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LARGE SIZE PIPE CLEANING, SEWER SYSTEM CLEANING AND FIRE FIGHTING VEHICLE

Filed June 15, 1962 2 Sheets-Sheet 1

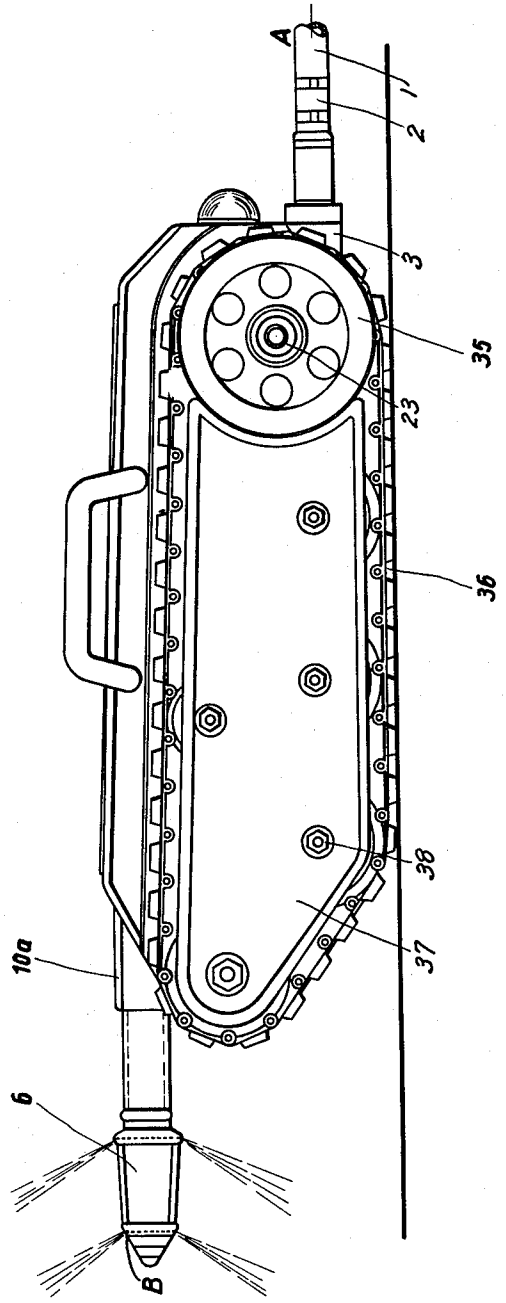


Fig. 1

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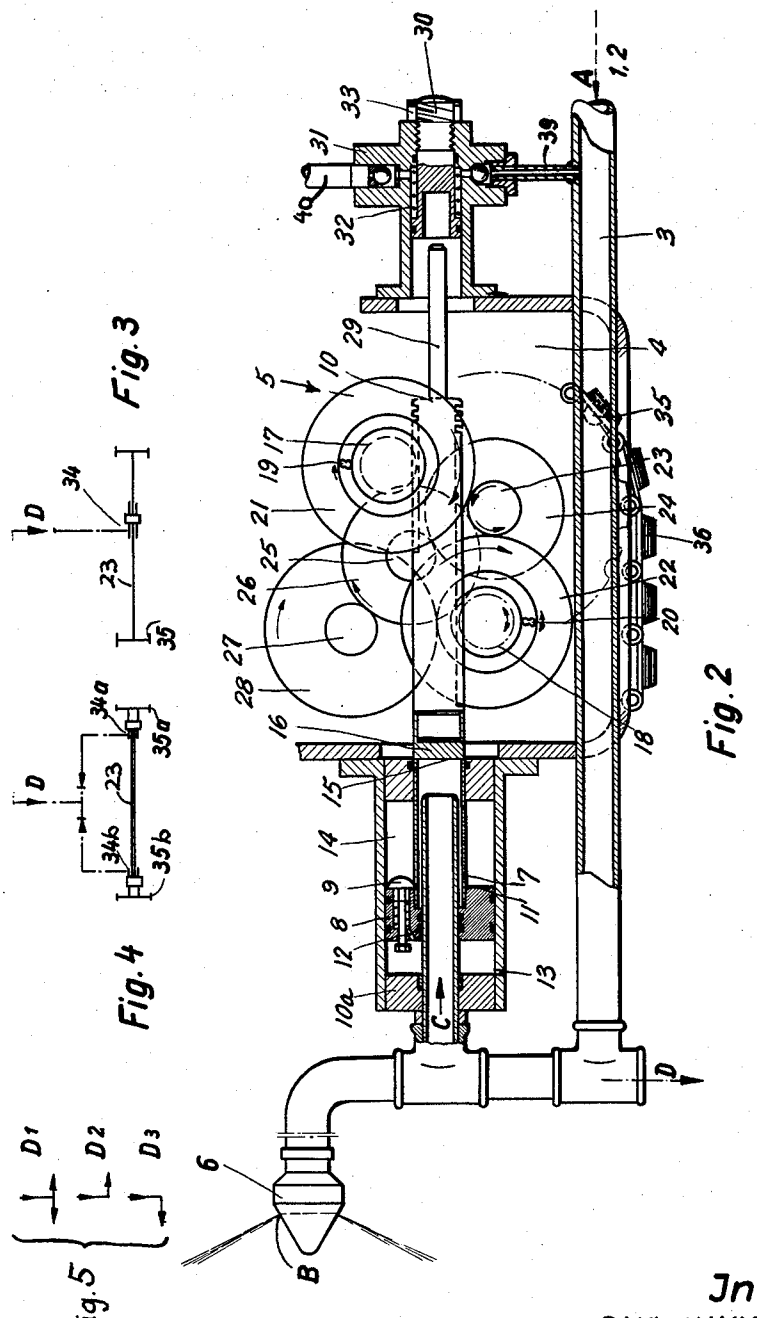


Fig. 2

Fig. 3

Fig. 4

Fig. 5

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LARGE SIZE PIPE CLEANING, SEWER SYSTEM CLEANING AND FIRE FIGHTING VEHICLE

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The present invention relates to a vehicle for frontally dispensing a water jet and which is useful for cleaning large pipes and sewers or for fighting fires. The vehicle is driven by a hydraulic motor supplied through a branch line from the main supply conduit of pressurized water producing the water jet and tows along a supply hose for the pressurized water as it is driven by the motor. Preferably, the vehicle runs on full tracks.

In a great number of fires, the firemen are unable to reach the center of the fire because of the very considerable heat even if they wear asbestos clothes and have special equipment. This is particularly true if the fire extends over a large area caused by flowing fuel in aircraft or fuel supply truck accidents. The same difficulty arises in mine shaft fires or in fires in paint or furniture factories. The main center of the fire may be known but it cannot be reached by men because of heat, smoke or danger of building collapse.

