FLIGHT

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Club Secretaries and others desirous of announcing the dates of important fixtures are invited to send particulars for inclusion in this list:—

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- **Jan. 15,** D.H. Technical School Dance at Portman Rooms, W.
- **Jan 28.** "Effect of Height on Range," Lecture by A. E. Woodward-Nutt and Flt.-Lt. A. F. C. Scroggs, before R.Ae.S.
- **Feb. 13.** Rugby: R.N. v. R.A.F., at Twickenham.
- **Feb. 24.** "A Flight to Abyssinia," Lecture by Sqdn.-Ldr. J. L. Vachell, before R.U.S.I
- **Mar. 4.** Leicestershire Ae.C, Annual Ball.
- **Mar. 10.** "Results with the New Wind Tunnel at N.P.L.," Lecture by E. F. Relf, before R.Ae.S.
- **Mar. 16.** "Development of Naval Air Work," Lecture by Commodore N. F. Laurence, before R.U.S.I.
- **Mar. 23.** "High-Speed Flying," Lecture by Sqd.-Ldr. A. H. Orlebar, before R.U.S.I.
- **Mar. 26.** Rugby: Army v. R.A.F., at Twickenham.
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- **June 25.** R.A F. Display, Hendon.

TO OUR READERS.

The Editor offers his best wishes for Christmas and the Coming Year, and many thanks for the daily batch of Greetings to ourselves—including a "bag full" by the First Australian Air Mail.

EDITORIAL COMMENT

FLIGHT LIEUTENANT STAINFORTH'S high-speed record for the world must be hailed as the outstanding event of British air effort in the year which is now drawing to its close. On looking back through our files for the year, this is the one event which strikes us as of outstanding importance. There have been other notable happenings, not a few of them, but with this one exception the year 1931 has been marked more by steady and gratifying progress in many directions than by a plethora of epoch-making events. That is not a melancholy swan-song for any year to have to sing.

1931

In our retrospect let us give pride of place to the Royal Air Force. The speed record and the winning of the last Schneider contest must go to the credit of the force—not forgetting the constructors of machine and engine. The winning of the Schneider for the third successive time, and the retaining of the trophy permanently for Great Britain, was a notable event, and will make the year 1931 long remembered. High-speed work, however, is but one form of the service's activities, and it is not the work for which the service exists. The R.A.F. is primarily a fighting service, and its record for the year must be judged by the way it has maintained or increased its efficiency as a fighting force to which definite British interests have been entrusted. That the efficiency of the force has been well maintained there is no manner of doubt. The amount of flying undertaken is always on the increase, and the quality is ever improving. No new aircraft or engine of startlingly new qualities has been adopted by the force during the year, but some gratifying progress has been made in re-equipping the force with aircraft of the latest types. One squadron received the interceptor "Fury," a second bomber squadron received the "Hart," and several more squadrons were equipped with "Bulldogs." The "Hart" has also made its début as a two-seater fighter and as an army co-operation machine. The Fleet Air Arm has received a number of "Ospreys" and "Nimrods." Some old war-time squadrons have been re-formed, and one new squadron of flying boats has come into being. The squadron at Basra has received "Rangoons" instead of "Southamptons." The flying boat Saro A.7 has flown non-stop from Gibraltar to Plymouth. Catapulting has been developed, and a "Virginia" has been launched into the air in this way. Major Savage's new grid searchlight may perhaps play a great part in keeping off enemy night-bombers, though there is no assurance that it may not also be used to defeat the ends of our own bomber formations. The age-limits for short-service commissions have been narrowed, which is a step in the right direction, and the experience necessary to a flying instructor has been lengthened, which is another very wise move. The Air Exercises held in the summer seemed to indicate that the losses of an enemy who tried to bomb London would be too heavy to be tolerated for many days. The year ends with the new Fairey-Napier long-distance monoplane slightly damaged on its leisurely return from a successful trial flight non-stop to Egypt.

Turning to civil and commercial flying, the chief event of the year has been the opening of the African airway by Imperial Airways Ltd. This is certainly an event of first-class importance, but, for various reasons, the opening of the through route to Capetown has been so long delayed that one hardly counts this event to the credit of 1931. The first mail machine for Capetown left Croydon on December 9. To the debit side of the year must be placed the decision of the Indian Government to close down all air-mail activities so far as possible, in spite of having placed an order for Avro 10 machines to work between Karachi and Calcutta. One of those machines has been delivered in India for the use of the Viceroy on his tours. In Australia the unsubsidised Australian National Airways Ltd. had to cease its regular services, but it has ended well by sending Christmas mails to England in an Avro 10 piloted by Kingsford Smith.

In interesting civil flights, useful and otherwise, the past year has been unusually rich. Many of these flights have been made in light aircraft. Taking them all together they show how reliable the modern aircraft and aero engines have become. Some pilots, both men and women, with comparatively little experience but a certain amount of luck, have travelled in all directions across the world. Experienced pilots, such as Hinkler, Scott, Mollison, Kingsford Smith, Store, Glen Kidston, and others, have set themselves exacting tasks and have put up performances at which the whole world has wondered. In one class of flight the crossing of the South Atlantic by Hinkler is outstanding, while in another class the records set up by Mollison and Store are remarkable examples of the endurance of the man and the machine. Butler's flight to Australia in a "Swift" deserves a word all to itself.

While we mention the great flights which have attracted the attention of the Press, we certainly ought not to forget the faithful regular work of the air mail pilots of Imperial Airways, the two Australian airways, and the numerous air services in Canada. Their work has nothing of the "stunt" element about it and therefore seldom receives recognition by the public. It is, however, the most praiseworthy form of civil flying, and the rarity of any failure proves the quality of the pilots more satisfactorily than it could be shown in any other way. With these pilots we should class those of the Royal Air Force who have taken part in formation flights to South Africa, to West Africa, to Basra, and elsewhere, and have seldom failed except through the experimental nature of some feature in their aircraft.

The clubs and schools are passing through a difficult time, and most of them have had to exercise all possible economy. Nevertheless, they have mostly held their own in membership and in efficiency. A very welcome movement is in progress to demand really high qualifications from the instructors who are employed, and most of the instructors at the schools have now been through courses at the Central Flying School. Courses in advanced flying, in instrument flying, and in ground engineering are now provided at many schools and clubs. A notable movement which has started during the year is the formation of flying clubs among the employees of commercial concerns, such as the London General Omnibus Company and United Dairies. Gliding has increased in popularity during the year.

From the point of view of the designer, the year 1931 has not been very rich. It has been a year of steady development rather than of startling innovation. The principle of the monospar wing has been incorporated in aircraft which have flown. The Pobjoy engine has been developed and put on production. Two four-engined commercial types have been brought to completion and put into regular service, namely, the "Kent" and the Handley Page 42. Another four-engined type is being designed by the Armstrong Whitworth firm for the African airway. In equipment certain useful refinements are becoming more general, such as wheel-brakes, tail wheels, and low-pressure tyres.

With the dismemberment of R 100 an end has been put to the airship activities of this country for the present. We have, however, been delighted to receive a visit from the *Graf Zeppelin*, and all who were at Hanworth greatly admired the skill with which Dr. Eckener and his crew brought the airship to earth both in calm weather and also on a rather gusty evening.

In conclusion our thoughts turn to the prominent members of the flying world who have passed away during the year. Among others we have to mourn Air Commodore Samson, Air Vice-Marshal Holt, Flt. Lt. Waghorn, Lt. Brinton, Lt. Com. Glen Kidston, Miss S. O'Brien, Mr. Montague Napier, and Sir Trevor Dawson. Lt. Col. Brinsmead, the Controller of Civil Aviation in Australia, is lying seriously ill in hospital after a crash in a Fokker in Siam. We wish him a complete recovery, and we are sure that all our readers will join with us in this wish.

Air Transport

THE START: The Avro 10 (Armstrong-Siddeley "Lynx"), "*Southern Sun,*" leaving Melbourne for England with mail on November 20. Six days later it crashed at Alor Star, and the mails—together with this and accompanying illustration—were brought on by Kingsford Smith in the "*Southern Star.*"

(Photo, courtesy Shell Co. of Australia, Ltd.)

The Australian Christmas Air Mail

PERHAPS one of the most interesting events in the history of air mails is the transport of a special consignment of Christmas mail from New Zealand and Australia to England, which was brought to a successful conclusion last week. It is interesting in many ways; first, perhaps, because of the active part played by Air Com. Kingsford Smith, who for the second time came to the rescue when the experiment looked like turning out a failure, and made it a success.

Secondly, in spite of weather delays on the final stage of the journey, Kingsford Smith accomplished the flight from Australia in only fourteen days, more or less establishing the certainty (taking into consideration also the previous experimental England-Australia air mail service made by Imperial Airways) that regular mail services on this route, occupying about twelve days, are a practicable proposition. Actually, of course, owing to the crash, the mails took 24 days.

Again, as a flight in itself, this dash from Australia by Kingsford Smith is a remarkable effort, for apart from the fact that he was flying against doctor's orders, he has made magnificent progress throughout, averaging about 1,000 miles per day. It is of interest to note, also, that this is the first time that a passenger has made the direct flight from Australia to England—for besides the mail a second pilot, Mr. G. U. Allan, and a mechanic, Mr. W. H. Hewitt, were carried.

Although we have already reported the progress from the start of this air mail in previous issues, it may be as well, as a matter of record, if we set it down here once again. It will be remembered that an Avro 10 (Armstrong Siddeley "Lynx" engines) monoplane, *Southern Sun*, piloted by Mr. G. U. Allan, with Mr. B. S. Calligan as second pilot and Col. Brimsmead as passenger, left Darwin, with mail from New Zealand and Melbourne, etc., on November 23, and was due to arrive at Croydon on

THE CREW OF THE "*SOUTHERN SUN*": Left to right: R. Boulton, assistant pilot; G. U. Allan, chief pilot, and B. S. Calligan, wireless operator.

(Photo, courtesy Shell Co. of Australia, Ltd.)

THE ARRIVAL: The *Southern Star*, which, piloted by Air-Commodore Kingsford Smith, brought on the mails from the *Southern Sun*, arrives at Croydon on December 16. (Flight *Photo.*)

A close-up of the *Southern Star* (top) and (below) its cargo of Xmas mail from New Zealand and Australia.
(Flight *Photos.*)

FATHER CHRISTMAS! Air-Commodore Kingsford Smith, M.C., A.F.C., R.A.A.F.
(Flight *Photo.*)

December 3. All went well according to schedule until taking off from Alor Star, Malay, on November 26, when the machine crashed, slightly injuring Col. Brinsmead and being so damaged that it was impossible to proceed.

Then Air Com. Kingsford Smith came to the rescue, as he did when the first experimental outward mail of Imperial Airways came to grief at Timor last April. He left Sydney in a similar machine, the *Southern Star*, on November 30, and took off from Darwin on December 3, having met with a slight mishap in landing the previous day. He reached Koepang and Bali the same day, and Singapore and Batavia on December 4, proceeding to Alor Star, where he picked up the stranded mails. On December 6 he reached Bangkok—the same day of the accident to the Dutch mail plane—and Rangoon. He arrived at Calcutta on December 7, and on the sixth day out from Darwin, December 8, he reached Karachi. The next day he flew to Bushire, on December 10 to Aleppo, on December 11 Athens, on December 12 Rome, and December 13 to Lyons. Here bad weather held him up until December 15, when he got as far as Le Touquet (not Le Bourget, as wrongly reported in our last issue), bad weather again preventing him proceeding to Croydon. He reached Croydon Airport eventually at 10.30 a.m. on December 16, and was officially welcomed by Mr. F. G. L. Bertram, Deputy Director of Civil Aviation, and others. His actual flying time was about 120 hours.

In handing over the mail, of some 50,000 letters and cards, Kingsford Smith said: "I hope this trip will be the forerunner of a regular fortnightly service of mail planes between England and Australia. We could do it, I think, all the year round in twelve days for each journey." The return flight to Australia was originally scheduled for December 18, but owing to the delays on the inward journey it was postponed to December 22.

MESSAGES RECEIVED BY THE ROYAL AERO CLUB BY THE FIRST A.N.A. AUSTRALIAN AIR MAIL

Aero Club of New South Wales, Mascot, New South Wales.—The President and Committee convey to the Royal Aero Club compliments of the Season, and are taking the opportunity of sending you greetings by the first Air Mail Service from Australia to England.

Associated Australian Aero Clubs, Melbourne.—On behalf of the Associated Australian Aero Clubs, I wish to take the opportunity of the first direct aerial mail of extending to your Members, through your good self, the best of wishes for the New Year.

Queensland Aero Club, Brisbane.—It affords me pleasure to avail myself of this eventful occasion—the first "All-the way" Air Mail Service between Australia and Britain—to convey this letter with greetings from the Queensland Aero Club to the Royal Aero Club in London. Although at one of the distant outposts of the Empire, we appreciate the great importance of Aviation, both in commerce and defence, and we feel a just pride in the pre-eminent position which has been attained by the Mother Country. It is with a sense of satisfaction that Queensland has been able to render some service in the interests of Aviation by producing men like Kingsford Smith and Hinkler. With the compliments of the Season and best wishes.

THREE OF THE 50,000: We received a number of letters by the Xmas mail, and here are three of them—one from New Zealand. (FLIGHT *Photo.*)

Aero Club of South Australia, Adelaide.—The President, Committee and Members of the Aero Club of South Australia extend Greetings to the President, Committee and Members of the Royal Aero Club, and the wish that Christmas and the New Year will bring much happiness and prosperity to those connected with the advancement of Aviation in the Old Country.

Australian Aero Club (Tasmanian Section).—We are taking advantage of the first Australia to England Air Mail, organised by the Australian National Airways, Ltd., to send you our warmest greetings for a Merry Christmas and a Happy New Year.

The Mail from New Zealand

WE are informed by the Cirrus-Hermes Engineering Co., Ltd., that the New Zealand portion of the air mail was carried from Invercargill to Auckland in a Hermes "Spartan," piloted by Sqd. Ldr. M. C. McGregor, D.F.C. From Auckland they crossed to Sydney by steamer, where they were picked up by the Australia-England Air Mail. It may also be of interest to know that one of these letters was an inquiry with regard to Cirrus engines.

Imperial Airways Xmas Mails

THE biggest load of air mail that has ever been despatched from this country left Croydon for the India route on December 12. The total weight of mails carried by one of the four-engined Handley Page liners on the first stage was 978 kilos, or about a ton. The Christmas mail flown to India last year weighed 834 kilos. The Imperial Airways liner, carrying the special Christmas air mail to the Cape, arrived at Salisbury, Southern Rhodesia, on December 19, a day late, having been delayed by violent storms. It arrived at Johannesburg the following day. This mail left London on December 9 and was scheduled to reach Capetown on December 20.

Experience with Junkers G.38

IN a lecture which he delivered on December 8 in Berlin, Capt. O. Brauer gave an account of his experience with the Junkers G.38 during several months of flying, partly on regular air routes and partly on demonstration tours. Of particular interest here is Capt. Brauer's reference to the next machine of the G.38 class. It was found that, although the arrangement of the first machine (D.2000) was very efficient aerodynamically, it was impossible to provide sufficient window area for the number of passengers which the machine *could* carry. For freight carrying the question of illumination did not, of course, matter, but if the type is to be used as a passenger machine better view and light must be introduced. In order to do this it has been necessary to re-design the machine somewhat, and the next type, which has already made a number of flights, has a different fuselage arrangement. It is claimed that this is as efficient, from an aerodynamic point of view, and gives good accommodation for 30 passengers. The 800-h.p. Junkers L.88 engines proved very successful, and four of them are to be fitted in the machine. (The farthest outboard engines in D.2000 were of 350 h.p. each.) The extra power will give an increase of about 1 ton in the pay load, while the cruising speed will go up from about 100 m.p.h. to about 115 m.p.h.

Swedish Aerotransport Traffic for 1931

DURING 1931 the Swedish Aerotransport Company carried 19,623 passengers and its machines flew a total distance of 310,000 miles. Freight and mail traffic increased by an average of 50 per cent. in comparison with 1930.

New Machine for Amsterdam-Batavia Service?

PLANS, says the *Daily Telegraph*, are under serious consideration in Holland for the construction of a new type of three-engined aeroplane designed to fly the 8,000 miles between Amsterdam and Batavia in three days.

Sahara Services

REGULAR air services across the Sahara Desert are being planned by the French authorities, reports the *Daily Telegraph*. Oases will be used as bases for the airway.

Heinkel building special Mailplane

THE Heinkel Aircraft Works, of Warnemünde, Germany, have under construction a new mailplane of special design. The machine is a low-wing monoplane with oval section fuselage and retractable undercarriage, and will be fitted with a 525-h.p. BMW-built Pratt & Whitney "Hornet" engine. In addition to the mail compartment there will be a small cabin for four passengers. The maximum speed of the new machine is estimated at 260 km./h. (161 m.p.h.).

Private Flying & Club News

BROOKLANDS.—Messrs. J. Joss and R. Richards carried out height tests for their "A" licences, and the pupil hailing from Norway—K. Haldorsen—has made his first solo flight, completed three hours' solo, and is now only awaiting favourable weather conditions to carry out his height test.

Messrs. Greaves, Van Dyck and Forrest have joined the School and commenced instruction.

The School Sales Manager, Mr. Parker, has returned from Holland, having had a difficult trip through Continental fogs, which seem to be general.

The Club hope to have their new School machine turned out early in the New Year, fitted for blind flying and night flying, and also equipped with wireless.

Referring to previous Brooklands notes, readers are reminded that this School will be closed from 5.30 p.m. on Wednesday, December 23, until 8 a.m. on Thursday, December 31.

