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Auxiliary Injection

Engine Concept (e.g. Ramjets)

Patent Application:

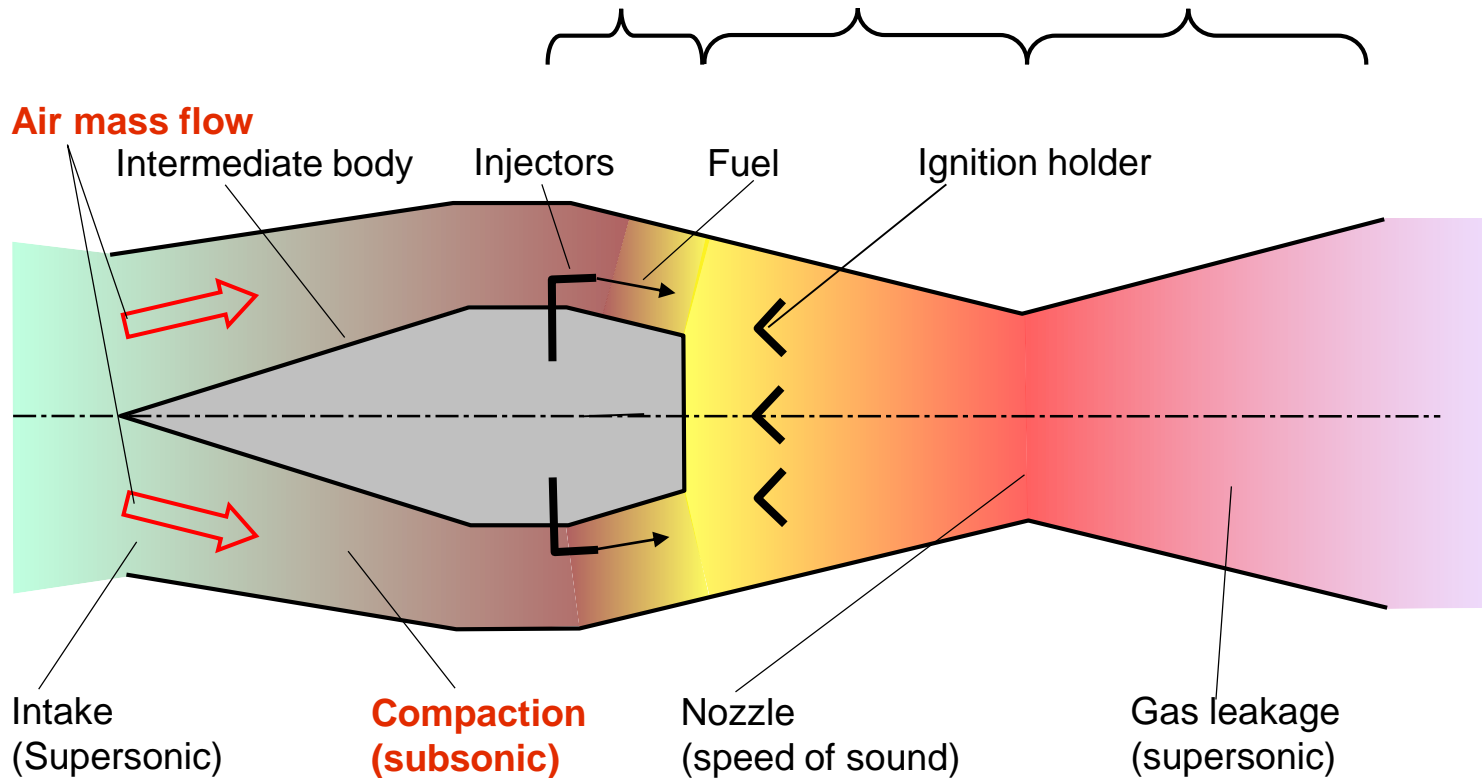
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