The vehicle of this invention solves this problem. It tows along a water supply hose of large diameter which loses only little pressure. The pressurized water needed for the hydraulic motor is supplied to it through a branch line from the main water supply and the torque of the motor is transmitted to the drive shaft or the drive wheels of the vehicle through a reduction gearing designed to determine the rotational speed of the shaft.

The drive shaft carries two drive wheels for the vehicle and a pressure responsive clutch controlled by the pressured water is mounted between the hydraulic motor and the drive wheels in such a manner that the clutch operatively connects the hydraulic motor and the drive wheels at a preselected minimum pressure of the water. In the absence of pressure in the supply line, the clutch means disconnects the hydraulic motor from the drive wheels and the vehicle may be pulled back by the supply hose attached to it.

Since the traction of the vehicle is considerable, several supply hoses of considerable length may be towed along with the moving vehicle. Since no heat-sensitive, electrically, gas or diesel operated drive or conduit elements are used, the vehicle may be driven into the flames and to the center of the fire, spraying itself and its path with specially arranged, exchangeable high-efficiency nozzles through which there are dispensed jets of water or foam and thus making a path for fire fighting personnel following the vehicle.

According to a preferred embodiment of the invention, the water supply conduit passes through the oil lubricating bath wherein the reduction gearing is immersed to cool the oil before the water is dispensed frontally from the spraying nozzle.

