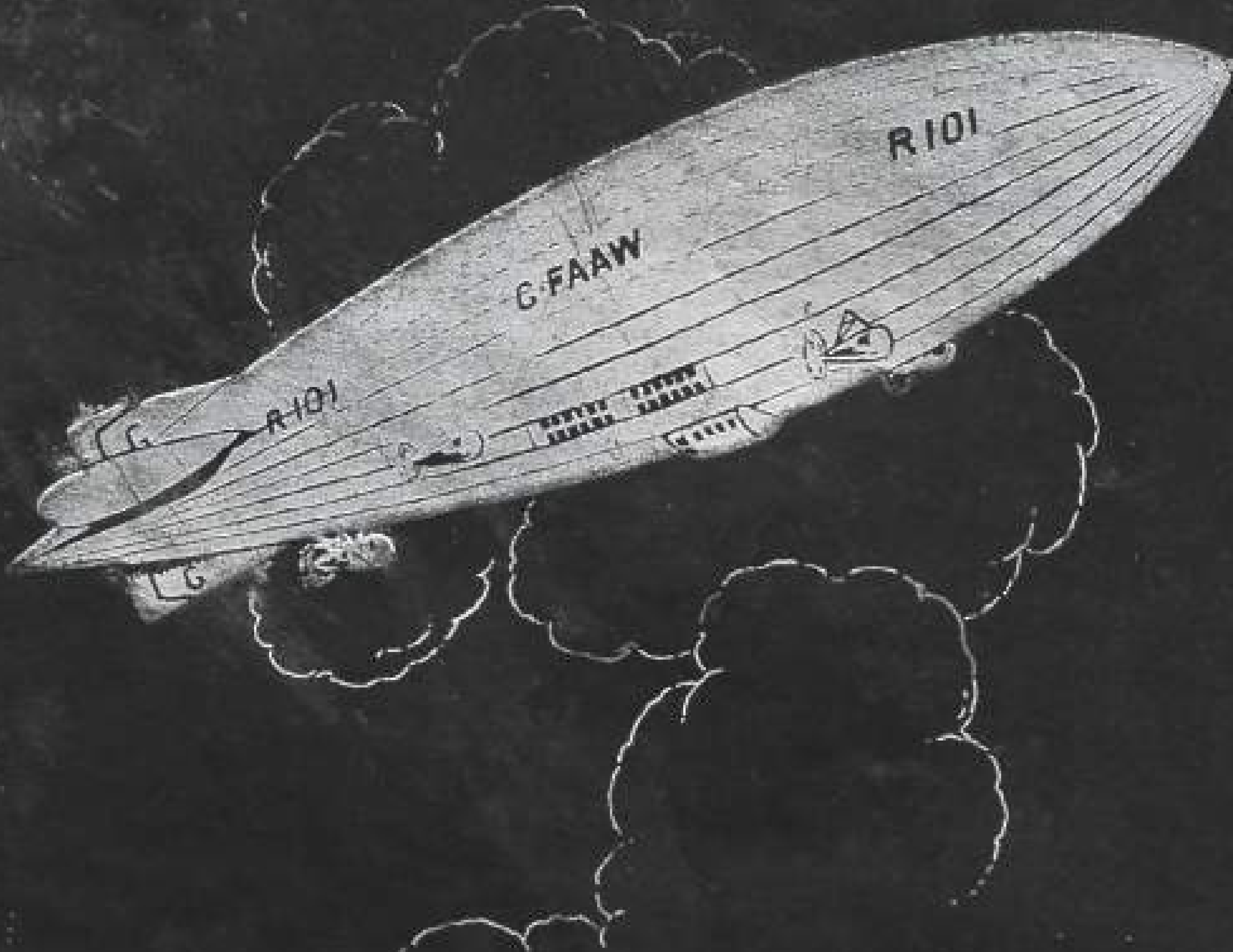
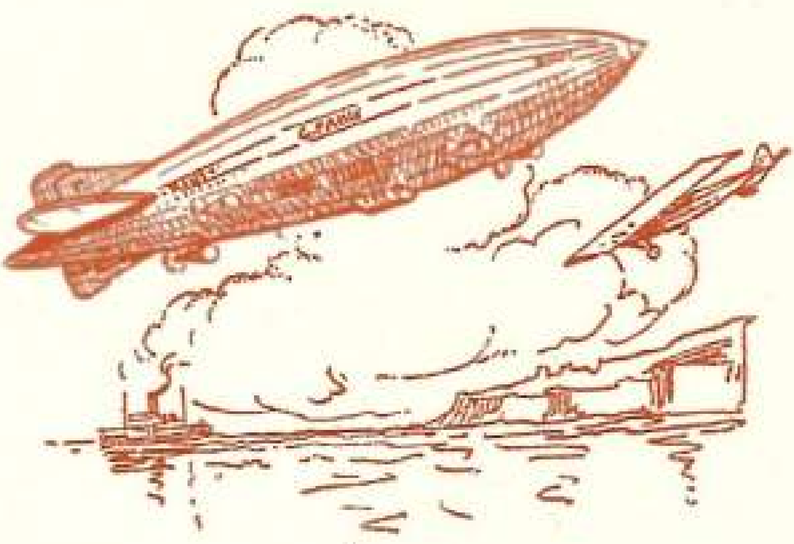


HABERSHON'S STEEL FOR AIRCRAFT

STEEL FOR AIRCRAFT



J. J. HABERSHON & SONS L^{TD}.
ROTHERHAM.

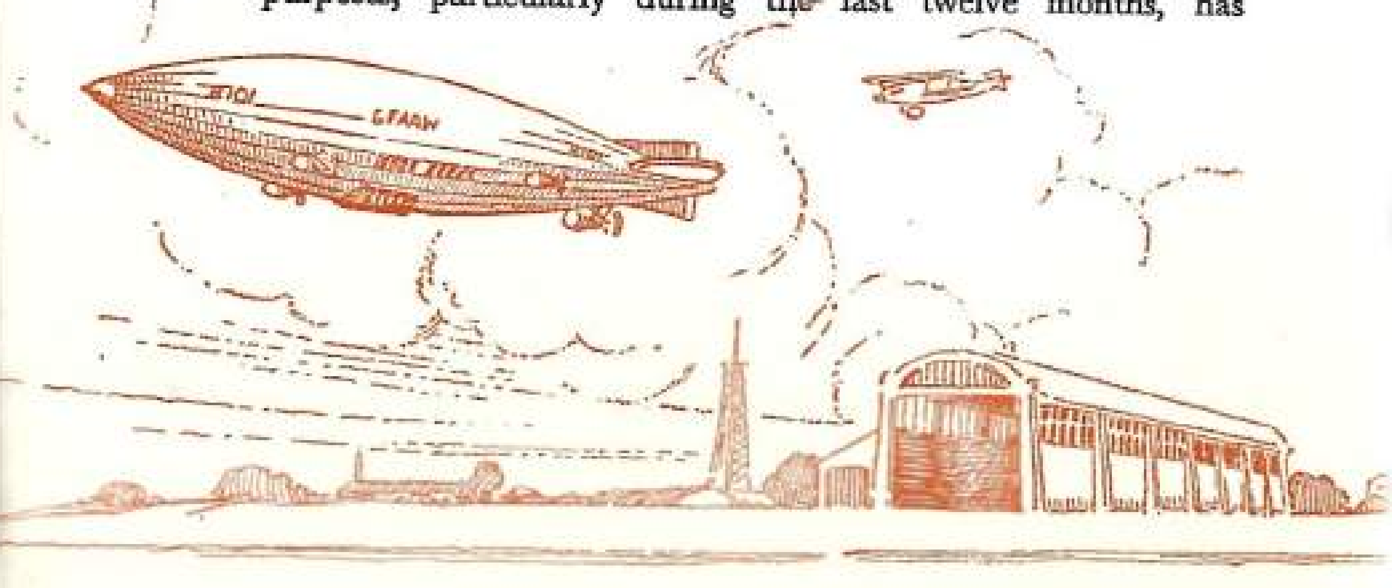
HABERSHON & SONS, LTD.

