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Description

[0001] The invention relates to a surface covering with at least one plate section, wherein the plate section of the surface covering has, on its upper side, several growth furrows running in parallel to each other and the growth furrows have apertures allocated to them from the upper side of the surface covering to the underside of the surface covering, with several apertures being allocated to each growth furrow.

10 [0002] For areas to paved and planted up at the same time, joined paving elements are known which have apertures and/or growth furrows, thereby allowing plant growth as well as seepage of rainwater. In DE 10 2004 017 534 A1 such a road paving element is described, with at least one opening extending from a top surface that can be used by traffic to a parallel lower surface, wherein the opening is intended to allow plant growth on the road paving element. DE 68 07 472 U sets out a concrete slab as used primarily for the paving of rural agricultural roads with less traffic. In order to also allow safe driving on these roads in the rain and when they are dirty, the concrete plate has recesses perpendicular to the direction of the roadway. DE 1964731 U shows a grass paver, called a
20 hard grass plate, with a symmetrical roof-shaped sloping side and a recess congruent to this side, which can be laid adjacently in a particular roadway direct as a type of joined paving. In order to allow growth, these grass pavers should have grooves on one plate surface, with apertures provided in these grooves. In a further embodiment the grooves should be parallel and arranged
25 in the roadway direction, wherein the apertures of adjacent grooves are offset with regard to each other.

[0003] Both DE 10 2004 017 534 A1 and also DE 68 07 472 U und DE 1964731 U meet the conditions for paved surfaces required for environmental and nature protection reasons, but pavings such as these often exhibit low dimensional stability and incur high maintenance costs. This is particularly important in the case of flotsam storage areas on dykes. Due to erosion resistance the flotsam storage area must be based on cohesive ground. A substrate of

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highly resilient stone mixtures is not suitable because of the risk of washing out. Particularly in the case of precipitation, the paving stones must be laid on ground with a low load bearing capacity and are then for the purpose of clearing the surface, particularly at times of high precipitation, driven on and damaged, which in turn makes the clearing of flotsam storage areas more difficult the next time.

[0004] In contrast, particularly for extensive areas of surface coverings slip forming machines or suchlike are preferable used, which endlessly produce cost-effective, continuous surface coverings with a high bearing capacity and bending stiffness in situ. A piece of construction equipment of this type with further developed means for the mounting and removal of interchangeable slip forming devices is set out in DE 196 44 397 A1. A surface covering produced with a slip forming machine is evident from EP 1522630 A2. This discloses edge reinforcement for roads or tracks to be produced continuously in the longitudinal direction of the road. The edge reinforcement adjoins the road with a first longitudinal side, while with the second side, facing away from the road, the soil extending to the road is delimited, so that a growth-free road margin on which even heavy vehicles can travel is created. On its upper side, this edge reinforcement can have recesses running perpendicularly to the longitudinal direction in order for surface water to drain off laterally. In order to be able to erect traffic sign posts, apertures with a cross-section matching the traffic sign posts are provided. In addition to the production of surface coverings such as roads or cycle paths, various monolithic profiles, such as concrete protective walls, kerbstones or drainage channels can also be produced. However, common to all profiles and coverings produced with a slip forming machine is that they form a closed surface and therefore seal off the area to be paved. The growing of plants, as with grass pavers or other forms of paving in which the stone are laid at a distance from one another, is not possible, and precipitation water is disadvantageously drained to the sides.

[0005] The aim of the invention is to provide a surface covering which is simple to produce and also allows the planting as well as reinforcement of an area.

[0006] This task is solved with a surface covering with the features of claim 1. The solution also includes a method of producing the surface covering with the features of claim 7 and a slip forming device with the features of claim 12. Advantageous further developments of the invention are described in the sub-claims.

[0007] In accordance with the invention, the surface covering with at least one plate section, wherein the plate section of the surface covering has, on its upper side, several growth furrows running in parallel to each other and the growth furrows have apertures allocated to them from the upper side of the surface covering to the underside of the surface covering, with several apertures being allocated to each growth furrow, is characterised in that the surface covering with the growth furrows and the apertures is formed as an unbroken surface covering produced in a continuous manner on a substrate, and in that the growth furrows are arranged in the direction of production of the surface covering.

