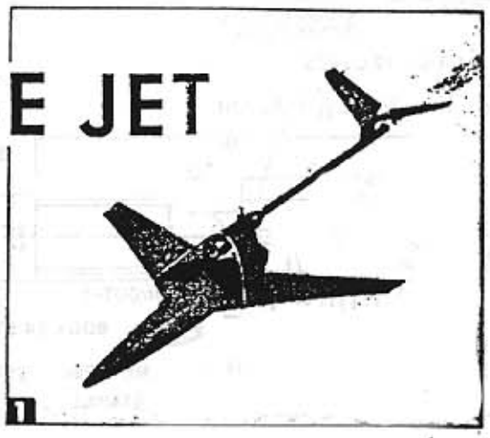
Power It with a PULSE JET



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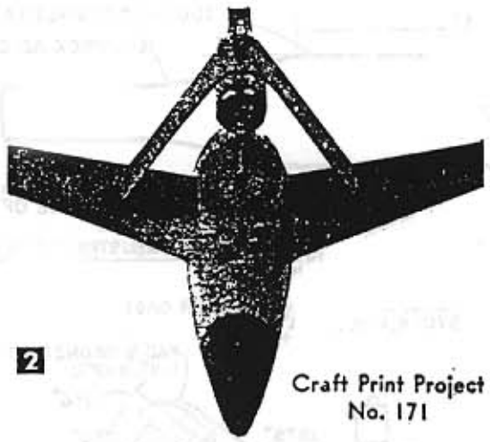

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Craft Print Project No. 171

THIS model plane project uses what may be the smallest successful pulse-jet engine ever built. It was developed after scores of experiments and the building of a dozen test models by Hiram Sibley, Jr., a California guided-missile engineer.

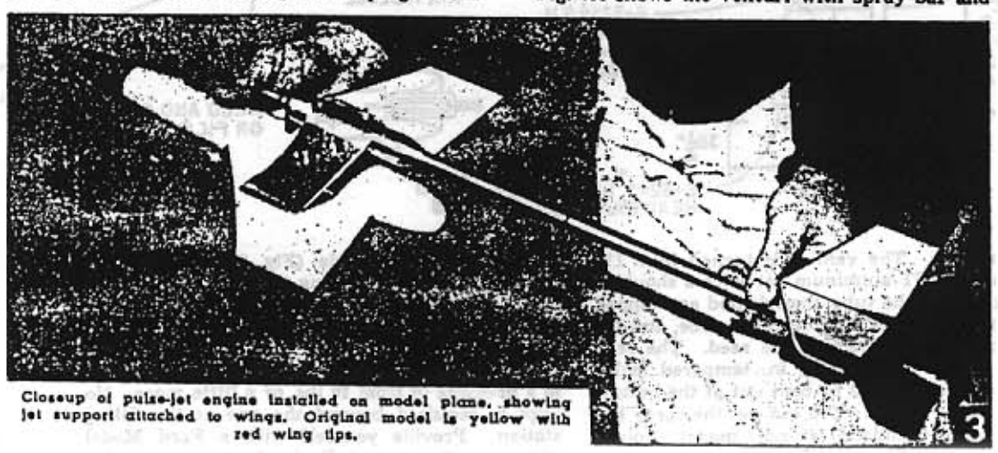
The ideal thing about this engine (Fig. 4A and B) is that it will cost little and can be built by the amateur who has had a fair amount of metal working experience in his home workshop. Also, if you are interested, the same basic design can be built large-scale for use on a bicycle or boat (Fig. 11). Let's concentrate, however, on first building the model plane-size engine.

