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(73) Patenthaver: **Rekers Verwaltungs GmbH & Co. KG, ., Gerhard-Rekers-Str. 1, 48480 Spelle, Tyskland**

(72) Opfinder: **FOPPE, Norbert, Löchteweg 6, 48480 Spelle, Tyskland**

(74) Fuldmægtig i Danmark: **Larsen & Birkeholm A/S Skandinavisk Patentbureau, Banegårdspladsen 1, 1570 København V, Danmark**

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Oscillating grate for a Feed box of a Block making machine

The present invention relates to a feed box of a block making machine with an oscillating grate, wherein the oscillating grate has an oscillating grate carriage with an oscillating grate linkage, and the oscillating grate carriage is connected to an actuator, which is e.g. known from DE 927560 C.

Block making machines are known in the prior art in a variety of embodiments. Basically, it all comes down to, in a synchronized process, provide a block forming mould, fill a concrete mass into the moulding cavities of the block forming mould, compact the concrete mass with a plunger and/or a vibrating apparatus, and subsequently demould the final concrete products that were produced by this, the so-called moulded products. Here, it has been proven successful to feed support pallets to the block making machines and to put block forming moulds, that are open at the top and the bottom, onto the support pallets. The concrete mass is filled from concrete hoppers into one or more feed boxes and is filled from the feed boxes into the block forming mould. Subsequently, the support pallet undergoes jolting by a vibrating unit and/or a plunger is lowered into the block forming mould. In this way, the concrete is compacted in the block forming mould. In the next step, the plunger and the mould are raised, and the support pallet together with the moulded products are removed from of the block making machine.

Here, the quality and the strength of the moulded products depend heavily on the filling of the block forming mould by the feed box. Since the material pressure, which is related to the filling level in the feed box, decreases during the travel of the feed box or rather with the progression of the filling of the block forming mould, the moulding cavities that are situated downstream in the filling travel direction will be filled to a lesser extent. Thus, there will unintendedly be obtained a filling level which is declining across the width of the block forming mould to be filled. This problem in particular arises when high or narrow block forming moulds are to be filled. The varying mass distribution across the block forming mould as well as the resulting mass difference have a negative effect on the block density and its optics, and may also have an adverse effect on the subsequent processes.

In order to minimize these problems as much as possible, it has proven successful the use so-called oscillating grates. To this end, during the filling operation an oscillating grate carriage having a linkage substantially moves horizontally back and forth within the feed box. This causes that the raw material can to be uniformly distributed into the block forming mould. The oscillating grate carriage is actuated by an actuator that is connected to the oscillating grate carriage.

A known oscillating grate is e.g. shown in JP 2003 127 128 A. Here, the oscillating grate includes an oscillating grate carriage with an oscillating grate linkage, a connecting rod, and an actuator performing a rotary motion. The connecting rod includes a connecting bar, a joint rocker, and a drive rocker that is connected to the actuator. The connecting bar is fastened via a first joint connection to the oscillating grate carriage. The connecting bar is fastened to the joint rocker via a second joint connection, wherein the joint rocker is fastened via a third joint connection to a static bearing. The drive rocker is fastened via a fourth joint connection to the joint rocker.

However, the oscillating grates known from prior art have the drawback that the horizontal travel component of the oscillating grate, which can vary according to the width or length of the product, can only be adjusted with great difficulties, or even not at all. Further, the force required to move the raw material is also given by the physical properties of the raw material. Thus, a concrete having a larger density will require the use of a larger force to move it. To this, as well, the known oscillating grates can be adjusted only in a limited way or not at all. And finally, for the oscillating grates known from prior art, there is an increased wear of the guides of the oscillating grate carriage on the feed box.

Given these circumstances, it is an object of the invention to provide a feed box of a block making machine with an oscillating grate which does not suffer from the previously described drawbacks.

The solution to the problem is achieved by a device according to claim 1. Advantageous embodiments of the invention are described in the dependent claims.

The feed box with an oscillating grate according to the invention differs from the initially described feed boxes in that the oscillating grate carriage is horizontally guided by sliding guides. This configuration is advantageous in that a rotary motion of the actuator is transformed into a horizontal movement of the oscillating grate, since by means of the static bearing of the joint rocker as well as the other joint connections, the system basically loses a degree of freedom. Thus, the vertical component of the force on the oscillating grate carriage is restricted, which has a positive effect on the service life of the guides.