In accordance with another embodiment, the hydraulic motor comprises a cylinder housing an automatically reciprocating piston with a piston rod and means for converting the reciprocal motion into rotational motion of high speed, this means preferably including a double rack, pinions, freewheeling means, gearing and a flywheel. Also, the reciprocating rack may be used to operate a metering device for feeding additives, such as foaming agents, to the water. These additives may be carried in or on the vehicle.

Since the fire extinguishing effect of the water depends primarily on the evaporation surface thereof, it is desirable to produce a multiplicity of droplets of the smallest possible size. This requirement is met best if the pressure under which the water jet leaves the nozzle is as high as possible. The high jet speed causes the water to be atomized at a distance from the nozzle, which may be varied in dependence on the nozzle shape, and the water jet entrains any gas, oil or other substances which have not yet burnt, thus cooling the same. At the same time, a blowing action of considerable force develops at the bottom, which acts like a brush and prevents an influx of inflammable liquid from the jet spraying direction.

The invention is illustrated by way of example in certain of its embodiments in the accompanying drawing wherein

FIG. 1 is a side view of the vehicle.

FIG. 2 is a longitudinal section showing the water supply system and the hydraulic motor.

FIG. 3 schematically shows one embodiment of the clutch connecting the drive shaft to the water supply system.

FIG. 4 schematically shows an embodiment of the clutch connecting the drive wheels individually to the water supply system, and

FIG. 5 schematically shows various connections between the water supply and the clutch means of FIG. 4.

Referring now to the drawing and first to FIG. 2, the structure and the corresponding operation of the vehicle will now be described in detail. The main supply conduit of pressurized water consists of water supply hose **1**, which is connected to the vehicle by coupling **2** (both shown in FIG. 1), pipe **3**, and T-fitting D one of whose legs distributes the pressurized water to nozzle **6**. The water jet issues from the nozzle through its bores B.

As shown, the conduit or pipe **3** passes from the supply hose to the nozzle through oil bath **4** wherein the gearing **5** is immersed.

Another T-fitting is mounted in the main water supply conduit one of whose legs connects the main supply conduit to a branch line C feeding pressurized water from the main supply conduit into chamber **14** of a hydraulic motor cylinder. The cylinder houses a piston **8** and the branch line C extends through the piston into the hollow piston rod **16** defining ports **7** leading into chamber **14**. The piston carries a normally closed valve **9** which, in its closed position, prevents water from chamber **14** from flowing into the other cylinder chamber. When pressurized water flows through branch line C and ports **7** into cylinder chamber **14**, the pressure therein increases and forces the piston to the left, as seen in the drawing. When the piston has moved so far leftwardly that the slidable valve rod end extending from the piston into the other cylinder chamber abuts cylinder end wall **10***a*, further piston movement will cause the valve rod to move to the right, as seen in the drawing, and thus to open valve **9**. Water will accordingly flow out of chamber **14** into the other cylinder chamber through bore **12** in the piston and port **13** in the cylinder. The pressure on piston surface **11** is accordingly reduced until there is no pressure in chamber **14**. At this point, the movement of the piston **8** is reversed since the pressure emanating from pressurized water branch line C remains effective on the smaller area **15** of the piston end wall.

In this manner, the hydraulic motor produces a reciprocating movement of the piston rod and the double rack **10** fixedly connected therewith. The rack **10** meshes with pinions **17** and **18** of gears **21** and **22**. The pinions are coupled to their gears by unidirectionally effective engaging means **19** and **20** so that the pinions rotate the gears only when they are rotated in one direction. In this manner, the reciprocating movement of the rack is converted into rotational movement of the gears. Gears

21 and 22 together drive the drive shaft 23 of the vehicle.

A gear 24 is fixedly mounted on shaft 23 and meshes with pinion 25 of gear 26 fixedly connected with the pinion. Gear 26 meshes with pinion 27 of a flywheel 28. The gear drive accelerates the flywheel to a high rotational speed and, in this manner, the reciprocal movement of rack 10 is maintained constant.

Any desired additive may be fed into the main water supply conduit through delivery conduit 39 leading into pipe 3 and connected to an additive feed conduit 40 by means of metering pump 31. Feed conduit 40 receives the additive from any suitable source (not shown) mounted in or on the vehicle. The metering pump is operated by the reciprocating rack 10, i.e. by the hydraulic motor, in the following manner.

