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(54) **Machine having an anti-slippage means for the diamond cutting belt for cutting stones**

Steinschneidmaschine mit Antislippmitteln für diamantierte Schneiderriemen

Dispositif de coupe de pierre ayant des moyens anti-glisement pour une courroie de coupe diamantée

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- **PATENT ABSTRACTS OF JAPAN vol. 013, no. 282 (M-843), 28 June 1989 (1989-06-28) & JP 01 078802 A (DAIWA KIKAI SEISAKUSHO:KK), 24 March 1989 (1989-03-24)**

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Description

[0001] This invention relates to a machine for cutting stones, such as marbles, granites and others, and particularly for cutting slabs from a stone block, for dividing a stone block into slabs having a predetermined thickness, for squaring stone blocks, and for other similar tasks, in which machine cutting operations are performed by at least one endless diamond belt, which slidably extends in the cutting plane around a belt-guiding arm substantially parallel to the cutting line and is returned on pulleys disposed at the ends of this arm, one of which is a driving pulley, and which diamond belt is guided with its active branch transverse to the cutting plane by grooved guide means provided on the longitudinal edge of the belt-guiding arm turned towards the cutting line and with its inactive return branch in grooved guide means provided on the edge of the belt-guiding arm opposite to the cutting line, the belt-guiding arm being translatable parallel to itself and to the cutting line in the cutting plane, and means being provided for moving the belt-guiding arm so that it can be first engaged with the stone block by the active branch of the diamond belt along the desired cutting line and then advanced through the stone block in the cut advancement direction, at a speed corresponding to the cutting speed, while keeping the active branch of the diamond belt pressed in operating contact with the stone, means being typically also provided for relative movement between the stone block and the belt-guiding arm transversely to the cutting plane, intended to bring them in the desired mutual cutting position.

[0002] A machine of this kind is known from the document DE 2154428.

[0003] In a preferred embodiment of said prior art machines, in order that the diamond belt can be guided transversely to the cutting plane in the grooved guide means provided on the longitudinal edges of the belt-guiding arm, the inner side of the diamond belt, i.e. the side turned towards the belt-guiding arm and not provided with diamond surfaces, and the grooves of the guide means have complementary and coincident cross sectional profiles, preferably tapering towards the bottom of the grooves, and particularly V-profiles, at least partly slidably engaged with each other.

[0004] In such prior art machines, it has been noted that stretching the diamond belt between the return pulleys at the ends of the belt-guiding arm, and profiling in a complementary and coincident way the diamond belt and the grooves of the guide means provided on the longitudinal edges of the belt-guiding arm, is sometimes not sufficient for keeping the inactive return branch of the diamond belt, opposite to the cutting line, safely engaged in the guide means on the corresponding longitudinal edge of the belt-guiding arm, and that it may occur that forces acting on this inactive return branch of the diamond belt cause said branch of the diamond belt to accidentally come or slip off the grooved guide means

of the belt-guiding arm associated thereto. So, for example, the slab cut from the stone block may happen to tilt towards the block during the cutting operation or following it, exerting transverse forces on the inactive return branch of the diamond belt, such as to cause this branch to slip, i.e. come off the associated groove/s of the guide means while the cutting operation is still in progress or at the end of it, upon extraction of the belt-guiding arm through the cutting slot between the block and the slab cut therefrom, by a corresponding translatory movement opposite to cut advancement.

[0005] The invention aims at obviating the above drawback and provides therefore along the edge of the belt-guiding arm opposite to the cutting line so-called anti-slippage means, which are arranged at least partially over the inactive return branch of the diamond belt and prevent it from disengaging from the associated grooved guide means provided on the corresponding longitudinal edge of the belt-guiding arm.

[0006] Preferably, according to a further characteristic of the invention, such anti-slippage means are also provided for the active branch of the diamond belt at the segments between the stone block and the diamond belt return pulleys.

[0007] The anti-slippage means in accordance with the invention may have any type of construction suitable for this purpose. According to a preferred embodiment, these anti-slippage means consist of continuous or discontinuous stationary protection means, overlaying the diamond belt and covering it at least partially.

[0008] These protecting and covering means may be continuous or discontinuous, i.e. may extend continuously as a shield along most of the inactive return branch of the diamond belt and/or along the side segments of the active branch of the diamond belt, or may be arranged at intervals along said branch and/or along said segments of the belt. Preferably, according to a particularly advantageous embodiment of the invention, the anti-slippage means consist of loose guide wheels.

[0009] The anti-slippage means according to the invention may be mounted at least partly on the belt-guiding arm and at least partly on an arm carrier guided in a frame in such a way that it can be translated parallel to the cutting plane and transverse to the cutting line.

[0010] According to a further preferred embodiment of the invention, the belt-guiding arm is delimited, on the side turned towards the cutting line and on the opposite side, by two corresponding separate substantially parallel longitudinal members, substantially parallel to the cutting line and connected to each other and/or to the bearing structure of the belt-guiding arm and provided at their longitudinal edges with grooved guide means for the diamond belt. Thanks to this characteristic of the invention, the advantage is provided that the opposite longitudinal parts of the belt-guiding arm can consist of the same type of longitudinal member prefabricated and used in two upside-down positions, so that the longitudinal side having the grooved guide means is always

turned outwards. This is an important advantage even when the two opposite longitudinal edges of the belt-guiding arm having the grooved guide means and hence the corresponding outer edges of the two respective longitudinal members are substantially rectilinear, but it is particularly important when - according to a further characteristic of the invention - the two opposite longitudinal edges of the belt-guiding arm having the grooved guide means and hence the corresponding outer edges of the two respective longitudinal members are curved and slightly outwardly convex. In this case, one type of pre-fabricated longitudinal member may be used to make the two opposite longitudinal parts of the belt-guiding arm, said type of member having grooved guide means or mounts therefor, on a convex longitudinal edge, and an opposite longitudinal edge which is rectilinear or anyway profiled as appropriate for its integration into the belt-guiding arm or into its bearing structure, and said type of member being mounted on each longitudinal edge of the belt-guiding arm, with its convex side, provided with the grooved guide means or with the mounts therefor, being always turned outwards.

[0011] With reference to the grooved belt guide means, a peripheral groove may be provided, which is continuous or in sections, in the outer longitudinal edges of the arm or in the edges of the longitudinal members which are to form the upper and lower outer sides of the arm. Here, sliding motion is enhanced by supplying a lubricant fluid into the guide groove, particularly forming a slide bearing, for example with an effect known as "aquaplaning".

[0012] In an alternative embodiment, the guide means consist of wheels, pulleys or rollers which are rotatably mounted on the outer peripheral edges of the arm or on the edges of the longitudinal members which are to form the outer peripheral edges of the arm. The rollers have annular coaxial grooves whose section is complementary or substantially coincident with the longitudinal guide rib of the belt. The rollers are aligned and installed along the longitudinal edges of the arm or the outer edges of the longitudinal members so that the rollers and the means for supporting them are narrower than the belt. Also in this case, means for supplying a fluid onto the rollers may be provided, although this fluid is mainly used to wash cutting residues away from the rotational supports of the rollers.

[0013] According to a variant embodiment of the invention, the grooved guide means may also consist of combinations of rollers and grooves with or without sliding fluid feed, alternated in any order, either within one of the two outer longitudinal edges of the arm, or between the two opposite longitudinal edges. For instance, the edge associated to the return branch may bear the guide rollers, whereas the edge associated to the cutting branch of the belt may be provided with the grooved wherein the sliding fluid is supplied.

[0014] In accordance with an additional characteristic of the invention, the machine, which, thanks to the

above characteristics has a comparatively slim and substantially lighter and smaller construction may be mounted in such a manner as to be able to slide on guides, such as rails or the like along a predetermined path and transverse, particularly perpendicular to the cutting plane. In this case, the block to be processed may be stationary, whereas it can be divided into slabs by moving the machine. Also, the machine may follow a path developing along a plurality of aligned blocks to be processed, thereby avoiding the need to load each block on cars.

[0015] These and other characteristics of the invention and the advantages derived therefrom will be explained in greater detail in the following description of an embodiment schematically shown by way of a non-restricting example in the annexed drawings, in which:

Fig. 1 is a front elevational view of a machine according to the invention, with parts in section.

Fig. 2 is a side elevational view of the machine as shown in fig. 1.

Fig. 3 is a front elevational and magnified view of a part of the machine shown in the lower right area of fig. 1.

Fig. 4 is a vertical sectional view as taken across lines IV-IV of fig. 3.

