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(54) **METHOD AND APPARATUS FOR MECHANICAL PAVING.**

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(56) References cited:
CH-A-348 919
DE-A-1 658 506
DE-A-2 329 827
DE-A-2 718 066
DE-A-2 753 972
DE-A-2 823 233
DE-A-2 918 232
NL-A-6 903 959
NL-A-7 215 130

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Description

The invention relates to a method of mechanically laying paving or the like, in which bricks are taken simultaneously from a packet of bricks, in batches of at least one group at a time, and placed in a desired pattern as they are moved to a sub-grade; wherein two or more rows of bricks may be removed at a time from the upper layer of a stack of bricks positioned in a first pattern, the bricks of the group of bricks after being removed from the packet are first spaced a small distance apart, then moved into the desired basic pattern, thereafter moved towards each other again and subsequently put in their place on the sub-grade.

It is an object of the invention to improve such a method disclosed in German Offenlegungsschrift 2,918,232 of laying profiled concrete bricks.

For this purpose a method of a kind mentioned above, is characterized by engaging the bricks of these rows each individually and simultaneously, then putting them into the desired second pattern and placing them all at the same time directly onto the sub-grade in said second pattern. In this way it is possible to prepare paving with the bricks in so-called herringbone pattern.

The invention further relates to an apparatus for carrying out the before described method, comprising a carriage equipped with suction-lift means comprising a frame equipped with at least one suction cup which is connected with a vacuum source, wherein the frame is equipped with a plurality of suction cups corresponding with the number of bricks to be placed simultaneously, which suction cups are movable in longitudinal and transverse direction. According to the invention the apparatus is characterized in that the suction cups also in a rotary sense are in mutually coupled fashion.

It is noted that Swiss patent 348,919 describes a movable lifting and transporting apparatus by means of which bricks can be transported along the track of the transporting apparatus. To this effect, the apparatus comprises a plurality of juxtaposed suction heads. However, further similarities with the invention are lacking.

For the sake of completeness it is pointed out that the already mentioned German Offenlegungsschrift 2,918,232 shows and describes an apparatus for laying profiled concrete bricks. The bricks of each row can be displaced relatively to each adjacent row. To that end, the apparatus comprises a parallelogram-shaped pivotal lever system, thus creating the possibility of having the spacing apart and the movement into the desired basic pattern and the movement towards each other take place simultaneously.

In a further elaboration of the invention each suction cup is secured to a hollow guide bush or a suction pipe extending through it, the bushes are accommodated, in groups, for sliding movement in relatively movable guides, each guide bush is fixed to a guide plate, and the guide plates which are fixed to one and the same guide are interconnected by two slotted coupling elements disposed diametrically relatively to the guide bush. In that embodiment the guides may each, with the help of sliding bearings, be connected with shafts disposed on opposite sides of the frame, and cylinder and piston combinations are mounted between the guides. For the positioning of the guide bushes one of the guide bushes of each set cooperating with one guide may be connected to the free end of the piston rod so as to be restrained from rotation and the guide plate located opposite the piston rod end may be engaged by a spring, on the one hand, and by a coupling plate, on the other, the other end of each of which is fixed to the frame.

Furthermore the frame may be provided with a vacuum tank, which, on the one hand, can be connected with a vacuum source and, on the other hand, is provided with a number of connecting nipples corresponding to the number of hollow guide bushes, which connecting nipples are each fixed, by means of vacuum tubes, to a hollow guide bush or a suction pipe extending through it. It is thus achieved that the apparatus operates correctly even in case one or more bricks are missing by whatever cause.

For convenience each guide may consist of two pairs of strips in spaced superimposed relationship, with the guide plates being each attached between the two lower and upper strips.

To elucidate the invention one embodiment of a paving machine according to the invention will be described with reference to the accompanying drawings. In said drawings,

Fig. 1 shows the upper layer of a stack of bricks in the successive positions during its placing in herringbone pattern;

Fig. 2 shows a view similar to Fig. 1, during the placing in shifted pattern of the upper layer of a stack of bricks;

Fig. 3 shows a top view of part of a carriage with suctiollift device according to the invention, for placing a plurality of bricks, in groups, in herringbone pattern;

Fig. 4 shows a side view of the apparatus of Fig. 3;

Fig. 5 shows a cross-section of a suction-lift device used on the apparatus of Fig. 3 and 4;

Fig. 6 shows a top view of the suction-lift device of Fig. 5, with the parts on the left in a position before placing the bricks in herringbone pattern and, on the right, after placing the bricks in herringbone pattern and

Fig. 7 shows a side view of the apparatus shown in Fig. 6.

According to Fig. 1, which shows a top view of a stack of bricks, bricks 1 are supplied in a number of rows, in this example four, of eleven bricks each. From the closed pattern shown in Fig. 1a the rows are spaced a small distance apart (Fig. 1b). As Fig. 1c shows, the bricks of each row are then spaced a small distance apart, at the same time the bricks of adjoining rows are put in

an off-set position relative to each other. Then all the bricks are turned, that is to say: each of the successive rows alternately in opposite direction (Fig. 1d).

Finally the rows of bricks are moved towards each other which leads to the herringbone pattern shown in Fig. 1e.

Figures 2a, 2b, 2c and 2d successively show the positions of the bricks when moved from the closed pattern in which they are supplied to the off-set pattern shown in Fig. 2d.

