

(19) World Intellectual Property Organization
International Bureau



(43) International Publication Date
1 November 2007 (01.11.2007)

PCT

(10) International Publication Number
WO 2007/123479 A1

(51) International Patent Classification:
A01B 29/04 (2006.01)

(74) Agent: ALBIHNS AB; P.O. Box 5581, S-114 85 Stockholm (SE).

(21) International Application Number:
PCT/SE2007/050243

(81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BH, 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, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RS, RU, SC, SD, SE, SG, SK, SL, SM, SV, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(22) International Filing Date: 13 April 2007 (13.04.2007)

(25) Filing Language: Swedish

(26) Publication Language: English

(30) Priority Data:
0600865-0 20 April 2006 (20.04.2006) SE

(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, MT, 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).

(71) Applicant (for all designated States except US): **VÄDERSTAD-VERKEN AB** [SE/SE]; P.O. Box 85, S-590 21 Väderstad (SE).

(72) Inventors; and

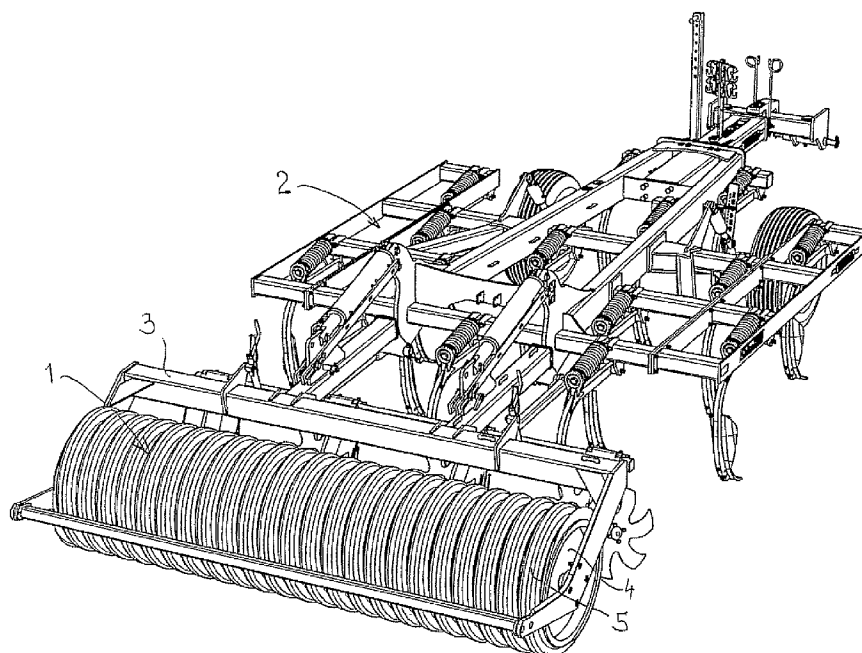
(75) Inventors/Applicants (for US only): **STARK, Crister** [SE/SE]; Lejonbacken, S-590 21 Väderstad (SE). **KARLSSON, Bo** [SE/SE]; Björklunda, Siktesbo, S-585 97 Linköping (SE). **DAHL, Jörgen** [SE/SE]; Sjögetorp, S-599 91 Ödeshög (SE). **NEEDHAM, Tim** [AU/AU]; P.O.Box 9075, Cleveland Dc, Queensland 4163 (AU).

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: ROLLER FOR AN AGRICULTURAL MACHINE AND AGRICULTURAL MACHINE WITH SUCH A ROLLER.



(57) Abstract: The present invention refers to a soilgoing roller (1) for agricultural machine comprising a cylinder body (4), which on its exterior is covered with a flexible and resilient material (5). According to the invention the covering material comprises an elongated string of material (5), which in a plurality of turns is spirally wound around the periphery of the cylinder body (4) and which in at least both of its ends is fastened to the cylinder body.

WO 2007/123479 A1

Soilgoing roller for an agricultural machine

BACKGROUND OF THE INVENTION

The present invention relates to a soilgoing roller for agricultural machine comprising a cylinder body, which on its exterior is covered with a flexible and resilient material.

BACKGROUND TO THE INVENTION

Soilgoing rollers in various forms have been used since ancient times on agricultural machines. The aim of such rollers is usually to recompact the soil after previous soil tillage or after sowing. Previously the roller was made from a log, later ring rollers with precast rings became common with industrial and agricultural development. Today such rollers are manufactured from a range of different materials, such as forged and hardened steel rings, rings of rubber and various plastic materials. There are also rollers made from steel pipe with so-called shark fins welded on.

Rollers of the above mentioned type can also be used to press down stones so that these do not enter the combine harvester during harvesting.

Through EP-B1-0 878 328 a roller of the above mentioned type is previously known, at which a number of tyre-like rings of rubber material are threaded one after another on a central pipe so that the entire cylinder surface of the pipe is covered by the rings. It has been shown that rings/rollers of rubber are very good from an agrarian perspective. They also allow the roller to be driven on the road. A problem with the known roller is that its manufacture is costly and complicated

since a large number of rings have to be threaded onto the pipe and linked together and compressed towards each other. Furthermore, the two outer rings threaded on a pipe have a different configuration than the rest of the rings on the pipe, which means that three different forms of rings must be manufactured and handled.

5

The present invention aims to achieve a roller of the initially described type that is simpler and cheaper to manufacture than the known roller, through which the benefit of an exterior covering in rubber or rubber-like material can be retained.

