

(19) World Intellectual Property Organization  
International Bureau



(43) International Publication Date  
20 April 2006 (20.04.2006)

PCT

(10) International Publication Number  
WO 2006/040397 A1

(51) International Patent Classification:  
E01H 5/06 (2006.01)

(21) International Application Number:  
PCT/FI2005/000435

(22) International Filing Date: 11 October 2005 (11.10.2005)

(25) Filing Language: Finnish

(26) Publication Language: English

(30) Priority Data:  
20041313 11 October 2004 (11.10.2004) FI

(71) Applicant (for all designated States except US): PATRIA  
VAMMAS OY [FI/FI]; PL 18, FI-38201 Vammala (FI).

(72) Inventor; and

(75) Inventor/Applicant (for US only): RUUSKA, Mauno  
[FI/FI]; Kivisillantie 65, FI-38250 Roismala (FI).

(74) Agent: NIEMINEN, Taisto; Patenttitoimisto T Nieminen  
Oy, Kehräsaari B, FI-33200 Tampere (FI).

(81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, LY, MA, MD, MG, MK, MN, MW, MX, MZ, NA, NG, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SM, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM, ZW.

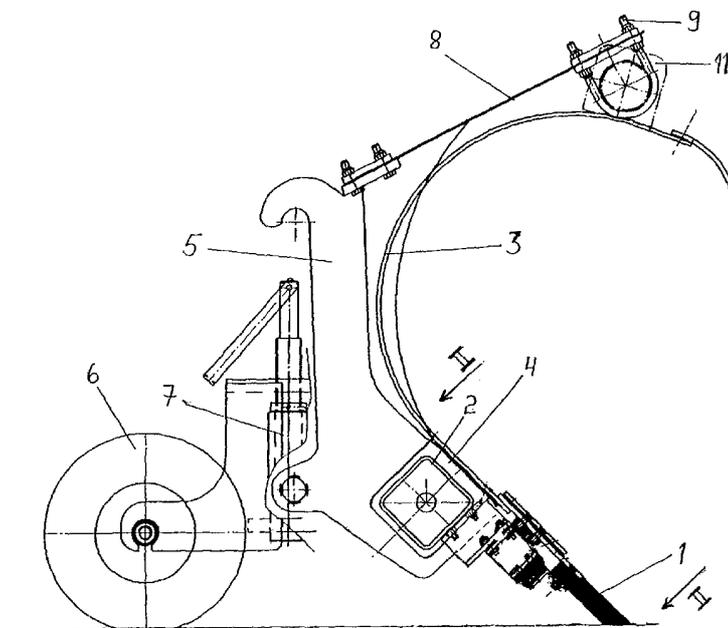
(84) Designated States (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IS, IT, LT, LU, LV, MC, NL, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:

— with international search report

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: A BLADE FOR A SNOW PLOUGH



(57) Abstract: A blade (3) meant to work in the curved form of a snow plough and attached from its lower edge to a rigid beam, the upper edge of which is supported by means of upper beam (12) or similar, and said blade is of flexible material, as plastic sheet. The blade is from its upper beam (12), essentially from its middle, supported by suspension means (9), which due to the ploughing load allows upper beam (12) and blade (3) upper edge to tilt and blade (3) to change the radius of curvature at least from the suspension spot on the blade area toward the blade point .

WO 2006/040397 A1

## A BLADE FOR A SNOW PLOUGH

The invention relates to a blade intended to work in the curved form of a snow plough, and the blade is from its lower edge fixed to a rigid beam and the upper edge of which is supported by the upper beam or similar and the said blade is of flexible material, as plastic sheeting. The blade portion of the snow plough shifts snow lifted on to it by the plough colter, from the area to be ploughed to the side of the snow plough. The aim is to shift snow effectively by means of small ploughing force, a clean mark of job without snow getting over the blade and control of the formation of the plough bank.

The flow of snow on the blade depends on the ploughing speed. By lower speeds the snow moves on the blade lower edge and along it not rising on the blade. It happens especially by small ploughing quantities of snow. By growing speed the snow rises onto the blade and falls down, while the course of snow is screw like. By most speedy ploughing the snow rises only once onto the blade and continues then thrown in the blade direction.

