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AIR SCREW OPERATION IN A NON–UNIFORM STREAM

by prof. E. PISTOLESI.

After having pointed out the importance, which such a problem may get on the study of screw operation in the neighbouring of bodies, or like a subsidiary means to the study of the screws in a side wind, the A. examines, at first, the case of a screw operation in an axially directed stream with a linearly variable speed in function of the distance from a fixed diameter of the screw disc.

He finds that the thrust is not sensibly influenced, but that the torque decreases; a confirmation of Petersohn’s experimental results about the efficiency improvement obtained, average speed being the same, in comparison with the propeller operating in a uniform stream is deducted by the A.

Further, a side thrust (parallel to the above mentioned fixed diameter) and a moment around it are obtained.

The relative dimensionless coefficients, τ₀, k₀, σ₀, and μ₀ are plotted on the diagram in function of γ₀; being γ₀ the effective average advance coefficient. One finds that τ₀ is represented by a straight line, as in the case of a uniform wind, k₀ by a parabola, σ₀ by a parabola, μ₀ by a straight line.

The A. examines further the passage from the speeds on the disc (effective relative speeds) to the original speeds (at infinite
distance upstream) by calculating the induced increments on base of simplifying hypotheses, which are the natural extension of the well known average increment method.

The main of these hypotheses is that the axial increment also may variate on a linear law. The interesting research result, which finds its base on the application of the momentum theorem, shows that axial increment is higher where axial speed $V_a$ is lower and vice-versa, so that screw work has a sensibly uniforming influence on the flow. There is, as it already was pointed out, the reason of increased efficiency.

The A. continues indicating in what manner the influence of section profile drag on the screw thrust and torque has to be taken into account.

At last, the more general problem, in which the presence of a side speed (which, for sake of simplicity, is supposed uniform) is considered too. The functional coefficients relative to this case are calculated and the possibility of side forces and of obliquely directed moments with regard to the side advancement direction is deducted; which confirms what already was experimentally pointed out on airscrews operating in an oblique wind relative to the rotation axis.

Such a possibility disappears when side stream is missed or axial speed is supposed uniform.

To be able to pass to the original speeds, it would be necessary to be able to calculate the induced increments, what, moreover, involves some great difficulties, owing to the complexity of the problem and to the impossibility of solving it with the methods employed in simpler cases.

G. B.

**EXPERIMENTS ON JUNCTIONS BY MEANS OF TUBULAR RIVETS BETWEEN THIN DURALUMIN SHEETS**

*BY DR. GIUSEPPE GABRIELLI.*

The Author recalls first of all the results of experiments carried out last year (which were shown by him at the Meeting of the 2nd Aerotechnical Week of Turin, September 1928) with the purpose of deducing the comportment of rivetting made by means
of durallumin nails between thin sheets of durallumin. After this the results are shown of experiments also carried out on the Piaggio Firm Establishment at Finalmarina (Genoa), in order to deduce the comportment of junctions effected by means of tubular rivets between sheets having a thickness of .4, .6, .8, 1, .2, 1.5 mm., concluding that the design of the junctions either by means of nails or rivets should be made according:

1st to the fact that the specific pressure exercised by the shaft of the nail or of the rivet against the sheet hole should not exceed a certain amount, which for nails is of 80 kg./mm and for rivets is 50 kg./mm².

2nd to the fact that the tensile stress of the sheet to be joined has to be equal to the shearing strength of the nails or of the rivets, reckoned on an average tangential tension of 20 kg/mm².

These conditions admitted, the Author deduces in both cases the formule furnishing the value of nail and rivet diameter in function of the sheet thickness and the value of the pitch, putting the nails on one or two lines and the rivets on two lines. According to these elements the Author compares to each other the two systems of junction, deducing that for thicknesses less than 8 mm. the junction by means of nails is to be preferred. The rivets can be utilised with reasonable and full exploitation for thicknesses of 1 mm.; over 1 mm. thickness the rivets are not suitable for the said conditions. The Author moreover points out that for these thicknesses the specific rivet pressure can be increased over 50 kg/mm², but for determining this value further experiments have to be made.

At last the Author observes that the great difference among specific breaking pressure, both on the case of junctions by means of nails (80 kg./mm²) and of rivets (50 kg./mm²), is not due alone to the fact that the friction between the sheets, produced by the pressure exercised by nail heads, preserves the sheets from the ovalisation much more than in the case of the junction by means of rivets, but it is also a consequence of the local stiffening around each nail supported by the sheets, which efficiently resists the phenomenon of crinkling, which for thin thicknesses appears in a remarkable way in junctions by means of rivets.
EXPERIMENTAL TESTS ON TUBES ACCOMPANYING THE AIRSCREW SLIP-STREAM

(Communication of the Aeronautical Laboratory of Turin University).

