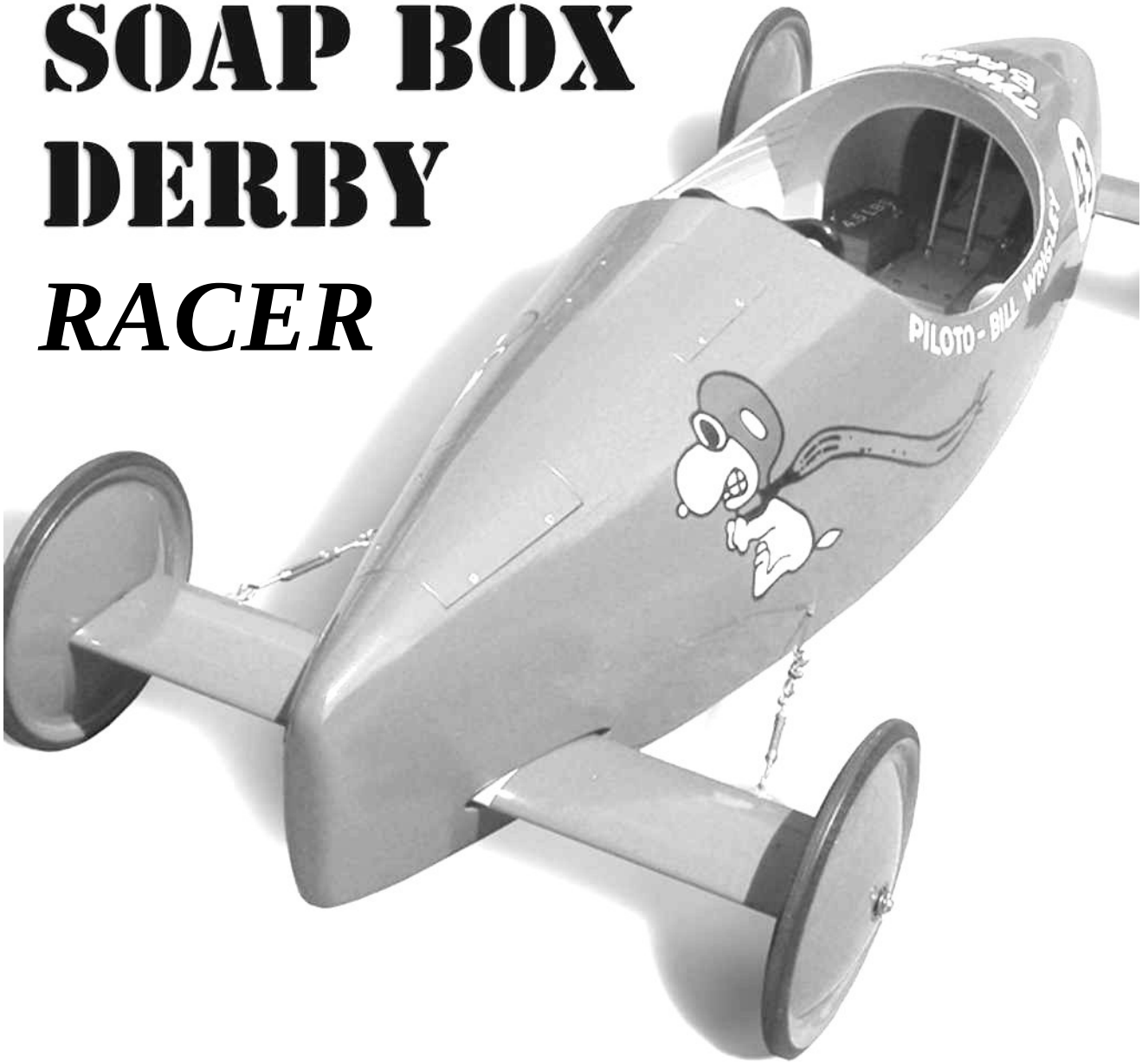
HOW TO BUILD A

SOAP BOX DERBY

RACER



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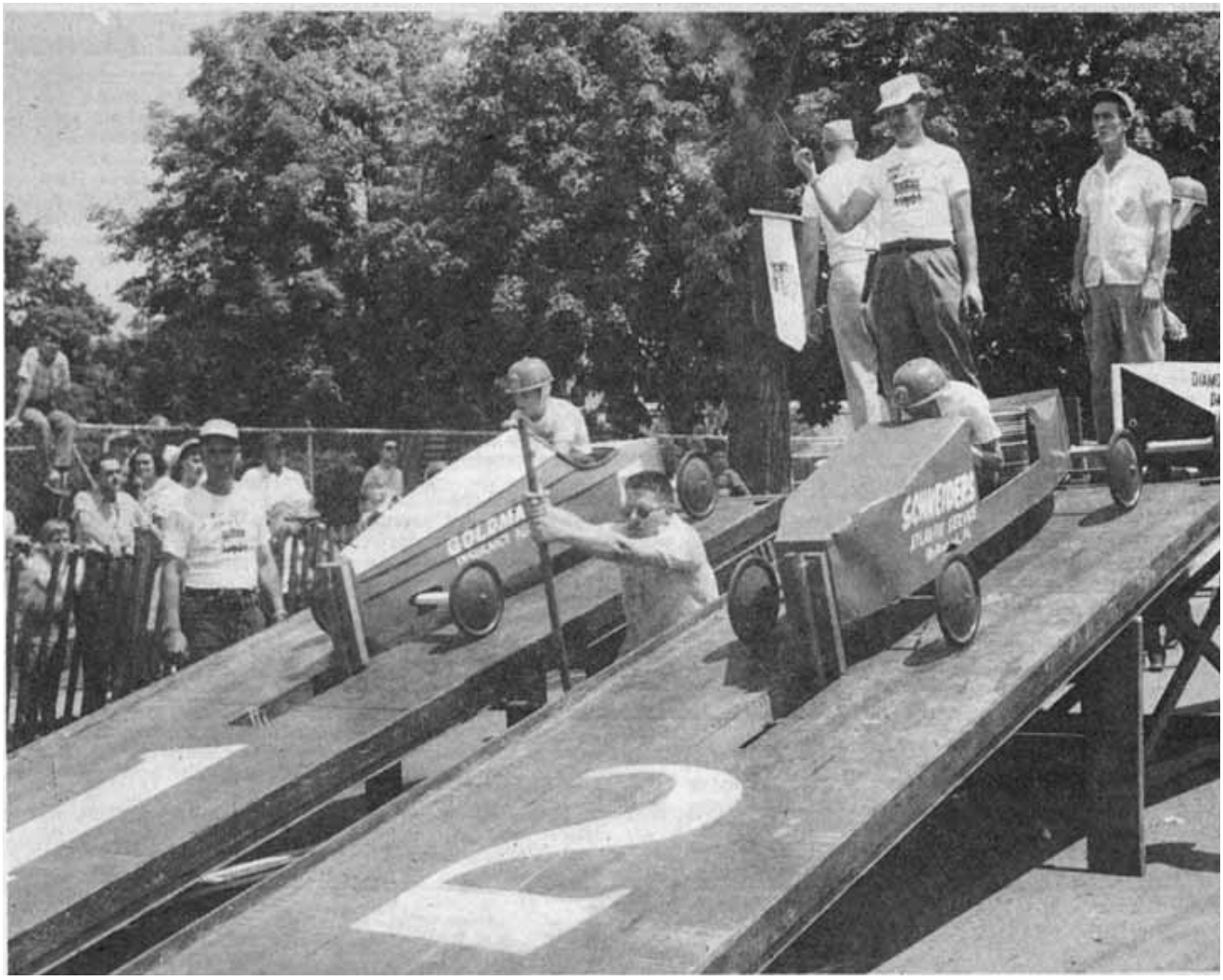
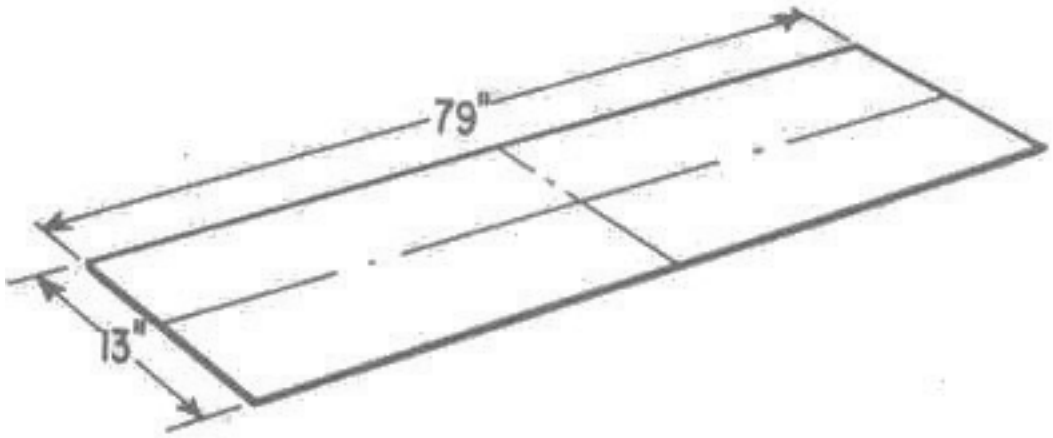


The soap box derby had its origins during the 1930s. Children in Dayton, Ohio, manufactured their own cars. They would build these cars from discarded lumber and other items and then race the autos down hills in the community. The cars were not powered by gasoline or any other type of fuel. The cars simply rolled down the hill with a child inside. The winner was the child that reached the bottom of the hill first.

Myron Scott, a Dayton reporter, covered one of these races. He decided that children across the United States could enjoy this activity, and he began to promote it across the country. In 1934, Dayton held the first "All-American Race," where soap box racers from across the country brought their creations to race. The following year, the race moved to Akron, Ohio due to its hillier terrain. Since 1935, the All-American Soap Box Derby has taken place in Akron. In 1936, Akron city officials decided to build a permanent facility for the race. With the assistance of the Works Progress Administration, one of President Franklin Delano Roosevelt's New Deal programs, the city completed Derby Downs, a soap box racetrack. Thousands of children from across the United States and from other nations have come to race their creations at Derby Downs every year since the track's completion. The only exception to this was during World War II, when many activities, including soap box derbies, came to a halt so that people could concentrate on the war effort. Today, children compete for college scholarships in addition to other prizes.

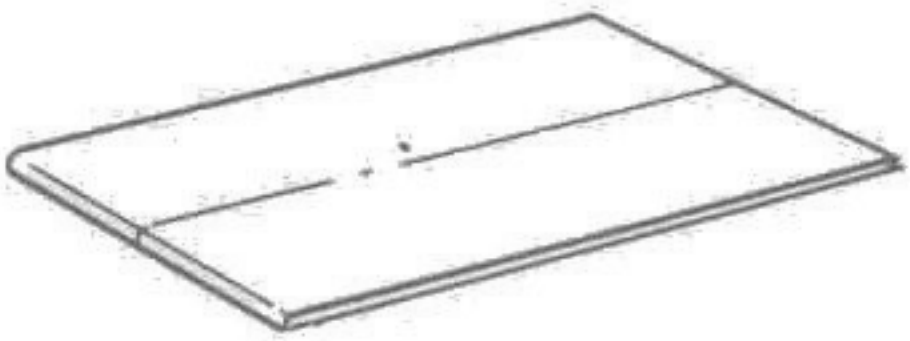
1 Floorboards

THE FIRST THING to do is to decide the approximate weight you want your car to be when finished, keeping in mind that its weight, plus your own, must not exceed 250 pounds. The weight of the door will vary according to the kind and thickness of wood used. To help you plan your construction, study the weights of your car parts, with just a little bit of figuring you can change any part of it to suit yourself. The rules do not require that each part be a certain weight, just be sure that your car does not exceed the total allowable weight when you are sitting in it.



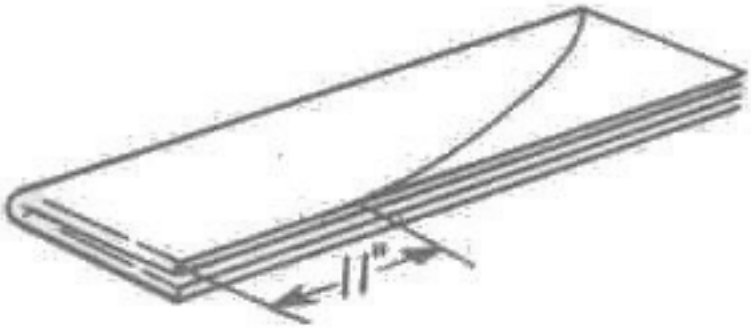
Drawing 1: Creating the floorboard template

Step 1. Mark out, on a large sheet of paper, a rectangle 79 inches long and 13 inches wide. By making your floorboard 79 inches long your car will not exceed the legal limit when the body is complete. At these dimensions you car will be 13 inches wide; if you require more than this width in which to sit, make your pattern wider.



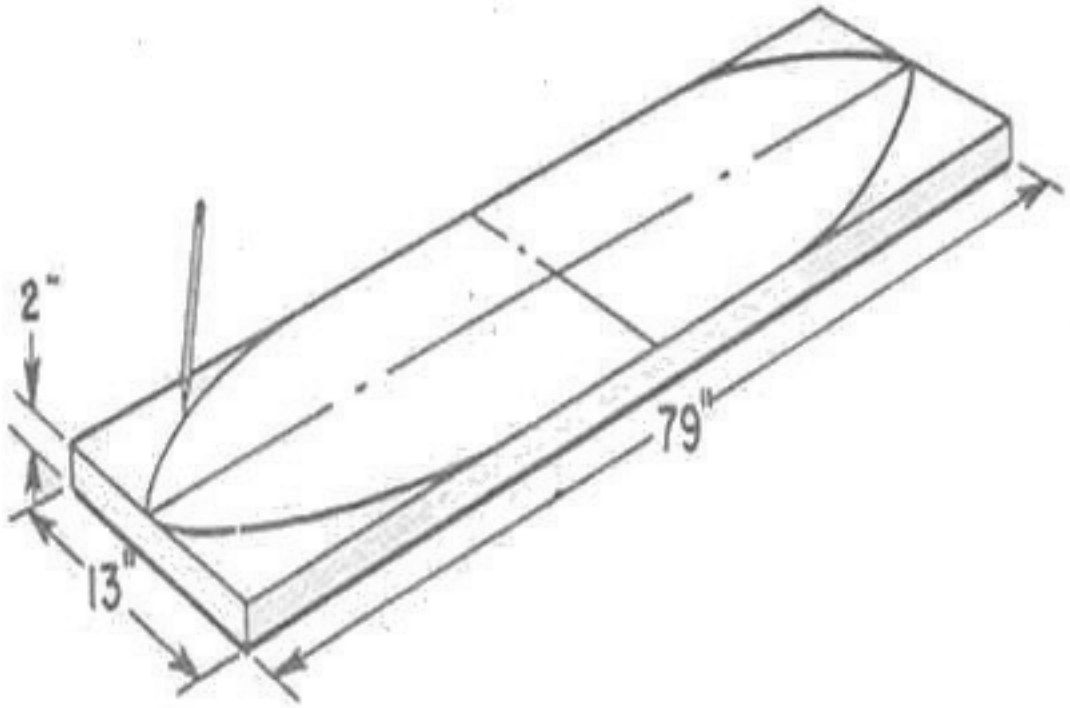
Drawing 2: Fold the template in half length-wise

Step 2. Cut the paper along the lines of the rectangle and fold it once.



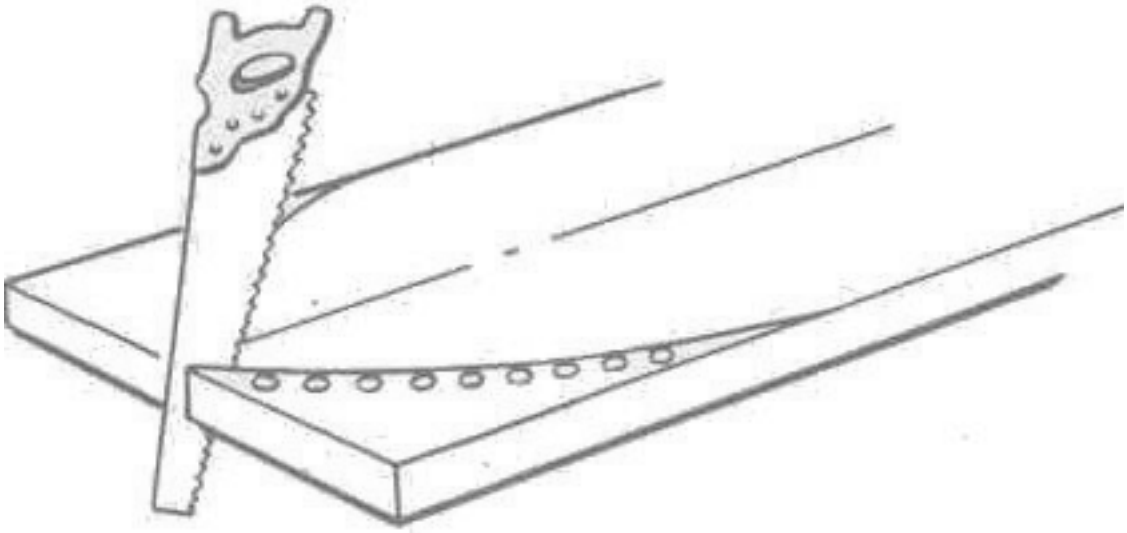
Drawing 3: Fold the template in half again and lay out the curve of the body

Step 3. Next, fold the paper once more in the opposite direction - the pattern should now be folded into four. Starting 11 inches from the corner of the first fold, draw an even curve to the opposite corner of the paper.



