

TEXAS ASTRONOMICAL SOCIETY

# The Couch-Potato Telescope

Assembly Instructions

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## THE COUCH-POTATO TELESCOPE

When I got interested in astronomy in 1986, during the appearance of Comet Halley, I read an article in a magazine about a person who had taken an office chair and attached a binocular mount to it. Since my telescope at the time consisted of a pair of 10x50 Tasco binoculars, I thought this was a wonderful idea. However, there was no way I could stuff an office chair into my Mazda RX7, so I decided to build something that folded flat enough to fit in the Mazda. I used the first version of my "Couch-potato Telescope" until I bought my first "real" telescope, a 10" Dobsonian. The binocular rig got stored in a closet.

The George Observatory is an astronomical observatory located in Brazos Bend State Park, south of my home in Houston, Texas. It contains a 36", an 18" and a 14" telescope mounted in permanent domes, and several Dobsonian scopes on wheels which can be set up on the observing deck. The George Observatory is open to the public on Saturday nights and is operated by local amateurs who enjoy showing people things in the night sky.

In 1993 I started setting the binocular rig up at the George Observatory on Saturday nights. It was real popular with ten-year-olds of all ages. It was not, however, very sturdy in the hands of the general public. During the summer of 1993, the "Couch-potato-Telescope" got scrambled on Saturday night and re-engineered on Sunday. By the fall of 1993, after about a dozen iterations, it was robust enough to withstand being exposed to the public.

Since then, many people have expressed an interest in acquiring their own Couch-potato Telescope. This booklet will explain how one is constructed.

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## ASSEMBLY INSTRUCTIONS

The next page lists the parts by subassembly. Fig. A-1 displays most of the small parts used. Numbers on the photo correspond to the descriptions on the parts list for those not familiar with these items.

I recommend that the builder read through all of the the instructions and look at the photos before starting assembly. The Carpenter's Credo; "Measure Twice, Cut Once" is an excellent way to proceed.

## BUYING PARTS

Home Depot stores carry the plywood, PVC tubing and fittings, polyethylene tubing, Lazy Susan bearings and metal clamps and brackets. Hardware stores carry aluminum tubing and some have a Specialty Hardware section of yellow trays where they carry 3/16" carriage bolts, clevis pins, hairpin clips, star washers and "O" rings. Common nuts, bolts and screws can be bought at either store. Target stores carry a Beach Chair with a frame made from 3/4" steel tubing that works well.



## COUCH-POTATO TELESCOPE PARTS LIST

- A 1. 1 ea. Folding Beach Chair. This is a low folding chair with armrests that allow the seat back angle to be adjusted.

SWIVEL BASE PARTS

- B 1. 1 ea. 48" x 48" x 1/2" plywood sheet. Any plywood will do, but a finished sheet looks better. Exterior plywood should be used on a system that will remain outdoors. Have the store cut the sheet into one 26" x 26", one 22" x 22" and one 12" x 12" square.
- B 3. 1 ea. 1" x 2" x 8 ft. Ash, Fir or Pine board.
- B 4. 1 ea. 5 1/2" Drawer pull handle.
- B 5. 2 ea. 1 1/4" Single-ended electrical conduit clamps.
- B 6. 3 ea. 5/8" x 2" 90° angle bracket.
- B 7. 4 ea. 1/2" x 1" 90° angle bracket.
- B 8. 4 ea. 3/16" x 1 1/4" Carriage bolts.
- B 9. 2 ea. 3/16" x 3/4" Carriage bolts.
- B10. 6 ea. 10-24 Acorn nuts.
- B11. 20 ea. #12 Flat washers. Get washers with holes big enough to fit a 1/4" screw, as they will be used on both 3/16" and 1/4" screws.
- B12. 2 ea. #6 x 1" Dry-wall screws or wood screws.
- B13. 20 ea. #6 x 1 1/2" Wood screws or dry-wall screws.
- B14. 20 ea. #6 x 1/2" Wood screws.
- B15. 1 ea. 12" Diameter Lazy Susan bearing. (Some stores call them Lazy Susans).

STRUT PARTS

- C 1. 20 ft. 1/4" O.D. Polyethelene tubing. This is a frosty-looking tubing that will be cut into 3" lengths to make the friction joints.
- C 2. 2 ea. 3/4" x 10 ft. Schedule 40 200 PSI thin wall PVC tubing. About 12 ft. of this tubing is all that is required, but it comes in 10 ft. lengths. Ensure that the aluminum tubing will slide easily into the PVC tubing.
- C 3. 1 ea. 7/8" O.D. x 96" Aluminum tubing; 4 x 21 1/2" and 2 x 5" pieces.
- C 4. 2 ea. 3/4" 90° Aluminum electrical conduit elbows. These MUST be the kind shown in Fig. A-1. The kind with rounded corners will not work.
- C 5. 6 ea. 3/4" PVC 90° Elbows.
- C 6. 2 ea. 3/4" PVC Slip-on end caps.
- C 7. 2 ea. 1/4-20 x 3" machine screws.
- C 8. 5 ea. 1/4-20 Plain nuts.
- C 9. 2 ea. 1/4-20 Self-locking nuts.
- C10. No longer used.
- C11. 4 ea. 3/32 dia. x 1 5/8" Hairpin clips.
- C12. 2 ea. 5/16" x 2" Universal clevis pins. Get pins with holes drilled along the whole length, to within 1/2" of the head.
- C13. 1 ea. 1 1/4" or 1 3/8" x 27" bicycle tube. This will be cut into 1/2" lengths to provide tension on the friction joints.
- C14. 4 ea. OPTIONAL 2" stainless steel hose clamps, used to tension the friction joints when the binoculars used are heavy enough to overcome the friction provided by the bicycle tube.
- C15. 25 ft. 1/8" braided cotton or nylon line; This will keep the struts from coming apart during operation.

CROSSBAR PARTS

- D 1. 1 ea. 3/4" PVC "T" joint with slip-on ends and a threaded "T".  
 D 2. 1 ea. 3/4" PVC threaded plug to screw into the PVC "T" joint.  
 D 3. 1 ea. 1/4-20 x 1 1/4" Round head machine screw.  
 D 4. 1 ea. 1/4-20 x 3/4" Carriage bolt.  
 D 5. 1 ea. 1" dia. x 1/8" ACE Tank Bolt washer, ACE Part No. 4016101. This is used to cushion the binocular mount.  
 D 6. 1 ea. 3/16" I.D. x 5/16" O.D. "O" ring.  
 D 7. 10 ea. 1" dia. fender washers with 3/16" holes.  
 D 8. 3 ea. 1 1/4" dia. fender Washers with 1/4" holes.  
 D 9. 2 ea. 3/16" star washers with inside teeth.  
 D10. 1 ea. 1/4" star washer with inside teeth.  
 D11. 2 ea. 10-24 Plain nuts.  
 D12. 2 ea. 10-24 Self-locking nuts.  
 D13. 2 ea. 10-24 x 6" machine screws.

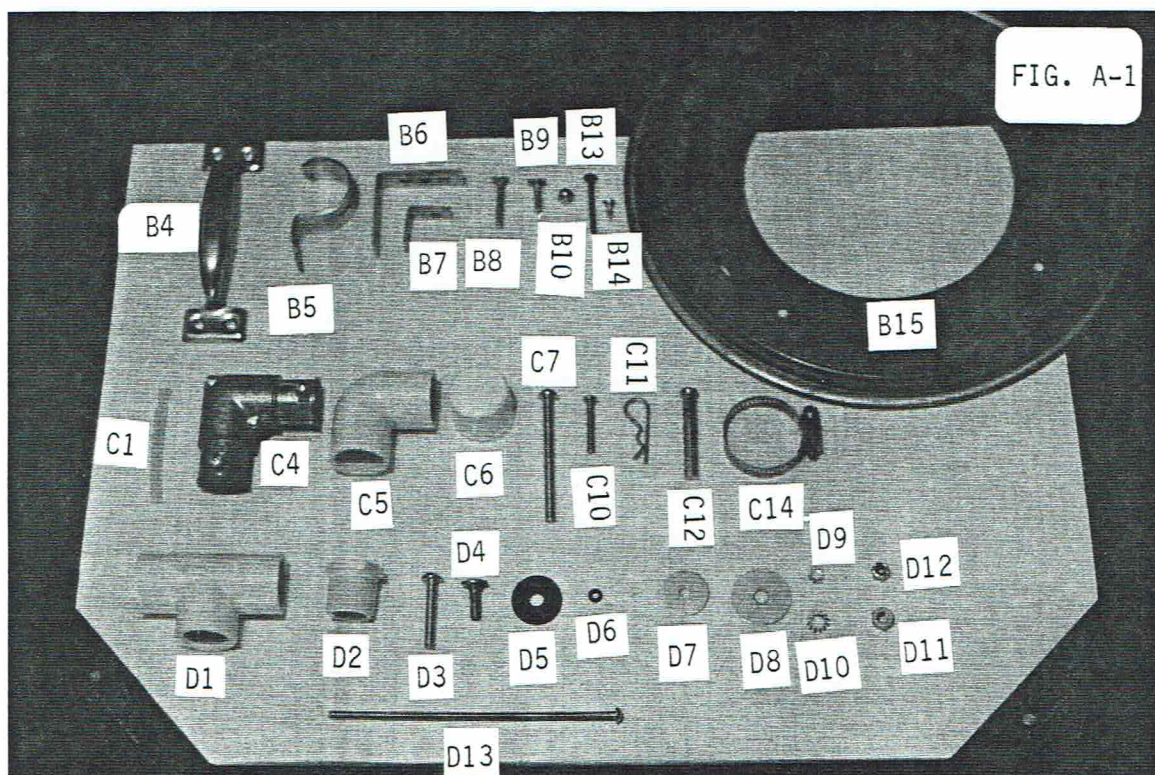
ADDITIONAL MATERIALS NEEDED

- 10 ft. 1 1/2" wide Black 3M Plastic Decorate and Repair tape, Catalog no. 191.  
 2 ft. 1 1/2" wide double-stick cloth-backed carpet tape.  
 10 ft. 3/4" masking tape.  
 50 ft. Strong string or twine.

\*\*\* A NOTE ABOUT THE ALUMINUM TUBING (C-3) AND THE BICYCLE TUBE (C-13)\*\*\*  
 One 8 ft. length of aluminum tubing is EXACTLY the length required to construct this mount:  $2 \times 5" + 4 \times 21 \frac{1}{2}" = 96"$ . Be carefull cutting it.

The bicycle tube should measure 1 1/4" to 1 1/2" across when flattened out. This will produce rubber bands that will stretch over the friction joints and provide the proper amount of tension.

THE PARTS SHOWN BELOW ARE LISTED IN THE PARTS LIST ABOVE





## ASSEMBLY ORDER

It is recommended that your Couch-potato Telescope be assembled in the following order:

1. Select a folding chair.
2. Assemble the Swivel Base.
3. Assemble the Rear Strut assembly.
4. Assemble the Front Struts.
5. Assemble the Crossbar.

## FOLDING CHAIR SELECTION

- 1.1 The dimensions, front-to-back and side-to-side, of the chair selected for your Couch-potato Telescope will determine the size of the top sheet of the Swivel Base. The widest part of the chair will determine the distance required between the rear struts of the binocular mount. The height of the chair seat will determine the length of the struts. A low beach chair with an adjustable back angle works very well. A chair that measures 21" front-to back at the base, 24" side-to-side at its widest part and 6" to 9" high at the seat will be assumed for the assembly instructions. Although the chair sold by Target Stores mentioned on page 1 is about 26" wide at the front, it will still fit the mount described in this manual without modifying anything.

## SWIVEL BASE ASSEMBLY

Use Fig. B-1 to identify items used in construction. The parts are laid out on 4-square-to-the-inch graph paper so that the size of each part is evident. Each part identifier will be indicated in parentheses as it is needed.

The swivel base assembly consists of a 22" x 22" BASEBOARD, in contact with the ground, a Lazy Susan bearing, a 12" x 12" SPACER and a 26" x 26" SWIVEL BOARD.

- 2.1 BASEBOARD (Fig. B-1 & B-2) - Round off the corners of the 22" x 22" BASEBOARD. A 10" dinner plate can be used as a pattern to provide a 5" radius curve. Build a 18" x 18" base extender around the bottom of the BASEBOARD. This extender will raise the base assembly above the ground, allowing easier entry and exit to the chair, and keeping grass and rocks from getting between the boards of the Swivel Base. Install two 18" lengths of 1" x 2" pine or ash board (B3) edgewise, 2" in from two sides of the BASEBOARD and centered on the other two sides. Cut two other pieces to fit snugly between them; approximate length 16 1/2". Use three #6 x 1 1/2" screws (B13) to attach each 1" x 2" piece to the BASEBOARD, forming an 18" square centered on the BASEBOARD. Drill 1/8" clearance holes in the plywood for each screw. Countersink the screw heads in the plywood so that they will not rub on the top sheet of the Swivel Base. (Fig. B-3 & B-6) - Center the Lazy Susan bearing (B15) on the top of the BASEBOARD and mark the 4 inside screw holes to attach the bottom of the bearing to the BASEBOARD. Drill 3/32" starter holes at these locations. Do not attach the bearing to the BASEBOARD at this time. Mark where the large 3/4" hole in the bottom of the Lazy Susan bearing appears on the BASEBOARD. Drill a 3/4" hole in the BASEBOARD at this location. If a 3/4" drill is not available, a 3/8" or larger hole will suffice.

