Aug. 14, 1945. P. BERMAN 2,382,391

EDUCTOR

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Fig. 2

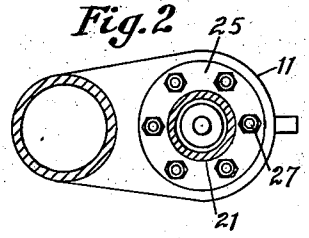


Fig. 1

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EDUCTOR

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2 Claims. (Cl. 103—260)

This invention relates to stream-lined eductors for pumping water containing sand, mud or sludge and which will efficiently utilize the energy of the incoming stream of water under pressure to evacuate or educt the sludge.

An object of this invention is to provide an eductor having a conical nozzle for drive water positioned in equally circumscribed relation in a hollow body for driven water with the lower portion of the nozzle projecting below the lower wall of the hollow body and with the inner contour of the nozzle forming a direct continuation of the contour of the drive water inlet to said hollow body, whereby turbulence is avoided and the full pressure of the drive water is maintained up to the point of entrance to the nozzle and without loss of energy to and through the nozzle.

Another object of this invention is to provide a pressure water inlet and nozzle carrier which may be selectively adjusted to various angular positions relative to the pump casing, and to provide a separable pipe coupling secured intermediate the pressure water inlet and pressure water supply line which may be disconnected at will to permit removal of the pressure water inlet and nozzle carrier without disturbing the set positions of the eductor and piping, and so that a single eductor having this angularly adjustable inlet and nozzle carrier will be adapted to take the place of quite a number of eductor units having fixed angular positions of the pressure water inlet, and simultaneously to provide full and unobstructed flow of the pressure water without turbulence, in all of the selective positions.

With the above and other objects in view, the invention will be hereinafter more particularly described, and the combination and arrangement of parts will be shown in the accompanying drawing and pointed out in the claims which form part of this specification.

Reference will now be had to the drawing, wherein like numerals of reference designate corresponding parts throughout the several views, in which:

Figure 1 is a vertical cross-sectional view of the water eductor embodying the invention.

Figure 2 is a cross-sectional view, taken as on line 2—2 in Figure 1.

In the illustrated embodiment of the invention the numeral 10 indicates a stream-lined eductor comprising a tubular central portion or body 11. A nozzle 12 is positioned axially of the said tubular body 11.

A Venturi or compound tube 13 is threadably secured at the outlet end of the tubular body 11 and in axial alinement therewith. The Venturi tube 13 has a converging lower portion 14, a diverging upper portion 15, a throat 16 and a cylindrical tubular portion 17.

The outlet of the nozzle 12 terminates in spaced relation from the throat 16 of the Venturi tube 13, leaving an annular gap. The nozzle 12 is of conical form so as to increase the velocity of the drive water passing therethrough.

As shown in Figure 1, it will be seen that the outlet edge of the nozzle 12 is substantially of knife-edged thickness which serves to maintain the annular space at the metering entrance and permits merging of the drive and driven streams of water without turbulence.

The tubular portion 17 forms a metering or mixing chamber in which the driven water meets the drive water from the nozzle. The chamber 17 has an upper metering plane 18 and a lower metering plane 19. As shown in Figure 1, it will be seen that the mixing chamber is of uniform cross-section throughout its length.

The metering junction of these streams takes place adjacent the lower metering plane 19. For maximum efficiency the meeting junction of the drive and driven streams should be positioned at a minimum distance above the lower metering plane of the metering part of the neck, or mixing chamber.

The body 11 of the water eductor 10 has an integral inlet 20 which is axially offset from the axis of the nozzle 12. Below the body 11 is a curved elbow-shaped inlet 21 for the drive water. As shown in the drawing, the body 11 provides a very large storage chamber 22. The lower elbow-shaped portion preceding the nozzle is so curved for easy flow as to overcome nearly all the loss of elbow friction. The inner contour of the nozzle forms a direct continuation of the contour of the elbow-shaped pressure water inlet, so as to produce a minimum of resistance to flow. As shown in Figure 1, it will be seen that the upper elevation of the nozzle is positioned considerably above the largest cross-section of the hollow body.

I provide the elbow-shaped inlet 21 with a circular flange 25 and a similar circular flange 26 is provided on the lower face of the body 11. Studs 27 passing through clearance holes in the flange 25 and threaded in the flange 26 provide means whereby the elbow-shaped inlet 21 may be detachably secured to the body 11.

The lower portion of the nozzle 12 has a straight thread 28. An unthreaded portion of the nozzle 12 passes freely through a clearance aperture or opening 29 in the flange or lower face 26

of the hollow body 11. The inner surface of the flange 25 has a thread 30 into which the nozzle may be threadably secured.

The bolts 27 are equally spaced around the circular flanges 25 and 26 to permit adjustment of the pressure water inlet 21 in selective angular positions in relation to the body 11, while maintaining axial alinement of the nozzle 12 with the axis of the mixing chamber 17 under all angular adjustments.

As shown in Figure 1, a separable pipe coupling 32, well known in the art as a union, is secured to the inlet 21 for the drive water and to the pressure water supply line 31. The separable pipe coupling 32 when unthreaded permits the nuts 33 on the studs 27 to be removed and the inlet 21 and the nozzle 12 to be detached as a unit from the eductor without disturbing the adjusted positions of the eductor 12 and of the pressure inlet line 31. Under operating conditions a gasket 34 is inserted between the flange 25 and the apertured lower face 26 of the casing 11 and assures a tight junction between the inlet 21 and the casing 11.