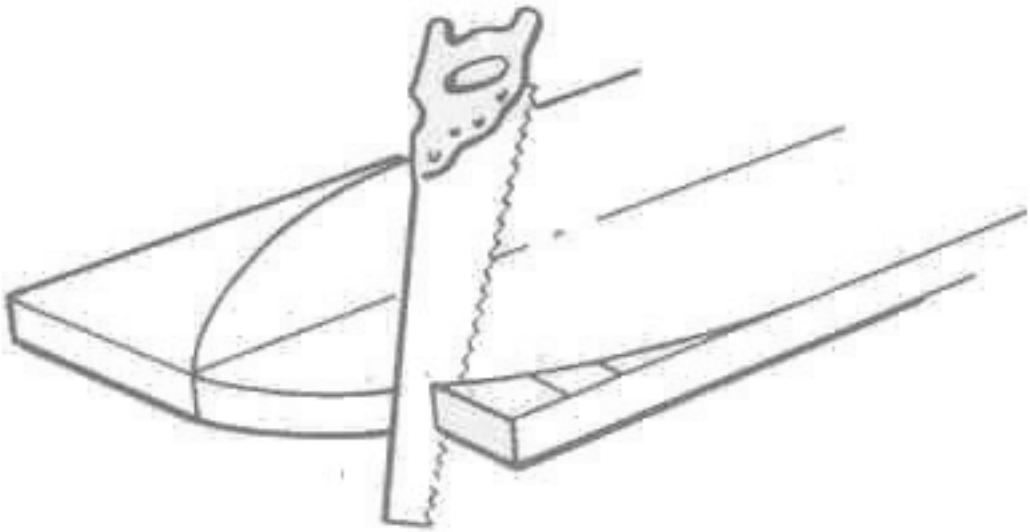
Drawing 4: Transfer the shape of the body from the template to the wood

Step 4. After cutting all four layers along the curve you have drawn. Unfold the pattern and lay it on the board you have decided to use for your floorboard. Trace the pattern outline on the board with a pencil.



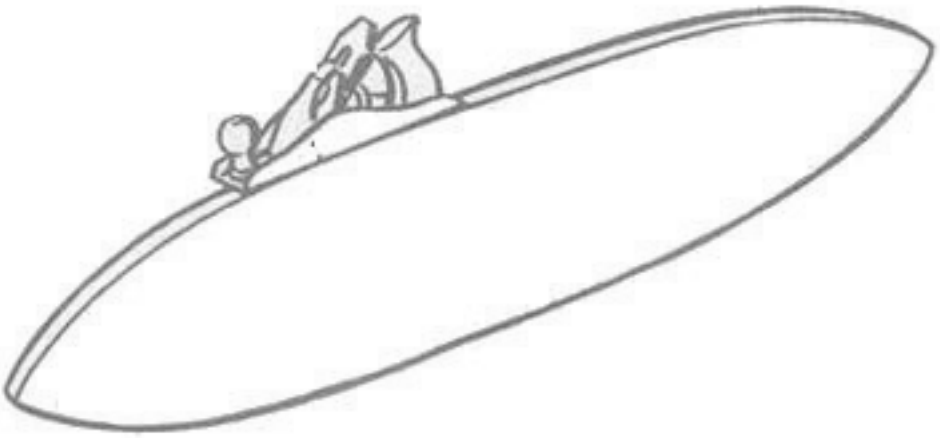
Drawing 5: Cut out the body shape using holes to guide the saw blade

Step 5. There are several ways of cutting the floorboard to the proper shape. One way is to drill holes through the plank all along the outline, just outside the line (Drawing 5). Then saw through the inner edges of these holes. This gives the floor its rough shape.



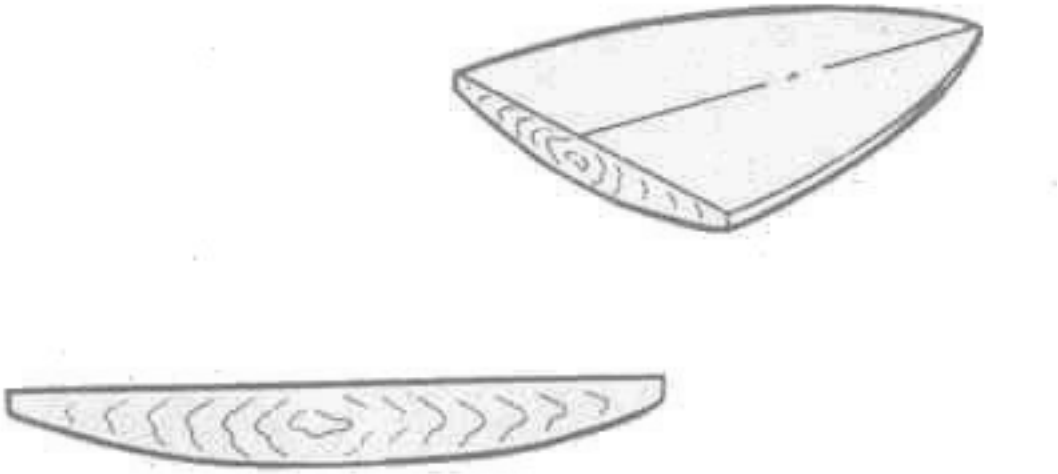
Drawing 6: Alternatively, make a series of vertical cuts to guide the saw

Another method (Drawing 6) is to saw in a series of straight lines, each time cutting through from the outside edge to remove the waste.



Drawing 7: Use a plane to smooth the rough cuts and give the floorboard its final shape

Step 6. After the floor is cut to the general shape, the next step to finish to its exact size. This may be done using wood plane (Drawing 7).



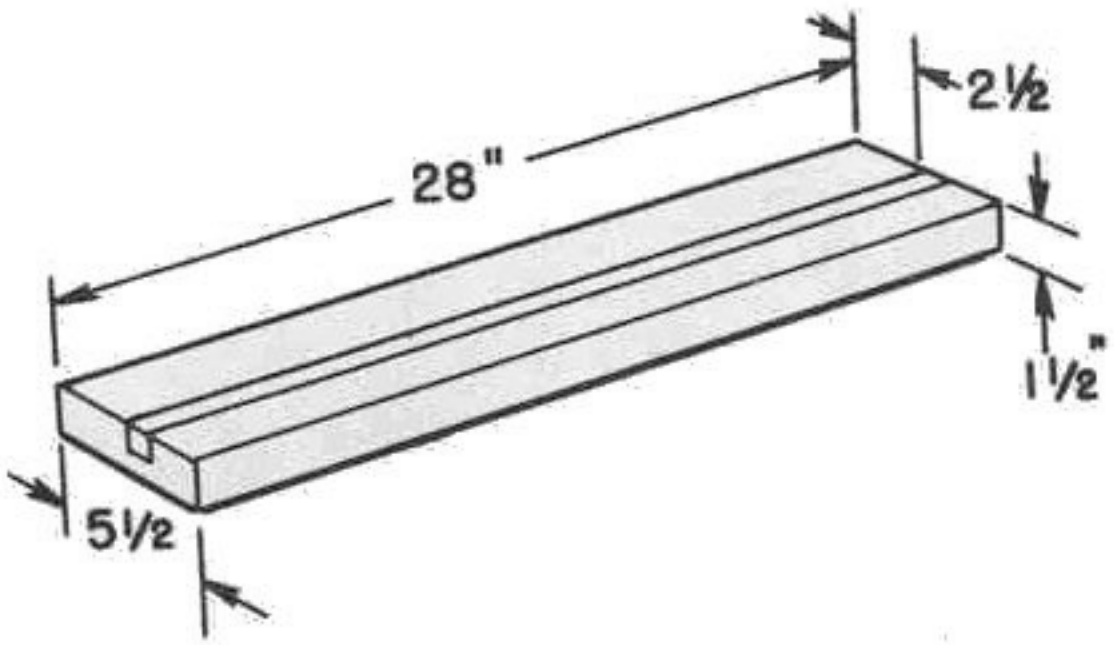
Drawing 8: Cross-sectional view of a properly shaped floorboard

Step 7. Now is the time to finish the bottom of the floorboard, if you have used a thick piece of wood. It should be streamlined by rounding it slightly toward both sides and ends, or by making it slightly V-shaped. This may be done by the use of a wood plane. Drawing 9 shows how the bottom should look after it has been rounded off towards the sides and ends. These are cross section views.

2 Axle Trees

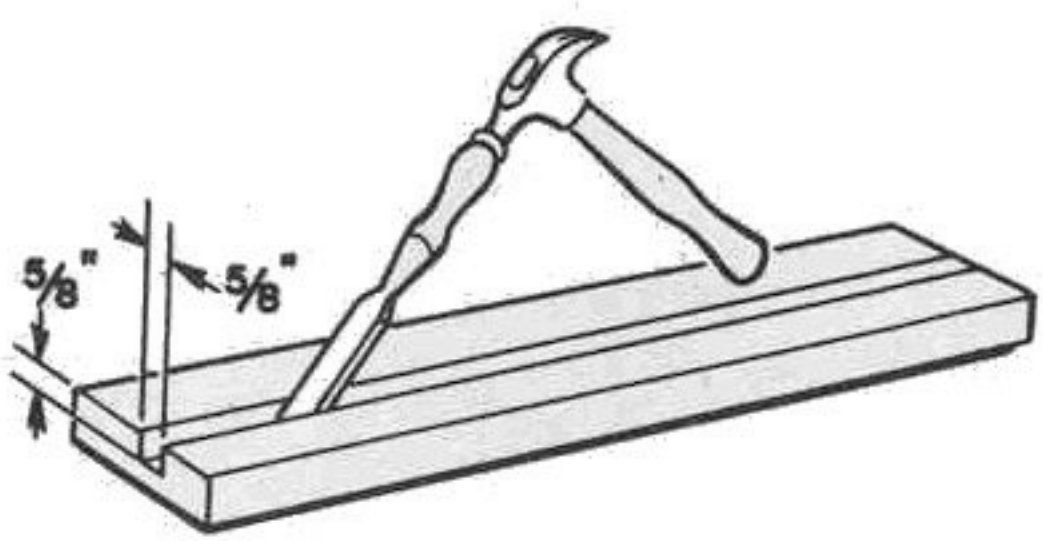
AXLE TREES are the wood coverings, which reinforce the axle rods. They keep the axle rods from bending under the weight of car and driver. If the rods were not reinforced they might bend, which would let the wheels slant. This would sacrifice speed, due to additional friction on the bearings and road drag on the tires.

The trees should be built to create as little wind resistance as possible. This means that they should be made as thin as is consistent with their purpose of keeping the rods from bending. Next, fold the paper once more in the opposite direction - the pattern should now be folded into four. When made with soft wood, the axle tree will have a tendency to break or split.



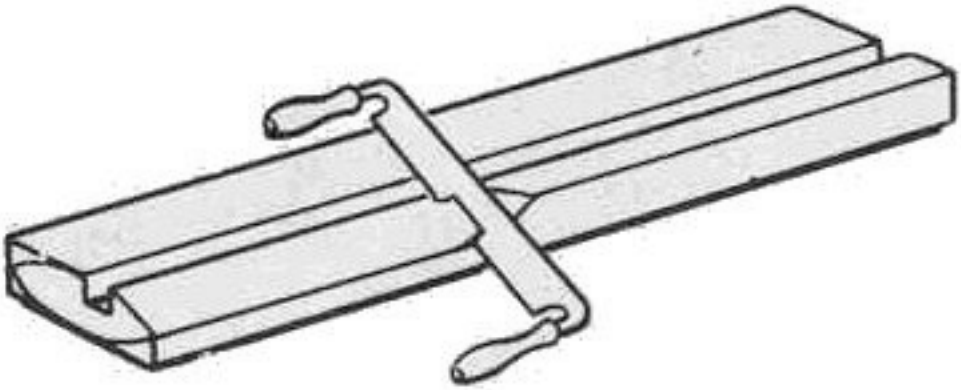
Drawing 9: Create two identical axle trees for the front and back of the car

Step 1. You'll need two axle trees; work two boards to size 1½" x 5½" x 28". Locate the grooves for the trees by drawing a line parallel to the front edge of the board, 2 ½" from it and another line 5/8" behind the first.



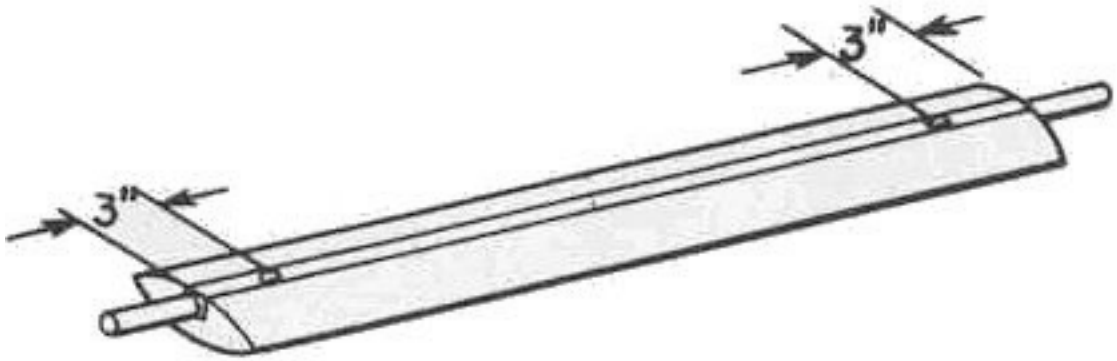
Drawing 10: Cut the grooves for the axle rods

Step 2. Next the grooves for the rods are to be cut. They are to be 5/8” deep and 5/8” wide. Cut the grooves for the rods 5/8" deep by 5/8" wide using a saw or chisel and hammer (as shown in Drawing 10).



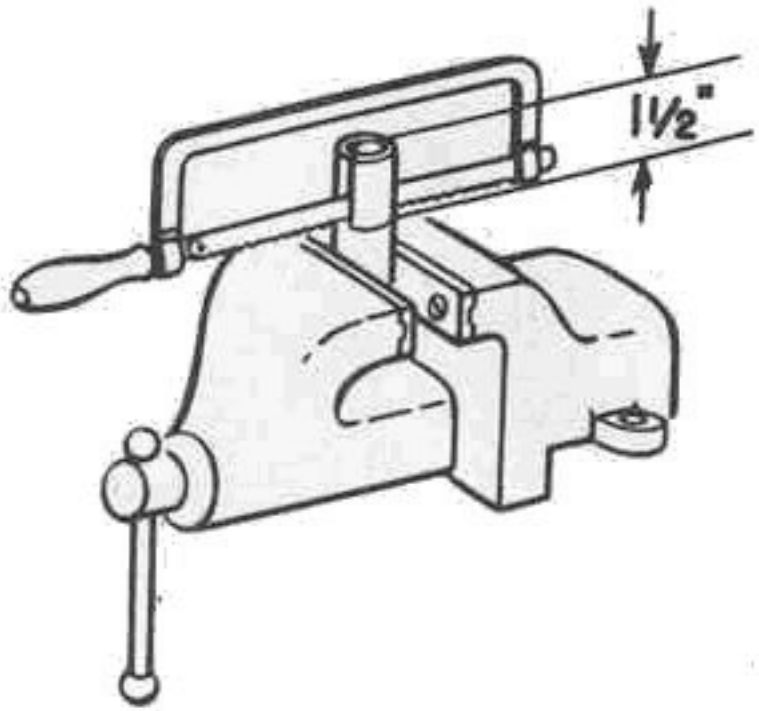
Drawing 11: Shape the trees using a drawknife or a plane

Step 3. Work the trees down to a streamlined shape using a drawknife or a plane (shown in Drawing 11) and finish them with sandpaper to give a smooth, even surface.



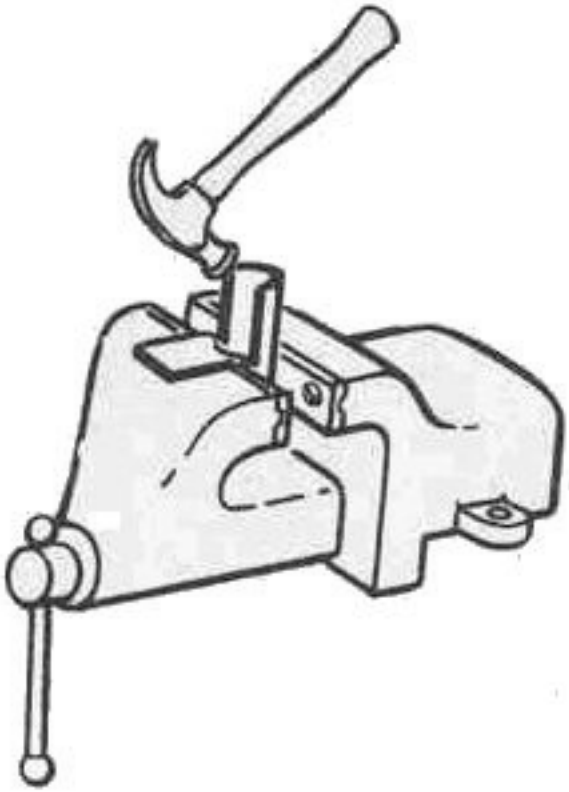
Drawing 12: Bolt the rods to the tree

Step 4. Now that you have the trees shaped and grooved, you must bolt the rods to them. If your rods already have holes drilled in them, you may use those - otherwise use one 3 1/16" stove bolt at each end of the rod drilled 3" from the square end.



