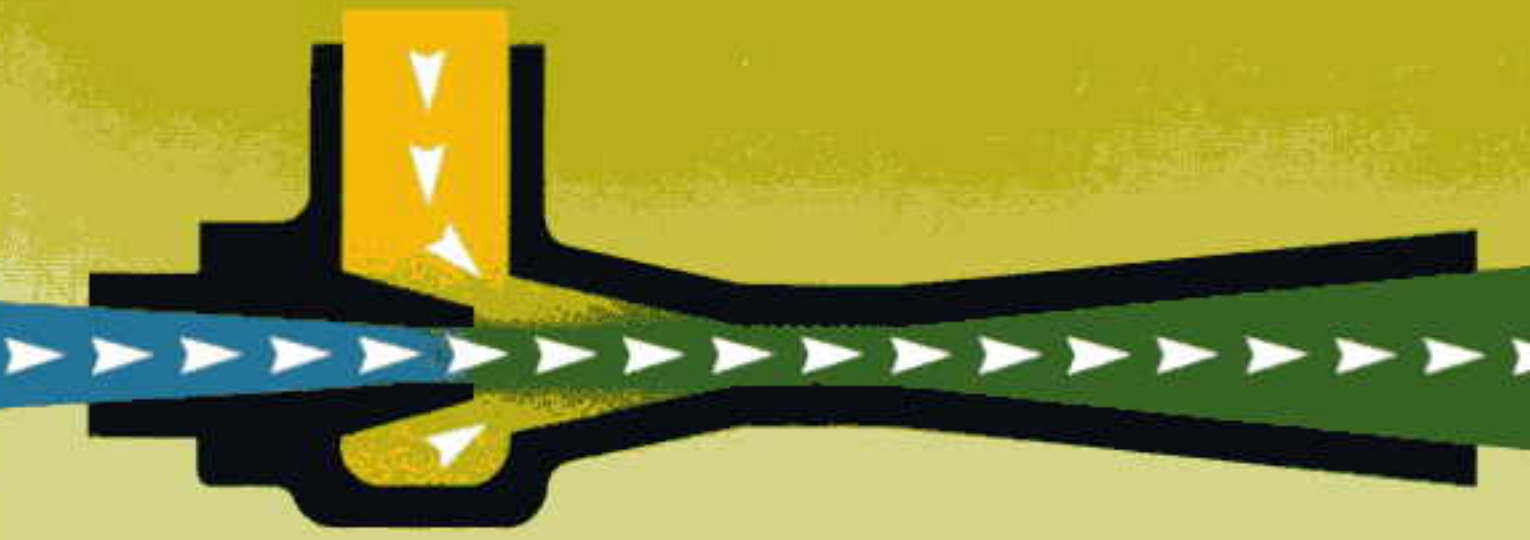
KORTING



FLUID JET PRODUCTS

Fluid Jet Products

The Korting Fluid Jet Products range is a group of products, most of which operate on the Ejector principle. The term "Ejector" or "Jet Pump" is a general name used to describe a piece of equipment with no moving parts which can be used to pump mix, heat, cool or produce vacuum. The illustration below (fig. 1) shows the main parts of an ejector – the nozzle, the diffuser and the body together with typical flow characteristics. Pressurised liquid, steam or air is used as the motive or driving fluid and this passes through the nozzle where its pressure energy is converted into a high velocity jet.

The jet displaces the fluid in front of it and creates a low pressure area around the nozzle exit. This has the effect of entraining or drawing in replacement fluid through the branch inlet and thus a suction flow is established. The motive and suction flows pass through the diffuser section where mixing of the two fluids takes place and the velocity energy of the fluid mixture is converted into pressure energy. This enables the Ejector to discharge against a back-pressure which is greater than the suction pressure. The suction fluid may be any fluid compatible with the motive fluid and direct contact of the two streams enables one unit to provide dual functions such as pumping and heating, pumping and diluting/mixing or condensing and vacuum producing.

The advantages of Korting Fluid Jet Products are derived from the simplicity of their design and construction and include:

- No moving parts – therefore minimal maintenance, simple to install and locate in restricted space, suitable for hazardous zones.
- Self priming therefore ideal for intermittent use.
- Can be manufactured in most common machinable materials.

Korting Fluid Jet Products can be supplied as single units or as packaged modules to include such associated equipment as vessels, pumps, control valves, instrumentation, etc., in sizes and materials to meet most needs.

