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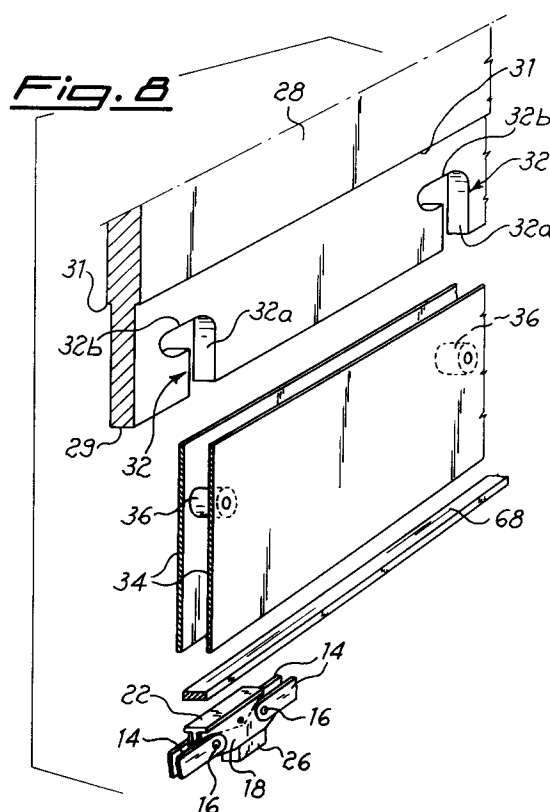
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I-31100 Treviso (IT)(54) **Machine for the cutting into slabs of stone blocks, such as marble, granite, porphyry and the like.**

(57) A machine for the cutting into slabs of stone blocks, such as marble, granite, porphyry and the like is described, a machine in which the cutting tool is a flexible diamond-insert bearing ring-closed chain 10 put forward in a sliding and guiding seat 24 of a chain-carrying support 28 by means of grooved pulleys 30, 30a provided with a peripheral race 52 designed to house the chain 10. The sliding seat 24 of the chain 10 is mounted on the chain-carrying support 28 by snap hooking means 36, 32. Antifriction and wearing means 68 are mounted on at least the bottom of said sliding seat 24 in a removable way in order to reduce the sliding friction of the chain 10 in the seat 24. Spacing means 38 are associated with the grooved driving pulley 30 at the entry and exit area of the chain 10 respectively into and from its peripheral race 52 in order to space apart the walls of the pulley by a predetermined amount.



The present invention relates to a machine for the cutting into slabs of stone blocks, such as marble, granite, porphyry and the like.

As known, machines of the above type have been recently produced in which the cutting tool is flexible consisting of a diamond-insert bearing ring-closed chain engaging the block to be cut. The above chain is, in turn, housed and movable in a seat of a supporting and guiding structure, known in the specific field with the term "chain-guiding or chain-carrying support", in which the chain slides at a very high speed (about 20-25 m/sec.) being moved by known means for example toothed wheels or grooved pulleys.

The chain is called diamond-insert bearing chain because, it comprises a series of tool-carrying members or links each of which has a diamond-insert bearing or abrasive metal insert. Moreover, the tool-carrying links are coupled and hinged each other by means of connecting members or links in order to form the above-mentioned flexible and ring-closed structure fitting to the profile of the chain-carrying support.

The diamond-inserts bearing or abrasive metal inserts are mounted on a side of each tool-carrying link and project outside the sliding seat of the chain, whereas the second side of the said links, opposite the previous one, houses in the above-mentioned seat of the chain-carrying support. The seat of the supporting and guiding structure also extends along a ring-closed path defining, for the chain, a generally rectilinear idle upper travel, and a generally convex operative or working lower travel.

In both the above travels, but in particular in the working one, the stresses, to which the elements or links forming the diamond-insert bearing chain are subjected, are considerable and the resulting drawbacks are numerous. In this regard, it is sufficient to mention from the main drawbacks, the wear of the sliding and guiding surface of the chain-carrying support as well as the wear of the chain. It results that the chain is no longer correctly guided thus causing the cutting operation to divert and, therefore the cut is no longer rectilinear. The obtained products, i.e. the cut slabs, are therefore of poor quality and unacceptable appearance making the subsequent corrective processing operations on these products necessary. Of course, that appreciably raises the production cost.

The above-mentioned stresses also produce other drawbacks from which there is the diameter decrease of the pins which hinge the tool-carrying links to the connecting links as well as the ovalization of the holes in which said pins are inserted. This latter deformation occurs especially in the longitudinal direction with respect to the chain, i.e. along the direction along which the above-mentioned

stresses originate. Obviously, after some time, this fact causes an elongation of the chain which, obviously, is an unwanted effect since the chain is no longer correctly coupled with its operating means whether they are toothed wheels or grooved pulleys.

Other drawbacks have been discovered when toothed wheels have been used as operating means of the chain. In fact, in this case there was the difficult problem consisting in choosing the teeth of the toothed wheel. If this material is too hard, such as steel, the teeth distort the chain causing breakages of some or many links but in any case originating burrs which obviously damage the sliding seat of the chain.

If, on the opposite case, said material is too soft, the fact that some or many teeth are seriously or irretrievably damaged by the same chain happens frequently.

The above-mentioned drawbacks have been mostly overcome by using grooved pulleys consisting, as known, of two metal disk-shaped bodies fastened each other and delimiting, on their contour, a race or peripheral groove covered, on the inside and on both its opposite surfaces, with a resilient material such as rubber. In consequence of the rotation of the two driving and driven pulleys, the chain enters into the groove of each pulley in a substantially tangential way and then comes out at an essentially opposite area lying on a diametric plane of the same.

