Oct. 25, 1938. A. VAN DEN HONERT 2,134,460

JET DEVICE (INJECTOR OR EJECTOR)

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FIG:1

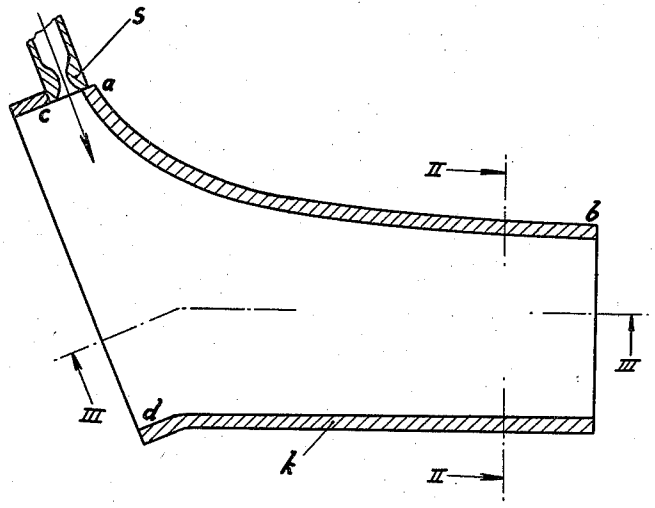

FIG:2

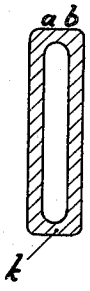

FIG:3

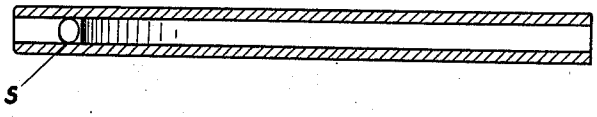

FIG:4

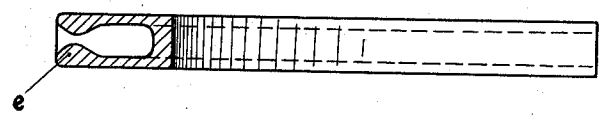

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FIG:5

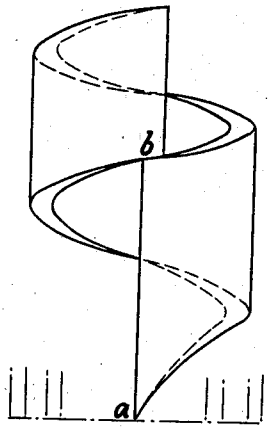


FIG:7

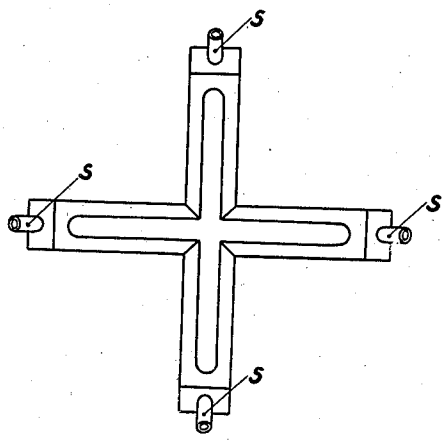


FIG:6

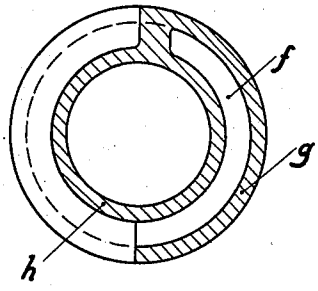
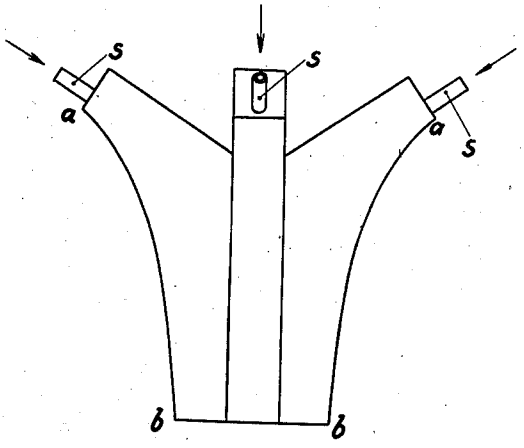