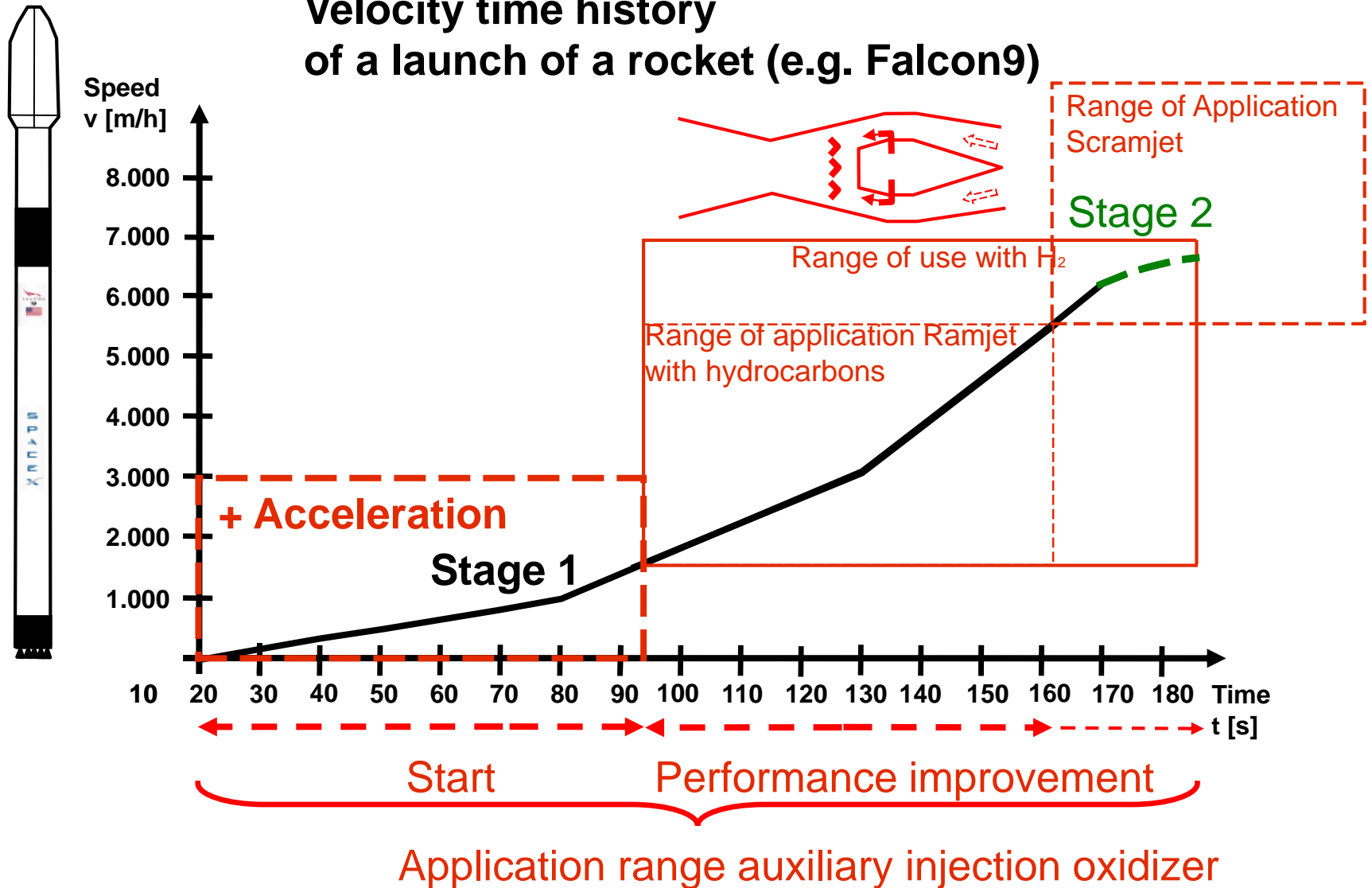
Use of the "ram effect" → Compression via inlet geometry on subsonic
No moving parts as with turbine
General inflow velocity required