A mechanic is being left on duty during this period for the convenience of private owners, and petrol and oil will be available.

BRISTOL & WESSEX AEROPLANE CLUB.—Since the first week of December Bristol has experienced a continuous spell of fair weather, which has been reflected in increased hours of flying by the Bristol & Wessex Aeroplane Club, as compared with December, 1930. During the month two pupils have completed the licence tests, and six others remain under instruction.

One of the Club aeroplanes is being fitted up for blind flying, and a blind-flying course for members of the Club will begin early in January. The charge for blind flying will be at the ordinary dual rate of £2 10s. an hour.

A CORNISH FLYING CLUB.—A light aeroplane club is being formed for Cornwall at Trewinnard Manor, St. Erth. It will be run in conjunction with a flying school which will offer sound and comprehensive training in ground subjects as well as in dual-control machines. It is hoped to open the club at Easter or in the early summer. Mr. W. Hornby, Trelissick, Hayle, is the hon. treasurer.

NORTHAMPTON.—Christmas has induced the Northampton Aero Club to produce a special number of *The Sywell Windstocking*. This is an amazing and ambitious journal for a club, with stiff covers and some 40 pages. At its price of 6d. monthly it should prove very popular among the club members. We are glad to learn from this that the Wellingborough Council have decided to paint an air sign on the top of their gasometer, and also that Northampton is contemplating the same action. This should be followed by all other local authorities. The cost, though larger than generally thought, is not really prohibitive, and undoubtedly if other towns were to do this it would assist flying enormously, particularly in bad weather. One would have thought that local authorities would have been only too glad to have their town advertised in this way, but that is not so in all cases; though (thank goodness) few have taken the extraordinary attitude of one gas company not so far from London which demanded £1,000 per year from the authorities of an adjacent aerodrome in return for permission to have the name painted on top of their gasometer, although the authorities were prepared to do the work themselves.

An important announcement is that Mr. Henry Deterding has taken over the club, and will run it until the end of April next. Mr. Deterding will guarantee any loss the club may sustain during that period, and any profits will be handed back to the club. This arrangement should smooth out any difficulties there were previously as to the club's policy.

"Sandy MacTavish" is contributing the Information Bulletin in his own inimitable style, and Capt. D. Davis has written an interesting section entitled "Trials of an Instructor," thus altogether making an excellent and very readable magazine.

MESSENGER BOYS NOW!—Following Busmen, Bank Clerks and Milkmaids, the Messenger Boys of the Commercial Cable Co. have now formed a Flying Club. A scholarship of the value of £70 is to be offered by B.A.T., Ltd., for subsequent competition among the boys. The winner will be taught to fly, and will afterwards be given precedence in duties requiring air transport.

THE B.A.C. "HYDROGLYDER": Two views of the glider with which Mr. Lowe Wylde has been carrying out tests on the Welsh Harp, Hendon. (Flight *Photos.*)

Airport News

DEVELOPMENTS AT IPSWICH

AFTER a period during which its fortunes have to a large extent been at stake, things now look brighter for the municipal aerodrome of Ipswich and for the Suffolk and Eastern Counties Aeroplane Club which will continue to operate there. This is made possible by the fact that the aerodrome is being taken over by Brian Lewis & Co., Ltd., who have now completed negotiations whereby they will be granted a lease of the aerodrome and will develop it on commercial lines. Ipswich aerodrome is an exceptionally good one, both from the flying point of view and from that of manufacturers whom, it is hoped, will build factories around its edges. Access from Ipswich is easier than at the majority of municipal aerodromes, for both the trams and trains run alongside it, the former taking only eight minutes to make the journey. A further advantage is the fact that the river is only between 300 and 400 yds. away from the edge of the aerodrome, thus supplying a source of water for manufacturers and also being a possible alighting ground for seaplanes in the future. Another great advantage for manufacturers is the proximity of the aerodrome to the Aircraft and Armament Experimental Establishment at Martlesham Heath. This will save quite a considerable cost to any manufacturer who builds aircraft in the vicinity, as he will have such a short distance to send his machine to be "vetted."

BRISTOL AIRPORT

THE date for the opening of the week's demonstration of the Bristol-Cardiff air ferry has been provisionally fixed for January 9. There is, however, a possibility that the demonstration will have to be postponed for a short period owing to the surface condition of a portion of the new Cardiff Municipal Aerodrome, where the land drainage has not been operating satisfactorily. The Cardiff authorities are making every effort to satisfy the Air Ministry requirements in this respect by January 9.

Many applications for seats in the Imperial Airways Avro 10, which is to operate on the service, have already been received, and it is to be hoped that this can be taken as an early indication that a regular service across the Bristol Channel would be well supported by the public, which is the primary object of the week's demonstration.

Bristol Airport is now being provided with sufficient night-flying equipment for occasional and emergency night landings. Electric obstruction lights are being fitted on the aerodrome buildings and boundary lights around the perimeter of the landing ground have been provided. For the present no flood lighting will be available, but a landing T consisting of Money flares will be put out when required.

Aerodromes in Malta

IN the House of Commons, on December 9, Rear Admiral Murray Sueter raised the question of developing a second aerodrome at Safi, Malta, but was told that though the Air Minister is fully alive to the desirability of the step, it has not been possible, on financial grounds, to proceed with the proposal.

An Aerodrome for Penang

PENANG, according to reports from Malay, is at last to have the long looked for aerodrome, and perhaps the first aeroplane will land in Bayan Lepas about the middle of April next year. Urgent instructions have been received from the Governor to expedite the work and, accordingly, the P.W.D. has already taken it in hand. The aerodrome will be 1,000 yds. in diameter, the minimum required by normal aviators. The contour survey had been completed in March and plans were to be ready a few months ago, but the delay in proceeding with the work was due to final sanction being temporarily withheld all this time.

An Aerodrome over the Thames?

THE Lord Mayor of London (Sir Maurice Jenks), speaking to some school boys at Clapham on December 12, said that a proposal had been made for an elevated aerodrome, 200 ft. above ground level, over the Thames in the neighbourhood of Charing Cross. This is not the first proposal of that sort, for it will be remembered we referred in our issue of June 12 last to a scheme proposed by Mr. C. W. Glover for an elevated aerodrome over King's Cross and St. Pancras railway stations.

FRANCE–MADAGASCAR IN 13½ DAYS

THAT the modern light aeroplane is far removed from the "toy" class, fit only for cruising around an aerodrome, or at best for short cross-country journeys, is being demonstrated almost daily. Hinkler's famous flight from New York to London via South America and Africa was made on a "Puss Moth" of 120 h.p. Butler's flight from England to Australia was made on a diminutive "Swift" of only 75 h.p. And now a French pilot has made a flight from France to Madagascar in 13½ days on a little Mauboussin monoplane with 45-h.p. Salmson engine.

René Lefèvre (the companion of Assolant and Lotti in the Transatlantic flight of the "Oiseau Canari") left Orly aerodrome, just south of Paris, at 11.45 a.m. on December 1. The Mauboussin is a cabin monoplane (high-wing) fitted with the Salmson AD9 engine of 45-50 h.p., and the particular machine flown by Lefèvre carries the identification letters F-AJUL, and is fitted with extra petrol tanks which give it a range of about 1 200 km. (745 miles) and a duration of approximately 10 hours.

Lyons was reached in the afternoon of December 1, and the next day Lefèvre got as far as Cannes, where he landed shortly after noon. On December 3 the crossing of the Mediterranean was successfully accomplished. Starting from Cannes at 6.20 a.m. and flying via Corsica and Sardinia, the Mauboussin alighted at Tunis at 12.50 p.m., having made the flight across the Mediterranean in 6½ hours. After less than an hour's stop at Tunis for refuelling, Lefèvre set out again, but bad weather compelled him to alight at Gabès at 4 p.m. From there the flight continued via Bengazi and Tobrouk to Heliopolis and Wadi Halfa, but at the moment exact details of the rest of the flight are not available beyond the fact that Lefèvre safely reached Madagascar in 13½ days' total lapsed time. For a machine with an engine of such low power the flight must rank as a very meritorious one.

Air Survey of the Nile Sudd Area

THE Air Survey Co., Ltd., has completed its work on the Sudd area of the Nile, and as a result plans are being considered for making a by-pass canal so as to bring the waters of the river from Mongalla to Malakal without their having to pass through the Sudd area. We hope to deal with this interesting piece of air work in greater detail as soon as a full account is available.

LORD WAKEFIELD AT THE FORUM CLUB

LADIES are showing an ever increasing interest in aviation, and on Tuesday evening, December 15, they paid tribute to the great work of Lord Wakefield for those who fly, by holding a dinner in his honour at the Forum Club. This dinner was certainly the best which the Aviation Group of this club have so far held. They were fortunately able to muster a large number of prominent guests, including, besides Lord and Lady Wakefield; Mrs. Bruce, Sqd. Ldr. H. J. Hinkler, Flt. Lt. G. Stainforth, Capt. de Havilland, Mr. Handley Page, Mr. J. D. Siddeley, Miss Amy Johnson, Miss Peggy Salaman, and Mr. Kaye Don.

MRS. SHELMERDINE, as Chairman of the Group, presided at the dinner, and in introducing their guest of honour she said that it was an auspicious occasion, as he was 72 last Saturday. Lord Wakefield was, she said, a wonderful benefactor to British aviation and a great optimist, and only last Saturday at a public gathering he announced the fact that he believed the passing of 1931 would see the end of the present wave of economic and financial depression. Mrs. Shelmerdine sketched in brief the career of Lord Wakefield in so far as it was connected with aviation. He started, she said, in 1910, when he spoke on the imperial aspects of aviation, and she followed with a brief description of the help which he had given such pilots as Sir Alan Cobham, Miss Amy Johnson, Sqd. Ldr. Hinkler and many others, thus enabling them to start on and successfully finish their wonderful flights. She recalled, when four years ago her husband had asked for help in establishing private and club flying in India, that help was immediately given by Lord Wakefield in a very generous manner. She referred also to the many other ways, mostly unknown to the general public, in which Lord Wakefield had been a benefactor to mankind; in fact, she said no appeal which had for its object the betterment of British aviation had as yet ever met with a refusal. Lord Wakefield had held, she said, the highest civil office of the country, as he was Lord Mayor of London in 1915, and it was at that time he opened the recruiting depôt in the Mansion House. He also supported the London hospitals generously, fostered boxing in the R.N. and R.A.F., endowed many scholarships, such as that at the R.A.F. cadet college at Cranwell, and last, but not least, was always ready to support attempts for speed records, whether with cars, motor-boats or aircraft. He had been the means of enabling Sir Malcolm Campbell to win back the record for us on land. He had supported Sir Henry Segrave and also Mr. Kaye Don in regaining for Britain the world's water-speed record in *Miss England II.*

LORD WAKEFIELD, in replying, adopted his typically optimistic, but somewhat whimsical, attitude, and said that he had been very pleased to listen to Mrs. Shelmerdine's kind speech, for he realised that it was good to praise men in public life, for thus (after a pause) will they be stimulated to do better! Lord Wakefield referred to the occasion in 1910 when he spoke upon British aviation. He said that it was at the Drapers' Hall, and the Duke of Argyll was in the chair; moreover, the speeches on that occasion were reprinted in pamphlet form, a copy of which he still possessed, thereby enabling him to confute the critics who might question his early association with aviation. He stressed the fact that he gets much pleasure out of helping youth, for he said the present generation still has iron in its blood and is made of the same stuff as the generation which laid the foundations of our Empire. With regard to his optimism, he made reference to the fact that he had recently been asked what he thought about the £, and quoted his reply, in which he said that next February, or thereabouts, should see the turn of the tide for the better. In conclusion, Lord Wakefield paid tribute to the part Lady Wakefield had played in his success in life, and he said that behind us all was the inspiration of a mother or a wife, and he personally was a great believer in the good which women were going to do in aviation.

MRS. VICTOR BRUCE said she was proud to pay tribute to Lord Wakefield, for he always believed in those who wished to do things in aviation, long before other people did. She then read a list of the prominent people who were present that evening, and introduced each in turn to the guests. Referring to Sqd. Ldr. Hinkler's flight, Mrs. Bruce stressed the fact that during his long trip across the South Atlantic he had seen the water on very few occasions, and this must therefore have made it very much more terrifying than it would have otherwise been, but in any case such a long flight over water was a very marvellous one. Mrs. Bruce went back to the beginnings of her own flight, when she always hated the idea of flying, but was gradually converted by the exploits of other people and of Miss Amy Johnson in particular. She recounted little incidents which she had noticed during her flight, and in particular one amusing one where she was told that in America one could always tell if one was flying off a recognised air route, as then the chickens and cows would start to dash about, for there they were not used to aircraft. One interesting point she brought out was that houses, where they are within easy access of an aerodrome, sell and let for a very much better price than those which are not. Mrs. Bruce bemoaned the fact that, over there, there was little private and club flying, the lack of which made things very dull, particularly when she arrived after a long and possibly hazardous flight.

SQD. LDR. HINKLER, in rising to address the gathering, remarked that he felt a regrettable weakness in his undercarriage, particularly as he was facing such a distinguished gathering. He referred with gratitude to the support which Lord Wakefield had given British aviation, thus enabling British aircraft to go all over the world, and so show the flag in places where they would not have been seen. Flying, he said, was a wonderful education and an extremely interesting one. By way of example, he quoted that, before arriving at Jamaica, that island had meant rum to him, but now it meant bananas! He deprecated the fact that he, as one of the chorus of pilots of the "British Aviation Revue," should have to talk, for he said the real heavy weights of the front bench of the "Aviation Parliament" were to follow, and they knew far more about speaking than he did.

MR. J. D. SIDDELEY said that he was not quite sure that he agreed with the previous speaker that women were the means of inspiration, for he himself well recollected how he had had to wait until his wife was out of the country before he had been able to make his first flight. He stressed the enormous amount of good which Lord Wakefield had done, and said that he was an example whom we should all follow. Very few of the record flights there had been in recent years, he said, would have taken place but for him, and those who secured his help were fortunate in that enterprises helped by him nearly always had a happy and successful ending. Mr. Siddeley referred to the fact that Lord Wakefield also, as he himself had, had come from Lancashire, and quoted a very old saying to the effect that it was always a good thing to put one of the younger boys in the oil trade, as the living was good and came of its own accord. That, however, he said, was not the case with Lord Wakefield; he had had to work hard to gain his success.

MR. KAYE DON said that he felt diffidence in speaking before so many aviation experts, for he himself had not flown for a very long time. He referred chiefly to his recent success in *Miss England II,* which was entirely due to the help of Lord Wakefield. It was unofficially announced, he said, that Mr. Gar Wood had already equalled that record, but he was not worrying, as Lord Wakefield had decided to build *Miss England III,* with which they were quite confident of raising and retaining the record.

MR. HANDLEY PAGE, in his usual humorous manner, took Sqd. Ldr. Hinkler's remarks as to the heavy weights of aviation to refer to himself; "but, he said, the best things are not always done up in small parcels; in fact, the elephant is one of the most sagacious of all animals." Nevertheless, he said, the flea was a great stimulant, and therefore both probably had their uses. He referred to the fact that a very dear lady friend of his had already flown in a well-known large aircraft carrying 40 passengers, but he himself had not done so. He had no doubt, however, that he would now be inspired to make this flight since having learnt that women were the inspirers behind the great flights made by most men. He asked the assembly to call Hinkler "Bert," and not "Sqd. Ldr. H. J.," etc., as it was much more endearing and more in keeping with this marvellous little pilot as they knew him. He was glad to hear Lord Wakefield say he dreamed dreams and saw visions, he said, for he seemed to remember a text saying that young men should see visions and old men should dream dreams. This went to prove that evidently Lord Wakefield, who is the greatest benefactor to the young, combined in himself those qualities of both youth and age, and was therefore able to see the visions as well as dreaming the dreams.

Mr. C. G. Grey moved a vote of thanks to the Chairman, Mrs. Shelmerdine. He also, he said, was glad to hear that women were the inspirers of men and could induce them to do things, for now, he said, all they would have to do was to get round Mrs. Shelmerdine, and then we, no doubt, should be able to get a great deal done through Col. Shelmerdine, the Director of Civil Aviation. With regard to Lord Wakefield's prophecy that the tide would turn in February next, he said that Lord Wakefield had a habit of backing winners, and if there was anything to be made out of the £ at that date, then he himself would back it. In conclusion, he asked everyone to drink the health of their Lady Chairman.

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HINKLER AT THE ROYAL AERO CLUB

SQD. LDR. H. J. L. HINKLER, A.F.C., D.S.M., R.A.A.F., was entertained at a House Dinner held in the Royal Aero Club on Wednesday evening, December 18. Lord Wakefield, who was to have taken the chair, was unfortunately unable to preside, and Mr. Handley Page officiated in his stead. "H.P.," in his opening speech, read a letter from Lord Wakefield expressing the latter's great regret that he was unable to be present, and paying tribute to the magnificent flight of the guest of the evening. He went on to sketch Bert Hinkler's career from the time he joined the R.N.A.S. in 1914, following on with his attempt, immediately after the war, to fly home to Australia on a "Dove," and so to his non-stop flight to Turin in the Avro "Baby" with the little 35-h.p. Green engine. This flight was, he said, the forerunner of all long-distance flights, and started the present-day craze for this form of recreation. Hinkler's record flight to Australia in 15 days was next described, and finally his last magnificent effort in flying the South Atlantic solo after having made the first flight from New York to Trinidad. Hinkler, he said, was, as already announced, being presented with the gold medal of the Royal Aero Club in recognition of this achievement.

