

A SCRAPER MACHINE

The present invention provides a machine for scraping away sediment or the like that is deposited on the bottom of a gallery, e.g. a drain, and to a method of
5 scraping away said sediment.

Scraping, i.e. removing sediment or other undesirable material that has become deposited on the bottom of a drain or more generally of a gallery, raises a certain number of problems. The machine of the
10 invention relates more particularly to a system that makes it possible to scrap sewers in a drainage network for conveying waste water or the like. As time progresses, material settles on the bottoms of the galleries constituting such drains. The operator
15 periodically subcontracts the work of scraping said galleries.

At present, such galleries are usually scraped by the following technique:

- a dam is set up so as to enable the gallery for
20 scraping to be unwatered; and

- scraping is performed by a self-propelled loader, e.g. of the type used in mines, having a bucket fitted with a blade for scraping the bottom of the gallery. Once the bucket is full, the loader needs to perform a
25 go-and-return trip between the scraping front and an access point to the surface where the bucket can be emptied. The bucket of the loader is emptied by filling a skip, that is then raised by means of a crane in order to be taken away. Such a solution is described in French
30 patent No. 2 701 278.

The main drawback of such a drain scraper machine is that while the scraper vehicle is traveling, scraping is interrupted. It will be understood that as the distance between the scraping front and the point for removing
35 recovered sediment increases, so the productivity of the machine decreases.

In addition, the type of vehicle described in the prior art usually consists in a mechanical digger type machine with conventional crawler tracks and it requires the gallery that is to be treated to be unwatered. It
5 will be understood that the necessity for the machine to perform go-and-return trips between the scraping front and the unloading zone leads to long periods during which the scraping machine is not scraping. This leads to a very significant reduction in the efficiency of the
10 machine.

A first object of the invention is to provide a machine for scraping away sediment or the like, and that enables the above-mentioned drawbacks to be avoided.

To achieve this object, the invention provides a
15 machine for scraping away sediment or the like deposited on the bottom of a gallery, the machine being characterized in that it comprises:

- a first movable body suitable for moving over the bottom portion of the wall of the gallery, said first
20 movable body presenting a front and a rear;
- first movement means for enabling said first movable body to move on the bottom portion of the wall of the gallery;
- scraper means for detaching sediment from the
25 bottom of the gallery and mounted at the front of said first movable body;
- first storage means mounted on said first movable body;
- first transfer means for transferring detached
30 sediment into said first storage means;
- second transfer means for transferring sediment stored in said first storage means to the outside of said first movable body;
- a second movable body, distinct from the first
35 movable body, and suitable for moving along the bottom portion of the wall of the gallery;

· second movement means for enabling said second movable body to move on the bottom portion of the wall of the gallery; and

· second storage means mounted on said second
5 movable body to collect the sediment transferred to the outside of the first movable body by second transfer means.

It will be understood that because the complete machine is made up of a first movable body, referred to
10 below as the "scraper vehicle", that performs the scraping operation proper, and that is fitted with buffer storage means for temporarily storing sediment removed from the bottom of the gallery, it is possible for the machine to include a second movable body, referred to as
15 a "removal vehicle", that can independently and periodically receive the sediment or the like as stored temporarily on the scraper vehicle and transport it to the zone of the gallery or the drain that corresponds to sediment removal. It will naturally be understood that
20 while the removal vehicle is performing go-and-return trips, the scraper vehicle can work continuously because of the presence of the temporary or buffer storage means referred to as "first" storage means.

Preferably, the first movement means are first motor
25 means mounted on the first movable body, or scraper vehicle.

Also preferably, the second movement means are second motor means mounted on the second movable body, or removal vehicle.

30 Also preferably, the first transfer means comprise a loader auger placed in register with the scraper means and/or a conveyor having a first end co-operating with the loader auger or the scraper device, and a second end that is located above the first storage means.

35 Also preferably, said first storage means are located at the rear of the first movable body.

Also preferably, the second transfer means are mounted on said first movable body.

The invention also provides a method of scraping sediment, particularly but not exclusively suitable for
5 being implemented with the help of the above-defined machine.