Fig. 5 is a front elevational and magnified view of a part of the machine shown in the upper left area of fig. 1.

Fig. 6 is a vertical sectional view as taken across lines VI-VI of fig. 5.

Fig. 7 is a view as shown in fig. 1, of a variant embodiment of the machine according to the invention, wherein the belt guide means consist of a plurality of wheels, pulleys or rollers, and wherein the machine can run on rails.

Figs. 8 and 9 show, like figs. 3 and 4, magnified construction details of the machine as shown in fig. 7.

[0016] The machine according to the invention, as shown in the drawings, is mainly used to cut up blocks B of stone (marbles, granites, and others) into slabs with a predetermined thickness, and is composed of a base 1, whereon a portal frame 2 is fitted. A vertical arm carrier 5 is slidably guided on vertical guides 3 of the uprights of the portal frame 2, by means of corresponding brackets 4. At the side ends of the arm carrier 5, return pulleys 6, disposed in a common vertical plane and about which an endless flexible diamond belt 7 is driven, are rotatably mounted.

[0017] The arm carrier 5 may be displaced vertically by means of pinions 8, mounted on the carrier 5, and driven by motor reducers 9, while meshing with vertical racks 10 disposed on the uprights of the mount 2. One of the return pulleys 6 is rotatably driven by a motor reducer 15 installed on the arm carrier 5.

[0018] The arm carrier 5 preferably has an inverted U-shape and in the lower part between the U stems a

belt-guiding arm 14 is fastened, which is substantially horizontal and extends in a vertical cutting plane. This belt-guiding arm 14 is as thin as possible transversely to the cutting plane, in so far as mechanical and functional needs of the arm 14 and of the diamond belt 7 allow.

[0019] With reference to the embodiment as shown in figs. 1 to 6, the upper and lower longitudinal edges of the belt-guiding arm 14 may be rectilinear, but - in the illustrated embodiment - are curved, i.e. slightly outwardly convex, each having a longitudinal groove, wherein the corresponding upper or lower branches of the diamond belt 7 are slidably driven.

[0020] In the illustrated embodiment, the diamond belt 7 has one or more longitudinal cables or wires 20, embedded in a body 21 made of a flexible material, particularly or rubber or plastic. As a whole, this body 21 of the diamond belt 7 has, on its outer side, i.e. opposite to the belt-guiding arm 14, a substantially plane surface, wherefrom diamond segments 22, spaced in the longitudinal direction of the belt 7 and fastened to the longitudinal cables or wires 20 thereof, as well as at least partially embedded in the body 21, project slightly. On the substantially plane outer surface of the diamond belt 7, opposite to the belt-guiding arm 14 and turned - at the lower edge of this arm - towards the stone block B to be cut, each diamond segment 22 extends transversely to the belt 7 all over the width of said outer surface. Further, each diamond segment 22 also extends over a part of the two sides of the belt 7, slightly projecting, also on these sides, out of the flexible body 21 of the belt 7. Preferably, but not necessarily, each diamond segment 22 has an extension on one side of the belt 7, towards the thickness of the belt 7 and towards the inner side thereof, which is longer than that on the opposite side. This asymmetric profile is alternately and specularly inverted in the following diamond segments 22, as is evident in figs. 3 and 5. On the inner side, turned towards the belt-guiding arm 14 and opposite to the stone block B to be cut and to the diamond segments 22, the body 21 of the belt 7 has a V-shaped part which is complementary to the cross section of the longitudinal grooves 17 of the upper and lower edges of the belt-guiding arm 14 and is slidably engaged in these grooves 17. The maximum width of the body 21 of the diamond belt 7 (out of the grooves 17 of the belt-guiding arm 14) substantially corresponds to the width of the lower part of the belt-guiding arm 14, whereas the diamond sectors 22 are slightly wider. So, the diamond sectors 22 project on both sides slightly beyond the width of the body 21 of the belt 7 and of the belt-guiding arm 14.

[0021] The belt slides in the guide grooves 17 with the help of fluid supplied with a method known per se, by means of feed nozzles connected to a feed circuit typically provided inside the arm 14. The sliding fluid, particularly water, forms a slide bearing, which reduces sliding friction with an effect similar to the so-called aquaplaning.

[0022] Naturally, the characteristics of this invention are not limited to the above diamond belt, but may be applied with the same advantages to machines having diamond belts made in any other suitable manner.

[0023] According to the invention, the belt-guiding arm 14 is upwardly and downwardly delimited by two separate longitudinal members 16, which may be vertically spaced and are fastened by their ends to the uprights of the arm carrier 5 and possibly even to each other in one or more intermediate locations. These two longitudinal members 16 are made from the same type of prefabricated longitudinal member, which has a rectilinear or slightly convex longitudinal edge, provided with the guide groove 17 for the diamond belt 7 and an opposite longitudinal edge, with no guide groove for the diamond belt thereon, which may have any type of profile, e.g. rectilinear, as shown. This single type of longitudinal member 16 is mounted both at the upper longitudinal edge and at the lower longitudinal edge of the belt-guiding arm 14, with its grooved edge, either rectilinear or convex, turned outwards, as particularly apparent in fig. 1.

[0024] In figs. 3 and 5, numeral 30 denotes reinforcement blocks, which may be fastened at the lower corners of the belt-guiding arm 14, out of the part thereof which is intended for penetration into the stone block B. These reinforcement blocks 30 have, coaxially to the groove 17 of the lower longitudinal edge of the belt-guiding arm 14, lead-in grooves which have the same profiles as the groove 17, but are wider than it and act as an aid for insertion of the diamond belt 7. Obviously, these reinforcement and lead-in grooved blocks may also not be present.

[0025] Under the frame 5, between the uprights of the portal frame 2, the block B of stone (marble, granite, or the like) is positioned, to be cut up, for instance, by the above described machine, into individual slabs having a predetermined thickness. In the embodiment as shown, in which the portal frame 2 is stationary, the stone block B is placed on a car 28, which can run on rails 29 horizontally and transversely to the belt-guiding arm 14 and to the associated active lower branch of the diamond belt 7.

[0026] In order to cut the stone block B, the diamond belt 7 is slid in the direction of its length by its driving return pulley, whereas the arm carrier 5 is lowered to bring the lower active branch of the diamond belt 7 to contact with the stone block B. The arm carrier 5 is further lowered by a continuous vertical translatory motion thanks to the motor reducers 9, to the pinions 8 and to the racks and at a uniform speed, corresponding to the speed whereat the stone block B is cut by the lower active branch of the diamond belt 7. During this cutting operation, the lower active branch of the diamond belt 7 is accurately and safely guided by providing that the inner profiled part of the body 21 of the diamond belt 7 is engaged in the accordingly profiled groove 17 of the belt-guiding arm 14. Besides this guiding action, the belt-

guiding arm 14 keeps the associated underlying lower active branch of the diamond belt 7 in contact with the stone block B and presses it with the necessary force against said block, i.e. against the bottom of the cutting slot made in the block B and that the belt-guiding arm 14 penetrates. Once the cutting operation is over, the arm carrier 5 is lifted together with the belt-guiding arm 14 and with the diamond belt 7, and then the stone block B is moved, by the car 28 on the rails 29, one step further, corresponding to the thickness of one slab, whereupon the following cutting operation is performed as described above.

[0027] In order to prevent the upper inactive return branch of the diamond belt 7, slidable along the upper longitudinal edge of the belt-guiding arm 14, from coming, i.e. slipping off its respective longitudinal guide groove 17 provided on said upper edge of the belt-guiding arm 14, by forces acting towards said slippage, for instance when the belt-guiding arm 14 is extracted upwards from the cutting slot formed between the stone block B and the slab cut therefrom, according to a characteristic of this invention, anti-slippage wheels 23 are provided above the belt-guiding arm 14, which are mounted in such a way as to rotate loosely, by support brackets 25, on a part 24 of the arm carrier 5 and are arranged at intervals along the upper grooved longitudinal edge of the belt-guiding arm 14, i.e. of the corresponding longitudinal member 16, as is particularly apparent from figs. 1, 5 and 6. These anti-slippage wheels 23 are arranged at least partly over the upper inactive return branch of the diamond belt 7 and may be at a small distance from said belt 7 or may be in contact therewith. Anyway, these anti-slippage wheels 23 prevent the upper inactive return branch of the diamond belt 7 from being lifted to such an extent as to disengage from its respective longitudinal guide groove 17 formed in the corresponding upper edge of the belt-guiding arm 14, i.e. in its respective longitudinal member 16.

