"COANDA-1910" - the first jet propulsor for airplane

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Abstract: *This paper contains the authors' research regarding the first airplane equipped with a jet propulsion system made by Henri Coanda in 1910, also being homage pays to Henri Coanda, his inventor.*

Keywords: Henri Coanda, jet propulsion, Coanda Effect

1. INTRODUCTION

This paper contains a presentation of the first jet propulsion airplane in the world made by Henri Coanda and exhibited at the Second International Aeronautic Salon in 1910. The operating principle of the engine, its features and subassemblies are presented.

2. COANDA-1910 AIRCRAFT

Coanda-1910 Aircraft was the first airplane equipped with a reactive propulsion system in the world, imagined, designed, built, tested and piloted by the Romanian engineer and inventor, Henri Coanda, at the age of only 24.

Fig. 1- Henri Coanda 1910

In October 1910 Grand Palais on Champs-Elysees in Paris hosted the second International Aeronautical Exhibition. The most recent products of aviation were exposed here, but the most interesting machine, which attracted lots of people, and caused the visitors to gather in a crowd around it, was a red airplane without a propeller; beside it, on a metallic shell, was written: COANDA-1910. This airplane caused the people to be so curious because

it was completely different from what people knew by that time an airplane looked like. It was a double-wing, one-seat plane equipped with a reactive engine. As the scientist Elie Carafoli well said Coanda's plane features were, "probative regarding the ingenuousness and the intuitive power of his constructor. The engineer Henri Coanda has given the mankind, many decades ago, a precious tool for breaking the air space: the jet engine, the first in the world. The engineer Henri Coanda's priority in inventing the jet engine is currently generally acknowledged."

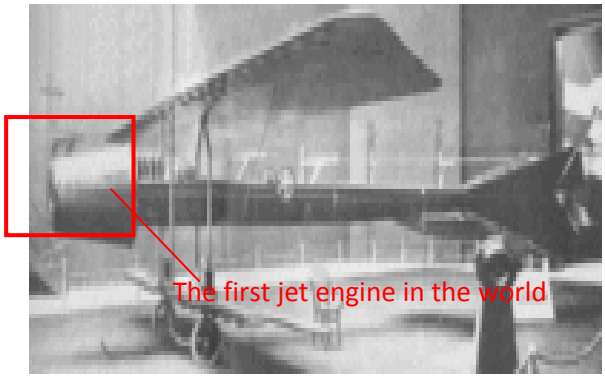


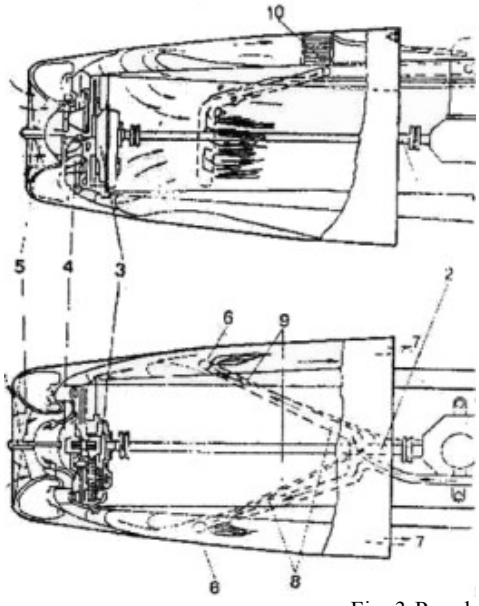
Fig. 1-The first world's airplane to be equipped with a jet engine-Paris 1910

Technical details:

- Span: 10.3 m; - Length: 12.5 m; - Wing Area: 32.7 m²; - Weight: 420 kg
- Power plant: Four-cylinder, In-line, Water-cooled engine developing 50 HP (37.3kW) at 1,000 rpm driving a compressor designed to produce a thrust of approx 2,000N.

3. OPERATING PRINCIPLE OF THE PROPULSOR

The turboprop, as it was named by Henri Coanda, was in fact a jet engine with centrifugal blower and post combustion according to the current terminology.



1. Internal combustion engine "CLERGET" 50 HP
2. Engine shaft
3. Multiplication device
4. "COANDĂ" compressor
5. Obturator
6. Combustion chambers
7. Nozzles
8. Gas exhausting pipes
9. Fuel pipes + injectors
10. Radiator

Fig. 3-Populsor operational diagram

The system involved an internal combustion engine with 4-cylinder in line CLERGET 50HP with 4000 rpm multiplication device for the turbine (with centrifugal blower) injectors and blowers (according to Henri Coanda's words).

