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(54) **FRICTION SNOWPLOUGH**

(57) The friction snowplough is a parallelepiped-shaped device that has a heavy mass, designed to remove the ice formed on the asphalt in extreme weather conditions and situations. Its operation is based on the friction work of two bodies in movement. The work used to move two bodies is transformed into heat energy, which is absorbed by the ice thus proceeding to melt it.

The heavy mass has the shape of a regular hexahedron (1) and at the front portion it forms an acute dihedron (2) where a fastening element (3) is arranged so as to be coupled to the tractor vehicle, and at the rear portion of the regular hexahedron (4) there is a transversal hook embedded in the heavy mass, and in the aforementioned embedded rear hook at least one roller (5) is assembled.

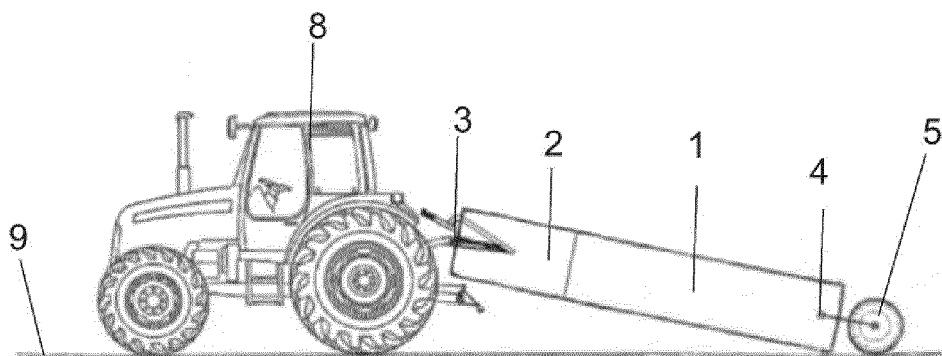


Fig. 4

Description

Technical field

[0001] The specification relating to the friction snowplough makes reference to a device for cleaning snow and ice from asphalt roads, this device being placed on the rear portion of a traction vehicle.

[0002] The friction snowplough is a heavy mass in the shape of a regular hexahedron with a protuberance on the front portion formed by an acute regular dihedron. The snowplow is operated with a tractor machine, and the coupling of the snowplow to the tractor is carried out by means of a three-point attachment.

Background of the invention

[0003] The snowploughs used to clean asphalt roads have evolved according to the function for which they are required. At the outset, wood triangles covered with metal that were towed around by tractor vehicles were used. Later on the snowplough was installed in the front portion of the tractor vehicle. These snowploughs were formed by a steel sheet shaped as a blade intended for scraping and removing snow and ice thanks to a dynamic effect, i.e., by a pushing force.

[0004] There are designs of trucks which incorporate gas burners to melt the snow, but those solutions are very sophisticated and too expensive.

[0005] Other systems used in alpine locations are pieces of equipment that collect snow and expel it through the action of a rotor. They are the so-called steerable snow sweepers, turbine snow sweeper or destroying arm.

[0006] The assemblies of snowplough with a steel blade carried on the front portion of the tractor vehicle work fine under mildly severe conditions, i.e., when the temperature does not drop many degrees Celsius.

[0007] For temperatures below zero degrees Celsius, the situation on the asphalt pavements becomes more complicated, as after the snowplough has passed there remains an ice layer that is strongly adhered. In such cases, chemical compounds such as common salt (sodium chloride) and urea are used. In extreme ice conditions, extreme changes in temperature along with the chemical compounds damage the pavement, and over time the asphalt deteriorates, i.e. the asphalt is attacked both physically and chemically.

[0008] When snowplough systems provided with a steel blade are at work on deteriorated asphalt pavement, it causes patches of asphalt to break and come loose, giving rise to potholes.

[0009] The friction snowplough object of the invention has basis on a friction force originated by the dragging force of a mass over the pavement, i.e., the sliding of a heavy mass.

[0010] Snowploughs with a steel blade do not operate well under certain circumstances, these circumstances

being when there is a thin ice layer that is firmly adhered to the surface.

[0011] The present invention presents a friction snowplough, which is used to remove ice from a surface using a friction energy between two surfaces, wherein the coefficient of friction is small, but the mass being moved is large.