[0028] Also at the lower active branch of the diamond belt 7, which is engaged with the stone block B and cuts it, on each side of this block B, between it and the corresponding return pulley 6 for the diamond belt 7, at least an anti-slippage wheel 26 is provided, which is mounted by a support bracket 27 on the overlying belt-guiding arm 14, i.e. on its respective longitudinal member 16, and is superposed from below to said lower active branch of the diamond belt 7, thereby preventing it to slip, i.e. to come off the longitudinal guide groove 17 of the lower edge of the belt-guiding arm 14, i.e. of its respective longitudinal member 16, as shown, particularly, in figs. 1, 3 and 4.

[0029] Fig. 7 shows a variant embodiment of the machine as described hereinbefore with reference to figs. 1 to 6. Here, the differences consist first in that, in lieu of the longitudinal groove 17, the arm 14 has a plurality of peripheral wheels, rollers or pulleys 17', arranged at predetermined intervals along the sliding edges of the inactive and active branches of the diamond belt 7 in

any order. Each pulley 17' has an annular coaxial throat 117' and is rotatably fitted in an accommodating throat 114 of the peripheral edge of the arm 14. Obviously, as shown in figs. 8 and 9, the overall thickness of the arm 14 with the wheels 17' and the rotational supports is smaller than that of the diamond teeth of the belt. The construction of the arm 14 may be identical to that of the previous embodiment, providing the same advantages as mentioned above. Furthermore, as regards the arched profile of the two opposite outer edges of the arm 114, associated to the inactive and active branches of the belt 7 respectively, this embodiment allows to obtain this profile by simply changing the diameter of the grooved wheels or rollers 17' depending on their position. By increasing the diameter of the pulleys or rollers 17' symmetrically to the transverse median axis of the arm 14, an arched profile of the corresponding branch of the diamond belt 7 can be obtained from a substantially rectangular shape of the arm, or of the longitudinal members 16 composing it.

[0030] Obviously, one of the two outer edges of the arm 14 may be made according to the embodiment of figs. 1 to 6, i.e. provided with the groove on its longitudinal edge, whereas the other may have the grooved rollers, wheels or pulleys 17'. Also, one or both opposite longitudinal edges of the arm 14 may have combinations of segments of grooves 17 and grooved rollers, wheels or pulleys 17'. Again, in the embodiment which provides the at least partial use of the rollers or wheels 17', a fluid feed, e.g. of water or the like may be provided, though only having, in this case, the function of keeping the rotational supports of said rollers 17' or similar clean.

[0031] Fig. 7 also shows a further difference with respect to the embodiment of figs. 1 to 6. Here, the machine is supported on a car 30, which slides or guides, e.g. rails 31, like the block-carrying car of the previous example. On the contrary, the block B to be cut is stationary. The moving direction is transverse to the cutting plane and the latter is moved relative to the block by moving the machine. Moreover, the path run by the machine may develop along a plurality of successive aligned blocks to be cut. This is particularly advantageous, because it doesn't require cranes for moving blocks from the storing site onto the cutting car. Blocks may be simply unloaded onto the storing site in the predetermined order for cutting, i.e. in any location of the path run by the machine and may be processed whenever need thereof arises.

[0032] Obviously, the invention is not limited to the above described and illustrated embodiment, but may be greatly varied and modified especially as regards construction and within the range of mechanical equivalents. Particularly, the arrangement of the anti-slippage means and the composition of the belt-guiding arm from two longitudinal members consisting of the same type of prefabricated longitudinal member, may be used, either in combination or separately, in any machine as described herein, regardless of the particular construction

thereof and of its respective diamond belt. Moreover, even two or more adjacent and parallel belt-guiding arms 14 may be mounted on the arm carrier 5, each associated to a diamond belt 7, so that two or more parallel cuts may be simultaneously made in the stone block B. In order to perform the cutting operation, the arm carrier 5 may be translated parallel to itself not only in a vertical plane, as described in the illustrated embodiment, but in a plane having any orientation in space and/or not only vertically from top to bottom, but, for instance, even horizontally, from one side to the opposite one, while orienting the belt-guiding arm 14 accordingly. All this without departure from the guiding principle disclosed above and claimed below.

Claims

1. A machine for cutting stones, such as marbles, granites and others, and particularly for cutting slabs from a stone block, for dividing a stone block into slabs having a predetermined thickness, for squaring stone blocks, and for other similar tasks, in which machine cutting operations are performed by at least one endless diamond belt (7), which slidably extends in the cutting plane around a belt-guiding arm (14) substantially parallel to the cutting line and is returned on pulleys (6) disposed at the ends of this arm (14), one of which is a driving pulley, and which diamond belt (7) is guided with its active branch transverse to the cutting plane by grooved guide means (17, 17') provided on the longitudinal edge of the belt-guiding arm (14) turned towards the cutting line and with its inactive return branch in grooved guide means (17, 17') provided on the longitudinal edge of the belt-guiding arm (14) opposite to the cutting line, the belt-guiding arm (14) being translatable parallel to itself and to the cutting line in the cutting plane, and means (8, 9, 10) being provided for moving the belt-guiding arm (14) so that it can be first engaged with the stone block (B) by the active branch of the diamond belt (7) along the desired cutting line and then advanced through the stone block (B) in the cut advancement direction, at a speed corresponding to the cutting speed, while keeping the active branch of the diamond belt (7) pressed in operating contact with the stone, means (28, 29) being typically also provided for relative movement between the stone block (B) and the belt-guiding arm (14) transversely to the cutting plane, intended to bring them in the desired mutual cutting position, **characterized in that** along the edge of the belt-guiding arm (14) opposite to the cutting line anti-slippage means (23) are provided, which are arranged at least partially over the inactive return branch of the diamond belt (7) and prevent it from disengaging from the associated grooved guide means (17, 17') provided on the cor-

responding longitudinal edge of the belt-guiding arm (14).

2. A machine as claimed in claim 1, **characterized in that** anti-slippage means (26) are also provided for the active branch of the diamond belt (7) at the segments between the stone block (B) and the return pulleys (6) for the diamond belt (7).
3. A machine as claimed in claim 1 or 2, **characterized in that** the anti-slippage means consist of continuous or discontinuous stationary protection means overlaying the diamond belt (7) and covering it at least partially.
4. A machine as claimed in claim 1 or 2, **characterized in that** the anti-slippage means consist of loose guide wheels (23, 26).
5. A machine as claimed in one or more of the preceding claims **characterized in that** the anti-slippage means (23, 26) are mounted at least partly on the belt-guiding arm (14) and at least partly on an arm carrier (5) guided in a frame (2) in such a way that it can be translated parallel to the cutting plane and transverse to the cutting line.
6. A machine as claimed in claims 1 to 5, **characterized in that** the belt-guiding arm (14) is delimited, on the side turned towards the cutting line and on the opposite side, by two corresponding separate substantially parallel longitudinal members (16), substantially parallel to the cutting line and connected to each other and/or to the bearing structure of the belt-guiding arm (14), as well as provided at their longitudinal edges with grooved guide means (17, 17') for the diamond belt (7).
7. A machine as claimed in claim 6, **characterized in that** the two opposite longitudinal members (16) of the belt-guiding arm (14) consist of the same type of longitudinal member prefabricated and used in two upside-down positions, so that the longitudinal side having the grooved guide means (17, 17') or the mounts and/or housings therefor (114) are always turned outwards.
8. A machine as claimed in claim 6 or 7, **characterized in that** the two opposite longitudinal edges of the belt-guiding arm (14) having the grooved guide means (17, 17'), and hence the corresponding outer edges of the two respective longitudinal members (16) provided with the guide means (17, 17') are substantially rectilinear.
9. A machine as claimed in claim 6 or 7, **characterized in that** the two opposite longitudinal edges of the belt-guiding arm (14) having the grooved guide

means (17, 17'), and hence the corresponding outer edges of the two respective longitudinal members (16) provided with the guide means (17, 17') are curved and slightly outwardly convex..