Coanda's turboprop in 1910 was designed to generate power by accelerating a cup of air set in motion by a centrifugal blower and was located inside a conical fairing. In this way, a reaction effect is produced, propelling the aircraft ahead, hence its movement in space. The turbine was preceded by a fixed guiding device, consisting of 15 fixed clockwise curved blades, which are visible in all pictures with the front of the plane. In accordance with Henri Coanda's words, behind the turbine (or downstream) there were two post combustion areas with a "hollow reaction" shape, located on two sides along the fuselage inside the same conical fairing. In this "hollow reaction" areas probably took place the fuel injection and combustion which produced "flames so strong" that generated "a high feeling temperature" that it was necessary to "cover this flames, with two small ceramic plates".

It is true that we haven't yet another proof of the existence of these "hollow reaction" areas except Henri Coanda's own statements made in 1967, but without the propeller and the post combustion and the geometric configuration as far as it is known, it could not generate a measured force of 220kgf. The turbine was sucking air in the quantity desired by the pilot through an obturator (similar to an camera iris), creating a pressure for the two combustion chambers where the fuel was ignited by the exhausting gases of the Clerget engine, the resulting gases being exhausted through the nozzles located on the side ways of the fuselage, obtaining in this way the force required for the propulsion.

Fig. 4- Similar 1909 engine

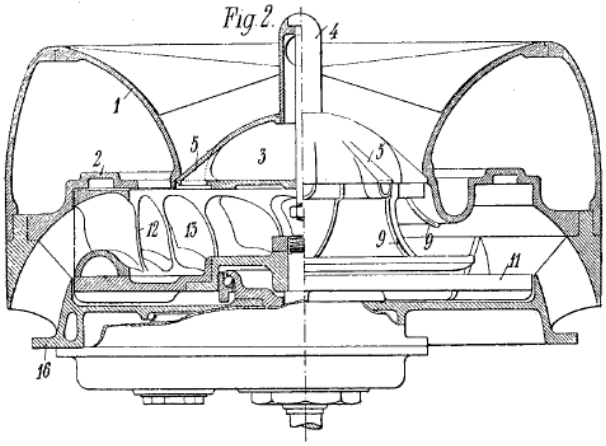


Fig. 5- Centrifugal compressor (two known variants)

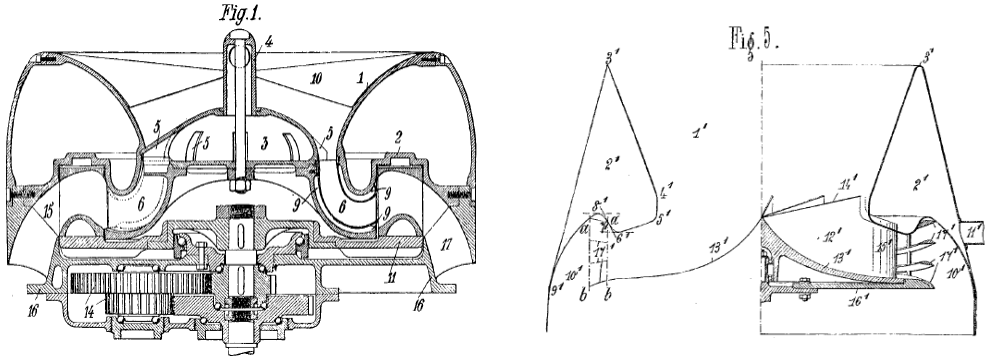


Fig. 6- Multiplication device

The technical features of the turboprop, as they were given in the presentation chart of the airplane, are: diameter: 0.5 m, depth: 1.1 m, turbine minimum rotational speed: 4000 rpm, measured thrust at 50 HP: 220kgf.

