

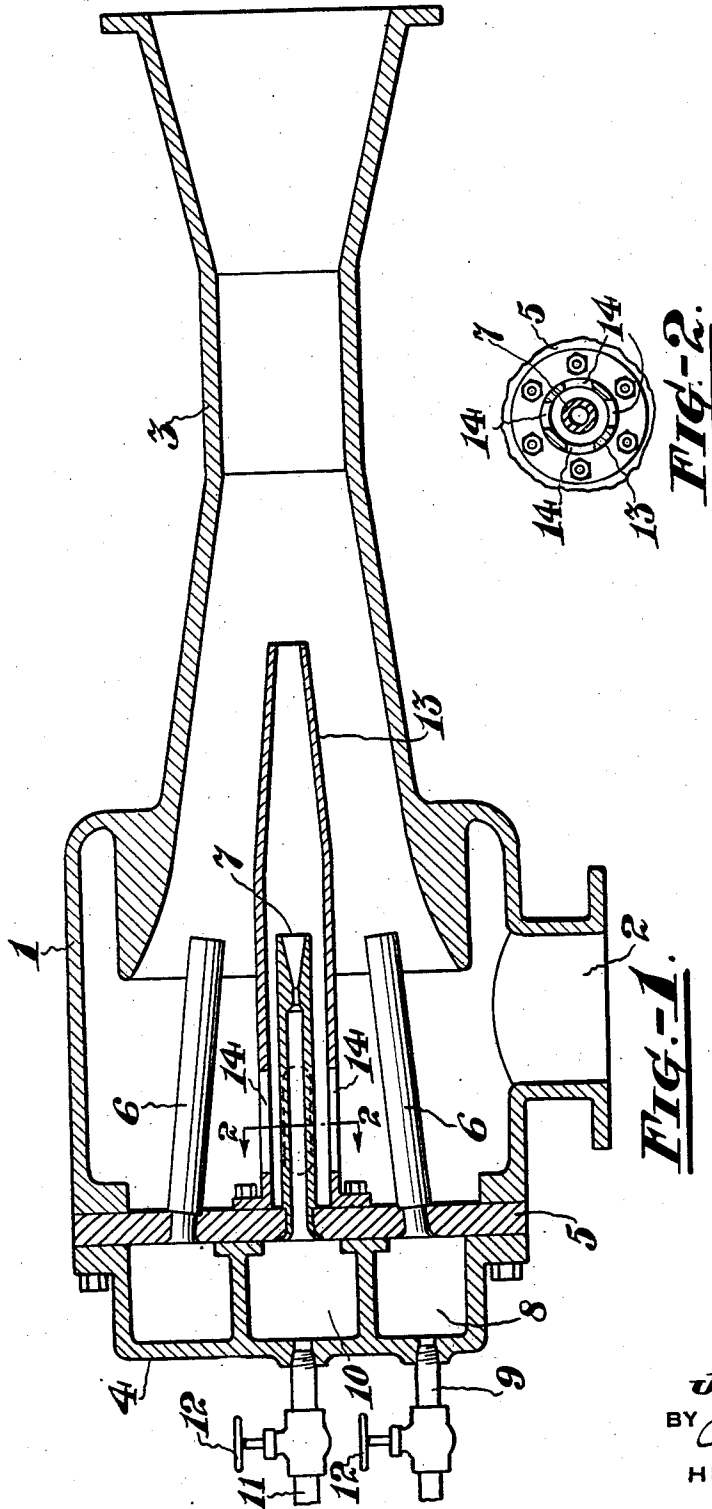
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REGULATING DEVICE FOR THERMOCOMPRESSORS

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REGULATING DEVICE FOR THERMOCOMPRESSORS

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7 Claims. (Cl. 230-103)

This invention relates to thermo-compressors of the steam-jet booster type, and particularly to a steam-jet booster designed for the regulation of capacity.

5 An object of the invention is to provide a steam-jet booster having a number of discharge nozzles capable of being supplied with steam or the like medium in such a manner that the capacity of the booster can be adjusted as required.

10 Another object of the invention is to increase the efficiency of a thermo-compressor by minimizing vortical action in the compressor.

Other objects and advantages will be made apparent in the following description which, taken 15 with the drawing, illustrate a preferred embodiment of the invention. But the disclosure is for purposes of explanation only and I may, of course, vary the construction shown in various ways without exceeding the scope of the appended 20 claims.