Description of the invention

[0012] An object of the invention is the creation of a snowplough based on the physical processes that take place when towing a block with a given mass over a surface.

[0013] The friction snowplough consists of a heavy mass formed by a regular hexahedron, which has an acute dihedron. The mass has in the front portion thereof, which corresponds to the acute dihedron, a three-point anchoring element used to fix the snowplough to a tractor machine. The three-point element has a mass-lifting function by means of the hydraulic device of the tractor machine.

[0014] On the rear portion of the heavy mass, i.e., the regular hexaedron, a hook is coupled so as to place a roller system. The wide roller that rotates has two functions, the first one consists of driving the tool rotationally and the second one of melting the ice that remains after the frictioning heavy mass has passed by. The friction snowplough can bear one roller or more, depending on how the device operates.

[0015] The forces generated when towing a mass made of a heavy material over the thin ice layer that is adhered to the asphalt can be divided into two types of forces: firstly when the mass remains static on the surface, there is a static friction force with a coefficient of static friction and secondly, when the mass moves over the surface then the inertia force of the bodies has been overcome and turns into a dynamic friction force with a coefficient of dynamic friction.

[0016] The energy consumed by the friction force of the two bodies does not disappear, it just dissipates in the form of heat; this heat energy is captured by the ice, thus melting and diluting it. In this way the ice layer thaws, melts and detaches itself.

Description of the drawings

[0017]

Figure 1 is a perspective view of the friction snowplough, wherein the four parts that make it up are perfectly differentiated.

Figure 2 is a side perspective view of the snowplough.

Figure 3 is a plan view of the snowplough.

Figure 4 is a view of the snowplough attached to the tractor unit.

Practical embodiment of the invention

[0018] The present specification is based on the physical processes that take place when towing a block with a given mass over a surface.

[0019] Following this process it is possible to constitute this snowplough, which is specially indicated to work under extreme ice conditions where current snowploughs leave a thin ice layer that cannot be separated from the asphalt when they operate.

[0020] The friction snowplough is intended for towing a heavy mass over the ice layer under extreme temperature conditions. The friction or frictional resistance is a contact force that acts to oppose the sliding motion between two or more surfaces. The force acts parallel to the surface and opposite to the sliding direction.

[0021] According to the laws of physics:

$$F = m \cdot a$$

$$F_{\text{friction}} = F_{\text{applied}}$$

[0022] The static friction has a different coefficient for the various materials.

$$F_r = \mu_s \cdot F_n$$

[0023] The kinetic friction has a different kinetic coefficient for the various materials.

$$F_f = \mu_k \cdot F_n$$

[0024] Examples of coefficients of friction for different surfaces are:

Ice/ ice	$\mu_s = 0.1$ $\mu_k = 0.03$
Rubber/ Dry Cement	$\mu_s = 1.0$ $\mu_k = 0.8$
Rubber/ wet cement	$\mu_s = 0.3$ $\mu_k = 0.25$
Ski (waxed) / Snow (0°)	$\mu_s = 0.1$ $\mu_k = 0.05$

[0025] The coefficient of kinetic friction for a rubber/ice surface is very small, therefore the mass has to be large to counter the friction force, which is the force transforming into caloric energy.

[0026] As shown in figures 1 and 2 the snowplough is formed by the mass volume of a material, in the shape of a regular hexahedron (1), the front portion of the mass being an acute dihedron (2). It is at the front portion of the mass, in the acute dihedron (2), where the attachment system (3) is embedded. Said attachment system is based on a three-point element.

[0027] At the end portion of the mass volume (1) is

located an embedded cylinder (4) where a roller (5) is coupled.

[0028] In figure 3 a second practical embodiment of the invention is shown, in which to the volume mass formed by a regular hexahedron (1) and with the acute dihedron (2) arranged at the front area of the snowplough, a wheeled support (7) has been added on the rear portion of the regular hexahedron (4) and on the front portion where the acute dihedron (1) is formed. In this practical embodiment the three-point support and the roller embedded in the mass (4) are provided in order to couple the double-roller (6) used.