The original jet tube is made of two different diameters of stainless steel (standard airplane tubing can be used if you can't get the stainless steel). First turn and bore on the lathe a swaging block of cold-rolled steel (Fig. 6B) and make a flaring tool also of c.r. steel, as in Fig. 6C. Lay a block of lead over the tube to be swaged and tap it down until drawn into the required diameter. The smaller tube is flared by tapping the tool, and when of a size to meet the swaged tube, they are welded. Tack-weld in three spots, then complete the weld all around, using stainless steel rod. There is, of course, the ever-present danger of burning stainless steel, and if you are not an experienced welder, have it done by an experienced man. Grind and file the weld until no joint is visible (Fig. 6D). Also flare the exhaust end of the tube to the angle shown in Fig. 6A. Now drill holes for the set screw and spark plug as shown in Fig. 6A. Tap spark plug hole ¼—28 (or 32) for Champion V-3 plug. Either tap is correct for this plug as only about 1½ threads engage in the thin tubing wall.

Fig. 7A shows the venturi with spray-bar and reed assembly. The venturi is turned from 1⅛ in. diameter 24ST aluminum bar with a shoulder to bring against the tube, then drilled and tapped for the set screw securing it to the tube, and for the machine screw holding the reed. The reed itself is made of .006 x ½ in. tempered feeler gage stock, and should be bent out at the bottom approximately 1/64 in. You can get the spray bar (Universal or Standard) at most model airplane stores for about 50c, which is a fraction of what your time would be worth attempting to make it yourself. To use the more elaborate nose assembly design shown in Fig. 4B, make the venturi without the spray bar and use a 6-32 x ⅜ S. H. oval point set screw to hold the nose assembly. Drill in lower part of venturi for set screw at the same point as spray bar location shown in Fig 7. This nose design requires a special air-starter nozzle (Fig. 5). For the jet engine you build following the simplified spray-bar shown in Fig. 7A, use the air-starter nozzle made as shown in Fig. 7B.

For your compressed air get a surplus oxygen tank and have it pumped up at the filling station, to a pressure of from 10 lbs. or a little more. No gage is required beyond the one at the filling station. Provide yourself with a Ford Model "T" coil (Sears and Roebuck, etc.), two dry cells, wire and switch, all of which most model airplane dealers can supply.

To test the engine, clamp it in a vise, fill the tank with unleaded gasoline and connect up the fuel line. Then open needle valve about 4 turns and slip air-starter over spray bar (Fig. 7B). Connect Ford coil to plug, turn on coil and then turn on air supply, just enough for good



Closeup of pulse-jet engine installed on model plane, showing jet support attached to wings. Original model is yellow with red wing tips.