[0008] Soil can be introduced into the growth furrows running parallel to one another and, in turn, plants can colonise the soil and provide the surface cover with greenery. For this, the growth furrows have a defined width and depth. The width of the growth furrows is preferably between 1 and 10 cm, more particularly between 1.5 and 8 cm, more particularly between 2 and 6 cm, more particularly between 2.5 and 4 cm. In a preferred form of embodiment the depth of the growth furrows corresponds to at least one twentieth of the width, more particularly at least one tenth of the width, more particularly at least one fifth of the width, more particularly half the width, more particularly the depth is at least equal to the width.

[0009] The apertures assure a connection with the soil located beneath the surface covering and therefore rooting of the plants located in the growth furrow in the soil beneath the finished surface covering, so that any plant cover on the surface covering also survives longer dry periods without watering. Because of the apertures and the associated root growth the plants can rely on large nutri-

ent stores in the soil, which in turn encourages plant growth on the surface covering. In addition, precipitation water can be drained off via the apertures. With the combination of growth furrows and apertures, optimum and lasting plant growth on the surface covering is guaranteed.

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[0010] Though the production of the surface covering on site, it is particularly cost-effective to produce and can be individually adapted to the local circumstances so that optimised solution are possible for the most varied of applications. In addition the time and personnel requirement for producing the surface
10 covering is advantageously reduced compared with laying joined paving.

[0011] A plate section of the produced surface covering can be a singly produced section of several plate sections or a contiguously produced surface covering separated by dummy joints. Usually the dummy joints consist of incisions
15 in the finished surface covering with a depth of 20 % to 25 % of the thickness of the surface covering. Due to the influence of weather, e.g. temperature differences, these dummy joints rupture and form the individual plate section. As on rupturing of the dummy joints an uneven rupture edge is formed, the individual plates sections “mesh” with each other so that transverse forces can be trans-
20 mitted from one plate section to the next plate section and the individual plate sections are held in at least three directions. To ensure “meshing” of adjacent plate sections of the surface covering, the plate sections can also have profiled lateral walls. In this way forces acting on one plate section are taken up by as large an area of the entire surface covering as possible.

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[0012] For even plant growth on the surface covering the parallel growth furrows must be arranged at equal distances from one another. According to a further development, it is envisaged that the growth furrow are designed in a fluted manner. The growth furrows thus have a trapezoidal cross-section in which the
30 base area of the growth furrow is narrower than the free area which finishes with the upper side of the surface covering. The angle of the oblique surface of the trapezium is preferably between 30° and 80°, more particularly between 40° and 70°, more particularly between 50° and 60°. Alternatively to the fluted

shape semi-circular or rectangular growth furrows preferably with rounded or chamfered edges or other forms of embodiment of growth furrow are possible.

5 [0013] In the same way as the growth furrows are arranged at an equal distance from one another, according to a further development the apertures in a growth furrow are also arranged at an equal distance from one another, through which in turn more even plant growth on the surface covering is made possible as the plants can develop more even roots.

10 [0014] Through producing the surface covering in situ it is advantageously achieved that in a boundary area on the underside of the surface covering a connection with the substrate is formed. Compared with paving that only lies on the substrate, better dimensional stability of the surface covering on the substrate is achieved.

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[0015] It is also envisaged that the surface covering comprises at least one concrete. This material makes it possible to simply and quickly produce the profile with the growth furrows. The thickness of the surface covering in a preferred embodiment is at least 10 cm, more particularly at least 15 cm, more particularly
20 at least 20 cm.

[0016] The invention also comprises a method of producing the surface covering with at least one plate section in which concrete is supplied to a slip forming device of a slip forming machine and formed by a forming unit of the slip forming device as an endless strip for producing the surface covering, wherein the
25 concrete supply and concrete forming take place continuously in a production direction, during the forming of the concrete with the slip forming device, on the upper side in the direction of production several growth furrows running in parallel to one another are formed in the surface covering, and in another processing step, in the region of the growth furrows of the formed surface covering, apertures are incorporated from the upper side of the surface covering to the lower side of the surface covering. Through the continuous production and the thus
30 simply produced particularly large plate sections, compared with joined paving,

a greater bearing capacity with simultaneous optimum plant covering of the surface covering can be guaranteed.

5 [0017] In order to prevent spalling and damage on the edges of the surface covering, the growth furrows are preferably formed in a fluted manner in the surface of the surface covering. In addition, in the production direction a profile can be formed in the surface covering via which "meshing" with other adjoining plate sections of the surface covering takes place.