For mechanically laying paving the apparatus shown in Figures 3-7 may be used. In Figures 3 and 4, in addition, jib 2 of a travelling crane 3 is shown. These two figures show that from the stack of bricks 4, supplied, by means of a suction-lift device 5 carried by the free end of jib 2, the upper layer can be taken from the stack of bricks 4. After placing the bricks in the correct pattern these can be placed in the pavement simultaneously.

The suction-lift device 5 will now be described in more detail with reference to Figures 5, 6 and 7. These show that the suction-lift device is provided with a frame 6. In this frame two parallel shafts are secured one above the other at both sides.

As stated before, each brick is engaged separately by a suction cup 8. Each of the suction cups is secured to a suction pipe 9 extending through a guide bush 10 which in turn is secured to a guide plate 11. The drawing shows that the guide bushes are mounted in a guide consisting of four spaced strips 12, 13, 14 and 15 for cooperation with the suction cups for engaging a single row of bricks. The ends of strips 12-15 are each attached, by means of couplings, to sliding bearings 17 mounted on shaft 7.

Guide bushes 10 are each positioned for sliding movement between strips 12, 14, on the one hand, and strips 13, 15, on the other, while guide plates 11, fixed to guide bushes 10, are positioned for sliding movement between strips 12, 13, on the one hand, and strips 14, 15, on the other.

The adjoining guide plates 11, fixed to guide bushes cooperating with one guide are each interconnected by two pairs of coupling strips 18. The coupling strips, each engaging with each guide plate diametrically opposite the guide bush, are at one end equipped with a slot 19.

As Figures 6 and 7 show, the coupling plate 11 located on one end of a row is secured to coupling 16 by a spring 20, on the one hand, and by a coupling rod 21, on the other.

For realizing the desired movement pattern, a piston-and-cylinder assembly 22 is used. The free end of piston rod 23 thereof is, by means of a strip 24, fixed to one of the guide bushes 10 cooperating with one guide 12-15. For the spacing apart of guides 12-15 during the execution of the desired movement pattern these are each interconnected by piston-and-cylinder combinations 25 on the position of couplings 16.

Figures 5 and 7 show a vacuum tank 26, arranged within frame 6 of the suction-lift device, which tank is provided with a number of connecting nipples 27 corresponding with the number of guide plates. Connecting nipples 27 are each, by means of vacuum tubes 28, connected with a suction pipe 9. Although not shown in the drawing, it will be clear that the vacuum tank may be connected with a vacuum pump fixed to carriage 3, by means of a tube.

Further the drawing shows that the top of the frame is provided with a connecting flange 29 for attachment to the movable jib 2 of crane 3. In this flange a servo motor not shown may be built in for selectively turning the frame of the suction-lift device, so that the position thereof may be adapted to the position of the stack of bricks from which the upper layer or part thereof is to be removed and for placing the same on the exact position in the pavement pattern.

Within the scope of the inventive idea a large number of changes and additions are possible, of course.

Thus the construction of the guides and the mutual connection of the guide plate could easily be changed. Further, in the frame of the suction-lift device means, such as clamping means could be provide to ensure that the rows of bricks to be engaged are held properly in contact with each other, so that each suction cup engage with the subjacent bricks approximately in the middle. Furthermore, the apparatus lends itself particularly well to placing smaller zones than the four or eleven bricks placed in this case, namely by covering some of the suction cups or closing them in some other way. Also the suction cup located in a fully enclosed corner can be closed, and the remaining brick, which is apt to give trouble during mechanical placing, may be manually put in its place afterwards.

Claims

1. Method of mechanically laying paving or the like, in which bricks (1) are taken simultaneously from a packet of bricks, in batches of at least one group at a time, and placed in a desired pattern (fig. 1d; fig. 2c) as they are moved to a sub-grade; wherein two or more rows of bricks are removed at a time from the upper layer of a stack of bricks positioned in a first pattern, (fig. 1a) the bricks of the group of bricks after being removed from the packet are then spaced a small distance apart, then moved into the desired basic pattern, thereafter moved towards each other again and subsequently put in their place on the sub-grade, characterized by engaging the bricks (1) of said rows each individually and simultaneously, then putting them in the desired second pattern (fig. 1d; fig. 2c) and placing them all at the same time directly onto the sub-grade in said second pattern (fig. 1e; fig. 2d).

2. Apparatus for carrying out the method according to claim 1, comprising a carriage

equipped with suction-lift means comprising a frame (6) equipped with at least one suction cup (8) which is connected with a vacuum source, wherein the frame is equipped with a plurality of suction cups corresponding with the number of bricks to be placed simultaneously, which suction cups are movable in longitudinal and transverse direction, characterized in that the suction cups (8) also in a rotary sense are in mutually coupled fashion.

3. Apparatus according to claim 2, characterized in that each suction cup (8) is secured to a hollow guide bush (10) or a suction pipe (9) extending through it, the bushes are accommodated, in groups, for sliding movement in relatively movable guides (12, 13, 14, 15), each guide bush is fixed to a guide plate (15), and the guide plates which are fixed to one and the same guide are interconnected by two slotted (19) coupling elements (18) disposed diametrically relatively to the guide bush.

