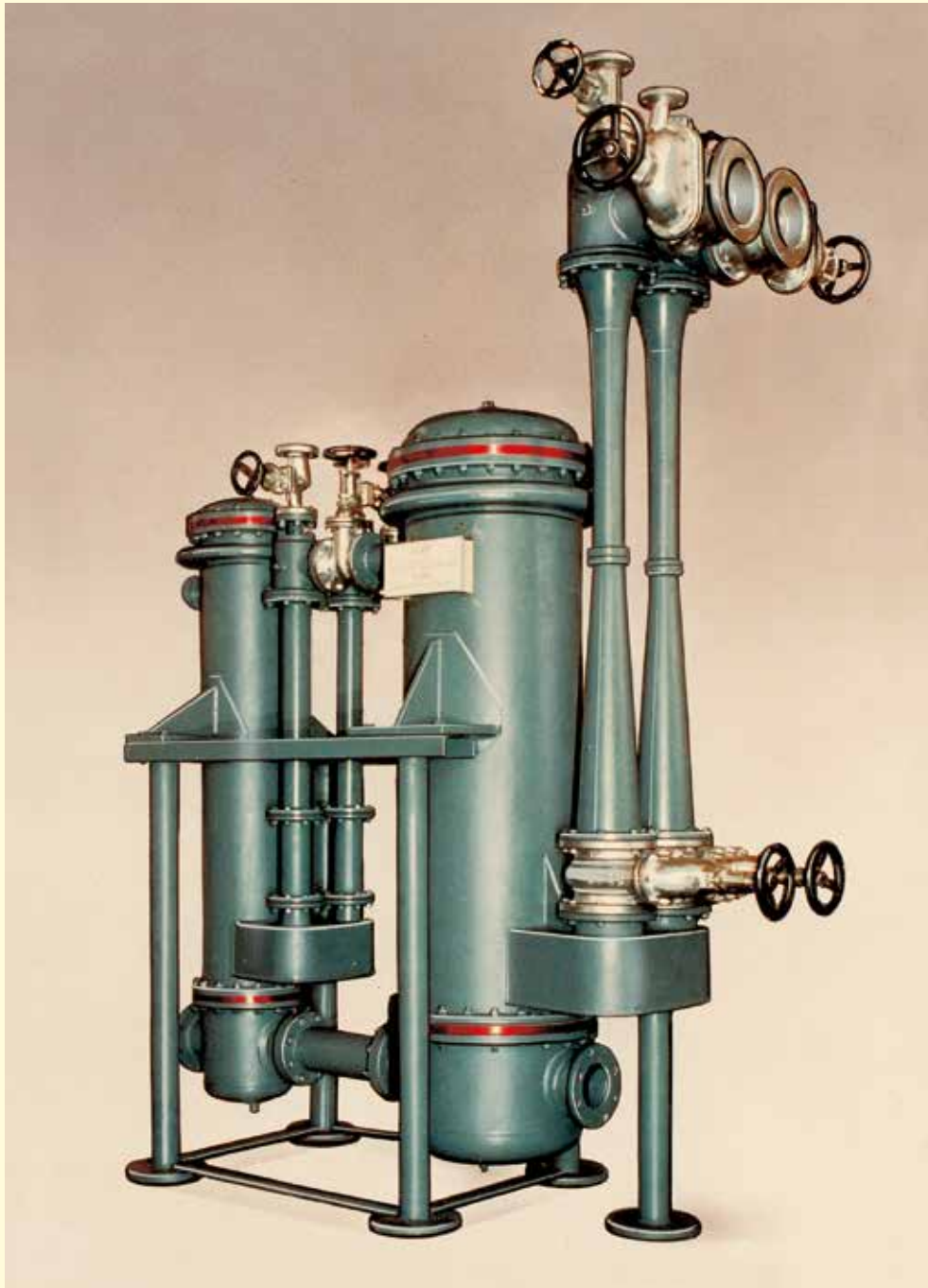


Single and multistage steam jet ejectors



SCAM ejectors

Since 1930, SCAM S.p.A. has been designing and manufacturing about 13,000 ejectors of various types for the most different applications and can boast, among its Customers, the main Italian and foreign industrial companies.