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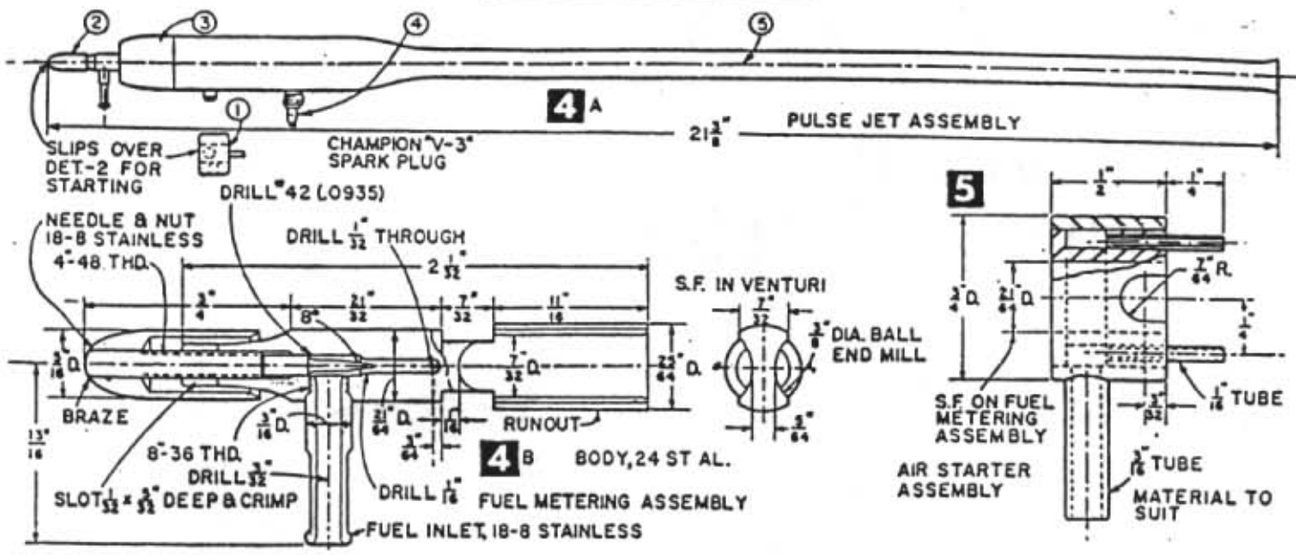
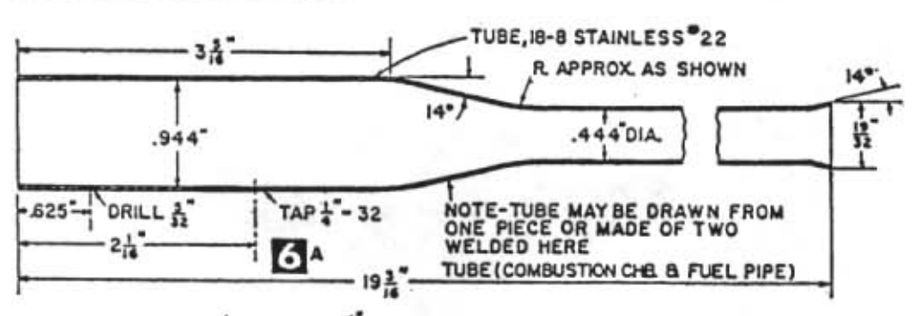