Further, an oscillating grate according to the invention is advantageous in that an excitation of the mould in the vertical direction via the pallet by the vibrating table unit, by which an improved filling of the block forming mould with the raw material is intended, could be entirely omitted. Thus, the block making machine can be operated under optimal conditions yet using less energy.

Advantageously, the connecting bar and the joint rocker have at least two, preferably three coupling points for the second joint connection. Thus, the position of the joint connections can be changed. This can be done in a fairly easy way by changing the position or the coupling point of the joint connection. By this change of position, the horizontal travel component of the oscillating grate carriage can be adjusted and at the same time the force that is applied can also be altered by changing the lever arm. In other words, the horizontal component of the travel and force of the oscillating grate can be altered by changing the amplitudes of movement.

Advantageously, the joint rocker includes at least two coupling points for the fourth joint connection. This results in additional setting options for adjusting the horizontal component of the travel and force by changing the position of the joint connection on the joint rocker. By suitably choosing a number and a position of coupling points, there will thus be created e.g. 3 x 2 different coupling options. By changing the position of the second and/or fourth joint connection on the joint rocker such that their distance to the third joint connection is increased, the horizontal travel component is also increased. In doing so, at the same time the horizontal force component is decreased. Thus, the horizontal travel component, which may vary according to the width or length of the final product, can easily be adjusted. Moreover, also the horizontal force component of the oscillating grate can be adapted to a variety of different concrete mixtures. Thus, an adaptation of the oscillating grate to a variety of block forming moulds and accordingly also to the moulded products that are to be produced can also be achieved easily.

Advantageously, the connecting bar comprises an L-shaped or T-shaped link piece, with the coupling points for the second joint connection being arranged within the area of the link piece. Such an arrangement is space-saving and allows to couple the connecting bar to the joint rocker in a simple and secure manner.

Advantageously, the drive rocker is eccentric. This is advantageous in that a rotary motion is transformed by the eccentric rocker into a horizontal or rather a linear movement.

Thus, a vertical travel component and a vertical force component, which would be acting on the guides of the oscillating grate carriage, will substantially be eliminated.

Any conceivable actuator, such as an electric motor or a hydraulic motor, may be used. Preferably, the actuator is a hydraulic motor. Hydraulic motors are advantageous in that they are space-saving and offer a high torque. A hydraulic motor is capable to provide a very large force which an electric motor of the same size is not capable to provide. Moreover, the rotary speed of the hydraulic motor can be adjusted by means e.g. of a throttle valve. Hydraulic motors are

further advantageous in that the output torque can be adjusted without changing the rotary speed.

It is advantageous to configure the joint connections as pin connections, in particular as socket pin connections and/or screw bolt connections. Pin connections allow to change coupling points of the joint connections in a simple and quick manner. Thus, by changing the position of the pins from one coupling point to another, the horizontal component of the travel and force of the oscillating grate carriage can be adjusted in a simple manner. However, since for the first and third joint connections usually a change of coupling points will not be carried out, it is conceivable to configure these joint connections as screw bolt connections or the like.

Basically, an oscillating grate carriage can be arranged in the feed box in an arbitrary manner, e.g. it is also possible to arrange one or two oscillating grate carriages on the left and/or the right-hand side. Advantageously, one oscillating grate carriage is arranged in the center of the feed box. By arranging the oscillating grate carriage in the center, the movement of the oscillating grate is acting on the raw material in an optimal manner, and thus a uniform filling of the moulding cavities of the block forming mould will be achieved.

According to the invention, the oscillating grate carriage is horizontally guided in a sliding guide, e.g. a slide bushing, linear ball bearing, etc. Due to the reduction of the vertical force component according to the invention, the sliding guide can here be used without additional lubrification.

It is advantageous to attach the oscillating grate linkage to the oscillating grate carriage in a releasable manner. This is advantageous in that, by changing the position of, or replacing, the linkage of the oscillating grate, an additional product-specific adaption can be carried out. In doing so, the filling of the moulding cavities with raw material is further improved as to variability and quality.