The temperature and water content of snow and the quantities to be ploughed do change. This makes quite different demands on the form and size of the snow plough blade. The friction between blade and snow with its variations is an influential factor of ploughing.

Light and dry frozen snow and smaller snow quantities are best ploughed with a relatively low blade turning down from the front. It is important to prevent light snow to get over the blade and to minimize turbulence at the back of the blade.

When snow quantity, specific weight the of snow quantity, water quantity and temperature of snow rise the firmness and ploughing resistance of snow increase. Then a higher blade with bigger bending radius, most preferably broadening conically, ploughs most effectively.

For moving snow by faster ploughings the most reasonable and most aimed form of blade is a cone broadening in the trailing direction. Then the blade shifts the snow a longer way only by one rise, while the quantity of snow grows. By sufficient speed for

throwing snow the most reasonable direction diagonally upwards can be achieved. On the other hand, the shallowness of the forepart of the blade is an advantage by speedy ploughing, since the turbulence arising at the back of blade remains smaller.

5

Slight friction between snow and blade facilitates the sliding of snow motion on the blade without snow gathering to get pushed in front of the blade into a heap to be mixed. The snow sliding on the blade begins to move to the sides and the width of the snow plough can be used with minimum overlap in regard to former ploughing width.

10

Same snow ploughs are used for ploughing on the right and on the left side and then conicality is needed in both directions. A known solution is achieved making in both ends of the cylindrical blade portion growing cylindrical blade extensions. There will be discontinuities in the blade, the blade forepart loses a part of its optimal form and it is high with its turbulence at the back.

15

Another known solution is a conical blade with knives in upper and lower edges and the whole cone is turned around an axle in direction of the longitudinal axle of the plough vehicle for achieving the ploughing direction wanted. The disadvantage of this solution is the great lifting height, especially with greater ploughs and double colter constructions.

20

Further, a known solution is to use a flexible blade attached from its lower and its upper edge to rigid beams and the upper beam is moved in regard to the lower beam by means of levers and hydraulic cylinders so that it is possible to make the blade broaden into a cone in wanted direction. The disadvantage here is complicated mechanical constructions and need for control according to the direction of work.

25

According to the solution of this invention the flexible form of the snow plough changes automatically from cylindrical into a broadening cone, when the load of snow grows on the blade. The snow plough according to this invention is characterized in that the blade is from its upper beam, essentially from its middle, supported by suspension means, which due to the ploughing load allows the upper beam and blade upper edge to tilt and the blade to change the radius of curvature at least at the suspension on the blade area towards the blade point. According to the flexible attachment of the upper beam of this

30

invention it is possible to get the upper beam motion automatically in the right direction. The upper beam that supports the blade is attached flexibly in regard to the lower beam. The direction of motion is determined by the direction flexible motion and the size by  
5 the stiffness of spring and the snow load getting to the blade. By higher driving speeds and greater snow quantities centrifugal force is directed on the blade, which force tends to lift the blade from its upper edge. The blade gets up especially in the trailing end of the plough blade, because of the impact of its greater snow quantity.

10 The advantage of the solution is the low cylindrical form of blade lifted up by transportation, whereby its visual obstruction is small compared to high form. By fast ploughing the conical form of the blade is of no benefit and the blade remains low. There is less turbulence at the back of the blade than with a high blade. By ploughing there is most snow in the blade trailing end and due to it the buoyancy caused by the snow whirl  
15 is at greatest in it causing most buoyancy forces, which open the blade into a growing cone. At the same time this produces the right direction of conicality.

Anyhow, the blade lifting force is a disturbing property, since at its worse, it tends to lift up the whole plough, whereby the cutting force weakens and at the same time the snow-  
20 removing property of the plough weakens. The blade opening into a broadening cone reduces the plough colter forces with no need for separate colter force control. The broadening blade cone reduces the rises of snow onto the blade by ploughings with average speeds and thus the quantity of ploughing capacity needed. With same plough capacity greater snow quantities as with a cylindrical blade can be shifted.