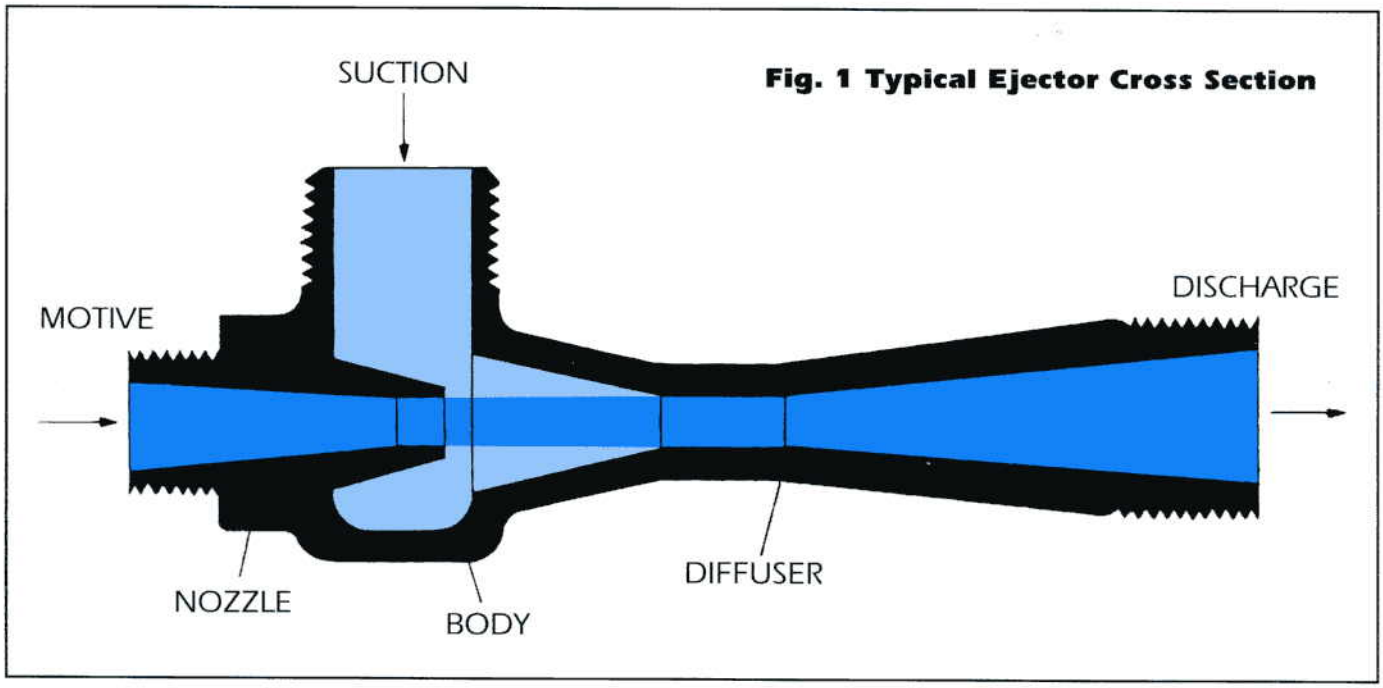


Fig. 1 Typical Ejector Cross Section

The following pages show how the basic ejector principle can be applied in a variety of ways with numerous potential applications in many types of industry. The examples given are typical only and are by no means exhaustive – our Sales and Technical Staff will be pleased to assist with further information and advice on any aspect of the Korting Fluid Jet Product range.

Pumping and Mixing Liquids and Solids

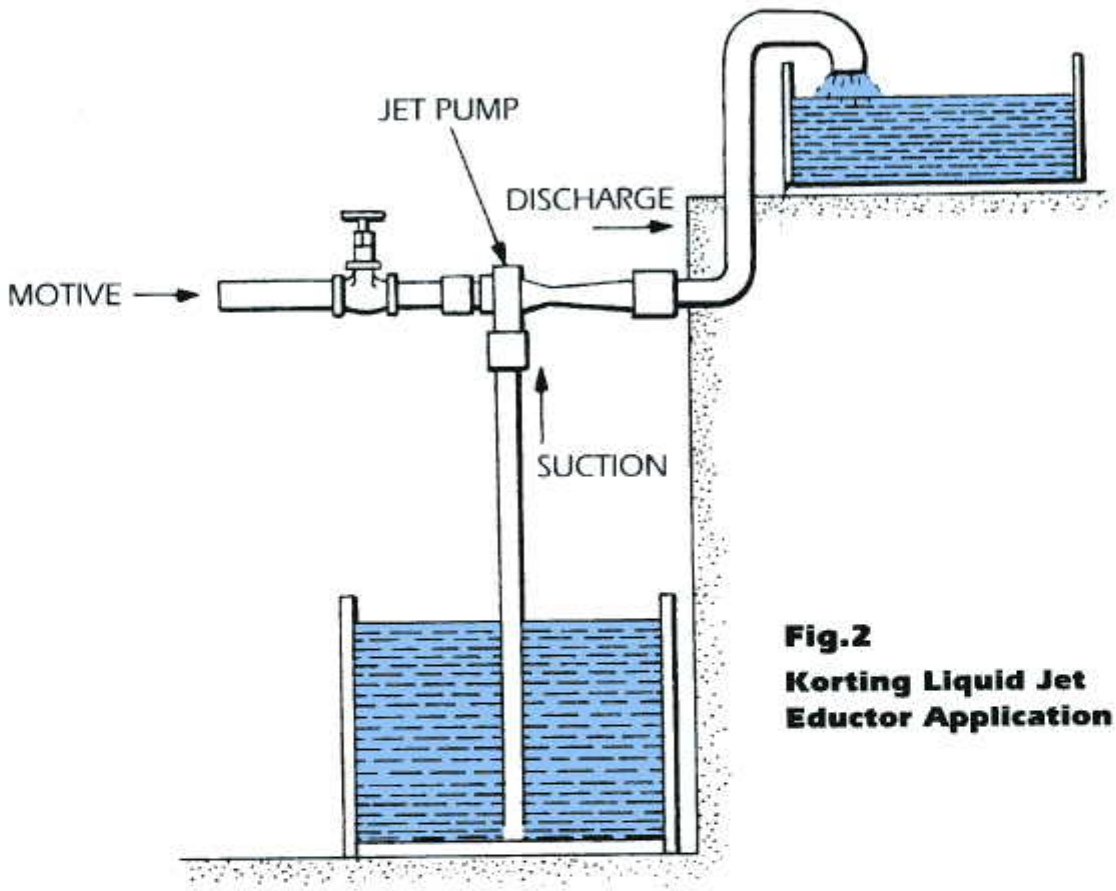


Fig.2
Korting Liquid Jet Eductor Application

An Ejector with liquid as the motive fluid used for pumping and mixing liquids and solids is usually called a Liquid Jet Eductor. Liquid Jet Eductors are particularly useful not only for pumping liquids where it would be difficult or expensive to use a mechanical pump but also where there is a specific requirement to dilute the suction fluid as well as pump it (fig.2).

Applications

- Used mainly in water treatment but also in other industries for pumping and diluting liquids such as acids, caustic solutions, hydrazine, brine, detergent, firefighting foam, machine tool coolant and other chemicals.
- For general pumping applications in place of a mechanical pump for emptying bunds, sumps, tanks, etc., where infrequent use or lack of space or access may not justify the expense of installing and maintaining a mechanical pump or where hazardous zones make the Liquid Jet Eductor with no moving parts an attractive solution.
- For use in conjunction with a mechanical pump when the suction lift available from the mechanical pump is insufficient or when the suction medium is corrosive or contains solids and would not be desirable in the mechanical pump.
- In marine applications where motive water is usually plentiful for ballasting, deballasting and emptying bilges and other spaces.

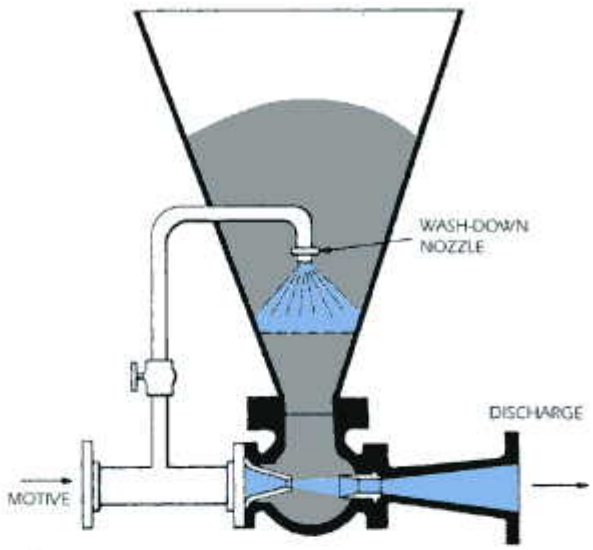


Fig.3
Korting Liquid Jet Solids Eductor

Liquid Jet Eductors are also used for pumping and mixing solids and powders either for transporting purposes or for production of solutions (fig. 3).