10 [0018] As opposed to the concrete feeding and concrete forming, the introduction of the apertures preferably takes place discontinuously, i.e. the part of the slip forming device for incorporating the apertures operates largely independently of the forming unit. This discontinuous operating mode is necessary in order to be able to incorporate the apertures vertically into the surface covering.
15 ing.

[0019] In order to introduce the aperture into the surface covering, preferably lances are pressed into the surface covering which then form the apertures. For the time during which the lances form the apertures, the part of the slip forming
20 device with the lances for introducing the apertures remains in position at a point above the not yet hardened surface covering. As soon as the lances are lifted out of the surface covering, the lances for incorporating further apertures are moved to catch up with the forming unit of the slip forming device. Once the lances are located completely above a newly produced section of the surface
25 covering the part of the slip forming device with the lances stops and further apertures are introduced into the surface as described above.

[0020] According to a further development, the lances are shaken on pressing into the surface covering, whereas on lifting out of the surface covering no shaking
30 takes place. This achieves that the lances can be particularly easily introduced into the surface covering without deforming or otherwise damaging it. In contrast, on removal a shake-free lifting movement is necessary so that the ap-

erture is preserved and not closed again through slipping of the material of the surface covering caused by shaking.

[0021] The invention also relates to a corresponding slip forming device for a slip forming machine with which a surface covering can be produced in accordance with the method described above. This slip forming device has a profiled slip form pan. According to the invention the profile of the slip form pan is formed by raised sections projecting from a plane on the side of the slip form pan facing surface covering to be produced, wherein with the raised sections growth furrows can be formed, whereby the raised sections are arranged in parallel to each other in the direction of production. In addition, the slip forming device in accordance with the invention has perpendicular lances in order to incorporate apertures into the surface covering, wherein in the direction of travel and production the lances are arranged flush behind the raised sections of the slip form pan of the slip forming device.

[0022] The raised sections represent the negative of the growth furrows introduced into the surface covering, so that details relating to the design of the raised sections are equivalent to design of the growth furrows. From this it also follows that the raised sections are arranged at an equal distance from one another and thus result in even plant growth on the surface covering. Through the flush arrangement of the lances and the raised sections it is ensured that the lances are guided to the device for introducing the apertures above the growth furrows formed by the profile of the slip form pan. The apertures are therefore arranged in the area of the growth furrows of the surface covering. In addition, the raised sections are preferably designed in a fluted manner, with their trapezoidal cross-section being in connected with the broad side of the trapezium on the plane of the slip form pan. The lateral forming elements of the forming unit can have further profiled structures.

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[0023] The lances are preferably arranged in a perpendicularly movable manner on the device for introducing the apertures and are characterised in that a shaking mechanism is assigned to the lances which ensures that the material of

the surface covering is displaced on introduction of the lances. In order to be able to facilitate the incorporation of the lances into the surface covering, the lances can be pointed at the free end projecting towards the surface covering. For simpler lifting of the lances out of the surface covering they can advantageously have a conical form. The diameter of the lances preferably corresponds maximally to the width of the growth furrows or, in particular, the base area of the growth furrows.

[0024] The device for introducing the aperatures can be designed as a trailing part of the slip forming device or as a separate device movable independently of the slip forming machine.

[0025] One example of embodiment of the invention exhibiting further inventive features is shown in the drawing, where

Fig. 1: shows a perspective view of a slip forming machine with a slip forming device in accordance with the invention as well as the surface covering produced with this slip forming device;

Fig. 2: shows a view from above of a slip forming machine with the slip forming device in accordance with the invention;

Fig. 3: shows a side view of a slip forming machine with a slip forming device in accordance with the invention;

Fig. 4: shows a perspective view of the surface covering in accordance with the invention;

Fig. 5: shows a detailed view of a cross-section of the surface covering; and

Fig. 6: shows a detailed view from above of the surface covering.

[0026] Fig. 1 shows a slip forming device 1 for forming a surface covering 18 which is mounted on a slip forming machine 2. This slip forming machine 2 comprises a drive unit 3 and an operator panel 4 which are arranged on a common bearing frame 5. The bearing frame 5 is borne by hydraulic caterpillar tracks 6, of which two hydraulic caterpillar tracks 6 are arranged between the drive unit 3 and the operator panel 4. Two further hydraulic caterpillar tracks 6 are connected via a movable forward track suspension 7 to the bearing frame 5. Each of these hydraulic caterpillar tracks 6 consist of the caterpillar track itself, a lifting device and steering device. Via the lifting device of the hydraulic caterpillar track 6 the bearing frame 5 of the slip forming machine 2 can be lifted and lowered.

