

1

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HIGH VACUUM STEAM EJECTOR

Harold A. Bradshaw, Easton, Pa., assignor to Ingersoll-Rand Company, New York, N.Y., a corporation of New Jersey

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This invention relates to steam ejectors of the type used to produce high vacuums.

The nozzle and body of a steam ejector operating under a high vacuum usually is large and contains substantial amounts of metal. Such a large amount of metal rapidly cools or extracts heat from the steam entering the nozzle. In addition, the amount of steam flowing through the nozzle in an ejector operating under a high vacuum must be relatively small. One reason for the small flow of steam is that it is expanded many times by the nozzle, due to the high vacuum. As a result of the relatively small steam flow, the orifice in the ejector nozzle is relatively small. All of these conditions make it likely that the steam entering the nozzle will contain water. This is undesirable because water interferes with the proper flow of steam through the small nozzle orifice. Attempts have been made to solve this problem by superheating the steam before it enters the nozzle but this has not been a complete solution for water still condenses in the steam and interferes with the flow of steam through the nozzle orifice.

The principal object of this invention is to provide a complete solution to the foregoing problem.

Other important objects include the following: to provide a steam ejector which prevents water in the steam from clogging its nozzle; to provide a steam ejector which solves the foregoing problem without superheating the steam prior to its entry into the ejector nozzle; and to provide a steam ejector nozzle which automatically extracts water from the steam entering it.

In brief, these objects are attained by arranging the nozzle so that water is separated from the steam as it enters the nozzle and is withdrawn therefrom before it can enter the nozzle orifice.

The invention is described in connection with the accompanying drawing wherein:

FIG. 1 is a vertical axial section of an ejector embodying this invention;

FIG. 2 is an enlarged view of the ejector nozzle of FIG. 1; and

FIG. 3 is a section taken along the line 3-3 of FIG. 2.

The ejector casing or body 1 shown in FIG. 1 is conventional and is shaped to form a gas inlet 2, a mixing chamber 3, a diffuser 4, and a throat 5. A nozzle unit 6 is mounted in the wall of the casing 1 to extend into the mixing chamber 3 and discharge axially toward the diffuser 4. As is well known in this art, the steam discharged from the nozzle 6 reduces the pressure in the ejector body 1 and creates a suction at the gas inlet 2.

The nozzle or nozzle unit 6 includes a discharge orifice body or spout 7 containing an inlet orifice 8 and a diverging passage 9 extending forwardly from the inlet orifice 8. The nozzle 6 further includes a cylindrical sleeve 10 surrounding the spout 7 and projecting rearwardly from it to form a chamber 11 located at the rear end of the spout 7 and the inlet orifice 8. The rear end of the

2

chamber 11 is closed by an end plate 12 fixed over the rear end of the sleeve 10.

Steam enters the nozzle 6 through a steam pipe 14 mounted in and extending through the end plate 12. The rear end 15 of the spout 7 is turned down or cut away to form a rearwardly projecting annular boss 16 surrounded by a conically shaped wall, also designated 15, diverging forwardly from around the boss 16. The steam pipe 14 extends forward slightly beyond the rear end of the boss 16 and is located above the axis of the inlet orifice 8 so that steam will be discharged from the pipe 14 against the conical end wall 15 of the spout 7 at a level above the axis of the inlet orifice 8. Any water in the steam will impinge against the conical end wall 15 and will flow to the bottom of the chamber 11. The boss 16 acts as a barrier to prevent the water from entering the nozzle orifice 8 as it flows over the conical end wall 15. Steam in the chamber 11 enters the inlet orifice 8 of the spout 7 surrounded by the boss 16.

Water in the bottom of the chamber 11 is drained therefrom by flowing into the drain pipe 17 and eventually into a steam trap 18. The steam trap 18 is conventional and acts to pass water while blocking steam from flowing through it. The steam trap 18 can be connected to any suitable condensate drain 19.

As a consequence of the foregoing structure, any water entering the nozzle 6 through the steam pipe 14 is automatically and continuously separated from the steam entering the nozzle and drained from the nozzle 6 before it can enter the nozzle orifice 8 and interfere with the operation of the nozzle. Only dry steam is allowed to enter the inlet orifice 8.

Although a preferred embodiment of the invention is illustrated and described in detail, it will be understood that the invention is not limited simply to this embodiment but contemplates other embodiments and variations which utilize the concepts and teachings of this invention.

Having described my invention, I claim:

1. A steam ejector nozzle comprising:

- (a) a body enclosing a steam discharge passage having an inlet orifice and an enlarged chamber located around the inlet orifice;
- (b) a surface surrounding said inlet orifice and extending forwardly of it and transverse to its axis;
- (c) a steam inlet conduit extending into said chamber and arranged to discharge steam and any water in the steam against said surface at a point located forwardly of and radially outward from said inlet orifice;
- (d) and means for draining water from said chamber before it can enter said inlet orifice.

2. The nozzle of claim 1 wherein said surface contains an annular boss surrounding the nozzle orifice and extending rearwardly of the outlet end of said steam conduit to form a barrier against water entering the nozzle orifice after it has struck said surface.

3. The nozzle of claim 2 wherein said surface diverges forwardly and radially outward from said boss; and said steam conduit discharges steam against said surface at a point above said boss.

No references cited.

LAURENCE V. EFNER, Primary Examiner.