Applications

- Entraining and transporting sand, activated carbon granules and ion exchange resin to filter beds and fly ash to lagoons.
- Pumping and mixing powders which will form a solution or suspension such as lime, cement, common salt, polyelectrolyte, gels and numerous other additives.

Liquid Jet Eductors mounted inside a liquid storage vessel are used to mix the contents (fig. 4).
This type of Tank Mixing Eductor has open ports rather than one suction connection and the motive jet entrains liquid through the ports from the surrounding liquid in the lower part of the tank and discharges towards the top of the tank thus creating circulation within the tank. The result is thorough mixing of the tank contents, preventing strata occurring and keeping solids in suspension.

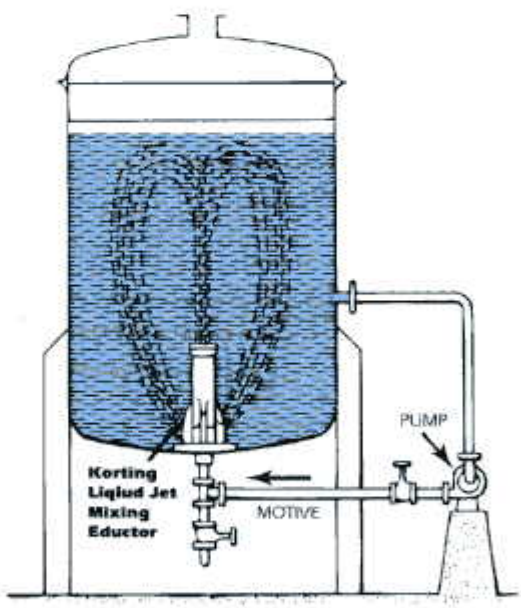


Fig.4 Korting Liquid jet Mixing Eductor Application

Applications

- General tank mixing including blending of oils, agitation of paints in the motor industry and lime solutions in the steel industry.

Ejectors which use steam as the motive fluid to pump liquids are usually called Steam Jet Syphons.

Applications

- General emptying of bunds and sumps, etc., as per Liquid Jet Eductors or where there is a specific requirement to pump and heat a fluid as in certain cleaning processes.

Ejectors operating with compressed air as the motive fluid are not recommended for entraining liquid except at very low liquid flow rates.
It is perfectly feasible to use compressed air to entrain solids and powders, however pneumatic transport of solids is a specialist field outside the current Northvale Korting sphere of operation.

Heating Liquids by Direct Injection of Steam

Heating of liquids is a very common requirement in a wide variety of industries and the Korting Steam Jet Heater range, consisting of three main types suitable for tanks and pipelines, offers a very efficient and convenient solution.

Korting Steam Jet Heaters work on the ejector principle with steam being injected directly into the liquid to be heated. During operation the steam and liquid are intimately mixed in the diffuser section and a continuous flow of liquid through the heater ensures continual and full condensation of the steam. In a correctly designed unit noise levels are minimal provided liquid temperatures are maintained below boiling point.

Because steam is injected directly into the liquid and all the available latent and sensible heat in the steam is transferred directly to the liquid, Korting Steam Jet Heaters are considerably more efficient than indirect types of heater.

Additional benefits of using Korting Steam Jet Heaters are that there is no condensate to handle, the units are usually smaller and easier to install than indirect heaters and particularly with tank heaters there is no requirement for additional circulating or mixing devices.

Korting Instantaneous Heaters (fig. 5) are used in pipeline applications where the liquid is pumped. In this type of heater steam is injected into the liquid via a series of small inclined holes in the nozzle. These small holes produce jets of steam which impinge on the liquid jet at its point of lowest pressure and greatest turbulence which results in thorough mixing of the steam and liquid with uniform heating and quiet operation.

For situations where a variable outlet temperature is required, automatic control is easily arranged using a modulating control valve in the steam line and a temperature controller sensing the liquid outlet temperature.

As the name suggests the Korting Instantaneous Heater will give an instantaneous supply of hot liquid and an automatically controlled unit will react instantly to changes of outlet temperature set point.

Applications

- Heating vessel coils and jackets and direct heating of water and other liquids for use in batch processes in the food, brewing and chemical industries.
- Heating and cooking starch products.
- Providing frost protection in pipelines in exposed locations.
- Producing hot water for washing kegs, drums, tanks, etc., and general washdown hose points in the food, brewing and chemical industries and for washing tinplate during manufacture in the steel industry.

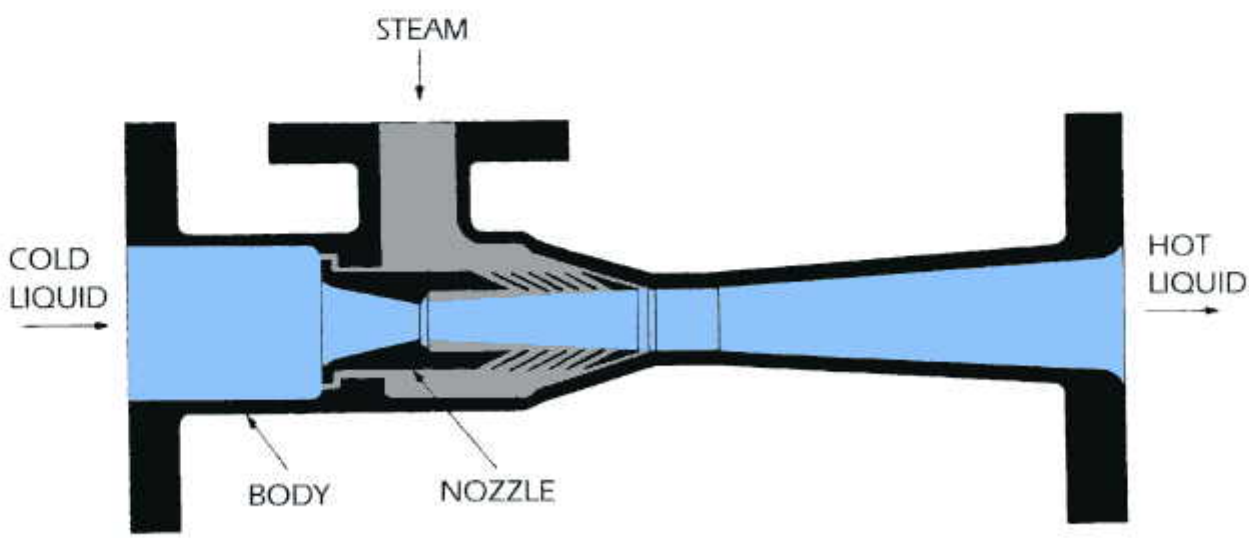


Fig.5 Korting Instantaneous Heater

Korting Circulating Heaters are used for heating the contents of tanks and are installed submerged below liquid level within the vessel generally as illustrated (fig. 6). The basis of their operation is the ejector principle whereby a jet of steam displaces the liquid in front of it and more liquid is entrained from the surroundings through open ports.
As with all Korting Heaters full condensation of the steam takes place and maximum heat is transferred to the liquid.
The continuous displacement and entrainment of liquid by the Korting Circulating Heater creates circulation within the vessel, ensuring uniform heating of the contents and means that no other agitating device is necessary.
The ability of Korting Circulating Heaters to fully condense the steam and produce a positive circulation throughout the tank makes them superior to sparge pipes.