10 SUMMARY OF THE INVENTION

This aim is achieved according to the invention by means of a soilgoing roller for agricultural machine comprising a cylinder body, which on its exterior is covered with a flexible and resilient material, characterised in that the covering material
15 comprises an elongated string of material which in a plurality of turns is spirally wound around the periphery of the cylinder body and which in at least both of its ends is fastened to the cylinder body. The elongated string of material, which can suitably be comprised of an extruded rubber profile, can be manufactured in great lengths and then divided up into individual strings fitting a certain dimension of
20 roller. This means a clear simplification and cost saving compared with having to manufacture tyre-like rings with three different profiles for each dimension of roller.

In a first preferred embodiment the covering material comprises a single string of
25 material.

In a second preferred embodiment the covering material comprises two or more elongated strings of material, which run beside each other from one end of the cylinder body to its other end.

In both embodiments each elongated string of material can have a base portion with a planar surface on the side facing the peripheral surface of the cylinder body and a portion protruding from the base portion, which at least in its outermost part has lesser width than the base portion. This is suitably achieved through one or more protruding portions protruding from the base portion. Each string of material is preferably hollow within the area of each protruding portion.

The elongated strings of material can advantageously comprise along their length one or more reinforcing elements of flexible material, which extend in longitudinal channels in the strings of material and which have a higher durability than the flexible and resilient material in the strings of material. Such reinforcement elements of flexible material extend beyond both ends of the strings of material and are fastened to the cylinder body and members for tightening the reinforcement elements are preferably arranged at at least one of these fastenings to the cylinder body.

The invention also refers to an agricultural machine comprising at least one such soilgoing roller, characterised in that it comprises a device for braking the roller. Such a machine can also comprise a driving device for the roller.

A scraper is suitably arranged on the machine to remove soil and similar from the roller.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention shall now be described with reference to the attached drawings, of which;

Figure 1 shows schematically a perspective view diagonally from the rear of an agricultural machine provided with a roller according to a first preferred embodiment of the invention,

- 5 Figure 2 shows a view from above and partly in cross-section of the roller in the agricultural machine according to Figure 1 provided with a scraper,

- Figure 3 shows schematically a side view of a spring arrangement for tightening the ends of wires in two elongated rubber profiles, which are spirally wound
10 beside each other on a roller according to a second embodiment,

- Figure 4 shows schematically an end portion of a roller according to a third embodiment, in which the ends of wires in two elongated rubber profiles are anchored on the inside of the cylinder body of the roller,

- 15 Figure 5 shows schematically a tightening device according to a fourth embodiment with an end plate, which allows incorporation of a brake drum or a driving motor,

- 20 Figure 6 shows schematically an end portion of a roller according to a fifth embodiment, in which wires are fastened on the inside of the cylinder body and an end plate is adapted for incorporation of a brake drum or a driving motor,

- Figure 7 shows schematically a side view of a roller according to a further
25 embodiment and a scraper in a working position,

Figure 8 shows schematically a wire end and its connection to a spring, and

Figures 9 and 10 show cross-sectional views of two different rubber profiles.

DESCRIPTION OF EMBODIMENTS

Figure 1 shows schematically a perspective view diagonally from the rear of an agricultural machine 2 provided with a soilgoing roller 1 according to a first preferred embodiment of the invention. The agricultural machine is comprised in this case of a cultivator but the roller 1 can advantageously also be used at other types of agricultural machines. The roller 1 is rotatably supported on a rear frame beam 3 at the agricultural machine 1.

10

The roller 1 consists mainly of a cylinder body 4, on the cylinder surface of which an elongated profile 5 of rubber or other flexible and resilient material has been spirally wound, whereby the edges of the rubber body abut each other in each spiral turn of the rubber body 5. Fig. 2 shows a view from above of the roller 1 and a scraper 6. Figure 2 is partly cross-sectional in the ends of the roller 1 to show that the profile is hollow, i.e. it comprises a longitudinal channel 7, which extends between the ends of the elongated rubber profile. Such a void 7 can be necessary to reduce heat build-up due to inner friction during driving on hard surfaces, such as roads.

20

The roller 1 is manufactured through a rubber profile being manufactured in great lengths, which can be several hundred metres. Manufacturing can occur through extrusion or by another suitable method with a high degree of automation. The extruded product is then cut into suitable lengths so that it can be wound spirally in a plurality of turns about a pipe body so as to cover its peripheral surface or cylinder body. An adjustment of the rubber profile to pipe bodies with different diameters and lengths is easily achieved through the pipe body being cut to different lengths, which is a great advantage compared with the technique known through EP-B1-0 0 878 328 where ring elements of rubber must be manufactured

25

individually for each diameter of a pipe body and also of such a width that the total width of the number of rings required to cover the peripheral surface of the pipe body corresponds with the width of the pipe body so that no part of the ring at the end of the pipe body shall protrude beyond it. With a rubber profile according
5 to the invention only the necessary length so that the spirally wound rubber profile shall completely cover the peripheral surface of the pipe body and the cutting angle need to be decided. One can even wind the rubber profile on a pipe body before it is cut and then cut it level with the end of the pipe body.

10 To reinforce the rubber profile one or more wires or bands of steel or other durable material can be vulcanised-in during manufacturing of the profile. When cutting the profile to a suitable length, that part of these reinforcing elements that shall extend beyond the ends of the rubber profile is freed to allow fastening of the reinforcing elements to the underlying pipe body. It should be pointed out in this
15 context that reinforcing material can instead or also be mixed into the rubber mass.

In addition to being fastened in the pipe body by means of the freed reinforcing elements rubber profiles with such reinforcing elements or rubber bodies without such reinforcing elements can be glued or vulcanised fast on the pipe body.