MESSRS. J. J. HABERSHON & SONS, LTD., have been established over 100 years, and are the largest producers of Cold Rolled Steel Strip in the United Kingdom.

They have specialised for many years in the production of Deep Drawing Steel Strip, Stainless, Rustless Iron, and various electrical steels, but during the past three or four years have concentrated on the specialisation of Steel Strip to the various Aircraft Specifications.

The whole of the steel strip used in the construction of the Airship R.101 was supplied by this firm, and all the leading aircraft firms in this country are using Habershon strip. The development of this branch of business has necessitated the installation of special plant—both with regard to the rolling and heat treatment—and the firm has now at its command a thoroughly efficient and up-to-date plant. The steel used is specially selected and undergoes a close examination, analysis and test, both in our Laboratory and Testing Department, before it passes into the mills for rolling.

The material is inspected by the Test Department between each process, and undergoes minute inspection and test before despatch. The big demand for Habershon strip for aircraft purposes, particularly during the last twelve months, has

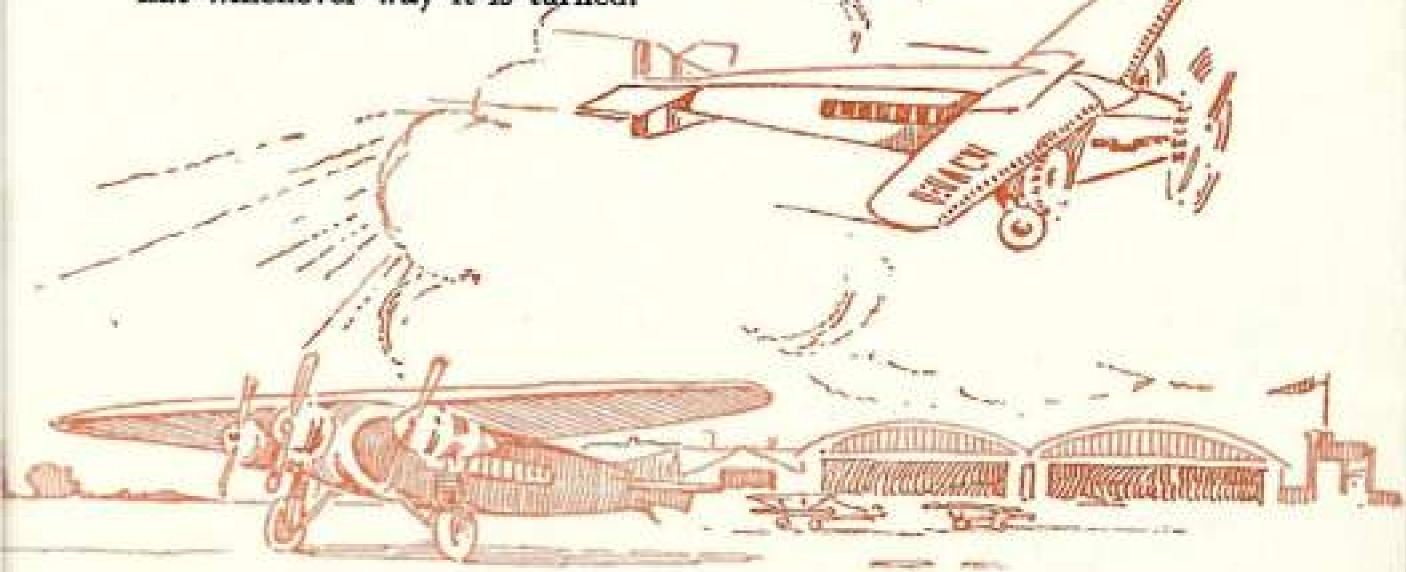


necessitated the building of a large testing room, fully equipped with every type of testing machine. The Testing Department comprises a staff of 37 inspectors, whose whole time and energy are concentrated on this work.

The following is a short synopsis of the specifications of the various aircraft steels produced by this firm, and it should be understood that the letter T referred to therein means thickness of strip or sheet.

Specifications of NICKEL CHROME STEELS

The strip to these specifications is produced from specially selected casts of high quality Nickel Chrome Steel made in special furnaces. Since the introduction of Habershon strip, the manufacture of the "all-metal" aeroplane has developed very rapidly. The heat treatment of the strip is done in a special way. This process produces strip of uniform strength throughout the coil, and at the same time has the great advantage of giving no permanent set in the strip, *i.e.*, it will lie perfectly flat whichever way it is turned.



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D.T.D. 16/S. 50 A.

This is a specification which calls for the very highest quality of steel. The proof stress of this strip has to be from 65 to 75 tons, and the strip has to give a bend test equal to the internal radius of 3 T. The strip must be free from all surface markings and defects, as the least indentation in the strip might prove to be very dangerous when stressed at this high tonnage.

Material can be supplied to this specification in the following dimensions :—

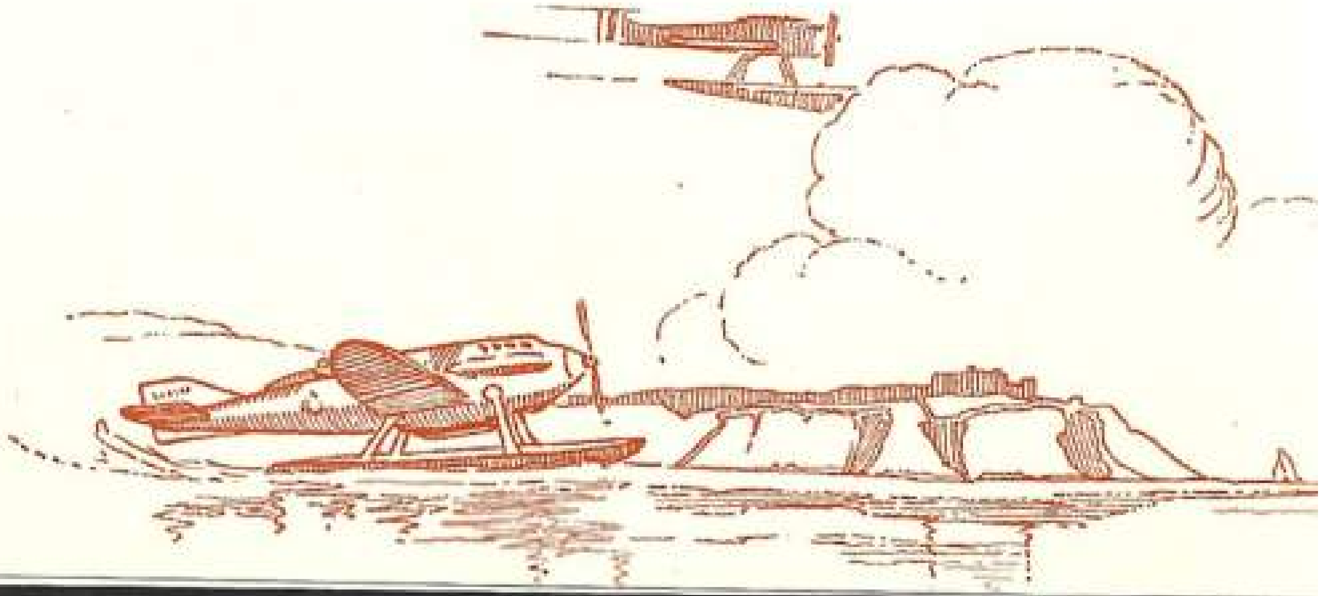
Down to 25 Gauge - - - - up to 12" wide.
As thin as 39 Gauge - - - - up to 3" wide.
The intermediate thicknesses in proportionate widths.

D.T.D. 16/S. 52 A.