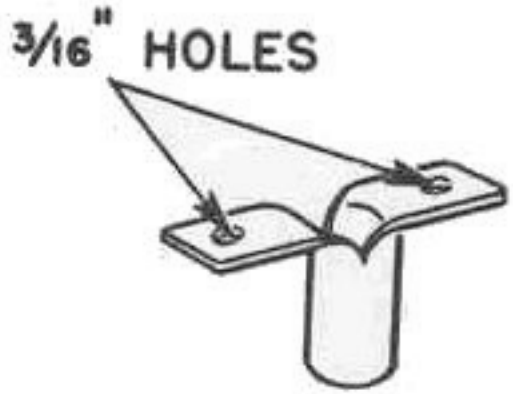
Drawing 13: Fashion the bushing for the king pin from a length of 1/8" pipe

Step 5. The bushing for the King pin may be made from a 3" length of 0/8" pipe. Using a hacksaw split the pipe for a distance of 1 ½" holding the pipe in a vise while working on it. Put an old bolt in the part of the pipe that is between the jaws of the vise to keep from crushing it.



Drawing 14: Flatten out the two halves of the pipe

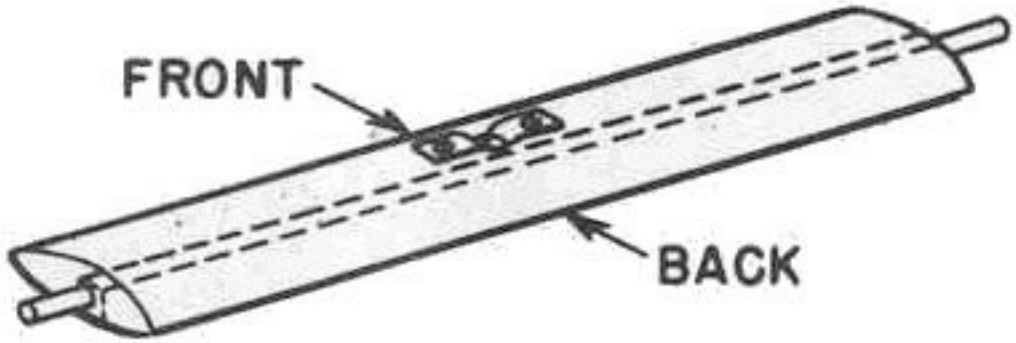
Step 6. Now flatten out the two halves into which you have split the pipe. Be sure that during this operation you do not squeeze the remainder of the pipe out of round. If this happened the King pin would not go through it nor would it work freely if you could get it in.



Drawing 15: Drill holes to fasten the king pin bushing to the front tree

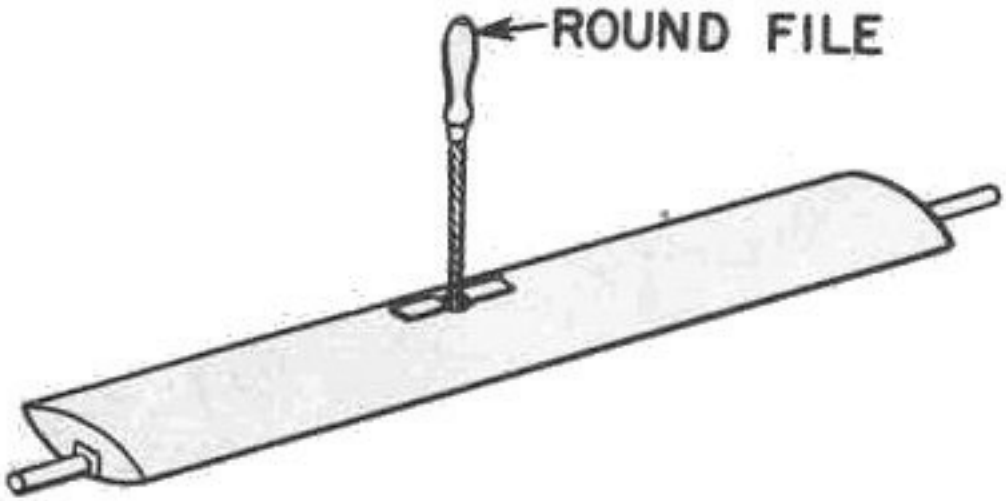
Step 7. Next, drill a 3 1/16” hole in each flat piece (Drawing 15). The King pin will be installed in the

front axle tree; a carriage bolt or a machine bolt. 0/8" in diameter and as long as necessary, makes a good King pin bolt.



Drawing 16: Attach the bushing to the front tree

Step 8. Drill a hole with a 9/16" drill in the exact center of the axle "tree lengthwise, in front of, but close to, the axle rod. Insert the bushing, with the flat pieces on top of the tree, and screw it into place, using wood screws. It is very important that the King pin be the same distance from each end of the axle rod, so that the wheels line up.



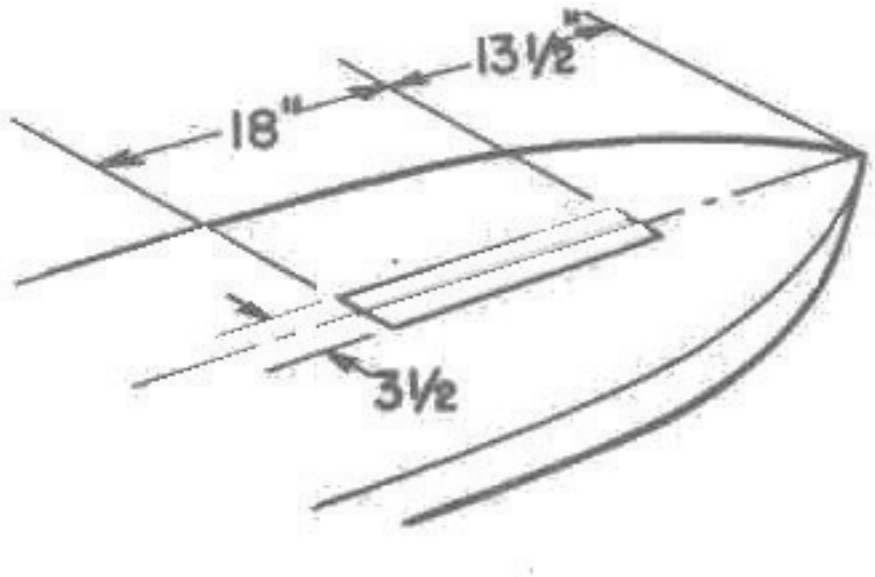
Drawing 17: Smooth the inside of the bushing if necessary

Step 9. If the King pin does not work freely inside the bushing smooth the inside with a round file. However, very little of this is likely to be necessary, if the pipe has not been pinched out of round in the vise.

3 Brake Holes

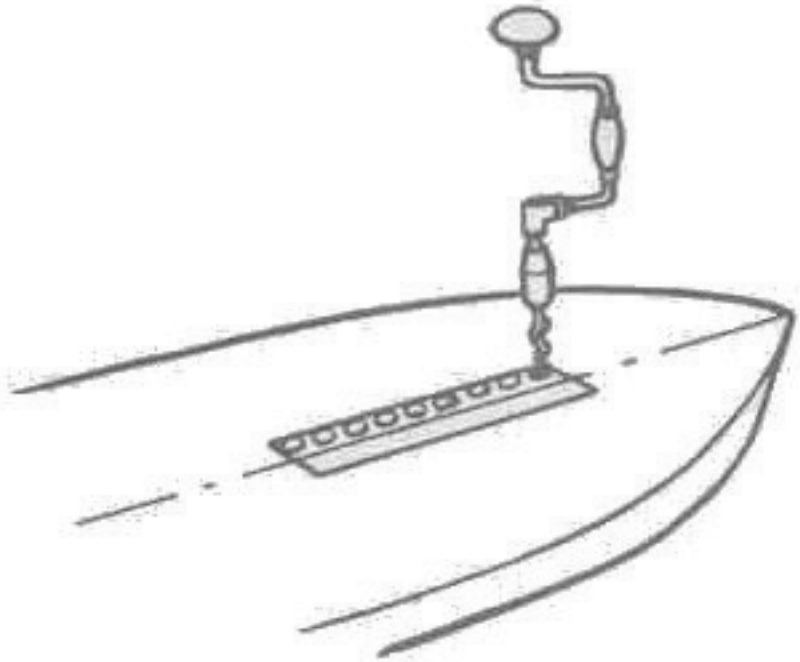
THE RULES are very definite about the location of the brake for the car. At this point in your construction you should cut the hole in the floorboard through which the drag will operate. Take great care in seeing that your measurements for this purpose are exact. If you have made your floor thicker than two inches it will be necessary for you to cut out places in the floor in which to set the trees, so that your car, with you in it, will have the necessary clearance of three inches, as provided in the rules.

Our model car shown here does not have a thick floor, so it was not necessary to make these cutouts; the way to make them is, however, shown below.



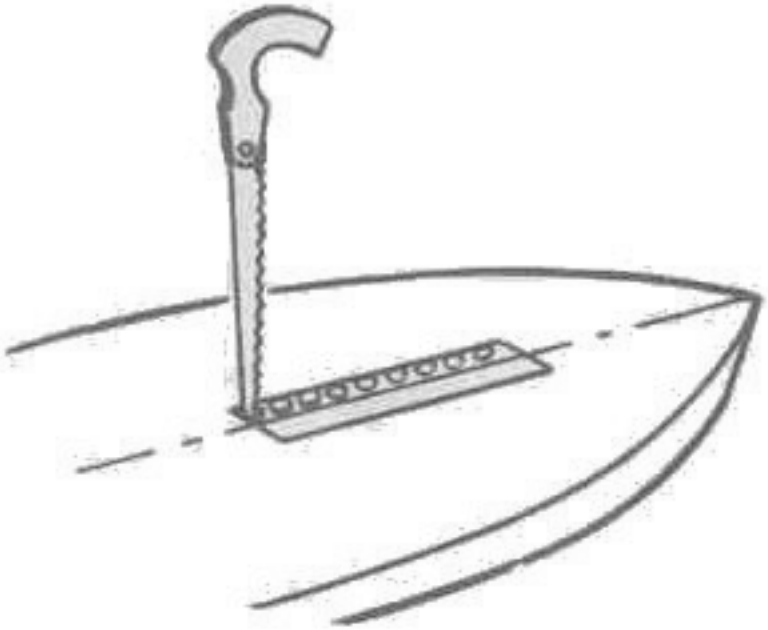
Drawing 18: Laying out the brake hole

Step 1. Draw an outline of the brake hole on the rear end of the floorboard as shown in this sketch. Make certain that it is located exactly between the sides of the floorboard. Otherwise your car would swing to one side or the other when you applied the brake. The size of the hole is 18" x 3 ½".



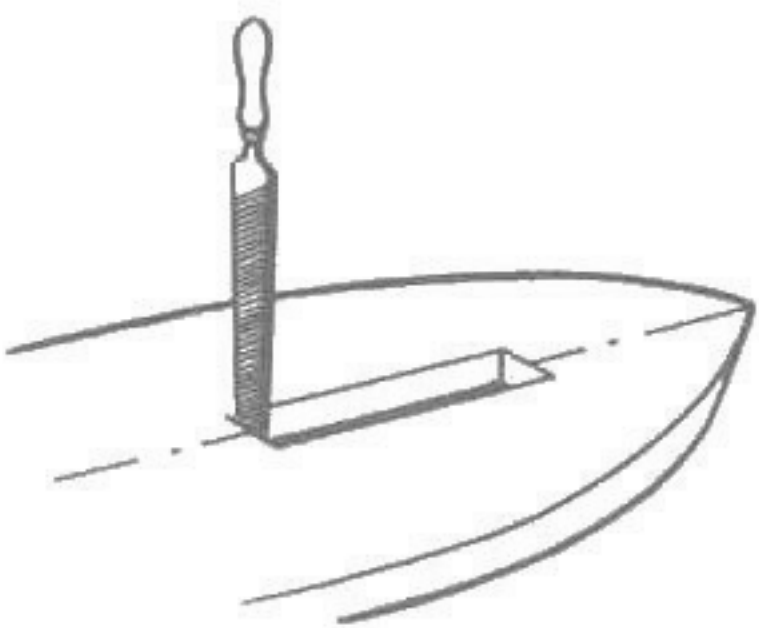
Drawing 19: Drill holes to guide the removal of wood from the brake hole

Step 2. Drill a series of holes through the floor along the inside of the lines you have drawn, until you have room to get a saw started. The edges of the drilled holes should adjoin each other.



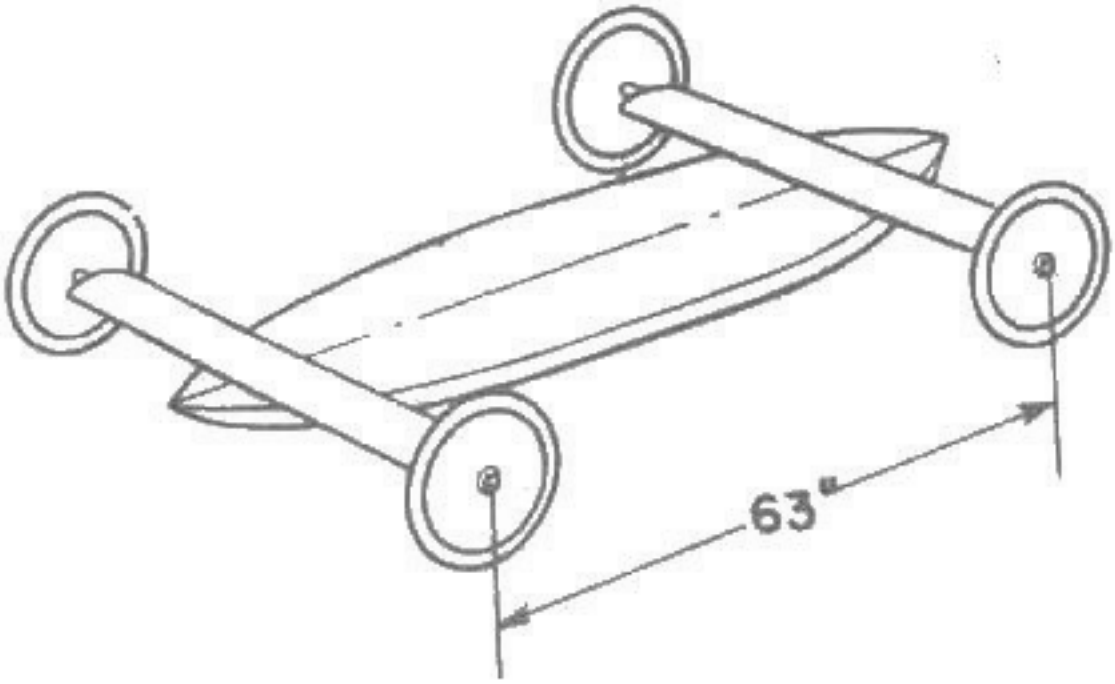
Drawing 20: Cut out the brake hole

Step 3. Saw along each line until the whole is finished



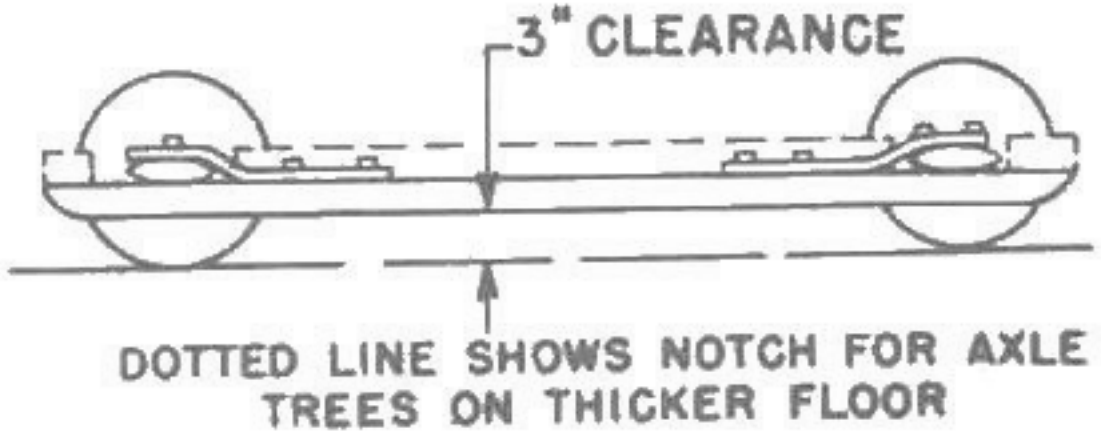
Drawing 21: Smooth all edges using a chisel

Step 4. Use a chisel or a file to smooth all the edges.



