This type of construction was chosen primarily because of the extremely limited access during the build-up and also due to the arrangement of jig control and method of assembly; the diagonal bracings with one bolt at each end were simpler to locate and attach than shear-webs with a multiplicity of fixings.

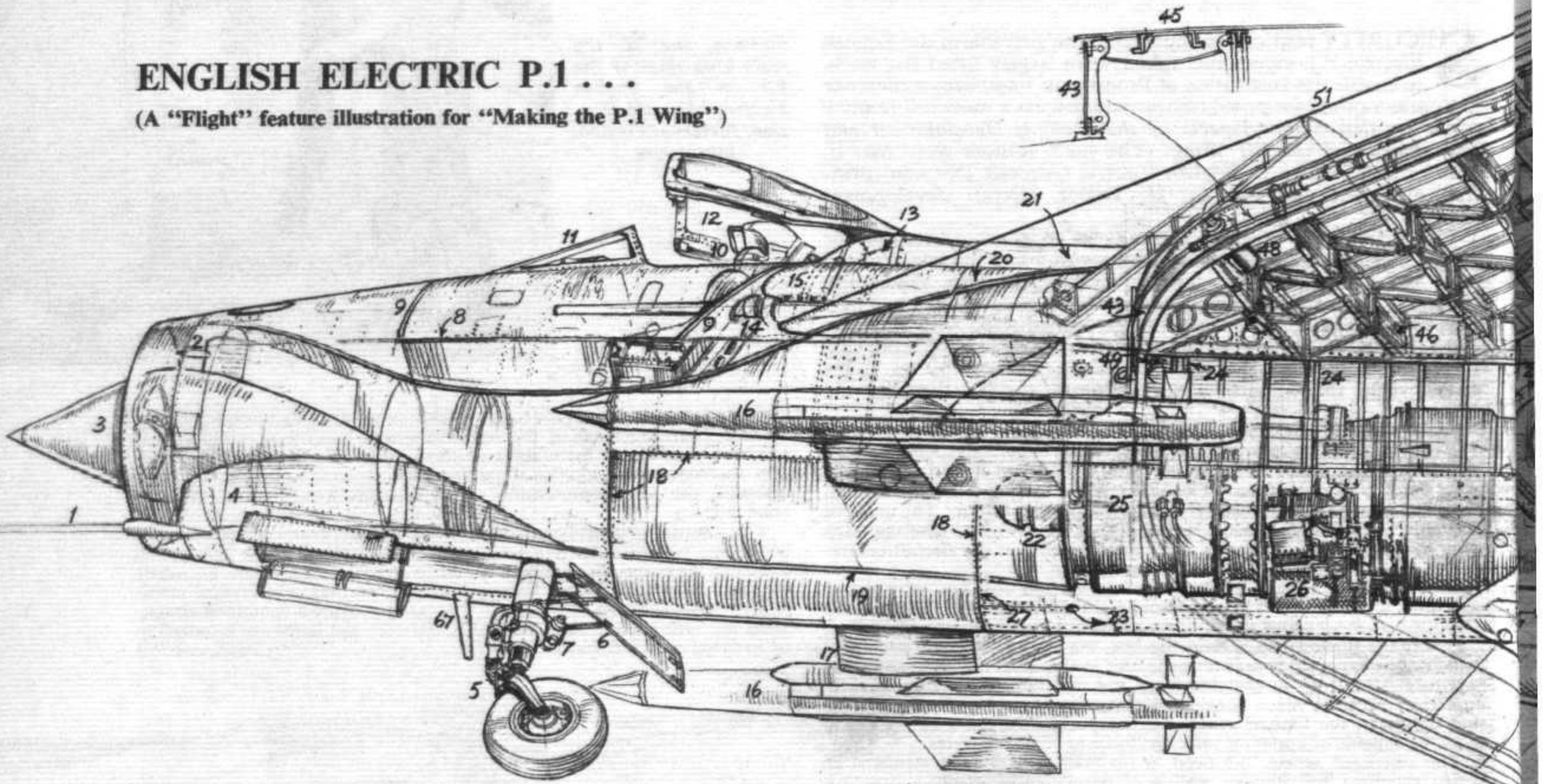
Each spar is provisionally built up on its individual jig, and is then transferred to the assembly jig, where locating pads and holes are repeated. The latter ensure accurate alignment later when the units are brought together for final assembly, and also permit the fitting and drilling to be done on the dry structure (i.e., without sealant). The remainder of the skeleton structure is assembled and each skin offered up in turn for location drilling. The structure is then dismantled and, after the drilling for rivets and bolts has been completed, the elements of the structure which are fitted to the skin are thoroughly cleaned, the interfaying surfaces coated with sealant, and then passed through the riveting machine described later.