This specification calls for a Cold Rolled Steel of more ductility than specification D.T.D. 16/S. 50 A. The strip has to give a proof stress of 45 to 55 tons, and has to stand a close bend equal to the internal radius of one thickness of the strip.

Material can be supplied to this specification in the following dimensions :—

Down to 25 Gauge - - - - up to 12" wide.
As thin as 39 Gauge - - - - up to 3" wide.
The intermediate thicknesses in proportionate widths.



STEEL FOR AIRCRAFT

D.T.D. 54.

This is an air hardening steel which is generally supplied in the annealed condition for subsequent profiling and forming. It is heat treated afterwards in the finished shape. In the annealed condition the maximum stress must not be greater than 45 tons, and must give a bend equal to internal radius of ½ T down to 23 gauge. Strip thinner than 23 gauge must stand bending flat.

Material can be supplied to this specification in the following dimensions :—

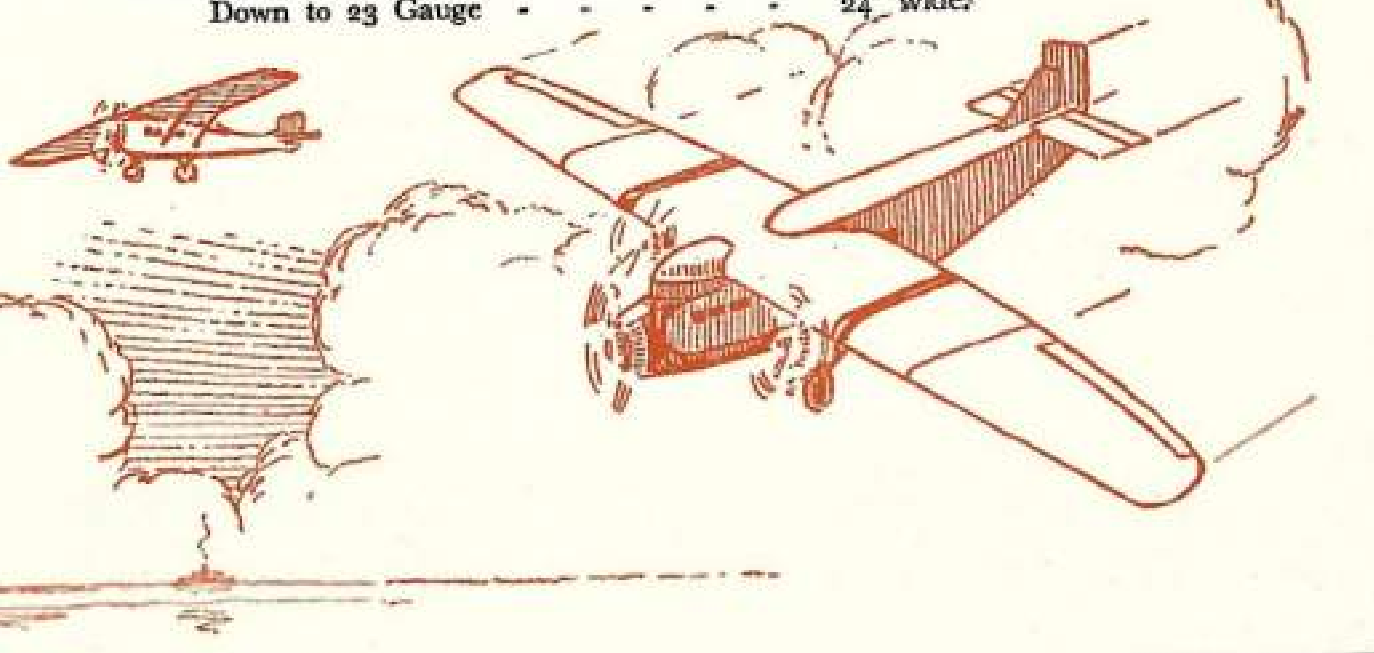
Down to 25 Gauge - - - - up to 12" wide.
As thin as 39 Gauge - - - - up to 3" wide.
The intermediate thicknesses in proportionate widths.

D.T.D. 98.

The sheet to this specification is a specially ductile and tough hot rolled steel. The mechanical properties are obtained by heat treatment. In the annealed condition these sheets must stand a close bend equal to internal radius of ½ T up to 23 gauge, and thinner sheets must stand bending flat without showing any signs of cracking. In the heat treated condition they must give an ultimate strength of not less than 55 tons, and a bend test of 1 T internal radius.

Material can be supplied to this specification in the following dimensions :—

Down to 23 Gauge - - - - - - 24" wide.



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D.T.D. 99.

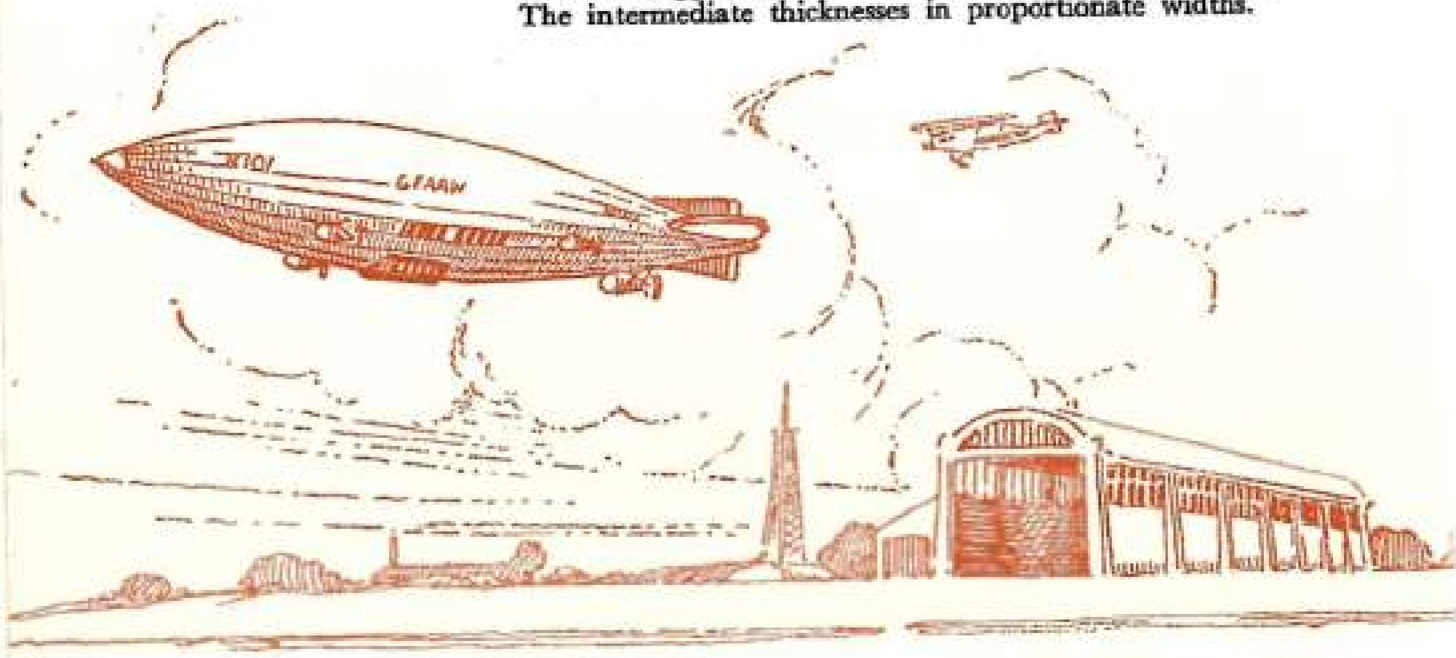
This specification calls for a very high-grade strip. Although the proof stress is not so high as some specifications (viz. :—55 to 65 tons), the bend test is very severe, and for this reason great care and attention is necessary in the production of the same. The tests required are a proof stress of 55 to 65 tons, with a bend of 3 T internal radius.