On the drawing, Figure 1 is a longitudinal section of a thermo-compressor according to this invention, and

25 Figure 2 is a cross section on the line 2-2 of Figure 1.

The same numerals indicate the same parts throughout.

The main casing or head of the ejector or booster is indicated at 1 with an inlet opening at the bottom as shown at 2. The discharge flue or diffuser conduit 3 is preferably provided with a throat section and projects from one side of the casing 1, and at the opposite side of the casing is a steam chest 4. The latter side of the casing 35 is open when the casing is formed, but when the ejector is completed it is closed by a supporting plate 5 in which are mounted the discharge nozzles 6 and 7. The steam chest 4 fits over the outer face of the plate 5 and in practice is preferably 40 divided into two or more compartments into which the steam or other power medium enters before passing through the discharge nozzles 6 and 7.

In the construction illustrated the nozzle 7 45 is at the center of the ejector and the nozzles 6 surround the nozzle 7. The nozzles 6 are all connected to a single chamber 8 in the steam chest 4 and are supplied from a pipe 9, while the central nozzle 7 communicates with another 50 chamber 10 in the steam chest, this chamber being supplied from a pipe 11. The chamber 8 surrounds the chamber 10. The pipes 9 and 11 are controlled by hand-operated valves indicated at 12.

55 I dispose the central nozzle 7 inside a so-called

"throat-piece" or tubular sleeve 13 which is attached at one end to the supporting plate 5 and projects beyond the nozzle 7 into the discharge flue 3 at the other. The sleeve 13 forms a discharge passage for the nozzle 7 and cooperates 5 with the conduit 3 to form other discharge passages for the nozzles 6. These passages lead from the inlet opening 2 and later merge into a common passage leading into the throat of the diffuser conduit 3. The point of merger is preferably adjacent the throat section, and the discharge passages are preferably constantly open 10 and uncontrolled. The portion of this tubular sleeve which lies within the conduit 3 is tapered, as indicated at 13, to conform to the shape of the 15 conduit, and adjacent to the plate 5 the sleeve 13 may have one or more openings 14 around the circumference thereof.

In practice the ejector may be mounted upon a vessel called an evaporator in which vapor is 20 generated and with which it communicates through the inlet 2, and the vapor will be drawn through the inlet 2 in the casing 1 and then forced through the flue 3 into a condenser where both the steam and vapor may be liquefied. 25

When all the nozzles are in use the booster will be operating at its maximum capacity. To reduce the capacity of the booster the steam coming from the pipe 11 may be throttled until the pressure of the steam issuing from the central nozzle 7 is so reduced that it no longer has any vapor-removing effect. Then the steam from this nozzle will not continue to flow out of the tapered end of the sleeve 13 and some of the vapor entering the casing and some steam from the nozzles 6 may break back into and circulate 30 through the sleeve 13. The throttled steam issuing from the nozzle 7 will thus be added to the load carried by the other nozzles and the volume of vapor entering inlet opening 2 will drop. The presence of the openings 14 will facilitate this operation because when the pressure of the steam issuing from the nozzle 7 is reduced far enough so that vapor and steam can enter the sleeve 13 45 where it projects into the flue 3 this vapor and steam together with the throttled steam from nozzle 7 will flow out through the openings 14 and be added to the volume of vapor which enters the casing through the inlet 2. The steam from the nozzles 6 will therefore do less work on the 50 vapor entering through the inlet opening 2 and the amount of vapor removed from the evaporator will decrease because the nozzles 6 must also carry off the steam issuing from the nozzle 7 and any of their own steam which is backing 55

up through the sleeve 13. Hence the effective capacity of the ejector is much lower.

The capacity of the ejector can thus be reduced to an even greater extent than would be the case if the steam for the nozzle 7 were to be cut off entirely, since by admitting some steam at very low pressure into the sleeve 13 through the nozzle 7, said nozzle then not only fails to do any work but it also adds to the burden upon the other nozzles and the capacity of the ejector is all the more decreased.

