

Feb. 9, 1954

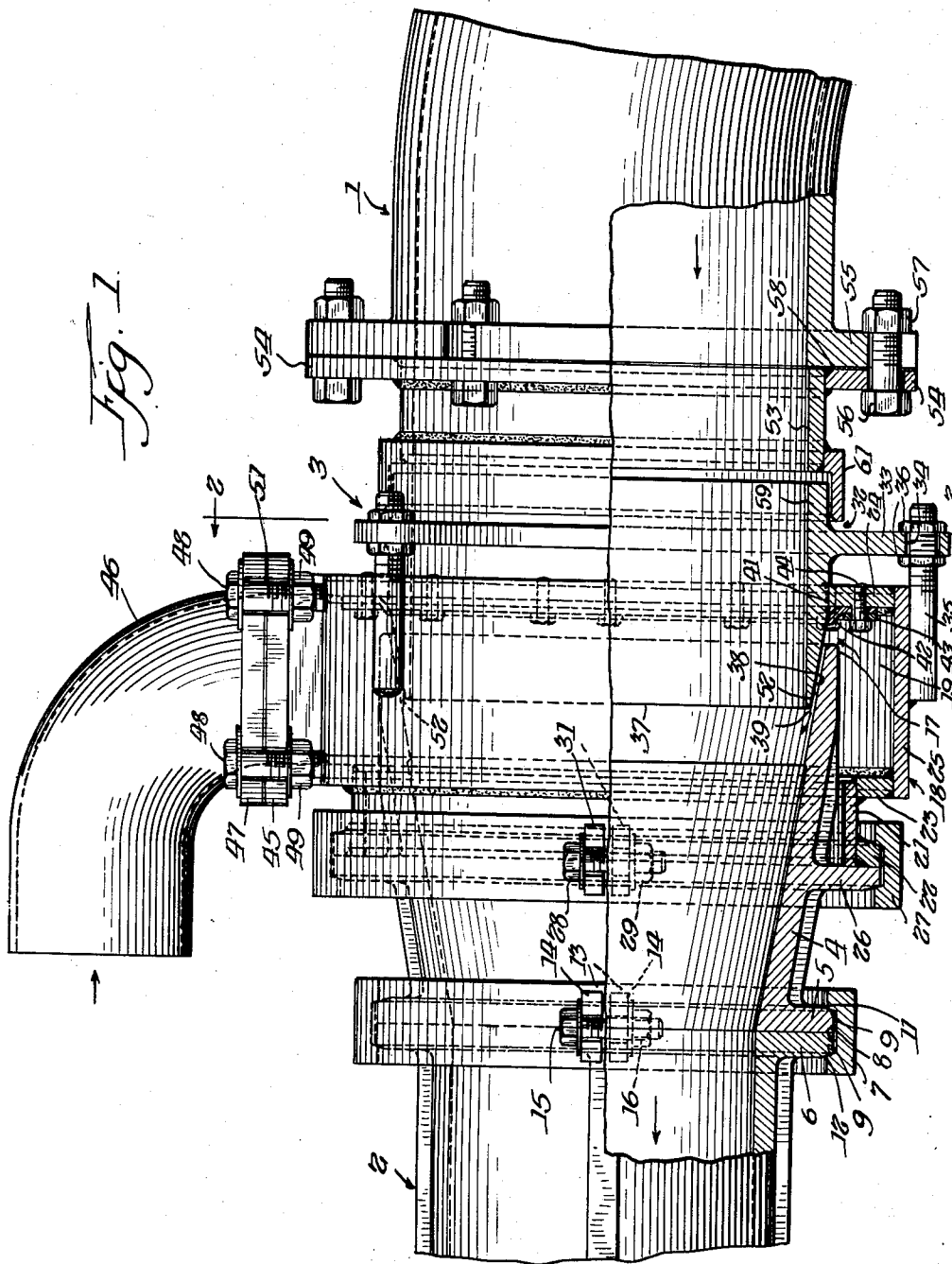
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JET NOZZLE