Where it is not practical or possible to install Korting Circulating Heaters within the vessel an alternative is to mount a Korting Ejector Heater external to the vessel as shown (fig. 7).
The Korting Ejector Heater operates in a similar manner to the Circulating Heater but in this case the steam is used to heat and circulate the tank contents via an external pipework loop.
In some cases a degree of suction lift can be provided so that the Ejector Heater can be mounted above the vessel.

Applications

- Korting Circulating and Ejector Heaters are used for producing hot water in a wide variety of industries however other liquids such as brine, liquid foods, dyes and metal treatment fluids can be heated in this way.

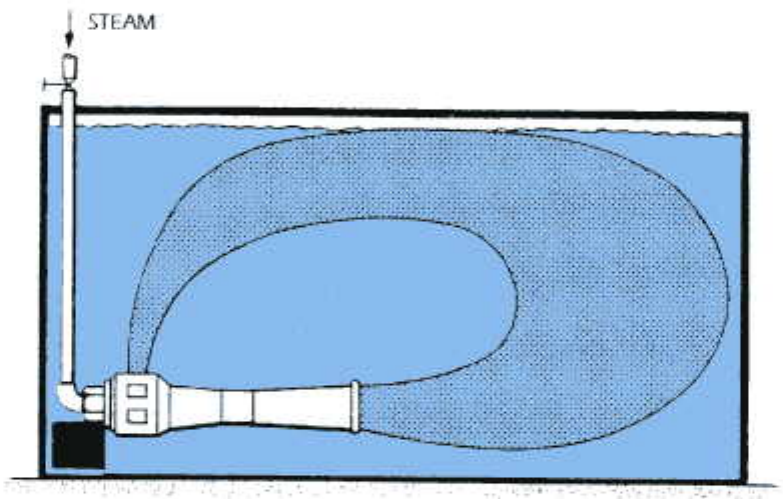


Fig.6 Korting Circulating Heater Application

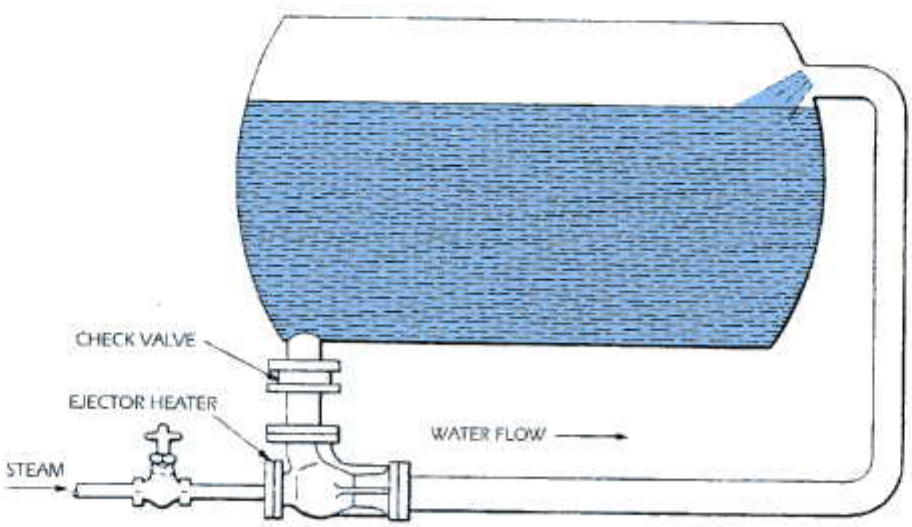


Fig.7 Korting Ejector Heater Application

Condensing by Direct Contact

Korting Direct Contact Condensers are simple devices in which cooling water is sprayed directly into a stream of water vapour or air/water vapour mixture in order to condense the steam.

There are two types of condenser within the Korting range – Multi Jet Spray Condensers and Counter-Current Spray Condensers.

Korting Multi Jet Spray Condensers are used where there are large volumes of water vapour to be condensed with relatively low non-condensable content.

As the illustration shows (fig. 9) a combination of spray and jet nozzles is utilised and the vapour and water flows are co-current.

The water from the jet nozzles has a condensing duty but is also used as the motive fluid to create the condenser's own vacuum, therefore auxiliary vacuum equipment is not needed. The condenser does however have to be mounted at barometric height.

Applications

- Commonly used for removing and condensing vapours from sugar pans during sugar refining but is also suitable for any similar evaporator duty.

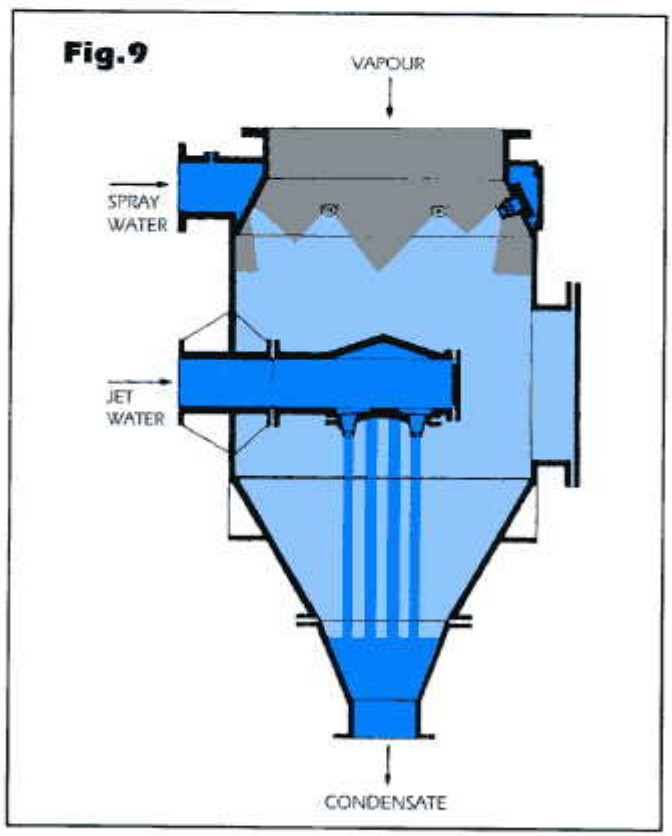
Korting Counter Current Spray Condensers (fig. 10) are used where there is a large proportion of non-condensables in the vapour streams.