4. Apparatus according to claim 3, characterized in that the guides (12, 13, 14, 15) are each, with the help of sliding bearings (17), connected with shafts (7) disposed on opposite sides of the frame (6), and cylinder and piston combinations (25) are mounted between the guides.

5. Apparatus according to claim 3 or 4, characterized in that one of the guide bushes (10) of each set cooperating with one guide are connected to the free end of the piston rod (23) so as to be restrained from rotation and the guide plates located opposite the piston rod end are engaged by a spring (20), on the one hand, and by a coupling plate (21), on the other, the other end of each of which is fixed to the frame (6).

6. Apparatus according to at least one of claims 2-5, characterized in that the frame (6) is provided with a vacuum tank (26), which, on the one hand, can be connected with a vacuum source and, on the other hand, is provided with a number of connecting nipples (27), corresponding with the number of hollow guide bushes (10), which connecting nipples (27) are each fixed, by means of vacuum tubes (28), to a hollow guide bush (10) or a suction pipe (9) extending through it.

7. Apparatus according to one or more of claims 2-6, characterized in that each guide (12, 13, 14, 15) consists of two pairs of strips (12,13; 14,15) in spaced superimposed relationship, with the guide plates (11) each attached between the two lower and upper strips.

8. Apparatus according to one or more of claims 2-7, characterized by means, such as a servo motor (not shown) for causing the frame (6) to turn about its vertical axis.

Patentansprüche

1. Verfahren zum maschinellen Verlegen einer Pflasterung od.dgl., wobei Steine (1) gleichzeitig, in Mengen von jeweils mindestens einer Gruppe, von einem Stapel abgenommen und nach einem gewünschten Muster (Fig. 1d; Fig. 2c) geordnet werden, während sie zum Untergrund gebracht werden, wobei jeweils zwei oder mehrere Steinreihen von der obersten Lage eines Stapels nach einem ersten Muster (Fig. 1a) geordneter Steine entfernt werden, worauf die Steine der Steingruppe, nach deren Entfernung vom Stapel, auf geringe Abstände voneinander gebracht, dann nach dem gewünschten Grundmuster (Fig. 1d; Fig. 2c) geordnet, dann wieder aufeinander zubewegt und anschliessend an ihrer Stelle auf dem Untergrund abgesetzt werden, dadurch gekennzeichnet, dass die Steine (1) der genannten Reihen einzeln und gleichzeitig ergriffen, dann nach dem gewünschten zweiten Muster geordnet (Fig. 1d; Fig. 2c) und alle gleichzeitig unmittelbar im genannten zweiten Muster (Fig. 1e; Fig. 2d) auf dem Untergrund abgesetzt werden.

2. Vorrichtung zur Durchführung des Verfahrens nach Anspruch 1, versehen mit einem Wagen mit Saughubvorrichtung, deren Rahmen (6) mindestens einen mit einer Vakuumquelle verbundenen Saugkopf (8) aufweist, wobei der Rahmen mit einer der Anzahl der gleichzeitig abzusetzenden Steine entsprechenden Vielzahl in Längs- und Querrichtung beweglicher Saugköpfe versehen ist, dadurch gekennzeichnet, dass die Saugköpfe (8) auch im Drehsinn mit einander verbunden sind.

3. Vorrichtung nach Anspruch 2, dadurch gekennzeichnet, dass jeder Saugkopf (8) an einer hohl ausgebildeten Führungsbuchse (10) oder einem sich durch diese erstreckenden Saugrohr (9) befestigt ist, die Buchsen gruppenweise zur Durchführung einer Gleitbewegung in verhältnismässig beweglichen Führungen (12, 13, 14, 15) untergebracht sind, jede Führungsbuchse an einer Führungsplatte (15) befestigt ist, und die an ein und derselben Führung befestigten Führungsplatten durch zwei mit Schlitzen (19) versehene, diametral zur Führungsbuchse angeordnete Kupplungselemente (18) miteinander verbunden sind.

4. Vorrichtung nach Anspruch 3, dadurch gekennzeichnet, dass die Führungen (12, 13, 14, 15) jeweils mit Hilfe von Gleitlagern (17) mit auf gegenüberliegenden Seiten des Rahmens (6) vorgesehenen Wellen (7) verbunden sind, und Zylinder- und Kolbenkombinationen (25) zwischen den Führungen angebracht sind.

5. Vorrichtung nach Anspruch 3 oder 4, dadurch gekennzeichnet, dass eine der Führungsbuchsen (10) eines jeden Satzes, die mit einer Führung zusammenwirkt, drehfest mit dem freien Ende der Kolbenstange (23) verbunden ist, und die gegenüber dem Kolbenstangenende angeordneten Führungsplatten einerseits von einer Feder (20) und andererseits von einer Kupplungsplatte (21) ergriffen werden, wobei das andere Ende derselben jeweils am Rahmen (6) befestigt ist.

6. Vorrichtung nach mindestens einem der

Ansprüche 2 bis 5, dadurch gekennzeichnet, dass der Rahmen (6) mit einem Vakuumbehälter (26) verbunden ist, der einerseits mit einer Vakuumquelle verbindbar ist und andererseits mit mehreren der Anzahl hohl ausgebildeter Führungsbuchsen (10) entsprechenden Verbindungsnippeln (27) versehen ist, die jeweils durch Vakuumrohre (28) an einer hohl ausgebildeten Führungsbuchse (10) oder einem sich durch diese erstreckenden Saugrohr (9) befestigt sind.