Filed Dec. 15, 1949

2 Sheets-Sheet 1



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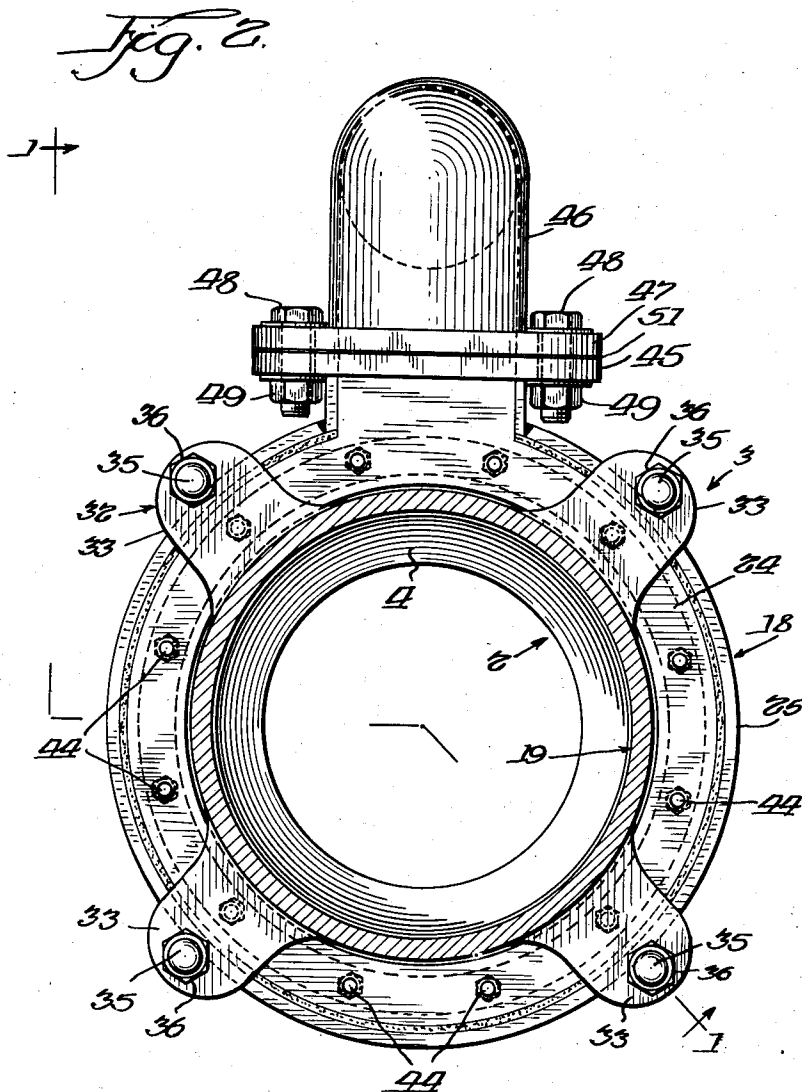
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UNITED STATES PATENT OFFICE

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JET NOZZLE

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4 Claims. (Cl. 103—272)

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The invention relates generally to jet nozzle structures and, more particularly, to a jet nozzle adapted to be employed in connection with dredging pumps, or the like.

The invention has among its objects the production of such a nozzle which may be employed in either the suction line or discharge lines of dredging pumps, which nozzle is very simple in construction, durable, and very efficient in operation for the purposes intended.

Another object of the invention is the production of such a nozzle which is so designed that the fluid admitted through the nozzle peripherally enters the fluid conduit or line, tending to direct the material passing through the conduit toward the center of the tube to materially reduce wear on the parts of the nozzle.

A further object of the invention is the production of such a nozzle which is so constructed that it may be readily adjusted for most efficient operation, and in which elements thereof which may be subject to wear may be readily replaceable.

Many other objects and advantages of the construction herein shown and described will be obvious to those skilled in the art from the disclosure herein given.

To this end my invention consists in the novel construction, arrangement, and combination of parts herein shown and described, and more particularly pointed out in the claims.

In the past, jet nozzles of the general type here involved, employed in connection with dredging pumps, normally utilized a nozzle discharging on the axis of the fluid conduit or line at the location of the nozzle. In such case, the material being conducted through the line comes into direct contact with the nozzle and, as normally abrasive materials are involved, wear on the nozzle is very rapid. Also, in such a construction the nozzle orifice is fixed in dimensions, the operational effect of the nozzle being controlled by the amount of fluid passing through the same.