Bert Hinkler himself then said that many people had told him that he was sadly lacking in a sense of publicity, and he had therefore decided to be his own publicity agent, for which purpose he was going to read out a number of so-called records which it is said he had created by means of his flight. These were:—The first British aircraft to arrive in Jamaica; the first non-stop flight of any nationality to Jamaica from New York; the first land machine to land in Jamaica; the first British aircraft to fly over the Caribbean Sea; the first non-stop flight between Venezuela and Trinidad; the first British aircraft to fly to the coast of South America; the first land aircraft to fly eastward along that coast; the first aircraft to land at Pera on the Amazon; the first British aircraft to land at Ceara; the first solo flight across the South Atlantic; the first British machine to fly over the South Atlantic; the first west-east successful flight over the South Atlantic; and the first Canadian registered aircraft to arrive in England under its own power. Bert Hinkler then described many of the more interesting incidents of his flight, such as the exceptional weather he found near Jacksonville on one occasion when preparing for this flight. He treated his arrival in Jamaica lightly, and similarly glossed over the difficulties he had encountered when flying from Trinidad to Natal. He mentioned the great surprise he had felt when he saw a "Moth" coming out to meet him from Trinidad. He then described some of the sights he had seen on his trip over the South American jungle, mentioning the wonderfully coloured birds and in particular the enormous flocks of scarlet ibis which he had seen flying beneath him. Incidentally, the "Ibis" is the name chosen by Bert Hinkler for the small amphibian boat which he built in this country and which was illustrated in Flight of December 18, 1931. The Amazon struck him particularly as a real river, for it took him, he said, over one hour's flying in the "Puss Moth" to cross the mouth of this "stream"! He scouted the idea that he was, as reported, arrested, the facts being, he said, that he was merely asked to wait a few days while certain papers relating to his movements were sent on from Pera. His actual flight over the South Atlantic from Natal to Bathurst, he also, in his usual modest manner, tried to dismiss in a very few words. It was only later that, in reply to a question by Mr. Handley Page, he expanded at all and described some of the terrific weather through which he had had to pass and the difficulties he had in maintaining the machine on an even keel during some of the terrible electric storms which occurred in the Doldrum regions. The flight from Bathurst to England he hardly mentioned, the only point he made being that he considered Morocco a suitable place for anyone who wished to do a little quiet flying, adding that there was an excellent flying club at Casablanca.

Col. Ormonde Darby moved a vote of thanks to Bert Hinkler for his speech, and also extended a welcome to Air Com. Kingsford Smith, who had arrived the same day with the Christmas mails from Australia and was present at the dinner. Kingsford Smith, in a few words, said he was proud to claim Bert Hinkler as a brother "Aussie." In a friendly, but admiring, way he reprimanded Bert for the risk he took in flying the South Atlantic in a "Puss Moth," and asked him if there was any big flight he was not going to do, as he himself would like to have due notice and a chance to try it.

A few other members having asked questions about particular points of the flight which, after being answered by Bert Hinkler in a few short modest words, wound up a very delightful evening.

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AN AERONAUTICAL ENGINEERING COLLEGE

Some two months ago the College of Aeronautical Engineering in Sydney Street, Chelsea, started its first course with about 60 students. The success of the scheme and the demand for the training provided were immediately apparent. Last week 20 of these students were given a preliminary examination by an Air Ministry official, it being the end of their probationary term: and of these, 18 were passed as well above the standard. A striking advertisement for the efficiency of their training

ON Saturday, December 19, this College, together with the Automobile Engineering Training College, held an annual dinner and dance at the Park Lane Hotel, London. The Principal of both Colleges, which are virtually one, certainly in so far as buildings and management go, Mr. C. H. Roberts, was in the chair, and he therefore proposed the toast of "H.M. The King." Following him came Mr. E. C. Gordon England with the toast of "The Automobile Engineering Training College."

Mr. Gordon England started by congratulating Mr. Roberts on the vast amount he had achieved in such a short time. He claimed that the apprenticeship system which had done so well in the past had now broken down, and that it was time for us to realise that boys required a thorough practical training on the lines given at this college instead of the haphazard method of gaining knowledge synonymous with the old apprenticeship system. We as a nation, he said, clung to our ancient traditions far too much, and all businesses would be far better off if they were to acknowledge this fact and allow youth to have its chance—a plea, he said, which was equally applicable to our Government. In giving a short history of the College, Mr. Gordon England said that it started in 1924 with 20 pupils, and that it now had 220, of whom 60 were aeronautical students. A particularly good innovation of the Principal, he said, was the institution of the Probationary Term Scheme. By this method pupils who gave evidence of an inability to reach the required standard were informed of the fact in order that both their time and their parents' money might not be wasted.

Referring to the instructors, the speaker informed those present that these, without exception, were chosen from among men who had spent many years actually in the industry, and that they were, therefore, fully qualified to teach the practical side of that industry. In conclusion, he suggested that the omission of Professor Low from the staff as an instructor in after-dinner speaking was a serious one.

Col. the Master of Sempill then proposed the toast of "The College of Aeronautical Engineering." He said that the College was only two and a-half months old, but was destined to grow, as aviation was going to be our largest industry, and it would therefore want a steady supply of really skilled men such as the College was going to turn out. They had on their Advisory Board, in the persons of Sir Alliott V. Roe, Col. Moore-Brabazon, Mr. Sigrist and Capt. Duncan Davis, gentlemen who had combined to build up the College so that it would turn out the type of men required; men trained in every branch of aeronautics, with a strong bias in favour of the practical side of their training. The college course, he said, was an excellent answer for those who so often had to deal with letters from fond parents who wished to start their boys on an aviation career, for the training which the students received there was such that it would be of the greatest value whatever branch of aeronautics that student eventually decided to take up. All those who received the College Diploma would, Col. Sempill said, be qualified Ground Engineers, and it was very gratifying to hear that an Air Ministry representative had within the last few days examined 20 of the first-term students in order to assess them for further training. The result of this preliminary examination was a striking tribute to the instruction, for 18 were passed as well above the standard required, while the other two were such that they should be able to pick up during the following term.

Mr. C. H. Roberts replied for both Colleges. He said that it had been his privilege to preside at the annual dinner of the Automobile Engineering Training College for a number of years, and now that privilege was greatly increased, for, for the first time, the College of Aeronautical Engineering was included. The Automobile College, he said, was founded seven years ago as a link between the schools and the industry, and it was hoped that the Aeronautical College would fill the same want. They had made a good start in obtaining the services of such an able Advisory Council, and he hoped that, with the co-operation of the aviation industry, they would soon be producing a steady supply of men suitable in every way to go out into that industry and assist it to become the most important in our Empire. In conclusion, Mr. Roberts paid tribute both to those in the industry who had helped him so much and also to his loyal staff, whom he named and eulogised in detail; space, however, is limited, and it would be impossible for us to enumerate in full all those whose ability and keenness have done so much to build up this College to where it now stands. Suffice it to say that Mr. Roberts averred that it would be impossible to find a body of men and women who were keener on their work and who—to use an aviation term—were more "flat out" to make a success of their undertaking.

Mr. Percy Bradley next proposed the toast of "Our Guests." His brain would appear to be the source from which developed the idea of the Aeronautical College. He had known Mr. Roberts, he said, for a number of years, and had come to the conclusion that he could profitably be linked up with the flying side of Brooklands. The ultimate result was the formation of the College of Aeronautical Engineering. This fact would, he felt, explain his presence on this occasion. He then read out a list of the guests whose health he had the honour of proposing, and gave a few interesting details about each one.

Among these were:—The Hon. Mr. and Mrs. Victor Bruce; Kathleen Countess of Drogheda; Capt. and Mrs. Duncan Davis, (Managing Director, Brooklands School of Flying); Mr. and Mrs. A. M. Desoutter; Col. P. T. Etherton; Miss L. Fleck, (Secretary of the College); Mr. and Mrs. Gordon England; Mr. and Mrs. Gillman, (Secretary, S.B.A.C.); Earl Howe; Prof. A. M. Low; Capt. and Mrs. A. G. Lamplugh, (British Aviation Insurance Co.); Earl of March, (whose marvellous exploits on the little M.G. Midget are so well known and who is a pilot of no mean ability); Brig. Gen. Magnus Mowat; Com. and Mrs. H. E. Perrin, (Secretary, R.Ae.C.); Capt. and Mrs. J. L. Pritchard, (Secretary, R.Ae.S.); Mr. R. K. Pierson, (Chief Designer, Vickers Aviation, Ltd.); Sir Alliott V. Roe; Col. the Master of Sempill; Flt. Lt. and Mrs. G. Stainforth; Mr. F. Sigrist.

Prof. A. M. Low, replying to the toast, said that he was very very nervous at having to perform this task, particularly so as he had just heard that Lord Howe was going abroad to procure a motor-car capable of 150 m.p.h. and even more so, as that keen advocate of safety first, Mr. Handley-Page, had been unable to come that evening. Prof. Low then interspersed his humorous stories and remarks with flashes of extremely sound common sense. For example, he said that nowadays it was vital that the young man going out into an industry should have a really sound technical and practical training upon which to work, and such a training was, he said, to be gained at a college like the College of Aeronautical Engineering, and certainly not as an apprentice in the workshops, where the knowledge gained was a matter of chance according to the work upon which the youth was engaged. Flying and motoring, he said, had helped very largely to put our civilisation where it was to-day, and a college like this one was helping to keep these great industries in the forefront of the world; he therefore expressed the hope that both Colleges would grow, and grow, and grow!

Flt. Lt. Stainforth, when called upon to speak, said that aviation owed an enormous amount to the engineering industry, and especially to such a college as this one. In reply to queries as to what it was like to fly at over 400 m.p.h., he said that the Schneider machines were quite nice, and that was all there was to it. In conclusion, he said he would like to thank everyone for the reception they had afforded him and for the pleasurable evening he was having.

Thereafter the party retired to various corners of the hotel while the floor was cleared for the appearance of the Gordon Marsh Cabaret. This was excellent, and the Sea with the Hornpipe was taken as the theme throughout. We hardly think that Mr. Gieve would have passed the uniforms as O.K., or for that matter the allegations contained in most of the songs, but, in spite of this (one might almost say *lèse majesté*), everyone will agree that the artistes deserved full marks for their show. Following the cabaret came Mr. Harry Tate in a burlesque entitled "Aviation." As usual, this veteran evoked roars of laughter at his sallies; the pity of it was that, just as everyone was getting worked up, the climax came, and amid the ruins of his busted "Autogiro" he walked off, leaving us to carry on with dancing to the tunes of Billy Sullivan's Orchestra. The management of the College should be congratulated on choosing the Park Lane Hotel as the venue for their celebration, for we, who have a large experience of such functions, always feel relieved when we see that any one we have to attend is being held there. The food is far better than at most hotels and the service exemplary; the music is always just right and the floor excellent. Above all, there is a subtle atmosphere about the place which ensures a cheerful evening whatever the party—what more could one want?

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A Schneider Substitute?

According to the Washington Correspondent of the *Daily Telegraph* a scheme for replacing the race for the Schneider Trophy, which was won outright by Great Britain this year, by an international high-speed seaplane contest for an American trophy was made public on December 15 by the National Aeronautical Association of America. The race, which, it is believed there, may become the world's speed classic, will be a competition for the Curtiss Marine Trophy, which has hitherto been the prize of the Navy and Marine Corps' seaplane races. It is planned to add **$5,000 (£1,000 at par)** prize money.

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FLIGHT ENGINEERING SECTION

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CONTENTS

SUPERCHARGING THE AEROPLANE ENGINE AND INCREASING SPEED WITH ALTITUDE

By Robert J. Nebesar.

Mr. Robert J. Nebesar, who was born in Czechoslovakia, is a Graduate Mechanical Engineer of the Technical University of Prague. After studies at the Ecole Supérieure of Paris he was with the Hispano-Suiza and Lorraine firms, and then went to the Skoda works in his native country. Some years ago Mr. Nebesar transferred his activities to the United States, and after being associated with various firms became Project Engineer to the Detroit Aircraft Corporation. The following article is a paper presented by Mr. Nebesar to the Aeronautical Division of the Fifth National Meeting of the A.S.M.E., and in this connection reference may be made to an earlier article, "The Theory of Long-Distance Flight," published in The Aircraft Engineer *of April 25, 1929. The present article deals with the advantages of using supercharged engines and flying at greater speed at considerable heights.*

The problem of high-speed transportation by aeroplane has many important factors. The desired speed depends primarily on the given distance and on the cost, that is, the efficiency of such transportation. For short distances a surplus of speed would not be justified at a higher cost; for long distances, where the questions of comfort and higher safety of daylight travel enter into the problem, a higher cruising speed is a necessity.

In this paper the author proposes to analyse the best available means of increasing speed and to obtain a criterion of efficiency which, as will be demonstrated, even for greater speeds can be kept reasonably high.

The following nomenclature is used:—

Nomenclature.

b = span of wings, ft.

$C_{D\text{ind.}}$ = coefficient of induced drag

$C_{D\text{prof.}}$ = ciefficient of profile drag

$C_{D\text{par.}} = C_{D\text{prof.}} + C_{D\text{struct.}}$ = coefficient of total parasite drag in the polar diagram (recalculated on unit area of wings)

C_L = coefficient of lift

$\varphi = \dfrac{C_{D\text{par.}}}{C_{D\text{prof.}}}$ = ratio of total parasite drag to profile drag

h = a certain altitude, ft.

$\lambda = b^2/S$ = aspect ratio of wing

L_B = power loading, lb. per h.p.

L_w = wing loading, lb. per sq. ft.

ρ_0 = standard density of air at sea level

ρ_h = density of air at altitude h

$T_{HP\text{av.}}$ = thrust horsepower available

$T_{HP\text{req.}}$ = thrust horsepower required

S = wing area, sq. ft.

V_0 = speed at sea level, miles per hour.

V_h = speed at altitude h, miles per hour

W = gross weight of aeroplane, lb.

I.—The Engine and its Efficiency in the Aeroplane

One of the main factors to be considered in flying is weight. The weight of an aeroplane consists of four parts:—

1. Weight of the *structure and equipment* of the plane, that is, wings, fuselage, landing gear, tail surfaces, flying controls, flying instruments, seats, electrical installations, gasoline and oil tanks.

2. Weight of the *power plant,* including engine mount, engine controls, engine instruments, propeller with hub, starter, gasoline and oil installations, and water radiator, water and its installation in the case of water-cooled engines.

3. *Useful load,* which includes pilots and attendants, gasoline and oil.

4. *Pay load,* that is, passengers, baggage, mail, etc., which is often included in the useful load.

The size and type of engine determines the weight of the power plant and also a part of the useful load—that is, the weight of gasoline and oil—which weight varies directly with the specific consumption of the particular type of engine. The difference in weight of tankage will be considered negligible.

Therefore, from the viewpoint of weight, two engines will be considered equivalent if they will enable us to

TABLE I.—COMPARISON OF TWO IDENTICAL 'PLANES WITH DIFFERENT-SIZED POWER PLANTS.

1 Gross Weight, Lb.	2 Pay Load, Lb.	3 Total Rated H.p.	4 Range at Cruising Speed, Miles.	5 Range in Hours.	6 High Speed, M.p.h.	7 Cruising Speed, M.p.h.	8 Fuel Capacity, Gall.	9 Fuel Consumption at Cruising Speed, Gall. per Hr.	10 Take-off Distance at Sea Level, Ft.	11 Climb at Sea Level, Ft. per Min.	12 Wing Load, Lb. per Sq. ft.	13 Power Load, Lb. per H.p.
4,500	1,100	420	700	4·6	180	152	100·0	21·7	700	1,350	16·35	10·70
4,500	1,500	300	700	5·2	160	135	81·5	15·7	980	850	16·35	15·00
4,100	1,100	300	700	5·2	160	135	81·5	15·7	890	950	14·90	13·65

obtain the horsepower per pound of combined weight of power plant and fuel for the same number of hours of flying.

From the standpoint of speed, flying range and transport capacity, this would be much more complicated, and no definite relation could be determined. The frontal area of the power plant, its adaptability for efficient cowling, would have to be considered. Also, the speed of the engine would be of great importance due to propeller efficiency.

The best way of comparing two different engines would be to test them out on a given plane, *e.g.*, a six-passenger single-engined machine having a pay load of about 1,100 lb. and a range of 700 miles. Let us therefore compare two identical planes of a well-known aerodynamically highly efficient type—the Lockheed Vega—one equipped with a 420-h.p. engine and the other with a 300-h.p. See Table I.

In order to have comparative results let us bring up the 300-h.p. plane to the same gross weight as the 420-h.p. one, the saving in weight resulting from decreased horsepower being taken care of in increased pay load.

We see then that the pay load of the 420-h.p. plane would be 24.5 per cent. of the gross load, and that of the 300-h.p. plane 33.3 per cent. of the gross, that is, an increase of 36 per cent. But the cruising speed of the 300-h.p. plane would decrease 12.5 per cent. and all its flying qualities would be very unfavourably affected. There would be a decrease of 59 per cent. in the rate of climb combined with a 40 per cent. increase in the take-off distance. Even in bringing the pay load down to the value of the 420-h.p. plane (as shown in the third line of Table I), the flying qualities would not be much improved; climb would be still 42 per cent. lower, and take-off distance 27 per cent. longer, while cruising speed would remain at its low value.

Now let us see what would happen if we went in the other direction, namely, increase the horsepower.

The higher horsepower would increase the speed and improve the flying qualities of the plane to an unnecessary extent, but the pay load would decrease. In order to keep the pay load at the same percentage of gross weight, we should have to employ a larger-sized plane—a problem which will be considered later.

For the case in question it will be seen that the combination of wing and power assumed is the most desirable. A landing speed of 62 m.p.h. for a plane with all-around good control at low speeds is within reasonable limits.