10. A machine as claimed in one or more of the preceding claims **characterized in that** the grooved guide means consist of an end groove (17) provided along or in the outer longitudinal edges of the arm (14) or of the longitudinal members (16) associated to the active and inactive branch of the belt (7) respectively, and that fluid feed means are associated to those grooves, for generating a fluid slide bearing.
11. A machine as claimed in one or more of the preceding claims 1 to 9, **characterized in that** the guide means (17') for one or both active and return branches respectively of the diamond belt (7) around the arm (14) consist of a plurality of rollers, wheels or pulleys, arranged at predetermined intervals and in a predetermined number along the longitudinal edges of the arm (14), associated to said branches of the diamond belt (7).
12. A machine as claimed in one or more of the preceding claims **characterized in that** a fluid feed is associated to the arm (14) for lubricating and/or cleaning the guide rollers, pulleys or wheels (17') for the diamond belt (7).
13. A machine as claimed in one or more of the preceding claims **characterized in that** the arm has opposite outer edges along which the active and return branches of the diamond belt (7) respectively slide, and particularly a substantially rectangular shape, whereas the radii of the guide pulleys, rollers or wheels (17') for the diamond belt (7) are changed depending on the position thereof on the arm, to obtain the desired profile of the corresponding branch of the diamond belt, particularly an arched profile, symmetric to the median transverse axis of the arm.
14. A machine as claimed in one or more of the preceding claims **characterized in that** it has a combination of guide rollers, wheels or pulleys (17') and end grooves (17) on one or the other outer edge of the arm (14) or within the same outer edge of the arm (14).
15. A machine as claimed in one or more of the preceding claims **characterized in that** it is mounted on a slidable car along a predetermined path, preferably rails, and in a direction which is at least transverse to the cutting plane, along one or more blocks arranged along said path of the machine.

Patentansprüche

1. Maschine zum Schneiden von Steinen, wie Marmor, Granit und anderen, und insbesondere zum Schneiden von Platten aus einem Steinblock, zum Teilen eines Steinblocks in Platten mit einer bestimmten Dicke, zum Quadrieren von Steinblöcken und für weitere ähnliche Aufgaben, bei denen die Schneidevorgänge der Maschine von mindestens einem diamantierten Endlosriemen (7) ausgeführt werden, der sich gleitend in der Schneideebene um einen riemenführenden Arm (14) im Wesentlichen parallel zur Schneidelinie erstreckt und über Riemenscheiben (6) zurückgeführt wird, die an den Enden dieses Armes (14) angeordnet sind, von denen eine eine antreibende Riemenscheibe ist, und wobei der diamantierte Riemen (7) mit seinem arbeitenden Abschnitt quer zur Schneideebene von gekerbten Führungsmitteln (17, 17'), die auf der länglichen Kante des riemenführenden Armes (14) bereitgestellt sind, der zur Schneidelinie weisend ist, und mit seinem ruhenden zurückgeführten Abschnitt in den gekerbten Führungsmitteln (17, 17') geführt wird, die auf der länglichen Kante des riemenführenden Armes (14) gegenüber der Schneidelinie bereitgestellt sind, wobei der riemenführende Arm (14) parallel zu sich selbst und zur Schneidelinie in der Schneideebene übersetzbar ist, und wobei Mittel (8, 9, 10) zum Bewegen des riemenführenden Armes (14) bereitgestellt sind, so dass er erst mit dem arbeitenden Abschnitt des diamantierten Riemens (7) entlang der gewünschten Schneidelinie mit dem Steinblock (B) in Eingriff gebracht werden kann und dann durch den Steinblock (B) in einer Schneidevortriebsrichtung mit einer Geschwindigkeit entsprechend der Schneidegeschwindigkeit vorgetrieben werden kann, während der arbeitende Abschnitt des diamantierten Riemens (7) im Arbeitskontakt mit dem Stein gehalten wird, wobei die Mittel (28, 29) typischerweise auch für die relative Bewegung zwischen dem Steinblock (B) und dem riemenführenden Arm (14) quer zur Schneideebene bereitgestellt sind, was sie in die gewünschte beiderseitige Schneidestellung bringen soll, **dadurch gekennzeichnet, dass** entlang der Kante des riemenführenden Armes (14) gegenüber der Schneidelinie Antislippmittel (23) bereitgestellt sind, die mindestens teilweise über dem ruhenden zurückgeführten Abschnitt des diamantierten Riemens (7) angeordnet sind und verhindern, dass dieser sich aus den zugeordneten gekerbten Führungsmitteln (17, 17') löst, die auf der entsprechenden länglichen Kante des riemenführenden Armes (14) bereitgestellt sind.
2. Maschine nach Anspruch 1, **dadurch gekennzeichnet, dass** die Antislippmittel (26) auch für den arbeitenden Abschnitt des diamantierten Riemens

(7) an den Segmenten zwischen dem Steinblock (B) und den Rückführriemenscheiben (6) für den diamantierten Riemen (7) bereitgestellt sind.

3. Maschine nach Anspruch 1 oder 2, **dadurch gekennzeichnet, dass** die Antislippmittel aus durchgehenden oder unterbrochenen feststehenden Schutzmitteln bestehen, die den diamantierten Riemen (7) überlagern und ihn mindestens teilweise abdecken. 5
4. Maschine nach Anspruch 1 oder 2, **dadurch gekennzeichnet, dass** die Antislippmittel aus losen Führungsrädern (23, 26) bestehen. 10
5. Maschine nach einem oder mehreren der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass die** Antislippmittel (23, 26) mindestens teilweise an dem riemenführenden Arm (14) und mindestens teilweise auf einem Armträger (5) angeordnet sind, der so in einem Rahmen (2) geführt ist, dass er parallel zur Schneideebene und quer zur Schneidelinie übersetzt werden kann. 15 20
6. Maschine nach einem der Ansprüche 1 bis 5, **dadurch gekennzeichnet, dass** der riemenführende Arm (14) auf der zur Schneidelinie hinweisenden Seite und auf der gegenüberliegenden Seite durch zwei entsprechende getrennte im Wesentlichen parallele längliche Elemente (16) begrenzt ist, die im Wesentlichen parallel zur Schneidelinie verlaufen und miteinander und/oder mit der Trägerstruktur des riemenführenden Armes (14) verbunden sind und an ihren länglichen Kanten mit gekerbten Führungsmitteln (17, 17') für den diamantierten Riemen (7) bereitgestellt sind. 25 30 35
7. Maschine nach Anspruch 6, **dadurch gekennzeichnet, dass** die beiden gegenüberliegenden länglichen Elemente (16) des riemenführenden Armes (14) aus derselben Art länglichem Element bestehen, das in zwei überkopfstehenden Stellungen vorgefertigt und verwendet wird, so dass die längliche Seite mit den gekerbten Führungsmitteln (17, 17') oder die Fassungen und/oder Gehäuse dafür (114) immer nach außenweisend sind. 40 45
8. Maschine nach Anspruch 6 oder 7, **dadurch gekennzeichnet, dass** die beiden gegenüberliegenden länglichen Kanten des riemenführenden Armes (14) mit den gekerbten Führungsmitteln (17, 17') und somit die entsprechenden äußeren Kanten der beiden jeweiligen länglichen Elemente (16), die mit den Führungsmitteln (17, 17') bereitgestellt sind, im Wesentlichen geradlinig ausgeführt sind. 50
9. Maschine nach Anspruch 6 oder 7, **dadurch gekennzeichnet, dass** die beiden gegenüberliegen-

den länglichen Kanten des riemenführenden Armes (14) mit den gekerbten Führungsmitteln (17, 17') und somit die entsprechenden äußeren Kanten der beiden jeweiligen länglichen Elemente (16), die mit den Führungsmitteln (17, 17') bereitgestellt sind, gebogen und leicht auswärts konvex ausgeführt sind.

