A vehicle for cleaning the aggregate material in a French drain or trench has a chassis (10) supporting tracks (14) for moving the vehicle along the drain or trench. An excavating conveyor (20) at the rear of the vehicle lifts the aggregate material and feeds it to cleaning devices including a sieve drum (40) for separating dirt and vegetable material from the aggregate. The aggregate is arranged to fall through a coarse gauge screen at the front end of the drum (40) onto a conveyor belt (52). This conveyor belt (52) forms part of a further separating device and is inclined to enable the aggregate to fall downwardly against the direction of conveying motion. The cleaned aggregate is conveyed by way of a further conveyor (90) to a delivery chute (98) at the rear of the vehicle which deposits the cleaned material back into the drain or trench.

* See back of page
+ DESIGNATIONS OF “SU”

Any designation of “SU” has effect in the Russian Federation. It is not yet known whether any such designation has effect in other States of the former Soviet Union.

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Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

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IMPROVEMENTS IN OR RELATED TO CLEANING AGGREGATE MATERIALS

The present invention relates to a method and apparatus for cleaning aggregate material in situ.

French drains are provided at the side of motorways and main roads for drainage. Such a drain is basically an elongate trench filled with stones or other aggregate material arranged to support the walls of the trench. However, the aggregate material within the trench becomes dirty, and weeds, rubbish and other contaminants clog the trench. It is therefore periodically necessary to clean the aggregate material within the trench.

Currently, French drains are cleaned by digging out the aggregate material, together with the dirt and contaminants, and replacing it with clean material. The removed material can then be carted off to a site where it may subsequently be cleaned for re-use if required. Traditionally, this cleaning is done by washing the removed material with water.

It is an aim of the present invention to make the cleaning of French drains and similar constructions, simpler, quicker and more efficient than at present.

According to a first aspect of the present invention there is provided apparatus for cleaning aggregate material in situ, said apparatus comprising excavating means for excavating material from its location, cleaning means arranged to receive and clean the excavated material, and delivery means arranged to receive the cleaned material and to return it to the original location.

It will be apparent that apparatus of the invention may be used on site to clean and then replace aggregate material, such as the stones in a French drain.

Preferably, the apparatus is self-contained. For example, the apparatus may have a chassis arranged to support the excavating means, the cleaning means and the delivery means. The chassis may comprise wheels and/or
tracks enabling it to be moved over the ground. In a preferred embodiment, the chassis supports drive means, for example an engine, for driving the wheels and/or tracks.

In a preferred embodiment, the cleaning means is arranged to clean the excavated material by separation.

The invention also relates to apparatus for cleaning aggregate material in situ, said apparatus comprising excavating means for excavating material from its location, cleaning means arranged to receive and clean the excavated material, and delivery means arranged to receive the cleaned material and to return it to the original location, wherein, said cleaning means is arranged to remove dirt and contaminants from the excavated material by separation.

For example, said cleaning means may comprise one or more separating devices.

In an embodiment, a separating device of the cleaning means may comprise a sieving device. For example, the sieving device may comprise a rotatable drum having a mesh or screen periphery.

Excavated aggregate material is arranged to be fed to within the drum, and the mesh or screen size is chosen as required. For example, the mesh or screen may be a fine gauge, having been chosen such that dirt falls through the periphery of the drum whilst the aggregate remains within the drum.

In a preferred embodiment, means are provided for propelling excavated material through the drum from one end towards the other. At the one end, the periphery of the drum is defined by a fine mesh screen such that dirt falls out of the drum and the excavated material remains therein. However, proximate to its other end, the periphery of the drum is formed by a coarse mesh screen though which the excavated material can exit the drum. At said other end, the drum is open whereby unwanted material may be discharged therethrough.

Additionally, and/or alternatively, one or more of the
separating devices may comprise conveyor means arranged to convey the excavated material, and associated diverting means for diverting dirt and contaminants away from the conveyed excavated material.

For example, the conveyor means may comprise an endless mesh or screen belt, the mesh gauge being such that dirt drops through the conveyor belt whilst the aggregate is supported thereon. Additionally and/or alternatively, diverting fingers, gates or the like may be associated with the conveyor means.

Where the apparatus is to be used to clean the material from French drains, the contaminants will include sticky materials such as mud and vegetable matter. In this case, the or one of the separating devices preferably comprises a conveyor having a conveying direction which is inclined with respect to the horizontal, and is arranged to convey generally upwardly. The angle of inclination and the conveying speed may be adjusted such that excavated material will tend to fall by gravity from the conveyor against the direction of conveyance, whereas the sticky matter remains on the conveyor and is conveyed thereby.

