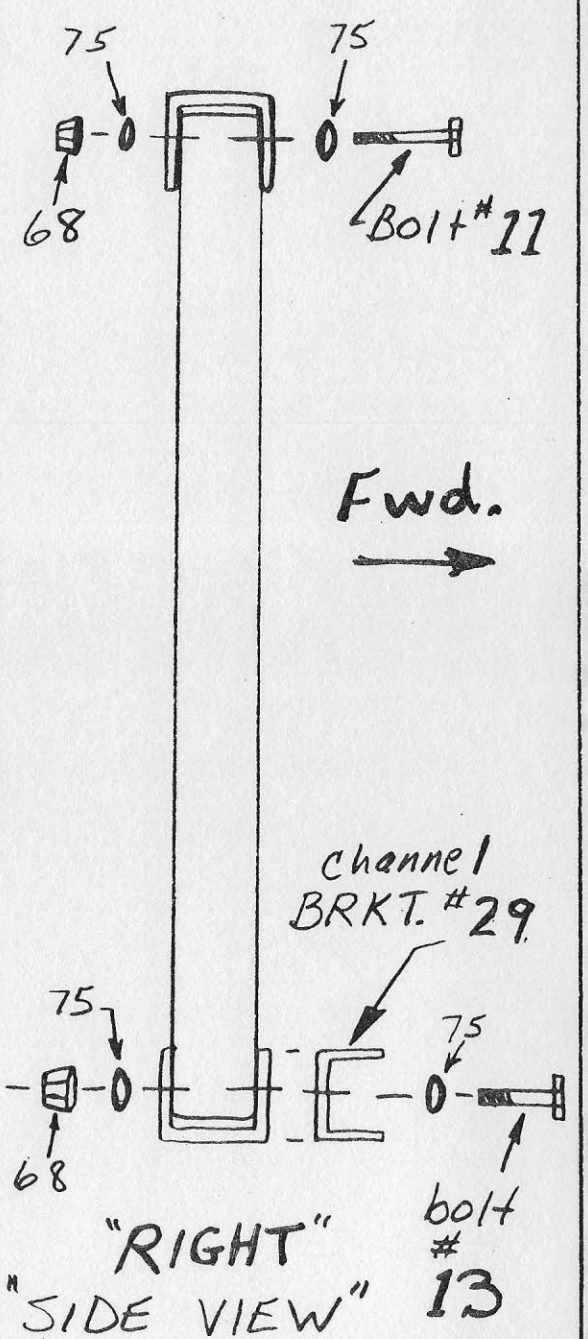
1 - STRAIGHT EDGE
1 - 1/4" STEEL ROD ABOUT 12" LONG
1 - KNIFE OR CABLE STRIPPER
1 - ELECTRICIANS CRIMPING TOOL
1 - MARKING PEN OR PENCIL
1 - MEDIUM FLAT TIP SCREWDRIVER
1 - LARGE PHILLIPS SCREWDRIVER OR IMPACT DRIVER
1 - SOLDER GUN WITH HEAT CUTTING TIP OR HOT KNIFE.
1 - SMALL FLAT FINE TOOTH FILE.
1 - PINT, WELDWOOD CONTACT CEMENT OR EQUIVALENT.
1 - DISPOSABLE BRUSH
1 - SWAGING TOOL - (SUPPLIED WITH KIT)

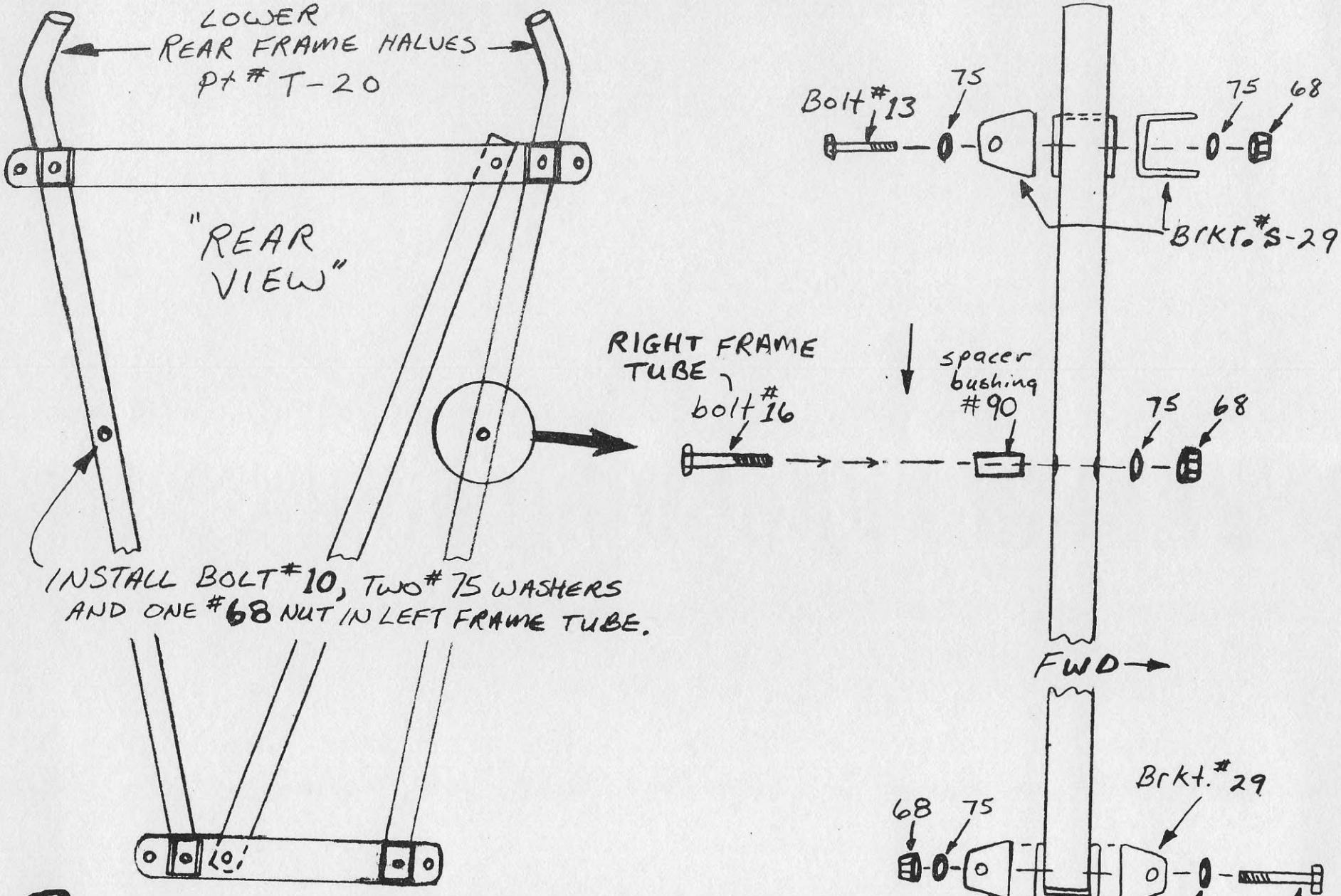
THE ABOVE LIST CONTAINS ALL THE BASIC TOOLS REQUIRED. THERE MAY BE OTHERS WHICH YOU MIGHT FIND HELPFULL THAT ARE NOT CONTAINED IN THIS LIST. PLEASE INFORM US IF YOU SHOULD DISCOVER ANY.

NOW THAT YOU HAVE GATHERED ALL YOUR TOOLS TOGETHER, INVENTORIED ALL YOUR PARTS AND THOROUGHLY STUDIED THE ASSEMBLY MANUAL, TURN TO STEP* 1 AND BEGIN.

STEP #1. BEGIN CONSTRUCTION OF LOWER-REAR FRAME ASS'Y. BY ATTACHING CHANNEL BRACKETS AND REAR FRAME DIAGONAL BRACE TOGETHER AS SHOWN.



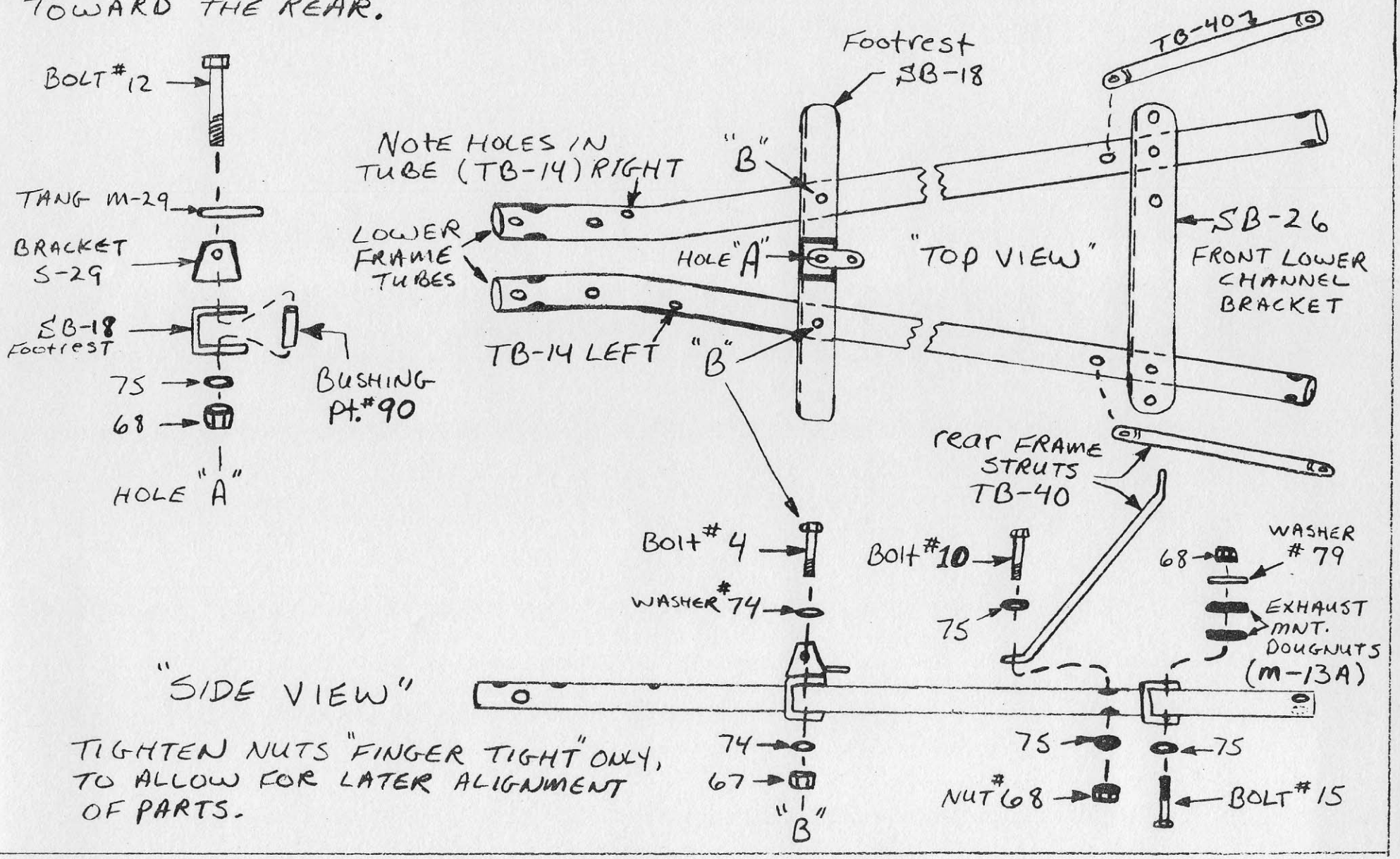






2. PLACE LOWER REAR FRAME HALVES IN POSITION AND WITH PROPER BOLTS, NUTS AND CHANNEL BRACKETS AS SHOWN.

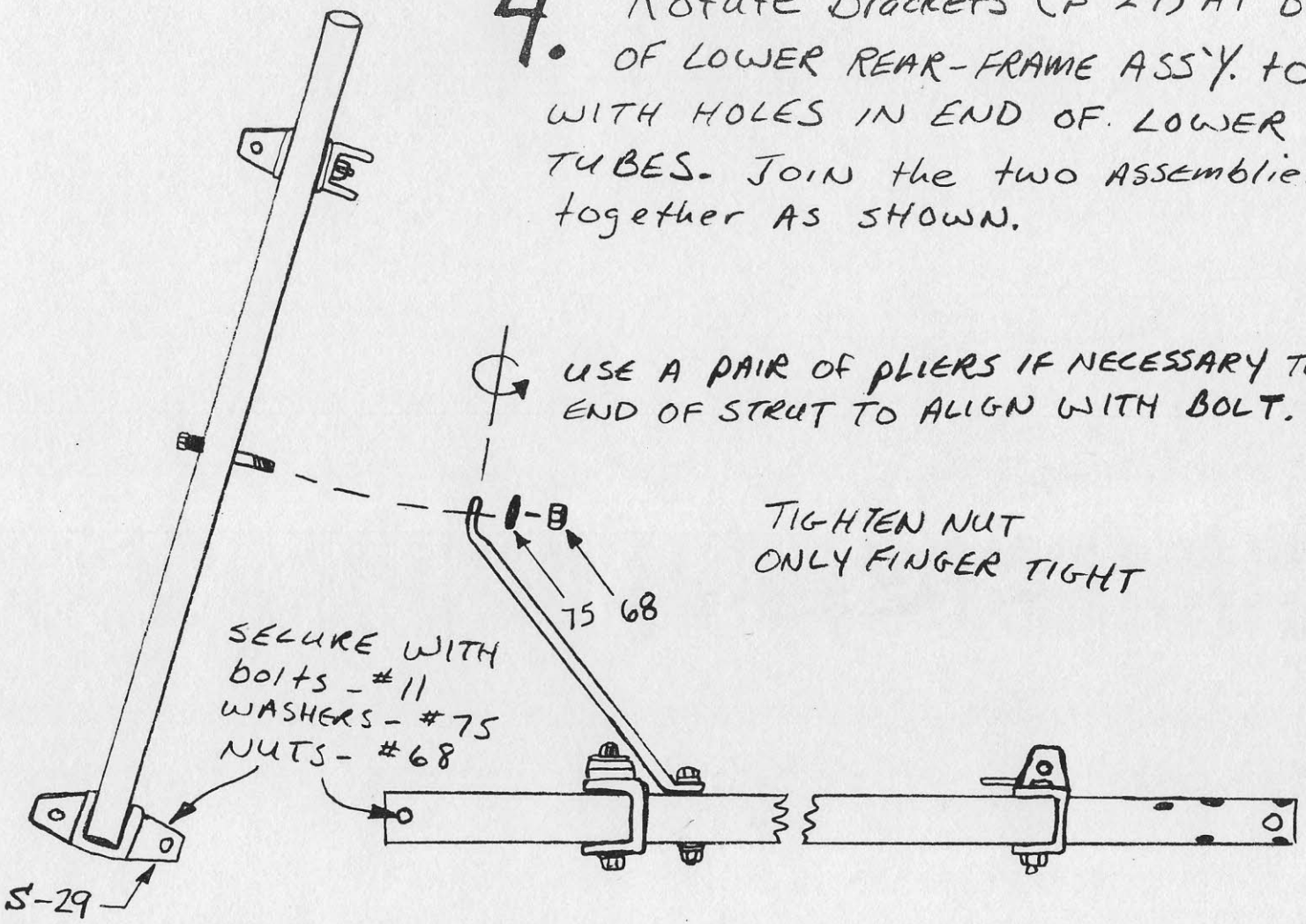
# 3. ATTACH HARDWARE TO HOLE "A" IN FOOTREST BRACKET (SB-18) AS SHOWN.

SLIDE FOOTREST AND FRONT LOWER CHANNEL BRACKETS INTO POSITION ON LOWER FRAME TUBES AND SECURE WITH PROPER BOLTS, NUTS AND HARDWARE. BE SURE OPEN END OF CHANNEL BRACKETS FACES TOWARD THE REAR.



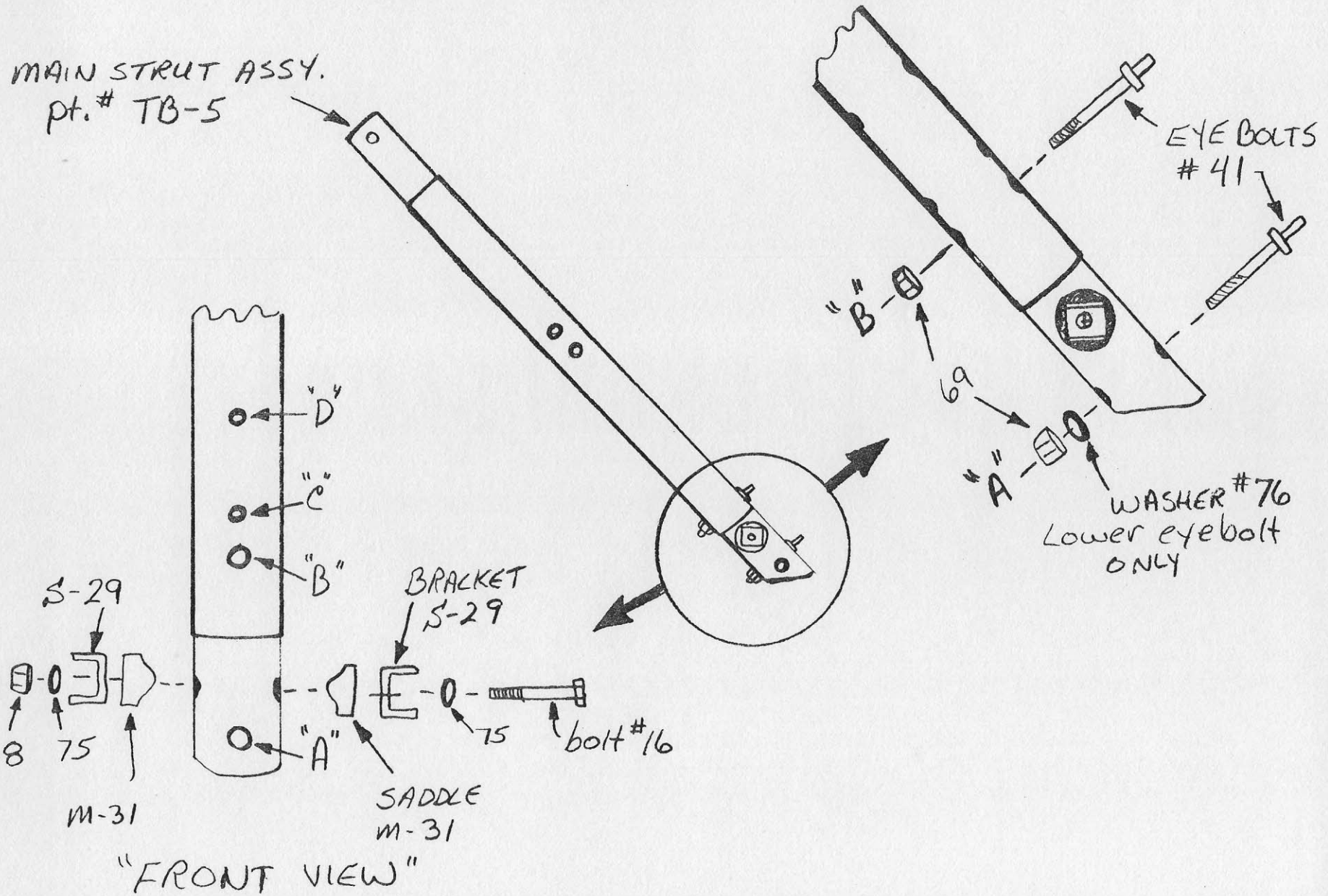

TIGHTEN NUTS "FINGER TIGHT" ONLY, TO ALLOW FOR LATER ALIGNMENT OF PARTS.

4. Rotate Brackets (S-29) AT BASE OF LOWER REAR-FRAME ASS'Y. TO ALIGN WITH HOLES IN END OF LOWER FRAME TUBES. JOIN the two ASSEMBLIES together AS SHOWN.

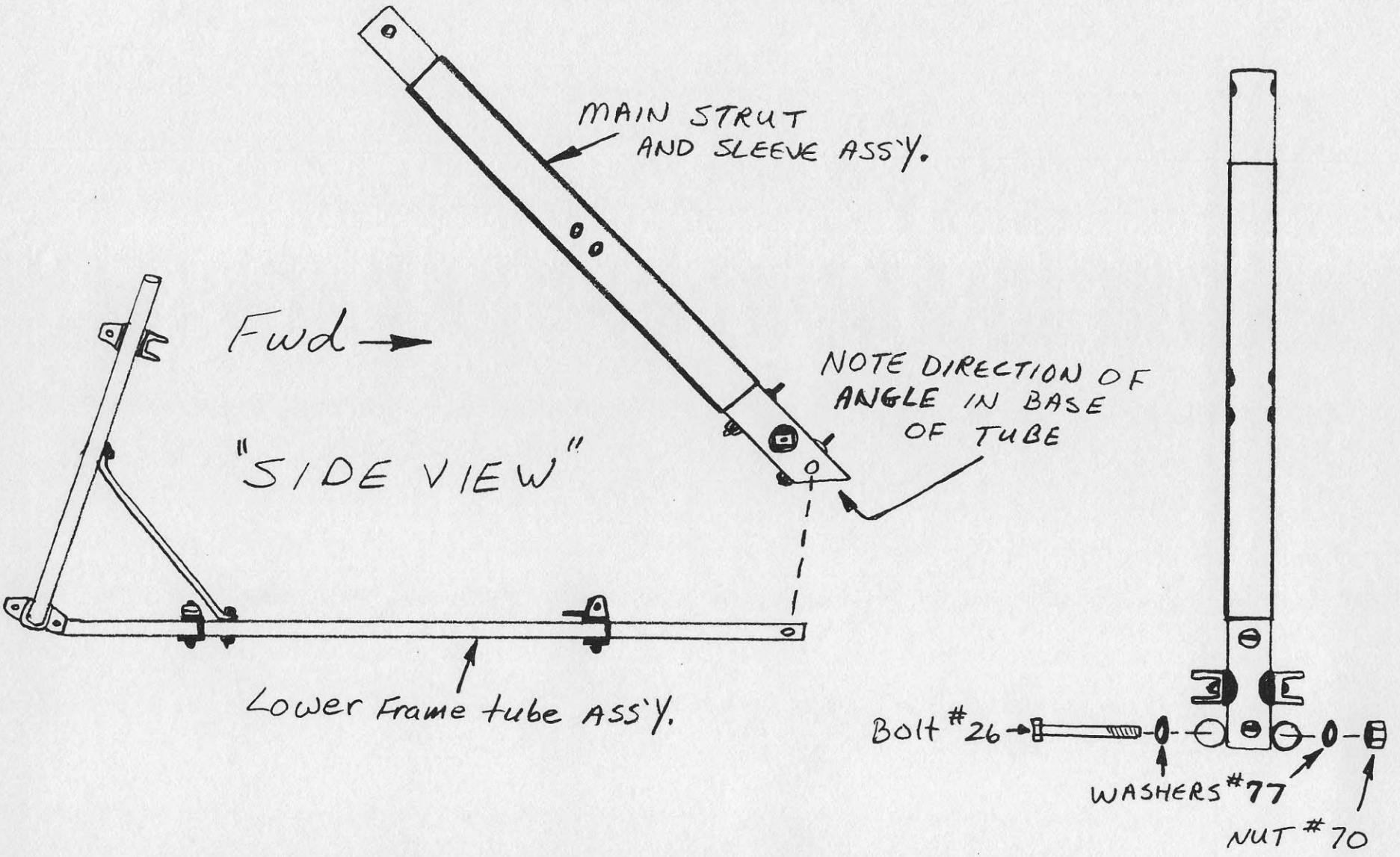



USE A CENTER PUNCH to ALIGN holes in brackets AND TUBES

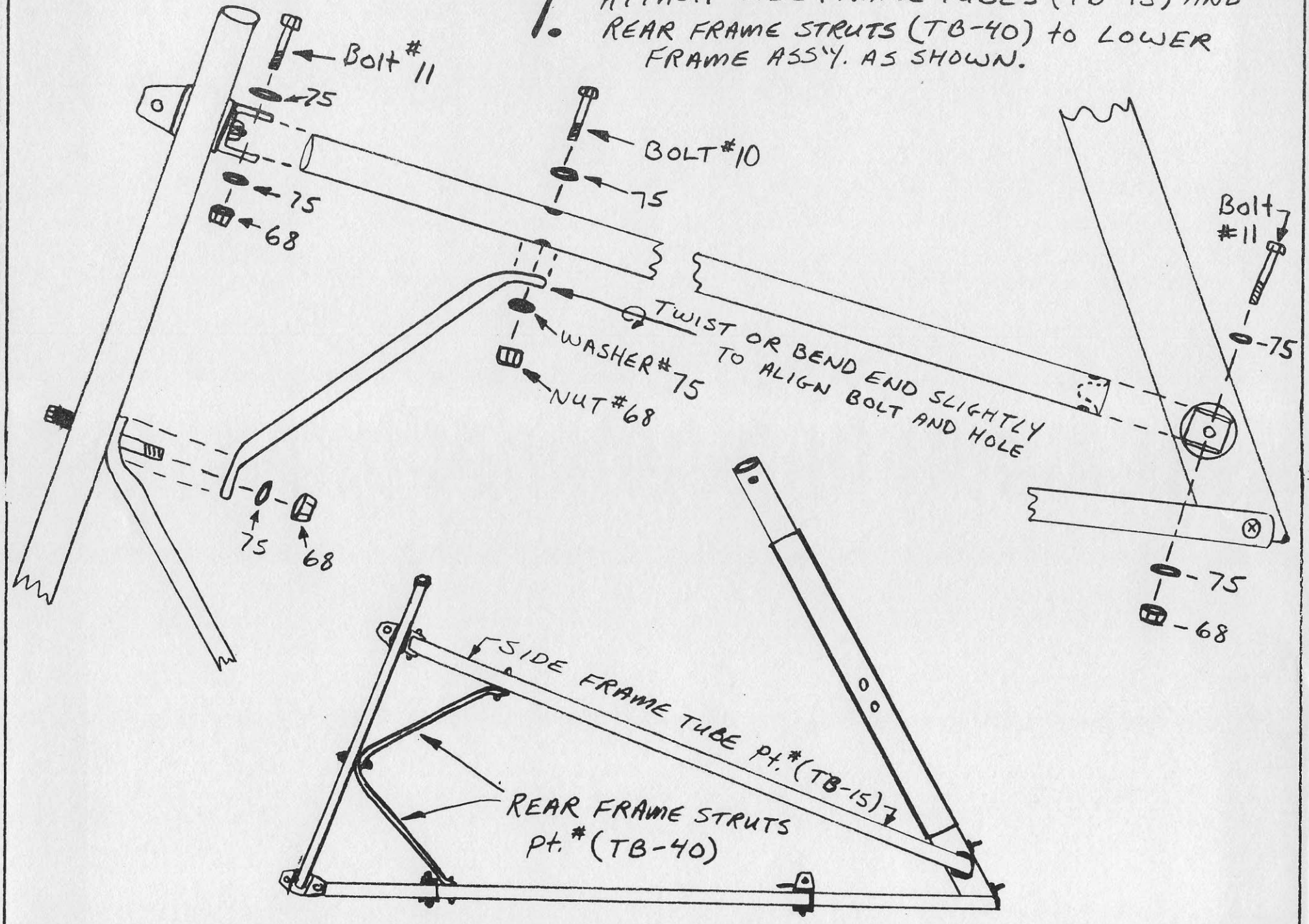
# 5. INSTALL HARDWARE IN BOTTOM OF MAINSTRUT AS SHOWN.

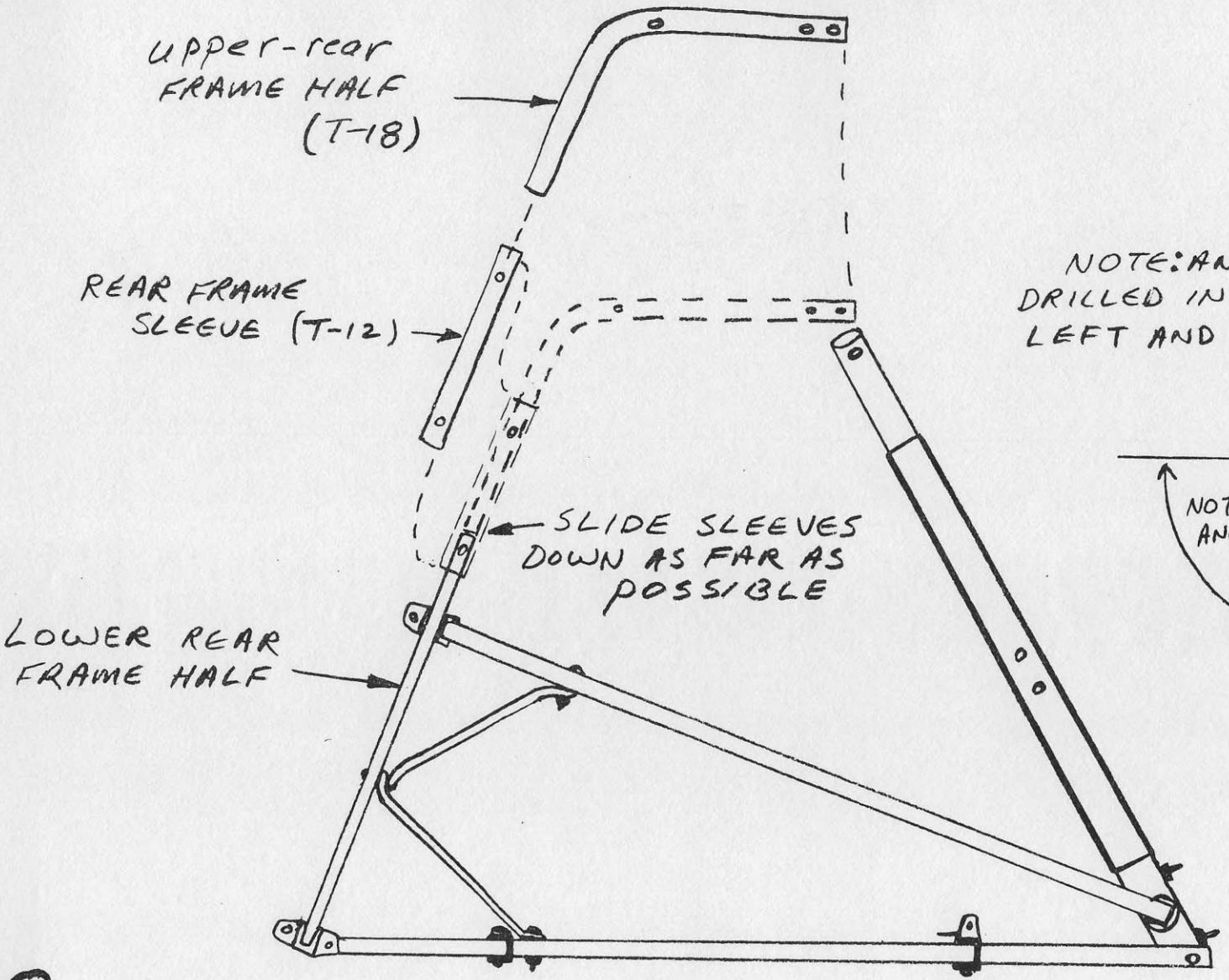


6. Connect Lower Frame TUBES TO MAIN STRUT AND SLEEVE USING proper Bolts, NUTS AND WASHERS AS SHOWN. TIGHTEN BOLT #26 IN BOTTOM OF MAIN STRUT SNUG.

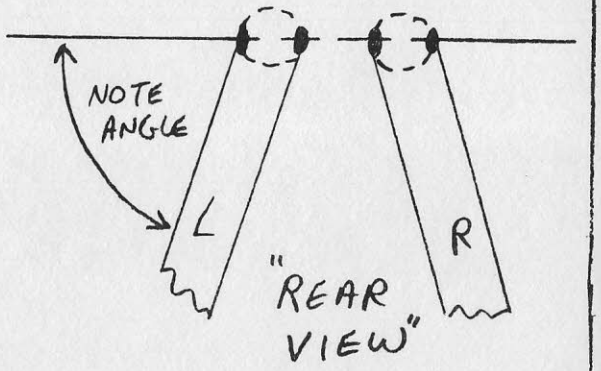


# 7. ATTACH SIDE FRAME TUBES (TB-15) AND REAR FRAME STRUTS (TB-40) to LOWER FRAME ASS'Y. AS SHOWN.



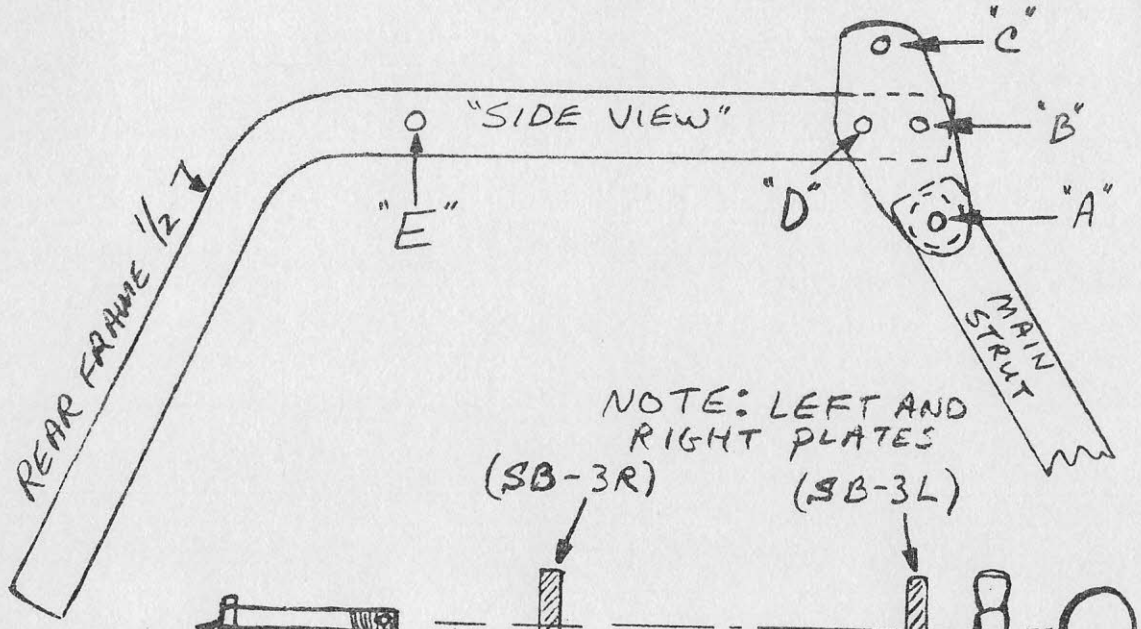



NOTE: ANGLE OF 1/4" HOLES DRILLED IN TUBES DETERMINES LEFT AND RIGHT SIDE TUBES.

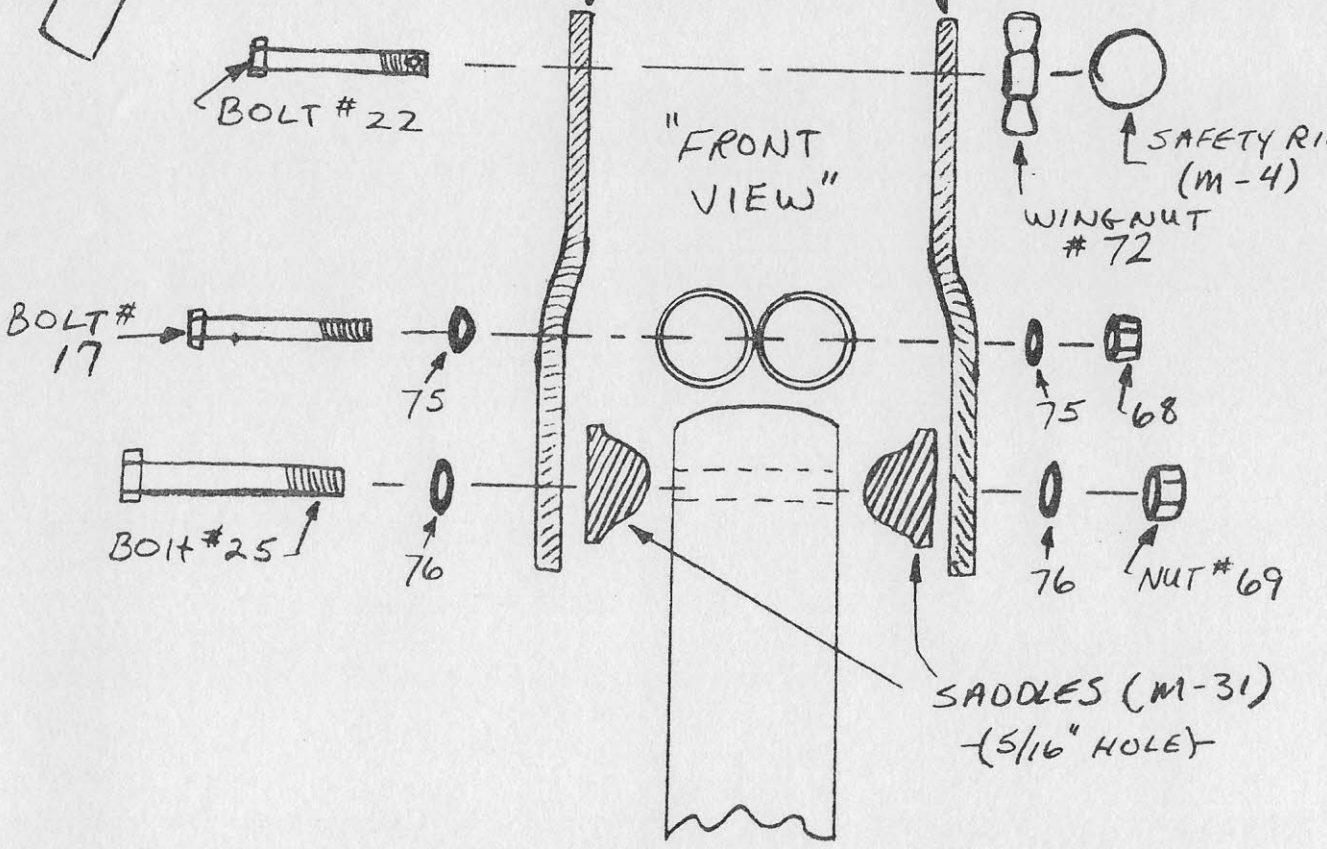



**8.** POSITION REAR FRAME SLEEVES OVER UPPER END OF LOWER-REAR FRAME HALF TUBES AS SHOWN. SLIDE UPPER-REAR FRAME HALVES (T-18) INTO SLEEVES UNTIL THEY BOTTOM OUT AGAINST TOP END OF LOWER-REAR FRAME HALF TUBES.

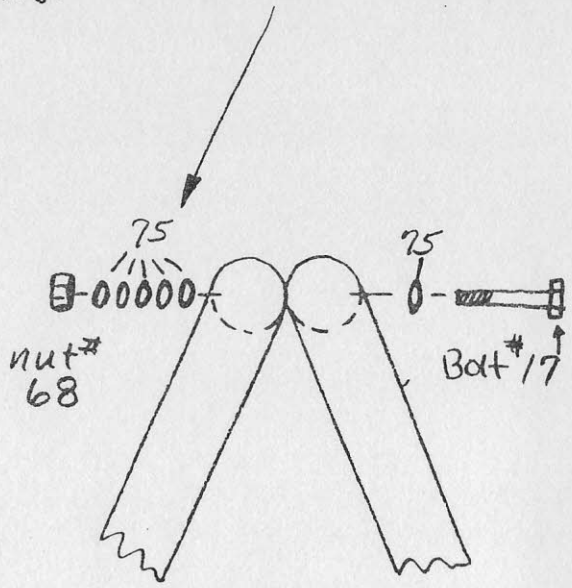
**9.** ATTACH UPPER-REAR FRAME to MAINSTRUT BY ASSEMBLING MAINSTRUT BRACKETS, SADDLES AND HARDWARE AS SHOWN. INSTALL BOLTS IN HOLES "A", "B" AND "C", ONLY. TIGHTEN UNTIL SNUG.




NOTE: LEFT AND RIGHT PLATES




INSTALL A SECOND BOLT #17 IN HOLE "E" AND TIGHTEN UNTIL SNUG. USE EXTRA WASHERS AS SHOWN.

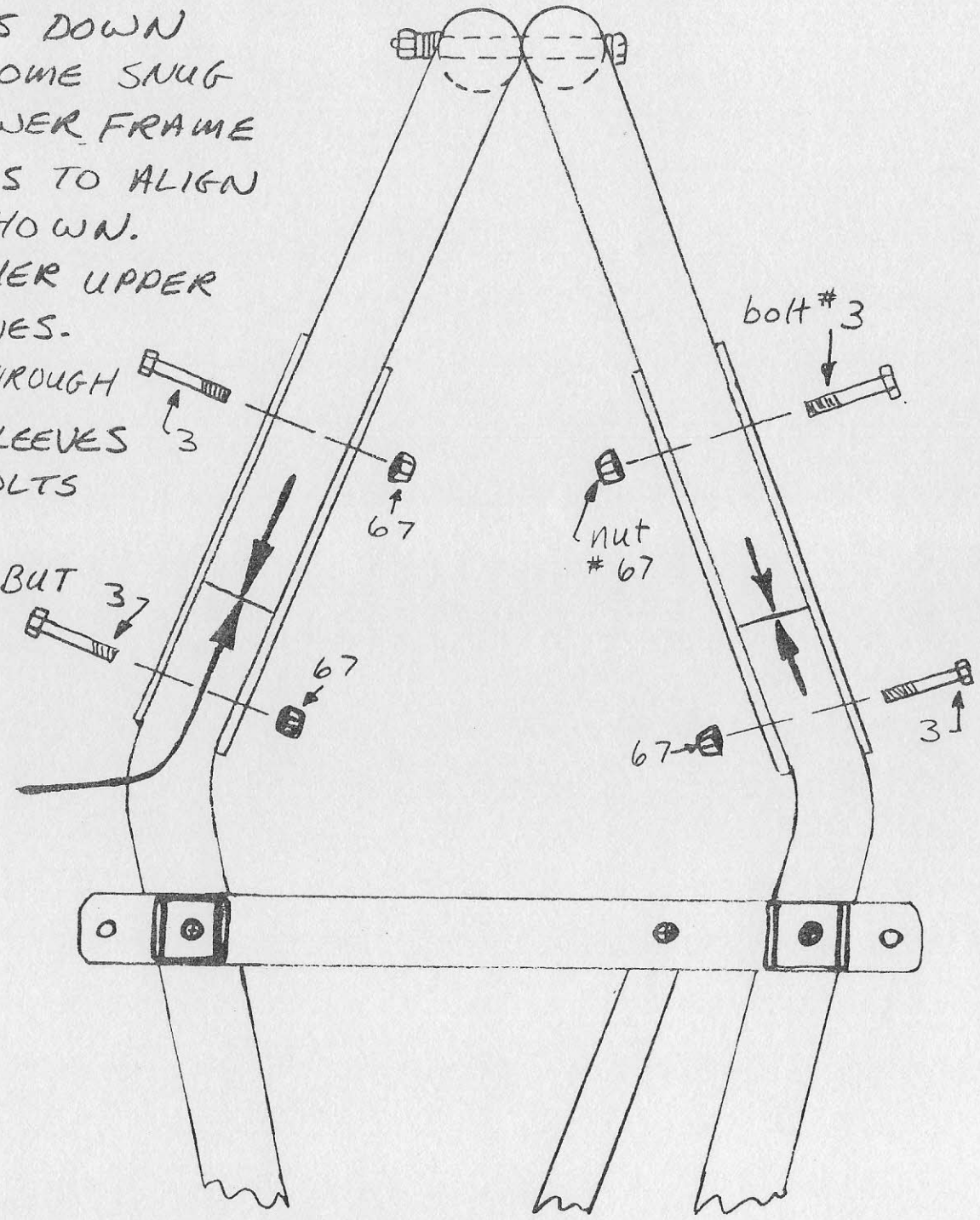


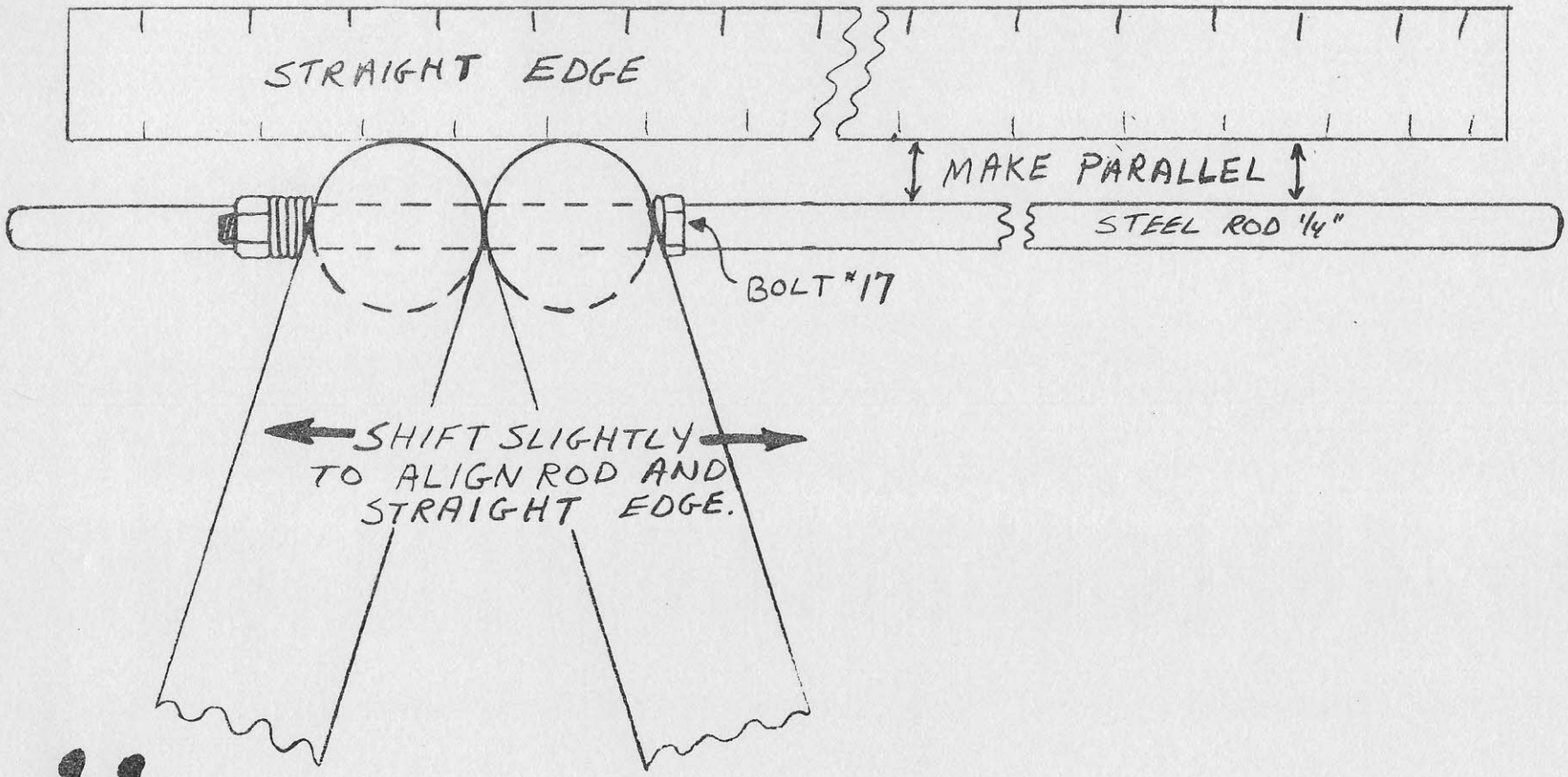

REAR VIEW UPPER-REAR FRAME

**10.** SLIDE SLEEVES DOWN UNTIL THEY BECOME SNUG AGAINST CURVE OF LOWER FRAME TUBE. ROTATE SLEEVES TO ALIGN HOLES IN POSITION SHOWN. TIGHTLY BUTT TOGETHER UPPER AND LOWER FRAME HALVES. DRILL 3/16" DIA. HOLES THROUGH SIDES OF REAR FRAME SLEEVES SECURE SLEEVES WITH BOLTS AND NUTS AS SHOWN.

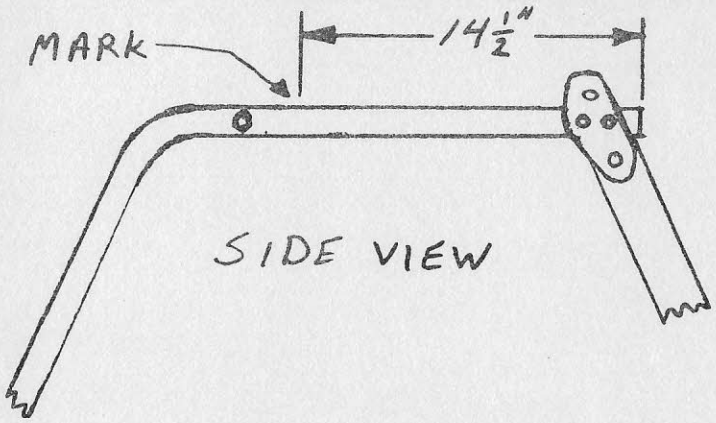
TIGHTEN NUTS SECURELY BUT DO NOT OVER TIGHTEN AND CRUSH TUBES.

BUTT TOGETHER TIGHTLY BEFORE DRILLING

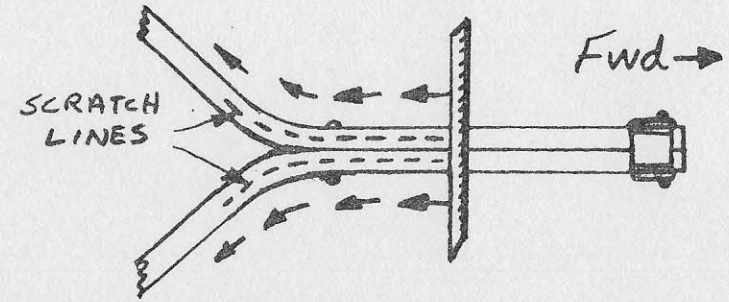




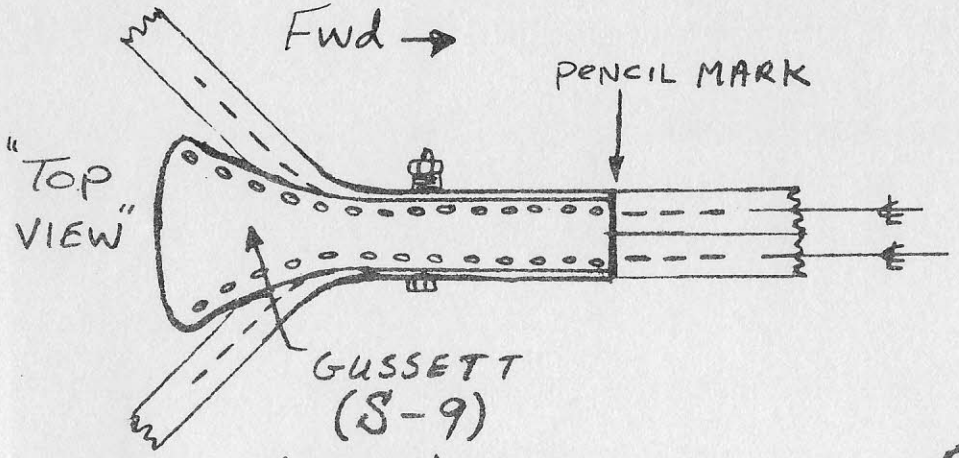

**11.** PLACE A 1/4" DIA. STEEL ROD ABOUT 12"-15" LONG (AVAILABLE AT MOST HARDWARE STORES) THROUGH FRONT OF FRAME AT HOLE "D". LAY A RULER OR STRAIGHT EDGE ACROSS TOP OF REAR FRAME ASS'Y DIRECTLY OVER BOLT # 17 IN HOLE "E". SHIFT REAR FRAME TUBES SLIGHTLY FROM SIDE TO SIDE UNTIL STRAIGHT EDGE AND 1/4" ROD ARE ALIGNED PARALLEL TO EACH OTHER. THIS WILL GUARANTEE THAT ALL 3 HOLES "B", "D", AND "E" THROUGH REAR FRAME 1/2 TUBES WILL BE IN ALIGNMENT. WHEN STRAIGHT EDGE AND ROD HAVE BEEN ALIGNED, TIGHTEN BOLT # 17 TO HOLD TUBES SECURELY IN POSITION.




**12.** MEASURE BACK 14½" FROM FRONT OF FRAME AS SHOWN AND PLACE A PENCIL MARK.

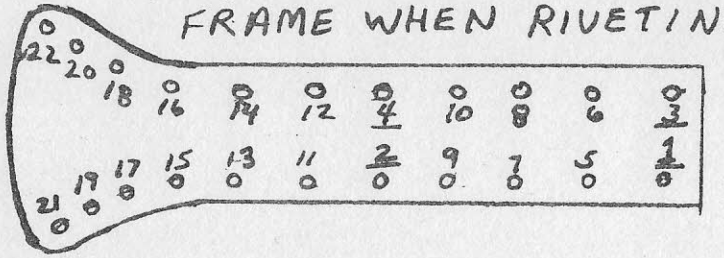



LAY A STRAIGHT EDGE ACROSS TOP OF BOTH FRAME TUBES. SCRATCH LINES ON TUBES AS SHOWN.



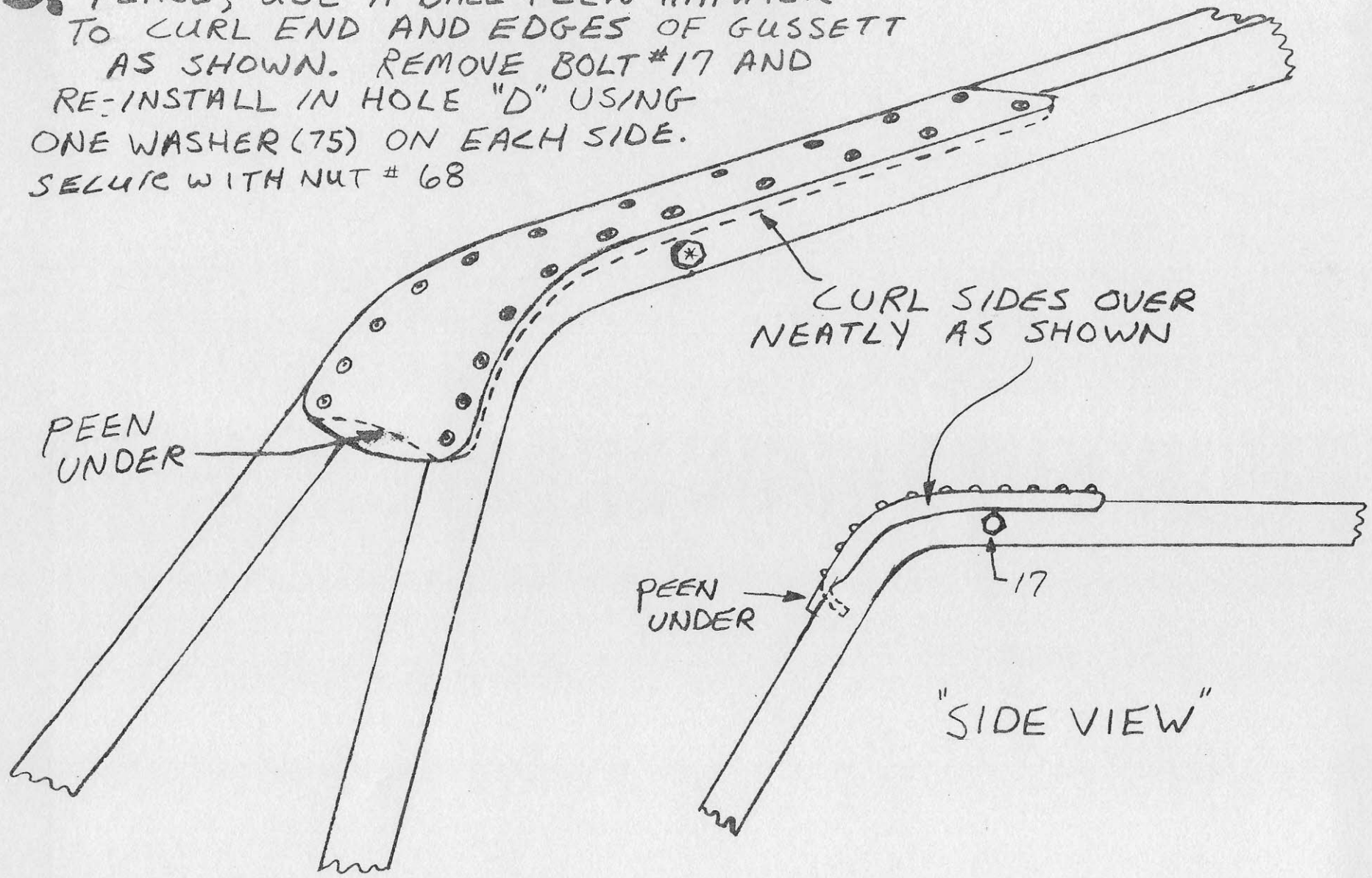

ATTACH WITH 1/8" pop rivets (pt#64)

ALIGN GUSSETT (S-9) SO THAT HOLES ARE CENTERED OVER MARKS PLACED ON TUBES WITH STRAIGHT EDGE. DRILL 1/8" HOLES AND POP RIVET GUSSETT INTO PLACE USING SEQUENCE AS SHOWN. BE SURE TO PULL GUSSETT TIGHT AGAINST FRAME WHEN RIVETING AROUND CURVE.

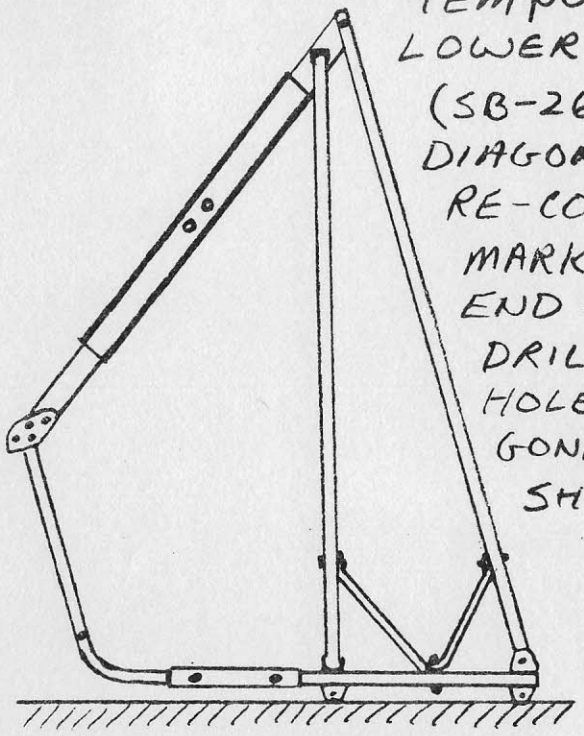



**NOTE:** ALWAYS USE A CENTER PUNCH PRIOR TO DRILLING

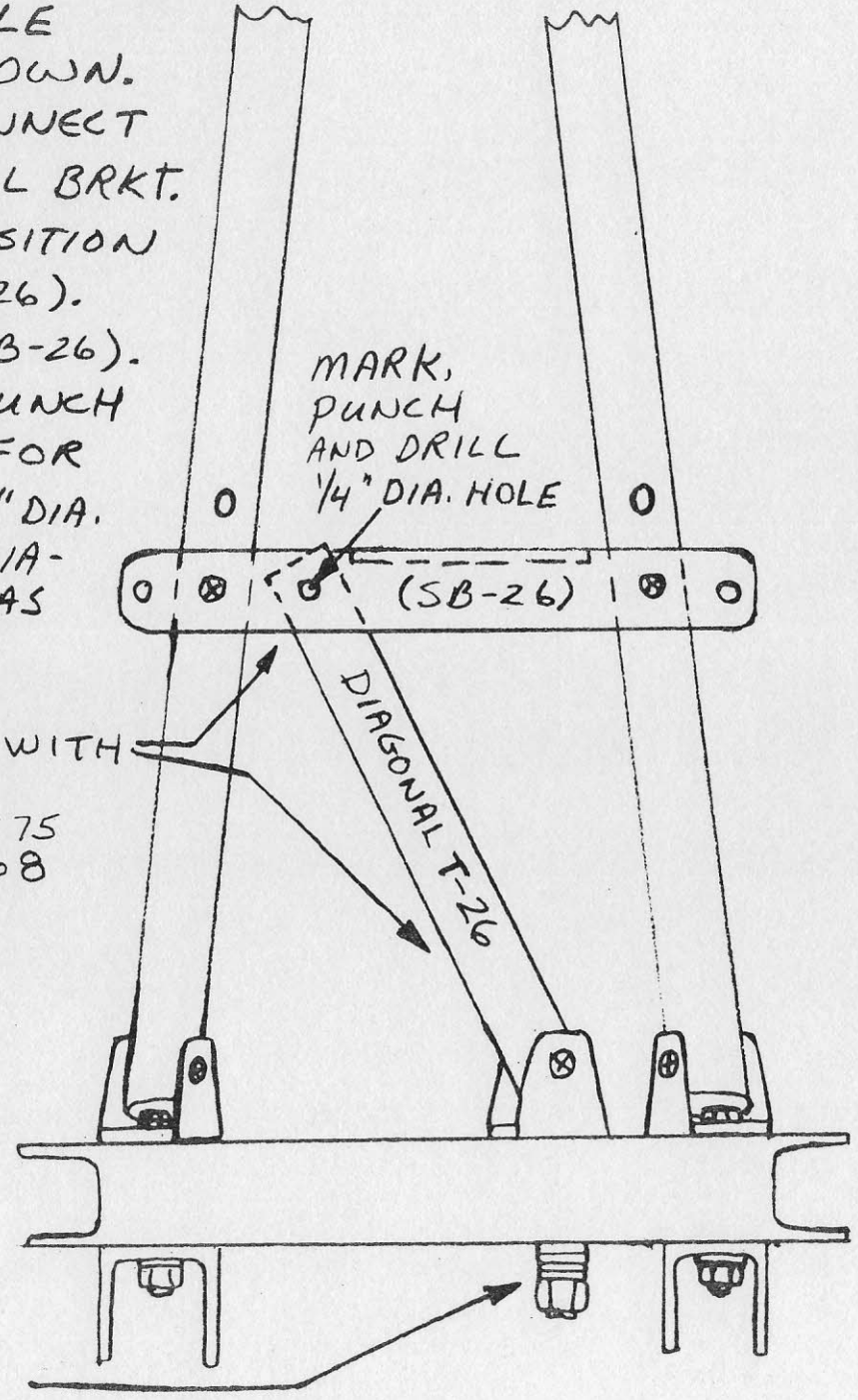
13. AFTER RIVETING GUSSETT INTO PLACE, USE A BALL PEEN HAMMER TO CURL END AND EDGES OF GUSSETT AS SHOWN. REMOVE BOLT #17 AND RE-INSTALL IN HOLE "D" USING ONE WASHER (75) ON EACH SIDE. SECURE WITH NUT # 68



**14.** PLACE FRAME ON WORKTABLE OR FLOOR IN POSITION SHOWN. TEMPORARILY DISCONNECT LOWER FRONT CHANNEL BRKT. (SB-26). PLACE IN POSITION DIAGONAL BRACE (T-26). RE-CONNECT BRKT. (SB-26). MARK AND CENTER PUNCH END OF DIAGONAL FOR DRILLING. DRILL 1/4" DIA. HOLE AND ATTACH DIAGONAL TO BRACKET AS SHOWN.