The non-condensables rise to the top of the condenser and when operating under vacuum are removed by auxiliary vacuum equipment. When operating at atmospheric pressure the condenser is self venting. This type of condenser can be mounted at barometric height or at low level if an extraction pump is used.

Applications

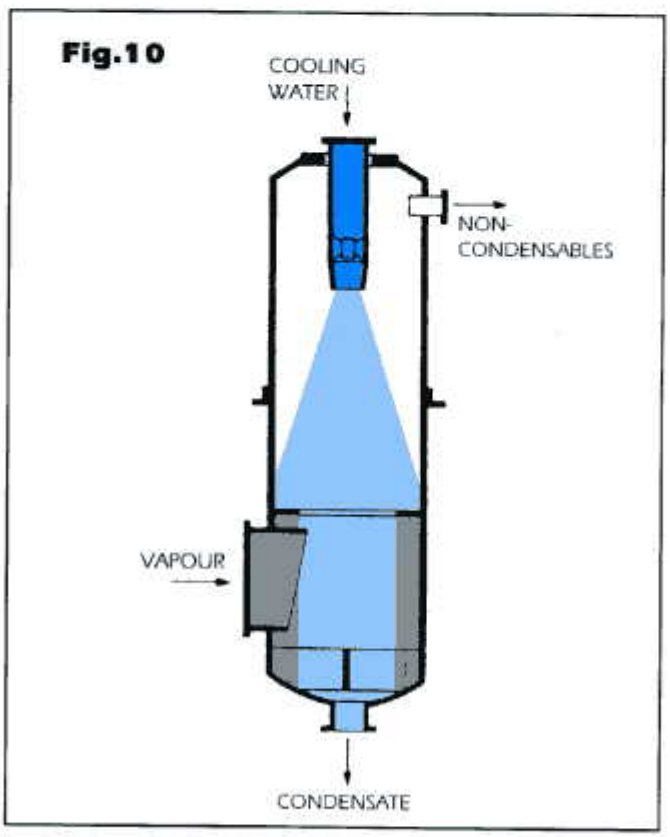
- Used in a wide range of process industries to reduce the volume of vapours discharged either to downstream vacuum equipment or to atmosphere.
- For heat recovery purposes.

Fig.9



Korting Multi Jet Spray Condenser

Fig.10



Korting Spray Type Condenser

Desuperheating

Within process plants different sections of the plant may require steam at different pressures and steam is therefore generated to satisfy the highest pressure demand. Devices which reduce the steam pressure such as turbines and control valves do not reduce the temperature significantly and the result is superheated steam.

This is not desirable in some cases and a desuperheater is therefore used to reduce the steam temperature. The Korting Desuperheater range consists of three types which all operate by direct injection of cooling water into the superheated steam but each type has differing cooling water atomisation methods and turndown limitations.

The Korting Spray Type Desuperheater (fig. 11) works by spraying cooling water through a simple spray nozzle and has a turndown limit of 2:1. Cooling water pressure is required at approximately 1.5 bar above steam pressure.

The Korting Venturi Type Desuperheater (fig. 12) has an internal nozzle and venturi through which a portion of the superheated steam passes. Cooling water is introduced through a series of small holes in the venturi and the jet of steam from the nozzle readily entrains the water, atomises it and thoroughly mixes it in the venturi section. Maximum turndown for this desuperheater is 10:1 and cooling water is required at a minimum pressure equal to the steam pressure.