- 2.2 SPACER (Fig. B-4) - Draw diagonal lines on the 12" x 12" x 1/2" plywood SPACER. Drill two 1/8" clearance holes on one of the diagonals, 2 1/2" from the center of the board.
- 2.3 SWIVEL BOARD (Fig. B-4) - The SWIVEL BOARD is 26" square. Center the SPACER on top of the SWIVEL BOARD. Drill two 3/32" starter holes through the SWIVEL BOARD, using the two 1/8" holes in the SPACER as guides. Use two #6 x 1" wood screws (B12) to attach the SPACER to the SWIVEL BOARD.
- 2.4 Center the Lazy Susan Bearing (B15) on the SPACER with the 1/4" outer holes in the bearing placed over the diagonal lines on the SPACER. Drill four 1/4" holes through the SPACER and the SWIVEL BOARD using the holes in the Lazy Susan bearing as guides. Placing a 1/4" bolt through the bearing and the SPACER as each hole is drilled will ensure proper placement of the holes. Once the holes are drilled, remove the Lazy Susan bearing.  
At this point you may want to paint the wooden parts before final assembly.
- 2.5 (Fig. B-5) - Turn the SWIVEL BOARD over and center the Drawer Pull Handle (B4) 5" from the FRONT of the SWIVEL BOARD. Attach the handle with four #6 x 1/2" wood screws (B14). Drill 3/32" starter holes for the screws.  
Locate two 1/2" x 1" angle brackets (B7) at the front edge of the swivel board starting 5" in from the edge of the board. Attach the angle brackets to the SWIVEL BOARD using #6 x 1/2" screws (B14). Drill 3/32" starter holes for the screws. Install two more angle brackets (B7) facing the opposite direction, just inside of the first two brackets. These four brackets form two "U"s in which the front bar of the beach chair can sit. They will prevent the chair from sliding forward or backwards on the SWIVEL BOARD.  
The clamps for the strut assembly (B5) and the mounting brackets for the front struts (B6) will be attached later.
- 2.6 ASSEMBLY (Fig. B-6) - Slip four 3/16" x 1 1/4" carriage bolts (B8) through the large 3/4" hole in the bottom of the Lazy Susan bearing and into the four 1/4" holes in the top of the bearing. Center the bearing on the top of the BASEBOARD and attach it using four #6 x 1/2" wood screws (B14) screwed into the 3/32" starter holes. Be sure to place the 3/4" hole in the bearing over the 3/4" hole drilled in the baseboard.  
Place the combined SPACER and SWIVEL BOARD over the four carriage bolts and use four 3/16" flat washers (B11) and four 10-24 acorn nuts (B10) to attach the bearing to the Swivel Board. Use the 3/4" hole in the BASEBOARD to push the carriage bolts up through the SPACER and SWIVEL BOARD if necessary. This completes the Swivel Base.  
You should now be able to set the folding chair on top of the Swivel Base and sit and swivel. Just this much of an assembly is extremely handy for sitting out under the stars and gazing in any direction without having to get up to rotate the chair.



- 3.1 STRUT ASSEMBLY **\*\*NOTE\*\*** It is recommended that all PVC and aluminum tubing parts be cut at this time. If an 8 ft. (96") piece of tubing has been obtained, the lengths of the four 21 1/2" struts and the two 5" crossbar pieces add up to exactly 96". Cut the two 5" pieces first and then divide what's left into four even lengths, presumably 21 1/2" each, but not a critical length. Care should be taken lest ye need to buy another piece of expensive tubing.  
Then cut one 24", four 22", four 2 1/2" and two 4 3/4" lengths of PVC tubing.
- 3.2 Refer to Section 7 (Page 12, Fig. G1 - G7) and install 6 friction joints, one on each of the four 22" lengths and one on two of the 2 1/2" lengths of PVC tubing.
- 3.3 REAR STRUT ASSEMBLY (Fig. C-1 thru C-7) - The rear strut assembly consists of two aluminum and PVC struts connected together at the bottom by a 24" piece of PVC and at the top by the crossbar assembly. Once the front struts are attached, friction joints on each strut will allow the crossbar to remain at a set height. The crossbar contains friction joints to allow the binoculars to remain at a set angle.
- 3.3 (Fig. C-5) - Lay the two 3/4" aluminum conduit elbows (C4) with the set-screws facing up and the ends facing downward and inward. Mark the downward facing ends of each elbow with a "Strut" label so that this leg will be drilled for the front strut mount.
- 3.4 (Fig. C-5) - Wrap 6 turns of 3/4" masking tape around one end of a 21 1/2" length of aluminum tubing. Insert the taped end of the aluminum tubing into a conduit elbow end marked "Strut" until it bottoms out. The elbows have an I.D. about .060" larger than the aluminum tubing's O.D., so the tape wrap is an effort to achieve a snug fit. Add or remove tape, one wrap at a time, as necessary. Once a snug fit is accomplished tighten the setscrew to lock the aluminum tubing in place
- 3.5 (Fig. C-5 & C-7) - Drill a 15/64" hole through the "Strut" leg of the elbow, drilling through the 7/8" tubing as well. This hole should be parallel to the other leg of the elbow, at right angles to the setscrew. Center the hole 5/16" above the center of the setscrew. Most electrical conduit elbows have ridges where this hole will go. File down the ridges and drill a small pilot hole on either side of the elbow, centered on the (removed) ridge; then drill the 15/64" holes. A 15/64" hole is just large enough to thread a 1/4" screw into with a little effort, making a very tight joint.
- 3.6 Cut a 5 ft. length of 1/8" braided nylon cord (C15). Fold one end over about 6" and tie a knot in the doubled cord, forming a 1 or 2 inch loop. Trim the end of the cord at the knot to about 1" and tape it with masking tape. Pull the cord tight and mark the other end of the cord 41" from the end of the loop.  
Remove the inspection plate from the elbow. (Fig. C-6) Insert the loop end of the cord into the open end of the aluminum tubing, working it toward the elbow end. When the loop reaches the 15/64" hole drilled through the elbow, thread a 1/4-20 x 3" machine screw (C7) through the hole with the screw end pointed away from the elbow's other leg (Fig. C-6) passing it through the loop in the cord. Thread a 1/4 - 20 nut onto the screw and tighten it up against the conduit fitting. Re-install the inspection plate on the elbow (Fig. C-7).  
Mark the open end of the aluminum tubing 3 1/2" from the end with a Magic Marker.



- 3.7 Insert the end of the nylon cord coming out of the aluminum tubing into the friction joint at the end of a 22" PVC tube. Work the cord down through the PVC. Slide the friction joint onto the aluminum tube. Take care when inserting the aluminum tubing into the friction joint. Work the aluminum carefully into the friction joint until it slides freely. If necessary, slip the two pieces of bicycle tube on the friction joint up onto the PVC section of the joint to loosen the joint so that the aluminum will slide in easily. Slide the PVC tubing fully up onto the aluminum tubing.
- Insert the end of the nylon cord through the 3/16" hole in a 1" fender washer (D7), sliding the washer up past the mark on the cord made earlier. Fold the cord over and tie a knot in the doubled cord at the 41" mark. Slide the PVC tube down the aluminum tube until the cord is stretched tight. The mark made 3 1/2" from the end of the aluminum tube should just show at the end of the friction joint. Adjust the position of the knot in the cord until this condition is obtained. Trim the remaining cord to 1" and tape it.
- 3.8 (Fig. C-4) - Extend the strut, pulling the cord tight and insert the cord and the open end of the PVC tubing into a 90° PVC elbow (C5), centering the 1" fender washer in the end of the elbow. Drill a 5/16" hole through ONE side of the outside of the elbow 1/2" from its end. Drill through one side of the PVC tubing also. Be careful not to hang the drill bit up in the cord. This hole will be used to store the front strut when not in use.
- Cement the PVC elbow onto the strut, taking care to line up the 5/16" hole in the side of the PVC elbow with the hole in the PVC tubing. Insert a 5/16" clevis pin (C12) in the hole to ensure a proper line-up.
- 3.10 Construct the other rear strut following the instructions in Para. 3.3 thru 3.8. Collapse the struts and paint the PVC on each strut, if desired, with Flat Black spray paint.
- 4.1 FRONT STRUTS (Fig. C3 and D2 thru D5) - Cut a piece of 1/8" braided nylon cord (C15) to a length of 5 ft. Double one end of the cord and tie a knot in the doubled cord very close to the end, leaving a very small loop. Trim the loose end to 1/2". Slip a 1" fender washer (D7) over the other end of the cord and slide it up to the knot. Stretch the cord tight and mark the cord 41" from the knotted end.
- Drop the free end of the cord through the open end of a 22" piece of PVC tubing and through the friction joint at the other end. Cement a 3/4" PVC end cap (C6) onto the free end of the PVC tubing, over the knotted cord and the washer. Push the end cap down hard on the PVC, flattening the knot.
- (Fig. D2) - Drill a 1/4" hole, crosswise, through both sides of the PVC end cap and the PVC tubing, 1/2" from the open end of the cap, so that a 1/4" Machine screw (C7) can be passed through them. This hole should be as perpendicular to the end cap as possible. A piece of masking tape wrapped once around the end cap, cut to the exact length of the circumference of the cap, removed, and marked at 1/2 the circumference can be used for a pattern. Drill small pilot holes before drilling the 1/4" holes. Be careful not to damage the nylon cord with the drill bit.



- 4.3 Obtain a piece of 7/8" aluminum tubing previously cut to a length of 21 1/2". Drill a 5/16" hole, crosswise, through one end of the aluminum tube, 1/2" from the end. As this hole should also be as square as possible to the tube, a masking tape pattern can be made for this tube also. Use a Magic Marker to mark the tube 3 1/2" from the un-drilled end.
- Insert the nylon cord into the aluminum tube and insert the aluminum tube into the friction joint on the PVC tube, leaving the drilled end of the aluminum tube outside the PVC.
- Fold the open end of the nylon cord over and tie a knot in the doubled cord at the previously marked 41" spot, leaving a 1" loop.
- (Fig. D-4) - Extend the strut until the knot is even with the 5/16" hole in the aluminum. Insert one of the 5/16" clevis pins (C12) through the 5/16" hole in the end of the aluminum and through the loop in the end of the cord. Insert a hairpin clip (C11) into the end of the aluminum tubing and through one of the holes in the clevis pin. This will retain the clevis pin in the tubing.
- Extend the strut to its full length as limited by the cord. The mark made at 3 1/2" from the end of the aluminum tube should just be visible at the end of the friction joint. Adjust the position of the knot in the cord until this condition is obtained. Trim the excess cord to 1" and tape the end.
- 4.4 Construct the other front strut following the instructions in Para. 4.1 thru 4.3. Paint the PVC on both struts Flat Black (or Chartreuse, if you like).
- 4.5 ASSEMBLING THE FRONT STRUTS ONTO THE REAR STRUTS (Fig. D5) Slip a flat washer over the end of the 3" 1/4 - 20 machine screw at the top of one rear strut. Slip the PVC end cap on the front strut onto the screw through the 1/4" hole in the end cap. Move the nylon cord aside, if necessary, to get the screw through the 1/4" hole. Slip a flat washer over the end of the screw and thread an 1/4" self-locking nut (C9) onto the end of the screw.
- Plug the 5/16" clevis pin at the end of the front strut into the 5/16" hole in the PVC elbow at the bottom of the rear strut. Cut a 1/2" x 7" strip of bicycle tube. Overlay the two ends about 1/2" and attach them together using double-stick carpet tape and twine. Slip the resulting 3" rubber band over the bottom ends of the combined strut assembly. This rubber band will keep the front struts plugged into the rear struts for storage.
- Install the other front strut in the same manner.
- 4.6 MOUNTING THE STRUT ASSEMBLIES TO THE SWIVEL BOARD (Fig. H-1)
- Once both strut assemblies have been constructed, insert the 24" PVC base tube into the PVC elbows at the bottom of the rear struts, forming a "U", lay the assembly on a flat surface, and cement the base tube into the elbows.
- 4.7 (Fig. H-1) - Lay the rear strut assembly on the Swivel Base with the base of the strut assembly parallel to the rear edge of the Swivel Base. The two struts should now lay along the right and left edges of the plywood. Place two 1 1/4" single ended conduit clamps (B5) over the PVC elbows in the corners of the strut assembly. Slide the assembly forward until the ends of the clamps are even with the rear edge of the plywood. Mark mounting holes for the clamps and drill a 3/16" hole through the plywood for each clamp. Insert a 3/16" x 3/4" carriage bolt (B9) into each hole through the bottom of the plywood and secure the clamps with a #12 washer (B11) and a 3/16" Acorn nut (B10).



- 4.8 Mount two 5/8" x 2" angle brackets (B6) at the left and right edges of the Swivel Board, about 3" back from the front edge. The brackets should mount just behind the friction joints on each PVC strut and the vertical part of each bracket should extend just outside the strut. Use #6 x 1/2" wood screws (B14) and drill 3/32" starter holes for them.
- Drill out the top hole in each bracket with a 5/16" drill bit. Drill from the side that is not counter-sunk. Use a 1 ft. length of twine to attach a hairpin clip (C11) to the bottom hole in each bracket.
- 5.1 CROSSBAR (Fig. C-2, E-1 thru E4) - The crossbar consists of a PVC assembly slipped over aluminum stubs. Friction joints will maintain binoculars at a set angle. The purpose of the "hump" in the crossbar is to allow the binoculars to mount near the center of rotation of the crossbar, providing better balance and requiring less tension on the friction joints to maintain the binoculars at the desired angle.
- 5.2 Lay the strut assembly down on the Swivel Board and ensure that the two rear struts are parallel by measuring the distance between the legs of the "U" at the base and then setting them the same distance apart at the tops. Face the aluminum conduit elbows inward and measure the distance between the ends of the elbows. This distance should be 21" if the length of the 24" piece of PVC tubing connecting the two rear struts has not been lengthened to accommodate a wider chair.
- 5.3 As shown in Figs. C-2 and E-2, the crossbar consists of four 90° PVC elbows and a PVC "T" connected together by short pieces of 3/4" PVC tubing. The length of the PVC assembly will be 18", allowing 1 1/2" at either end for the friction joints to grip the aluminum stubs. The aluminum stubs bring the total length of the crossbar to 23", allowing 1" at the end of each aluminum stub for insertion into the aluminum elbows.
- 5.4 Slip two 3/16" x 1" fender washers (D7) onto a 10-24 x 6" machine screw (D13). Slip a 3/16" star washer (D9) onto the screw and thread a 10-24 nut (D11) onto the screw. Tighten the nut very tight against the washers. Slip this assembly through one of the 2 1/2" pieces of PVC with a friction joint on it and insert the tubing into one of the PVC elbows (C5), washer end first. Press the PVC into the elbow and ensure that the PVC wedges the screw assembly tightly in place against the shoulder in the PVC elbow. If the screw assembly is loose, cut a 6" piece of 3/4" masking tape into 1/4" strips and wrap several turns of masking tape around the edge of the washers, increasing their diameter so that the PVC will wedge the washers into the shoulder in the PVC elbow.
- Build another screw and washer assembly for the other end of the crossbar and insert it into another of the PVC elbows.
- 5.5 Assemble the crossbar as shown in Fig. E-2, pressing the PVC connecting pieces firmly into the elbows and the "T" fitting. Do not cement anything at this time. Wrap six turns of 3/4" masking tape around one end of each of the 5" aluminum tubes and insert the other ends of the tubes over the 6" screws and into the friction joints at the ends of the crossbar. Measure the distance between the ends of the Aluminum tubing. This distance should be 23".