Mixing area Combustion chamber Nozzle



Gas leak (supersonic) Source: wikipedia.org/wiki/ramjet-engine of 16.03.2021

Velocity time history of a launch of a rocket (e.g. Falcon9)



No civilian operational examples so far → Inhibits development for vertical takeoff

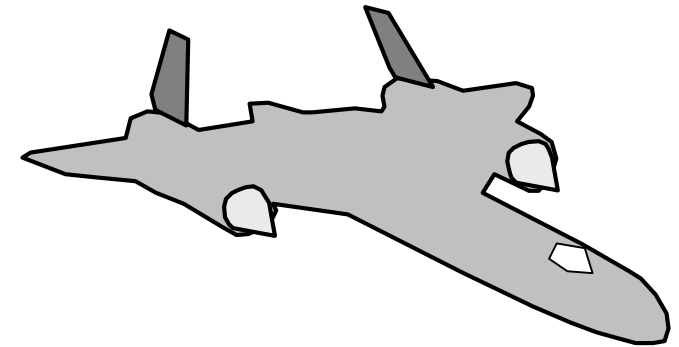
Aviation

SR71 - "Blackbird"

Combination of turbojet / ramjet (ramjet + afterburner)

First flight already in 1964. Used until 1998

For speeds up to over Mach 3



uneconomical in civil aviation due to higher fuel consumption than turbine engines (spec. impulse)

Aerospace

Development trials for aircraft, or in the space sector (e.g. for Singer concept).

→ but thermal problems and energy challenges with high drag / launch acceleration.

SABRE combined cycle engine (UK) - national / EU major project.

→ Combination of turbine engine with ramjet and over approx. Ma 5.14 as rocket

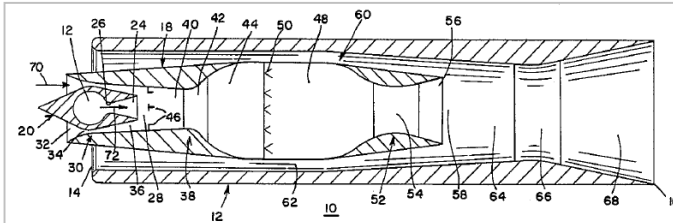
→ research for several decades - technical details are secret

→ High-performance cooling

→ according to own information, consumption could be reduced significantly

SKYLON

The decisive factor is the mixture of fluids: increasing flow and additional injection. enclosed a short selection:

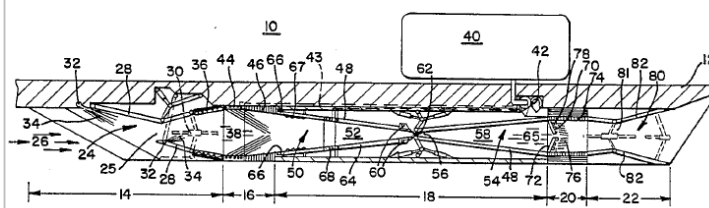


Patent specific. US 4,644,746:

GAS COMPRESSOR FOR JET ENGINE

Neil W. Hartman (filed 02/24/1987)

- Injection from intermediate body
- Multi-flow principle

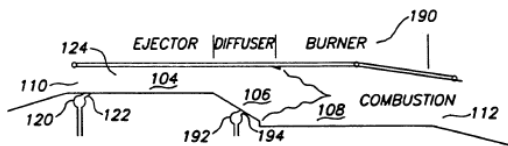


Patent specific. US 4,644,746:

GAS COMPRESSOR FOR JET ENGINE

Neil W. Hartman (filed 03.11.1988)

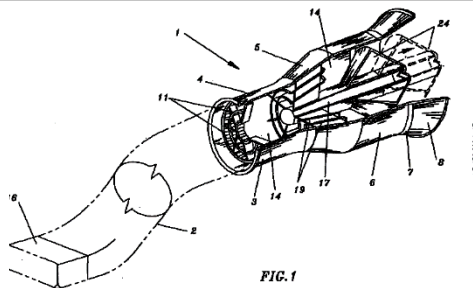
- multiple adjustment device
- additional injection in the inlet



Patent specific. US 5,129,227:

LOW SPEED ENGINE FOR SUPERSONIC AND HYPERSONIC VEHICLES

- Garry W. Klees et. al (filed 10.04.1991)
- Complex of topics of mixing of fluids