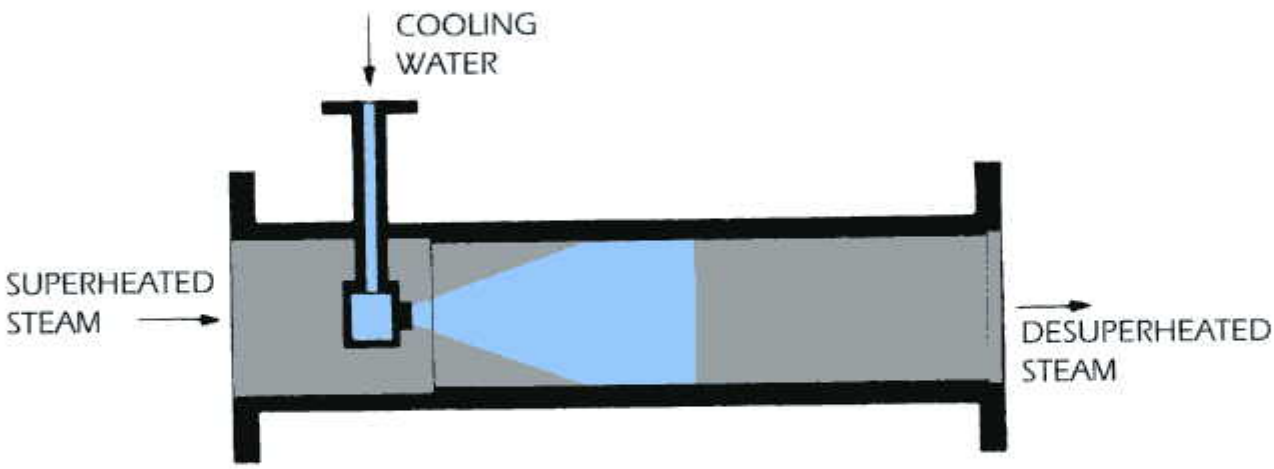


Fig.11 Korting Spray Type Desuperheater

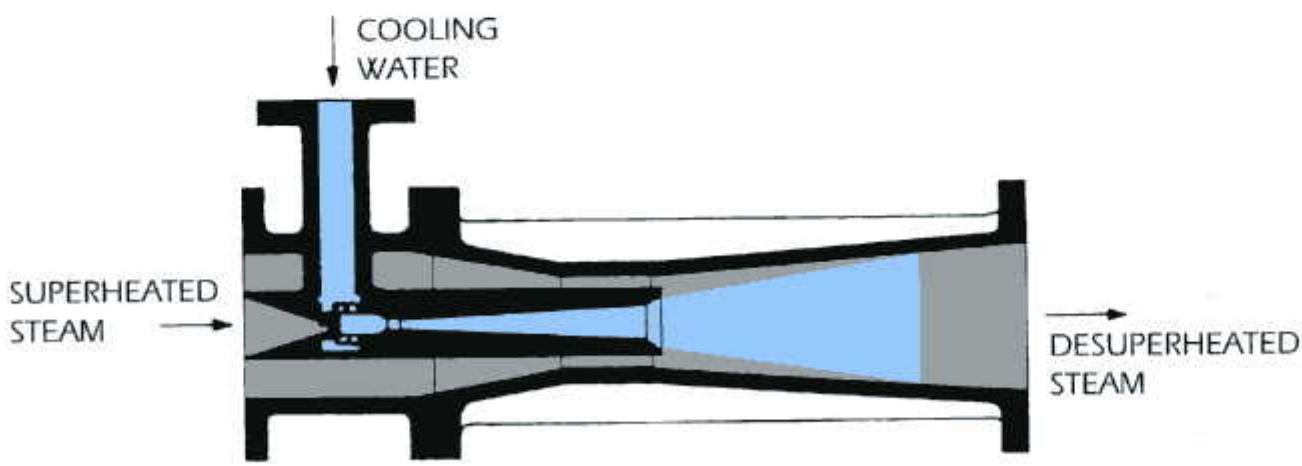


Fig.12 Korting Venturi Type Desuperheater

The final type, the Korting Ejector Type Desuperheater (fig. 13) has a 10:1 turndown but this can be increased to 50:1 if a condensate recycle loop is used in the downstream pipework. The Korting Ejector Type Desuperheater has an ejector built inside it which is driven by a small amount of steam at a pressure of at least 1.5 times the desuperheated steam pressure. The ejector entrains cooling water which can be at pressures less than the desuperheated steam pressure and using the velocity of the jet thoroughly atomises the water for ease of evaporation downstream.

As part of our service, complete pressure reducing and desuperheating systems can be supplied incorporating the relevant type of Korting Desuperheater, steam pressure reducing valve, pressure controller, cooling water control valve, temperature controller and cooling water pump (fig. 14).

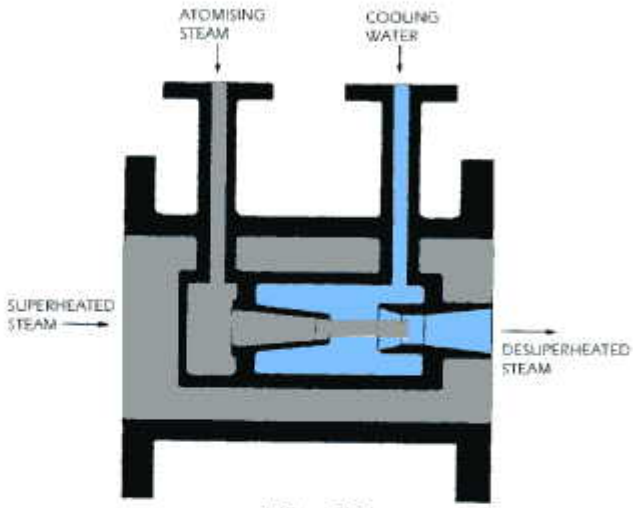


Fig.13
Korting Ejector Type Desuperheater

Applications

- Steam supplies to equipment which has limited operating temperatures and pressures such as heating systems, cookers, etc.
- Steam supplies to heat exchangers – heat transfer rates are improved if inlet superheat is reduced.
- Process systems where steam is used directly or indirectly and higher temperatures would be detrimental to the product e.g. food, textiles, paper, tobacco, chemicals, etc.
- Steam turbine bypass and dump lines.

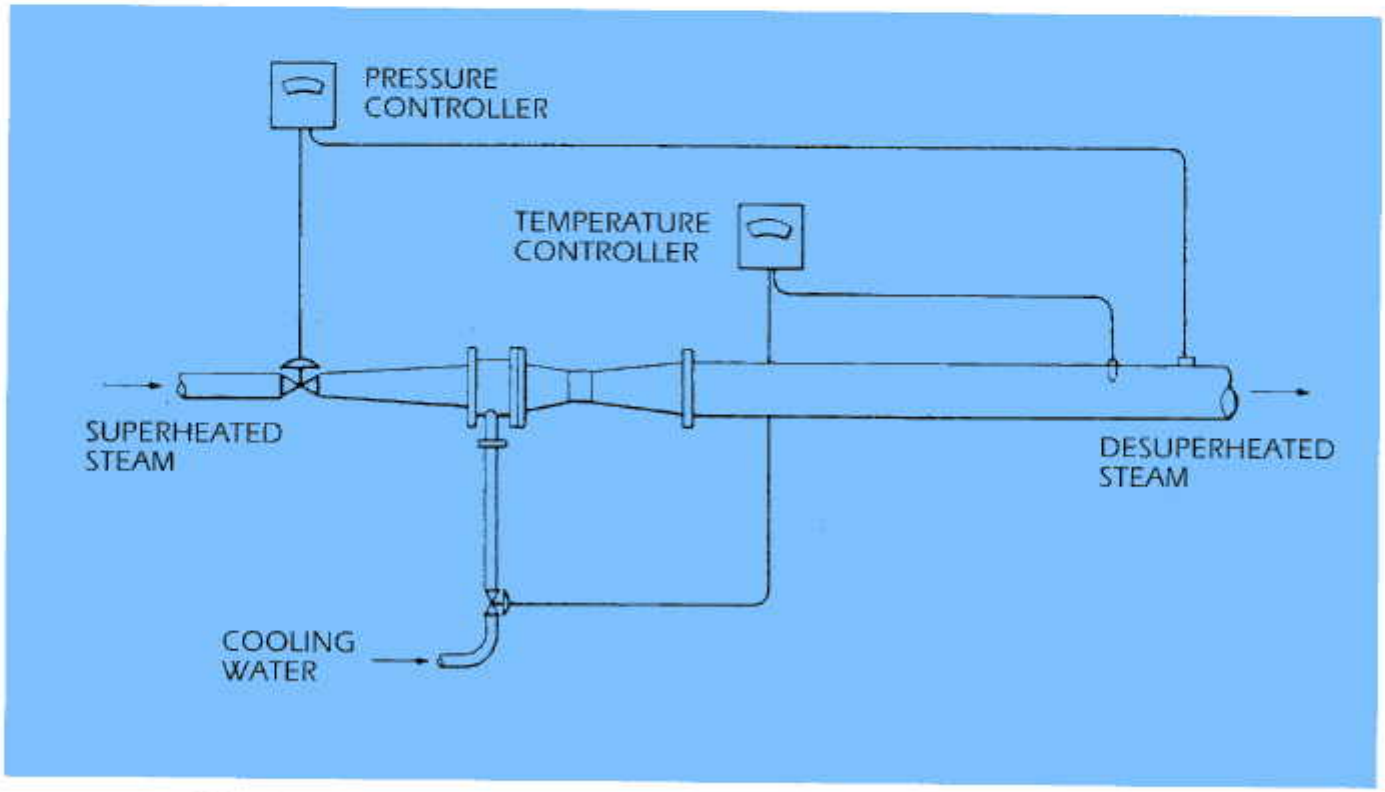


Fig. 14 Typical Korting Desuperheater System Flow Diagram

Vacuum Producing

It is often necessary to create a vacuum in a vessel or process system necessitating the pumping of non-condensable gases or a mixture of condensable and non-condensable vapours and gases.
This can be done using Korting Fluid Jet Equipment with steam, liquid or compressed air as the motive fluid. Working on the ejector principle Korting Steam, Liquid or Air Jet Ejectors entrain the suction gases creating a vacuum and discharging them to a higher pressure – usually to atmosphere.
Liquid and Air Jet Ejectors are usually single stage units, however Steam Jet Ejectors can be multi-staged with liquid ring vacuum pumps or Liquid Jet Ejectors (fig. 16). In certain cases where steam is not available and the gases or vapours to be handled are corrosive a Korting Liquid Jet Ejector package complete with pump, tank and interconnecting pipework, constructed in a corrosion resisting material, may be more practical than a liquid ring vacuum pump (fig. 15).