- 5.6 CROSSBAR TRIAL ASSEMBLY (Figs. E-5 & E-6)  
 Unplug the ends of the front struts from the PVC elbows in the rear struts. Lift each strut assembly and swing the front struts to the front of the Swivel Board. Insert the 5/16" clevis pins on the ends of the front struts into the 5/16" holes in the angle brackets. Insert the teathered hairpin clips into holes in the clevis pins, pinning the clevis pins to the brackets.  
 (Fig. E-4) - Insert the temporarily completed crossbar into the conduit elbows on the rear strut assembly. Check to see that the sides of the rear struts are still parallel within about 1/4". If they are not, make adjustments to the 4 3/4" PVC pieces connected to the PVC "T", shortening them if they spread the legs of the rear strut assembly too far, and cutting new, longer pieces if the tops of the rear struts are closer together than the bottoms.  
 Remove the crossbar from the strut assembly. File or sandpaper any bumps or flashing off the sides of the PVC elbows and "T" fitting. When cemented together, all the pieces should be pressed down on a flat surface so that they line up in one plane.
- 5.7 CROSSBAR ASSEMBLY - Cement the two 4 3/4" (or adjusted length) PVC tubes into the ends of the PVC "T". Use PVC Primer or Cleaner solution as well as PVC Cement. These joints take a lot of twisting and will loosen if not well cemented. Lay this assembly on a flat surface and cement two PVC elbows onto the ends of the PVC tubing, pointing the open ends of the elbows in the same direction as the "T" section of the PVC "T". Press down on each elbow and the "T" while the cement is setting to keep the parts in the same plane.  
 Cement the two 2 1/2" PVC tubes without friction joints into the open ends of the elbows. Cement the remaining two elbows to these tubes, pointing the open ends of the elbows outward and pressing them down on the flat surface to maintain a flat assembly.  
 Insert the 10-24 x 6" screw assemblies into the ends of the PVC elbows, washer end first, and cement the two 2 1/2" PVC tubes with the friction joints on them into the elbows, forcing the washers firmly into the elbows. Be VERY sure to insert the screws into the elbows BEFORE cementing the PVC sections in over them. You only get one shot at this. The bolts and washers will keep the PVC portion of the crossbar from slipping off the aluminum tubes, and, along with the setscrews, will keep the aluminum tubes from coming out of the conduit elbows at the tops of the rear struts. Insert the free ends of the 5" aluminum tubes into the friction joints.
- 5.8 (Fig. E4) Remove the inspection covers on the conduit elbows.  
 Insert the taped ends of the aluminum tubes into the 90° aluminum elbows at the top of the rear struts. Tighten the setscrews. Slip a 3/16" x 1" fender washer (D7) over the end of each 6" screw and thread the 10-24 self-locking nuts (D12) onto the screws. Tighten the nuts to a snug fit and then back them off 1/2 turn. This should produce a crossbar suspended on the aluminum stubs that will rotate freely on the friction joints but not pull off the stubs. Replace the inspection plates on the conduit elbows.

- 6.1 BINOCULAR MOUNT (Fig. F-1 thru F-3) - These instructions assume that the binoculars to be mounted have a 1/4-20 threaded socket, like a camera, into which a 1/4-20 screw can be threaded. If your binoculars do not have a threaded socket, skip to Para. 6.3 and construct a Universal Binocular Mount which uses bungee cord to mount binoculars to a 1" x 3" x 12" board.
- 6.2 Drill out the four screw holes in a 5/8" x 2" angle bracket (B6) with a 1/4" drill bit. Drill from the side that is not counter-sunk.  
 Drill a 1/4" hole through the center of a 3/4" PVC plug (D2). Insert a 1/4" x 3/4" carriage bolt (D4) into the plug from the inside. Slip a flat washer over the exposed end of the screw and thread a 1/4-20 nut (D6) onto the screw. Tighten the nut sufficiently to draw the square part of the carriage bolt into the plastic. Remove the nut and washer.  
 Slide three 1/4" x 1 1/4" fender washers (D8) and a 1/4" star washer (D10) onto a 1/4-20 x 1 1/4" machine screw (D3). Thread a 1/4-20 nut (C8) onto the screw and tighten it as tight as possible. This assembly will serve as a threaded "KNOB" to mount the binoculars.  
 (Fig. F-2 & F-3) - A little experimentation is now in order. Slip the knob assembly through the end 1/4" hole in the 2" angle bracket and attach your binoculars to it. Determine where the binoculars balance best; whether the angle bracket should face forwards or backwards, and which hole should mount the bracket to the PVC plug. Perfect balance is not required; the friction joints on the crossbar will overcome any residual imbalance.  
 (Fig. F-1) - Once the orientation and balance points on the angle bracket have been determined, increase the size of the hole in an ACE tank washer (D5) enough so that an "O" ring (D6) fits loosely in the hole. Attach the tank washer to the binocular side of the angle bracket with double-stick carpet tape or foam double-stick mounting tape. Slip one or more #12 flat washers over the KNOB and slip the KNOB through the bracket and the tank washer. Press an "O" ring (D6) over the end of the 1/4-20 x 1 1/4" screw. The "O" ring will retain the screw on the mount when not in use. Screw the PVC plug into the "T" fitting on the crossbar. Attach the bracket to the PVC plug with a 1/4-20 nut and washer.
- 6.3 UNIVERSAL BINOCULAR MOUNT (Fig. I-1) - This mount consists of a 1" x 3" x 12" board with notches cut into its ends and a hole drilled through its center so that it will slide down between the legs of the "U" in the crossbar and bolt onto a PVC plug screwed into the "T" on the crossbar.

This mount will require the following materials:

- |    |       |   |
|----|-------|---|
| E1 | 1 ea. | 1" x 3" x 12" Board.                      |
| E2 | 6 ea. | #6 x 1 1/2" Drywall screws or wood screws |
| E3 | 1 ea. | 36" length of 1/4" Bungee cord.           |
| E4 | 1 ea. | 1/4" x 1 1/4" Carriage bolt.              |

Measure the distance between the vertical legs of the "U" in the crossbar. This distance should be about 10 1/2". Cut a half-circle notch into the center of each end of the board, 1 3/16" in diameter and approximately 5/8" deep. These notches should allow the board to slide down onto the PVC "T" while fitting snugly against the 90° PVC elbows.



Drill a 1/4" hole through the center of the PVC plug (D2). Insert the 1 1/4" carriage bolt (E4) through the hole from the inside. Slip a #12 flat washer (B11) onto the screw and thread a 1/4" nut (C8) down tight enough to draw the square part of the carriage bolt into the plastic. Screw the PVC plug into the PVC "T" on the crossbar.

Slip the board between the legs of the "U" on the crossbar and press it down on the bolt head hard enough to make an impression in the wood. Remove the board and drill a 5/16" hole at the impression.

- 6.4 Center the binoculars on the board and mark the front edge of the board under the center of each of the binoculars' front tubes. Drill two 3/32" starter holes 1/2" to either side of the marks. Screw four #6 x 1 1/2" screws into the holes, leaving about 1/4" of the screw extending out the front of the board.

Fold one end of the Bungee cord over about an inch and tie it together with twine or a cable tie, leaving a small loop. Button the loop in the bungee over one of the outside screws. Stretch the bungee over the binocular tube on that side, around the inside screw on that side, around the inside screw on the other side, around the binocular tube and down to the outside screw on the other side. Fold a loop in the bungee at this screw and tie it together.

Mark the rear edge of the board just outside the binoculars. Screw two screws at the marks as was done on the front side. Make a loop in the remaining bungee cord and tie it together. Button the loop onto one of the screws and stretch it over the binoculars to the other screw. Fold a loop in the bungee at this screw and tie it together.

A piece of high-density foam rubber can be glued to the top of the board for the binoculars to sit on, making an even more secure mount.

- 6.5 Remove the 1/4" nut and washer from the PVC plug, slide the board down onto the plug and secure it to the plug with the nut and washer.

- 7.1 FRICITION JOINTS (Figs. G-1 thru G-7) - The six friction joints, one on each strut and two on the crossbar, are identical. Assembly for all six is the same.

- 7.2 Cut the 20' length of 1/4" polyethelene tubing (C1) into 3" lengths. This will provide 80 pieces, 78 of which will be used on the 6 joints, 13 pieces on each joint.

(Fig. G1) - Wrap one turn of 1 1/2" wide double-stick carpet tape around one end of the PVC. Remove the backing, leaving a sticky surface facing outward. Slip a length of aluminum tubing into the PVC, allowing the joint to be supported from both ends.

**\*\*NOTE\*\*** When assembling the friction joints on the two 2 1/2" pieces for the crossbar, plug these pieces temporarily into the ends of the 3/4" PVC "T" joint and slip the "T" joint over a length of aluminum tubing. Once these joints are finished, remove them from the "T" joint.

(Fig. G-1 & G2) - Center one of the pieces of 1/4" polyethelene tubing over the end of the PVC tubing, leaving 1 1/2" on the PVC and 1 1/2" overhanging the end of the PVC. Space a total of 13 pieces of 1/4" tubing evenly around the circumference of the PVC tubing. Cut a 6 ft. length of twine and wrap it tightly around the poly tubes to press them firmly to the carpet tape. Use halfhitches at each end of the wrap to maintain a tight wrap.

(Fig. G-4) Cut a 5" piece of 1 1/2" wide 3M Plastic Repair tape. Wrap the tape around the twine keep it from loosening and to provide a neater appearance.

7.3 (Fig. G-3) - Wrap two turns of twine around the ends of the polyethelene tubing that overhang the aluminum tubing and pull the polyethelene down snugly around the aluminum tubing. Tie a temporary knot in the twine. Wrap 2 or 3 turns of masking tape tightly around the polyethelene tubes. Remove the twine. (Fig. G-5) - Wrap two turns of 1 1/2" wide plastic tape snugly around the polyethelene tubing. This should produce a joint with a slight amount of friction.

7.4 (Fig. G-6) - Cut six 1/2" lengths of 1 3/8" bicycle tube (C13) and stretch them over the ends of the poly tubing. Slide four of the pieces of bicycle tube up over the PVC portion of the joint. Slip two pieces over the Aluminum portion of the joint, allowing the tube to squeeze the poly tubing down onto the aluminum. When the mount is in operation these should provide enough tension to support most binoculars.

(Fig. G-7) - If more tension is required more of the pieces of bicycle tube can be slid down to the end of the joint overhanging the aluminum to provide more friction. If even more friction is required, hose clamps (C14) can be tightened over the bicycle tube.

8.0 OPERATION (Figs. E-5 & E6) - Lift the crossbar up enough to allow the front struts to hang down. Insert the 5/16 clevis pins in the ends of each front strut into the holes in the angle brackets. Insert 3/32" hairpin clips in the clevis pins to keep them in the brackets.

Mount your binoculars to the mount. Set the beach chair on the Swivel Board and ensure that the friction joints on the struts and the crossbar work smoothly, are not too tight or too loose, and will support your binoculars at all positions.

(Fig. E-7) - Attach a 1/8" nylon cord teather between the SWIVEL BOARD and one strut, allowing the strut assembly to tilt backwards about 45°. The teather will keep the strut assembly from going all the way to the ground if left unattended for long periods in a backwards-tilted position.

9.1 STORAGE (Fig. H-1) - Collapse the struts to their shortest length. Disconnect the front struts from the angle brackets. Lay the strut assembly down on the Swivel Board and plug the clevis pins on the front struts into the 5/16" holes in the PVC elbows at the base of the rear strut assembly. Use the 3" rubber bands constructed earlier to keep the struts together.

(Fig. H-2) - Clip the hairpin clips into the top holes in the angle brackets and orient them crossways across the struts. These will keep the struts folded down onto the swivel base.



