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(54) **Splitting machine for stones**

(57) A splitting machine for use in splitting a solid object includes relatively movable blades (1 & 13), support surfaces (3 & 4) for supporting an object (2) while

it is subjected to a splitting operation as a result of relative movement of the blades (1 & 13) and encased resilient means acting on at least one of the support surfaces (3, 4).

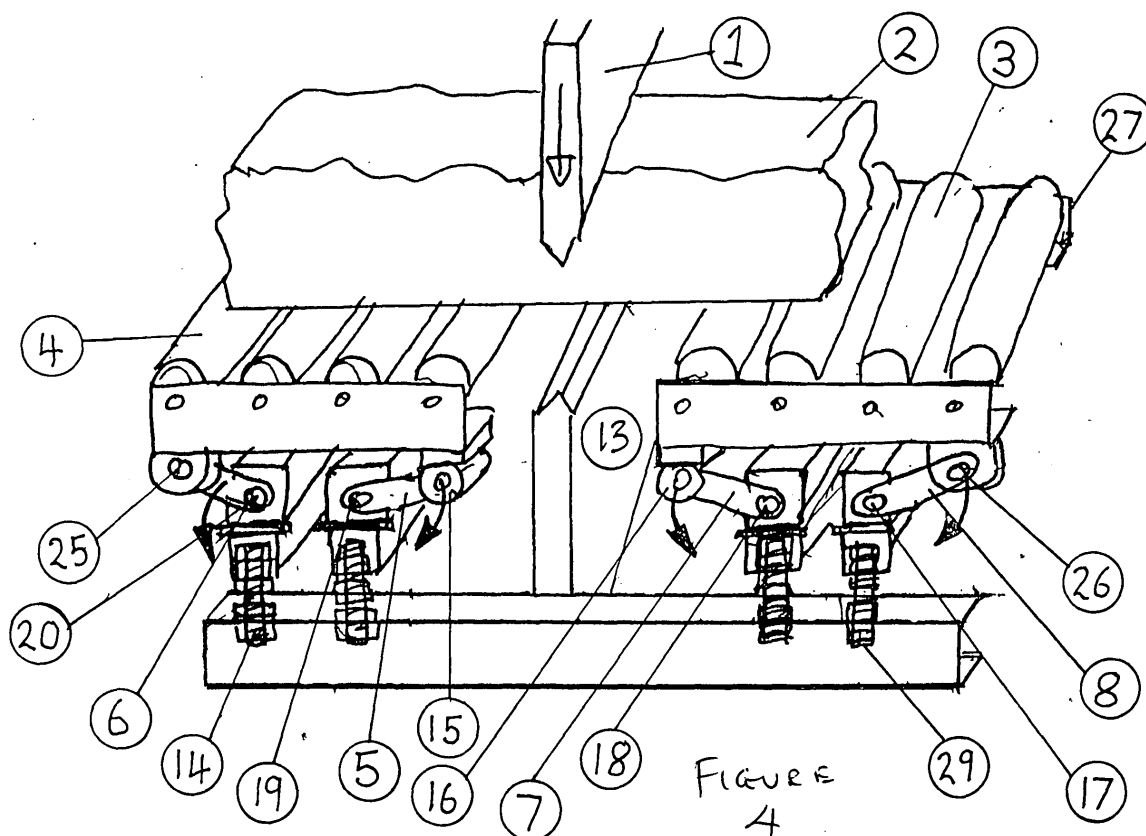


FIGURE
4

Description

Field of the Invention

[0001] This invention relates to splitting machines and to methods of splitting natural stone and concrete blocks and/or other objects.

[0002] A widely used method of splitting natural stone and concrete blocks includes the use of a top blade that is pushed or pulled down onto the stone or concrete block by hydraulic force within the framework of a machine with guide means for the moving blade. Underneath the stone or concrete block there is a fixed lower blade that is normally in the same plane as the moving blade. As the force applied to the moving blade increases, the block is split into two parts.

[0003] A machine that operates in this way is shown in Figure 1. It includes a top blade 2 positioned above a stone 1 and a bottom blade 3. Tables 4 and 5 are positioned either side of the bottom blade 3 to catch the two halves of the stone 1 when it is split in half.

[0004] It will be appreciated that the stone 1 must be supported temporarily by hand or by elastic wedges during the splitting cycle. If, as shown in Figure 2, the stone 1 rests unequally across the bottom blade 3, the resulting split may not be square and large forces may be applied to one of the tables 4, 5 through the stone 1 resulting in damage to the table 4, 5. It will also be appreciated that big, heavy stones will be cumbersome to lift over the bottom blade 3, which projects above the upper surfaces of the tables 4, 5.

[0005] It is also common practice to use a sprung table that, in its normal position, is slightly higher than the bottom, fixed blade, thus making it easier to slide the stone or concrete block into position. When the top blade descends onto the stone or block, the table is pushed down on compression springs, the stone or block comes into contact with the fixed bottom blade and is subsequently split. The table then returns, under the action of the springs to its original position, ready to receive the next stone or concrete block.

[0006] Such an arrangement is illustrated in Figure 3. This figure shows a top blade 1, a stone 2, a table having two parts 3 and 4 that are supported on springs 5. The springs 5 act between the table parts 3, 4 and a common base 7 on which the fixed bottom blade 6 is mounted.

[0007] The use of a fixed, unsprung table is not desirable with larger stones. There are also serious safety considerations if a stone is held temporarily by hand, even with small stones.