TWO-STAGE EJECTOR TWIN ELEMENT with inter surface condensers

To conclude this outline of possible applications, it is important to mention two recent uses: the maintenance of vacuum in test rooms for the simulation of flights at high altitudes - as well as in the space - and the degassing of molten steel during casting operations in steel mills. In these cases, the residual pressures on suction are lower than 1 mbar and the quantities of intaken fluid are considerable. This involves the setting up of huge plants with suction ducts having a diameter up to 3 m.s.



Three-stage ejector with direct contact inter-after condensers

Applications

There are many diversified applications of SCAM ejectors; the original one, which is the extraction of incondensable substances from the steam condensers, was followed by many others, mainly in the chemical and petrochemical fields, thanks to the easy operation and maintenance of these equipment. One of the most interesting fields of application of SCAM ejectors is the vacuum cooling branch: water or an aqueous solution brought to a suitable temperature under vacuum, literally cools itself as a result of evaporation.



Vacuum system for small capacity condensing unit

Similarly, technologies have been developed for the vacuum cooling of solids which originally contain humidity or which can be sprayed with water before the cooling phase. For instance, we can mention the cooling processes of fresh vegetables and of small size fruits.

On this subject, it is important to underline the adoption of ejectors for "flash" effect cooling (instant vacuum evaporation) of some corrosive liquids and some solutions where the solute is precipitated in consequence of the cooling action; in such cases, the use of conventional heat exchangers would be expensive and hardly practicable.



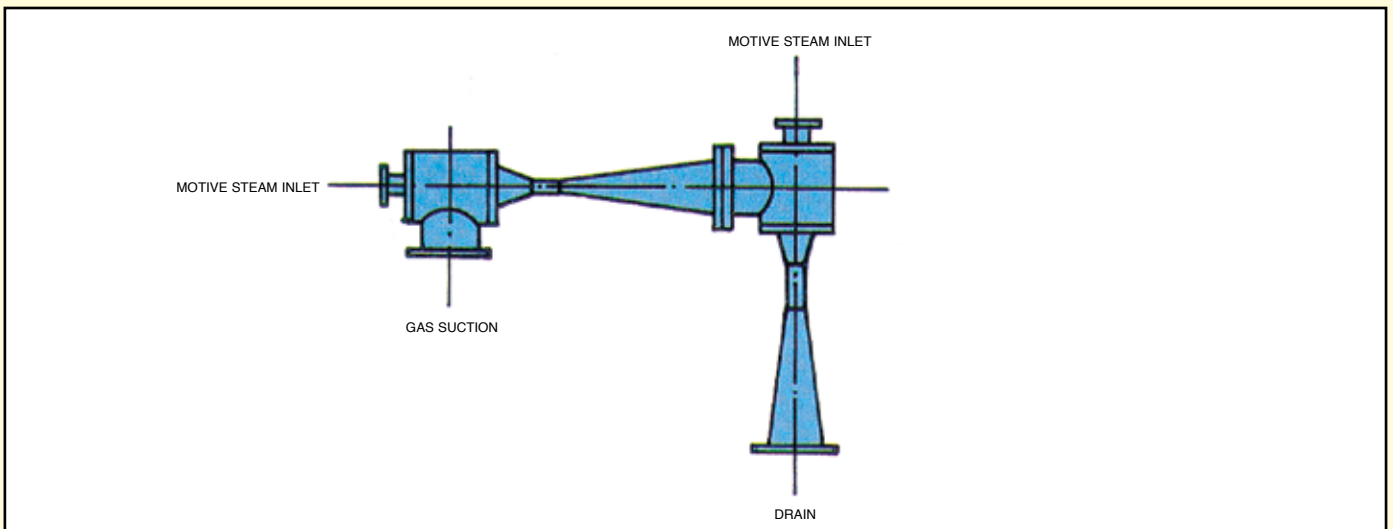
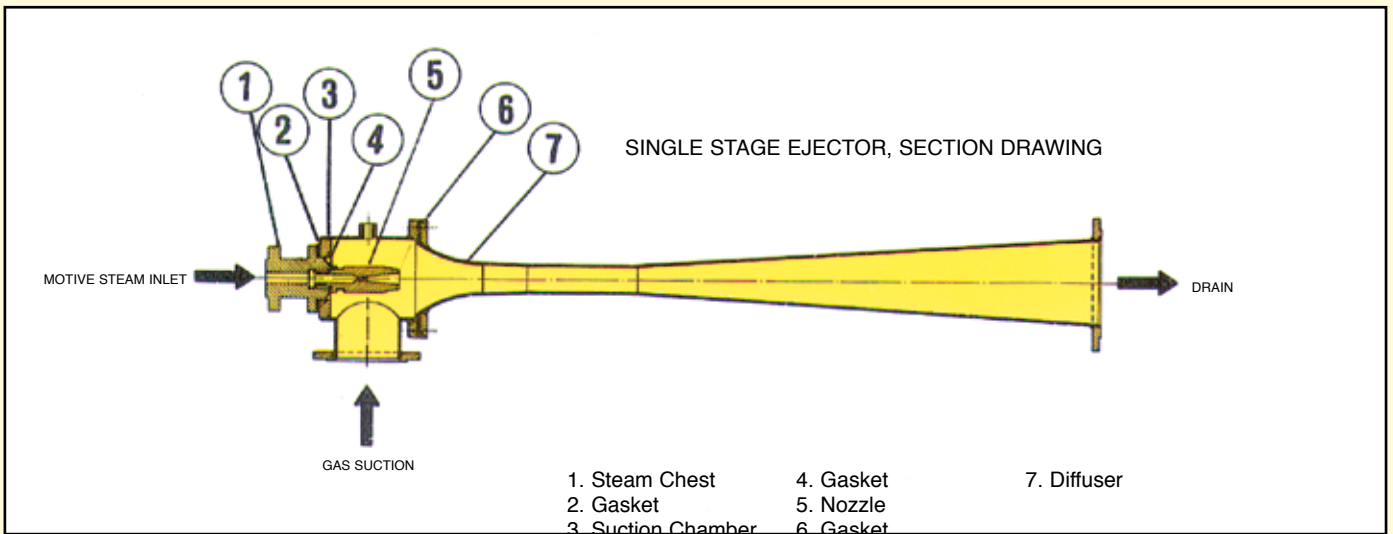
Two-stage twin element vacuum group with separate inter-after condenser