7. Vorrichtung nach einem oder mehreren der Ansprüche 2 bis 6, dadurch gekennzeichnet, dass jede Führung (12, 13, 14, 15) aus zwei, in Abständen übereinanderliegenden Streifenpaaren (12, 13; 14, 15) besteht, wobei die Führungsplatten (11) jeweils zwischen den zwei unteren und oberen Streifen befestigt sind.

8. Vorrichtung nach einem oder mehreren der Ansprüche 2 bis 7, gekennzeichnet durch Mittel, wie ein (nichtdargestellter) Servomotor, den Rahmen (6) um seine vertikale Achse drehen zu lassen.

Revendications

1. Une méthode d'installation mécanique d'un carrelage en briques ou analogue, dans lequel des briques (1) sont prises simultanément d'un paquet de briques dans des charges d'au moins un groupe à la fois, et placées dans une structure désirée (Fig. 1d; Fig. 2c) comme elles avancent vers une plate-forme; dans laquelle deux ou plusieurs rangées de briques sont transportées à la fois de la couche supérieure d'une pile de briques placées dans une première structure (Fig. 1a), les briques du groupe de briques, après avoir été transportées du paquet, sont alors espacées légèrement, ensuite transportées dans la structure de base désirée (Fig. 1d; Fig. 2c), après quoi elles sont transportées de nouveau l'une vers l'autre, et ensuite installées sur la plate-forme, caractérisée par la prise des briques 1 desdites rangées individuellement et simultanément, alors leur installation dans la deuxième structure désirée (Fig. 1d; Fig. 2c) et leur installation directe à la fois sur la plate-forme dans ladite deuxième structure (Fig. 1e; Fig. 2d).

2. Un appareil pour exécuter la méthode selon la revendication 1, comprenant un chariot ayant des moyens de levage par aspiration comprenant un cadre (6) ayant au moins une ventouse (8) jointe à une source à vide, ledit cadre ayant une pluralité de ventouses correspondant au nombre de briques à installer simultanément, lesquelles ventouses sont transportables en direction longitudinale et transversale, caractérisé en ce que les ventouses (8) sont accouplées mutuellement également en sens rotatif.

3. Un appareil selon la revendication 2, caractérisé en ce que chaque ventouse (8) est fixée sur un manchonguide creux (10) ou un tuyau d'aspiration (9) se prolongeant à travers, lesdits manchons étant arrangés en groupes pour mouvement de glissement dans des guides à mouvement relatif (12, 13, 14, 15), chaque manchon-guide étant fixé sur une plaque-guide (15), et les plaques-guide fixées sur le méme guide sont jointes entre elles par deux éléments de couplage (18) encochés (19) placés diamétralement en égard au manchon-guide.

4. Un appareil selon la revendication 3, caractérisé en ce que chacun des guides (12, 13, 14, 15) est joint, à l'aide de paliers à glissement (17), à des arbres (7) placés aux côtés opposés du cadre (6), et des combinaisons de piston-cylindre (25) sont montées entre les guides.

5. Un appareil selon la revendication 3 ou 4, caractérisé en ce que l'un des manchons-guide (10) de chaque groupe coopérant avec un guide est couplé à l'extrémité libre de la tige de piston (23), ainsi assurant résistance à la torsion, et les plaques-guide situées en face de l'extrémité de la tige de piston sont prises par un ressort (20) d'un côté, et par une plaque de couplage (21) de l'autre côté, l'autre extrémité de chacune étant fixée sur le cadre (6).

6. Un appareil selon au moins l'une quelconque des revendiations 2-5, caractérisé en ce que le cadre (6) est muni d'un réservoir à vide (26) qui, d'un côté, peut être raccordé à une source à vide et, de l'autre côté, est muni d'un nombre de douilles de raccordement (27) correspondant au nombre de manchons-guide creux (10) chacune desdite douilles de raccordement (27) étant fixée, à l'aide de tubes à vide (28), sur un manchon-guide creux (10) ou un tuyau d'aspiration (9) se prolongeant à travers.

7. Un appareil selon l'une quelconque des revendications 2-6, caractérisé en ce que chaque guide (12, 13, 14, 15) consiste en deux paires de bandes (12, 13; 14, 15) en rapport espacé et surimposé, des chacune plaques-guide (11) étant attachée entre les deux bandes inférieures et supérieures.

8. Un appareil selon l'une quelconque des revendications 2-7, caractérisé par des moyens, par exemple un servomoteur (non représenté) pour forcer le cadre (6) à tourner autour de son axe vertical.

