United States Patent [19]

Masters

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[54] **NOZZLE**

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[73] Assignee: **McNeil Corporation,** Akron, Ohio

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[52] **U.S. Cl.**..... **239/558,** 239/561, 239/DIG. 13, 134/167 C, 134/168 C

[51] **Int. Cl.**..... **B05b 1/14**

[58] **Field of Search**..... 239/DIG. 13, 558, 560, 239/561; 134/167 C, 168 C, 169 C

[56] **References Cited**

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Assistant Examiner—John J. Love
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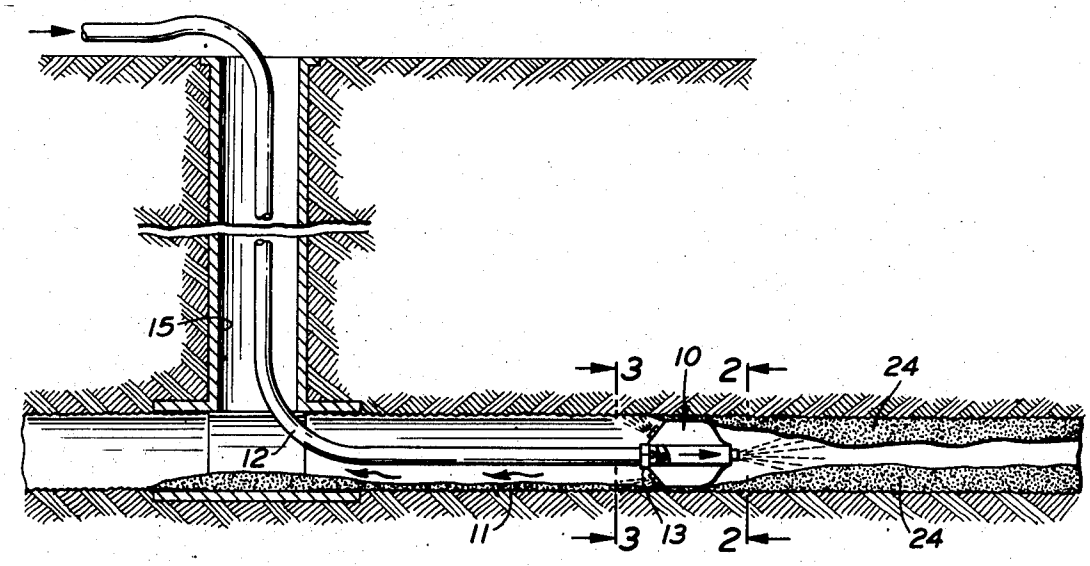
[57] **ABSTRACT**

A nozzle for cleaning the inside of piping, such as sewer lines and the like, receives high pressure water from a hose attached to the back thereof. The water is emitted from a front port or jet to dislodge debris clogging the pipe. The body of the nozzle is fluted thereby being divided into a series of vanes to permit the passage of loosened debris through the flutes and toward the rear of the nozzle. Each vane includes a plurality of thrust ports or jets mounted on a surface angular to the circumferential extremity of the nozzle and emitting water generally rearwardly to drive the nozzle and hose through the pipe. Each vane also includes a flusher port or jet which is mounted on a surface angular to both the circumferential extremity of the nozzle and the surface of the thrust port and which has an axis askew to the axis of the nozzle to create a volute flow of water to clear debris or sediment adhering to the inside of the pipe.

