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CORRESPONDENCE.

THE CONSTANT SPEED VARIABLE PITCH AIRSCREW.

To the Editor of the JOURNAL OF THE ROYAL AERONAUTICAL SOCIETY.

SIR,—From the time the possibilities of the aeroplane began to be understood, which was only a few years ago, the importance of the airscrew as the real organ of propulsion was realised, although this was only after attempts (such as by Dædalus and Icarus) to imitate the flight of birds by wings and vibrating surfaces.

Records of the Royal Aeronautical Society, which was founded in 1866, of which the Duke of Argyll was the first President, show that many contributions had been made in the form of papers dealing with the subject.

An Aeronautical Exhibition was held under the patronage of the Society at the Alexandra Palace as early as 1885, of which the writer of this note was one of the three jurors. Amongst many other exhibits there was a machine by the Border Aerial Transit Company for measuring the lifting power of revolving screws. The trial of this machine was memorable from the fact that one of the blades of an airscrew revolving at a high rate became detached and caused a

serious accident to Mr. F. W. Brearey (the first Secretary of the Society). The report prepared of the trial states that happily Mr. Brearey completely recovered, but gave a warning of the dangerous nature of a revolving screw and the necessity for its proper construction.

The writer himself in his Presidential Address to the Liverpool Engineering Society in 1894 (nearly half a century ago) gave an account of the Maxim flying machine, the most ambitious attempt at an aeroplane that was ever made up to that time. The width of the whole machine was 104 feet, and the length 125 feet; there were two large screw propellers, each 7 feet in diameter, 16 feet pitch and 6 feet wide, made of canvas stretched on framework, and driven by a steam engine.

Although this machine never really flew, in its trials the weight lifted, which included three men on board, was no less than 8,000 pounds.

In the annals of the Society an account has been given of various papers on airscrews. Major Baden-Powell, who in 1904 was President of the Society, read one on "Experiments with Aerial Screw Propellers," and with others had experimented with different shapes of airscrew.

The scientific aspect of the form and strength of the airscrew was often discussed as an engineering problem, and an account of the graphic method of calculation by Captain Ferber (one of the many pioneers to lose their lives in aviation) was given by the writer in a paper on "Aeronautical Engineering" in 1910,* and a curve of efficiency is shown.

The construction of the propeller itself, sufficiently strong and light for its purpose, was difficult enough, but the idea of producing a propeller in which the angle of pitch could be varied automatically, we are told by Lord Sempill (Royal Aeronautical Reprint No. 31, p. 15), had been discussed at nearly every meeting, at the commencement of the war, of the Advisory Committee on Aeronautics (of which he was a member); the outcome of the above discussions was a production of a variable pitch airscrew at the Royal Aircraft Factory.

On December 3rd, 1924, Mr. Beacham and the writer lodged (as joint inventors) a provisional patent (No. 29015/24) entitled, "Feathering Screw Propellers," and the complete patent was accepted in April, 1926 (No. 250,292). The opening sentence of the provisional patent was:—

> "Our invention is a new method of feathering propellers by means of hydraulic pressure."

In the complete specification the invention was described in detail by means of diagrams, and with ten claims attached. The first of the latter is as follows:—

> CLAIM 1.—"Driving mechanism for aircraft and the like comprising a propeller having its blades capable of swivelling movement about axes to vary their pitch, an engine for driving said propeller, a hydraulic system of transmission for moving said blades about their axes and a governor mechanism driven by the engine and operating to control the hydraulic transmission mechanism and as a consequence the pitch of the blades in relation to the engine speed."

The remaining nine claims and descriptive matter disclose details such as hand control of the governor, and subsequent patents have been taken out in connection with such details.

An estimate was invited, addressed to Messrs. Hele-Shaw Beacham, by the Director of Contracts of the Air Ministry, 28th February, 1925, for an all-metal variable pitch airscrew, suitable for a Condor Series III engine. This estimate which was for £1,500 was sent on 6th March, 1925, and was accepted in a letter by the Director of Contracts on 1st May, 1925.

The designs were shown and the Director of Technical Development, who expressed his satisfaction, asked for the general arrangement drawings.

* Trans. of Liverpool Engineering Society, Vol. XXXI.

These drawings were duly sent and approved of and the first Hele-Shaw Beacham propeller was made, the blades by Messrs. Metal Propellers, Ltd., of Croydon, and the hub by Messrs. Harper, Sons and Bean, of Dudley.

In August of that year (1925) spinning trials were held and finally a successful flight was made.

In view of the fact that the inventors were not in a position to manufacture themselves or enter into contracts, they were fortunate in securing the co-operation of the Gloster Aircraft Co., Ltd., with whom they entered into an agreement in August, 1926. Under this agreement a number of Hele-Shaw Beacham airscrews were made, and eleven were supplied to the Air Ministry after successfully passing all tests.

On the 12th April, 1928, a paper, entitled "The Variable Pitch Airscrew," was read by Mr. Beacham and the writer before the Royal Aeronautical Society, and full discussion took place. Since that time, this type of propeller has been recognised as a practical feature of modern aviation.

H. S. HELE-SHAW.

REVIEWS.

WALTER ZUERL: "DAS VERSCHWINDFAHRWERK" (The Retractable Undercarriage). Muenchen, 1937. Publ. by Curt Pechstein Verlag., 135 pp., 243 fig.

According to the author this booklet is intended as a treatise for aircraft designers and others technically interested.

The author has done his best to give a fair survey of practical solutions hitherto known, and in this respect students may find the work useful. Besides retractable undercarriages, different types of oleo legs and wheel brakes are described.

Historically, one addition may be worth while mentioning. The first retractable undercarriage (folding-back principle) had been used on a racing monoplane designed by the late German pilot Eugen Wincziers in 1911, and this solution can be considered a really simple and practical one. Incidentally, it is the first single leg undercarriage, therefore quite modern and worth while remembering.

TIMBER. ITS STRUCTURES AND PROPERTIES.
H. E. Desch, P.A.S.I., B.Sc., M.A. (Oxon.). 90 illustrations. MacMillan and Co. 12s. 6d. net.

The author has written a book for which he claims no originality for the subject matter, and which is a compilation of information from standard works and the various publications issued by the different research laboratories.

The use of timber will always be of interest to the aircraft engineer, and for those who wish to understand the general structure of timber this book will be of use. It is divided into four parts, the first dealing with the structure of wood, the second with the gross features of wood, the third with its properties (weight, strength, moisture, and conductivity of heat value), and the fourth with considerations influencing the utilisation of wood.

Directly, part three is of most interest to the aircraft engineer, but the author has not been concerned with giving the practical values of density of various woods or their strengths. He is only concerned with general principles of testing, obtaining density, moisture content and the like.

The book is of value for its clear outline of what timber is in the general sense, but the aircraft engineer will not find in it the data which he wants in practice. That is no fault of the author, and the reviewer wishes to make is perfectly clear that it is a good general book on the subject, though it does not directly appeal to the aircraft designer.