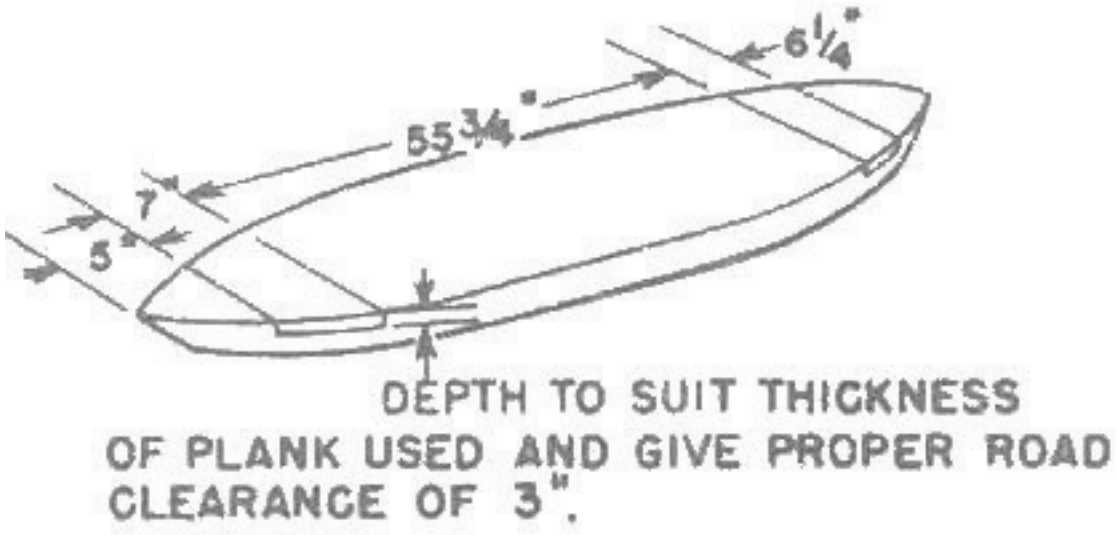
Drawing 22: Proper wheel placement

Step 5. Before you do any more work on the floor you are reminded that the front wheels of the car must be behind the nose of the car. The front axle tree must not be placed so near the front that the rims of the front wheels are as far forward as the nose of the car.



Drawing 23: Road clearance is important

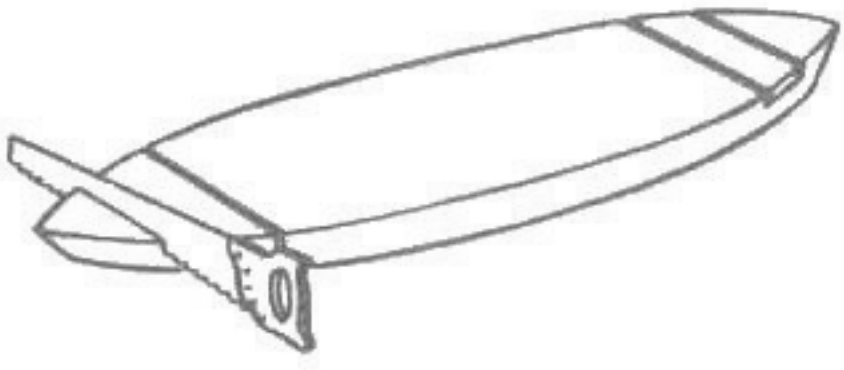
Step 6. If you are using a floor more than 2" thick it is necessary to cut out channels in the floorboard in which to set the trees, so that your car, when loaded, will have a minimum clearance of 3" provided by the rules.



Drawing 24: Removing cutouts (if necessary) for the correct road clearance

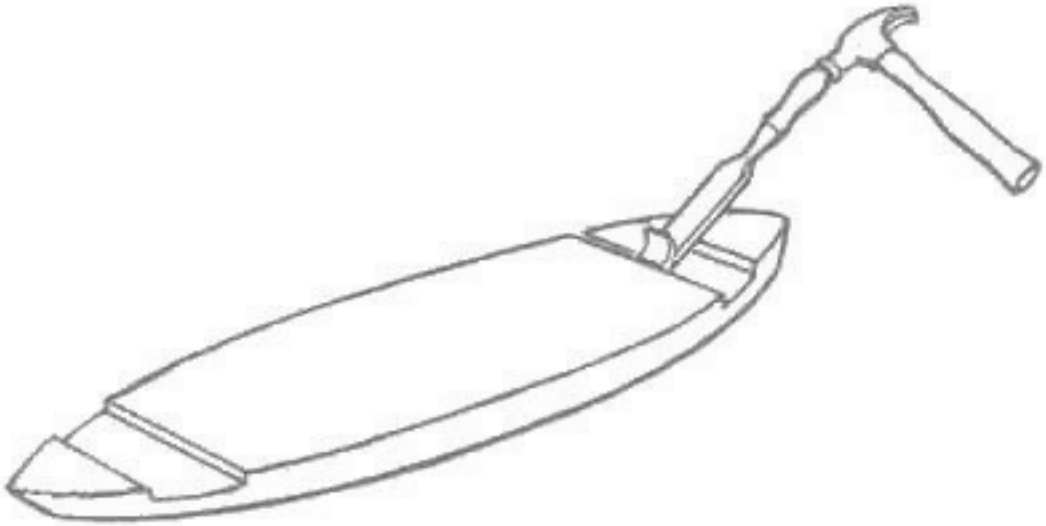
Step 7. If you decide that you should provide cutouts for the trees on your car, draw the outline of them on the floorboard as shown here. The channel for the front tree should be a little wider, you notice, to

allow the front wheels to turn for steering.



Drawing 25: Notching the cutouts with a saw

Step 8. Saw across the floorboard along the lines you have drawn. Make the cuts only as deep as you have decided necessary to give the bottom of the car the 3” clearance.



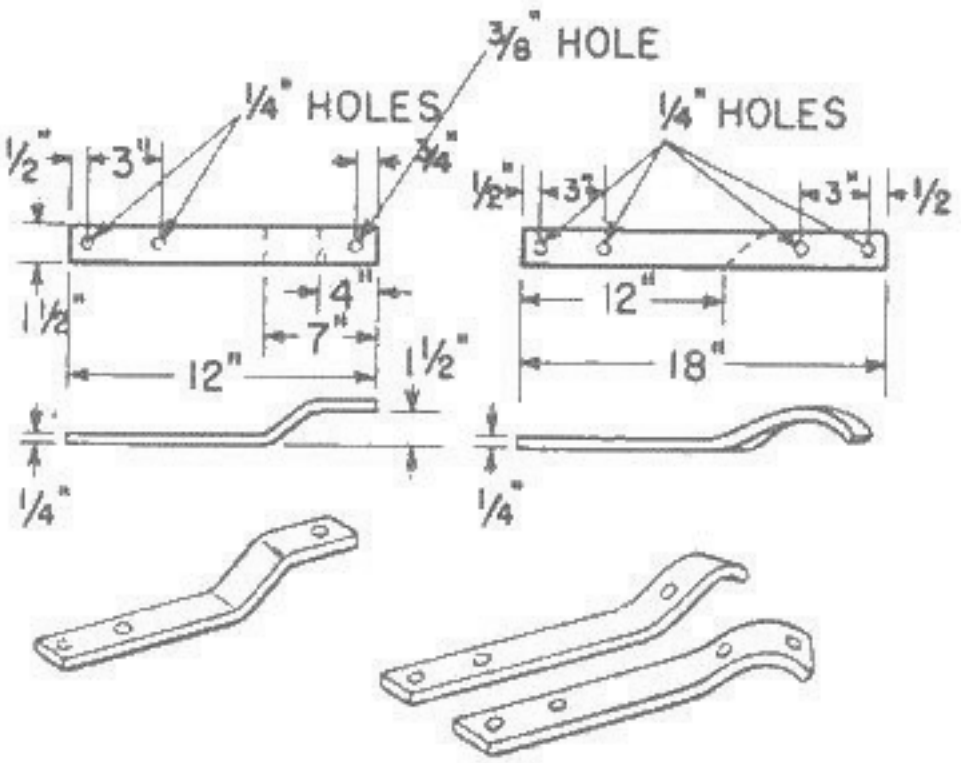
Drawing 26: Removing the cutouts with a wood chisel and hammer

Step 9. Use a hammer and chisel to clear out the waste wood between the cuts you have made with the saw. When about done finish with a wood plane and sandpaper.

4 Suspension

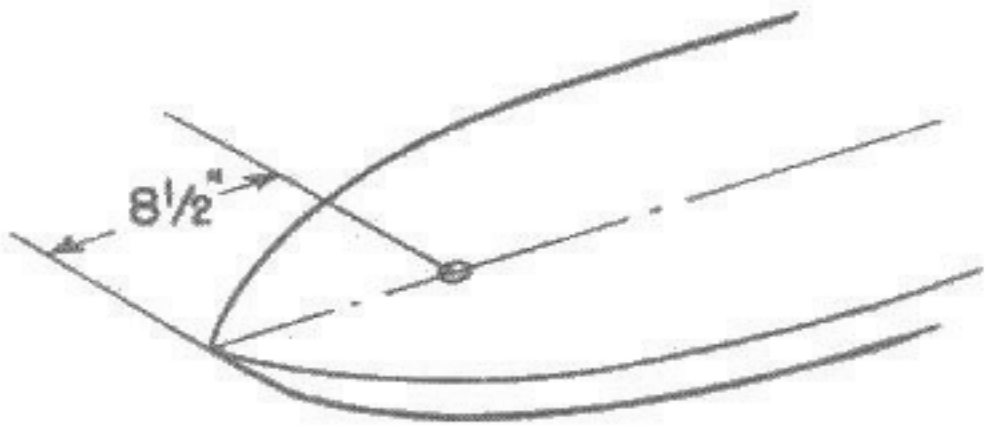
IT IS NOT NECESSARY to equip your car with a springing system, but results of special tests made on Derby Downs, as well as lessons learned from past years' races, prove that well-suspended cars handle better, ride better and have more speed than cars without springs. Derby rules allow the use of almost any kind of spring suspension as long as the action of the springs does not interfere with proper control of the car.

Flat auto springs are the safest and the, easiest to obtain and to install. Soap Box Derby rules permit you to have a workshop cut, shape, temper, taper, trim, punch or drill the leaves to suit your needs.



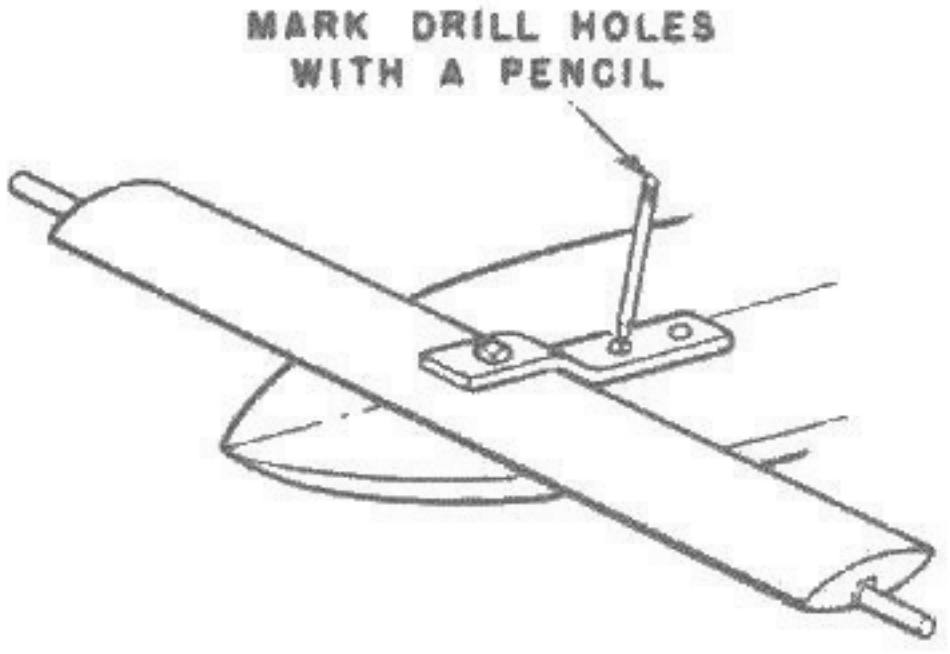
Drawing 27: Fabricating springs for better performance

Step 1. You will need three pieces of old auto springs: two which measure 1/4" x 1 ½” x 18" for the rear, and one 1/4" x 1 ½” x 12" for the front. Most any auto shop or spring company can provide you with these, and also drill and shape them for you as shown in the above sketches.



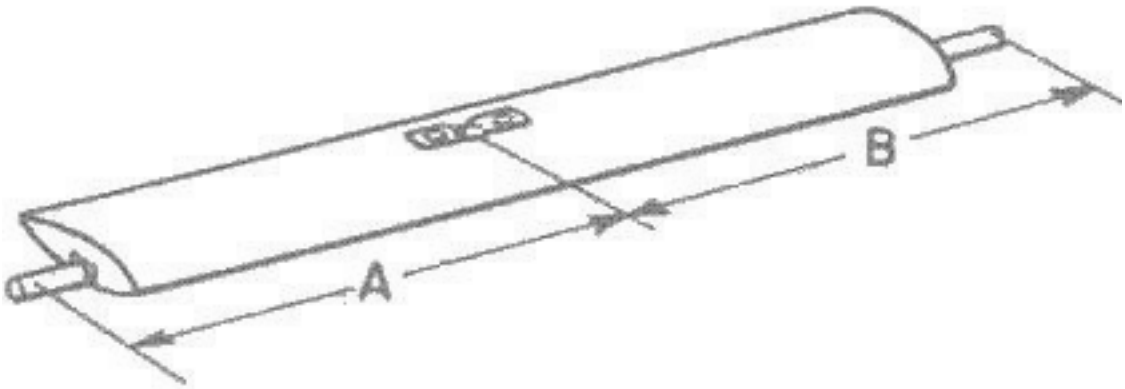
Drawing 28: King pin hole placement

Step 2. Drill a 3/8" hole in the floorboard in the exact spot which will bring the front axle rod just 8 ½" from the front point of the floor- board. Be extremely careful to locate this hole exactly on the centerline of the floor.



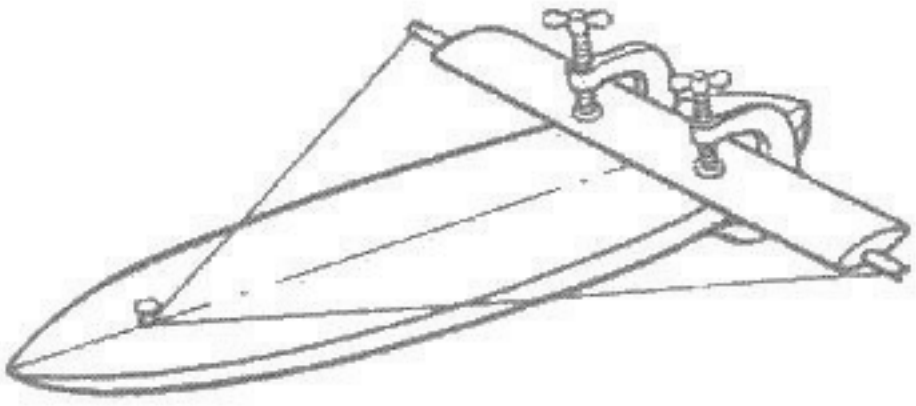
Drawing 29: Mark drill holes

Step 3. Now insert the King pin up through the floorboard, through the bushing in the front tree, and through the 3/8" hole in the front end of the front spring. Taking great care that this hole in the spring is DIRECTLY over and in line with the King pin hole in the floor, carefully bolt the leaf on the floor.



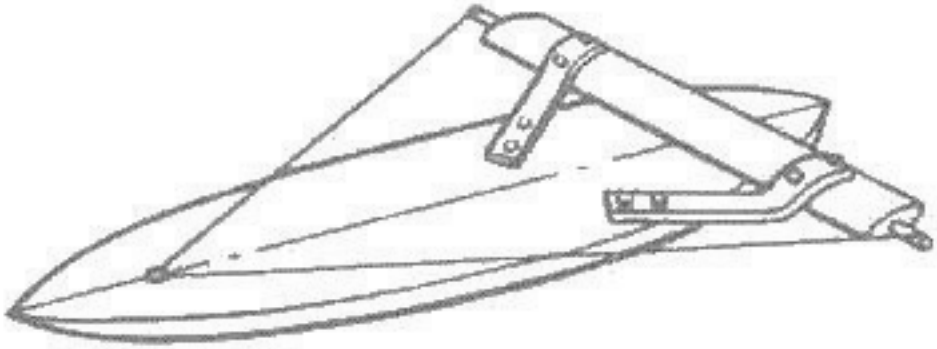
Drawing 30: Checking the placement of the king pin – A and B should be equal

Step 4. With a steel tape, or something else that won't stretch, check the distance from the King pin to the cotter pin holes in each end of the front axle rod. The distance to each hole, from the King pin, should be exactly the same.