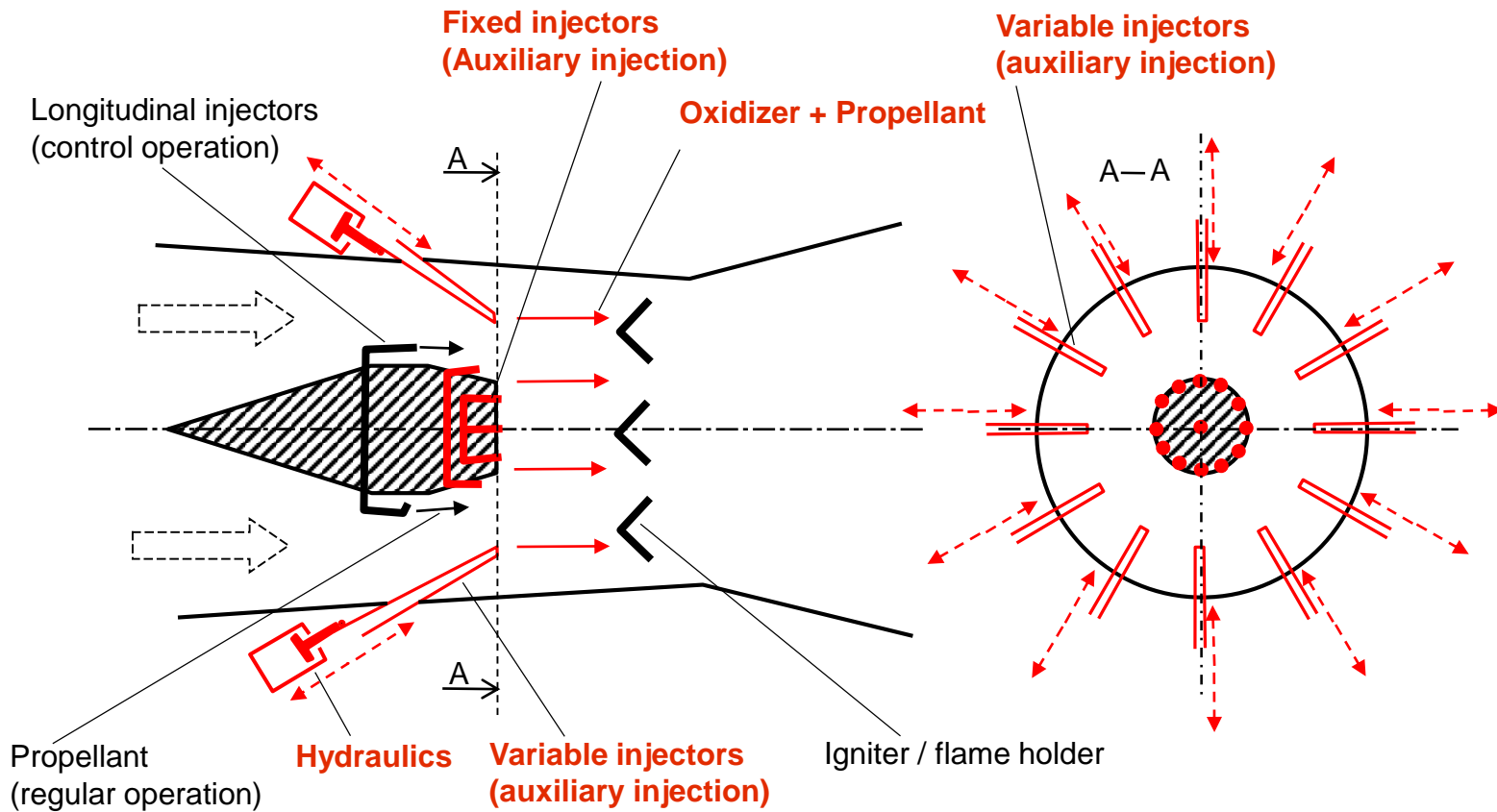


