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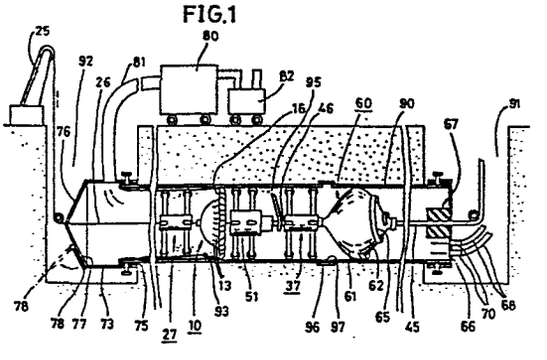
(54) **Cleaning apparatus for pipes.**

(57) A cleaning apparatus for a pipe (9) which comprises a scratching device (10) having a plurality of scratching segments being radially elongated and being disposed around the axis of the scratching device (10) so as to contact elastically and annularly to the interior surface of the pipe (90) as a whole at scratching portions (16) formed at outer peripheries thereof, and driving means (25) for moving the scratching device (10) in the pipe (90). The apparatus may have a grinding device (37) which is connected to the scratching device (10) at back position thereof and has an injection pipe (46) for injecting mixed flow (95) of compressed air and abrasive material from at least one nozzle formed at the outer end of a radially elongated portion of the injection pipe (46), and a rotating means (51) of the injection pipe (46).

FIG.1



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Cleaning apparatus for pipes

This invention relates to a cleaning apparatus for pipes, and it more particularly relates to a cleaning apparatus for pipes having large interior diameters . The pipes are made of metal and are used for passing fluid, for example water, gas, oil or the like therethrough. On the interior surfaces of pipes are attached various deposits such as rust, scale and other matters produced by use of the pipes. Therefore, it is necessary to remove the deposits from the interior surfaces of the pipes using the cleaning apparatus for pipes.

In a cleaning apparatus for a pipe, according to the prior art shown in US -A- 3,073,687, abrasive material such as sand or the like is supplied in the pipe by a rotational air flow. But, in case of a pipe having a large interior diameter, it is impossible to make effective cleaning of the pipe. A large quantity of abrasive material is consumed without effective action for removing the deposits and a large quantity of the compressed air is consumed. Thus, a cleaning apparatus for pipes which is suitable for use in pipes having large interior diameters has not been provided.

Accordingly, one object of the present invention is to provide a cleaning apparatus for pipes which makes effective cleaning of pipes having large interior diameters.

Another object of the present invention is to provide a cleaning apparatus for pipes which is able to reduce the consumption of the abrasive material and the compressed air.

The present invention provides a cleaning apparatus for a pipe, which comprises a scratching device having a

plurality of scratching segments being radially elongated and being disposed around the axis of the scratching device so as to contact elastically and annularly to the interior surface of the pipe as a whole at scratching portions formed at outer peripheries thereof, and driving means for moving the scratching device in the pipe.

Other objects, features, and attendant advantages of the present invention will be more clear from the following description referring to the accompanying drawings wherein :

FIG. 1 is a side view of an embodiment of the present invention showing a using condition partially sectioned and partially cut away;

FIG. 2 is a front view of the embodiment;

FIG. 3 is a sectional view taken along the line 3 - 3 in FIG. 2;

FIG. 4 is a perspective view partially showing a scratching device of the embodiment;

FIG. 5 is a perspective view showing an adjusting device ;

FIG. 6 is a sectional view taken along the line 6 - 6 in FIG. 3; and

FIG. 7 is a sectional view taken along the line 7 - 7 in FIG. 3.

In an embodiment of the present invention shown in FIG. 1, a pipe 90 which is to be cleaned has a comparatively large inner diameter and is embedded in the earth. A pair of vertical bores 91, 92 are formed in the earth at both ends of the pipe 90 for cutting the connection with the both sides of the pipe. Various deposits 93 are attached to the interior surface of the pipe 90.