[0008] Sprung tables (as shown in Figure 3), and also roller tables, can be used in most situations, but they still have a number of drawbacks. One is clogging of the springs with stone dust and chippings until the springs no longer operate. Another is that the springs release energy after splitting of a stone and can catapult the two halves of the stone. A further drawback is that, if the table is inadequately guided by the springs, additional

guiding means may be required, and this can again suffer from damage by the stone dust and chippings.

[0009] It is accordingly an object of the present invention to provide an improved machine for splitting stones or concrete blocks that does not suffer from the above drawbacks.

[0010] It is also an object of the present invention to provide an improved method of splitting stones and concrete blocks.

Summary of the Invention

[0011] According to a first aspect of the present invention there is provided a splitting machine for use in splitting a solid object, said splitting machine including relatively movable blades, support surfaces for supporting an object while it is subjected to a splitting operation as a result of relative movement of the blades and encased resilient means acting on at least one of the support surfaces.

[0012] The encased resilient means preferably comprises spring means contained within a housing and acting on an arm arranged to rotate relative to the housing. The resilient means preferably acts on an arm that rotates during upward or downward movement of the associated support surface.

[0013] The housing is preferably mounted on a base and adjustment means may be provided for adjusting the height of the housing relative to the base.

[0014] According to a second aspect of the present invention there is provided a splitting machine for use in splitting a solid object, said splitting machine including a pair of spaced support surfaces, a pair of relatively movable blades arranged for movement into contact with an object supported on and extending between the two support surfaces, and spring means acting on pivotable support arms for at least one of the spaced support surfaces.

[0015] The support surfaces comprise beds or tables and both beds or tables may be supported on pivotable arms on which the spring means are arranged to act.

[0016] The spring means acting on the arms may comprise resilient elements acting on end formations attached to the arms, the resilient elements and end formations being contained within housings.

[0017] The pair of relatively movable blades may comprise a fixed lower blade and a movable upper blade and an opening may be formed in the lower blade, the two support surfaces being interconnected by a connection element that passes through the opening in the lower blade.

[0018] According to a further aspect of the present invention there is provided a method of splitting a stone, concrete block or other solid object that includes the use of a splitting machine as defined above.

Brief Description of the Drawings

[0019]

Figures 1 to 3 have been referred to above,

Figure 4 is a schematic perspective view of a splitting machine for use in splitting stones and concrete blocks,

Figures 5 and 6 illustrate operation of part of the machine shown in Figure 4,

Figures 7 and 8 show alternative methods of mounting a support table, and

Figure 9 is a schematic view of a splitting machine that includes two interconnected support tables.

Description of the Preferred Embodiments

[0020] The machine shown in Figure 4 includes a top blade 1 that descends under force onto a stone 2 that pushes down sprung roller tables 3, 4 so that the stone 2 comes into contact with a fixed bottom blade 13.

[0021] The roller tables 3 and 4 are mounted on swing arms 5, 6, 7 and 8 disposed at one side of each roller table 3, 4 and corresponding arms at the other side of each table 3, 4. The swing arms 5, 6, 7 and 8 rotate about axes 17, 18, 19, 20 and the outer arms 6 and 8 are pivotally connected to the tables 3 and 4 at 25, 26, 27 at the outer corners of the tables 3, 4. The inner arms 5 and 7 are provided at their upper ends with rollers 15 and 16 on which the tables 4 and 3 are supported, the rollers 15, 16 permitting transverse movements of the tables 4, 3 as a result of rotation of the arms 5, 6, 7 and 8. The swing arms 5, 6, 7 and 8 do not become clogged with stone dust or chippings, unlike compression springs.

[0022] The start height positions of the tables 3, 4 are adjustable by stud and nut mechanisms 29.

[0023] The swing arms 5, 6, 7 and 8 are torsion rubber suspension units as used on vehicle trailers. They provide progressive springing and operate as illustrated in Figures 5 and 6.

[0024] Figure 5 shows a pivotable or swing arm 1 that is connected to a square shaft 2 that is surrounded by elastic cords 3, 4, 5 and 6 that are contained within a square cross-section tubular housing 7 that is mounted on a base plate 8. The elastic cords 3, 4, 5 and 6 are contained wholly within the tubular housing 7 so that they are not affected by stone dust, chippings or the like.

[0025] Figure 5 shows one angular position of the arm 1, while Figure 6 shows a condition that obtains when the force on the arm 1 has caused it to pivot and the square shaft 2 has rotated about its centre, compressing the cords 3, 4, 5 and 6. On release of the applied load, the arm 1 will return to its starting position and the units

shown in Figures 5 and 6 will, to some extent, acting as damping units and will absorb some of the energy that is released when a stone or block is split in two.

[0026] Figure 7 shows an alternative to the use of rollers 15, 16 at the upper ends of the inner swing arms 5 and 7. Thus, a sliding block 16A is mounted at the upper end of an arm 7A and engages in or against a guide 16B attached to the underside of the roller table 3A.

[0027] Figure 8 shows a further alternative arrangement in which a pin 16C is attached to the upper end of an arm 7C and engages in a horizontal slot 16D in a guide block 16E attached to the underside of the roller table 3A. This arrangement serves to prevent upward movement of the roller table 3A.