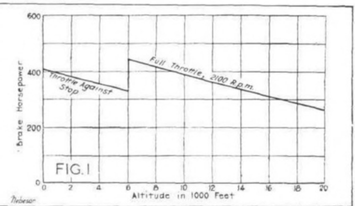


Fig. 1.—Power at Altitude: Pratt & Whitney "Wasp," Series SC engine.

Flying at altitude with a standard engine would decrease the speed and also the cruising range, owing to the lower efficiency of such an engine at altitude. This will be shown in the next section. However, there is a decided advantage in altitude flying with a supercharged engine.

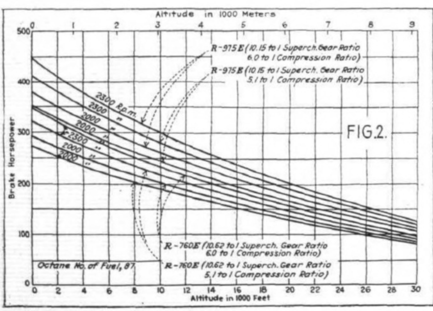


Fig. 2.—Estimated Power at Altitude: Wright "Whirlwind" engines.

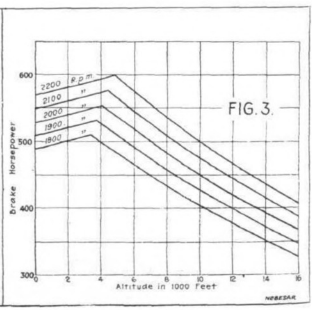


Fig. 3.—Power at Altitude: "Jupiter" XF AM and XF AB engines.

The weight of a supercharged engine delivering a constant horsepower at a certain altitude would not be practically increased, and the specific fuel consumption would not be much higher, because of the higher compression ratio and therefore the greater thermodynamic efficiency of such an engine.

As the speed of the plane would be increased and the combined power-plant and fuel weight per horsepower would be constant, the range of the plane would increase with the speed for the same pay load; and as the good flying qualities, landing speed, take-off, and climb would be maintained, we should have a more efficient, more desirable aeroplane.

Fig. 1 shows the performance at altitude of a Pratt & Whitney "Wasp" Series SC engine, which has a 5.25 : 1 compression ratio, and a 10 : 1 impeller gear ratio, and develops 450 h.p. at 6,000 ft. altitude.

Fig. 2 shows the altitude performance of Wright "Whirlwind" J.6 engines and Fig. 3 that of English "Jupiter" engines.

The Diesel engine would seem to offer many advantages for altitude flying. As it has a high compression ratio and excess of air and oxygen, the power at altitude decreases slower than with the gasoline engine. This has been verified by different flight tests, where the top speed increased to a maximum value at an altitude of 8,000 ft. Further, the lower specific fuel consumption will, of course, extend the cruising range.

The power at altitude of a 225-h.p. Packard Diesel engine is given in Fig. 4.

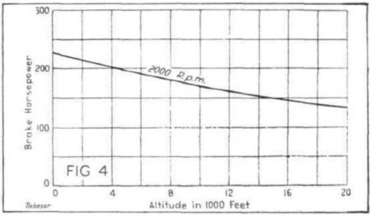
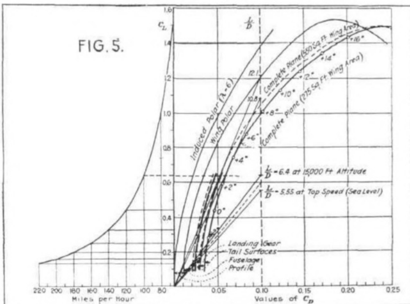


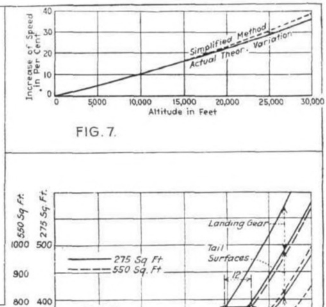
Fig. 4.—Power at Altitude: 225 h.p. Packhard Diesel engine

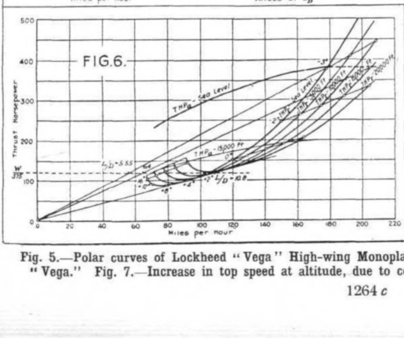
II.—Speed at Altitude

Before developing the mathematical equation for high speed at altitude, let us consider the problem for a certain plane, the polar curve of which has been established from the test results as shown in Fig. 5.

The maximum lift coefficient (C_L = 1.5) and wing loading (16.35 lb. per sq. ft.) determine the stalling speed of 65 m.p.h. Due to the ground effect, the landing speed is few miles lower. To any lift coefficient there corresponds a certain speed at sea level—shown by means of the curve at the left in Fig. 5. The efficiency of flying at any speed, or any angle, can be determined by projecting that point corresponding to the desired speed, or angle of attack, on the polar curve from zero point on the vertical line through C_D = 0.10, where we find the value of L/D. The efficiency, as determined by the L/D ratio, depends very much on the wing loading, and therefore on speed. For planes with low wing loading and with large wing area, a higher value







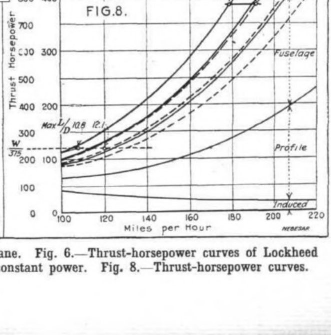


Fig. 5.—Polar curves of Lockheed "Vega" High-wing Monoplane. Fig. 6.—Thrust-horsepower curves of Lockheed "Vega." Fig. 7.—Increase in top speed at altitude, due to constant power. Fig. 8.—Thrust-horsepower curves.

of L/D max. could be reached, but the speed would be much lower. For increasing speed the ratio L/D would decrease.

In the present case the maximum L/D is 10.8, and is reached at an angle of attack of +3 deg. for a speed of 95 m.p.h. For the high speed of 179 m.p.h., corresponding to a angle of −3 deg., the value of L/D is only 5.55.

Let us now transform our polar curve into the regular required thrust-horsepower curve, as shown in Fig. 6, and see what happens at altitude. To any point on the required thrust-horsepower curve at sea level would correspond a point in altitude where the speed, as well as the thrust horsepower required, would increase in the ratio of the square root of the air densities:

$$\frac{V_h}{V_0} = \sqrt{\frac{\rho}{\rho_h}} \quad \text{......[1]}$$

$$\frac{T_{HP\ \text{req.}\ h}}{T_{HP\ \text{req.}\ 0}} = \sqrt{\frac{\rho_0}{\rho_h}} \quad \text{......[2]}$$

If we neglect the variation in slipstream effects on wing and tail, the given angle of attack will maintain its L/D ratio and will shift on a line passing through the zero point; and the value of L/D can be read on a horizontal line corresponding to $W/375$. Plotting the thrust-horsepower-available curve we check the high speed of 179 m.p.h. corresponding to the angle of attack of −3 deg.

For the case of a standard engine, the thrust horsepower available at constant speed would decrease in the ratio given in the empirical formula:

$$\frac{T_{HP\ ah}}{T_{HP\ a0}} = \left(\frac{\rho}{\rho_0}\right)^{1.35} \quad \text{......[3]}$$

In order to visualise the decrease of speed at altitudes, some of the altitude curves have been plotted in Fig. 6. These show that the speed decreases very rapidly and the angle of attack increases rapidly. For an altitude of 15,000 ft. the high speed is only 152 m.p.h., and the angle of attack about 0 deg.

For a supercharged engine, if we neglect the increase in efficiency of the propeller due to higher value of V/ND, the speed will increase and the angle of attack will increase but slowly. Nevertheless a better L/D value for higher speed will be reached. For an altitude of 15,000 ft. the speed would be 206 m.p.h., L/D would increase in same ratio, from 5.55 to 6.4, and the angle of attack would increase to about $-2\frac{1}{2}$ deg.

If we replot the change in the angle of attack on the polar diagram, Fig. 5, a mathematical expression for the increase in speed at altitudes may be developed.

Since the equation for the thrust horsepower required for steady horizontal flight at sea level is:

$$T_{HP\ \text{req.}\ 0} = \frac{1}{375 \times \pi \times 0.002558} \times S \times \left(\frac{W}{S}\right)^2 \times \frac{S}{b^2} \times \frac{1}{V_0} + \frac{0.002558}{375} \times S \times C_{D\text{par.}} \times V_0^3 \quad \text{......[4]}$$

for top-speed flight the thrust horsepower required at that speed must equal the maximum thrust horsepower available.

As stated in Equation [2], the thrust horsepower required for a given angle of attack increases at altitude as the square root of the air density. Then, since at an altitude h (density ρh) the thrust horsepower required equals the maximum thrust horsepower available at sea level, the corresponding thrust horsepower at sea level for a given angle of attack would be:

$$\frac{T_{HP\ \text{av. max.}}}{\sqrt{\frac{\rho_0}{\rho_h}}} = \frac{1}{375 \times \pi \times 0.002558} \times S \times \left(\frac{W}{S}\right)^2 \times \frac{S}{b^2} \times \frac{1}{V_0} + \frac{0.002558}{375} \times S \times C_{D\ \text{par.}} \times V_0^3 \quad \text{......[5]}$$

From this equation we can determine the corresponding speed at sea level, and the top speed at the altitude h will be

$$V_h = V_0 \times \sqrt{\frac{\rho_0}{\rho_h}} \quad \text{......[6]}$$

Equation [5] is of the fourth degree and to solve it for speed V would be somewhat difficult, but if we analyse its components we can obtain very simple results.

The portion

$$\frac{1}{375 \times 0.002558 \times \pi} \times S \times \left(\frac{W}{S}\right)^2 \times \frac{S}{b_2} \times \frac{1}{V_0}$$

of Equation [5] is the induced thrust horsepower required and varies inversely as the speed. For usual wing loading W/S is about 16 lb. per sq. ft. and the aspect ratio S/b^2 about 6, and for high-speed, well-designed planes its value at top speed would be about 5 to 10 per cent. of the total thrust horsepower required. Its variation with speed with the supercharged engines up to 30,000-ft. altitudes is small, as may be seen from the polar curve.

The portion

$$\frac{0.002558}{375} S \times C_{D\ \text{par.}} \times V_0^3$$

of Equation [5] is the parasite thrust horsepower required. It depends primarily on the aerodynamical fineness of the design, the value $C_{D\ \text{par.}} = \varphi \times C_{D\ \text{prof.}}$, being measured in terms of the profile drag coefficient. For the range of speeds considered, this portion of the drag can be assumed constant, that is, $C_{D\text{par.}}$ is parallel to $C_{D\text{ind.}}$ and increases as the cube of the speed.

Neglecting the variation of the induced thrust horsepower required for a range of speeds up to 30,000 ft. altitude, as previously stated, we can, for a given plane, by substituting the constants A, B and C, transform Equation [5] as follows:

$$\frac{A}{\sqrt{\frac{\rho_0}{\rho_h}}} = B + C \times V_0^3 \quad \text{......[7]}$$

and

$$V_0 = \sqrt[3]{\left(\frac{A}{\sqrt{\frac{\rho_0}{\rho_h}}} - B\right) \times \frac{1}{C}} \quad \text{......[8]}$$

Top speed at altitude h will then be

$$V_{h\ \text{max.}} = \sqrt[3]{\left(\frac{A}{\sqrt{\frac{\rho_0}{\rho_h}}} - B\right)\frac{1}{C}} \times \sqrt{\frac{\rho_0}{\rho_h}} \quad \text{......[9]}$$

Top speed at sea level is

$$V_{0\ \text{max.}} = \sqrt[3]{(A - B)\frac{1}{C}} \quad \text{......[10]}$$

and if we omit the constant B, whose influence on top speed at sea level is approximately the same as at altitude, we obtain a simple equation

$$V_{h\ \text{max.}} = V_{0\ \text{max.}} \sqrt[3]{\frac{1}{\sqrt{\frac{\rho_0}{\rho_h}}}} \times \sqrt{\frac{\rho_0}{\rho_h}} = V_{0\text{max.}} \times \sqrt[3]{\frac{\rho_0}{\rho_h}} \quad \text{[11]}$$

or the speed at altitude increases as the cube root of the air-density ratio.

For the altitude of 30,000 ft. the difference between the speed obtained with this simplified method and the theoretical value calculated for a given case will be little over 2 per cent., and the increase of speed will be only 36 per cent. instead of 39 per cent. as given by Equation [11].

Curves showing the increase of top speed at different altitudes are given in Fig. 7.

III.—Effect of Size of Plane

The size of the plane is of primary importance in obtaining high speed and flight efficiency.

In Fig. 5 there is shown the polar curve of a six-passenger plane with 275 sq. ft. wing area. The wing loading is 16.35 lb. per sq. ft. and the power loading 10.7 lb. per h.p. The maximum L/D is 10.8, and for a top speed of 179 m.p.h. $L/D = 5.55$.

From different flight and wind-tunnel tests the author has determined the drag of different parts of the plane and has plotted the corresponding values in the polar diagram, Fig. 5, and in the thrust-horsepower diagram, Fig. 8. Due to the angle of incidence of wing and to the interference, it has been found that the drag coefficients for fuselage, tail surfaces, and especially landing gear decrease as the low angle of attack is approached. The wing-profile drag-coefficient variation is taken from data obtained with the Langley Memorial Aeronautical Laboratory high-density wind tunnel (N.A.C.A. Tech. Note No. 367, Fig. 6).

12 m.p.h. in speed, with increased efficiency. L/D at high speed will be = 6, as compared with 5.55 for the 275-sq. ft. plane.

Flying at altitudes would still improve the efficiency, and the speed would increase quite considerably. At 20,000 ft. altitude the top speed of 233 m.p.h. could be easily attained.

Apart from the aerodynamical advantage obtained, the improvements will be as follow:—

1. Weight saving; a more efficient and lighter structure could be built for a larger unit.

2. More comfort for passengers could be provided because of a larger and roomier fuselage.

3. Better inherent stability could be obtained, because of the easier problem of weight distribution and the increased damping moment of a larger aeroplane. It has been shown by Prof. Klemin that the disturbing moment increases with the cube of the dimensions of the aeroplane, while the damping moment increases with the fourth power.

TABLE II.—EFFECT OF INCREASING SIZE OF 'PLANE.
(Single-engined 'plane; speed, 100 m.p.h.)

	S = 275 sq. ft.; W = 4,500 lb.				S = 550 sq. ft.; W = 9,000 lb.			
	Area or Cross-section, in Sq. Ft. (or size).	Drag. Lb.	Per cent. of Wing Profile Drag.	Thrust Horse-power required.	Area or Cross-section, in Sq. Ft. (or size).	Drag. Lb.	Per cent. of Wing Profile Drag.	Thrust Horse-power required.
Wing induced	275	153	—	40·8	550	306	—	81·6
Total parasite: Wing profile	275	88	—	23·4	550	176	—	46·8
Total parasite: Fuselage group, including wind-shield, engine, and cowl	18	94	106·8	25·0	28	146	83·0	39·0
Total parasite: Tail surfaces—horizontal and vertical	70	40	45·5	10·6	99	56·5	32·1	15·0
Total parasite: Landing-gear group, including wheels, struts, and tail wheel	32 × 6 wheels	46	52·3	12·2	36 × 8 wheels	66·0	37·5	17·6
Total	—	421	204·6	112·0	—	750·5	152·6	200·0
$\varphi = \frac{C_D\ par.}{C_D\ prof.}$	—	—	3·046	—	—	—	2·526	—
L/D	—	$\frac{4,500}{421} = 10·7$	—	—	—	$\frac{9,000}{750·5} = 12$	—	—

The values of drag and thrust horsepower required for these different items at 100 m.p.h. are tabulated in the left half of Table II.

The efficiencies of the different parts of the plane are compared with the efficiency of the wing on the basis of the ratio of the drag of each part to the profile drag, expressed as a percentage. φ = 3.046, and L/D at 100 m.p.h. = 10.7.

Let us now consider a larger plane—twice the size—of similar design. The wing and power loading will be kept the same, so that the landing speed, take-off and climb will not be changed.

The drag and thrust horsepower required at 100 m.p.h. for this plane of 550 sq. ft. wing surface are given in the right half of Table II. We can accordingly visualise how the corresponding parasite drags decrease in their ratio to the wing drag.

The fuselage drag coefficient is only 77.6 per cent. of that of the smaller plane; the tail surfaces drag coefficient, 70.6 per cent., and the landing-gear drag coefficient, 71.8 per cent.

The ratio of total parasite drag to wing profile drag, or φ, is decreased to 2.526, and L/D at 100 m.p.h. is increased to 12.

Corresponding values are plotted in the polar diagram, Fig. 5, and shown by broken lines.

The thrust-horsepower curves are shown by broken lines in Fig. 8 to half-scale, so that the induced and profile thrust-horsepower curves for 275 and 550 sq. ft. wing are identical. We can check up an increase of

4. The aeroplane will have a lower operating cost per passenger, not only because of higher aerodynamical efficiency, but also because of proportionally lower investment and depreciation charges. The cost of material and production for a large machine is proportionally lower than that for a small one.

A NEW LIGHT ALLOY

A NEW light alloy has recently been put on the market by James Booth & Co. (1915), Ltd., of Birmingham.

The new alloy is known as M.G.7, and is protected by patent rights. It is composed mainly of aluminium in combination with magnesium and manganese in such proportions as to produce a material having a specific gravity of only 2.63, whilst its mechanical properties are similar to those called for by the B.E.S.A. Specifications for the well-known wrought light alloy "Duralumin." Official specifications are under preparation, and, it is expected, will be issued shortly.