[0027] The arrangement and structure of the movable forward track suspension 7 are made particularly clear in figures 2 and 3. From figures 2 and 3 it can also be seen that in addition to the two forward hydraulic caterpillar tracks 6, a concrete feed 8 is mounted on the movable forward track suspension 7. The concrete feed 8 in the illustrated example of embodiment is a screw-type conveyor or a conveyor belt which is movably fastened to the movable forward track suspension 7. With the movable forward track suspension 7 the position of the forward hydraulic caterpillar track 6 can be adjusted to the operating situation. In the same way as the forward hydraulic caterpillar track 6, the rear hydraulic caterpillar tracks 6 fastened to the bearing frame 5 can also be adjusted to different operating situations. In figure 2, for example, one of the rear hydraulic caterpillar tracks 6 is laterally exposed.

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[0028] The slip forming device 1 is attached to the bearing frame 5 of the slip forming machine 2 by way of the form suspension 9. The slip forming device 1 comprises a concrete receiving hopper 10, a forming unit 11 arranged below the concrete receiving hopper 10 with lateral forming elements 12 adjoining in the direction of production and the internally located slip form pan 16.

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[0029] Also assigned to the shown form of embodiment of the slip forming device 1 is a device 13 for introducing apertures 20 which is arranged on two run-

ning rails 15 in a movable manner behind the forming unit 11 in the direction of travel and production. Each of the running rails 15 is fastened by one end to the forming unit 11. Arranged under the device 13 are vertically movable lances 14 which can be retracted into the device 13 and are shown in figure 3.

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[0030] Figures 4 to 6 show a produced surface covering 18. Shown in particular are the growth furrows 19 introduced into the surface covering 18 and apertures 20 provided at regular interval in the growth furrows 19. Figure 5 and figure 6 each show an example of embodiment of the surface covering which differ
10 from one another through the different diameter of the introduced apertures 20. Whereas the aperture 20 in figure 5 has a width that is equal the side of the base area 22 of the growth furrow 19, the diameter of the apertures 20 in fig. 6 is smaller than the width of the base area 22. The angle of the lateral oblique surfaces 21 which at the same time delimit the width of the base area 22, is ap-
15 proximately 60° in each case. Common to both examples of embodiment is the advantageous design of the growth furrows 19 in a fluted manner with a trapezoidal cross-section.

[0031] To produce the surface covering 18, the slip forming machine 2 travels
20 over a pre-determined path and carries the slip forming device 1 with it. Traveling ahead of the slip forming machine 2 in the direction of travel is a travelling mixer which provides the concrete for the concrete feed 8 of the slip forming machine 2. Via the concrete feed 8, concrete is conveyed to the concrete receiving hopper 10 of the slip forming device 1. From the concrete receiving
25 hopper 10 the concrete slides into the forming unit 11 in which the concrete is compacted by an internal shaker and is formed by the lateral forming elements 12 as well as the slip form pan 16 into the surface covering 18. During this, through raised sections under the slip form pan 16 on the side facing the surface covering 18 growth furrows 19 are moulded into the surface covering 18.

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[0032] Following on from the forming of the surface covering 18 with the growth furrows 19, the apertures 20 are introduced into the surface covering 18. For this, the device 13 which trails the forming unit 11 of the slip forming device

1 and is movably connected to the forming unit 11 on running rails 15, is through displacement on the running rails 15 held in position at one point and the lances 14 assigned to the device 13 can, through the lowering of the latter, be incorporated into the surface covering 18. In doing so the device 13 remains
5 in one position, without moving forward together with the continuously operating slip forming machine 2 and the forming unit 11, until the lances 14 are lifted out of the surface covering 18 again. In order to displace the material of the surface covering 18 on introduction of the apertures 20 with the lances 14, the lances 14 are shaken while being lowered. In contrast, the lances 14 are lifted out of
10 the surface covering 18 without shaking. The lances 14 of the device 13 are arranged in such a way that they are centrally located above the growth furrows 18 moulded into the surface covering 18. The apertures 20 are thus located in the area of the growth furrows 19. Once the apertures 20 have been introduced into the surface covering 18 and the device 13 has been lifted out again, it travels
15 on the running rails 15 into the next position. The process of introducing the apertures 20 is repeated depending on the section to be produced, whereby the distance between the apertures 20 in a growth furrow 19 remains the same over the entire section to be produced.