According to the invention, the method of scraping sediment or the like deposited on the bottom of a gallery is characterized in that it comprises the following
10 steps:

- moving a first movable body provided with scraper means on the bottom portion of the gallery;
- storing sediment on said movable body as it is removed;
- 15 · moving a second movable body on the bottom portion of the wall of the gallery;
- periodically transferring the sediment stored on the first movable body to the second movable body while the second movable body is kept close to the first
20 movable body;
- after the sediment has been transferred, moving the second movable body between its position close to the first movable body to a second stationary position for unloading the sediment stored on said second movable body
25 to the outside of the gallery; and
- returning said second movable body towards its position close to the first movable body;

whereby the first movable body can perform the scraping operation continuously, including during stages
30 of unloading the sediment with the help of the second movable body.

Other characteristics and advantages of the invention appear better on reading the following description of an embodiment of the invention given as a
35 non-limiting example.

The description refers to the accompanying figures, in which:

- Figure 1 is a side view of the vehicle as a whole;
- Figure 2A is a view of the vehicle looking along arrows A-A, the scraper blade and the loader auger being in the raised position;

5 · Figure 2B is a view of the scraper vehicle as seen looking along arrows B-B;

- Figure 2C is a view of the removal vehicle as seen looking along arrows C-C of Figure 1; and

10 · Figures 3A and 3B are simplified diagrams showing the implementation of the method of the invention.

With reference initially to Figure 1, there follows a description of the general structure of the scraper machine. As mentioned above, the scraper machine is essentially constituted by a scraper vehicle 10 and by a
15 removal vehicle 12. The scraper vehicle constitutes the first movable body and the removal vehicle constitutes the second movable body. The scraper vehicle 10 comprises a support chassis 14 fitted with a front wheel set 16, and in the particular example described, with two
20 rear wheel sets 18 and 20. At the front 22 of the scraper vehicle, there can be seen a vehicle device 24 that is essentially constituted by a cleaner or scraper blade 26 that can be seen more clearly in Figure 2A. As shown in this figure, the shape of the shaft portion of
25 the scraper blade 26 matches the shape of the bottom portion 28 of the wall 30 of the gallery or drain 32 in which the scraper machine is to operate. Preferably, the scraper device 24 can take up a raised position on standby and a lowered position in operation. An actuator
30 34 serves to move between these positions.

The scraper device 24 is associated with first transfer means for transferring sediment and other debris recovered by the blade 26 and given overall reference 36. Preferably, the first transfer means 36 are constituted
35 by a loader auger 38 placed in relationship with the scraper blade 26. The loader auger 38 is preferably constituted by two end portions 38a and 38b, each

provided with a respective screw 37, and a central portion 38c having no screw. The function of the loader auger 38 is firstly to use its screws 37 to cut up pieces of sediment scraped from the bottom of the gallery, and
5 secondly to convey these cut-up pieces of sediment towards the center. An actuator 35 preferably serves to move the auger 38 from a raised position to a lowered, working position.

The first transfer means 36 also comprise a conveyor
10 40 having a first end 40a facing the loader auger 38 and preferably secured to the scraper blade 26, and a second end 40b. Naturally, both the loader auger 38 and the conveyor 40 are mounted on the chassis of the scraper vehicle. At its rear end 42, the scraper vehicle also
15 has a buffer tank 44 that constitutes the first storage means. This portion, which is secured to the rear wheel sets 18 and 20, is preferably hinged about a vertical axis 46 relative to the front portion of the scraper vehicle 10. The hinge 46 enables the scraper vehicle 10
20 to match the path followed by the gallery 30. The buffer tank 44 preferably has a sloping bottom 38. The scraper vehicle 10 also has second transfer means constituted by a conveyor 50. The conveyor 50 has a first portion 50a that is disposed inside the tank 44 close to its bottom
25 48, and a second portion 50b that is outside the tank. The end 50c of the conveyor 50 is placed well beyond the rear end 44a of the tank 44.

As can be seen better in Figure 2A, the wheel sets 16, 18, and 20 are mounted to pivot about axes that are
30 at an angle relative to the horizontal. This disposition makes it possible to match the movement of the scraper vehicle to the shape of the bottom 28 of the wall 30 of the gallery.