The chain section lying in the groove of the pulley is subjected to a strong operating action which constantly moves the chain forwards. This is due both to the friction between the chain and the resilient material of the groove inner covering, which prevents relative slidings between the chain and the pulley, and to the appreciable pressure, by which the two disks forming the pulley are kept against each other, produced by appropriate known fastening means, as for example screws, which screw transversely in the two disks. Obviously this pressure is transmitted to the walls of the peripheral race of the pulley increasing the chain operating efficiency.

Furthermore, it is to be taken into account another feature consisting in the fact that the chain, kept in the above-mentioned grooves for the whole length, is subjected to neither damages nor wears owing to the fact that both the walls of the grooves are of slightly deformable material and that the reciprocal fastening means of the two disks forming the pulley contain elastic means which make the coupling of these two members slightly "yielding".

However, although the above-mentioned features are substantially satisfactory in general, there are drawbacks which must be taken into account since they are appreciable and precisely involve

the chain integrity since the chain is operated by the pulleys, as herebelow explained.

Unfortunately in fact, it is to be noted that the chain links are always subjected to appreciable stresses which may damage their structure although the groove walls of the above-mentioned pulleys are deformable and the coupling between the disks forming the pulleys is "yielding". More precisely, these stresses originate at the entry and exit area of the chain in and from the grooves and more specifically where a single link "enters" into or "comes out" from the groove.

In fact, the driving pulleys, in spite of the above-mentioned features of being deformable and "yielding", are however a member with appreciable rigidity which depends exactly on the pulley function which is the operation of the diamond-insert bearing chain. In the above condition and owing to this rigidity, the above-mentioned stresses acting on the chain links actually originate an obstacle or resistance for the chain to enter into or come out from the grooves. More specifically, at the entry area, the links are transversally compressed due to the fact that the width is slightly wider than that of the groove, and at the same time they are longitudinally compressed due to the operating action. At the exit, on the contrary, the links are contemporaneously subjected to a longitudinal tensive action due to the movement of the chain and as the links are wider than the grooves, they return to its original length thus expanding slightly. The amount of these stresses must be evaluated also with regard to the high speed of the chain.

Another surely appreciable drawback of the standard machines results from the fact that, as known, the sliding and guiding seat for the diamond-insert carrying chain and the chain-carrying support are made of a single piece and therefore, when said seat is worn and can no longer be used, it, and the chain-carrying support as well, must be replaced. This is surely serious from the cost point of view owing to the fact both that a part of the machine, i.e. the chain-carrying support which could operate without problems, must be eliminated and that this replacement involves long idle times during which the machine is inactive.

The machine for the cutting into slabs of stone blocks, such as marble, granite, porphyry and the like of the present invention is designed to eliminate all the drawbacks of the standard machines and contemporaneously to increase in number the advantages which are achieved.

More specifically, the machine according to the present invention is of the type which uses, as cutting member, a diamond-insert bearing chain and grooved pulleys for the chain operation.

Therefore, a principal object of the present invention consists of a machine, as herebelow con-

cisely defined, in which the sliding and guiding seat of the chain is provided with means designed to considerably reduce the friction between the areas in contact with the seat and the chain during the movement of the latter so that the wear of the seat and chain is reduced or even eliminated.

Furthermore, in particular, the achievement of the above object enables the service life of these components to prolong reducing at the same time the maintenance need.

Another important object of the present invention consists of a machine of the above kind in which the above-mentioned means are essentially wearing means, i.e. designed to gradually wear and subsequently to be replaced. In this regard, it is to be pointed out that these means, besides to be evidently of low cost, are mounted on the sliding seat of the chain in a very simple way so as to be subsequently replaced in a easy and quick way.

Another appreciable object of the present invention consists of a machine with a diamond-insert bearing chain for the cutting of stone materials and wherein, at the entry and exit area of the chain, the operating means of the chain are grooved pulleys provided with spacing means in order to space apart the pulley walls between each other, preventing the chain links from being subjected to the above-mentioned stresses.

Another particularly advantageous object which can be attained by the machine of the invention, consists in the fact that the sliding seat of the chain is spaced apart from the chain-carrying support and is mounted on the latter by snap hooking means so that, when necessary, the replacement occurs in a very short time.

Therefore, the object of the present invention consists of a machine for the cutting into slabs of stone blocks, such as marble, granite, porphyry and the like, in which the cutting tool is flexible consisting of a diamond-insert bearing ring-closed chain engaging the block to be cut, said chain being housed and movable in a sliding and guiding seat of a chain-carrying support and put forward by operating means, such as grooved pulleys provided with a peripheral groove designed to house the diamond-insert bearing chain, the latter comprising a series of tool-carrying members or links each of which has, on one side, a diamond-insert bearing or abrasive metal plate projecting outside said sliding and guiding seat of the chain whereas the second side, opposite the previous one, is housed and movable in the seat, the tool-carrying links being coupled and hinged each other by means of connecting members or links in order to form the above-mentioned flexible and ring-closed structure which fits to the profile of the chain-carrying support, said machine being characterized in that the sliding and guiding seat of the chain is

mounted to the chain-carrying support by snap hooking means, antifriction and wearing means being mounted on at least the bottom of said sliding and guiding seat in a removable way in order to reduce the sliding friction of the chain into the seat, spacing means being associated with each of said grooved pulleys at the entry and exit area of the chain respectively into and from its peripheral groove in order to space apart the walls of the pulley.

The features as well as the advantages of the machine according to the present invention will appear more clearly from the following detailed description of an exemplifying but not limiting embodiment with reference to the enclosed figures in which;

- figure 1 is an overall schematic side view of the machine according to the present invention;
- figure 2 is an enlarged side view illustrating the detail contained in the circle of figure 1 marked by reference II;
- figure 3 is a transverse section view of a grooved pulley showing one of the spacers of a first embodiment which correspond to that depicted in figure 1;
- figure 4 is a similar view of that of figure 2 showing a variant of the same detail;
- figure 5 is a transverse section view of a grooved pulley showing one spacer of figure 4 variant;
- figure 6 is a view similar to figure 2 showing the same detail of another variant;
- figure 7 is a transverse section view of a grooved pulley showing one of the spacers of the figure 6 variant;
- figure 8 is a schematic exploded view of a part of the chain-carrying support, sliding and guiding seat of the chain and a chain link;
- figure 9 is a schematic cross-section view of the assembled components of figure 8.

