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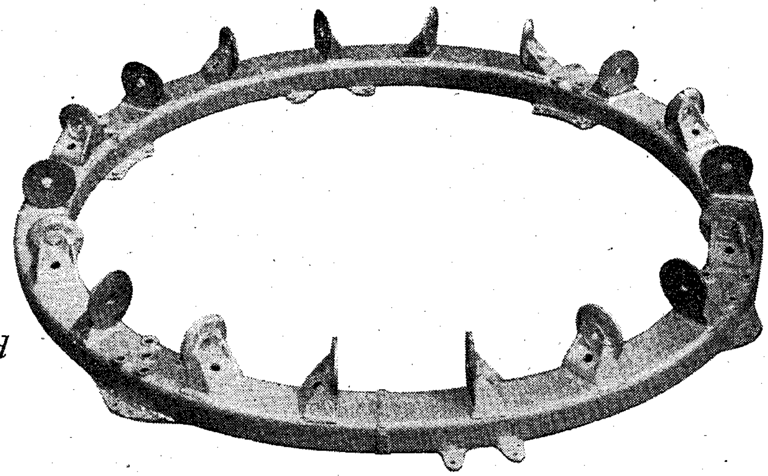
REYNOLDS

AIRCRAFT COMPONENTS

MORE THAN MEETS the EYE

Knowledge and Craftsmanship in the Specialized Production of Aircraft-tubing Assemblies



An exacting job: Dynafocal mounting for Centaurus in Ambassadors

IN our contacts with what, for want of a better term, is often known as "the ancillary aircraft-industry" we never cease to marvel at the vast store of specialized knowledge and skill that lies behind the manufacture of the average material or component, whether it be a complicated or a relatively simple one. Though the same might be said of almost any branch of industry, its truth in application to aircraft manufacture is particularly obvious to anyone who knows anything of the subject.

The aircraft constructor designs his product and then calls upon the ancillary industry for the materials and bits and pieces from which to fashion it. Sometimes his requirements are simple; more often they are difficult; occasionally they verge on the impossible. But whatever he wants there are people who can provide it, and it is a measure of his long-established confidence in such specialists that he is almost always happy to "leave it to them": provided its performance meets the required standards, official or otherwise, then he is content. Whereas from long business association he is apt to take this background of know-how for granted, to the detached observer—such as ourselves—it is, as we have said, a constant source of wonder.

Such thoughts passed through our minds during a recent visit to the Tyseley, Birmingham, works of the Reynolds Tube Co., Ltd. As most readers associated with the industry will be aware, this old-established concern is a member of the Tube Investments Ltd., group. Until 1947, its aircraft products included both steel-tube work and light-alloy tubing and extrusions; then the light-alloy side of the business was taken under the control of the light-alloy division of the T.I. Group and Reynolds were left to specialize in steel, though a modicum of alloy manipulation is still performed.

Engine mountings are the principal aircraft product, though, as will presently appear, there are a number of other items, not all of which (except in quality) are in a directly comparable category. Mountings recently delivered and/or in current production include the five varied types listed at the top of the next column, designed for in-line and radial engines and for turboprops:—

Rolls-Royce Merlin 35 mounting for Boulton Paul Balliol 2.
Bristol Centaurus Dynafocal ring for Airspeed Ambassador.
Various Bristol Hercules rings.
Armstrong Siddeley Mamba mounting for Armstrong Whitworth Apollo.
Mamba-Dakota experimental-installation mounting.

In addition, Merlin mountings for the Lincoln are still in production.

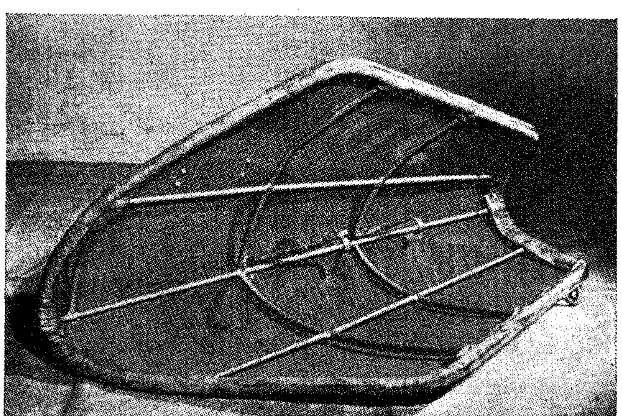
The seamless steel tubing from which these assemblies are fabricated is manufactured "on the premises" from hollows or blooms; the various stages in the process—cold drawing, annealing, pickling and so forth—are rather grimly spectacular and quite fascinating to watch. Actual fabrication begins with cutting to length and then bending—a process which, in view of the complex nature of the finished assembly, and the close limits specified, calls for considerable craftsmanship. Though power-operated forming-rolls are used they are in no sense automatic, and the precision of the job is largely dependent upon the operator. Cerrobend and similar-type fillers are used to prevent kinking.