12 Claims, 7 Drawing Figures



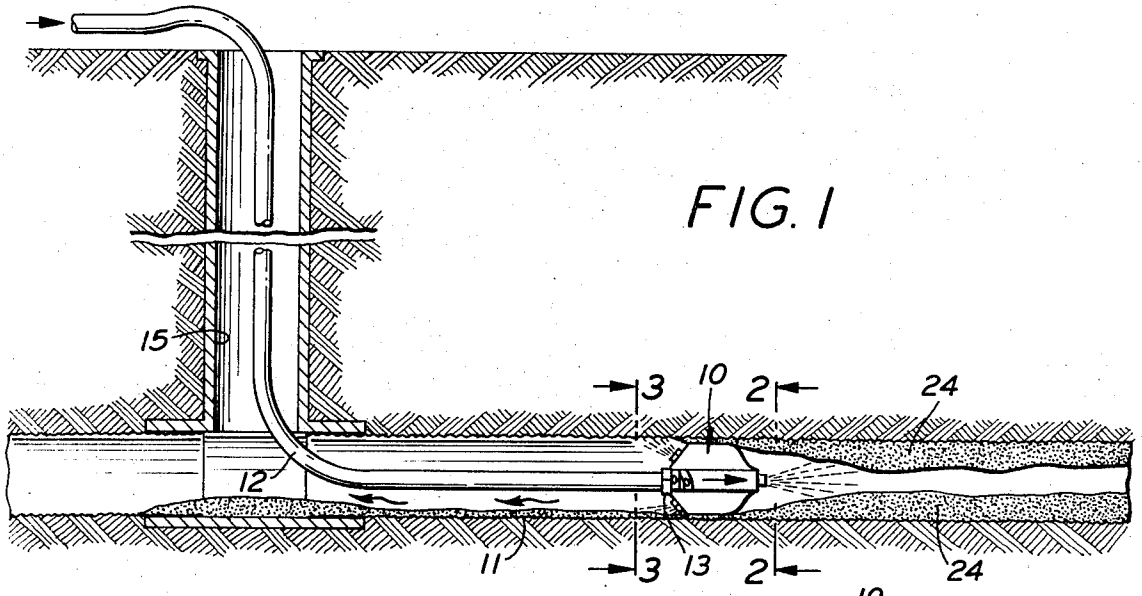


FIG. 1

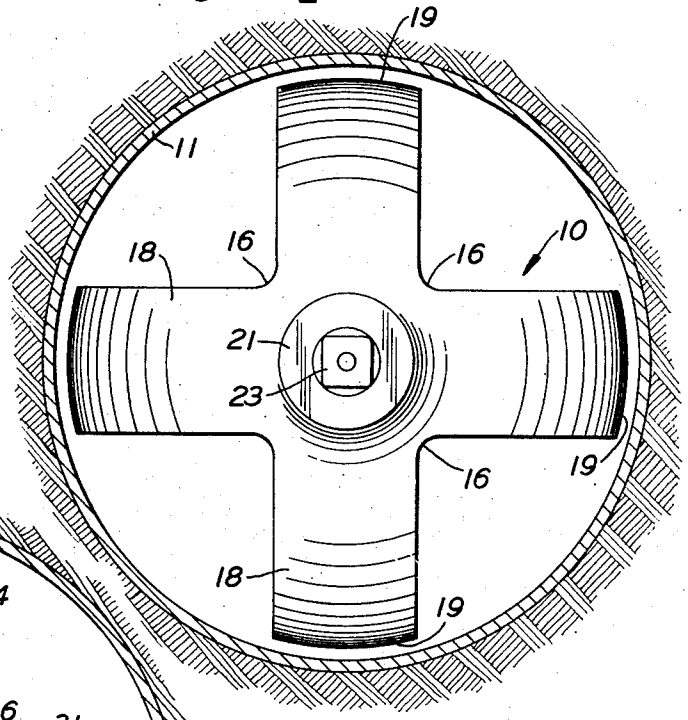