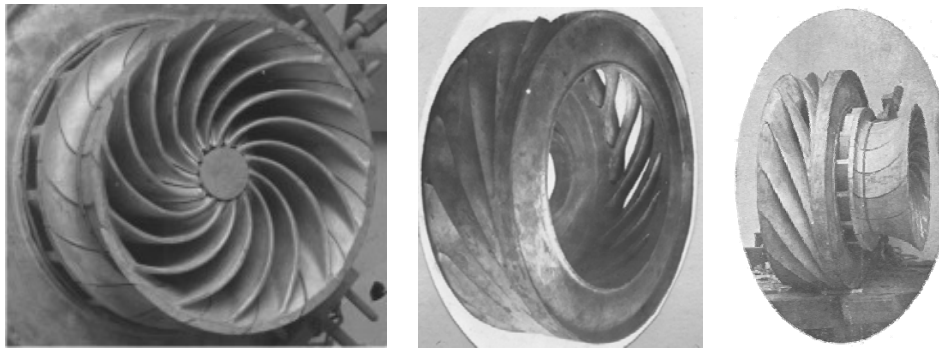


Fig. 7-Stator-rotor assembly

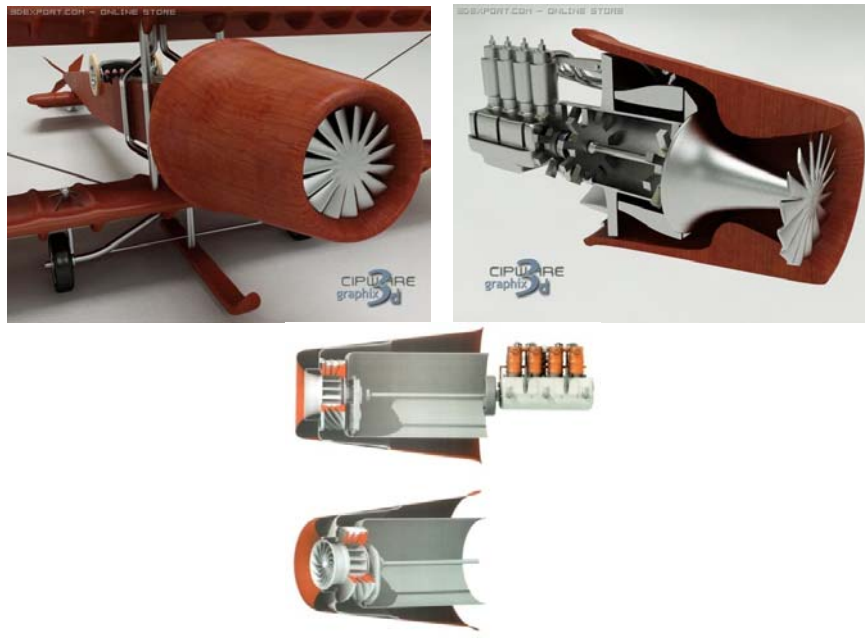


Fig. 8-3D Model of Coanda's engine

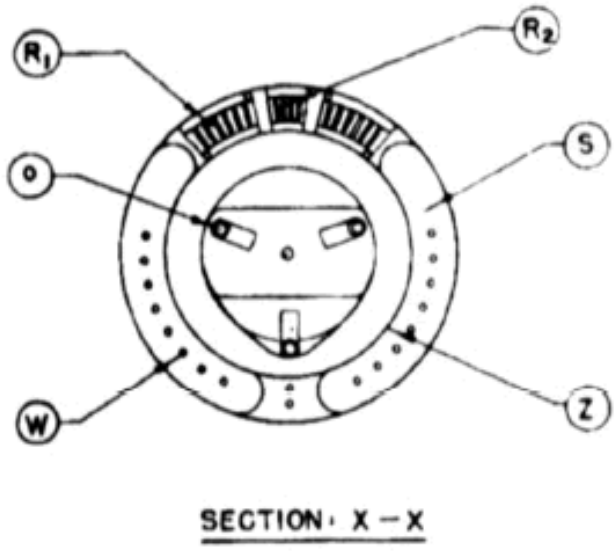


Fig. 9 -Injectors and burners (according to Coanda`s specification)

This system was patented as an invention under the license number 416541, submitted in Paris on 30th of May 1910 and published on 29th of October 1910, under the name of *Propulseur.*

RÉPUBLIQUE FRANÇAISE.

OFFICE NATIONAL DE LA PROPRIÉTÉ INDUSTRIELLE.

BREVET D'INVENTION.

VI. — Marine et navigation.
2. — MACHINES MARINES ET PROPULSEURS.

N° 416.541

Propulseur.

M. HENRI COANDA résidant en France (Seine).

Demandé le 30 mai 1910.
Délivré le 9 août 1910. — Publié le 22 octobre 1910.

Fig. 10- Propulseur - Patent number FR416541, submitted in Paris on 30th of May 1910 and published on 29th of October 1910

CONFÉDÉRATION SUISSE

BUREAU FÉDÉRAL DE LA PROPRIÉTÉ INTELLECTUELLE

EXPOSÉ D'INVENTION

N° 58323 — 26 mai 1911, 6 ¾ h. p. — Classe 128 c

BREVET PRINCIPAL

Henri COANDA, Paris (France).