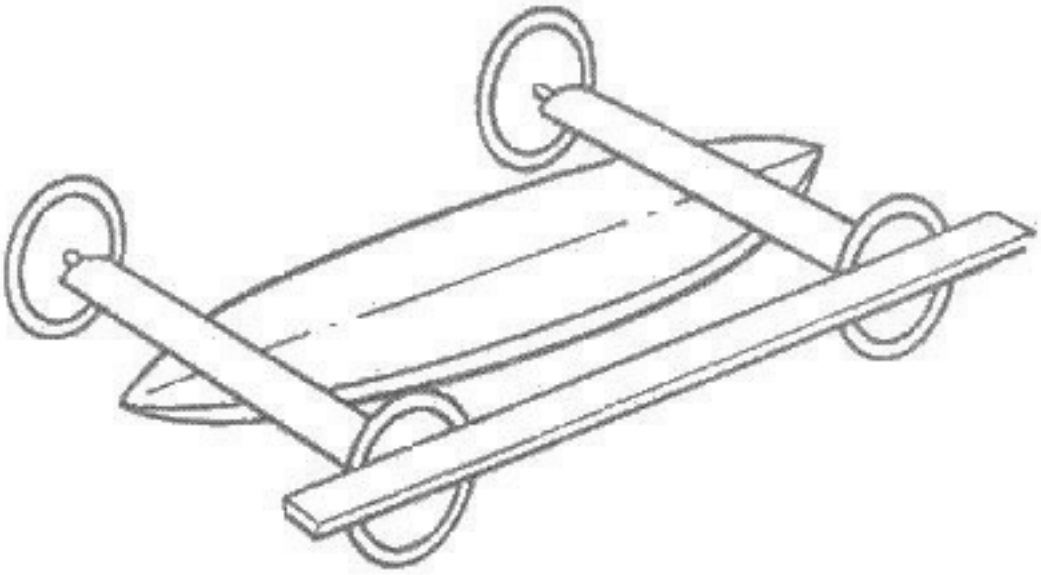
Drawing 31: Proper alignment of the rear axle is important

Step 5. Now it's time to attach the rear axle tree. Clamp the tree with the rod in its place onto the car floor. This should be at the spot, which will bring the centers of the front and the rear axle rods just 63" apart. Distance from each cotter pin hole in the rear axle to the center of the King pin must be the same for proper alignment.



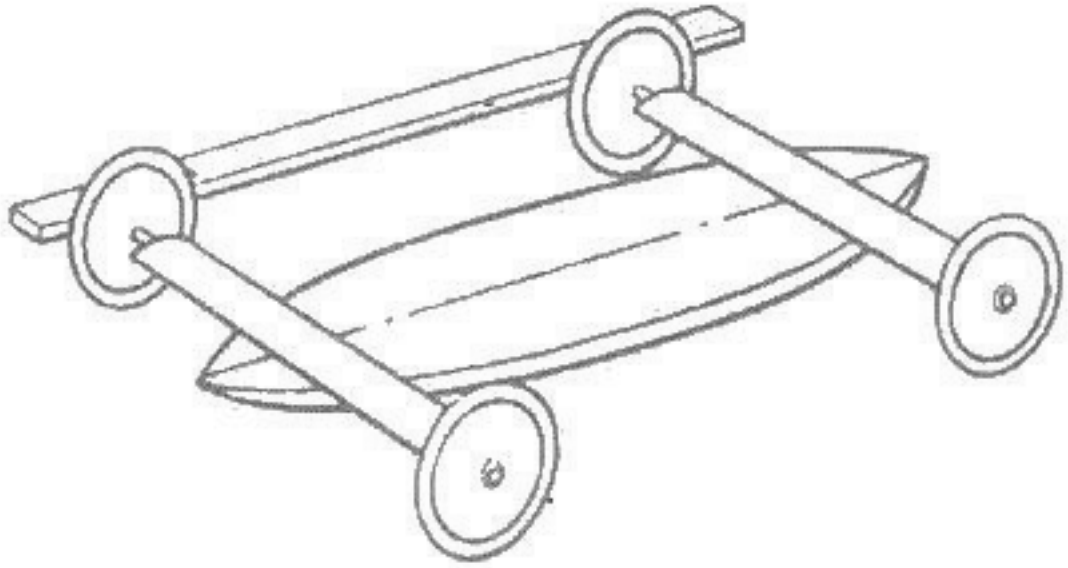
Drawing 32: Fastening the springs to the rear axle

Step 6. Fasten the two springs to the rear axle tree as shown, using bolts. Then bolt the other ends of the springs to the floorboard. Recheck to see that the tree did not slip out of alignment during this operation.



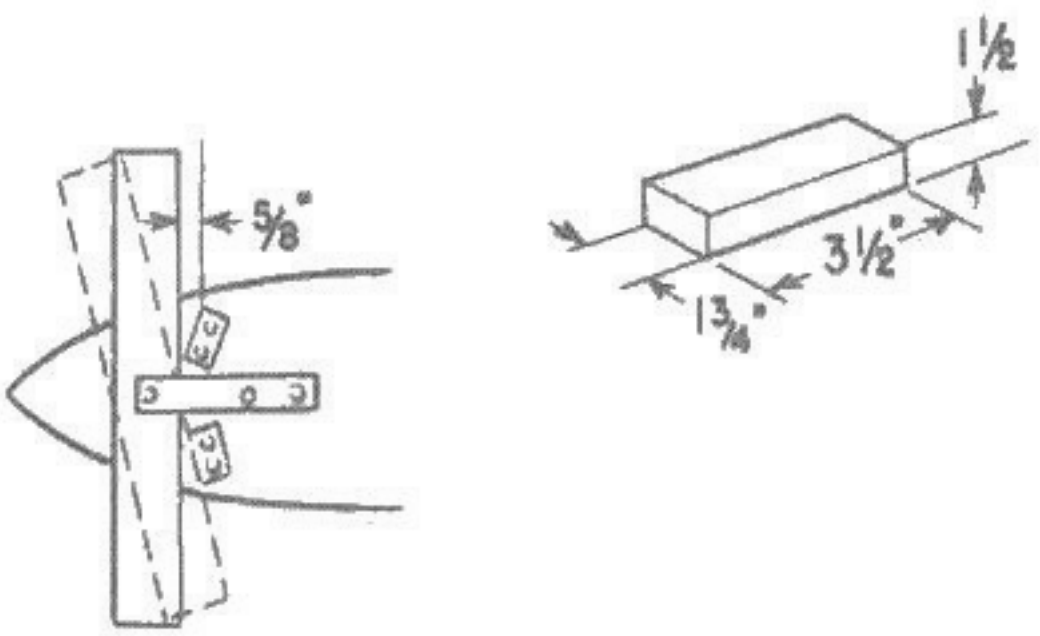
Drawing 33: Checking the left-side wheel alignment

7. Put all four wheels on the car and make another check on alignment. As shown here place a long and perfectly straight piece of wood or metal against the left front and rear wheels so that it touches both the front and the rear rims of both of the wheels at the same time.



Drawing 34: Checking the right-side wheel alignment

8. Using a similar straight edge, make the same test on the wheels on the other side of the car. To repeat: the edge must touch front and rear rims of both wheels AT THE SAME TIME. In addition, all of these points must touch at the same time, that is, both straight edges must be in perfect position with all points touching.



Drawing 35: Positioning the stop blocks to limit the movement of the front axle

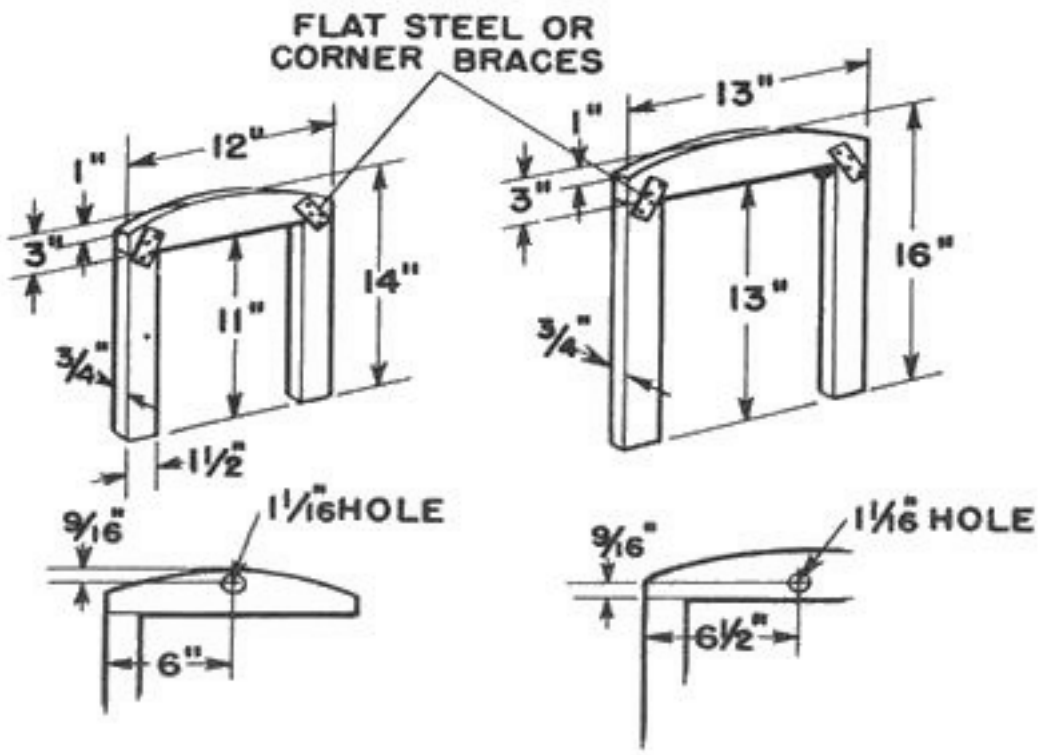
9. Two pieces of wood worked to 1 ½” x 1 3/4" x 3 ½” are used as stop blocks to limit movement of the front axle so that the front wheels can turn not more than 2" either way. To install, align axle in straight forward steering position: put a mark on floorboard edge just 5/8" from rear edge of tree. Turn axle so that edge of tree meets this mark. Install block. Do same with other block.

5 Steering

NO PART of a Soap Box Derby Racer is more important than the steering assembly, just as no part of the race you drive is more important than the steering you do. Between otherwise equal cars, the car which runs in the straightest line will win the race. Mechanical steering, of any type, is not allowed.

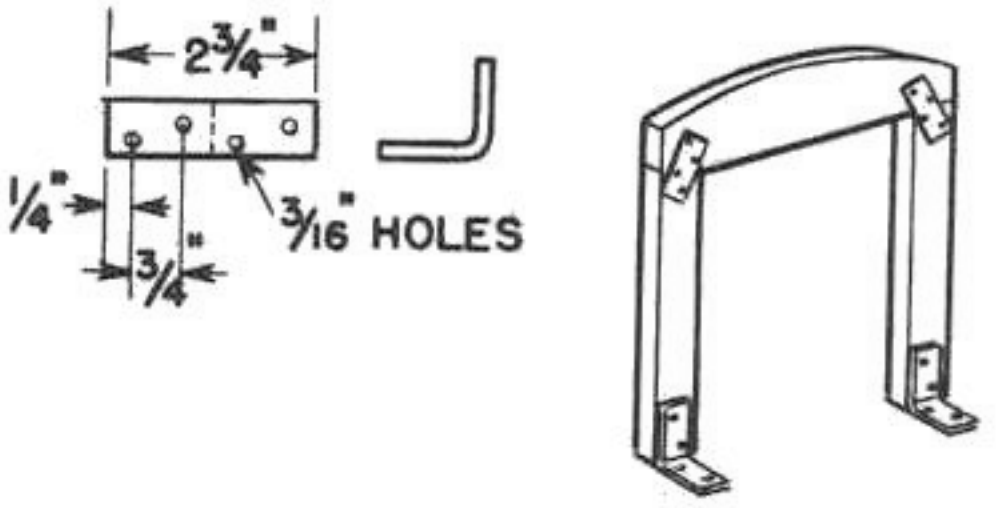
You may use either the vertical or the horizontal type of steering assembly. Either type may suit the small person, but larger people are inclined to favor the horizontal, because it gives them more leg room.

The type shown here is the horizontal. It is designed for safe, sure control of the car.



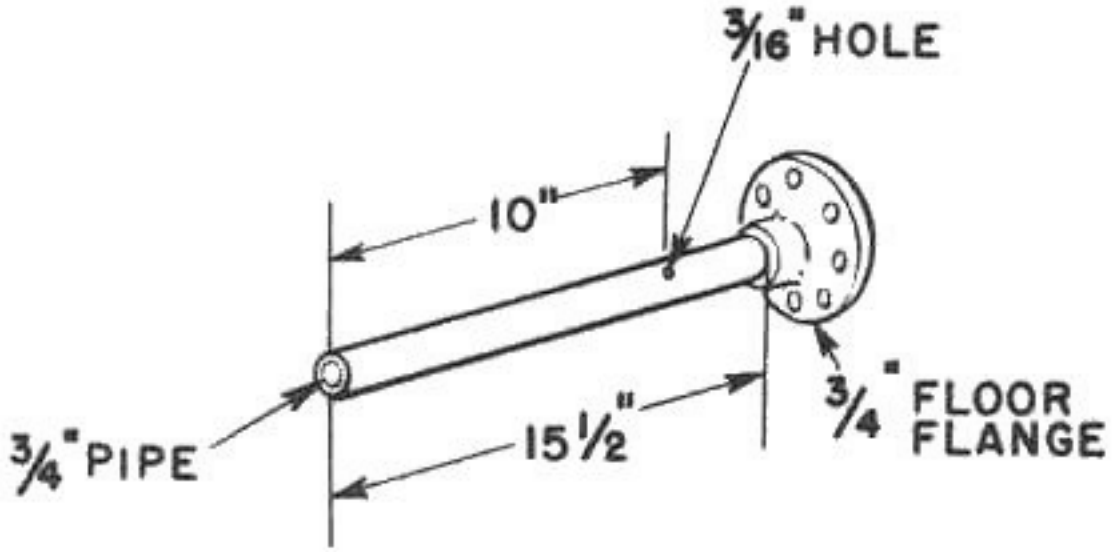
Drawing 36: Constructing the two bulkheads

Step 1. Construct two body bulkheads. Each one is made of three pieces of wood, held together by flat steel or corner braces. Drill a hole in each one through which the steering shaft will go.



Drawing 37: Installing the bulkheads

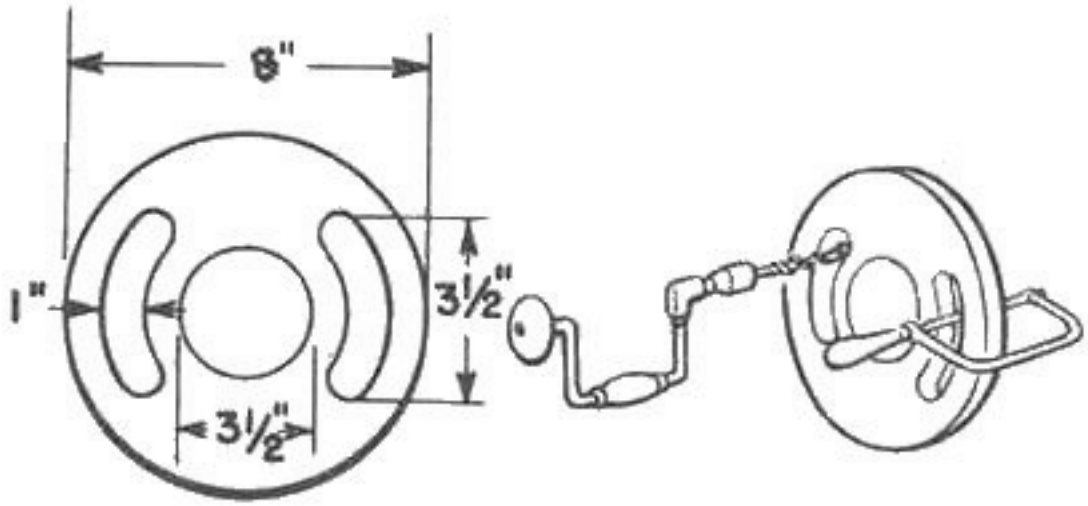
Step 2. This drawing shows how to install the bulkheads. Study the second sketch of the last step of this chart to see just where the bulkheads are to go on the floorboard. The smaller one goes in front.



Drawing 38: Making the steering shaft

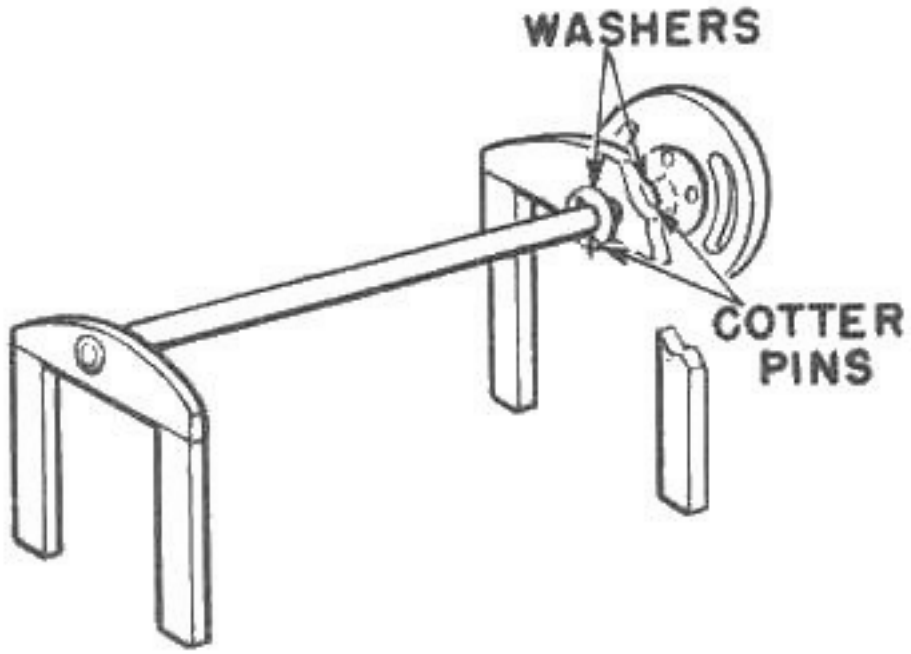
Step 3. For a steering shaft obtain a piece of 3/4" iron pipe (3/4" inside diameter, 1 1/16" outside diameter) 15 ½” long. Drill a 3/16" hole 10 inches from one end. Have a 3/4" floor flange WELDED to the end of the pipe nearest to the hole you have drilled. Don't use a drum on the steering shaft, the

steering is more accurate without.