Material can be supplied to this specification in the following dimensions :—Down to 25 Gauge - - - - up to 12" wide.
As thin as 39 Gauge - - - - up to 3" wide.
The intermediate thicknesses in proportionate widths.

D.T.D. 100.

This is a specification in which a little latitude is allowed in the preparation. The tests can be obtained in several ways, viz., either by hardening and tempering, blueing the strip after cold rolling, or by cold rolling alone. We are able to produce strip by cold working which will give this test, and we claim in this way the advantages of a much cleaner strip due to the absence of heat treatment oxidation. The tests required are a proof stress of 40 to 50 tons, and the strip must stand a bend of 1 T internal radius.

Material can be supplied to this specification in the following dimensions :—Down to 25 Gauge - - - - up to 12" wide.
As thin as 39 Gauge - - - - up to 3" wide.
The intermediate thicknesses in proportionate widths.



STEEL FOR AIRCRAFT

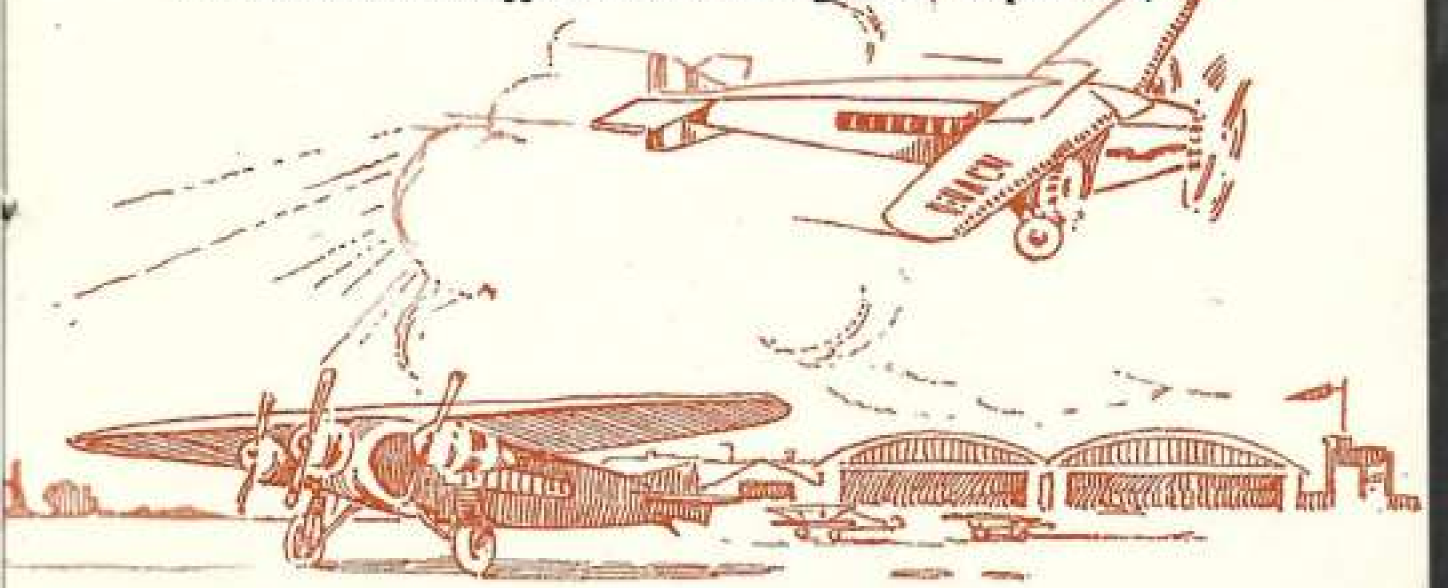
Stainless Steel Specifications

This firm, as previously stated, supplied the whole of the Steel Strip used in the construction of the R.101—and the material in question was Stainless Steel, samples of which can be seen on this Stand.

The strip is rolled from specially selected casts, and every precaution is taken to test the steel in every respect before it is rolled into strip. The product is the result of years of investigation and experiment, and it was due to the excellence of this strip—both with respect to the stainless qualities and the tests it gives—that Habershons first entered into the production of aircraft materials.

D.T.D. 42 H. & S.

This is an Austenitic Steel and is stainless in every condition. The mechanical properties of the Hard Sheets are obtained by cold working. In the softened condition it has to give a maximum stress of not less than 40 tons with an elongation of 30 per cent. minimum per square inch, and must stand a close bend over a radius equal to half the thickness of the sheet or strip. In the hardened condition it has to give a maximum stress of not less than 55 tons with an elongation of 20 per cent.,



and must stand bending over a radius equal to the thickness of the sheet, all the bends to be the weak way of the grain.

This material is particularly suitable for seaplane purposes, as it is capable of withstanding the effects of sea water, which are so disastrous to most steels.

Material can be supplied to this specification in the following dimensions :—

Down to 22 Gauge - - - - - -	30" wide.
Down to 23 Gauge - - - - - -	24" wide.
As thin as 39 Gauge - - - - - -	4" wide.

The intermediate thicknesses in proportionate widths.

D.T.D. 46.

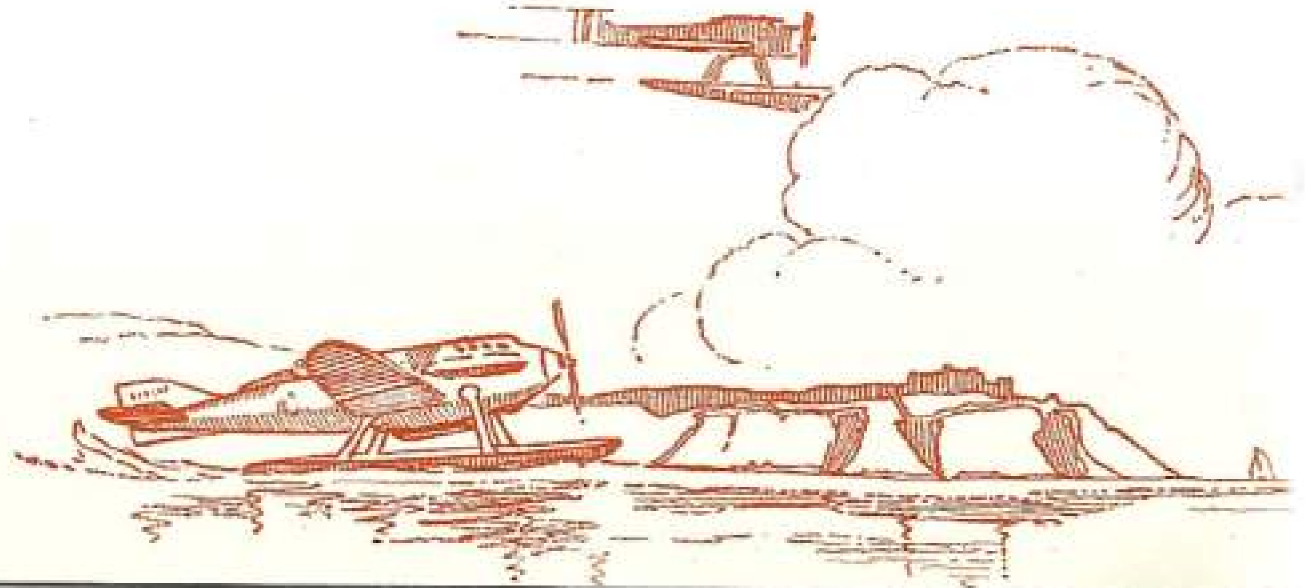
This specification calls for a steel of the very finest quality. The steel has to stand, in the heat treated condition, a proof stress of between 65 to 75 tons, and has to stand a bend of 3 T internal radius. The steel is only stainless in the hardened and tempered condition.

Material can be supplied to this specification in the following dimensions :—

Down to 25 Gauge - - - -	up to 12" wide.
As thin as 39 Gauge - - - -	up to 3" wide.