[0029] The material of the wheels of which the roller (5) or the double-roller (6) as well as the heavy mass are formed is preferably rubber. The wheels and the heavy mass have patterns on the contacting surface. The mass, which has a large volume, weighs between three and four thousand kilograms.

[0030] As can be observed in figure 4, the tractor vehicle (8) hooks together with the fastening element (3) the large volume mass, which has the shape of a regular hexahedron (1). By means of the lifting elements, with which the tractor vehicle (8) is itself provided, the front portion of the mass, i.e. an acute dihedron (2), is lifted above the ground level (9) thus preventing wear thereof due to rubbing while it is conveyed up to the point of operation.

[0031] The friction snowplough is an alternative to steel blade snowploughs to clean roads, airports or concrete pavements that have an ice layer adhered to them.

Claims

1. A friction snowplough that comprises a heavy mass to be towed, **characterised in that** the heavy mass has the shape of a regular hexahedron (1) and at the front portion it forms an acute dihedron (2) where a fastening element (3) is arranged so as to be coupled to the tractor vehicle (8) and at the rear portion of the regular hexahedron (4) there is a transversal hook embedded in the heavy mass and in the aforementioned embedded rear hook at least one roller (5) is assembled.
2. The friction snowplough according to claim 1, **characterised in that** the fastening element is a three-point element formed by two hooks and a central adapter.
3. The friction snowplough according to the main claims, **characterised in that** the roller is formed by a plurality of wheels that rotate freely around its axis.
4. The friction snowplough according to any of the previous claims **characterised in that** the heavy mass has a wheeled support (7) at the rear portion of the regular hexahedron (4) and at the front portion where

the acute dihedron (1) is formed.

5. The friction snowplough according to any of the previous claims **characterised in that** the material of the wheels and the heavy mass is preferably rubber. 5
6. The friction snowplough according to any of the previous claims, **characterised in that** the wheels and the heavy mass have a pattern on the contacting surface. 10
7. The friction snowplough according to any of the previous claims **characterised in that** the mass weighs between three thousand and four thousand kilograms. 15

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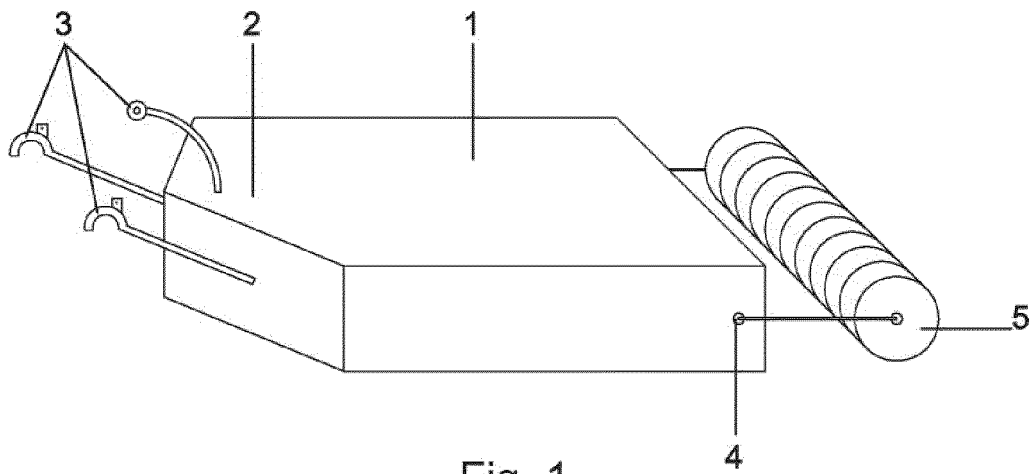