A particularly prominent and useful characteristic of this alloy is that its resistance to corrosion is claimed to be very high indeed, and it is particularly applicable in those circumstances where intercrystalline corrosion is to be feared.

M.G.7 alloy can be produced in all the usual wrought forms such as sheets, tubes, bars, sections, forgings, drop forgings, wire, rivets, etc., and owing to its high inherent resistance to corrosion, the necessity for additional protection such as that conferred by the anodic process is rendered superfluous under all ordinary circumstances. This applies to all forms in which the alloy can be fabricated and is not confined, as with some other alloys, to material in the sheet form.

Another notable feature of the alloy is that no heat-treatment is necessary in order to produce the maximum strength values. In addition, the material can be welded satisfactorily by anyone ordinarily skilled in the art of welding aluminium and its alloys.

Those accustomed to manipulating light alloys will instantly recognise the value of an alloy which can be welded and yet possess its maximum strength. They will also appreciate the advantages of a material which can be shaped without having subsequently to be exposed to the risk of distortion due to the heat-treatment process.

The alloy can be softened by annealing and in the annealed condition can be readily pressed, spun and forged.

The principal properties of the M.G.7 alloy are:—Specific gravity, 2.63; annealing temperature, 380 deg. C.; forging temperature 400-420 deg. C.; fatigue range, $\pm$9.5 to $\pm$10.25 tons/sq. in.; Brinell hardness, 90-115; Izod impact value, 17 ft. lb.

	Yield Point. Tons/sq. in.	Ult. Stress. Tons/sq. in.	Elongn. Per cent. on 2 in.	Reverse Bends.
Soft sheets ...	11-14	22-24	20-26	8-10
Hard sheets ...	15-20	24-26	12-20	2-6
Very hard rolled sheets ...	20-28	26-30	4-12	2-3

LIMITS, FITS AND ALLOWANCES

By R. RODGER.

THE question of limits is always distinctly controversial and is bound to remain, more or less, a matter of personal opinion. Intensity of production must be a dominant factor affecting the evolution of a system of limits governing any particular engineering project. When that engineering project happens to be the manufacture of aircraft, mass production, as associated with the names of Morris and Ford, is negligible, and the general imposition of standard limit systems as fine as Newall's or that of the British Engineering Standards Committee does not, in the opinion of the writer, appear to be justified in view of the extra labour charges inevitably involved.

In general, a system of limits has two main objectives, viz.:—

(1) Mechanical refinement, and
(2) Interchangeability.

By far the greater proportion of an aircraft is a rigid structure, and mechanical refinement by limits does not, therefore, arise to any marked degree. One notable exception, however, is remote control by link mechanism, particularly as applied to flying controls and/or outboard engine controls.

In such cases the cumulative effect of comparatively slight chatter in the numerous pin joints of the linkage may well give rise to considerable backlash and thus occasion appreciable lag between the man-handled and controlled ends of the system. Here, the application of fine limits would appear to be indicated, but, even so, the writer finds it somewhat difficult to reconcile himself to their adoption in a mechanism wherein the levers are probably interconnected by cable which *does* stretch in service despite proof loading on the bench prior to rigging. The practice appears to be incongruent.

Furthermore, in applying a system of limits such as Newall's, for instance, it is practically essential to success that selective assembly be employed, a process which, from the point of view of the aircraft engineer, is directly antagonistic towards interchangeability, as hand-finishing is nearly always involved.

For example, using Newall's limits, consider the case of a half-inch pin required to be a push fit in a standard hole. The class B hole will be ½ in. $\pm$ 0.0005 in. and the push fit pin ½ in. $\begin{matrix}-\ 0.00025 \text{ in.} \\ -\ 0.00075 \text{ in.}\end{matrix}$ Taking extremes, we may have a hole ½ in. + 0.0005 in. and a pin ½ in. − 0.00075 in., giving a pin virtually 0.00125 in. bare. A class X running fit pin would be ½ in. $\begin{matrix}-0.001 \text{ in.} \\ -0.002 \text{ in.}\end{matrix}$ Again taking extremes, we may have a hole ½ in. − 0.0005 in. and a pin ½ in. − 0.001 in., giving a pin virtually 0.0005 in. bare, which would actually be a better fit than our push fit pin.

This example serves to emphasise the importance of selective assembly to the success of such a system of limits.

The foregoing remarks constitute the nucleus of the argument against the general application to aircraft production of any of the standard limit systems peculiar to general engineering practice, it being possible to ensure the requisite degree of interchangeability in aircraft with coarser limits and at reduced manufacturing costs.

In arriving at a decision as to the coarseness of such limits another consideration arises, and one which is critical only to aircraft practice, viz.:—

Weight Control

which must necessarily fix our ideas with regard to oversize limits.

The limits suggested in detail hereafter are not in any way advanced as hard and fast rules to be rigidly adhered to, but are, nevertheless, offered as a sound basis compatible with the various requirements—both design and production—which have to be met.

TABLE I.

General Limits.

Nominal Size.	Female Part.			Male Part.			Total Tolerance.
	High Limit.	Low Limit.	Tolerance.	High Limit.	Low Limit.	Tolerance.	
In.							
$\leq$ ½ ..	+ 0·004	+ 0·001	0·003	− 0·001	− 0·004	0·003	0·008
$>$ ½–3..	+ 0·005	+ 0·001	0·004	− 0·001	− 0·005	0·004	0·010
$>$ 3–12	+ 0·010	+ 0·001	0·009	− 0·001	− 0·010	0·009	0·020
$>$ 12–36	+ 0·015	+ 0·001	0·014	− 0·001	− 0·015	0·014	0·030

General Limits

As general limits applicable to all cases where mating occurs, the values given in Table I are suggested as constituting a satisfactory compromise.

It is here recommended as being good practice that actual figures should always be quoted on the drawing for limits, such nomenclature as "Running fit on Item 4," "Push fit on Item 6," and so on, being religiously avoided owing to the wide diversity of opinion existing amongst mechanics as to what actually constitutes any particular kind of fit.

Bolt Holes

Bolt holes in timber should be within the limits of the *nominal diameter of the bolt and* +0.02 in. They should be indicated on the drawings as the nominal diameter the bolt + 1/64 in., *e.g.*, for a ⅜ in. diameter bolt the drawing should read: 25/64 in. drill.

Bolt holes in metal fittings should be drilled 1/64 in. greater than the nominal diameter of the bolt, *e.g.*, for a ⅜ in. diameter bolt the drawing should read: 25/64 *in.* drill.

Pin Holes

The fit required for a pin will depend upon the nature of the loading to which it is subjected.

Thus, pin holes in members which are subject to either direct tension or direct compression should be drilled the nominal size of the pin, *e.g.*, for a $\frac{3}{8}$ in. diameter pin the drawing should read: $\frac{3}{8}$ in. drill.

In the case of members which are subject to alternating tension and compression, the pin holes should be reamed, *e.g.*, for a $\frac{3}{8}$ in. diameter pin the drawing should read: $\frac{3}{8}$ in. ream.

Rivet Holes

With heavy work such as one encounters in, say, structural engineering, the practice is to drill the rivet hole dead size and to drive blanks $\frac{1}{16}$ in. smaller in diameter than the hole. The blank is ordered sufficiently long so that, when upset, it flows and completely fills the hole, thus making a sound mechanical joint.

In aircraft practice this procedure must be modified owing to the comparatively small rivet sizes and plate thicknesses dealt with. Aircraft rivets are delivered fairly consistently to the nominal diameter, and the holes to house them should be drilled clearance and radiused slightly on both faces of the grip. This will ensure that the rivet, when driven, will flow and completely fill the hole, and will, furthermore, form small fillets under each head, thus strengthening the rivet by eliminating the sudden change of section under the head.

Standard Morse drills as set out in Table II are recommended for drilling rivet holes as giving satisfactory clearances, and should be quoted on the drawing, *e.g.*, for a $\frac{1}{8}$ in. diameter rivet hole the drawing should read: Drill Morse 30.

Table II.

Morse Drills for Rivet Holes.

Nominal Rivet Diameter.	Morse Drill.	Rivet Hole Diameter.
In.		In.
$\frac{1}{16}$	51	0·0670
$\frac{3}{32}$	41	0·0960
$\frac{1}{8}$	30	0·1285
$\frac{5}{32}$	21	0·1590
$\frac{3}{16}$	11	0·1910
$\frac{7}{32}$	2	0·2210
$\frac{1}{4}$	F	0·2570
$\frac{9}{32}$	L	0·2900
$\frac{5}{16}$	O	0·3160
$\frac{11}{32}$	S	0·3480
$\frac{3}{8}$	V	0·3770

Bolts and Nuts

The limits for bolts and nuts quoted in Table III are collected from the A.G.S. system of standards for these parts and should be adhered to for similar but non-standard parts.

In the case of the flats the actual limiting dimensions are given, as these are important as affecting the use of standard spanners. It is remarkable how often this point is overlooked in the design of special bolts, particularly when, for some reason or other, the head and the shank are odd, *e.g.*, a small head on a standard $1\frac{1}{2}$ in. shank.

The flats quoted in the table are to the Whitworth Standard but they show the following peculiarities. For sizes from $\frac{1}{4}$ in. B.S.F. to $\frac{3}{4}$ in. B.S.F., inclusive, the heads are stepped down $\frac{1}{16}$ in., *i.e.*, in the A.G.S. Standard a $\frac{1}{2}$ in. B.S.F. bolt has a $\frac{7}{16}$ in. Whitworth head, and so on. Similarly, for sizes from $\frac{13}{16}$ in. B.S.F. to $1\frac{3}{4}$ in. B.S.F., inclusive, the heads are stepped down $\frac{1}{8}$ in., and the 2 in. B.S.F. size is stepped down $\frac{1}{4}$ in.

As a point of interest, the width between the jaws of standard Whitworth spanners is given in the table

Table III.

Bolts and Nuts.

Nominal Size.	Shank Diameter. + 0.	Bolt Heads and Nuts. Flats. Max.	Flats. Min.	Thickness. − 0.	Standard Whitworth Spanners. Size. Whit.	Width between Jaws. Max.	Width between Jaws. Min.
In.					In.		
6 B.A.	− 0·003	0·193	0·190	+ 0·005	—	—	—
4 B.A.	− 0·003	0·248	0·245	+ 0·006	—	—	—
2 B.A.	− 0·003	0·324	0·321	+ 0·007	—	—	—
$\frac{7}{32}$ B.S.F.	− 0·005	0·413	0·410	+ 0·010	—	—	—
$\frac{1}{4}$	− 0·005	0·445	0·440	+ 0·010	—	—	—
$\frac{9}{32}$	− 0·005	0·525	0·520	+ 0·010	$\frac{1}{4}$	0·530	0·527
$\frac{5}{16}$	− 0·006	0·525	0·520	+ 0·010	$\frac{1}{4}$	0·530	0·527
$\frac{3}{8}$	− 0·006	0·600	0·595	+ 0·010	$\frac{5}{16}$	0·605	0·602
$\frac{7}{16}$	− 0·007	0·710	0·705	+ 0·010	$\frac{3}{8}$	0·715	0·712
$\frac{1}{2}$	− 0·007	0·820	0·815	+ 0·010	$\frac{7}{16}$	0·825	0·822
$\frac{9}{16}$	− 0·007	0·920	0·915	+ 0·010	$\frac{1}{2}$	0·925	0·922
$\frac{5}{8}$	− 0·008	1·010	1·002	+ 0·010	$\frac{9}{16}$	1·015	1·012
$\frac{11}{16}$	− 0·008	1·100	1·092	+ 0·010	$\frac{5}{8}$	1·105	1·102
$\frac{3}{4}$	− 0·008	1·200	1·192	+ 0·010	$\frac{11}{16}$	1·205	1·202
$\frac{13}{16}$	− 0·008	1·200	1·192	+ 0·010	$\frac{11}{16}$	1·205	1·202
$\frac{7}{8}$	− 0·009	1·300	1·292	+ 0·010	$\frac{3}{4}$	1·305	1·302
$\frac{15}{16}$	− 0·009	1·390	1·382	+ 0·010	$\frac{13}{16}$	1·395	1·392
1	− 0·009	1·480	1·468	+ 0·010	$\frac{7}{8}$	1·485	1·482
$1\frac{1}{8}$	− 0·010	1·670	1·658	+ 0·010	1	1·675	1·672
$1\frac{1}{4}$	− 0·010	1·860	1·845	+ 0·020	$1\frac{1}{8}$	1·870	1·864
$1\frac{3}{8}$	− 0·010	2·050	2·035	+ 0·020	$1\frac{1}{4}$	2·060	2·054
$1\frac{1}{2}$	− 0·010	2·220	2·200	+ 0·020	$1\frac{3}{8}$	2·230	2·224
$1\frac{5}{8}$	− 0·010	2·410	2·390	+ 0·020	$1\frac{1}{2}$	2·420	2·414
$1\frac{3}{4}$	− 0·011	2·580	2·555	+ 0·020	$1\frac{5}{8}$	2·590	2·584
2	− 0·011	2·760	2·735	+ 0·020	$1\frac{3}{4}$	2·770	2·764

enabling direct comparison, but one should note carefully that these spanners have a modified significance in aircraft practice. Thus, the spanner quoted in the table against 1 in. B.S.F. is actually a $\frac{7}{8}$ in. standard Whitworth spanner, and so on.

A general covering limit for both the overall length and the plain length of the shank is ${}^{+0.04}_{-0}$ in. In special cases, where it is desired to ensure that bearing does not occur on the thread, this limit may be reduced to ${}^{+0.03}_{-0}$ in. to permit the use of a standard A.G.S. washer under the nut. A finer limit than this is not advisable, as fine threads cut by dies are rather difficult to guarantee beyond this degree of accuracy.

Screw Threads

All B.S.F. screw threads should be in accordance with B.E.S.A. Report No. 84, and all B.A. threads with B.E.S.A. Report No. 93/1919.

Screw threads for designed parts should be of Whitworth formation, and confined to the sizes recommended in T.D.I. 532A, as given in Table IV.

Table IV.

Screw Threads for Designed Parts.

Diam.	T.P.I.	Diam.	T.P.I.	Diam.	T.P.I.	Diam.	T.P.I.
In.		In.		In.		In.	
$\frac{9}{16}$*	26	$1\frac{1}{8}$	20	2	16	$2\frac{7}{8}$	16
$\frac{11}{16}$*	26	$1\frac{1}{4}$	16	$2\frac{1}{16}$*	16	$2\frac{15}{16}$*	16
$\frac{11}{16}$	20	$1\frac{5}{16}$	16	$2\frac{1}{8}$	16	3	16
0·725*	28	$1\frac{3}{8}$	16	$2\frac{3}{16}$*	16	By $\frac{1}{8}$ steps to	—
$\frac{3}{4}$	20	$1\frac{7}{16}$	16	$2\frac{1}{4}$	16	$5\frac{1}{4}$	16
$\frac{13}{16}$	20	$1\frac{1}{2}$	16	$2\frac{3}{8}$	16	$5\frac{1}{2}$	16
$\frac{7}{8}$	20	$1\frac{5}{8}$	16	$2\frac{7}{16}$*	16	6	16
$\frac{15}{16}$	20	$1\frac{11}{16}$	16	$2\frac{1}{2}$	16	$6\frac{1}{2}$	12
0·984*	26	$1\frac{3}{4}$	16	$2\frac{9}{16}$*	16	—	—
1	20	$1\frac{7}{8}$	16	$2\frac{5}{8}$	16	—	—
$1\frac{1}{16}$	20	$1\frac{15}{16}$*	16	$2\frac{3}{4}$	16	—	—

N.B.—All threads to be of Whitworth formation.

* These threads should not be used if an unstarred size can be used instead.

(*To be continued*)

TECHNICAL LITERATURE

SUMMARIES OF AERONAUTICAL RESEARCH COMMITTEE REPORTS

These Reports are published by His Majesty's Stationery Office, London, and may be purchased directly from H.M. Stationery Office at the following addresses: Adastral House, Kingsway, W.C.2; 120, George Street, Edinburgh; York Street, Manchester; 1, St. Andrew's Crescent, Cardiff; 15, Donegall Square West, Belfast; or through any Bookseller.

THE MOTION OF H.M.A. R.101 UNDER CERTAIN ASSUMED CONDITIONS. By D. H. Williams, B.Sc., and A. R. Collar, B.A., B.Sc. R. & M. No. 1401 (Ae. 522). (17 pages and 28 diagrams.) May, 1931. Price 1s. 3d. net.

At the close of the public sittings of the Court of Inquiry* into the disaster to H.M.A. R 101, near Beauvais, on October 5, 1930, the Court asked the National Physical Laboratory to assist Professor Bairstow in certain calculations relative to the aerodynamics of the airship. Information was required as to the motion of the airship when there was a loss of lift due to leakage of gas from various gas-bags; with specified elevator movements; when encountering atmospheric disturbances; and under other conditions which might suggest themselves in the course of the work. The conditions assumed for the various cases were determined in consultation with Professor C. E. Inglis and Professor L. Bairstow, acting for the Court of Inquiry, before the cases were worked out in detail. The first cases were tentative and the results obtained in any particular case usually suggested the conditions to be assumed for the succeeding case.

The conditions assumed included loss of gas from a forward gas-bag; various amounts of heaviness; specified elevator movements; atmospheric disturbances; and increase of drag.

Though heaviness at the nose might cause the ship to dive, recovery was always possible if the elevators were put up, and she would descend finally on an inclined path with her nose up. This would also be the case if the dive were accentuated by assuming the ship to encounter a gust, although the height loss might then be serious. A second dive could be produced by assuming the engines shut down and ballast dropped.