[0028] The support tables or beds 3, 4 of the arrangement shown in Figure 4 act independently of each other on either side of the splitter blade. In an alternative form, the tables or beds can be linked to each other through holes or slots in the bottom blade support, as shown in Figure 9, so that the tables or beds 3 and 4 act as one single structure. In order to assemble the composite table or bed, it will be necessary to join the two sides 3 and 4 of the composite bed or table with nuts and bolts with an overlapping plate 2 or other joining means. Alternatively, yoke-shaped table or bed supports could pass through a hole or slot in the lower splitter blade 1 and the structure then assembled either side of the lower splitter blade 1.

[0029] The number of pairs of torsion spring units is unlimited and roller tables or beds may be as long as required to feed or take away stone or blocks to and from the splitter.

[0030] In a preferred configuration, there will be one non-sliding pivot pair of arms per roller table or bed with the other pair or pairs of arms rolling or sliding in relation to the former. It is, however, possible to have all attachment points to a roller table or bed sliding or rolling provided there are limiting means to prevent the table or bed from becoming unseated.

[0031] The splitting machine of the present invention is not limited to the use of roller tables and beds but may include conveyors used in conjunction with splitting blades, the supporting runs of the conveyors being forced to dip during the splitting process.

[0032] In a simple version of the present invention the table, bed or conveyor may have an unsprung pivot axis furthest from the fixed splitter blade, enabling the bed to rotate about this axis. Torsion springs would, however, be used for supporting the splitter end of the table or bed. This arrangement could be used in long configurations but would not be normally suitable for short support surfaces.

[0033] The swing arms or torsion spring units can be directly or indirectly mounted on additional resilient means such as rubber blocks, to provide some elasticity in the event of forces such as knocks acting on the sides of the tables or beds other than the vertical forces from the downward force of the splitter blades.

[0034] The present invention is not confined to handling stone and concrete but the splitting machine can be used for splitting wood or other materials.

[0035] Additional damping can be applied to the tables or beds by other means including telescopic hydraulic units.

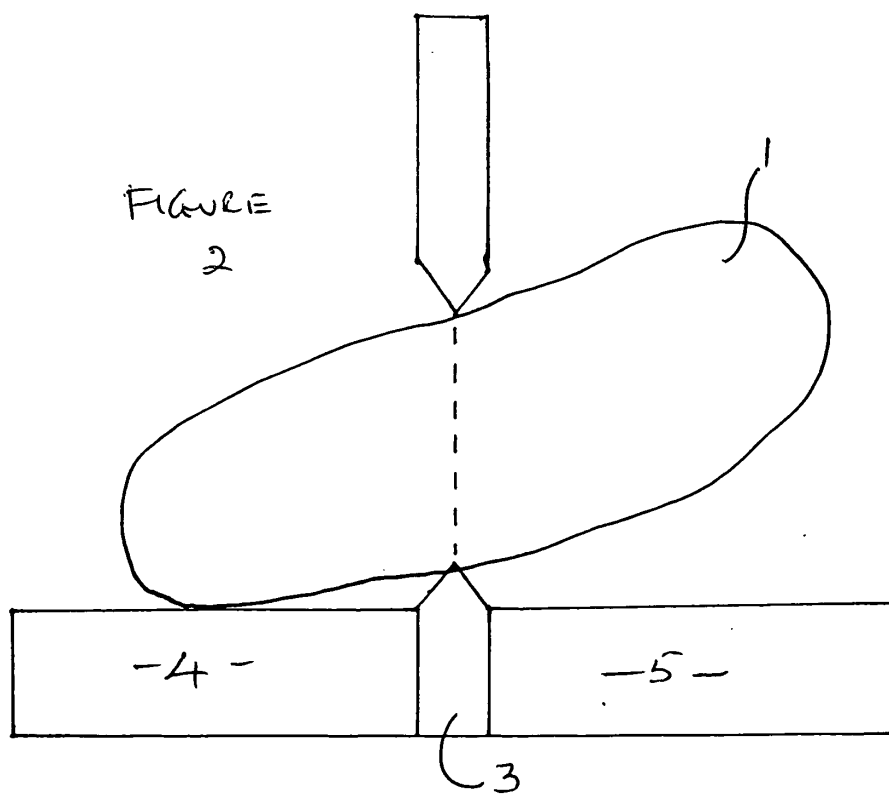
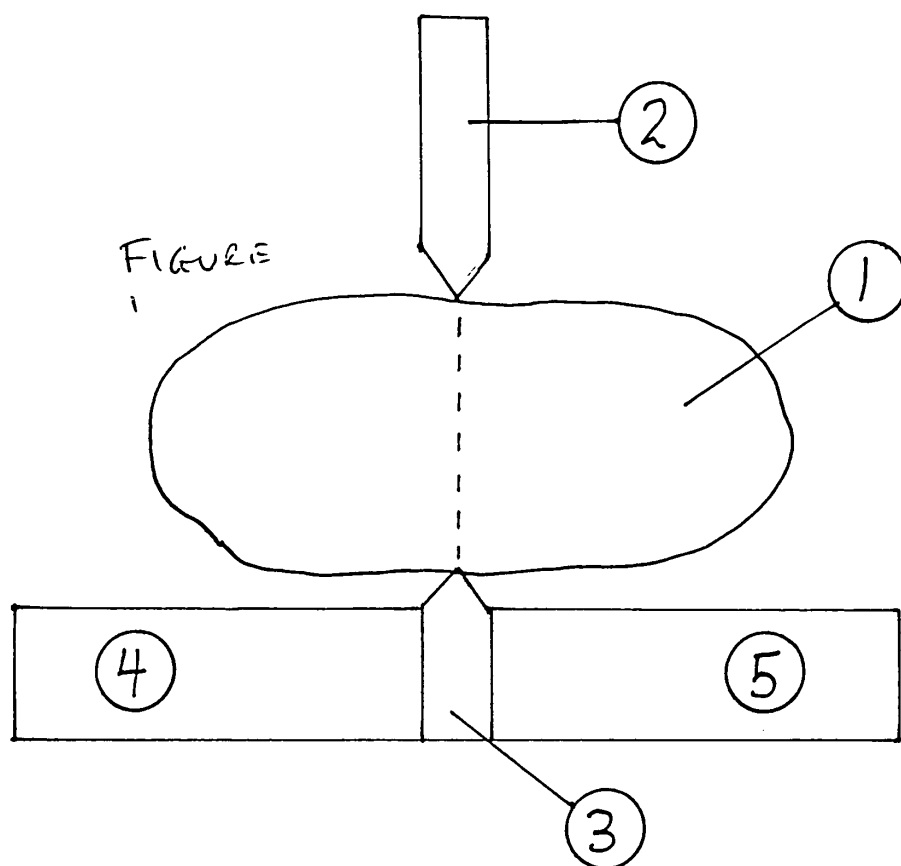
[0036] Roller beds or tables or flat beds or tables may alternatively be suspended by the torsion spring units, whereby they are mounted outside the boundary of the beds or table instead of being installed underneath. They may alternatively be mounted with the arms below the level of the main body of the torsion spring unit and still providing springing.