The Report deals with experiments carried out in the Aeronautical Laboratory of Turin University by Mr. C. Ferrari under the supervision of Professor M. Panetti. The experiments relate to the behaviour of a propeller working within an accompanying tube, according to a disposition designed by Professor L. S. Dal Rios, and have been carried out in the said Laboratory on a 2 blade propeller 600 mm. in diameter (D) and 318 mm. in pitch \( p = 0.53 \text{D} \) with a rotation speed between 1100 and 2300 R. P. M. and a wind speed between 6.2 and 15.9 m/s and the working ratio \( \gamma = v/\omega R \) ranging from 0.12 to 0.22.

The thrust on the propeller, on the accompanying tube and on the unity were obtained, and, by means of pneumometric experiments, the pressure distribution on the two sides of the tube was found. The results are that the resistance of the tube is a little diminished by the propeller action, especially at the lowest numbers of the working ratio \( \gamma \) and that the thrust of the propeller is a little increased by the influence of the tube, being such an influence increasing in proportion to the increase of \( \gamma \). The thrust of the unity is then becoming less than that of the isolated propeller, the difference increasing remarkably in proportion to the increase of \( \gamma \).

The thrust of the tube, obtained as an integral of the rise of pressure on both sides of it, results in good accord with the thrust measured directly by means of the balance.

THE FIRST EXPERIMENTS IN THE WIND WITH THE "AIR SCREW RING" SYSTEM

by prof. L. S. Da Rios.

The A. demonstrates, at first, how the drag of a suitling tubing downstream a tractor propeller may substitute the drag of a common fuselage; further, on the base of experimental data, obtained at the Turin wind tunnel, with two different forms of accompanying tubes (rings), he points out the advantage offered by the air-screw-ring system; advantage of "suction", which in some cases reaches values very near to those of isolated air screw thrust. G. B.
FLIGHT IN NATURE AND SCIENCE

(A lecture delivered by R. Giacomelli on October 26th at the Historical Exhibition of Sciences in Florence).

Locomotion in a fluid – air or water – was realized by the statical and the dynamical principle: ship and airship, hydroplane and aeroplane, respectively.

But practically locomotion in water refused the vehicle founded on dynamical lift – the hydroplane – limiting itself to one solution: that founded on statical lift – the ship. Between two solutions, both possible, one only turned out practical.

On the contrary locomotion in air accepted, at least till now, the vehicles founded on both principles: airship and aeroplane. But are both the solutions, besides being possible, also practical?

On this point, there are technicians who think that the airship can not definitely compete with the aeroplane; but there are also others who maintain that both the means of air transportation have a right to live.

The example of nature however is not favourable to this second opinion: in fact nature realized aerial locomotion only on the dynamical principle, as it realized water locomotion only on the statical principle.

At any rate the question is not to be decided by arguing nor by analogies, but by experience. Let us construct great airships and increasingly greater, because only in the greatness of size the practicability – if practicality there is – can be found, and at last we will see if this way is right or wrong.

But this experimentation is very expensive and difficult, and not all countries are disposed to contribute to it. Italy and France for instance refused to carry out such a work; but as there are countries – England and Germany – which are disposed to try it, let us to be grateful to these countries for their work, of which we await the results.

After this preliminary discussion the lecturer illustrates the various means which both nature and science employed in solving the problem of flight, setting forth the high function which natural flight accomplishes in the economy of terrestrial life and which mea-
canical flight will accomplish for civilisation and for the definite human conquest of our planet.

Mr. Giacomelli closed his lecture by pointing out the work of Leonardo da Vinci about human flight and expressing the wish that on that Monte Ceceri in the neighbourhood of Fiesole (Florence), from which he hoped to start his first flight, a great international monument will be erected to human flight personified by Leonardo.

After the lecture two very interesting films were shown. The first of Mr. M. Boel, a Belgian scientist, on various subjects of natural flight and the second of Mr. G. Fieseler, a German pilot, on stunt manoeuvres carried out by him.

THE ITALIAN MACHINES AT THE SCHNEIDER TROPHY

BY C. DE RYSKY.

After having set forth the importance of the contest from the point of view of promoting both aeroplane and engine development, the Author describes the Italian machines which entered the competition: 'Fiat C 29', 'Macchi M 67' and 'Savoia S 65', with their 'Fiat' and 'Isotta–Fraschini' engines.

Prof. ENRICO PISTOLESI, Direttore responsabile.
Questo motore costruito dalla «Isotta Fraschini» colma una lacuna nella produzione dei motori marini da corsa.

Finora infatti i nostri migliori costruttori navali avevano dovuto servirsi di motori esteri per correre nella categoria con cilindrata non superiore ai 12 litri.

Il risultato ottenuto dalla «Isotta Fraschini» è quello che testimoniano le superbe prove fornite dallo scafo Montelera alle recenti gare di Venezia e di Como. Lo scafo condotto dal conte Rossi ha battuto recentemente e con esuberanza di mezzi tutti gli altri concorrenti anche nella categoria libera il che dimostra l'eccellenza dello scafo ed il perfetto rendimento del motore.