10. Maschine nach einem oder mehreren der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** die gekerbten Führungsmittel aus einer Endkerbe (17), die entlang der oder in den äußeren länglichen Kanten des Armes (14) bereitgestellt ist, oder aus den länglichen Elementen (16) bestehen, die jeweils dem arbeitenden und dem ruhenden Abschnitt des Riemens (7) zugeordnet sind, und dass diesen Kerben Flüssigkeitszuführungsmittel zugeordnet sind, um ein Flüssigkeitsgleitlager zu erzeugen. 10
11. Maschine nach einem oder mehreren der vorhergehenden Ansprüche 1 bis 9, **dadurch gekennzeichnet, dass** die Führungsmittel (17') für jeweils einen oder beide arbeitenden und zurückgeführten Abschnitte des diamantierten Riemens (7) um den Arm (14) aus mehreren Rollen, Rädern oder Riemenscheiben bestehen, die in bestimmten Abständen und in einer bestimmten Anzahl entlang der länglichen Kanten des Armes (14) angeordnet sind, der den Abschnitten des diamantierten Riemens (7) zugeordnet ist. 20
12. Maschine nach einem oder mehreren der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** dem Arm (14) eine Flüssigkeitszuführung zugeordnet ist, um die Führungsrollen, Riemenscheiben oder Räder (17') für den diamantierten Riemen (7) zu schmieren und/oder zu reinigen. 35
13. Maschine nach einem oder mehreren der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** der Arm gegenüberliegende Außenkanten aufweist, entlang welcher die arbeitenden und zurückgeführten Abschnitte des diamantierten Riemens (7) jeweils gleiten, und insbesondere eine im Wesentlichen rechteckige Form hat, während die Radien der Führungsriemenscheiben, Rollen oder Räder (17') für den diamantierten Riemen (7) entsprechend ihrer Stellung auf dem Arm gewechselt werden, um das gewünschte Profil des entsprechenden Abschnittes des diamantierten Riemens, insbesondere ein gebogenes Profil, symmetrisch zu der mittleren Querachse des Armes, zu erhalten. 40
14. Maschine nach einem oder mehreren der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** sie eine Verbindung aus Führungsrollen, Rädern oder Riemenscheiben (17') und Endkerben 55

(17) an einer oder der anderen Außenkante des Armes (14) oder innerhalb derselben Aussenkante des Armes (14) aufweist.

15. Machine nach einem oder mehreren der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** sie entlang eines bestimmten Weges, vorzugsweise auf Schienen, und in einer Richtung, die mindestens quer zur Schneideebene verläuft, entlang eines oder mehrerer Blöcke, die entlang des Weges der Maschine angeordnet sind, auf einem verschiebbaren Wagen angeordnet ist.

Revendications

1. Machine pour découper des pierres, par exemple du marbre, du granit et autres, et en particulier pour découper des dalles dans un bloc de pierre, pour diviser un bloc de pierre en dalles d'épaisseur prédéterminée, pour dresser des blocs de pierre et pour d'autres tâches similaires, les opérations de découpe par la machine étant réalisées par au moins une courroie sans fin diamantée (7) qui s'étend à coulissement dans le plan de découpe autour d'un bras (14) de guidage de courroie essentiellement parallèle à la ligne de découpe et qui est renvoyée sur des poulies (6) disposées aux extrémités de ce bras (14) et dont l'une est une poulie d'entraînement, la courroie diamantée (7) étant guidée avec son brin actif transversalement au plan de découpe par des moyens de guidage (17, 17') à rainures prévus sur le bord longitudinal du bras (14) de guidage de courroie tourné vers sa ligne de découpe et dont le brin de retour inactif est guidé dans des moyens de guidage (17, 17') à rainures prévus sur le bord longitudinal du bras (14) de guidage de courroie opposés à la ligne de découpe, le bras (14) de guidage de courroie pouvant être déplacé parallèlement à lui-même et à la ligne de découpe dans le plan de découpe, de moyens (8, 9, 10) étant prévus pour déplacer le bras (14) de guidage de courroie de manière à pouvoir être engagé en premier sur le bloc de pierre (B) par le brin actif de la courroie diamantée (7) le long de la ligne de découpe souhaitée pour être ensuite avancé dans le bloc de pierre (B) dans la direction d'avancement de la découpe à une vitesse qui correspond à la vitesse de découpe, tout en maintenant le brin actif de la courroie diamantée (7) repoussé en contact fonctionnel contre la pierre, des moyens (28, 29) étant typiquement également prévus pour permettre un déplacement relatif entre le bloc de pierre (B) et le bras (14) de guidage de courroie transversalement par rapport au plan de découpe, pour les amener dans la position mutuelle souhaitée de découpe, **caractérisée en ce que** le long du bord du bras (14) de guidage de courroie opposé à la ligne de découpe

sont prévus des moyens anti-glissement (23) qui sont agencés au moins partiellement au-dessus du brin de retour inactif de la courroie diamantée (7) et qui l'empêchent de se désengager des moyens associés de guidage (17, 17') à rainures prévus sur le bord longitudinal correspondant du bras (14) de guidage de courroie.

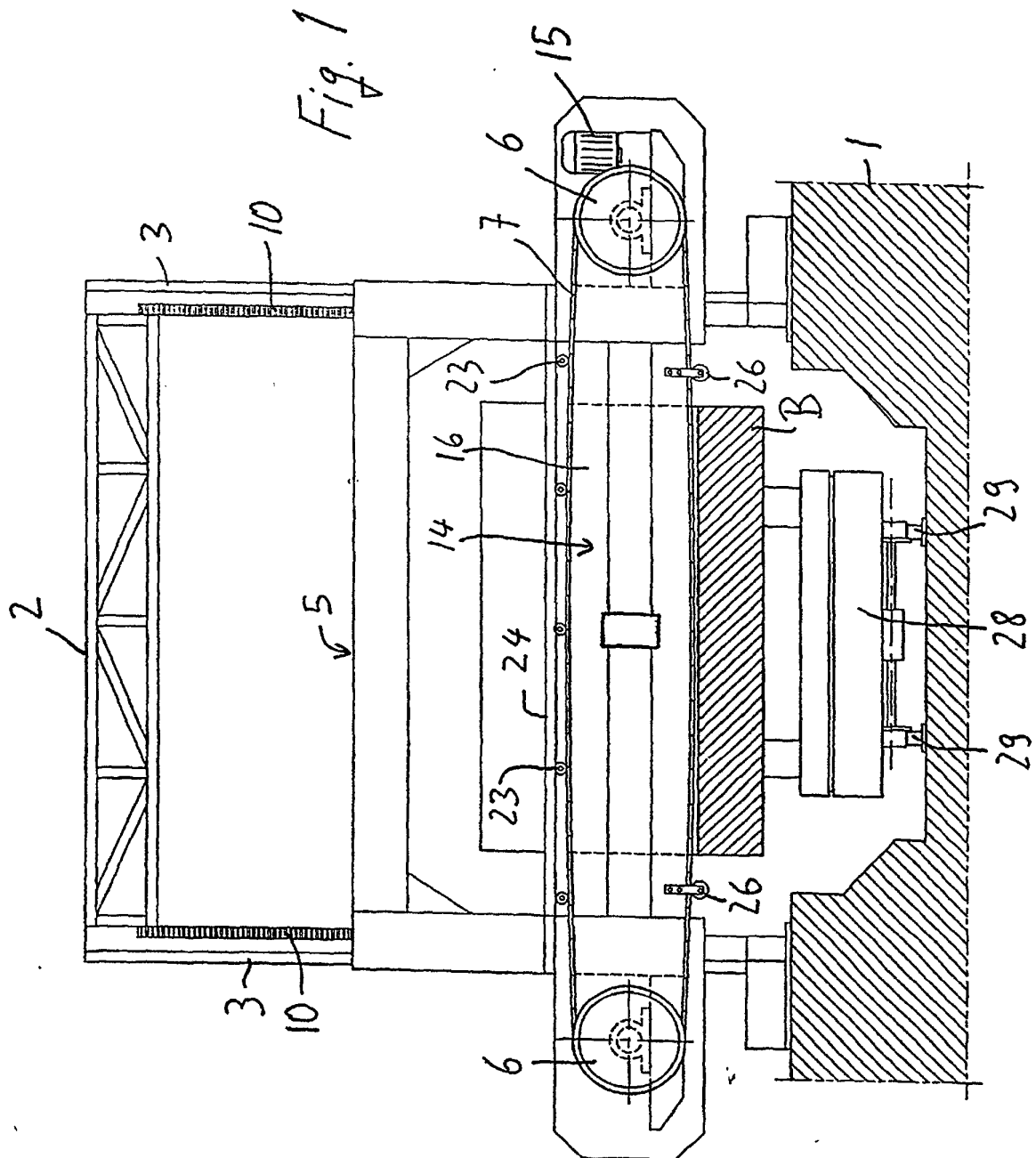
2. Machine selon la revendication 1, **caractérisée en ce que** des moyens anti-glissement (26) sont également prévus pour le brin actif de la courroie diamantée (7) sur les segments situés entre le bloc de pierre (B) et les poulies de retour (6) de la courroie diamantée (7).
3. Machine selon la revendication 1 ou 2, **caractérisée en ce que** les moyens anti-glissement sont constitués de moyens de protection, continus ou discontinus, stationnaires, qui sont superposés à la courroie diamantée (7) et la couvrent au moins en partie.
4. Machine selon les revendications 1 ou 2, **caractérisée en ce que** les moyens anti-glissement sont constitués de roues de guidage libres (23, 26).
5. Machine selon l'une ou plusieurs des revendications précédentes, **caractérisée en ce que** les moyens anti-glissement (23, 26) sont montés au moins en partie sur le bras (14) de guidage de courroie et au moins en partie sur un support de bras (5) guidé dans un bâti (2) de manière à pouvoir être déplacé parallèlement au plan de découpe et transversalement par rapport à la ligne de découpe.
6. Machine selon les revendications 1 à 5, **caractérisée en ce que** sur son côté tourné vers la ligne de découpe et sur le côté opposé, le bras (14) de guidage de courroie est délimité par deux éléments longitudinaux (16) correspondants, séparés et essentiellement parallèles, essentiellement parallèles à la ligne de découpe et reliés l'un à l'autre et/ou à la structure de support du bras (14) de guidage de courroie, et qui sont également dotés sur leurs bords longitudinaux de moyens de guidage (17, 17') à rainures pour la courroie diamantée (7).
7. Machine selon la revendication 6, **caractérisée en ce que** les deux éléments longitudinaux opposés (16) du bras (14) de guidage de courroie sont constitués du même type d'éléments longitudinaux préfabriqués et utilisés dans deux positions renversées de telle sorte que le côté longitudinal qui présente les moyens de guidage (17, 17') à rainures ou les supports et/ou les logements (14) prévus pour ceux-ci soient toujours tournés vers l'extérieur.
8. Machine selon les revendications 6 ou 7, **caracté-**