FIG. 2

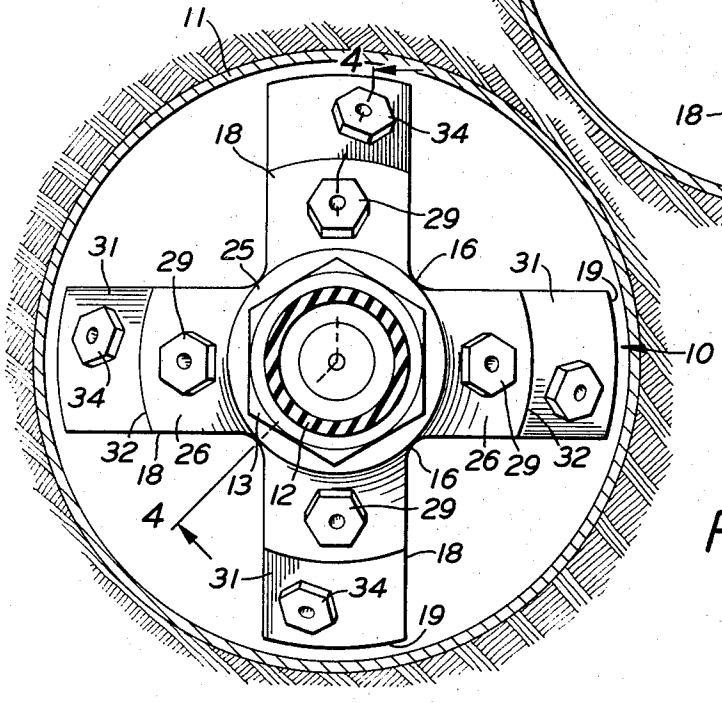
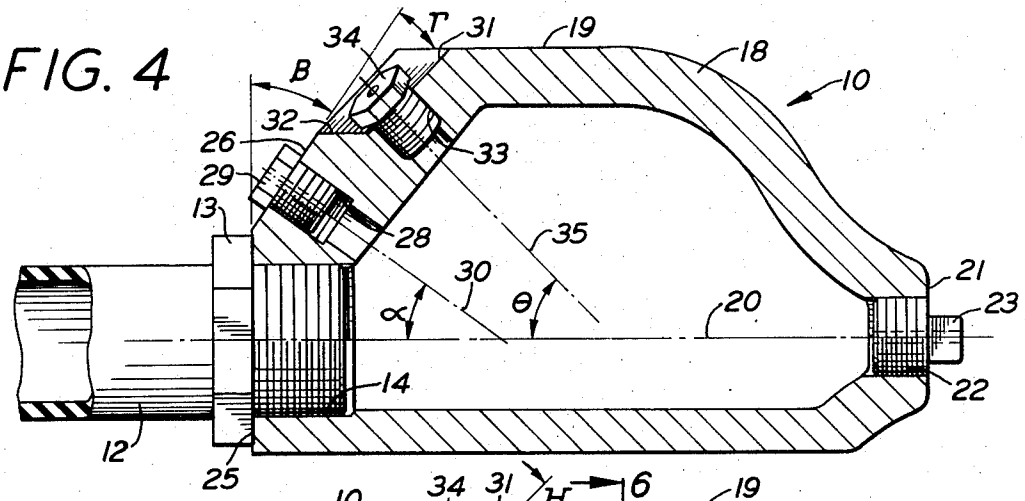