Naturally, the scraper vehicle 10 also includes a
35 cabin 52 for driving the vehicle, motors (not shown) for driving the wheel sets, these motors being hydraulic motors, for example. The chassis 40 also carries

pressurized fluid feeder means for driving the loader
auger 38 in rotation, for driving the actuators 34 and 35
that change the position of the scraper blade 26 and of
the auger 38, and also for driving the conveyors 40 and
5 50.

The scraper machine also has a second movable body
that is constituted by the removal vehicle 12 that
serves, as explained above, to transfer sediments between
the scraper vehicle 10 and an unloading zone provided in
10 the gallery. The removal vehicle 12 is essentially
constituted by chassis 52, e.g. fitted with four wheel
sets 54, 56, 58, and 60.

These wheels are naturally likewise on axes of
rotation that are inclined relative to the horizontal so
15 as to bear against the walls of the gallery. Preferably,
these wheels bear against the wall at a position that is
further from the bottom of the gallery than the positions
where the wheel sets 16 to 20 of the scraper vehicle 10
bear. This produces better running conditions for the
20 removal vehicle, since the bottom of the gallery may be
uneven. It will be understood that this disposition is
particularly advantageous, since although the scraper
vehicle 10 moves only very slowly and runs along the
distance corresponding to the length of the gallery for
25 scraping only once, the removal vehicle 12 is used to
perform a large number of go-and-return journeys between
the scraper vehicle 10 and the unloading point. The
removal vehicle 12 is fitted with a storage skip 62 that
is preferably removable from the chassis 52 of the
30 removal vehicle 12. The removal vehicle 12 is also
fitted with a driver's cabin 64 and with motors for
driving at least some of the wheel sets 54 to 60.

The wheels may either be standard wheels, or else
they may be roller wheels of the type described in French
35 patent FR 2 808 491 in the name of the Applicant.

The travel speed of the scraper vehicle 10 when in
operation is naturally very limited in order to obtain

effective scraping of the gallery. By way of example it may lie in the range 1 meter per minute (m/min) to 2 m/min. In contrast, on making its go-and-return trips, the removal vehicle 12 may naturally travel at a higher speed, e.g. of the order of 15 kilometers per hour (km/h).

To optimize the operation of the scraper machine, it is desirable to define appropriately the volume capacity of the tank 44 of the scraper vehicle 10. This volume capacity must be not less than the quantity of sediment extracted by the scraper vehicle 10 while the removal vehicle 12 makes a go-and-return trip between the scraper vehicle 10 and the point for unloading sediment, while the scraper vehicle 10 is itself at its greatest distance from the unloading point. First storage means (the tank 44) thus constitutes a buffer zone for temporary retention of the results of scraping that thus serve to make the two movable vehicles independent of each other. Naturally, it is also necessary for the capacity of the skip 62 to match that of the tank 44.

With reference to Figures 3A and 3B, there follows a brief description of the way in which the scraper machine of the invention is used.

As sediment is detached by the scraper blade 26, it is transferred to the storage tank 44 via the loader auger 38 and the first conveyor 40. When the tank 44 is sufficiently full of sediment, the removal vehicle 12, located behind the scraper vehicle 10, is filled with the sediment by means of the second conveyor 50. The removable skip 62 of the removal vehicle 12 is thus filled. Once this operation has been performed, the conveyor 50 is stopped and the removal vehicle 12 travels to the unloading point P corresponding to an access 64 into the gallery 32. When the removal vehicle 12 comes into register with the access 64, hoist means 66 serve to extract the removable skip 62 full of sediment or debris and to replace it with an empty skip 62, which is put

into place on the removal vehicle 12. This vehicle then returns to the scraper vehicle 10 and it follows the slow advance of the scraper vehicle 10. When the tank 44 is full, it is again unloaded into the skip 62 of the removal vehicle 12 as explained above. During this operation, the conveyor 40 continues to transfer sediment into the tank 44. The total quantity of sediment transferred into the skip 62 can thus be equal to the quantity that was in the tank at the beginning of the transfer operation plus the quantity of sediment that is transferred into the tank during the transfer operation.