The present invention contemplates a jet nozzle wherein the liquid being discharged therefrom enters the conduit or line peripherally or circumferentially, and tends to direct material passing through the conduit away from the nozzle toward the center of the conduit. As the fluid being ejected into the conduit from the nozzle enters peripherally, the insertion of the nozzle in the line does not obstruct the conduit nor vary the effective size of the latter; in view of which the nozzle may be readily inserted at

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any point in the suction line or discharge line of the dredge pump as may be required. When placed in the suction line, the nozzle increases the percentage of solids which may be handled by the pump, increases the effective suction in the line, and is effective in breaking up lumps of clay, or other material, as they pass there-through. When placed in the discharge line, the nozzle is operative to inject liquid under high pressure in the same direction as the normal flow in the line, thus imparting additional energy into the column of water being moved, thereby maintaining the velocity of the discharge line under long distance pumping operations. When material is pumped through a long discharge line, as for example, 3 to 6 thousand feet or more, even though the velocity of the discharge line may be maintained fairly high, such material has a tendency to drift to the bottom of the pipe or conduit, whereby the solids adjacent the bottom of the pipe travel at a slower velocity than the liquid adjacent the top conduit, which does not contain as high a percentage of solids. The insertion of the nozzle in such cases is effective in agitating such solids, tending to produce a more uniform distribution of the material throughout the area of the conduit, resulting in an increase in the percentage of solids which can be handled by the particular dredge pump employed.

In the drawings, wherein like reference characters represent like or corresponding parts:

Fig. 1 is a side elevational view of a jet nozzle embodying the present invention, with the lower portion thereof shown in section, the figure being taken approximately on the line 1—1 of Fig. 2; and

Fig. 2 is a transverse sectional view taken approximately on the line 2—2 of Fig. 1.

Referring to the drawings, there is illustrated generally the discharge end of a conventional dredge nozzle 1, and a portion 2 of the intake conduit or line to a dredging pump. Interposed between the discharge end of the nozzle 1 and intake conduit or line 2 is a jet nozzle structure, indicated generally by the numeral 3. Secured to the adjacent end of the conduit 2 is a member or cone 4, the latter, in the construction illustrated, terminating in an outwardly extending flange 5, which butts a like flange 6 on the intake conduit or line 2, the flanges 5 and 6 being firmly secured together by means of a split clamp ring 7 having a channel 8 therein in which are positioned the edge portions of

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the flanges 5 and 6. The side walls 9 of the channel 8 are inclined and complementary to the beveled edges 11 and 12 of the respective flanges 5 and 6, whereby the adjacent opposed faces of the flanges are securely clamped together. The ends 13 of the clamp ring 8 are provided with outwardly extending lugs 14, through which extends a bolt 15 co-operating with a nut 16 to clamp the ends of the ring 8 positioned adjacent the free end 17 of the member 4, and carried by the latter is an annular raised portion or ring-shaped member 18 which forms a water chamber 19 adjacent the end 17 of the member 4, the member 18 having a concentric portion 21 terminating at its free or rear edge in an outwardly extending flange 22. The side walls 23 and 24, and outer wall 25 of the chamber 19, as well as the extension 21 and flange 22 may be suitably constructed from one or more individual pieces, the construction in the embodiment of the invention illustrated employing individual pieces welded together at their corresponding junctures to form an integral structure.

The member 18 is secured to the member 4 by means of the flange 22, flange 26 on the member 4, and split clamp ring 27, the details of the construction of the flanges and ring 27 being similar to the flanges 5 and 6 and ring 7, with the clamp ring 27 securely maintained in clamping relation to the flanges 22 and 26 by means of a bolt 28 and nut 29 passing through the lugs 31 on the ring 27.

Carried by the member 18 is a member, indicated generally by the numeral 32, which comprises a tubular sleeve provided with a plurality of radially extending projections or lugs 33 having apertures 34 therein through which extend studs 35, welded or otherwise suitably secured to the member 18 with the lugs 33 being locked in position relative to the studs by lock nuts 36 positioned at each side of the respective lugs. The external circumferential surface of the member 32 adjacent the end 37 thereof is tapered, as indicated at 38, to form a surface complementary to the surface 39 on the member 4. The inner edge 41 of the side wall 24 of the water chamber engages the adjacent external surface of the member 32 in a sliding fit, and the joint therebetween is sealed by a flexible ring gasket 42 secured to the side wall 24 by a retaining ring 43 and a plurality of bolts 44. The member 18 is provided with suitable means for connection to a liquid supply line comprising, in the form illustrated, suitable pipe flange 45 secured to the outer wall 25 of the member 18, on which may be mounted a suitable pipe connection, as for example, the L 46, which is provided with a co-operating flange 47, the flanges being secured together by bolts 48 and nuts 49 extending through the respective flanges, with a gasket 51 interposed between the flanges to effect a fluid-tight joint.