FIG. 3

FIG. 4



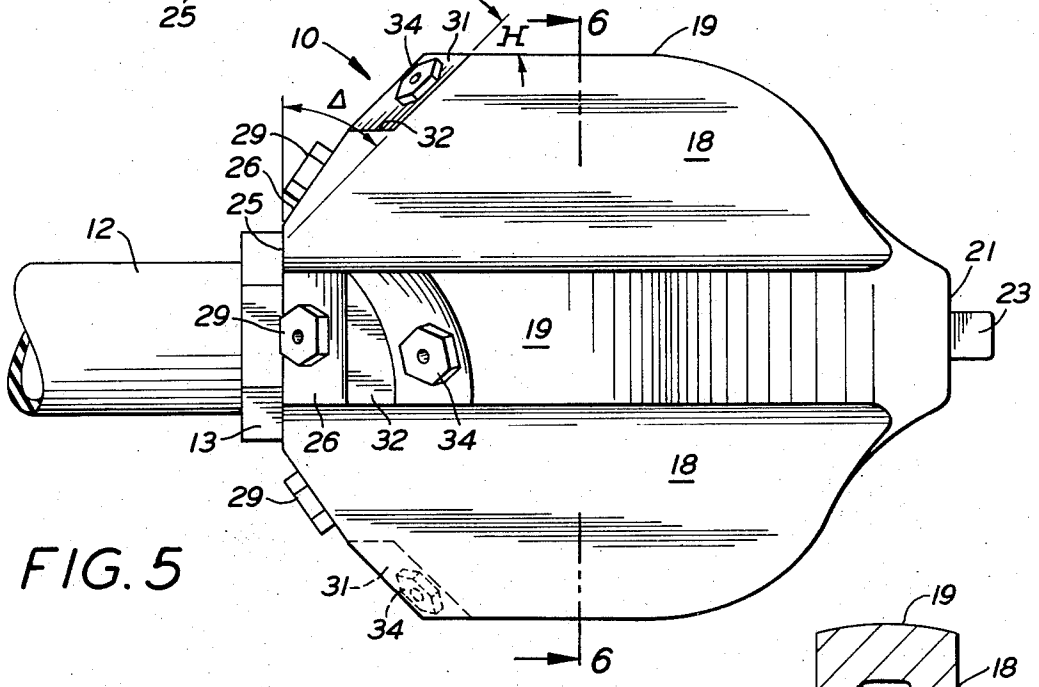


FIG. 5

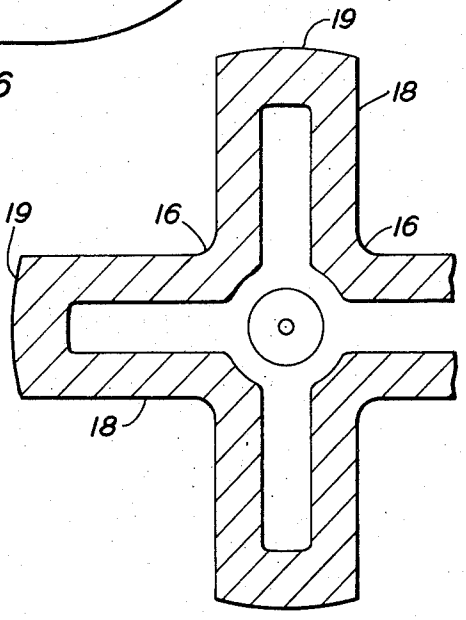


FIG. 6

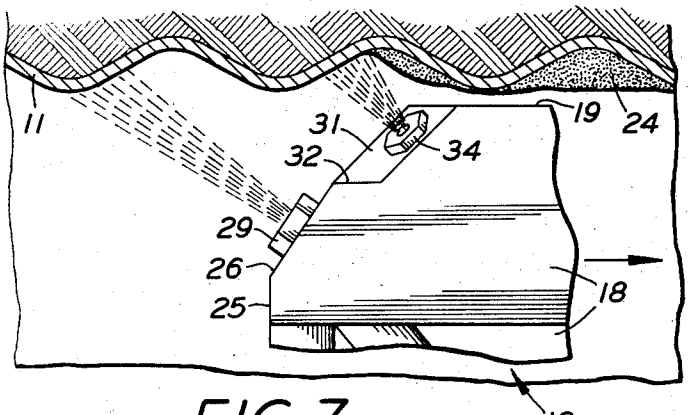


FIG. 7

NOZZLE

BACKGROUND OF THE INVENTION

The invention relates to a nozzle for cleaning the interior of pipes and the like. More particularly this invention relates to a nozzle having a fluted body with a forward jet to dislodge material, rearward jets to render the nozzle self-propelled, and tangentially angled jets to dislodge materials which might adhere to the inside of the pipe, particularly a corrugated pipe.

Nozzles emitting a forward stream of water to dislodge debris in pipes, such as sewer pipes, and emitting generally rearwardly directed streams to propel themselves through the pipes are generally known in the art. Usually, these nozzles are mounted on the end of a hose and move through the pipe dislodging sediment until the limit of the hose has been reached. Then the nozzle is pulled back through the pipe with the rearwardly directed jets flushing the sludge toward the manhole or other means of access for subsequent removal.

This process is not always totally satisfactory for universal applications. For example, if there is a tendency for the sediment to adhere to the pipe and especially in the case of a corrugated pipe where sediment tends to lodge in the corrugations, neither the forward jet during its passage through the pipe nor the rearward jets in their passage and withdrawal through the pipe will satisfactorily dislodge and flush away this sediment. While some nozzles have utilized radially directed sprays in an attempt to remove lodged sediment, satisfactory, flushing action is not created thereby, but rather, travel through the pipe is hampered by the radial force of the jets.

