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MANUFACTURING AN AIRPLANE

By JOHN SANDFORT, M. E. 1

In the central part of Ohio, in Troy, is the home of the Waco Aircraft Company, one of the largest builders of light airplanes in this country. It is interesting to note that within thirty miles of Troy is Dayton, Ohio, the home of the Wright brothers, inventors of the airplane.

The Waco Company manufactures two general types of planes; namely, the straight-wing and taper-wing. The straight-wing is used as, and has the characteristics of a training plane, while the taper-wing, being much faster and having a more powerful motor, is used as a sport plane.

FUSELAGE CONSTRUCTION

The first step in the manufacture of the airplane is the fuselage construction. For this purpose steel is used, which has a decided advantage over wood in durability and structural strength. .1025 mild carbon steel tubing, varying in size, is selected for its light weight, and is supplied to the welding department in ready-cut lengths.

In making the fuselage, correct pieces of tubing are selected and placed in flat jigs where they are welded into one piece. These pieces, which are in turn welded together, form the four sides of the fuselage.

Two types of engine mounts are used for the two different models of motors to be installed. One is circular in design, fitted for the radial motors, while the other is flat, and holds the Hisso and OX models. When these mounts are completed they are in turn welded to form an integral part of the fuselage. Thus, when the fuselage is completed it stands as a rigid unit, no wire bracing of any kind being used. This is thoroughly tested against possible flaws or warps, and after it has been sandblasted it is passed on to another department.

WING CONSTRUCTION

This is probably the most interesting department of the whole factory, and undoubtedly the one requiring the greatest exactness. As the wings determine the performance of an airplane, each one must be exactly like the other if the airplane is to have standard performance.

Wood, wire, and fabric are used in the construction of the wings. Each wing is made in two

parts, built independently of the other. With but little inconvenience the wings may be detached for shipment or storage.

The ribs, or sections to which the fabric is fastened, are made from selected spruce over steel forms. Here they are nailed and glued firmly into one piece. (An example of the care which is constantly being exercised is the fact that the glue is freshly mixed four times daily.) The ribs are then taken from the form, and made ready for the spar.

The spars are received at the factory in a semi-finished condition, and together with other pieces are dressed down with wood working machinery, which consists of rip and rotary saws, planers, sanders, shapers, and other machinery of this type. The spars are approximately thirteen feet long, and taper at one end. When correctly dressed down they are passed through a row of ribs and fastened. Of course proper places are left for aileron constructions which are placed on both upper and lower wings. The leading and trailing edges, which are of metal, are then fastened to the ribs, and after complete bracing of wire and turn-buckles the wing section is ready for covering. Through all these steps the work is constantly checked and rechecked according to government standards.

FABRIC APPLICATION

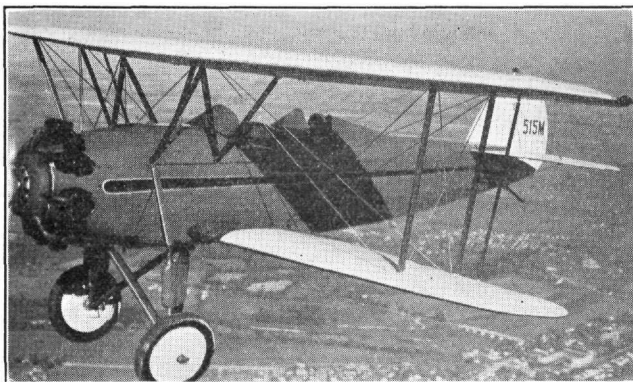
After the wing has been varnished it is passed down the line to be covered with a Grade A cotton airplane fabric of very close weave. These coverings are first made to a general pattern, and machine sewn. They are then slipped over the wing, and hand sewn, and tacked tightly in place. Wherever there is the slightest bit of strain it is reinforced with a double layer of fabric. When covered, the wing sections are given to the paint shop.

The center section and tail surfaces are next covered in a like manner, and also passed to the paint shop.

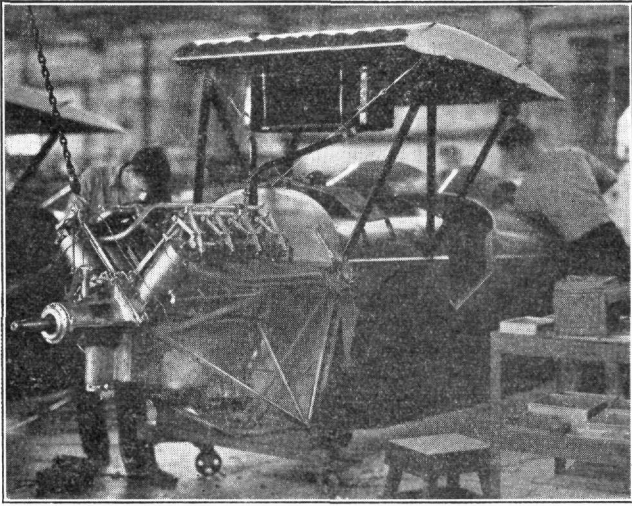
FIRST ASSEMBLY

After the fuselage has been covered, the first assembly begins, and it is here that the airplane begins to take its first real shape. The tail group and skid are first placed in position, and next the cockpits are completed. These are very roomy seats, and are thoroughly padded and covered with Fabricoid. The whole thing is done in a pleasing color scheme.

Dual control is provided for safety and instruction purposes. Floor boards of mahogany plywood, cockpit cowling, instrument boards, cables, etc. are here installed in proper order. The gasoline tank, riveted and soldered to guard against possible leaks, is situated in the center section of the upper wing which is permanently installed above the front cockpit. The engine cowling is stamped out of aluminum and made over a master form. With these operations completed, the entire body with accessories is finished and ready for the paint shop.



Wright-powered Waco Straight-wing Biplane



Installing the OX-5 Motor

PAINT DEPARTMENT

The paint department occupies one corner of the main factory building, and is divided off by cement block walls. Nine powerful exhaust fans draw off the paint fumes, and dry warm air is injected into the room to maintain an even temperature for proper drying. Paint and dope are applied with spray guns, at ninety pounds per square inch pressure.

Airplane dope is applied in three coats to the fabric covering the wings, center section, and tail surfaces. This shrinks the already taut surfaces to the maximum. The fabric may then be painted to fit the general color scheme. The fuselage is painted to any desirable color, and is given a finish equal to that of an automobile body.

The fuselage is now transferred to the second assembly line where the motor is installed and the airplane finished. Instruments are here installed. Standard equipment consists of an altimeter, tachometer, compass, gasoline and oil pressure gauges, and ignition switch.

POWER PLANT

The power plant in the Waco straight-wing is optional, but generally consists of either an OX or Hisso. These motors are surplus war stock, and although old are excellent performers. Each engine is completely overhauled and rebuilt in the Waco factory. A Wright Whirlwind is used in the Waco sport, but other motors may be installed if desired.

Gasoline is supplied by the gravity feed system, and an emergency tank with gasoline pump.

Landing gears of the split axle type are next installed. Brakes are optional.

The wings are then completely rigged on the plane, with N struts to permit correct "stagger."

A minute inspection is given as a final precaution, and the plane is ready for its test flight. This consists of a series of rolls, banks, and dives; a checking of instruments, etc. These tests are conducted by a well-trained corps of test pilots.

When the planes are O.K'd they are ready for delivery. About fifty per cent of them fly away, the rest being freight shipments. The production of the Waco factory is three planes per day.

WRITER'S NOTE

Most of the material for this article was gathered on a recent inspection trip through the Waco factory.