In the following, the invention is explained in detail using an embodiment shown in the drawing. In the drawing:

Fig. 1 schematically shows a perspective view of a block making machine; and
Fig. 2 schematically shows a side view of a feed box with an oscillating grate according to the invention.

Fig. 1 shows a block making machine 1 in a perspective view. The block making machine 1 comprises a movable main frame 2 that is attached to a static frame 32 and guided by it, and on

which two concrete hoppers 3, 4 are laterally arranged. The first hopper 3 serves to receive the so-called core concrete and the second hopper 4 serves to receive the so-called face concrete. Since usually the face concrete is applied as a thin covering layer onto the core concrete, the face concrete hopper 4 has a smaller volume than the core concrete hopper 3.

Support pallets 6 are fed to the block making machine 1 in a synchronized way via a conveyor 5. The support pallets 6 are halted on a vibrating table 7 arranged in the center of the block making machine 1 and serve to receive the moulded products 8.

Below each of the concrete hoppers 3, 4, one feed box 9 is arranged which is represented in more detail in Fig. 2. The feed box 9 is filled with concrete from the hoppers 3, 4 via a filling device and is moved by an actuator towards the halted support pallet 6 or rather the vibrating table 7. There, the concrete in the feed box is poured into the moulding cavities of a block forming mould that is sitting on the support pallet 6.

After the block forming mould has been filled with concrete from the feed box 9, the concrete in the block forming mould can be compacted by a plunger and/or by moving the vibrating table 7. To this end, as shown in Fig. 2, the vibrating table 7 is being attached to the static frame 32 of the block making machine 1 by rubber-to-metal bonded elements 30. The actuation of the vibrating table 7 is performed by two unbalanced mass vibration generators 31 arranged under the vibrating table 7. In this embodiment, the unbalanced mass vibration generators 31 rotate in opposite directions, as is correspondingly indicated by arrows.

Subsequently, the block forming mould is raised and the support pallet 6 together with the moulded products 8 are removed by the conveyor 5.

As already mentioned, Fig. 2 shows a feed box 9 with an oscillating grate 10 according to the invention that is employed in the block making machine 1 shown in Fig. 1. The oscillating grate 10 comprises an oscillating grate carriage 11 and an oscillating grate linkage 12 and is arranged in the center of the feed box 9. For its actuation, the oscillating grate 10 is connected to an actuator 13 via a connecting rod 14.

The connecting rod 14 comprises a connecting bar 15, a joint rocker 16, and a drive rocker 17 that is connected to the actuator 13 and configured in the form of an eccentric rocker. The connecting bar 15 is connected to the oscillating grate carriage 11 via a first joint connection 18 and is connected to the joint rocker 16 via a second joint connection 19. The joint rocker 16 is rotatably connected to a static bearing 21 by a third joint connection 20. The static bearing 21 is a

part of the frame of the feed box 9. By a fourth joint connection 22 the joint rocker 16 is connected to the drive rocker 17.

It is particularly suitable to use a hydraulic motor as the actuator 13 which can provide a high torque of 900 Nm while having a small size.

The oscillating grate carriage 11 is horizontally guided in sliding guides 26 configured as slide bushings which are arranged on the frame of the feed box 9. By means of the described arrangement, a rotary motion DB generated by the actuator 13 is converted to a horizontal movement HB of the oscillating grate carriage 11, as also is correspondingly indicated by arrows.

For adjusting the horizontal component of the travel and force of the oscillating grate carriage 11, the connecting bar 15 and the joint rocker 16 comprise three coupling points 23 for the second joint connection 19. For this purpose, the connecting bar 15 comprises, at its end that is facing the actuator 13, an L-shaped link piece 25 in the area of which the coupling points 23 of the second joint connection 19 are arranged. For this purpose, the joint rocker 16 comprises corresponding coupling points 23. Further, the joint rocker 16 comprises two coupling points 24 for the fourth joint connection 22. In the illustration of Fig. 2, the connecting bar 15 is coupled to the joint rocker 16 at the central coupling point 19. Further, the drive rocker 17 is coupled to the joint rocker 16 at the lower coupling point 24. In order to allow a quick changing of the position for the second and fourth joint connections 19, 22, these are configured as socket pin connections with removable locking means. A simple changing of the position of the socket pins of the joint connections 19, 22 thus results in 3 x 2 options for the transformation of the rotary motion DB of the actuator 13 into a horizontal movement HB of the oscillating grate carriage 11, or rather into the horizontal force component of the oscillating grate carriage 11.