In addition, in small piping, or pipes which have an internal diameter approaching the external diameter of prior art nozzles, there is often no room for the material dislodged by the front jet to pass by the nozzle. In many instances, the self-propelled nozzle thus lodges itself in the sediment in the pipe and the entire cleaning process is aborted.

SUMMARY OF THE INVENTION

It is thus a primary object of the present invention to provide a nozzle which can satisfactorily clean a wide range of sizes and types of piping including corrugated piping.

It is another object of the present invention to provide a nozzle, as above, which is self-propelled through the pipe being cleaned but which will not lodge itself in the sediment in the pipe.

It is yet another object of the present invention to provide a nozzle, as above, which is fluted to permit the passage of loosened sediment past the nozzle to the rear to be washed away.

It is a further object of the present invention to provide a nozzle, as above, which includes outlets spraying water rearwardly and somewhat tangentially of the nozzle body to provide a swirling agitation within the confines of the piping to remove sediment lodged on the walls thereof.

These and other objects of the present invention which will become apparent from the following description are accomplished by means hereinafter described and claimed.

In general, a generally cylindrical nozzle body is fluted or grooved at equally circumferentially spaced

locations forming a plurality of axially extending vanes therebetween. The nozzle is attached to a hose at the back end thereof with the front end thereof being provided with a port which emits a stream of water substantially along the longitudinal axis of the nozzle to dislodge sediment in a pipe. The rear of each vane is provided with generally rearwardly directed thrust ports which have an axis rearwardly inclined at an acute angle to the axis of the nozzle body and which are mounted on a surface angular to the circumferential extremity of the vanes. The thrust ports emit a stream of water to propel the nozzle through the pipe and to flush debris which passes through the flutes rearwardly. A plurality of sweeper ports are mounted on volute surfaces extending generally between the thrust port surfaces and the circumferential surface of the nozzle. The volute surfaces are angular to the thrust port surfaces and the circumferential surface of the nozzle with the sweeper port being on an axis askew to the longitudinal axis of the nozzle body.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is an elevational view of the nozzle of the present invention depicted in the operative environment of a laterally extending pipe such as a sewer, shown partially in section.

FIG. 2 is an enlarged sectional view taken substantially along line 2—2 of FIG. 1 and showing the front of the nozzle of the present invention in elevation.

FIG. 3 is an enlarged sectional view taken substantially along line 3—3 of FIG. 1 and showing the back of the nozzle of the present invention in elevation.

FIG. 4 is a sectional view taken substantially along line 4—4 of FIG. 3.

FIG. 5 is a side elevation of the nozzle of the present invention.

FIG. 6 is a partial sectional view taken substantially along line 6—6 of FIG. 5.

FIG. 7 is an enlarged broken away view of the nozzle of the present invention shown in the operative environment of removing sediment from a corrugated pipe.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Apparatus according to the concept of the present invention includes a nozzle body, generally indicated by the numeral **10** in the drawings and shown in FIG. **1** in the environment of a laterally extending sewer pipe line **11.** The rear of nozzle body **10** receives a hose **12** whose coupling **13** is threaded into inlet bore **14** of nozzle body **10** (FIG. **4**). Hose **12** is provided with water under high pressures and can be lowered, with nozzle body **10,** through a manhole shaft **15** and into pipe line **11.**

Nozzle body **10** is fluted or grooved at a plurality of locations, as at **16,** substantially along the entire length thereof thereby defining a plurality of radially extending longitudinal vanes **18.** The outermost surface **19** of each vane **18** is generally parallel to the longitudinal axis **20** (FIG. **4**) of nozzle body **10,** although precisely, in the preferred embodiment, surfaces **19** are slightly arcuate together defining a circle about the axis **20** as best shown in FIGS. **2, 3** and **6.** Vanes **18** are hollowed out so that they will receive water under pressure from hose **12.**

As best shown in FIGS. 4 and 5, the forward or front end of vanes 18 arcuately converge from the surface 19 to a vertical front surface 21 thereby forming a bullet-shaped front of nozzle body 10 which permits and facilitates penetration into clogged pipes. Surface 21 is bored, as at 22, to receive an insert nozzle or jet 23 thereby forming a front port which emits a jet of water whose axis substantially corresponds to the longitudinal axis 20 of nozzle body 10. The front jet, as shown in FIG. 1, acts to dislodge debris 24 which may be clogging the pipe 11. The loosened debris 24 is then permitted to pass through the flutes 16 and toward the rear of nozzle body 10.