Additionally and/or alternatively, means may be provided for vibrating the conveyor to encourage the ejection of aggregate material therefrom. Again, the sticky matter will tend to remain on the conveyor. For example, the conveyor may be a belt conveyor and said vibrating means may be arranged to vibrate the belt.

According to further aspect of the invention there is provided apparatus for cleaning aggregate material, said apparatus comprising at least one separating device, and feeding means for feeding aggregate material together with any contaminants to said separating device, wherein said separating device comprises a conveyor arranged to convey the said material in one direction, and diverting means for diverting the aggregate material in a second, different direction.
Preferably, said second direction is opposite to said first direction. For example, the aggregate material may be diverted by inclining said conveyor means, and/or by vibrating said conveyor means.

In a preferred embodiment, said apparatus may comprise one or more further separating devices.

Generally, it is preferred that cleaning means of the apparatus is arranged to clean by separating rather than by washing the material. For example, where the material is aggregate excavated from French drains and the like, a very large quantity of water would be required in order to wash it. This is not generally practicable if a self-contained machine, for example, is to be used to clean the material in situ. However, it may be advantageous to wash the excavated material after most of the contaminants have been separated therefrom. In this case, spray or washing means may additionally be provided.

Of course, it would be possible for the cleaning means to comprise washing means either additionally to, and/or alternatively to, the separating devices defined.

In a preferred embodiment, the apparatus is arranged to be moved over the ground, and said delivery means is arranged at the rear of the apparatus in the direction of movement.

In this manner, the cleaned excavated material can be returned substantially to the same place from which it was excavated.

According to a still further aspect of the present invention there is provided apparatus arranged to be moved along a path, said apparatus comprising excavating means for removing material from said path, cleaning means to receive and clean the excavated material, and delivery means arranged at the rear of said apparatus in its direction of movement and arranged to return the cleaned material to the path.

In a preferred embodiment, the delivery means is
arranged adjacent to said excavating means.

Preferably, the width of the said delivery means, and
of the said excavating means is adjustable such that each
may be adjusted to fit within a trench or the like.

In a preferred embodiment, said delivery means
comprises a delivery chute arranged to be positioned within
a trench such that it acts to guide materials thereinto.
In a preferred embodiment, the delivery chute has a
upstanding wall at the rear of, and adjacent to, said
excavating means.

The invention also relates to a method of cleaning
aggregate material using apparatus as defined above.

According to a further aspect of the present invention
there is provided a method of cleaning a trench containing
aggregate material, the method comprising the steps of
moving apparatus as defined above along the trench,
excavating the aggregate material from the trench by way of
the excavating means, removing contaminants from the
aggregate material by way of said cleaning means, and then
causing the delivery means to return the cleaned material
to the trench.

Embodiments of the present invention will hereinafter
be described, by way of example, with reference to the
accompanying drawings, in which:-

Figure 1 shows a side elevation of apparatus of the
invention for cleaning aggregate material,

Figure 2 shows a plan view of the apparatus of Figure
1,

Figure 3 shows a cross-section of the apparatus taken
along the line C-C of Figure 1 and showing the drive for a
rotatable sieve device,

Figure 4 shows a cross-section of the apparatus taken
along the line B-B of Figure 1 and showing a separating
conveyor, and

Figure 5 shows an end view of the apparatus taken
along the line A-A of Figure 1 and showing a conveyor for
discharging dirt and contaminants.

Figure 1 shows a side elevation of a tracked vehicle, embodying apparatus of the invention, for cleaning the aggregate material in a French drain or other trench. In this respect, the vehicle shown in these drawings has been specifically designed for use in cleaning French drains, but it will be appreciated that the invention is not limited to such a cleaning function. In this respect, apparatus of the invention may be used for any appropriate cleaning or separating function.

The vehicle illustrated in the figures has a chassis comprising a main frame supporting tracks indicated at 14. It is preferred that tracks 14 rather than wheels are provided so that the vehicle can be used on any terrain. As is indicated in Figure 3, the vehicle is arranged such that one of its tracks 14 actually moves over the trench containing the material to be cleaned. This means that the vehicle can still be used even if the trench is adjacent to a bank, crash barrier or the like.