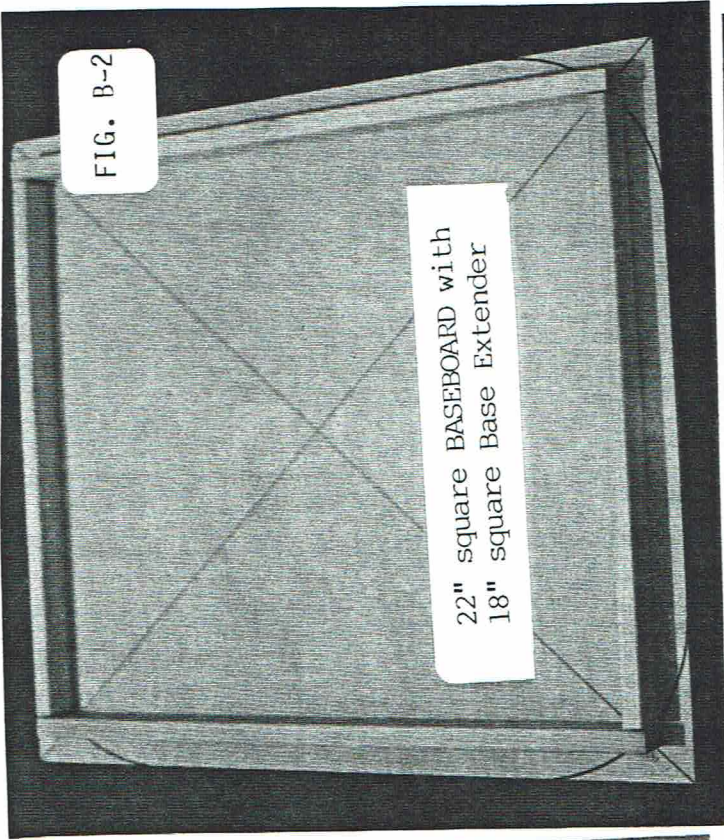


FIG. B-2

22" square BASEBOARD with 18" square Base Extender

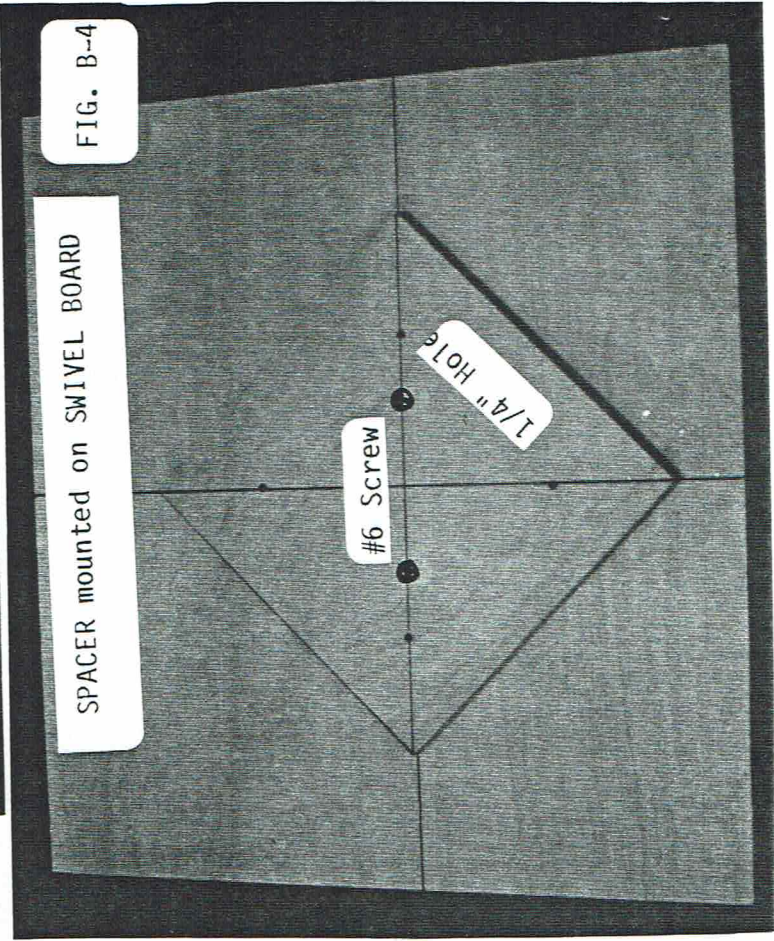


FIG. B-4

SPACER mounted on SWIVEL BOARD

#6 Screw

1/4" Hole

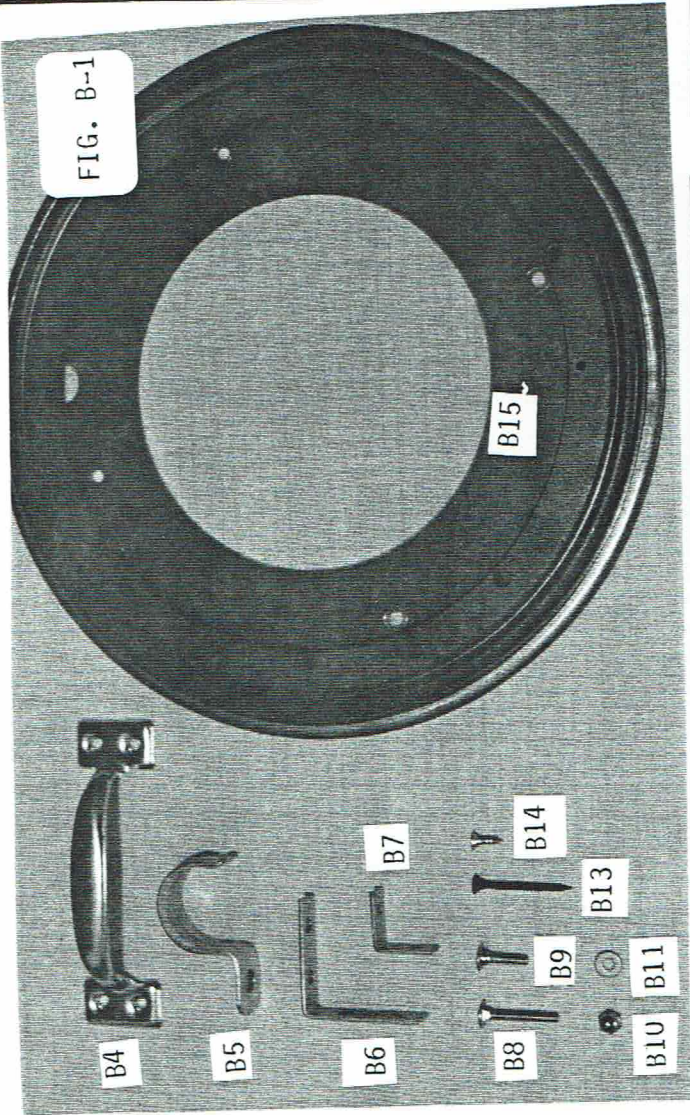


FIG. B-1

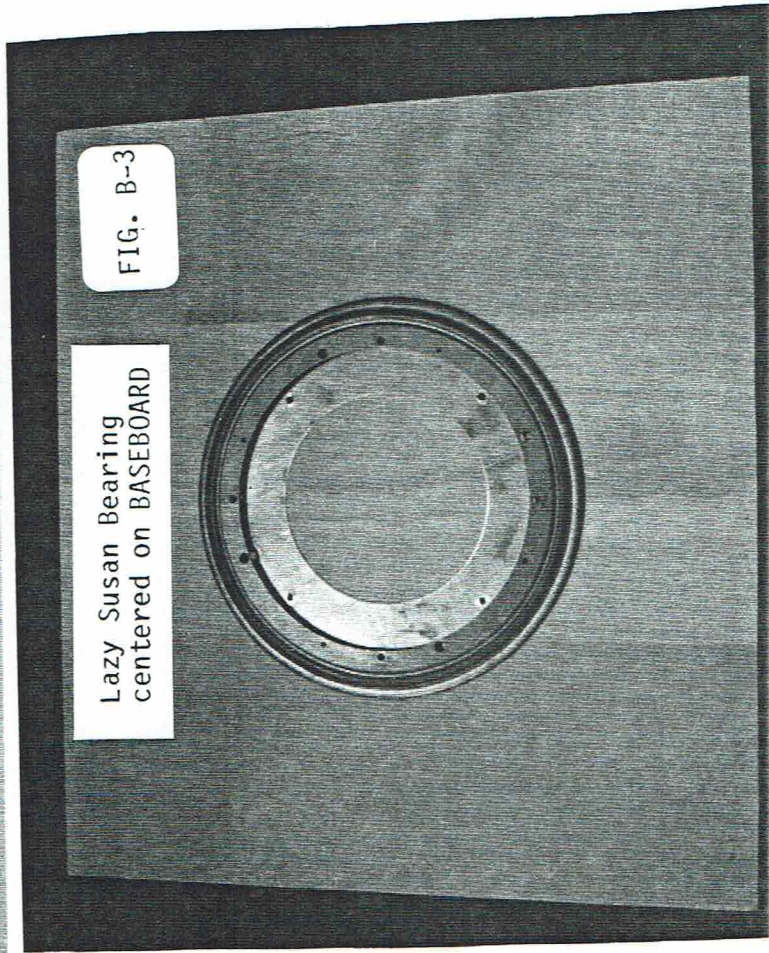


FIG. B-3

Lazy Susan Bearing centered on BASEBOARD



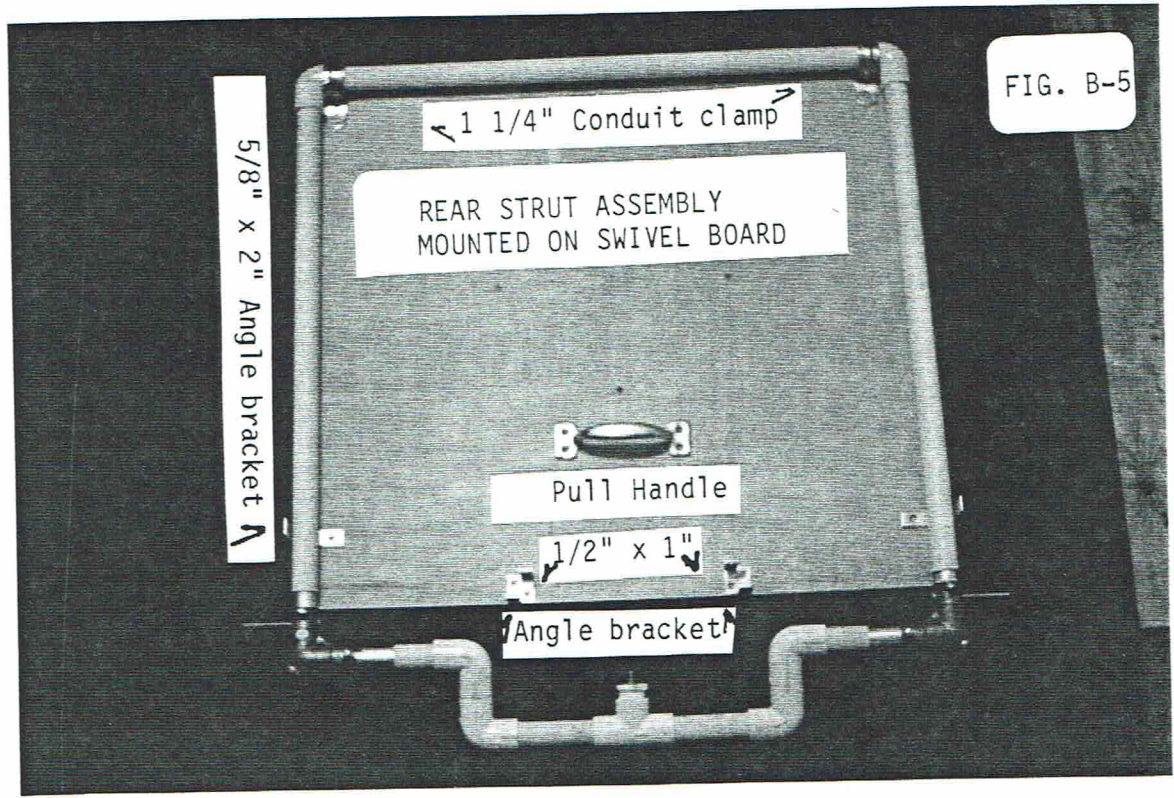


FIG. B-5

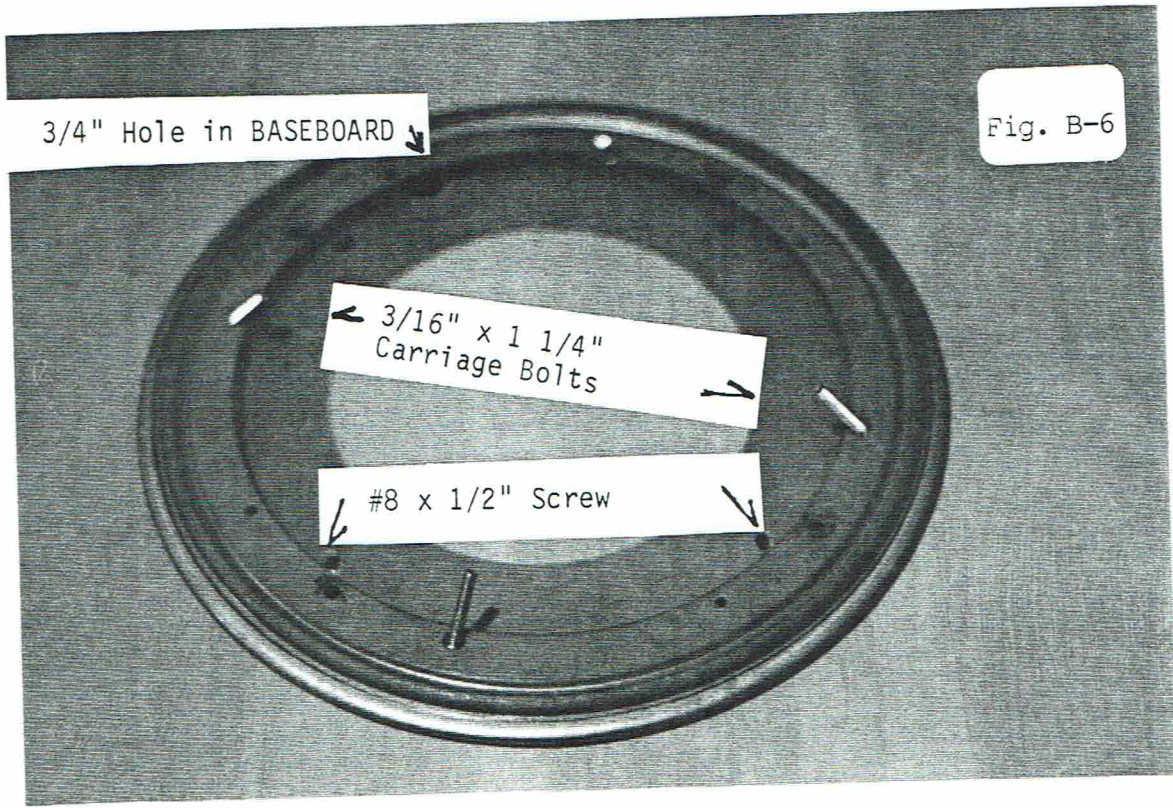