[0037] The support beds or tables can be floor-mounted or independently mounted and not attached directly to the splitter. The beds or tables may include grids, slats or inset balls or the like and are not necessarily flat.

[0038] A platform, bed, table or the like with torsion springs may be provided at one side only of the splitter.

Claims

1. A splitting machine for use in splitting a solid object, said splitting machine including relatively movable blades, support surfaces for supporting an object while it is subjected to a splitting operation as a result of relative movement of the blades and encased resilient means acting on at least one of the support surfaces.
2. A splitting machine as claimed in Claim 1, in which said encased resilient means comprises spring means contained within a housing and acting on an arm arranged to rotate relative to the housing.
3. A splitting machine as claimed in Claim 1, in which the resilient means acts on an arm that rotates during upward or downward movement of the associated support surface.
4. A splitting machine as claimed in Claim 2, in which the housing is mounted on a base and adjustment means are provided for adjusting the height of the housing relative to the base.
5. A splitting machine for use in splitting a solid object, said splitting machine including a pair of spaced support surfaces, a pair of relatively movable blades arranged for movement into contact with an object supported on and extending between the two support surfaces, and spring means acting on pivotable support arms for at least one of the spaced support surfaces.
6. A splitting machine as claimed in Claim 5, in which the support surfaces comprise beds or tables.
7. A splitting machine as claimed in Claim 6, in which both beds or tables are supported on pivotable arms on which the spring means are arranged to act.
8. A splitting machine as claimed in Claim 6, in which the spring means acting on the arms comprises resilient elements acting on end formations attached to the arms, the resilient elements and end formations being contained within housings.
9. A splitting machine as claimed in any one of the preceding claims, in which the pair of relatively movable blades comprise a fixed lower blade and a movable upper blade and in which an opening is formed in the lower blade, the two support surfaces being interconnected by a connection element that passes through the opening in the lower blade.
10. A method of splitting a stone, concrete block or other solid object that includes the use of a splitting machine as claimed in any one of the preceding claims.