SCAM single stage ejectors

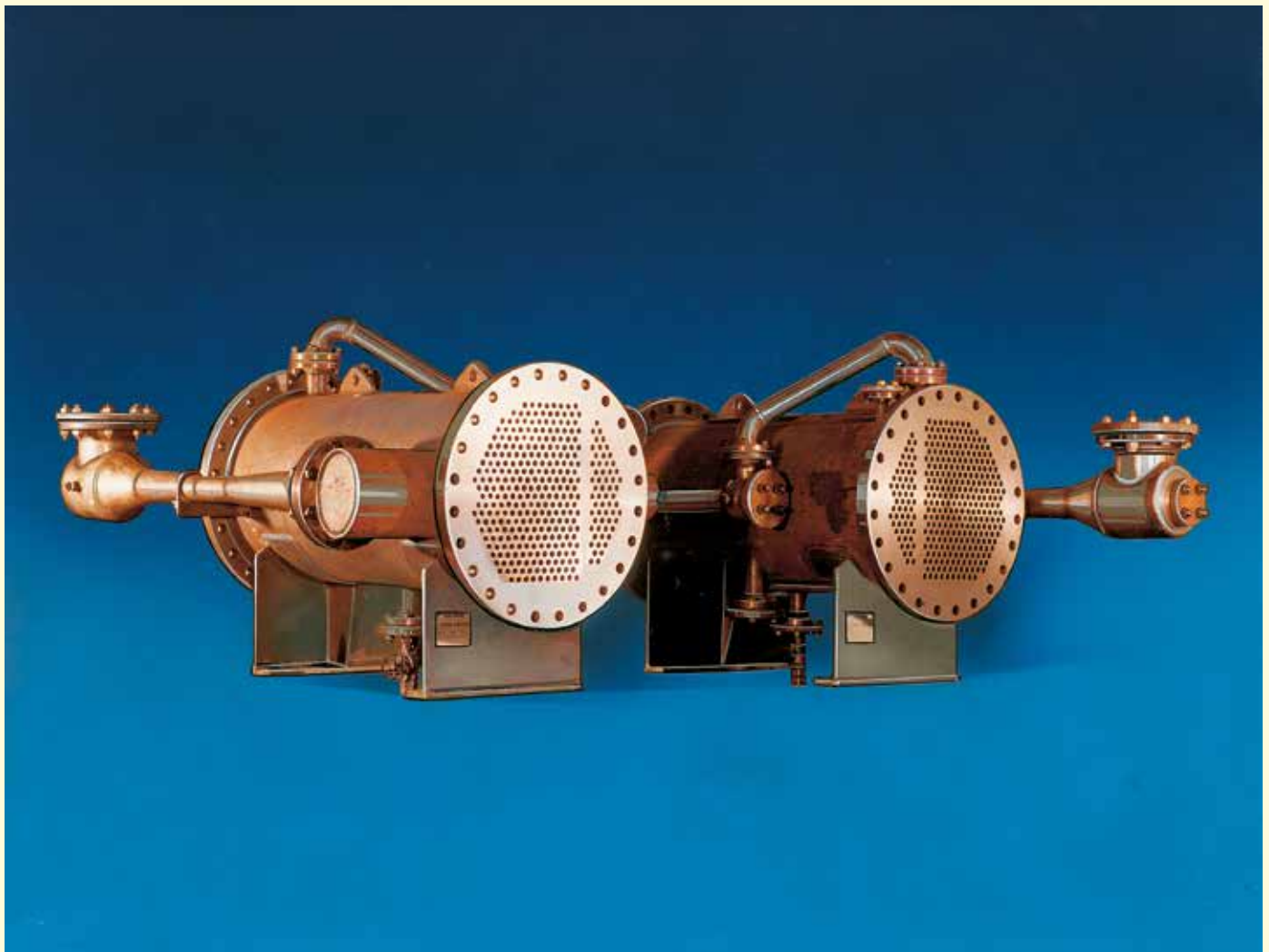
SCAM multistage ejectors

SCAM SINGLE-STAGE EJECTOR is the most commonly used version. It is generally recommended for residual pressures at suction not lower than 100 mbar, with atmospheric or quasiatmospheric exhaust pressure, i.e. for compression rati not higher than 10.

SCAM MULTI-STAGE EJECTORS without condensers are adopted whenever lower residual pressures must be reached. These units are often used when a low installation cost is considered more important than a low running cost, e.g. when intermittent operation is required or when cooling water is not available.



In processes involving the use of ejectors in the more specific pharmaceutical and foodstuff fields include lyophilization, vacuum packaging, fruit juice concentration as well as sugar and syrup production processes. In most cases, the intaken fluid consists almost entirely of steam and the term "thermoccompression" is widely employed to define the ejector performance; actually, the intaken steam undergoes a real compression at the expenses of the motive steam.