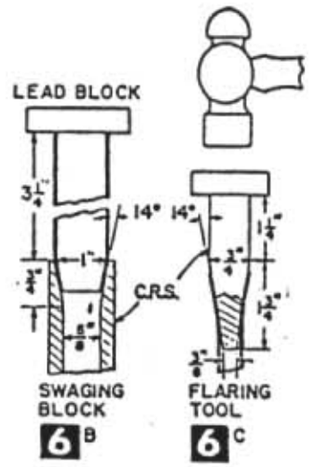
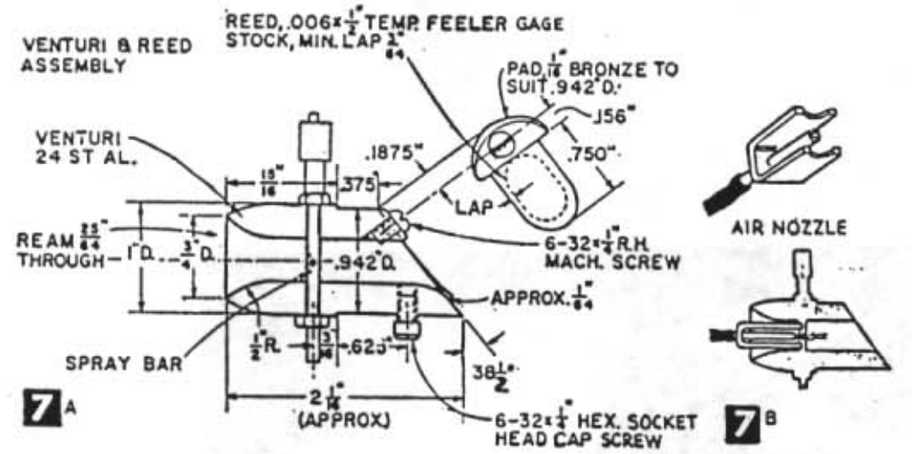
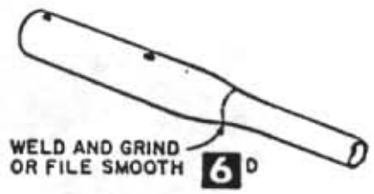
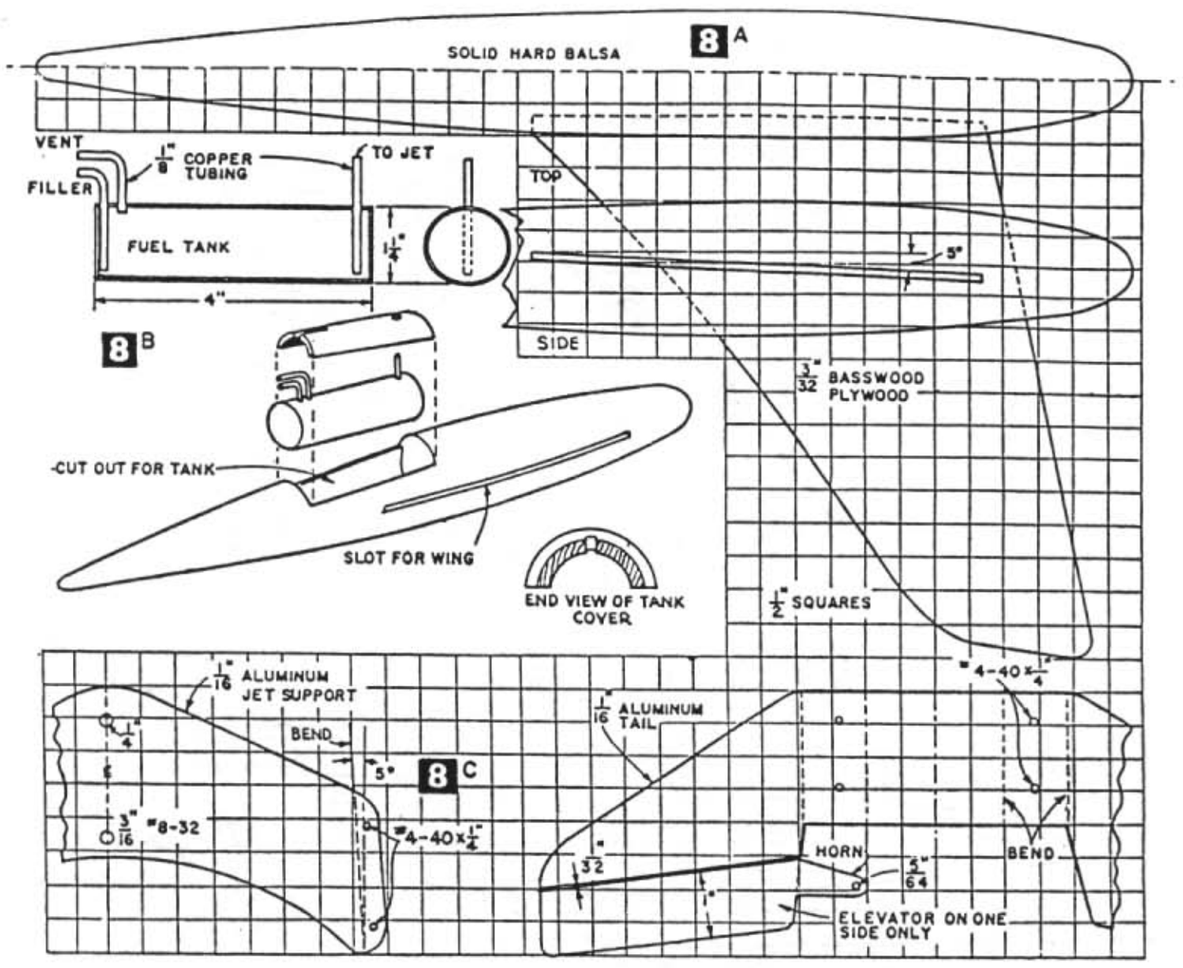