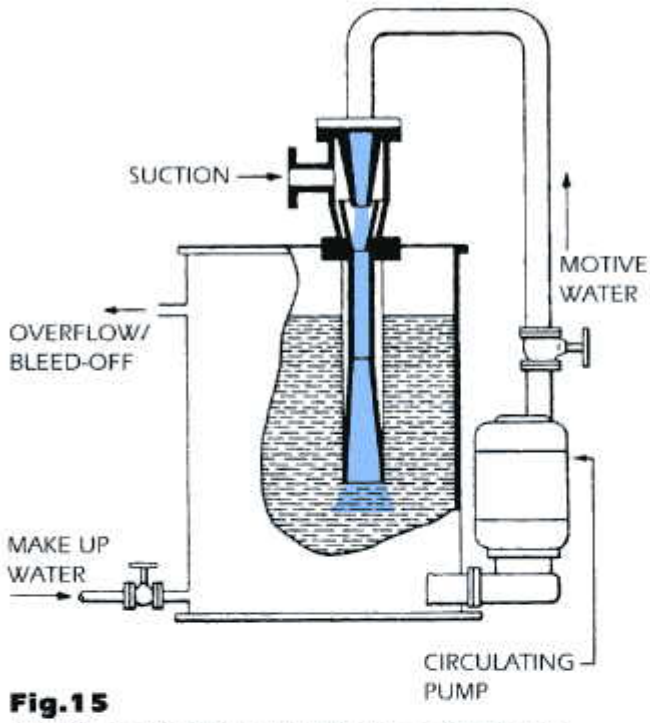


Fig.15
Korting Liquid Jet Ejector Package

Applications

- Evacuation of vacuum vessels and maintaining vacuum in food and chemical processes.
- Creating vacuum in acid measure vessels.
- Deaeration of liquids and solids.
- Desalination of sea water.
- Turbine condenser venting.
- Pump priming.
- Removing residual gases from empty gas bottles.

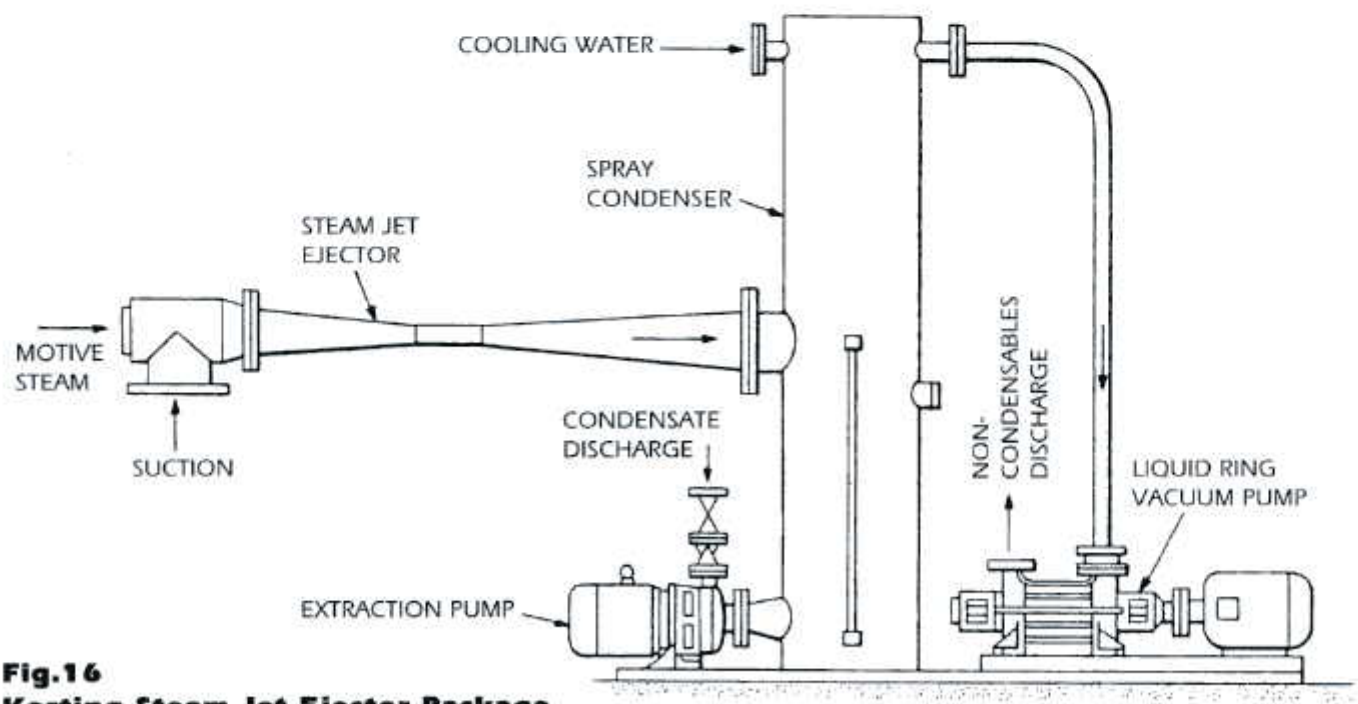


Fig.16
Korting Steam Jet Ejector Package

Aeration of Liquids

Aeration of liquids is another area where Korting Fluid Jet Equipment finds uses. In ponds and tanks, a Liquid Jet Ejector is used submerged below liquid level as illustrated (fig. 18).
The liquid to be aerated is used as the motive fluid and air from the atmosphere or in some cases from a blower is entrained. The liquid and air mix in the diffuser section allowing transfer of oxygen from the air into the liquid and the discharge stream creates further mixing of the liquid within the pond or tank. Motive pressure can be provided by submersible or externally mounted pump.