Le caratteristiche generali del motore «Asso M. 12» sono quasi le stesse del motore per aviazione «Asso 200» per quanto riguarda la disposizione generale meccanica e i dettagli costruttivi, salvo importanti variazioni relative allo speciale impiego per quanto riguarda la cilindrata che è stata contenuta nel limite dei 12 litri ed il rendimento volumetrico che è stato notevolmente aumentato tanto che con solo 11,94 di cilindrata il motore rende al suo regime normale 330 HP ed al suo regime massimo 340/350 HP.
Il tipo «Asso M. 12» consiste sommariamente in un motore «Asso 200» d'aviazione accoppiato ad un potente innesto con snodo a sfera per l'albero dell'elica.

Le caratteristiche del motore sono le seguenti:

<table>
<thead>
<tr>
<th>Caratteristica</th>
<th>Valore</th>
</tr>
</thead>
<tbody>
<tr>
<td>Numero dei cilindri</td>
<td>6 in linea</td>
</tr>
<tr>
<td>Alesaggio</td>
<td>mm. 130</td>
</tr>
<tr>
<td>Corsa</td>
<td>mm. 150</td>
</tr>
<tr>
<td>Cilindrata totale</td>
<td>litri 11,94</td>
</tr>
<tr>
<td>Regime normale</td>
<td>giri 2600 al primo</td>
</tr>
<tr>
<td>Potenza corrispondente</td>
<td>HP 330</td>
</tr>
<tr>
<td>Regime massimo</td>
<td>giri 3000 al primo</td>
</tr>
<tr>
<td>Potenza corrispondente</td>
<td>HP 340/350 (senza collettori di scarico)</td>
</tr>
<tr>
<td>Peso del motore completo in ordine</td>
<td>kg. 320 circa</td>
</tr>
<tr>
<td>di marcia con raffreddatori di</td>
<td></td>
</tr>
<tr>
<td>acqua e olio ed avviamento ad aria</td>
<td>gr. 230 circa</td>
</tr>
<tr>
<td>compressa</td>
<td></td>
</tr>
<tr>
<td>Consumo benzina per HP/ora</td>
<td>gr. 20 circa</td>
</tr>
<tr>
<td>Consumo olio per HP/ora</td>
<td></td>
</tr>
</tbody>
</table>

DESCRIZIONE DEL MOTORE

**Cilindri.** - In acciaio al carbonio stampati, separati con camicia in lamiera riportata autogenamente, nel loro fondo vi sono le sedi delle valvole.

**Testa.** - In alluminio in un sol blocco per il gruppo di sei cilindri. Contiene le valvole (per cilindro 4) le loro guide, i passaggi per i gas di aspirazione e di scarico, porta gli alberi a *cames* ed è chiusa ermeticamente da un coperchio smontabile.

**Carter motore.** - In alluminio, diviso in 4 parti di cui la superiore fa da base ai cilindri, da supporto all'albero a gomito e da guida agli ingranaggi di distribuzione.

La inferiore media fa da cappello all'albero a gomiti e porta la pompa dell'olio e di circolazione acqua dolce nel motore. La inferiore raccoglie l'olio di lubrificazione. L'anteriore centrale a forma di mensola porta i magneti ed i loro comandi e la pompa ad ingranaggi per la circolazione dell'acqua nel refrigerante.

**Distribuzione.** - Ogni cilindro ha due valvole di aspirazione e due di scarico comandate da due alberi a *cames*. Ognuna valvola è richiamata da due molle ad elicoidali concentriche.

Fra *cames* e valvole sono interposte delle levette ciascuna delle quali comanda due valvole. Il movimento agli alberi a *cames* è trasmesso a mezzo di albero ad ingranaggi conici.
Albero a gomiti. - Ha sei gomiti con otto cuscinetti ed è forato per la circolazione del lubrificante.

Bielle. - A sezione ad H in acciaio speciale trattato.

Pistoni. - In lega speciale di alluminio fuso in conchiglia, lo spinotto è libero sia nei mozzi del pistone che nella bussola del piede di biella.

Magneti. - Due da 6 cilindri ad anticipo variabile, per cui ogni cilindro porta due candele di accensione.

Carburatori. - Due gemelli verticali; le tubazioni d’ammissione hanno camice riportate per la circolazione regolabile dell’acqua di riscaldamento.

Lubrificazione. - A mezzo di due gruppi di due pompe di ricupero che aspirano l’olio dal fondo del carter e lo mandano al serbatoio ed una di pressione che lo dirama in tutte le canalizzazioni del motore.

Circolazione dell’acqua. - A mezzo di pompa centrifuga che prende l’acqua dolce da un serbatoio refrigerante. Una specie di cucchiaio opportunamente disposto sotto lo scavo incanalà l’acqua di mare e la fa circolare nel refrigerante del serbatoio dell’acqua dolce.

Messa in marcia. - Ad aria compressa con distributore rotativo comandato dal motore stesso.

Apparecchi accessori. - La pompa per benzina è fissata alla parete anteriore della testa del gruppo cilindri ed è comandata a mezzo ingranaggi dell’albero verticale inclinato.

Giunto a snodo sferico. - Il motore è munito sul prolungamento dell’albero a gomito di un giunto a snodo sferico ed a tenuta d’olio che permette di montare il motore con un certo angolo del suo asse rispetto all’asse dell’albero del’elica.