25

In the following the invention is disclosed with reference to the enclosed drawing where Figure 1 shows the snow plough viewed from its end.

Figure 2 shows the snow plough viewed from its front.

30

Figure 1 shows snow plough 3 furnished with body 5, support wheel 6 furnished height adjusting means and colter 1 furnished with a blade 3 as its extension. Blade 3 is of flexible material and supported by means of holder 8. The blade lower edge is fixed to square formed beam 2 by means of winding band 4. Lower beam 2 does wind, so thus

the lower edge of blade 5 is stiff. The upper edge of the flexible blade is with brackets 11 attached to rigid beam 12, which can wind in regard to round balk 12. This construction enables change of blade form from cylinder to broadening cone.

5

When according to figure 2 the blade is locked lengthwise only from the middle, brackets 11 in upper beam 12 and also pieces 4 in the lower edge allow sliding of blade on body beams 2 and differences of thermal extensions. Upper beam 12 is suspended on one leaf spring 8. If upper beam 12 is suspended on two leaf springs 8, so in its normal position, without forces caused by the snow, leaf springs 8 will most reliably keep upper balk 12 in lower beam 2 direction. By ploughing the snow load tilts upper beam to position 12' and at the same time the curvature of blade 3 changes. The curvature becomes more gently sloping from the suspension spot toward the blade trailing edge and becomes steeper from the suspension spot toward the blade front edge. The plastic or for instance rubber material of the blade allows bending and winding of a plate structured blade.