Patentkrav

1. Overfladebelægning med mindst ét pladeafsnit, hvor dette pladeafsnit i overfladebelægningen (18) på oversiden har flere parallelt med hinanden forlø-
5 bende bevoksningsriller (19), hvilke bevoksningsriller (19) er forsynet med gennem-
brydninger (20), som strækker sig fra oversiden til undersiden af overflade-
belægningen (18), **kendetegnet ved, at** hver bevoksningsrille (19) har flere
gennembrydninger (20), og
- 10 at overfladebelægningen (18) med bevoksningsriller (19) og gennembrydninger
(20) udgøres af en ubrudt overfladebelægning, der er fremstillet på et sted på
kontinuerlig måde på et substrat, og hvor bevoksningsrillerne (19) er anbragt i
overfladebelægningens (18) produktionsretning.
- 15 2. Overfladebelægning ifølge krav 1, **kendetegnet ved, at** bevoksningsriller-
ne (19) er anbragt med ens afstand fra hinanden.
3. Overfladebelægning ifølge krav 1 eller 2, **kendetegnet ved, at** bevoks-
ningsrillerne (19) er udformet på hvælvet måde.
- 20 4. Overfladebelægning ifølge et af kravene 1 til 3, **kendetegnet ved, at** de
gennembrydninger (20), som er anbragt i en bevoksningsrille (19), er anbragt i
ens afstand.
- 25 5. Overfladebelægning ifølge et af kravene 1 til 4, **kendetegnet ved, at** der i
et grænseområde ved undersiden af overfladebelægningen (18) er tildannet en
forbindelse til det underliggende substrat.
6. Overfladebelægning ifølge et af kravene 1 til 5, **kendetegnet ved, at** over-
30 fladebelægningen (18) i det mindste omfatter en beton.
7. Fremgangsmåde til fremstilling af en overfladebelægning med mindst ét
pladeafsnit ifølge et af kravene 1 til 6,

og hvor beton tilføres til en glideforskallingsindretning (1) i en glideforskallingsmaskine (2) og formes af en forskallingsenhed (11) i glideforskallingsindretningen (19), idet der dannes en endeløs streng til dannelse af overfladebelægningen (18),

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og hvor betontilførslen og betonformningen sker i én produktionsretning,

kendetegnet ved

at der ved formningen af betonen ved hjælp af glideforskallingsindretningen (1),
10 i oversiden af overfladebelægningen i produktionsretningen tildannes flere parallelt med hinanden forløbende bevoksningssriller (19), og

at der i området for bevoksningssrillerne (19) på den formede overfladebelægning (18) tildannes gennembrydninger (20) fra oversiden af overfladebelægningen
15 til undersiden af denne overfladebelægning.

8. Fremgangsmåde til fremstilling af en overfladebelægning ifølge krav 7,
kendetegnet ved, at bevoksningssrillerne (19) er udformet som hvælvinger i
overfladen af overfladebelægningen (18).

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9. Fremgangsmåde til fremstilling af en overfladebelægning ifølge et af kravene 7 eller 8, **kendetegnet ved, at** tildannelsen af gennembrydningerne (20) foretages diskontinuerligt.

25 10. Fremgangsmåde til fremstilling af en overfladebelægning ifølge et af kravene 7 til 9, **kendetegnet ved, at** der i overfladebelægningen (18) indtrykkes lanseorganer (14), som former gennembrydningerne (20).

11. Fremgangsmåde til fremstilling af en overfladebelægning ifølge et af kravene 7 til 10, **kendetegnet ved, at** lanseorganerne (14) under indtrykningen i
30 overfladebelægningen (18) rystes, og at der ved udtrækningen af lanseorganerne fra overfladebelægningen (18) ikke foretages nogen rystning.

12. Glideforskallingsindretning til en glideforskallingsmaskine, især til udøvelse af fremgangsmåden ifølge et af kravene 7 til 11, og som har en profileret formsål (16),

5 **kendetegnet ved,**

at formsålens (16) profil er tildannet ved hjælp af fra et plan udragende forhøjninger ved den side af formsålen, som vender mod et overfladelag (18), der skal færdiggøres, og hvor der ved hjælp af forhøjningerne kan formes bevoksningsriller (19),

at forhøjningerne forløber parallelt med hinanden i fremstillingsretningen,

at glideforskallingsindretningen (1) har lodrette lanseorganer til frembringelse af gennembrydninger (20) i overfladebelægningen (18), og

at lanseorganerne (14) i køre- og fremføringsretningen er indrettet flugtende med hinanden bag ved forhøjningerne på formsålen (16) i glideforskallingsindretningen (1).