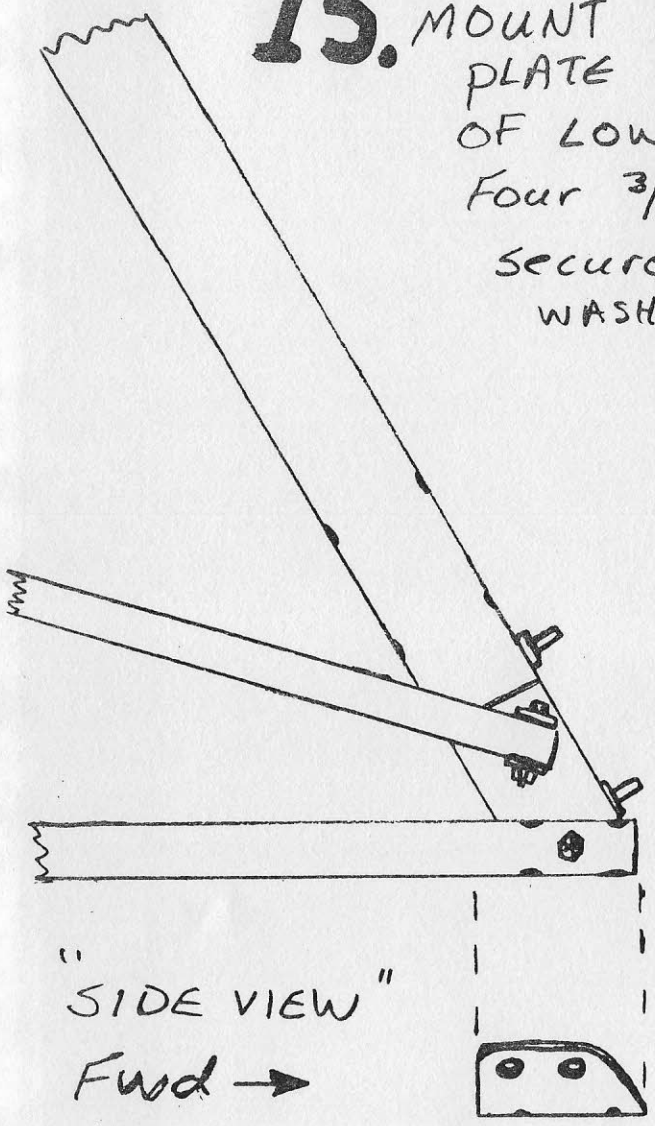
"SIDE VIEW"

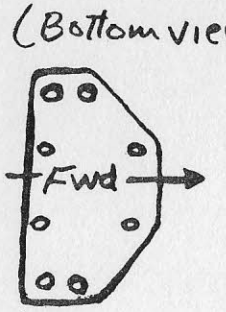


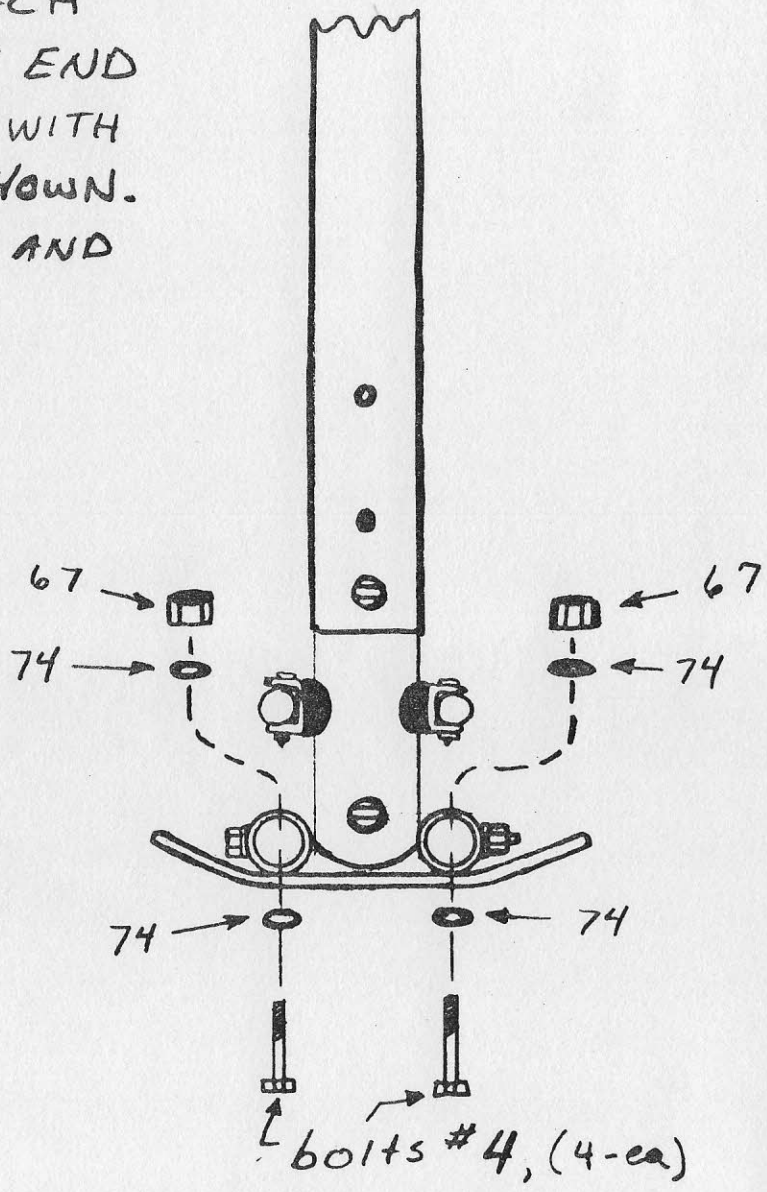

ATTACH ENDS WITH
BOLTS #11
WASHERS #75
NUTS #68

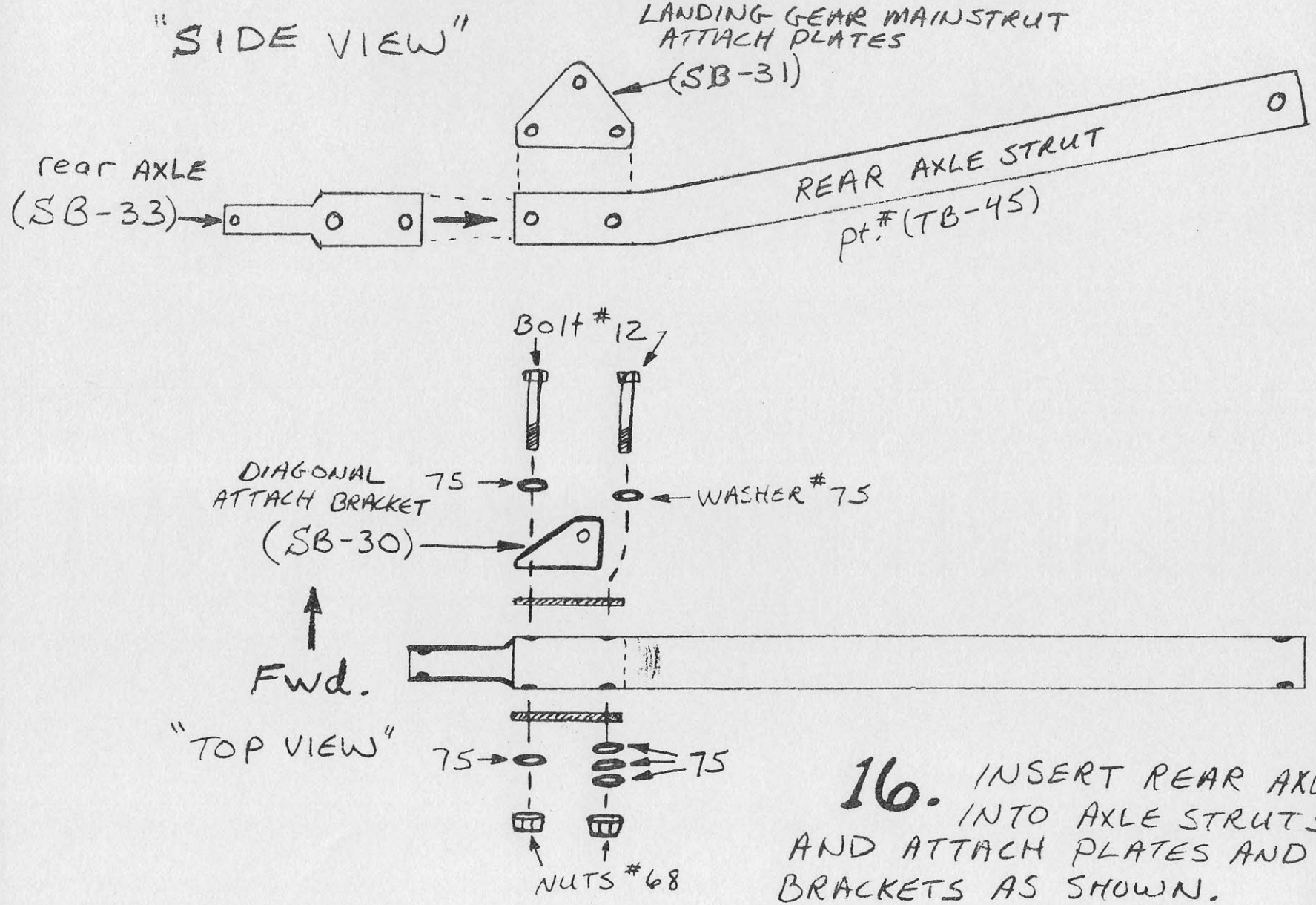
TIGHTEN REAR END OF DIAGONAL IN BRACKET.
TEMPORARILY INSTALL 4-#75 WASHERS ON BRACKET MOUNT BOLT AND TIGHTEN SECURELY WITH NUT #68 BEFORE DRILLING

**15.** MOUNT FLYING WIRE ATTACH PLATE ON BOTTOM-FRONT END OF LOWER FRAME TUBES WITH Four 3/16" DIA. BOLTS AS SHOWN. secure with proper nuts AND WASHERS.



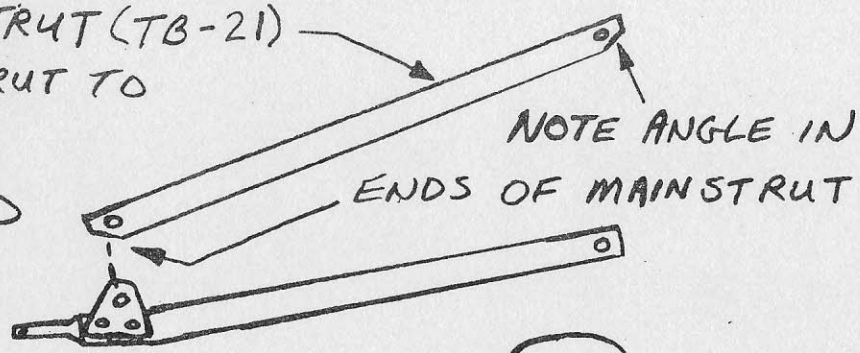


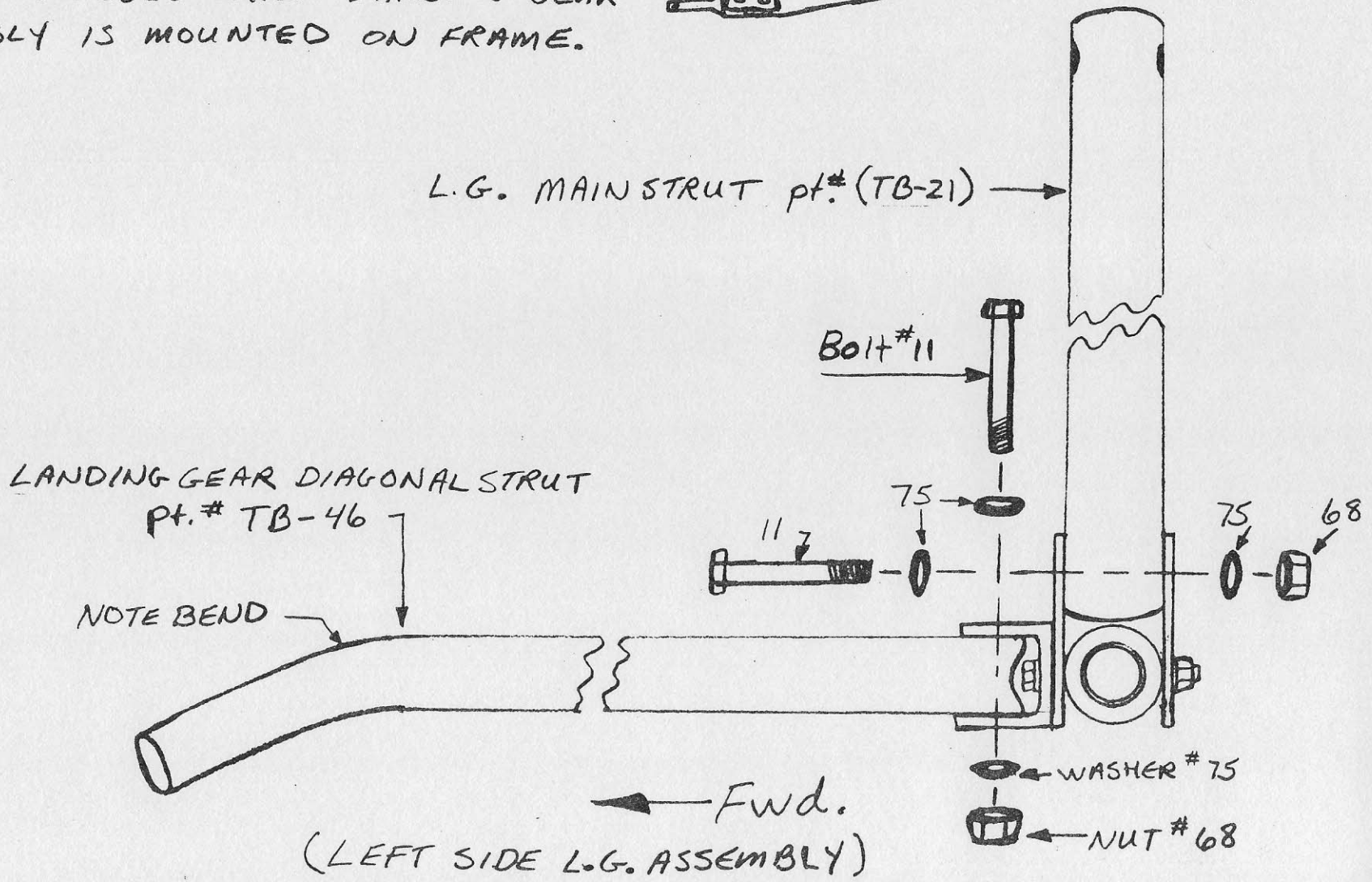

**16.** INSERT REAR AXLES INTO AXLE STRUTS AND ATTACH PLATES AND BRACKETS AS SHOWN.

THIS DIAGRAM SHOWS LEFT SIDE REAR AXLE ASSEMBLY. MAKE ONE LEFT SIDE ASSEMBLY AND ONE RIGHT.

**17.** ATTACH LANDING GEAR MAINSTRUT (TB-21) AND LANDING GEAR DIAGONAL STRUT TO REAR AXLE ASSEMBLY AS SHOWN.

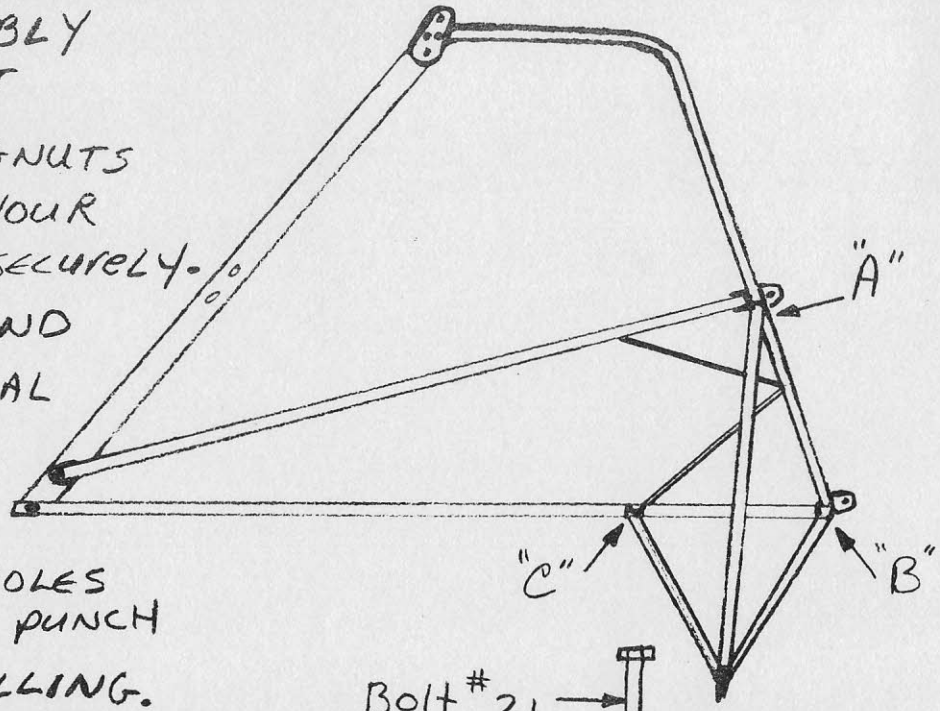
NOTE DIRECTION OF BEND IN UNDRILLED END OF DIAGONAL STRUT. THIS END WILL BE DRILLED WHEN LANDING GEAR ASSEMBLY IS MOUNTED ON FRAME.

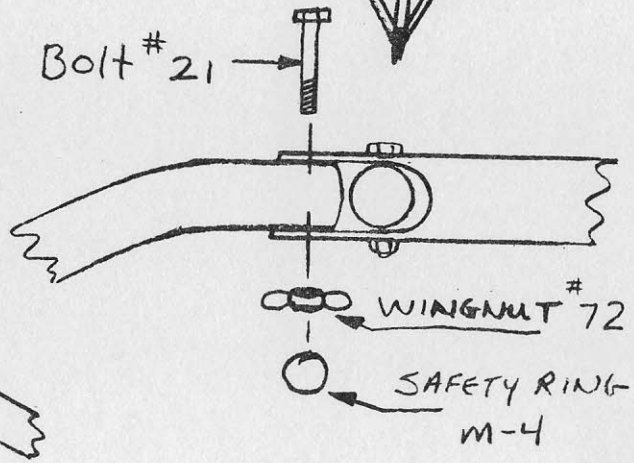


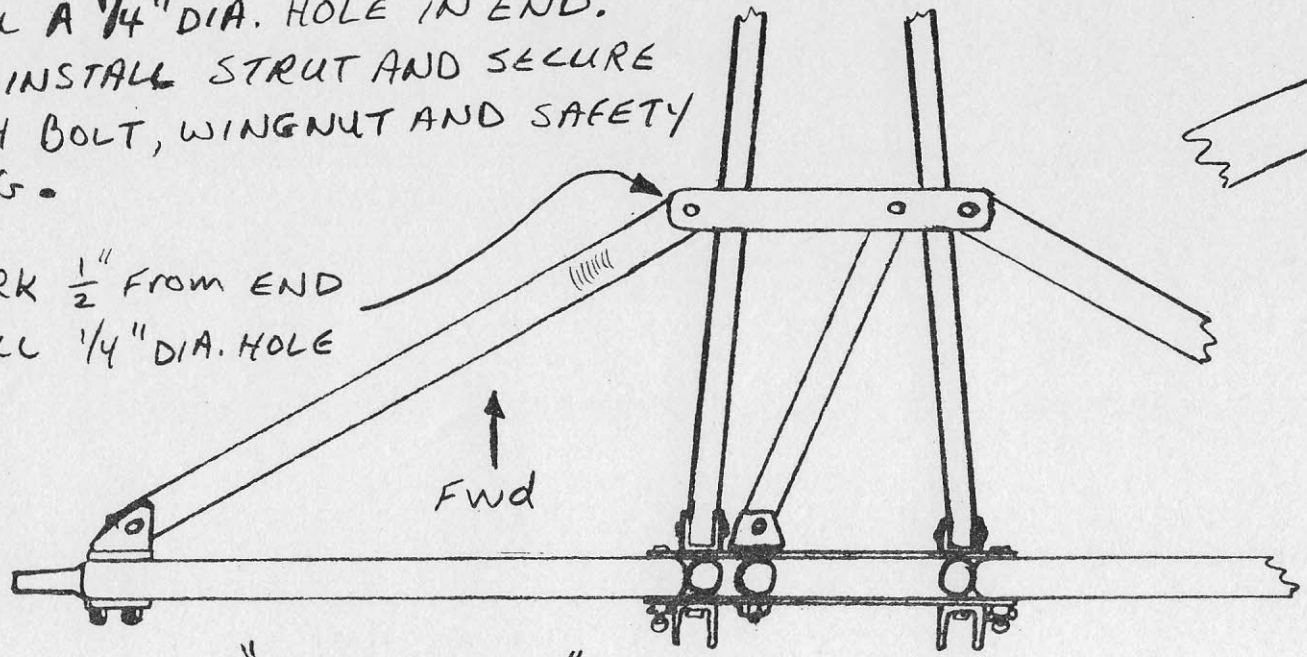



**18.** ATTACH LANDING GEAR ASSEMBLY TO UNDERCARRIAGE FRAME AT POINTS "A", "B" AND "C" WITH BOLTS, WINGNUTS AND SAFETY RINGS AS SHOWN. USE YOUR FINGERS ONLY TO TIGHTEN WINGNUTS SECURELY.

PLACE A PENCIL MARK 1/2" FROM END OF TUBE ON TOP AND BOTTOM OF DIAGONAL STRUT. PLACE STRUT END IN BRACKET AND CLAMP OR HOLD IN POSITION FOR MARKING. BE SURE STRUT END AND PENCIL MARKS ARE CENTERED UNDER HOLES IN BRACKET END. MARK AND CENTER PUNCH TOP AND BOTTOM OF STRUT END FOR DRILLING. DRILL A 1/4" DIA. HOLE IN END. RE-INSTALL STRUT AND SECURE WITH BOLT, WINGNUT AND SAFETY RING.



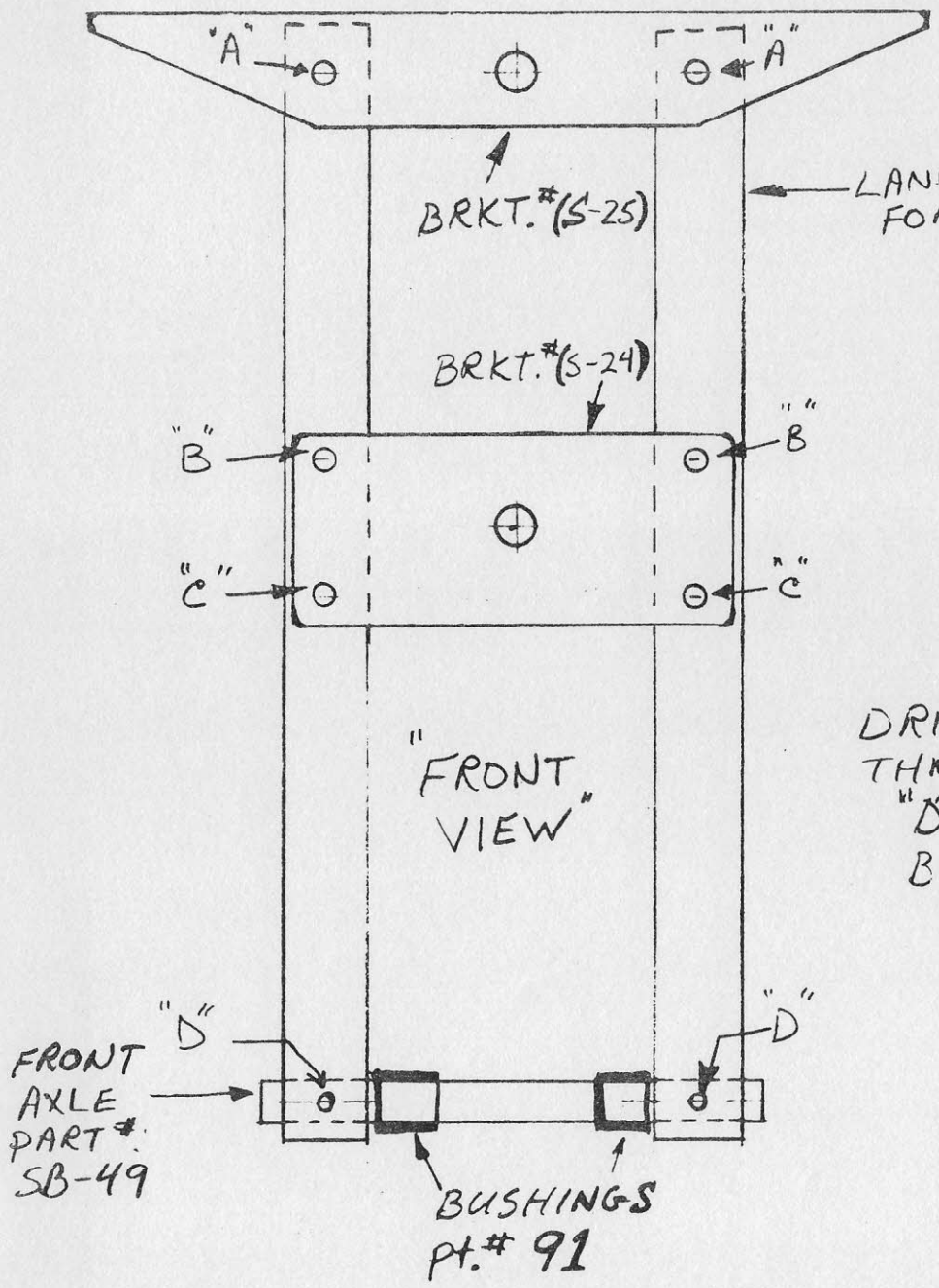



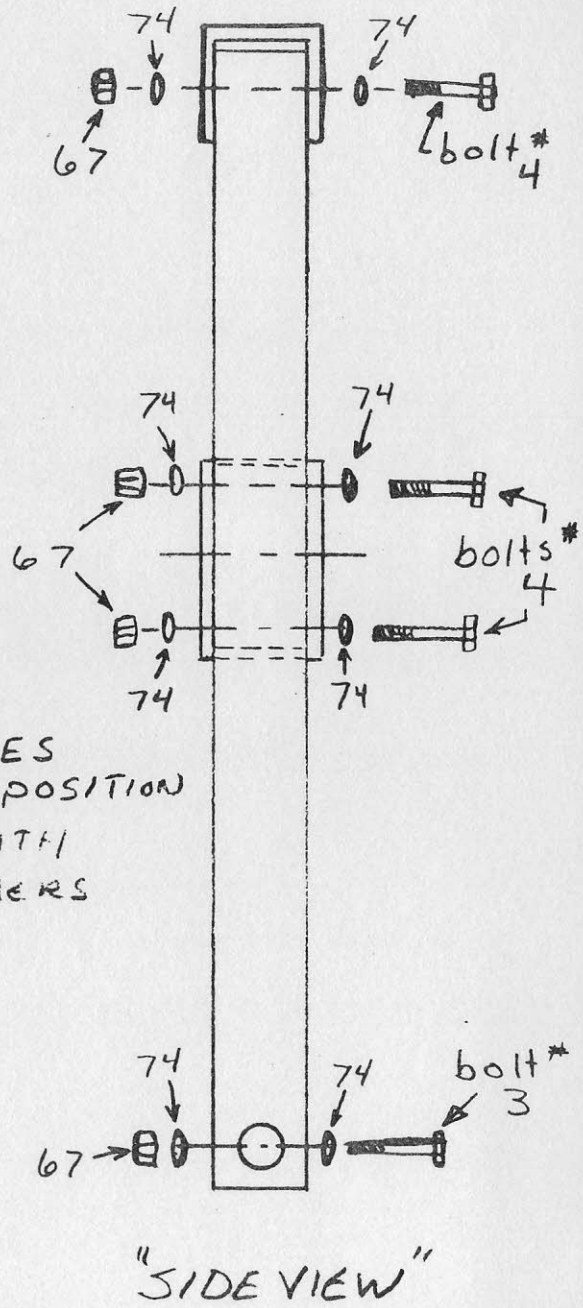



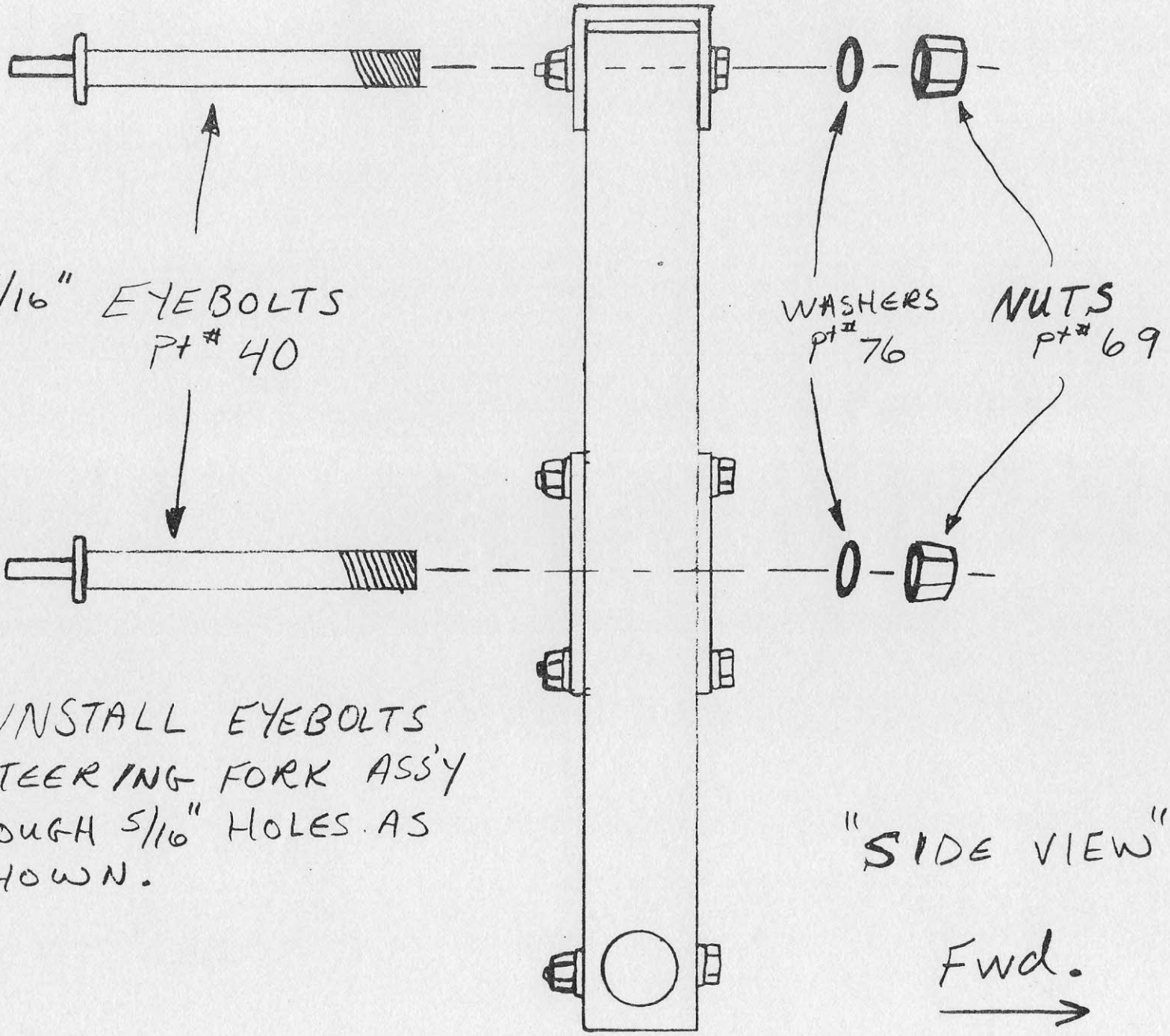

"TOP VIEW"
—LEFT SIDE L.G. ASSEMBLY—

# 19.

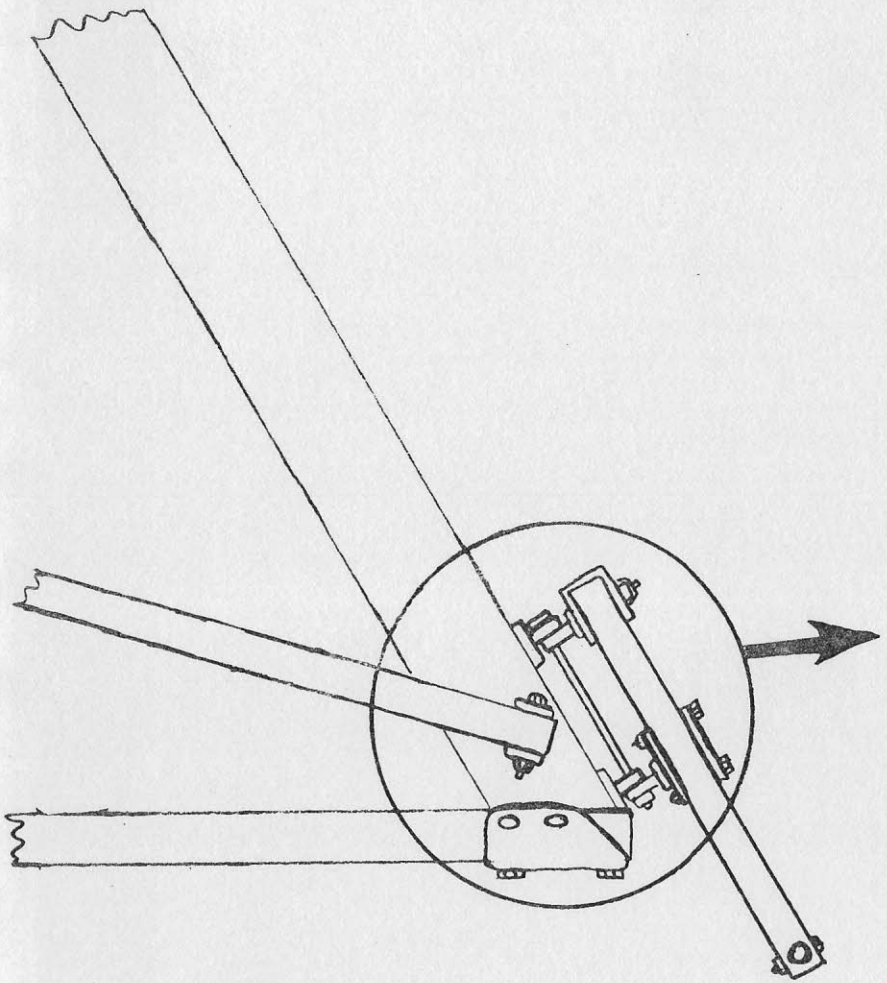
ASSEMBLE STEERING FORK ASS'Y BY PLACING TUBES AND BRACKETS IN POSITION AS SHOWN. INSTALL BOLTS IN HOLES "A", "B" + "C", AND SECURE WITH NUTS AND WASHERS.

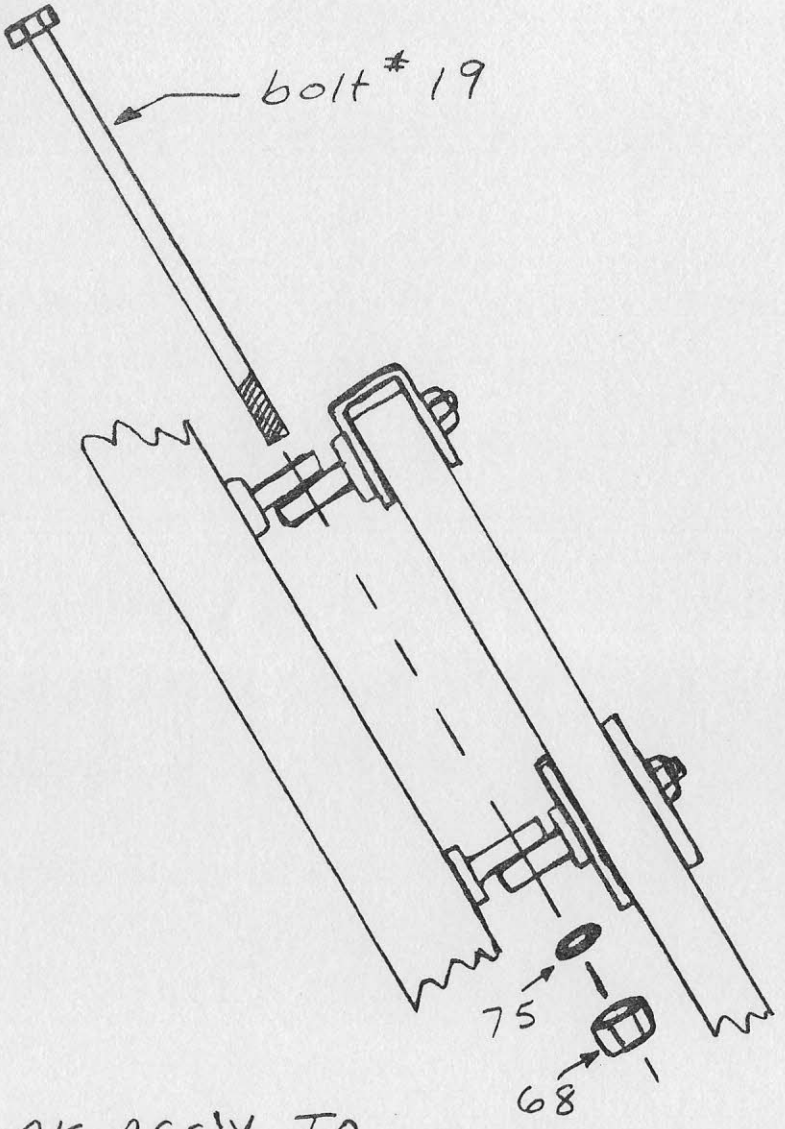




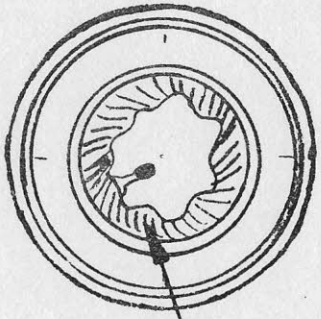

**20.** INSTALL EYEBOLTS IN STEERING FORK ASS'Y THROUGH 5/16" HOLES AS SHOWN.

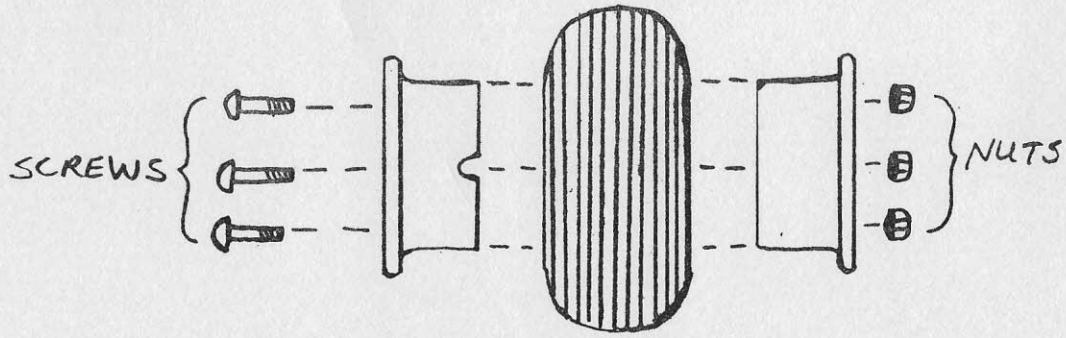





**21.** ATTACH STEERING FORK ASS'Y TO BOTTOM OF MAIN STRUT AS SHOWN.
TIGHTEN NUT # 68 UNTIL SNUG SO THAT FORK DOES NOT FLOP FROM SIDE TO SIDE.
DO NOT OVERTIGHTEN.

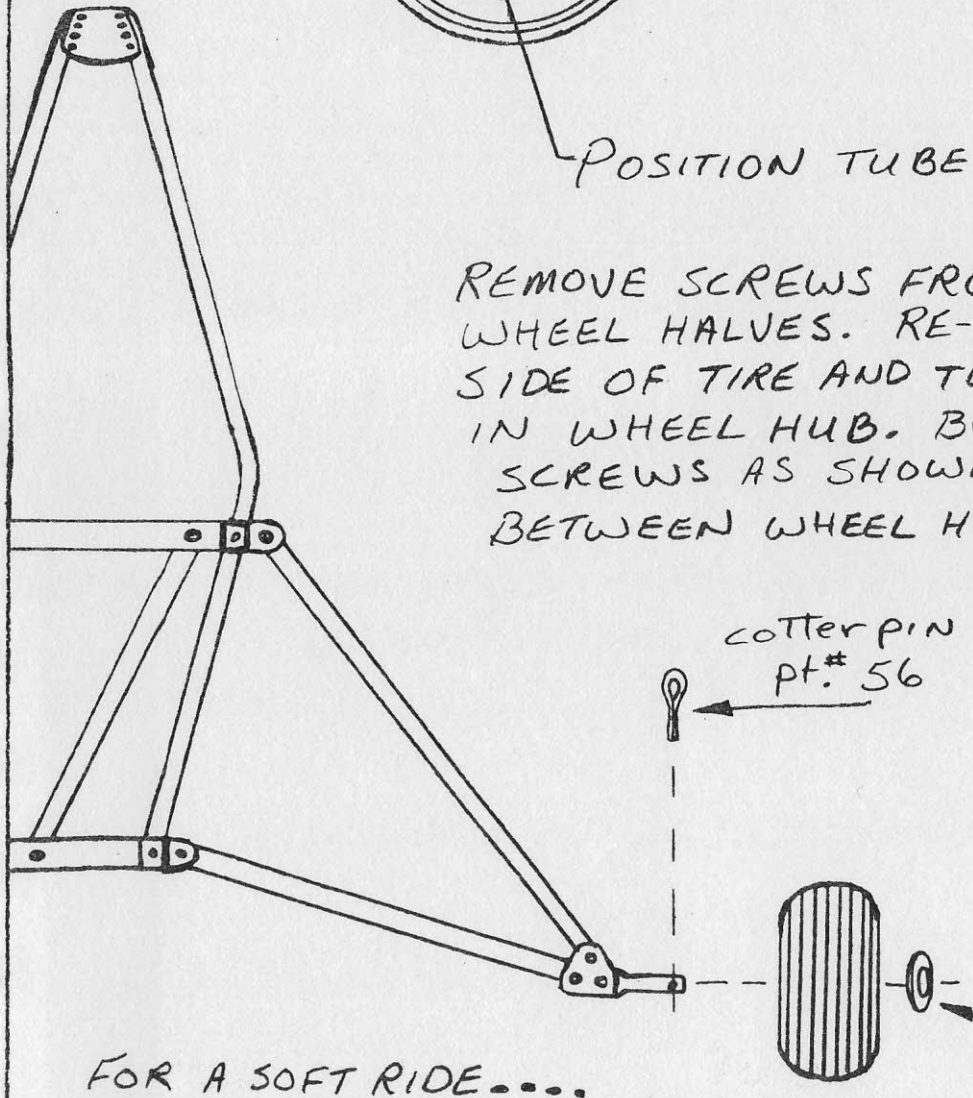
# 22.






POSITION TUBE EVENLY INSIDE TIRE

REMOVE SCREWS FROM WHEEL HUBS AND SEPERATE WHEEL HALVES. RE-ASSEMBLE WHEEL HALVES ON EITHER SIDE OF TIRE AND TUBE. ALIGN VALVE STEM WITH NOTCH IN WHEEL HUB. BOLT TOGETHER WHEEL HALVES WITH SCREWS AS SHOWN. BE CAREFUL NOT TO PINCH TUBE BETWEEN WHEEL HALVES DURING ASSEMBLY.

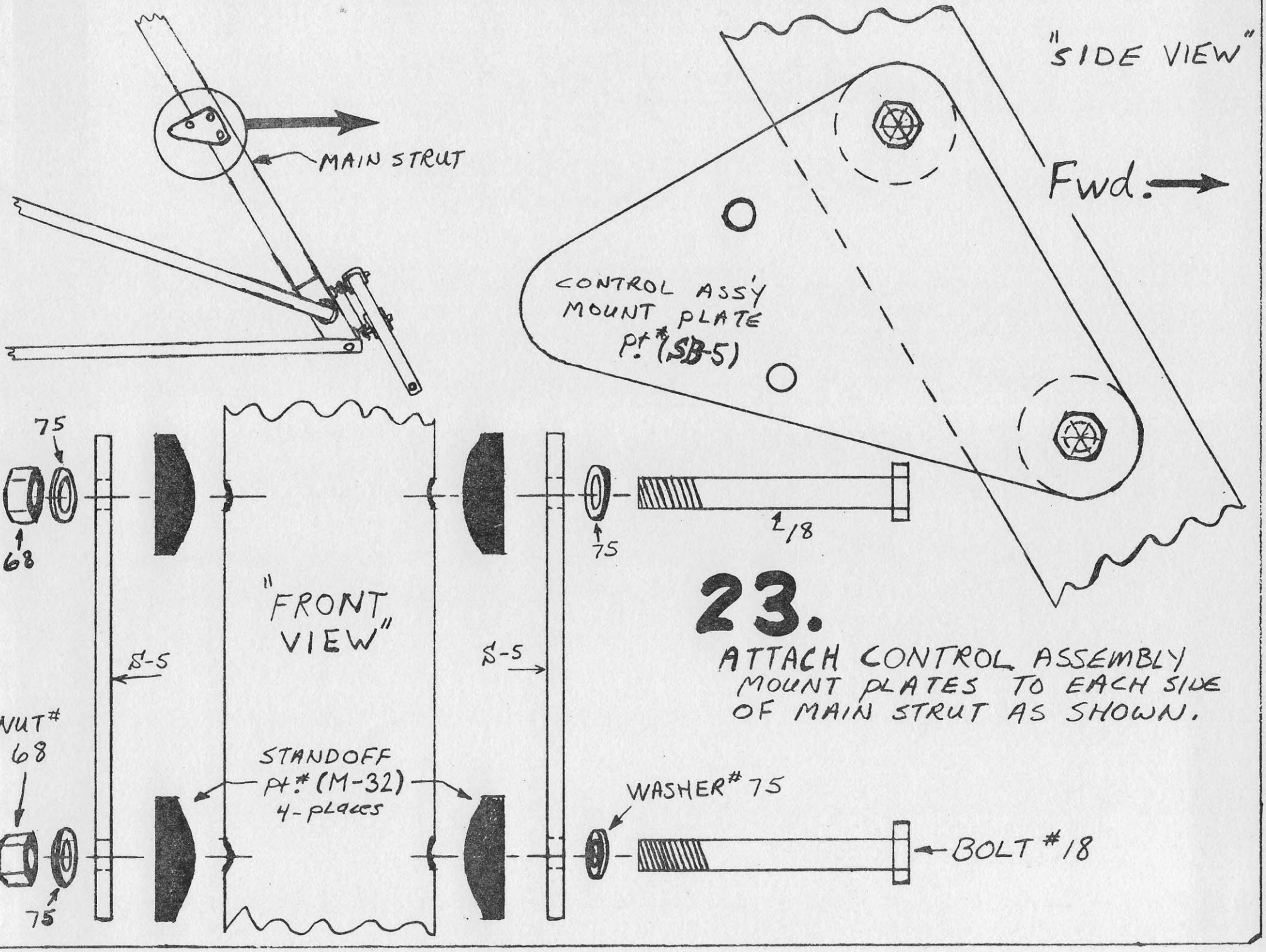



MOUNT WHEELS ON STEERING FORK AND REAR AXLES AS SHOWN.

SECURE WHEELS ON REAR AXLES WITH LARGE WASHER AND COTTER PIN.

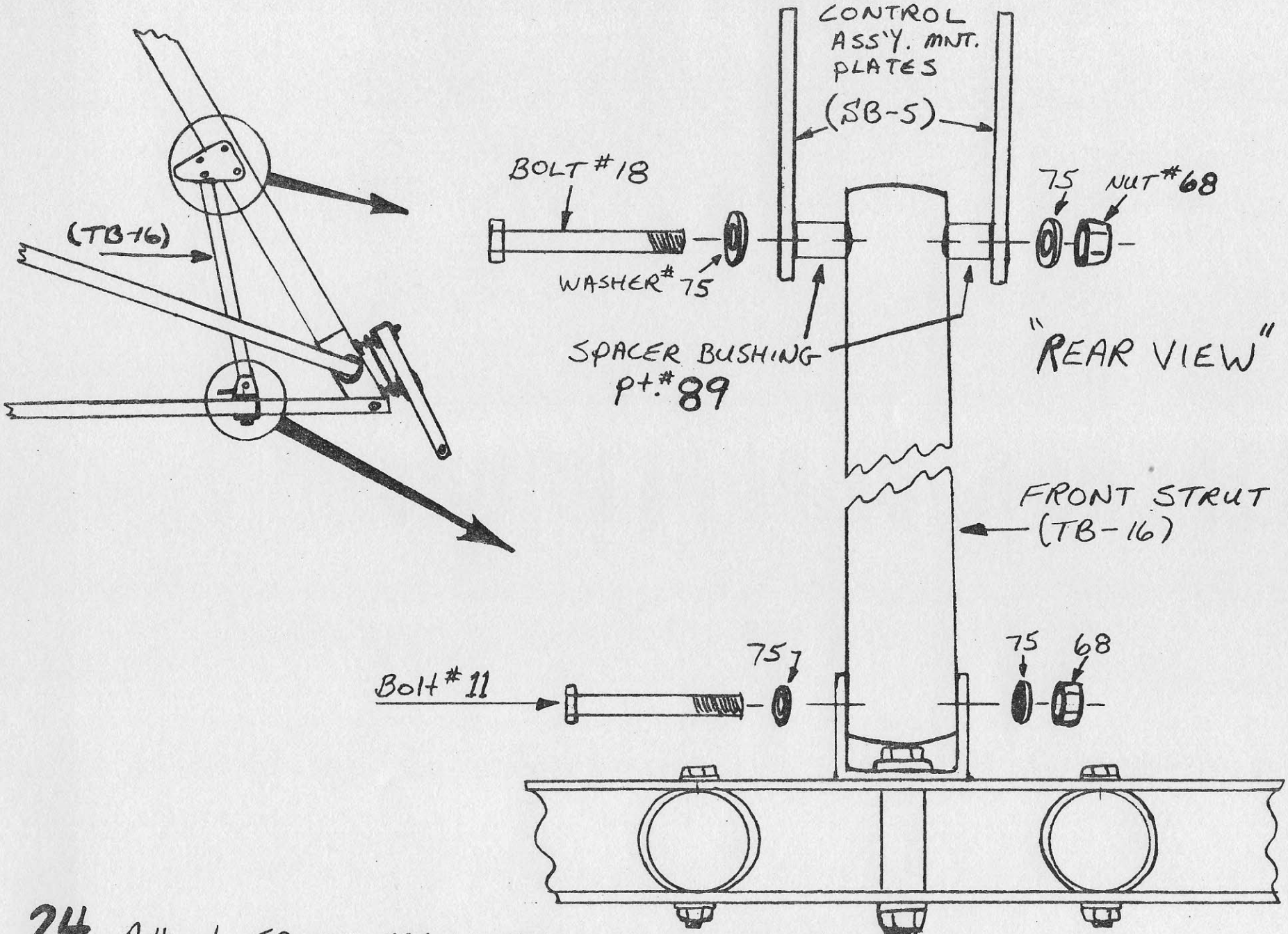
BEND COTTER PIN AFTER INSTALLATION.

FOR A SOFT RIDE....
INFLATE TIRES TO 15 p.s.i. to SEAT INNER TUBE, THEN RUN Pressure AS LOW AS POSSIBLE.




# 23.

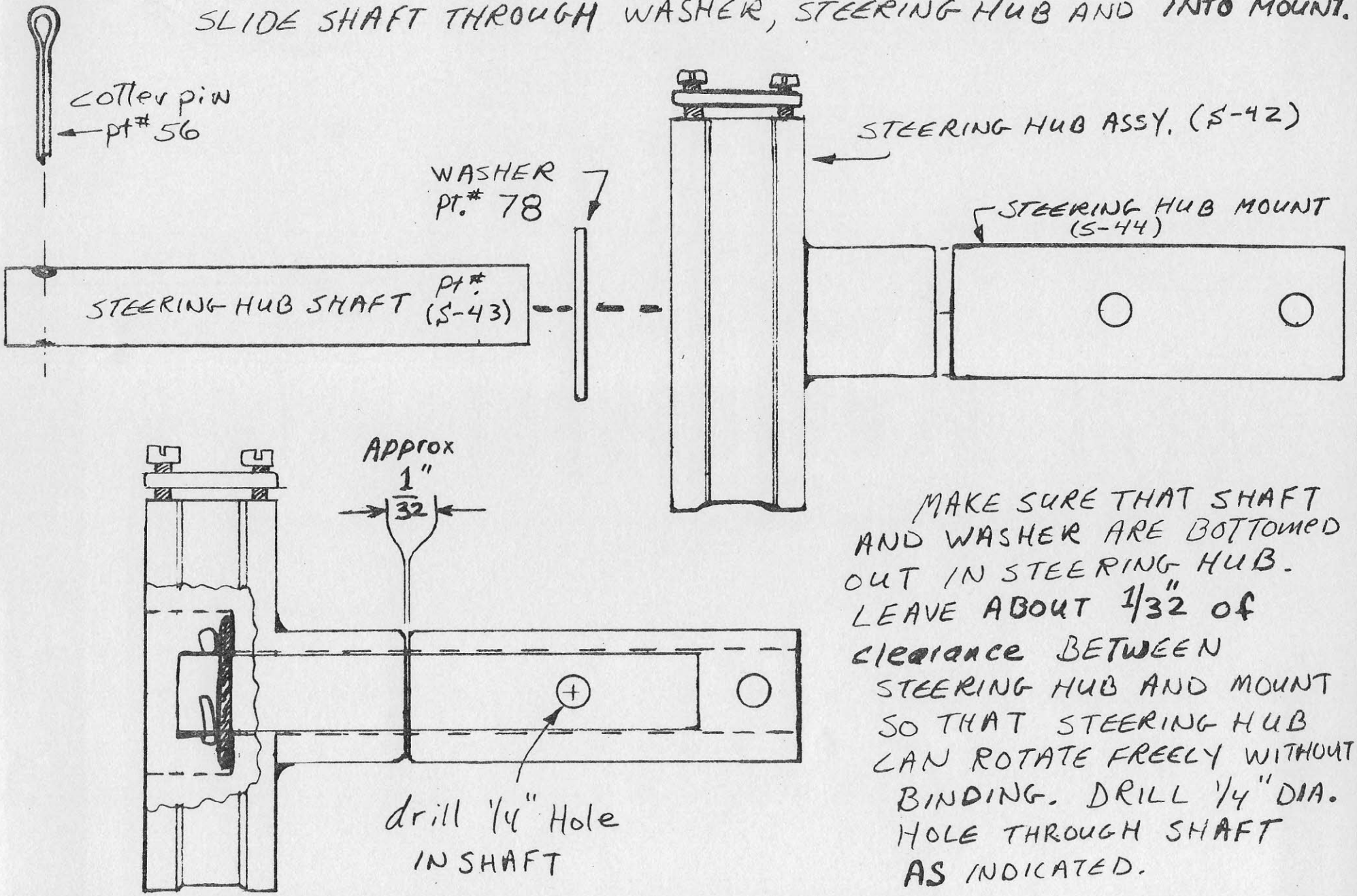
ATTACH CONTROL ASSEMBLY MOUNT PLATES TO EACH SIDE OF MAIN STRUT AS SHOWN.




**24.** Attach FRONT FRAME STRUT TO UNDERCARRIAGE WITH BOLTS, NUTS, WASHERS AND SPACER BUSHINGS AS SHOWN. TIGHTEN SECURELY.

# 25. ASSEMBLE MISC. STEERING COMPONENTS AS SHOWN.

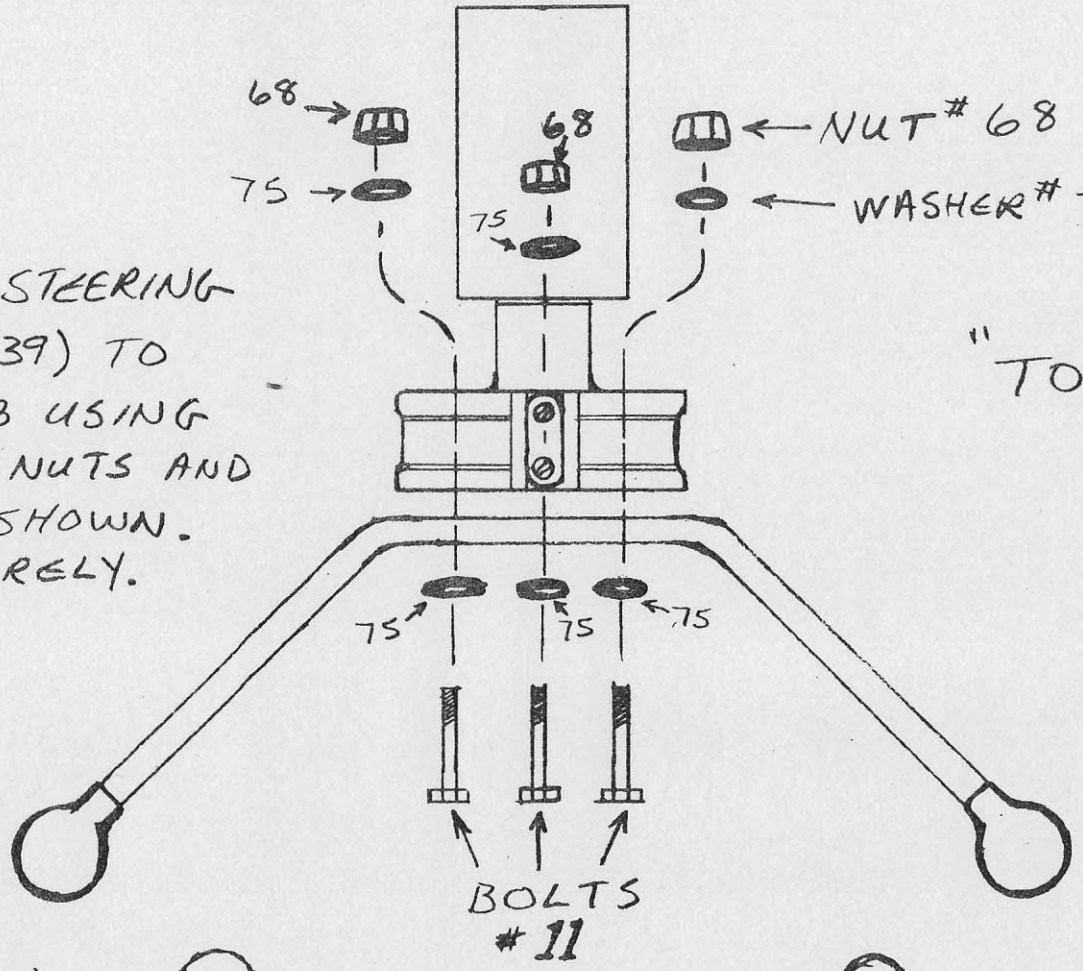
INSTALL COTTER PIN IN SHAFT END AND BEND ENDS OVER.
SLIDE SHAFT THROUGH WASHER, STEERING HUB AND INTO MOUNT.



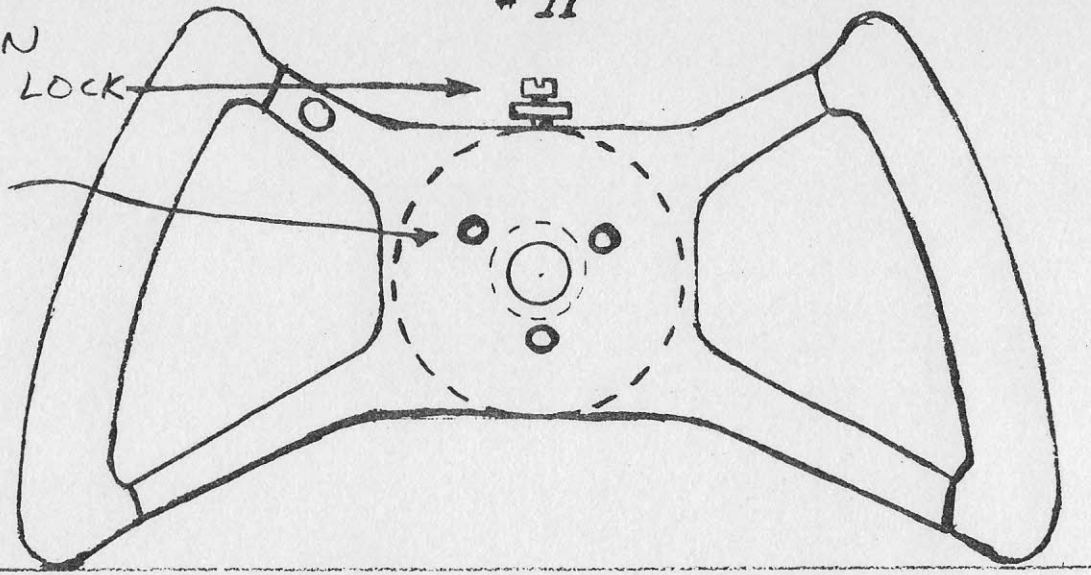

MAKE SURE THAT SHAFT AND WASHER ARE BOTTOMED OUT IN STEERING HUB. LEAVE ABOUT 1/32" of clearance BETWEEN STEERING HUB AND MOUNT SO THAT STEERING HUB CAN ROTATE FREELY WITHOUT BINDING. DRILL 1/4" DIA. HOLE THROUGH SHAFT AS INDICATED.

# 26.

ATTACH STEERING WHEEL (Pt.# M-39) TO STEERING HUB USING PROPER BOLTS, NUTS AND WASHERS AS SHOWN. TIGHTEN SECURELY.

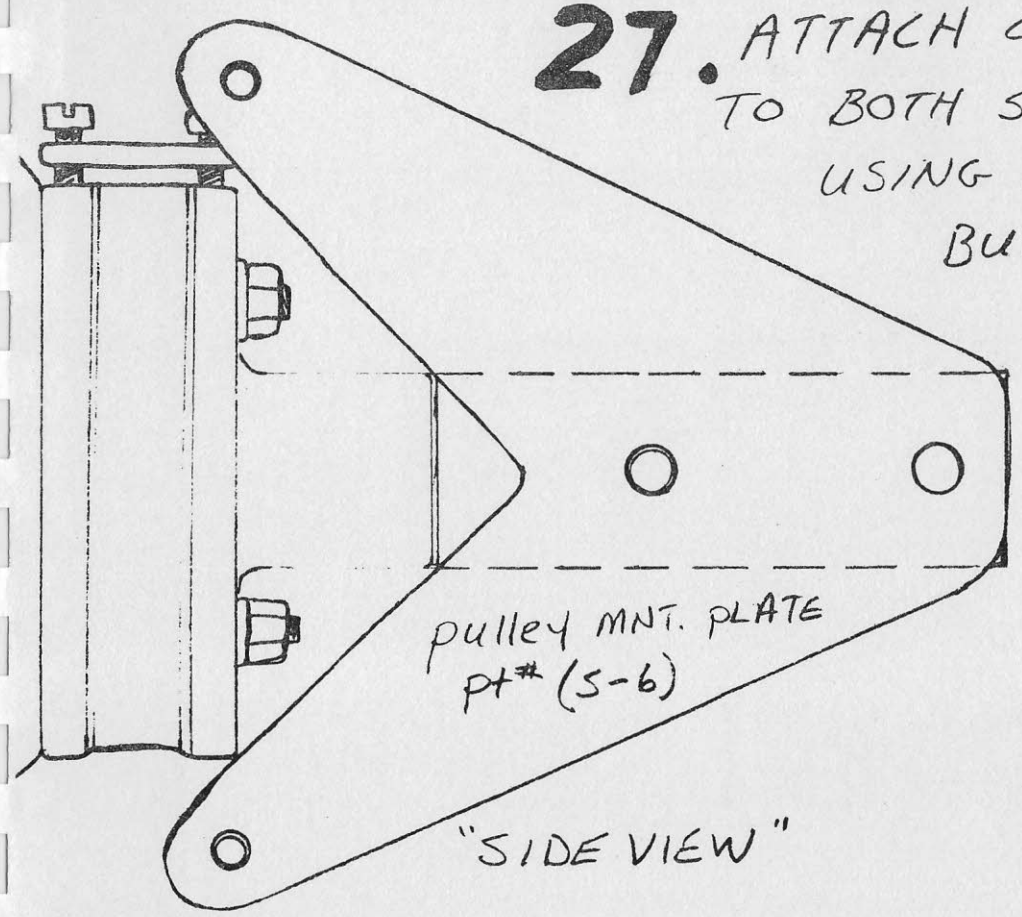



NOTE POSITION OF STEERING HUB LOCK TAB AND HOLE PATTERN IN HUB AND WHEEL.

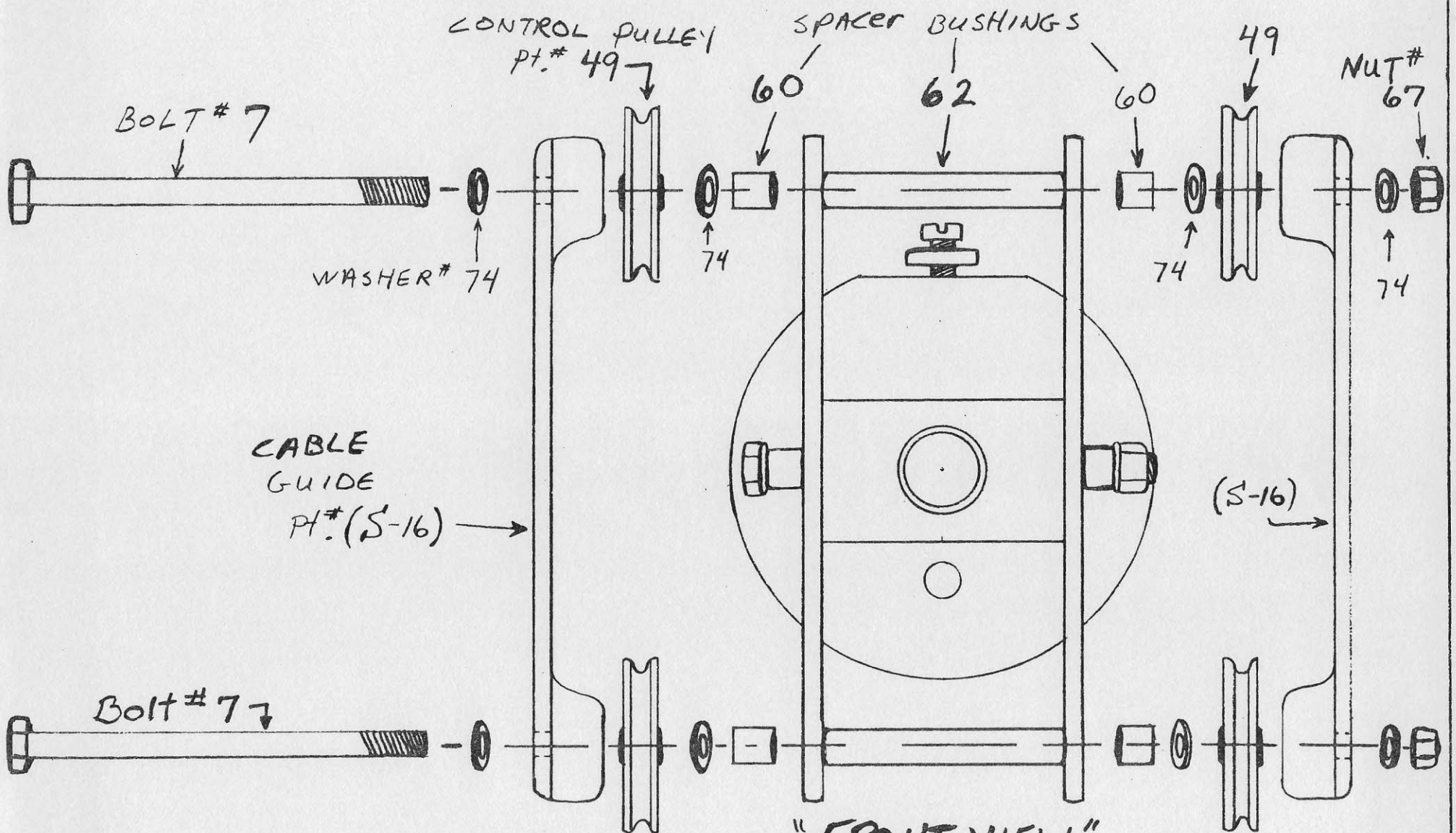


"REAR VIEW" (LOOKING Fwd.)

# 27. ATTACH CONTROL PULLEY MNT. PLATES TO BOTH SIDES OF STEERING HUB MNT. USING BOLTS, NUTS, WASHERS AND SPACER BUSHINGS AS SHOWN.