risée en ce que les deux bords longitudinaux opposés du bras (14) de guidage de courroie qui présentent les moyens de guidage (17, 17') à rainures et donc les bords extérieurs correspondants des deux éléments longitudinaux (16) respectifs dotés des moyens de guidage (17, 17') sont essentiellement rectilignes.

9. Machine selon les revendications 6 ou 7, **caractérisée en ce que** les deux bords longitudinaux opposés du bras (14) de guidage de courroie qui présente les moyens de guidage (17, 17') à rainures et donc les bords extérieurs correspondants des deux éléments longitudinaux (16) respectifs dotés des moyens de guidage (17, 17') sont incurvés et légèrement convexes vers l'extérieur. 5 10
10. Machine selon l'une ou plusieurs des revendications précédentes, **caractérisée en ce que** les moyens de guidage à rainures sont constitués d'une rainure d'extrémité (7) prévue le long ou dans les bords longitudinaux extérieurs du bras (14) ou des éléments longitudinaux (16) associés respectivement au brin actif et au brin inactif de la courroie (7), et **en ce que** des moyens d'alimentation en fluide sont associés à ces rainures pour créer un support coulissant fluide. 20 25
11. Machine selon l'une ou plusieurs des revendications 1 à 9 qui précèdent, **caractérisée en ce que** le moyen de guidage (17') pour un brin ou les brins respectifs actifs et de retour de la courroie diamantée (7) autour du bras (14) sont constitués d'une pluralité de rouleaux, de roues ou de poulies agencés à des intervalles prédéterminés et en nombre prédéterminé le long des bords longitudinaux du bras (14) associés auxdits brins de la courroie diamantée (7). 30 35
12. Machine selon l'une ou plusieurs des revendications précédentes, **caractérisée en ce qu'une** alimentation de fluide est associée au bras (14) pour lubrifier et/ou nettoyer les rouleaux, les poulies ou les roues de guidage (17') de la courroie diamantée (17). 40 45
13. Machine selon l'une ou plusieurs des revendications précédentes, **caractérisée en ce que** le bras présente des bords extérieurs opposés le long desquels le brin actif et le brin de retour de la courroie diamantée (7) coulissent respectivement, et en particulier une forme essentiellement rectangulaire, les rayons des poulies, des rouleaux ou des roues de guidage (17') de la courroie diamantée (7) étant remplacés en fonction de leur position sur le bras pour obtenir le profil souhaité du brin correspondant de la courroie diamantée, en particulier un profil arqué, symétriquement par rapport à l'axe transversal 50 55

central du bras.

14. Machine selon l'une ou plusieurs des revendications précédentes, **caractérisée en ce qu'elle** présente une combinaison de rouleaux de roues ou de poulies de guidage (17') et des rainures d'extrémité (17) sur l'un ou l'autre des bords extérieurs du bras (14) ou à l'intérieur du même bord extérieur du bras (14).
15. Machine selon l'une ou plusieurs des revendications précédentes, **caractérisée en ce qu'elle** est montée sur un chariot apte à coulisser sur un parcours prédéterminé, de préférence des rails, et dans une direction qui est au moins transversale au plan de découpe, le long d'un ou de plusieurs blocs agencés sur ledit parcours de la machine.