As can be seen in Figure 2, the chassis supports an engine 16 and a drivers cab 18 in which are housed controls and steering mechanisms. From the cab 18, the driver is able to cause the vehicle to travel forwardly, in the direction of the arrow A, along the length of the trench containing the aggregate which is to be cleaned. In this respect, it would be possible to tow the vehicle, if required. However, it is generally preferred that it be self propelled and have a driver, so that the driver can control all of the various elements thereof.

Towards the rear, in the direction of movement, the chassis 10 supports excavating means generally indicated at 20. Clearly, any means capable of lifting the aggregate out of the trench could be employed as excavating means. In the embodiment illustrated, the excavating means comprises a generally upwardly extending, continuous chain conveyor 22 carrying a number of flights, buckets or vanes.
This chain conveyor 22 has a single chain 25 on which a plurality of longitudinally spaced, laterally extending flights 24 are supported. The chain 25 extends around two sprocket wheels 26 supported for rotation relative to the chassis 10. One of the sprocket wheels 26 is driven by an appropriate motor (not illustrated), to circumvolute the chain 25.

In the illustrated embodiment, the upper one of the sprocket wheels 26 is driven, whilst the lower one of the sprocket wheels 26 is rotationally fixed to a central shaft (not shown). Laterally extending cutters (not shown) may be fitted to this shaft to increase the width of the excavating means.

As is shown in Figure 1, a tensioning roller 30 is provided to contact one of the runs of the chain 25. This tensioning roller 30 is rotationally mounted on a pivotable arm (not illustrated). Pivoting of the arm is arranged to move the tensioning roller 30 and thereby alter the path of the chain 25 and hence its tension. An alternative position of the tensioning roller 30, and of the chain 25, is illustrated in dashed lines in Figure 1. In this respect, it will be appreciated that it is the return run of the chain 25 which is not used in the excavating process which is appropriately tensioned by the roller 30.

As can be seen, the chain conveyor 22 is arranged such that its working run is adjacent to the vehicle and extends upwardly at an angle with respect to the vertical. In this respect, the excavating means 20 is supported by lever arms indicated at 32 which are pivotally connected to the main frame 12 and to the excavating means 20. Thus, the position of the excavating means 20 can be adjusted as required. This enables the position of the bottom of the excavating means 20 relative to the chassis 10 to be adjusted such that the digging depth is adjustable. In addition, and as indicated in dashed lines, the pivotable lever arms 32 enable the excavating means 20 to be lifted
relative to the chassis 10. Thus, when the vehicle is not being used to clean trenches, the excavating means 20 can be lifted well clear of the road.

The excavating means 20 carry a trough 34 which is positioned at the rear of the main frame 12 of the vehicle and which extends upwardly at an angle to the vertical. The trough 34 has laterally spaced side walls between which the working run of the chain conveyor 22 is guided. A base wall of the trough 34 extends between its side walls and prevents material which is lifted by the conveyor 22 from falling therefrom during lifting. Thus, the material being excavated from the trench is guided upwardly within the trough 34. At its top, the trough 34 carries a feed chute 36 onto which the excavated material is deposited. Of course, and if required, the flights 24 and the chain 25 may be arranged to swivel, or otherwise assist in the deposit of material into the inlet chute 36.

The material discharged onto the inlet chute 36 is fed to cleaning means comprising a first separating device to separate dirt from the aggregate material which has been excavated. This separating device comprises a sieve drum 40 which is arranged to be rotated by way of at least two rotatable tyres 42 engaged in a perimetral rim 44 of the drum 40. This rim 44 is in the form of a channel section. The excavated material is fed within the drum 40 by the inlet chute 36, and means are provided to propel that material axially through the drum in the direction of arrow C. In the embodiment illustrated, the propelling means comprise a series of angled plates (not illustrated) which, in conjunction with the rotation of the drum, serve to push the material axially through the drum. Of course other propulsion means may be used. For example, an auger, a lead screw or the like could be provided within the drum 40. Additionally and/or alternatively, it would be possible to arrange for the axis of the drum to slope downwardly from its input to its output to assist in the
propulsion of material therethrough.

The periphery of the drum is generally cylindrical and is formed by a screen or mesh. In the embodiment illustrated, the drum is provided adjacent its input end with a screen or mesh of fine gauge, for example of 15mm gauge. Thus, as the excavated material moves axially through the drum from the input end thereof, it cascades onto the screen. Dirt will fall outwardly from the drum, through the screen whilst the aggregate remains therein.

In this respect, the sieve drum 40 is arranged such that dirt falling therefrom lands on a dirt collecting conveyor 50 which extends through the machine generally axially thereof.