Case N gave a flight path approximating to the final path of the ship, and included all the above assumptions. Case P shows that the ship, undamaged and in trim, with the same amount of gross heaviness, under identical atmospheric conditions, and with the same elevator movements, would not have experienced more than a normal oscillation.

* This report was submitted before publication to Sir John Simon, who presided over the Court of Inquiry.

FREE-FLIGHT SPINNING EXPERIMENTS WITH SINGLE-SEATER AIRCRAFT H AND BRISTOL FIGHTER MODELS. By A. V. Stephens, B.A. Communicated by the Director of Scientific Research, Air Ministry. R. & M. No. 1404 (Ae. 525). (12 pages and 10 diagrams.) April, 1931. Price 1s. net.

In the earlier spinning model experiments at the Royal Aircraft Establishment the models were launched in a stalled glide and in consequence most of the available height drop (81 ft.) was used in the preliminary stages of the spin. It was thought that, if the models were launched in a spin at the top of the shed, and the spins observed over the whole of the height drop, sufficiently accurate data could be obtained without making use of a high-speed camera. Accordingly, a rotary launching gear has been devised so that the models can be released with a variety of spinning motions.

Spinning tests on Bristol Fighter models were carried out with various positions of the C. G. and with six modified tail units. The moments of inertia were also varied.

Spinning tests were made on aircraft H* model and on three modified models in each of which the tailplane is raised a distance corresponding to 2·04 ft. on the full-scale machine.

It appears that models of both types can spin stably in two distinct ways at incidences in the regions of 30° and 65°. The effect of moving the centre of gravity further back was to increase the incidence of both kinds of spin. The effects on the spins at low incidences of varying the mass distribution to the extents mentioned above were very small; on the spins at high incidence, however, weights on the wing tips produced a marked increase in incidence and rate of rotation, whereas loading the fuselage reduced both incidence and rate of turn.

Raising the tail plane to a position near the top of the rudder was found to give greatly improved recoveries from fast spins at high incidence and fairing the fuselage was found to enhance these effects.

* See R. & M. 1403. Measured spins on Aeroplane H.—S. B. Gates.

THE R.A.E. AUTOMATIC OBSERVER MARK IA. By D. A. Jones, A.M.I.Ae.E. Communicated by the Director of Scientific Research, Air Ministry. R. & M. No. 1405 (Ae. 526). (6 pages and 6 diagrams.) January, 1931. Price 1s. net.

For performance and research work on aircraft, an accurate knowledge of time, height, engine r.p.m. and air speed is required, and in order to correlate these quantities the readings should be taken simultaneously. This condition cannot obtain when the readings are taken by an observer or pilot, although the errors arising with a skilled observer are perhaps small.

An instrument is described which has been designed to record automatically the simultaneous readings of instrument dials and is so designed as to be readily installed in the wireless cabin of an aircraft.

A reproduction of a portion of a record obtained during a flight is given and demonstrates that the instrument provides a satisfactory means of recording simultaneously a series of readings of height, time, engine r.p.m., indicated speed bubble inclinometer and temperature.

NOTE ON CHANGE OF WIND WITH HEIGHT. By L. W. Bryant, A.R.C.Sc. R. & M. No. 1407 (Ae. 528). (8 pages and 3 diagrams.) March, 1931. Price 6d. net.

The results of four sets of observations of wind gradient at sea are collected and analysed on the basis of the "eddy conductivity" theory due to G. I. Taylor. It is probable that the largest gradients occur at sea when eddy conductivity throughout the first few thousand feet has a low value corresponding to overcast conditions and a light wind. The lowest gradients, on the other hand, occur when the sky is clear, sunshine is brilliant and the wind gusty and moderate to strong; they may also occur in light winds when the sea is exceptionally calm and the average eddy conductivity exceptionally low.

The formula derived from experiments with smooth or moderately-rough pipes by Hopf and Fromm, viz., wind speed varies as (height) 0·157, and used by Prandtl and Tollmien in a study of wind gradients, appears to fit very well the average curve for land surfaces given by Dr. G. C. Simpson from Meteorological Office records. The same formula is also not very far from agreement with average sea conditions. There does not appear to be any definite evidence that wind gradients over the sea differ notably from over flat country.

NOTE ON THE MEASUREMENT OF THE DRAG OF SMALL STREAMLINE BODIES. By E. Ower, B.Sc., A.C.G.I., and C. T. Hutton, B.A. R. & M. No. 1409 (Ae. 530). (7 pages and 3 diagrams.) June, 1931. Price 6d. net.

Recent research has shown that the large variations in the drag of a streamline body frequently obtained in different wind tunnels, or even in the same tunnel at different times, are due to variations in the state of the boundary layer of the body. Within the normal wind tunnel range of Reynolds' number, it is found that the boundary layer is partly laminar and partly turbulent, and the ratio of the lengths of the surface over which these two states exist, and upon which the drag partly depends, is materially affected by the degree of turbulence present in the airstream. Complete wind tunnel data for a streamline body should, therefore, include a specification of the ratio of laminar to turbulent layer.

As a means of promoting turbulence in the boundary layer the fixing of a number of rings of fine thread to the surface of the body in transverse planes near the nose was suggested in R. & M. 1271 as being the most convenient from a practical point of view, and this was done in the present experiments.

To provide comparative data, as in the interference work now proceeding, and where full scale performance has not to be predicted, the most important point is that the body drag as measured in the tunnel shall not be subject to variation from day to day or in different tunnels. It would seem to be sufficient to use enough threads to give a curve of drag coefficient against Reynolds' number of what may be termed the turbulent type.

EXPERIMENTS ON THE FLOW PAST A ROTATING CYLINDER. By A. Thom, D.Sc., Ph.D., Carnegie Teaching Fellow, University of Glasgow. Communicated by Prof. J. D. Cormack. R. & M. No. 1410 (Ae. 531). (13 pages and 16 diagrams.) March, 1931. Price 1s. net.

As yet, there is no satisfactory theory giving the lift experienced by a rotating cylinder in an air stream. There seems, however, to be general agreement that the circulation is affected largely by the eddies generated on the surface. The method adopted was to measure the total head and the static pressure separately, *i.e.*, at different times all round the cylinder. Experiments were made both in still air and in an air current of 8 ft./sec. with a rotational speed of the cylinder of 820 r.p.m.

It has been shown that there is no very marked change in the circulation outside a contour of about twice the area of the cylinder section. There is also no circulation in the wake as a whole. The upper part contains positive vorticity and the lower an equal amount of (more concentrated) negative. This is in accordance with Prandtl's idea that a state of balance has been attained in the production of positive and negative eddying above and below (see R. & M. 1082).

As these earlier experiments gave no information regarding the conditions close to the surface of the cylinder, a series of measurements in the boundary layer was made in 1927. These experiments are described in the present report.

From the results it appears that for a cylinder rotating in still air, the effective coefficient of viscosity increases rapidly with the distance from the surface.

It is interesting to compare the static pressure close to the surface as obtained by the small static tube with that obtained by a different method in R. & M. 1082.* This comparison is shown in Fig. 15. Unfortunately, different cylinder diameters were used in the two experiments. The influence of the channel walls will, of course, depend on the cylinder diameter, and possibly explains the differences between the two curves.

The writer has elsewhere shown that the circulation round a contour enclosing a rotating cylinder some distance from the surface corresponds with the observed lift. Fig. 16 shows how, in the present experiment, the circulation decreases rapidly in the first millimetre from the surface and thereafter more slowly as it approaches the value corresponding to the lift.

* R. & M. 1082. The pressures round a cylinder rotating in an air current.

AMERICAN NEWS

American Marines to go Afloat

TWO squadrons, composed of six fighters each, have been organised from the Marine Corps and appointed to the aircraft carriers *Saratoga* and *Lexington*. These will become units of the regular aviation side of the Navy for the time being, in order to give Marine Corps pilots experience in operating aircraft from carriers. The *Saratoga* and *Lexington* are both operating in American waters, and are the only carriers maintained there. The *Langley* is going to the Far East, relieving the *Jason*. This will be the first American carrier to operate in Asia.

New Navy Contracts

The recent contracts placed by the Navy Department are interesting:—The Berliner-Joyce Aircraft Corporation will build 18, XOJ-1, two-seater observation aircraft of a new type, at a unit price of about $20,600 without spares. This is a somewhat smaller and lighter aircraft than the Vought Corsair, and can be operated as a land plane from carriers, as a seaplane from smaller ships; it is also fitted for catapult launching. The total contract price is $463,700.

The Glenn L. Martin Co. have a contract for 16 machines at a unit price of about $26,700 each, making $534,662 in all. These are bombers of the heavy diving type capable of delivering a 1,000-lb. bomb from a vertical dive.

The Chance Vought Corporation have a contract for 15, O3U-2, observation aircraft, which is really the latest type of Corsair, at a price of $15,000 each. Also 28 machines of the convertible O3U-3 type, with Wasp engines and floats, which will cost about $17,400 each, and, finally, 65 machines of the O3U-4 type, costing $14,000 each; making the total contract with spares, for this Corporation, of $2,024,961.

New Army Contracts

Several contracts have also been placed by the Army Air Corps.

Thirteen low-wing two-seater fighters, from which an extremely high performance is expected, are being built by the Curtiss Corporation. These will have the new liquid-cooled V-1570-E Curtiss 600-h.p. engine. Their cost will be $26,300 each, which, together with spares and instruments, brings the total contract to $427,615.

The contracts placed with the Detroit Corp. are particularly interesting, as they call for a number of the first military machines, which have been designed as a result of commercial experience, these include five Lockheed two-seater pursuit aircraft of the type Y1P-24, with Curtiss V-1570-E engines. Their cost will be $27,700 each. Another contract is for five Lockheed attack aircraft, costing $26,600 each. These are of the YA-9 type, with Curtiss engines, and are low-wing aircraft of metal monocoque construction.

The Douglas Aircraft Co. has a contract for a total of 35 aircraft, costing $718,879. Five are two-seater high-wing observation monoplanes, with Curtiss engines of 600 h.p., costing $18,350 each, 12 are twin Curtiss-engined aircraft and prestone cooled, five are of the observation type, and seven a light bombardment type. These are designed to test the comparative efficiency of prestone and air cooling. Eighteen of the standard O-38B, for the use of the National Guard, are also ordered at a cost of $9,000 each.

Other News

The annual report of the Chief of the Air Corps, which has just been issued, contains, besides many other interesting details, the important fact that the number of flying hours per fatal accident has increased 114 per cent. over the 1930 figure, while the total number of flying hours has also increased 22 per cent.

The Aeronautics Branch of the Department of Commerce has extended the federal airways system and at present there are 17,500 miles of airway lighted and equipped with wireless direction and communication facilities as well as weather reporting services. There are in addition 1,123 miles provided with facilities for flying by day, portions of which will be lighted during the year. The number of airway radio communication stations now in operation for the broadcast of weather information at frequent intervals has been increased by 13 during the last year to a total of 48, 10 more are under construction. 51 radio range beacons are in operation, providing directional signals along the airways, and 13 more are under construction. There are also 9,500 miles of automatic telegraph typewriter circuits for the collection and transmission of weather reports in operation.

The National Advisory Committee for Aeronautics decided, at its annual meeting on October 22, to open the Langley Field Laboratory to individuals in the aircraft industry who were willing to bear the cost of research. Such individuals will receive the results, while the committee reserves the right of releasing them for general distribution at its discretion.

Col. Charles A. Lindbergh has been appointed to the committee to fill the vacancy left by the death of Dr. Samuel W. Stratton, one of the three organisers of the N.A.C.A. and a member of the group since its formation 15 years ago. Dr. Stratton was also head of the Bureau of Standards since it started in 1901.

The "Joy-Stick" Suit

Enormous sums of money are at stake in the suit which M. Robert Esnault-Pelterie has brought against the U.S. Government, and the Chance Vought division U.A. & T. The judges' decision will probably be delayed until early next year. A victory for M. Esnault-Pelterie in this case would presumably be followed by the filing of suits against many other manufacturers. M. Esnault-Pelterie still maintains that he holds master patents covering the use of a single control column to control the ailerons and elevators of aircraft in the method which is now in normal use.

An Agreement with Italy

A Reciprocal Air Navigation Arrangement has been entered into by the U.S. and Italy, and became effective on October 31. This places emphasis on reciprocal trade arrangements and provides means whereby Certificates of Airworthiness for aircraft, Acceptance Test Certificates for aircraft engines, and spare parts of aircraft and engines, built in either country, are recognised by the aeronautical authority of both countries, providing they are in accordance with the requirements for airworthiness of the country of origin. This will very greatly reduce the difficulties of exporting American aircraft to Italy and *vice-versa*. It is understood that similar arrangements may be made with other countries.

Passenger Traffic Decreases

Traffic on air lines in the U.S. was from 8 per cent. to 4 per cent. less during the first six months of this year than during the same period of the previous year. Greater decreases were, however, shown by the railways, which were down by 14.7 per cent. The eastbound Transatlantic steamship traffic was down by 18.2 per cent., and the westbound down by 51.8 per cent. Great concern over the loss of patronage to the railways was expressed at the annual meeting of the American Association of Passenger Traffic Officers in Chicago in October. It was agreed that the only way would be for the railways to participate in air transportation.

Aeroplane and Bus

An innovation in air transport is the reciprocal arrangement between Trans-Continental and Western Air and Greyhound bus lines. It will now be possible for passengers to book through from points not touched by the air lines, and the Greyhound agents will handle T. & W.A. tickets.

A Pan-American Extension

The Pan-American passenger and mail service will now run between Santos and Buenos Aires, a stretch of over 1,000 miles which Pan-American Airways has not operated since it took over Nyrba more than a year ago. P.A.A. thereby completely encircle South America; flying boats and amphibians being used throughout the east-coast route. Machines for the South from Miami leave every Monday morning and arrive at Buenos Aires 15 days later.

Airisms from the Four Winds

Mr. A. J. Mollison's Plans

It is reported in Dublin, writes our Irish representative, that Mr. J. A. Mollison is planning a double flight across the Atlantic to take place early next Spring. Capt. J. P. Saul, navigator of the *Southern Cross* on Kingsford Smith's Atlantic flight last year, is to be Mollison's partner on the flight. It is likely that a third member of the crew will be invited to join the venture, probably as wireless operator, but up to the present no definite information is available. The machine which it is proposed to use is a Lockheed "Vega," and in some quarters it is stated that one has already been acquired. Capt. Saul is of the opinion that the flight will start from Portmarnock Strand, Co. Dublin, the place from which Kingsford Smith took off, but the details have not yet been settled. Mr. Mollison, it will be remembered, had to abandon his attempt on the England-Cape record following serious damage to his machine when landing in Upper Egypt. While on his way back to England he had to make a forced landing at Konia on December 11, and he was detained by the Turkish authorities as he did not possess the necessary authorisation to land.

BUTLER IN AUSTRALIA: This photograph, which arrived in England by the Australian Xmas Air Mail, shows Mr. C. A. Butler landing at Hargrave Park, Sydney, in his Comper "Swift" (Pobjoy engine) after his record-breaking flight from England.

Bert Hinkler Sees the Prince

On December 18 the Prince of Wales received Sqd. Ldr. Bert Hinkler at York House and had a long talk with him concerning the Atlantic flight and the "Puss Moth," of which type the Prince himself is an owner. Mr. S. G. Watkins and Mr. A. Courtauld were also received by the Prince as President of the British Arctic Air Route Expedition, in connection with which the explorers were in the Arctic regions.

The Long-range Monoplane Damaged

On December 15 the Fairey-Napier long-distance monoplane was being brought back by Sqd. Ldr. O. R. Gayford and Flt. Lt. D. L. G. Bett to England after its trial flight non-stop to Egypt, when fog obliged the pilots to land at a spot some three miles from Saffron Waldon, in Essex. The machine came down in a ploughed field and tipped up on to its nose, breaking the propeller and damaging the wings. Repairs have been effected on the spot, and it was hoped that the machine would fly again on December 21. The non-stop flight to the Cape is not likely to be attempted at least until the January full moon.

A Shoe-King's Air Tour

M. Bata, the Czecho-Slovakian shoe manufacturer—who, as previously recorded in Flight, is a keen advocate of aircraft as an aid to business—is engaged on a business air tour to the Far East in his private aeroplane. The machine, which is carrying six passengers, is being piloted by Capt. Neville Stack, who is now his pilot.

Honour for Vicomte de Sibour

Vicomte de Sibour, the airman son-in-law of Mr. Gordon Selfridge, has been appointed a Chevalier of the French Legion of Honour.

Seaplane Sees Speedboat's S.O.S.

A seaplane from Calshot air station noticed a speedboat in distress off the Needles on December 17, and reported by wireless to the station. The message was passed on to Yarmouth (I.O.W.) lifeboat station, and the lifeboat at once put off. It eventually rescued a Mr. Downs-Martin, who explained that he was on his way from Southampton Water to Christchurch, when his engine broke down about 2 p.m., just off the Needles. He drifted about until darkness, and, being without matches, he short-circuited his battery to set fire to the cushions in his boat. These he soaked with petrol and used as distress flares, thus attracting the attention of the seaplane.

R.101 Memorial

The Lord Lieutenant of Bedfordshire and the late Mayor of Bedford announce that £1,398 1s. 3d. was subscribed to the fund for a memorial to the victims of the R.101 disaster. The memorial on the grave at Cardington has been erected at a cost of £1,075 5s. 6d., and there remains £322 15s. 9d. for the assistance of the dependents.