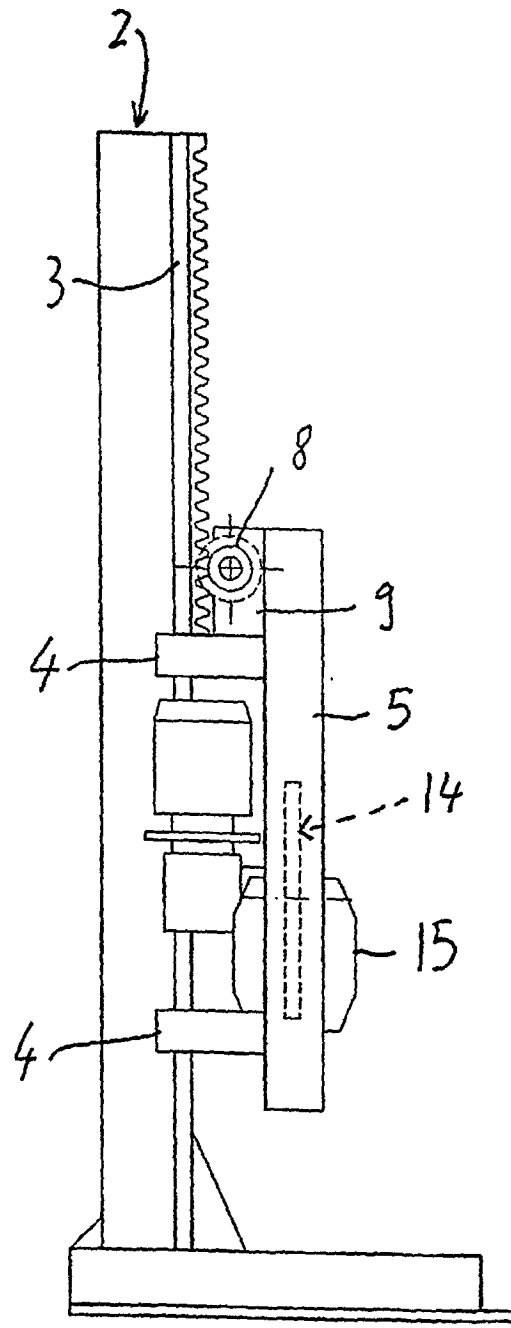
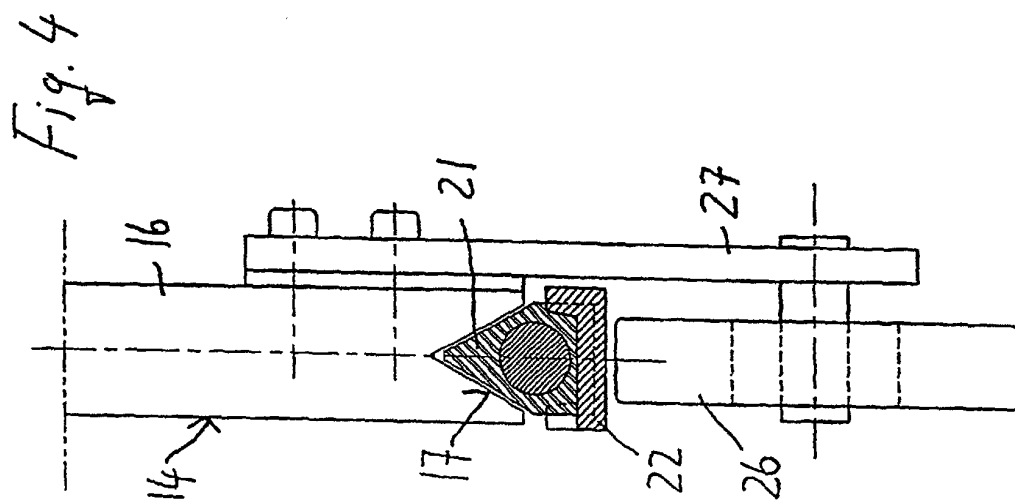
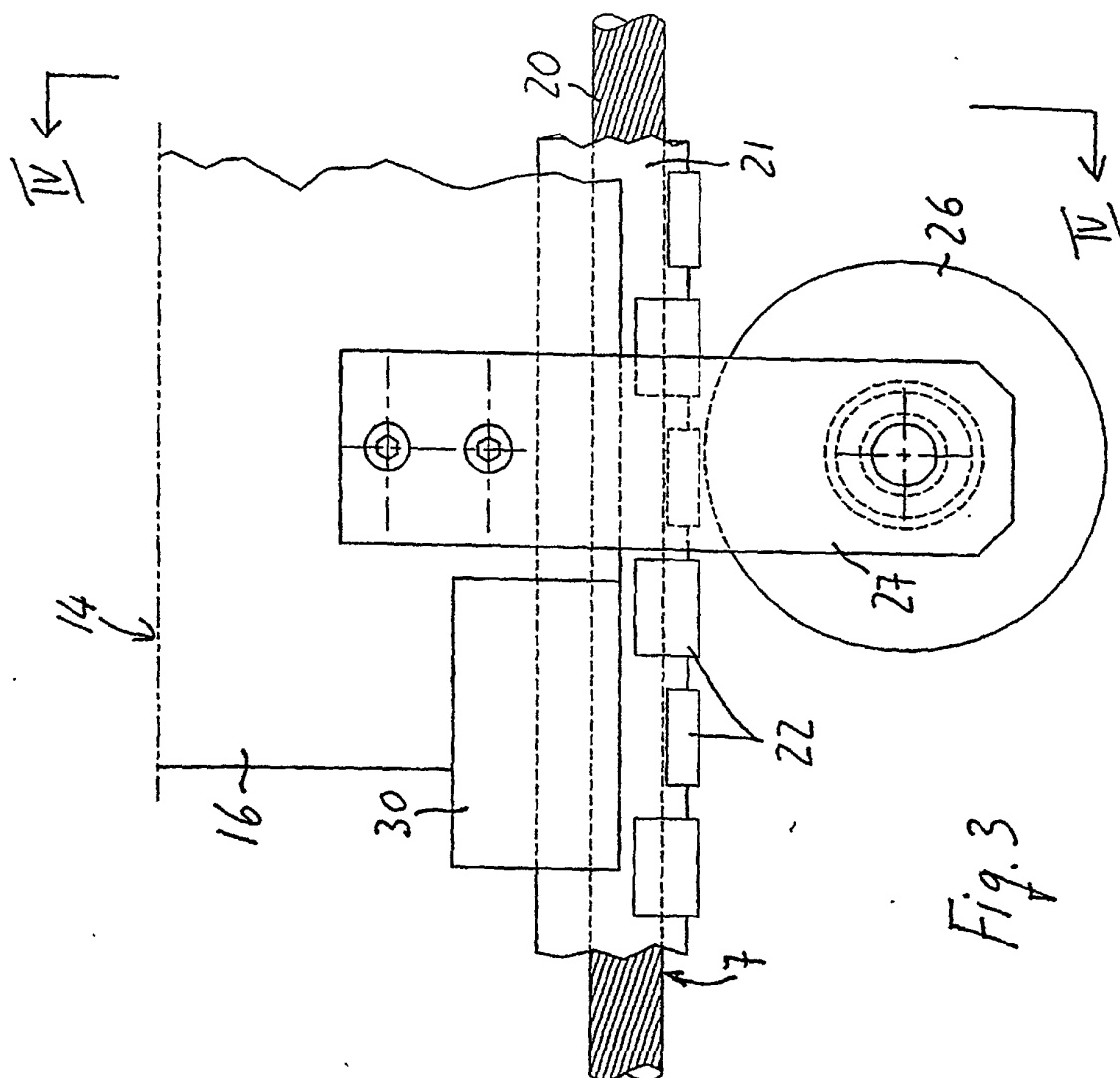


Fig. 2



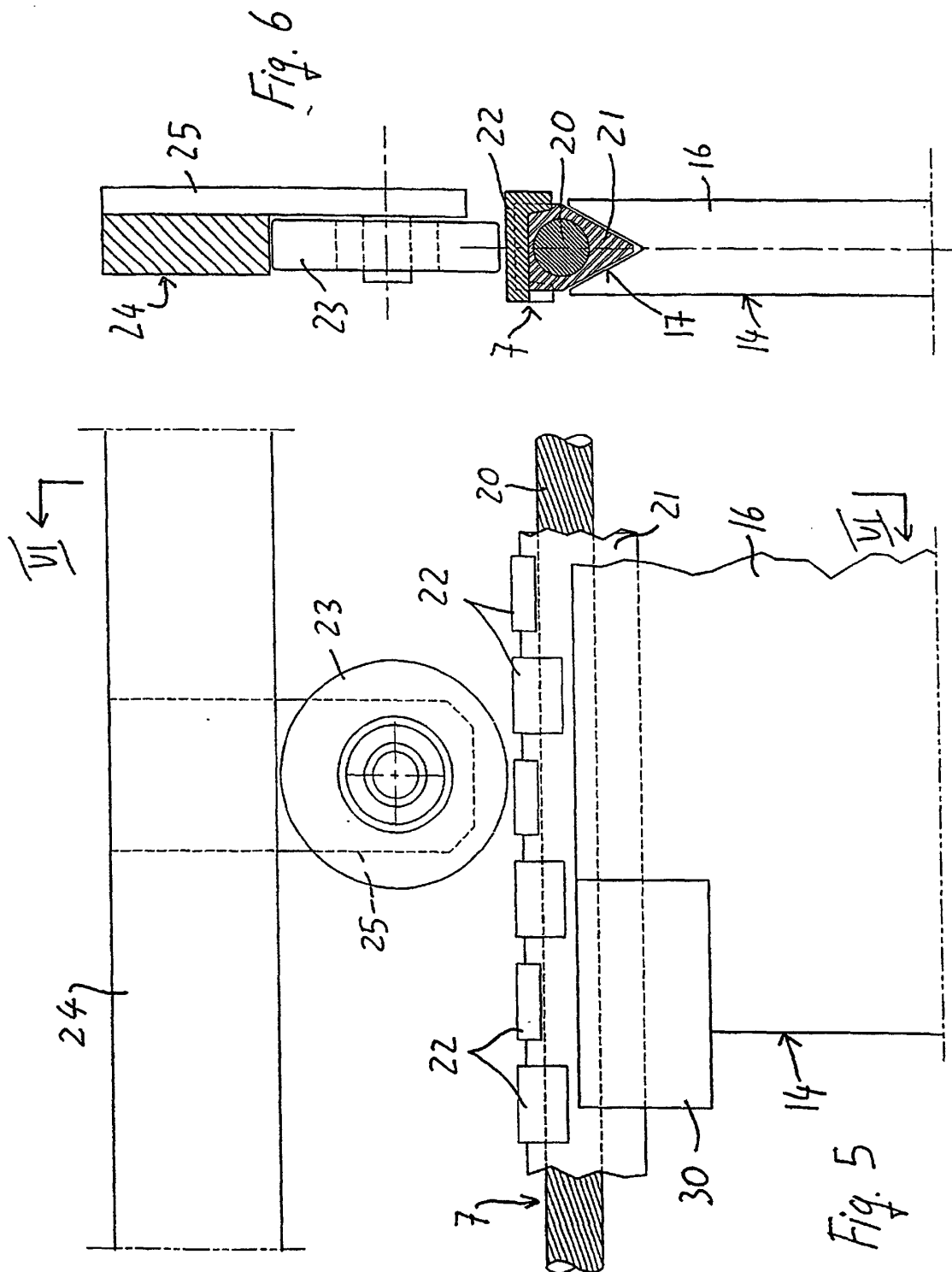
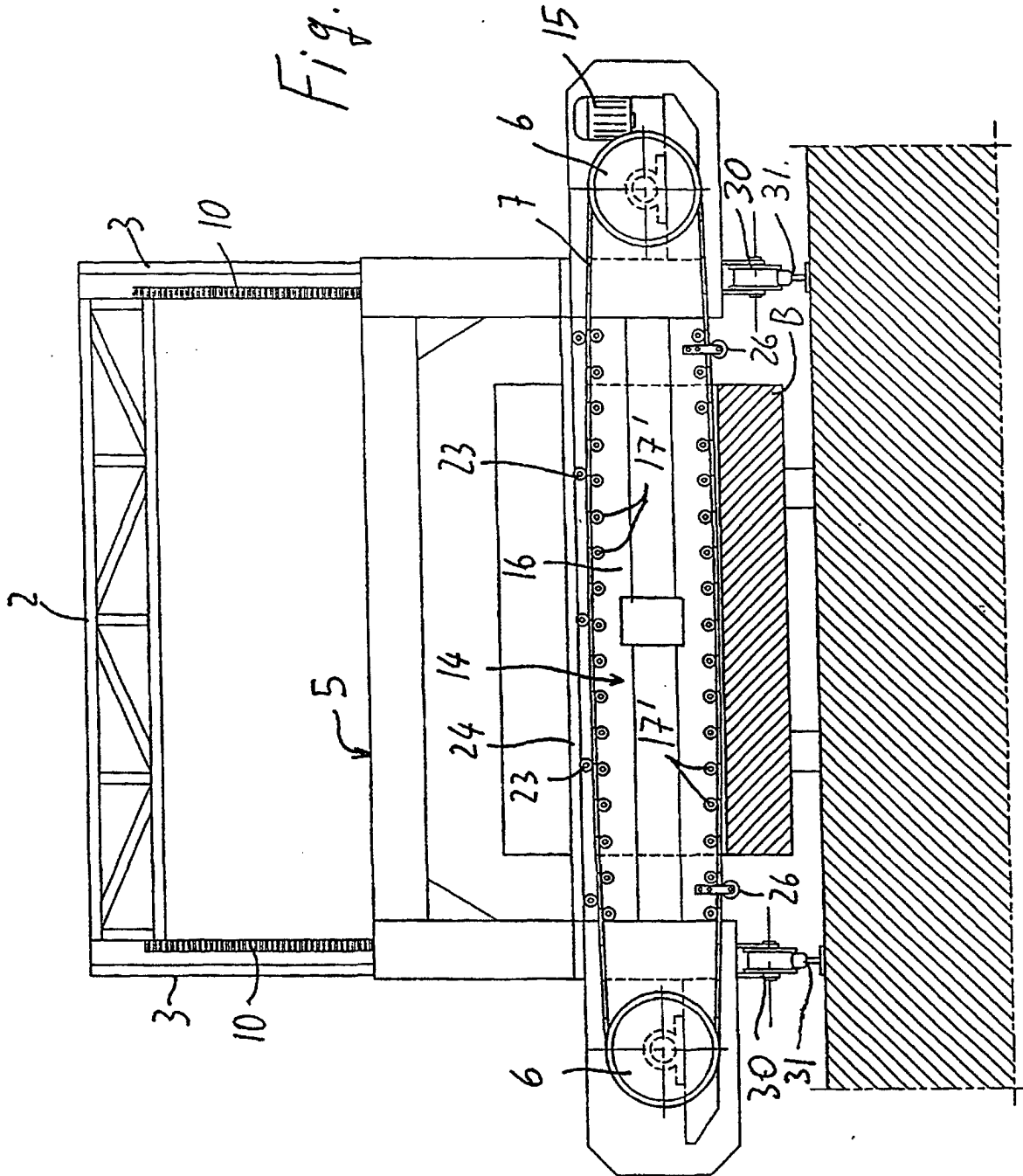