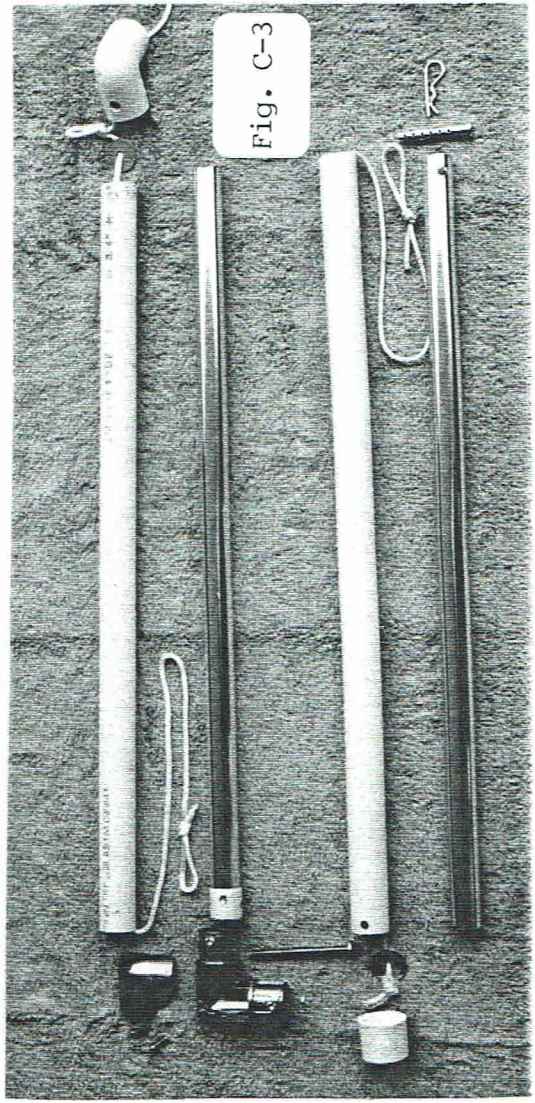
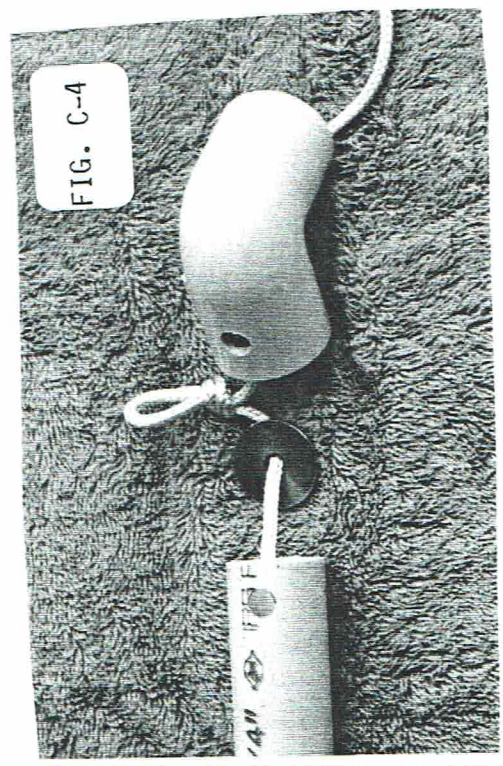
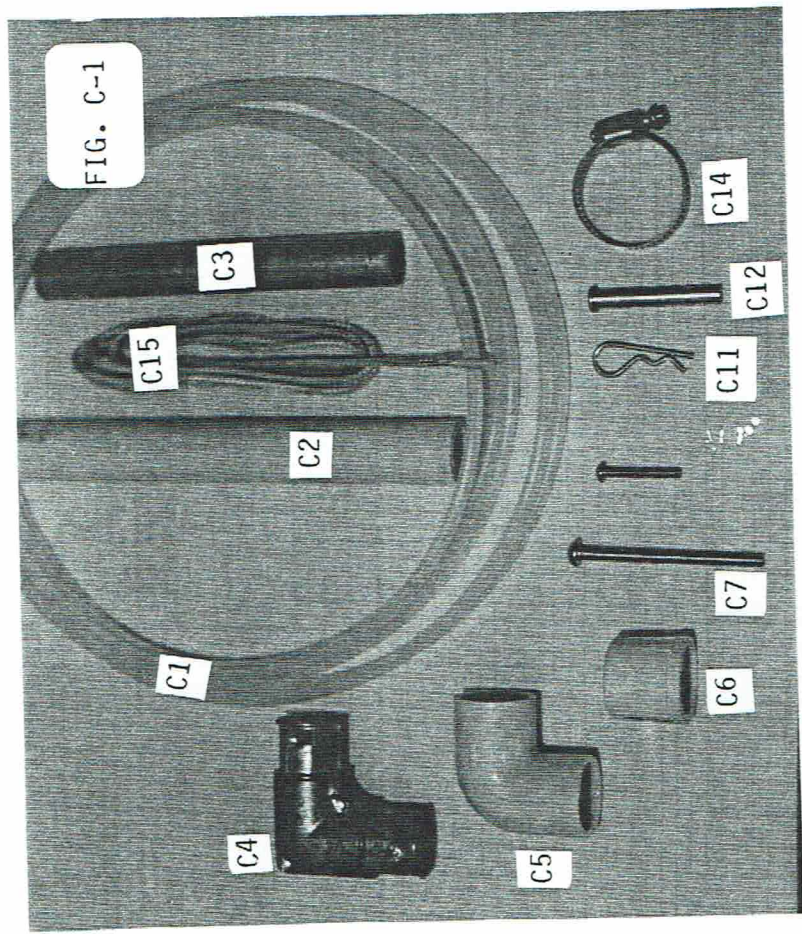
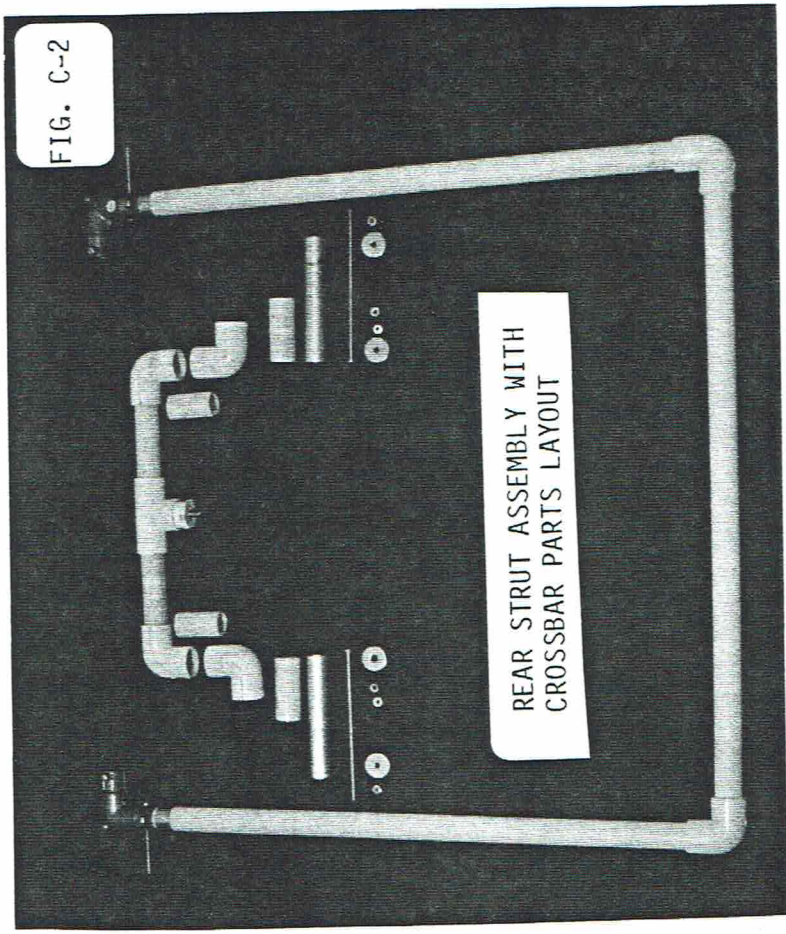


Fig. B-6







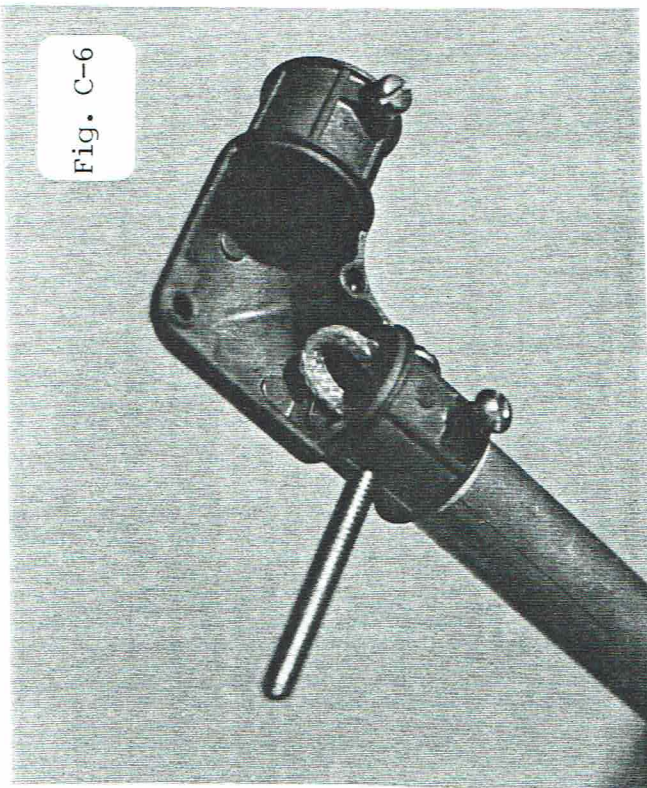


Fig. C-6

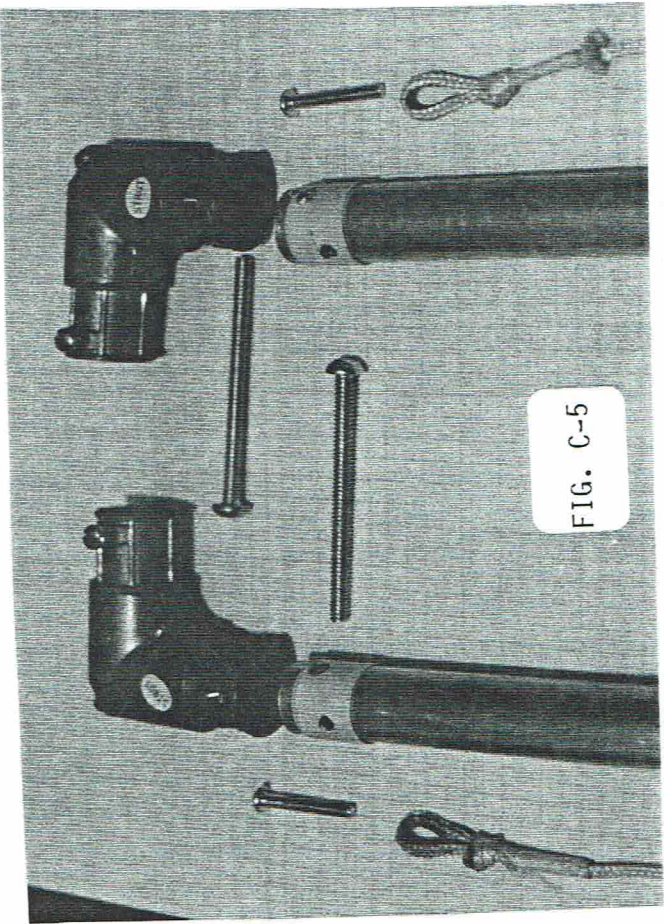


FIG. C-5

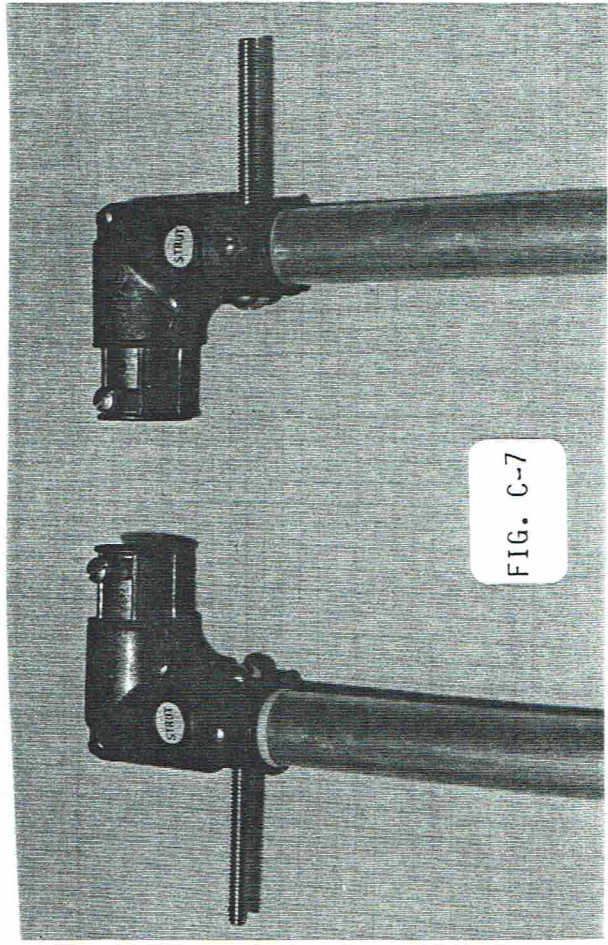


FIG. C-7



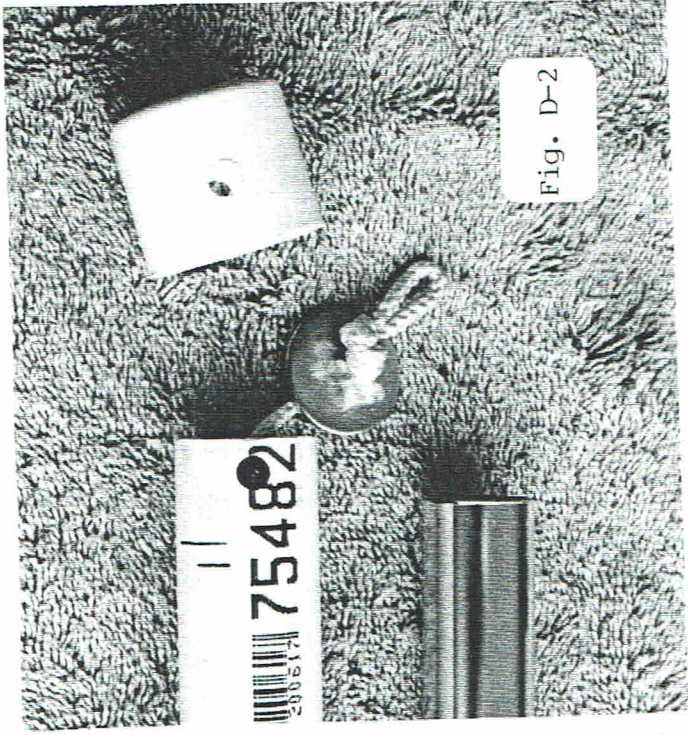


Fig. D-2

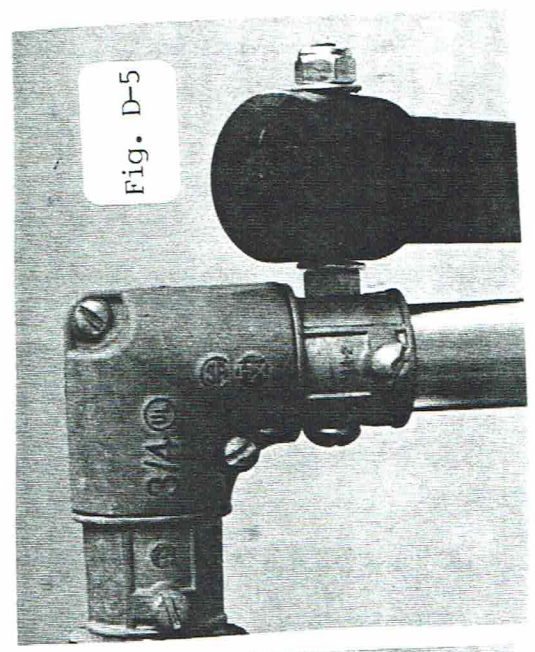
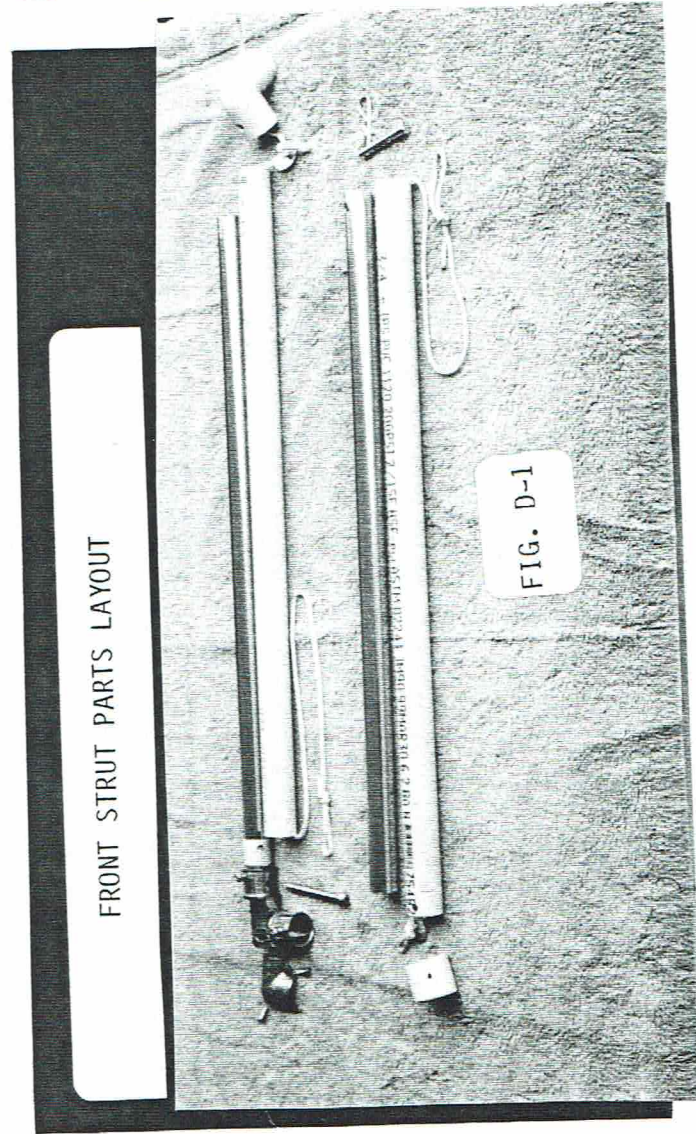