Applications

- Effluent treatment – for aerating sludges and contaminated water thus promoting aerobic digestion and reducing biological and chemical oxygen demand, sludge volumes, suspended solids and odour.
- Fish farms – aeration of water to increase dissolved oxygen level and allow increase of fish holding capacity.

A further type of unit for aerating water is the Korting Air/Water Mixer (fig. 17) which is specifically designed for mixing compressed air and pressurised water in pipelines. Compressed air is directed through a small annular opening close to the nozzle exit to ensure a high velocity and give good mixing.

Applications

- The Korting Air/Water Mixer is used in the water treatment industry in the dissolved air flotation process in which aerated water is introduced into a vessel to assist in floating unwanted material to the top of the liquid where it can be removed.

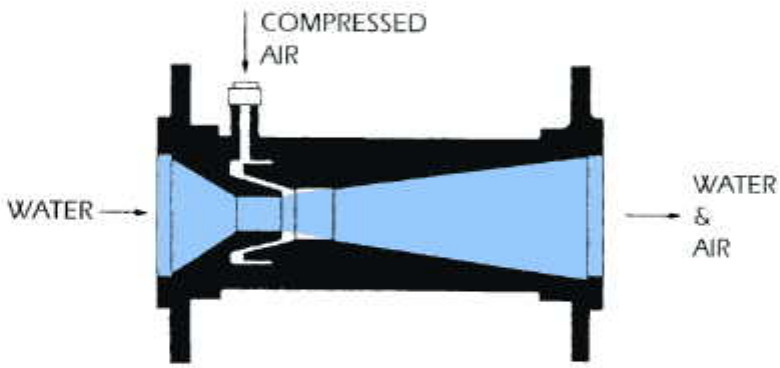


Fig.17 Korting Air/Water Mixer

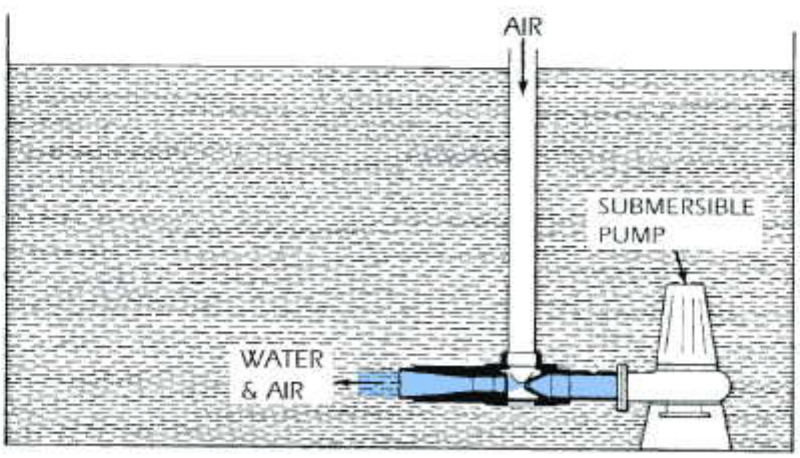


Fig.18 Korting Liquid Jet Ejector – Aeration Application

Compressing Steam and Gases

Ejectors which use high pressure motive steam to compress low pressure steam are frequently called Steam Jet Thermocompressors regardless of whether they operate in vacuum or positive pressure ranges. Korting Steam Jet Thermocompressors (fig. 19) operate on the ejector principle and can be supplied with a manually or pneumatically actuated variable orifice arrangement for use in applications where varying suction and discharge conditions are encountered.

Applications

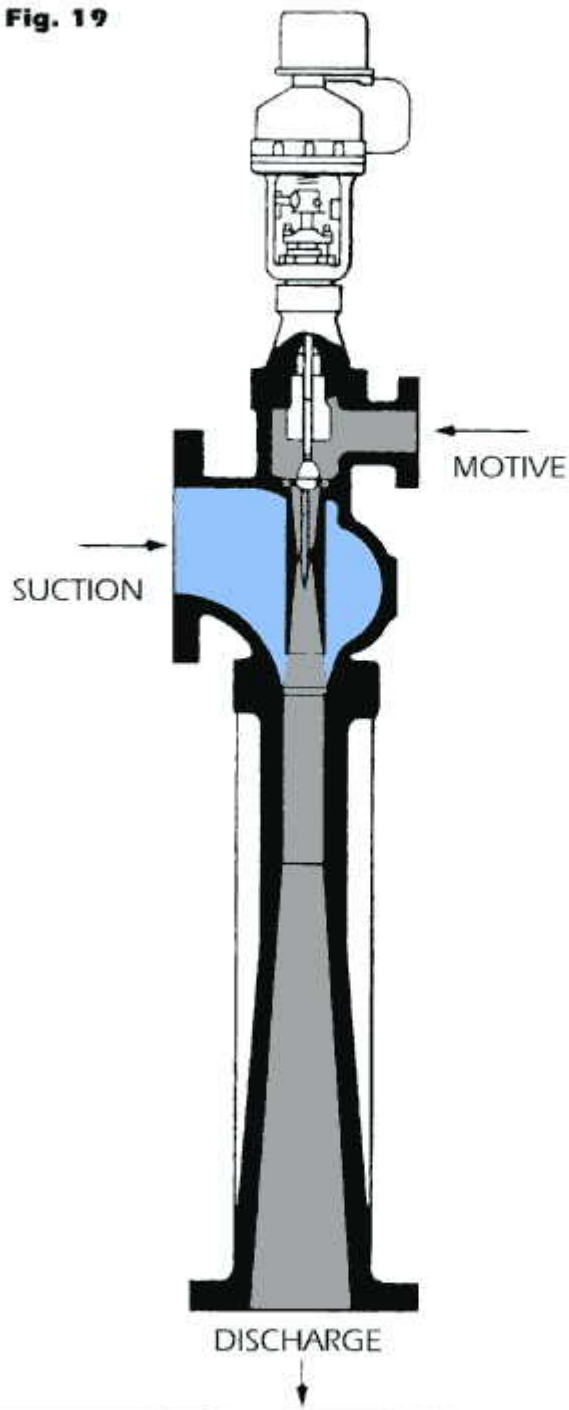
- Generally used in processes where steam is used as an essential part of the process but is also recycled as in paper drying, rubber vulcanising and evaporators in food and chemical industries.
- As part of general energy conservation schemes, Korting Steam Jet Thermocompressors are used to boost the pressure of otherwise waste low pressure steam.

Korting Liquid Jet Ejectors are also used for entraining gases and compressing them.

Applications

- Entraining air from the atmosphere into water and discharging it at sufficient pressure to backwash filter beds.
- Entraining chlorine or ozone gas under a slight vacuum into water and discharging against a back pressure for use in water treatment.

Fig. 19



Korting Steam Jet Thermocompressor