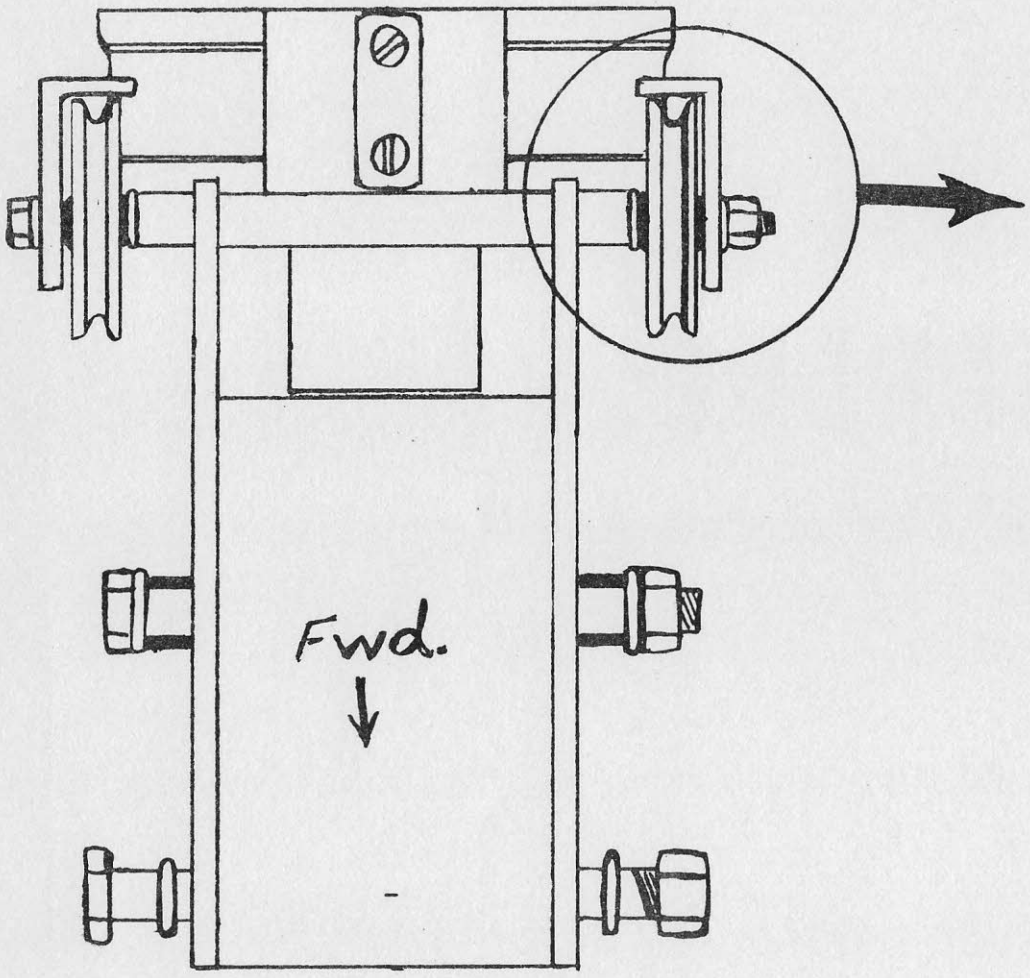
(NOTE: STEERING WHEEL NOT SHOWN FOR CLARITY)

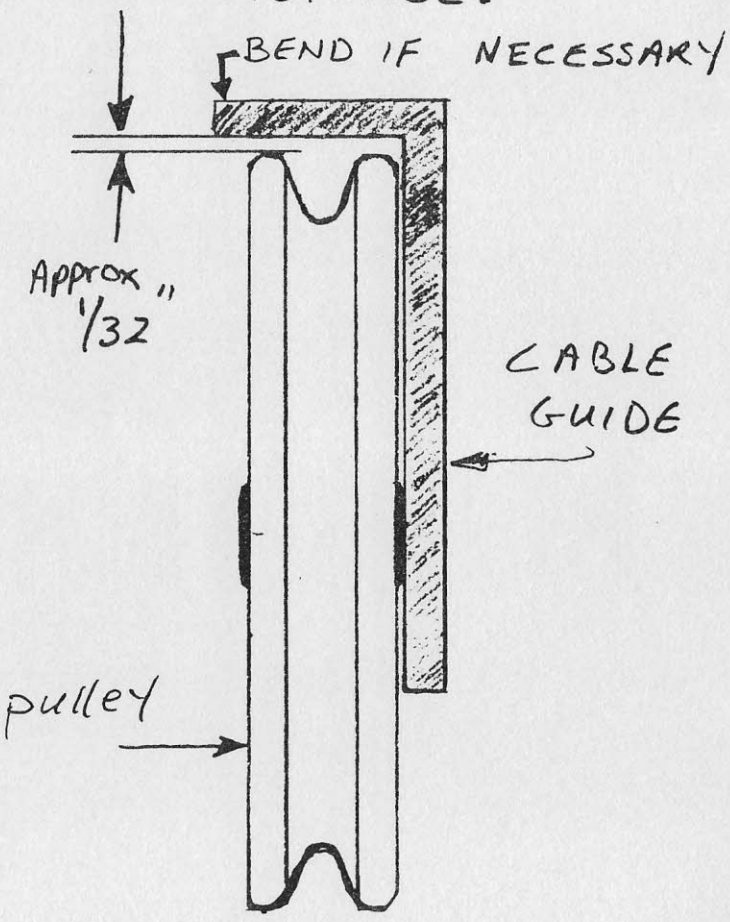



**28.** ASSEMBLE CABLE GUIDES, CONTROL PULLEYS AND SPACER BUSHINGS ON STEERING HUB ASSEMBLY USING BOLTS, NUTS AND WASHERS AS SHOWN.

29. CHECK CLEARANCE BETWEEN PULLEYS AND CABLE GUIDES. IF CLEARANCE IS GREATER THAN 1/32", BEND EDGE OF GUIDE TO ADJUST DISTANCE.

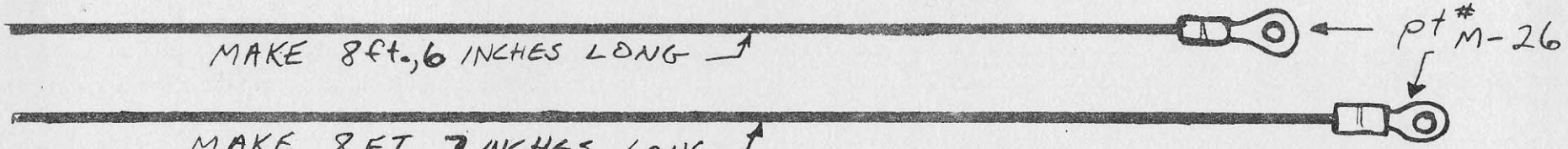
"TOP VIEW"



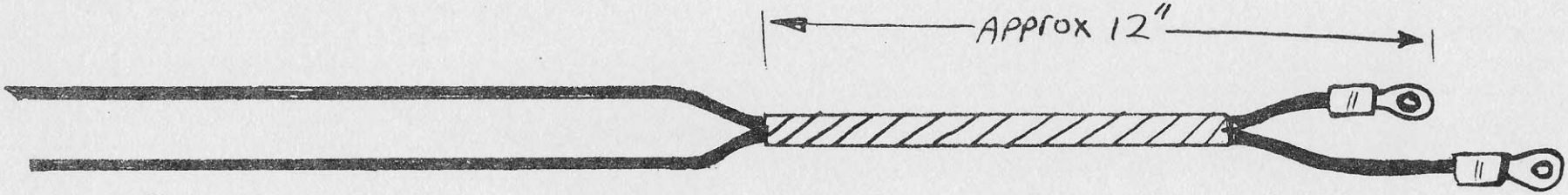




ENLARGED "TOP VIEW"

CUT TWO PIECES OF 20 GAUGE IGNITION WIRE TO LENGTHS SHOWN.
STRIP ENDS AND CRIMP ON WIRE CONNECTORS.

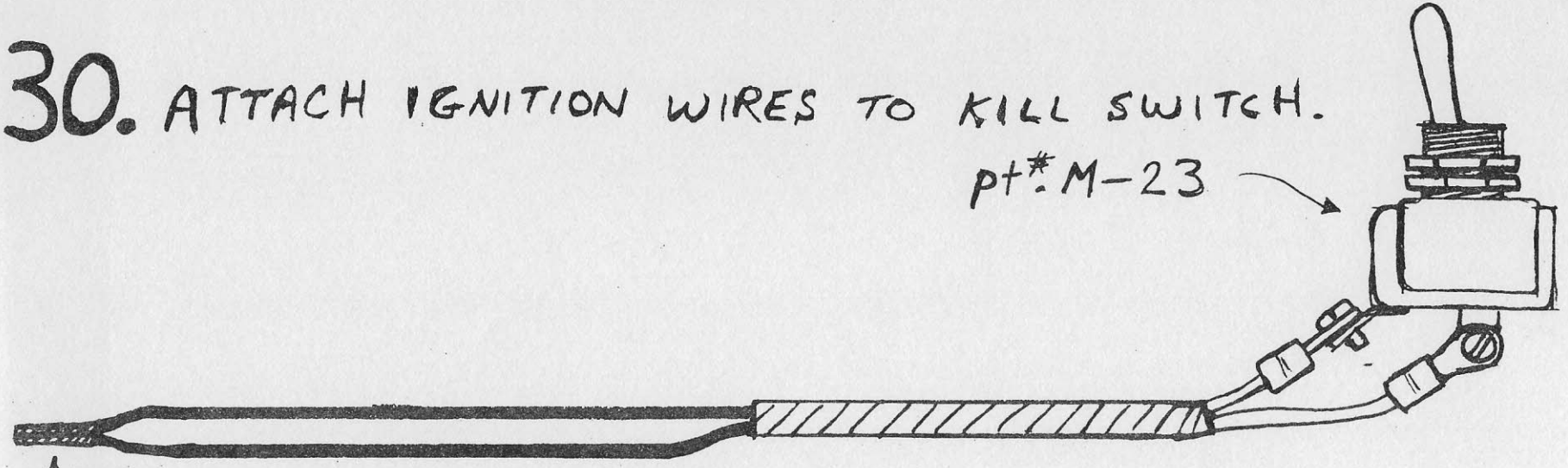



NOTE: USE A PROPER ELECTRICIANS CRIMPING TOOL FOR CRIMPING ENDS.
— DO NOT USE PLIERS! —



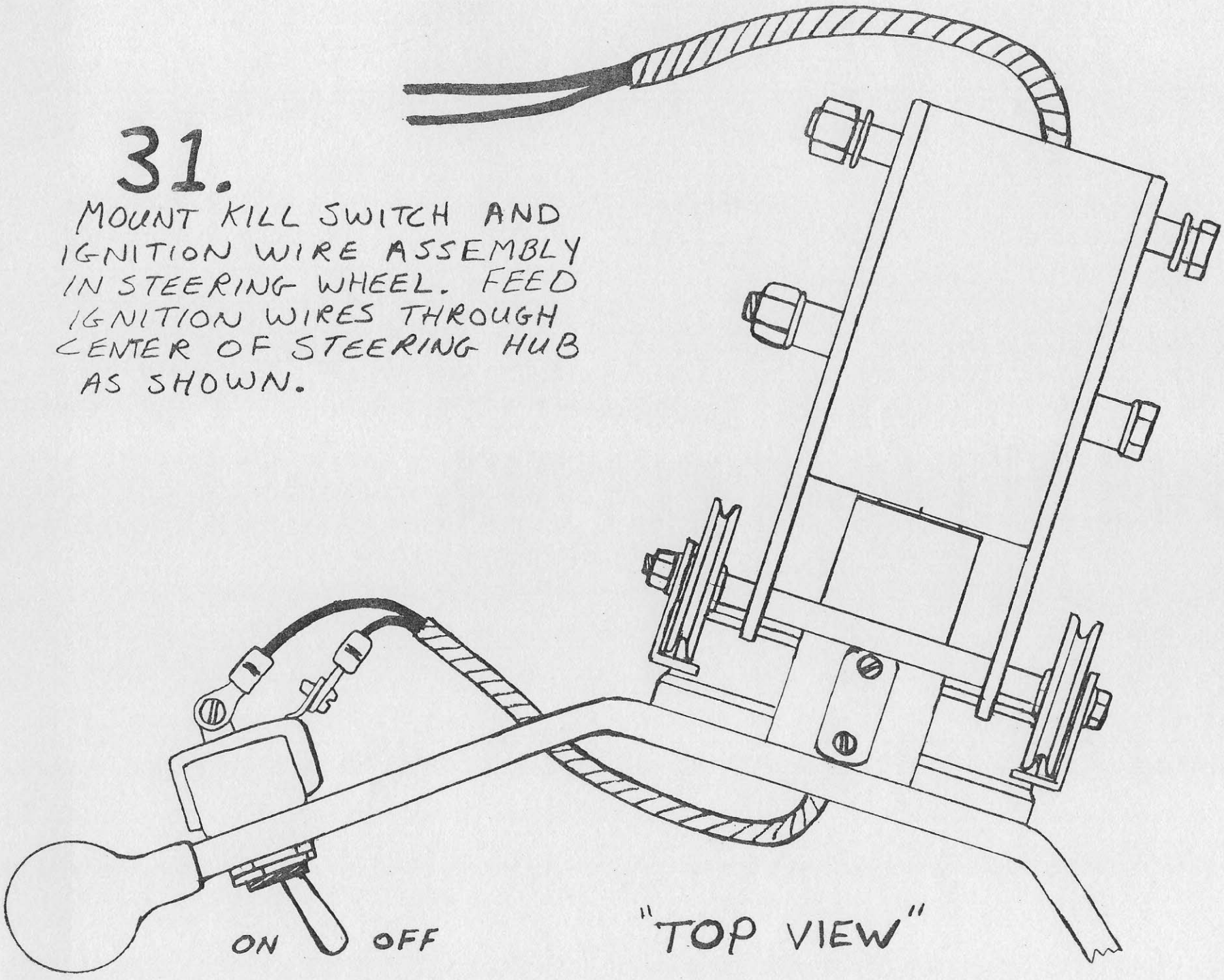

USE ELECTRICAL TAPE AND WRAP WIRES TOGETHER
FOR ABOUT 12" INCHES AS SHOWN.

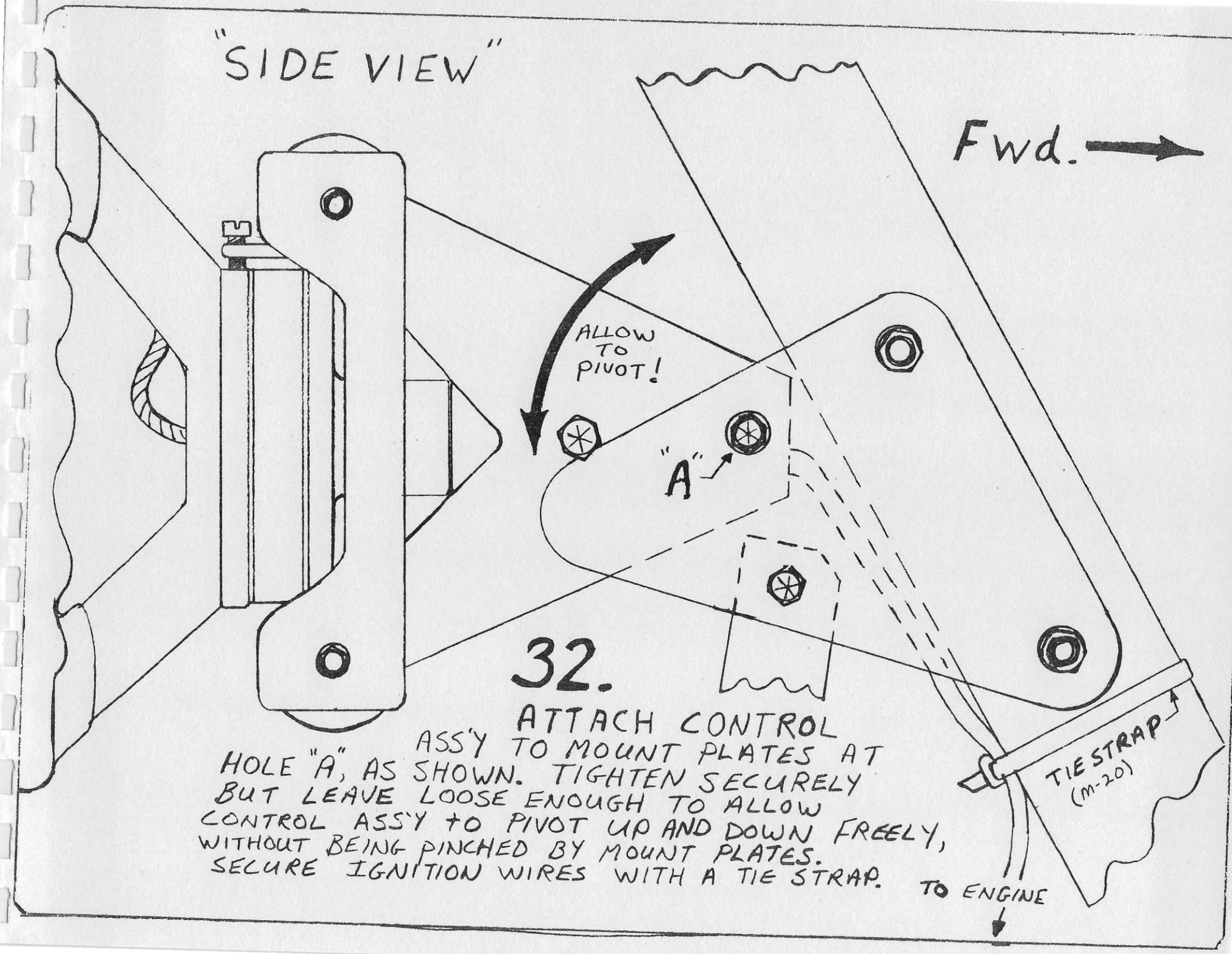
## 30. ATTACH IGNITION WIRES TO KILL SWITCH.



# 31.

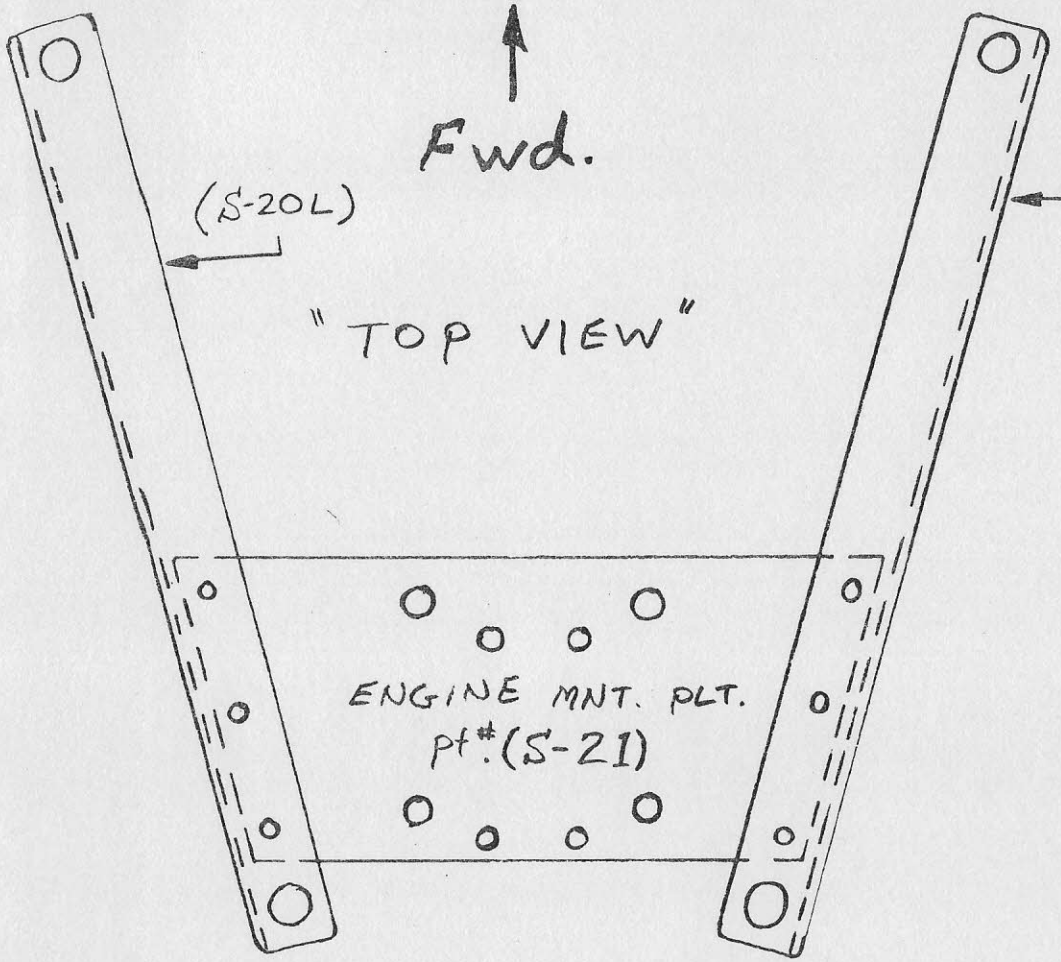
MOUNT KILL SWITCH AND IGNITION WIRE ASSEMBLY IN STEERING WHEEL. FEED IGNITION WIRES THROUGH CENTER OF STEERING HUB AS SHOWN.

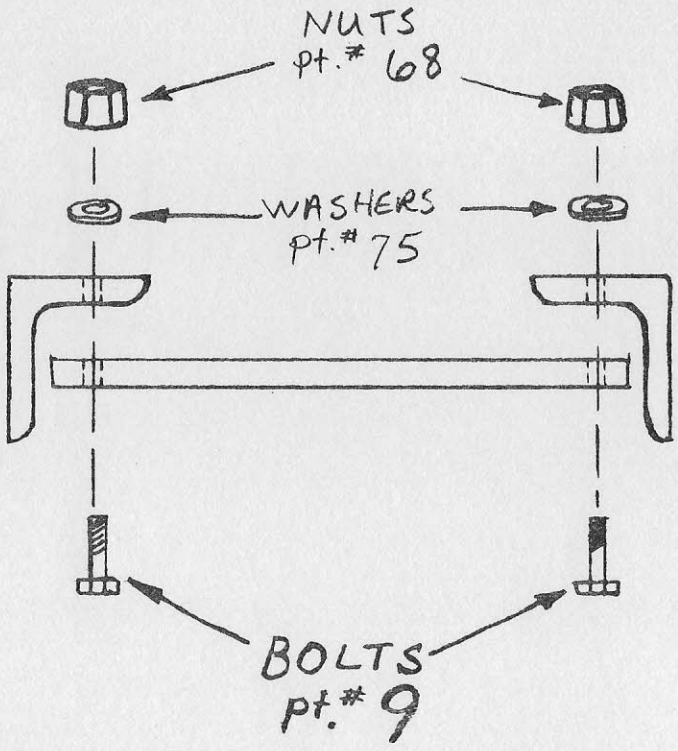





# 32.

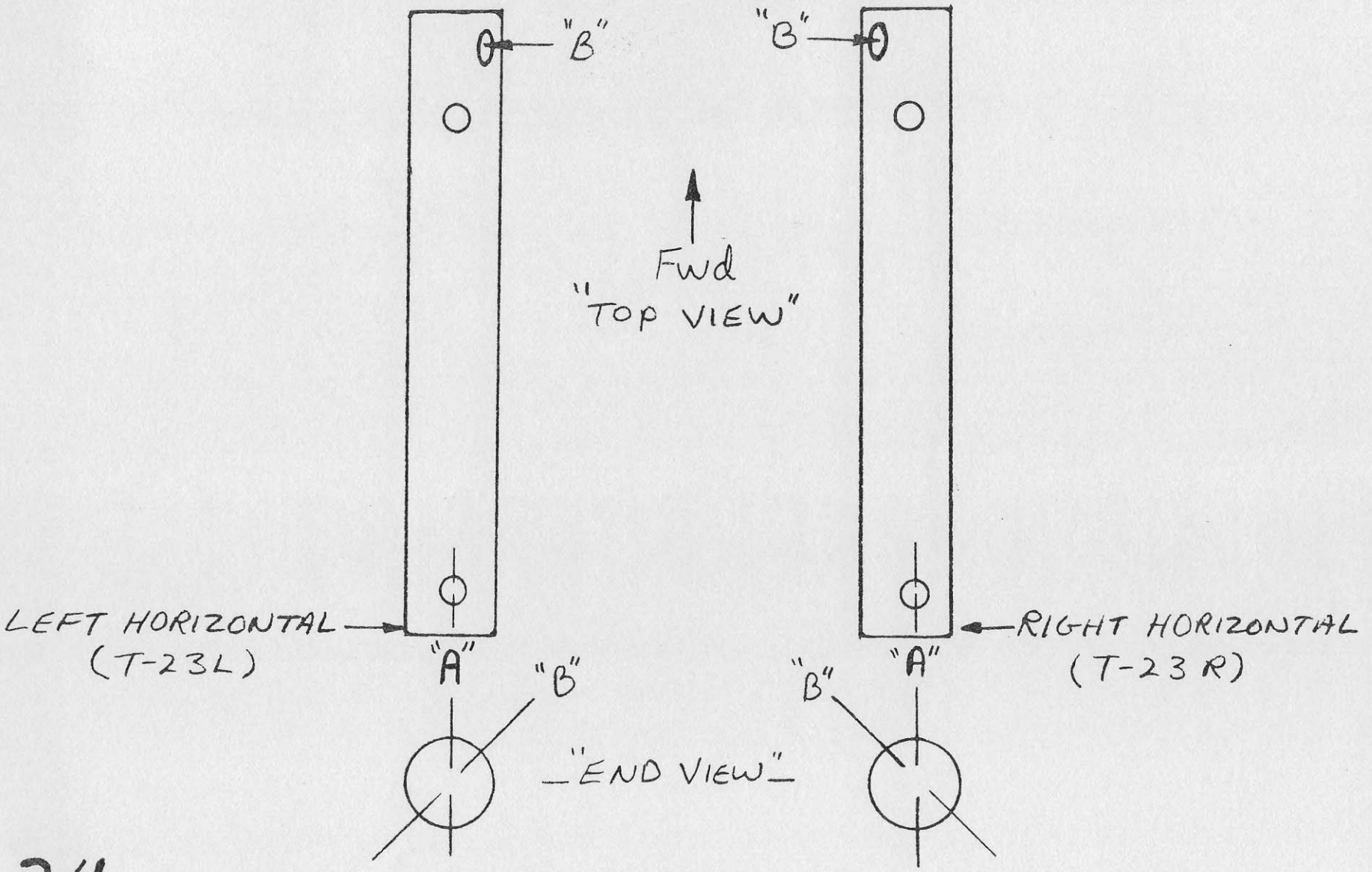
ATTACH CONTROL ASS'Y TO MOUNT PLATES AT HOLE "A", AS SHOWN. TIGHTEN SECURELY BUT LEAVE LOOSE ENOUGH TO ALLOW CONTROL ASS'Y TO PIVOT UP AND DOWN FREELY, WITHOUT BEING PINCHED BY MOUNT PLATES. SECURE IGNITION WIRES WITH A TIE STRAP.



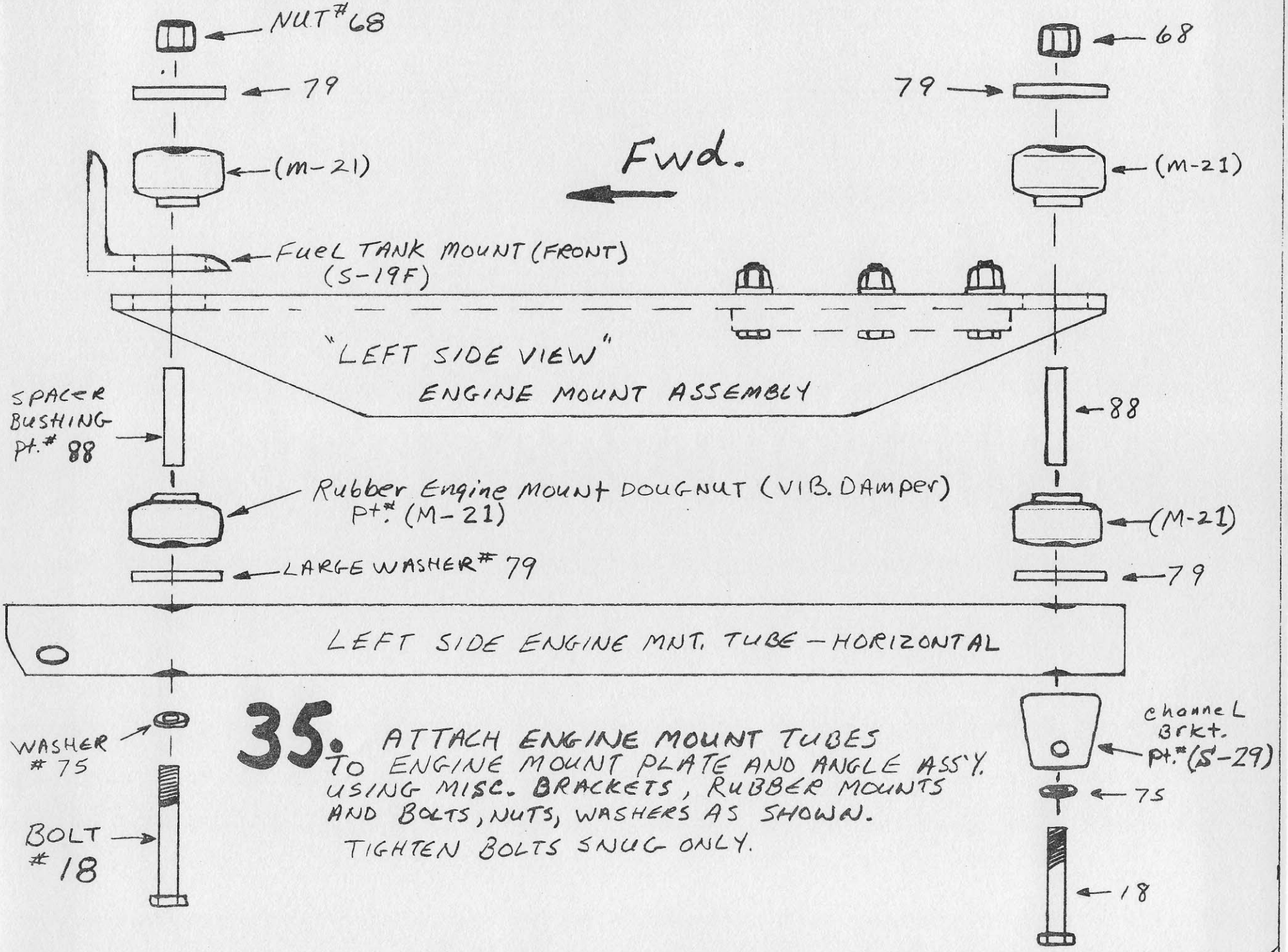




"REAR VIEW"

**33.** ATTACH ENGINE MOUNT PLATE AND LEFT AND RIGHT ENGINE MOUNT ANGLES TOGETHER USING 6 BOLTS, NUTS AND WASHERS AS SHOWN. TIGHTEN SECURELY!

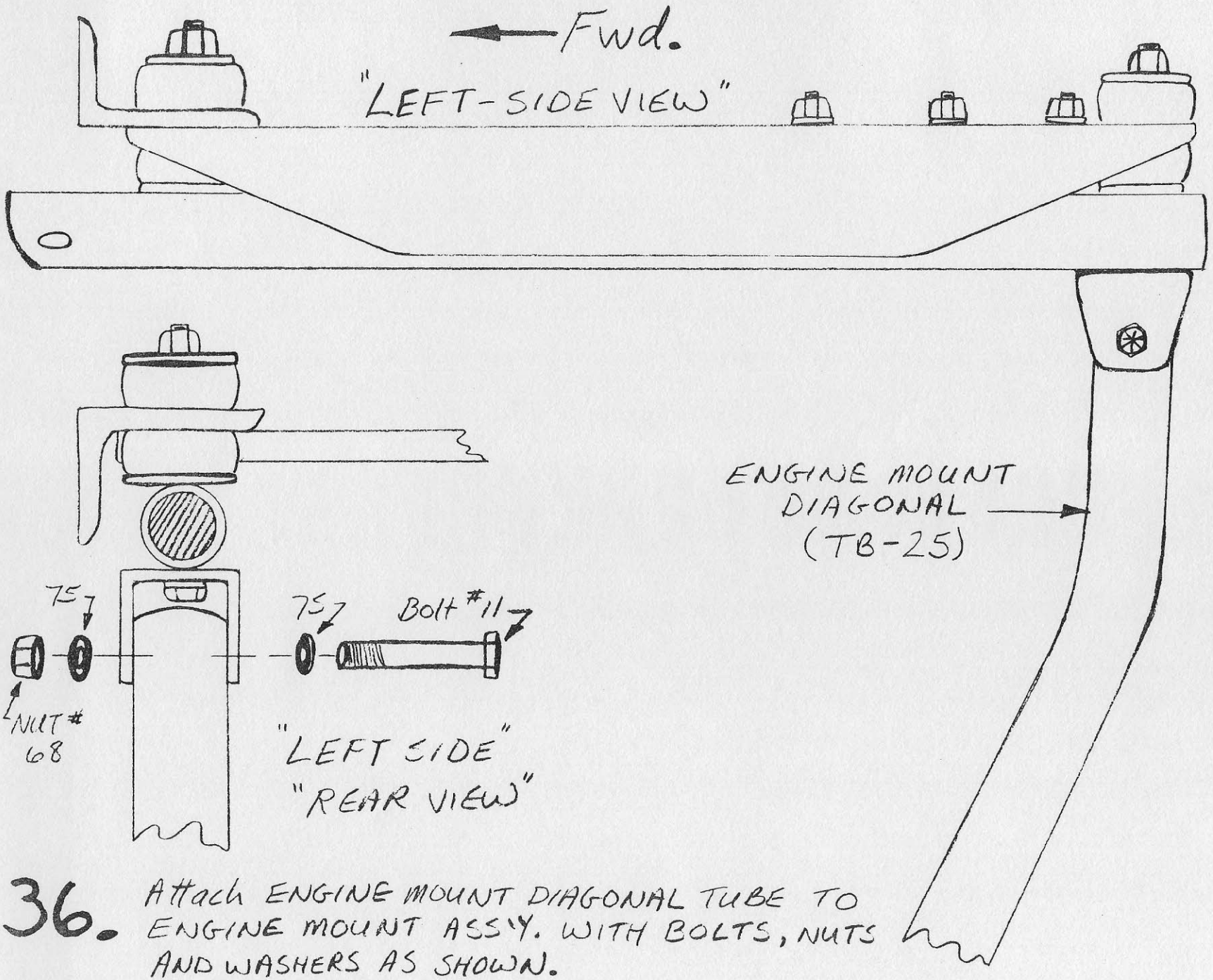



34. LAY OUT ENGINE MOUNT TUBES AS SHOWN. NOTE THE DIFFERENT ANGLES BETWEEN HOLES "A" AND "B" IN END OF EACH TUBE. THIS IS TO DISTINGUISH RIGHT SIDE TUBE FROM LEFT SIDE PRIOR TO NEXT STEP OF ASSEMBLY.

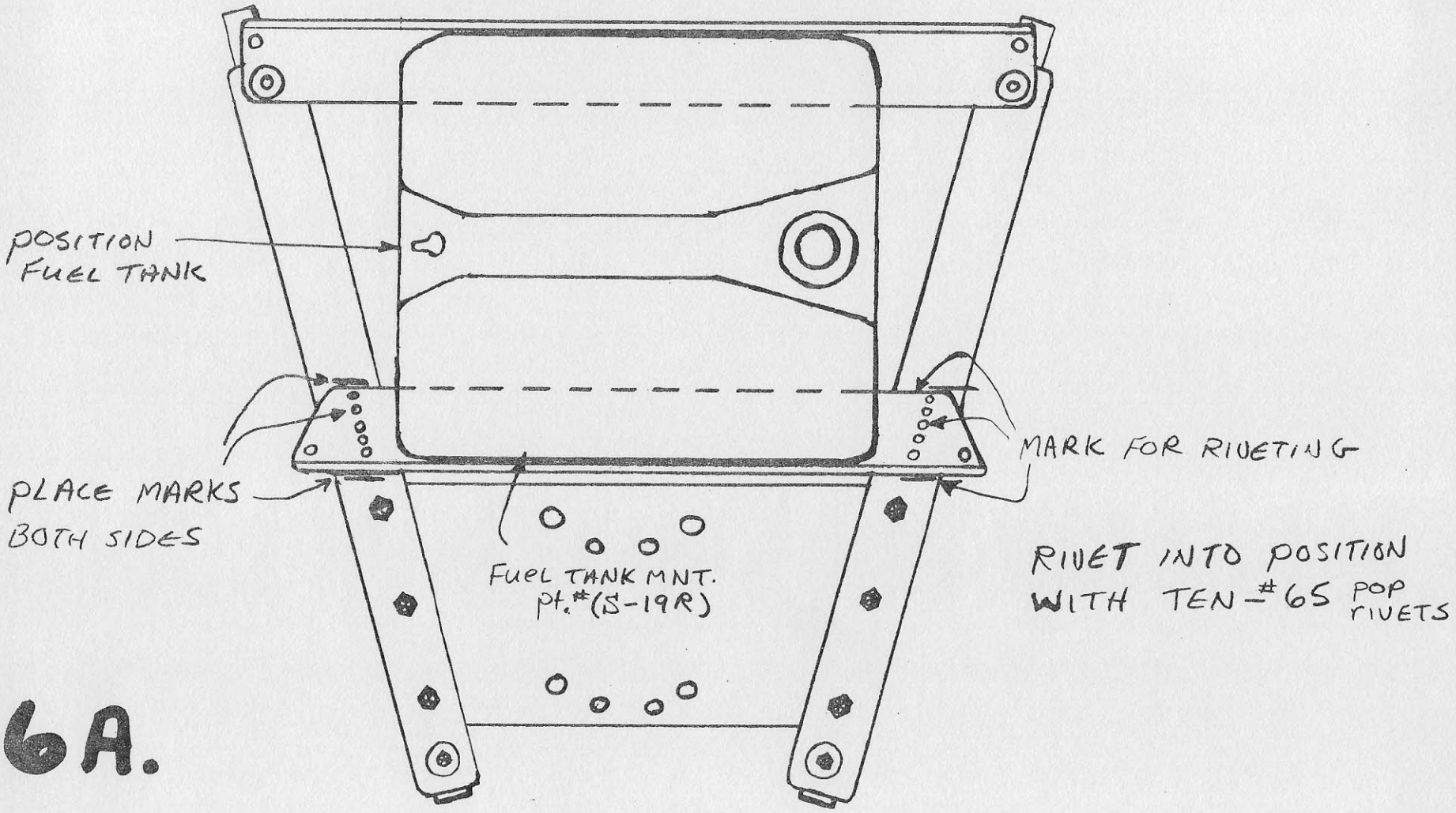



**35.** ATTACH ENGINE MOUNT TUBES TO ENGINE MOUNT PLATE AND ANGLE ASS'Y. USING MISC. BRACKETS, RUBBER MOUNTS AND BOLTS, NUTS, WASHERS AS SHOWN.

TIGHTEN BOLTS SNUG ONLY.




**36.** Attach ENGINE MOUNT DIAGONAL TUBE TO ENGINE MOUNT ASS'Y. WITH BOLTS, NUTS AND WASHERS AS SHOWN.



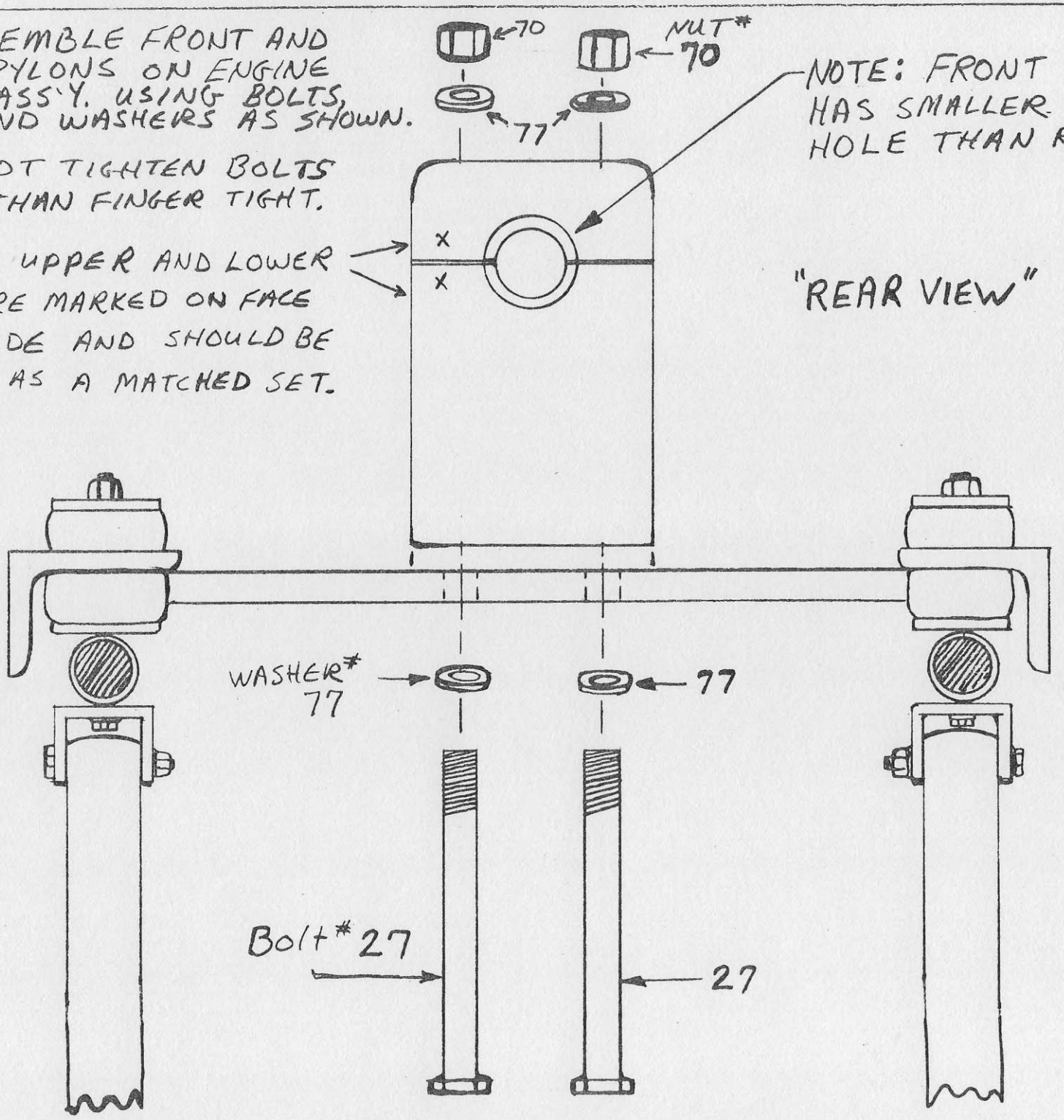

# 36A.

POSITION FUEL TANK AND FUEL TANK MNT. (REAR), ON ENGINE MNT. ASSY. AS SHOWN. MARK ENGINE MNT. ANGLES FOR POSITION OF REAR TANK MNT. BRACKET. REMOVE FUEL TANK AND DRILL 1/8" POP RIVET HOLES AS SHOWN. RIVET REAR TANK MNT. INTO POSITION WITH LONG 1/8" POP RIVETS.

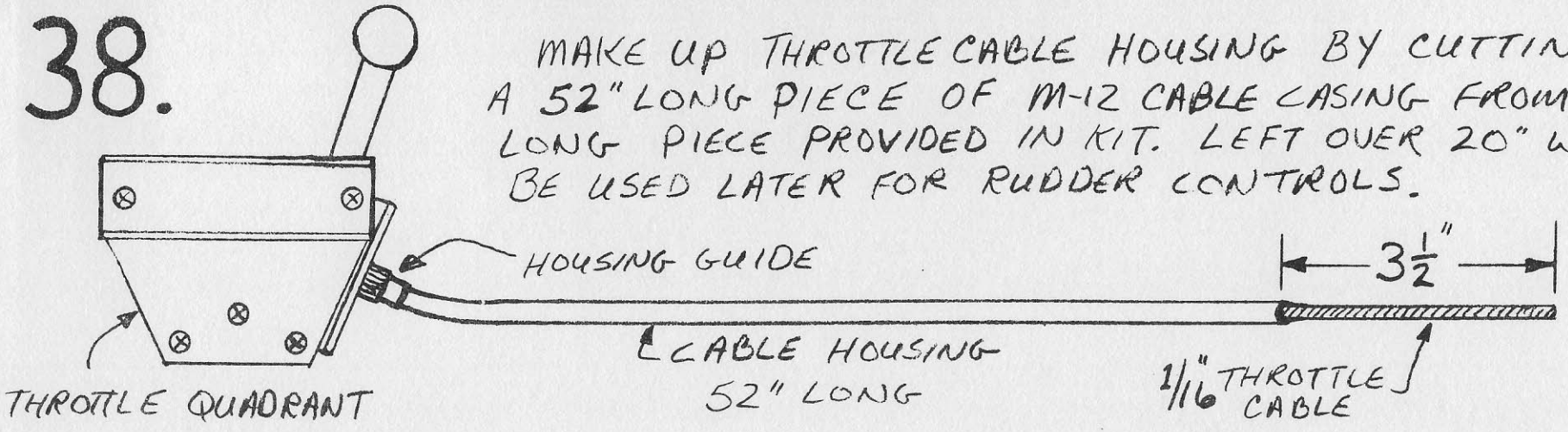
**37.** ASSEMBLE FRONT AND REAR PYLONS ON ENGINE MOUNT ASS'Y. USING BOLTS, NUTS AND WASHERS AS SHOWN.

DO NOT TIGHTEN BOLTS MORE THAN FINGER TIGHT.

PYLON UPPER AND LOWER HALVES ARE MARKED ON FACE OR ON SIDE AND SHOULD BE MOUNTED AS A MATCHED SET.



# 38.

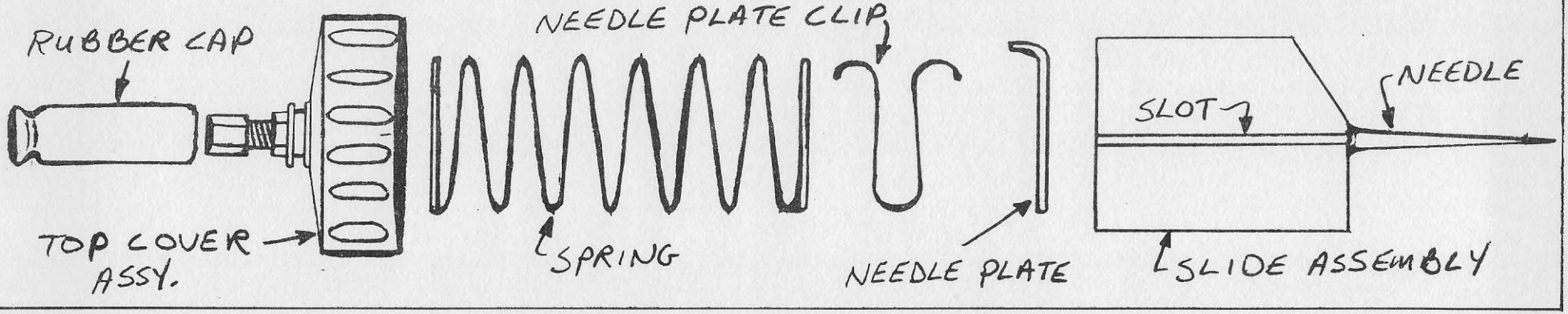



MAKE UP THROTTLE CABLE HOUSING BY CUTTING A 52" LONG PIECE OF M-12 CABLE CASING FROM 72" LONG PIECE PROVIDED IN KIT. LEFT OVER 20" WILL BE USED LATER FOR RUDDER CONTROLS.

SQUIRT W.D. 40 OR OTHER LIGHT LUBRICANT INSIDE HOUSING UNTIL SATURATED. SLIDE HOUSING INTO POSITION OVER END OF THROTTLE CABLE. BE SURE THROTTLE LEVER IS IN THE FULLY CLOSED (AFT POSITION) AGAINST IT'S STOP AND END OF CABLE HOUSING IS FIRMLY SEATED INSIDE GUIDE.

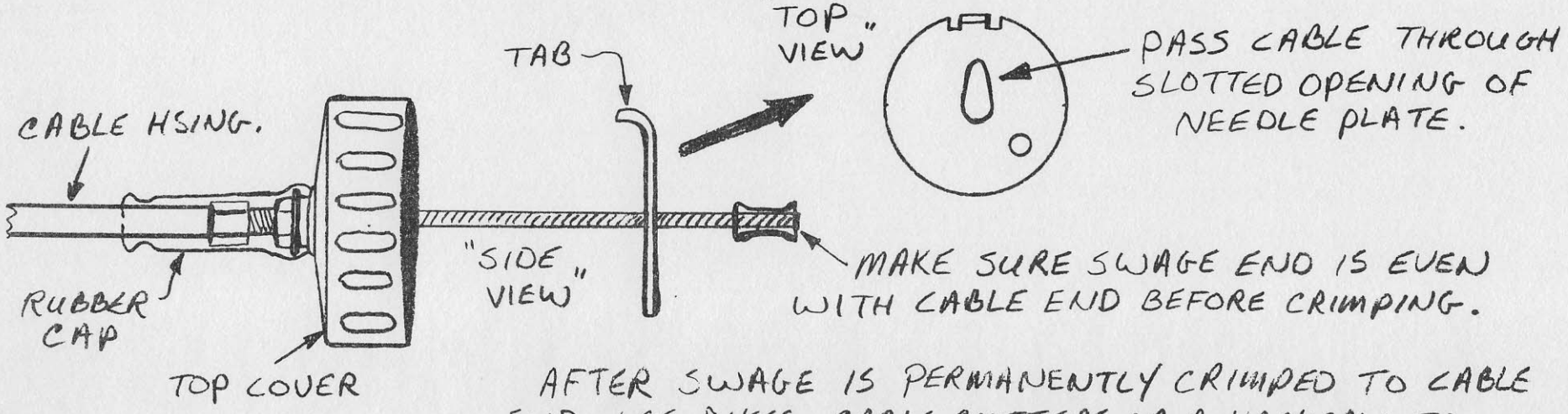
CAREFULLY MEASURE AND TRIM END OF THROTTLE CABLE TO DIMENSION SHOWN.

REMOVE KEIHIN CARBEURATOR FROM ENGINE BOX. UNSCREW CARBEURATOR TOP COVER AND REMOVE SPRING AND SLIDE ASSEMBLY. DIS-ASSEMBLE AND LAYOUT SLIDE PARTS AS SHOWN, CAREFULLY NOTEING THEIR POSITION.

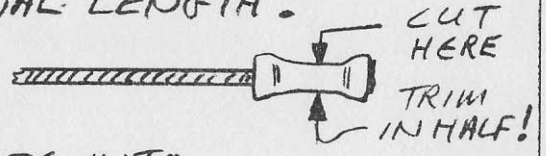


# 39.

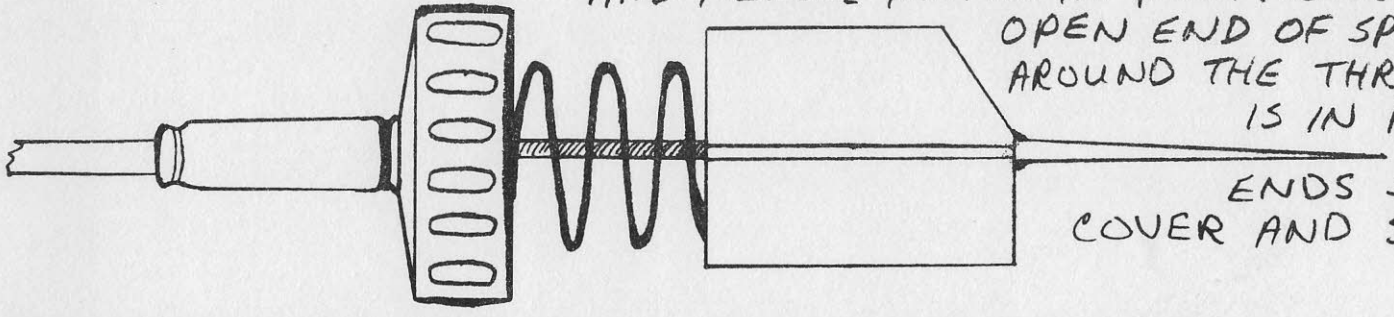
INSERT END OF THROTTLE CABLE AND HOUSING INTO RUBBER CAP AND CARB. TOP COVER ASSY. AS SHOWN. PASS THROTTLE CABLE END THROUGH PROPER HOLE OF NEEDLE PLATE AND BE SURE NEEDLE PLATE TAB IS POINTING TOWARD TOP COVER. CRIMP A 1/16" SWAGE pt.# 47 ON TO END OF THROTTLE CABLE USING A PROPER SWAGING TOOL.



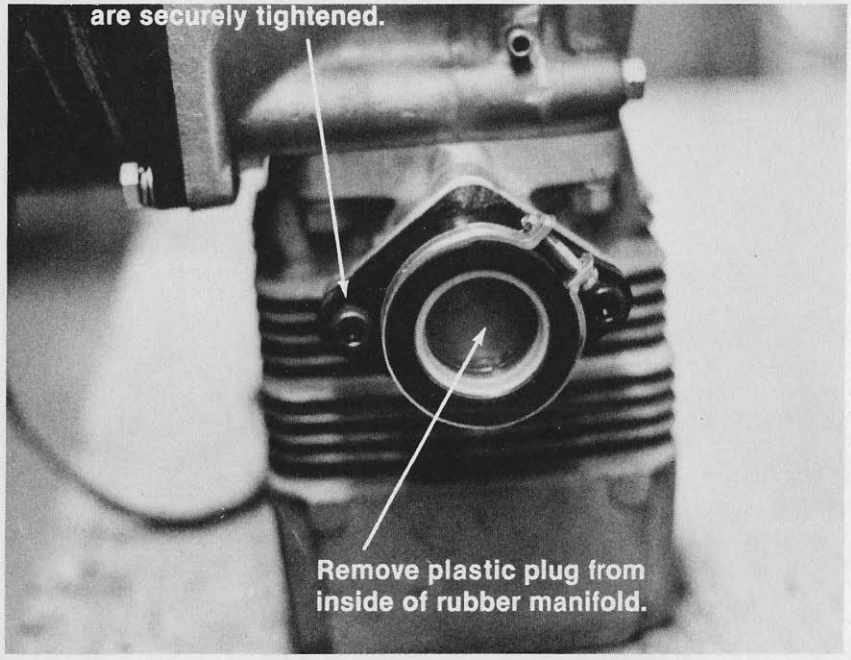

AFTER SWAGE IS PERMANENTLY CRIMPED TO CABLE END, USE DIKES, CABLE CUTTERS OR A HACKSAW TO TRIM SWAGE TO HALF IT'S ORIGINAL LENGTH.



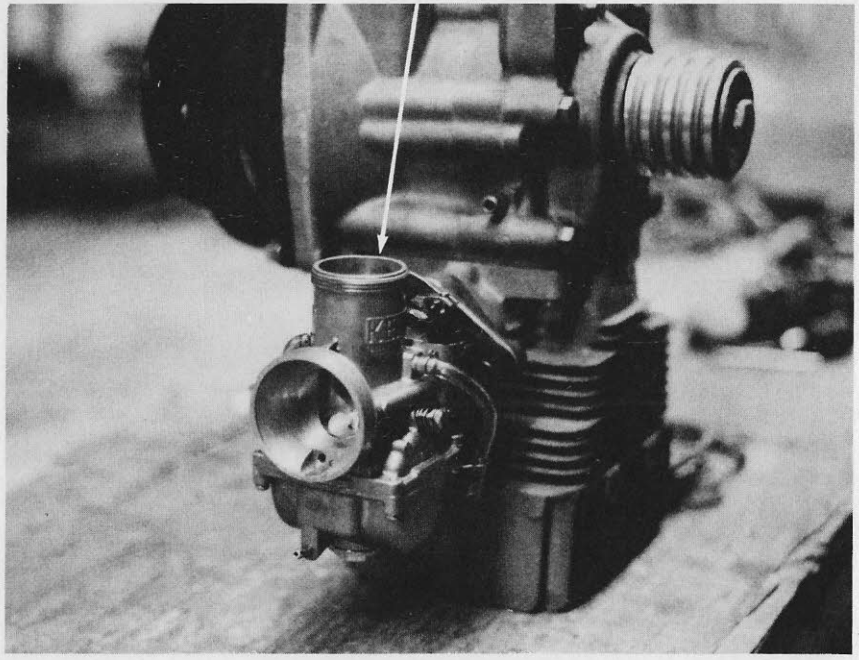

RE-ASSEMBLE CAP, SPRING AND CARB. SLIDE ASSEMBLY. PASS CABLE THROUGH SLOT OF SLIDE ASSY. AND POSITION SWAGE END IN DEPRESSION AT END OF SLOT. PLACE NEEDLE PLATE INTO BOTTOM OF SLIDE. INSTALL NEEDLE PLATE CLIP IN GROOVE OF SLIDE LOCKING NEEDLE AND NEEDLE PLATE IN POSITION. SLIGHTLY TWIST OPEN END OF SPRING AND WRAP IT AROUND THE THROTTLE CABLE UNTIL IT IS IN PROPER POSITION WITH ENDS SEATED INSIDE TOP COVER AND SLIDE ASSEMBLY.



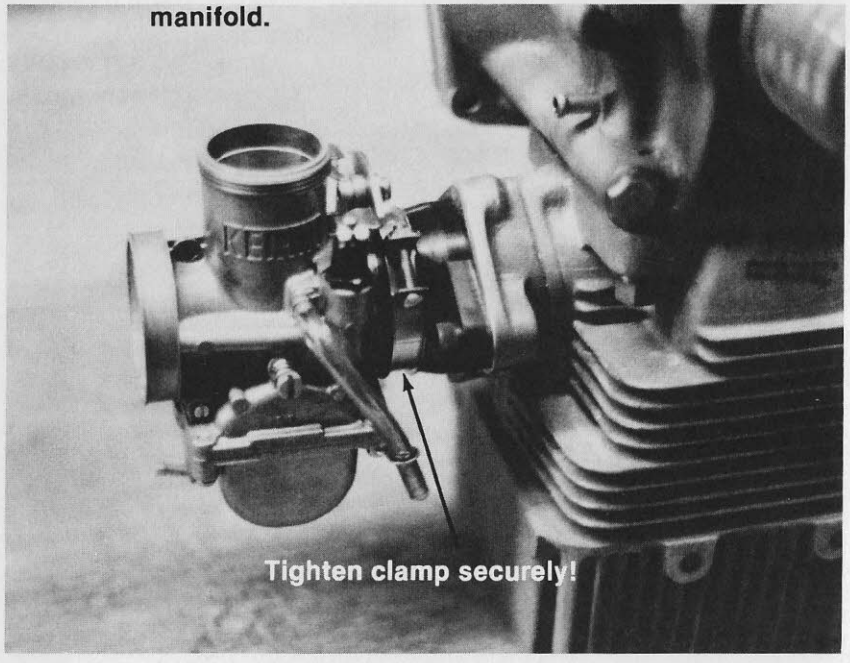
**40.** Use a 6 mm Allen wrench to be sure manifold screws are securely tightened.



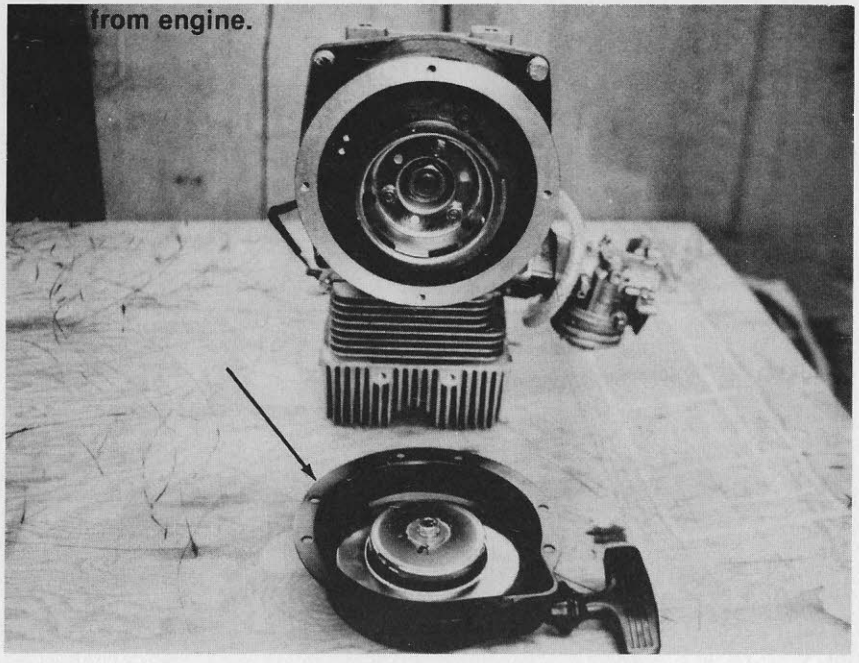

**40A.** Mount carburetor vertically in position as shown.



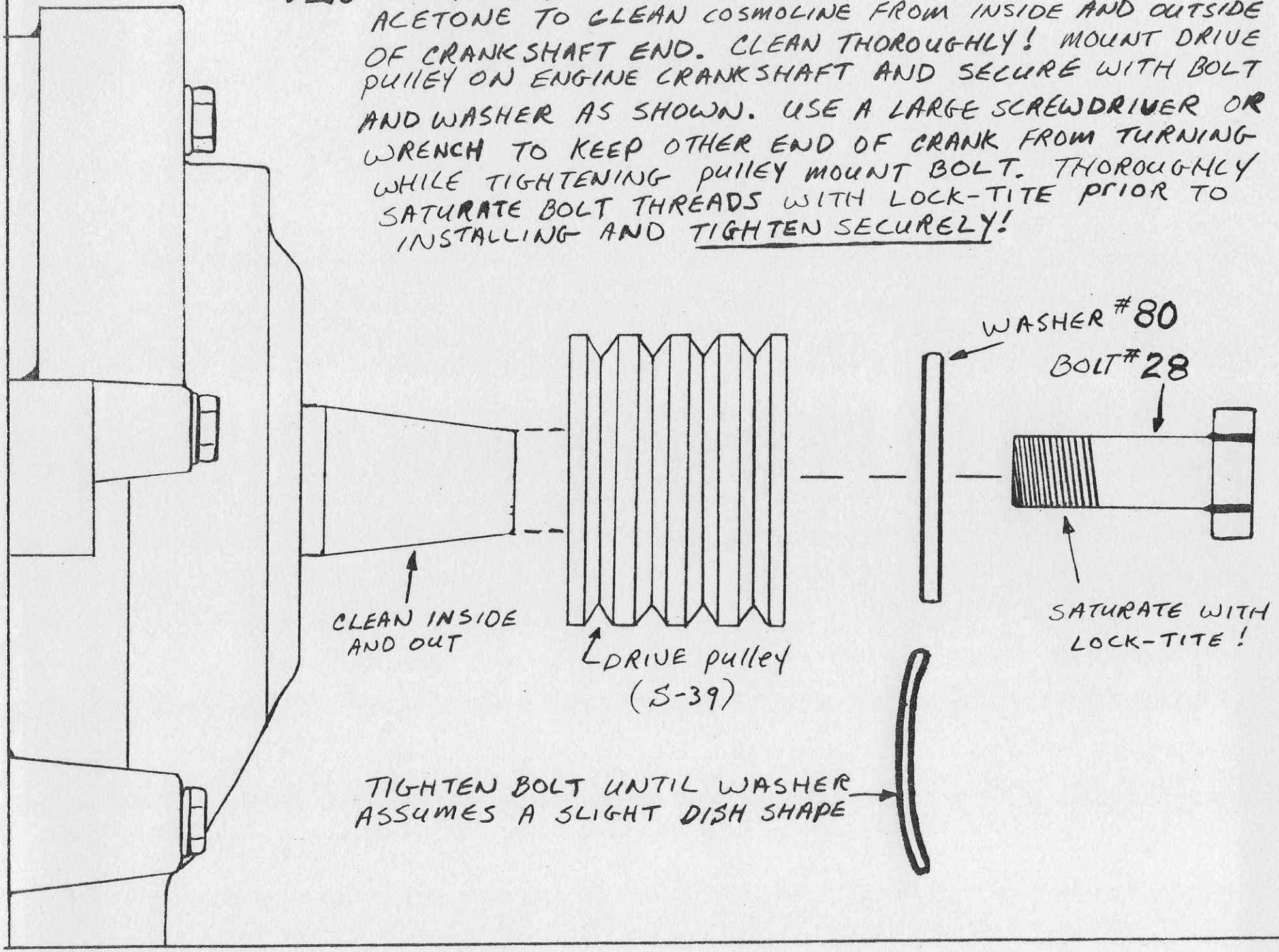
**40B.** Be sure carburetor is securely seated in end of manifold.



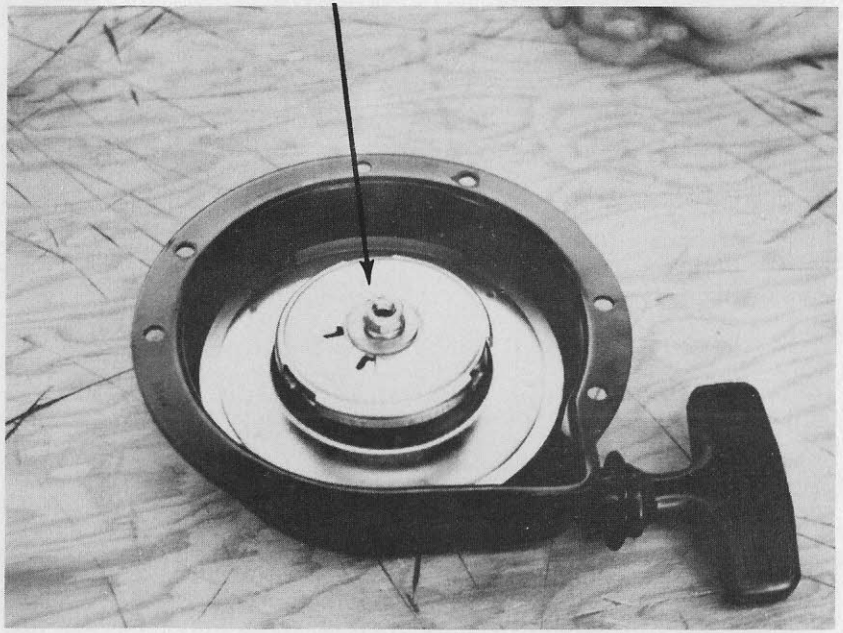

**41.** Use an impact screwdriver and remove recoil starter case from engine.



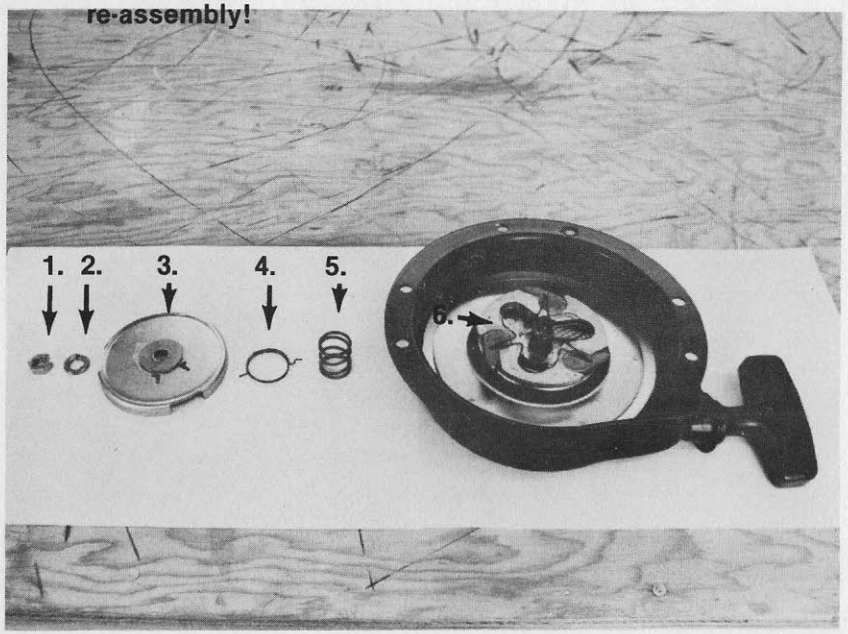
42. USE AN OLD TOOTHBRUSH ETC. AND PAINT THINNER OR ACETONE TO CLEAN COSMOLINE FROM INSIDE AND OUTSIDE OF CRANKSHAFT END. CLEAN THOROUGHLY! MOUNT DRIVE PULLEY ON ENGINE CRANKSHAFT AND SECURE WITH BOLT AND WASHER AS SHOWN. USE A LARGE SCREWDRIVER OR WRENCH TO KEEP OTHER END OF CRANK FROM TURNING WHILE TIGHTENING PULLEY MOUNT BOLT. THOROUGHLY SATURATE BOLT THREADS WITH LOCK-TITE PRIOR TO INSTALLING AND <u>TIGHTEN SECURELY!</u>



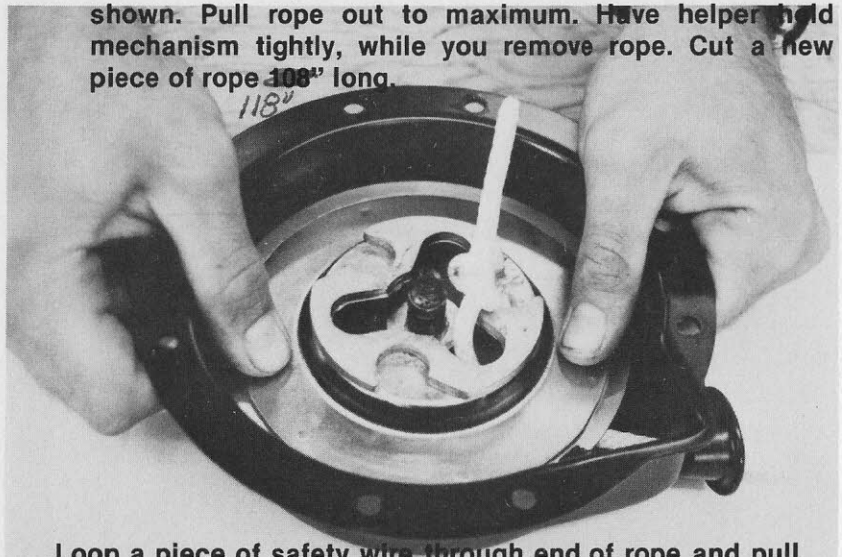
**43.** Carefully loosen nut.