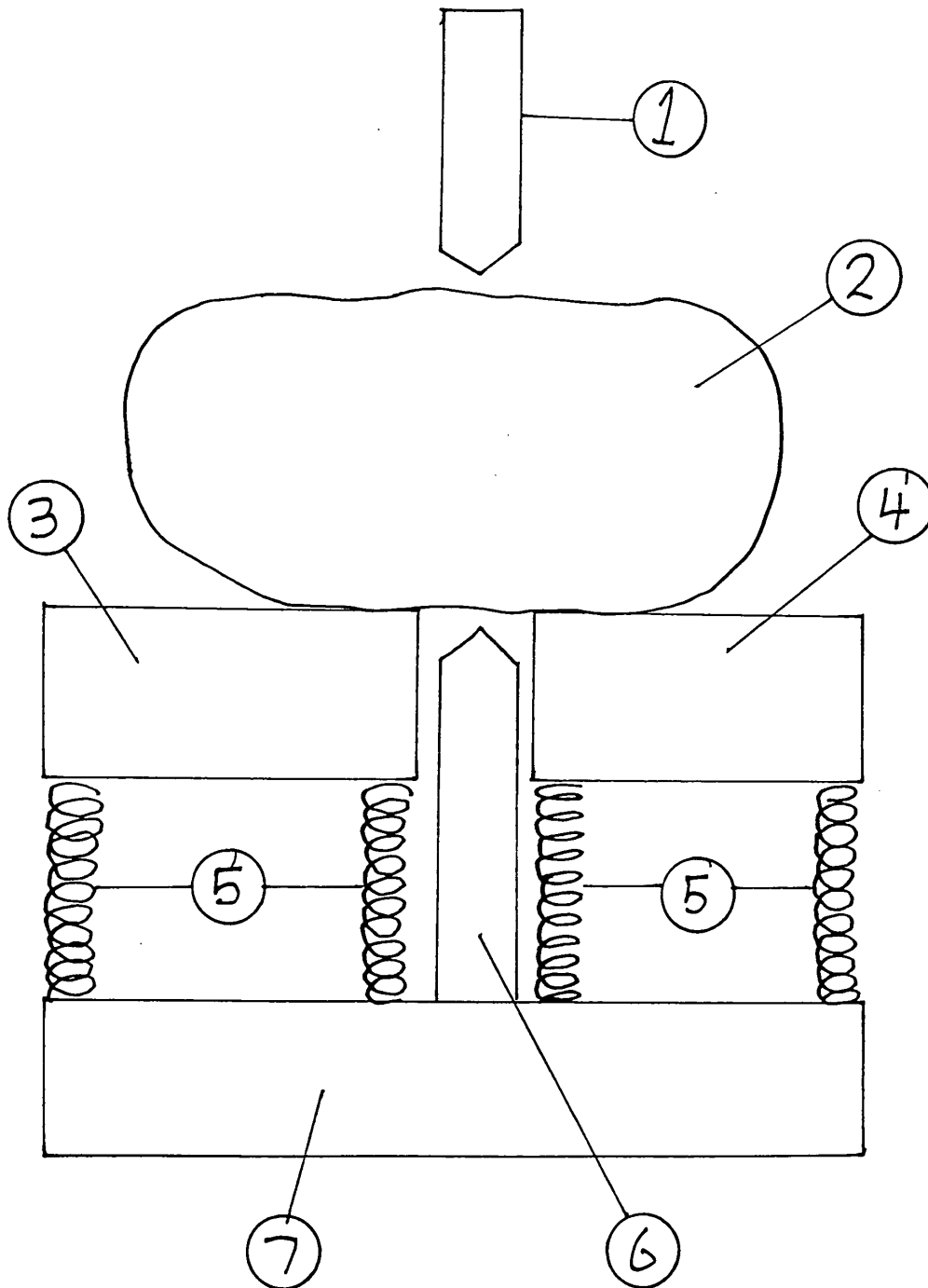
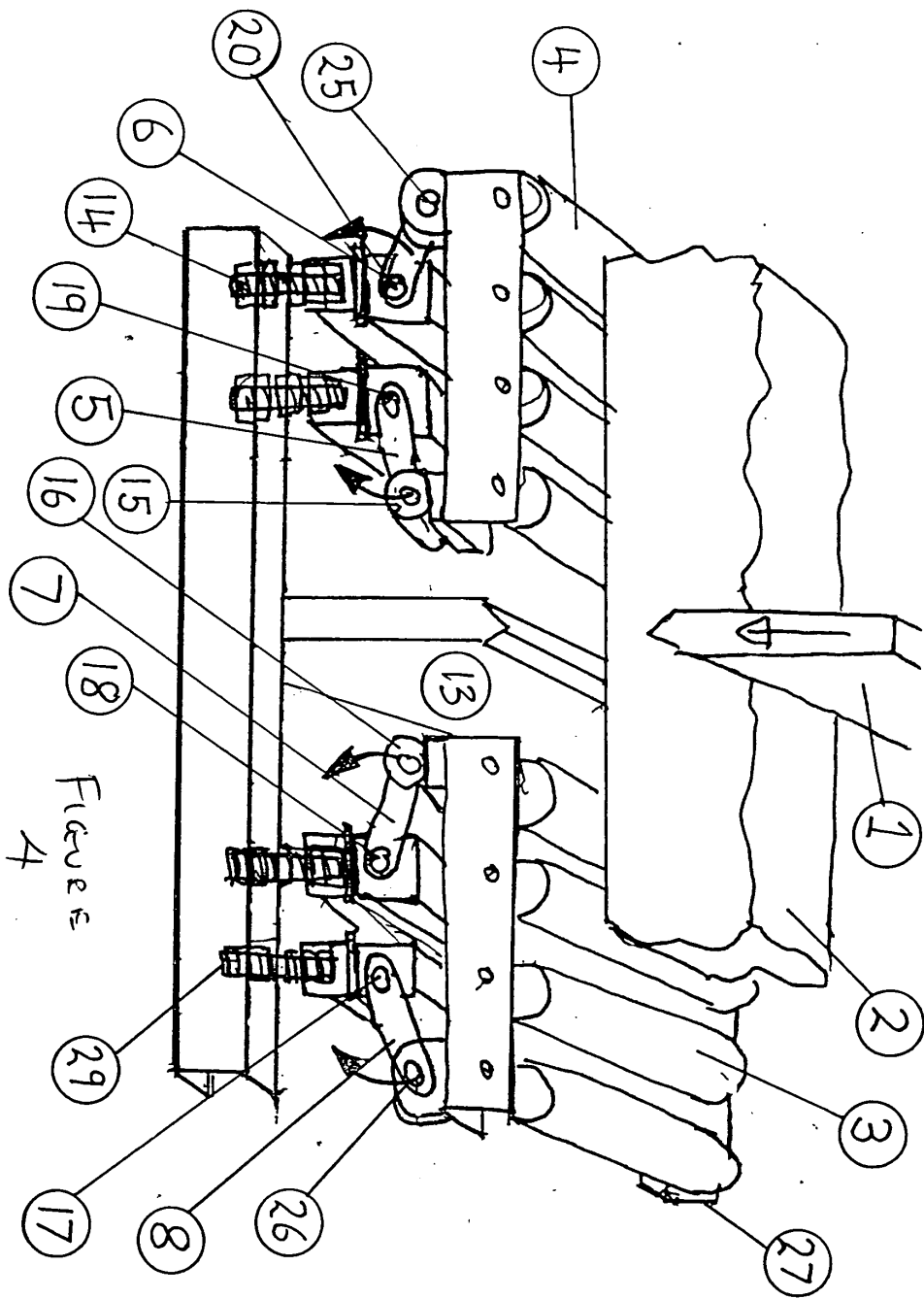