It will be apparent that as the member 32 is adjustable on the studs 35, the member may be moved axially relative to the end 17 of the member 4 operative to vary the size of the annular orifice 52 formed between the adjacent valve surfaces 38 and 39, movement of the member 32 towards the member 4 reducing the size of the orifice, and movement away from the member 4 increasing the same. The effective size of the orifice may, therefore, be readily varied from

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the exterior of the structure by adjustment of the respective nuts 36 on each of the studs 35.

Operatively connecting the member 32 with the discharge end of the nozzle 1 is an annular member 53 having an external mounting flange 54 positioned adjacent a corresponding flange 55 on the discharge end of the nozzle 1, the two flanges being secured together by bolts 56, or the like, passing through the flanges and nuts 57, with a suitable gasket 58 being interposed between the adjacent surfaces of the flanges. Carried by the member 53 and overlying the adjacent end 59 of the member 32 is a tubular guide sleeve 61 concentrically positioned with respect to the end 59 of the member 32, with the internal diameter of the sleeve 61 being such that a sliding fit between the latter and the member 32 is achieved. While the member 53 is illustrated as comprising several pieces welded together, obviously the member may be suitably constructed from one or more pieces, as desired. The length of the guide sleeve 61, studs 35, and the relative positions of the respective members in the line is such that the axial movement of the member 32 is sufficient to give a desired size range of the discharge orifice 52.

In operation, liquid and material is drawn through the nozzle 1 and intake conduit or line 2 by action of the dredge pump to which the structure is connected, free flow through the jet nozzle structure 3 being achieved as the construction of the latter is such that no projections or obstructions are positioned in the flow path. Water under high pressure is fed through the L 46 into the chamber 19, from which it is discharged through the annular orifice 52 into the line, such water entering peripherally in the same direction as the liquid flow in the line, thus, in effect supplementing the suction in the line to increase the material flow therein, as well as break up lumps of clay, or other like material, as they pass through the jet nozzle. The size of the orifice 52 will depend on the operating conditions and may be readily determined under operating conditions to achieve the most efficient results.

It will be noted that the ejection of water from the orifice 52 tends to carry material away from the periphery of the conduit toward the axis of the latter, resulting in a minimum abrasive action on the members 4 and 32, and, consequently, relatively long life of the nozzle structure. However, in the event that it becomes desirable to replace one or more parts of the jet nozzle, such replacement can be readily and quickly made by disconnecting the respective parts.

While the invention has been illustrated in the drawings in connection with a nozzle 1, it is believed apparent that the jet nozzle structure may be readily inserted in the discharge line of the dredge pump by breaking the latter and inserting the nozzle structure at such break, the adjacent ends of the line being suitably constructed for attachment to the member 53 and member 4. Obviously, when so inserted in the discharge line, the flow of water under high pressure through the discharge orifice will impart additional energy into the flow, thus maintaining the desired velocity of the liquid in the conduit. This action also will, as previously mentioned, agitate the solids carried through the conduit to maintain more uniform distribution of such material, whereby a higher percentage of solids may be handled by the dredge pump

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and enable efficient operation, even though long discharge lines are involved.

It will be noted from the above description that I have provided a novel jet nozzle construction which may be readily employed in either the suction or discharge line of a dredge pump, which nozzle construction is very efficient in operation, simple in construction, and readily adjustable to achieve the desired results. It will also be noted that, due to the construction of my nozzle construction, abrasive wear on the parts thereof is reduced to a minimum, resulting in a relatively durable structure.

Having thus described my invention, it is obvious that various immaterial modifications may be made in the same without departing from the spirit of my invention; hence, I do not wish to be understood as limiting myself to the exact form, construction, arrangement, and combination of parts herein shown and described or uses mentioned.