The intermediate thicknesses in proportionate widths.

The Airship R.101 was largely constructed of material to this specification, the whole of which (about 25 tons) was supplied by this firm. Sample tubes may be seen on this Stand.



STEEL FOR AIRCRAFT

D.T.D. 57 A.

This is a steel of similar composition to D.T.D. 42, and is used for similar purposes where a higher stress is required. It is extremely difficult to produce, as the properties of the steel are obtained by cold work, but, nevertheless, this firm claims to supply consistently to this specification.

It has to give proof stress of not less than 50 tons, with a close bend test equal to internal radius of 2 T in gauges thinner than 10 down to 16 and 1 T in thinner gauges than 16.

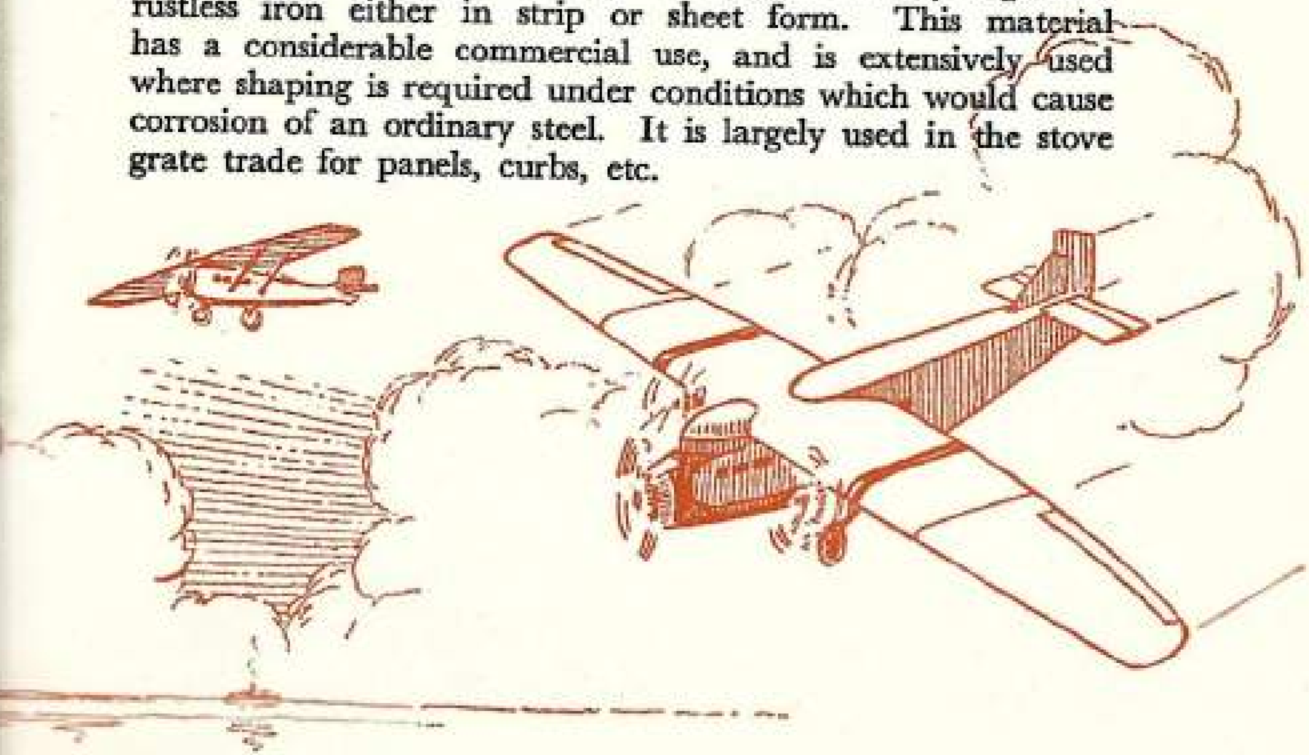
Material can be supplied to this specification in the following dimensions :—

Down to 23 Gauge - - - - - -	24" wide.
As thin as 39 Gauge - - - - - -	4" wide.

The intermediate thicknesses in proportionate widths.

RUSTLESS IRON SPECIFICATION

This firm has for some years supplied a very high-class rustless iron either in strip or sheet form. This material has a considerable commercial use, and is extensively used where shaping is required under conditions which would cause corrosion of an ordinary steel. It is largely used in the stove grate trade for panels, curbs, etc.



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It has recently been found very useful for various aircraft purposes—particularly where intricate shapes are required in positions where a plain carbon steel will not withstand corrosion, such as petrol tanks, etc.

D.T.D. 39.

This specification calls for a rustless iron with a chemical composition as follows :—

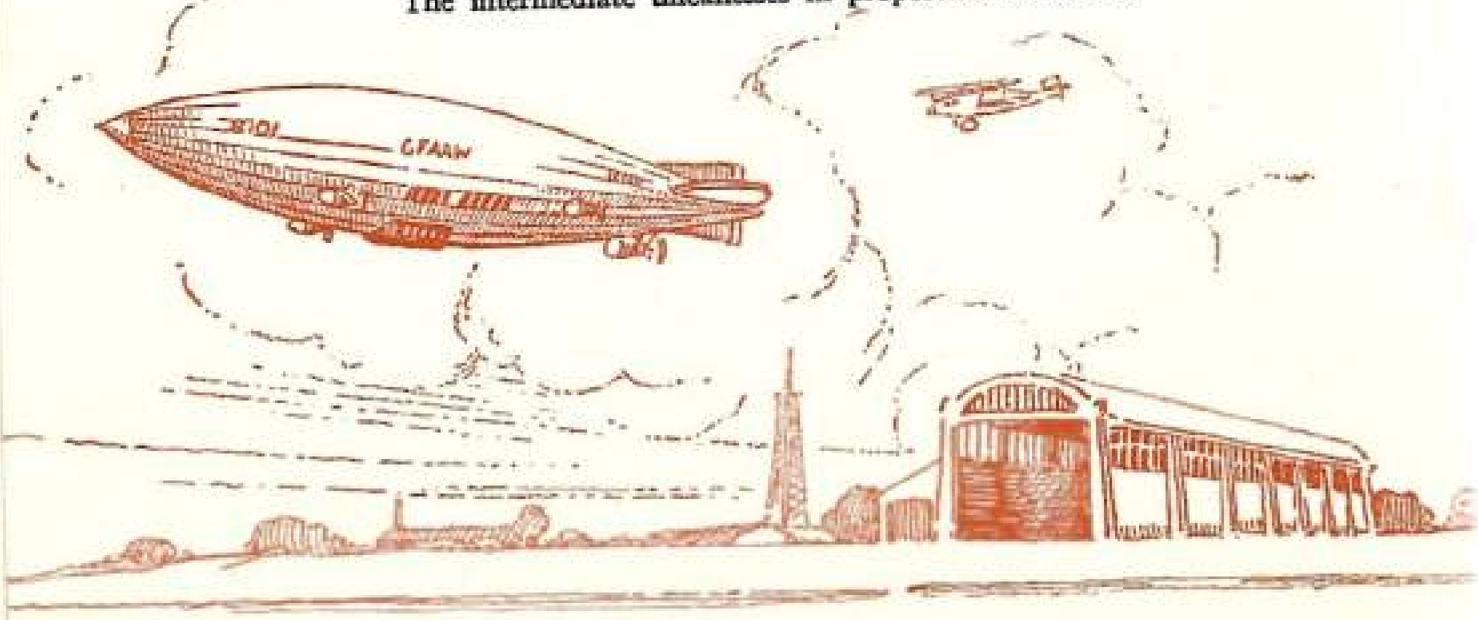
Carbon - - -	not more than 0.10%
Nickel - - -	not more than 1.0%
Chrome - - -	not less than 12.0%

It is supplied in the fully annealed condition, and must have a maximum stress of 28 to 35 tons. In gauges 24 and thinner it must stand bending over flat. In gauges thicker than 24 it must bend over ½ T internal radius without showing any signs of cracking.