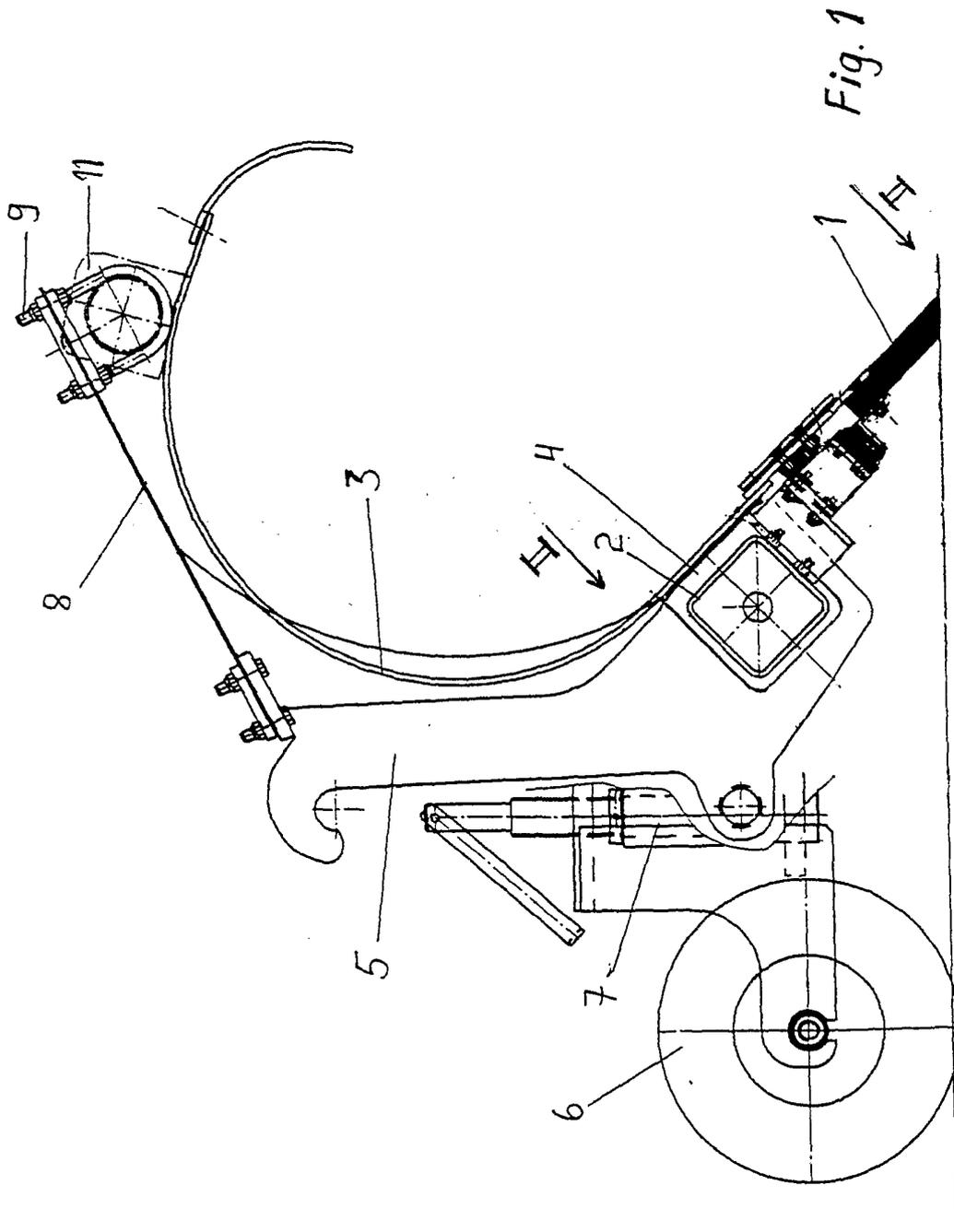
10  
15

Due to the centrifugal force caused by the sliding snow flow on the blade more lifting forces are directed on the blade left portion and the blade back part gets up and backward, while the front part gets down and forward. The blade becomes a cone broadening in the trailing direction.

20

## CLAIMS

1. A blade (3) meant to work in the curved form of a snow plough and fixed from its lower edge to rigid beam (2), the upper edge of which is supported by means of upper beam (12) or similar, and said blade is of flexible material, as plastic sheet, **c h a r -**  
5 **a c t e r i z e d** in that the blade is from its upper beam (12), essentially from its middle, supported by suspension means (9), which due to the ploughing load allows upper beam (12) and blade (3) upper edge to tilt and blade (3) to change the radius of curvature at least from the suspension spot on the blade area toward the blade point .
- 10
2. A blade according to claim 1, **c h a r a c t e r i z e d** in that the blade portion of blade (3), which changes its curvature, is attached at least to the blade upper part.
3. A blade according to claim 1, **c h a r a c t e r i z e d** in that the blade upper edge is  
15 attached windingly to upper beam (12) and upper beam (12 is suspended on spring (8), while, the spring allows change of blade curvature also in the suspension spot.
4. A blade according to claim 1, **c h a r a c t e r i z e d** in that upper beam (12) is suspended from the middle or near the middle with two leaf springs (8), which allow rise  
20 and tilting of upper beam (12) for change of blade (3) into a broadening cone due to the load of the snow flow essentially at the most in blade (3) trailing end.
5. A blade according to claim 1, **c h a r a c t e r i z e d** in that blade (3) is by means of brackets (4) connected to it attached from its lower edge non windingly and from its  
25 upper edge windingly on rigid beams (2), (12), while the attachments are arranged to allow changes of length due to material differences in the blade lengthwise direction.