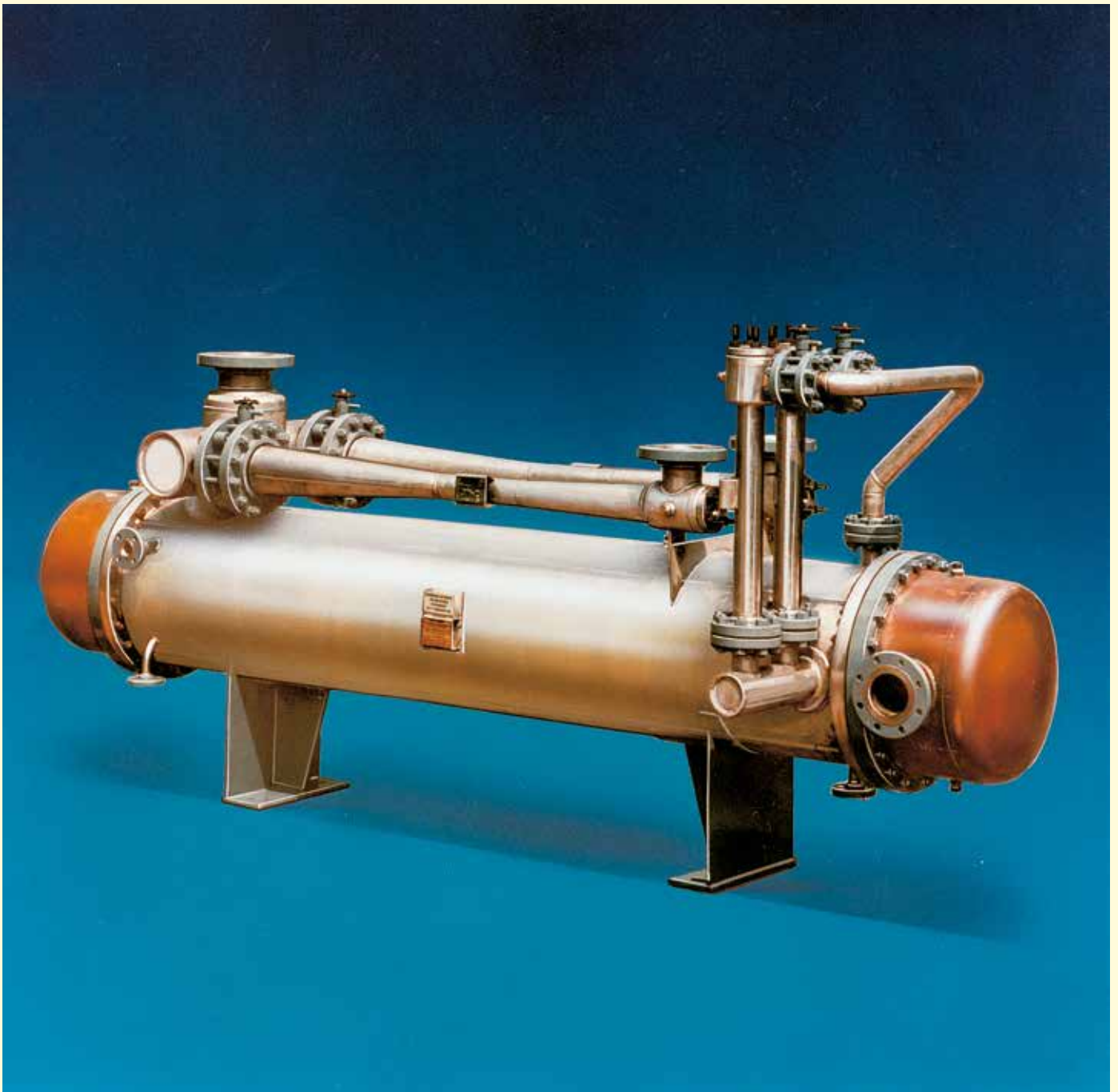


Two-stage ejector with Condensers in a Single Body

An interesting application of thermocompression occurs in compression-type sea water desalting units, where the “booster ejector” can suitably replace the mechanical compressor.

The use of ejectors for the discharge of the incondensable substances present in steam condensers is well known; a similar function is entrusted to SCAM ejectors running in sea water desalting units for distillation purposes.

In referring to this sort of application, it can be mentioned that since 1930 SCAM S.p.A. has been equipping more than 1,700 ships of all types and nationalities with desalting units.