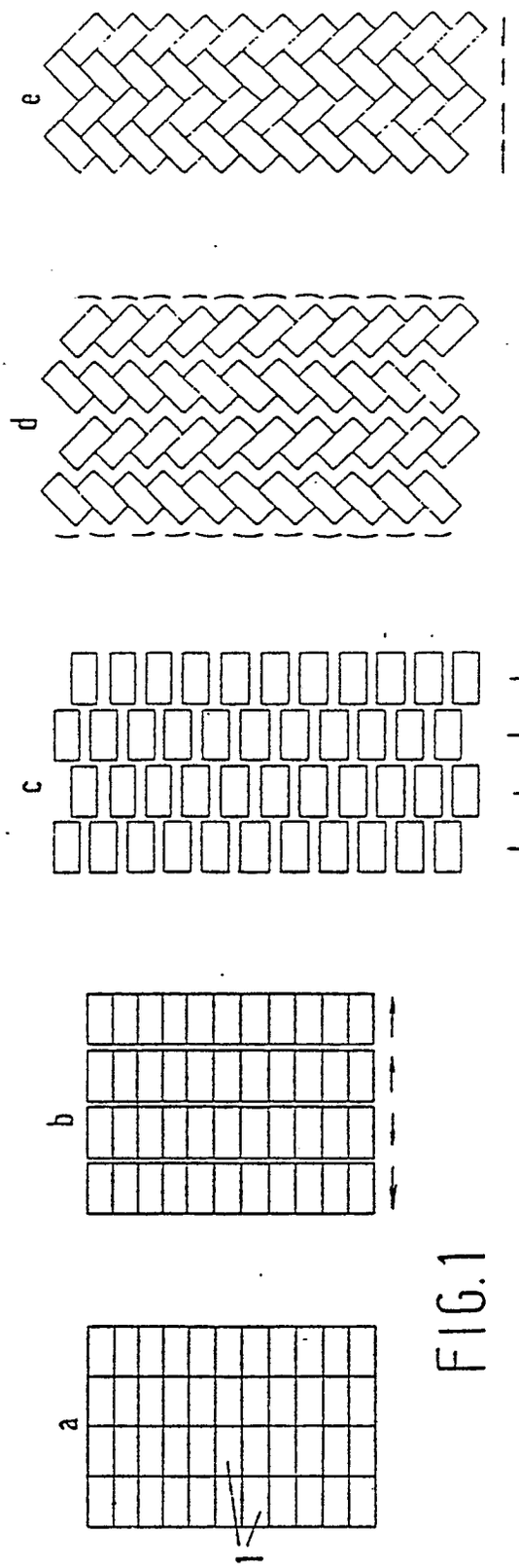


FIG.1

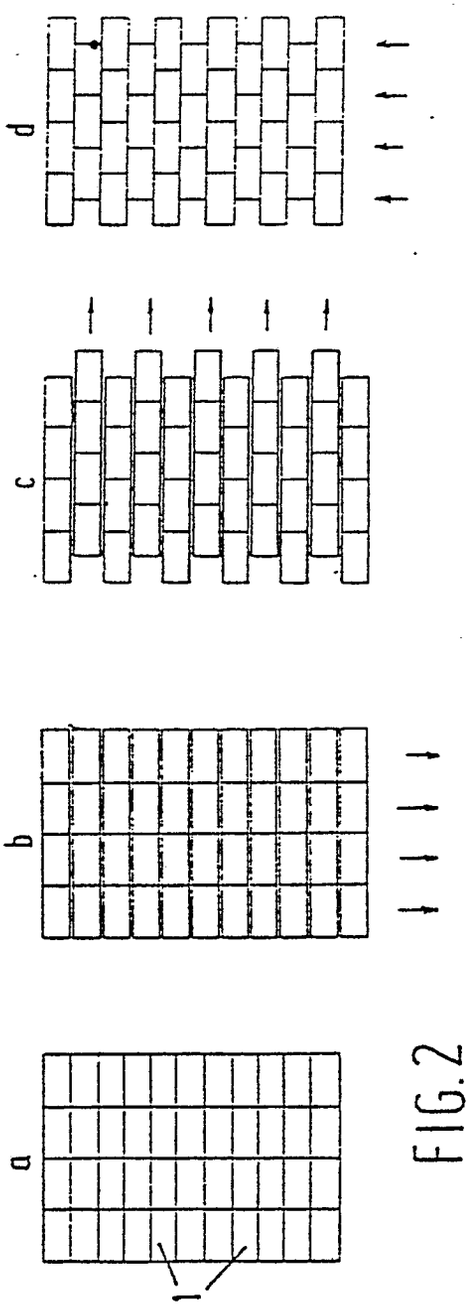