It will be understood that while the scraper vehicle 10 is still far away from the maximum distance that it is to act from the loading point, the trips performed by the removal vehicle 12 are relatively short, and apart from the time taken for a go-and-return trip, the removal vehicle follows the scraper vehicle. In contrast, when the scraper vehicle 10 is close to the maximum expected distance for treating the drain, the removal vehicle 12 remains beside the scraper vehicle substantially only for the time required to transfer sediment or debris from the tank 44 to the skip 62 via the conveyor 50.

A preferred embodiment of the invention is described above. Nevertheless, it is clear that numerous variants could be envisaged. In particular, the movable bodies constituted by the scraper vehicle 10 and the removal vehicle 12 need not be self-propelled and they could be driven by external propulsion means. Or else the scraper vehicle 10 and the removal vehicle 12 could be self-propelled but under automatic remote control.

Instead of the second sediment transfer means constituted by the conveyor 50 being mounted on the scraper vehicle 10, as described above, it is also possible to make provision for the second transfer means to be mounted on the removal vehicle. Under such circumstances, the second transfer means may be constituted for example by a suction pipe or by an auger

system for transferring sediment from the tank 44 to the skip 62.

5 In certain stages of operation of the machine, the removal vehicle 12 may also be used for transporting fuel for the scraper vehicle 10, personnel, or indeed other elements for maintaining the scraper vehicle.

CLAIMS

1. A machine for scraping away sediment or the like deposited on the bottom of a gallery, the machine being characterized in that it comprises:

- 5 · a first movable body (10) suitable for moving over the bottom portion of the wall of the gallery, said first movable body presenting a front and a rear;
- first movement means (16, 18, 20) for enabling said first movable body to move on the bottom portion of
- 10 the wall of the gallery;
- scraper means (26) for detaching sediment from the bottom of the gallery and mounted at the front of said first movable body;
- first buffer storage means (44) mounted on said
- 15 first movable body (10);
- first transfer means (36) for transferring detached sediment into said first buffer storage means;
- second transfer means (50) for transferring sediment stored in said first buffer storage means (44)
- 20 to the outside of said first movable body;
- a second movable body (12) distinct from the first movable body, and suitable for moving along the bottom portion of the wall of the gallery;
- second movement means (54, 56, 58, 60) for
- 25 enabling said second movable body to move on the bottom portion of the wall of the gallery; and
- second storage means (62) mounted on said second movable body to collect the sediment transferred to the outside of the first movable body by second transfer
- 30 means.

2. A machine according to claim 1, characterized in that the first movement means (16, 18, 20) are first motor means mounted on the first movable body.

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3. A machine according to claim 1 or claim 2, characterized in that the second movement means (54, 56,

58, 60) are second motor means mounted on the second movable body.

4. A machine according to any one of claims 1 to 3,
5 characterized in that the first transfer means (36) comprise a loader auger placed in register with the scraper means and/or a conveyor (50) having a first end co-operating with the loader auger and/or the scraper means, and a second end that is located above the first
10 buffer storage means.

5. A machine according to any one of claims 1 to 4, characterized in that said first buffer storage means (44) are located at the rear of the first movable body.
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6. A machine according to any one of claims 1 to 5, characterized in that the second transfer means (50) are mounted on said first movable body.

20 7. A machine according to any one of claims 1 to 6, characterized in that said second storage means (62) are removable relative to said second movable body.

8. A machine according to any one of claims 1 to 7,
25 characterized in that said first buffer storage means (44) comprise a buffer tank.

9. A method of scraping sediment or the like deposited on the bottom of a gallery, the method being characterized
30 in that it comprises the following steps:

- moving a first movable body provided with scraper means on the bottom portion of the gallery;
- storing sediment on said movable body as it is removed;

35 · moving a second movable body on the bottom portion of the wall of the gallery;

· periodically transferring the sediment stored on the first movable body to the second movable body while the second movable body is kept close to the first movable body;

5 · after the sediment has been transferred, moving the second movable body between its position close to the first movable body to a second stationary position for unloading the sediment stored on said second movable body to the outside of the gallery; and

10 · returning said second movable body towards its position close to the first movable body;

 whereby the first movable body can perform the scraping operation continuously, including during stages of unloading the sediment with the help of the second
15 movable body.