20

Figure 2 also shows a scraper 6, which consists of a beam 8, which on its underside comprises a row of scraper elements 9, which are rotatably attached to the beam 8. The beam 8 is in its turn supported via suitable arms by the beam 3, which carries the roller 1. The scraper elements 9 have nearly the form of a five-
25 point star with five scraper rods 10, which extend radially from a central hub. As is shown in Figure 2, the rubber profile has a protruding part 11, which has lesser width than the base of the rubber profile, which means that the protruding parts 11 of the spirally wound rubber profile act as the threads of a standing screw. In the position of the scraper 6 shown in Figure 2, a scraper rod 10 interacts with each

such thread in the roller 1. If the roller rolls on the soil the rods that are disposed in the threads become displaced laterally in the thread grooves, whereby the scraper elements 9 come to rotate and the scraper rods then after a certain rotation will leave the thread grooves in question. Just before a scraper rod leaves a thread groove on the roller 1 an immediately adjacent scraper rod 10 in the rotation direction of the scraper element 9 is through the rotation of the scraper element brought into a thread groove neighbouring the groove that was vacated. During their time in each groove the scraper rods scrape off wet soil that has fastened on the roller 1. The scraper 6 thereby solves the difficult task of removing wet soil or clay from the roller 1.

The beam 8 that bears the scraper elements 9 is suitably formed so that it can be swung aside or displaced in some other way from interacting with the threads in the roller 1 in dry conditions or when driving on roads in order to prevent unnecessary wear. The scraper elements 9 can for example be manufactured of steel plate, forged material or plastic. The number of scraper rods and the dimensions of these are dependent on the dimensions of the rubber profile and the pitch of thread in the spirally wound rubber profile.

The scraper elements 9 can of course have a different shape than star-shaped, e.g. cogwheel-shaped with the number of cogs adapted to the threads in the roller.

Figures 1 and 2 show a roller 1, at which a rubber profile is wound on a pipe body 4. With such a design it can be a problem to finish off the profile neatly at the ends of the roller since the profile has a slight angle to the ends of the pipe. The profile then has a phasing off of a full turn to be finished off perfectly. An easy way to make the angle greater in such a rubber profile is to wind the roller with two profiles lying beside each other, whereby the problem is halved. It is also possible to use three or more parallel profiles.

Fig. 3 shows schematically a side view of a spring arrangement for tightening the ends of wires 11,12 in two elongated rubber profiles 13,14, which are spirally wound beside each other on a roller according to a second embodiment. Each rubber profile 13,14 contains two wires 11,12, which with freed ends extend from the ends of the rubber profiles. The freed ends of the wires have been formed into loops, through which hooks on the springs 15 are passed. The springs 15 are themselves in a suitable way fastened in the end of the pipe body 16 so that the wires are subjected to tensile stress. In the opposite end (not shown) of the pipe body 16 the wires can be fastened in a similar way or be rigidly fixed.

Figure 4 shows schematically an end portion of a roller 17 according to a third embodiment, in which the ends of wires 18, 19 of two elongated rubber profiles 20,21 are anchored on the inside of the cylinder body of the roller 17. The wires 18,19 extend through holes 20,21 created in the cylinder body. Figure 4 also shows parts of a scraper 6 in the displaced position.

Figure 5 shows schematically a tightening device for the ends of wires 22,23 in a rubber profile 24, which ends are anchored on the inside of the cylinder body 26 of the roller 25 according to a fourth embodiment with an end plate 27, which allows incorporation of a brake drum or a driving motor. The pipe body is usually empty, which means that the springs can be fastened at any chosen place on the inside of the pipe body.

Figure 6 shows schematically an end portion of a roller 29 according to a fifth embodiment, in which two wires 30,31 are fastened on the inside of the cylinder body 32 and an end plate 33 is adapted for incorporation of a brake drum or a driving motor.

Figure 7 shows schematically a side view of a roller 34 according to a further embodiment, in which two wires 35,36 are fastened via springs 37 to shackles 39 on the pipe body 38. To allow for adjustment of the spring power the shackles 39 can be displaceable or also more shackles can be arranged. In addition Figure 7
5 shows a scraper 6 with the scraper rods engaged in the thread grooves in the roller 34.

Figure 8 shows schematically a wire end 40 and its connection 41 to a spring 42. The connection 41 is comprised of a cable clamp with a ring-shaped end, which
10 allows hooking in of the spring 42.

Figures 9 and 10 show cross-sectional views of two different rubber profiles 43 and 44 respectively. The rubber profile 43 has a base portion 45, which has a planar under surface for abutting at the cylinder surface of a pipe body, and a
15 protruding central part 46, which protrudes narrowing upwards from the base part. In addition the profile 43 has a channel 47 within the area of the protruding part. The rubber profile is as mentioned previously suitably provided with reinforcing elements 48 that extend longitudinally through the entire rubber profile. The rubber profile 44 shown in Figure 10 differs from the body shown in Figure 9
20 mainly only through it having two protruding parts 49, which protrude upwards from a base part 50.