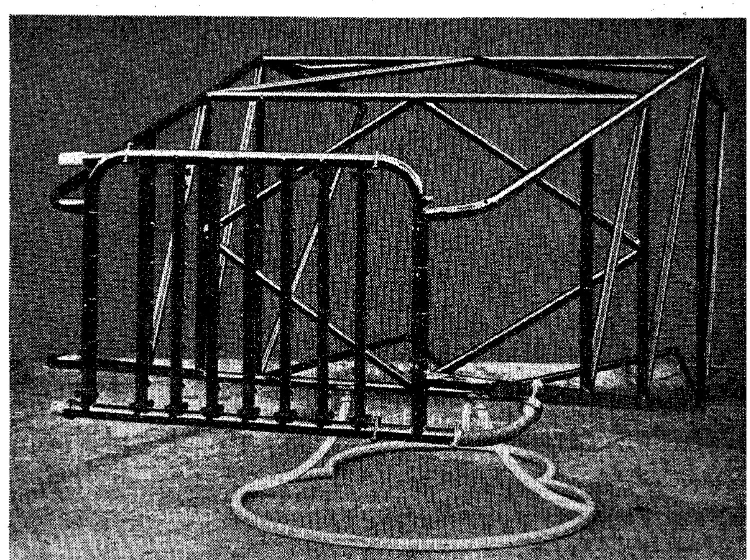
Personal skill is again very evident in the second stage of fabrication, that of welding. Though elaborate jigs—built in the works—are used for this purpose, the risk of distortion occurring between closely adjacent welds has to be constantly kept in mind. Fabrication of the 31- 36in-diameter Dynafocal mounting, with its 18 accurately ground faces radially disposed round the rectangular-cross-section (3in × 2in) ring, is particularly satisfying to watch. Typical limits on this job are 0.005in for hole-centre locations and 0.0005in for hole diameters.

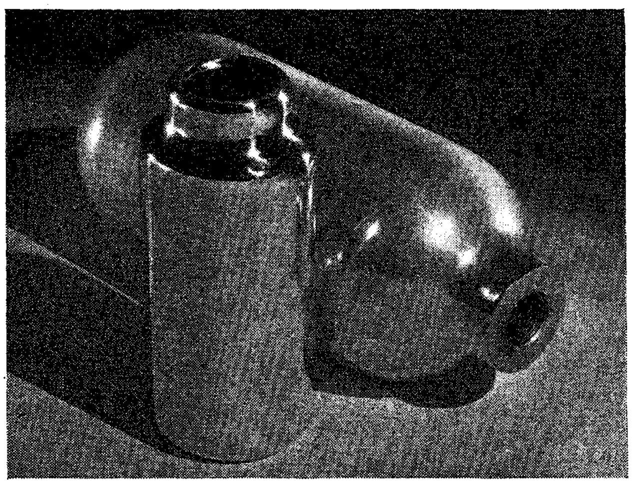
Calling for less precision was another item which we saw going through in fairly large batches—an air-intake guard, assembled from steel tube and wire mesh, for the D.H. Vampire.

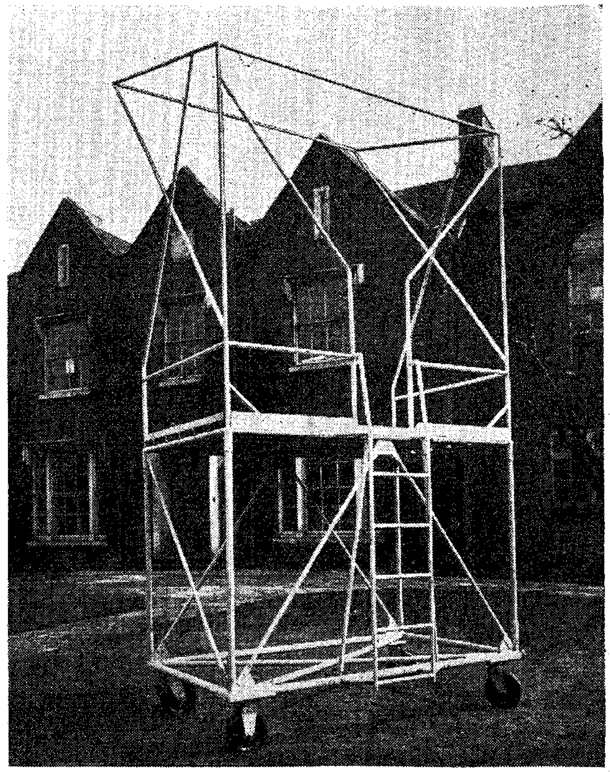
Nobody needs reminding that aircraft research and development frequently call for special apparatus, often of complex design. Frequently it is made in the aircraft factory or experimental establishment itself; but sometimes—and especially if it is to be used in flight-test work—its construction becomes something

Respective examples of "batch" and "one off" production of aircraft components by Reynolds: (Right) Spray grid for ice tests on Mambas installed in Lancaster flying test-bed. (Below) Vampire air-intake guard; the outer frame is padded to prevent damage to the leading edge.