**44.** Remove parts carefully in sequence, note position for re-assembly!

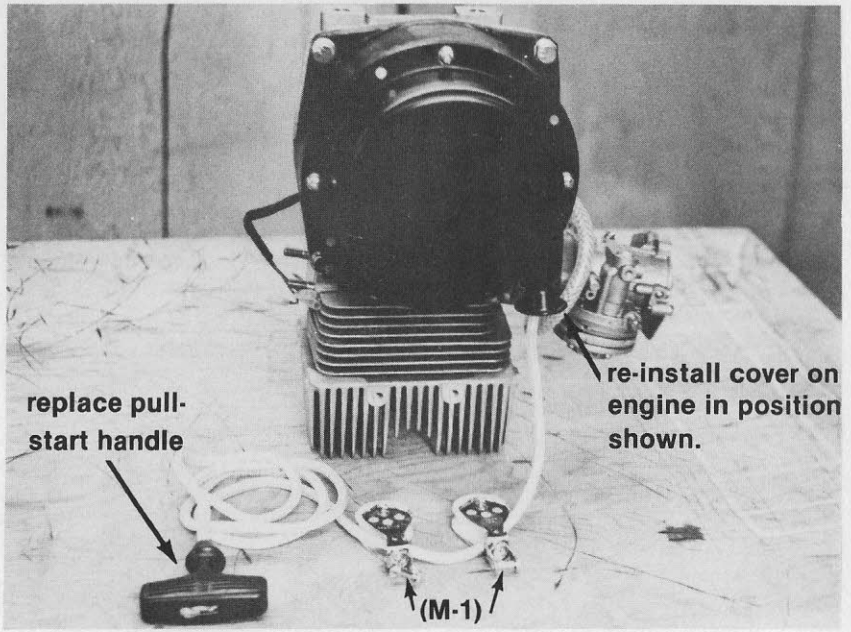



**45.** Have a helper position thumbs on recoil mechanism as shown. Pull rope out to maximum. Have helper hold mechanism tightly, while you remove rope. Cut a new piece of rope ~~108"~~ 118" long.



Loop a piece of safety wire through end of rope and pull back through recoil assembly. Re-tie knot in end and re-wind rope slowly. Re-assemble cover by reversing sequence.

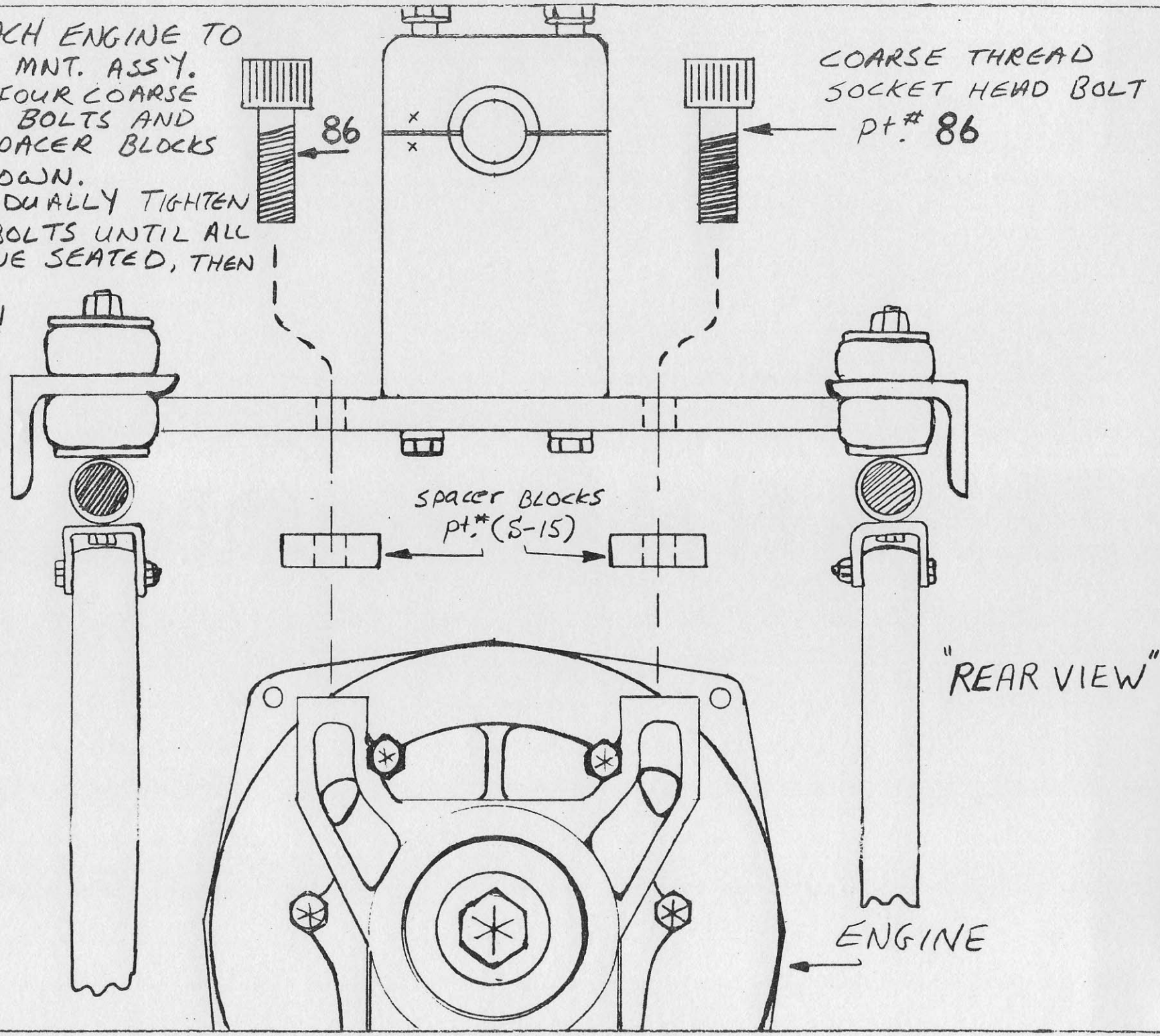
**46.** Slip rope through 2 pulleys part #(M-1)



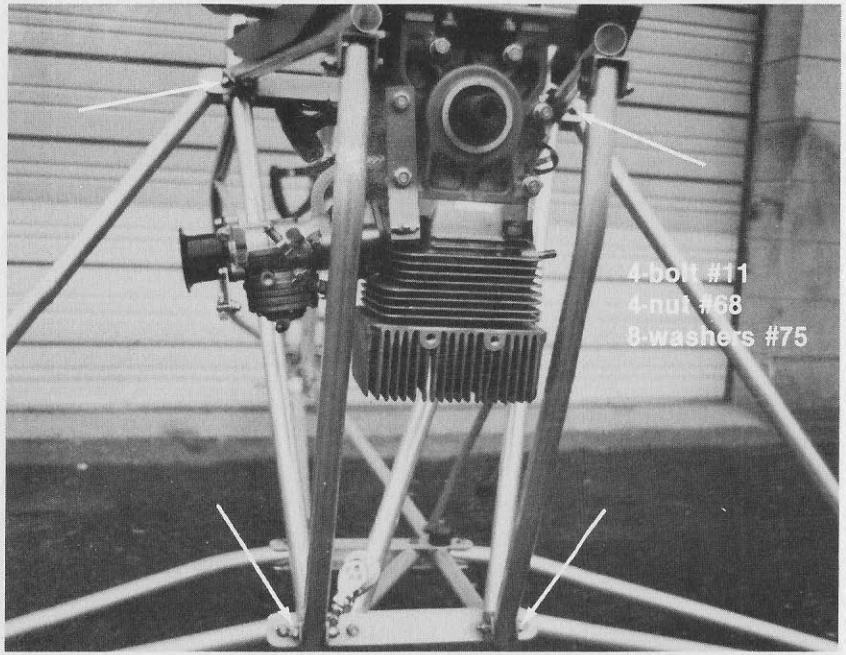

Heat seal ends of rope with "Hot Knife" or solder gun!

**47.** ATTACH ENGINE TO ENGINE MNT. ASS'Y. USING FOUR COARSE THREAD BOLTS AND TWO SPACER BLOCKS AS SHOWN.

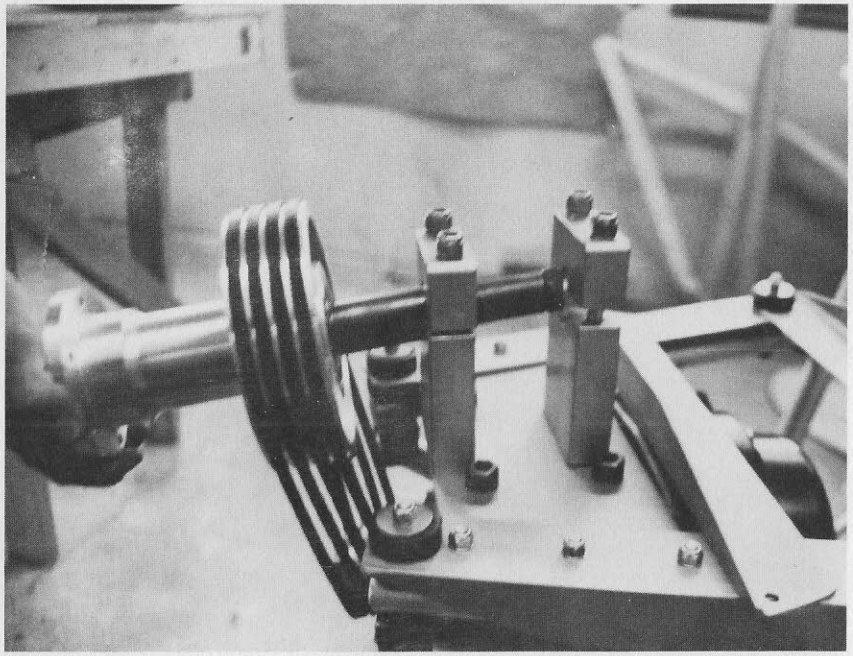
GRADUALLY TIGHTEN MOUNT BOLTS UNTIL ALL FOUR HAVE SEATED, THEN TIGHTEN SECURELY!



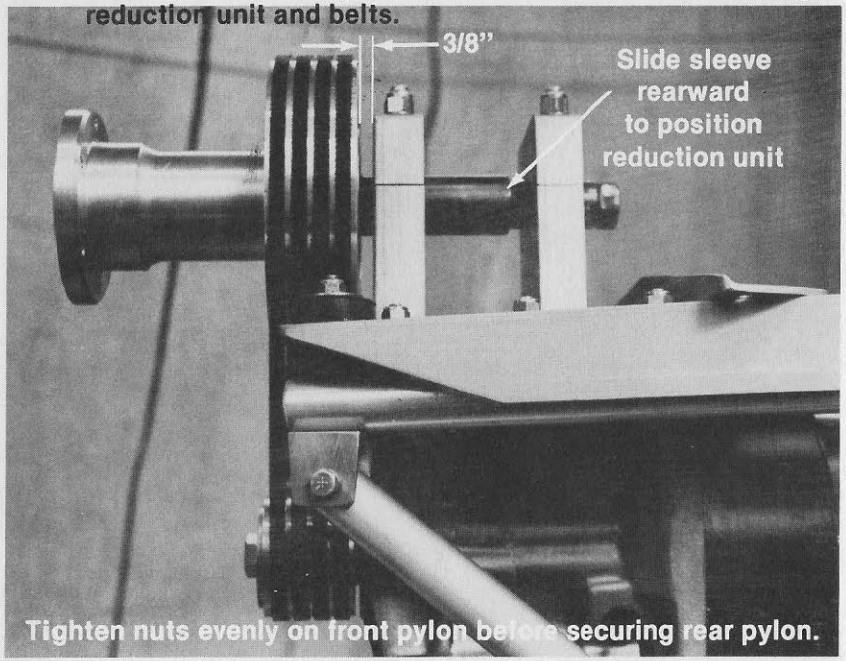
**48.** Attach engine assembly to rear of frame using:



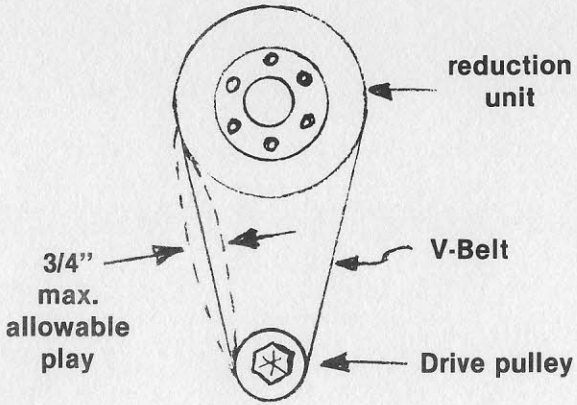

**49.** Position reduction unit and belts in pylons as shown.

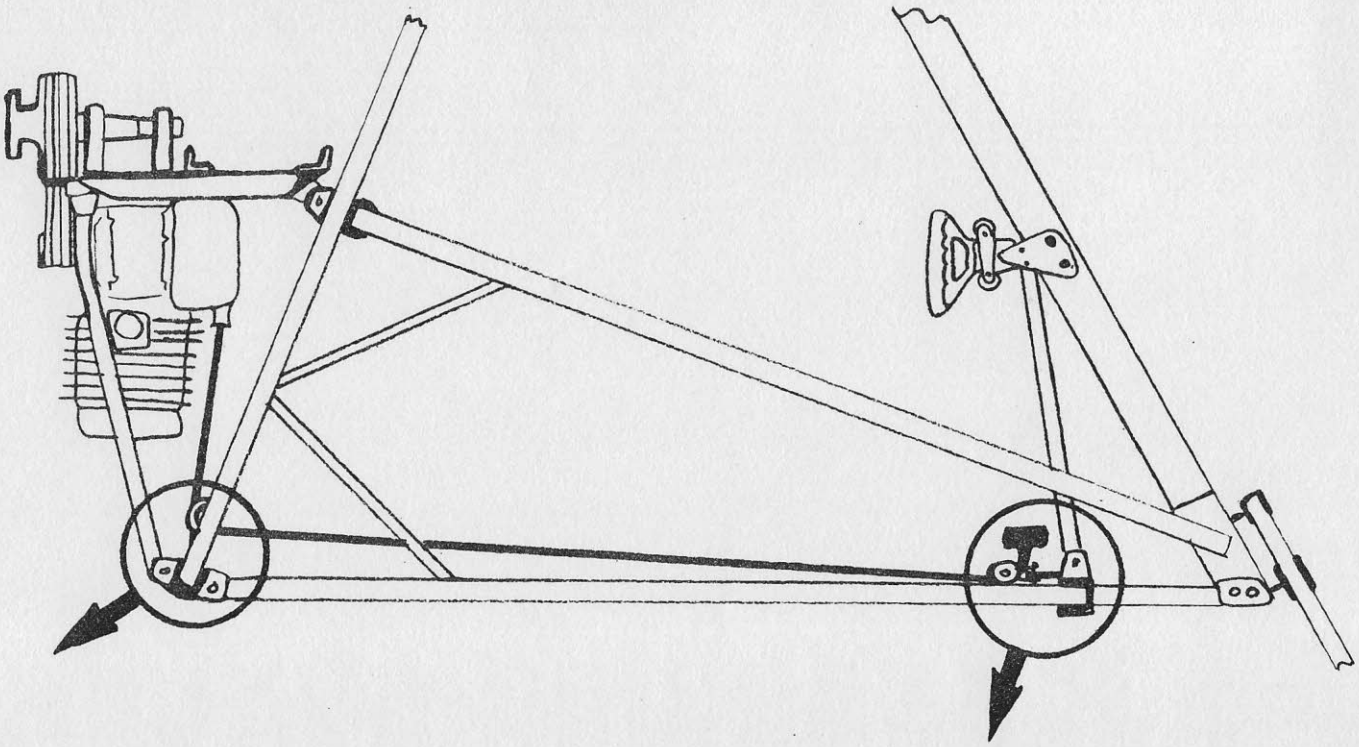


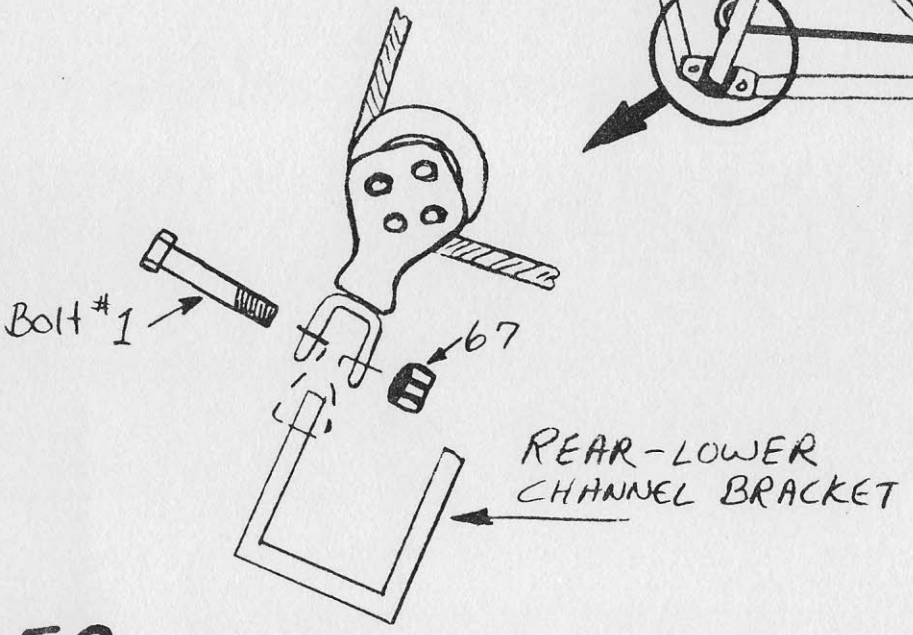
**50.** Be sure sleeve is against face of front bearing and align reduction unit and belts.

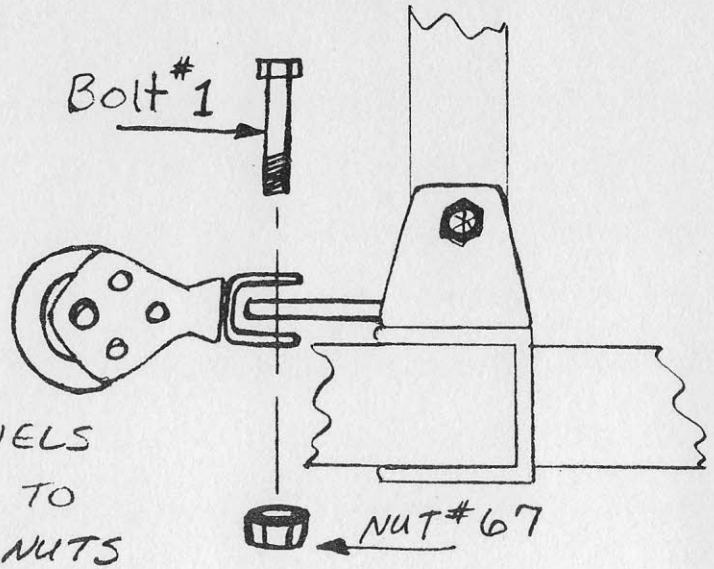



**51.** Check V-Belt tension by applying pressure to belts as shown. If belts have more than 3/4" of slack, or if slippage occurs install shim spacers (pt. #S-14) on top of spacer block, refer to step #47.



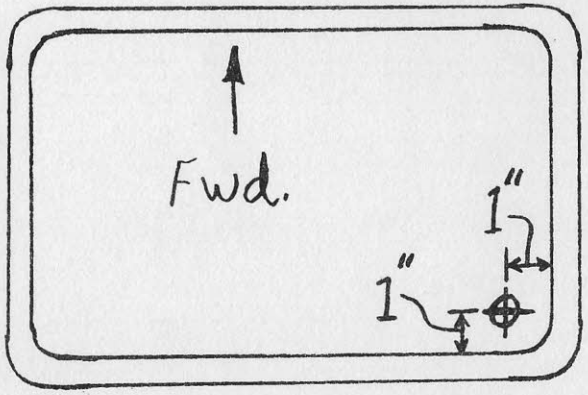




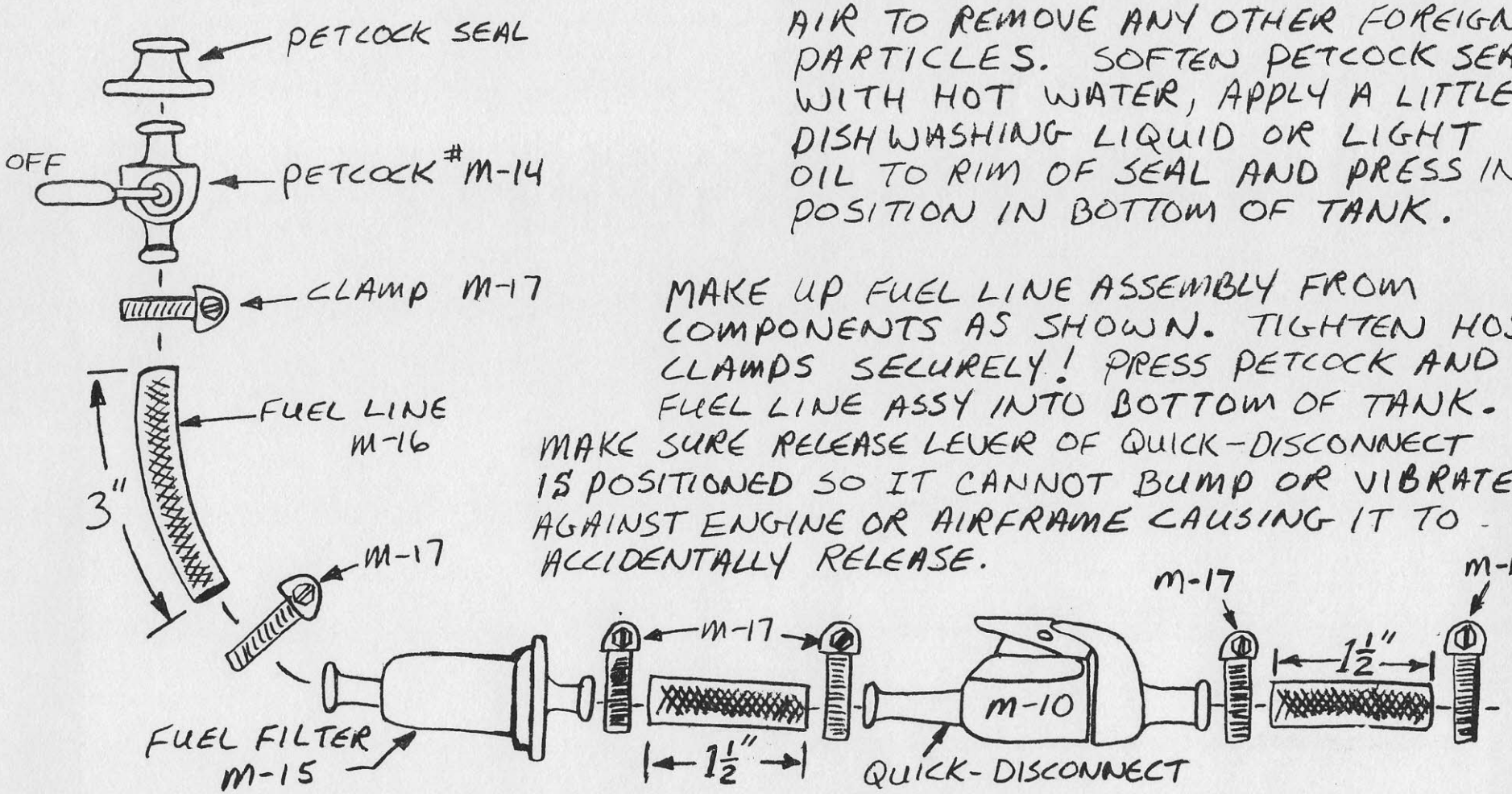

52. DRILL OUT PULL STARTER PULLEY SWIVELS TO 3/16" DIA. ATTACH FRONT AND REAR PULLEYS TO TANG AND CHANNEL BRACKET WITH BOLTS AND NUTS AS SHOWN. TIGHTEN NUTS SECURELY OR UNTIL 3-THREADS SHOW.

"BOTTOM VIEW"

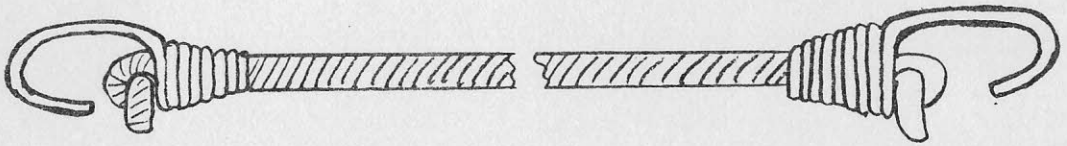



53. DRILL A 1/2" DIA. HOLE IN BOTTOM (LEFT REAR) CORNER OF FUEL TANK. START WITH A SMALLER 1/8" DIA. DRILL AS A PILOT AND THEN GRADUALLY ENLARGE HOLE BY USING progressively LARGER DRILL BITS UP TO 1/2" DIA. REMOVE BURRS FROM EDGES OF HOLE. RINSE INSIDE OF TANK WITH GAS OR BLOW OUT WITH COMPRESSED AIR TO REMOVE ANY OTHER FOREIGN PARTICLES. SOFTEN PETCOCK SEAL WITH HOT WATER, APPLY A LITTLE DISHWASHING LIQUID OR LIGHT OIL TO RIM OF SEAL AND PRESS INTO POSITION IN BOTTOM OF TANK.

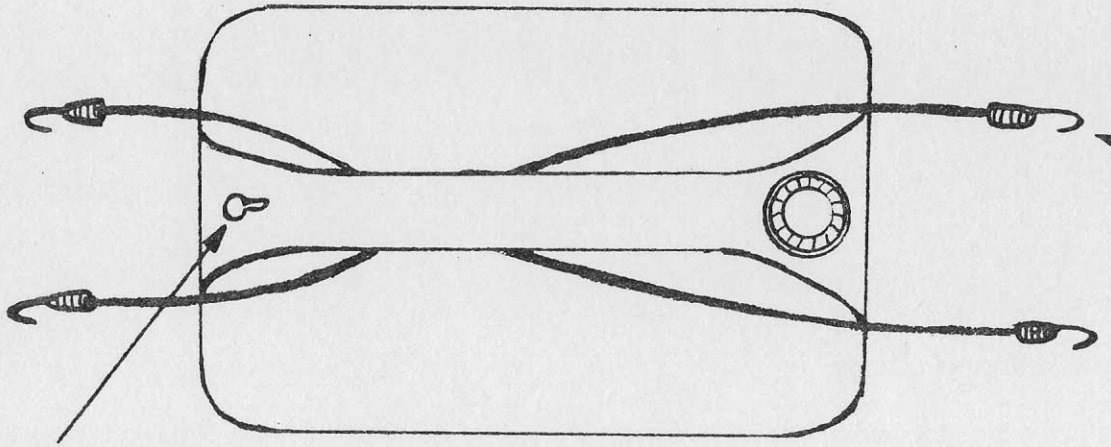
MAKE UP FUEL LINE ASSEMBLY FROM COMPONENTS AS SHOWN. TIGHTEN HOSE CLAMPS SECURELY! PRESS PETCOCK AND FUEL LINE ASSY INTO BOTTOM OF TANK. MAKE SURE RELEASE LEVER OF QUICK-DISCONNECT IS POSITIONED SO IT CANNOT BUMP OR VIBRATE AGAINST ENGINE OR AIRFRAME CAUSING IT TO ACCIDENTALLY RELEASE.



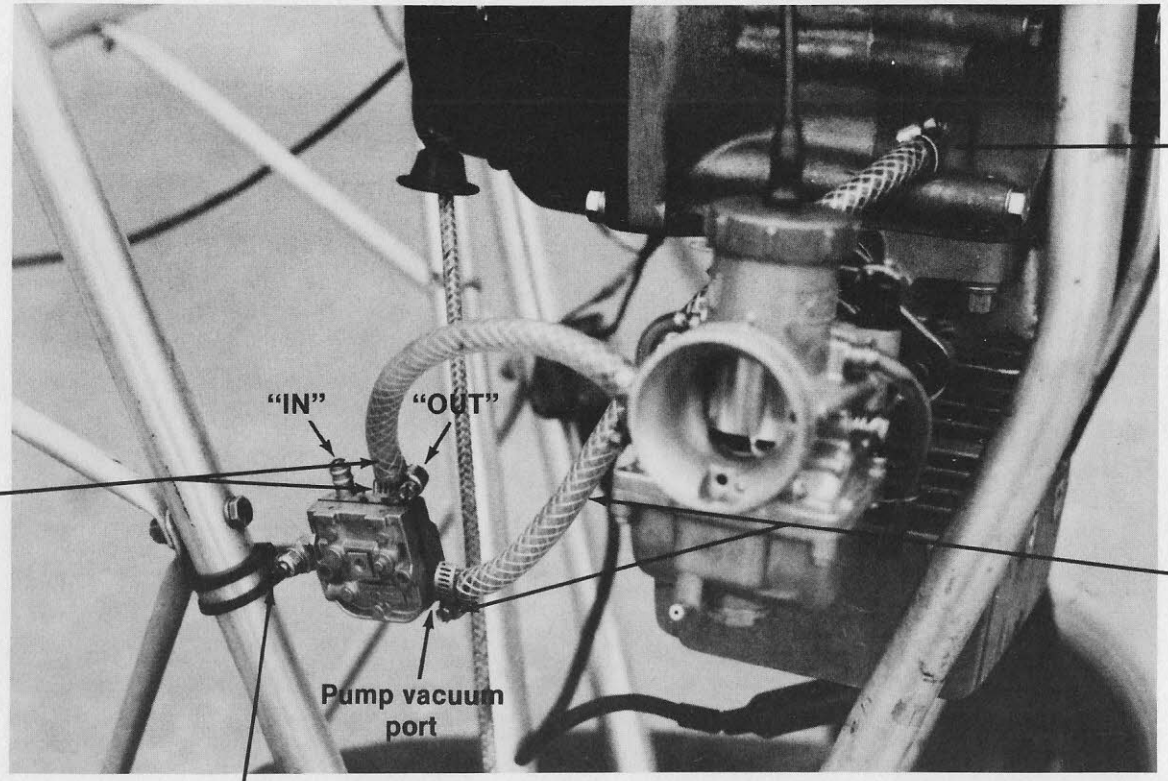
54.



USE A "HOT KNIFE" OR "HEAT CUTTING TOOL" TO CUT AND HEAT SEAL TWO PIECES OF 5/16" BUNGEE CHORD (m-6), 24" LONG FROM A 48" PIECE. MAKE-UP TWO FUEL TANK ANCHOR CHORDS USING HOOKS AS SHOWN. SLIDE BUNGEE THROUGH HOOKS AND TIE KNOTS IN ENDS. SECURE FUEL TANK IN PLACE AS SHOWN.




BE SURE TO LEAVE "VENT TAB" OPEN WHEN RUNNING ENGINE!



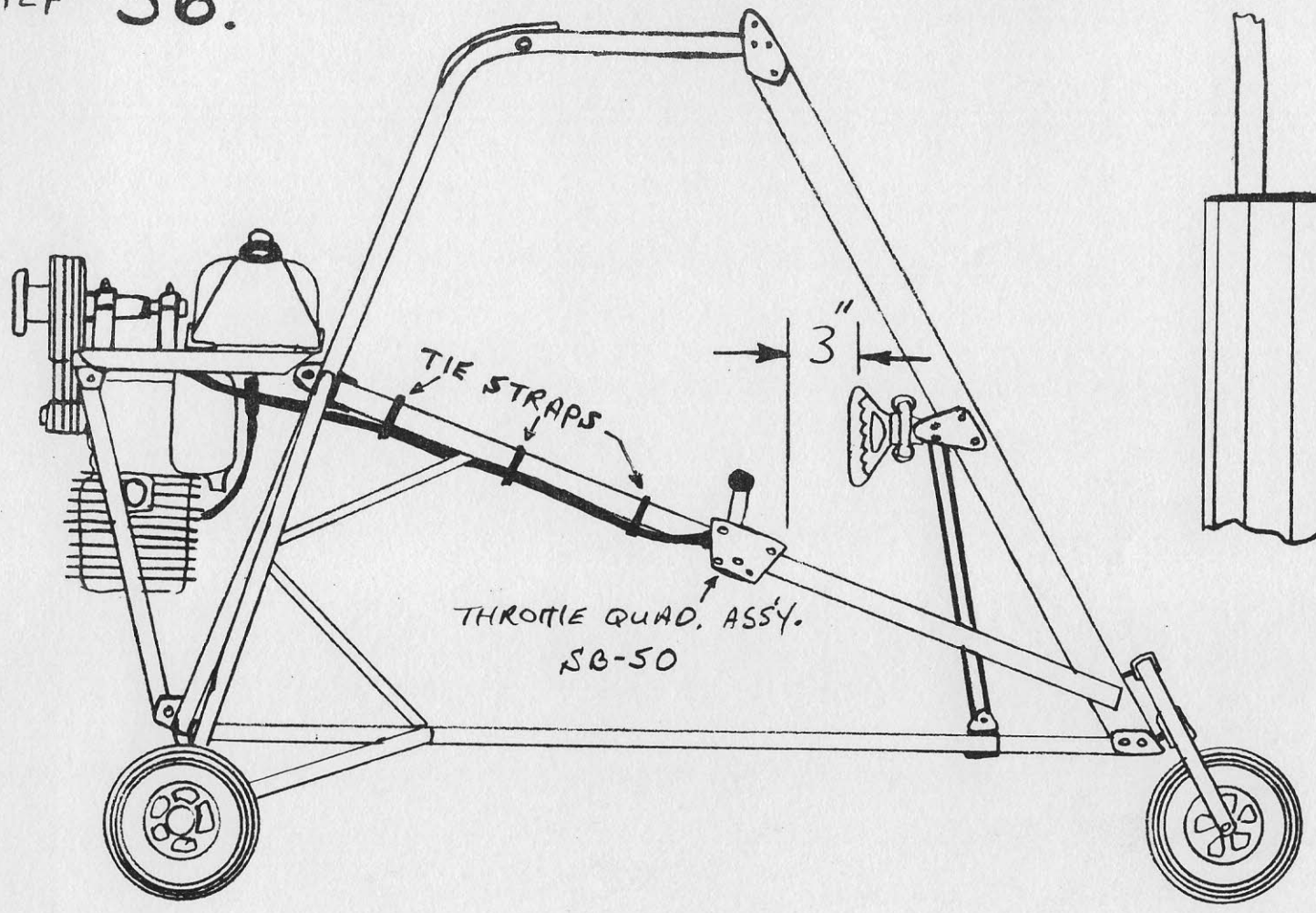

Fuel pump nipples are labeled "in" or "out". Connect a 7" long fuel line from "out" nipple of pump to carburetor fuel inlet nipple. Secure both ends of fuel line with hose clamps pt. #M-17.

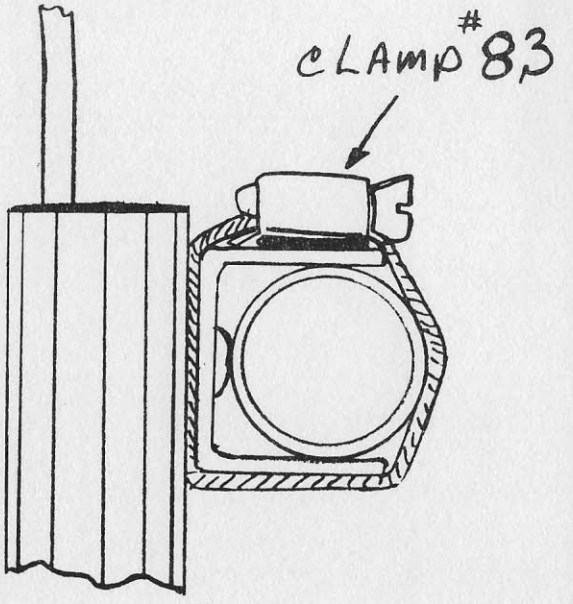
Engine vacuum port.

Connect an 11" length of braided fuel line to vacuum ports of engine and fuel pump. Secure ends with clamps as shown.

Mount fuel pump to rear frame tube with DG-16 clamp.
Bolt #1, 2-washers #74, nut #67.
Tighten bolt #1 securely!

STEP # 56.

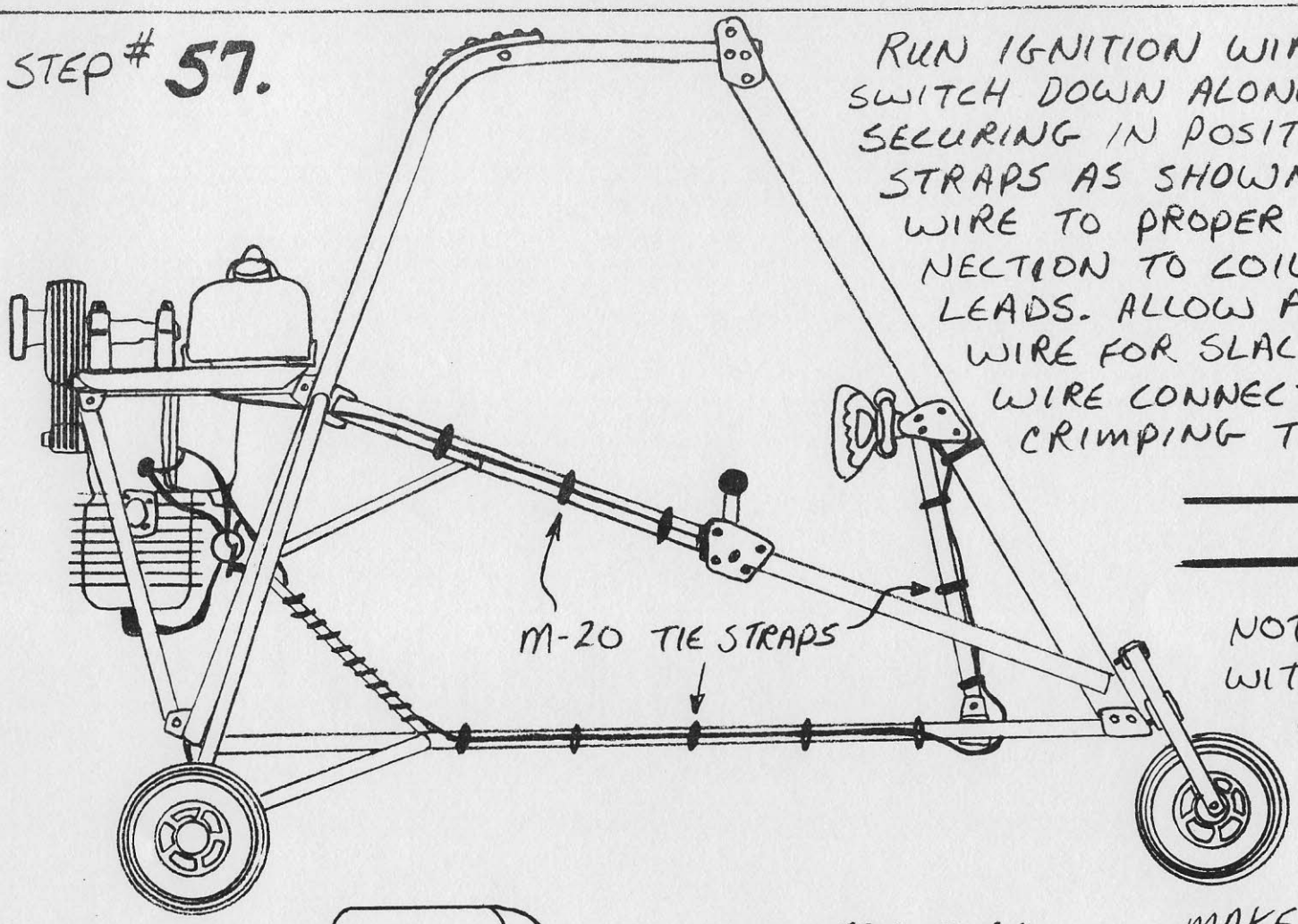


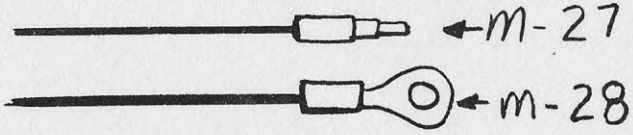




ATTACH THROTTLE QUADRANT ASSY. TO RIGHT SIDE FRAME TUBE IN POSITION SHOWN. SECURE WITH STAINLESS STEEL CLAMP pt #. 83. ROUTE THROTTLE CABLE AND SLIDE ASSEMBLY BACK THROUGH FRAME TUBES, OVER TOP OF PULL STARTER COVER AND ATTACH SLIDE ASSY TO CARBURATOR. TRY TO ROUTE THROTTLE CABLE IN THE SMOOTHEST CURVES POSSIBLE. SECURE CABLE TO SIDE FRAME TUBES WITH PLASTIC TIE-STRAPS (M-20) AS SHOWN.

STEP # 57.

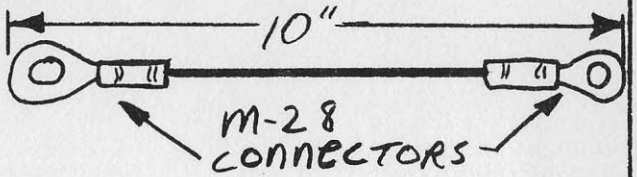
RUN IGNITION WIRES FROM KILL SWITCH DOWN ALONG BOTTOM OF FRAME SECURING IN POSITION WITH TIE-STRAPS AS SHOWN. TRIM ENDS OF WIRE TO PROPER LENGTH FOR CONNECTION TO COIL AND IGNITION LEADS. ALLOW A LITTLE EXCESS WIRE FOR SLACK. CRIMP ON WIRE CONNECTORS USING PROPER CRIMPING TOOL AS SHOWN.

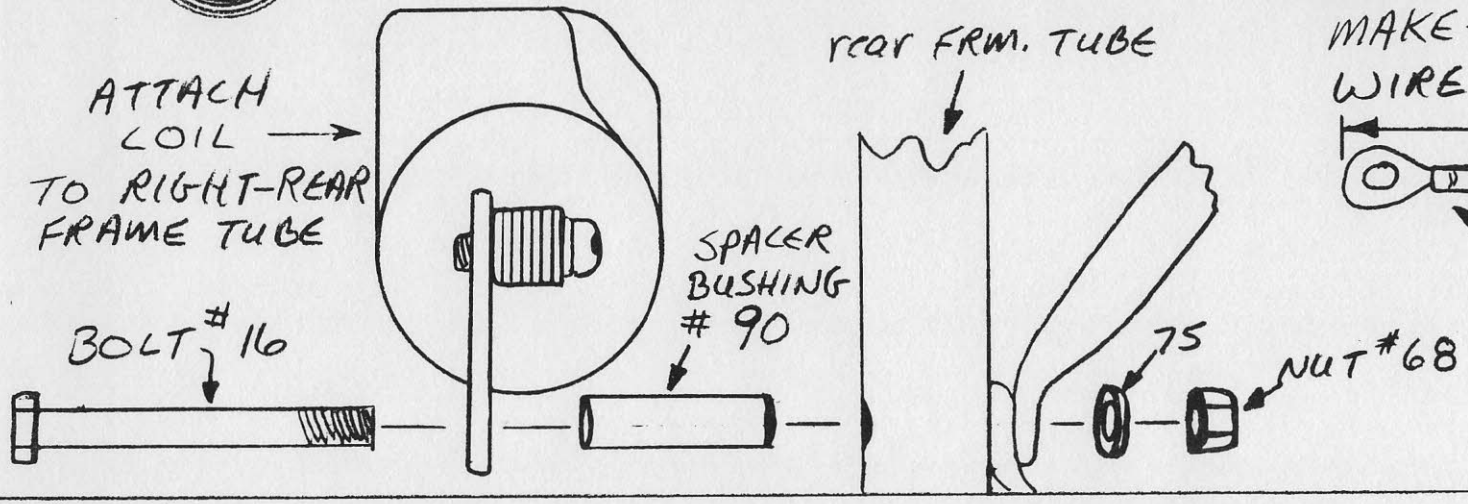


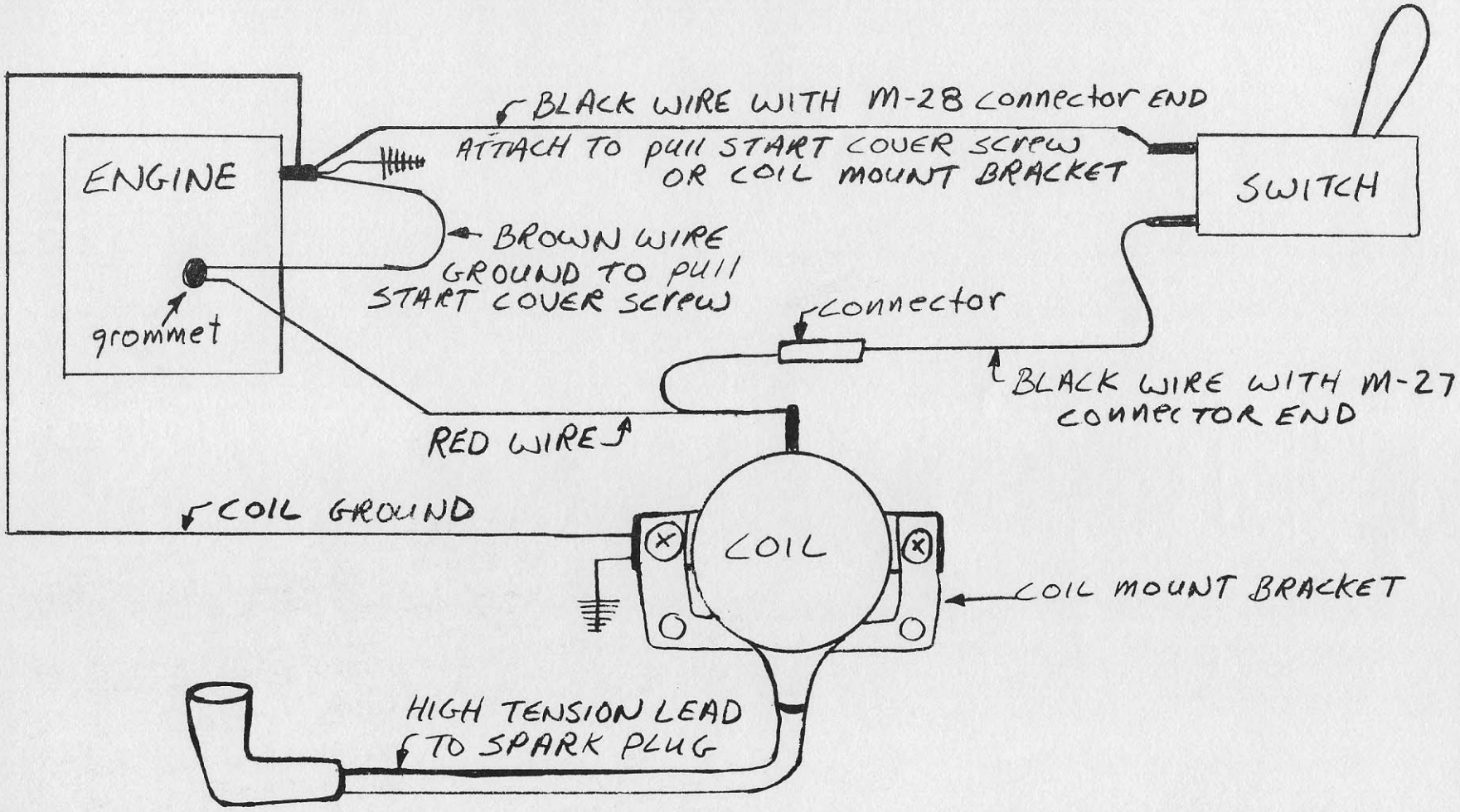

NOTE: MAKE THE WIRE WITH THE M-28 END 6" LONGER THAN THE OTHER WIRE.

MAKE-UP A COIL GROUND WIRE AS SHOWN.



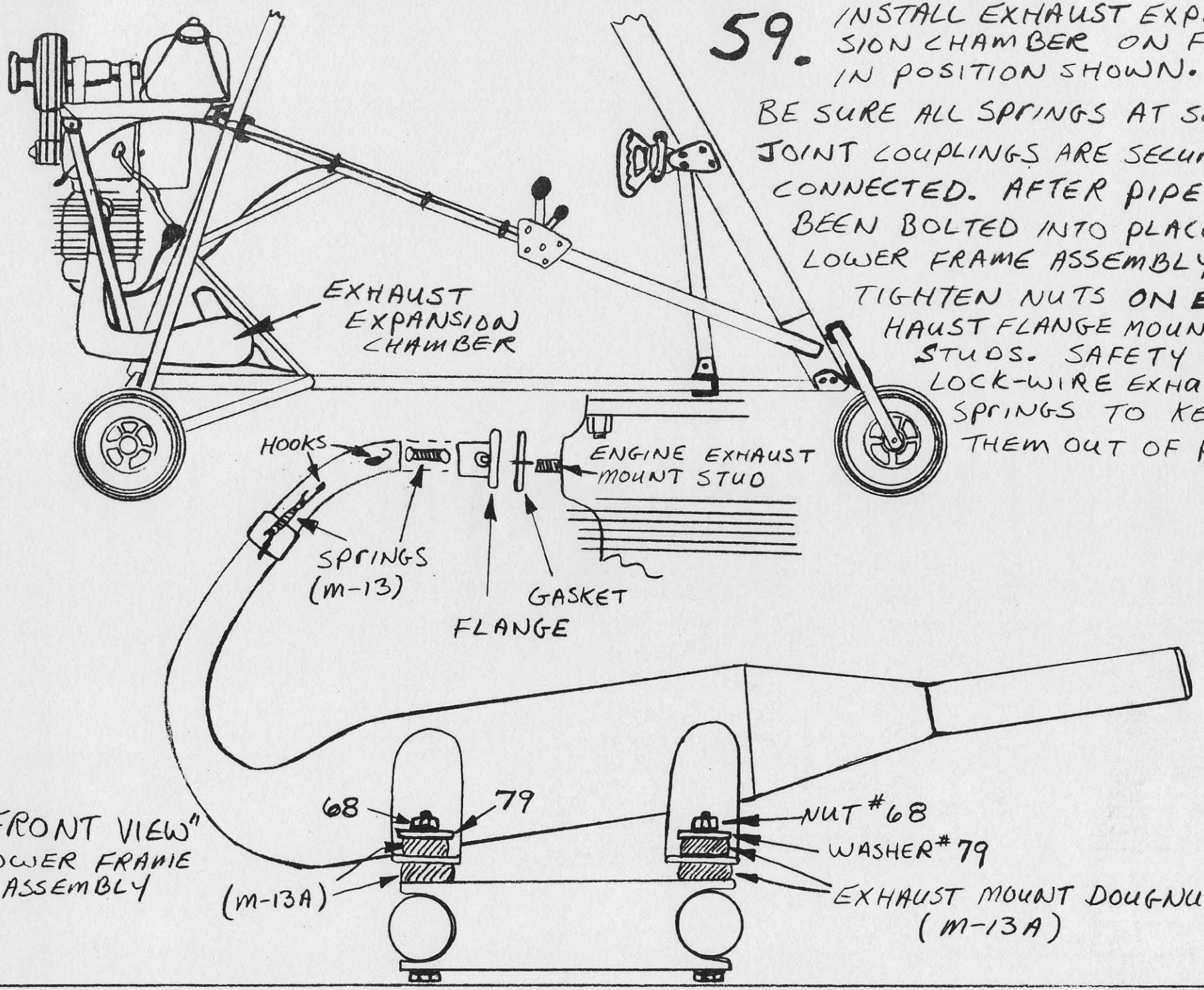
# STEP # 58. IGNITION WIRING DIAGRAM




ATTACH BROWN ENGINE WIRE, SWITCH WIRE AND COIL GROUND WIRE TO MOST CONVENIENT PULL START COVER SCREW. TIGHTEN SECURELY! CONNECT OTHER WIRES TO COIL AND SWITCH AS SHOWN. MAKE SURE ALL CONNECTORS ARE SECURELY ATTACHED!

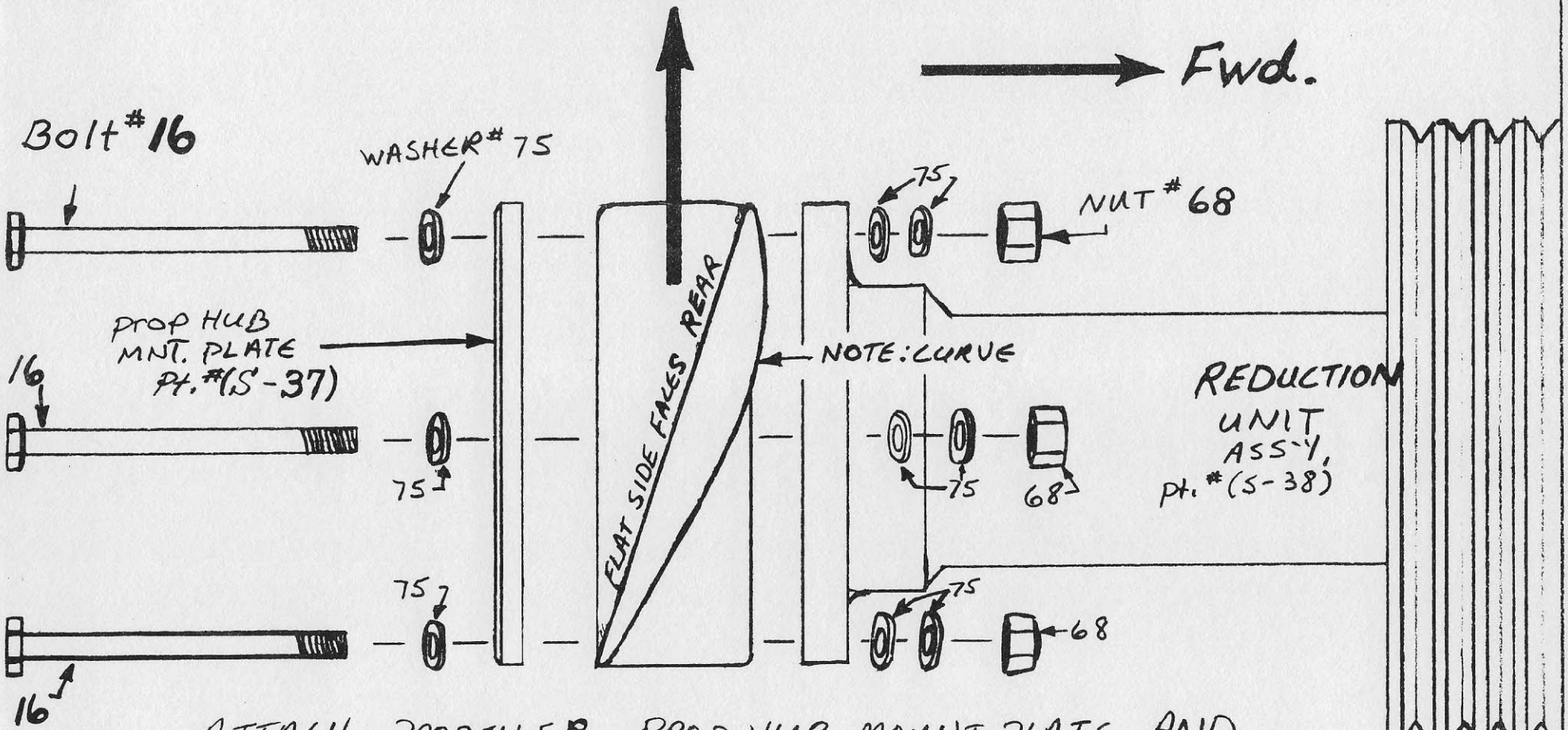
**59.** INSTALL EXHAUST EXPANSION CHAMBER ON FRAME IN POSITION SHOWN.

BE SURE ALL SPRINGS AT SLIP-JOINT COUPLINGS ARE SECURELY CONNECTED. AFTER PIPE HAS BEEN BOLTED INTO PLACE ON LOWER FRAME ASSEMBLY, TIGHTEN NUTS ON EXHAUST FLANGE MOUNT STUDS. SAFETY OR LOCK-WIRE EXHAUST SPRINGS TO KEEP THEM OUT OF PROP.



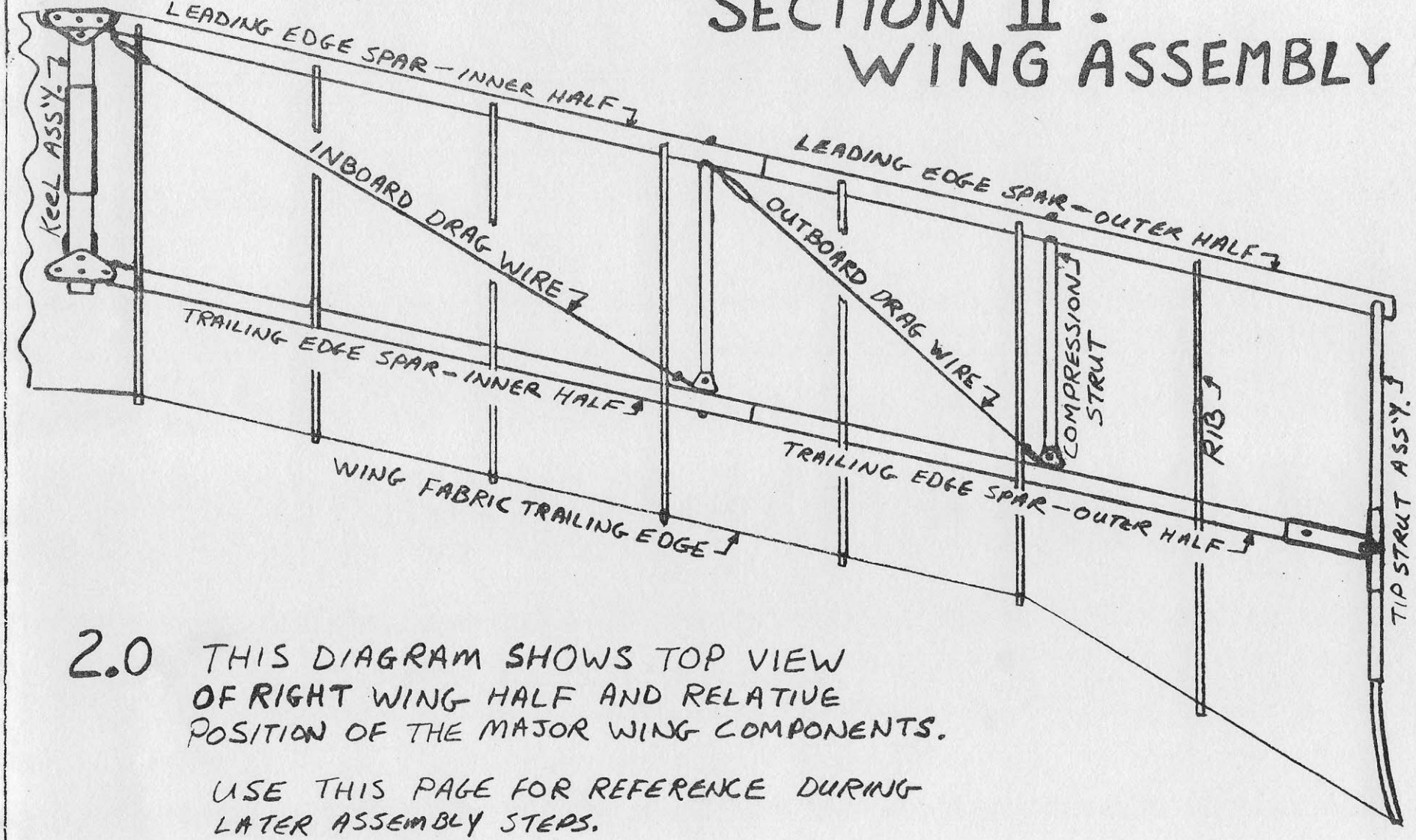
STEP #
60.

DIRECTION OF ROTATION.



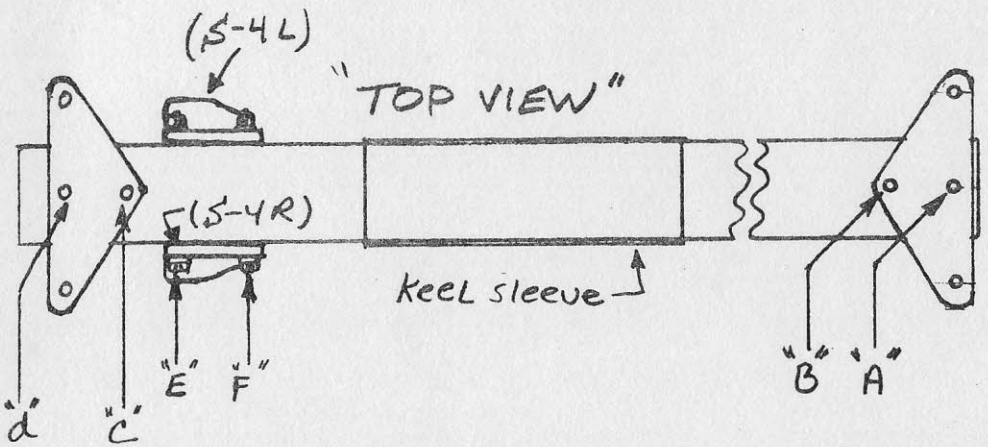

ATTACH PROPELLER, PROP HUB MOUNT PLATE, AND REDUCTION UNIT TOGETHER WITH PROPER BOLTS, NUTS, AND WASHERS AS SHOWN. NOTE: DIRECTION OF PROPELLER ROTATION WHEN VIEWED FROM REAR LOOKING FORWARD IS COUNTER CLOCK-WISE. (LEFT HAND!) CURVE OF PROPELLER AIRFOIL GOES FORWARD. TIGHTEN ALL SIX BOLTS SECURELY AND <u>EVENLY</u>. DO NOT OVERTIGHTEN!

# SECTION II: WING ASSEMBLY

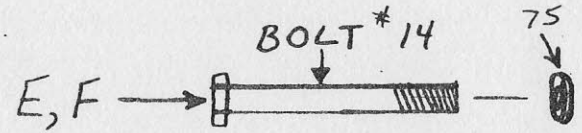


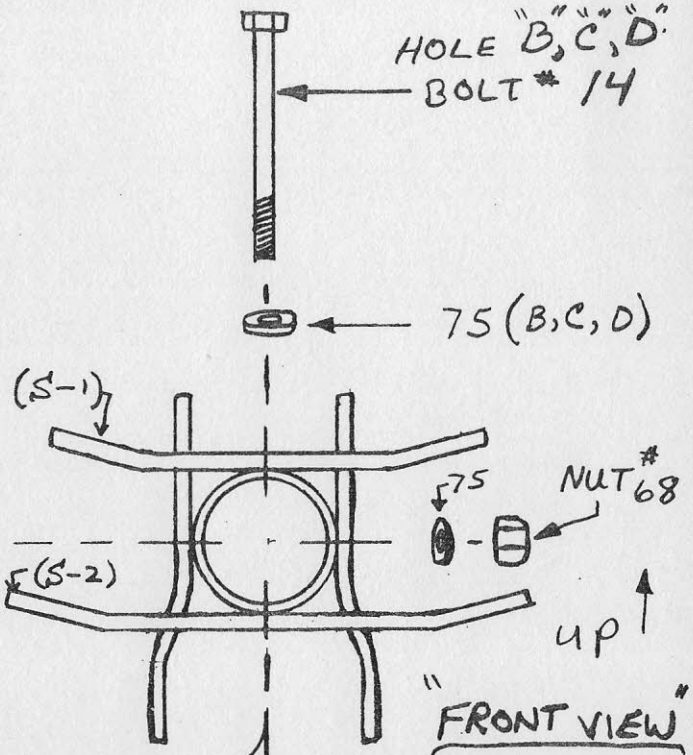

2.0 THIS DIAGRAM SHOWS TOP VIEW OF RIGHT WING HALF AND RELATIVE POSITION OF THE MAJOR WING COMPONENTS.

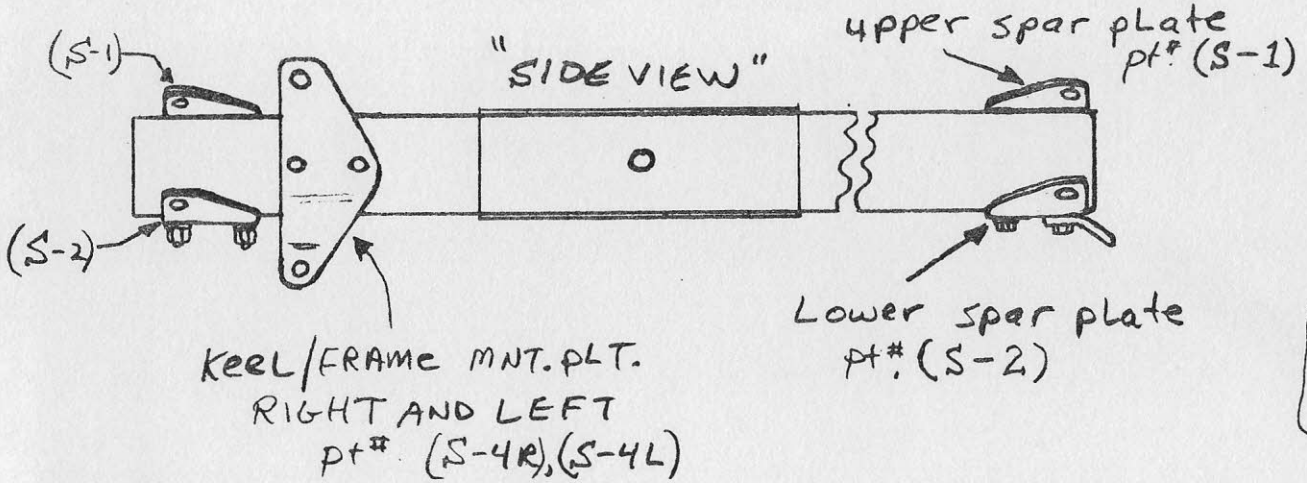
USE THIS PAGE FOR REFERENCE DURING LATER ASSEMBLY STEPS.