Drawing 39: Cutting out the steering wheel

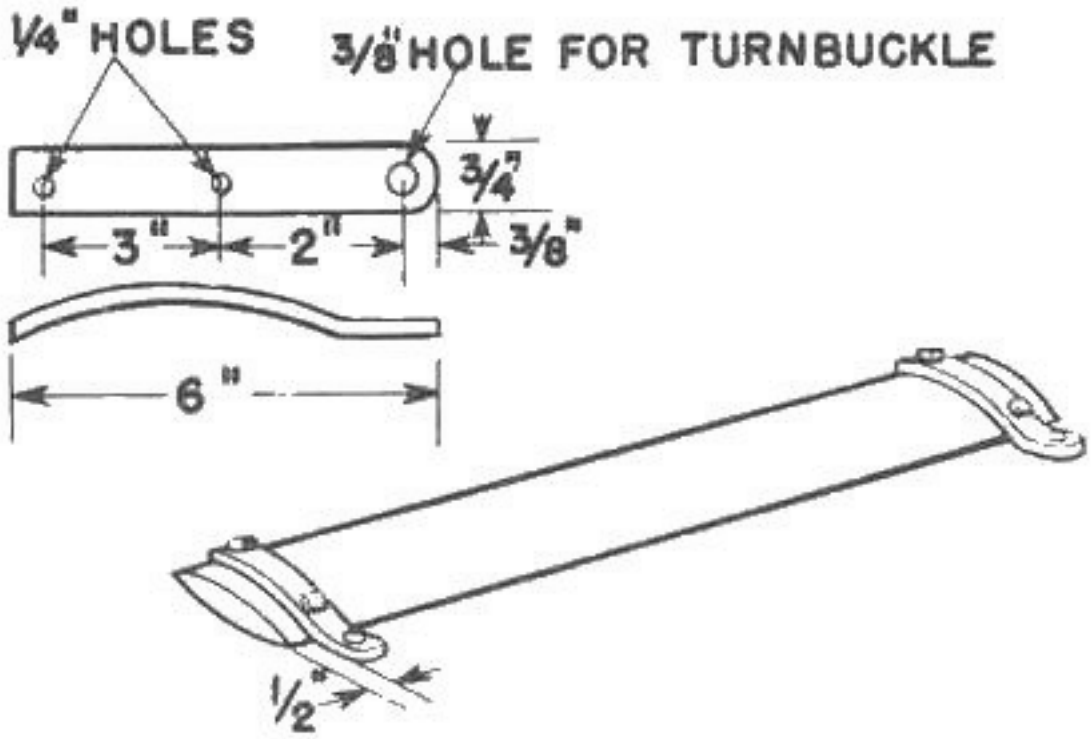
Step 4. You may use any kind of steering wheel allowed by the rules. If you want to use one like the one shown here you may cut it out of 3/4" plywood. Cut out slots for your fingers. Use either a coping saw or a keyhole saw to do this. Bolt the wheel firmly to the flange, which has been welded to the steering shaft.



Drawing 40: Mounting the steering shaft

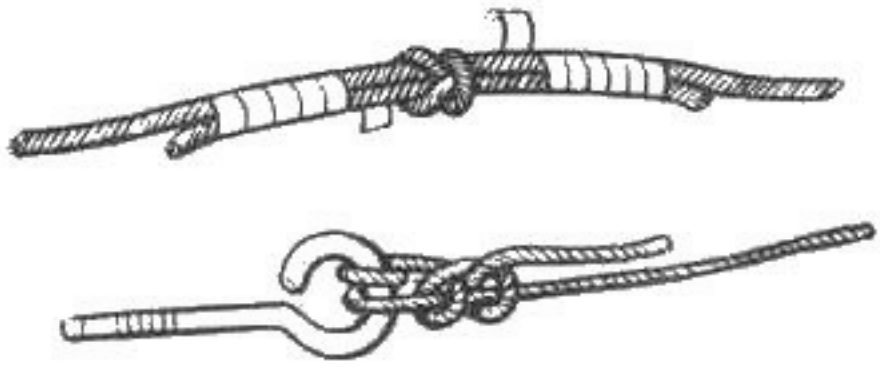
Step 5. Next run the steering shaft through the holes in the two bulkheads; running it from the large bulkhead to the smaller one. Washers should be placed on each side of the large bulkhead and you

should fasten them by putting cotter pins through holes drilled in the shaft for that purpose. This will prevent end play.



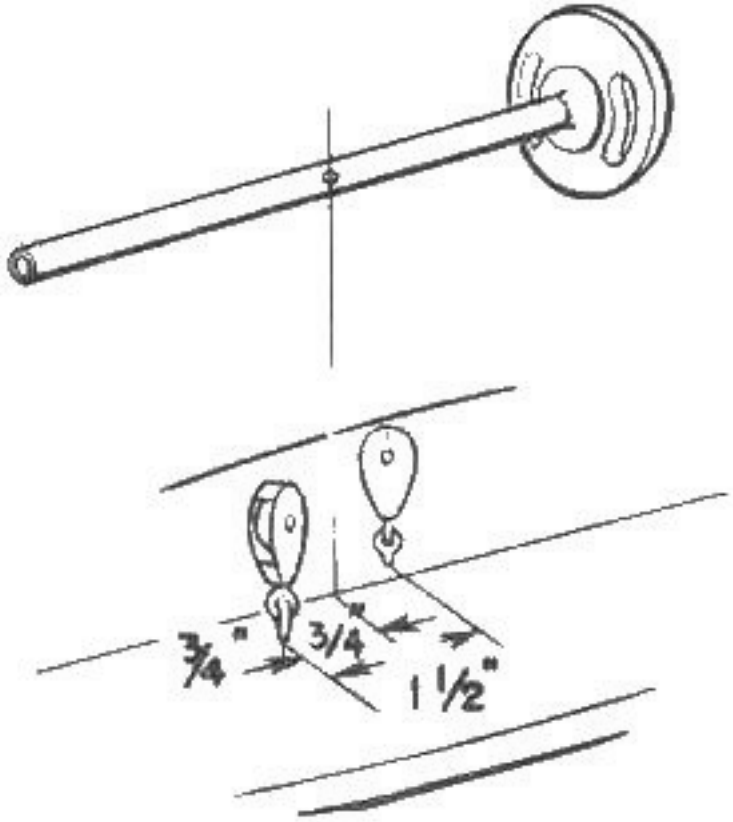
Drawing 41: Making the fastener for the turnbuckle

Step 6. Get two pieces of ¾" strap iron and shape and drill them according to the directions in this sketch. Fasten them to the front axle tree at the locations also shown here. Use bolts to fasten them securely to the tree. Fasten 3/16" turnbuckles to each of these pieces of strap iron. Use hitch shown in next sketch.



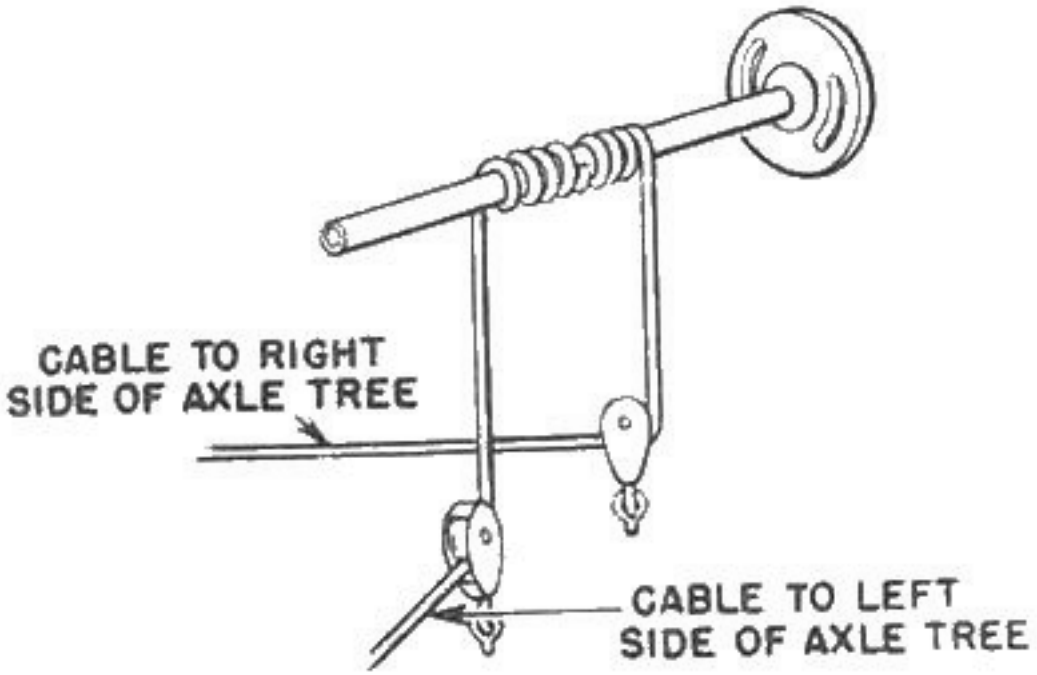
Drawing 42: Connect all cables securely with a good hitch knot

7. In fastening all cables throughout the steering and the braking assemblies use the hitch shown in this sketch. Bring the cable through the eye at least two times. Then make one or two knots around the cable and then clamp or wire the end of the cable to the cable proper. This will hold.



Drawing 43: Mounting the awning pulleys that will guide the steering cables

Step 8. Bolt two 3/4" awning pulleys to the floorboard under the steering shaft, one about l ½” in front of the other. Start rigging by fastening one end of a length of 1/8" cable to the eye of the turnbuckle on the right hand end of the front axle tree. Thread the cable through the back pulley, then up and over the left side of the shaft.

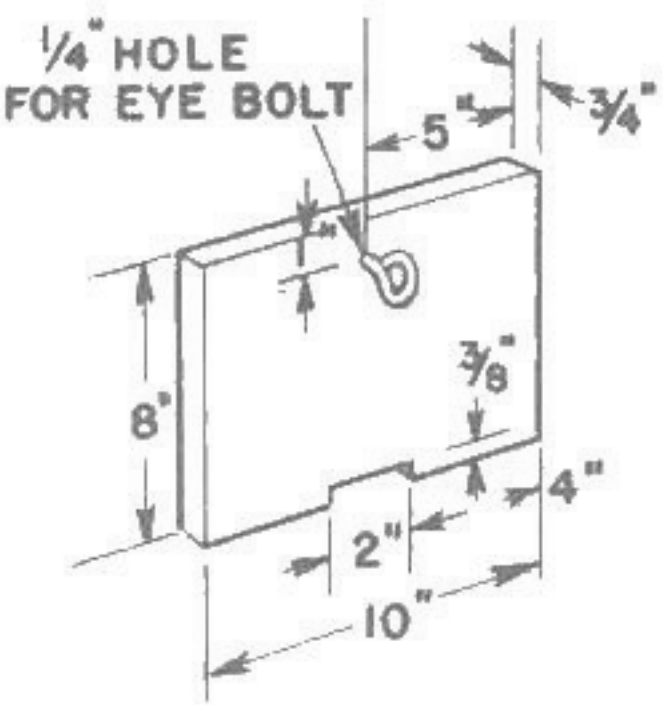


Drawing 44: Making the steering assembly

Step 9. Make four complete turns around the shaft and then thread the cable through the hole in the shaft. Continue with another four turns, in the same direction. Then bring the cable down to, and through, the other pulley and then anchor it to the turnbuckle on the left end of the axle tree adjust the turnbuckles to take the slack our of the cable.

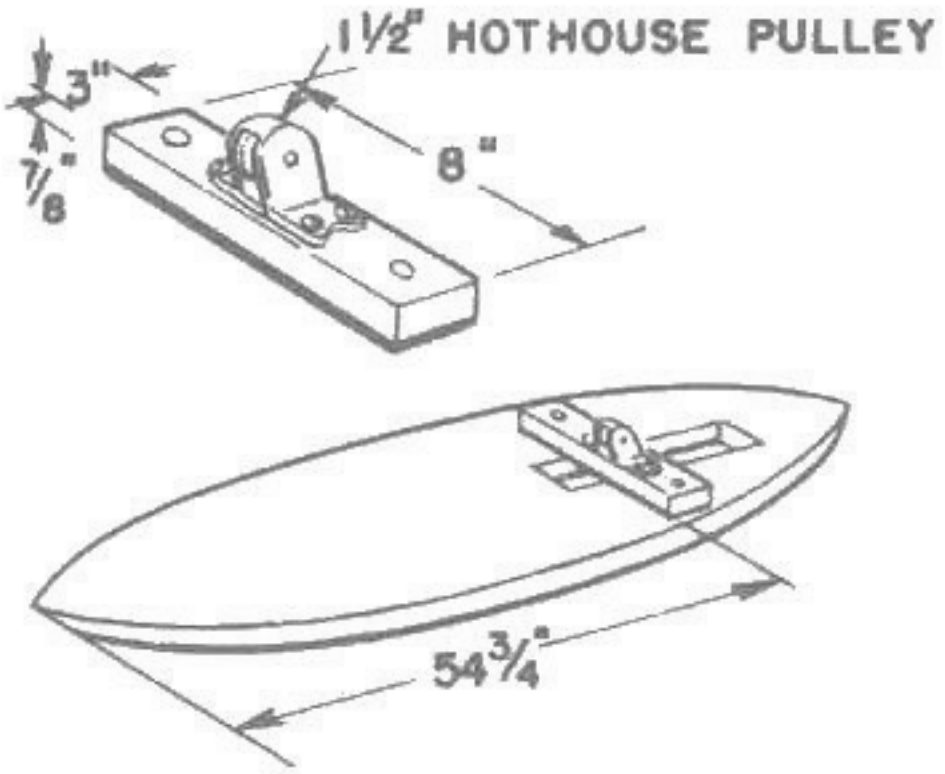
6 Brakes

THE SINGLE DRAG BRAKE, operated by a pedal is the only type of brake allowed. It is not permissible to use a brake which is operated by direct pressure of the foot on the drag bar. Note: you are not allowed to use a brake system activated by a hand lever. The rules are very specific about the brake system, its location, its size and the facing on the drag. Don't slight any feature of your brake construction; check and then recheck to make sure that every bolt, screw and cable connection will withstand the strain of quick stopping which may be required. Remember that the inspectors who will go over your car before the races will give close attention to the soundness of your brake assembly. Be prepared.



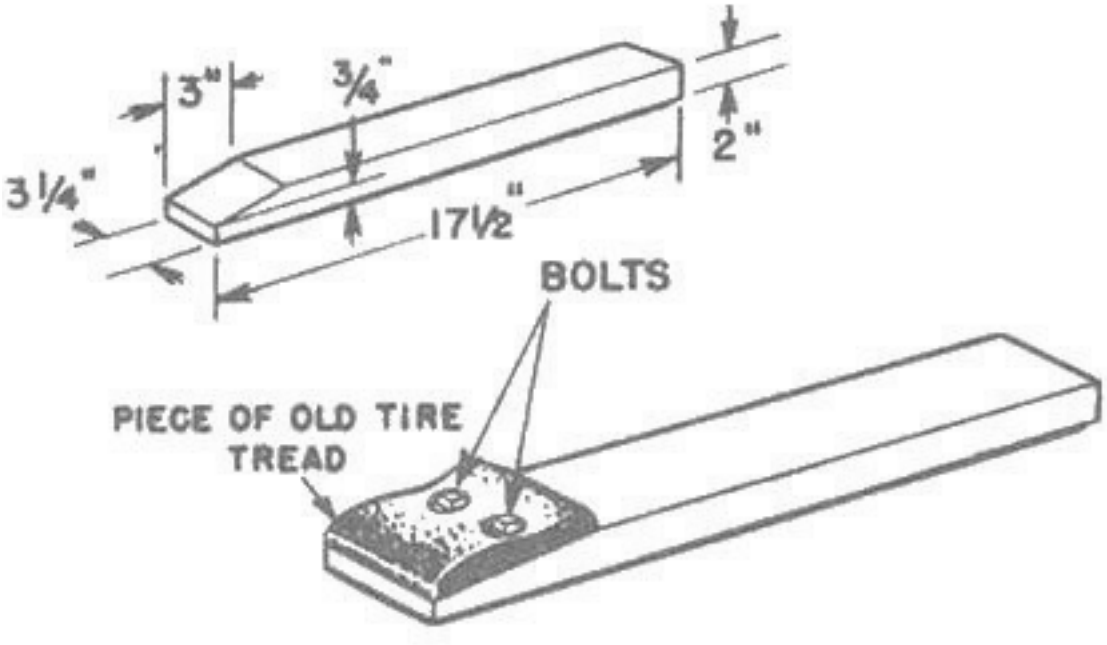
Drawing 45: Making the Brake pedal.