In operation the drive water passes through the nozzle 12 and causes the liquid discharged therethrough to be under increased high velocity. The nozzle 12 projects directly into the entrained stream so that the general direction of the entrained stream is not changed. The entrained liquid is given an impulse by the eductor jet in the direction in which it is flowing.

The conical nozzle of the eductor imparts an impulse effect to the liquid and functions to increase the velocity of the liquid and to create a high suction at the throat of the Venturi tube 13.

Eductors have heretofore been designed wherein the contour of the pressure water inlet did not form a direct continuation of the contour of the conical nozzle. This arrangement of the operating mechanism interfered with the flow and produced turbulence and otherwise interfered with the efficient operation of the instrument.

The improved eductor herein disclosed avoids the objectionable construction of the features of the prior art and comprises flow passages which are stream-lined in the direction of flow, and so that sharp angles and indentations which would cause turbulence are avoided and which permits flow therethrough with the least possible resistance.

Under operating conditions, after an installation is made it is desirable to be able to change the size of the nozzle without dismantling the entire piping arrangement. This substitution of nozzles may be due to varying pressure inlet conditions that may be different from those contemplated before the installation was made.

Inlet positions are always specified, as side inlet perpendicular to the direction of flow of the suction and discharge, inlet parallel to suction and discharge, but in a vertical position forming a return L, or parallel to suction and discharge and in the same direction as suction and discharge, as well as the inlet being in any angular relation with the axis of flow and suction.

It is readily seen from the drawing that this unit will answer any of the above specified conditions and this flexibility in design often makes possible the completion of a ship, naval vessel, etc., without waiting for the particular specified eductor unit or units.

The design of eductor herein disclosed, where the nozzle forms a direct continuation of the contour of the pressure water inlet, does in actual practice bring the nozzle discharge very close to the theoretical discharge, that is, as close as ½ of 1% from the theoretical, thus not reducing the driving power and permitting the full energy to be developed in the mixing chamber.

In accordance with the patent statutes I have described and illustrated the preferred embodiment of my invention, but it will be understood that various changes and modifications can be made therein without departing from the spirit of the invention as defined by the appended claims.

I claim:

1. In a stream-lined water eductor, an elongated hollow body for driven water, said hollow body having an opening in its lower face and a cylindrical metering or mixing chamber of circular cross-section for drive and driven water at its upper portion, said mixing chamber being of uniform cross-section and being defined by upper and lower metering planes, a curved elbow-shaped pressure water inlet having an opening in its upper face, a conical nozzle for drive water under pressure mounted in said opening, the outlet edge of said nozzle being of substantially knife-edge thickness to permit merging of said drive and driven streams of water without turbulence, said nozzle passing freely through said lower face opening in said hollow body, the upper elevation of said nozzle being positioned considerably above the largest cross-section of said hollow body, releasable means for securing said elbow-shaped inlet to said hollow body to bring said nozzle into axial alinement with the axis of said mixing chamber, said hollow body being of circular cross-section and in equally spaced circumscribing relation around said nozzle and providing a balanced storage chamber of constantly diminishing cross-sections toward the outlet from said nozzle, said hollow body having an inlet positioned to one side of said nozzle and in parallel relation with the axis of said nozzle, the lower portion of said nozzle projecting below the lower wall of said hollow body, the inner contour of said nozzle being positioned so as to form a direct continuation of the contour of said curved elbow-shaped inlet, and substantially without loss of energy due to shock in passing through said mixing chamber whereby turbulence is avoided and the full pressure of the drive water is maintained up to the point of entrance to said nozzle and without loss of energy through said nozzle.

2. In a stream-lined water eductor, an elongated hollow body for driven water, said hollow body having an opening in its lower face and a cylindrical metering or mixing chamber of circular cross-section for drive and driven water at its upper portion, said mixing chamber being of uniform cross-section and being defined by upper and lower metering planes, a curved elbow-shaped pressure water inlet having an opening in its upper face, a conical nozzle for drive water under pressure mounted in said opening, the outlet edge of said nozzle being of substantially knife-edge thickness to permit merging of said drive and driven streams of water without turbulence, said nozzle passing freely through said lower face opening in said hollow body, the upper elevation of said nozzle being positioned considerably above the largest cross-section of said hollow body, releasable means threaded in equally spaced angular positions relative to said body to bring said nozzle into axial alinement with the

axis of said mixing chamber, said hollow body being of circular cross-section and in equally spaced circumscribing relation around said nozzle and providing a balanced storage chamber of constantly diminishing cross-sections toward the outlet from said nozzle, said hollow body having an inlet positioned to one side of said nozzle and in parallel relation with the axis of said nozzle, the curved lower portion of said nozzle projecting below the lower wall of said hollow body, the inner contour of said nozzle being positioned so as to form a direct continuation of the contour of said elbow-shaped inlet, whereby turbulence is avoided and the full pressure of the drive water is maintained up to the point of entrance to said nozzle and substantially without loss of energy due to shock in passing through said mixing chamber.

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