The embodiments described can of course be modified within the framework of the invention. In particular several soilgoing rollers can be arranged beside each
25 other, whereby all, one or some can be removable from their soilgoing position so that for example only two smaller rollers are used during driving on the road. Thereby only those rollers that are intended to be used on the road need be provided with brakes. In the embodiment with several rollers these can have a shared scraper or a scraper for each roller. In addition, not all rollers have to be

driven as it can be sufficient with one or two. The turns of the strings of material do not have to abut each other and instead an intermediary metal strip or similar can be arranged between the different spirally wound turns. Such a strip can be provided with members that lock fast the string of material, e.g. a longitudinal
5 edge flange that extends over the edge of the neighbouring spiral turn and eventually fits into a groove in the string of material. Furthermore the string of material does not have to have a planar surface facing the cylinder body even though this is preferable and instead the surface can be curved. In addition the mentioned surface can have a central recess or a plurality of recesses. Furthermore
10 the ends of the wires can be provided with protection against wear and abrasion, for example through a suitable pipe sheath of soft-annealed steel. Furthermore the holes in the pipe body for the wires to pass through can be covered or lined in some other way so as to reduce wear on the wires. In addition such holes can be created at an angle so that the wires do not have to be bent over sharp edges. The
15 hollow rubber profile within the area of the protruding parts can be filled with matter with different characteristics than the surrounding rubber. It is also conceivable to allow the void to be pressurised so as to provide the roller with more tyre-like characteristics. With such an embodiment the plugs or similar that are required for airtight closing of the ends of this void can be provided with
20 valves that permit refilling of air into the void. Tightening devices other than springs can be used, such as hydraulic cylinders, pneumatic cylinders or manual tightening devices, such as rigging screws. It is also conceivable to combine springs with manual tightening devices, e.g. rigging screws. In addition, the wire fastening can be variable and combined with a tightening device, e.g. of the type
25 oldfashioned ski binding, possibly combined with a spring. The present invention shall therefore only be limited by the content of the enclosed patent claims.

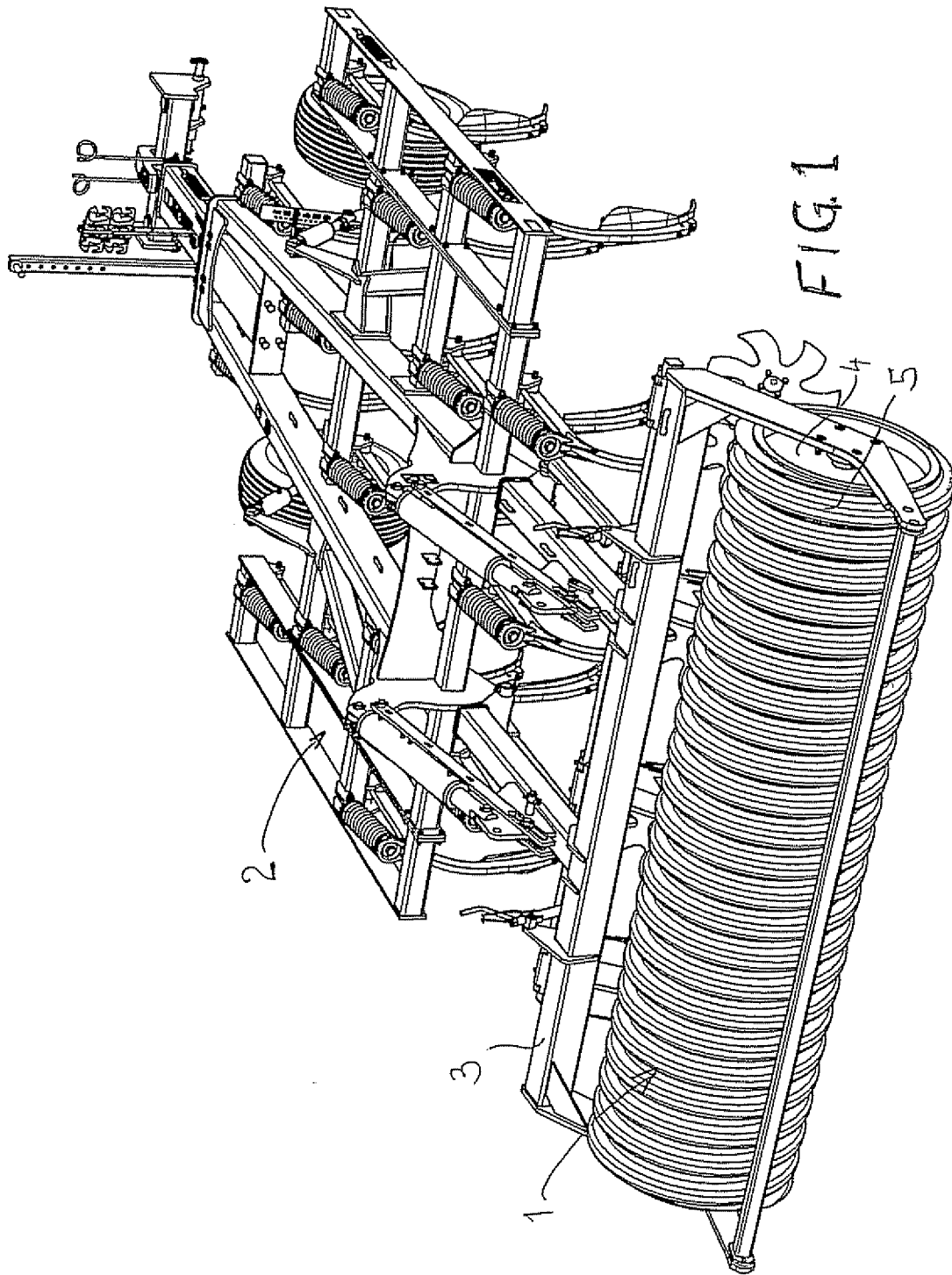
CLAIMS

1. Soilgoing roller (1) for agricultural machine comprising a cylinder body (4), which on its exterior is covered with a flexible and resilient material (5),
5 **characterised in** that the covering material comprises an elongated string of material (5), which in a plurality of turns is spirally wound around the periphery of the cylinder body (4) and which at least in both of its ends is fastened to the cylinder body.
- 10 2. Soilgoing roller according to Claim 1, **characterised in** that the covering material comprises two or more elongated strings of material (13,14), which run beside each other from one end of the cylinder body (16) to the other end.
- 15 3. Soilgoing roller according to Claim 1 or 2, **characterised in** that each elongated string of material (43) has a base portion (45) with a planar surface on its surface facing the peripheral surface of the cylinder body and a portion (46) protruding from the base portion (45), which at least in its outermost part has lesser width than the base portion.
- 20 4. Soilgoing roller according to Claim 3, **characterised in** two or more protruding portions protrude out from the base portion (50).
5. Soilgoing roller according to Claim 3 or 4, **characterised in** that each string of material (43) is hollow within the area of each protruding portion (46).
- 25 6. Soilgoing roller according to any one of Claims 1-5, **characterised in** that the elongated strings of material (43) along their length comprise one or more reinforcing elements (48) of flexible material, which extend in longitudinal