Material can be supplied to this specification in the following dimensions :—

Down to 22 Gauge - - - - - -	30″ wide.
Down to 23 Gauge - - - - - -	24″ wide.
As thin as 39 Gauge - - - - -	4″ wide.

The intermediate thicknesses in proportionate widths.



Carbon Steels Specifications

The rolling of Carbon Steels has been undertaken by this firm over a very long period of years, and their experience in this branch of trade has fitted them for rolling this class of material for aircraft purposes. The steel is very carefully examined and analysed before rolling, and throughout the processes the material is inspected and tested.

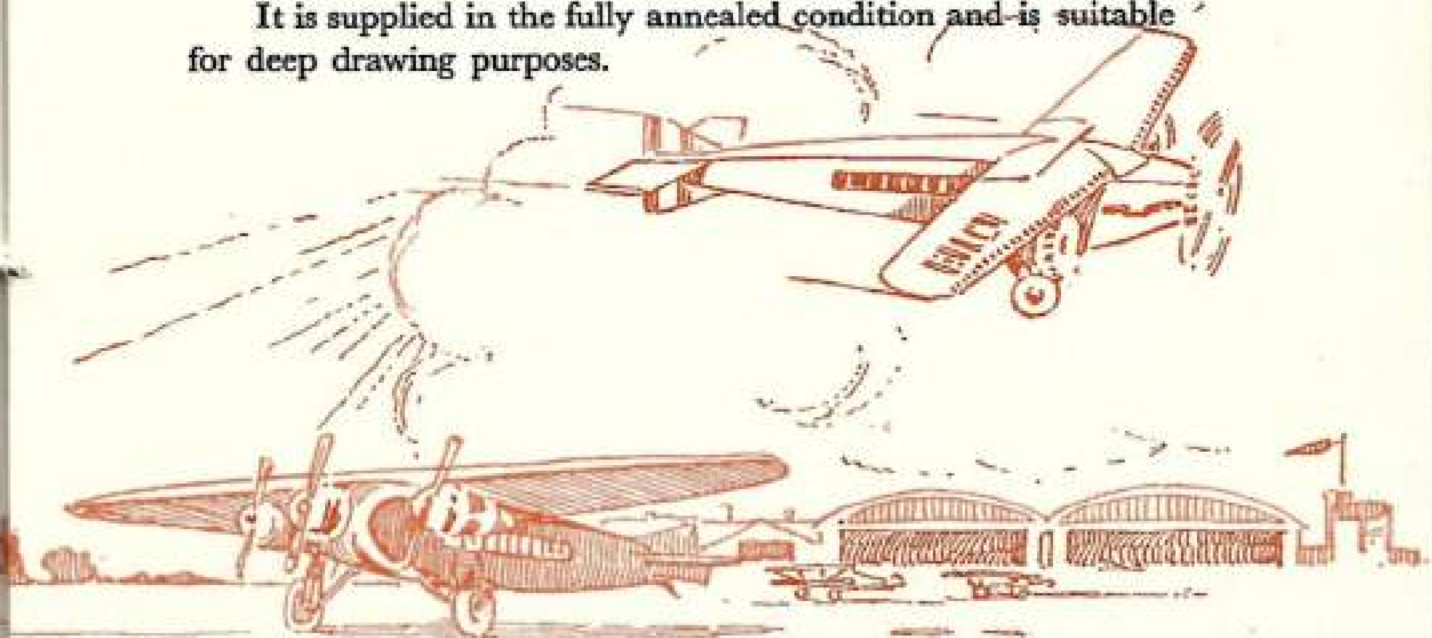
D.T.D. 12 A.

This specification calls for a strip made from steel with the following analysis :—

Carbon - - - -	.04 to .12%
Manganese - - -	.20 to .50%

The mechanical properties required are tensile, not more than 22 tons, and to be capable of bearing a close bend test each way of the grain without cracking.

It is supplied in the fully annealed condition and is suitable for deep drawing purposes.



High Manganese Steel
D.T.D. 91.

This is a strip made from a steel with carbon content of not more than .45 and a manganese not exceeding 1.5 per cent. The mechanical properties are :—

Maximum Tensile - - -	not less than 50 tons.
Yield - - -	not less than 45 tons.

These properties are obtained by a specified amount of cold work, together with a blueing operation.

S. 3 or 2 S. 3.

This specification calls for a strip made from steel with the following analysis :—

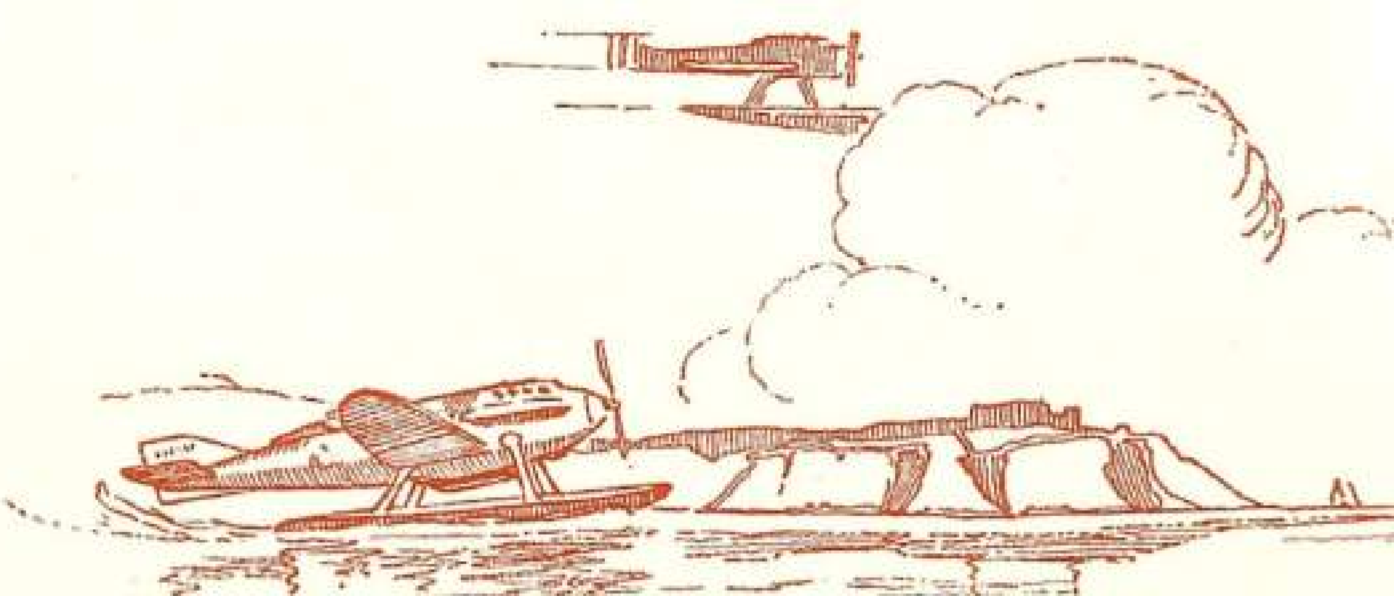
Carbon - - - - -	.20 to .25%
Manganese - - - -	.60%

The mechanical properties required are a maximum stress of not less than 26 tons, and a yield of not less than 18 tons. It is required to stand the following bend tests :—

Close bend 180° over radius = $\frac{1}{2}$ T.
Reverse Bend—

12 Gauge and thinner -	3 reversals.
12 Gauge to 6 Gauge -	2 reversals.

The steel to this specification is ductile and is chiefly used for forming intricate parts of an aeroplane, and which, therefore, necessitates stringent tests.



2 S. 6.

A specification for bars for machining and forging. The analysis is carbon .35/.45 per cent., and manganese 1.20 per cent. maximum. It has to give the following tests :—

Maximum stress - - -	35 to 45 tons.
Elongation - - - -	not less than 20%
Reduction of Area - - -	not less than 40%
Izod value - - - -	not less than 20 ft. lbs.