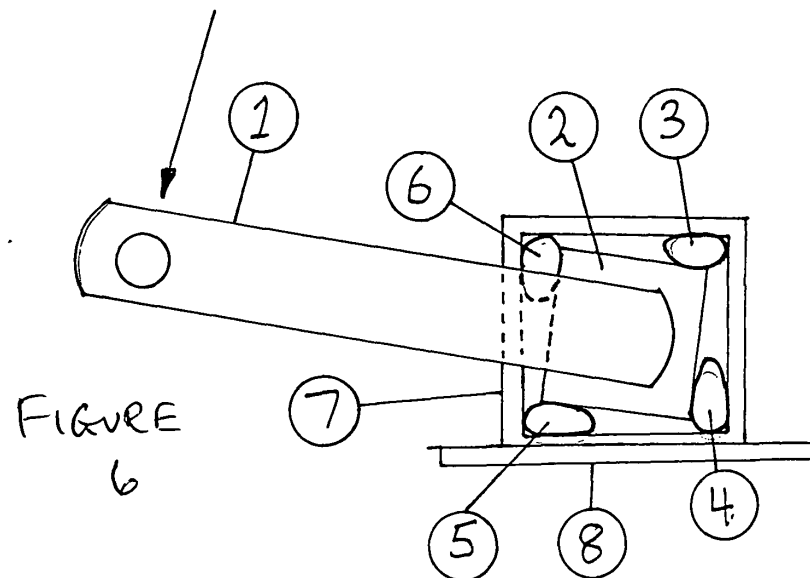