What I claim as new and desire to secure by Letters Patent is:

1. In a jet nozzle, a pair of spaced, axially aligned tubular sections comprising a portion of a conduit for carrying a primary fluid, a concentric annular housing mounted on the upstream end portion of the downstream section and having an inwardly opening, annularly-shaped recess therein, the upstream end portion of the downstream section extending partially across the mouth of said recess, a sleeve operatively connecting the adjacent end portions of said spaced tubular sections and axially movable relative to said sections, the upstream end portion of the downstream section, said sleeve, and said housing forming a fluid chamber encircling the conduit, means for admitting a secondary fluid under pressure into said chamber, the downstream end of said sleeve being positioned adjacent to but spaced from the upstream end portion of the downstream section to form a passageway therebetween connecting the conduit interior with said fluid chamber for admitting secondary fluid from said chamber into said conduit, the opposite end of said sleeve having a portion concentric with the downstream end portion of the upstream section to provide an adjustable joint therebetween, gasket means operatively interposed between said sleeve and the adjacent housing wall, and means carried by said housing for supporting said sleeve in a relatively adjusted position with respect to the end portions of said spaced sections.

2. In a jet nozzle, a pair of spaced, axially aligned tubular sections comprising a portion of a conduit for carrying a primary fluid, the upstream end portion of the downstream section having outwardly tapering, internal surfaces, a concentric annular housing mounted on the upstream end portion of the downstream section and having an inwardly opening, annularly-shaped recess therein, the upstream end portion of the downstream section extending partially across the mouth of said recess, a tubular sleeve operatively connecting the adjacent ends of said spaced tubular sections and axially movable relative said sections, the upstream end portion of the downstream section, said sleeve, and said housing forming a fluid chamber encircling the conduit, means for admitting a secondary fluid under pressure into said chamber, the downstream end of said sleeve being positioned adjacent to but spaced from the upstream end portion of the downstream section and having an

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external shape complementary to the tapering surface of the latter to form an annularly-shaped passageway between said surfaces connecting the conduit interior with said fluid chamber, with the opposed side walls of said passageway being inclined toward the conduit axis in a downstream direction for admitting secondary fluid from said chamber into said conduit in the same general direction as the fluid flow in the latter, the opposite end of said sleeve having a portion concentric with the downstream end portion of the upstream section to provide an adjustable joint therebetween, gasket means operatively interposed between said sleeve and the adjacent housing wall, and means carried by said housing for supporting said sleeve in a relatively adjusted position with respect to the end portions of said spaced sections.

3. A jet nozzle comprising a conduit for carrying a primary fluid, said conduit including a first tubular section and a second tubular section, said tubular sections being aligned with the adjacent ends thereof spaced apart, one of said sections having a raised portion around the outer periphery thereof defining an annular chamber, said annular chamber including a connection for operatively connecting the annular chamber to a second fluid under pressure, an axially movable sleeve operatively connecting the adjacent ends of said sections, said sleeve having a plurality of radially extending projections formed about the outer periphery thereof and having means connected to said projections and to one of said sections having the raised portion for supporting said sleeve in operative position relative to said conduit, one end portion of said movable sleeve serving to partially close said annular chamber, and being positioned adjacent to but spaced from the interior surface of the portion of said section having the raised portion thereon adjacent the said raised portion, said one end of said sleeve together with the aforementioned interior surface serving to form an annularly shaped passageway connecting the conduit interior with the interior of said annular chamber for discharging the second fluid from the chamber through the passageway to the conduit interior, and the opposite end of said sleeve having a portion concentric with the adjacent end of the remaining tubular section to provide a closed adjustable joint therebetween.

4. In a jet nozzle, a conduit for carrying a primary fluid, a housing carried by and encircling a portion of said conduit and having an annular fluid chamber, means for admitting a secondary fluid under pressure into said chamber, said conduit being divided into downstream and upstream tubular sections at said housing with the adjacent ends of said sections being spaced apart, the upstream end portion of the downstream tubular section communicating with said fluid chamber, and the end of the upstream tubular section being axially spaced from said chamber, a sleeve operatively connecting the adjacent end portions of said tubular sections and axially movable relative to said sections, said sleeve having a plurality of radially extending projections formed around the rear outer periphery thereof, means connected to said projections for supporting said sleeve in operative position relative to said conduit, one end of said sleeve being positioned adjacent to but spaced from the upstream end portion of the downstream section to form an annularly shaped passageway con-

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necting the conduit interior with said fluid chamber, and the opposite end of said sleeve having a portion concentric with the downstream end portion of the upstream section to provide a closed adjustable joint therebetween.

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