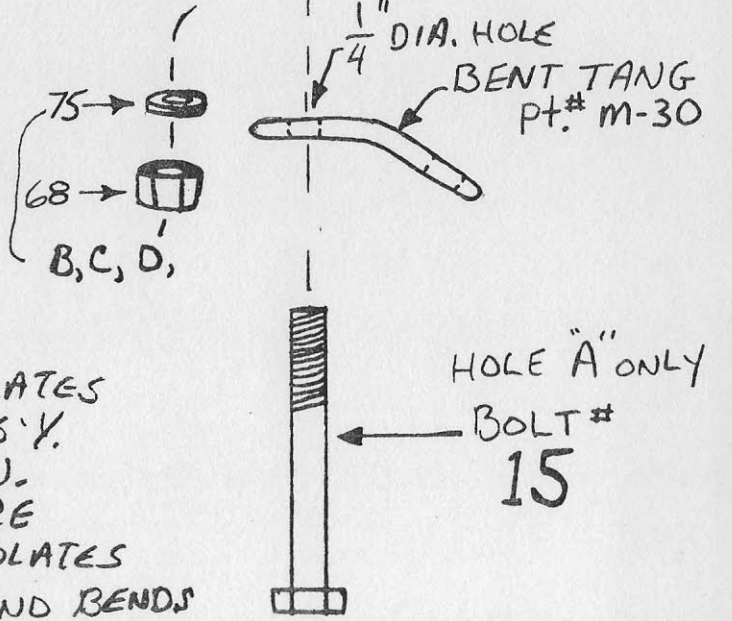



Fwd. →



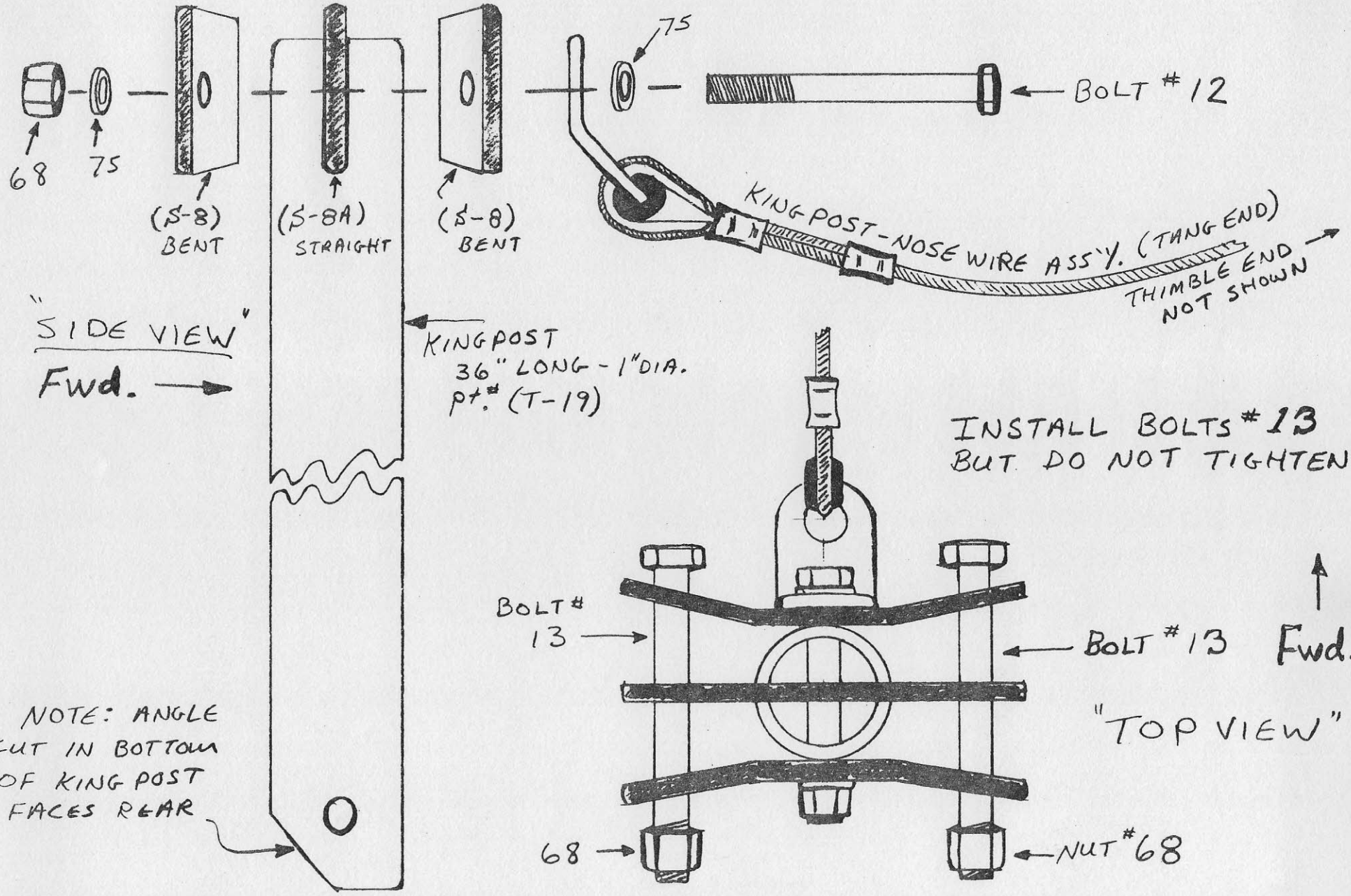



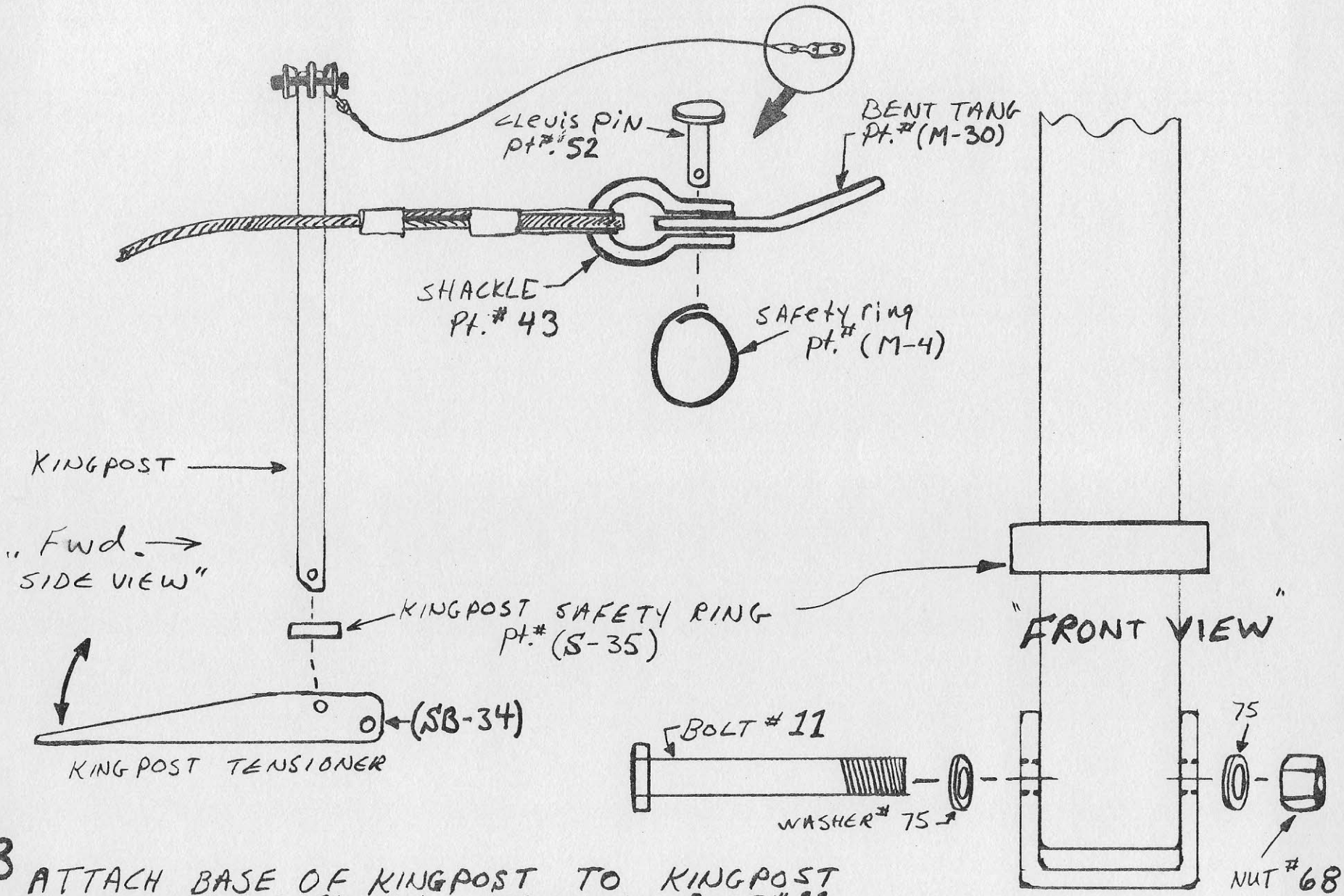



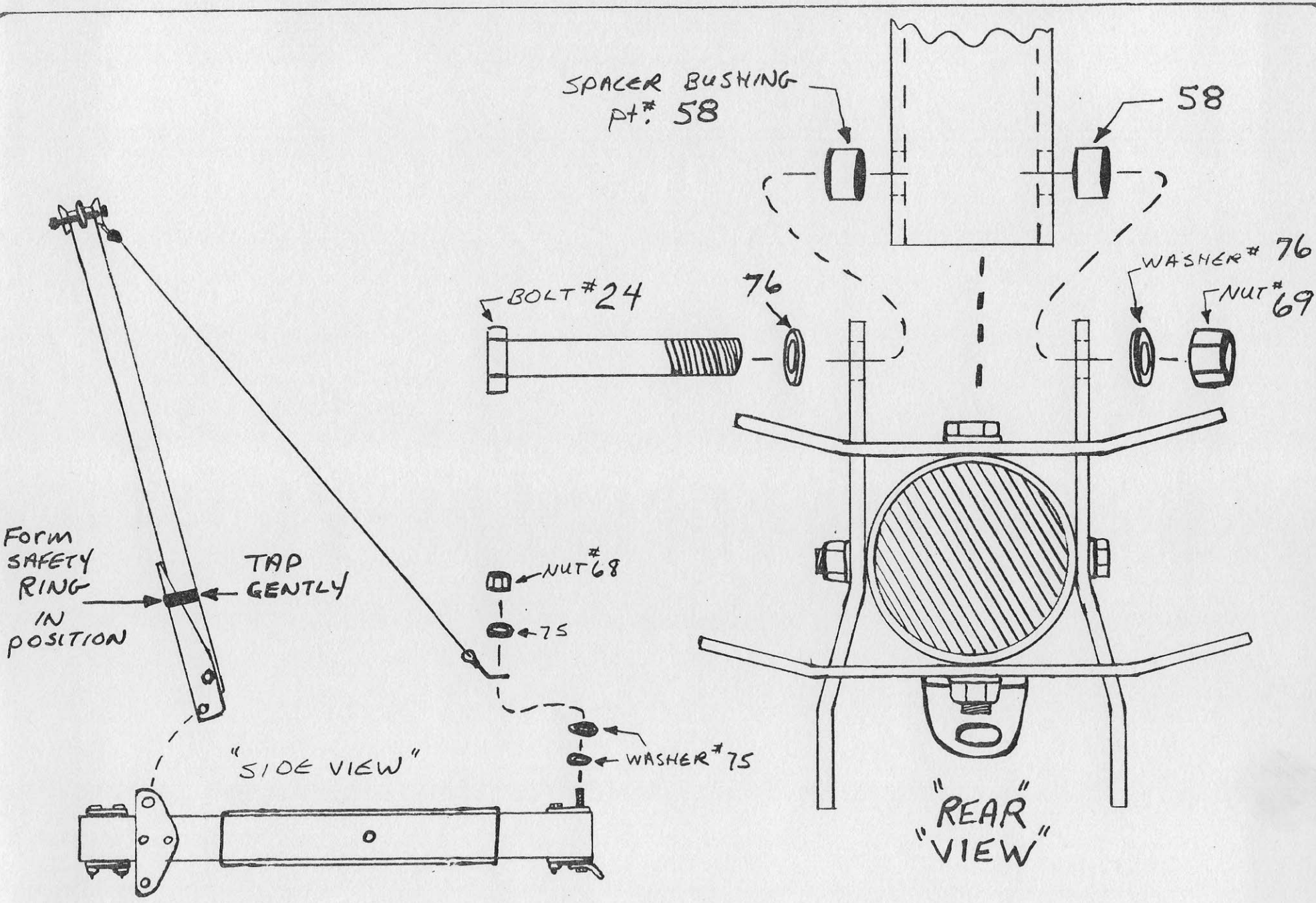

2.1 ATTACH SPAR PLATES, KEEL/FRAME MNT. PLATES AND CHANNEL BRACKET TO KEEL TUBE ASS'Y. USING NUTS, BOLTS AND WASHERS AS SHOWN. MAKE SURE KEEL SLEEVE IS IN POSITION BEFORE FINAL ASSEMBLY BEGINS. NOTE: LOWER SPAR PLATES ARE SLIGHTLY LARGER THAN UPPER SPAR PLATES AND BENDS IN BOTH UPPER AND LOWER PLATES ANGLE UPWARD.

2.2 ATTACH LANDING WIRE TANGS AND NOSE WIRE ASS'Y. TO TOP OF KINGPOST AS SHOWN. TIGHTEN BOLT # 12 SECURELY. PASS A 1/4" DRILL THROUGH REMAINING TWO HOLES IN ALL THREE TANGS TO INSURE ALIGNMENT.

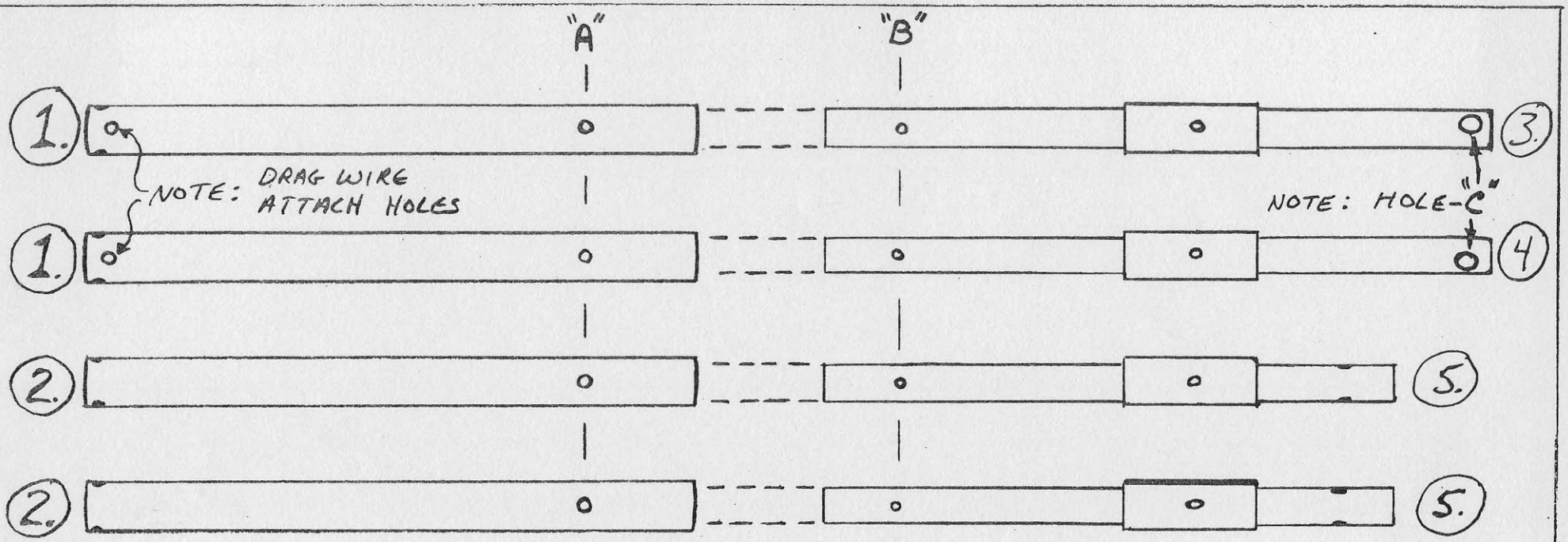





2.3 ATTACH BASE OF KINGPOST TO KINGPOST TENSIONER AS SHOWN. TIGHTEN BOLT # 11 SECURELY BUT LEAVE LOOSE ENOUGH TO ALLOW KINGPOST AND TENSIONER TO MOVE FREELY ONCE ASSEMBLED. ATTACH SHACKLE, TANG, CLEVIS PIN AND SAFETY RING TO END OF NOSE WIRE ASS'Y. AS SHOWN.



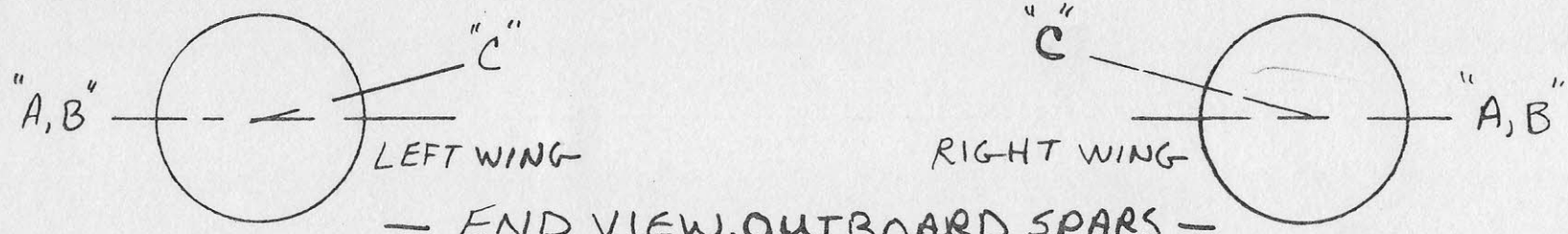

**2.4** ATTACH KINGPOST AND NOSEWIRE TO KEEL TUBE ASSEMBLY USING BOLTS, NUTS, SPACER BUSHINGS AND WASHERS AS SHOWN. TIGHTEN BOLT #24 SECURELY BUT ALLOW KINGPOST TENSIONER TO PIVOT FREELY. FORM SAFETY RING AROUND KINGPOST WITH HAMMER




1. LEADING EDGE SPAR - INNER HALF (RIGHT OR LEFT WING)
2. TRAILING EDGE SPAR - INNER HALF (RIGHT OR LEFT WING)
3. LEADING EDGE SPAR - OUTER HALF (RIGHT WING)
4. LEADING EDGE SPAR - OUTER HALF (LEFT WING)
5. TRAILING EDGE SPAR - OUTER HALF (RIGHT OR LEFT WING)

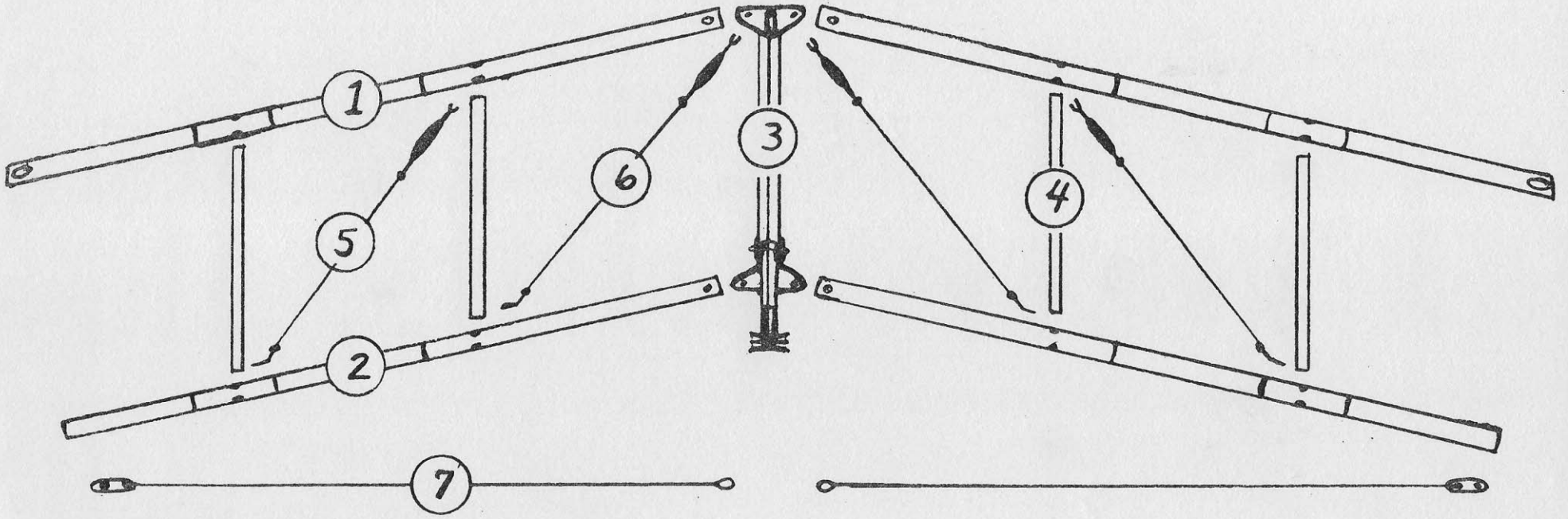
---

**2.5** ASSEMBLE SPAR TUBES BY SLIDING TOGETHER INNER AND OUTER HALVES UNTIL HOLES "A" AND "B" ALIGN. NOTE ANGLES OF 1" DIA. HOLE "C" IN END OF OUTER, LEADING EDGE SPARS.




— END VIEW, OUTBOARD SPARS —

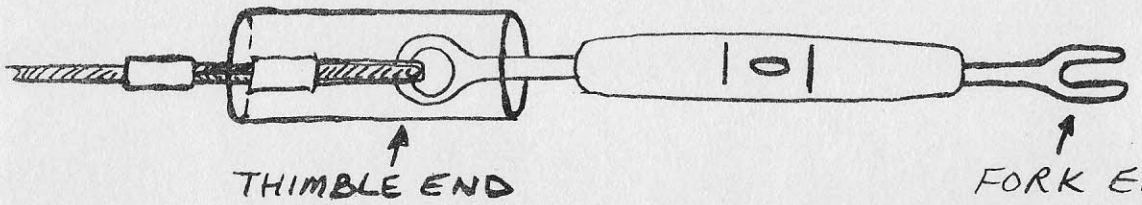
# 2.6 TO BEGIN WING ASSEMBLY, LAY OUT VARIOUS WING COMPONENTS AS SHOWN. IT WILL HELP TO FIND A LARGE OPEN SPACE (PREFERABLY INDOORS) APPROXIMATELY 20ft. x 40ft. TO FINISH THE REMAINDER OF THE ASSEMBLY AND RIGGING PROCESS.



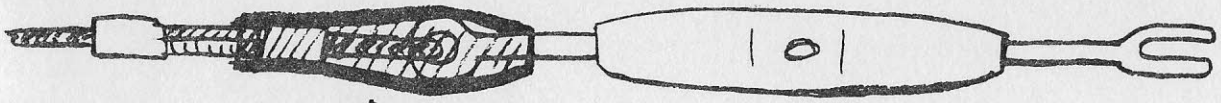

1. LEADING EDGE SPAR ASSEMBLY
2. TRAILING EDGE SPAR ASSEMBLY
3. KEEL TUBE ASSEMBLY
4. COMPRESSION STRUT
5. OUTBOARD DRAG WIRE ASSEMBLY – APPROXIMATELY 92 3/8" LONG
6. INBOARD DRAG WIRE ASSEMBLY – APPROXIMATELY 105 1/2" LONG
7. DIHEDRAL WIRE ASSEMBLY – 165" LONG

NOTE: THE ABOVE NUMBER SEQUENCE IS FOR IDENTIFICATION PURPOSES ON THIS PAGE ONLY.

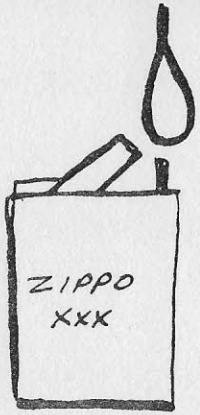
**2.6A** CUT 12" LONG PIECE OF HEAT SHRINK TUBE (PART NO. M-24) INTO EIGHT, 1½" LONG PIECES. SLIP A PIECE OF HEAT SHRINK ONTO END OF DRAG WIRE TURNBUCKLE AND POSITION OVER THIMBLE AS SHOWN. USE A HEAT GUN OR OPEN FLAME SUCH AS A BUTANE LIGHTER OR MATCHES TO SHRINK HEAT SHRINK TUBE INTO PLACE OVER THIMBLE AND TURNBUCKLE EYE. BE CAREFUL NOT TO OVERHEAT **AND** MELT OR CATCH HEAT SHRINK ON FIRE. WHEN FIRST PIECE OF HEAT SHRINK HAS BEEN SHRUNK TOTALLY, PLACE ANOTHER PIECE OVER TOP OF FIRST ONE AND SHRINK IT IN PLACE TOO! USE OF HEAT SHRINK WILL PREVENT THIMBLES FROM TWISTING AND KINKING.




POSITION HEAT SHRINK

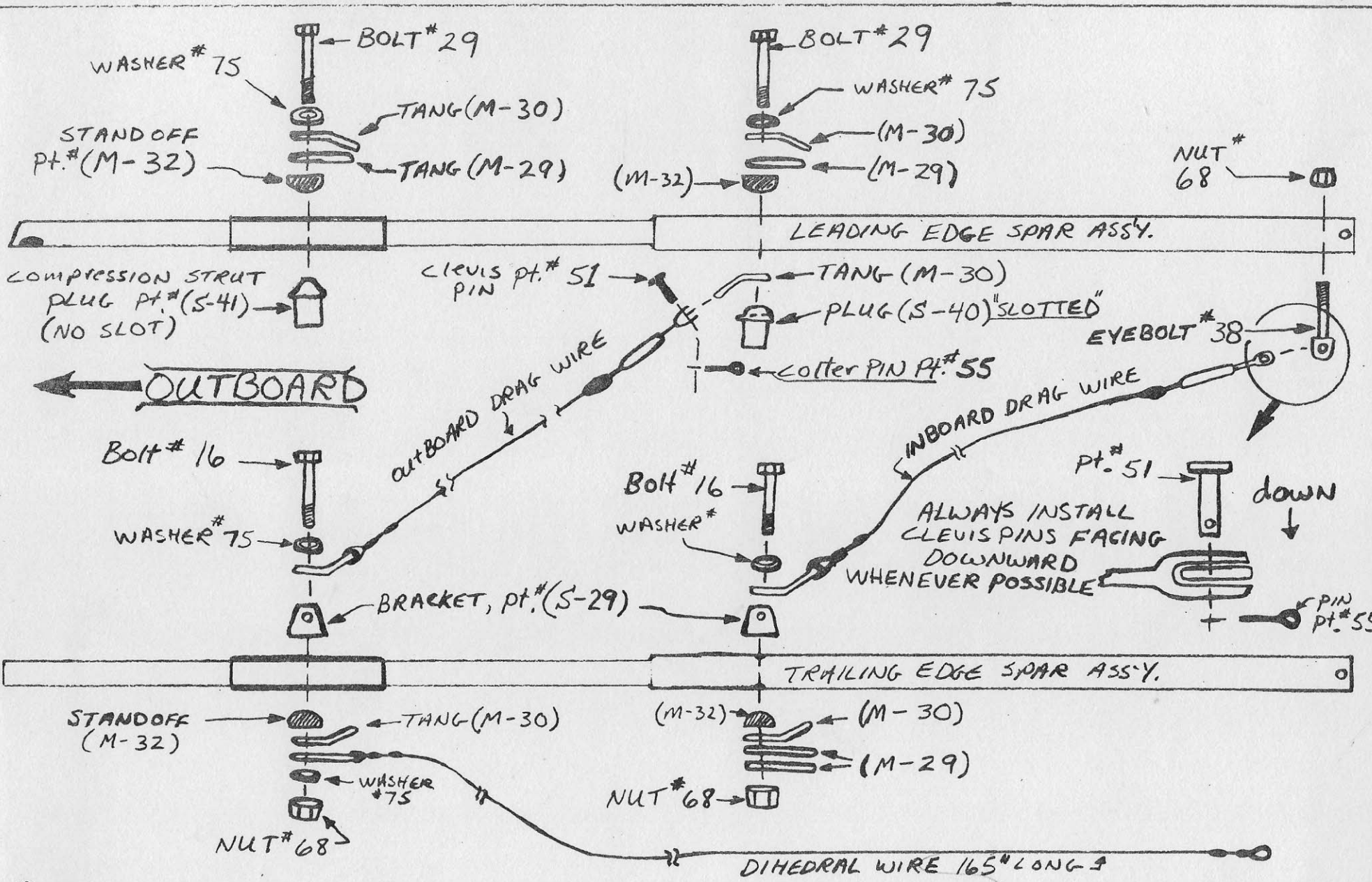


SHRINK IN PLACE

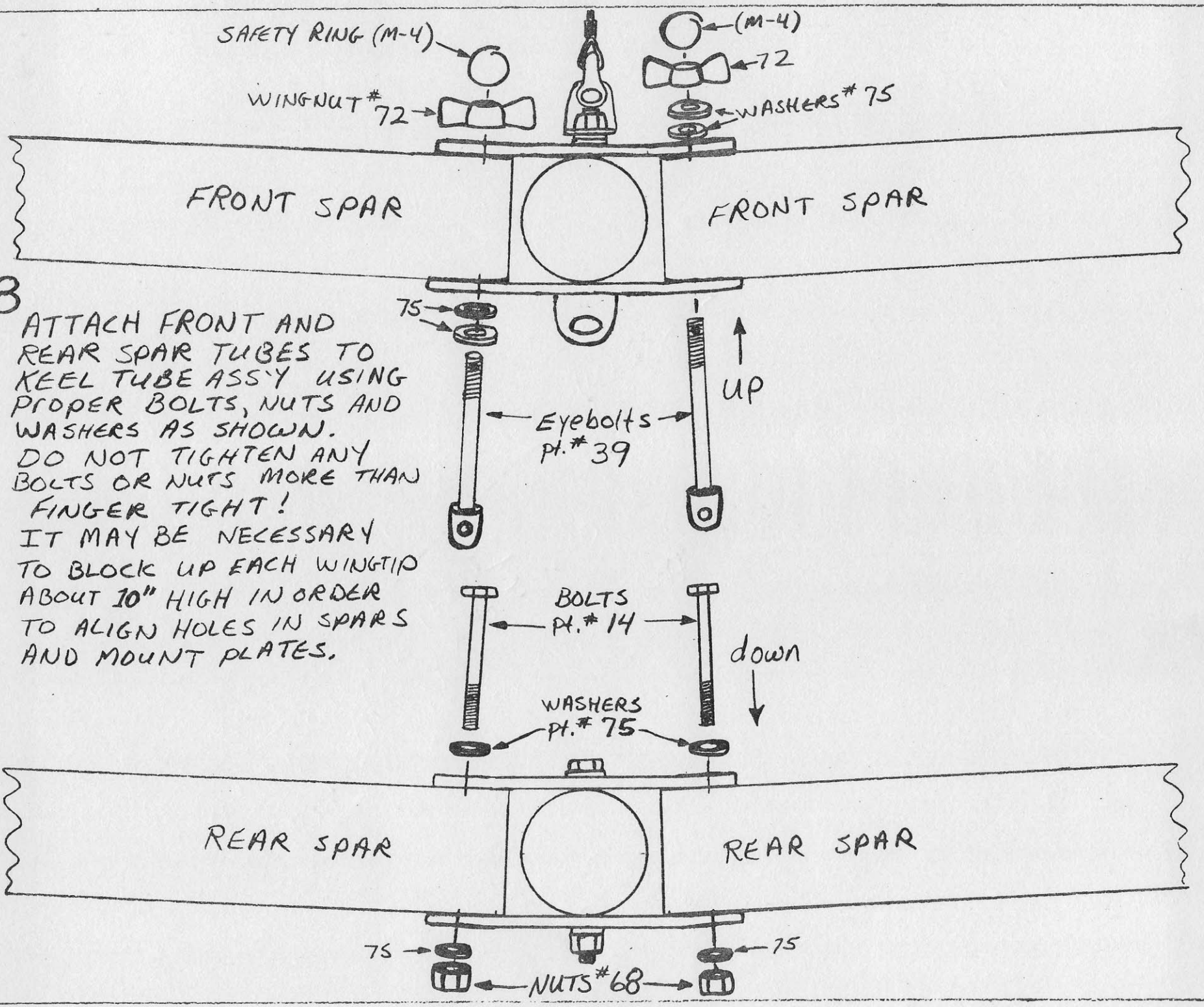



STOP HEATING WHEN HEAT SHRINK **STOPS** SHRINKING

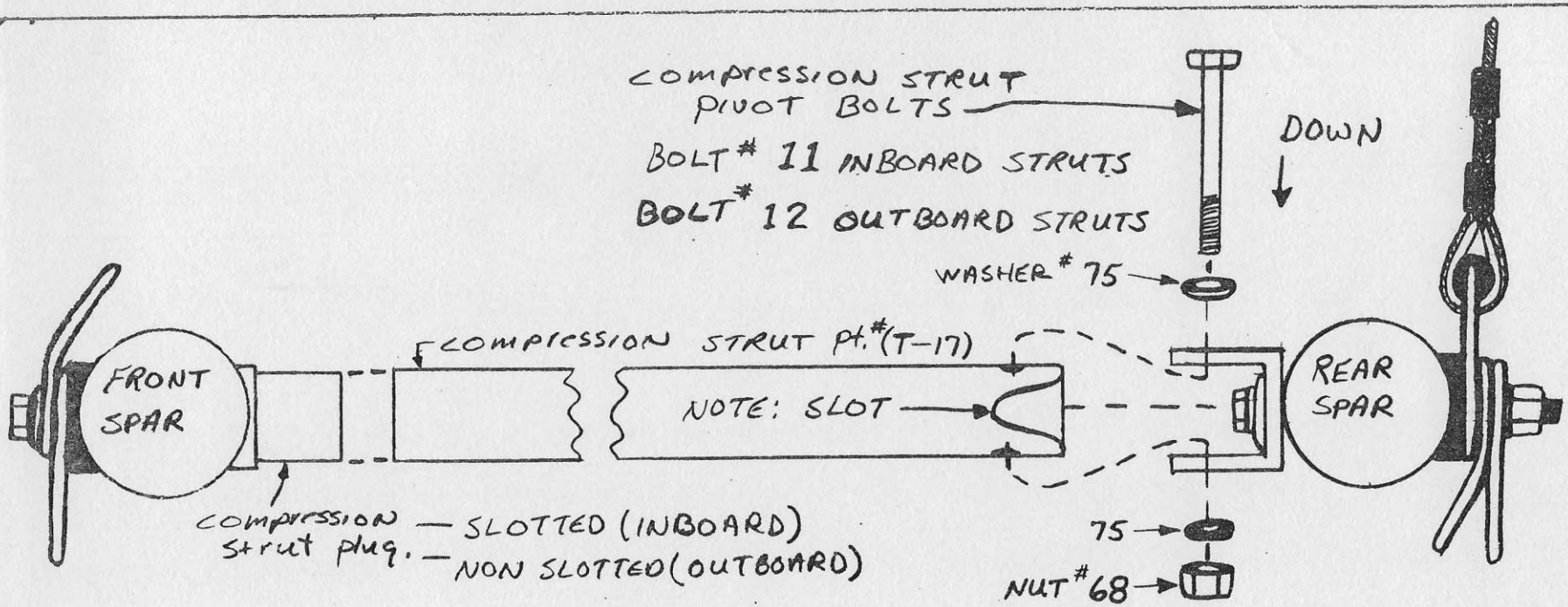
REPEAT TO OTHER THREE TURNBUCKLES




2.7 ATTACH ALL STRUCTURAL AND MISCELLANEOUS PARTS TO FRONT AND REAR SPAR ASSEMBLIES AS SHOWN. USE PROPER NUTS, BOLTS, AND WASHERS WHERE INDICATED. BE SURE TO SECURE DRAG WIRES TO proper TANGS OR EYEBOLTS WITH CLEVIS PINS AND COTTER PINS AS INDICATED. BEND OVER COTTER PINS ONCE INSTALLATION IS COMPLETE. DO NOT TIGHTEN ANY BOLTS OR NUTS MORE THAN FINGER TIGHT AT THIS POINT.




2.8 ATTACH FRONT AND REAR SPAR TUBES TO KEEL TUBE ASS'Y USING PROPER BOLTS, NUTS AND WASHERS AS SHOWN. DO NOT TIGHTEN ANY BOLTS OR NUTS MORE THAN FINGER TIGHT! IT MAY BE NECESSARY TO BLOCK UP EACH WINGTIP ABOUT 10" HIGH IN ORDER TO ALIGN HOLES IN SPARS AND MOUNT PLATES.



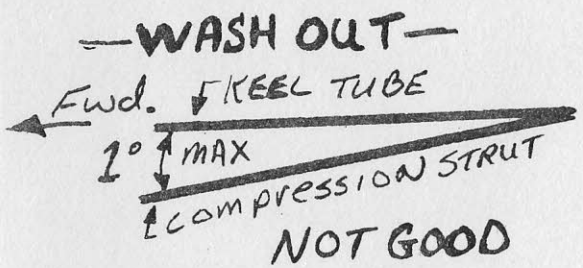

2.9 ATTACH COMPRESSION STRUTS TO BRACKETS LOCATED ON REAR SPAR AS SHOWN. SLOT IN END OF COMPRESSION STRUT ALWAYS FACES OUTWARD TOWARD WINGTIP. THIS WILL ALLOW FRONT END OF COMPRESSION STRUT TO PIVOT OUTWARD AND LIE AGAINST REAR SPAR WHEN FOLDING WING FOR TRANSPORT BY CAR TOP OR VAN. NOTE ALSO COMPRESSION STRUT PIVOT BOLTS. THE LONGER BOLTS, pt.# 12, ATTACH THE <u>OUTER</u> COMPRESSION STRUTS TO THEIR BRACKETS AND THE SHORTER BOLTS, pt.# 11, ATTACH THE INNER COMPRESSION STRUTS. THE LONGER BOLTS WILL LATER PROVIDE A MOUNTING POINT FOR CONTROL CABLE GUIDE CLAMPS. DO NOT TIGHTEN ANY BOLTS MORE THAN FINGER TIGHT AT THIS POINT. CONNECT FRONT SPARS TO COMPRESSION STRUTS BY INSERTING PLUG INTO END OF STRUT.

# 2.10 RIGGING INTRODUCTION:

BEFORE INTRODUCING YOU TO THE STEP BY STEP PROCESS WHICH YOU WILL USE TO COMPLETE THE RIGGING OF YOUR KASPERWING, I would FIRST LIKE TO FURNISH YOU WITH A LITTLE GENERAL BACKGROUND. ALL OF THE UPPER CABLES WHICH SUPPORT THE WING FROM ABOVE ARE CALLED "LANDING WIRES". ALL OF THE LOWER RIGGING CABLES WHICH SUPPORT THE WING IN FLIGHT ARE CALLED "FLYING WIRES." THE LANDING AND FLYING WIRE CABLES WILL BE REFERED TO IN THE ASSEMBLY SEQUENCE BY THE NUMBERS #1, #2, #3, ... #9, Etc. AND ARE USUALLY MADE UP AND INSTALLED IN PAIRS. SINCE MOST PEOPLE DON'T HAVE ACCESS TO, NOR COULD THEY AFFORD AN AIRCRAFT GRADE CABLE TENSIOMETER TO CHECK FOR PROPER CABLE TENSION, IT MAY BE NECESSARY TO LITERALLY "PLAY IT BY EAR". ONCE YOU HAVE ESTABLISHED THE LENGTH AND TENSION OF A PARTICULAR CABLE ON ONE SIDE OF THE WING, IT IS EASY TO CHECK THE TENSION IN A CORRESPONDING CABLE OF EQUAL LENGTH ON THE OTHER SIDE BY simply "PLUCKING" THE CABLE, LISTENING TO IT'S SOUND LIKE YOU WERE TUNING A MUSICAL INSTRUMENT. WHEN TWO CABLES OF EQUAL LENGTH SOUND THE SAME, THEY WILL HAVE EQUAL TENSION. IN GENERAL, ALL THE CABLES SHOULD BE RIGGED AS "TAUGHT" AS YOU CAN MAKE THEM AND STILL GET THE WING ASSEMBLED. IF A CABLE IS "TOO TAUGHT" YOU WILL NOT BE ABLE TO CONNECT THE FLYING WIRES DURING WING ASSEMBLY. FOLLOW THE RIGGING SEQUENCE. DO NOT JUMP AROUND SKIPPING STEPS OR TAKING SHORT CUTS AS THIS WILL ONLY MAKE THE RIGGING PROCESS MORE COMPLEX. SOME OF THE CABLES HAVE ALREADY BEEN SWAGED TO LENGTH. THE REST YOU WILL HAVE TO CUT, TRIM, CLAMP, INSTALL AND ADJUST ON THE WING. ONE END OF ALL THE CABLES WHICH YOU WILL FINISH WILL BE SWAGED AND ATTACHED TO THE WING. THE OTHER END WILL BE LEFT CLAMPED FOR FINAL ADJUSTMENT WHEN ALL THE RIGGING IS COMPLETED. DO NOT PERMANENTLY SWAGE ANY CABLES TO LENGTH UNTIL ALL CABLE LENGTHS ARE COMPLETELY SET.

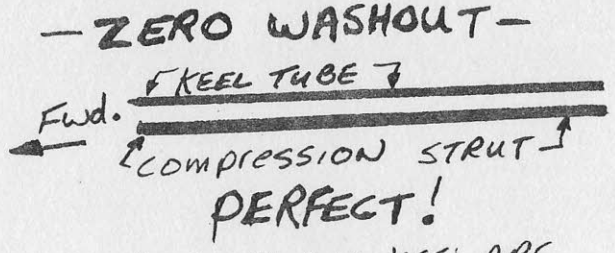
## 2.11

PHYSICALLY OUR WING IS RIGGED WITH BOTH SPARS STRAIGHT AND ALL THE COMPRESSION STRUTS ARE "PARALLEL". IN CONVENTIONAL AIRCRAFT THE WINGS TWIST GRADUALLY AS THEY EXTEND AWAY FROM THE FUSELAGE OR CENTER SECTION. THE WINGTIPS OF THE MACHINE FLY AT A LOWER ANGLE OF ATTACK THAN THE CENTER OF the WING SO the CENTER SECTION ALWAYS BEGINS TO STALL FIRST HELPING TO PREVENT THE MACHINE FROM ENTERING A SPIN. THIS EFFECT IS USUALLY REFERED TO AS "WASH OUT" OR "GEOMETRIC TWIST". IN THE KASPERWING, WASHOUT IS ACCOMPLISHED BY THE UPSWEPT HORIZONTAL STABILIZER INTERACTING WITH THE WINGTIP ASSEMBLY WHICH HELPS PREVENT THE WINGTIP FROM STALLING. WHEN ASSEMBLING THE RIGGING, YOU SHOULD TAKE PARTICULAR CARE TO SEE THAT THE SPARS COME OUT "STRAIGHT", NOT BOWED IN ANY DIRECTION. TOO MUCH CABLE TENSION OR CABLES IMPROPERLY ADJUSTED CAN CAUSE THE SPARS TO "BOW" UP OR DOWN. THE WING SHOULD BE RIGGED WITH "ZERO WASHOUT." BELOW ARE THREE DIAGRAMS ILLUSTRATING SOME OF THE POSSIBLE RIGGING CONFIGURATIONS YOU WILL ENCOUNTER. BY SIGHTING DOWN ALONG THE COMPRESSION STRUTS, COMPARING THEM TO THE KEEL TUBE, YOU WILL BE ABLE TO ADJUST CABLE LENGTHS AND TENSION TO ALIGN KEEL AND STRUTS QUITE ACCURATELY.



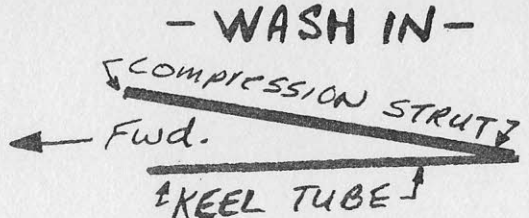

NOT GOOD

NO MORE THAN 1-DEGREE DIFFERENCE ALLOWED




PERFECT!

STRUTS AND KEEL ARE "PARALLEL"




BAD!

NO AMOUNT OF WASH IN CAN BE TOLERATED. ANY WILL RESULT IN POSSIBLE DANGEROUS CONDITION.

## 2.11A

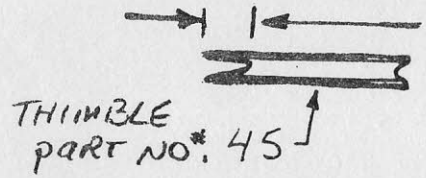
THE THREE DIAGRAMS ON PAGE 2.11 ILLUSTRATE THE LIMITS OF RIGGING TOLERANCE ALLOWED, AS VIEWED LOOKING DOWN THE LEFT WING FROM TIP TOWARDS THE CENTER. AS SEEN FROM THE DIAGRAMS, UP TO ONE DEGREE OF "WASHOUT" CAN BE TOLERATED BUT NO AMOUNT OF "WASH IN" SHOULD EVER BE PERMITTED. THIS IS THE SINGLE MOST IMPORTANT THING TO KEEP IN MIND WHEN COMPLETING THE RIGGING. IF AT ANY TIME DURING OR AFTER THE RIGGING PROCESS YOU DISCOVER A WASHIN CONDITION EXISTS, DO NOT FLY THE MACHINE UNTIL YOU HAVE ADJUSTED OR REPLACED THOSE CABLES WHICH ARE CAUSING THE "WASH IN". CABLE TENSION WILL PLAY AN IMPORTANT PART DEFINING "WASH IN" OR "WASHOUT". IF YOUR WING APPEARS PROPERLY RIGGED while on the ground, it can STILL HAVE "WASH IN" OR WASHOUT IN FLIGHT IF THE TENSION ON THE LEADING EDGE FLYING WIRES IS GREATER OR LESSER THAN THAT ON THE REAR SPAR. PRIOR to PERMANENTLY SWAGING ALL THE RIGGING, HAVE A HELPER OR TWO LIFT THE WING BY THE CENTER OF THE OUTBOARD COMPRESSION STRUTS TO SIMULATE A POSITIVE FLIGHT LOAD WHILE YOU AGAIN SIGHT DOWN OR MEASURE THE COMPRESSION STRUTS LOOKING FOR "ZERO-WASHOUT." BE SURE TO TIGHTEN CABLE CLAMPS ENOUGH TO KEEP THE CABLES FROM SLIPPING DURING THIS FINAL CHECK PRIOR TO SWAGING.

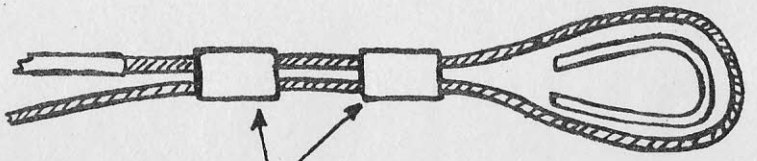
WING SYMMETRY IS ANOTHER IMPORTANT DETAIL. TRY TO GIVE BOTH WINGS THE EXACT SAME GEOMETRY. ZERO-WASHOUT ON THE LEFT WING AND ONE DEGREE OF WASHOUT ON THE RIGHT CAN CAUSE THE WING TO TURN RIGHT UNDER CERTAIN CONDITIONS. TRY TO MAKE BOTH WINGS EXACTLY THE SAME. TAKE YOUR TIME AND WORK SLOWLY. STRIVE FOR ACCURACY AND PERFECTION, AS THIS STAGE OF ASSEMBLY CAN PROFOUNDLY AFFECT HOW YOUR KASPERWING PERFORMS.

2.12 TO MAKE UP UPPER RIGGING (LANDING-WIRES), BEGIN BY CUTTING 6-pieces of coated 3/32" CABLE FROM 190ft. ROLL PROVIDED.

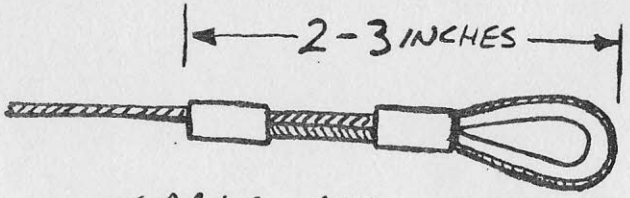
1. _____ 112" LONG - 2EA.
2. _____ 178" LONG - 2EA.
3. _____ 105" LONG - 2EA.

USE A POCKET KNIFE OR OTHER SUITABLE TOOL TO (STRIP) REMOVE ABOUT 8" OF COATING FROM ONE END OF EACH CABLE.



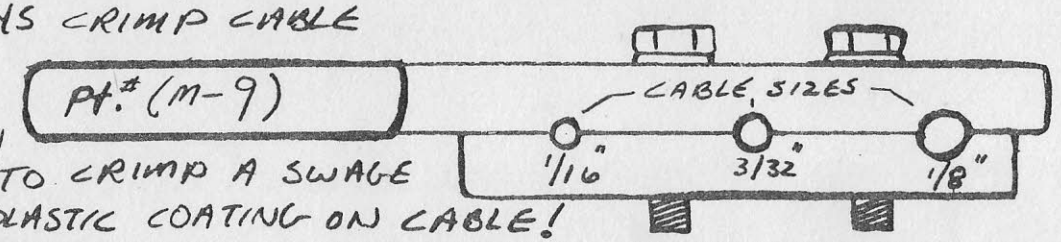



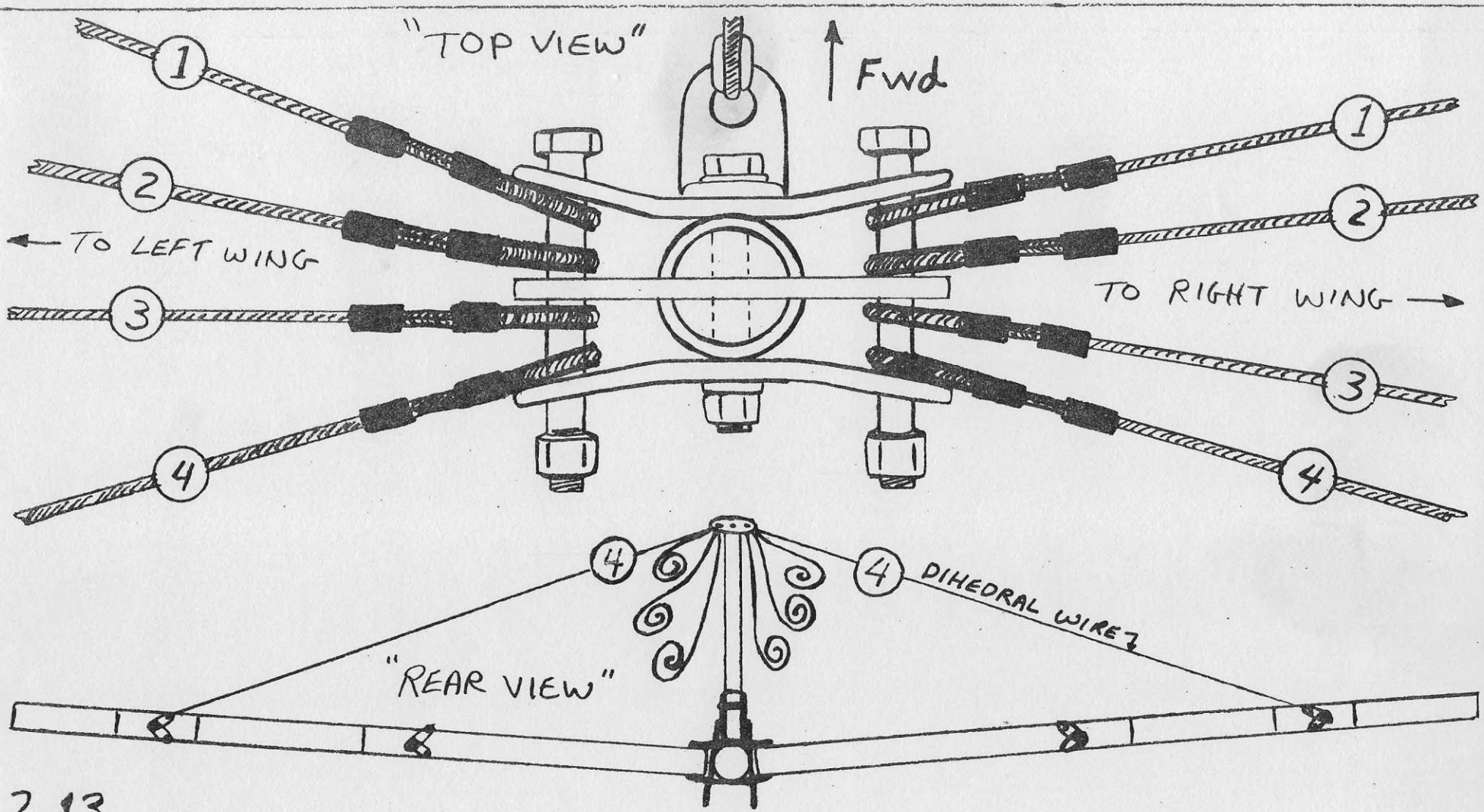
SLIP TWO SWAGES, PART NO.# 46 OVER STRIPPED END OF CABLE, PASS CABLE AROUND THIMBLE AND BACK THROUGH SWAGES AS SHOWN.




PULL SWAGE UP "TIGHT" AGAINST BACK OF THIMBLE AND CRIMP SWAGE PERMANENTLY INTO POSITION AS SHOWN USING PROPER CRIMPING TOOL. TRIM EXCESS CABLE AND CRIMP A SECOND SWAGE INTO POSITION OVER CUT END OF CABLE AS SHOWN.

CAUTION: BE SURE TO USE PROPER HOLE IN SWAGING TOOL WHEN CRIMPING CABLE. ALWAYS CRIMP CABLE EVENLY AND COMPLETELY BY TIGHTENING BOLTS TIGHT SO THAT SWAGES ARE THOROUGHLY CRIMPED. NEVER ATTEMPT TO CRIMP A SWAGE OVER THE OUTSIDE OF CLEAR PLASTIC COATING ON CABLE!






2.13

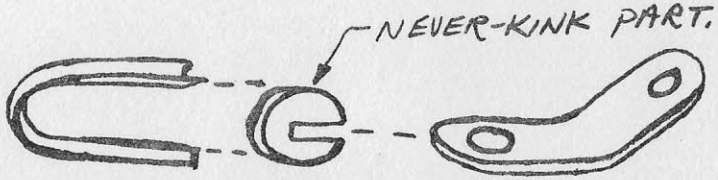
CONNECT ALL UPPER RIGGING TO KINGPOST AS SHOWN. REAR VIEW SHOWS POSITION OF CABLES READY TO BE CLAMPED INTO POSITION PRIOR TO SWAGING. TOP VIEW SHOWS PLACEMENT OF ALL UPPER RIGGING CABLES RELATIVE TO EACH OTHER AFTER THEY HAVE BEEN **CLAMPED TO WINGSPAR TANGS.**

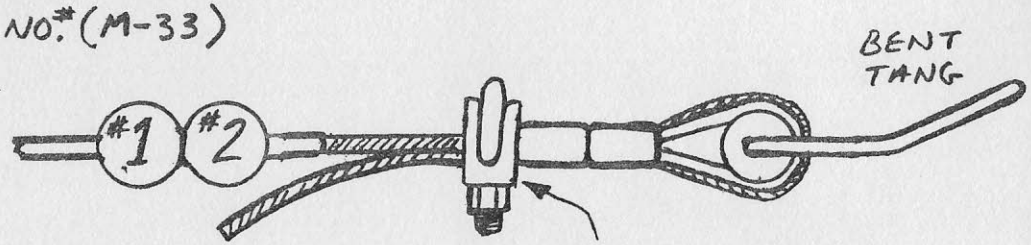
FROM STEP # 2.12

1. TO LEADING EDGE SPAR - INBOARD
2. TO LEADING EDGE SPAR - OUTBOARD
3. TO TRAILING EDGE SPAR - INBOARD
4. TO TRAILING EDGE SPAR - OUTBOARD

NOTE: DIHEDRAL WIRE (CABLE #4) comes as a pre-swaged assembly supplied with KIT.

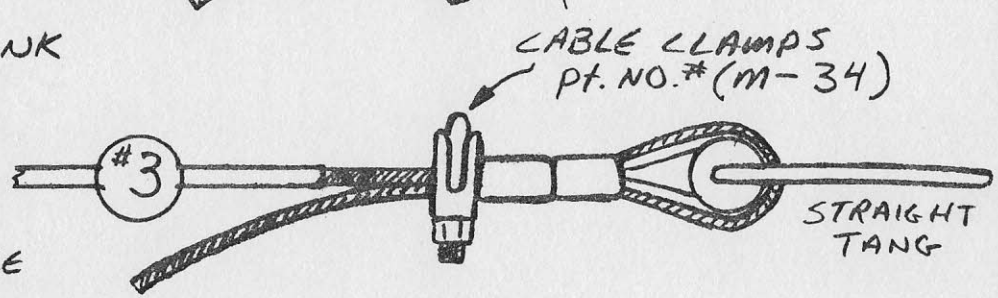
# 2.14 CLAMP CABLES #1, #2 AND #3 TO WING SPAR TANGS USING PROPER THIMBLES, SWAGES, NEVER-KINKS AND CLAMPS AS SHOWN.

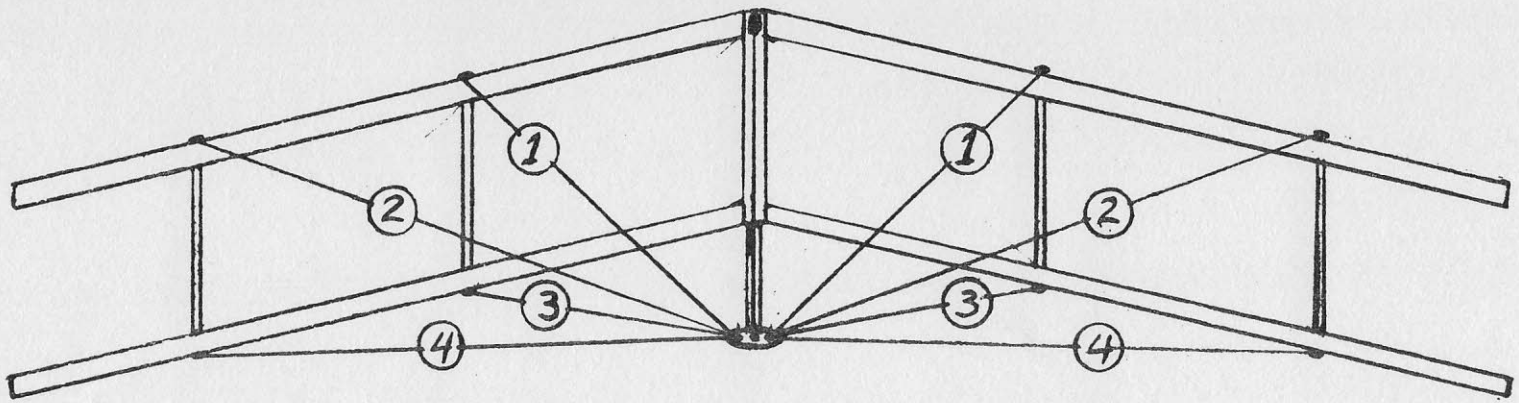



TRIM ENDS OF THIMBLE AND SPREAD OPEN AS SHOWN. INSTALL NEVER-KINK ON TANG END WITH LARGE HOLE. PLACE THIMBLE IN POSITION AROUND NEVER-KINK AND SQUEEZE THIMBLE CLOSED USING PLIERS. CLAMP CABLE AND TWO SWAGES TO TANG AND THIMBLE AS SHOWN. TIGHTEN CLAMP ONLY ENOUGH TO KEEP CABLE FROM SLIPPING.

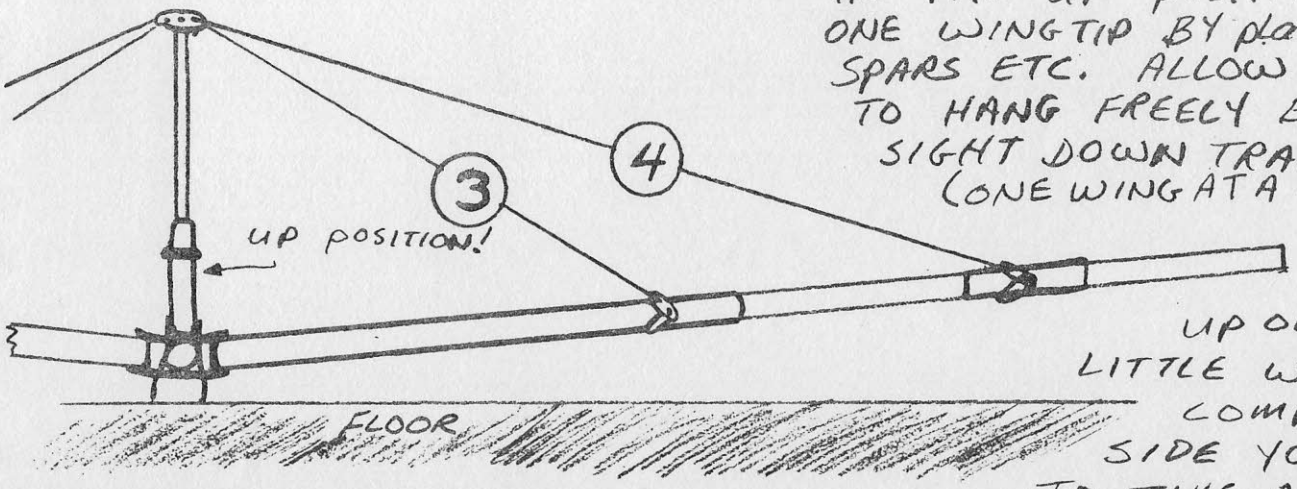
NOTE: BE SURE TO PEEL BACK CABLE COATING BEFORE CLAMPING OR SWAGING. NEVER CRIMP A SWAGE OVER THE CABLE COATING!

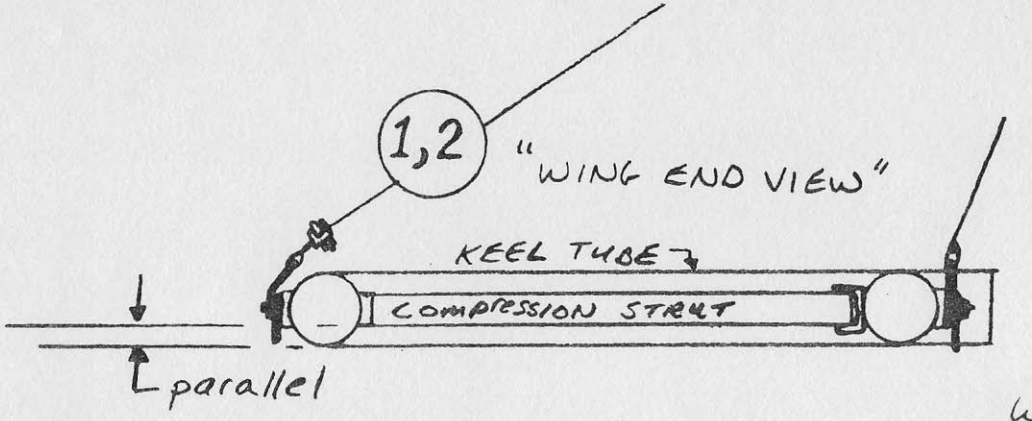



CLAMP CABLES INTO POSITION, DO NOT SWAGE YET!

2.15 MAKE SURE THAT KING-POST TENSIONER IS IN THE "UP" POSITION! ANCHOR THE END OF ONE WINGTIP BY PLACING WEIGHT ON TOP OF SPARS ETC. ALLOW THE OTHER SIDE OF WING TO HANG FREELY BY CABLES #3 AND #4. SIGHT DOWN TRAILING EDGE SPAR TUBE (ONE WING AT A TIME) AND ADJUST LENGTH OF CABLE #3 UNTIL SPAR IS STRAIGHT (NOT BOWING UP OR DOWN). YOU CAN ADD A LITTLE WEIGHT TO THE INBOARD COMPRESSION STRUT ON THE SIDE YOU ARE RIGGING IN ORDER TO TAKE ANY SLACK OUT OF CABLE #3, OR SIMPLY HAVE A HELPER APPLY A LITTLE DOWN PRESSURE TO STRUT WHILE YOU SIGHT DOWN SPAR. WHEN YOU ARE CONFIDENT REAR SPAR IS AS STRAIGHT AS POSSIBLE, CLAMP CABLE #3 INTO POSITION. REPEAT PROCESS TO OTHER SIDE OF WING.