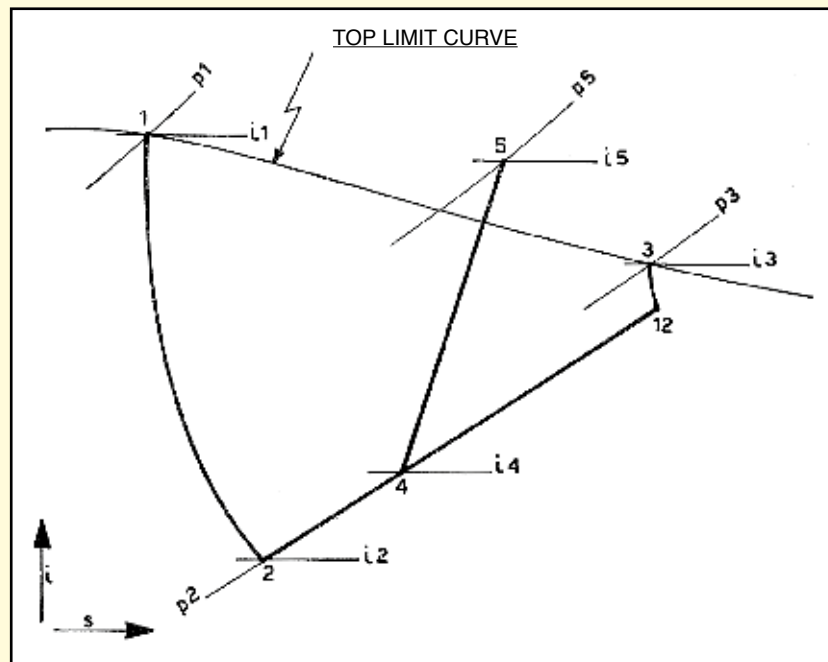


Single-stage hogging ejectors

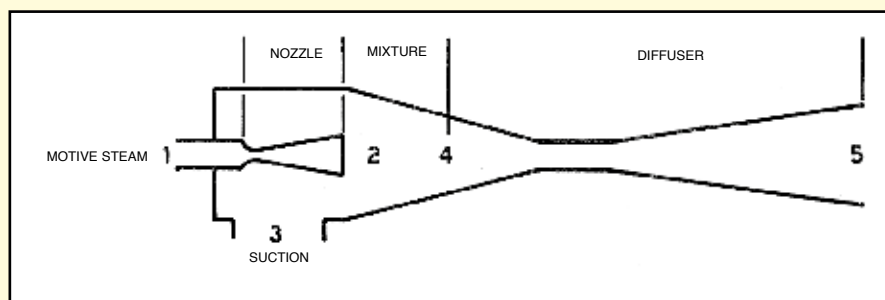
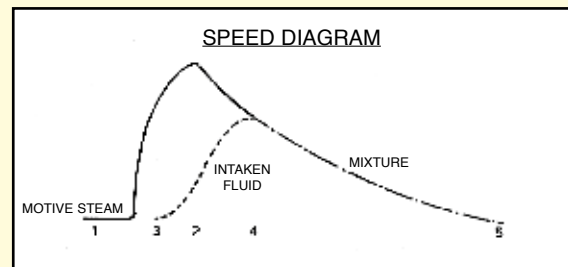
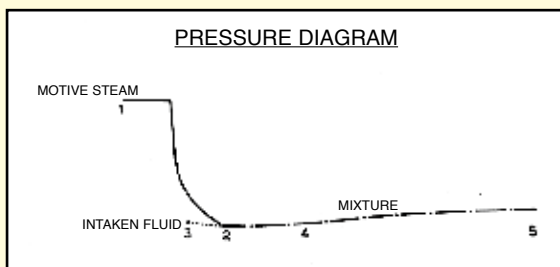
Operating principle

The ejector consists of four main components: the steam chest, the nozzle, the suction chamber and the diffuser. During the operation, the motive steam passes through the steam chest and enters the nozzle, where its pressure decreases but its speed increases; at the nozzle outlet, the steam reaches the minimum pressure and the maximum velocity, that is supersonic. The so-accelerated steam jet enters the suction chamber, where there is the fluid to be evacuated, driving and pushing it into the diffuser.