combustion—not full blast. Your engine should then respond. If not, check gas supply and spark. Yellow flame from tailpipe indicates mixture is too rich; popping or backfiring means mixture is too lean. Adjust needle valve accordingly. When mixture is correct jet will give out an even, high-pitched whine. Then you may remove air-starter and let jet warm up for 10 seconds. Turn off coil and remove wire and the jet should continue running. When the test is successful, jet engine is ready to be mounted in the plane.

Now we have the plane to build. Shape the fuselage from a solid block of hard balsa 2 in. x 2 in. by 16 in., cutting out a well for the fuel tank (Fig. 8B) and making slots for the wings. The latter can best be located and cut before the balsa block has been shaped (Fig. 8A). On the original model the slots were cut by hand with an X-acto tool, but an easier way is to use a routing tool on a drill press, insuring a uniform depth and width. Make

MATERIALS LIST—PULSE-JET POWERED PLANE

Pulse-Jet Engine

1 pc. stainless steel or airplane tubing 4" x 1" O.D., .035" wall or less
1 pc. stainless steel or airplane tubing 15½" x ½" O.D., .035" wall or less
1 pc. round aluminum 1⅛" x 2¼" for the venturi
1 standard spray bar for model planes
1 pc. .006 x ½" tempered feeler gage stock for the reed
1 rh mach. screw 6-32 x ¼"
1 cap screw 6-32 x ¼" S.H.
1 Champion "V-3" spark plug
1 pc. cold-rolled steel 1⅛" x 2¾" for swage block
1 pc. cold-rolled steel ¾" x 2¾" for flaring tool

Air Starter

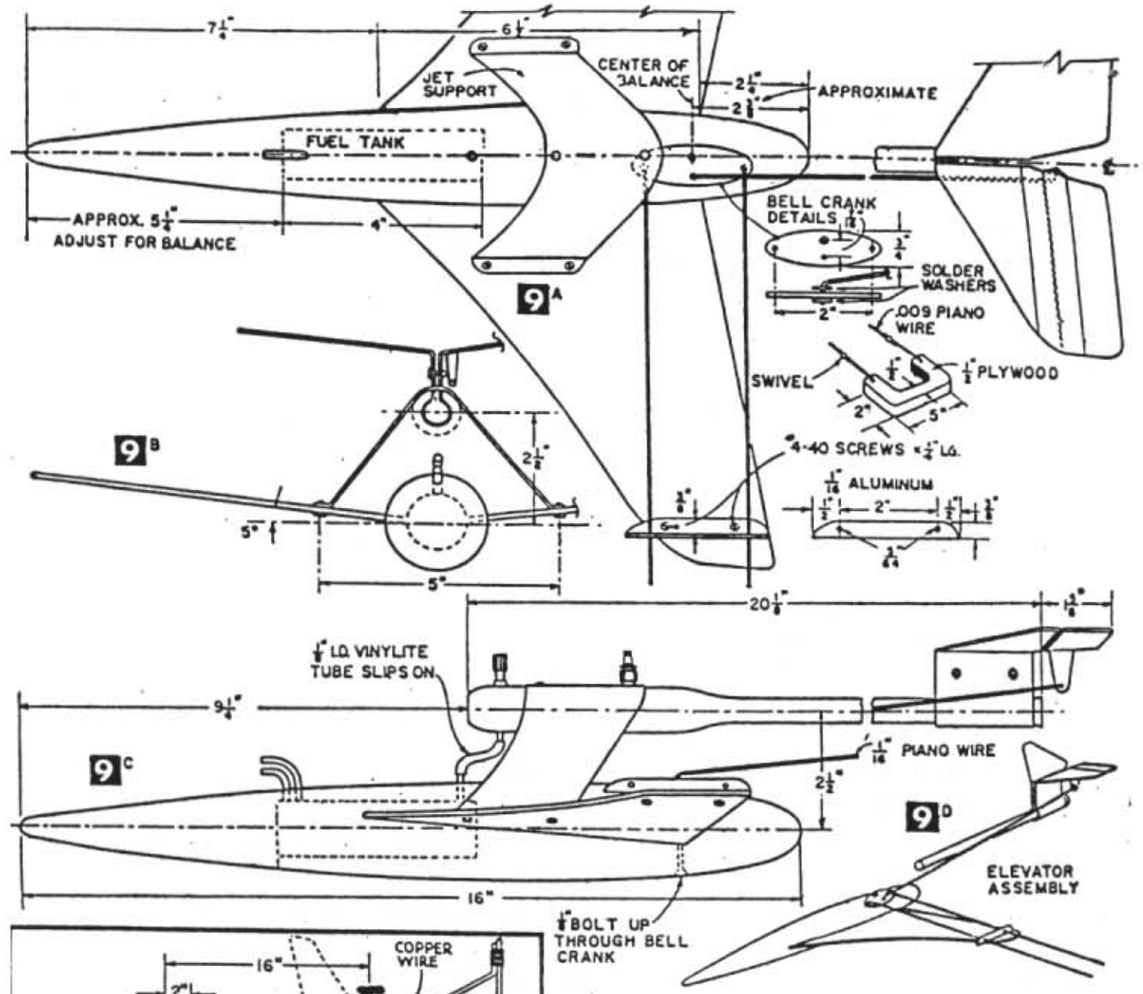
1 surplus oxygen tank
1 pc. ¼" x 1/16" x 1½" flat steel
1 pc. brass tubing ⅛" x 1"
3 ft. rubber tubing
Ford "T" coil (available at airplane model stores or Sears Roebuck)
2 dry cells, wire and switch