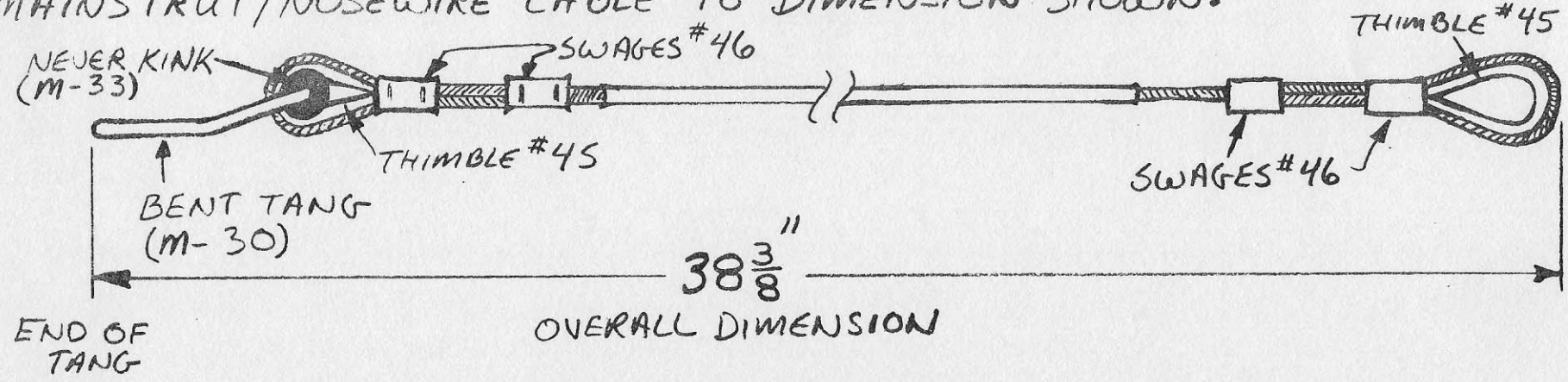



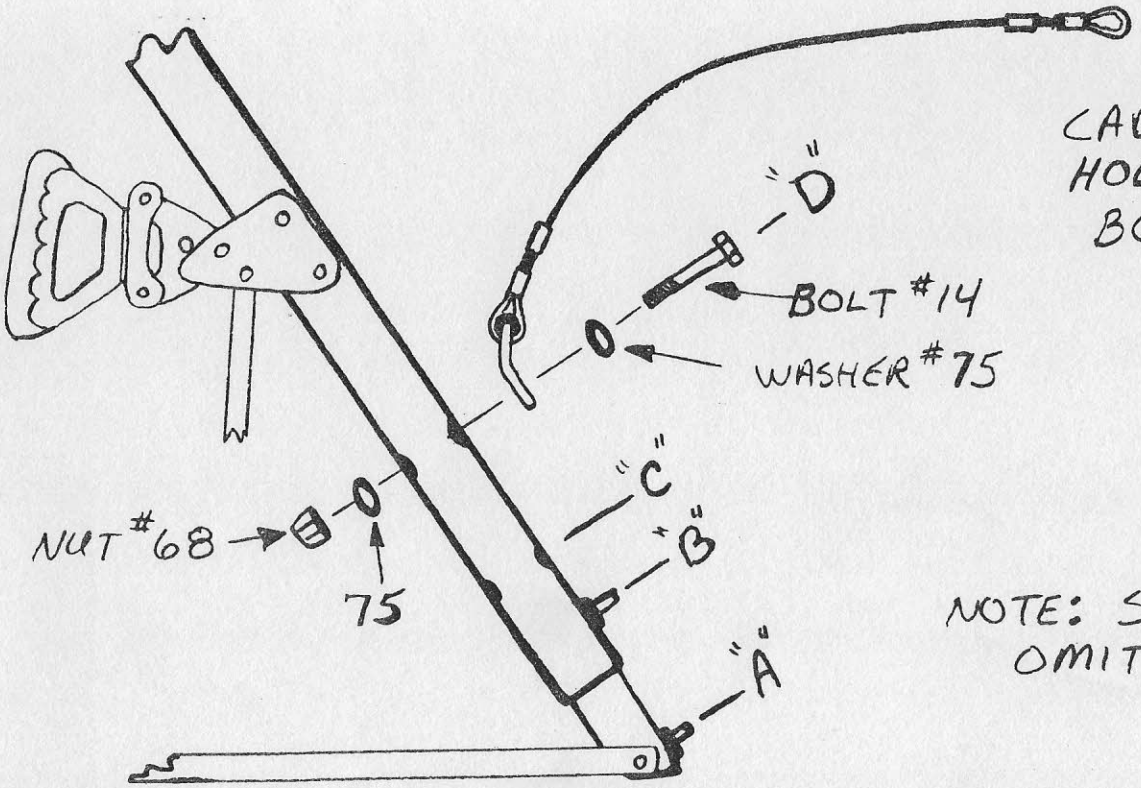

ADJUST CABLES #1 AND #2 UNTIL COMPRESSION STRUTS ARE ALIGNED "PARALLEL" TO KEEL TUBE AND CLAMP CABLES INTO POSITION.

NOW THAT YOU KNOW HOW THE UPPER RIGGING ATTACHES TO THE WING, UNBOLT SPARS, STRUTS, KEEL TUBE, KINGPOST AND ALL UPPER RIGGING AND DRAG WIRES. CAREFULLY NOTE WHAT POSITION ALL THE COMPONENTS WERE IN PRIOR TO DIS-ASSEMBLY! LAY WING COVERING (SAIL), BOTTOM SIDE UP ON A FLAT "CLEAN" SURFACE. SLIP SPAR TUBES INTO SPAR POCKETS. ATTACH KEEL TUBE, COMPRESSION STRUTS AND DRAG WIRES AS BEFORE BUT DO NOT TIGHTEN BOLTS. FLIP WING OVER AND ATTACH KING-POST AND UPPER RIGGING.

# 2.15A

CUT A PEICE OF 3/32" CABLE, 48" LONG. STRIP ABOUT 8" OF PLASTIC COATING FROM BOTH ENDS. MAKE UP A MAINSTRUT/NOSEWIRE CABLE TO DIMENSION SHOWN.

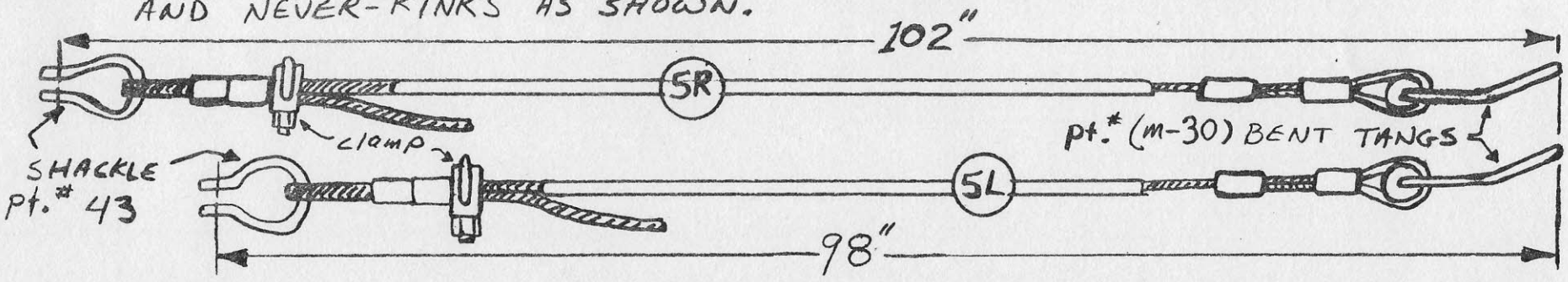



ATTACH MAINSTRUT/NOSEWIRE CABLE TO MAINSTRUT TUBE AT HOLE "D" AS SHOWN. TIGHTEN BOLT #14 SECURELY!

NOTE: STEERING FORK AND MISC. HOWR, OMITTED FOR CLARITY

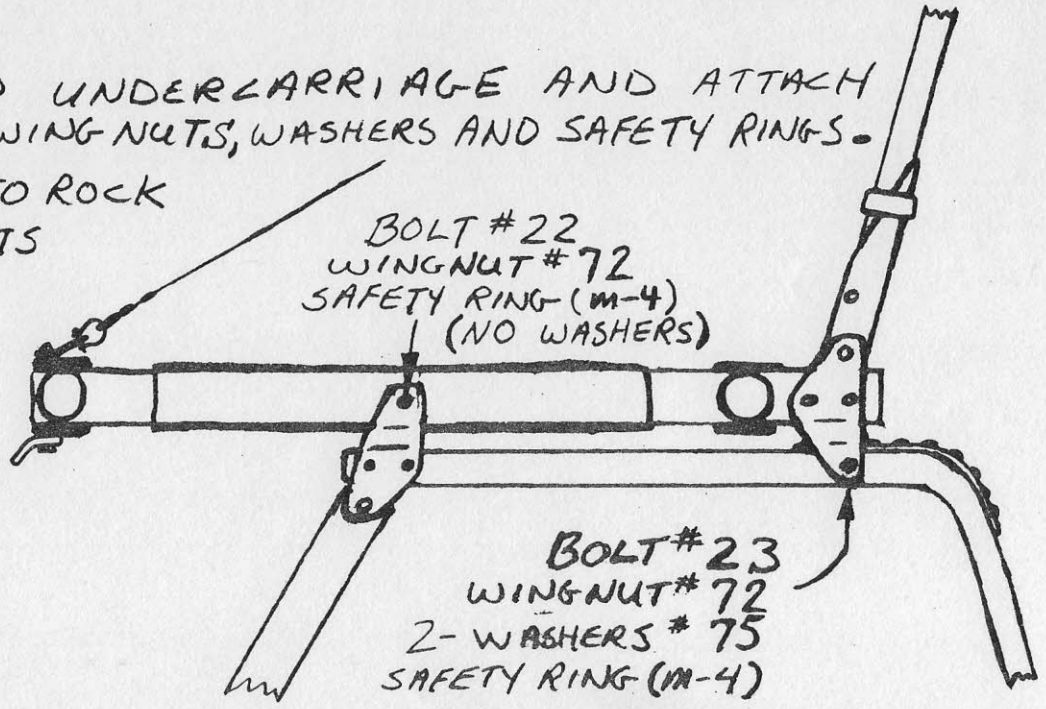
2.16 CUT ONE PIECE OF 3/32" CABLE 114" LONG AND ONE PIECE 110" LONG. STRIP ABOUT 8" OF COATING FROM ONE END OF EACH CABLE AND SWAGE ENDS TO TANGS USING PROPER SWAGES, THIMBLES AND NEVER-KINKS AS SHOWN.




STRIP ABOUT 12" OF COATING FROM UN-SWAGED END OF CABLES AND ATTACH SHACKLES TO CABLE ENDS USING PROPER THIMBLES, SWAGES AND CABLE CLAMPS AS SHOWN. ADJUST ASSEMBLED CABLES TO LENGTHS SHOWN AND TIGHTEN CLAMP ONLY TIGHT ENOUGH TO KEEP CABLE FROM SLIPPING.

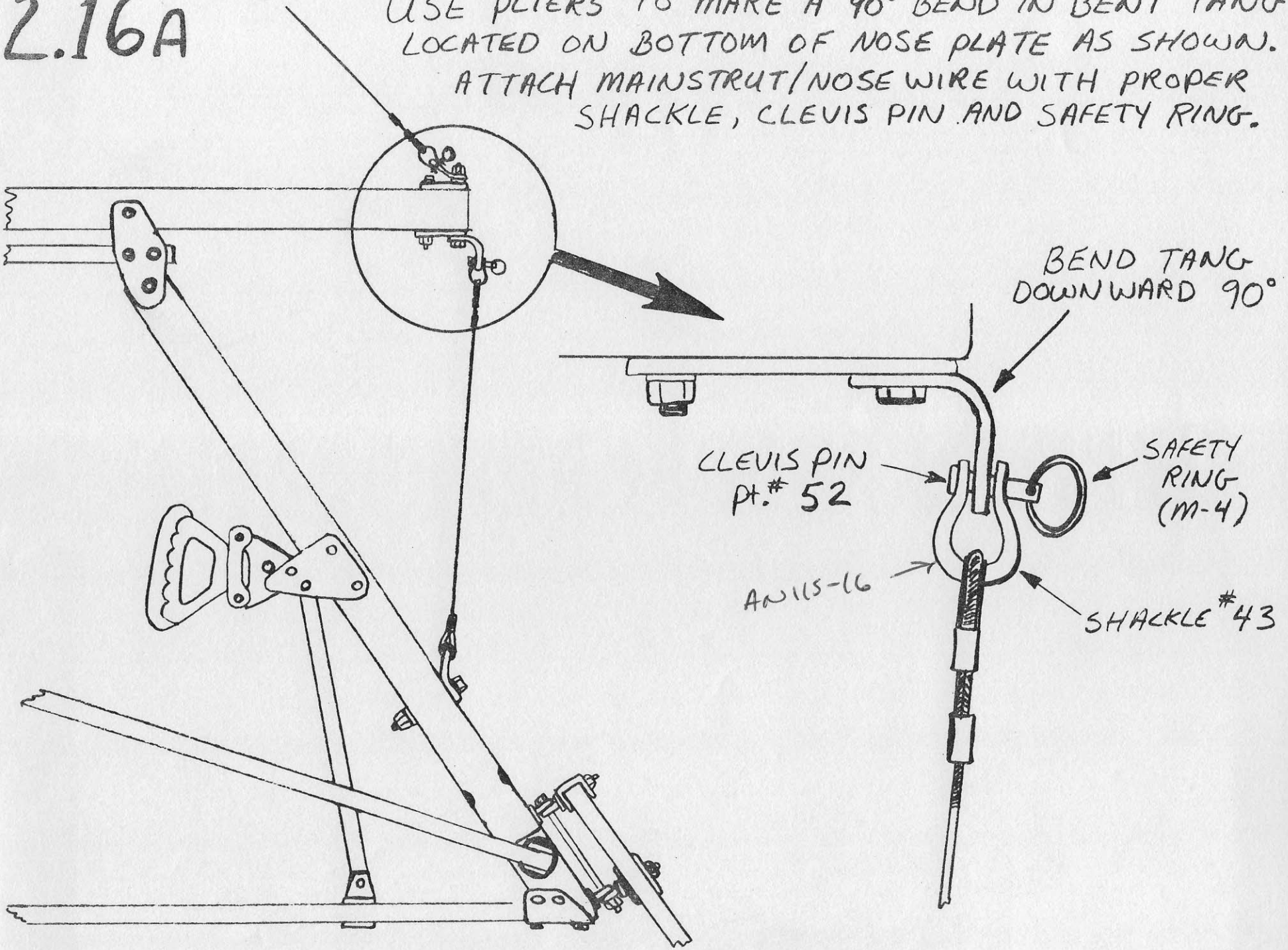
SET WING ON TOP UNDERCARRIAGE AND ATTACH WITH PROPER BOLTS, WING NUTS, WASHERS AND SAFETY RINGS.

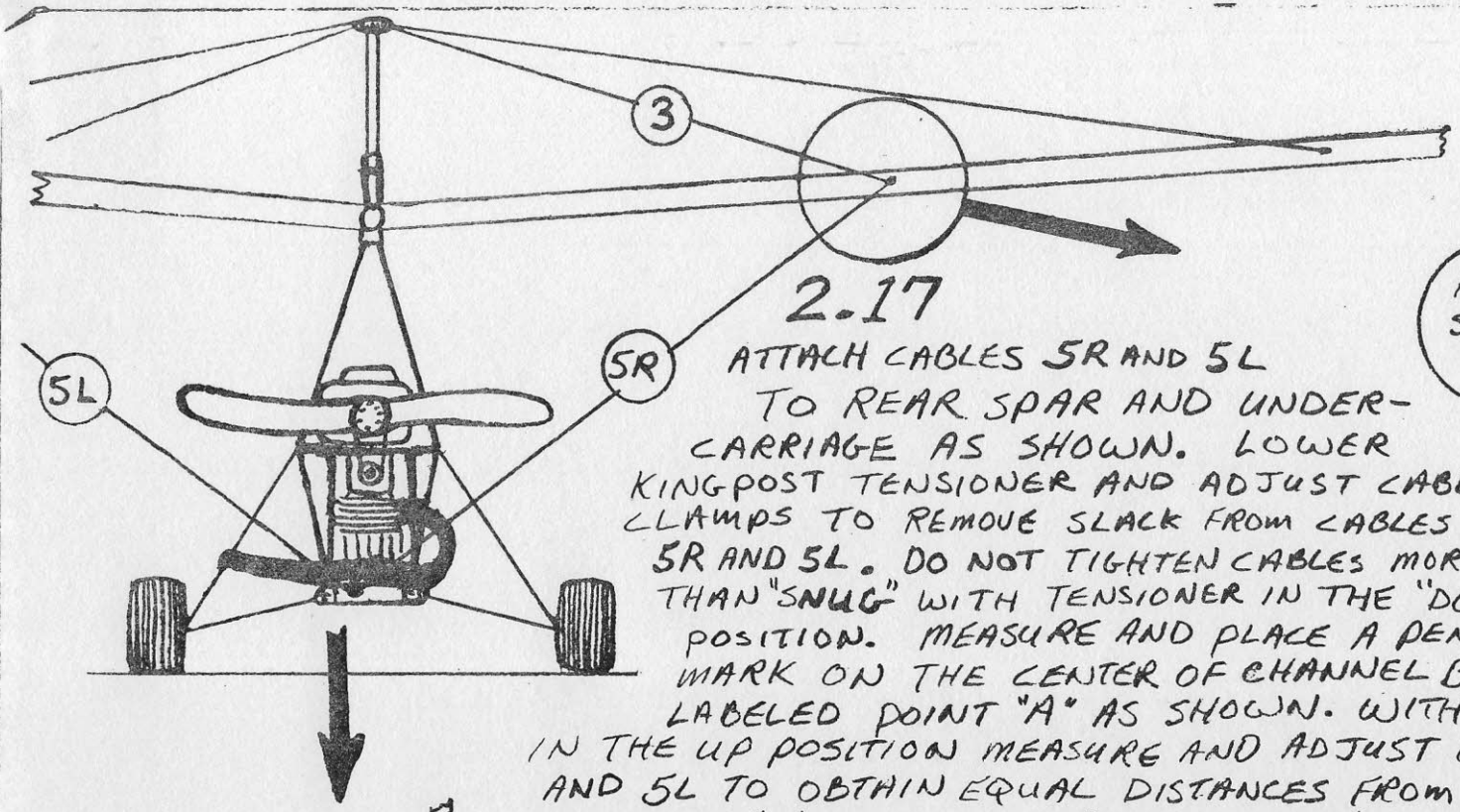
NOTE: DO NOT ALLOW WING TO ROCK FROM SIDE TO SIDE WITH BOLTS INSTALLED OR FRAME DAMAGE MAY RESULT.



# 2.16A

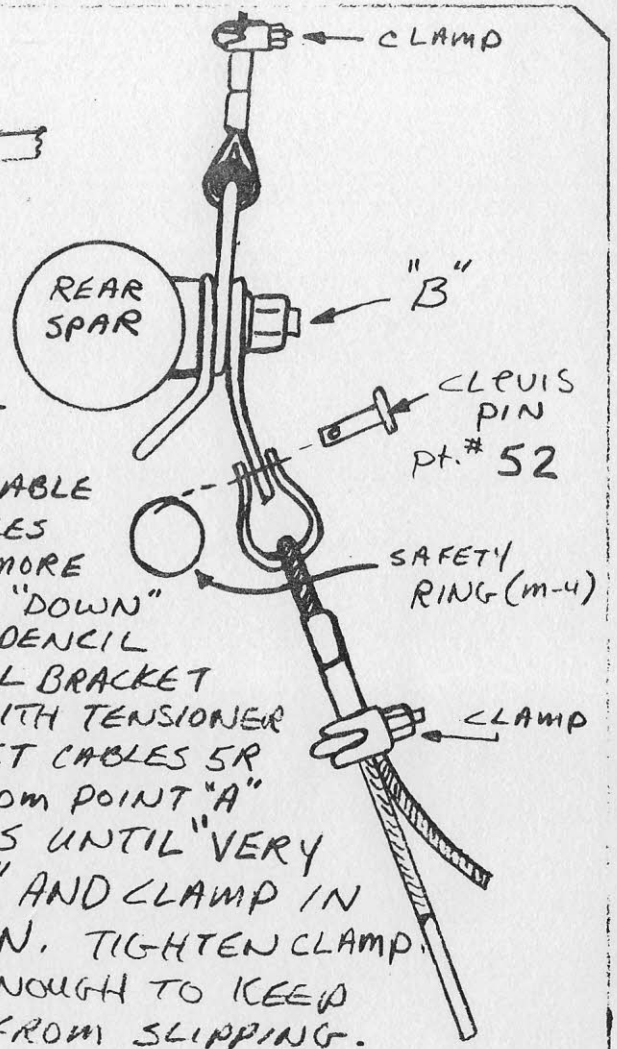
USE PLIERS TO MAKE A 90° BEND IN BENT TANG LOCATED ON BOTTOM OF NOSE PLATE AS SHOWN. ATTACH MAINSTRUT/NOSE WIRE WITH PROPER SHACKLE, CLEVIS PIN AND SAFETY RING.

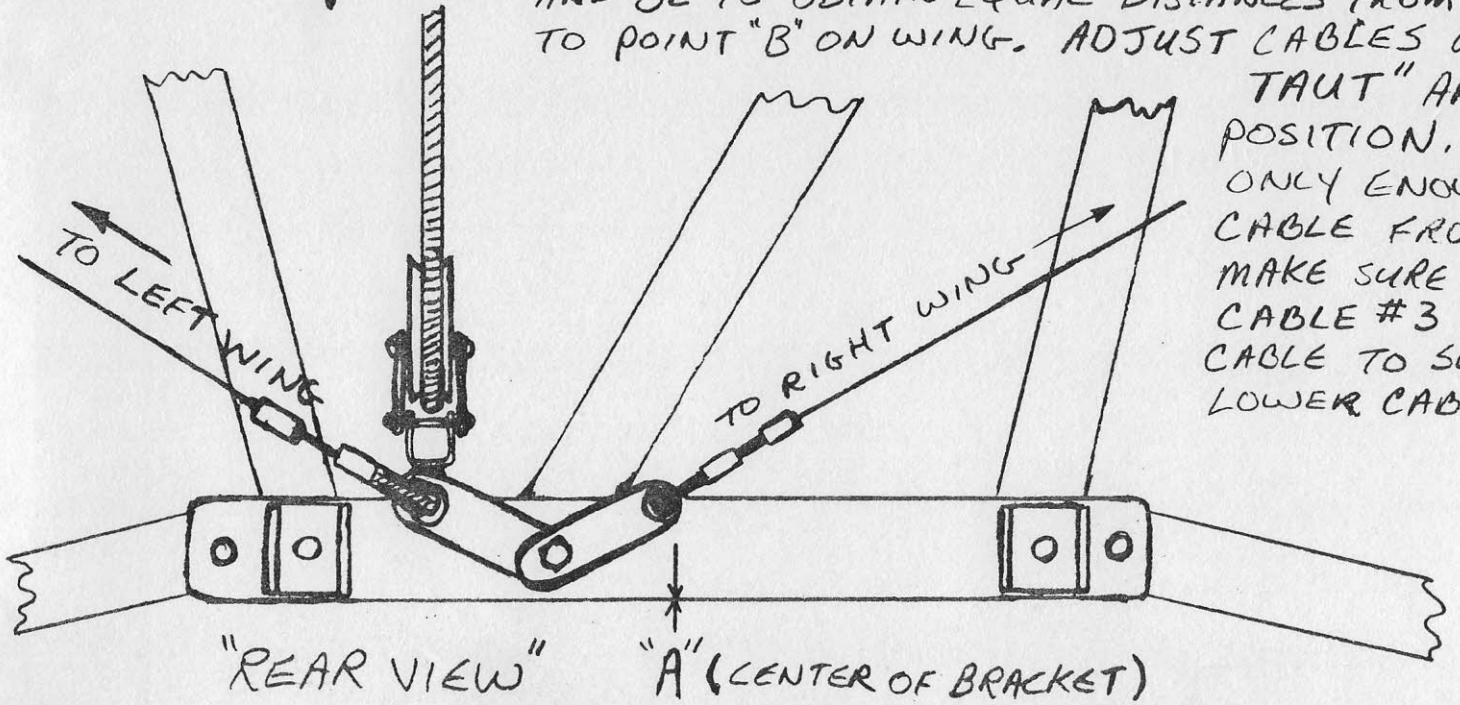





# 2.17

ATTACH CABLES 5R AND 5L TO REAR SPAR AND UNDER-CARRIAGE AS SHOWN. LOWER KINGPOST TENSIONER AND ADJUST CABLE CLAMPS TO REMOVE SLACK FROM CABLES 5R AND 5L. DO NOT TIGHTEN CABLES MORE THAN "SNUG" WITH TENSIONER IN THE "DOWN" POSITION. MEASURE AND PLACE A PENCIL MARK ON THE CENTER OF CHANNEL BRACKET LABELED POINT "A" AS SHOWN. WITH TENSIONER IN THE UP POSITION MEASURE AND ADJUST CABLES 5R AND 5L TO OBTHIN EQUAL DISTANCES FROM POINT "A" TO POINT "B" ON WING. ADJUST CABLES UNTIL "VERY TAUT" AND CLAMP IN POSITION. TIGHTEN CLAMP ONLY ENOUGH TO KEEP CABLE FROM SLIPPING. MAKE SURE THAT CLAMP ON UPPER CABLE #3 HAS NOT ALLOWED CABLE TO SLIP WHILE ADJUSTING LOWER CABLES.



## 2.18

Cut 8-PIECES OF 3/32" CABLE INTO 4-PAIRS OF VARIOUS LENGTHS AS SHOWN. STRIP ABOUT 12" OF COATING FROM EACH CABLE END.

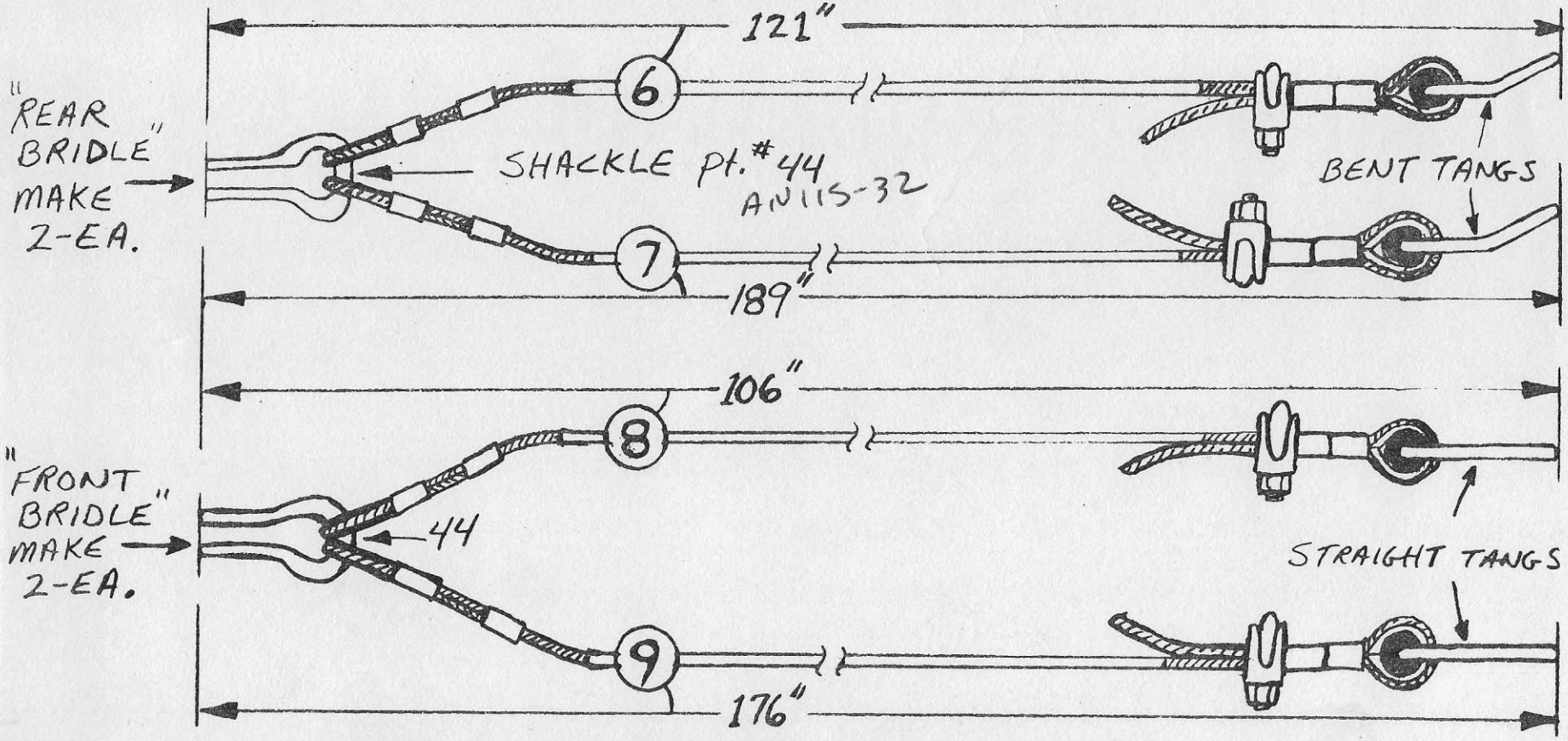
#6 - 2EA. 131" LONG

#7 - 2EA. 199" LONG

#8 - 2EA. 116" LONG

#9 - 2EA. 186" LONG

REMOVE THE 8-TANGS FROM WING WHICH DON'T ALREADY HAVE A CABLE ATTACHED AND MAKE UP FOUR-FLYING WIRE BRIDALS AS SHOWN. SWAGE CABLES TO SHACKLES AND CLAMP TO TANGS AS IN STEP # 2.14

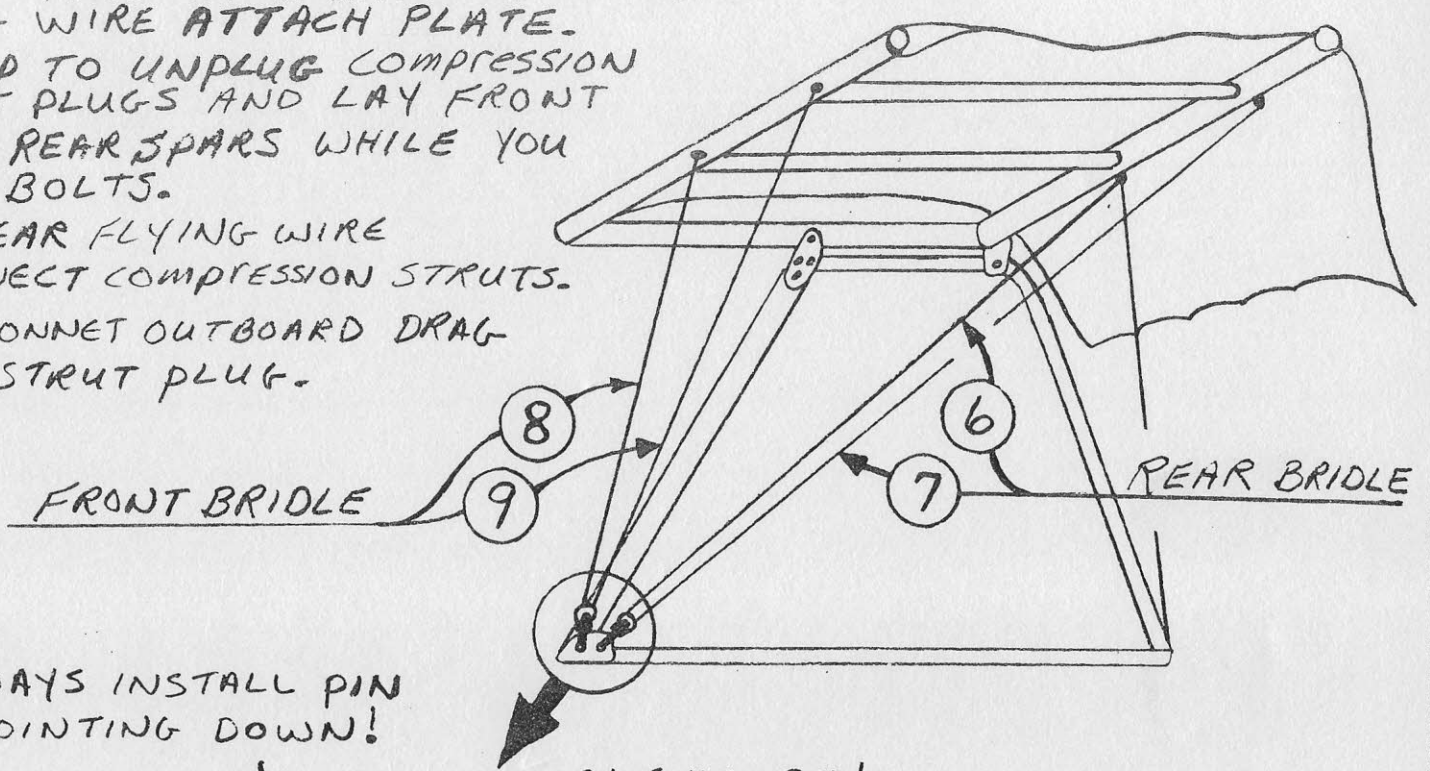


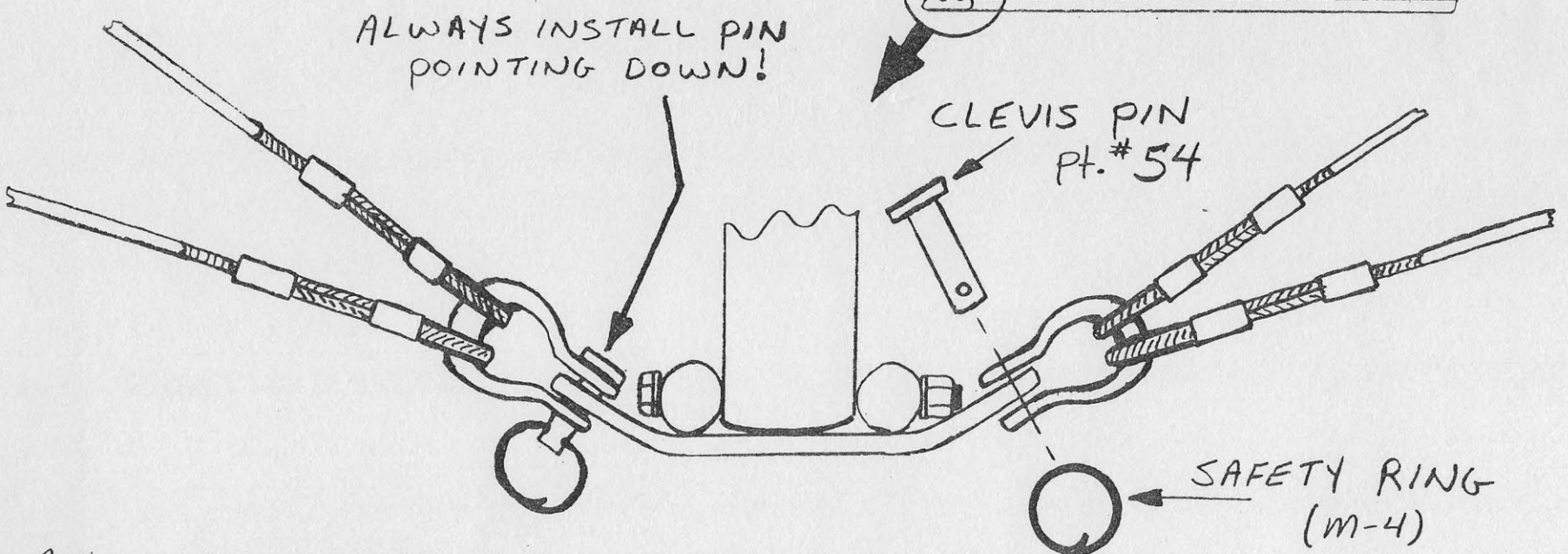
# 2.18A

CONNECT FLYING WIRE BRIDLES TO WING SPARS AND FLYING WIRE ATTACH PLATE. IT MAY HELP TO UNPLUG COMPRESSION STRUTS FROM STRUT PLUGS AND LAY FRONT SPARS BACK ON TOP REAR SPARS WHILE YOU REMOVE FRONT SPAR BOLTS.

ATTACH FRONT AND REAR FLYING WIRE BRIDLES AND RE-CONNECT COMPRESSION STRUTS.

DON'T FORGET TO RE-CONNET OUTBOARD DRAG WIRE TANG BENEATH STRUT PLUG.

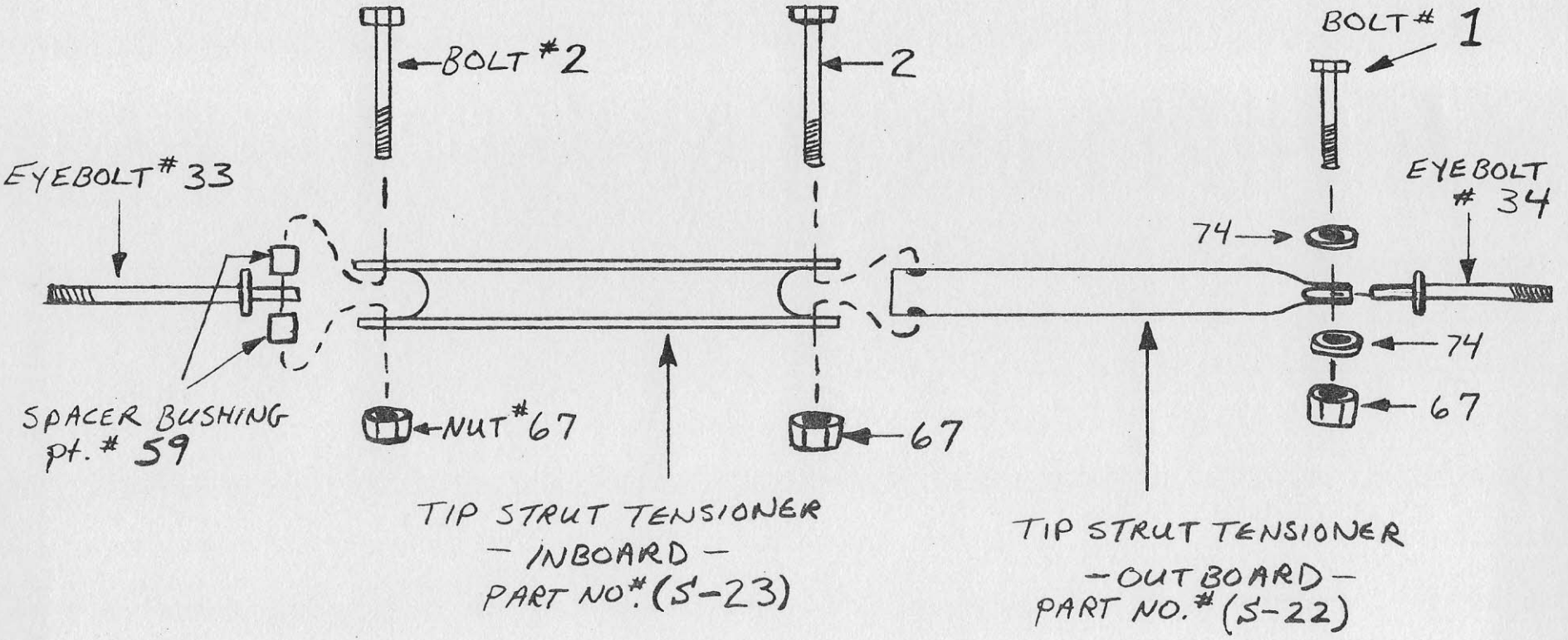


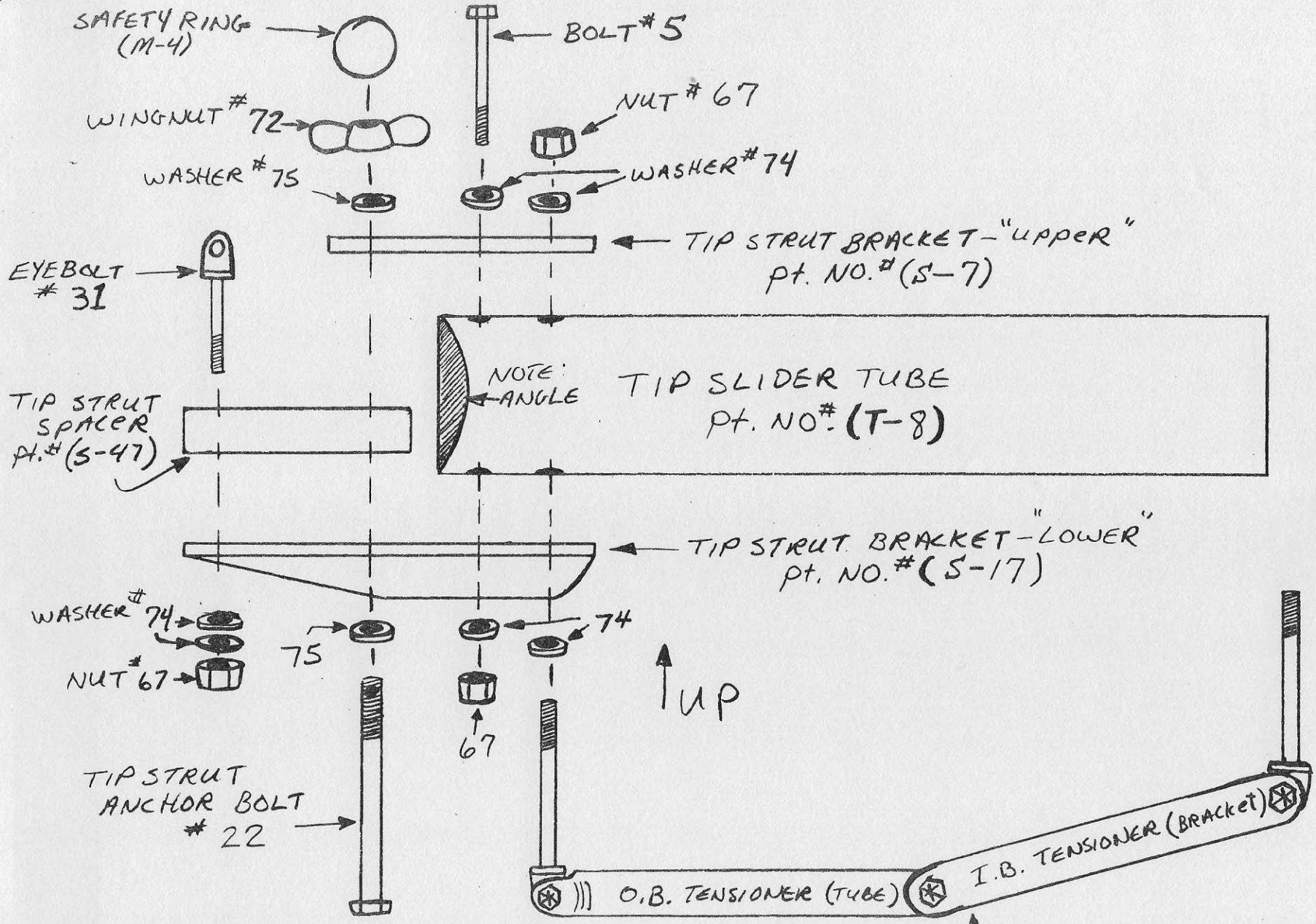




ATTACH BRIDLES TO FLYING WIRE PLATE WITH CLEVIS PINS AND SAFETY RINGS AS SHOWN. ALWAYS INSTALL PINS POINTING DOWN SO THEY MUST "FALL UP" TO FALL OUT.

**2.19** CONSTRUCT TWO-EACH, TIP STRUT TENSIONER ASSEMBLIES (ONE PAIR FOR EACH WING) USING PROPER NUTS, BOLTS AND WASHERS AS SHOWN. TIGHTEN NUTS AND BOLTS SNUG, BUT LEAVE LOOSE ENOUGH TO ALLOW ALL PARTS TO WORK FREELY.

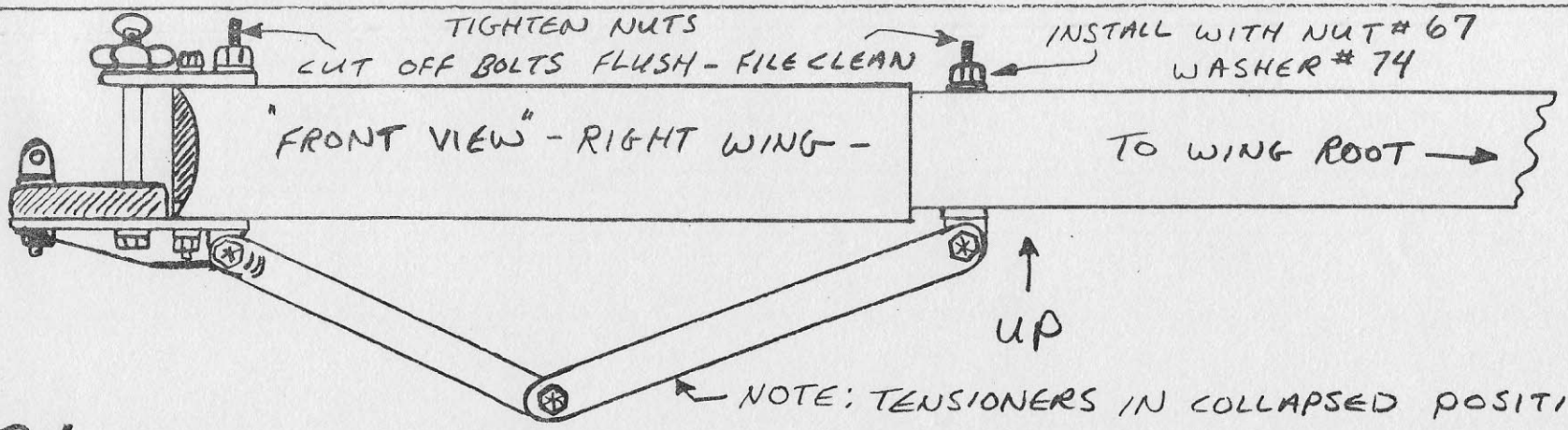
## TIP STRUT TENSIONER ASSEMBLY
"TOP VIEW"



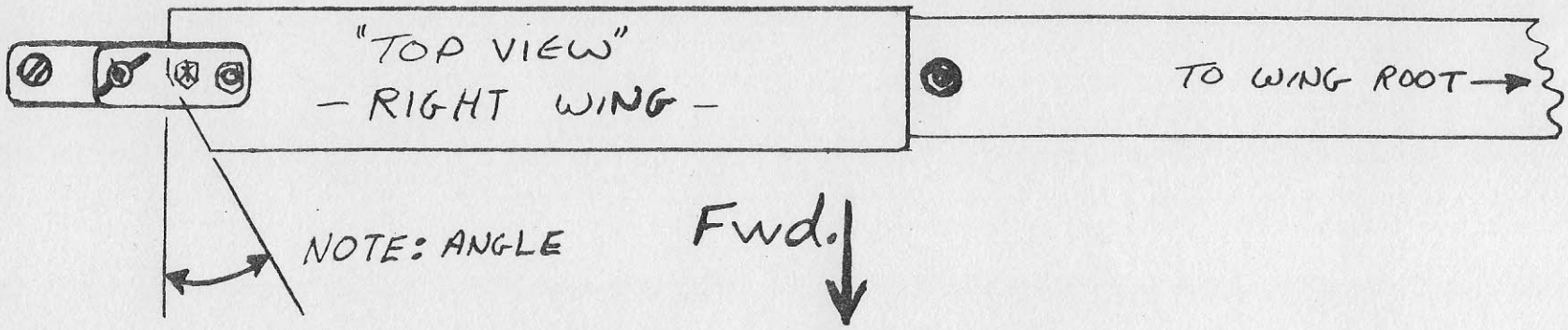



## 2.20

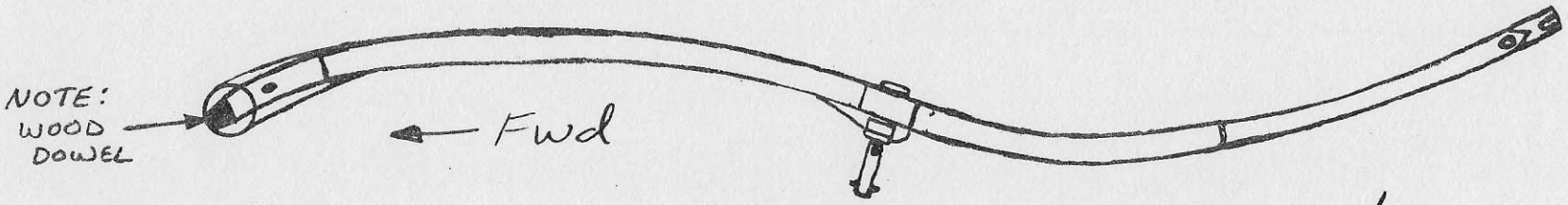
ASSEMBLE TWO-EACH, TIPSLIDER/TENSIONER ASSEMBLIES (ONE FOR EACH WING) USING PROPER NUTS, BOLTS, WASHERS AND BRACKETS AS SHOWN. NOTE: ANGLE IN END OF TIP SLIDER TUBE FACES FORWARD!




2.21 INSTALL TIP SLIDER/TENSIONER ASSEMBLIES ON TIP OF REAR SPARS AS SHOWN. MAKE SURE THERE ARE NO "BURRS" OR FOREIGN MATTER INSIDE TIP SLIDER TUBE PRIOR TO INSTALLATION. TO MAINTAIN SMOOTH OPERATION IT WILL HELP TO SQUIRT A LITTLE W.D.40 OR OTHER SUITABLE LIGHTWEIGHT LUBRICANT INSIDE TIP SLIDER TUBE BEFORE MOUNTING ON REAR SPAR. BE SURE TO WIPE OFF ANY EXCESS. CUT OFF PROTRUDING ENDS OF EYEBOLTS AND SMOOTH WITH A FILE. THIS WILL PREVENT ABRASION OF WING COVER (SAIL). BEFORE PERMANENT MOUNTING, BE SURE THAT LEFT TIP SLIDER ASSEMBLY AND RIGHT TIP SLIDER ASSEMBLY ARE MOUNTED ON THEIR PROPER RESPECTIVE WING TIPS AS INDICATED BY ANGLE CUT IN END OF TIP SLIDER TUBE! ANGLE ALWAYS FACES FORWARD.

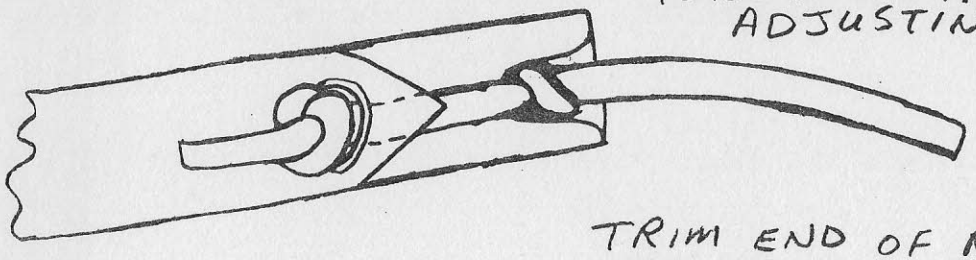


**2.22** LOCATE LEFT AND RIGHT SIDE TIP STRUT ASSEMBLIES. NOTCH AT REAR OF TIP STRUT ALWAYS FACES OUTWARD AWAY FROM CENTER OF WING. THIS DISTINGUISHES LEFT FROM RIGHT TIP STRUTS. CHECK THAT TIP STRUT TENSIONERS ARE IN THE COLLAPSED POSITION. REMOVE TIP STRUT ANCHOR BOLTS FROM TIP STRUT BRACKETS. INSERT REAR END OF TIP STRUT INTO FRONT OF TIP STRUT POCKET. SLIDE END OF TIP STRUT BACK THROUGH TIP STRUT BRACKETS AND CONTINUE TO SLIDE REARWARD UNTIL END PROTRUDES FROM BACK OF TIP STRUT POCKET. INSERT FRONT END OF TIP STRUT THROUGH HOLE LOCATED ON REAR SIDE OF FRONT SPAR TIP AS SHOWN.



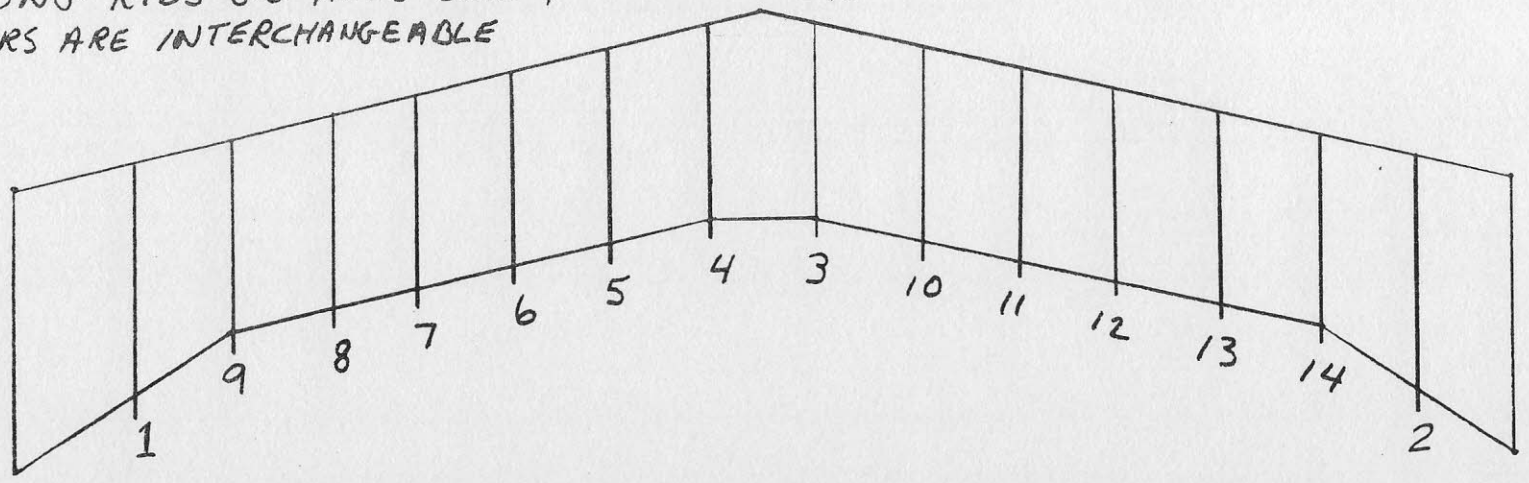

— ALWAYS SLIDE STRUT INTO POCKET FROM FRONT TO REAR ! —

USE A "HOT KNIFE" OR SOLDER GUN WITH CUTTING TIP TO CUT AND HEAT SEAL TWO PIECES OF 1/4" NYLON ROPE, EACH 13" LONG. TIE A SQUARE KNOT ABOUT ONE INCH FROM END OF EACH ROPE. SLIP FREE END OF ROPE THROUGH SAIL GROMMET LOCATED AT EACH WINGTIP. TIE ANOTHER KNOT ABOUT 1/4" FROM THE FIRST ONE. PULL ROPE REARWARD STRETCHING SAIL "TAUGHT" AND HOOK KNOT IN NOTCH IN END OF TIP STRUT. IF IT BECOMES TOO DIFFICULT TO HOOK KNOT IN NOTCH, LOOSEN KNOT A LITTLE TO GIVE ROPE A LITTLE MORE SLACK. BE SURE FRONT END OF TIP STRUT IS "SEATED" IN FRONT SPAR AND TIP STRUT TENSIONERS ARE COLLAPSED WHEN HOOKING OR ADJUSTING ROPE. RE-INSTALL TIP STRUT ANCHOR BOLT AND SECURE WITH A WING NUT AND SAFETY RING.



TRIM END OF ROPE TO LEAVE ABOUT 3 INCHES PROJECTING REARWARD FROM NOTCH AS SHOWN.

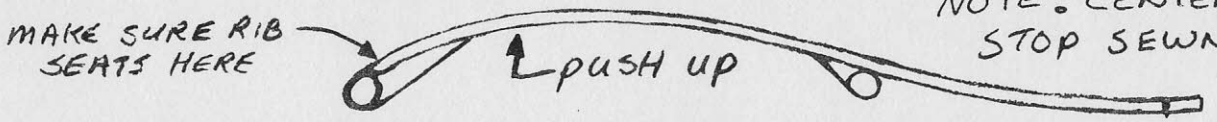
NOTE: LONG RIBS GO INTO END POCKETS ONLY.
ALL OTHERS ARE INTERCHANGEABLE

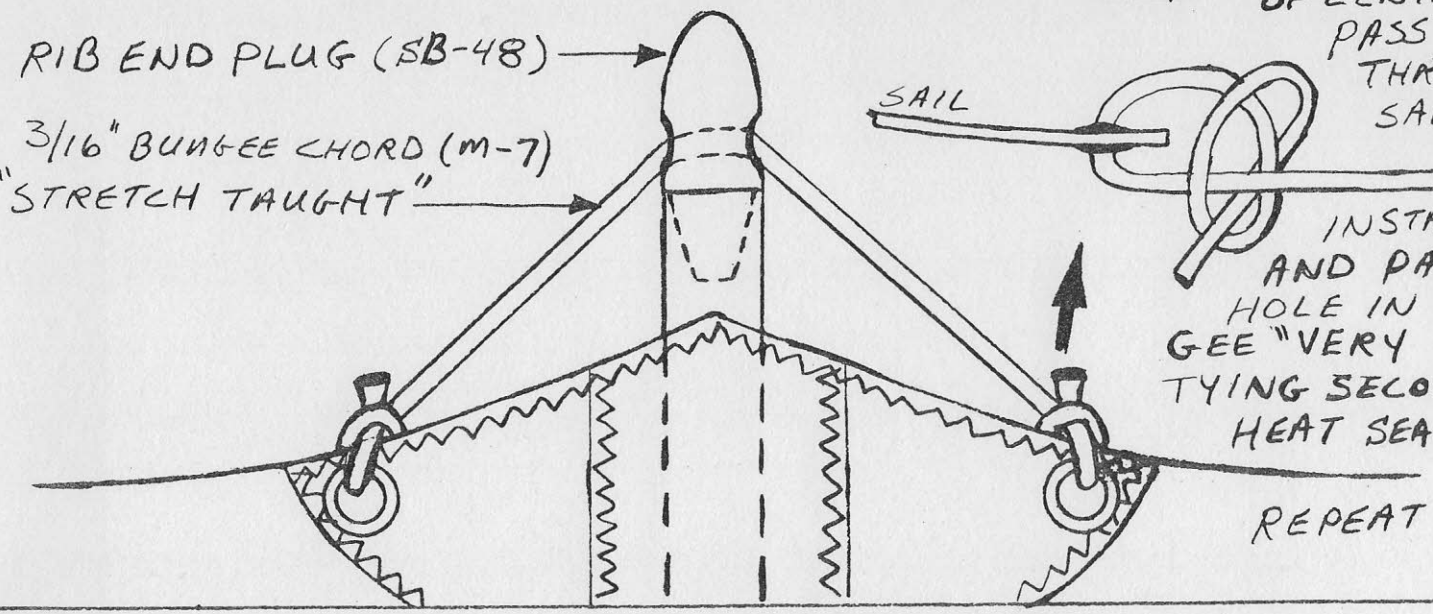



# 2.23

MATCH RIBS AGAINST RIB TEMPLATE PRIOR TO INSTALLING IN SAIL.
SLIDE RIBS INTO RIB POCKETS USING SEQUENCE SHOWN.
BE SURE NOSE OF RIB SEATS AGAINST STOP IN FRONT END OF POCKET.
WHILE SAIL IS VERY NEW IT MAY BE NESCESSARY TO PUSH UP RIB POCKET NEAR LEADING EDGE IN ORDER TO ALLOW RIB TO SLIDE FULLY FORWARD.

NOTE: CENTER RIB POCKETS DO NOT HAVE A STOP SEWN INTO SAIL. BE CAREFULL NOT TO PUSH RIBS THROUGH FRONT OF CENTER RIB POCKETS.



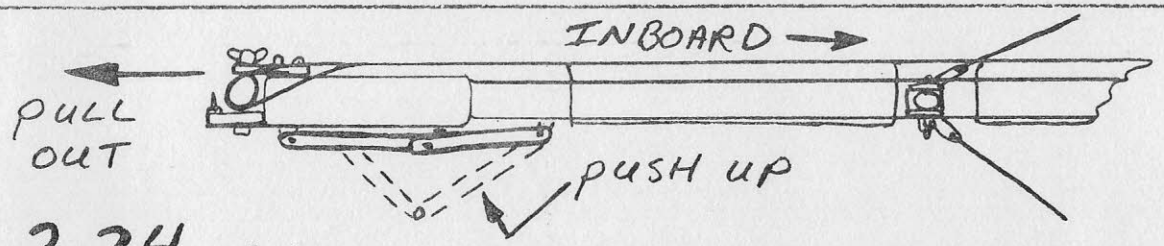




PASS END OF 3/16" BUNGEE THROUGH GROMMETT IN SAIL AND TIE KNOT AS SHOWN.

INSTALL PLUG IN RIB END AND PASS BUNGEE THROUGH HOLE IN SIDE. STRETCH BUNGEE "VERY TAUT" BEFORE TYING SECOND KNOT. CUT AND HEAT SEAL BUNGEE ENDS.

REPEAT ON OTHER RIBS.

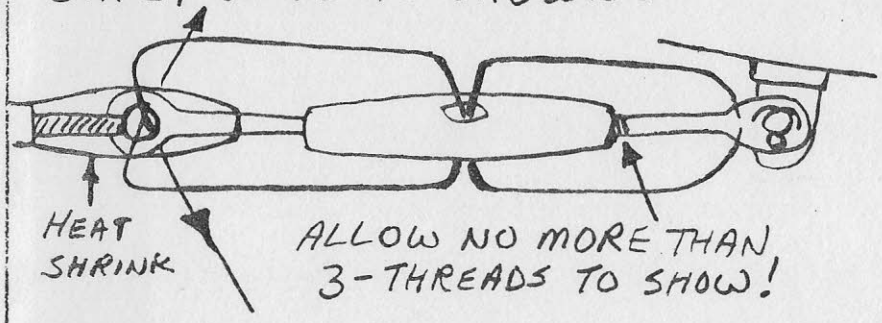


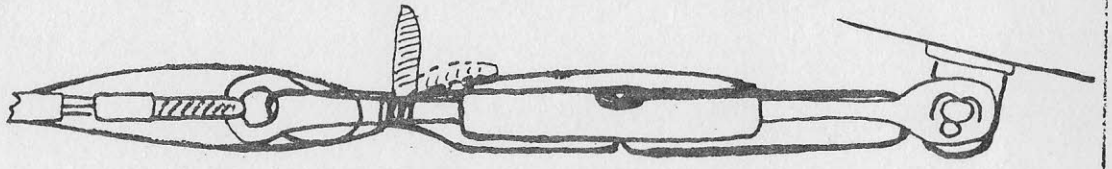

NOTE: LEAVE FRONT SPAR BOLTS A LITTLE LOOSE TO ALLOW SAIL MATERIAL TO MOVE.

**2.24** CHECK TO BE SURE SAIL MATERIAL IS NOT PINCHED BEHIND COMPRESSION STRUT BRACKETS OR CAUGHT ANYWHERE ON FRAME, BOLTS, ETC. PUT ONE HAND UNDER INBOARD TIP STRUT TENSIONER WHILE PULLING OUTWARD ON TIP STRUT AND SNAP TENSIONERS INTO THE EXTENDED POSITION. REPEAT ON OTHER WING.

ADJUST AND TIGHTEN DRAG-WIRE TURNBUCKLES UNTIL ALL WRINKLES IN SAIL HAVE DISAPPEARED. COMPRESSION STRUTS SHOULD BE ROUGH SET TO ZERO-WASHOUT AND SLACK SHOULD BE REMOVED FROM ALL FLYING-WIRES. MAKE DRAG-WIRES AS TIGHT AS POSSIBLE WITHOUT PUTTING WRINKLES BACK IN SAIL. TUG ON THE DRAG-WIRES WITH YOUR HAND DURING ADJUSTMENT OF TURNBUCKLES TO SEE WHEN TO STOP TIGHTENING. MAKING DRAG-WIRES TOO TIGHT WILL CAUSE NEW WRINKLES TO APPEAR. BE SURE KING-POST TENSIONER IS IN THE "UP" POSITION DURING ADJUSTMENT. CHECK TO SEE THAT NONE OF THE DRAG WIRE THIMBLES HAVE BEEN TWISTED AND PULLED OUT OF SHAPE. INBOARD DRAG-WIRES WILL BE ADJUSTED "VERY TAUT" AND OUTBOARD DRAG WIRES WILL HAVE ABOUT HALF THE TENSION OF THE INNER ONES.

WHEN DRAG-WIRES ARE PROPERLY ADJUSTED, CHECK SPARS TO SEE THAT THEY ARE REASONABLY STRAIGHT AND LOCKWIRE TURNBUCKLES WITH .032" SAFETY WIRE AS SHOWN.

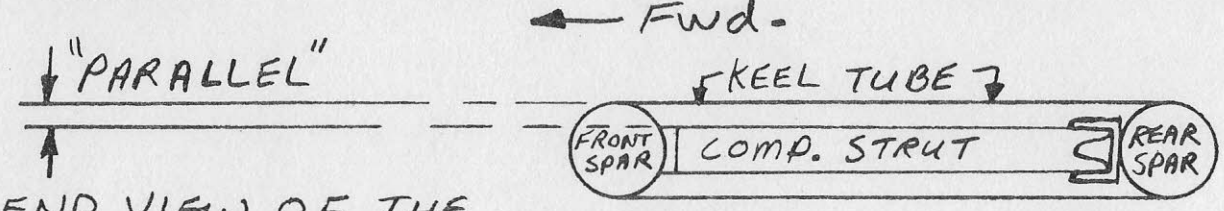


WRAP WIRE AROUND EYESTOCK SEVERAL TIMES AND TWIST TIGHTLY, 8-10 TURNS. SNIP END AND BEND OVER.

## 2.25 FINAL RIGGING ADJUSTMENT: REFER TO STEP 2.18A.

ADJUST THE INBOARD REAR FLYING WIRES (#6) ON BOTH WINGS TO EQUAL LENGTHS AND EQUAL TENSION. LOWER THE KINGPOST TENSIONER TO SLACKEN CABLES WHEN TIGHTENING BUT BE SURE TENSIONER IS UP WHEN TAKING MEASUREMENTS BETWEEN SIDES. WHEN CABLES (#6) ARE BOTH EQUAL LENGTH WITHIN 1/16", TIGHTEN CLAMPS SECURELY. USE THE SAME PROCEDURE TO TIGHTEN AND SET THE LENGTH OF CABLES (#7). SIGHT DOWN REAR SPAR AND ADJUST CABLES UNTIL SPARS ARE AS STRAIGHT AS POSSIBLE. CABLES SHOULD BE "VERY TAUT" AND TENSION IN BOTH CABLES (#7) SHOULD BE ABOUT EQUAL. SETTING EQUAL LENGTHS IN CABLE (#7) IS NOT AS IMPORTANT AS HAVING THE SPARS STRAIGHT AND ABOUT EQUAL TENSION IN THE CABLES. WHEN YOU ARE SATISFIED WITH THE ADJUSTMENT OF THE REAR FLYING WIRE BRIDLES ON BOTH WINGS, MOVE ON TO THE FRONT SPARS. ADJUST THE LEADING EDGE FLYING WIRES IN THE SAME WAY YOU DID THE REAR WIRES. ADJUST CABLES (#8) FIRST AND ALIGN THE INBOARD COMPRESSION STRUTS "PARALLEL" TO THE KEEL TUBE. MAKE SURE BOTH INBOARD STRUTS HAVE BEEN SET TO "ZERO-WASHOUT" BEFORE MOVING TO THE OUTBOARD STRUTS. IT MAY BE NECESSARY TO LOOSEN OR TIGHTEN CABLES IN THE UPPER RIGGING IN ORDER TO FINE ADJUST THE LOWER RIGGING. DO THIS BY LOWERING THE KINGPOST TENSIONER AND/OR DISCONNECT ONE OF THE SHACKLES TO OBTAIN THE DESIRED SLACK. USE PLIERS OR VISE-GRIPS TO PULL ON THE LOOSE CABLE END WHEN ADJUSTING. FINALLY ADJUST THE OUTBOARD FLYING WIRES (#9) AND SET THE OUTBOARD COMPRESSION STRUTS AT "ZERO-WASHOUT" AS SHOWN.




THIS IS WHAT AN END VIEW OF THE STRUTS AND KEEL TUBE SHOULD LOOK LIKE WITH PROPER RIGGING!