Memorial to Italian Atlantic Airmen

General Balbo, the Italian Air Minister, together with 22 men who took part in the formation flight from Italy to South America last January, left Naples by boat on December 16 for Bolama (Portuguese Guinea), where a monument will be unveiled in memory of the five airmen who lost their lives in the flight. In the same boat were about 350 persons who will attend the ceremony. Many of them took wreaths of flowers sent by public bodies and individuals.

U.S. Navy and Ford Planes

The U.S. Navy has placed a contract with the Aeroplane Division of Ford Motor Company for two specially equipped three-engined planes for transport service. The special equipment includes a chromium-plated mast and brackets for mounting a wind-driven generator for the operation of a wireless outfit. The planes will also be equipped with a floor hatch to permit loading of spare engines; disappearing petrol tanks in the wing tips with a capacity of 1,600 lb.; landing lights, parachute flares and 103-gallon reserve petrol tanks.

Success of New York "Air Ferry"

The New York "air ferry," originally inaugurated as a link between the Newark, Glenn & Curtiss and Floyd & Bennett airport, is rapidly achieving popularity as a service for sightseers. An hourly schedule for the triangular trip is adhered to, thus providing quick transportation between the aerodromes, particularly to Newark Metropolitan Airport, from which most of the passenger air lines radiate. The Ford three-engined monoplane employed on this circuit carried more than 1,100 passengers during the first week of operation. Sightseers adopting this up-to-date method of touring the city obtain a wonderful bird's-eye view of the towering peaks of New York's skyscrapers.

The Royal Aero Club and Xmas

The Royal Aero Club will be closed on Friday (Christmas Day), December 25, 1931, except in so far as affects bedroom accommodation (with breakfast only). The Club will also be closed on Saturday, January 2, 1932, from 3.0 p.m. to midnight, for the Annual Staff Dance.

THE U.S. NAVY AIRSHIP "AKRON"

FOLLOWING a series of flights that tested successfully the speed, fuel consumption, controllability, rate of climb and various other important factors, acceptance of the U.S.S. *Akron*, the world's largest airship, was announced recently by the United States Navy, and authorisation given the Goodyear-Zeppelin Corporation for the construction of a sister ship, the ZRS.5.

The acceptance of the *Akron* was announced formally by Secretary of the Navy Charles F. Adams, and several days later the huge airship was commissioned officially at Lakehurst, New Jersey, the Navy's great air station.

The commissioning of the U.S.S. *Akron* by the United States Navy consummated two years of construction work by Goodyear and a series of exhaustive tests. The final test was a 48-hr. endurance flight over the central part of the United States, which was pronounced by Rear Admiral George C. Day, President of the Navy Board of Inspection and Survey, as "highly successful."

From Lakehurst the *Akron* will soon be sent on a number of cruises with a view to further determining her capacities, and breaking in her crew for regular duty. These trips, some of which will be of several thousand miles' duration, will constitute the *Akron's* ship cruise. Each naval vessel is given such a cruise before it starts work with a fleet. Following these flights it is probable that the *Akron* will be stationed at the United States Navy's new lighter-than-air base at Sunnyvale, California, for duty with the Pacific Fleet.

Construction work on the ZRS.5 has already been started. The ZRS.5 will cost the Navy $2,000,000 and is to be delivered by Goodyear within 15 months. The *Akron* cost the Navy more than twice as much, because of the necessity of providing construction facilities, doing a great deal of development and training a working force. The new ship will probably contain a number of new developments which construction experience with the *Akron* suggested.

The ZRS.5 will be the same size and gas capacity as the *Akron*—785 ft. long, 133 ft. in diameter, and a gas capacity of 6,500,000 cub. ft. Helium gas will be used.

With the airship *Akron* in Lakehurst, engineers and workmen of the Goodyear-Zeppelin organisation will be able to utilise the mammoth dock on the outskirts of the city, especially built for the first Navy ship, for the construction of the ZRS.5. This dock, a Mecca for more than 50,000 people each week during work on the *Akron*, is the largest building in the world without interior supports. It measures 1,175 ft. long, 325 ft. wide and 211 ft. high, and is built in the shape of a hollow half egg shell.

Following construction of the second airship, Goodyear will probably start work on a still larger ship to be used for commercial trans-oceanic service. P. W. Litchfield, President of The Goodyear Tyre & Rubber Company and the Goodyear-Zeppelin Corporation, is also head of the organisation which was formed some time ago to develop trans-oceanic air transportation.

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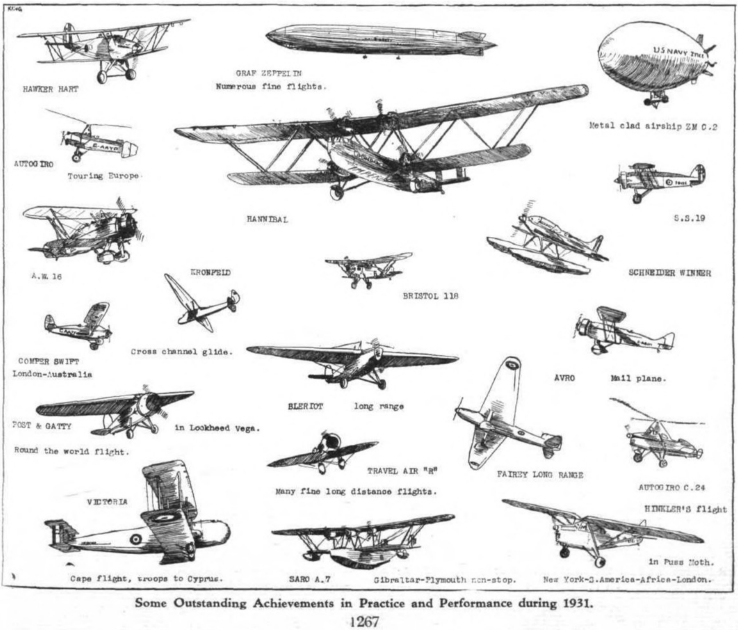


Some Outstanding Achievements in Practice and Performance during 1931.

Control Beyond the Stall

IN spite of his opening remarks to the effect that his paper was not a complete survey of all the theoretical and experimental work done on the subject, there was more than a touch of German thoroughness about the paper which Dr. Gustav Lachmann read before the Royal Aeronautical Society on December 17. Dr. Lachmann, as most of our readers will probably be aware, invented the slot in Germany at approximately the same time that Mr. Handley Page invented it in this country. For a couple of years or so Dr. Lachmann has been on the Handley Page technical staff, and has played a prominent part in the more recent development of the various forms of slot. It was thus natural that his paper should deal largely with that part of control beyond the stall to which the Handley Page-Lachmann slot is applicable. We have not the space, nor would it be of general interest, to give Dr. Lachmann's paper in full. The best that can be done in such space as we can set aside for the subject is to give a very brief general review of the paper, omitting many of the proofs furnished by the lecturer and skipping lightly over certain sections and passages which, if more space were available, one would naturally include.

Dr. Lachmann divided his paper into six sections and an appendix, and it may interest readers to know that if printed in full his paper would occupy something like one-half of an issue of FLIGHT. That must be our excuse for the summary which follows. The five sections were:—I—General problem of control beyond the stall; II—The aerodynamic characteristics of wing tip slots; III—The improvement of lateral control beyond the stall; IV—Spin-proof aeroplanes; V—Longitudinal stability and control in stalled flight; and VI—Technique of stalled landings.

Dr. Lachmann referred to R. & M. No. 1000, the classic report of the Stability and Control Panel, and said that as the principles of lateral stability and control had been dealt with so instructively there, he would confine himself to the development done since the publication of that report. The problem of longitudinal stability and control in stalled flight was still far less explored than that of lateral stability, but it was now receiving attention both in England and Germany.

The lecturer mentioned three schools of thought on the subject of stalling: *Avoiding* the stall by warning devices; *preventing* the stall by limiting the elevator power to such an extent that the wing could not reach stalled flight in normal conditions of straight flying; and the aircraft that was stable and controllable in the stall. With modern highly-efficient aircraft a steep gliding angle could not be achieved without an accompanying increase in speed. The only way to steepen the glide was to extend the flying range of the aircraft beyond the present limits of the stalling angle.

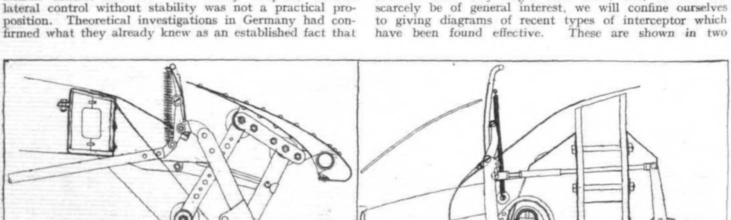
In dealing with the development of the slot, Dr. Lachmann said that the earlier type of interconnected slot and aileron control had not been widely adopted, because lateral control without stability was not a practical proposition. Theoretical investigations in Germany had confirmed what they already knew as an established fact that the automatic slot, even when there was very little control, gave practically all that was required to prevent the incipient spin.

On the subject of the aerodynamic characteristics of wing-tip slots, Dr. Lachmann explained that, although most people connected the word "slot" with a lift increase, this was a secondary effect, the main being the delay of the breakdown of potential flow over the back of the wing section. With a completely slotted wing, the increase in angle at which stalling took place was of the order of 10-12 deg. When wing-tip slots only were fitted, the increased lift was less than that calculated for the area slotted plus the unslotted portion. With wing-tip slots, autorotation was found in the wind tunnel to be delayed up to angles of about 35-40 deg. With the same aerofoil completely slotted, autorotation began as soon as the angle of maximum lift, *i.e.*, about 22-26 deg., was exceeded. On an aerofoil with tip slots, the angle of downwash at the tips was of the same order as the delay in autorotation over the completely slotted aerofoil. The effect was, therefore, to produce a strong downwash at the tips, resulting in a reduction in effective angle of incidence. This was not accompanied by the drop in lift experienced with "washed-out" wing tips. The span of wing-tip slots depended upon the behaviour of the unslotted portion beyond the stall. The more vicious the stall, the greater should be the span of the wing-tip slots. Certain sections were so bad that they could not be made stable by wing-tip slots. Max Munk had pointed out that, of all the wing sections known, 90 per cent. were unsuitable. Yet many designers continued to select their wing sections from this 90 per cent. Wing-tip slots should be fitted as far outboard as possible. Square wing tips were best from this point of view and elliptical wing tips worst.

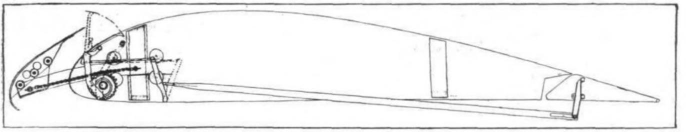
Wing-tip slots gave lateral stability, but they did not contribute greatly to lateral control. Two devices were useful for giving powerful lateral control—the spoiled automatic slot and the interceptor. The spoiled automatic slot differed from the interconnected slot and aileron, in that the slot was closed by the up-going aileron, thus spoiling the smooth flow and losing lift. When tested on a "Siskin," this device was found less powerful than either the interconnected slot and aileron or the interceptor.

The interceptor was a plate arranged behind the slot so as to lie flat or disappear into the wing at small angles of incidence, but to stand upright at large angles, thus spoiling the flow and causing it to break down. Three points were important in ensuring the effective working of the interceptor—the position relative to the slot; the size, span and depth of the interceptor plate; and the gear ratio between interceptor and aileron movement.

Dr. Lachmann explained in great detail the reasons why certain of the earlier types of interceptors were less effective than they might have been, but, as this will scarcely be of general interest, we will confine ourselves to giving diagrams of recent types of interceptor which have been found effective. These are shown in two



RECENT TYPES OF SLOT AND INTERCEPTOR: On the left a mechanism suitable for the link type of slot, and on the right an interceptor arrangement designed for use with the track type of slot.



INTERCONNECTING THE INTERCEPTOR AND AILERON: It is important that the interceptor plate should be raised when only a small upward movement of the aileron has been made.

blocks, and it will be seen that they are for the link type and track type of slot respectively.

Concerning the gear ratio between interceptor and aileron movement, Dr. Lachmann said that the interceptor should be fully up by the time the aileron had moved up a relatively small amount, say 6 to 8 deg. This was important for two reasons: Firstly, because in many aircraft the degree of lateral movement of the control stick, when it was right back, was limited, and, secondly, because if the interceptor did not come into action quickly, the aileron on the other side would introduce an adverse yawing moment before the favourable yawing moment of the interceptor came into action.

Model experiments on interceptor effects had indicated that the most powerful control was obtained when top and bottom wings of a biplane were fitted with slots and interceptors and the ailerons had a range of plus and minus 30 deg.

Spin-proof Aeroplanes

In dealing with this subject, Dr. Lachmann referred to experiments made in Germany by Fuchs and Schmidt, using small auxiliary aerofoils above the leading edge at a negative angle of incidence in one case and a series of slits parallel to the wing span in another. He thought the key to the situation lay in the use of smaller rudders. Large rudders came into use on British machines when we still had the adverse yawing moments from ordinary ailerons. Now that automatic wing-tip slots had removed the danger of the incipient spin, and the interceptor had changed the adverse into a favourable yawing moment, there was no longer the need for such large rudders.

Longitudinal Stability and Control

Conventional types of modern aeroplanes could be placed in three categories as regards the efficiency of their longitudinal control at and beyond the stall:—Aeroplanes whose elevator control and tailplane range were insufficient to reach the stalling angle at all; aeroplanes in which the controls were such that the stalling angle could just be reached or slightly exceeded; and third, aeroplanes which were "fully stallable." Under the second category one had to distinguish between two types, one with pleasant and the other with unpleasant characteristics. The former had its elevator control become soggy at large angles, the control fading out when the stall was reached. The nose dropped gently, and the machine gathered speed. In the unpleasant type, on the other hand, the loss of elevator control was very sudden, and was accompanied by a rapid dropping of the nose and a rather prolonged nose-dive. The third group of machines were only safe when they were laterally stable when stalled. They were the only suitable type to perform steep stalled glides, and in order further to develop this technique, the elevator control should still be improved. "The real problem," Dr. Lachmann said, "of flying at large angles of incidence is not longitudinal stability, but longitudinal control."

Loss of elevator control at large angles was mainly due to two causes: Reduction of downwash angle, and shielding of the tail. Tests on a model of a Handley Page "Hare" in the wind tunnel had shown that at large angles of incidence the downwash angle became nearly zero, which explained why so many aeroplanes could hardly be stalled at all, and why they were so difficult to hold in the stalled condition. An extraordinarily large tail angle range was required to maintain large angles of incidence with normal centre of gravity positions. The characteristics of downwash were a consequence of changes in the lift distribution on the wings. For elliptic distribution the induced velocity across the span was constant, and the angle of downwash was proportional to k_y. When the distribution was not elliptical, and it rarely was, a "saddle" was formed in the middle of the wing, where the flow had broken down, and this "saddle" produced a sheet of vortices behind the centre of the aerofoil, turning in opposite direction to those due to the regular distribution. These opposite vortices produced upwash at the tail. The centre section had great influence on the breakaway of the downwash, and if it was cut down in chord and thickness, as was often the case, a drop in lift might easily result, with sudden change of downwash angle and loss of elevator control. This applied more to the engine-off case. With engine-on the slipstream made conditions better.

From these considerations Dr. Lachmann deduced that increase in elevator efficiency at large angles of incidence was not in the first place a question of increase in elevator size, but rather of elevator and tailplane range of angles. Merely extending the range of present orthodox arrangements would not suffice, as the tailplane trimming gear did not give sufficiently quick operation. What was wanted was an all-movable tail which would allow the pilot to combine the operation of elevator and tailplane in a single action.

On the subject of shielding of the tail Dr. Lachmann's views appeared to differ somewhat from certain other high authorities. He had found that behind the wings of an aeroplane "wind shadows" existed covering a region of reduced pressure. These "shadows," he said, had clearly-defined contours, and the reduction in pressure within them was considerable and increased with incidence. Pressure plottings as the result of wind tunnel experiments had indicated that:—(1) Below the stall the "wind shadow" was below the wing and indicated the direction of downwash; (2) when stalling was approached, the wake travelled upwards, and beyond the stall the angle of the "wind shadow" of the centre of the aerofoil was directly behind the wing, indicating that the downwash had broken away from the centre; (3) inside the wake there was a considerable reduction in dynamic pressure. This diminished the stabilising and controlling effect of the tail. The sentence in Dr. Lachmann's paper which appears to show a divergence of views read as follows:—

"The conclusions which can be drawn from these observations are obvious. In order to keep up the efficiency of the tail controls, they should be arranged *as low as possible* relatively to the main wing chord so as to prevent shielding at large angles, and buffeting. One often finds the opinion expressed that low-wing monoplanes have this advantage in that they permit the tailplane to be arranged above the wings so as to avoid the turbulent wake from the wings, which causes shielding of the controls, and buffeting. This, however, is a delusion. Shifting the tailplane up will bring it right into the wake."

"From this point of view," Dr. Lachmann continued, "the advice 'tails up' in order to avoid shielding of the rudder should be applied with discretion, as it may otherwise happen that unshielding the rudder will result in completely shielding the elevator by the wings." Some German research work had recently indicated that the wake behind the wings was apparently not greatly influenced by wing shape nor aspect ratio.

Technique of Stalled Landings

In turning his attention to the aeroplane fully controlable beyond the stall, the lecturer referred to the two sensations which accompanied stalled flying—a noticeable increase in the rate of descent, and the reversed effect of the elevator control. Of the former, Dr. Lachmann said: "As the rate of descent in the fully-stalled condition is about twice as high as the maximum for which ordinary undercarriages are designed, it follows that at least four times the total travel (actually even more) would be required to make the fully-stalled landing a feasible proposition."