FIG.2

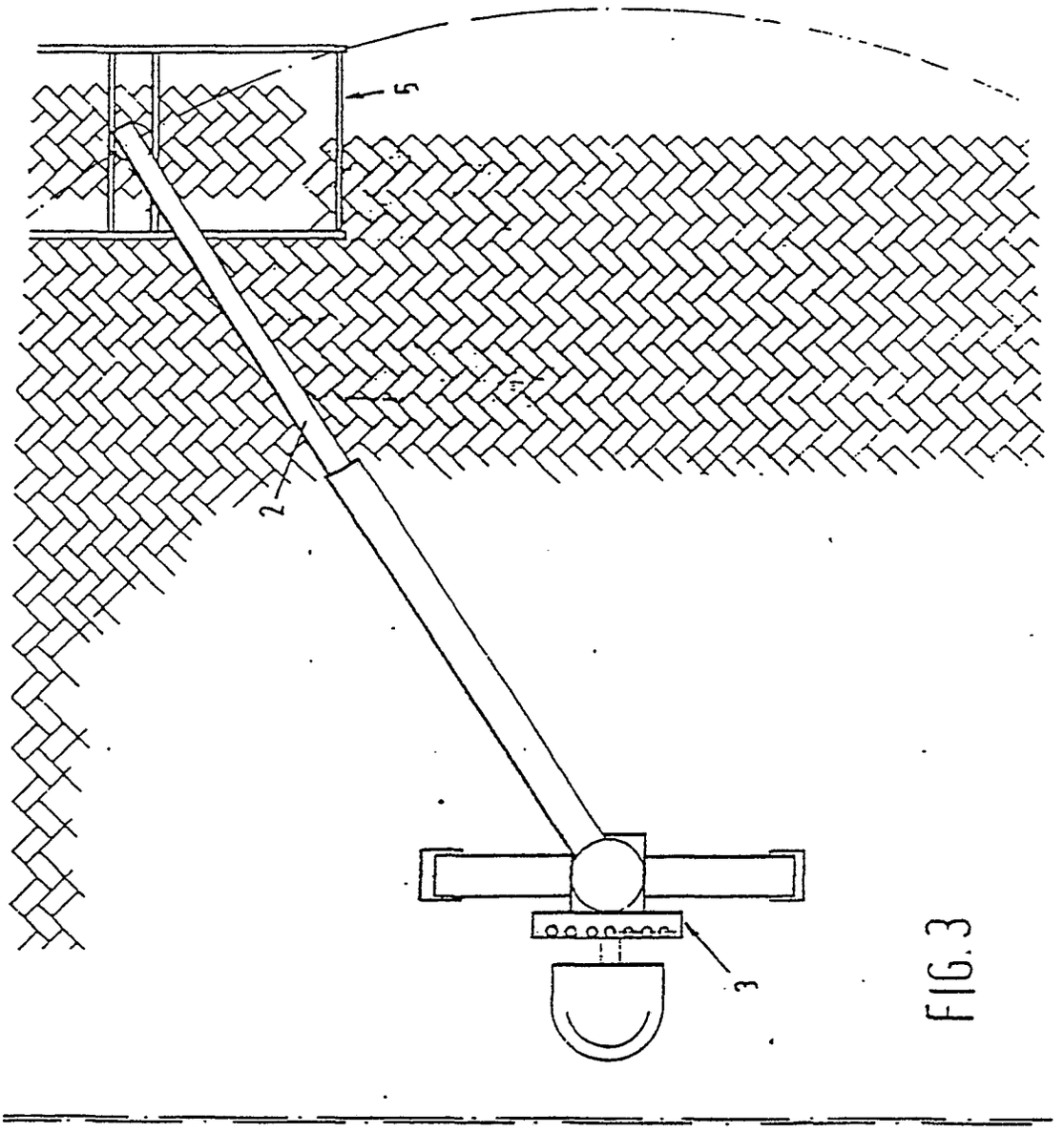
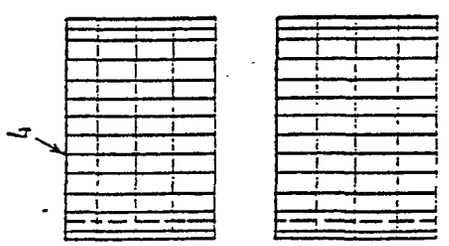