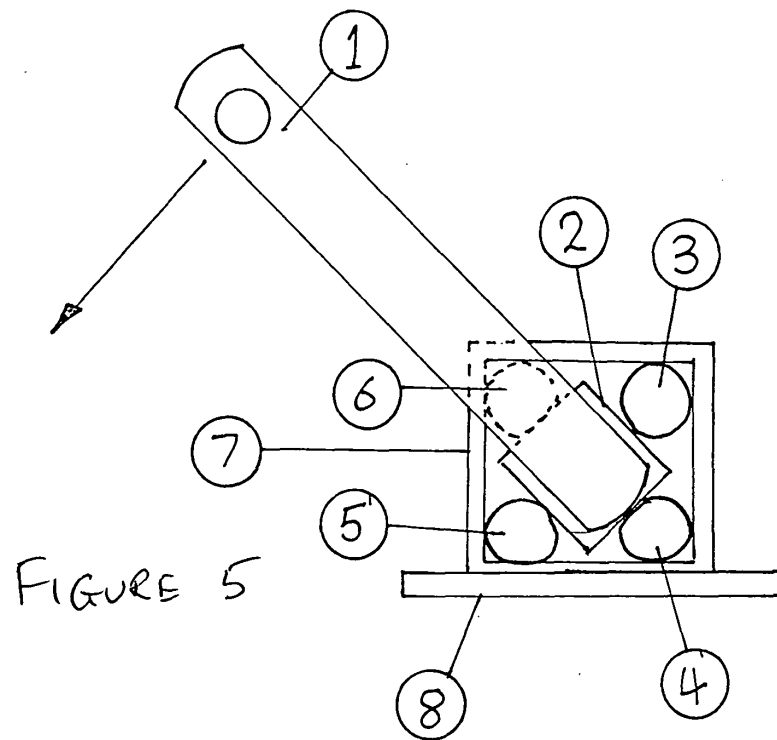
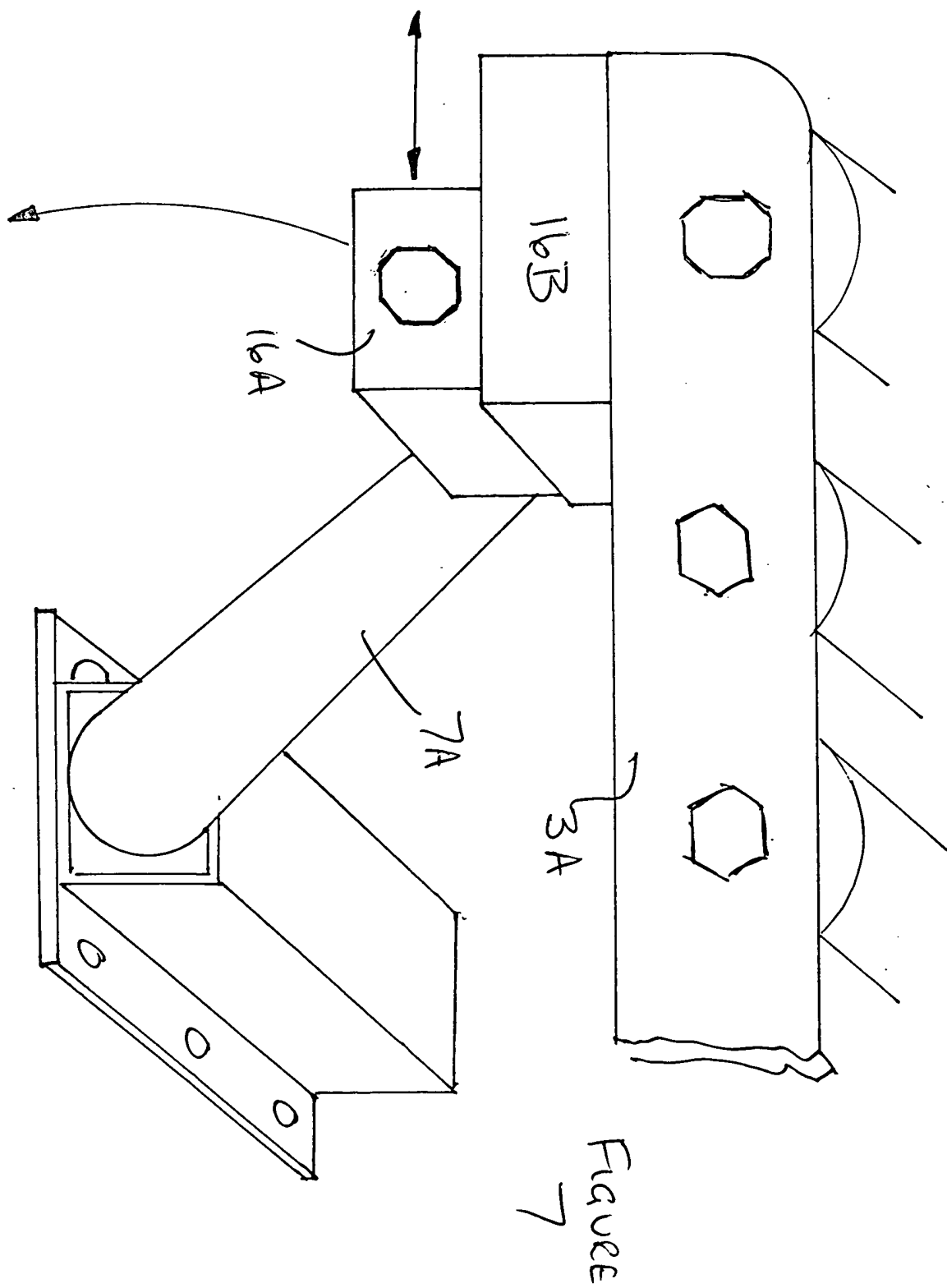