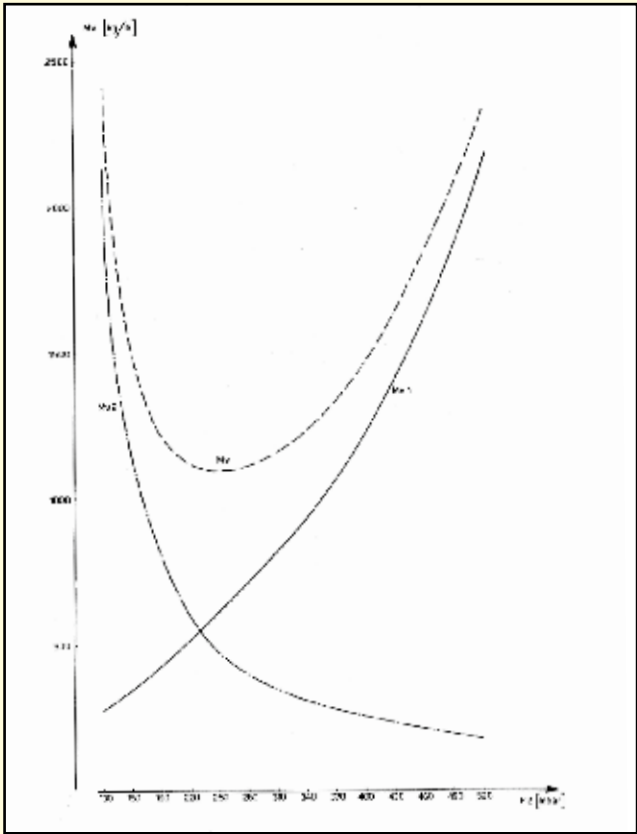
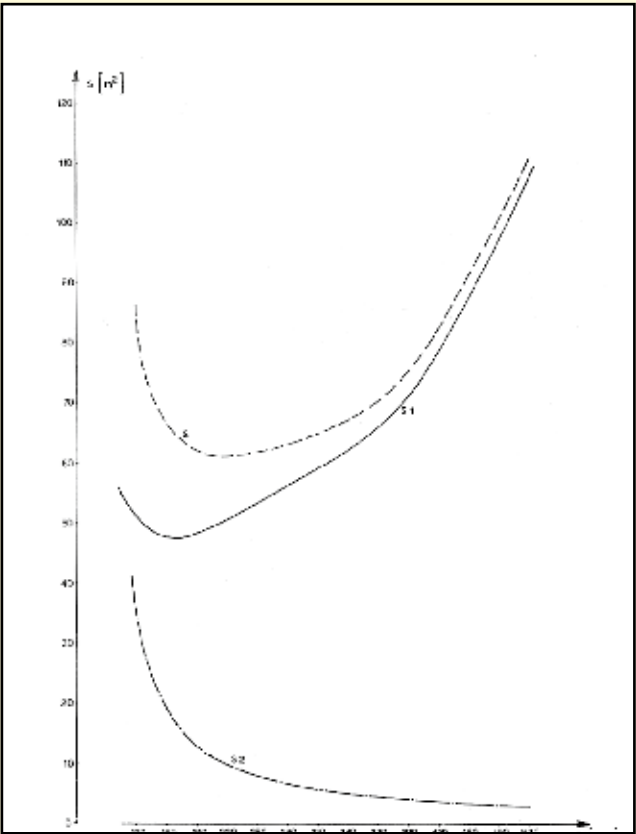
There driving and pushing actions, usually comprised under the phenomenon called "mixing", occur mainly for two reasons: the formation of a low pressure area, created by the jet coming out from the nozzle and the large amount of motion present in the jet itself.



Thermodynamic transformations inside an ejecting element on the water steam enthalpy-entropy diagram



Countless chemical and petrochemical plants adopt ejectors to maintain the vacuum necessary for the development of processes such as fractional distillation, crystallization, desiccation, deaeration, filtration, impregnation, deodorization and many others.



Example of optimization curves for two-stage vacuum unit with surface inter-after condenser

- m_{v1} = 1st stage motive steam consumption (Kg/h)
- m_{v2} = 2nd stage motive steam consumption (Kg/h)
- m_v = Total motive steam consumption (Kg/h)
- P_2 = Intermediate absolute pressure of the unit (mbar)
- S_1 = Intercondenser surface (m^2)
- S_2 = Aftercondenser surface (m^2)
- S = Total surface of condensers (m^2)

Multistage ejectors with condensers

SCAM MULTI-STAGE EJECTORS with condensers may be of two or multistage type. The condensers placed between one stage and the other are meant to condensate the steam coming from the previous stage in order to reduce the quantity of intaken fluid and, therefore, the motive steam consumption of the following stage. The number of stages (max. 5-6) is fixed according to the required operating performances.



Direct contact condenser for vacuum unit

Since 1930 SCAM has been designing and manufacturing:

- Steam jet ejectors
- Booster ejectors
- Vacuum pumps
- Evaporating distilling plants
- Sea water desalting units
- Boiler feed water heating and degassing units
- Surface condensers
- Direct contact condensers
- Heat exchangers
- Refrigerating machines
- Air, water and oil coolers
- Air/air radiators
- Natural, induced or forced draft cooling towers
- Degassing towers
- SCAMATIC self-cleaning fluid filters
- Corrugated and oiled metal sheet air filters



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