channels in the strings of material and which have a higher durability than the flexible and resilient material in the strings of material.

7. Soilgoing roller according to Claim 6, **characterised in** that each reinforcing
5 element of flexible material (11,12) extends beyond both ends of the strings of material (13, 14) and is fastened to the cylinder body (16).
8. Soilgoing roller according to Claim 7, **characterised in** that members (15) for
10 tightening the reinforcing element (11,12) are arranged at at least one of its fastenings to the cylinder body (16).
9. Agricultural machine (2) comprising at least one soilgoing roller (1) according
15 to any one of Claims 1-8, **characterised in** that it comprises a device for braking the roller.
10. Agricultural machine according to Claim 9, **characterised in** that it comprises
a driving device for the roller.
11. Agricultural machine according to Claim 9 or 10, **characterised in** that it
20 comprises a scraper (6) for removing soil and similar from the roller (1).

1/6



4/6

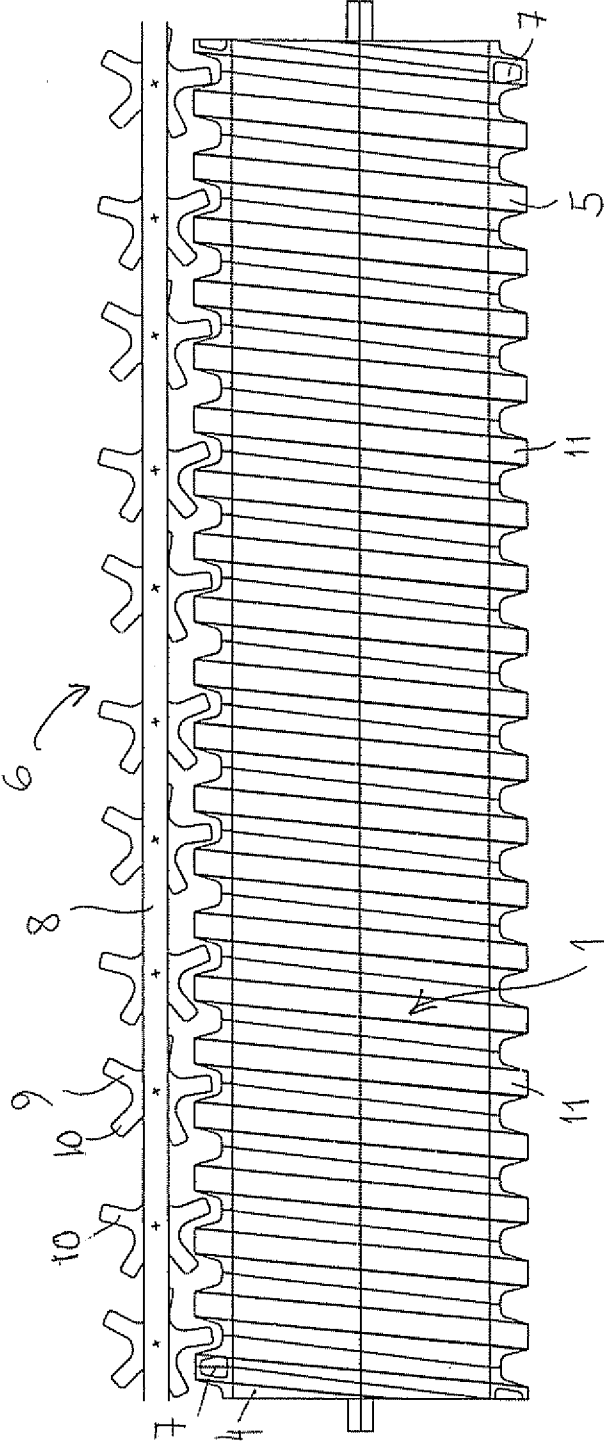


FIG. 2

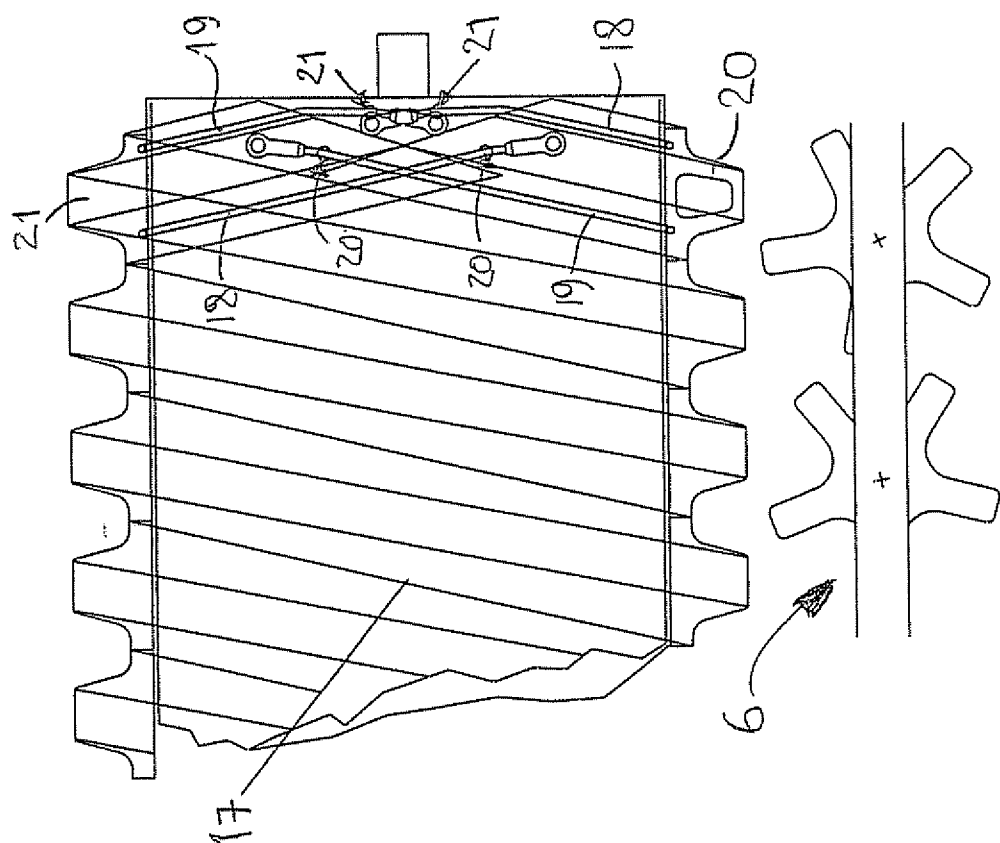


Fig 4

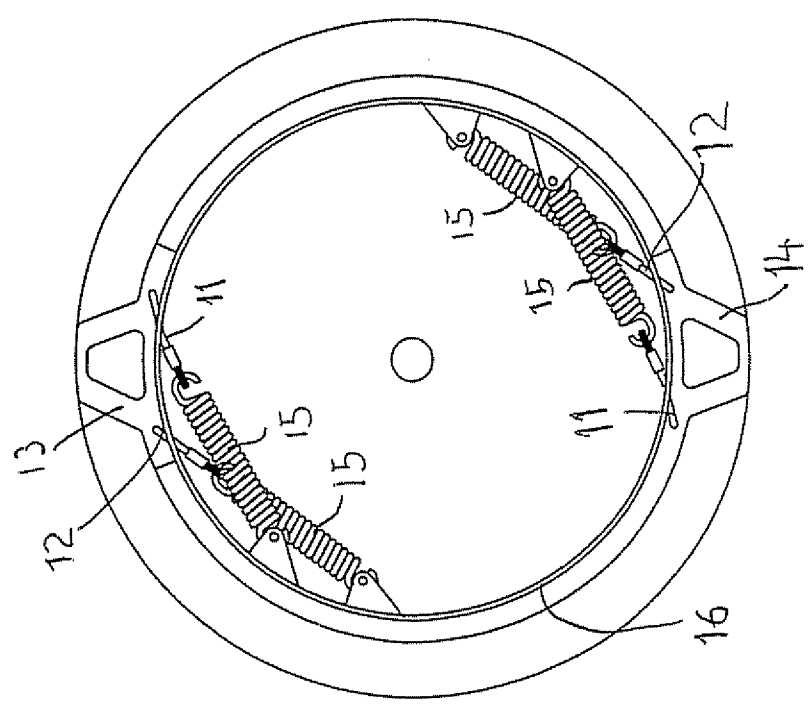
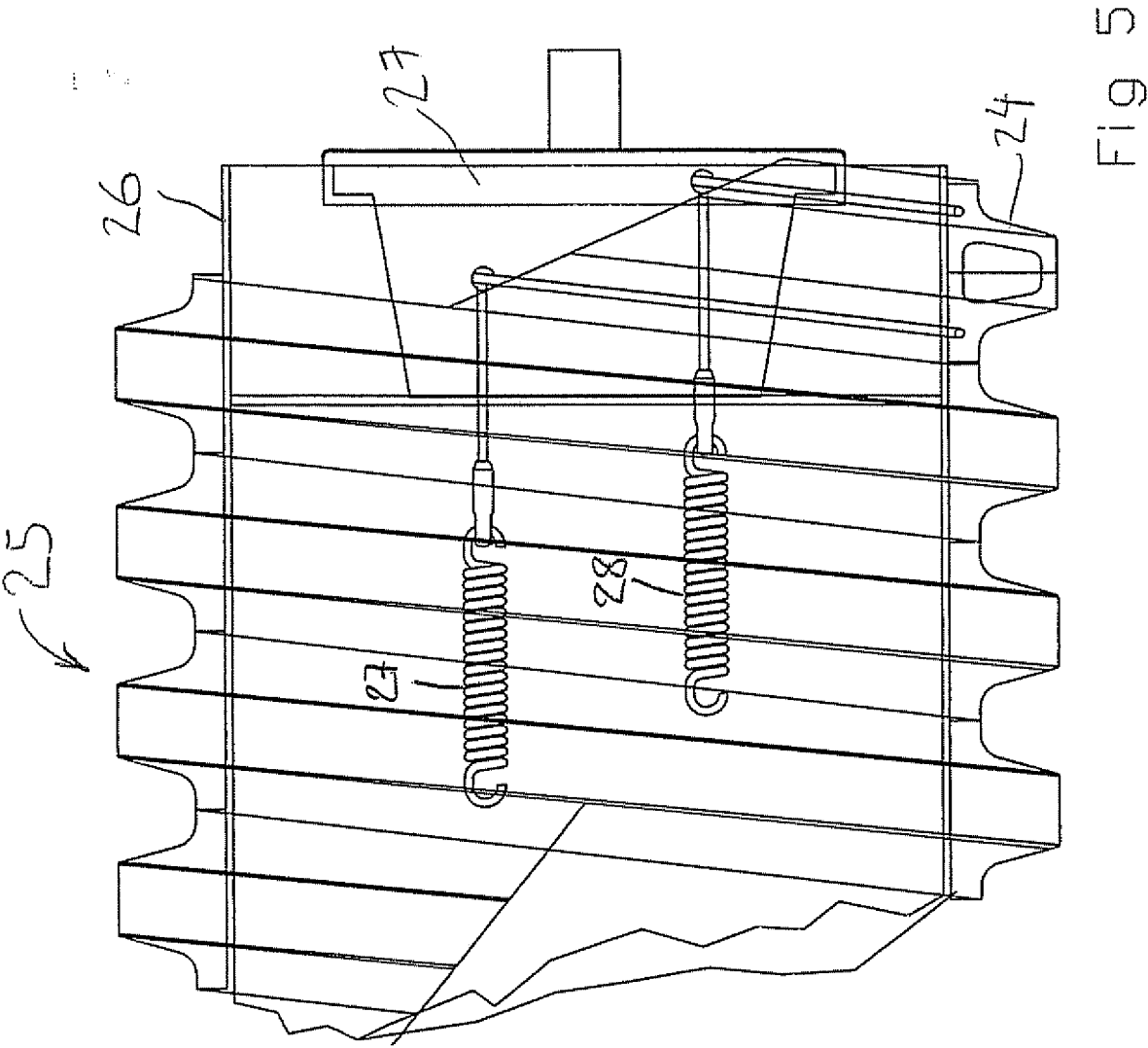