These tests are taken after normalising, and the material is usually supplied in the "as rolled" condition.

2 S. 14.

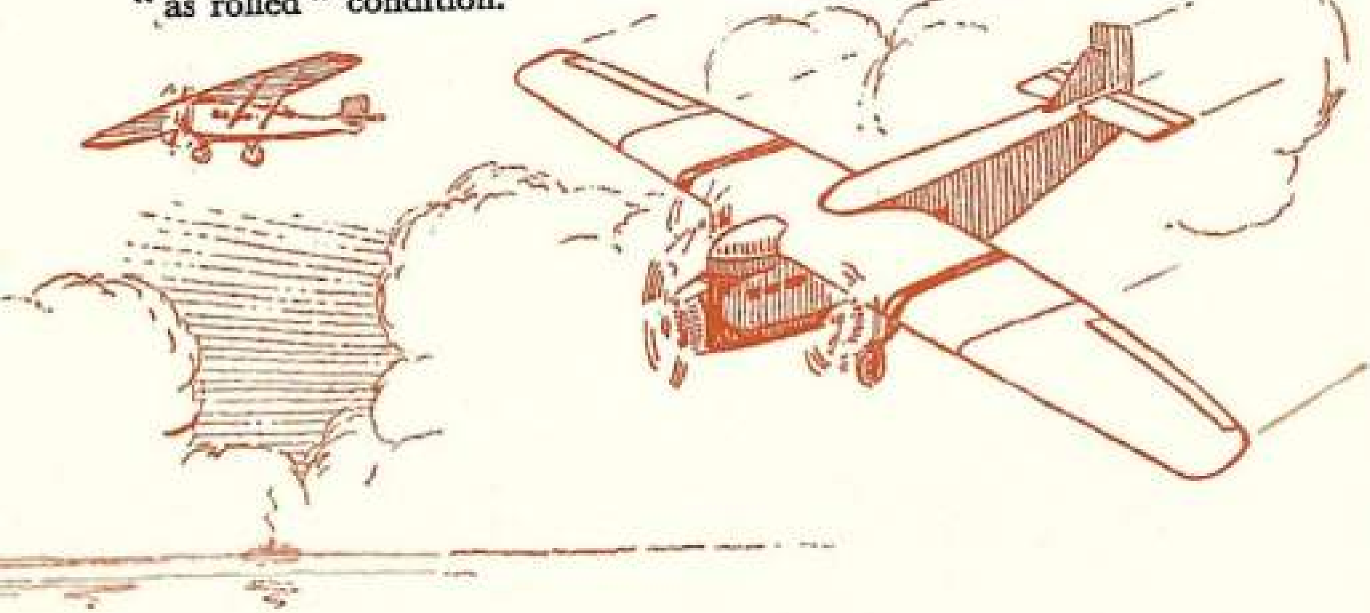
A specification for Carbon Case Hardening Steel for bars for machining and forging. The analysis is :—

Carbon - - - -	.10/.18%
Manganese - - -	.90% maximum.

It has to give the following tests :—

Maximum stress - - -	not less than 32 tons.
Elongation - - - -	not less than 20%
Reduction of Area - - -	not less than 50%
Izod value - - - -	not less than 40 ft. lbs.

These tests are taken after heat treatment. Supplied in the "as rolled" condition.

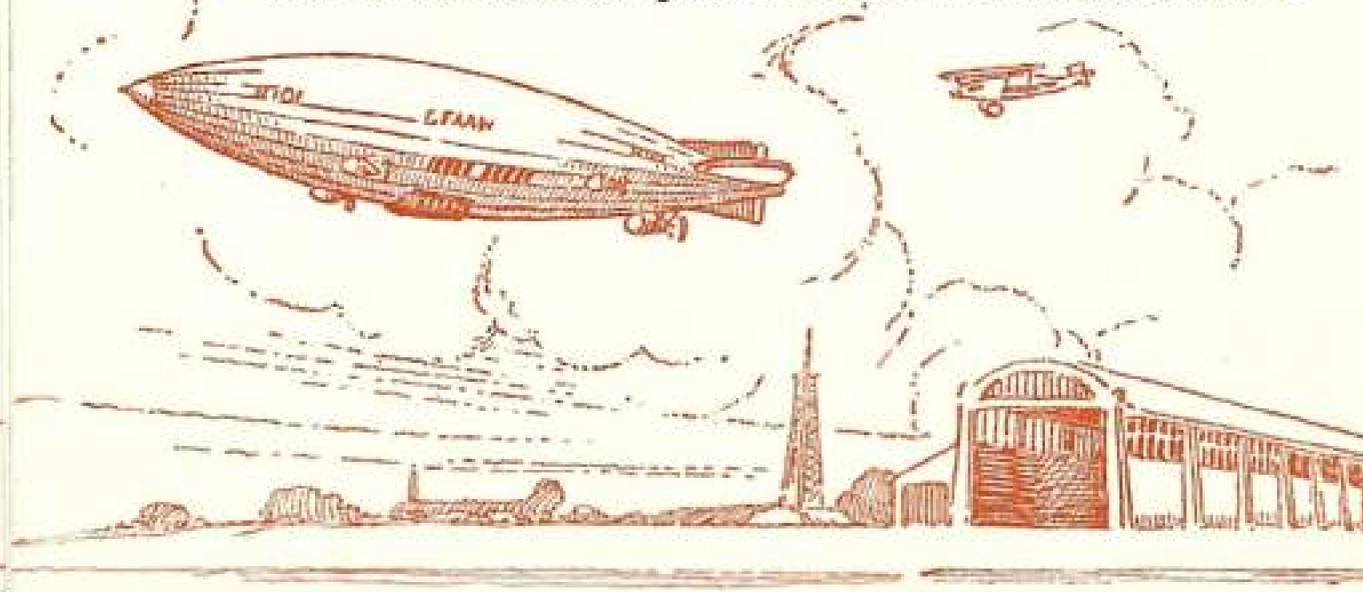


The R.101

WITHIN the past few weeks, the writer of this article, together with several members of the Staff, had the privilege of visiting the Government Airship Works at Cardington, and saw the R.101 in a very advanced stage of construction.

The first impression created in one's mind on approaching the shed in which the airship is being constructed is the immense size of the building—the second largest building in the British Empire. Perhaps the greatest impression—and also a thrilling one—is the first sight of the airship itself. Its size, its structure, and the wonderful detail of the various parts and members comprising same are a revelation, and inspire one with pride in the genius and workmanship of all concerned with the design and construction.