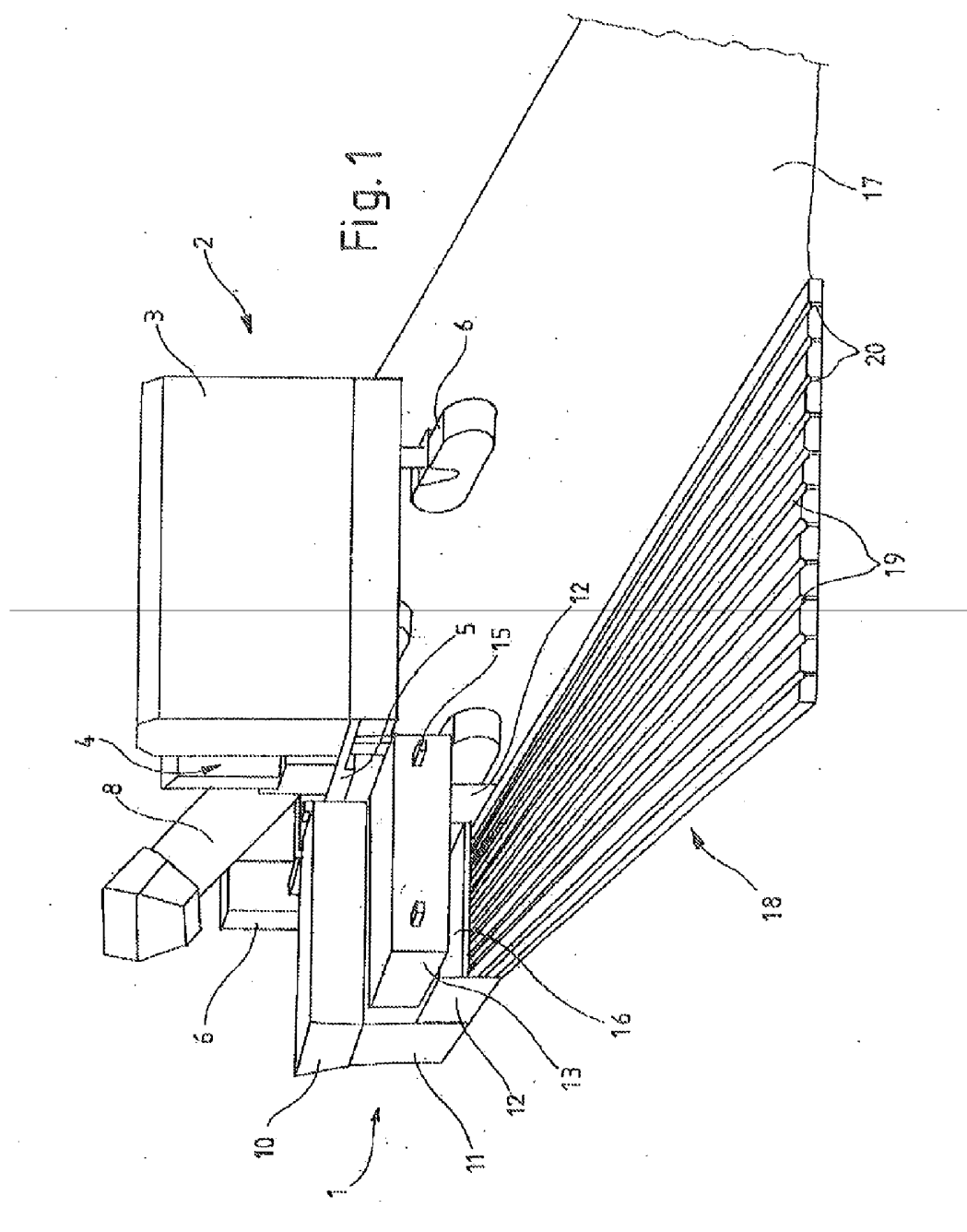
20

13. Glideforskallingsindretning ifølge krav 12, **kendetegnet ved, at** forhøjningerne er udformet som hvælvinger.

14. Glideforskallingsindretning ifølge krav 12 eller 13, **kendetegnet ved, at** forhøjningerne er indrettet i ens afstand fra hinanden.