The rear of nozzle body 10 includes a generally vertically oriented surface 25 in which inlet bore 14 reposes. Thus surface 25 is substantially parallel to surface 21 and at right angles to surfaces 19. Each vane 18 includes, near the end thereof, a surface 26 which is angular to both surfaces 19 and 21. A bore 28 extends through each vane surface 26 to receive an insert nozzle or thrust jet 29 thereby forming generally rearwardly directed thrust ports which emit a jet of water to propel the nozzle body 10 and hose 12 through the pipe 11. The jet of water from the thrust ports also acts to move at least some of the debris 24 loosened by the front jet rearwardly in pipe 11 toward manhole shaft 15.

As best shown in FIG. 4, the axis 30 of each thrust jet or port 29 is rearwardly inclined at an acute angle α to the longitudinal axis 20 of the nozzle body. Angle α is shown as being approximately 35° which is found to be best for giving a sufficient amount of thrust and some cleaning effect. However, an angle α at least in the range of 15° to 55° would also be appropriate.

Surface 26 of each thrust jet 29 is inclined at an angle β of preferably 35° from vertical surface 25 and therefore at an angle Γ of preferably 55° from the radially outermost surface 19 of vanes 18. However, it has been found that an angle β in the range of 15° to 55° and an angle Γ in the range of 35° to 75° is acceptable. In addition, in the preferred embodiment, the plane of surface 26, if extended to intersect axis 20, will have a line therein which is perpendicular to axis 20. Thus with port insert 29 placed squarely in surface 26 with its axis 30 at right angles thereto and because axis 30 intersects axis 20, no moment or twisting action will be created by the emission of fluid through port 29.

Between surfaces 19 and 26 of each vane 18 is a flush port or volute surface 31 and a shelf 32. Flush port surface 31 is angular to both surface 19 and surface 26 while shelf 32 is generally parallel to surface 19. A bore 33 extends through surface 31 to receive an insert nozzle or flush jet 34. As best shown in FIG. 5, surface 31 of each flush jet 34 is inclined to an angle Δ of preferably 45° from vertical surface 25 and thus the angle η of 45° from radially outermost surface 19. However, it has been found that angles Δ and η in the range of 35° to 55° are acceptable.

In addition to the angles Δ and η, the plane of surface 31 is tilted to the side with respect to the plane surface 26 such that one angle of intersection thereof will be at an angle of preferably about 15° but which could be as high as 20°. Thus, a plane passing through volute surface 31, if extended to intersect axis 20, will not have a line therein which is perpendicular to axis 20 but rather, every line drawn in the plane of surface 31 will be at an angle of other than 90° to axis 20. Thus, with flush port insert 34 placed squarely in surface 31 with its axis 35 at right angles thereto, a small twisting force will be created by the emission of fluid through ports 34. However, as long as the tilt angle of surface 31 is kept under approximately 20° with respect to surface 26, this force will not twist the nozzle but will rather cause a swirl of water to be directed against the pipe 11 creating a vortex to scour the inside thereof.

The axis 35 of each flush port 34, being mounted on surface 31 is rearwardly inclined at an acute angle θ to the longitudinal axis 20 of the nozzle body but will not intersect and can therefore be considered askew to axis 20. Angle θ is shown as being approximately 45° which, combined with the 15° tilt, is found to be best for creating the flushing vortex action. However, an angle θ at least in the range of 35° to 55° would also be appropriate. This action created by flusher ports 34 is particularly helpful to clean debris or sediment 24 which may still adhere to the pipe 11 after acted upon by forward jet 23. This is especially true when the pipe 11 is corrugated as shown in FIG. 7.