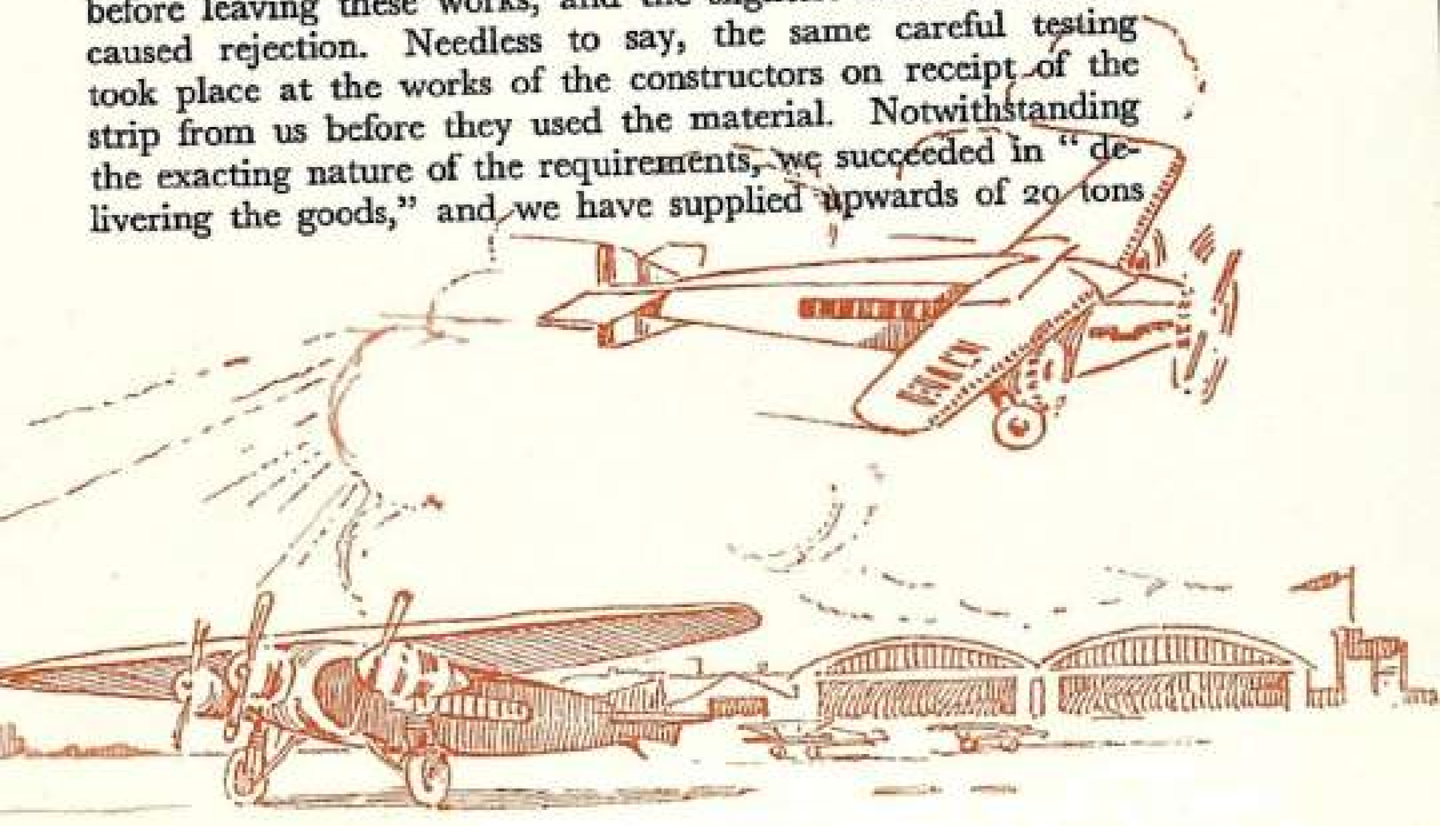
On looking over the detail of the construction, one feels proud that Habershons have played such a very important part in the work. All the main ribs and the longitudinal members of the frame—in fact, every part called upon to bear the greatest strain, was made from strip rolled at Holmes Mills. It is entirely due to the workmanship in connection with the strip supplied



STEEL FOR AIRCRAFT

to the R.101, that aircraft work has become such an important factor in our mills.

When we were first approached with regard to rolling strip for the R.101, the constructors (Messrs. Boulton & Paul, Limited) and the Air Ministry were almost at their wits' end—as months of experiments and endeavours to obtain suitable strip had resulted in failure. We probably did not realise the difficulties that lay ahead of us when we undertook to produce suitable stainless steel strip for the purpose. When it is realised that the steel has to give a proof stress of 65 to 75 tons, and at the same time to stand a transverse bend equal to a radius of three times its own thickness, the difficulties will, no doubt, be appreciated. This entailed the testing of every coil of steel before the Air Ministry would pass it ; the product of every heat of annealing had to be tested and every coil had to be subjected to the bend test before leaving our works. In addition to these physical tests, the surface of every inch of strip was carefully scrutinised before leaving these works, and the slightest mark or scratch caused rejection. Needless to say, the same careful testing took place at the works of the constructors on receipt of the strip from us before they used the material. Notwithstanding the exacting nature of the requirements, we succeeded in "delivering the goods," and we have supplied upwards of 20 tons



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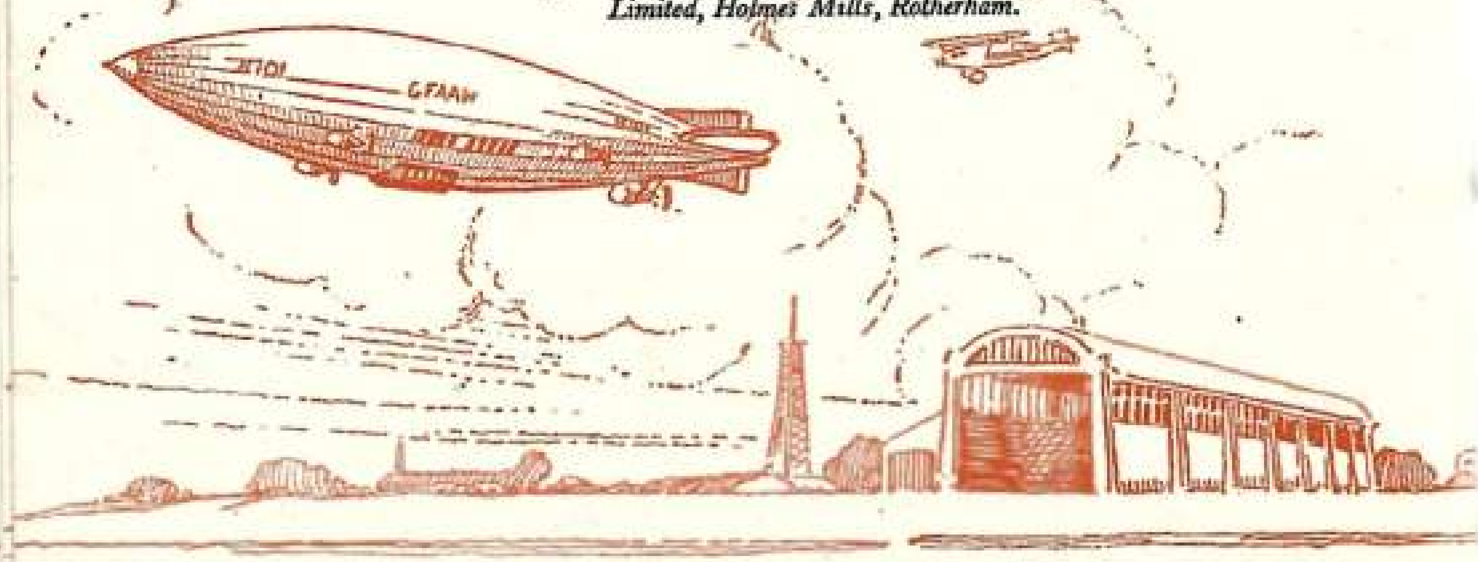
of perfect strip for the R.101—all of which met the requirements of the Air Ministry's Specifications.

It became necessary to install an efficient testing department for this class of work—and one which would meet the requirements of the Air Ministry. The Air Ministry were so satisfied with the efficiency of our testing that three members of our staff are now certified inspectors under the A.I.D.

Our close association with the Air Ministry, and our success in the production of strip for the R.101, resulted in pressure being put on us by the authorities to give our attention to the production of strip for aircraft purposes, which was only at that time satisfactorily produced in Sweden. On completion of the strip for the airship, we made various experiments with nickel chrome and other alloys, with the result that to-day we are producing aircraft strip which is considered by the authorities equal to any strip they have hitherto handled. We are supplying all the leading aircraft firms in the country with strip to all specifications, and our steel is being tested in several countries in Europe.

We are satisfied that the trials and troubles of the early days of our aircraft experience have been well worth while, and we are satisfied that our firm is to-day producing aircraft strip in every way superior to any yet produced in this country.

Copy of article written for "The Gauge"—the monthly Journal of Messrs. J. J. Habershon & Sons, Limited, Holmes Mills, Rotherham.



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