Fig. D-5



FIG. D-4



FRONT STRUT PARTS LAYOUT

FIG. D-1

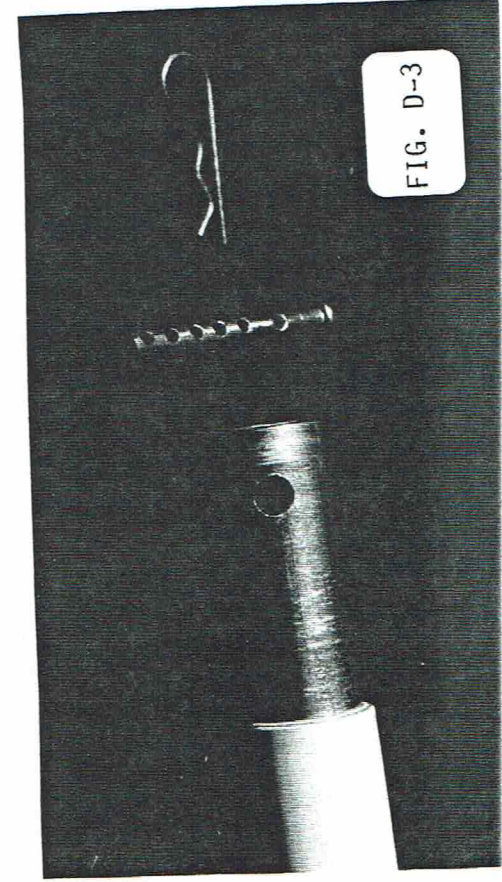


FIG. D-3



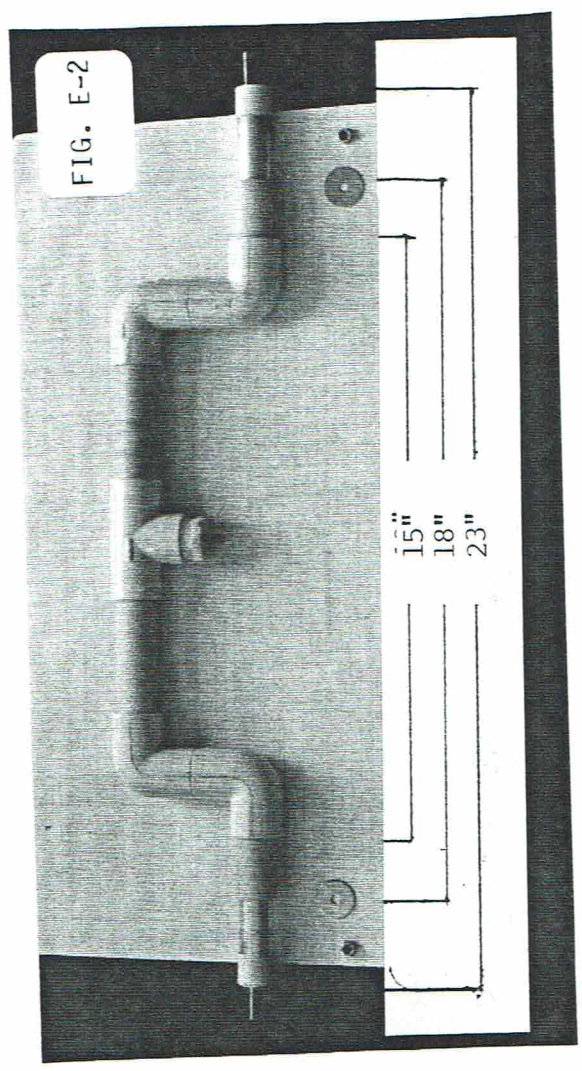


FIG. E-2

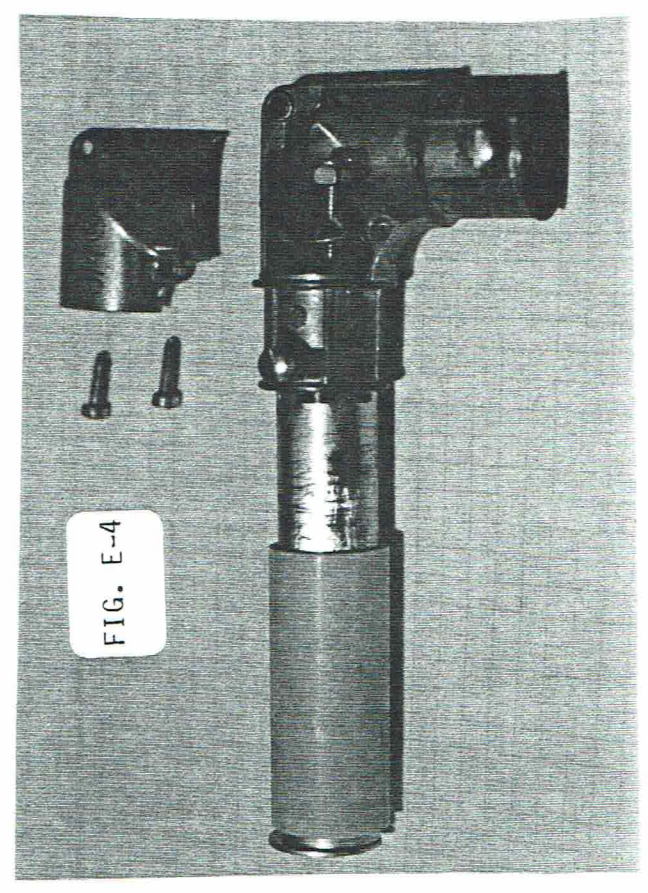


FIG. E-4

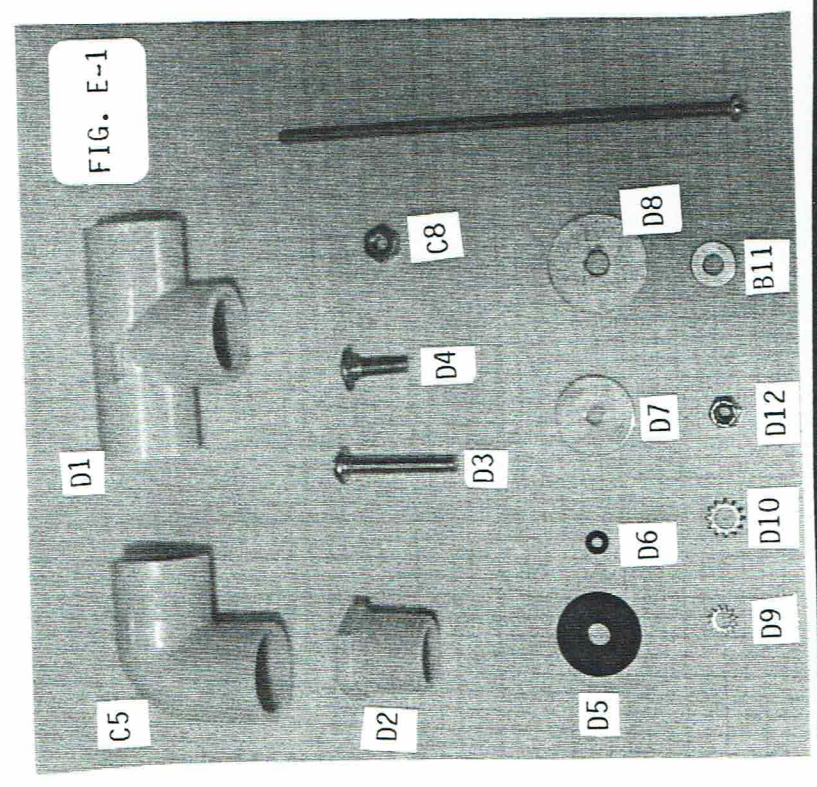


FIG. E-1

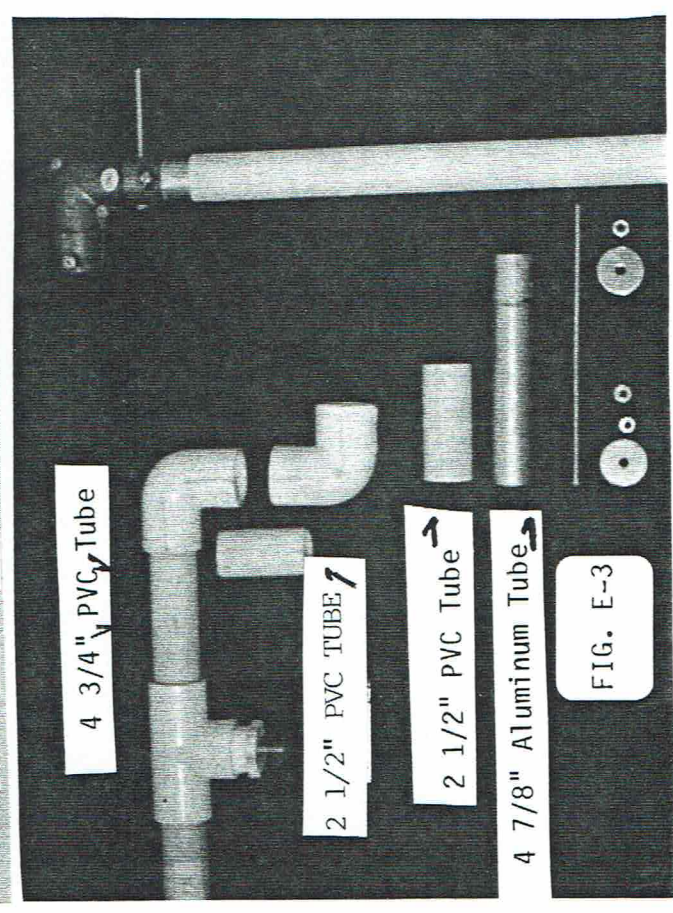


FIG. E-3

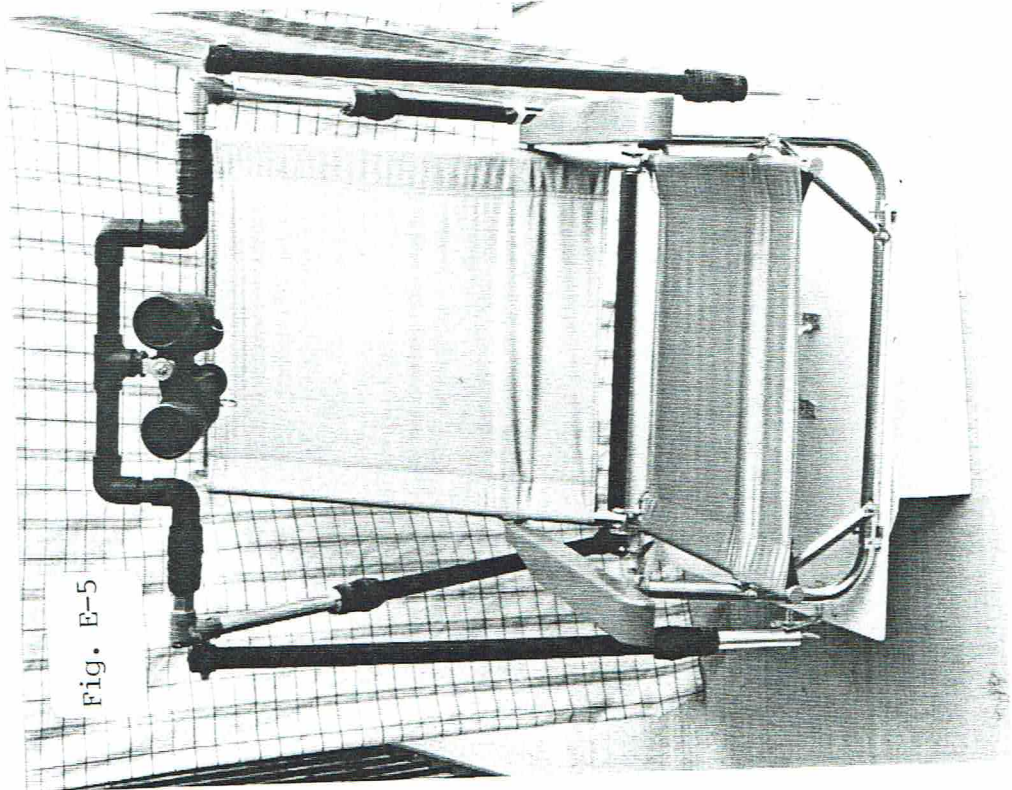
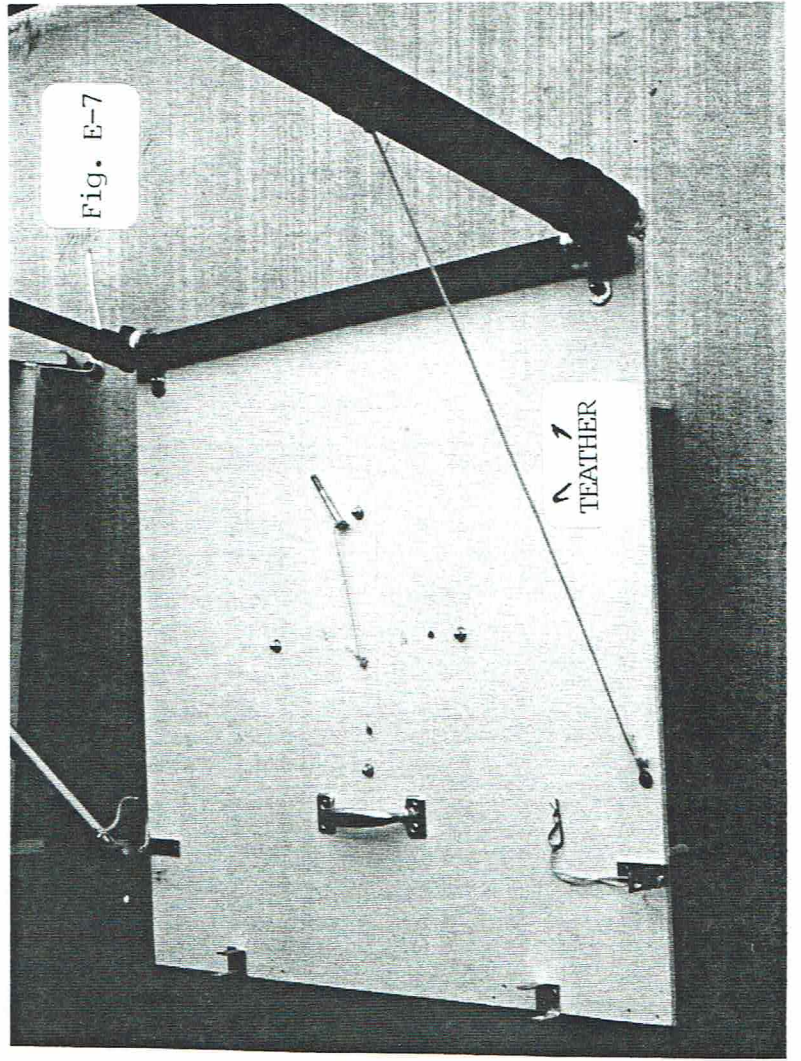
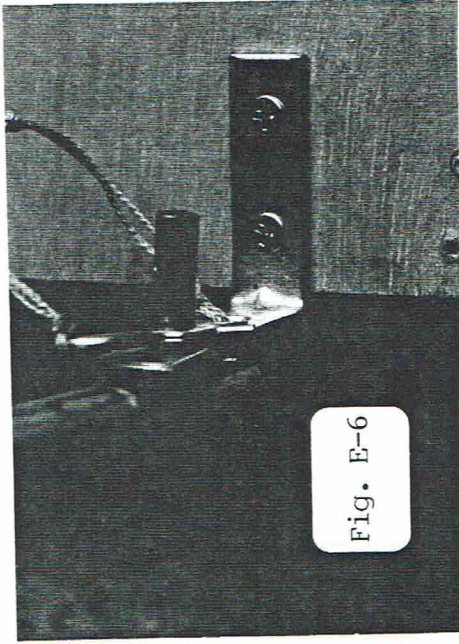
4 3/4" PVC Tube