The aggregate retained within the sieve drum 40 continues to move axially therethrough generally in the direction of travel of the vehicle. Towards the front end of the drum, the screen defining its periphery is changed to a coarse gauge screen, for example of 50mm gauge. In this area of the drum, therefore, the stones, pebbles and the like making up the aggregate are ejected from the drum 40 through the screen, whilst rubbish and vegetable material is retained within the drum. This retained material is subsequently ejected from the open front end of the drum which is arranged over the dirt collecting conveyor 50. Hence, the rubbish and vegetable matter is discharged onto the dirt collecting conveyor 50.

The aggregate from which dirt and rubbish has been removed by the action of the sieve drum 40, is deposited onto a further separating device 52 arranged beneath the coarse screen part of the sieve drum 40. In the embodiment illustrated, this cleaning device 52 comprises an endless conveyor belt 53 driven by way of two spaced drums 54 in the rotation direction indicated by the arrow D in Figure 4. One or both of the drums 54 may be driven by way of a suitable motor (not shown). The position of the or each drum 54 can be adjusted to tension the belt.
The conveyor belt 53 is arranged to extend at an angle to the horizontal, and this angle can be adjusted as required. As can be seen from Figure 4, the working run of the belt 53 of the conveyor is the upper run, and the circumrotation of the conveyor means that this upper run moves generally upwardly. Accordingly, if the aggregate landing on the upper run of the belt 53 is generally comprised of hard and round stones and pebbles, those stones and pebbles will tend to fall downwardly relative to the conveyor irrespective of the upward direction of the conveying motion. It would be possible to achieve this effect simply by appropriate adjustment of the angle of inclination of the conveyor belt 53 and of the conveying speed. However, in a preferred embodiment this effect is enhanced by providing within the conveyor belt 53 two rollers, (not shown) which are rotatable around a common shaft. Rotation of the shaft is arranged to periodically abut the rollers against, and therefore lift, the upper run of the belt 53 from its underside. The upper run of the belt 53 is therefore vibrated and this tends to shake stones off the belt in the direction opposite to the conveying direction. By contrast, lumps of mud, and other vegetable matter will tend to sit on and be conveyed by the upper run of the belt 53. Clearly, the inclination of the belt 53 to the horizontal, and the periodicity and the amplitude of the shaking or vibrating motion given thereto can be adjusted to get the effect required.

The vegetable matter and mud and the like being conveyed on the conveyor belt 53 is discharged as its upper run is reversed by the upper drum 54. It will be seen from Figure 4 that material discharged from the conveyor belt 53 is deposited onto the dirt collecting conveyor 50 which is positioned thereunder.

The dirt collecting conveyor 50 is a wide flat belt conveyor which extends under the inlet end of the sieve drum 40, under the delivery end of the cleaning device 52,
and under the discharge end of the sieve drum 40. Generally, there will be return drums, as 56, at each end of the conveyor length and intermediate drums may also be provided. In the embodiment illustrated, the upper run of the dirt collecting conveyor 50 runs along a polyethylene plate bed (not shown). The conveyor 50 is preferably provided with side skirts indicated at 62 along its full length. These side skirts 62 are preferably carried by the mainframe 12 of the vehicle rather than by the belt itself. Preferably, the return run 60 of the conveyor 50 is also supported by way of suitable plates or the like.

The dirt collecting conveyor 50 is circumvolute so that its upper working run moves from the rear to the front of the machine as considered in its direction of movement A. At its front end, the conveyor 50 is arranged to deposit the dirt, rubbish, weeds and the like which has been collected thereon onto a dirt delivery conveyor generally indicated 70. This conveyor 70 is again an endless belt conveyor which circumlocates around two end drums 72. However, at the front end of the vehicle, the conveyor 70 is supported by way of framework 74 which is pivotable about a vertical pivot axis 76. It will therefore be appreciated that the upper, free end of the conveyor 70 can be positioned, by pivoting movement relative to the axis 76, on either side of the machine or to the front thereof. If required, the dirt delivery conveyor 70 may also be supported so that the angle at which it extends to the horizontal can also be adjusted. This enables the conveyor 70 to be positioned suitably to enable it to discharge into a lorry, onto a banking or into any other required container. To assist in the discharge where the conveyor 70 is to be inclined upwardly, chevron cleats or other projections (not shown) may be provided on the belt of the conveyor 70. Where the conveyor 70 is to be arranged to discharge onto a lorry it may be preferred to connect the lorry to the vehicle by way of a tow bar or the
like, such that the lorry is pushed forwardly by movement of the vehicle.