25

15. Glideforskallingsindretning ifølge et af kravene 12 til 14, **kendetegnet ved, at** lanseorganerne (14) er indrettet lodret bevægelige, og at lanseorganerne (14) er tilforordnet en rystemekanisme.



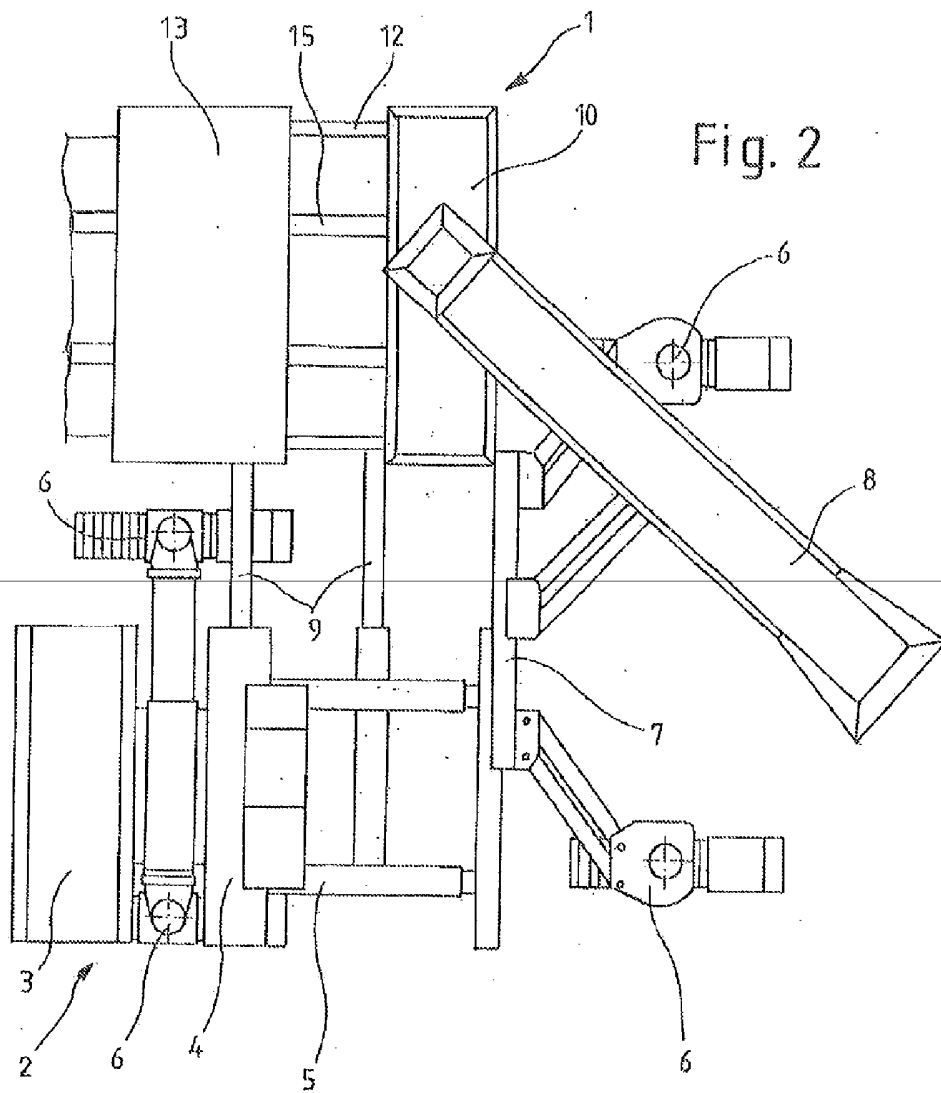


Fig. 3

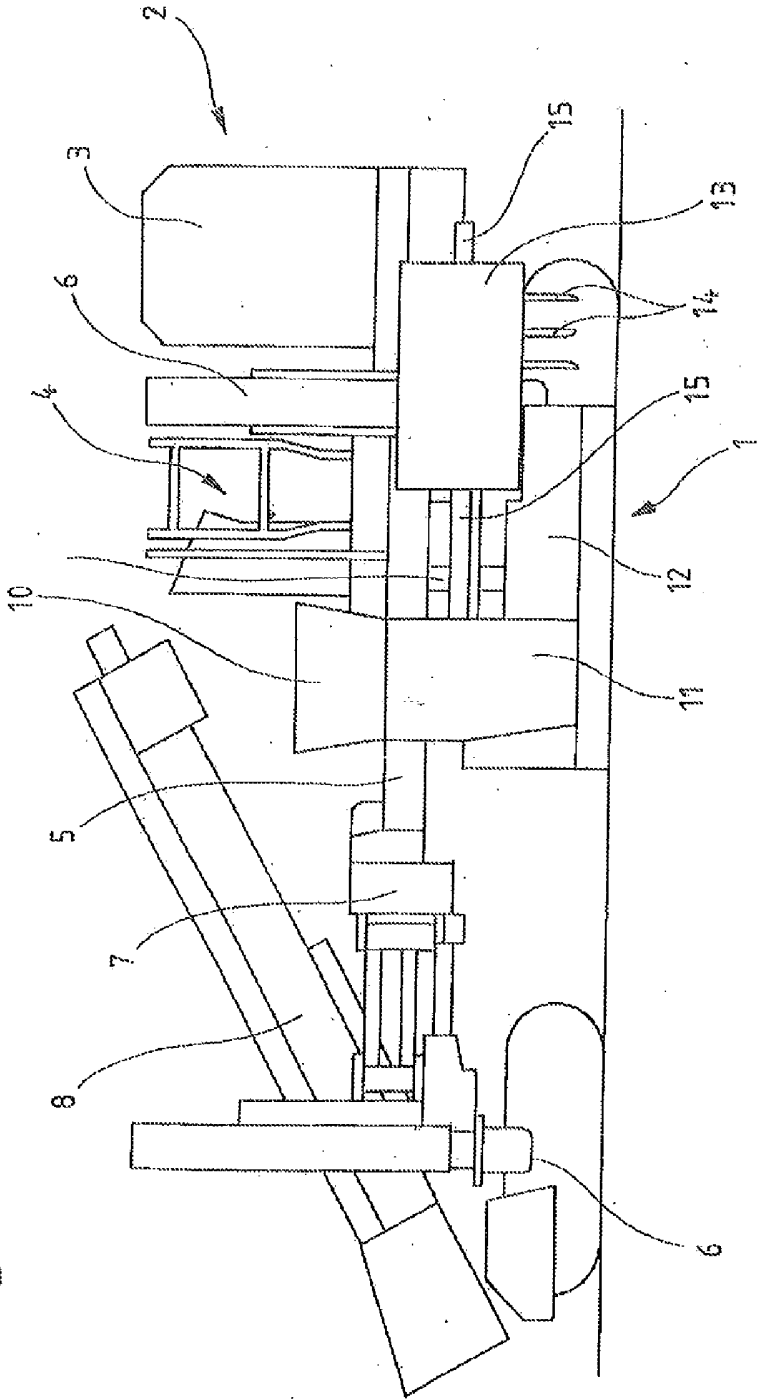


Fig. 4

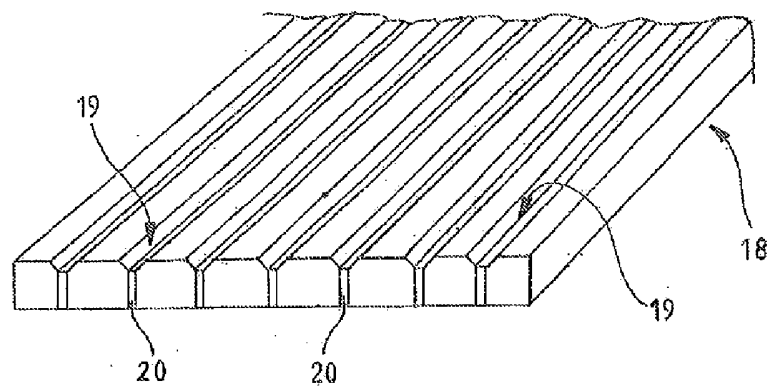


Fig. 5

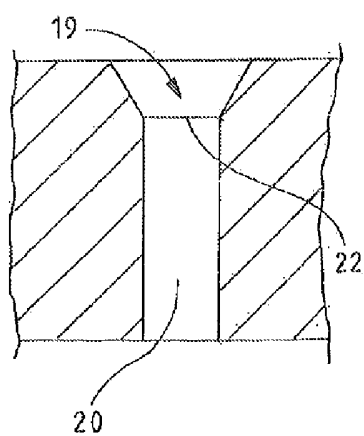


Fig. 6