2 1/2" PVC TUBE

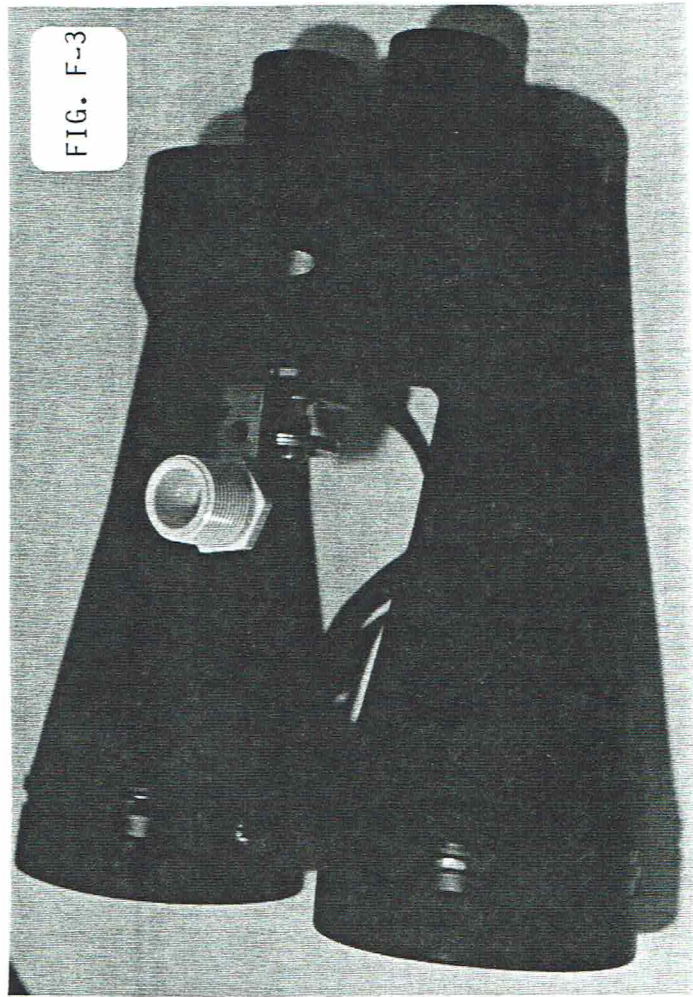
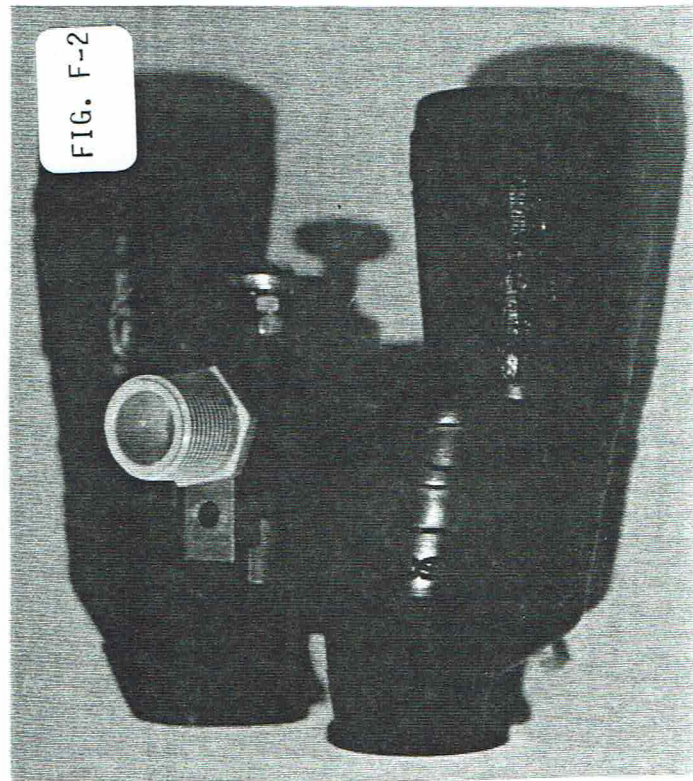
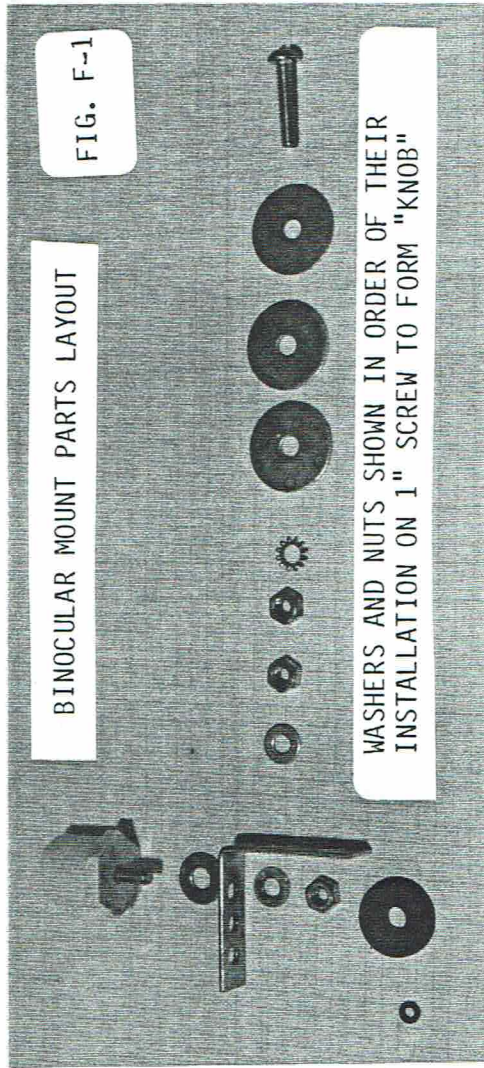
2 1/2" PVC Tube

4 7/8" Aluminum Tube



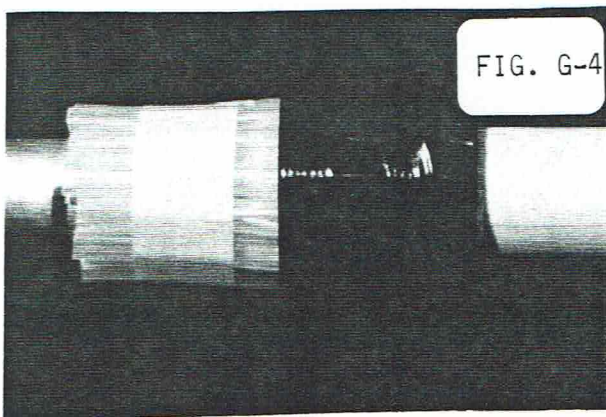
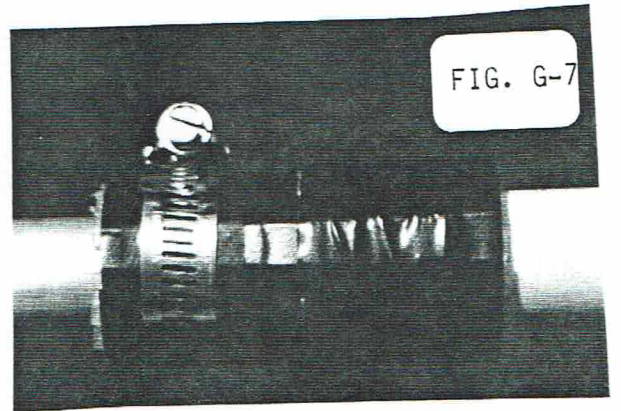
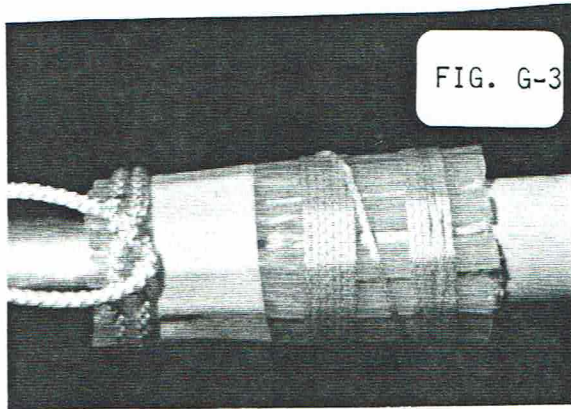
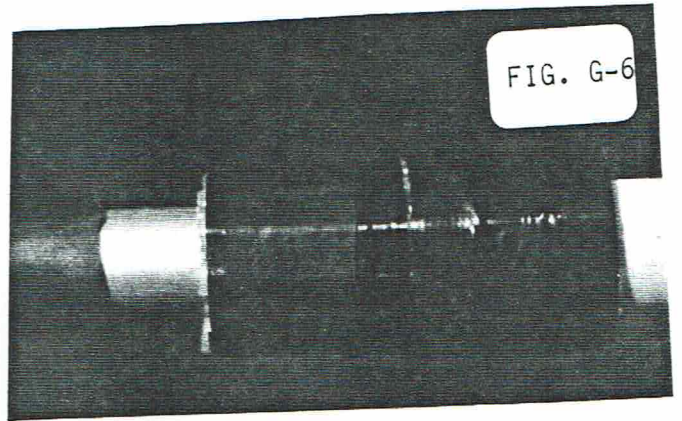
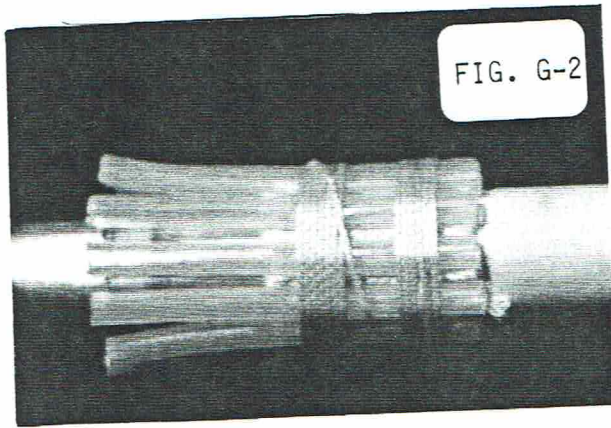
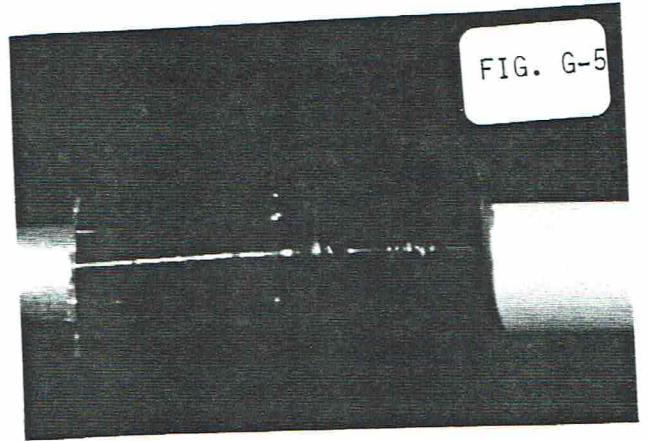
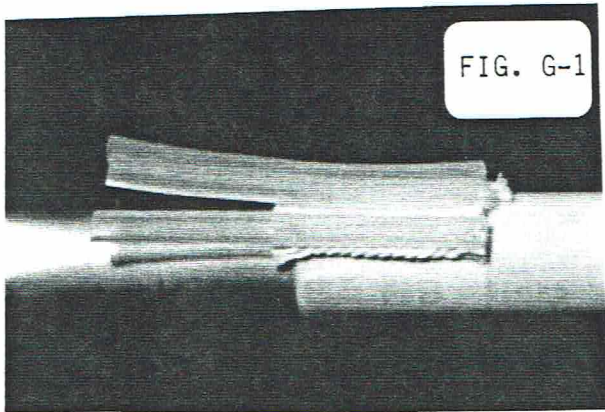