As is shown in Figure 5, the dirt delivery conveyor 70 is provided with hinge means 80 intermediate its length so that the conveyor 70 can be folded upon itself. This is useful when the vehicle is to be driven from site to site.

We have seen that clean stones and the like applied to the cleaning device 52 are discharged downwardly in the opposite direction to the direction in which it conveys.

As can be seen in Figure 4, those stones and other clean material are diverted to a return conveyor 90 which extends approximately the length of the vehicle. As can be seen from Figure 4, the return conveyor 90 is a flat belt conveyor which has its upper run supported by a polyethylene plate bed (not shown). The working run of the belt is provided with side skirts 92 which run the full length of the belt. At its ends the belt conveyor 90 is provided with return drums 94, one or more of which may be driven. As is indicated in Figure 1, the drum 94 nearest the front of the machine is moveable to provide appropriate tensioning to the belt.

As can be seen in Figure 1, the return conveyor 90 is arranged to convey the clean material in the direction of arrow E from the front to the rear of the vehicle. The clean material is discharged from the return conveyor 90 into a feed chute 96 which guides the material into a delivery chute 98. The delivery chute 98 is at the rear of the machine adjacent to the excavating means 20 and has a front wall 100 adjacent that excavating means. The chute 98 also has two spaced side walls 102 which serve to keep the walls of the trench open as the trench is excavated by the means 20. The spacing of the side walls of the chute 98 are preferably adjustable so that the walls can support the walls of the trench irrespective of the size of trench.

The delivery chute 98 is pivotally connected to the excavating means 20 so that it can also be pivoted upwardly
when the machine is not in use.

It will be appreciated that, in use, the vehicle is driven so that it moves slowly along the trench in the direction of arrow A. In the use position the delivery chute 98 is positioned within the trench adjacent the bottom of the excavating means 20. As the machine moves forward, rotation of the excavating means 20 digs out the aggregate together with dirt and other contaminants, and feeds the excavated material to the cleaning means comprising the sieve drum 40 and the cleaning conveyor 52. The dirt, rubbish, weeds and the like separated from the aggregate arrive on the dirt collecting conveyor 50 and are fed thereby onto the dirt discharge conveyor 70 which feeds this material to a lorry or other collecting means. The aggregate from which the contaminants have been removed is conveyed rearwardly of the vehicle by way of the return conveyor 90. Then, by way of a delivery system including the delivery chute 98, the cleaned aggregate is fed back into the trench just behind the excavating means 20.

Clearly, the speed of progression of the vehicle has to be judged to be appropriate for the speed of the cleaning process and there will be optimum speeds for the conveyors and the separating devices. In a preferred embodiment, the conveyors are supplied by way of hydraulic motors driven by one or more hydraulic pumps. Of course, any suitable power means may be used as required. Control valves associated with the hydraulics can be pre-set to determine the speeds of all of the elements, and the relative speeds. It would, of course, be possible to adjust each of the elements manually in accordance with the results being obtained. However, some degree of presetting, or ganging of controls to keep the relationship between the speeds of various of the components constant is generally advisable.

Additionally and/or alternatively, processing means could be provided to provide control signals to the various motors, and to adjust the angles of various components.
It will be appreciated that modifications and variations to the invention as described above may be made within the scope of this application.
CLAIMS

1. Apparatus for cleaning aggregate material in situ, said apparatus comprising excavating means for excavating material from its location, cleaning means arranged to receive and clean the excavated material, and delivery means arranged to receive the cleaned material and to return it to the original location.

2. Apparatus as claimed in Claim 1, wherein the apparatus is self-contained.

3. Apparatus as claimed in Claim 2, further comprising a chassis arranged to support the excavating means, the cleaning means and the delivery means, said chassis being movable over the ground.

4. Apparatus as claimed in Claim 3, wherein said chassis comprises wheels and/or tracks enabling the chassis to be moved, and further comprising drive means, supported by the chassis, for driving the wheels and/or tracks.

5. Apparatus as claimed in any preceding claim, wherein said cleaning means is arranged to clean the excavated material by separation.

6. Apparatus for cleaning aggregate material in situ, said apparatus comprising excavating means for excavating material from its location, cleaning means arranged to receive and clean the excavated material, and delivery means arranged to receive the cleaned material and to return it to the original location, wherein, said cleaning means is arranged to remove dirt and contaminants from the excavated material by separation.