The apparatus includes a scratching device 10 which has a backward concaved central portion 12 and a plurality of branched portions 13 which are backward and radially elongated from the central portion 12. The central

portion 12 and the branched portions 13 are made of elastic metal plate, but the central portion 12 may be made of hard metal plate which can not be deflected. The scratching device has scratching segments 15 which are made of elastically deformable metal plates and are fixed to the outer ends of the branched portions 13, respectively. The scratching segments 15 are radially and shortly forward elongated and are disposed around the axis of the scratching device 10 so as to contact elastically and annularly to the interior surface of the pipe 90 as a whole at scratching portions 16 formed at outer peripheries thereof. The scratching segment 15 may be made by the elongation of the branched portion 13 and may have only the outward elongated portion without the forward bent portion. The scratching portion 16 preferably has many short cut away portions 17 for well contact of the scratching portion 16 with the interior surface of the pipe 90. The scratching device 10 is associated with an adjusting device 20 for adjusting the width surrounded by the periphery thereof. The adjusting device 20 has an annular member 21 and a turnbuckle 22 connected between the annular member 21 and the central portion 12. The annular member 21 able to be moved backward and forward using the turnbuckle 22 and engages with guide members 23 each of which is fixed to the inner surface of the branched portion 13 at one end thereof. Therefore, the scratching device 10 can be converged or enlarged by moving the annular member 21 backward or forward, respectively, for elastic contact of the scratching portions 16 with the interior surface of the pipe 90. The apparatus may not have the adjusting device 20, wherein the branched portions 13 with the scratching segments 15 make elastic deformation for contact the periphery of the scratching device 10 with the interior surface of the pipe 90.

A winch 25 is provided and is connected to the scratching device 10 using a wire rope 26, guide device 27

and a wire rope 28. The guide device 27 has a central member 29 and a plurality of radially elongated arm devices 30 each of which is composed of a fixed portion 31 fixed to the central member29, a movable portion 32 inserted into the fixed portion 31 at one end thereof, a coil spring 33 for outward forcing the movable portion 32, and a wheel 35 installed to the outer end of the movable portion 32. The guide device 27 is able to avoid the incline of the scratching device 10, especially in a not shown bent portion of the pipe 90.

A grinding device 37 is provided and is constructed as follows. A tubular member 38 is positioned so as to pass the central portion in the pipe 90 by means of a plurality of arm devices 40 each of which is composed of the same manner with the arm device 30. A passage 43 is formed through the tubular member 38. A hose 45 is connected to the passage 43 for feeding a mixed flow 95 which is mixed abrasive material such as sand, etc. with the compressed air. An injection pipe 46 is rotatably supported at the front portion of the tubular member 38 and formed a radially elongated portion 48 which is somewhat inclined and has a nozzle 50 at outer end thereof. Therefore, by supplying the mixed flow 95 from the hose 45, the mixed flow is injected from the nozzle 50, and the injection pipe 46 is received a torque for opposite direction against the direction of the injection from the nozzle 50. 51 designates an electric motor having a not shown reduction gear and a shaft 52 which slowly drives the injection pipe 46 with suitable rotating velocity by eliminating quick rotation thereof by the torque owing to the injection. The motor 51 is supplied an electric current from a not shown battery or using electric wire from the outer space. The motor 51 has a plurality of arm devices 53 each of which is composed of the same manner with the arm device 30 so that the motor is able to pass the central portion of the pipe 90. The

motor 51 is connected to the back portion of the adjusting device 20 using a wire rope 55.

A supporting device 60 is provided for support and progress of the hose 45 by receiving a force from an air flow fed from back portion of the pipe 90. The supporting device is hollow and enlarged at the central portion thereof and projected to both sides thereof and has a front portion 61 and a back portion 62. The hose 45 penetrates the supporting device 60 and is fixed to the both ends 63, 64 of the supporting device 60. A spiral member 65 is projected at the back portion 62 of the supporting device 60 and makes a rotational movement of an air flow fed from the back portion of the pipe 90. The air flow made rotational movement is able to pass the clearance between the pipe 90 and the supporting device 60.