A modification of the fully-stalled landing was the "pancake landing," in which the shock of impact was lessened by flattening out the gliding path before the machine touched. This entailed reversed elevator control. To flatten out from a steep glide the control stick had to be pushed forward. Dr. Lachmann described a novel technique of landing theoretically worked out in Germany by Dr. Wilhelm Schmidt, but as the theoretical arguments were rather involved, while a wing section very unsuitable in other respects (sudden drop in lift curve after stall) had to be used, and the actual manœuvre appeared much more complicated than a normal side-slip landing, we need hardly deal with this part of the paper here.

THE DISCUSSION

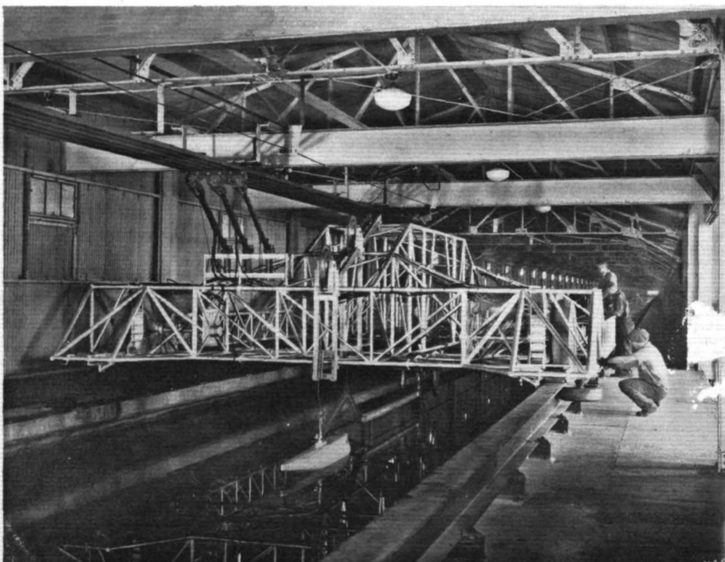
In reply to questions raised in the discussion, the lecturer said that he regretted very much indeed the absence of Professor Melvill Jones, yet at the same time he was glad, as Professor Melvill Jones was so much an acknowledged expert that he (Dr. Lachmann) would have felt diffident in answering any of the questions of others before him. Replying to Mr. McKinnon Wood, he said that he was sorry to hurt this gentleman's feelings, but he had not meant to detract from the value of the controlled slot and aileron; he only meant to infer that it had not maintained its position, but had been supplanted by the automatic slot and interceptor. With regard to the question which had been raised about the position of the tailplane, he said he strongly advised designers of low-wing monoplanes to place the tailplane as high as possible, though probably on top of the fuselage was sufficient in the case of biplanes. In reply to another speaker, he said there probably was an optimum useful span for the slot, and he thought that this was most likely between 25 and 30 per cent. of the semi-span of the wing.

In reply to the suggestion that ailerons might be done away with and interceptors substituted, he said that interceptors could be used for lateral control, but he did not think they were effective for getting a machine out of a prolonged flat spin. In answer to Dr. Thurston, he said that in the picture of the very large birds Dr. Thurston had appeared to see only the alula, whereas he himself had been most struck by the multi-slot feather formation at the ends of the wings.

After Mr. Wimperis (Director of Scientific Research) had seconded the vote of thanks to the lecturer and announced the fact that the new 12-ft. vertical wind tunnel had that same day started working successfully at Farnborough, Dr. Pleinis, of the D.V.L., read a short paper, illustrated with lantern slides, describing the work which had recently been done in Germany on the same subject, particularly by mass loading of the wing tips with water containers and investigating the behaviour of the machine when this water was released. He also showed a short film depicting the behaviour of wool tufts attached along each spar on the bottom wing of a biplane, when that wing was stalled.

Capt. Höver, of the Aeronautical Department of the Norwegian Navy, also contributed to the discussion, and described a certain amount of the work which his department had been doing. The machine to which he referred had previously been shown on the screen by Dr. Lachmann, and Capt. Höver described how on two occasions a flat spin had been developed with this machine, in the first place at 25,000 ft. and in the second place at 3,000 ft., and in each case the machine had spun right down to the water without damage to the pilot.

After the lecture some 40 guests attended a small dinner given at the Royal Aero Club by Mr. Handley Page.



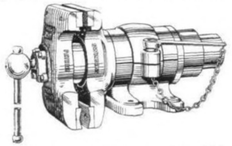
AMERICA'S NEW WATER TANK: The model towing tank at Langley Field, Virginia, is 2,040 ft. long, 24 ft. wide and 12 ft. deep. The car is built of welded steel tube and runs on pneumatic tyres inflated to 125 lb. pressure. A maximum speed of 50 m.p.h. can be attained.

The Industry

A SENSIBLE VICE

EVERY Works Manager of an aircraft factory knows only too well the trouble and delay which is often caused by the inability to fit long and awkwardly shaped jobs into the common or garden vice. Swindens Patents, Ltd., of 14, Queen Victoria Street, London, E.C.4, have recently produced a vice which should entirely overcome all difficulties on this score.

This tool has a revolving head with double jaws. One of the pairs of jaws is fitted with the usual flat serrated liners, while the other has curved grooved liners which form a non-slipping grip for tubes or any other form



of round or irregular work. The whole head of this vice revolves quite freely about a horizontal axis and may instantly be locked in any particular position. A later model (not the one illustrated) has the added refinement of free revolution about a vertical axis as well, also with a frictional lock, thereby allowing the vice to be adapted to any possible form of work. The three principal parts of this vice are machined from high tensile steel castings and have withstood extreme tests by users in many and varied trades. The barrel of the front jaw casting traverses the entire length of the back jaw casting, providing a bearing surface which makes for great strength, while both are locked in relation to one another by a slot in the front jaw barrel engaging with the centre screw nut. This nut is a solid steel drop forging which is tapped with a robust square thread permitting of heavy leverage on the screw handle without distortion. The screw itself is machined from 40-ton steel and engages with the nut around its entire circumference, thereby enabling it to stand up to any amount of use without appreciable wear.

The rotation of the jaws is controlled by the friction hold of the split base casting, and may be locked immediately by a lever on one side. It can readily be seen that for such work, where for instance a long article has to be held vertically, this vice is invaluable. In the normal vice work like this can only be gripped with the extreme ends of the jaws, whereas with the Swinden vice the jaws may be revolved until they are vertical and thereby grip the work with the entire length, while the work itself is, if necessary, resting on the ground. For gripping light alloy work or soft materials, alternative jaw liners of red fibre may be supplied.

Evidence of the practicability of this vice is given by the fact that one of the 2 in. size, that is with jaws of 2 in. width giving a 2 in. opening and weighing only 8 lb. was carried by Sir Alan Cobham in the Short "Valetta" (3 Jupiters) during his recent survey trip to Africa and back.

REDWING DEVELOPMENTS

REDWING Aircraft will, after January next, be built in a new factory at Colchester. This factory adjoins the aerodrome and is at present in process of completion. After the transfer is made the shops at Croydon will be closed down.

Following on this comes the information of certain changes in the Board of the Redwing Company which should still further establish it as one of the most go-ahead of our younger aircraft manufacturing companies. Mr. R. R. Darling, who has up to the present represented the interests of the American backer of the Company, will shortly be returning to his native land, and in his place Flt. Lt. N. M. S. Russell has been appointed General Manager. An addition to the Board is Mr. H. R. Trost as Technical Director, and with him will be Mr. R. C. Bartlett, Governing Director, and Mr. A. L. Bostock, Director. His many friends will, we feel sure, regret that Mr. Darling is leaving this country, for he was one of the pleasantest men one could wish to meet in business. We sincerely hope we shall see him back here again from time to time.

BERT BUYS BURBERRYS

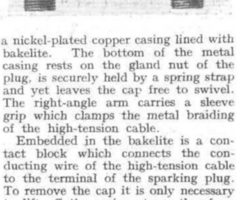
BERT HINKLER, filled with remorse on reading our remarks anent his clothes on his arrival at Hanworth from Brazil, has taken the first opportunity to make amends. He joined the throng of Xmas shoppers in the West End the other day with the object of improving his wardrobe, and with characteristic Hinkler judgment of the best, eventually found his way into Burberrys, Ltd., in Haymarket. Now one can hardly recognise our Bert. We do not know if he induced Burberrys to introduce a few "Hinklerisations" into his greatcoat, but possibly we shall soon see a new model, known as the "Bert Burberry," and possessing several novel improvements.

B.A.T. EXPAND

BRITISH AIR TRANSPORT, who operate their school and taxi service at Croydon, have now taken the Croydon agency for the Redwing aircraft. A machine of this type will in future be kept there and ready at all times for demonstration and instruction. A sales and service depôt with a comprehensive stock of spares will also be in operation, for the B.A.T. Co. are determined to make the "Redwing," in so far as they are able, one of the best serviced aircraft in England. They are also offering free tuition in flying to anyone who purchases a "Redwing." This tuition will not be skimped in any way, but will ensure that the pupil becomes a certified and safe pilot. The same Company is also opening a London office at 5, Carlton Street, Lower Regent Street, W.1, with a qualified man in charge, who will be able to answer all questions concerning taxi work, instruction or "Redwing" sales. The school itself, at Croydon, is now doing very well indeed, for it is found that the deferred payment terms under which instruction may be taken is inducing a large number of pupils to come forward and qualify for their "A" licences.

SPARKING PLUG SCREENING

WHEN using a wireless set in an aircraft, it is necessary to screen various parts of the engine ignition circuit, such as the sparking plugs, magnetos, and high-tension cables. The sparking-plug screen must form a good conducting path from the metal screening braiding of the cable to the metal of the engine without reducing the insulation resistance of the ignition circuit, and must be arranged so that the cables can be laid in any radial direction. The fitting of the screen should also put no difficulty in the way of attending to the sparking plugs. The illustration shows two views of a sparking-plug screening cap made by Lodge Plugs, Ltd., of Rugby. This cap consists of



a nickel-plated copper casing lined with bakelite. The bottom of the metal casing rests on the gland nut of the plug, is securely held by a spring strap and yet leaves the cap free to swivel. The right-angle arm carries a sleeve grip which clamps the metal braiding of the high-tension cable.

Embedded in the bakelite is a contact block which connects the conducting wire of the high-tension cable to the terminal of the sparking plug. To remove the cap it is only necessary to lift off the spring strap, therefore, besides acting as a screen, it also forms a quickly detachable cable terminal.

THE ROYAL AIR FORCE

London Gazette, December 15, 1931

General Duties Branch

Lieut.-Cdr. C. B. Tidd, R.N., is reattached to R.A.F., as Flight-Lieut. with effect from Dec. 3, and with seny. of Jan. 1, 1930; Pilot Officer D. W. Morrish is promoted to rank of Flying Officer (Oct. 11). (Substituted for *Gazette*, Nov. 17); Flying Officer R. H. Cave Penney takes rank and precedence as if his appointment as Flying Officer bore date July 14, immediately following Flying Officer E. V. N. Bramley on gradation list. Reduction takes effect from Oct. 15; Flying Officer H. R. Dale takes rank and precedence as if his appointment as Flying Officer bore date May 22. Reduction takes effect from Oct. 19. The follg. cease to be attached to R.A.F. on return to Naval duty:—Lt.-Cdr. R. G. Poole, R.N., Flight-Lt., R.A.F. (Dec. 7); Lt. R. P. Garnett, R.N., Flying Officer, R.A.F. (Dec. 3).

Flight-Lieut. J. P. Hinks is placed on retired list at his own request (Dec. 15).

Stores Branch

The follg. Flight-Lieuts. are placed on retired list:—A. S. Berry (Dec. 10); G. Baker (Dec. 12); F. E. Shersby (Dec. 13).

Dental Branch

Squadron Leader R. H. Bebb, O.B.E., L.D.S., Major, Army Dental Corps, relinquishes his temp. commn. on return to Army duty (Nov. 11).

RESERVE OF AIR FORCE OFFICERS

General Duties Branch

Flying Officer G. J. E. Howard is transferred from Class C to Class AA (ii) (Nov. 6). The follg. relinquish their commns. on completion of service:—Fl.-Lieut. R. W. F. Dunning (Oct. 6); Flying Officer A. H. Grace (Nov. 13). Squadron Leader H. C. Fuller relinquishes his commn. on completion of service, and is permitted to retain his rank (Oct. 24).

Accountant Branch

Flight-Lieut. J. Baines relinquishes his commn. on completion of service (Oct. 1).

Medical Branch

Flight-Lieut. F. W. G. Smith, M.B., B.A., relinquishes his commn. on completion of service (Oct. 8).

SPECIAL RESERVE

General Duties Branch

Pilot Officer on probation F. L. D. Salter is confirmed in rank (July 8). (Substituted for *Gazette*, Dec. 1.)

AUXILIARY AIR FORCE

General Duties Branch

No. 600 (City of London) (Bomber) Squadron.—G. L. S. Dawson-Damer, Viscount Carlow, is granted a commn. as Pilot Officer (Oct. 15).

ROYAL AIR FORCE INTELLIGENCE

Appointments.—The following appointments in the Royal Air Force are notified:—

General Duties Branch

Squadron Leaders: B. E. Harrison, A.F.C., to H.Q., Coastal Area; 30.11.31. E. L. Ardley, to Special Duty List, for duty with Indian Air Force; 7.8.31.

Flight Lieutenants: W. R. Day, to H.M.S. *Furious*; 7.12.31. J. E. G. H. Thomas, to No. 20 Sqdn., Peshawar, India; 7.11.31. R. W. E. Bryant, to No. 4 Flying Training School, Abu Sueir, Egypt; 19.11.31. C. R. Mason, to Aircraft Depot, Hinaidi, Iraq; 20.11.31. J. D. Greaves, to Aircraft Depot, Hinaidi, Iraq; 18.11.31.

Pilot Officer E. W. Whitley, to No. 84 Sqdn., Shaibah, Iraq; 13.11.31.

Stores Branch

Flight Lieutenant G. Scarrott, to Station H.Q., Heliopolis, Egypt; 21.11.31.

Flying Officers: C. M. P. Hartley, to R.A.F. Depot, Aboukir, Egypt; 19.11.31. C. P. Wingfield, to R.A.F. Base, Calshot; 9.12.31. J. W. Hunt, to No. 4 Sqdn., S. Farnborough; 4.12.31.

Accountant Branch

Flying Officer D. Lumgair, to No. 4 Sqdn., S. Farnborough; 8.12.31.

Medical Branch

Flight Lieutenant A. S. Burns, to H.Q., R.A.F. Mediterranean, Malta; 4.12.31.

Chaplains Branch

Revd. G. H. Piercy, M.A., to H.Q., R.A.F., Cranwell; 7.12.31. Revd. R. N. Shapley, M.C. A.K.C., to No. 5 Flying Training School, Sealand; 6.12.31.

PUBLICATIONS RECEIVED

Katapulte und Katapultieren von Flugzeugen. Ernst Heinkel Flugzeugwerke G.m.b.H., Warnemünde, Germany.

Naval Eight: A History of No. 8 Squadron, R.N.A.S. London: The Signal Press, Ltd. Price 10s. 6d.

War Birds and Lady Birds. By Elliott White Springs. London: John Hamilton, Ltd. Price 7s. 6d. net.

German War Birds. By "Vigilant." London: John Hamilton, Ltd. Price 8s. 6d. net.

Report on Monetary and Financial Policy. Federation of British Industries, 21, Tothill Street, London, S.W.1. Price 1s.

Cours d'Electricité Théorique. Vol. III. By J.-B. Pomey. Bibliothèque des Annales des Postes, Télégraphes et Téléphones. Paris: Gauthier-Villars et Cie. Price 90 fr.

Our Fathers (1870-1900). By Alan Bott. London: William Heinemann. Price 8s. 6d. net.

Double-Decker C. 666. By Haupt Heydemarck. Translated by C. W. Sykes. London: John Hamilton, Ltd. Price 8s. 6d.

Aeronautical Research Committee Reports and Memoranda: No. 1,403 (*Ae.* 424—*Spin* 61). *Measured Spins on Aeroplane H.* By S. B. Gates. April, 1931. Price 6d. net. *No.* 1,408 (*Ae.* 529—*T.* 3,060). *Relation between Heat Transfer and Surface Friction for Laminar Flow.* By A. Fage and V. M. Falkner. April, 1931. Price 1s. 6d. net. *No.* 1,410 (*Ae.* 531—*T.* 3,095). *Experiments on the Flow past a Rotating Cylinder.* By A. Thom. March, 1931. Price 1s. net. London: H.M. Stationery Office, W.C.2.

Coming Events in Great Britain and Ireland. No. 24. November, 1931. The Travel Association of Great Britain and Ireland, Kinnaird House, Pall Mall East, London, S.W.1.

AERONAUTICAL PATENT SPECIFICATIONS

(*Abbreviations*: Cyl. = cylinder; i.c. = internal combustion; m. = motors. The numbers in brackets are those under which the Specification will be printed and abridged, etc.)

APPLIED FOR IN 1930

Published December 24, 1931

15,740 Sperry Gyroscope Co., Inc. Navigational instruments for aircraft. (361,836.)

16,173 J. J. Fitzgerald. Flying machine. (361,932.)

24,699. C. H. Lundholm Aktiebolag. Locking devices for parachutes harness. (361,859.)

25,406. T. E. Lomas. Screw propellers. (361,897.)

25,798. D. Napier and Son and G. S. Wilkinson. Liquid-fuel-injectio pumps for i.-c. engines. (361,970.)

26,364, T. E. Lomas. Parachutes. (361,997.)

27,186. Sir F. H. Royce. Multi-cylinder reciprocating engines. (362,021.)

27,187. Sir F. H. Royce. Carburettors for i.-c. engines. (362,022.)

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