7. Apparatus as claimed in Claims 5 or 6, wherein said cleaning means comprises one or more separating devices.

8. Apparatus as claimed in Claim 7, wherein at least one said separating device comprises a sieving device.

9. Apparatus as claimed in Claim 8, wherein said sieving device comprises a rotatable drum having a mesh or screen periphery.
10. Apparatus as claimed in Claim 9, wherein means are provided for propelling excavated material through the drum from one end towards the other, and wherein, at the one end, the periphery of the drum is defined by a fine mesh screen, and proximate said other end, the periphery of the drum is formed by a coarse mesh screen, said other end of the drum being open.

11. Apparatus as claimed in any of Claims 7 to 10, wherein one or more of the separating devices may comprise conveyor means arranged to convey the excavated material, and associated diverting means for diverting dirt and contaminants away from the conveyed excavated material.

12. Apparatus as claimed in Claim 11, wherein said conveyor means comprises an endless mesh or screen belt.

13. Apparatus as claimed in Claims 11 or 12, further comprising diverting means associated with the conveyor means.

14. Apparatus as claimed in any of Claims 7 to 13, wherein at least one of the separating devices comprises a conveyor having a conveying direction which is inclined with respect to the horizontal, and is arranged to convey generally upwardly.

15. Apparatus as claimed in Claim 14, further comprising means for vibrating the conveyor to encourage the ejection of aggregate material therefrom.

16. Apparatus as claimed in any preceding claim, wherein said cleaning means include spray or washing means.

17. Apparatus as claimed in any preceding claim, wherein the apparatus is arranged to be moved over the ground, and said delivery means is arranged at the rear of the apparatus in the direction of movement.

18. Apparatus arranged to be moved along a path, said apparatus comprising excavating means for removing material from said path, cleaning means to receive and clean the excavated material, and delivery means arranged at the rear of said apparatus in its direction of movement and arranged
to return the cleaned material to the path.

19. Apparatus as claimed in Claims 17 or 18, wherein said delivery means is arranged adjacent to said excavating means.

20. Apparatus as claimed in any of Claims 17 to 19, wherein the width of the said delivery means, and of the said excavating means is adjustable.

21. Apparatus as claimed in any of Claims 17 to 20, wherein said delivery means comprises a delivery chute arranged to be positioned within a trench to guide materials thereinto, and wherein the delivery chute has a upstanding wall at the rear of, and adjacent to, said excavating means.


23. A method of cleaning a trench containing aggregate material, the method comprising the steps of moving apparatus as claimed in any of Claims 1 to 21 along the trench, excavating the aggregate material from the trench by way of the excavating means, removing contaminants from the aggregate material by way of said cleaning means, and then causing the delivery means to return the cleaned material to the trench.

24. Apparatus for cleaning aggregate material in situ substantially as hereinbefore described with reference to the accompanying drawings.

25. A method of cleaning aggregate material in situ substantially as hereinbefore described with reference to the accompanying drawings.
FIG. 5.
INTERNATIONAL SEARCH REPORT  
International Application No. PCT/GB 91/01707

I. CLASSIFICATION OF SUBJECT MATTER  
(if several classification symbols apply, indicate all)  
According to International Patent Classification (IPC) or to both National Classification and IPC  
Int.Cl. 5 E02F7/06; B07B1/10

II. FIELDS SEARCHED  
Minimum Documentation Searched

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III. DOCUMENTS CONSIDERED TO BE RELEVANT

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<td>EP,A,0 184 236 (DANIELI&amp;C. OFFICINE MECCANICHE S.P.A.) 11 June 1986</td>
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<td>DE,A,3 605 040 (A. GOCHT) 27 August 1987</td>
<td>1, 17</td>
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<td>see column 2, line 21 - line 46</td>
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"A" document member of the same patent family.

IV. CERTIFICATION

Date of the Actual Completion of the International Search  
17 DECEMBER 1991

Date of Mailing of this International Search Report  
23. 01. 92

International Searching Authority  
EUROPEAN PATENT OFFICE

Signature of Authorized Officer  
ESTRELA Y CALPE J.
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<td>Y</td>
<td>FR-A-419 756 (SOCIETE DROUARD FRERES) 14 January 1911</td>
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This annex lists the patent family members relating to the patent documents cited in the above-mentioned international search report. The members are as contained in the European Patent Office EIDP file on. The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information. 17/12/91

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For more details about this annex: see Official Journal of the European Patent Office, No. 12/82