With particular reference to figures 1, 8 and 9, the machine according to the invention makes use of a diamond-insert bearing chain, indicated in its entirety with number 10, comprising a plurality of tool-carrying members or links 12 coupled and hinged each other, by pins 16, by means of connecting members or links 14. In the considered exemplifying embodiment, the diamond-insert bearing chain 10 is of the same structure of the chain of the utility patent application No. TV93 U000050 filed on 4 November 1993 in the name of Dario Toncelli. This structure is herebelow briefly described only for a prompt reference.

Each tool-carrying link 12 consists of a pair of identical parallel plates 18, 20 on which a sliding block 22 is mounted and movable in a corresponding guiding and sliding seat which is indicated in

its entirety by number 24 and described in the following in more detail.

On the opposite side to that where there is the sliding block 22, the link 12 is provided with a diamond-insert bearing or abrasive metal insert 26. The insert 26, when the chain 10 houses in the sliding seat 24, projects from the seat in order to engage the block 25 to be cut. The sliding seat 24 of the chain 10 is mounted on a supporting and guiding structure 28, which is known with the term "chain-guiding or chain-carrying support" in the specific field, simply named "chain-carrying support" for the sake of brevity in the following, a support in which the chain slides at a very high speed being operated by known means such as, in this case, a pair of grooved pulleys 30.

According to one of the innovative features of the machine of the present invention, the sliding seat 24 is not of a single piece with the chain-carrying support 28 but it is mounted on and fixed to the support by snap hooking means, described in the following, which make the replacement quick, when it is necessary, for example when the seat is worn, enabling the chain-carrying support 28 to continuously be used thus achieving obvious economical advantages as explained above.

As can be still noted with particular reference to figures 1, 8 and 9, the lower edge 29 of the chain-carrying support 28 has a series of slots 32 substantially L-shaped, each slot having a first side 32a perpendicularly positioned to said lower edge and open towards the outside of the chain-carrying support 28, said first side 32a prolonging with a second side 32b perpendicularly positioned to the first one and extending in the forward movement direction of the chain 10. The number of the slot 32 depends on the length of the sliding seat 24 of the chain 10 but, in any case, the number is such as to assure a steady coupling between the chain and the chain-carrying support.

The sliding seat 24 of the chain 10 is essentially formed by the lower edge 29 of the chain-carrying support 28 forming the bottom whereas the support side walls are delimited by a pair of parallel plates 34 designed to be mounted, for part of their height, on the chain-carrying support 28 whereas for the remaining part of said height the plates 34 project from said support forming said side walls of the sliding seat 24.

As can be appreciated in particular from figures 8 and 9, the plates 34 are firmly connected each other by a series of transverse pins 36 perpendicularly arranged with respect to the plates and all arranged on said plates 34 at the same height.

Said pins 36 together with the slots 32 of the chain-carrying support 28 form, in the considered exemplifying embodiment, the snap hooking means

for fixing the sliding seat 24 to the chain-carrying support 28. In fact, it is sufficient to mount the plates 34 on the lower edge 29 of the chain-carrying support 28 and continue this action until the pins 36 are completely inserted into the slots 32, i.e. until they reach the end of the second side 32b.

In this situation, the upper edge of the plates 34 abuts on a step 31 of the chain-carrying support 28 formed on both the support surfaces and this makes the connection very firm.

Furthermore, the distance between the plates 34 is self evidently to such an extent that the plates 34 are spaced apart so that the assembly with the chain-carrying support 28 occurs at a reduced force in order to give more stability to the above-mentioned connection.

From the above, it is evident that the assembly of the plates 34 with the chain-carrying support 28 is very quick and easy. In fact, this operation needs only two consecutive and relative movements and more precisely, by drawing the plates 34 up to the support 28 in the perpendicular direction to the edge 29 of the support and subsequently by transversely moving the plates in the parallel direction to the above-mentioned edge 29. On operating in a opposite way, the plates 34 are disengaged from the support 28 as quickly as the previous operation.

As can be noted with particular reference to figure 1, the sliding seat 24, and more precisely its side walls formed by the plates 34, is composed of various parts for the two following reasons. Firstly, if one or any more portions of said seat wear before the other one do, it is sufficient replace worn portions thus preventing the other one from replacing. Secondly, the portion-composed seat 24 is produced and mounted easily.

Another innovative feature of the machine according to the present invention results from the fact that, as can be noted more specifically in figures 1,2 and 3, a pair of spacing means, each of which indicated in its entirety by number 38, is associated with the grooved driving pulley 30, each of these spacers being indicated with number 38 in its entirety and very schematically represented in figure 1, whereas in figure 2 and more particularly in figure 3 only one of them is represented in detail since the structure of the spacer means 38 is substantially the same. Consequently, the case in which the driven pulley 30a is not provided with spacer means 38 is not considered since this pulley operates only as snub pulley.

The grooved pulley 30 houses in a box-like protection casing 40 and essentially consists of two disk-shaped bodies 42 and 44, the latter being in particular ring-formed, which are of the same outer diameter and are coaxial with respect to a freely

rotating central shaft 46 mounted on the box-like casing 40 and the first disk-shaped body 42 is keyed on the central shaft.