The sleeve 13 also performs another function for by forming several separate discharge passages for the nozzles 6 and 7, the formation of vortexes in zones of comparative inactivity in the conduit 3, as between nozzles or in front of inactive nozzles, for example, is effectively eliminated. The steam flowing in each passage is isolated from the steam flowing in the other passage, and the nozzles discharging into any one of the passages, may, therefore, be rendered inactive, or regulated as may be desired, without creating disturbances in the steam flowing in the other passage. With the sleeve in place vortical action, if any, is limited to the zone at the outlet of the sleeve, but the conduit 3, at this point, is so restricted that the inactive zone is very small, and the flow of steam past this point is of such a magnitude as to reduce the action to a minimum. Vortical action in the discharging steam is thereby minimized and the efficiency of the compressor is held at a high level regardless of the number of nozzles in operation.

In modifications, it will be understood that each of the outer nozzles 6 may be connected, if desired to a separate steam pipe and one or more of the nozzles 6 throttled in the way earlier described, if the capacity of the steam ejector is to be reduced still further, or, other well known methods of separately controlling the nozzles may be employed.

With this construction and mode of operation the capacity of the steam ejector can be regulated over a considerable range according to the amount of work which the ejector must perform at a given time, and the efficiency of the operation is enhanced by preventing the formation of vortexes in the discharging steam. The construction is quite simple and at the same time very effective for attaining the desired results.

I claim:

1. A thermo-compressor having a casing and a number of nozzles therein, means for supplying a power fluid to the nozzles, means for throttling the flow of fluid to some of said nozzles to vary the pressure of such fluid, and means within the casing for returning a part of the fluid discharging through the casing to the fluid streams issuing from the unthrottled nozzles, the rate of fluid return being controlled by the pressure of the throttled fluid.

2. A thermo-compressor having a casing and a number of nozzles therein, means for supplying a power fluid to the nozzles, means for varying the pressure of the fluid supplied to some of said nozzles, and means within the casing whereby at a predetermined pressure of the variable pressure fluid a part of the fluid discharging through the casing is returned to the fluid streams of the remaining nozzles to reduce the effective capacity of the compressor.

3. In a thermo-compressor, a casing having an

inlet and outlet opening, nozzles in the casing to discharge power fluid thereinto, means to supply power fluid to the nozzles, and a sleeve in the casing surrounding one of the nozzles and forming a discharge passage therefor, the other nozzles being positioned exteriorly to the sleeve and the sleeve cooperating with the casing and conforming to the shape thereof to form another passage into which said other nozzles discharge, said passages leading from the inlet opening and merging near the outlet opening, and the sleeve acting to separate the fluid in one passage from the fluid in the other passage thereby to minimize vortical action in the discharging power fluid.

4. In a thermo-compressor, a casing having an inlet opening and defining a convergent-divergent throat passage leading from the inlet opening, nozzles in the casing to discharge power fluid into said passage, means to supply power fluid to the nozzles, and a member surrounding some of the nozzles and extending into the casing to form a discharge passage therefor, the member having a convergent portion conforming to the convergent portion of the casing, said convergent portions forming discharge passages for the nozzles not surrounded by the member, said discharge passages leading from the inlet opening and merging near the throat of the convergent-divergent passage, and the member acting to shield the fluid in each discharge passage from the fluid in the other discharge passages.

5. In a thermo-compressor, a casing having an inlet opening and defining a convergent-divergent throat passage leading from the inlet opening, nozzles in the casing to discharge power fluid into said passage, means to supply power fluid to the nozzles, one of the nozzles being axially aligned with said passage, and a sleeve surrounding and aligned with the one nozzle to form a discharge passage therefor, the sleeve having circumferential openings near the inlet opening and having a convergent portion cooperating with the convergent portion of the casing to form a discharge passage for the nozzles not surrounded by the sleeve, said discharge passages leading from the inlet opening and merging near the throat of the convergent-divergent passage, and the sleeve acting to shield the fluid in one discharge passage from the fluid in the other discharge passage.

6. In a thermo-compressor having a casing and a number of nozzles for discharging fluid into the casing to compress a fluid medium, means to supply fluid to the nozzles, means for controlling the operation of the nozzles, and means becoming effective when certain of the nozzles are inactive to introduce discharge fluid into the fluid medium to augment the latter and thereby reduce the effective capacity of the compressor.

7. In a thermo-compressor having a casing and a number of nozzles for discharging power fluid into the casing to compress a fluid medium, means to supply power fluid to the nozzles, means for varying the flow of power fluid through the nozzles, and conduit means within the casing cooperating with certain of the nozzles and becoming effective at a predetermined flow of the power fluid through said certain nozzles to discharge the latter power fluid into the fluid medium being compressed to reduce the effective capacity of the compressor.

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