FIG. 3



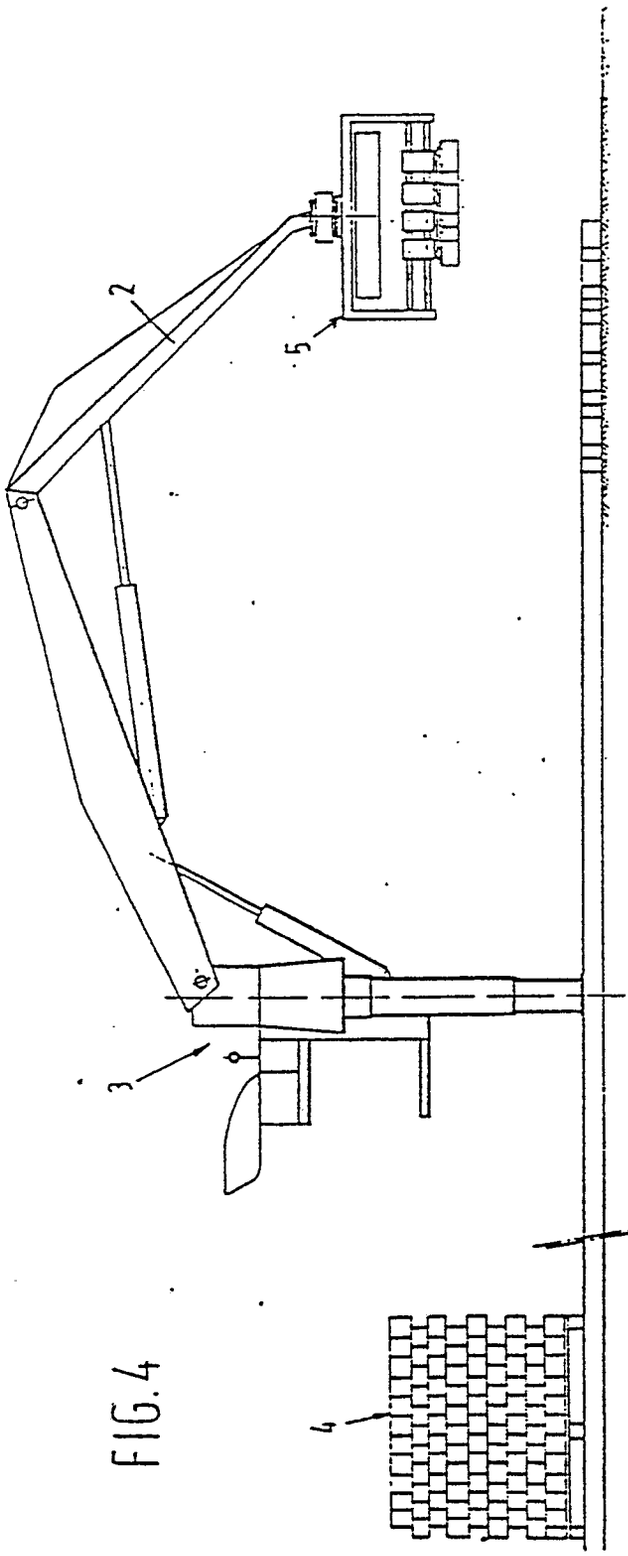
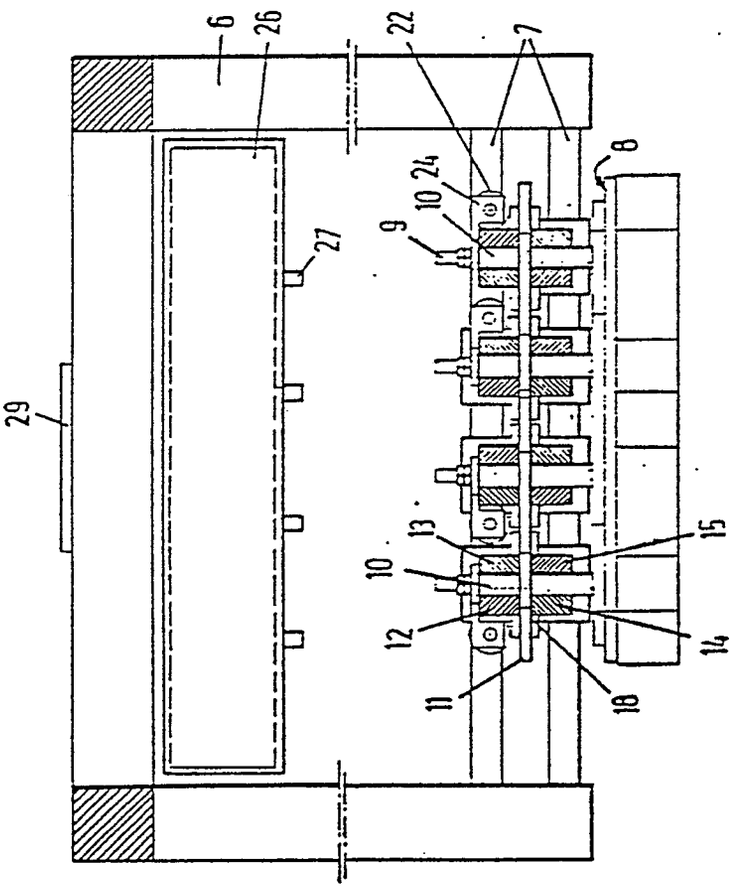