FIG:8



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Patented Oct. 25, 1938 2,134,460

UNITED STATES PATENT OFFICE

2,134,460

JET DEVICE (INJECTOR OR EJECTOR)

August van den Honert, The Hague, Netherlands

Application February 3, 1937, Serial No. 123,923

In the Netherlands February 8, 1936

9 Claims. (Cl. 230—95)

This invention relates to a jet device (injector or ejector) in which the driven or passive medium is forced into the path of the driving or active medium, for the purpose of transferring the kinetic energy of the latter to the greater mass of the resulting flow, with the highest possible efficiency.

Devices having this same object are known, in which the contents of a number of channels, grouped around a cylindrical rotor, are periodically brought in front of a driving jet nozzle.

These devices all have the disadvantage that the flow through a large number of narrow channels causes a considerable loss of energy by friction and the further disadvantage that it is necessary to use either a very high number of revolutions per minute or a rotor of very large dimensions, in order to work a large volume of the medium per unit time.

The object of the present invention is to eliminate these disadvantages in such a way that, though the driven medium is forced to enter the path of the driving jet, this is done without confining it in a plurality of rotating channels. According to the invention the jet of driving medium after leaving the nozzle, enters a channel tangentially, or approximately tangentially, to a curved wall forming one of the sides of said channel, the suction opening for the passive medium being located on the side of the nozzle opposite to this curved wall.

Constructional examples of the subject matter of the invention are illustrated in the accompanying drawings, in connection with which the action of the apparatus will now be more fully described.

Fig. 1 is a longitudinal section through one form of jet device according to the present invention.

Fig. 2 is a cross section on the line II—II of Fig. 1.

Fig. 3 is a cross section on the line III—III of Fig. 1.

Fig. 4 is a cross section of a modified constructional form.

Figs. 5 and 6 show diagrammatically a constructional form in which the passage of the jet device is curved in two directions.

Figs. 7 and 8 are a top plan and side view, respectively, of a further modified constructional form.

In the form of construction shown in Figs. 1, 2 and 3 the jet chamber has substantially the shape of a flat box of approximately rectangular cross-section, the internal width of which corresponds or approximately corresponds to the thickness of the driving jet, while the curved wall *a*—*b* is one of the edge or narrower side walls.

The other edge or narrow side wall *k* is parallel to the end portion *b* of the curved wall *a*—*b*, and the broad inlet end *c*—*d* of the jet chamber is approximately parallel to the inlet end *a* of the curved wall. The nozzle *s* opens into the jet chamber at the end *a* of the curved wall *a*—*b*, and directs a jet of pressure medium tangentially of the curved wall and substantially transversely of the axis of the jet chamber, as indicated by the arrow in Fig. 1. It is to be noted that the driving jet is confined on only three sides by the curved wall and the adjacent parallel side walls. The open inlet *c*—*d* lies at the fourth side of the driving jet.

The jet of driving medium emerging from the nozzle *s*, and entering the channel at *a*, tangentially to the curved wall *a*—*b*, tends to continue its movement in a straight line. This tendency causes a depression along the curved wall *a*—*b* and in the driving jet itself. The medium situated, for example, at *c* is set in motion by this pressure difference, towards the point of lowest pressure and thus is forced into the path of the driving medium. By the collison of driving and drawn in (passive) media, the direction of movement of both will be altered, resulting in only one stream in which the two are completely mixed. The passive medium thus never reaches the point of lowest pressure and consequently the depression is kept up undiminished and an uninterrupted inflow of passive medium results. The resulting stream again causes a depression along the next part of the curved wall, with the similar result of drawing in passive medium again.

The impulse of the resulting stream after the collision is the geometrical resultant of the two original impulses of driving and driven media. The direction of the resulting stream is parallel to a tangent to the curved wall *a*—*b*. The curvature of this wall, therefore, is to be calculated from the impulses of the two component streams of driving and driven media. For instance, if it be required that equal amounts of passive medium be drawn in per unit of length of the suction opening *c*—*d*, the curve *a*—*b* should be a parabola.