The disk-shaped bodies 42 and 44 are kept against each other by means of a series of fastening screw 48 and interposed elastic means 50, such as helical springs, Belleville washers or the like, each of which engages the head of the screw 48 and a seat 49 of the body 44. A peripheral race or groove 52 is formed in the outer edge of these bodies and a covering 54, made of resilient material as for example rubber, covers on the inside both the opposite surfaces of the grooves. As can be generally seen in figure 1 and in figures 2 and 3 in more detail, the chain 10 enters into the race 52 of the pulley 30 in a substantially tangential way and comes out at an essentially opposite area lying on a diametral plane of the chain.

According to the invention, a spacer 38 is placed at the entry and exit areas of the chain 10 respectively into and from the peripheral race 52 and a first exemplifying embodiment of the spacer, shown in figures 1 to 3, is herebelow described.

The spacer 38 essentially consists of a disk 56 which is mounted and freely rotates on a shaft 58. The longitudinal axis of the shaft 58 and thus the rotation axis of the disk 56 are parallel to the rotation axis of the pulley 30 and, as can be seen more specifically in figure 3, the disk 56 is permanently inserted in the race 52 and is rotated by the same pulley 30. The thickness of the disk 56 is obviously to such an extent that the walls of the race 52 are spaced apart by a sufficient amount so as to allow the links 12 of the chain 10 to enter or come out without undergoing considerable stresses.

With particular reference now to figures 4 and 5, an embodiment variant of the spacer 38 is described. The driving pulley 30 is not described since it is substantially the same of that described above but a structural difference in the spacer 38 structure is to be taken into account. This difference consists in the fact that the outer diameter of the disk-shaped body 44 is greater than that of the disk-shaped body 42 as illustrated more specifically in figure 5 in which it is to be noted that the body 44 has a projecting edge 66.

In this case, the spacer 38 essentially consists of a roller 60, for example a ball bearing, mounted on the end of a stationary shaft 62 so as to freely rotate, this shaft being mounted on a flange 64 fixed to the box-like casing 40.

The longitudinal axis of the shaft 62 is perpendicular to the rotation axis of the pulley 30 and is positioned below the projecting edge 66 of the box-like casing 44 at a height such that the roller 60 engages, with pressure, said projecting edge 66 thus spacing, by the required amount, the walls of

the race 52 owing to the same above-explained reasons.

With particular reference now to figures 6 and 7, another embodiment variant of the spacer 38 is described. The driving pulley 30 is not described since it is substantially the same of that described above with reference to figure 5 and also in this case the body 44 has a projecting edge 66.

In this embodiment, the spacer 38 essentially consists of a nozzle 72 delivering a pressurized fluid jet, for example water, which is splashed on the projecting edge 66 thus spacing, by the required amount, the walls of the race 52 owing to the same above-explained reasons. Preferably, the portion of the edge 66 splashed by the pressurized fluid jet is provided with an antifriction covering, for example teflon.

Referring now to figures 1,2,4,6,8 and 9, the antifriction and wearing means are described, reducing the sliding friction and mounted on the sliding and guiding seat 24 of the chain 10 so as to be removable.

In the considered exemplifying embodiment, these means consists of a ribbon-like member 68 mounted on the bottom of the seat 24. The ribbon-like member has also the duty of covering the open ends of the sides 32a of the slots 32. The member 68 merely rests on the lower edge 29 of the chain-carrying support 28 and its ends are fixed to the ends of the chain-carrying support 28 by known snap hooking means so as to be separable.

In a preferred embodiment, albeit not the only one, the ribbon-like member 68 is a composed structure of cotton cloths impregnated with phenolic resins and molybdenum disulphite as additive.

A pump, indicated with the number 70 and drawn schematically, is used to spray a preferably adhesive and biodegradable lubricating grease. The use of an adhesive grease is due to the fact that it remains in the cutting area for a longer time thus achieving a more strong and efficient action.

Furthermore, the delivery of said substance occurs upstream the cutting area since the chain 10 moves forward in the direction of arrow F of figure 1.

From the above, the advantages of the machine according to the present invention clearly appear, the main ones of them having been already described above.

Finally, it is self evident that functionally and mechanically equivalent variants and/or modifications might be brought to the machine according to the present invention without departing from its scope.

Claims

1. Machine for the cutting into slabs of stone blocks, such as marble, granite, porphyry and the like, in which the cutting tool is flexible consisting of a diamond-insert bearing ring-closed chain engaging the block to be cut, said chain being housed and movable in a sliding and guiding seat of a chain-carrying support and put forward by operating means, such as grooved pulleys provided with a peripheral race designed to house the diamond insert-bearing chain, the latter comprising a series of tool-carrying members or links each of which has, on one side, a diamond-insert bearing or abrasive metal insert projecting outside said sliding and guiding seat of the chain whereas the second side, opposite the previous one, is housed and movable in the seat, the tool-carrying links being coupled and hinged each other by means of connecting members or links in order to form the above-mentioned flexible and ring-closed structure fitting to the profile of the chain-carrying support, said machine being characterized in that the sliding and guiding seat 24 of the chain 10 is mounted on the chain-carrying support 28 by snap hooking means 36,32, antifriction and wearing means 68 being mounted on at least the bottom of said sliding and guiding seat 24 in a removable way in order to reduce the sliding friction of the chain 10 in the seat 24, spacing means 38 being associated with the grooved driving pulley 30 at the entry and exit area of the chain 10 respectively into and from its peripheral race 52 in order to each other space apart the walls of the pulley.
2. Machine according to claim 1, characterized in that the sliding and guiding seat 24 of the chain 10 is essentially formed by the lower edge 29 of the chain-carrying support 28 forming the bottom whereas the side walls of the support are delimited by a pair of parallel plates 34 designed to be mounted, for part of their height, on the chain-carrying support 28 whereas for the remaining part of said height the plates 34 project from said support forming said side walls of the sliding and guiding seat 24.
3. Machine according to claim 1, characterized in that the plates 34 are firmly connected each other by a series of transverse pins 36 perpendicularly arranged with respect to the plates and all arranged on said plates 34 at the same height.