FRICTION JOINT ASSEMBLY SEQUENCE





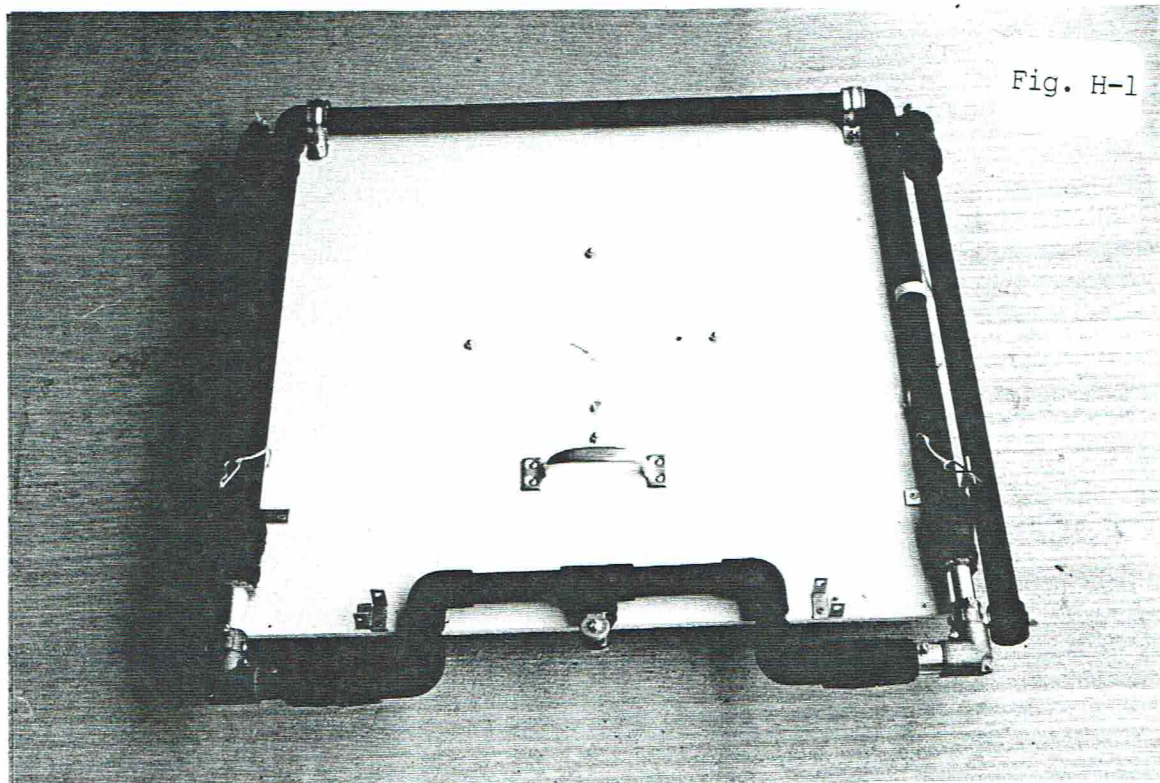
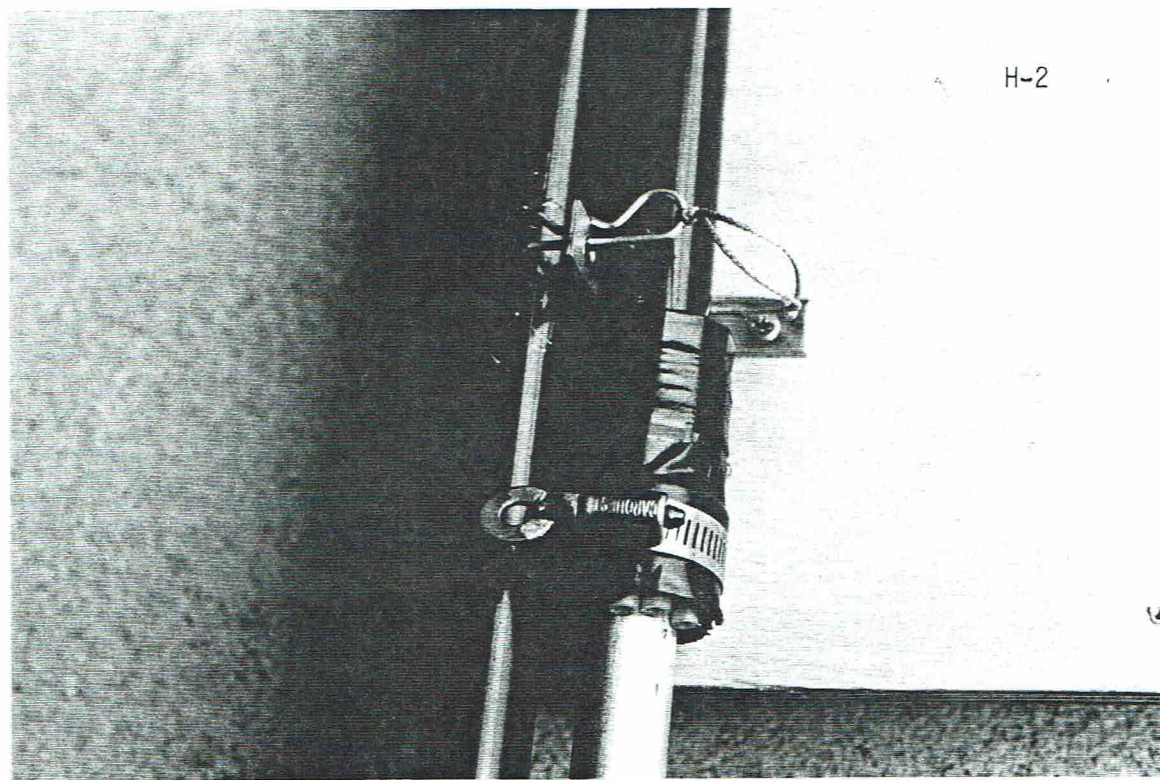


Fig. H-1



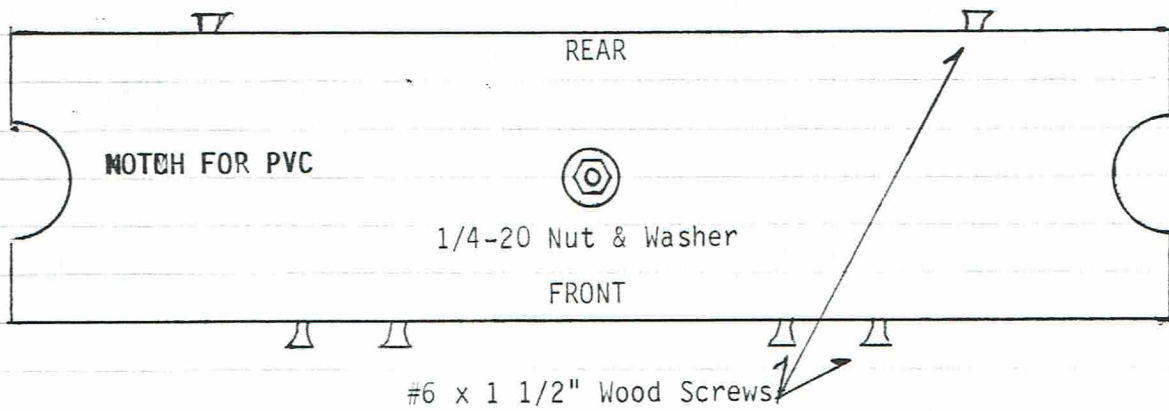
H-2



FIG. I-1 UNIVERSAL BINOCULAR MOUNT

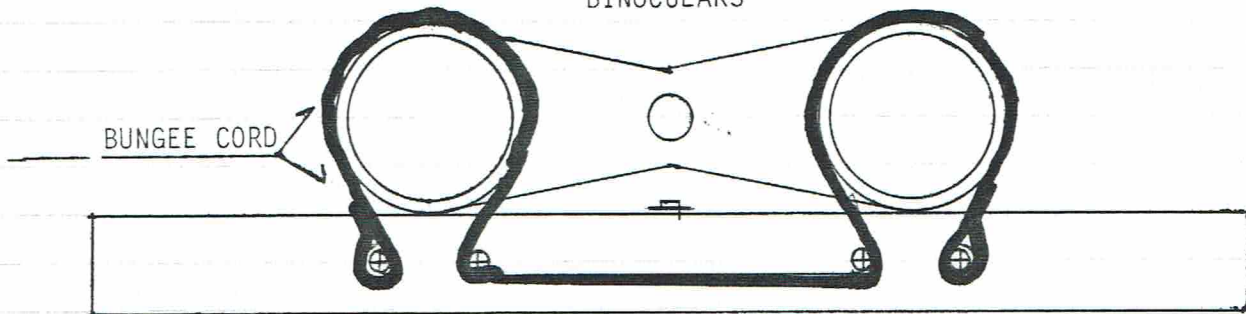
DRAWN HALF SIZE: 1/2 IN. TO THE SQUARE

TOP VIEW



FRONT VIEW

BINOCULARS





APPENDIX ONE  
FOLD-OUT BASE EXTENSION

Depending on the physical condition of the couch-potatoes operating this particular Couch-potato Telescope, it may be desirable to construct a fold-out base extender to raise the seat an additional distance above the ground. This fold-out extender adds a pound or so to the weight of the assembly but does make it easier to get into and out of.

The following parts are required:

- F1 3 ea. Pairs of 2" tight-pin brass or steel hinges.
- F2 1 ea. Pair of 2" loose-pin hinges (with removable pins).
- F3 4 ea. 3" lengths of 1" x 2" wood.
- F4 2 ea. 1/2" x 6" x 16 1/2" plywood boards. The 6" dimension will determine the height of the raised platform. The 16 1/2" dimension is approximate; a more exact measurement is described below.
- F5 1 ea. 1/2" x 6" x 15 3/4" plywood board. Exact length to be determined below.
- F6 28 ea. #6 x 1/2" wood screws.

ASSEMBLY INSTRUCTIONS

10.1 The fold-out base consists of two 6" x 16 1/2" boards that are mounted with hinges on top of four 1" x 2" x 3" spacers glued to the bottom of the baseboard. These boards are mounted inside of the 1" by 2" base extender on the bottom of the baseboard (Page 14, Fig. B2). A 1/2" x 6" x 15 3/4" board is mounted crossways between the other two boards and hinged to the bottom of the baseboard with tight-pin hinges. Loose-pin hinges are mounted between the ends of the 17" board and the middle of the 20" boards to tie the three boards together into a sturdy platform. The 20" boards are spaced above the bottom of the baseboard by the short 1x2x3" boards mounted in the corners to leave room for the 15 3/4" length of board to fold down flat beneath the 16 1/2" boards and for the 16 1/2" boards to fold down on top of the 15 3/4" board.

10.2 SIDEWALLS - (Fig. J1) - Lay the four 1x2x3" spacers flat in the corners of the original base extender (hereafter referred to as the "box"). Glue or 1 1/4" wood screws will be used later to mount them. If screws are used, take care that they won't interfere with the mounting screws for the hinges to be mounted later.

Measure the exact distance between the insides of the box. Cut a 1/2" x 6" wide piece of plywood to 1/4" less than this length. Making this piece 1/4" shorter than the space it will go into will allow room for sawing and positioning errors.

Stand the piece vertically, 6" side vertical, in the bottom of the box, on top of two 1x2x3 in. spacers. Press it against the inside wall. Center a 2" tightpin hinge on each of the two 1x2x3 in. spacers. Press each hinge against the just installed 16 1/2" board and mark the 1x2x3 in. spacers for hinge mounting screws. Do not mark the 16 1/2" board at this time.

Glue or screw these two 1x2x3 in. spacers into the corners of the box, taking care not to interfere with the marks made to mount the hinges. Mount the two hinges using the screws that came with them.



Re-insert the 16 1/2" board between the hinges and the wall of the box. Center the board between the ends of the box and use #6 x 1/2" screws to attach the hinges to the board. The board should now fold down on top of the spacers, leaving about 3/4" space between it and the bottom of the baseboard in which the 15 3/4" board will fit when folded down.

Once this side is finished, install another 16 1/2" board into the opposite side of the box using the instructions in Para. 10.2.

- 10.3 CROSSPIECE - Once both sides of the fold-out base have been installed, fold them up vertically against the sides of the box and measure the exact distance between them. Take this measurement at the bottom of the boards, next to the hinges. Cut a 1/2" x 6" piece of plywood to 1/8" less than this measurement. Lay this crosspiece flat in the bottom of the box, crossways between the two folded up sides. Position it so that there is about a 1" space between the edge of the board and the ends of two of the 1x2x3" spacers.

Raise the crosspiece to a vertical position and ensure that it will fold up without hitting the side walls. Trim it a little if it is too long. With the crosspiece centered between the sidewalls, position a tight-pin hinge about 1" from each end of the crosspiece on the side of the crosspiece that will allow the crosspiece to fold down without hitting the 1x2x3" spacers. Screw the hinges to the bottom of the box and the crosspiece using #6 x 1/2" screws. Once the crosspiece is installed and raised vertical, it will keep the side walls from folding down.

Position a loose-pin hinge at the top edge of each end of the crosspiece. Position the hinges near the top of the board, on the side opposite the hinges holding it to the baseboard. Use #6 x 1/2" screws to attach the hinge to the end of the crosspiece and to the middle of each side wall. Leave the pins in the hinges while installing the screws. The crosspiece and the side walls are now firmly attached together, making a firm extended base on which to sit. Remove the pins from the loose-pin

hinges and fold the crosspiece down. Raise the crosspiece again and ensure that the hinge parts go together smoothly. A little filing on the hinges may be necessary. Teather the hinge pins to the sidewalls with short lengths of string. Store the hinge pins in the part of the hinge attached to the sidewalls. Fold the crosspiece down. Fold the side walls down and use Velcro fasteners to keep the side walls folded down on the crosspiece. Attach the Velcro near the edge of the crosspiece where the crosspiece hinges are. This completes the fold-out extender.



FOLD-OUT BASE EXTENDER