2.26 YOU MAY FIND AFTER YOU HAVE ADJUSTED ALL THE CABLES THAT A FEW HAVE LOOSENED UP. GO BACK OVER ALL THE CABLES ON THE ENTIRE MACHINE (INCLUDING THE DRAG WIRES) AND RE-CHECK AND ADJUST THE CABLES WHICH HAVE CHANGED. MAKE ALL THE CABLES AS "TAUT" AS YOU POSSIBLY CAN AND STILL HOOK-UP THE FLYING WIRE SHACKLES WITH THE KINGPOST TENSIONER DOWN. THE INBOARD CABLES MUST BE ATLEAST SNUG AND THE OUTBOARD CABLES SHOULD BE "TAUT" OR "VERY TAUT", PARTICULARLY THE OUTBOARD-FRONT FLYING WIRES. THE FOLLOWING IS A CHECKLIST WHICH SHOULD BE SATISFIED PRIOR TO FINAL SWAGING OF CABLES.

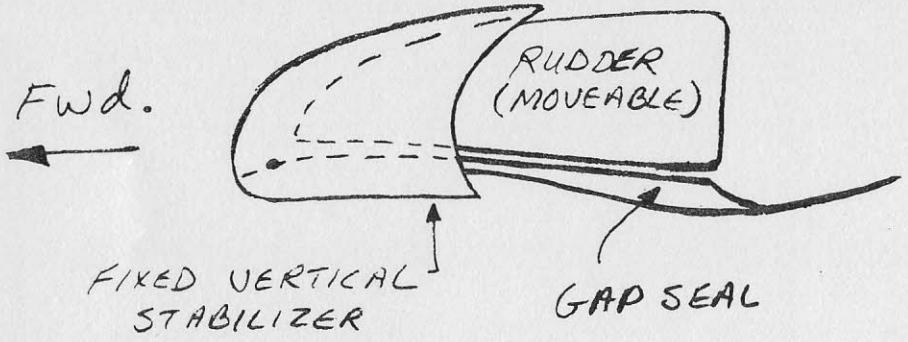
1. ALL SPARS AS STRAIGHT AS POSSIBLE
2. ALL COMPRESSION STRUTS AT ZERO-WASHOUT
3. ALL INNER FLYING AND LANDING WIRES AT LEAST "SNUG" OR "TAUT"
4. ALL **OUTER** FLYING AND LANDING WIRES **"TAUT" OR "VERY TAUT"**
5. FLYING WIRE SHACKLES CAN ONLY BE CONNECTED WITH DIFFICULTY (KINGPOST DOWN)
6. DRAG WIRES TUNED TO EQUAL TENSION AND SAFETY WIRED.
7. ALL CABLE THIMBLES PROPERLY ALIGNED - NOT TWISTED

HAVE A HELPER LIFT UP ON THE CENTER OF EACH OUTBOARD COMPRESSION STRUT WHILE YOU CHECK FOR ZERO-WASHOUT ONE LAST TIME. THIS WILL SIMULATE A FLIGHT LOAD AND TOTALLY MAKE APPARENT ANY TENSION DIFFERENCE BETWEEN FRONT AND REAR OUTER WIRES. BE SURE CABLE CLAMPS ARE TIGHT ENOUGH TO KEEP CABLES FROM SLIPPING BUT DO NOT OVER TIGHTEN AND put a PERMANENT KINK IN THE CABLES.

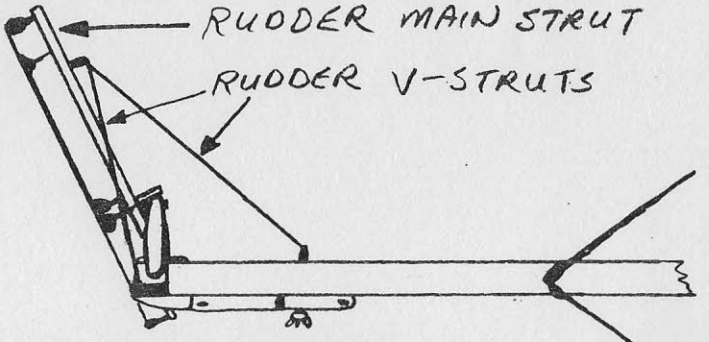
WHEN YOU ARE SATISFIED THE RIGGING OF YOUR WING IS CORRECT, LOOSEN TIP STRUT TENSIONERS, REMOVE RIBS AND TIP STRUTS. LOWER KINGPOST TENSIONER, DIS-CONNECT ALL LOWER RIGGING EXCEPT WIRES FROM WING TO REAR OF FRAME (5R AND 5L). UNPLUG FRONT SPAR FROM COMPRESSION STRUTS AND LAY ON TOP REAR SPAR. PERMANENTLY SWAGE AND TRIM ALL CABLES. BE SURE TO USE ONLY PROPER SWAGING TOOL. RE-ASSEMBLE WING.

# 2.27 CONTROL INSTALLATION

THE WINGTIP CONTROL SURFACES CONSIST OF A STATIONARY END PLATE OR VERTICAL STABILIZER, AND A MOVEABLE RUDDER ASSEMBLY WHICH CONTROLS THE YAW AND ROLL OF THE MACHINE. EACH WINGTIP CONTROL ASSEMBLY IS SUPPORTED BY A TUBULAR MAIN STRUT WHICH THE RUDDER HINGES ON, AND LONG (INNER) AND SHORT (outer) V-STRUTS WHICH TRIANGULATE AND MAKE THE ASSEMBLY VERY RIGID. THE RUDDER MAIN STRUT AND STABILIZER FRAMES ATTACH TO THE WINGTIP STRUT ASS'Y AND THE V-STRUTS ATTACH TO THE REAR SPAR. EACH RUDDER IS INDEPENDENTLY OPERATED BY A CONTINUOS LOOP CABLE (1/16" DIA.) WHICH WRAPS AROUND THE STEERING HUB, PASSES THROUGH A PULLEY SYSTEM LOCATED ON THE WING AND UNDERCARRIAGE, AND TRAVELS OUT AND ATTACHES TO THE RUDDER AT TWO POINTS AFTER PASSING THROUGH A COUPLE OF GUIDES. SOUNDS COMPLICATED, HUH! AFTER CLOSER EXAMINATION AND STUDY, I THINK YOU'LL FIND THAT THE WHOLE SYSTEM IS REALLY FAIRLY SIMPLE.



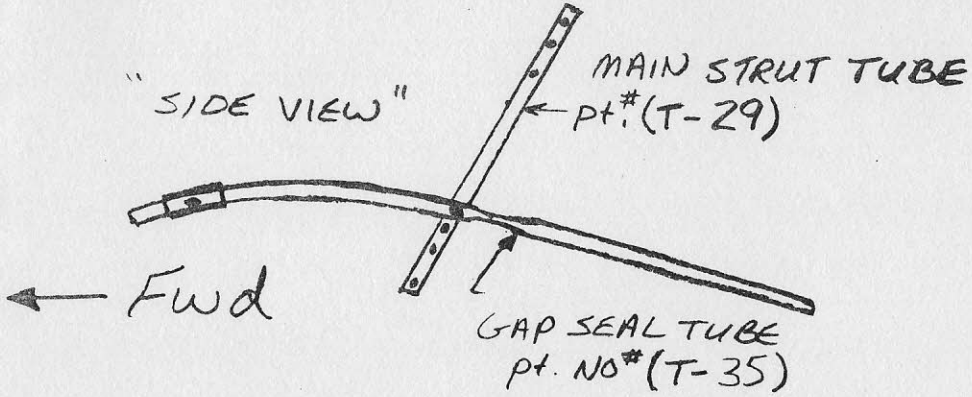

"SIDE VIEW"

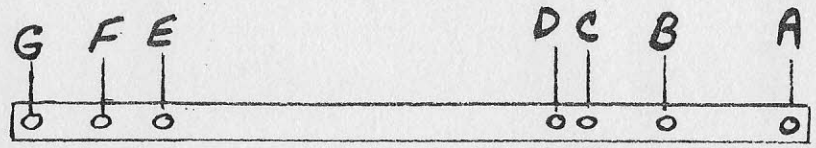



REAR VIEW

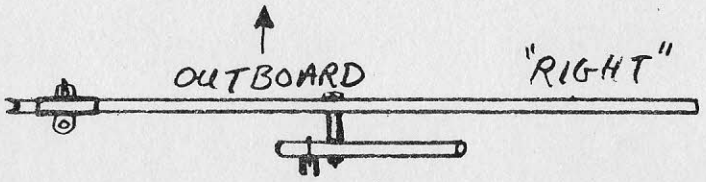
← OUTBOARD

**2.28** BEGIN RUDDER ASSEMBLY BY MOUNTING HARDWARE IN MAIN STRUTS AND ATTACHING TO GAP SEAL TUBES AS SHOWN. ATTACH GAP SEAL TUBE TO HOLE "C" IN MAIN STRUT

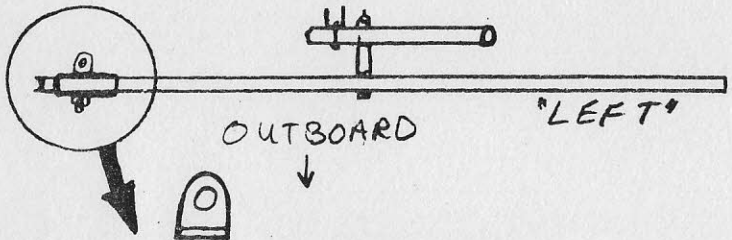


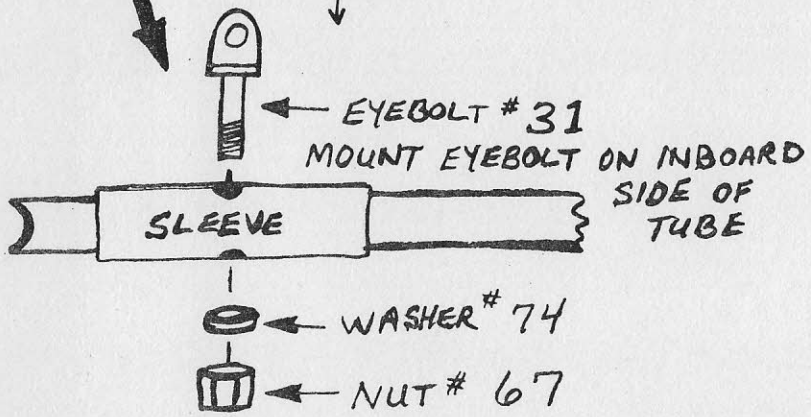



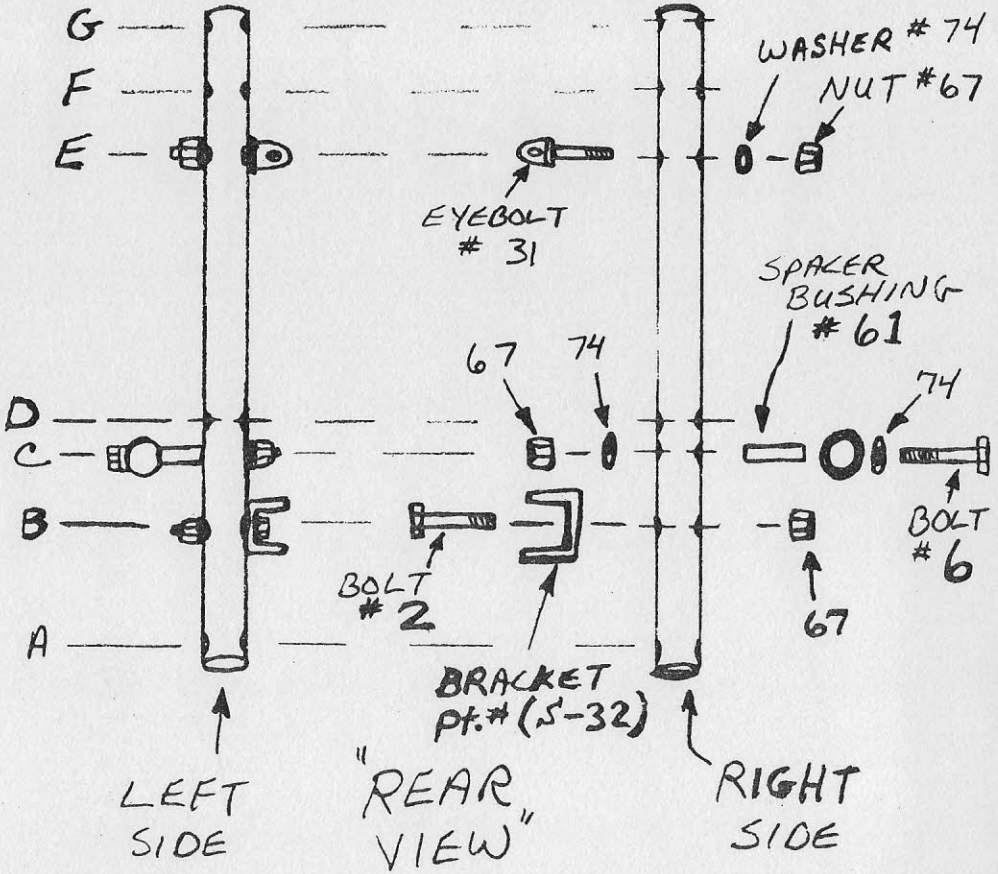

RUDDER MAIN STRUT TUBE HAS HOLES LOCATED AS SHOWN.




Fwd "TOP VIEW"

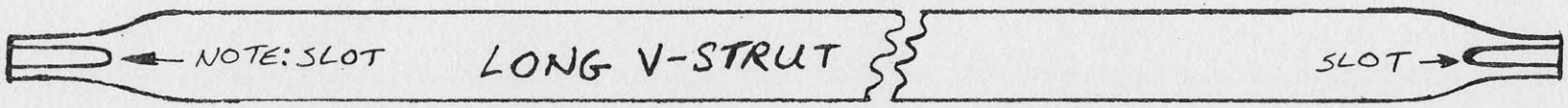


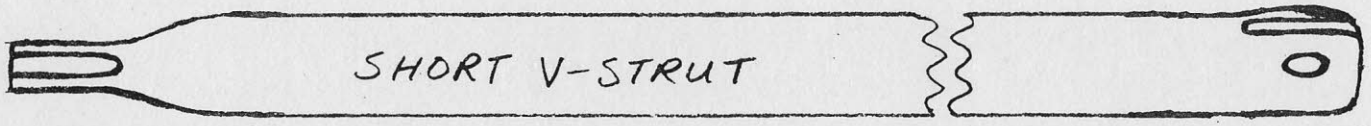



**2.29** LOCATE V-STRUT TUBES. LONG V-STRUTS CAN BE USED ON EITHER THE LEFT OR RIGHT RUDDER ASSEMBLY AND ARE **INTERCHANGEABLE**. THE SHORT V-STRUTS ARE MADE TO FIT ON THE LEFT OR RIGHT RUDDER ASSEMBLY ONLY AND CANNOT BE INTERCHANGED.

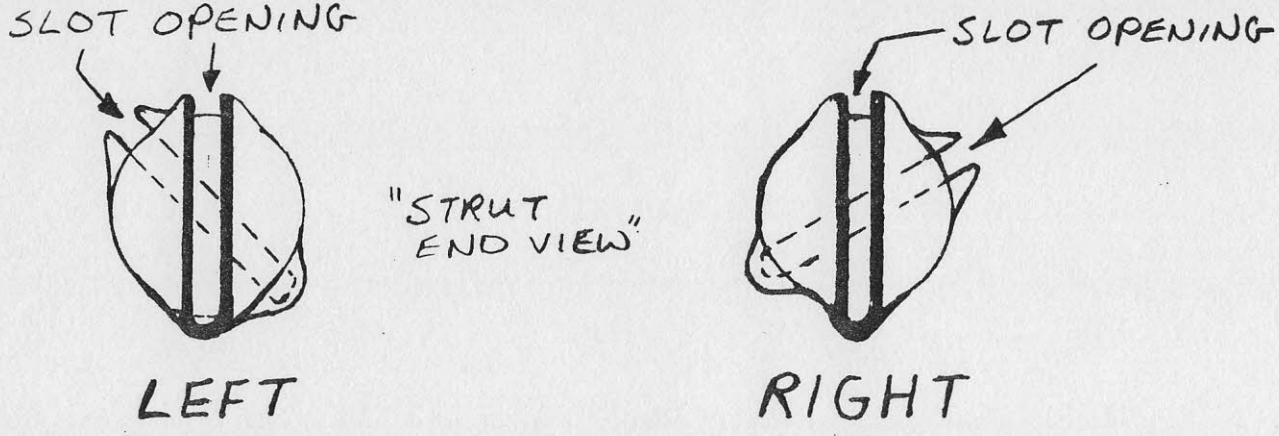
YOU WILL NOTICE THAT ON THE LONG V-STRUTS THE SLOTTED ENDS ARE FACING THE SAME DIRECTION.




ON THE SHORT V-STRUTS, THE ENDS ARE ALIGNED AT APPROXIMATELY A 45° ANGLE TO EACH OTHER

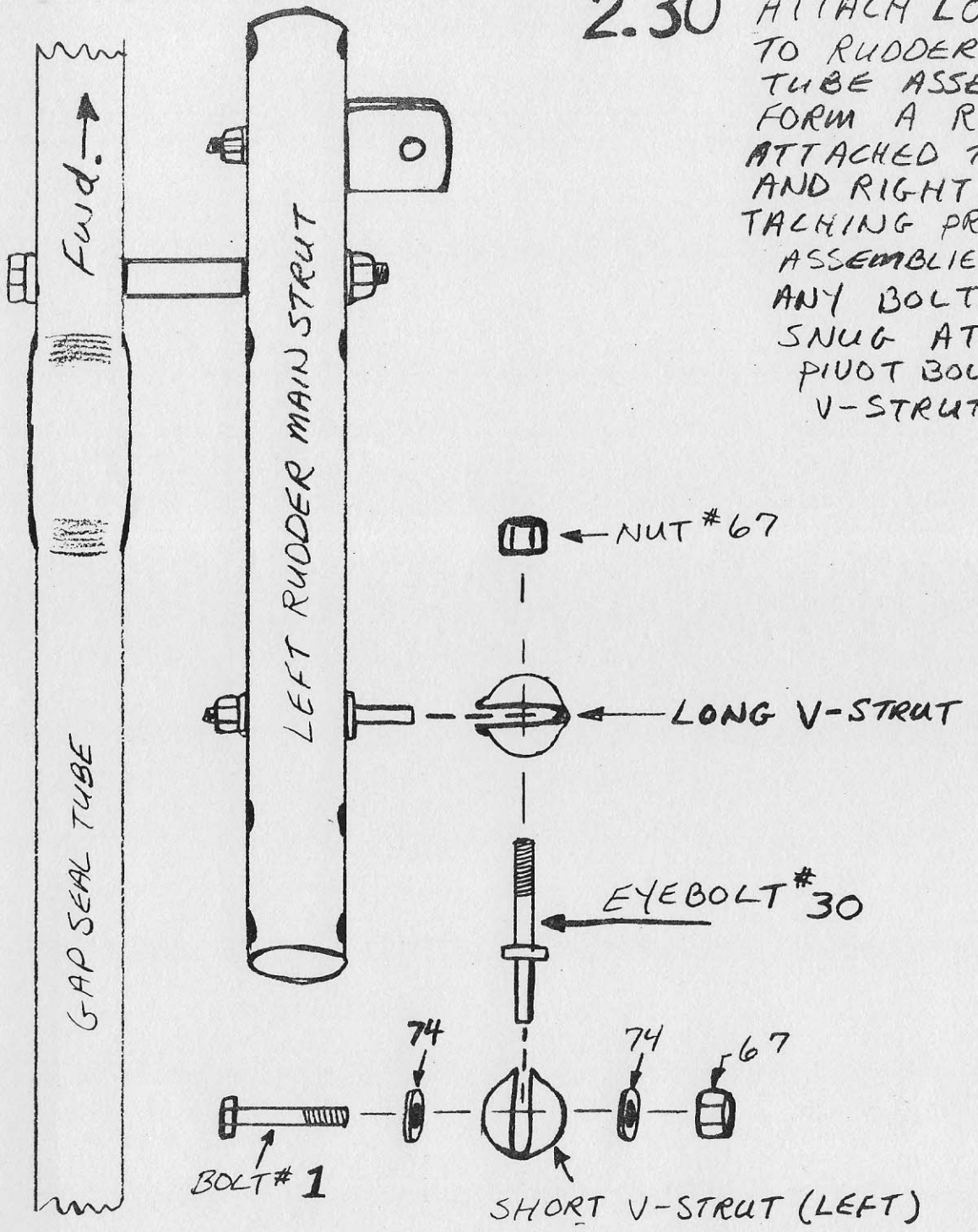



THE END VIEW BELOW WILL INDICATE WHETHER A SHORT STRUT MOUNTS TO THE LEFT OR RIGHT RUDDER ASSEMBLY.



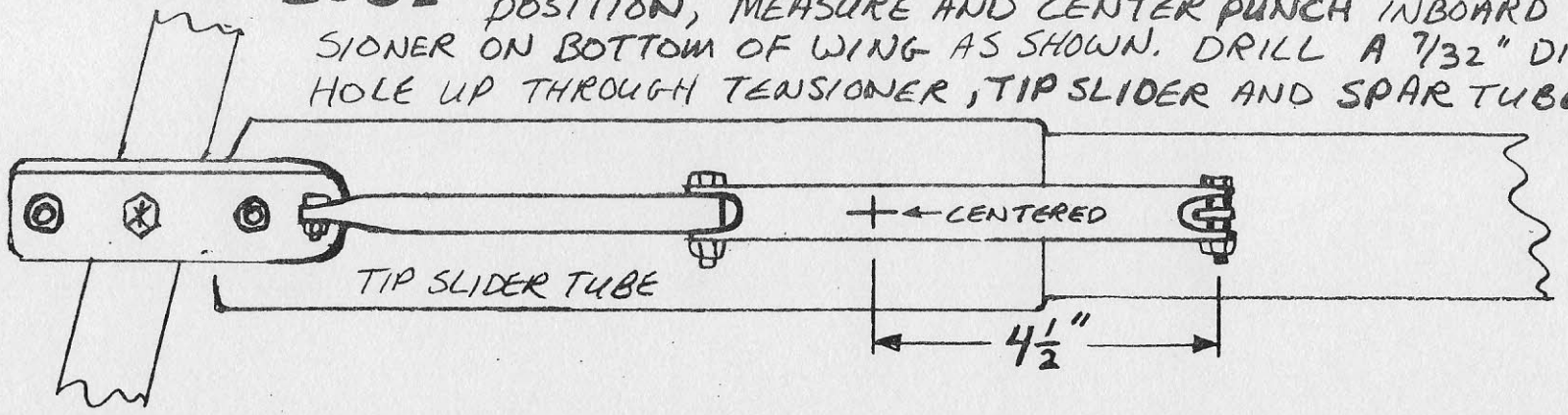
# 2.30

ATTACH LONG AND SHORT V-STRUTS TO RUDDER MAIN STRUT AND GAP SEAL TUBE ASSEMBLY AS SHOWN. THIS WILL FORM A RUDDER MOUNT PYLON WHEN ATTACHED TO THE WING. MAKE UP LEFT AND RIGHT PYLON ASSEMBLIES BY ATTACHING PROPER V-STRUTS TO MAIN STRUT ASSEMBLIES. DO NOT TIGHTEN DOWN ANY BOLTS OR NUTS MORE THAN SNUG AT THIS POINT. LEAVE V-STRUT PIVOT BOLTS LOOSE ENOUGH TO ALLOW V-STRUTS TO ROTATE FOR ALIGNMENT.

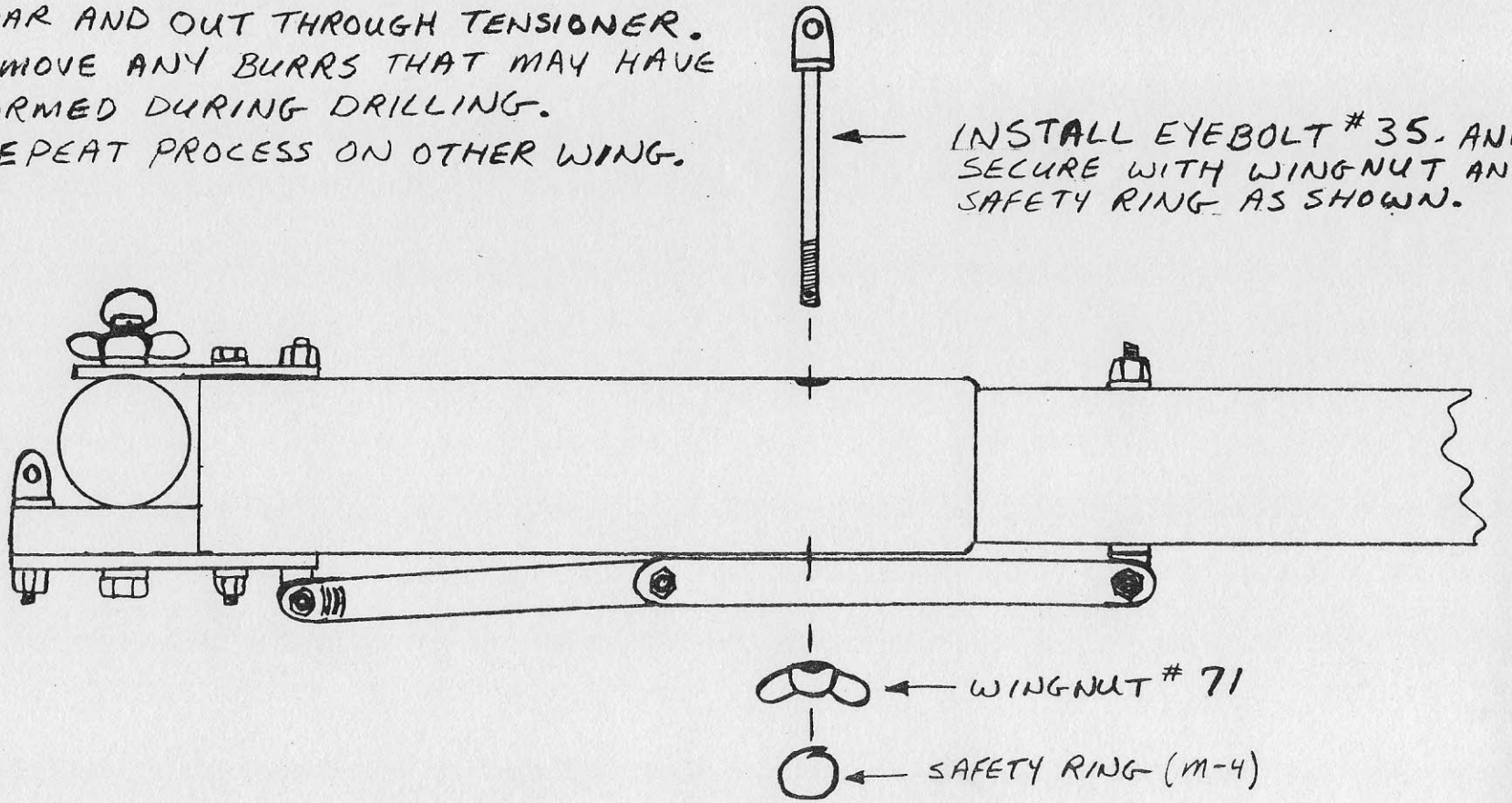



"TOP VIEW"
LEFT SIDE
MAIN STRUT/PYLON
ASSEMBLY

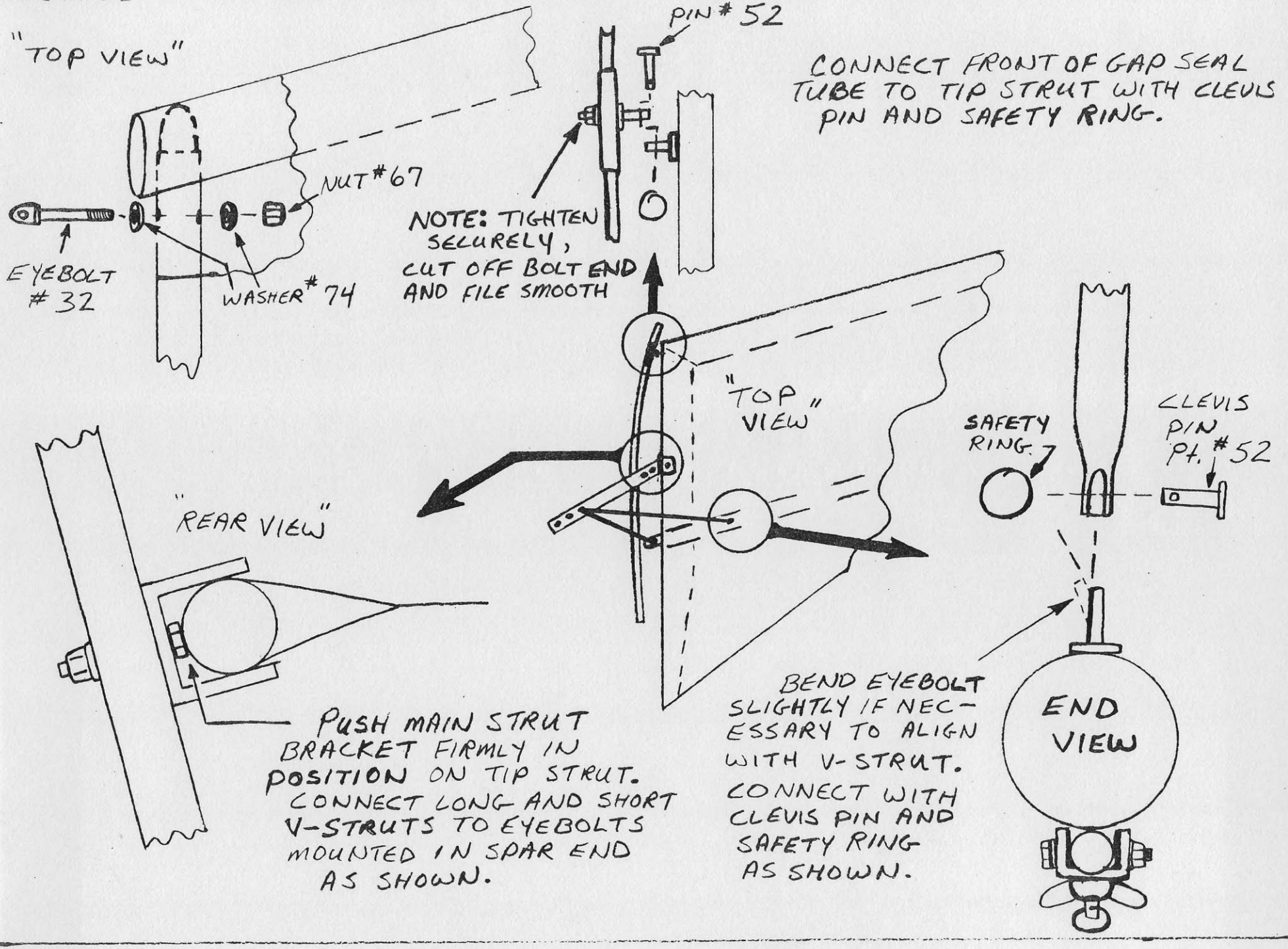
**2.31** WITH TIP STRUT TENSIONERS IN THE EXTENDED POSITION, MEASURE AND CENTER PUNCH INBOARD TENSIONER ON BOTTOM OF WING AS SHOWN. DRILL A 7/32" DIA. HOLE UP THROUGH TENSIONER, TIP SLIDER AND SPAR TUBE.




PRESS DOWN ON TOP OF SAIL AND LOCATE POSITION OF PRE-DRILLED HOLE IN TOP OF TIP SLIDER TUBE. DRILL A 7/32" HOLE DOWN THROUGH SPAR AND OUT THROUGH TENSIONER. REMOVE ANY BURRS THAT MAY HAVE FORMED DURING DRILLING. REPEAT PROCESS ON OTHER WING.

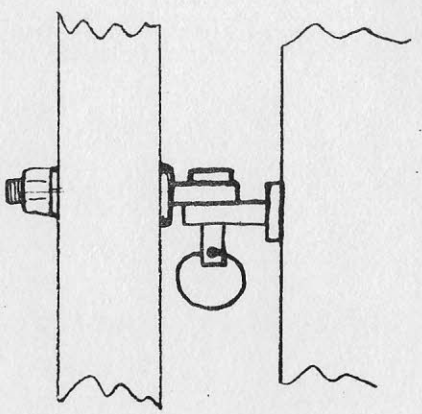


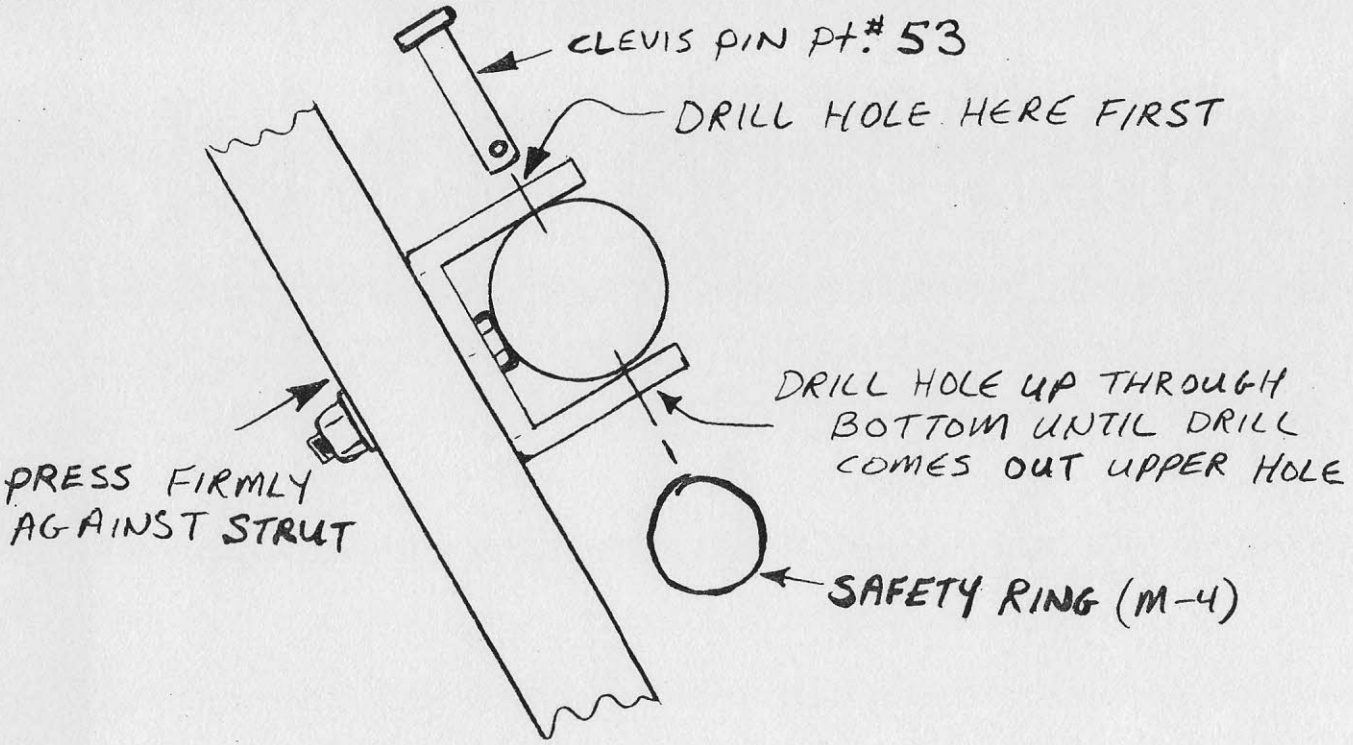
# 2.32 MOUNT EYEBOLT IN FRONT END OF EACH TIP STRUT AS SHOWN.



2.33 _ MAKE SURE THAT EYEBOLTS WHICH MOUNT FRONT END OF GAP SEAL TUBE TO TIP STRUT ARE POSITIONED SO THAT THERE IS NO SLACK BETWEEN THEM AS SHOWN.

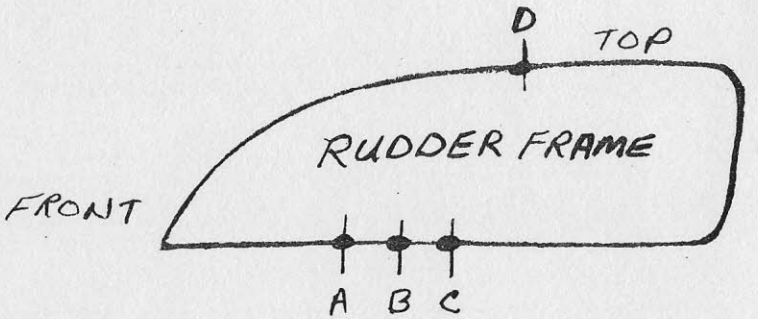
CHECK TO BE SURE RUDDER MAIN STRUT BRACKET IS FIRMLY POSITIONED ON TIP STRUT AND BOTH V-STRUTS ARE PROPERLY CONNECTED. DRILL A 3/16" DIA. HOLE DOWN THROUGH MAIN STRUT BRACKET AND TOP OF TIP STRUT TUBE. PLACE A 3/16" DIA. PIN OR BOLT IN HOLE TO HOLD BRACKET IN POSITION. DRILL 3/16" DIA. HOLE UPWARD THROUGH BRACKET AND TIP STRUT TUBE. REMOVE PIN OR BOLT AND PASS DRILL OUT THROUGH TOP OF BRACKET. SECURE BRACKET IN POSITION WITH CLEVIS PIN AND SAFETY RING AS SHOWN.

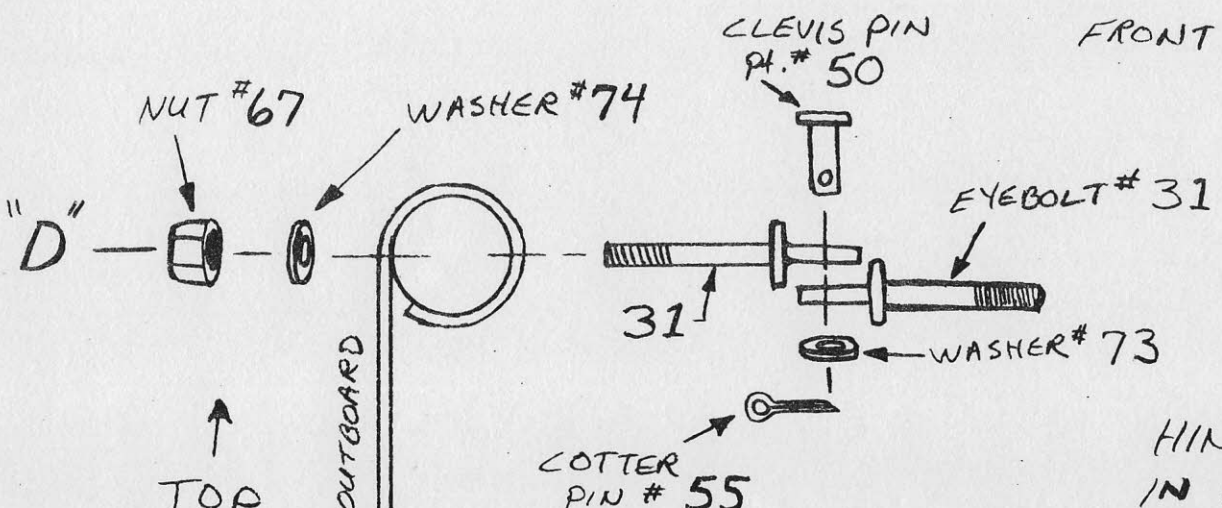




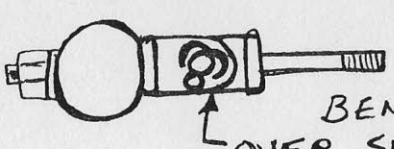
# 2.34

MOUNT EYEBOLTS IN RUDDER FRAME FORMING RUDDER HINGES AND CONTROL CABLE CONNECTION POINTS AS SHOWN.

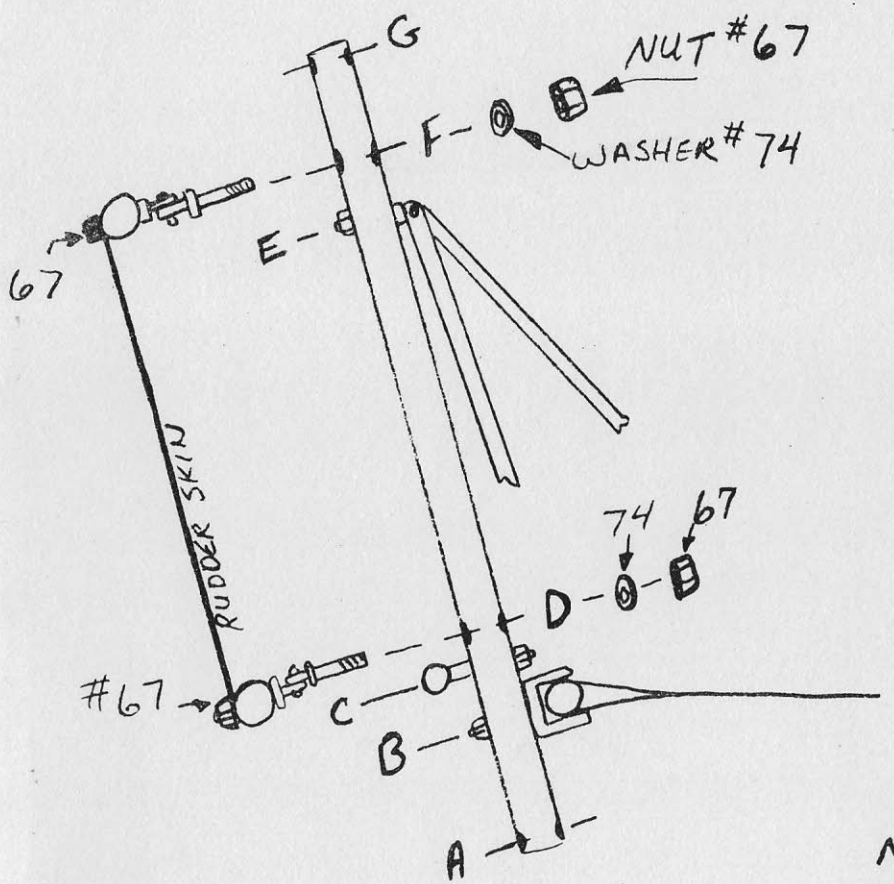


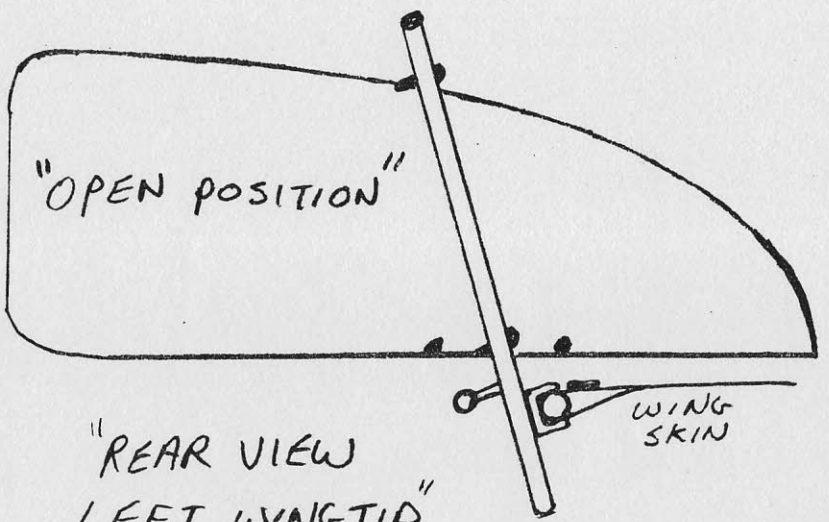




HINGE POINT EYEBOLTS MOUNT IN HOLES "B" AND "D" ONLY.
NOTE: STAGGERED ARRANGEMENT.
HINGE PINS ALWAYS GO IN FROM TOP TO BOTTOM (FACE DOWNWARD).



**2.35** ATTACH RUDDER TO MAIN STRUT PYLON AS SHOWN. IT MAY BE EASIER TO ATTACH IF YOU ROTATE EYEBOLT HINGES 180°, MOUNT RUDDER AND THEN ROTATE BOLTS BACK TO ORIGINAL AND PROPER POSITION IN ORDER TO TIGHTEN SKIN. SWING RUDDER INTO THE <u>FULL OPEN</u> POSITION. BE SURE EYEBOLTS ARE IN THE STAGGERED POSITION SHOWN IN STEP* 2.34. TIGHTEN NUTS* 67 ON RUDDER FRAME AND MAINSTRUT SECURELY!

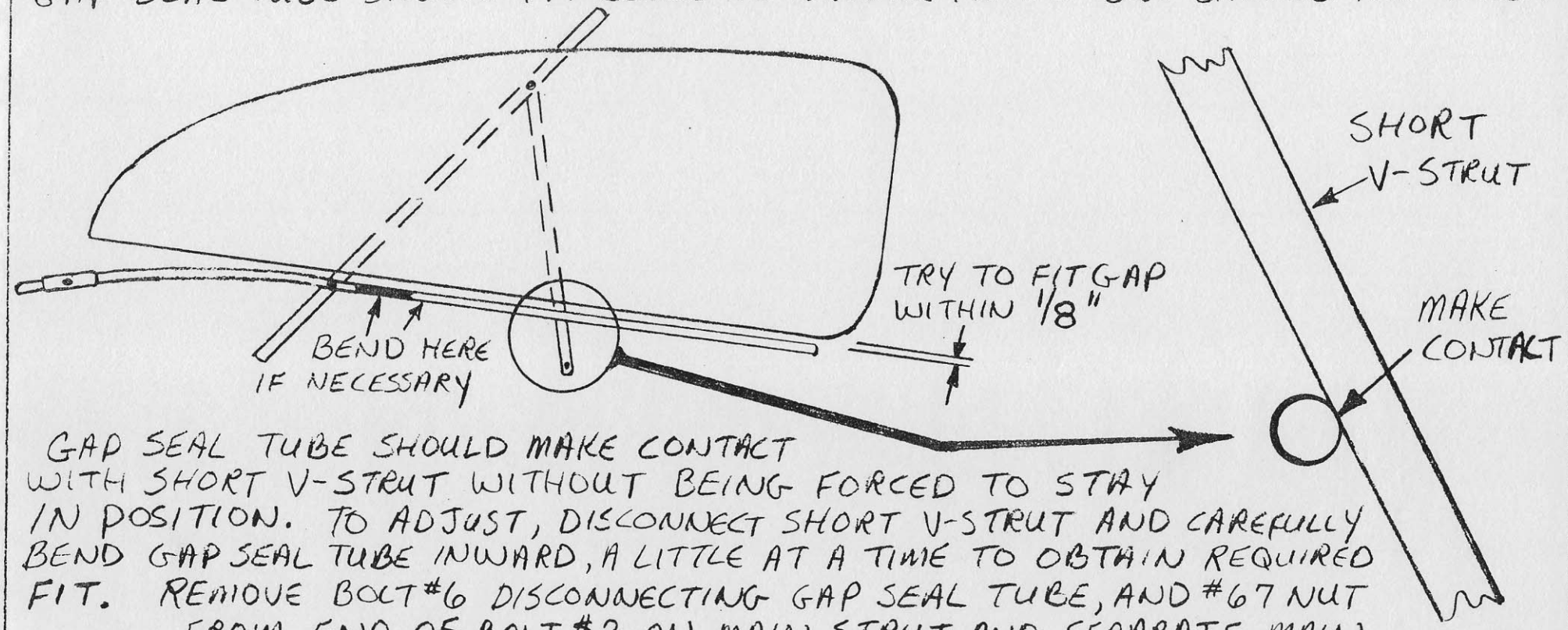


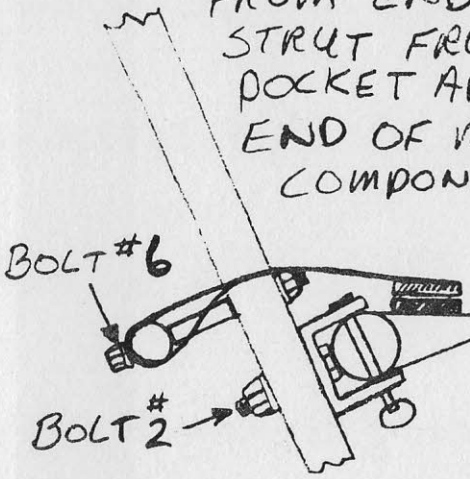

"REAR VIEW LEFT WINGTIP"

SWING RUDDER OPEN AND CLOSED A FEW TIMES TO CHECK FOR PROPER NON-BINDING OPERATION. A LITTLE W.D.40 OR OTHER LIGHT LUBRICANT ON HINGES WILL KEEP RUDDER OPERATION SMOOTH.

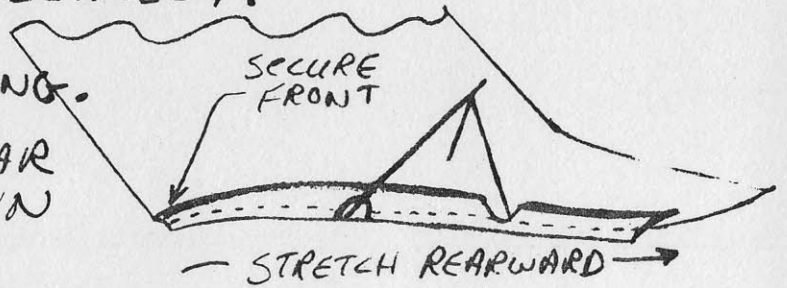
2.36 WITH RUDDER IN POSITION AS SHOWN, CAREFULLY BEND AND ADJUST GAP SEAL TUBE TO FOLLOW CONTOUR OF RUDDER FRAME WITHIN 1/8" AS SHOWN, FROM THE RUDDER HINGE REARWARD. GAP SEAL TUBE SHOULD FIT CLOSE TO RUDDER FRAME BUT SHOULD NOT RUB.



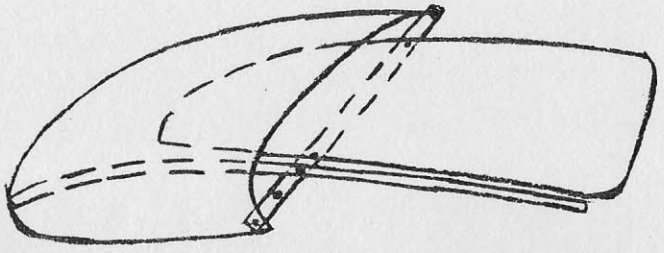

GAP SEAL TUBE SHOULD MAKE CONTACT WITH SHORT V-STRUT WITHOUT BEING FORCED TO STAY IN POSITION. TO ADJUST, DISCONNECT SHORT V-STRUT AND CAREFULLY BEND GAP SEAL TUBE INWARD, A LITTLE AT A TIME TO OBTAIN REQUIRED FIT. REMOVE BOLT #6 DISCONNECTING GAP SEAL TUBE, AND #6 NUT FROM END OF BOLT #2 ON MAIN STRUT AND SEPARATE MAIN STRUT FROM MOUNT BRACKET. PLACE GAP SEAL TUBE END IN GAP SEAL POCKET AND SLIDE GAP SEAL FORWARD INTO POSITION. INSERT BOTTOM END OF MAINSTRUT THROUGH OPENING IN GAP SEAL. RE-ATTACH ALL COMPONENTS AND TIGHTEN NUTS SECURELY!

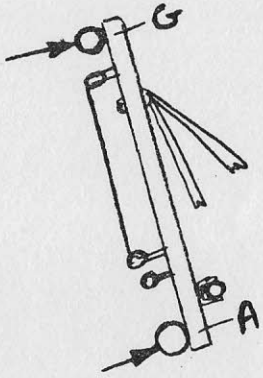



SECURE FRONT END OF GAP SEAL VELCRO TO WING. STRETCH GAP SEAL TIGHTLY TOWARD THE REAR AS YOU SECURE VELCRO IN POSITION AS SHOWN.

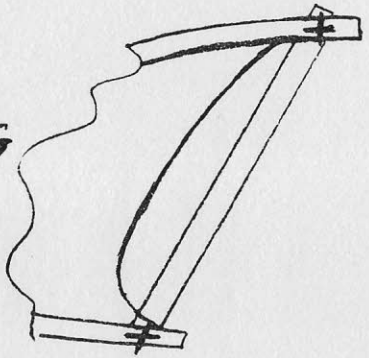


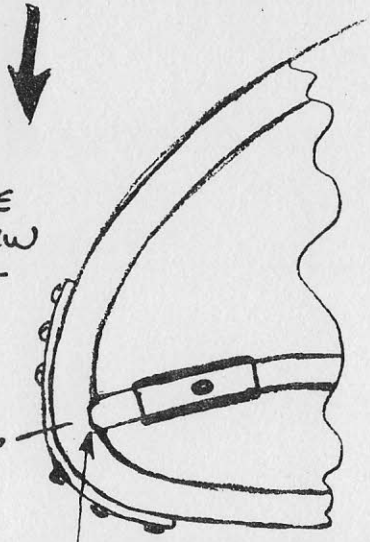
2.37 PLACE VERTICAL STABILIZER (END PLATE) IN POSITION AS SHOWN. ATTACH FRONT OF FRAME TO GAP SEAL TUBE WITH SCREW #91 TIGHTEN SCREW JUST ENOUGH TO HOLD FRAME IN POSITION TO BE MARKED FOR **DRILLING.** HOLD FRAME AGAINST MAIN STRUT TUBE AND ALIGN WITH HOLES "A" AND "G". MARK STABILIZER FRAME FOR DRILLING AT THOSE POINTS USING A PENCIL. REMOVE FRAME AND LAY ON A FLAT **SURFACE.** CENTER PUNCH **AND DRILL** 3/16" DIA. HOLES IN STABILIZER FRAME. BOLT STABILIZER TO MAIN STRUT.






MARK FOR **DRILLING**



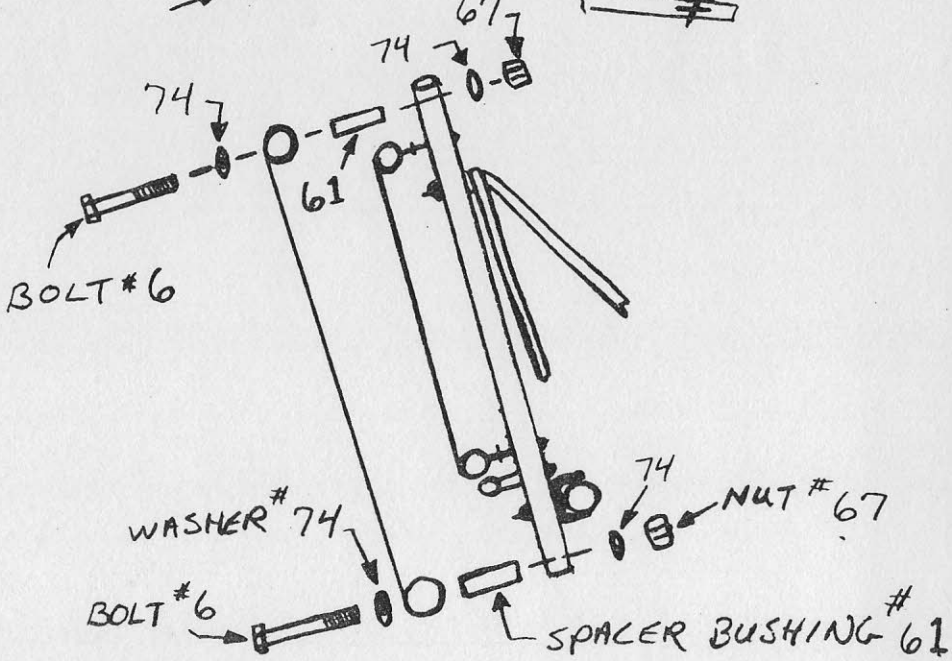


TEMPORARILY SECURE FRONT END OF FRAME

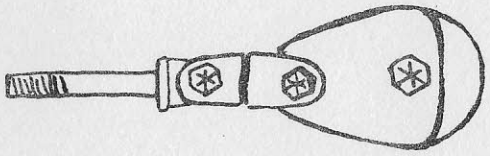
RUB A LITTLE SOAP ON SCREW TO EASE ASSEMBLY

SCREW Pt. # 87

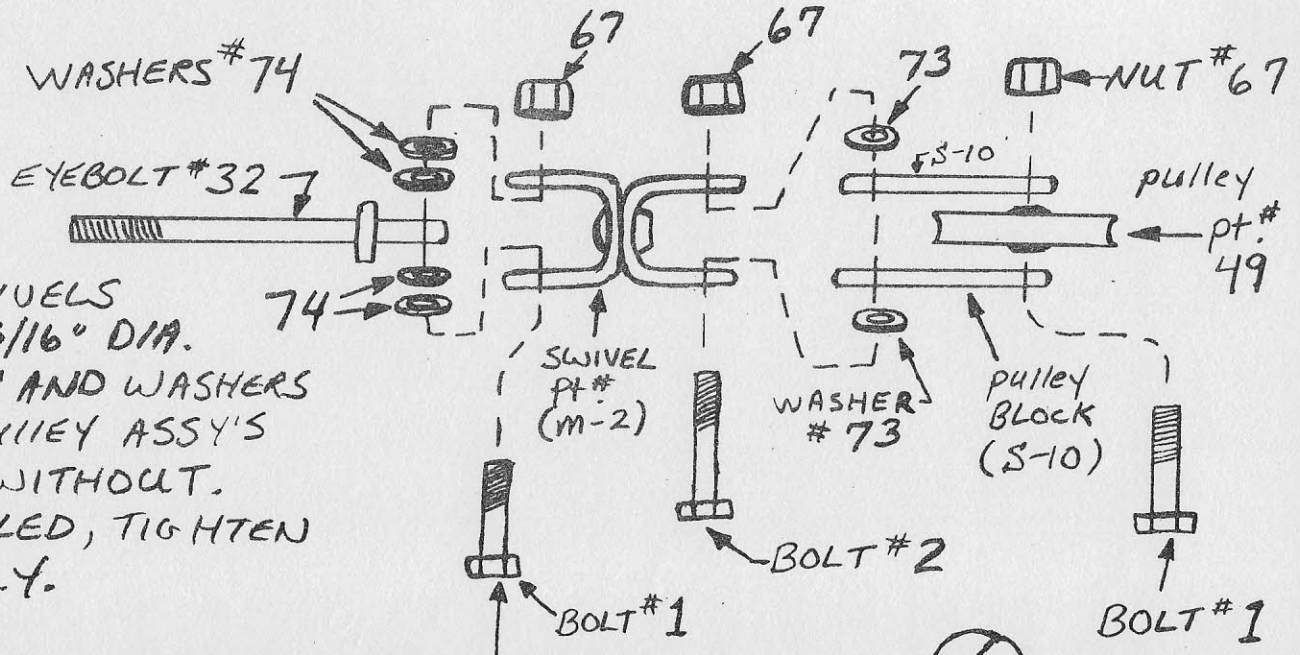
BE SURE FRAME is pulled up SNUG AGAINST GAP SEAL TUBE END.



# 2.38 ASSEMBLE FOUR CONTROL CABLE PULLEYS AS SHOWN.

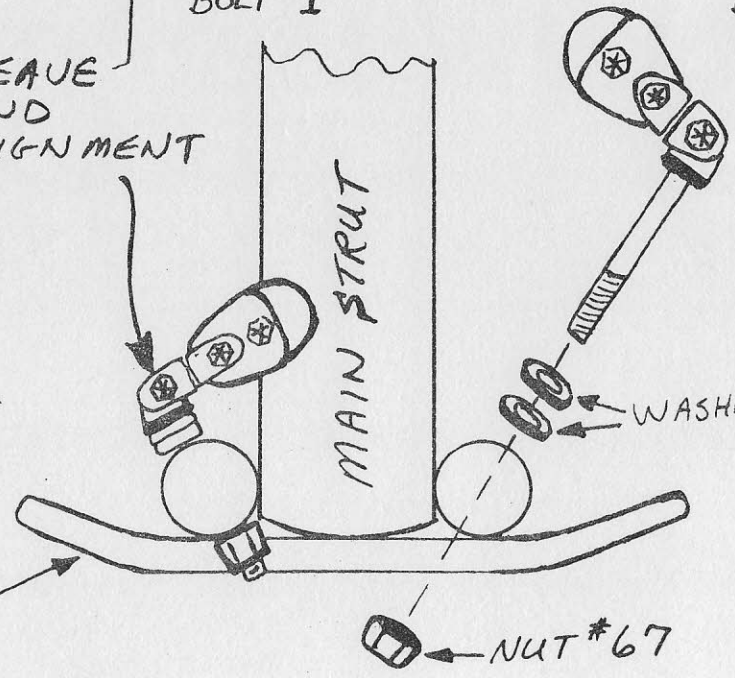


REMOVE LOCK PINS FROM SWIVELS AND DRILL OUT HOLES TO 3/16" DIA. ASSEMBLE WITH BOLTS, NUTS AND WASHERS AS SHOWN. MAKE TWO PULLEY ASSY'S WITH EYEBOLT #32, TWO WITHOUT. WHEN PULLEYS ARE ASSEMBLED, TIGHTEN BOLTS AND NUTS SECURELY.



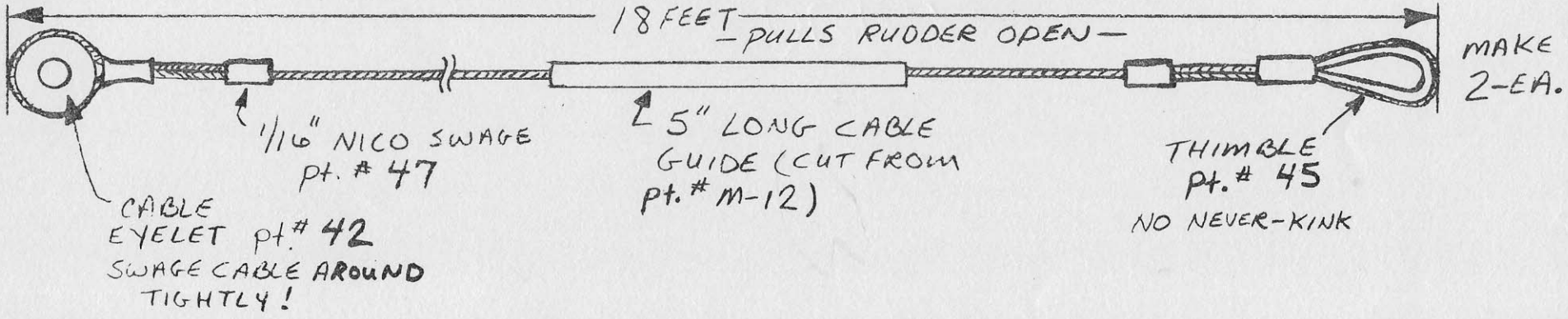

TIGHTEN THIS BOLT SECURELY BUT LEAVE LOOSE ENOUGH TO ALLOW SWIVEL END TO ROTATE ON EYEBOLT FOR LATER ALIGNMENT

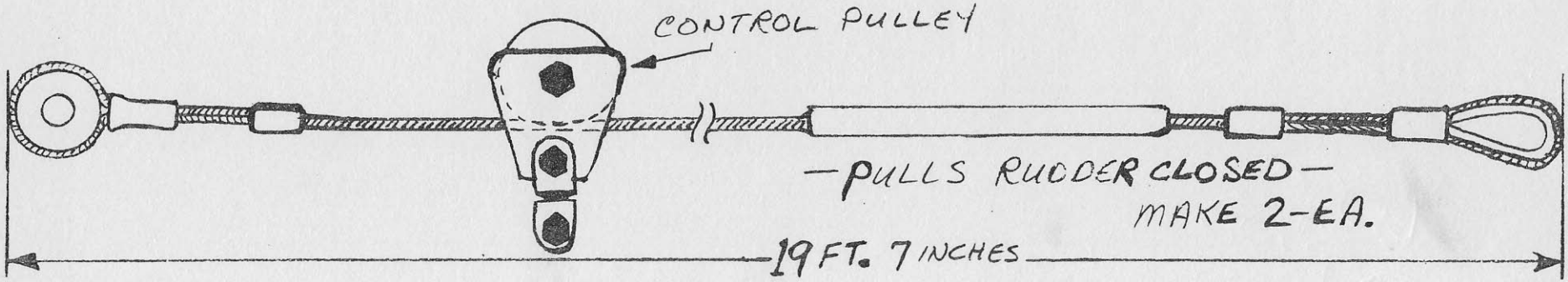
MOUNT TWO OF THE FOUR PULLEY ASSEMBLIES (THE ONES WITH THE EYEBOLTS) IN HOLES LOCATED AT FRONT OF LOWER FRAME TUBES AS SHOWN. TIGHTEN SECURELY BUT LEAVE NUT #67 LOOSE ENOUGH TO ALLOW PULLEY ASSEMBLIES TO BE ROTATED FOR LATER ALIGNMENT.

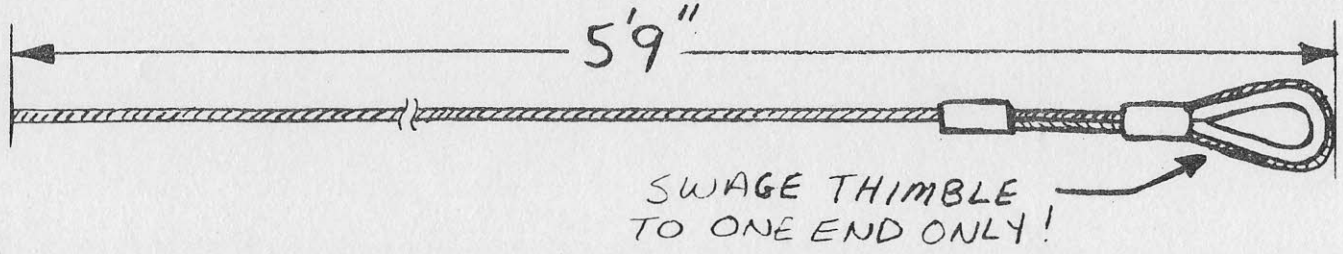



"REAR VIEW"

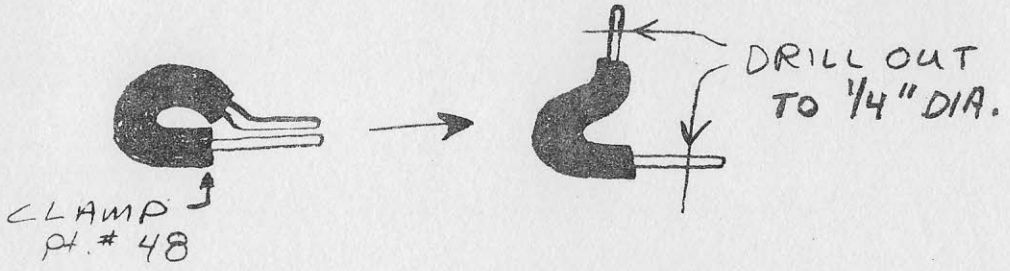
**2.39** MAKE UP 1/16" RUDDER CONTROL CABLES AS SHOWN. SQUIRT A LITTLE W.D. 40 INSIDE CABLE GUIDES BEFORE SLIDING THEM OVER CABLE AND SWAGING CABLE ENDS. BE SURE TO USE PROPER SWAGING TOOL FOR CONTROL CABLES (1/16" ONLY). UNDER NO CIRCUMSTANCES TRY TO USE ANYTHING BUT A TOOL DESIGNED FOR CRIMPING 1/16" SWAGES. USE OF ANYTHING ELSE (SUCH AS A 3/32" SWAGING TOOL) WILL RESULT IN CONTROL CABLE FAILURE!