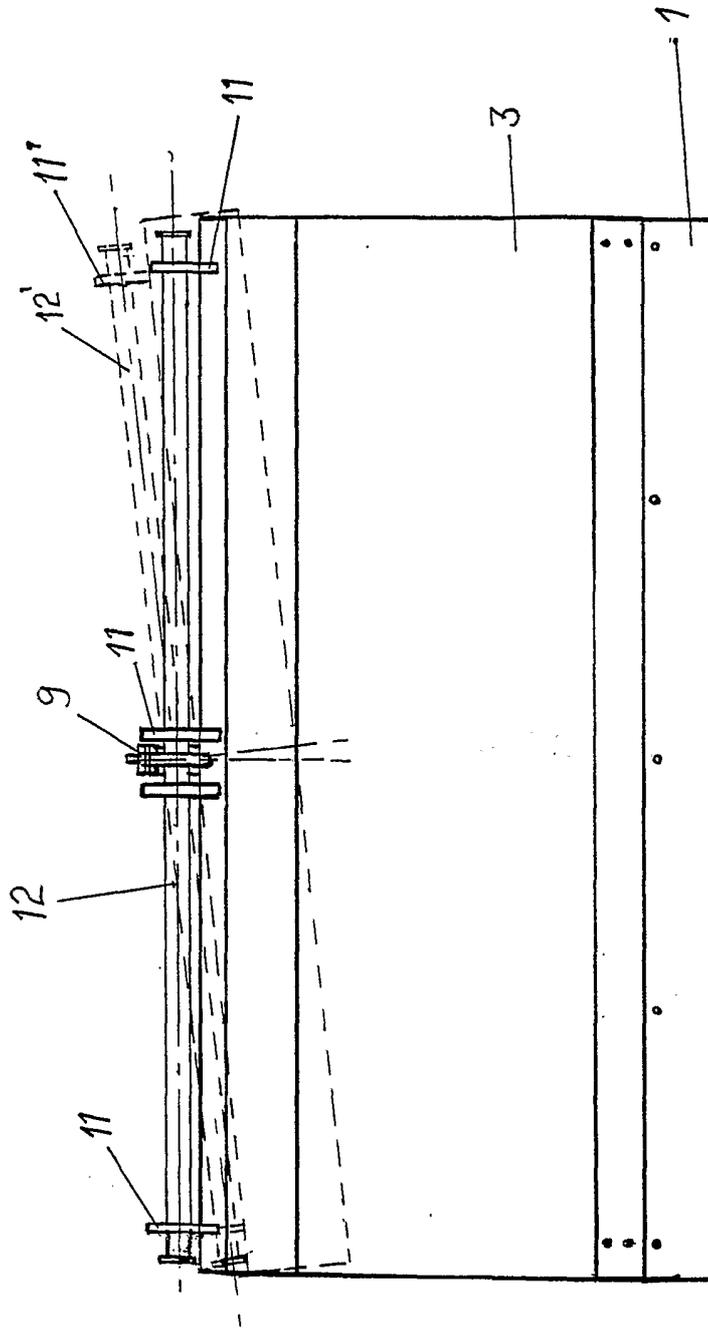


Fig. 2

## INTERNATIONAL SEARCH REPORT

International application No.

PCT/FI2005/000435

A. CLASSIFICATION OF SUBJECT MATTER See extra sheet 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) IPC7: E01H  Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched FI, SE, NO, DK  Electronic data base consulted during the international search (name of data base and, where practicable, search terms used) EPO-INTERNAL, WPI, PAJ		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 5477600 A (HOULE BERTRAND Y et al.) 26 December 1995 (26.12.1995), whole document	1 - 5
A	US 5079866 A (FARRELL EUGENE A) 14 January 1992 (14.01.1992), whole document	1 - 5
A	US 5025577 A (VERSEEF JAN H) 25 June 1991 (25.06.1991), whole document	1 - 5
<input type="checkbox"/> Further documents are listed in the continuation of Box C. <input checked="" type="checkbox"/> 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 "E" earlier application or patent but published on or after the international filing date "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "O" document referring to an oral disclosure, use, exhibition or other means "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 22 December 2005 (22.12.2005)		Date of mailing of the international search report 26 January 2006 (26.01.2006)
Name and mailing address of the ISA/FI National Board of Patents and Registration of Finland P.O. Box 1160, FI-00101 HELSINKI, Finland Facsimile No. +358 9 6939 5328		Authorized officer Raimo Herjo  Telephone No. +358 9 6939 500

**INTERNATIONAL SEARCH REPORT**  
**Information on patent family members**

International application No.  
PCT/FI2005/000435

Patent document cited in search report	Publication date	Patent family members(s)	Publication date
US 5477600 A	26/12/1995	CA 2109172 A1	26/04/1995
.....			
US 5079866 A	14/01/1992	US 5185946 A CA 2029602 A1	16/02/1993 24/10/1991
.....			
US 5025577 A	25/06/1991	None	
.....			

INTERNATIONAL SEARCH REPORT

International application No.  
PCT/FI2005/000435

CLASSIFICATION OF SUBJECT MATTER

Int.Cl.  
**E01H 5/06** (2006.01)