The pipe 90 is closed by a closing member 66 at the back end thereof. The hose 45 movably passes through the closing member using a rubber member 67 for maintain the air tightening. A plurality of inlet ports 70 are provided to the closing member 66 and hoses 68 are connected thereto for supplying compressed air from a not shown compressed air source. The compressed air from the inlet ports 70 progresses the supporting device 60 for supporting the hose 45 which has a heavy weight for passing the mixed flow 95. The compressed air passed through the clearance between the pipe 90 and the supporting device 60 progresses the scratching device 10. A tubular member 73 is fixed to the front end of the pipe 90 using a packing 75 made of rubber for the air tightening and has an end plate portion 76 which has an opening 77 releasably covered by a cover 78 at lower portion thereof. A dust collector 80 is connected to the upper portion of the tubular member 73 by means of a hose 81 and is associated with a vacuum suction device 82. By the suction of the vacuum suction device the dust collector filters the air passing therethrough and removes the deposits and the

abrasive material or the like.

In use of the apparatus as described above, the winch 25 is driven for pulling the wire rope 26, the compressed air is supplied from the inlet ports 70, the vacuum suction device 82 is driven, the mixed flow 95 of the compressed air and the abrasive material is supplied from the hose 45, therefore the apparatus of the present invention is progressed in the pipe 90. In this case, the deposits 93 are almost removed by the scratching device 10. The deposits 93 which have not been removed are easily removed by the grinding of the mixed flow 95 injected from the injection pipe 46, and the mixed flow 95, which is used for the grinding and includes the deposits, is almost forward flowed through the clearances such as the cut away portions 17 with the compressed air. The mixed flow with the removed deposits and the compressed air flowed in the front portion of the pipe 90 is almost flowed into the dust collector 80. The removed deposits and the abrasive material left in the bottom portion of the tubular member 73 can be removed by opening the cover 78 when the scratching device 10 has been reached to the front end. In a downward concaved portion such as a connecting portion 96 of the pipe 90 or the like, various small matters 97 such as the removed deposits, the abrasive material or the like are left behind. But, they are removed by the rotational movement of the air flow by means of the spiral member 65 of the supportig device 60.

In the present invention, the supporting device may not be installed, and the guide device 27 also may not be installed. The injection pipe 46 of the grinding device 37 may be formed so as to has a plurality of radially elongated portions 48 with nozzles 50.

The foregoing is of course considered as illustrative only of the principle of the invention. Obviously, numerous modification are possible in light of the above teachings.

Claims

1. A cleaning apparatus for a pipe (90) comprising a scratching device (10) having a plurality of scratching segments (15) being radially elongated and being disposed around the axis of said scratching device (10) so as to contact elastically and annularly to the interior surface of the pipe (90) as a whole at scratching portions (16) formed at outer peripheries thereof , and driving means (25), (26) for moving said scratching device (10) in the pipe (90).

2. An apparatus as set forth in claim 1, wherein said scratching device (10) includes a backward concaved central portion (12) and a plurality of branched portions(13) being branched from said central portion (12) and being made of elastic metal, each of said scratching segments (15) being fixed to the outer end of each of said branched portions (13).

3. An apparatus as set forth in claim 2, wherein said scratching device (10) has an adjusting device (20) for adjusting the width surrounded by the periphery thereof.

4. An apparatus as set forth in claim 1, wherein said apparatus includes a grinding device (37) which is connected to said scratching device (10) at back position thereof and has an injection pipe (46) for injecting mixed flow (95) of compressed air and abrasive material from at least one nozzle (50) formed at the outer end of a radially elongated portion (48) of said injection pipe (46) to the interior surface of the pipe (90), and a rotating means (51) of said injection pipe (46).