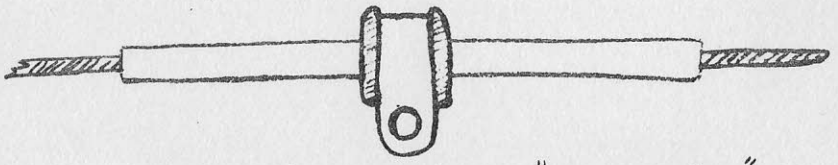


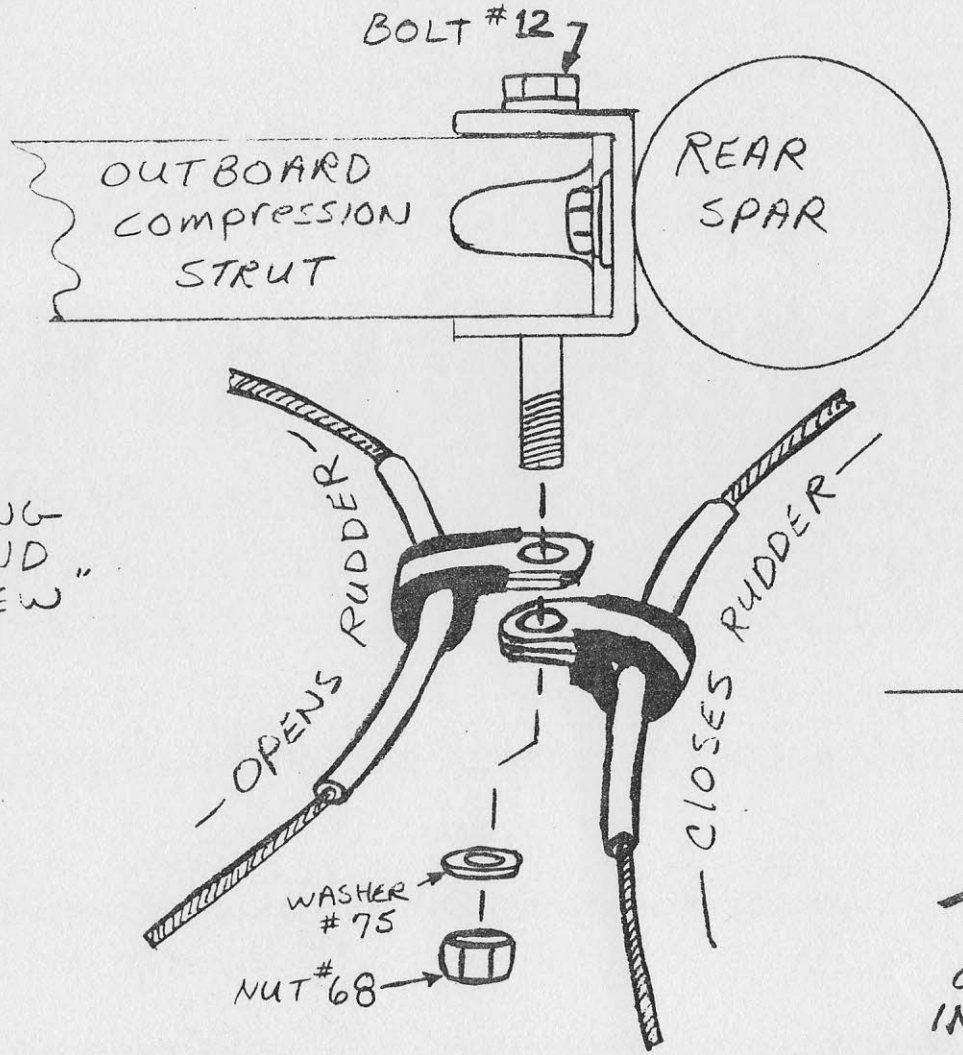



2.40 SPREAD CLAMP #48 OPEN AND PLACE IN VISE OR HOLD SECURELY WITH PLIERS. DRILL OUT 3/16" DIA. HOLES TO 1/4" DIA. AS SHOWN.

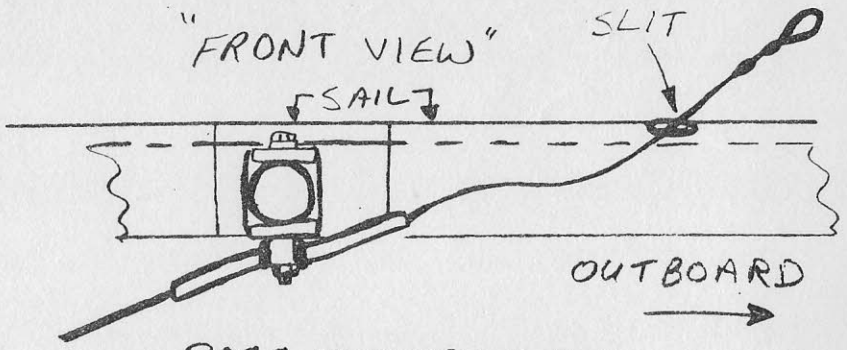


MOUNT CLAMP "CENTERED" ON CABLE GUIDE.



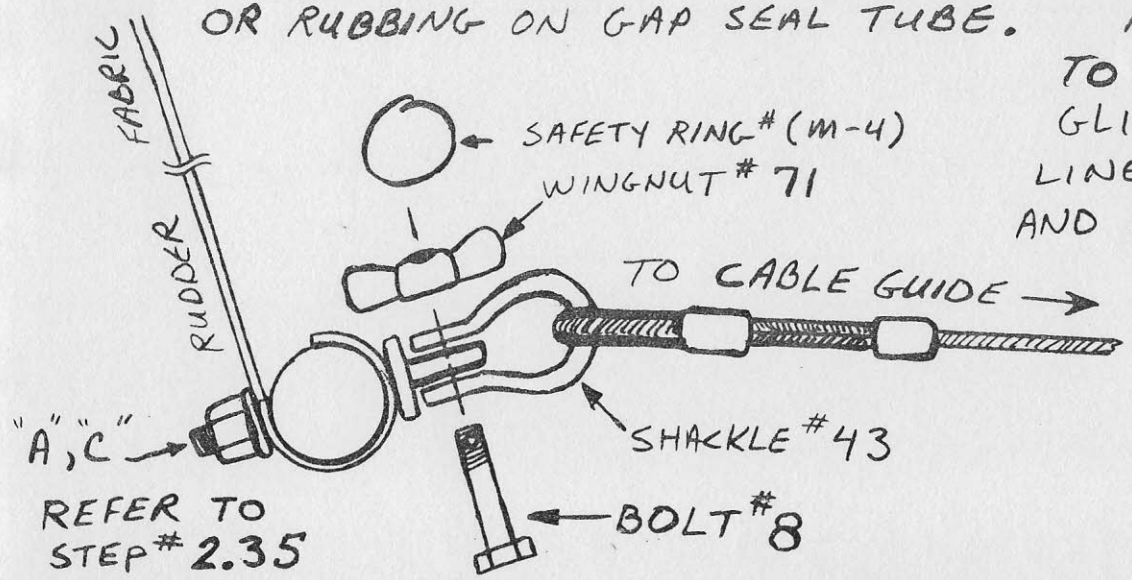

ATTACH CONTROL CABLE GUIDES AND CLAMP TO BOLT #12 ON BOTTOM OF OUTBOARD COMPRESSION STRUT BRACKET AS SHOWN.



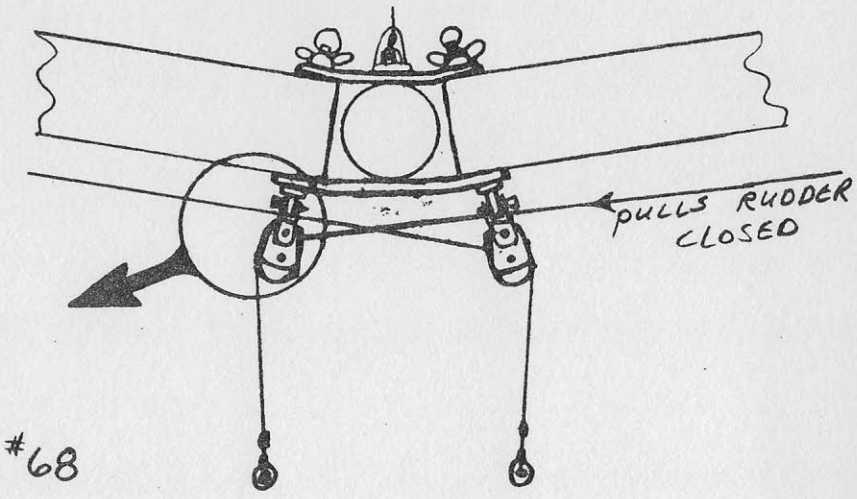

PASS THIMBLE END OF CABLES OUT THROUGH SLIT IN SAIL AS SHOWN.

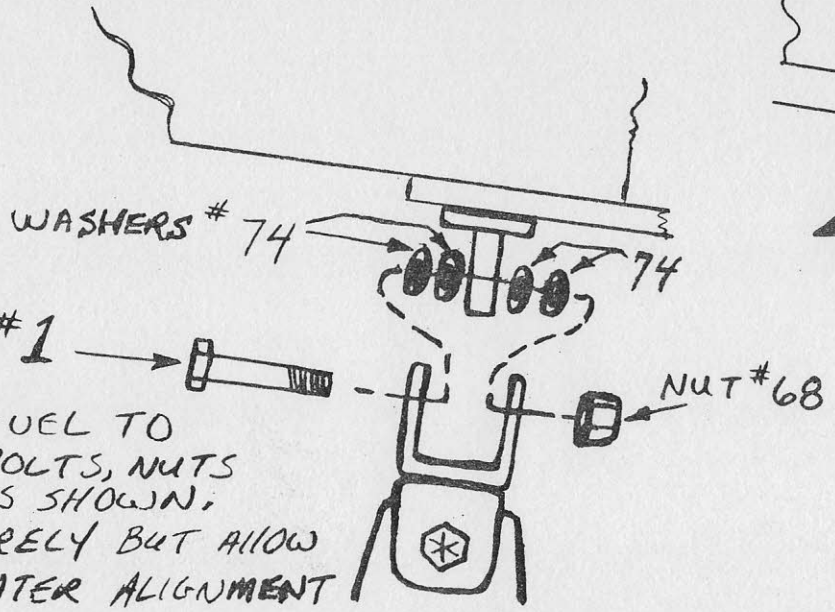
# 2.41

ATTACH RUDDER CONTROL CABLES TO EYEBOLTS "A" AND "C" USING PROPER SHACKLES, BOLTS, WINGNUTS AND SAFETY RINGS AS SHOWN. ALWAYS INSERT BOLT #8 FROM BOTTOM UP. THIS WILL PREVENT IT FROM CATCHING OR RUBBING ON GAP SEAL TUBE. ATTACH RUDDER CONTROL LINE PULLEYS TO EYEBOLTS LOCATED ON NOSE OF GLIDER AS SHOWN. NOTE THAT CONTROL LINES CRISS CROSS BENEATH EACH OTHER AND ONE EYEBOLT HAS SEVERAL WASHERS MOUNTING IT LOWER THAN THE OTHER EYEBOLT. THIS IS TO KEEP CABLES FROM RUBBING ON EACH OTHER DURING OPERATION. (SEE STEP 2.8)



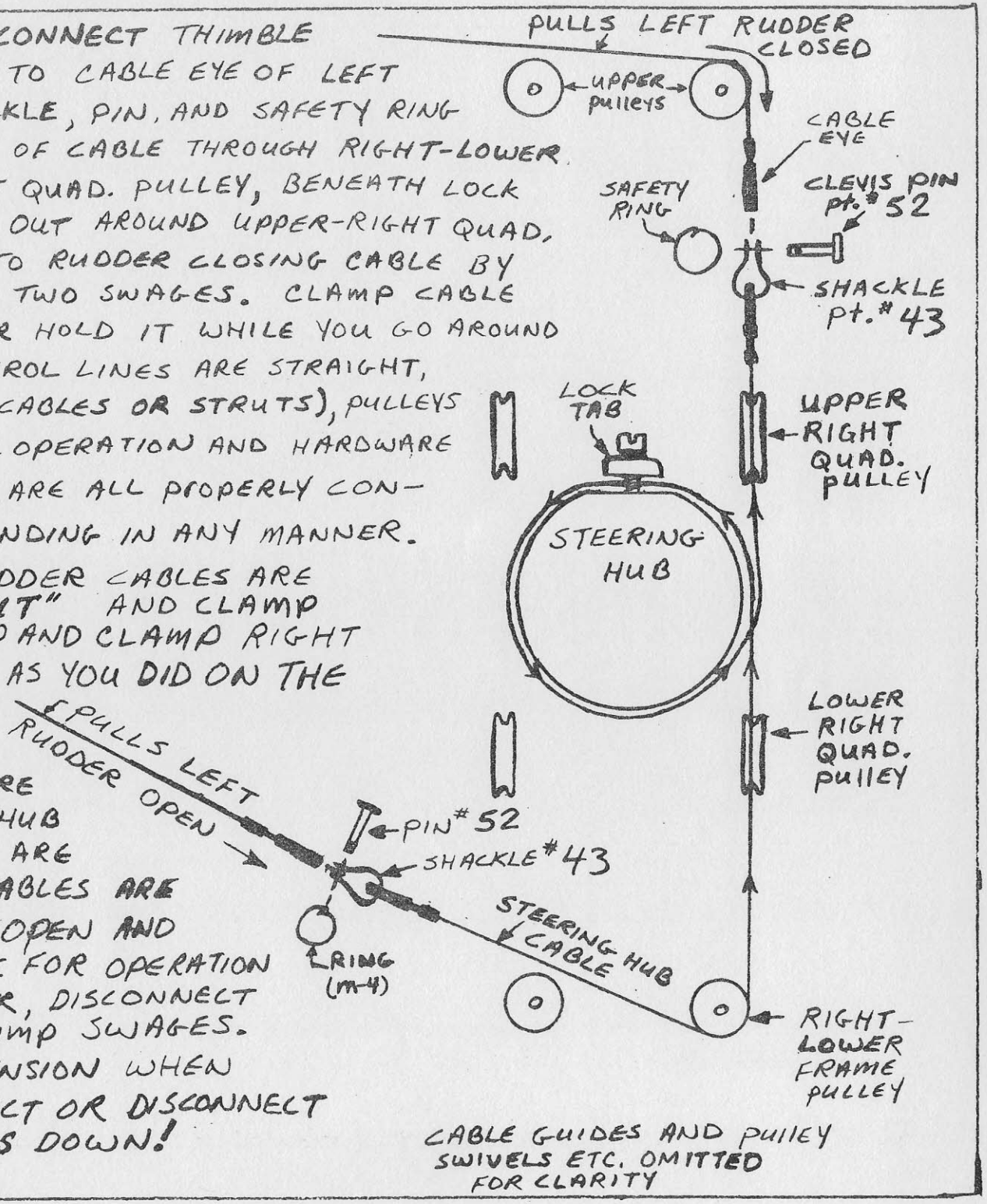

"FRONT VIEW"



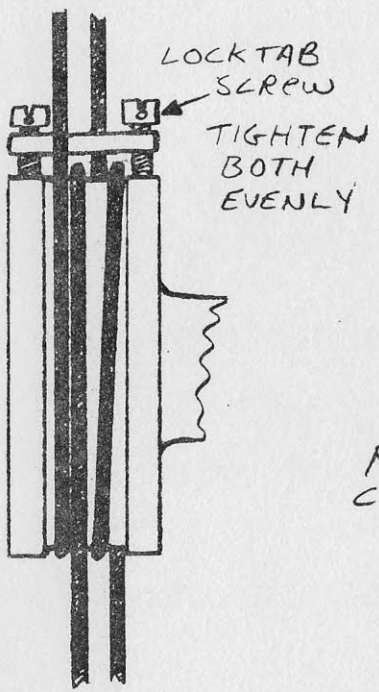

ATTACH pulley SWIVEL TO EYEBOLT WITH BOLTS, NUTS AND WASHERS AS SHOWN. TIGHTEN SECURELY BUT ALLOW TO ROTATE FOR LATER ALIGNMENT

**2.42** REFER TO STEP # 2.39. CONNECT THIMBLE END OF STEERING HUB CABLE TO CABLE EYE OF LEFT RUDDER OPENING CABLE USING SHACKLE, PIN, AND SAFETY RING AS SHOWN. PASS UNSWAGED END OF CABLE THROUGH RIGHT-LOWER FRAME PULLEY, UP TO LOWER-RIGHT QUAD. PULLEY, BENEATH LOCK TAB AND AROUND STEERING HUB, OUT AROUND UPPER-RIGHT QUAD. PULLEY, AND FINALLY CONNECTING TO RUDDER CLOSING CABLE BY MEANS OF A SHACKLE, THIMBLE AND TWO SWAGES. CLAMP CABLE IN THIS POSITION OR HAVE A HELPER HOLD IT WHILE YOU GO AROUND AND CHECK TO BE SURE ALL CONTROL LINES ARE STRAIGHT, (NOT WRAPPED OR ANGLING AROUND CABLES OR STRUTS), PULLEYS ARE ALIGNED AT BEST ANGLE FOR OPERATION AND HARDWARE SUCH AS THIMBLES AND SHACKLES ARE ALL PROPERLY CONNECTED AND NOT TWISTED OR BINDING IN ANY MANNER. WHEN SATISFIED THAT LEFT RUDDER CABLES ARE CONNECTED, PULL CABLE "TAUT" AND CLAMP SWAGES IN POSITION. SET UP AND CLAMP RIGHT RUDDER CABLES THE SAME WAY AS YOU DID ON THE LEFT RUDDER, CHECKING TO BE SURE CABLES ARE NOT RIDING OVER EACH OTHER WHERE THEY PASS AROUND STEERING HUB AND UPPER AND LOWER PULLEYS ARE PROPERLY ALIGNED. MAKE SURE CABLES ARE STRAIGHT AND "VERY TAUT". OPEN AND CLOSE BOTH RUDDERS TO CHECK FOR OPERATION THEN LOWER KINGPOST TENSIONER, DISCONNECT CABLES AND PERMANENTLY CRIMP SWAGES. RUDDER LINES HAVE PROPER TENSION WHEN THEY ARE DIFFICULT TO CONNECT OR DISCONNECT WHEN THE KINGPOST TENSIONER IS DOWN!

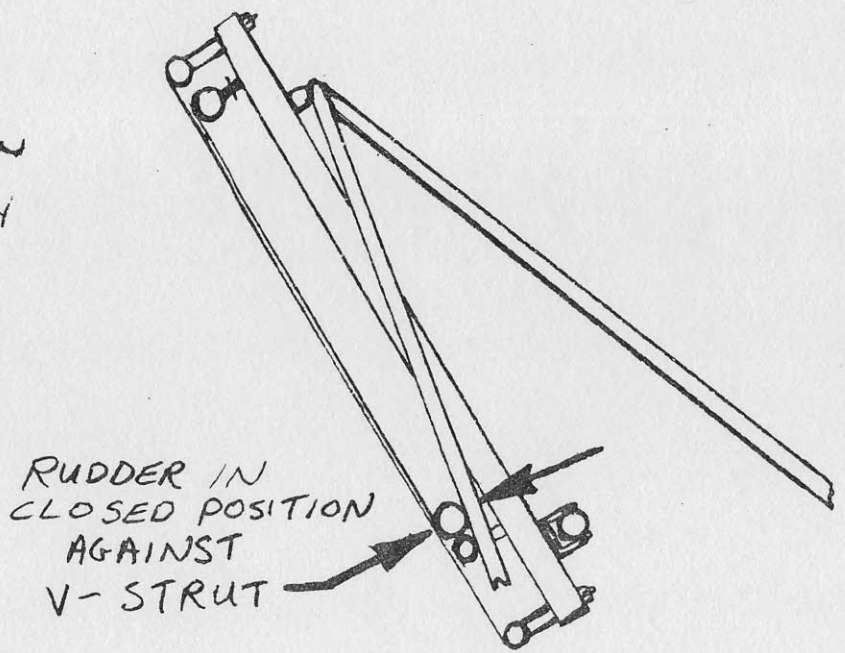


**2.43 CONTROL ADJUSTMENT** – EXAMINE STEERING HUB. MAKE SURE CABLES ARE WRAPPED EVENLY AROUND HUB, NOT RIDING OVER THE TOP OF ONE ANOTHER. CABLES ARE PERMITTED TO RUB AGAINST EACH OTHER A LITTLE DURING OPERATION AND A FEW SQUIRTS OF W.D.40 IN THIS AREA WILL HELP KEEP ACTION SMOOTH BUT CABLES SHOULD NOT OVERRIDE EACH OTHER OR BIND IN ANY MANNER.

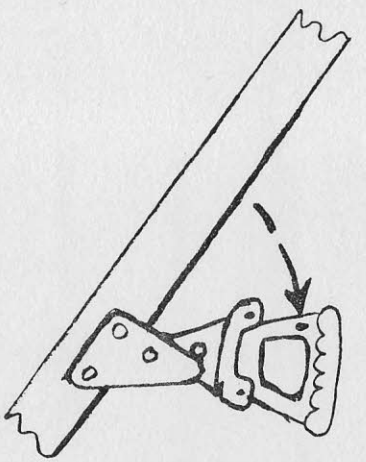
HAVE SOMEONE HOLD RUDDERS CLOSED AGAINST V-STRUTS. SHORT V-STRUTS SERVE AS A RUDDER STOP. ADJUST CONTROL YOKE SO THAT IT IS IN THE DOWN AND LEVEL POSITION. WHEN BOTH RUDDERS ARE CLOSED AND YOKE IS DOWN AND LEVEL, TIGHTEN LOCK TAB SCREWS EVENLY AND SECURELY TO PREVENT CABLES FROM SLIPPING AROUND HUB WHEN RUDDERS ARE APPLIED. LOCK-WIRE LOCKTAB SCREWS WITH .032" SAFETY WIRE.



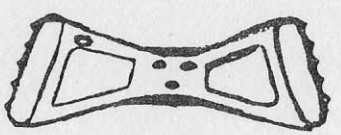

CABLES WRAPPED PROPERLY!




"REAR VIEW"



STEERING YOKE DOWN AND AGAINST STOP



ADJUST LEVEL

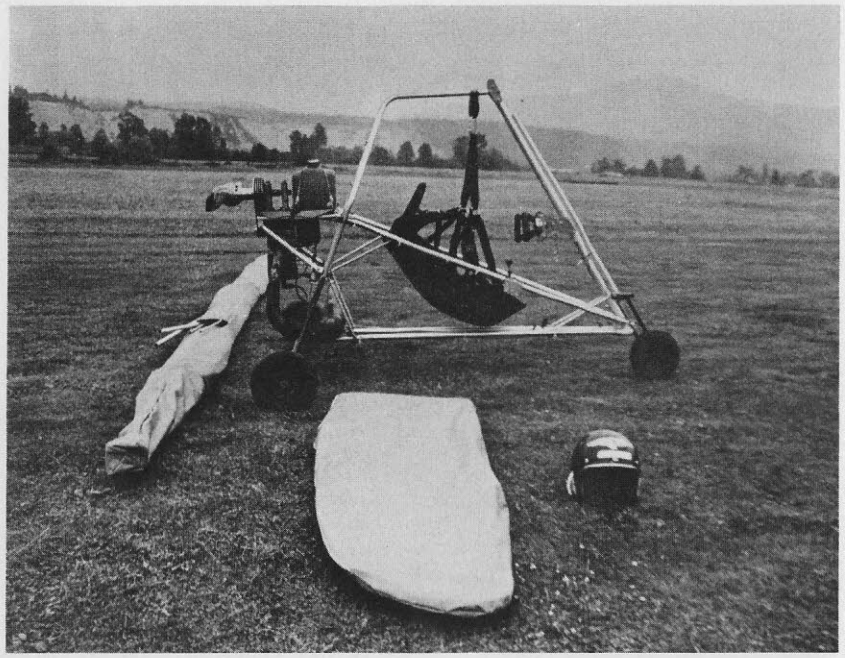
2.44 NOW THAT YOU HAVE THE ENTIRE GLIDER TOGETHER, GO BACK OVER IT AND CHECK EVERY NUT AND BOLT IN THE MACHINE TO BE SURE THEY ARE PROPERLY AND SECURELY FASTENED. ALSO CHECK ALL THE COTTER PINS TO SEE THAT THEY ARE BENT OVER AND PROPERLY SECURE. CHECK TO BE SURE THAT ALL SAFETY RINGS ARE PROPERLY INSTALLED AND SECURED. USE THE LIST BELOW AS A GUIDE WHEN GIVING YOUR WING A FINAL THOROUGH INSPECTION.

## =FINAL ASSEMBLY CHECKLIST=

1. ALL BOLTS, NUTS, CLEVIS PINS, COTTER PINS AND SAFETY RINGS PROPERLY SECURED.
2. ALL FLYING WIRES PROPERLY AND SECURELY FASTENED.
3. DRAG WIRE THIMBLES STRAIGHT AND TURNBUCKLES SAFETY WIRED.
4. KING POST TENSIONER UP AND LOCK RING IN PLACE.
5. RUDDERS AND STRUTS SECURELY MOUNTED AND SAFETY RINGS INSTALLED.
6. RUDDER HINGE PINS PROPERLY MOUNTED AND COTTER PINS PROPERLY INSTALLED.
7. RUDDERS HINGE OPEN AND CLOSED WITHOUT BINDING.
8. CONTROL CABLES PROPERLY AND SECURELY FASTENED, NOT BINDING ON TUBES OR CABLES.
9. STEERING YOKE AND PULLEY SYSTEM FUNCTIONING PROPERLY.
10. ALL CONTROL SYSTEM PULLEYS AND GUIDES PROPERLY ANCHORED TO AIRFRAME.
11. ENGINE, PROPELLOR AND DRIVE BELTS PROPERLY AND SECURELY MOUNTED.
12. EXHAUST SYSTEM COMPONENTS PROPERLY AND SECURELY MOUNTED.
13. FUEL TANK PROPERLY MOUNTED AND BUNGEE CHORDS PROPERLY SECURED.
14. QUICK DIS-CONNECT FITTINGS, FUEL FILTER AND FUEL LINES CLAMPED AND NO LEAKS.
15. ALL IGNITION WIRES PROPERLY ROUTED AND SECURED.
16. THROTTLE AND CHOKE CABLES PROPERLY ROUTED AND SECURE.
17. ALL ENGINE CONTROLS FUNCTIONING PROPERLY.
18. KILL SWITCH FUNCTIONING PROPERLY.
19. PULL STARTER ROPE PROPERLY AND SECURELY MOUNTED AND FUNCTIONING.
20. ALL WHEELS AND TIRES PROPERLY INFLATED AND COTTER PINS INSTALLED.

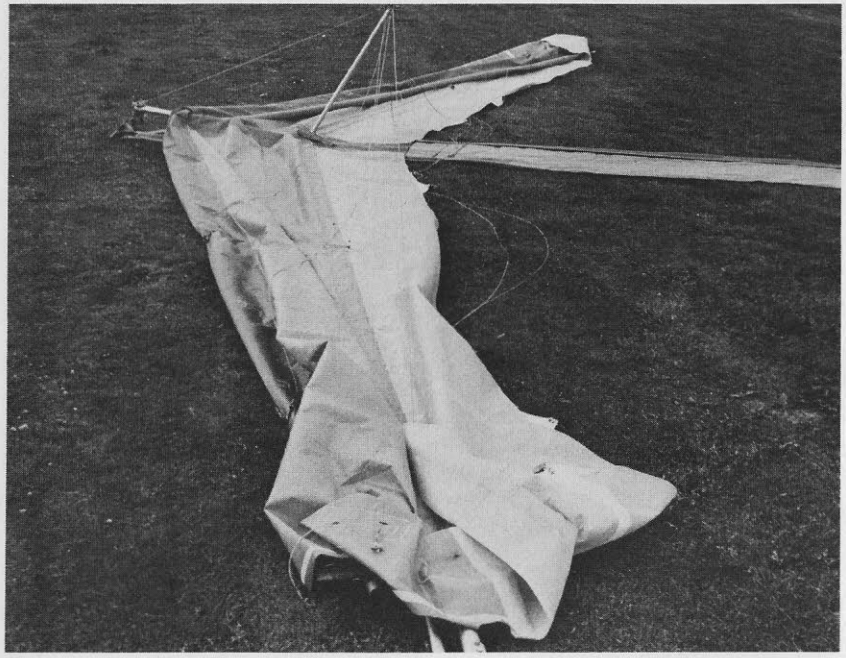
KASPER WING IS NOW READY FOR PRE-FLIGHT!
REFER TO FLIGHT OPERATIONS MANUAL PRIOR TO ATTEMPTING FLIGHT.

## KASPERWING READY FOR PRE-FLIGHT ASSEMBLY

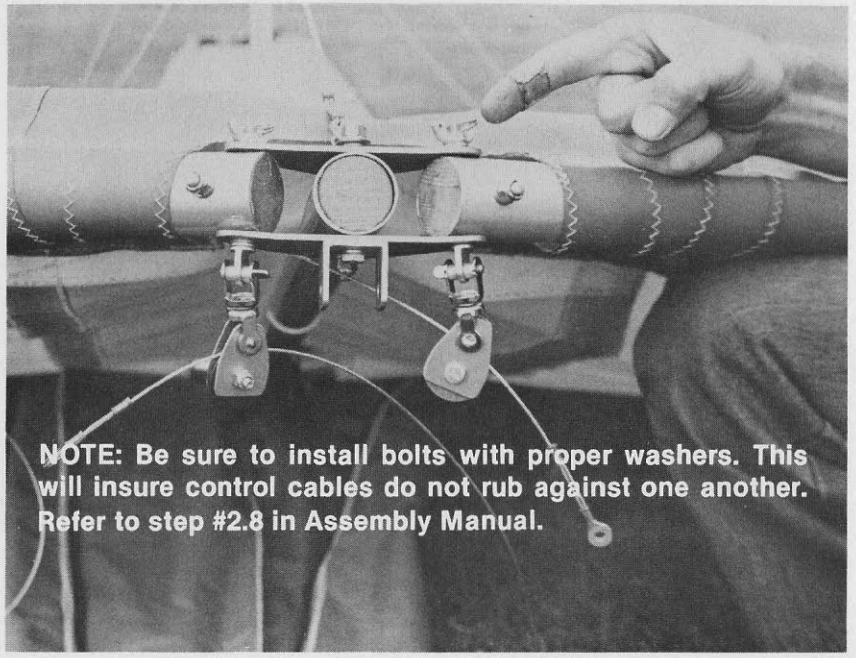


**1.** Remove ribs and struts from bag pocket

**2.** Flip Glider over and spread wings

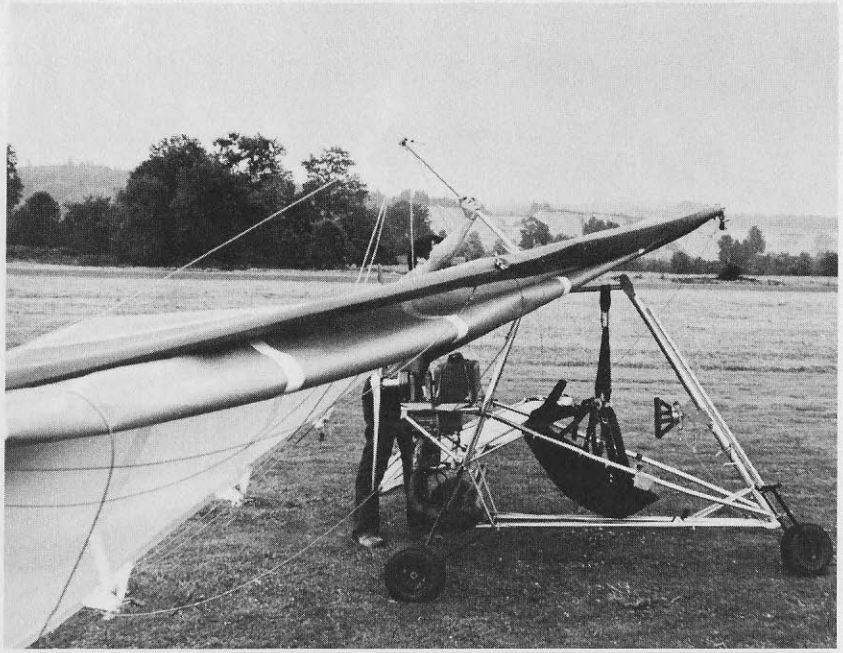


**3.** Install spar anchor bolts, wing nuts, and safety rings.

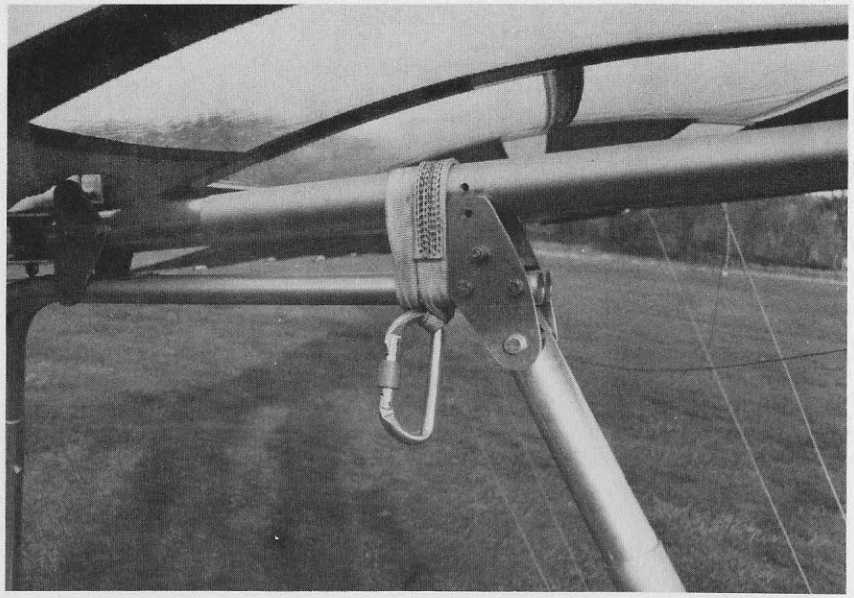


NOTE: Be sure to install bolts with proper washers. This will insure control cables do not rub against one another. Refer to step #2.8 in Assembly Manual.

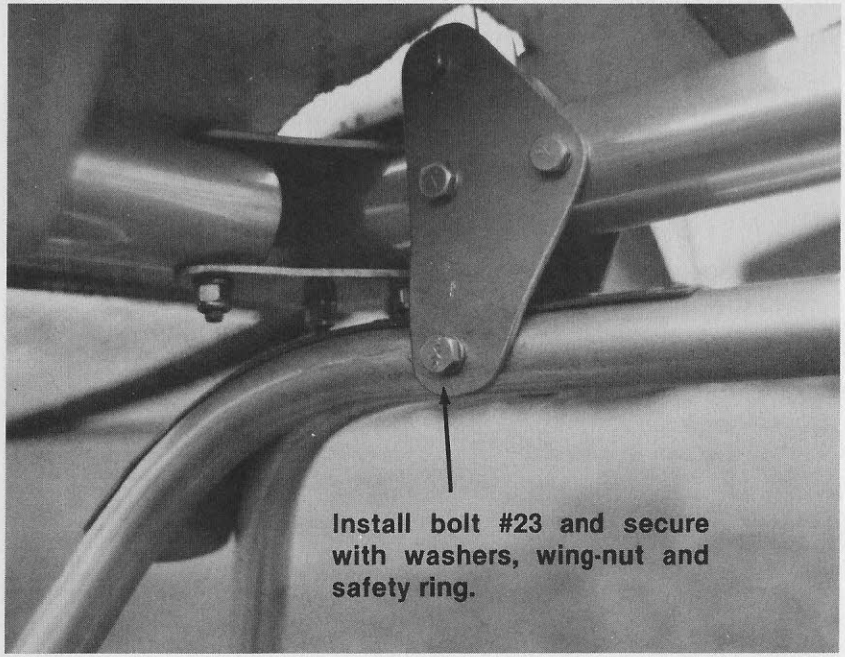
**4.** Grab kingpost, lift wing into position on top of frame.



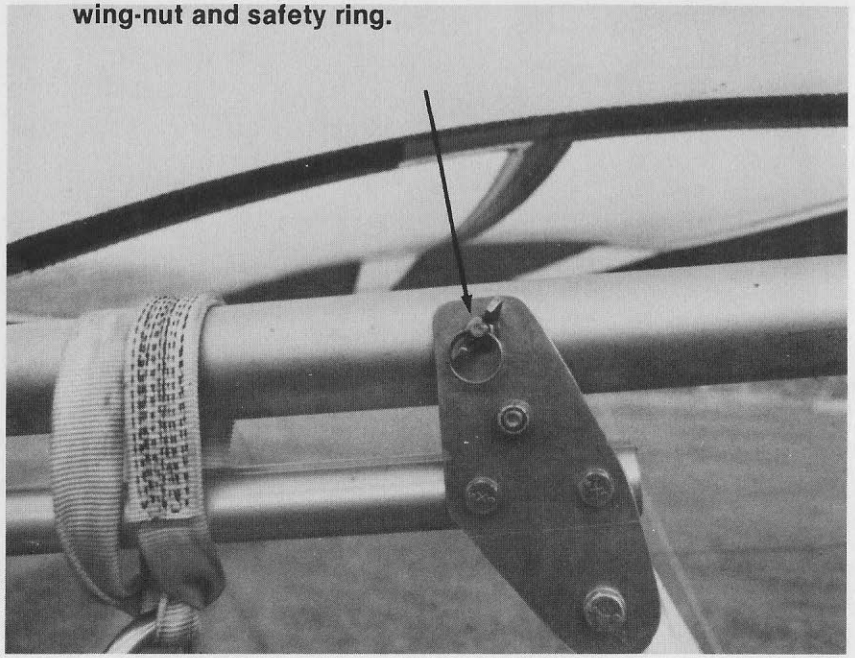
**5.** Use carabiner and hang strap to hold wing in position.



**6.**

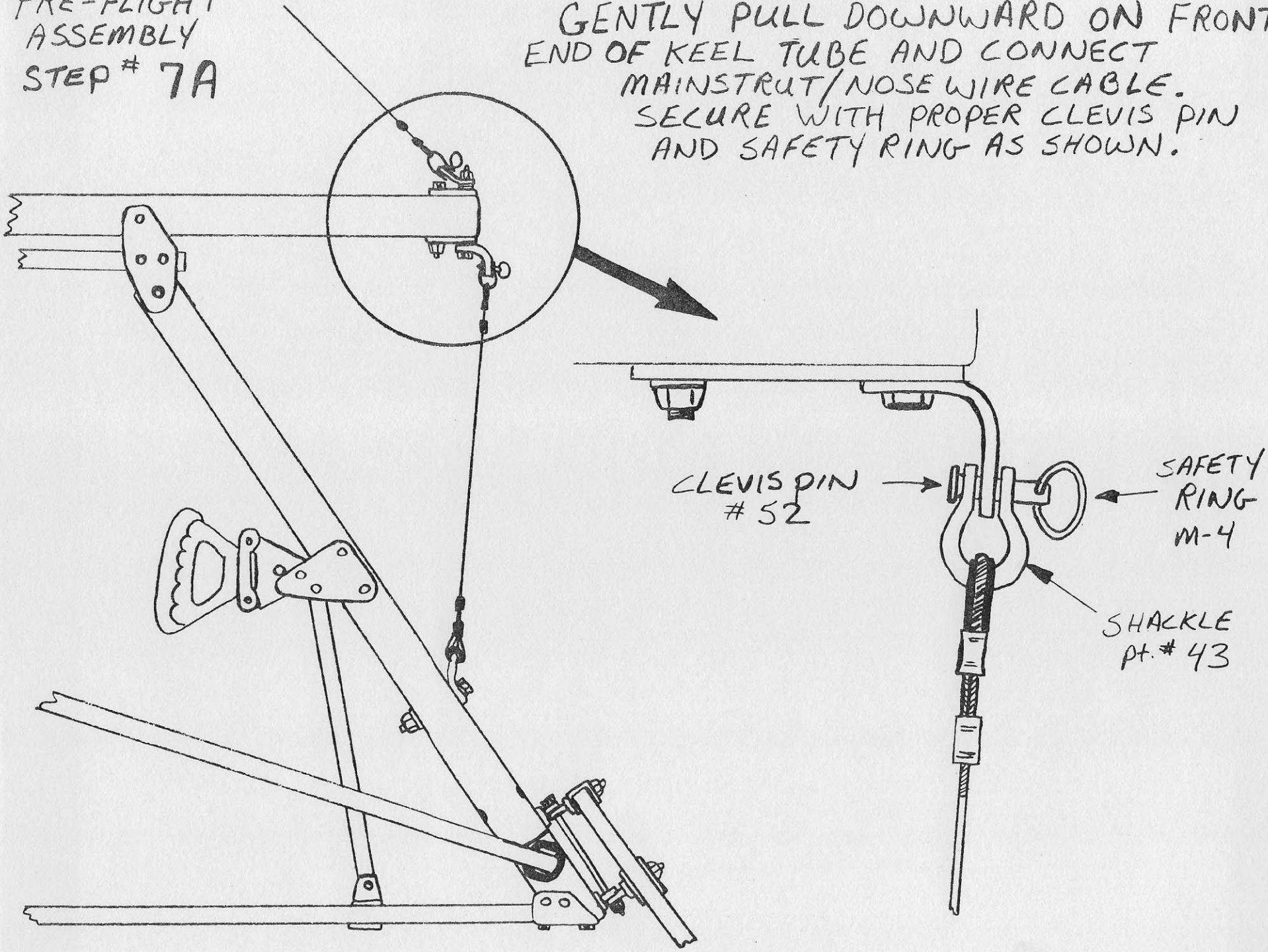



**7.** Connect keel to frame with bolt #22 and secure with wing-nut and safety ring.

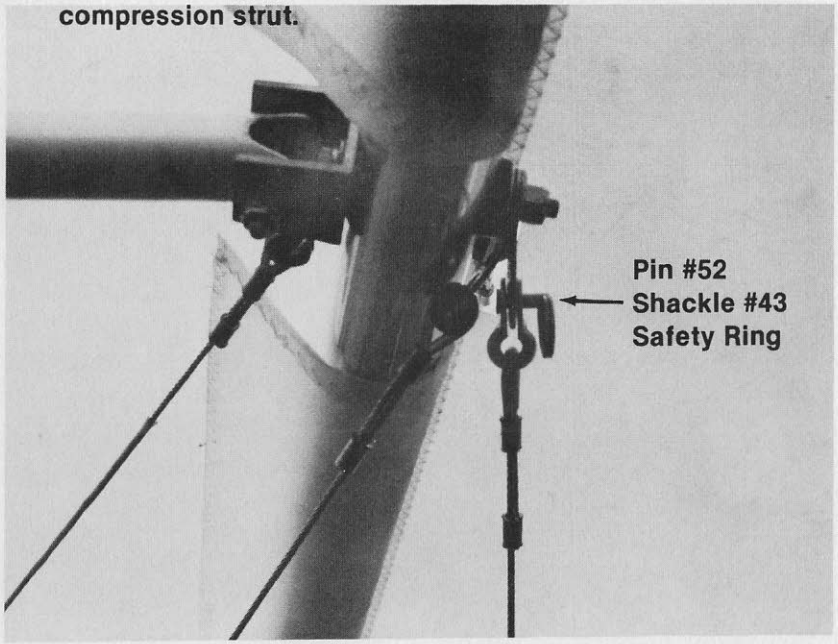


PRE-FLIGHT ASSEMBLY STEP # 7A

GENTLY PULL DOWNWARD ON FRONT END OF KEEL TUBE AND CONNECT MAINSTRUT/NOSE WIRE CABLE. SECURE WITH PROPER CLEVIS PIN AND SAFETY RING AS SHOWN.

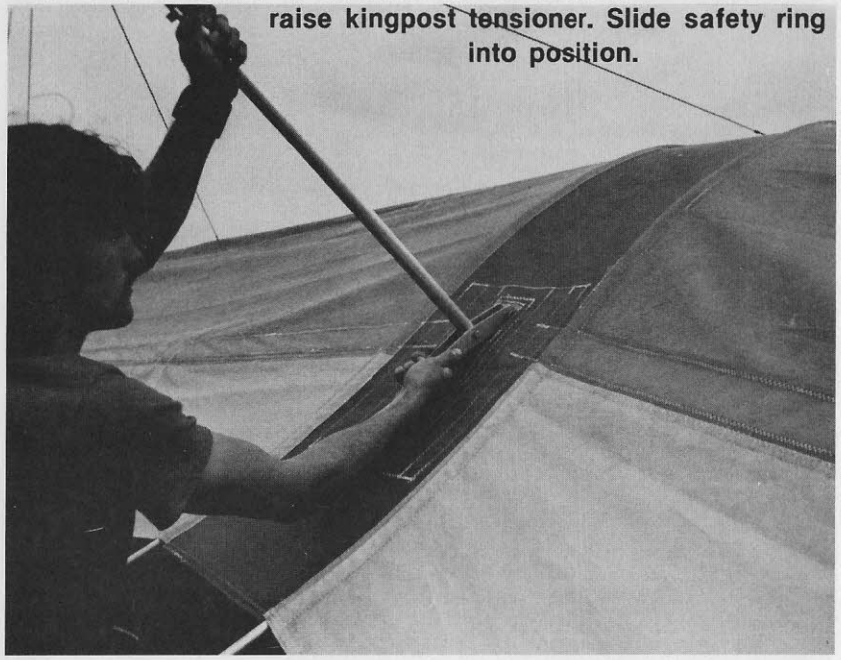


**8.** Attach rear frame landing wires to each wing at inner compression strut.

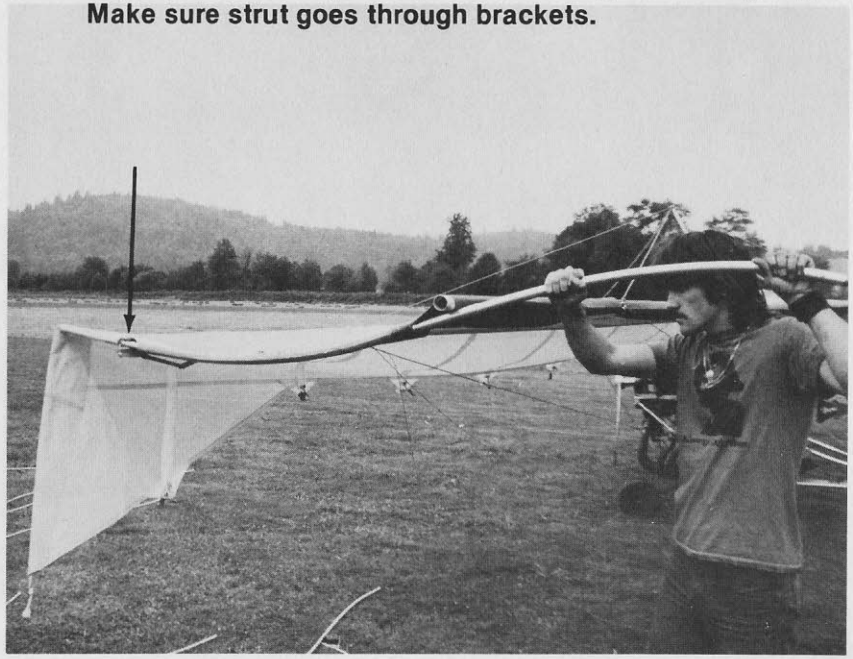



**9.** Attach flying wires to flying wire attach plate and plug compression struts into back of front spar.

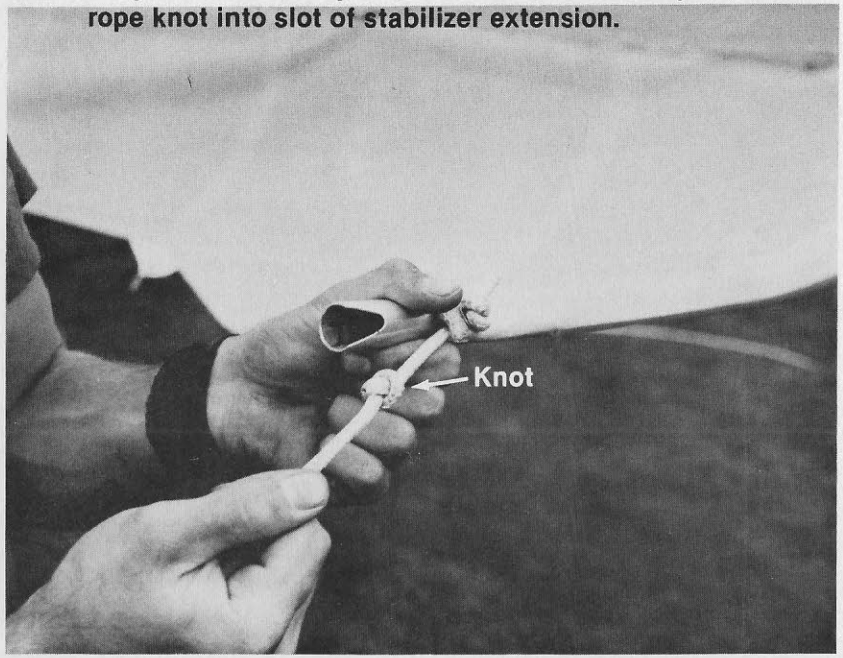
**10.** Double check to be sure no thimbles are twisted and raise kingpost tensioner. Slide safety ring into position.



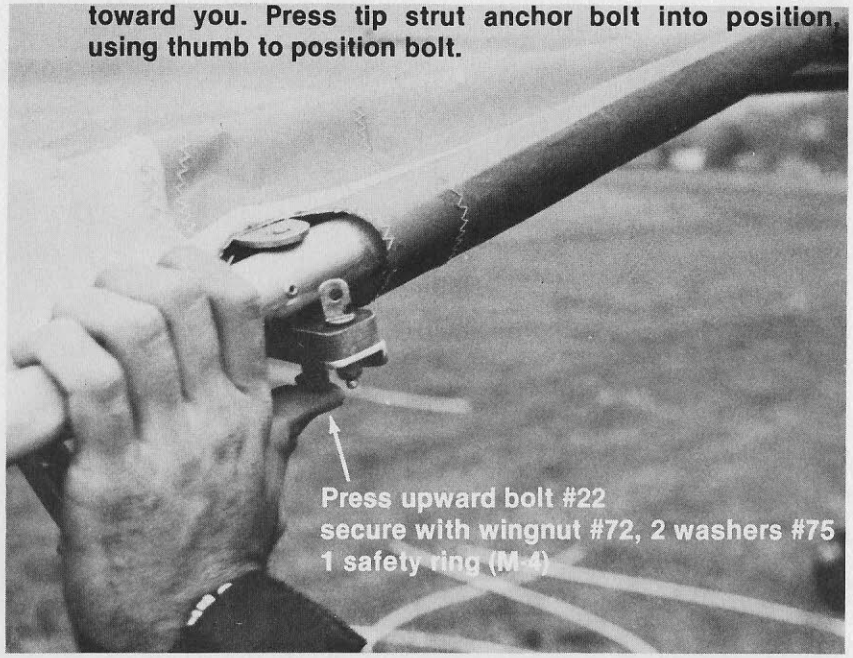
**11.** Slip tipstrut into tipstrut pocket starting at leading edge. Make sure strut goes through brackets.



**12.** Plug front end of tip strut into hole in front spar. Anchor rope knot into slot of stabilizer extension.



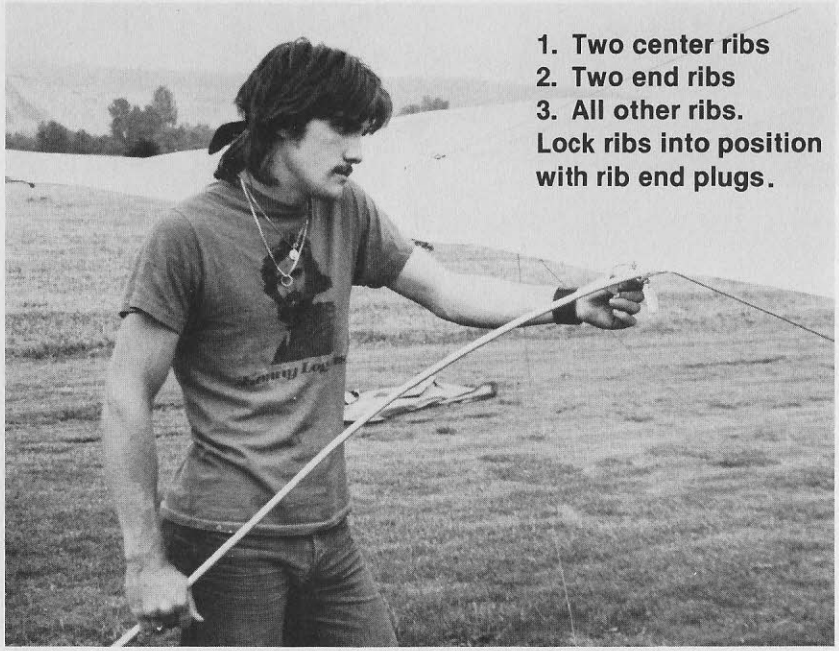

**13.** Put one hand on cambered portion of tip strut and pull toward you. Press tip strut anchor bolt into position, using thumb to position bolt.



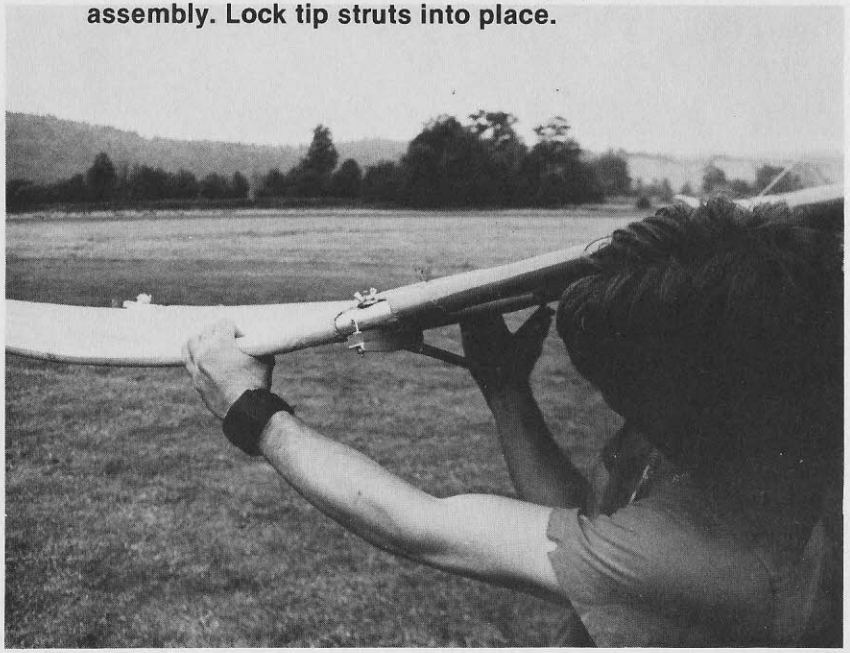

**14.** Slide ribs into rib pockets in back of sail starting with:

1. Two center ribs
2. Two end ribs
3. All other ribs.

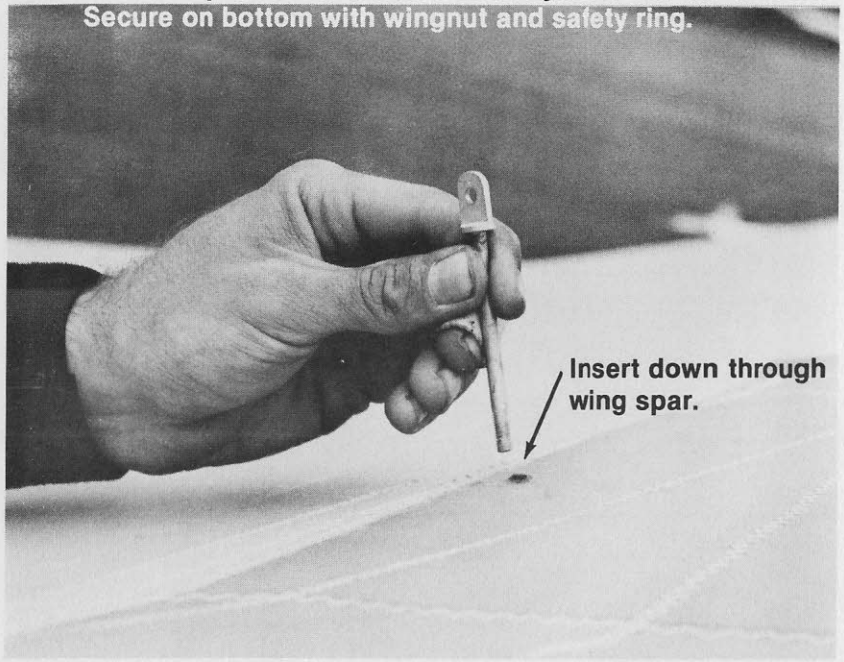
Lock ribs into position with rib end plugs.



**15.** Pull tip strut outward while pushing upward on tensioner assembly. Lock tip struts into place.

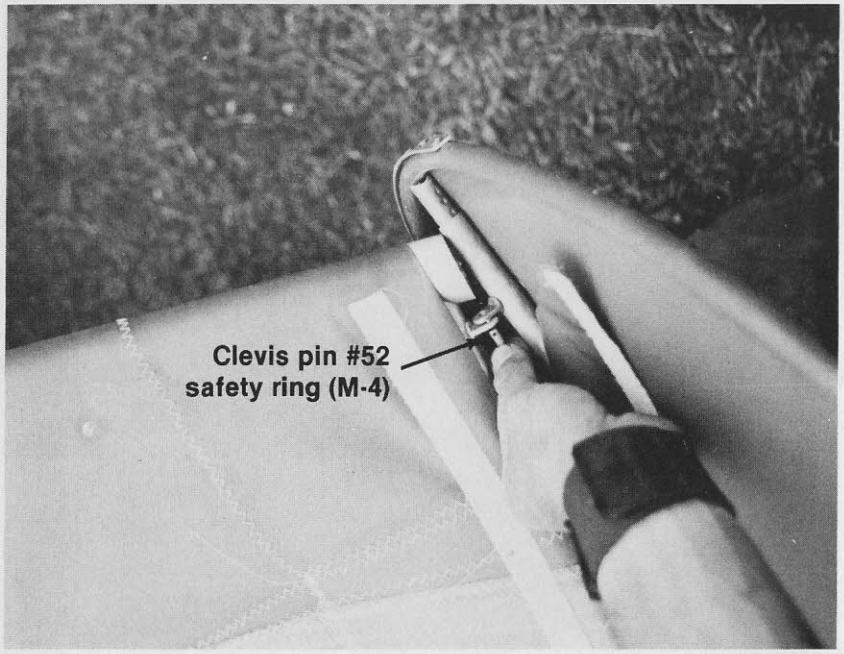


**16.** Secure tip strut tensioners with eyebolt #35 as shown. Secure on bottom with wingnut and safety ring.

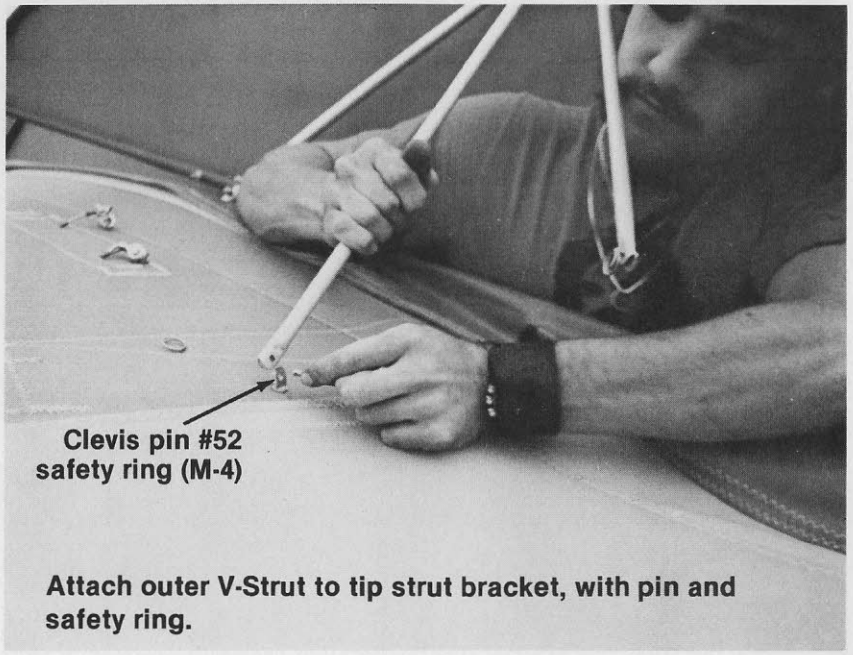



**17.** Attach rudder to tip strut, using clevis pin and safety ring. NOTE: have someone hold wing down if available.

**18.** Secure vertical stabilizer with clevis pin and safety ring.

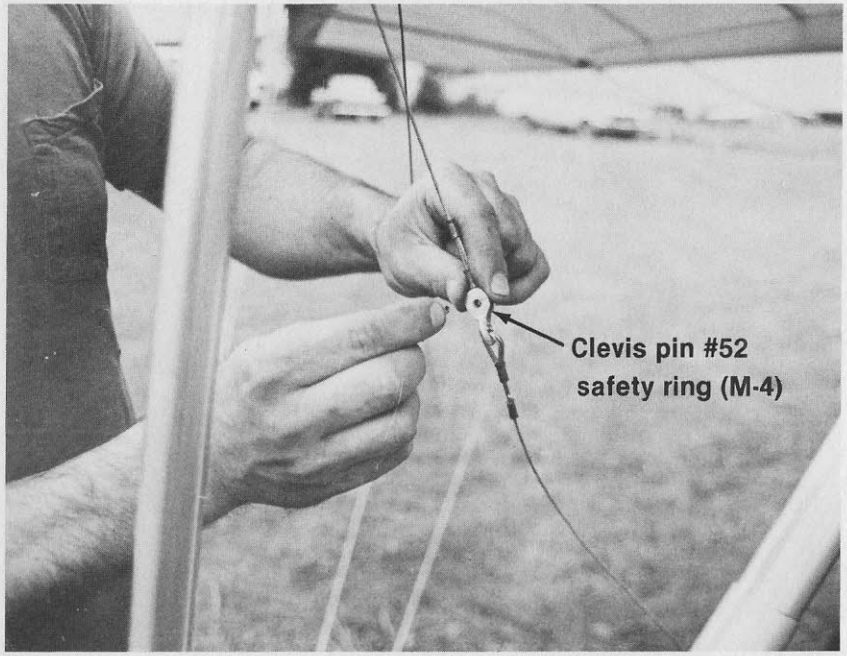



**19.** Attach inner V-Strut to eyebolt with pin and safety ring.

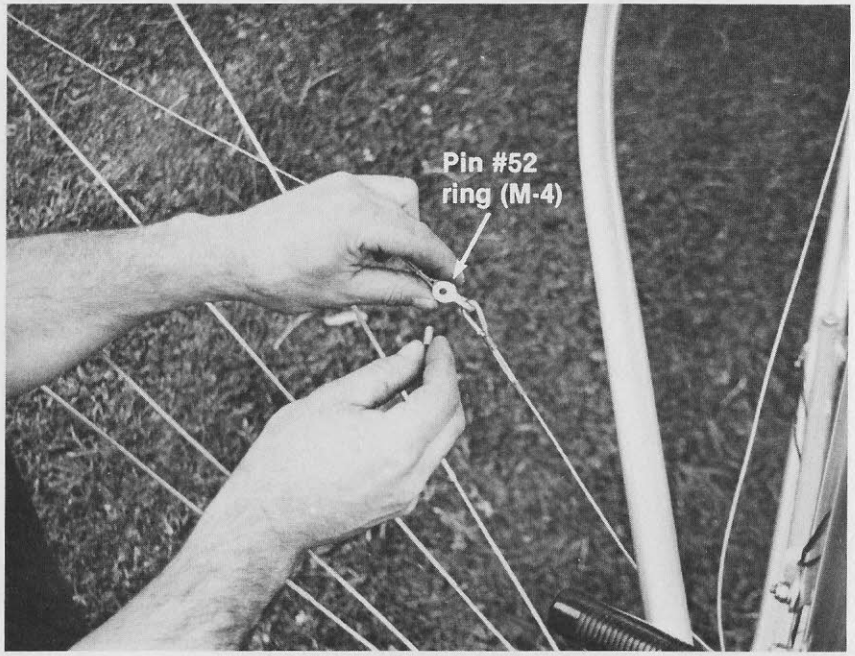



Attach outer V-Strut to tip strut bracket, with pin and safety ring.

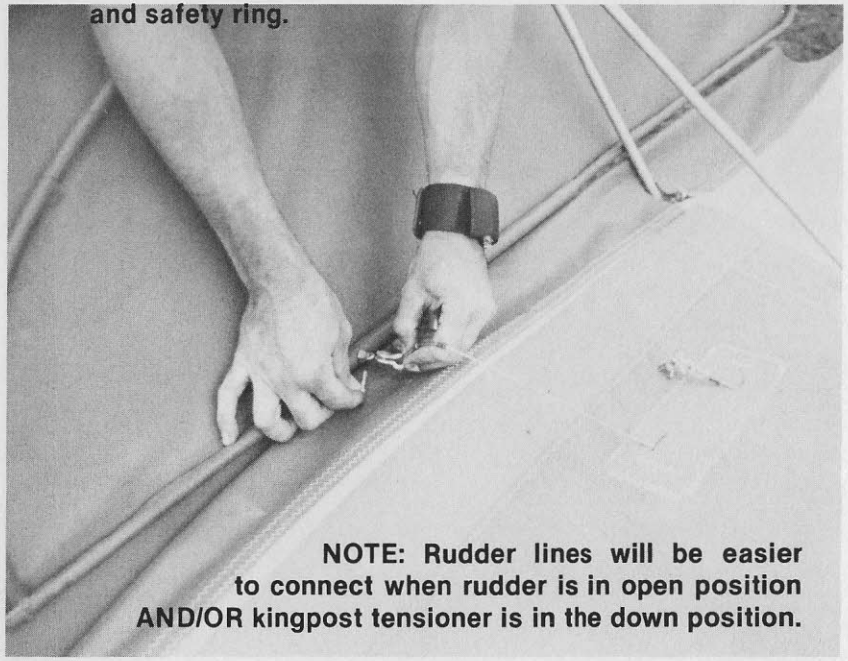
**20.** Connect Rudder return lines with pin and safety ring




**21.** Connect rudder opening lines with pin and safety ring.




**22.** Attach both control lines to rudders using bolt, wingnut and safety ring.



NOTE: Rudder lines will be easier to connect when rudder is in open position AND/OR kingpost tensioner is in the down position.

Be sure to attach rudder lines to rudders with shackle bolt facing UPWARD. This will prevent it's catching on Rudder-Gapseal tube or wing, when opened or closed.