(Above) Allied with tube work, yet representing a different technique of fabrication, are pressure vessels, two examples of which are seen above.

(Right) A tubular engine-maintenance staging built to the order of Trans-Canada Airlines. In the background is part of the 650-year-old mansion, Hay Hall, which serves nobly as Reynolds' office block.

of a specialist job. Reynolds will tackle such "one off" orders, and can also assist in the detail design if the broad requirements are specified. A good example is the assembly illustrated overleaf—perhaps a little reminiscent of a Victorian bedstead minus the brass knobs, but actually made for the "Mamba-Lanc" flying test-bed, and used to spray water into the intakes during icing tests. Six spray-nozzles are mounted on each of seven vertical tubes; overall dimensions are approximately 13ft × 5ft 6in and total weight about 150 lb. Clearly, in view of the probably serious results if any part were to come adrift, a device of this kind cannot be just "thrown together."

Another category of product is the engine-servicing staging also shown here; a number of these were made by Reynolds to the order of Trans-Canada Airlines. The principal components are bolted-up, so that the structure can easily be broken-down for transport, and some of the stagings have also been supplied with canopy-rails to provide protection for ground staffs when engines are being serviced in the open.

In a different category again—though still one that is basically "tubular"—are pressure vessels, and the Reynolds Company makes these in considerable quantity for the aircraft industry. Oxygen, air and other bottles are manufactured, in both cylindrical and spherical forms, for pressures of up to 3,000 lb/sq in. The making of such a vessel is another process that is fascinating to watch. A cylindrical bottle begins as a plain, fairly thick disc of aluminium alloy. This blank is first converted into a spherical-based cup by hot forming in a hydraulic press. It is then cold-drawn to approximate diameter and wall thickness, trimmed to length, chemically cleaned, and "necked" again in a press, after which it is heat-treated, screwed, anodized and pressure-tested.

Two examples of this work are illustrated here. One is a cylinder used in the Dowty hydraulic installation in the Gloster Meteor; the other is an oil-water trap as employed in the high-pressure air systems made by the Hymatic Engineering Co., Ltd.

To return, finally, to tubes pure and simple—or perhaps not quite so simple. Fifty-six years ago the Reynolds business (which even then had been in existence over fifty years) turned its attention to seamless steel tubing, and in 1897 Alfred Reynolds, Jnr., patented something that was to revolutionize cycle-manufacture—the butted tube. It is still a Reynolds speciality to-day.

Though the term "butted tube" may suggest some kind of joint with a brazed-in sleeve it has, in fact, little direct connection with such assemblies. It is associated with the taper-gauge tube (i.e., a tube having a constant outside diameter but an increasing wall-thickness) but in this case provides a comparatively sudden increase in wall-thickness at the end or at any other point where extra material is required for joint-making purposes.

So far as we are aware, neither taper-gauge nor butted tubes are being employed on any large scale in aircraft construction, in spite of their apparent advantages and their practical use by at least one constructor: in the early years of the war, taper-gauge tubes made by Reynolds were extensively used in the manufacture of the Blackburn Botha, and the method formed the subject of articles in our sister journal *Aircraft Production*.*

To anyone with some mechanical knowledge but no acquaintance with this particular product there is a suggestion of the impossible about making a tube with a constant outside diameter yet a wall-thickness that increases at both ends.

In reality, the process—as we saw at Tyseley—is almost absurdly simple. The material enters the shop as a normal tube of constant inside and outside wall-thickness; it is then fitted on to an accurately ground mandrel which tapers-off at each end, and cold-drawn by dies of such a diameter that, while the exterior diameter of the tube is reduced to a constant degree over its whole length, the wall-thickness is built-up over the tapered areas of the mandrel (or, in other words, so that the inside diameter decreases). The mandrel is now, of course, firmly imprisoned; but it is released in a matter of a few seconds by a "reeling," i.e., by passing the tube between two rolls which expand the metal sufficiently to allow the mandrel to be withdrawn.

The variations in wall-thicknesses obtainable are very considerable, and can be produced over long or short lengths, depending upon the type of machine or drawbench used.

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