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FIG.1

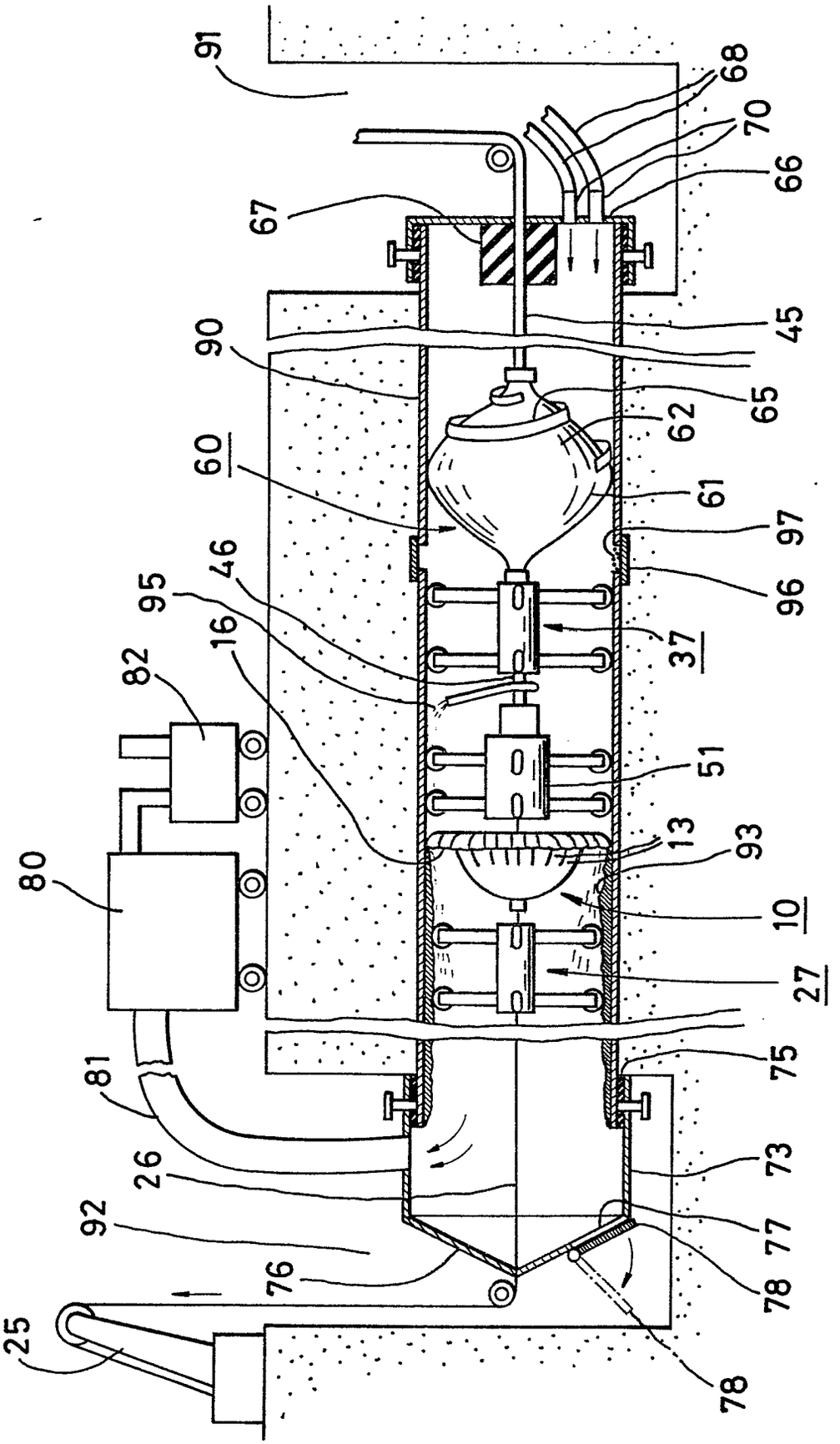

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FIG. 4

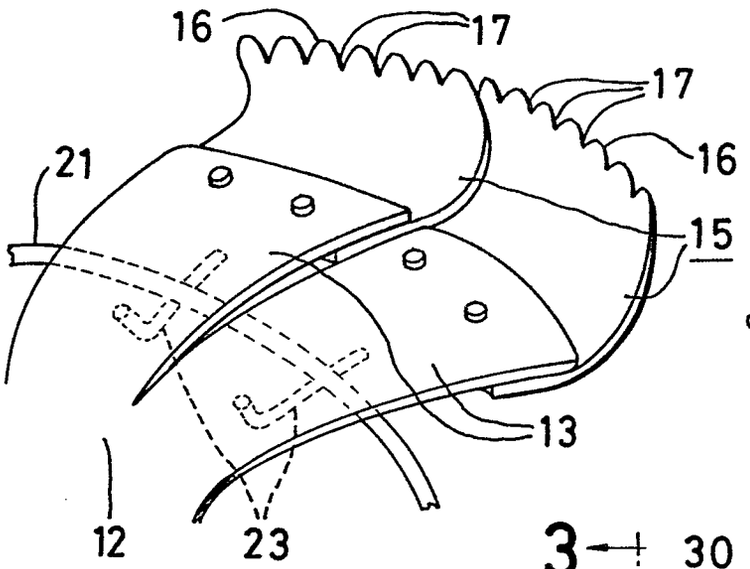
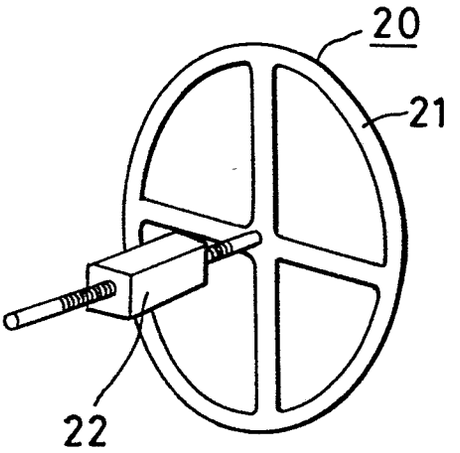