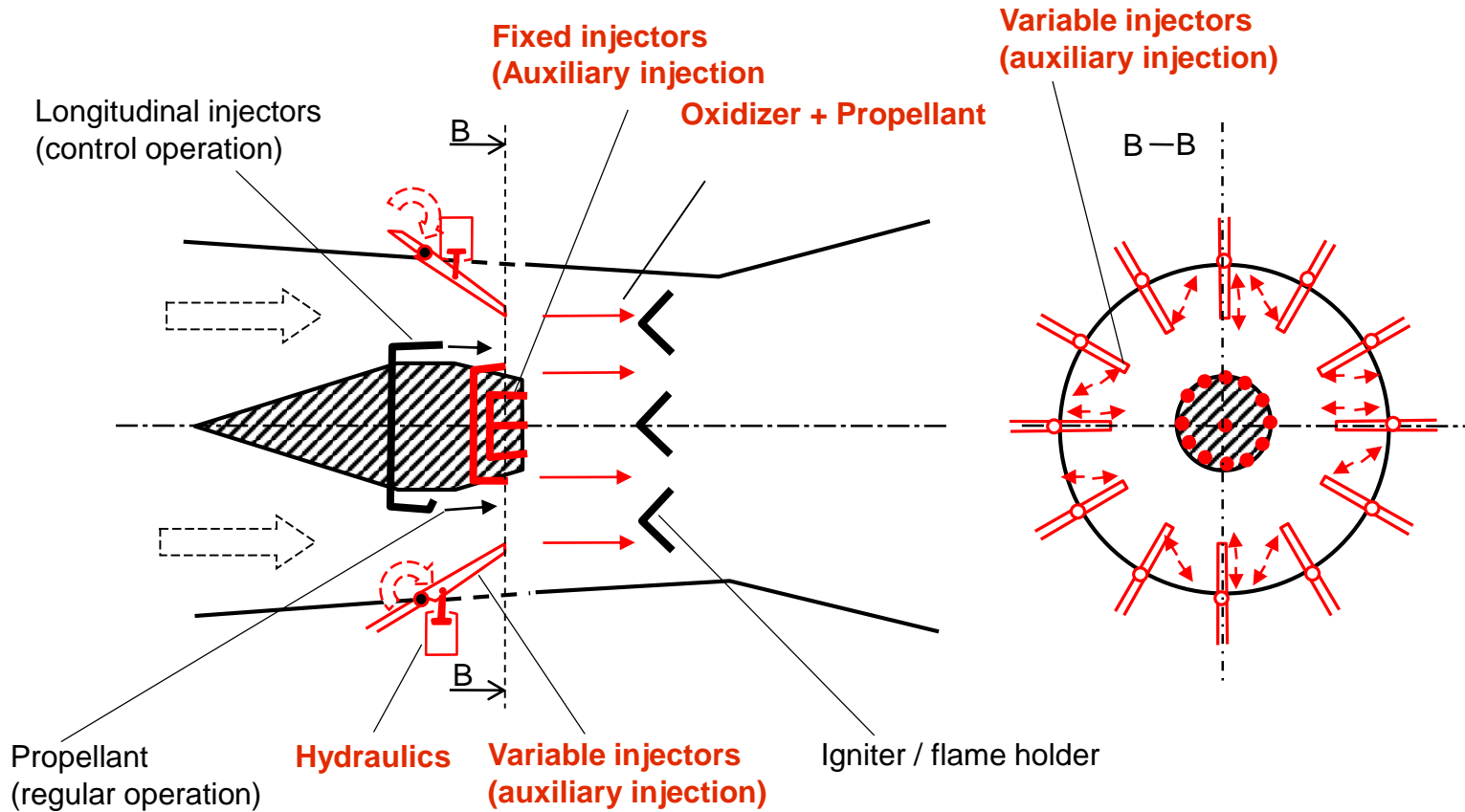
Patent specific. EP1 009927B1:

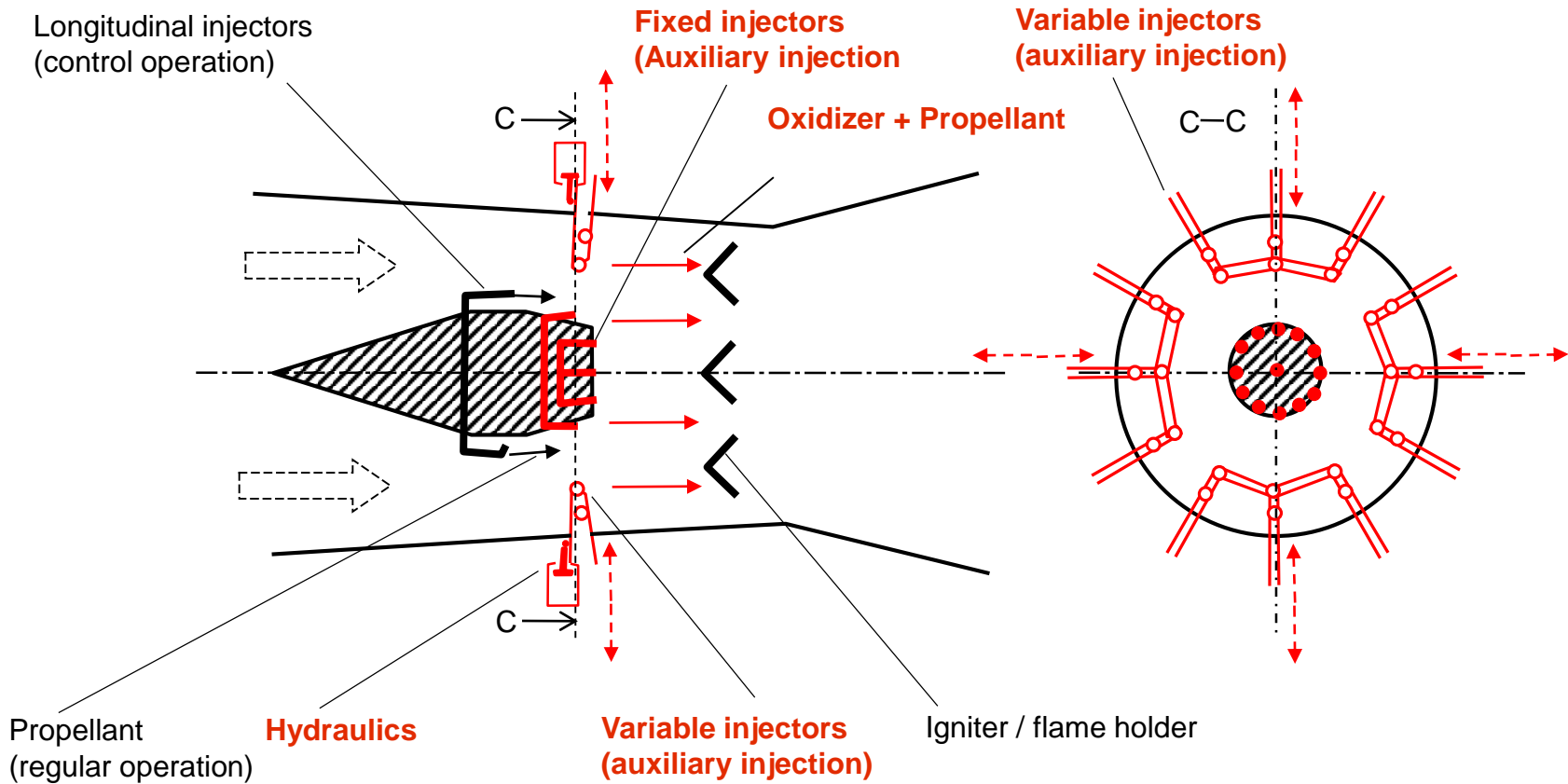
EJECTOR RAMJET ENGINE

BENDOT, Joseph G. (priority 12.08.1997)

- Fixed constrictions
- Movable constrictions for variable shocks
- additional injection before mixing section







Summary - when used in siphon concept: variable additional injection = limitation of energetic losses