FIG.4

FIG.5



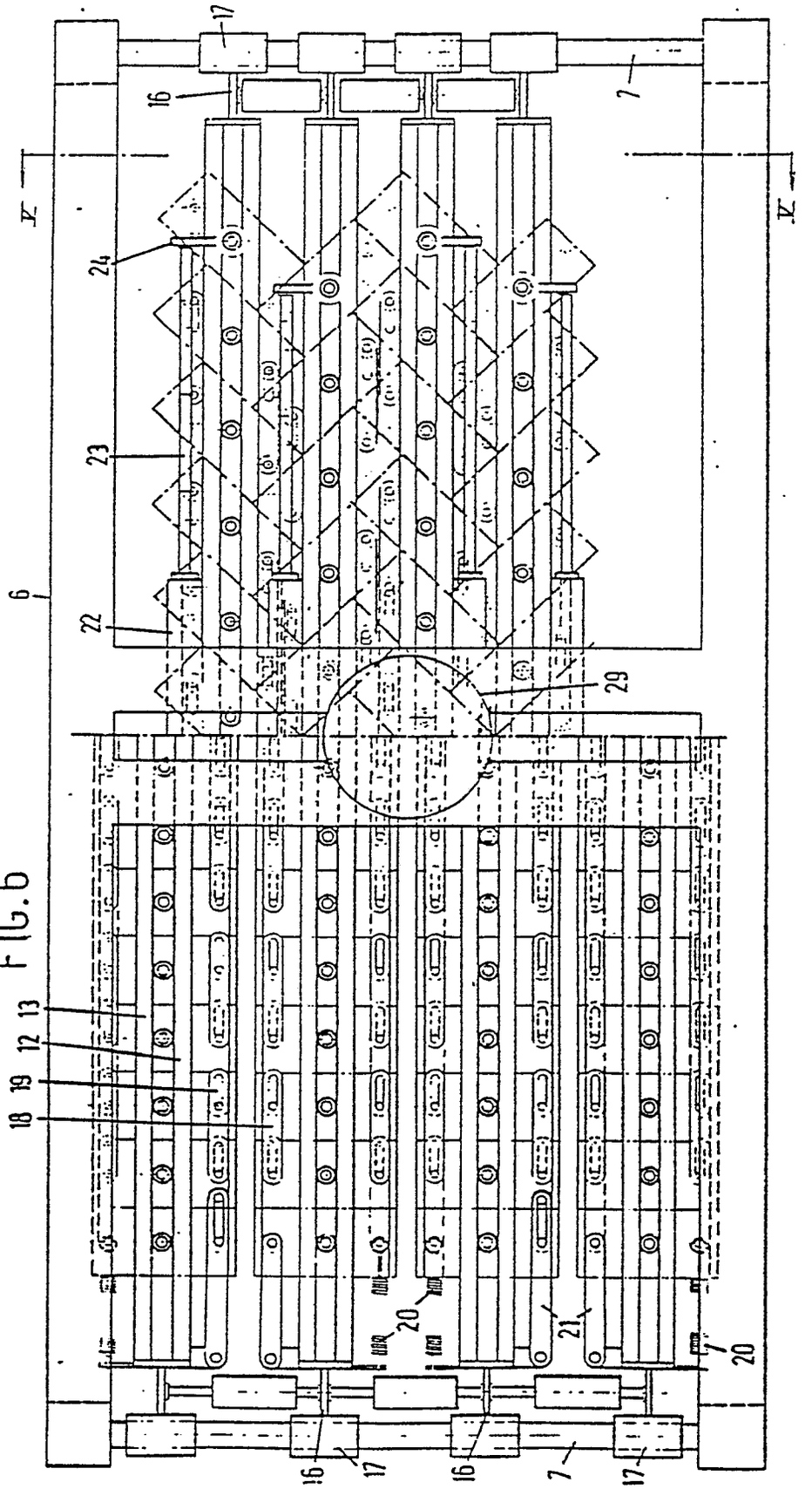


FIG.6

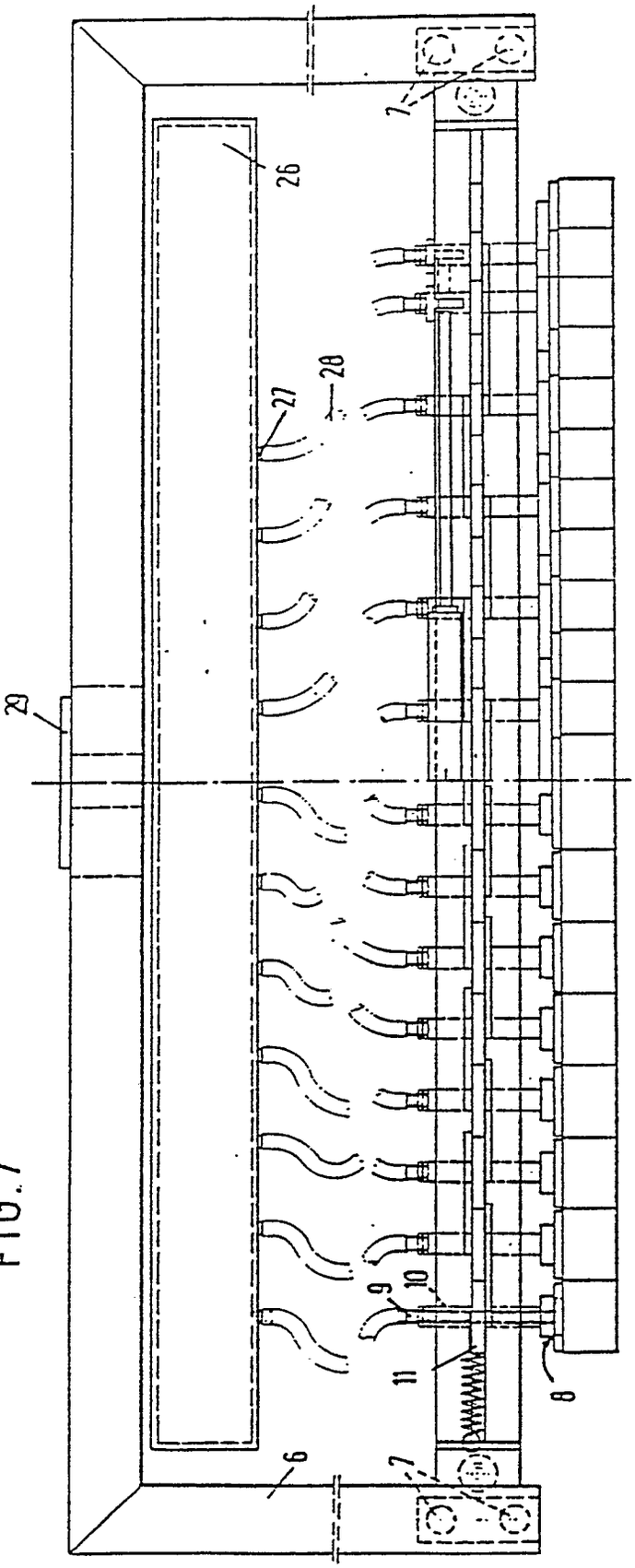


FIG.7