During an operation of the actuator 13 at a constant rotary speed and a constant torque, it is, depending on the width or the length of the block forming mould 27 that is used, possible to change the horizontal component of the travel and force of the oscillating grate carriage 11. For example, the horizontal travel component of the oscillating grate carriage 11 can be reduced by changing the position of the connecting pin of the second joint connection 19 to the lowest coupling point 23. This, at the same time, results in an increase of the horizontal force component.

The contrary will be achieved by changing the position of the connection pin of the second joint connection 19 to the uppermost coupling point 23. There will be an increase of the horizontal travel component while at the same time the horizontal force will be decreased.

Said horizontal movement HB of the oscillating grate carriage 11 causes the raw material 28 to be distributed in an optimal and uniformly manner into the moulding cavities of the block forming mould 27 that is sitting on the support pallet 6. In this embodiment, the block forming mould 27 has six moulding cavities per row, however, the oscillating grate 10 according to the invention can flexibly be adjusted to a variety of block forming moulds 27 having varying width, length, depth, and number of moulding cavities.

By detaching the connections 29, the oscillating grate linkage 12 can be detached from the oscillating grate carriage 11, and thus can be replaced, changed in position, or adjusted in height, whereby the variability and flexibility of the oscillating grate 10 according to the invention is further increased. For example, the connections 29 between the oscillating grate carriage 11 and the oscillating grate linkage 12 can be configured as screw connections or the like.

List of Reference Numbers

1	block making machine
2	movable main frame
3	hopper for core concrete
4	hopper for face concrete
5	conveyor
6	support pallet
7	vibrating table
8	moulded product
9	feed box
10	oscillating grate
11	oscillating grate carriage
12	oscillating grate linkage
13	actuator
14	connecting rod
15	connecting bar
16	joint rocker
17	drive rocker
18	first joint connection
19	second joint connection
20	third joint connection
21	static bearing
22	fourth joint connection
23	coupling point
24	coupling point
25	link

26	sliding guide
27	block forming mould
28	raw material
29	connection
30	rubber-to-metal bonded element
31	unbalanced mass vibration generator
32	static frame
DB	rotary motion
HB	horizontal movement

PATENTKRAV

1. Fyldekasse (9) i en stenformemaskine (9), hvor fyldekassen (9) udviser en rysterist (10), et plejlstangsystem (14) og en drivanordning (13), der udfører en drejebevægelse (DB), hvor rysteristen (10) udviser en rysteristslæde (11) med et rysteristtstangsystem (12), og rysteristslæden (11) via plejlstangsystemet (14) er forbundet med drivanordningen (13), der udfører drejebevægelsen (DB), hvor plejlstangsystemet (14) udviser en forbindelsesstang (15), en ledoscillator (16) og en drivanordningsoscillator (17), der er forbundet med drivanordningen,
hvor forbindelsesstangen (15) via en første ledforbindelse (18) er fastgjort på rysteristslæden (11), og forbindelsesstangen (15) via en anden ledforbindelse (19) er fastgjort på ledoscillatoren (16), og ledoscillatoren (16) via en tredje ledforbindelse (20) er fastgjort på et statisk leje (21), og drivanordningsoscillatoren (17) via en fjerde ledforbindelse (22) er fastgjort på ledoscillatoren (16), **kendetegnet ved, at** rysteristslæden (11) styres horisontalt i glideføringer (26), således at der sker en omsætning af drivanordningens (13) drejebevægelse (DB) til en horisontalbevægelse (HB) af rysteristslæden (11).

2. Fyldekasse (9) ifølge krav 1,
kendetegnet ved, at
forbindelsesstangen (15) og ledoscillatoren (16) udviser mindst to, fortrinsvis tre, koblingspunkter (23) til den anden ledforbindelse (19).

3. Fyldekasse (9) ifølge krav 1 eller 2,
kendetegnet ved, at
ledoscillatoren (16) udviser mindst to koblingspunkter (24) til den fjerde ledforbindelse (22).