Propulseur.

Fig. 11- Propulseur - Patent number CH58323, published on 26th of May 1911

Coanda used the same engine type, also in 1910, for building and equipping a two seat sledge for the Grand Duke Cyril of Russia, to take part in an engine sledges contest in Saint Petersburg.

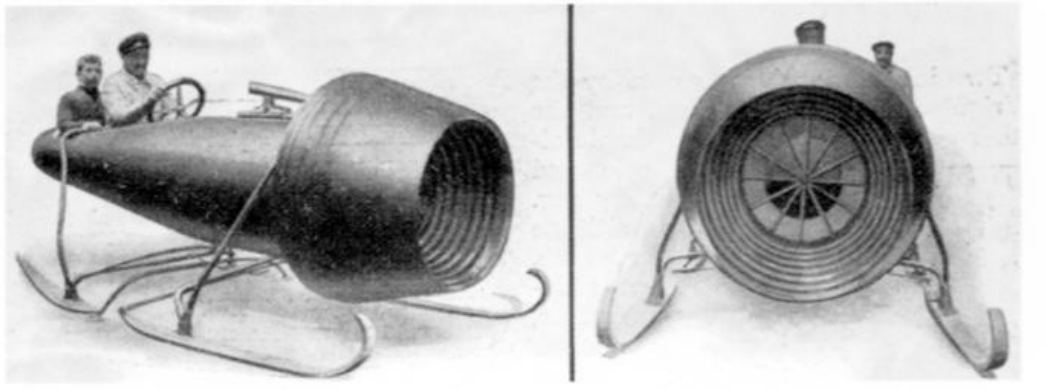


Fig. 12-Sledge equipped with the turboprop Coanda-1910

4. COANDA EFFECT

After the exhibition closed its doors, on December 16, 1910, Henri Coanda transported his airplane at Issy-les-Moulineaux.

There, he only intended to verify the engine, not to fly. So Coanda got into his machine, and after several minutes of warming up, pushed the buttons that commanded the obturator and the rotation speed of the engine.

The airplane began to move faster and faster, and flames and fume could be seen along the fuselage getting out from the engine.

After a very short time, before Coanda could realize what was going on, the airplane was in the air.

Impressed by the flames and worried about the fact that he had never piloted an airplane by then (only gliders); Coanda lost the control of his machine which began to lose speed and height. In a short time it stroked the ground and caught fire.

This attempt constitutes the first flight of an airplane equipped with a reactive engine, the first reactive flight of an airplane in the world. But lacking the financial support Coanda could not improve his invention so that a second reactive airplane made by Coanda could not be seen flying again.

After spending years in studying the phenomenon that led to his plane destruction, Coanda obtained his French patent, "Method and apparatus for deviation of a fluid into another fluid", only in 1934 (no. 792754 from 8th of October 1934) and the Romanian one in 1935 (no. 24376 from 4th of October 1935). This phenomenon is known as "Coanda effect" in current terminology and it is approached in a large number of important theoretical and experimental studies.