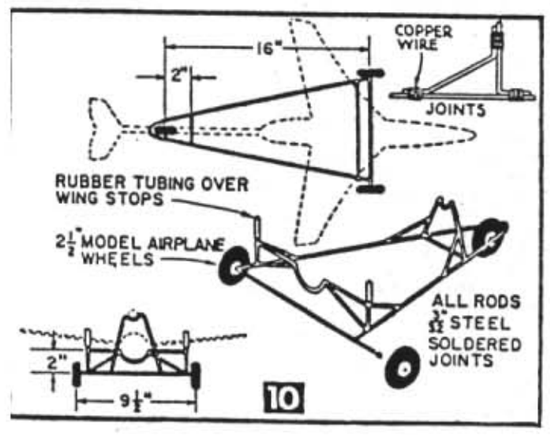
Airplane Body

1 pc. hard balsa 18" x 2¼" x 2¼" for fuselage (allows for trimming)
1 pc. basswood plywood 3/32" x 18" x 12" for wings
1 pc. stainless steel or 1/16" alum. 4½" x 8" for engine support
1 pc. stainless steel or 1/16" alum. 4" x 12" for tail assembly
1 pc. piano wire 1/16" x 16" for elevator control
Control wires and grip from model airplane store; 1 bolt 2¼" x ⅛", fulcrum for bell crank.

Launching Dolly

1 pc. steel rod 3/32" x 72"; 3 model airplane wheels 2½" dia., rubber tubing.





stainless steel or 1/16 in. aluminum with tin snips and bend in a vise. Before bending, drill for screws as indicated as in Figs. 8 and 9. Cut the tail assembly from one piece of aluminum as in Fig. 8C and bend on dotted lines in a vise. Next clamp it over the tail pipe with two #4-40 x ¼ rh machine screws (Fig. 9).

The fulcrum of the bell-crank (Fig. 9D) to which control wires are connected should be at center of balance and it may be necessary to move slightly forward or back, the proper location to be determined by experiment. Control wires are carried through a guide on the tip of the left wing (Fig. 9D). The tail assembly has an elevator on one side only, and is hinged with cloth, silk or muslin. The fabric should be glued on both sides with model airplane cement, before painting, of course. Use 1/16 in. piano wire for control link between bell crank and horn. See Fig. 10 on how to build the launching dolly.

If you would like to see what the dimensions of a pulse-jet engine, based on this same design but large enough for applications to bicycles, boats, etc., would be, Fig. 11 suggests these for you. Plans for such installations are not available, since you'll probably have your hands full turning out the little engine for model planes, and the larger applications involve construction procedures and technical skills beyond the capacity of the average home-workshop builder. —

the fuel tank of brass or tin (Fig. 8B) with soldered joints, and vent, filler and supply pipes of ⅛ in. copper tubing. (You may find a suitable tank at a model airplane store in your locality.)

Apply model airplane cement and install the wings in the slots. Set the tank in the well (Fig. 8B) and cover over with a balsa lid. This can be made to lift out, with a spring fastener, or sealed permanently with Plastic Wood around vent and filler tubes. Cut the jet support from