Fig 3

4/6



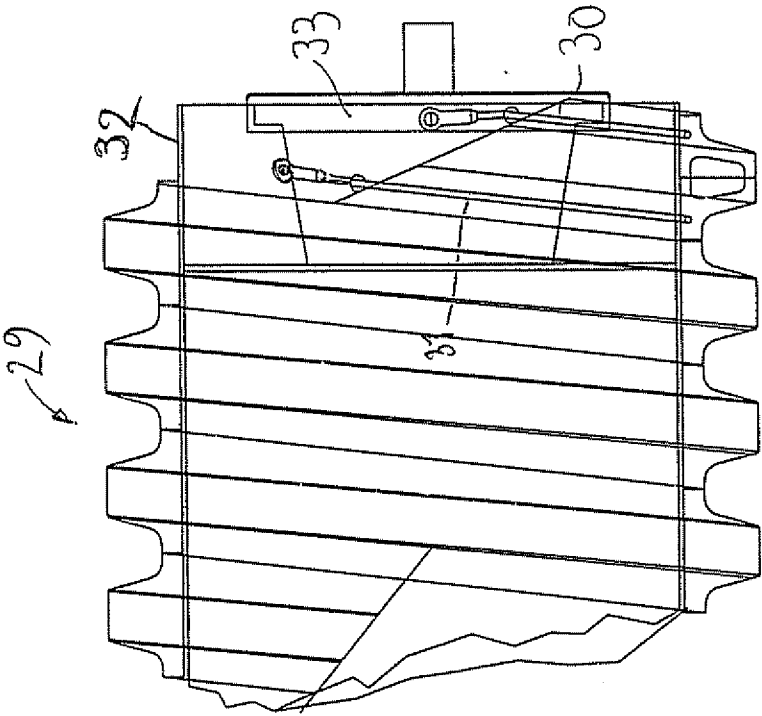


Fig 6

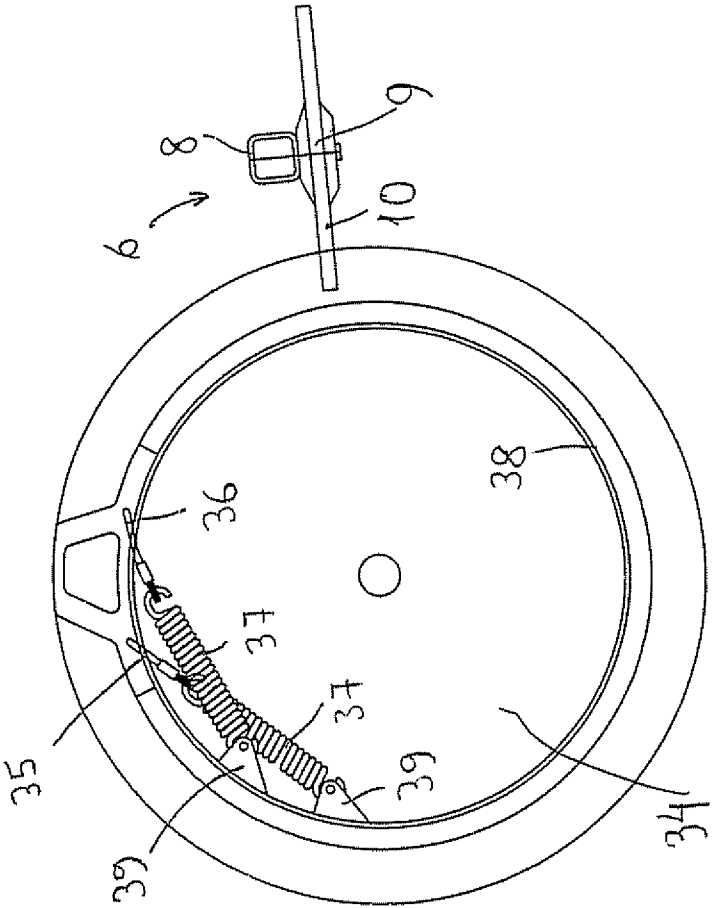


Fig 7

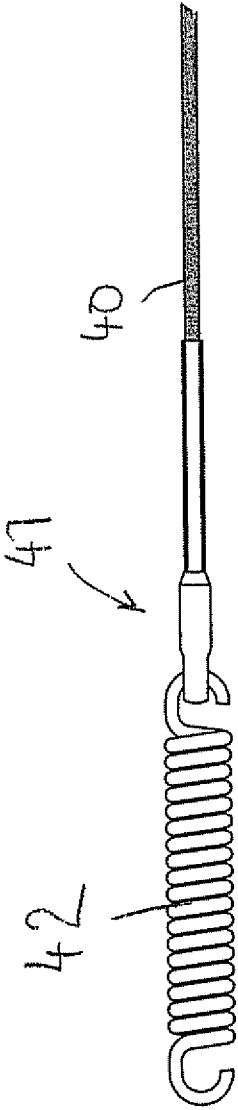


Fig 8

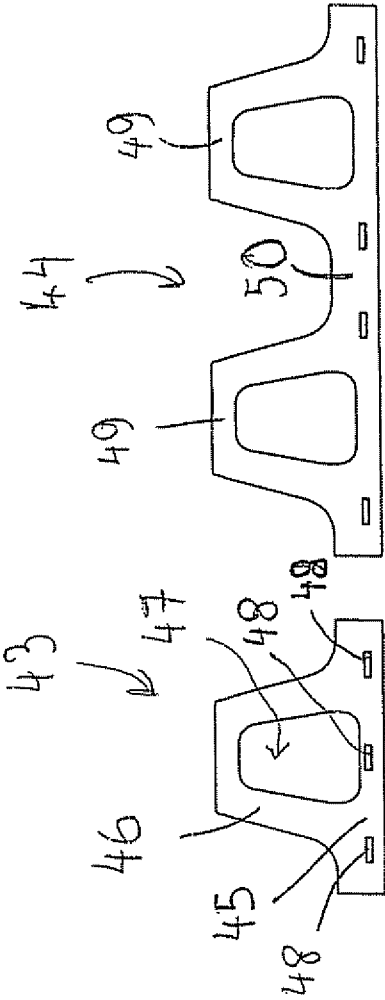


Fig 9

Fig 10

INTERNATIONAL SEARCH REPORT

International application No.

PCT/SE2007/050243

A. CLASSIFICATION OF SUBJECT MATTER

IPC: 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)

IPC: A01B

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

SE,DK,FI,NO classes as above

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

EPO-INTERNAL, WPI DATA, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	EP 1380198 A1 (OTICO), 14 January 2004 (14.01.2004), figures 1-3, claim 2, paragraph (0026) --	1-6,9-11
A	DE 29615079 U1 (HENDLMEIER, K.), 6 February 1997 (06.02.1997), page 5, line 4 - line 13, figure 2 --	1-5
A	DE 29608373 U1 (HORT, C.), 29 August 1996 (29.08.1996), page 8, line 6 - line 8, figures 1,2 --	1,2
A	EP 0047981 B1 (GEBR. KÖCKERLING), 27 December 1984 (27.12.1984), claim 1 --	1,3,5

☒ Further documents are listed in the continuation of Box C.☒ See patent family annex.

* Special categories of cited documents:	"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
"A" document defining the general state of the art which is not considered to be of particular relevance	"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
"E" earlier application or patent but published on or after the international filing date	"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
"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)	"&" document member of the same patent family
