

overlaps itself, but not to any portion that touches the body tube. Remove the completed collar from the tube. It will be used to hold the wings in place.

J. Cut four one inch diameter circles in the rear disc as shown in Fig. 6.

K. Cut  $\frac{1}{4}$ " off of the eight "D" motors (remove material from the end w/o the nozzle). The black powder grains should now be exposed. Glue these ends together to form four 5" long motors. Apply glue to the paper tube only, not to the black powder area. Wrap tape around the motors until they are almost 1" in diameter. They should be a snug fit in the holes of the rear of the wing assembly.

L. Place three or four layers of fireproof wadding (Estes) between the front bulkhead and each motor and glue motors in place.

#### Section Two - Guidance

The guidance system is comprised of a receiver, two servo units and a battery. (The battery will also be wired into the detonator system). Specific details will depend upon the size and type of servos you buy. A general outline of the system is shown in Fig. 7. The two control rods are attached to the servos, extend through the bulkhead and are hooked to two arms that extend from the dowel hinges on the trim tabs. Most servos have about 45 degrees of travel, and will turn the trim tabs about 23 degrees in either direction. This is more than enough to steer the missile in flight.

The control rods and arms can be purchased from radio control model companies or can be fabricated from brass sheet, nylon, etc. Mount the above components so that the body tube will slip over them. Mounting tips are included with the servo/receiver set. The antenna for the receiver should be mounted on the front edge of one of the wings.

#### Section Three - Payload and Detonator

A. Form a 4" tall cone out of the 1/16" copper sheet and solder it together. The cone should slip into the body tube without resistance. Leave a 1/8" diameter hole at the point of the cone.

B. Cut  $7\frac{1}{2}$ " from the spare 3 7/8" diameter tube. Split this tube lengthwise and overlap the edges so that it will slip into the 16 $\frac{1}{2}$ " long body tube. Apply glue to the overlap area, hold together with rubber bands, and set aside to dry. After the glue has set, glue the copper cone from Step A to this inner tube as shown in Fig. 8.

C. Cut a  $\frac{1}{4}$ " thick balsa disc to slip into the rear of the inner tube from Step B. Glue a blasting cap or improvised electric initiator to this disc.

D. Cut three or four  $\frac{1}{2}$ " x  $\frac{1}{2}$ " x 3" balsa strips to be used to join the front bulkhead of the wing section and the disc from Step C. The strips should be glued into notches cut in the two discs. Placement will again depend upon the arrangement of the radio components. Cut the four feet of bell wire in half and attach to battery and blasting cap as shown.

*NOTE: For building and testing purposes, a small light bulb should be used in place of the blasting cap. Unhook one set of wires after testing. These wires are reconnected when it is time to arm the missile prior to use.*

E. Use several shopping bags or a long piece of wrapping paper to make a tube about 7" long with walls about  $\frac{1}{4}$ " thick. This tube should fit into the inner tube and cone. Glue this tube in place.

*NOTE: The purpose of this thick walled tube is to resist the force of the explosive and direct it toward the copper cone at the front. The cone melts and a narrow jet of flame is then directed to the target. This focused jet will burn through several inches of steel armor. This type of charge is known as a shaped charge and the principle behind it is called "The Monroe Effect."*

F. Feed the two free ends of bell wire through the hole in the copper cone. Pack the  $7\frac{1}{2}$ " tube/copper cone assembly with about two pounds of high explosive or potassium chlorate/vaseline filler. (See *Improvised Munitions Handbook* section for instructions on making this improvised plastic explosive.) Glue the tube assembly to the disc on the front of the wing assembly. The copper cone should now be recessed about  $\frac{1}{2}$ " from the front end of the 16 $\frac{1}{2}$ " body tube when the body tube is in place. The missile is now complete except for the nose cone assembly. The nose serves to streamline the missile in flight and also creates the correct "standoff" distance from the target.