4. Machine according to claims 1 to 3, characterized in that said snap hooking means of the sliding and guiding seat 24 of the chain 10 consists of said pins 36 which connect the plates 34 and of a series of shaped slots 32 formed on the lower edge 29 of the chain-carrying support 28 and designed to receive and retain said pins 36 fastening the plates 34 to the chain-carrying support 28. 5
5. Machine according to claim 4, characterized in that said slots 32 are of a L-shaped form with a first side 32a open towards the outside of the chain-carrying support 28 and perpendicularly positioned to its lower edge 29, said first side 32a prolonging with a second side 32b perpendicularly positioned to the first one and extending in the forward movement direction of the chain 10. 10
6. Machine according to claim 4, characterized in that when the plates 34 are fastened to the chain-carrying support 28, the upper edge of the plates 34 abuts on a step 31 of the support formed on both its surfaces. 15
7. Machine according to claim 2, characterized in that the plates 34 are spaced apart so that the assembly with the chain-carrying support 28 occurs at a reduced force. 20
8. Machine according to claim 2, characterized in that the side walls of the sliding seat 24, formed by the plates 34, are composed of various parts. 25
9. Machine according to claim 1, characterized in that said spacing means 38 consist of a disk 56 which freely rotates on a shaft 58, the longitudinal axis of which is parallel to the rotation axis of the pulley 30, the disk 56, the thickness of which is greater than the distance between the walls of the race 52 by a pre-determined amount, being permanently inserted in the race 52 and rotated by the same pulley 30. 30
10. Machine according to claim 1, characterized in that said spacing means 38 consist of a roller 60 which freely rotates on a stationary shaft 62, the longitudinal axis of which is perpendicular to the rotation axis of the pulley 30 and the shaft 62 is arranged, with respect to the pulley 30, so that the roller 60 engages, with pressure, an annular projecting portion 66 of the pulley 30 integral with one of the walls of the race 52 thus spacing said wall with respect to the other one by the required amount. 35
11. Machine according to claim 1, characterized in that said spacing means 38 consists of a nozzle 72 delivering a pressurized fluid jet which is splashed on an annular projecting portion 66 of the pulley 30 integral with one of the walls of the race 52 thus spacing said wall with respect to the other one by the required amount. 40
12. Machine according to claim 11, characterized in that the surface of the portion 66 splashed by the pressurized fluid jet is covered by an antifriction material covering. 45
13. Machine according to claim 12, characterized in that said antifriction material is teflon. 50
14. Machine according to claim 1, characterized in that said antifriction and wearing means, placed on the sliding and guiding seat 24 of the chain 10, consist of a ribbon-like member 68 mounted on at least the bottom of the seat 24. 55
15. Machine according to claim 14, characterized in that said ribbon-like member 68 is merely laid down on the lower edge 29 of the chain-carrying support 28 and its ends are fixed to the ends of said lower edge 29 of the chain-carrying support 28 in a separable way by means of snap hooking means. 60
16. Machine according to claim 14, characterized in that said ribbon-like member 68 is a composed structure of cotton cloths impregnated with phenolic resins and molybdenum disulphite as additive. 65
17. Machine according to claim 1, characterized in that upstream the cutting area with respect to the forward movement direction of the chain 10 there are means 70 to deliver an adhesive and biodegradable lubricating substance to the chain. 70