A piston 30 is mounted in the pump housing and is reciprocable by engagement with plunger 29 fixedly attached to, and extending from, rack 10. Upon rightward movement of the plunger, the piston 30 is accordingly moved against the bias of compression spring 32 mounted in an annular chamber between the pump housing and the piston, the annular chamber interconnecting the feed conduit 40 and the delivery conduit 39. Depending on the stroke of the piston, a corresponding amount of additive, for instance foaming agent, will be metered into the delivery conduit. The stroke of the piston may be adjusted by means of adjusting nut 33 threadedly engaging one piston end.

FIGS. 3 and 4 show alternative embodiments of clutch means arranged between the drive wheels of the vehicle and the hydraulic motor. The clutch means is operable automatically by the pressure in the main water supply conduit and is connected thereto by one of the legs of T-fitting D.

In the embodiment of FIG. 3, a clutch 34 couples the drive shaft 23 with the drive wheels 35 carried by the shaft. When the water pressure supplied to the clutch is reduced in pipe 3, the wheels are operatively disconnected from the drive shaft and no rotational motion is transmitted from the shaft to the wheels. If water under full pressure is supplied to the clutch, shaft and wheels are operatively connected and the shaft drives the wheels.

In the embodiment of FIG. 4 each drive wheel 35*a* and 35*b* has its own clutch 34*a* and 34*b* operatively connecting the shaft with the wheels. As shown in FIG. 5, this embodiment has the advantage that each drive wheel may be driven independently, if desired. According to scheme D_1, the water pressure is supplied equally to both clutches 34*a* and 34*b*. Scheme D_2 shows the case wherein water is supplied only to the other clutch. Depending on the water pressure distribution, the clutches operative connect or disconnect one, the other or both wheels.

FIG. 1 shows the vehicle in operation. The pressurized water A is supplied to the vehicle through hose 1 attached to the supply pipe 3 by coupling 2. The drive wheel 35 is carried by drive shaft 23 and operates the full track 36. The water jet nozzle 6 is mounted on the cylinder end wall 19*a* of the hydraulic motor and the whole vehicle includes a housing 37 enclosing the operative parts and mounted by bolts and nuts 38.

What I claim is:

1. A vehicle for frontally dispensing a water jet, comprising a main water supply conduit including a supply hose delivering water under pressure, coupling means attaching the supply hose to the vehicle, nozzle means mounted at the front of the vehicle and connected to the main water supply conduit for receiving and dispensing the water under pressure, drive wheel means for driving the vehicle, a drive shaft carrying the drive wheel means, a hydraulic motor for rotating the drive shaft, a branch line leading from the main water supply conduit to the hydraulic motor and delivering water under pressure thereto for operation of the hydraulic motor, and clutch means arranged between the drive shaft and the drive wheel means for operatively connecting and disconnecting the drive shaft and wheel means, the clutch means being connected to the main water supply conduit and being operated in response to the water pressure in said conduit to connect the drive shaft and wheel means, the clutch means operatively disconnecting the drive shaft and wheel means in the absence of pressure in the conduit.

2. The vehicle of claim 1, wherein the clutch means comprises two clutches, each clutch being associated with a respective wheel of said drive wheel means and being independently connected to the main water supply conduit.

3. The vehicle of claim 1, wherein the hydraulic motor includes gearing means in operative connection with the drive shaft.

4. The vehicle of claim 1, wherein the hydraulic motor includes a cylinder, an automatically reciprocable piston in the cylinder and dividing the same into two chambers, the branch line leading into one of the cylinder chambers and delivering water under pressure thereto, a rack-and-pinion drive connected to the piston, a flywheel, and a gearing meshing with pinions of said drive, of the drive shaft and of the flywheel, respectively.

5. The vehicle of claim 4, further comprising a lubricating oil bath wherein said gearing is immersed, the main water supply conduit leading through said oil bath whereby the same is cooled.

6. The vehicle of claim 1, further comprising metering means for supplying an additive to the water in the main water supply conduit, and means operatively connecting the hydraulic motor to the metering means for operating the metering means by the hydraulic motor.

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