FIGURE 3







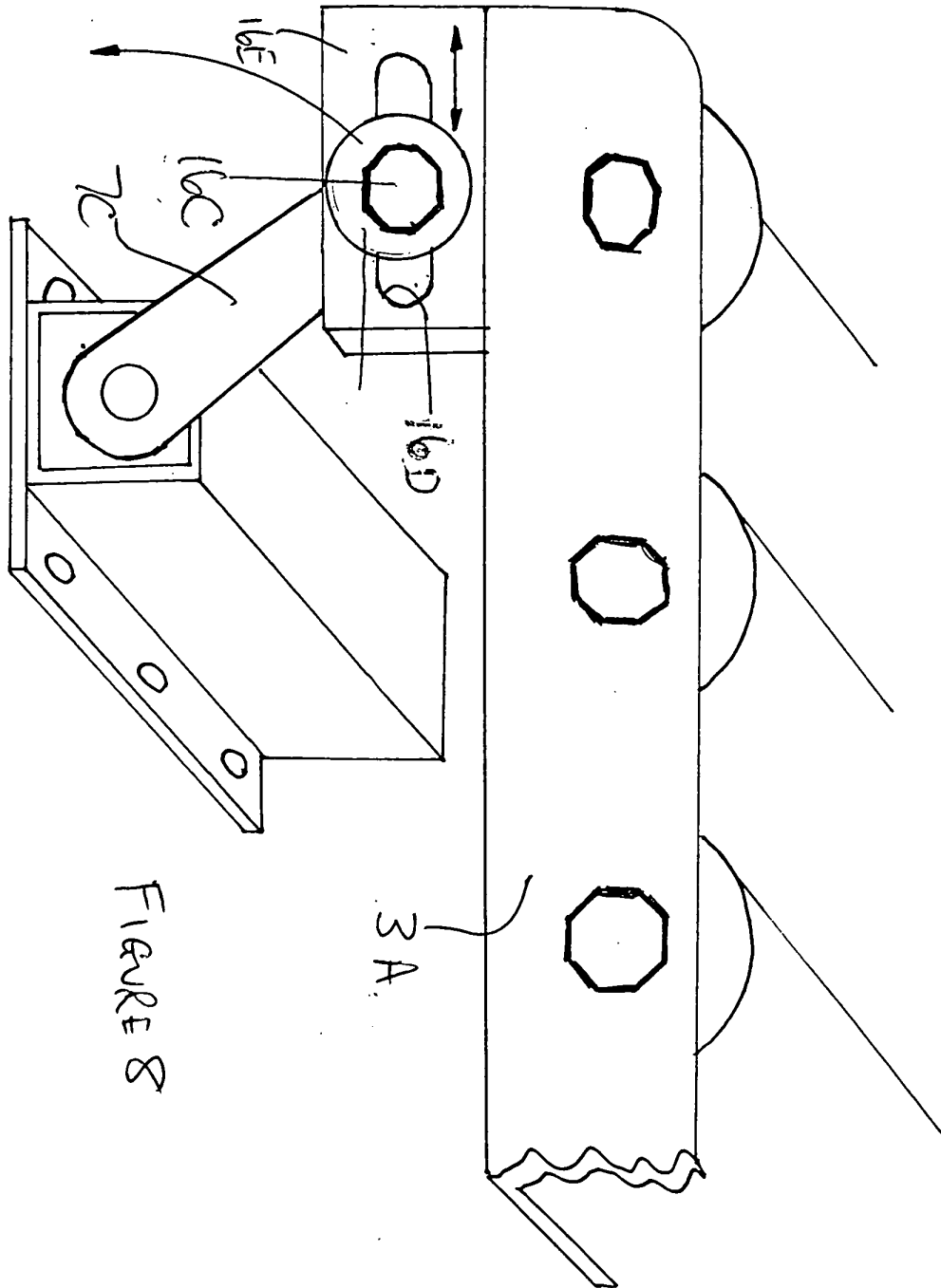
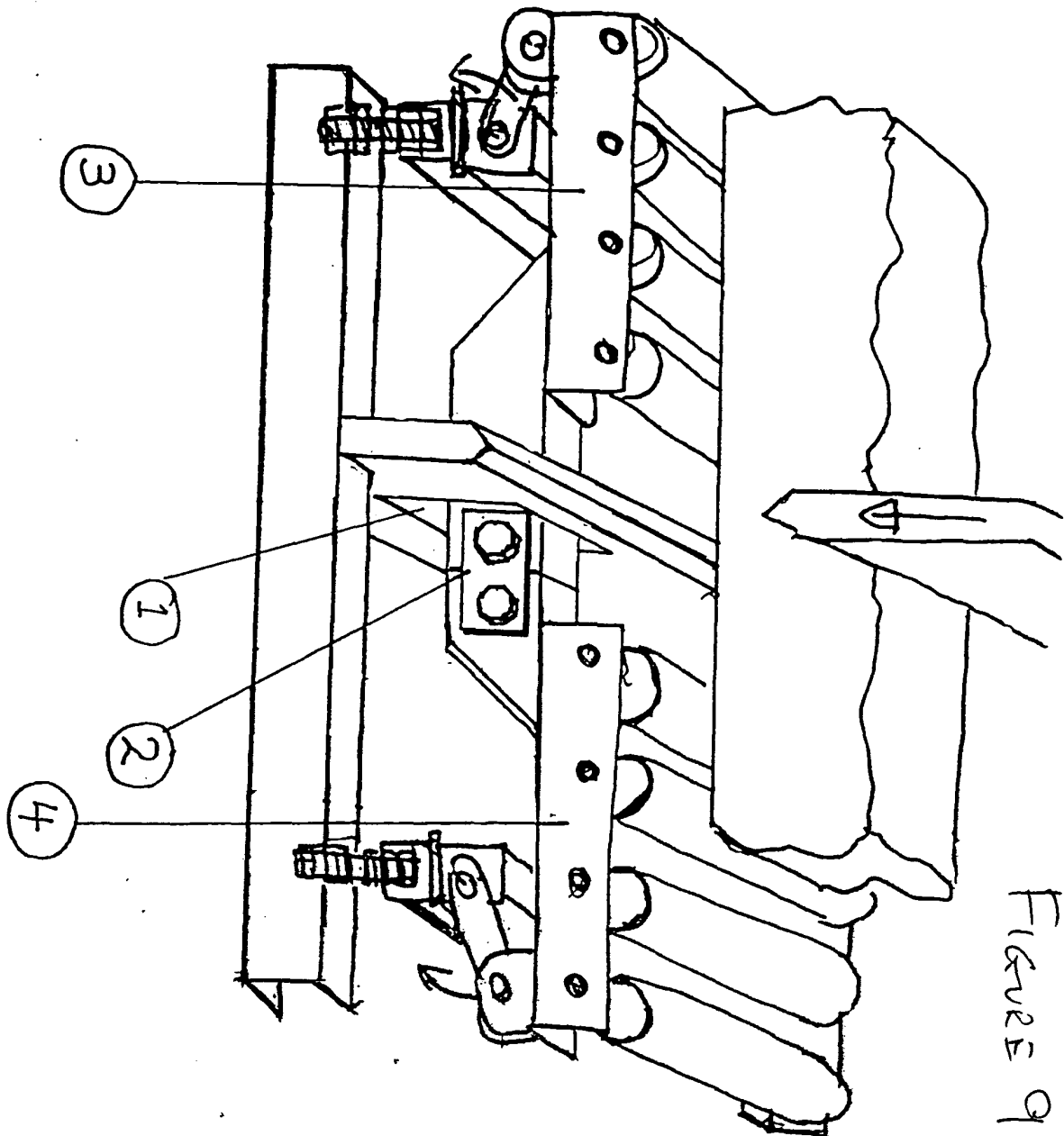


FIGURE 8





European Patent
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EUROPEAN SEARCH REPORT

Application Number
EP 04 25 0632

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| Place of search MUNICH | | Date of completion of the search 25 March 2004 | Examiner Frisch, U | | |
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