Fig. 1

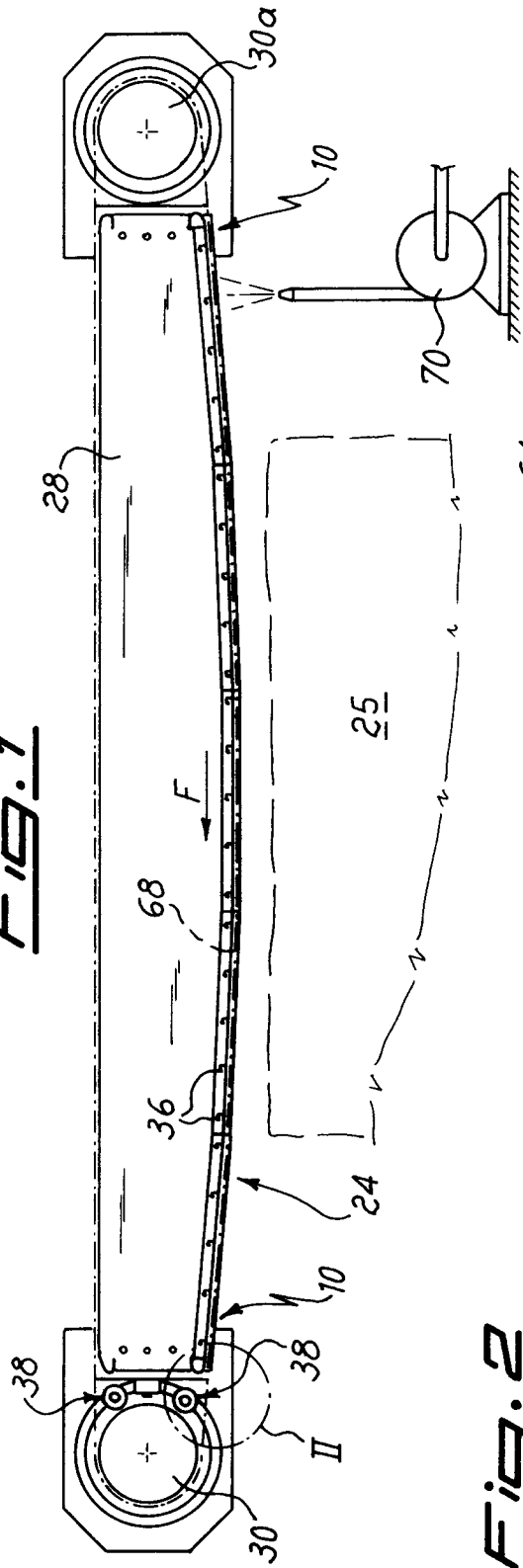


Fig. 2

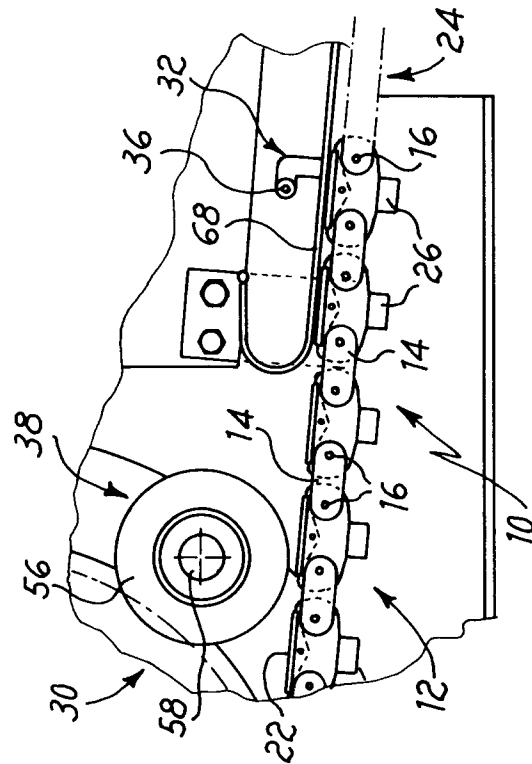


Fig. 4

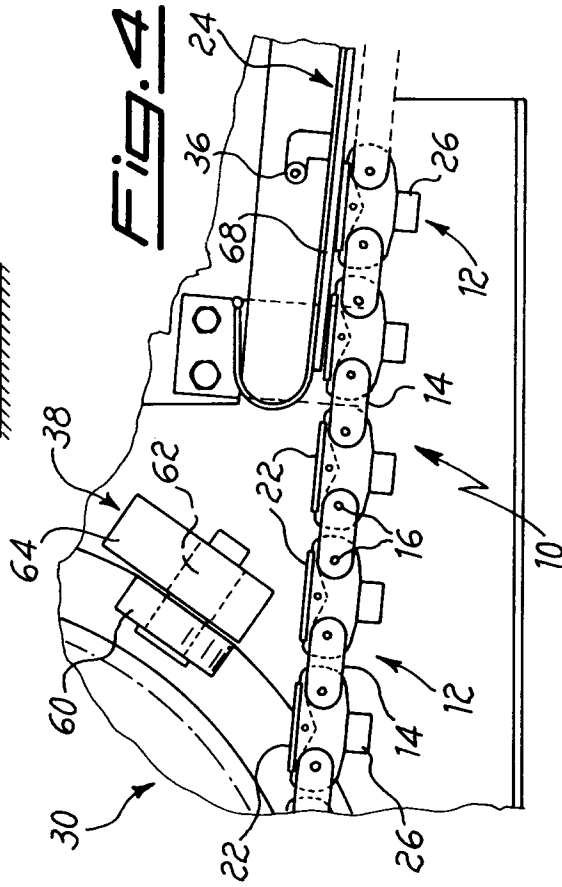


Fig. 3

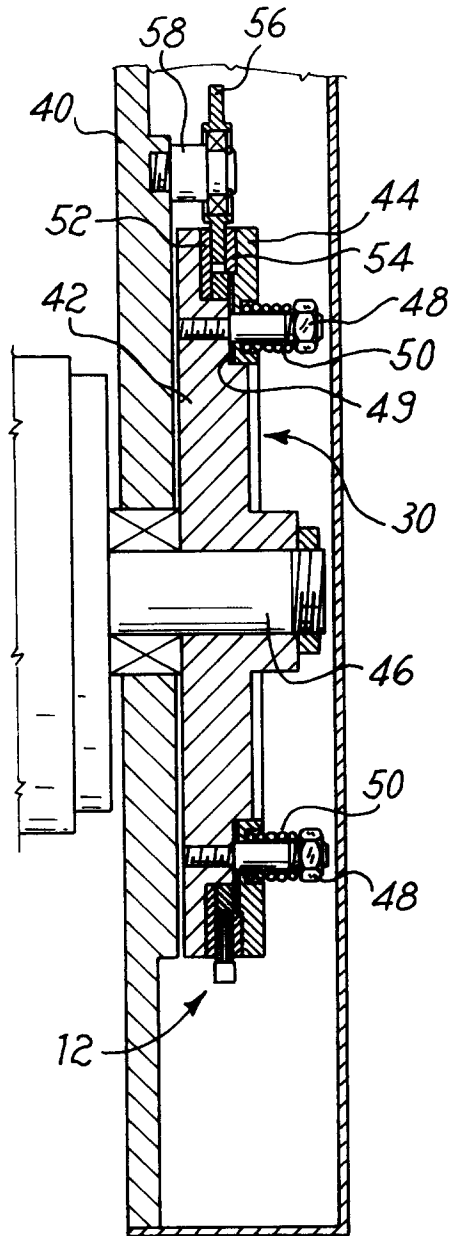
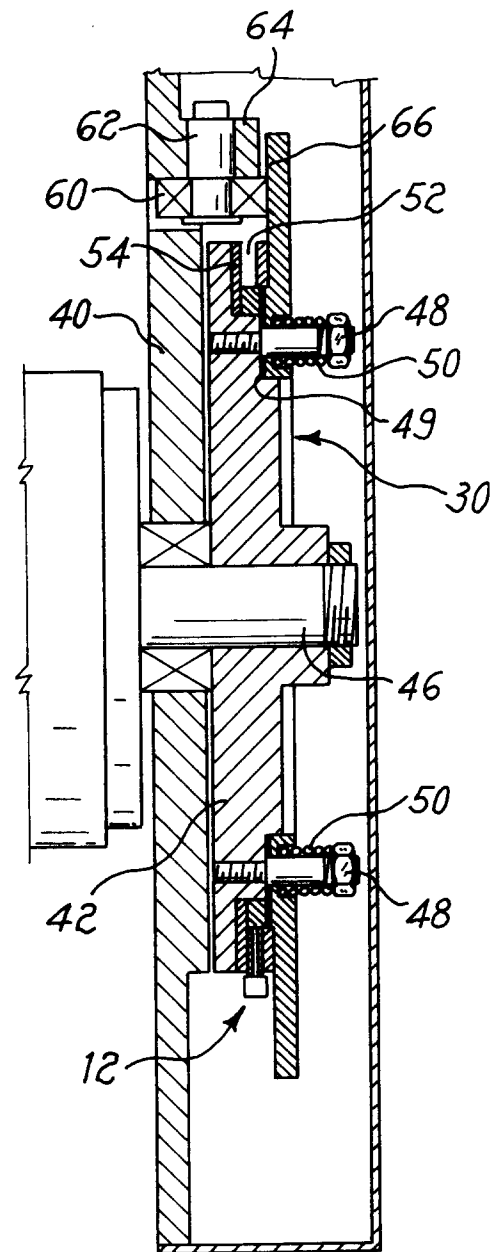
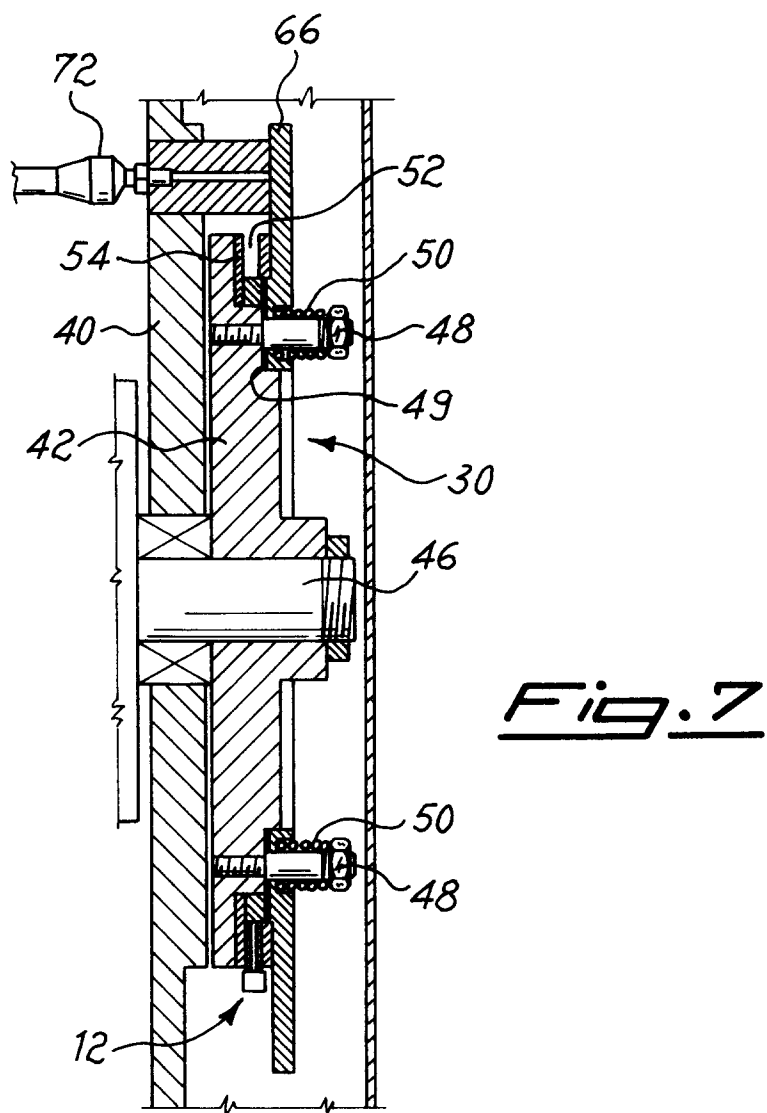
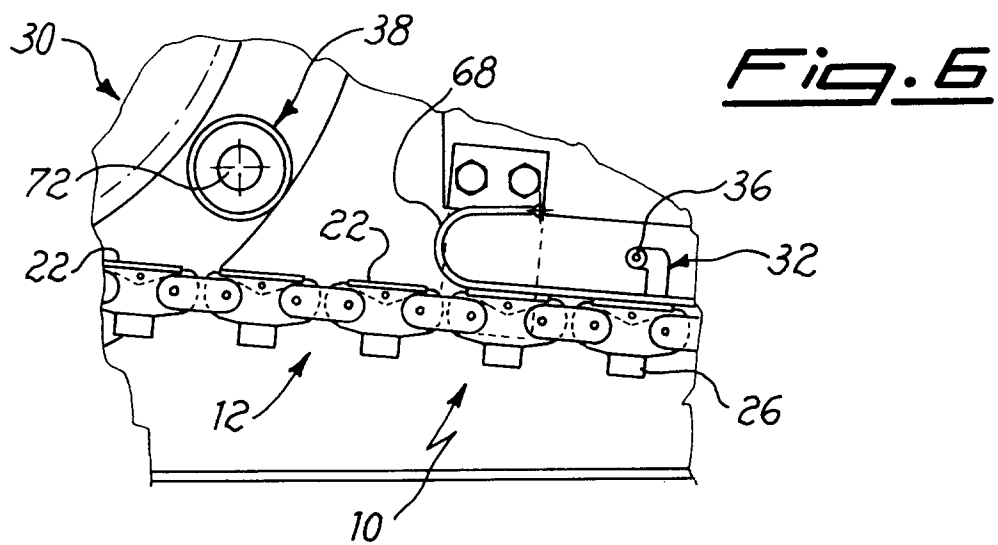
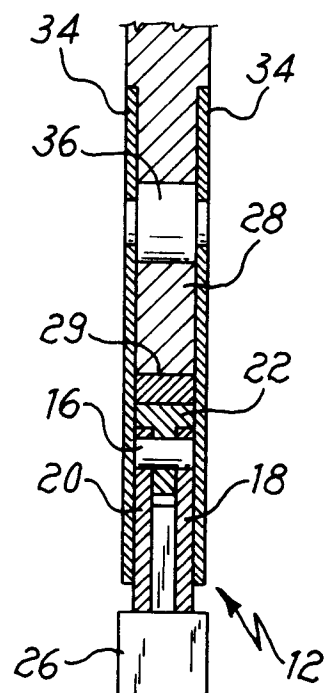
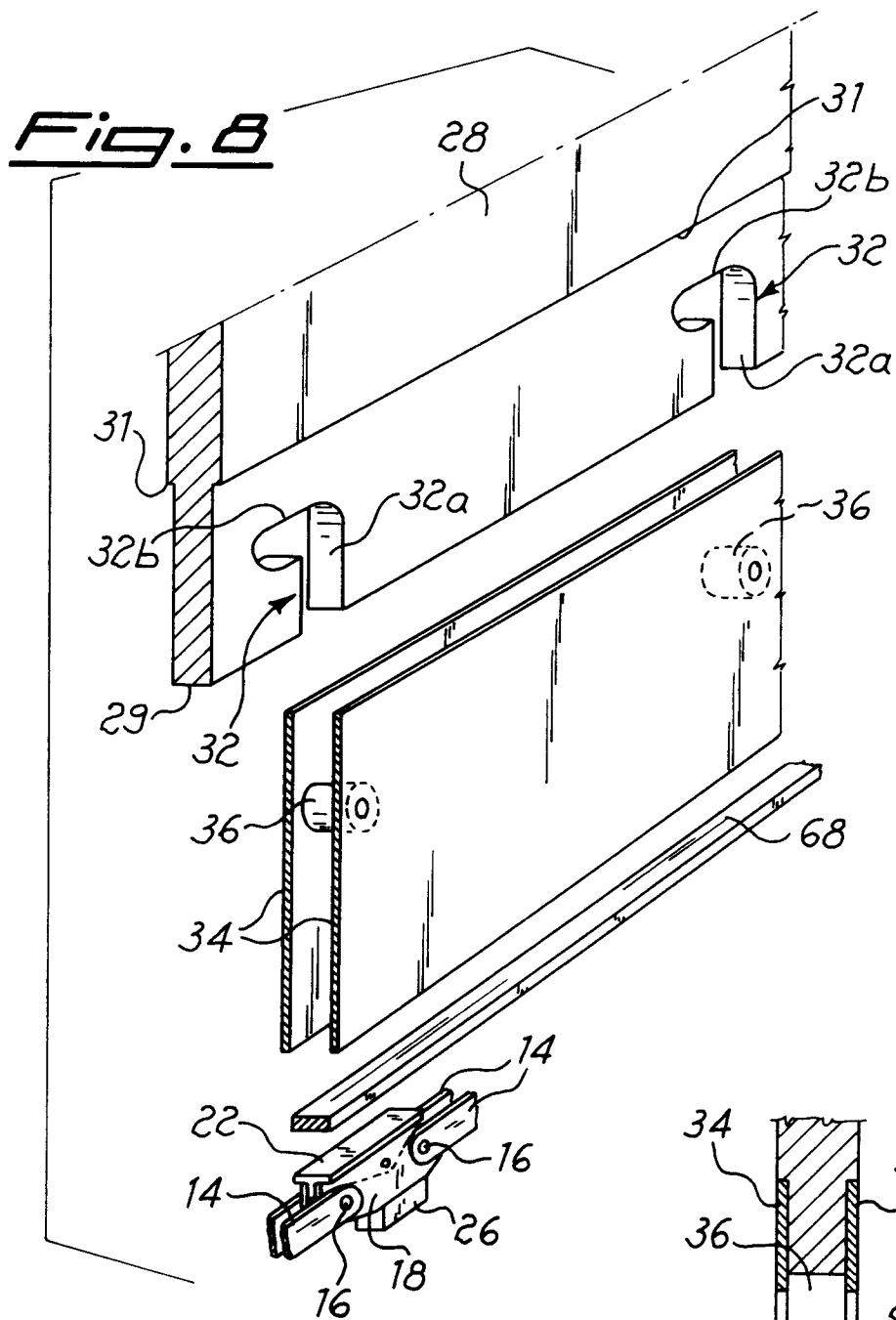


Fig. 5









European Patent
Office

EUROPEAN SEARCH REPORT

Application Number
EP 95 20 1196

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
A	US-A-2 656 832 (PERRIER) * column 3, line 33 - line 39 * * column 8, line 15 - line 22; figures 2,10,28,29 * ----	1,2,6-8, 14,15,17	B28D1/08 B27B17/02
A	US-A-2 948 309 (HOFF) * column 2, line 35 - line 56; figures 3,4 * ----	1,3,4	
A	PATENT ABSTRACTS OF JAPAN vol. 12 no. 61 (M-671) ,24 February 1988 & JP-A-62 208822 (KENTAROU OONISHI) * abstract * ----	1,4,5	
A	DE-U-89 08 262 (GAMMA STAWAG AG) -----		
			TECHNICAL FIELDS SEARCHED (Int.Cl.6)
			B28D B27B B23D
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 20 July 1995	Examiner Ljungberg, R
CATEGORY OF CITED DOCUMENTS			
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