Fig. 1

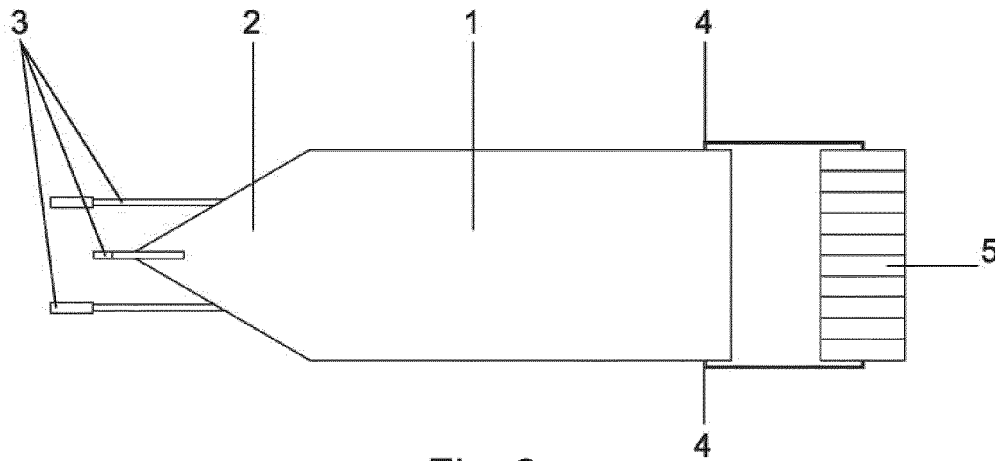


Fig. 2

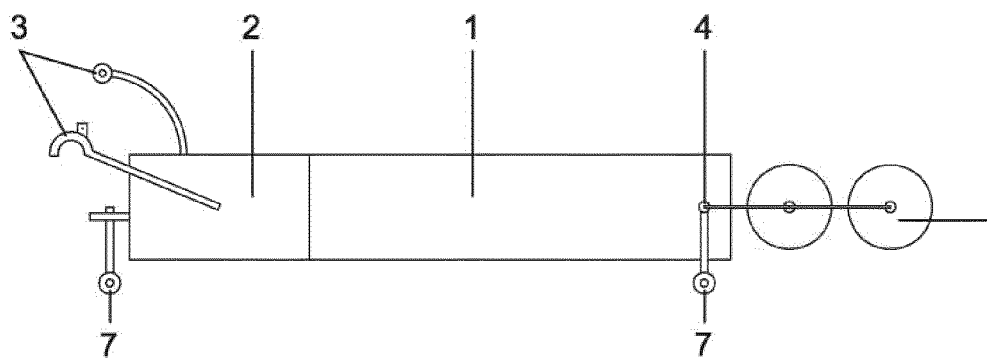


Fig. 3

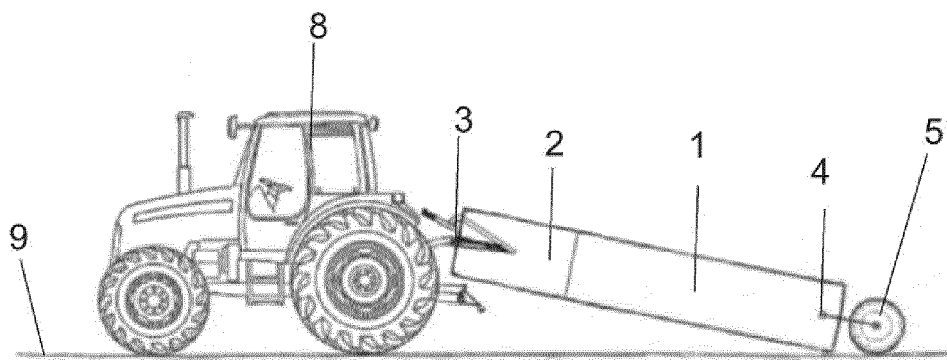


Fig. 4

INTERNATIONAL SEARCH REPORT

International application No

PCT/ES2015/070095

A. CLASSIFICATION OF SUBJECT MATTER

INV. E01H5/06 E01H5/10
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

E01H

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	DE 5 161 C (WINDELS) 10 August 1878 (1878-08-10)	1-4,6,7
A	figure 1	5
A	----- US 293 569 A (FILBERT) 12 February 1884 (1884-02-12)	1-7
Y	figure 1 ----- US 2004/211095 A1 (HAAS THEODORE OTTO [US]) 28 October 2004 (2004-10-28)	1-4,6,7
	figures 1,2 -----	

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

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"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search

8 May 2015

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/ES2015/070095

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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
DE 5161	C	10-08-1878	NONE
US 293569	A	12-02-1884	NONE
US 2004211095	A1	28-10-2004	NONE