FIG. 5



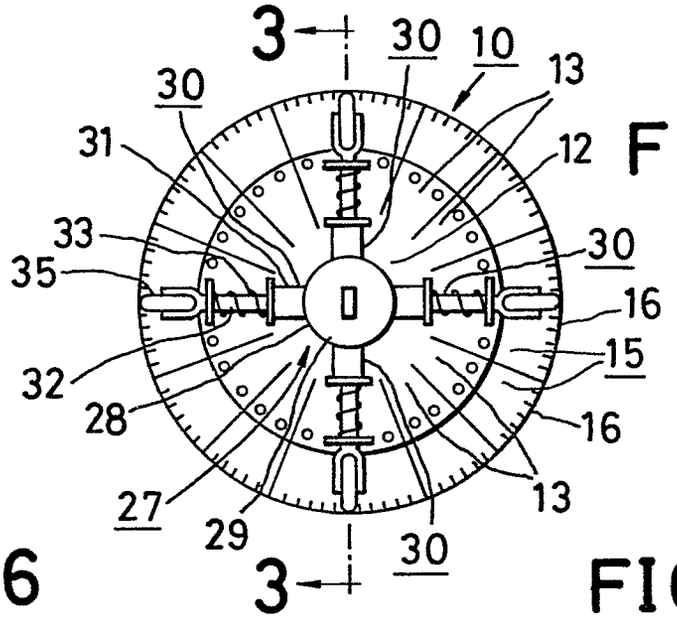


FIG. 2

FIG. 6

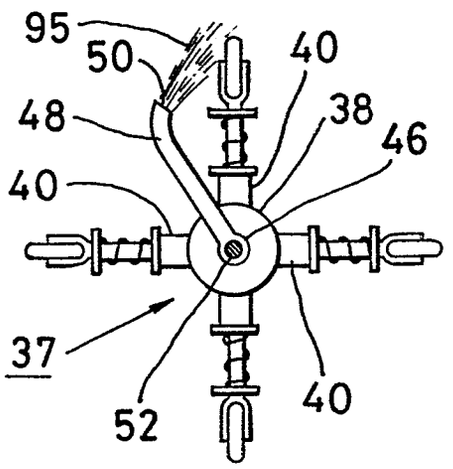


FIG. 7

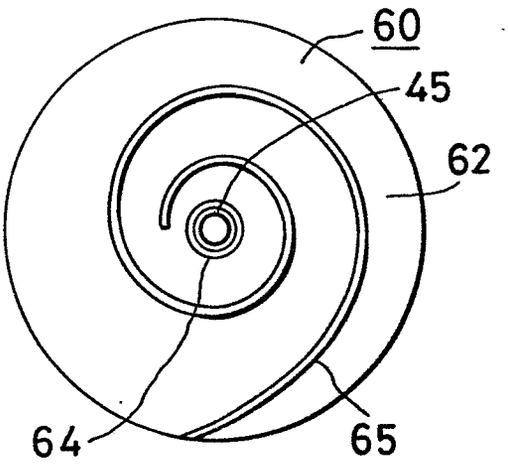


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FIG. 3