Step 1. Make a brake pedal of hard wood, size 3/4" x 8" x 10". Fasten, as shown in the sketch, an eyebolt into the pedal. The brake cable will be attached to this.



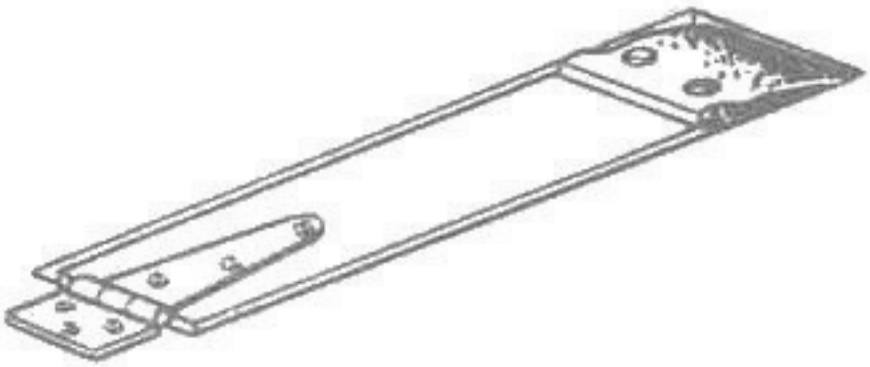
Drawing 46: Positioning the "hothouse" pulley

Step 2. Now cut a piece of hardwood to this size: 7/8" X 3" x 8". Bolt it to the floor at the location shown in this sketch. Bolt a hothouse pulley onto the center of this board. The brake cable will run through this.



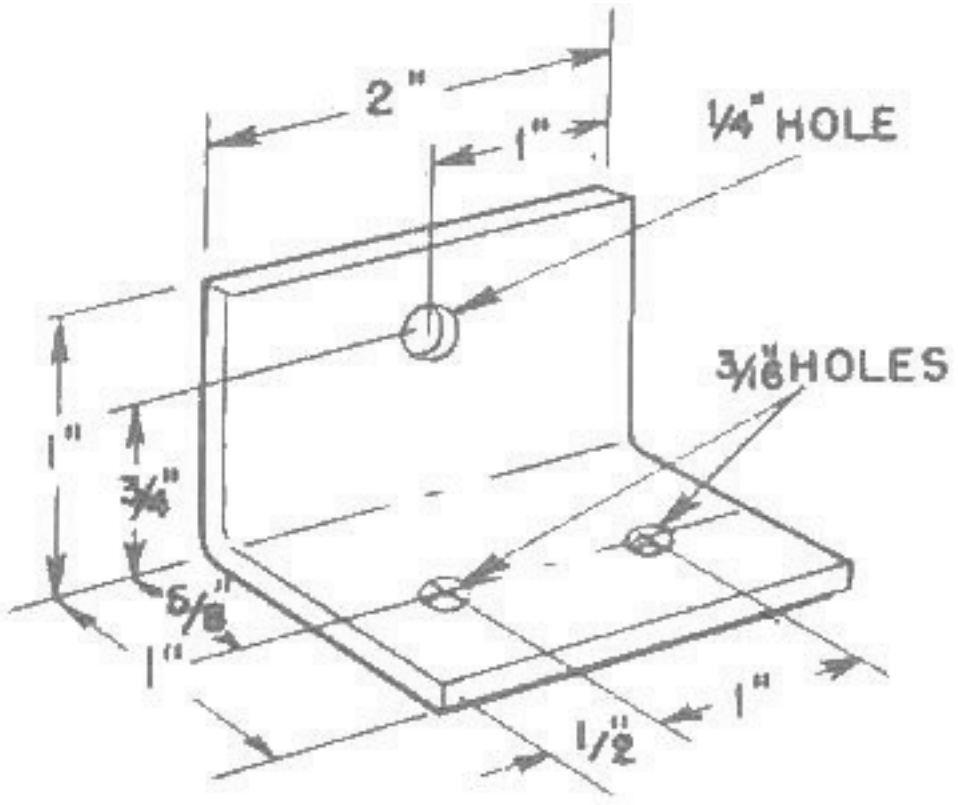
Drawing 47: Making the brake pad

Step 3. Cut a hardwood board to these dimensions: 2" x 3/4" x l7 ½". Next make a diagonal cut across one end of it, as shown on the drawing above. Obtain a piece of old auto tire tread and cut it to fit the surface of this diagonal cut; bolt it in place. There must be, according to the rules, as least 9 square inches of tire tread to touch the road.



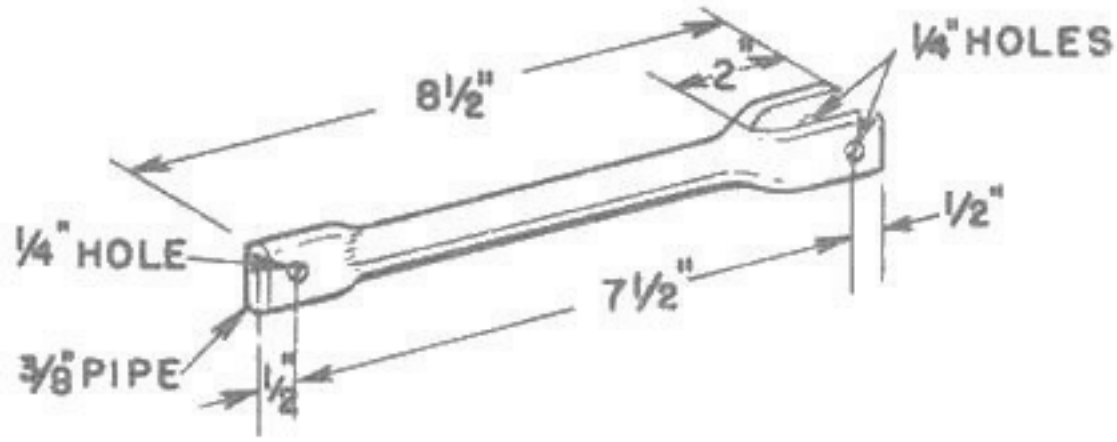
Drawing 48: Making the strap hinge

Step 4. Using a 3" strap hinge, attach the brake to the underside of the floorboard by bolts.



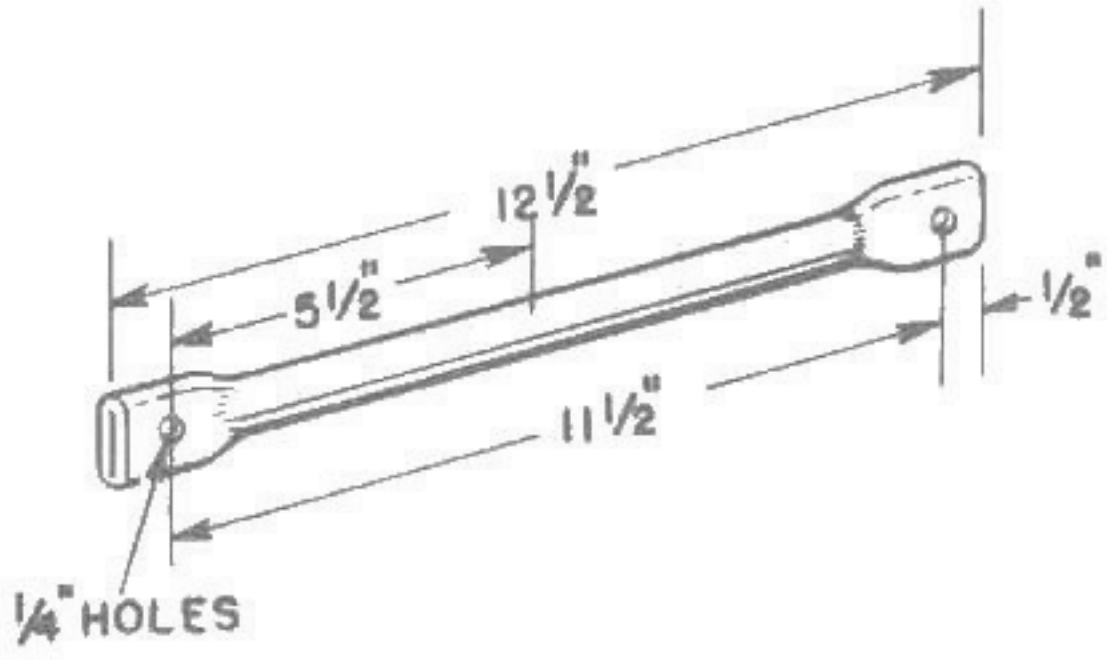
Drawing 49: Fabricating the brackets

Step 5. Four brackets are necessary; you can make them out of 1” x 1” angle iron. Directions are given in this sketch for location of the holes.



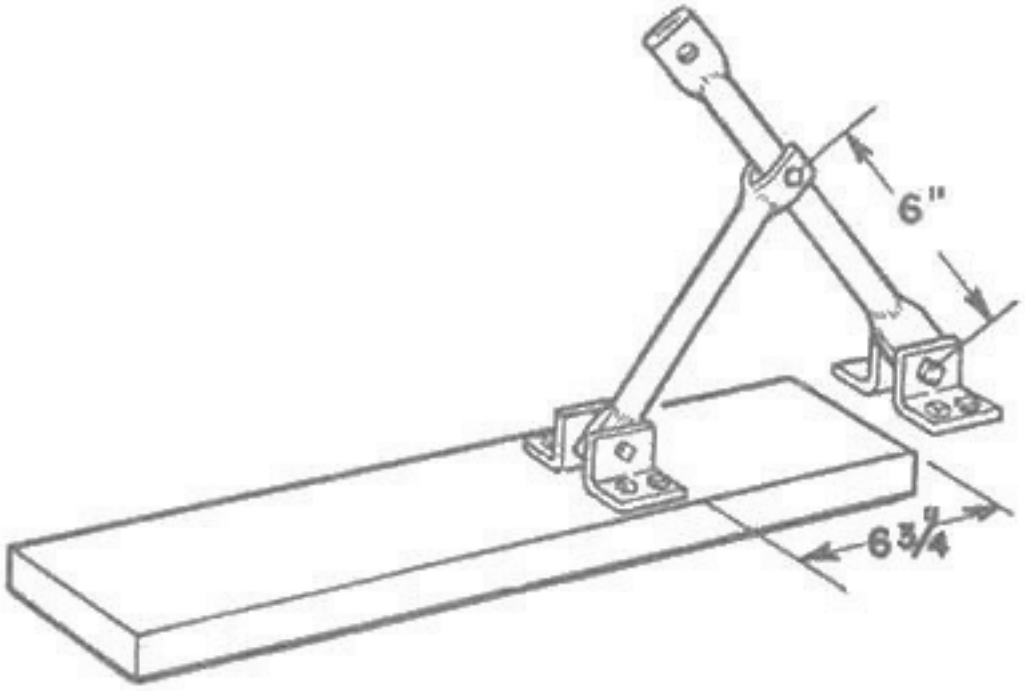
Drawing 50: Making the fork

Step 6. Put an 8 ½” length of 3/8" pipe in the vise. Use a hack saw to split one end for a distance of two inches. Widen the fork thus formed so that it will go around another piece of 3/8” pipe. Flatten the other end with a hammer and drill a hole for a 1/4 “ bolt. Drill holes in the split top end. Check your measurements with the drawing.



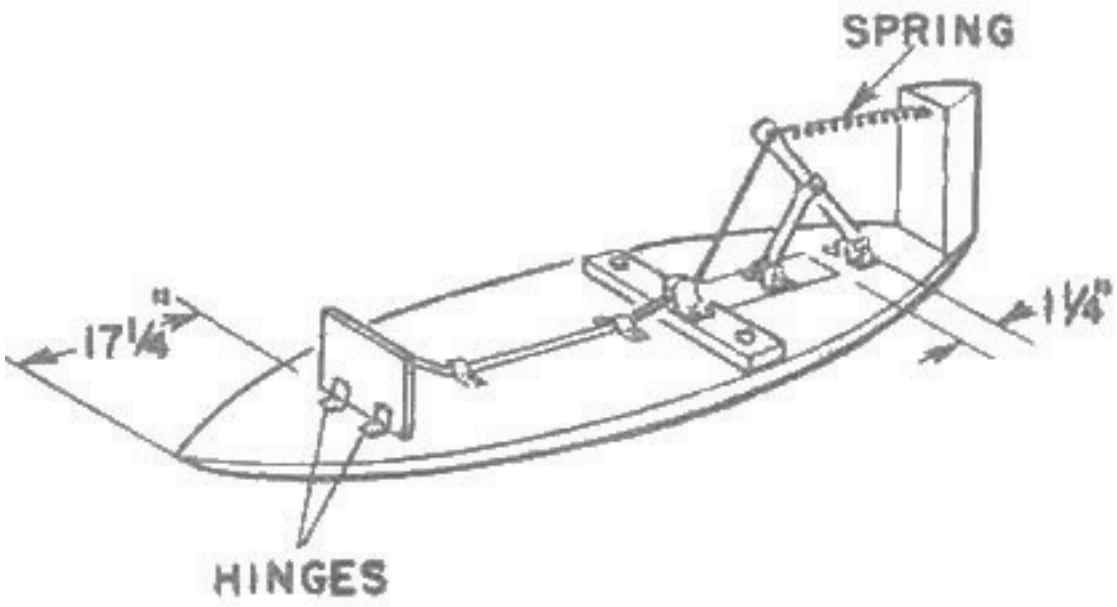
Drawing 51: Dimensions for the brake arm

Step 7. Now flatten both ends of a l2 ½” length of 3/8" pipe and drill ¼” holes in them. Drill another ¼” hole in the pipe 5 ½” from one of the holes in the ends. Follow the directions shown in this sketch.



Drawing 52: Constructing the brake assembly

Step 8. Bolt the brackets to the pieces of pipe as you see here. Then bolt the bracket on the short pipe to the drag bar in position shown. Bolt the other bracket to the floorboard in the position shown in the next sketch. Fasten a length of screen door spring to the top of the long piece of pipe; fastened later to the end-piece, it'll keep the drag up.



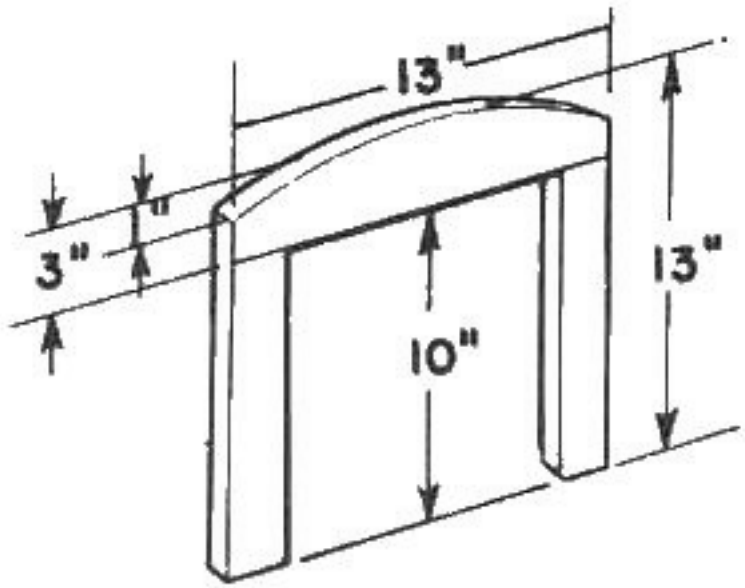
Drawing 53: Attaching the brake to the floorboard

Step 9. Using two 3" hinges, bolt the brake pedal to the floor. Anchor a length of 1/8” cable through the hole in the top of the 12" pipe. Then thread the cable through the pulley, through a 20" length of ¼” copper tubing which you should fasten to the floor by staples or narrow strips of metal. Anchor end of cable to eyebolt in brake pedal.

7 Finishing

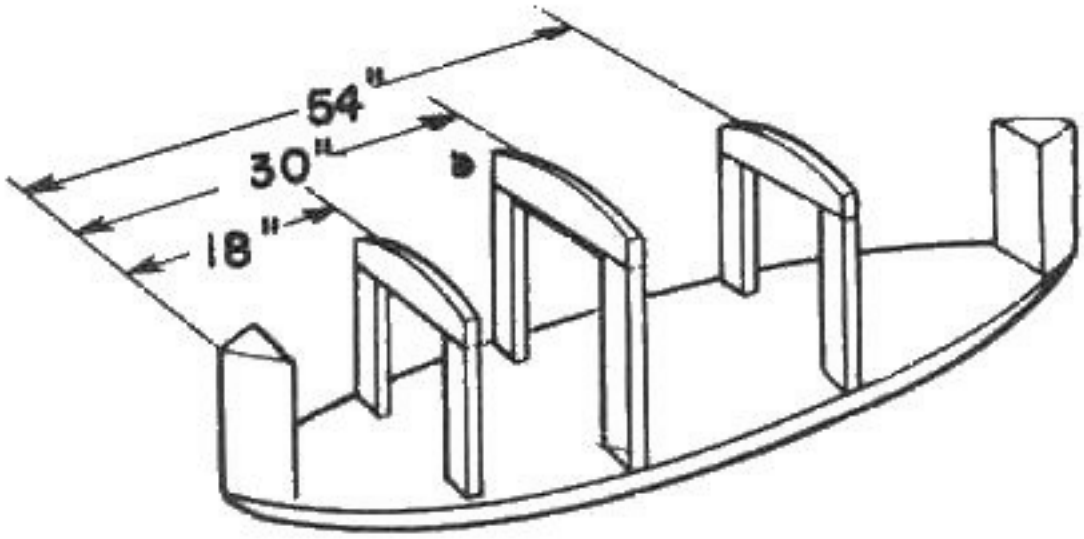
THE SHAPE OF THE RACER BODY is somewhat determined by the shape of the floor. Pointed front and rear ends of the floor quite naturally call for pointed front and rear ends of the car body. No matter what the general design, or of what materials you construct it, it is very important that the car body be as long and as narrow as the rules allow. This provides a minimum of skin surface to create air friction or drag.