If the passive medium is a gas, the velocity of influx may, under certain circumstances, rise above the critical (sound) velocity. In this case the suction opening should show a contraction

(*e* in Fig. 4): it must consist of a converging and a diverging part, for the purpose of accelerating the gas movement, gradually to above the critical velocity, with as little loss of energy as possible. Figure 4 shows suction inlet of the kind in question.

It may be preferable, mainly for constructional reasons, to give the channel a curved shape instead of a flat one, as shown in Figs. 1, 2 and 3. The channel may be bent, say into a cylindrical form, as shown diagrammatically in Figs. 5 and 6. The channel, in this case, is formed by the annular space *f*, between the two cylindrical shells *g* and *h*. This annular space is shown in Fig. 5 as if it were a solid body. The curved wall, denoted by *a*—*b* in the flat channel of Fig. 1 here takes the shape of a helix with a varying pitch. (In Fig. 5 the same designation *a*—*b* is used).

Various combinations are possible. Thus Figs. 7 and 8 show, diagrammatically, a combination of a number of jet devices working parallel with each other. Owing to the fact that these devices are arranged symmetrically around an axis, the driving jets being all directed towards this axis, the walls *k* of Fig. 1, situated opposite the curved walls *a*—*b* of the several channels, would coincide and may, therefore, be omitted entirely. The passive medium may, furthermore, be drawn in stages. If the first jet device be so dimensioned that only a portion of the total amount of passive medium is actually sucked in, the resultant stream of this first jet device may act in a succeeding device as the driving jet. This may be repeated, thus obtaining a number of jet devices, arranged in series, worked by only one primary driving jet.

What I claim is:—

1. In a jet device, a chamber having walls forming a channel open at both ends and of approximately rectangular cross-section, the side walls being substantially uniformly spaced and one edge wall being curved with its convex side towards the channel, and a nozzle at and substantially tangential to the inlet end of said curved edge wall for directing a jet of driving medium substantially transversely of the open end of the channel adjacent said nozzle, whereby the jet of driving medium is unconfined along one side and that open side serves as the suction inlet for the passive medium.

2. A jet apparatus as claimed in claim 1, wherein the side walls of said chamber at the suction inlet converge toward and then diverge from each other in the direction of flow, thereby to accelerate the motion of the passive medium gradually to a velocity above the critical gas velocity with a minimum loss of energy.

3. A jet apparatus as claimed in claim 1, wherein the side walls of said chamber are curved transversely, thereby imparting a curved shape to the channel.

4. A jet apparatus as claimed in claim 1, wherein the side walls are concentric helical surfaces.

5. A jet apparatus as claimed in claim 1, wherein the wall means of said chamber define a plurality of channels arranged symmetrically about and merging into each other along a central axis, the curved wall of each channel being spaced from the axis and the several nozzles being directed towards the axis.

6. A jet apparatus as claimed in claim 1, wherein said nozzle produces a jet of driving medium having a thickness substantially equal to the width of the channel.

7. In a jet device, a chamber having walls forming a channel having an inlet end and an outlet end, a nozzle at the inlet end of said channel for directing a jet of a driving medium substantially transversely of the open inlet end of the channel, one wall of the chamber being tangent to the nozzle and convexly curving progressively from the nozzle, whereby the reduction in pressure at the surface of the curved wall deflects the jet of driving medium to flow along the curved wall and thereby produce a moving stream of reduced pressure, the mass of the stream being continuously increased by the sucking up of passive medium through the unconfined side of the stream.

8. The invention as claimed in claim 7, wherein the cross-section of said channel is approximately rectangular, the walls of said chamber adjacent said curved wall being uniformly spaced from each other.

9. The invention as claimed in claim 7, wherein the cross-section of said channel is approximately rectangular, the walls of said chamber adjacent said curved wall being uniformly spaced from each other and curved to define a helical channel.

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