Fig. 7



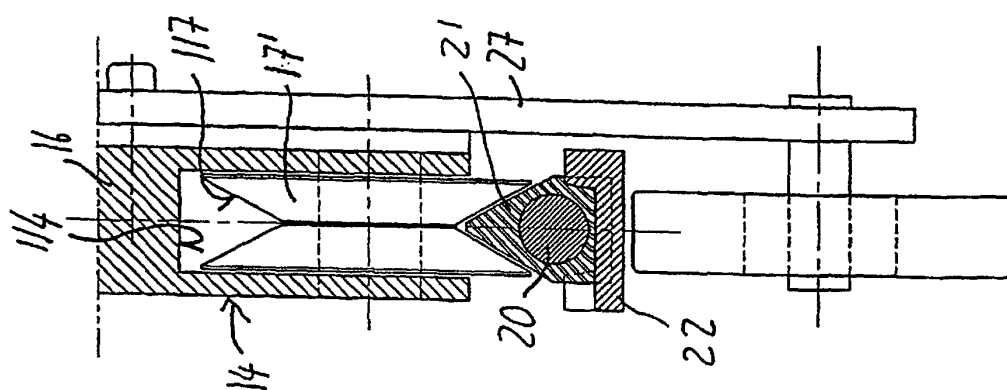


Fig. 3

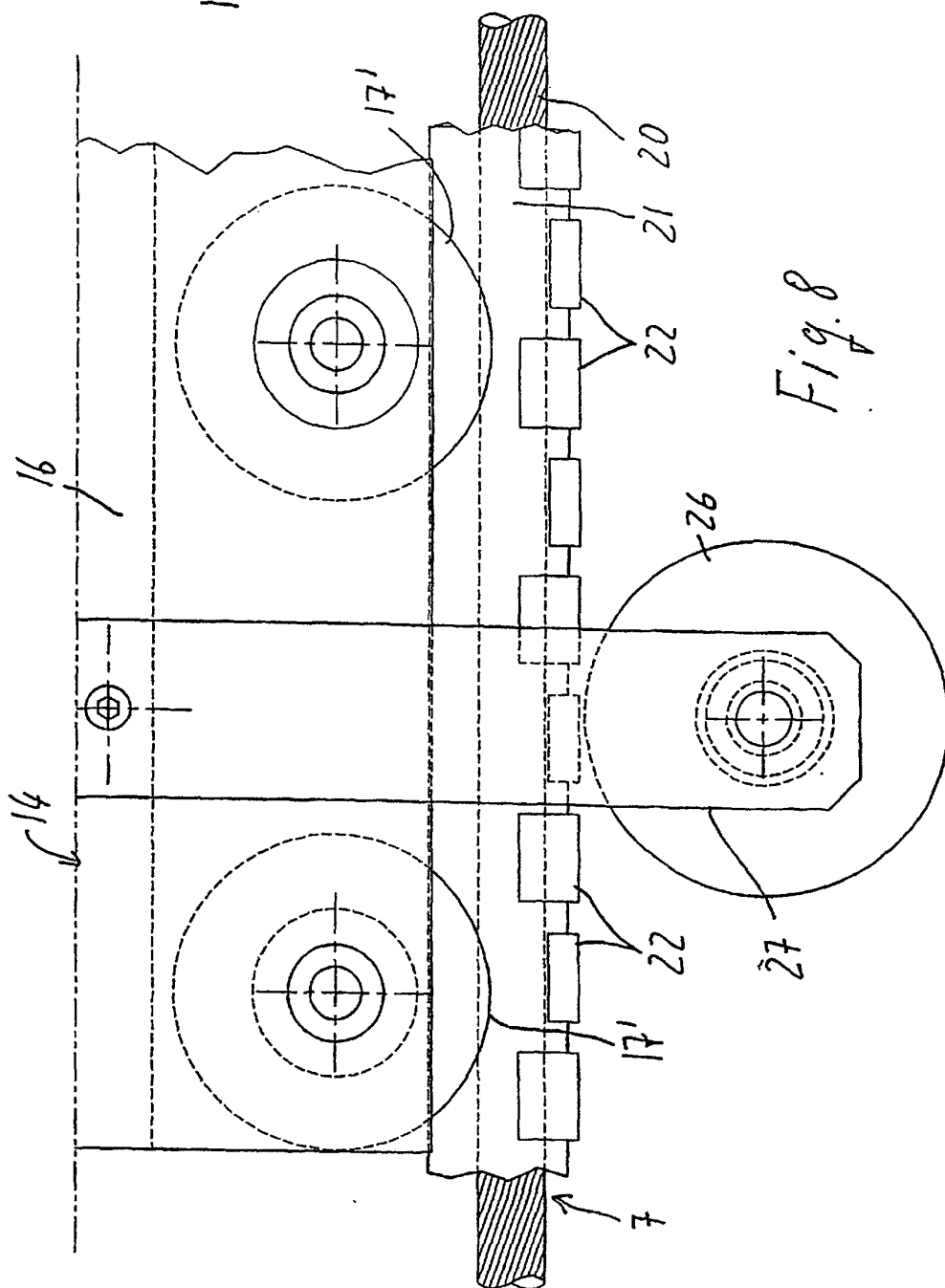


Fig. 8