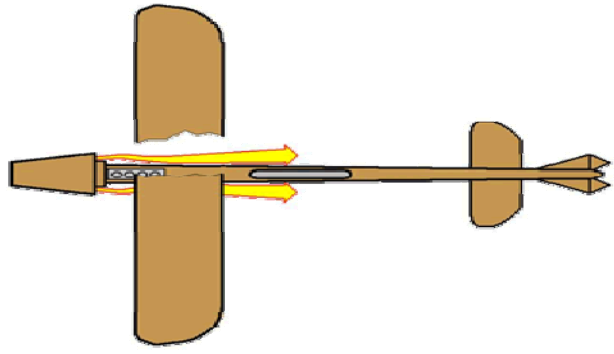


Fig. 13-Coanda 1910 plane diagram with the jet attached to the fuselage

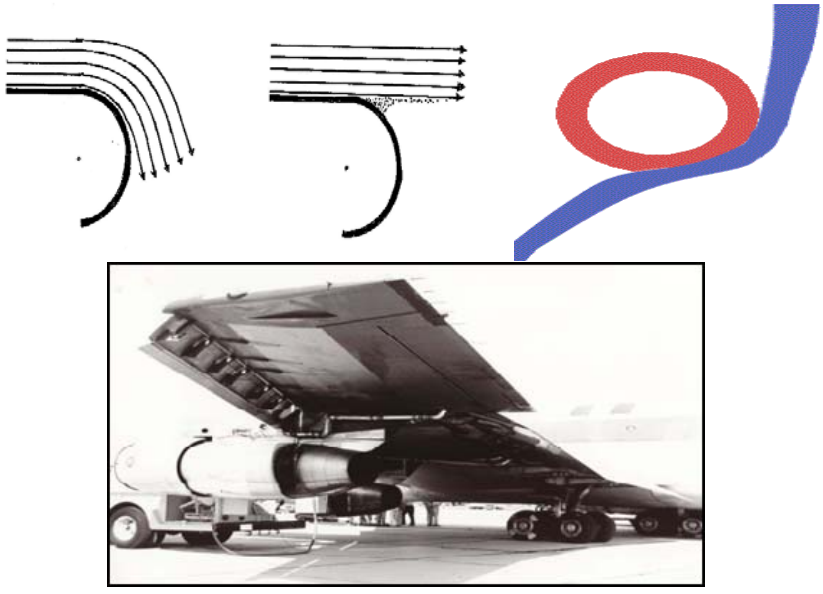


Fig. 14 -Coanda Effect and its usage

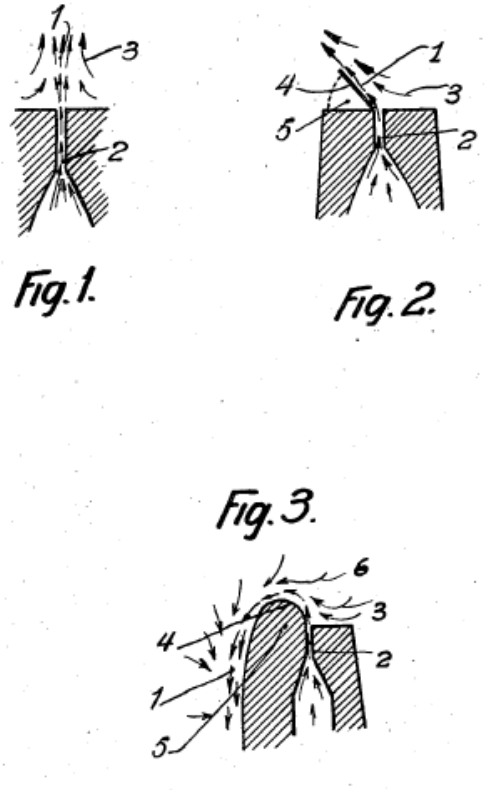


Fig. 15 – Coanda Effect

Fig.15.1. - The induced flow of the surrounding fluid by a fluid stream issuing from a nozzle

Fig.15.2. - Preventing the flow of the surrounding fluid on one side by means of a flap and the deflection of the issuing stream

Fig.15.3. - Suitably checking the surrounding fluid on one side of the orifice by extending the flap according to a given line and, thus producing a strong suction, the issuing fluid will move towards the side on which the flow of the surrounding fluid has been made more difficult.

In the end, Henri Coanda's 1910 invention was never furthered into practical use - no doubt because of the complexity of the propulsion method and of the fact that his design was realistically years ahead of anything else available in 1910. Decades later, the Italian Campini-Caproni CC.2 turbojet and piston-powered design would take to the skies in the middle years of World War 2. In this instance, the technology was outplayed by the development of the turbojet by both the British and German researchers, basically making the CC.2 an aerial wonder to behold yet inevitably a technological dead end.

Whether or not pursuing this technology, so early in the century, would have had much of an impact in making a faster fighter design is only matter for speculation and debate. Some might argue that it would have been an improvement over propeller-driven designs but others disagree that the propulsion technology would have had a significant impact in terms of performance gains. Obviously the old “wood and wire” approach in construction should have been reviewed to produce a design capable to bear the stress and rigors of this new form of propulsion. In any case, the world was not yet ready for Henri Coanda and his jet approach to flight.

Fig. 16- Henri Coanda- Centenary

Societies advance for many reasons. One of these is the ability to innovate – which simply put means creating new and better ways of solving problems. This is, in fact, the basis of the genuine wealth creation.

A shared trait among innovators is curiosity and passion for their chosen work. In that respect, Coanda has done well for himself and for his country, his visionary jet engine in 1910 doing away "with the limitations of current thinking-that a propeller was indispensable..."

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