A simple body, and a very efficient one; is covered by just four pieces of material. It is easy to make out of any of the approved coverings. Be sure that you leave no exposed rough or sharp edges.



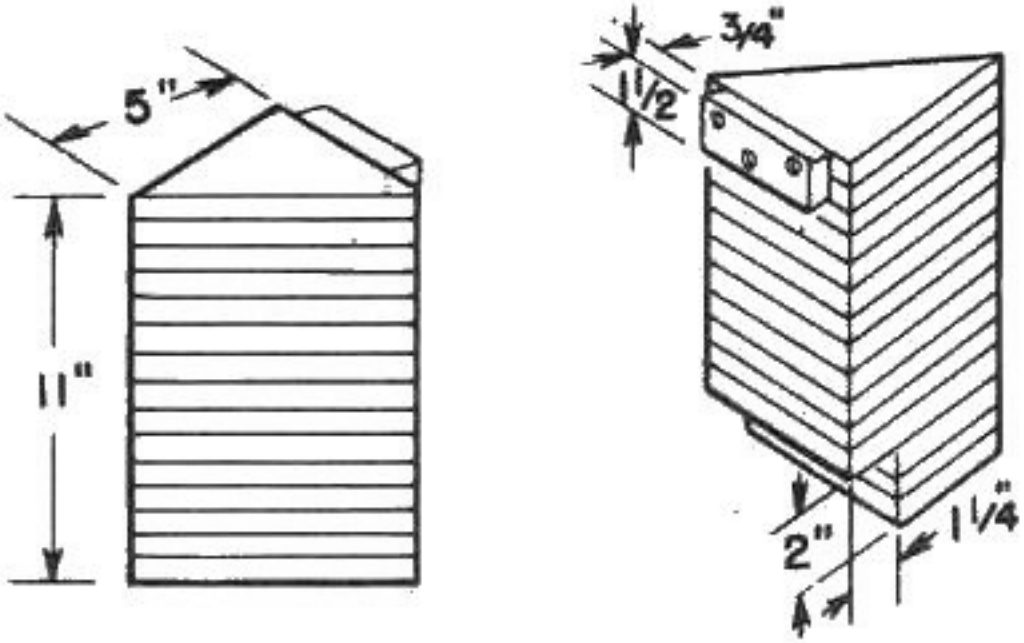
Drawing 54: Dimensions of the 3rd bulkhead

Step 1. You have already installed two of the bulkheads necessary. Now make the third one according to the dimensions in this sketch (Drawing 54 above).



Drawing 55: Installing the bulkheads

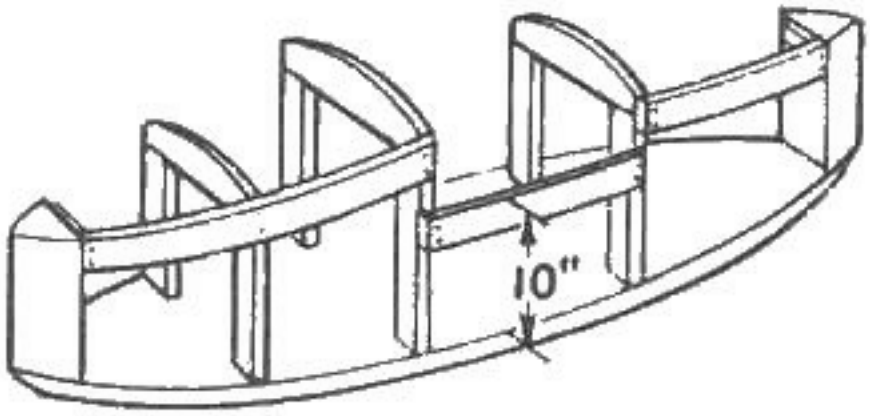
Step 2. Install the new bulkhead by the same method used in attaching the others. This one is placed so that the front of it is 54” from the nose of the car.



Drawing 56: Glue blocks to make the front and rear noses

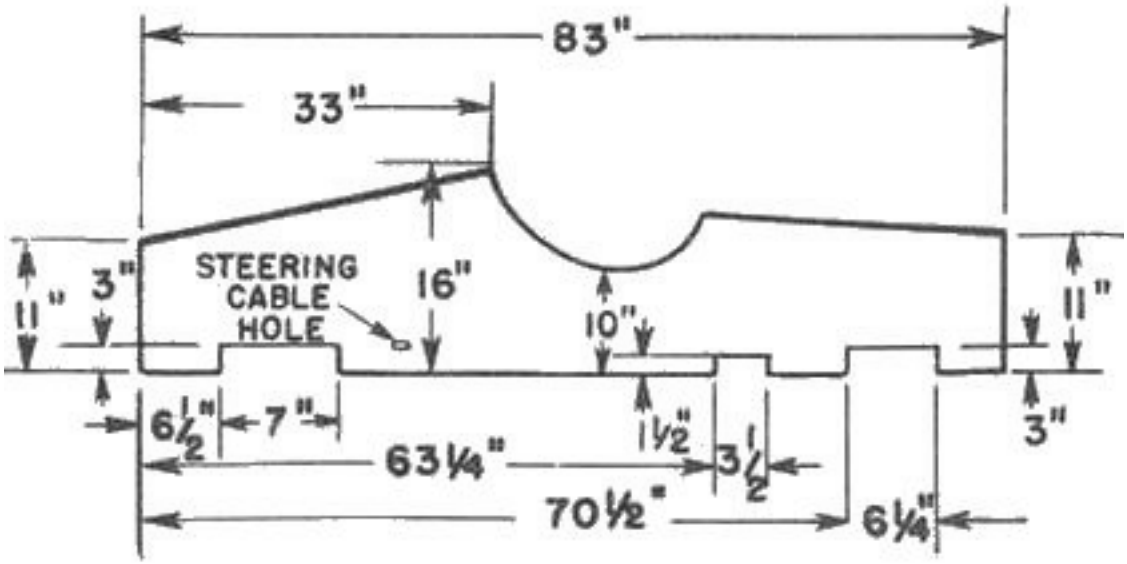
Step 3. Make front and rear end pieces by nailing together a number of pieces of wood. Dimensions are shown here. The notch in the bottom of the rear one allows axle to move up and down. The ½” x ¾”

blocks come to ¼” of the tops and the sides of the end pieces. Now screw both end pieces to the floorboard.



Drawing 57: Attaching the strip between 2nd and 3rd bulkheads

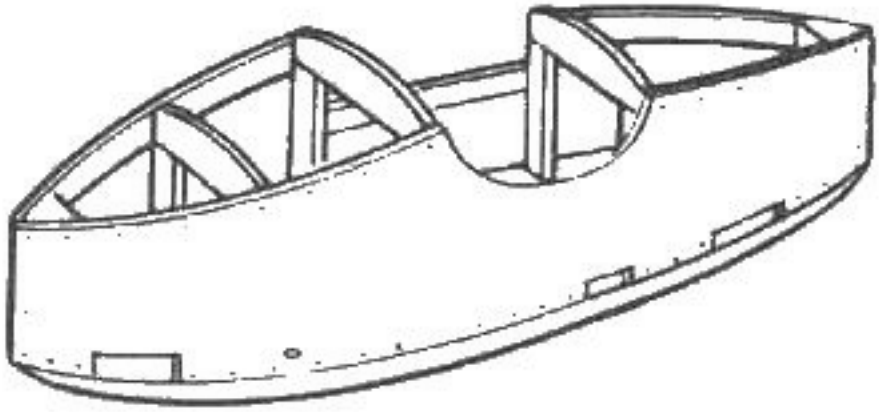
Step 4. Nail, or screw strips of wood ¼” thick by about 1 ½” wide to the block on the rear of the front end piece and to the sides of the first two bulkheads. Do the same from the rear block to the third bulkhead. Fasten other strips between the second and third bulkheads.



Drawing 58: Dimensions for the paper pattern

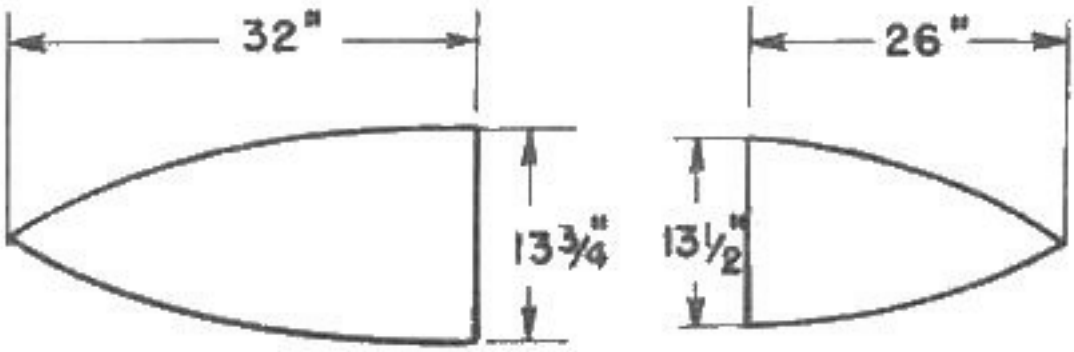
Step 5. Before you cut the material for the sides and the top you should make paper patterns of these sections. Cut them to the proper dimensions and then fit them to the body. If they fit perfectly, cut the

cover material to the same figures. If they don't fit trim them to size or make whatever adjustments are called for.



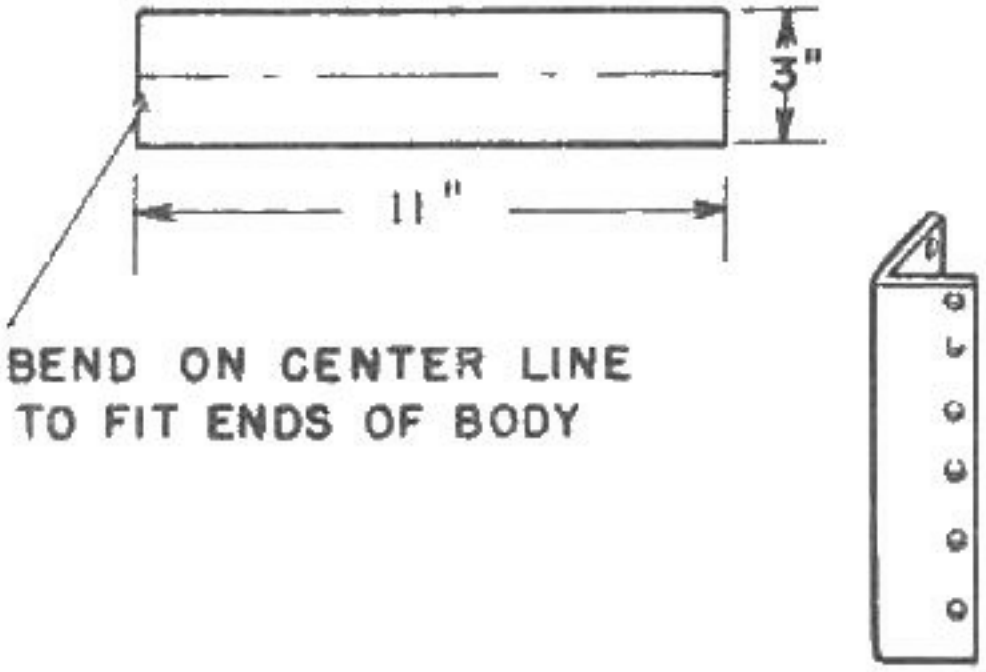
Drawing 59: Covering the side of the car

Step 6. The side covering should be nailed or screwed to the side rails and to the floor board for the full length on both sides, except for the cutouts over the axle tree.(These cutouts allow the axles to spring up and down). The sides should be attached before the top is put on.



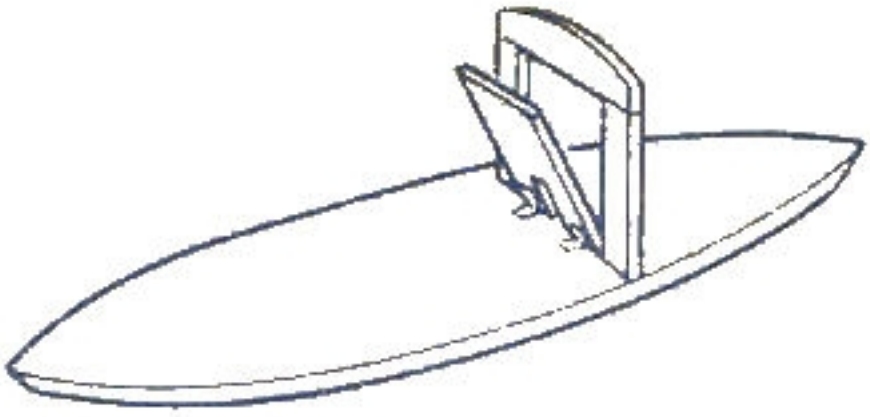
Drawing 60: Cut-outs for the top pieces (front and back)

Step 7. If the top paper patterns fir, cut the top material and attach it to your car with nails.



Drawing 61: Making the end plates

Step 8. You will want knife-like ends, front and rear, on your racer. To make them, use two pieces of metal 3" x 11", bent as shown above. Nail or screw them around the front and the rear pieces. These will shield the ends from damage.



Drawing 62: Attaching the seatback

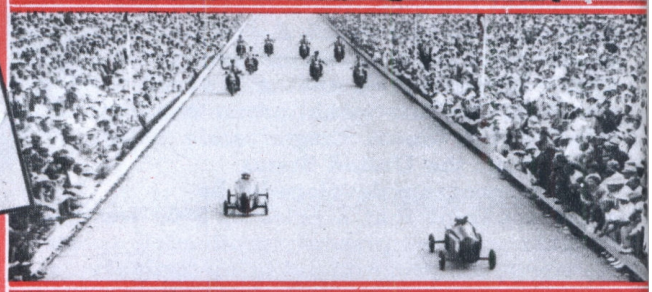
Step 9. It is not advisable to build a seat bottom over the floor, because that would make you sit higher

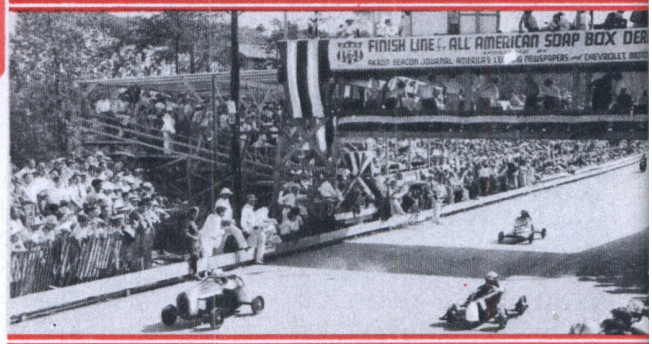
than necessary, thus increasing the wind resistance. A seatback, however, is necessary, it gives you something to push against when you apply the brakes. It must be either hinged or removable so inspectors can see into the back of the car.

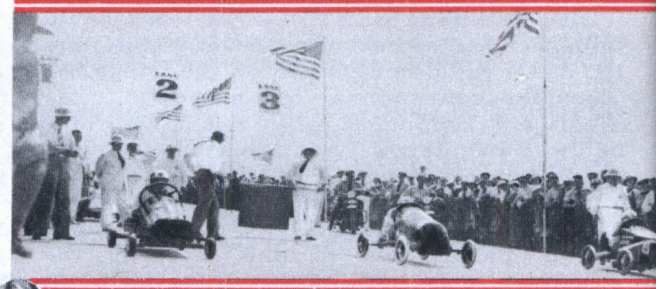
100,000 See Soap Box Derby

Mrs. Herbert E. Muench happily embraces her son, Herbert, winner of the 1936 Soap Box Derby. Representing a St. Louis newspaper, young Muench set a pace of 39 miles per hour over a 1,100 foot course. His time was 28.2 seconds for the run, just two seconds faster than the runner-up, Harold Hansen, of White Plains, New York. The Derby was sponsored by the Chevrolet Motor Co. and 116 newspapers.

President M. J. Coyle presents the Soap Box Derby Trophy to Herbert Muench while the American runner-up, Harold Hansen, and the International runner-up, Norman Neumann, of South Africa, look on.







Happy parents are these. Mr. and Mrs. Herbert Muench, Sr., congratulate their son after winning the famous classic. His tiny motorless car outclassed 115 others.

The Soap Box Derby in action as the 100,000 people who witnessed it at Akron, Ohio, urge the drivers on. In these races no motive power is used. The racers must depend entirely upon the momentum provided by the incline at the start of the race. Here is shown the Derby during the semi-finals with the youthful contestants receiving the right of way from a police escort.