"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	

Date of the actual completion of the international search

4 July 2007

Date of mailing of the international search report

05 -07- 2007

Name and mailing address of the ISA/
 Swedish Patent Office
 Box 5055, S-102 42 STOCKHOLM
 Facsimile No. +46 8 666 02 86

Authorized officer

Magnus Thorén / MRO
 Telephone No. +46 8 782 25 00

INTERNATIONAL SEARCH REPORT

International application No.

PCT/SE2007/050243

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 2261893 A (N.E.W. NORMAN), 4 November 1941 (04.11.1941), whole document --	1,11
A	DE 3009589 A1 (AMAZONEN-WERKE H. DREYER GMBH & CO KG), 17 Sept 1981 (17.09.1981), claim 4 -- -----	10

International patent classification (IPC)**A01B 29/04** (2006.01)**Download your patent documents at www.prv.se**

The cited patent documents can be downloaded at www.prv.se by following the links:

- In English/Searches and advisory services/Cited documents (service in English) or
- e-tjänster/anförda dokument(service in Swedish).

Use the application number as username.

The password is **JEQCOQQSUJ**.

Paper copies can be ordered at a cost of 50 SEK per copy from PRV InterPat (telephone number 08-782 28 85).

Cited literature, if any, will be enclosed in paper form.

INTERNATIONAL SEARCH REPORT

Information on patent family members

28/05/2007

International application No.

PCT/SE2007/050243

EP	1380198	A1	14/01/2004	FR	2841733 A,B	09/01/2004
DE	29615079	U1	06/02/1997	NONE		
DE	29608373	U1	29/08/1996	NONE		
EP	0047981	B1	27/12/1984	AT	10893 T	15/01/1985
				DE	3034216 A	06/05/1982
US	2261893	A	04/11/1941	NONE		
DE	3009589	A1	17/09/1981	NONE		