4. Fyldekasse (9) ifølge krav 2 eller 3,
kendetegnet ved, at
forbindelsesstagen (15) udviser en L-formet eller T-formet lask (25), hvor koblingspunkterne (23) til den anden ledforbindelse (19) er anbragt i området af lasken (25).

5. Fyldekasse (9) ifølge et af de foregående krav,
kendetegnet ved, at
drivanordningsoscillatoren (17) er en excenteroscillator.

6. Fyldekasse (9) ifølge et af de foregående krav,
kendetegnet ved, at
drivanordningen (13) er en hydromotor og/eller en elektromotor.

7. Fyldekasse (9) ifølge et af de foregående krav,
kendetegnet ved, at
ledforbindelserne (18, 19, 20, 22) er boltforbindelser.

8. Fyldekasse (9) ifølge et af de foregående krav,
kendetegnet ved, at
rysteristslæden (11) er anbragt midt i fyldekassen (9).

9. Fyldekasse (9) ifølge et af de foregående krav,
kendetegnet ved, at
rysteriststangsystemet (12) er fastgjort aftageligt på rysteristslæden (11).

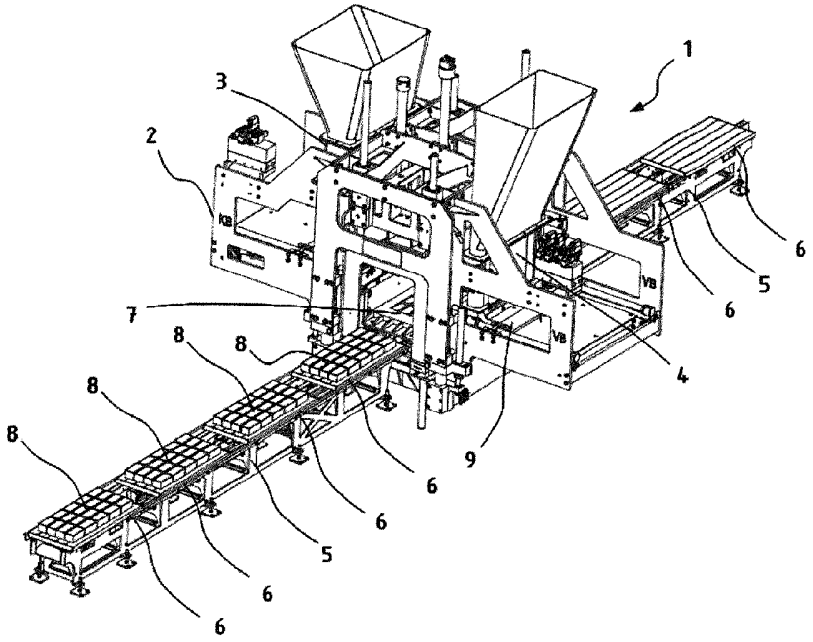
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Fig. 1

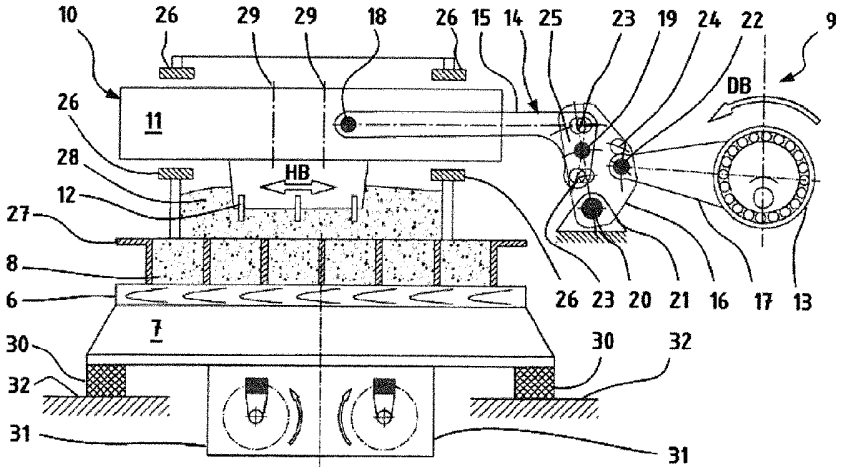
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Fig. 2