When the bottom skin component has been sealed and riveted, it is returned to the assembly jig and all spar verticals and rib diagonal bracings are fitted. Only the bottom fixings of each of these parts can be completed at this stage. The top skin is then lowered into position and the remainder of the internal structure completed, working progressively outwards from the centre. It is during this stage that the amount of work necessary inside the structure has to be kept to a minimum, since the gap for access is seldom more than 8in deep.

It was considered essential to attain 100 per cent tank sealing even under extreme conditions. Earlier experiments had proved the failure of sealants subsequently applied to completed structures, and that where possible more than one line of defence against leaks should be provided. Therefore, development work was necessary on the following main problems relating to the fuel tank: sealing of corner joints; sealing of access panels; improvement of riveting and bolting techniques and sealing of gaps in the structure. Previous experience had shown that static pressure testing was of little value, and that the only way to prove the efficiency of the sealing was to apply a racking load to the tanks whilst under pressure. Accordingly model tanks were built, representative in all detail of the actual aircraft tanks. The various interfaying sealants, structure joints, access panels and types of riveting were tested repeatedly under the severest conditions.

ENGLISH ELECTRIC P.1 . . .

(A "Flight" feature illustration for "Making the P.1 Wing")



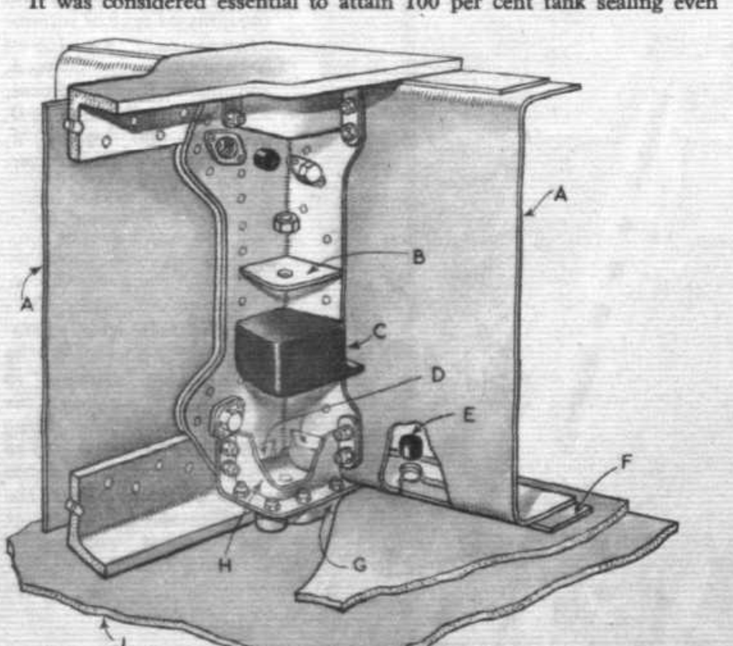
In the test frame the tank is sandwiched between heavy steel plates, supported at two diagonally opposite corners and loaded unsymmetrically at the other two.

The test schedule included: repeat loading to 40 per cent design load with the tank pressurized to 7.4 lb/sq in; at each 100 cycles, pressure increased to 13.5 lb/sq in and held for 20 minutes; pressure was then raised to 23 lb/sq in and held for one minute; in addition, tests were carried out at extreme temperatures from −47 deg C to +95 deg C, and at similar loading and pressure cycles.

Regular inspections of the tanks under test enabled a case history to be compiled from which further investigations or improvements were decided upon. A typical report indicates the failure of the standard rivets used in building the tank to remain leak-proof, even though they were well sealed by coating with sealant before closure and later brushed over with a heavier type of sealing medium. Also the tests indicated the efficiency of the rubber-block sealing of the corners, though naturally there were many difficulties to be overcome before a really satisfactory solution was reached.

Distortion at the corners is one of the most serious effects of stress applied to a tank. The three faces forming each corner are invariably slightly changing their angular relationship and this, coupled with the variety of sections meeting to form the corner, probably make these the most critical of all joints to seal. Any rigidly attached seal, which cannot withstand slight displacement, is most likely to leak under load. Illustrations show a typical corner design where, by use of a resilient form of seal, intimate contact between the sealing block and tank walls or skin is maintained continuously.

A synthetic rubber block moulded to a comparative shape is fitted to [Contd. on page 50]



On the left is a detail of the rubber-block internal sealing employed at a typical corner joint of the wing tankage. A, tank wall; B, pressure plate; C, moulded Hycar block; D, tapered faces to be sealed; E, Hycar sealing plug; F, packing strip; G, butt gap sealed by plug; H, retaining welded-steel box for Hycar block, the latter removed by unbolting.