Thus, after the nozzle body 10 is lowered into position within pipe 11, fluid under high pressure is introduced thereto through hose 12. As the force from the thrust jets 29 forces the nozzle through the pipe in the direction of the arrow in FIG. 7, the forward jet 23 loosens the debris. That debris which the forward jet is unable to dislodge, if any, is cleaned away by the vortex action of flush jets 34. The debris is pushed generally rearwardly by both jets 34 and jets 29. When the end of the hose 12 or pipe 11 is reached, the hose is withdrawn while the water pressure is maintained high thus completing the transfer of all debris toward the manhole shaft 15 where it can be picked up by a vacuum device or other means.

It should thus be evident that a nozzle constructed and operated as described herein can clean a wide range of sizes and types of pipes, accomplishes the objects of the invention, and otherwise substantially improves the nozzle art.

I claim:

1. Apparatus for removing debris and the like from a pipe comprising a nozzle body having a longitudinal axis and adapted to receive water under pressure from a hose affixed to one end thereof, said nozzle body being fluted to permit the passage of debris rearwardly past said nozzle body and to define longitudinally extending vanes having radially outermost surfaces generally parallel to said longitudinal axis, flusher port means extending through a surface on said vanes and having an axis rearwardly inclined at an acute angle to said longitudinal axis of said nozzle body, said axis of said flusher port means further being askew with respect to said longitudinal axis of said nozzle body to emit a jet of water thereby creating a vortex to scour the inside surface of the pipe when said nozzle body is introduced within the pipe, and thrust port means extending through a surface on said vanes and having an axis rearwardly inclined at an acute angle to said longitudinal axis of said nozzle body and emitting a jet of water generallly rearwardly of said nozzle body to propel said nozzle body through the pipe, said surface of said flusher port means being angular to said surface of said thrust port means and said radially outermost surface of said vanes.

2. Apparatus according to claim 1 further comprising forward port means at the front of said nozzle body

having an axis generally corresponding to said longitudinal axis of said nozzle body and emitting a jet of water generally axially of said nozzle body to dislodge debris in the pipe.

3. Apparatus according to claim **1** wherein said acute angle between said axis of said flusher port means and said longitudinal axis of said nozzle body is in the range of 35° to 55°.

4. Apparatus according to claim **1** wherein said acute angle between said axis of said thrust port means and said longitudinal axis of said nozzle body is in the range of 15° to 55°.

5. Apparatus according to claim **1** wherein said vanes arcuately converge from said radially outermost surface of the front of said nozzle body.

6. Apparatus according to claim **1** wherein, said surface of said thrust port means being angular to said radially outermost surface of said vanes and lying in a plane having a line perpendicular to said longitudinal axis of said nozzle body.

7. Apparatus according to claim **6** wherein all the lines in a plane of the surface of said flusher port means lie at an angle of other than 90° to said longitudinal axis of said nozzle body.

8. Apparatus according to claim **7** wherein the angularity of said surface of said thrust port means to said radially outermost surface is in the range of 35° to 75°.

9. Apparatus according to claim **7** wherein the angularity of said surface of said flusher port means to said radially outermost surface is in the range of 35° to 55°.

10. Apparatus according to claim **7** wherein the plane of said surface of said flusher port means and the plane of said surface of said second port means intersect at an acute angle of less than 20°.

11. Apparatus according to claim **7** wherein each vane includes said flusher port means and said thrust port means.

12. A nozzle for removing debris and the like from a pipe comprising a plurality of hollow radially extending vanes joined to form a body having a longitudinal axis and receiving fluid under pressure from a hose affixed to one end thereof, flusher port means extending through a first surface on said vanes and having an axis rearwardly inclined at an acute angle to said longitudinal axis to emit a jet of fluid to remove debris from the inside of the pipe, and thrust port means extending through a second surface on said vanes and having an axis rearwardly inclined at an acute angle to said longitudinal axis to emit a jet of fluid to propel said nozzle through the pipe, said first and second surfaces being angular to each other.

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