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Remarks:

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(54) **Tip for earth moving machinery and locking key therefore**

(57) The invention relates to a tip assembly for earth moving machinery, comprising a tip (11) having a pocket (12) open at the back, said tip exhibiting a hole (16) for seating a locking key, a adapter (41) having a nose (42) that geometrically couples with said pocket (12), said nose being crossed by a seat (43) for seating the locking key, and a locking key (61) inserted in said hole in the tip and in said seat in the adapter for locking the tip to

the adapter. At least one surface of the nose exhibits a lowered or recessed zone obtained around the seat for the locking key. At least the wall of the pocket facing said surface of the nose internally exhibits a relief complementary to said lowered or recessed zone. In this way, the coupling between the tip and the adapter is made stronger by the interaction between at least two respective facing surfaces.

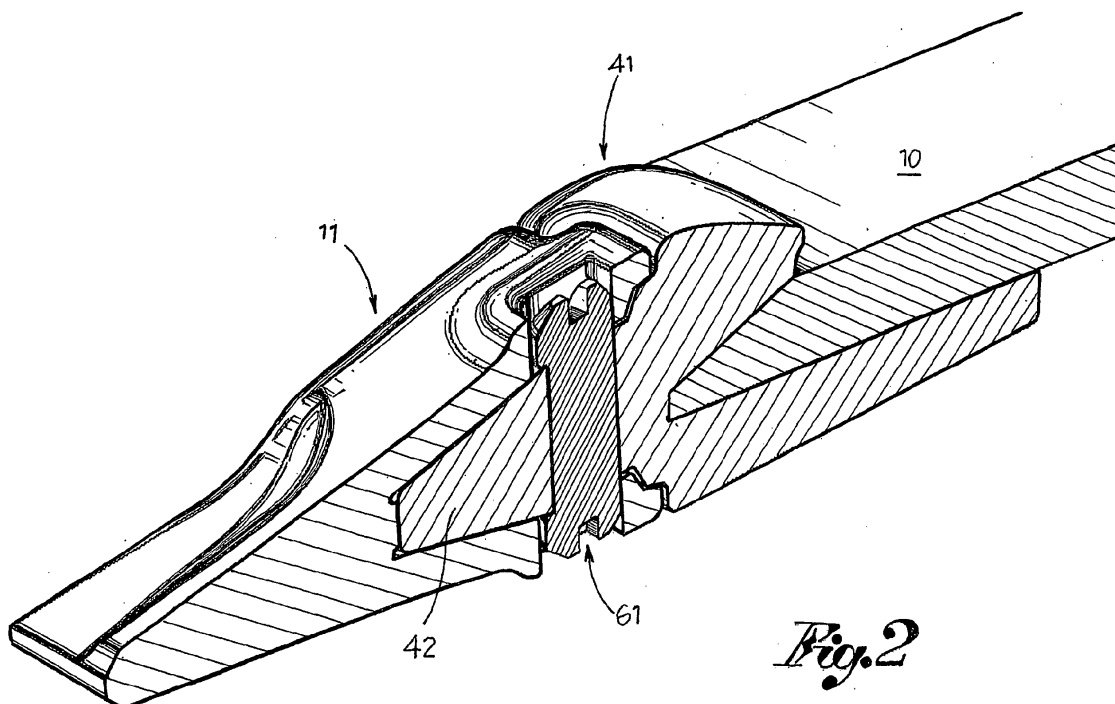


Fig. 2

Description

[0001] The present invention relates to a tip assembly for earth moving machinery, such as excavators.

[0002] In accordance with the preamble of claim 1, tip assemblies for earth moving machinery are known, comprising a tip, an adapter and a key for locking the tip to the adapter.

[0003] The tip exhibits a pocket open at the back defining a female portion and a hole for seating the locking key obtained in a pair of opposed walls defining said pocket.

[0004] The adapter exhibits a body shaped to be attached, for example by welding or bolting, to the machine bucket and a nose that extends from said body and that defines a male portion that geometrically couples with the tip pocket. The nose is crossed by a seat of the locking key, said seat extending between two opposed surfaces of said nose and being aligned with the hole in the tip.

[0005] The manufacture of the tip assembly into two separable portions, tip and adapter, advantageously allows the replacement of the tip only, when worn, while the adapter remains permanently attached to the machine bucket. The system for locking the tip to the adapter, obtained for example by the key, must therefore be suitable for allowing an easy and quick replacement of the tip.

[0006] However, this need is in conflict with the need of making the coupling between tip and adapter as tight as possible, due to the considerable strains the tip is subject to.

[0007] In fact, in some known tip assemblies, in order to make the tip replacement operation easy and quick, the due interference between the locking key and the seat thereof is not provided, with the result that with the extended use, the key could extract from said seat, thus causing the separation of the two portions of the tool.

[0008] In other known embodiments, special stopping devices, for example of the elastic type, suitable for interacting with the nose of the adapter, have been provided in the key itself in order to tightly constrain the locking key into position. Besides making the tip assembly structure more complex to manufacture and therefore more expensive, such solutions have not completely solved the problem of avoiding the disconnection of the tip from the adapter in heavy operating conditions. In fact, all the efforts aimed at this have basically addressed the coupling between the locking key, the tip and the adapter, and therefore they have been restricted to a limited area of the tip assembly.

[0009] Some strains the tip assembly is subject to while in use, in fact, are such that if they are mainly opposed by the locking key only, they could cause the breakage thereof and therefore the tip disconnection from the adapter.

[0010] The need of combining the requirement of making the tip as integral as possible with the adapter so as to effectively oppose even the heaviest strains the tip

assembly is subject to, and of facilitating the tip replacement, for example through a convenient and quick removal of the locking key, is therefore greatly felt.

[0011] The object of the present invention therefore is to meet the above need while solving the disadvantages of the tip assemblies of the prior art.

[0012] Such object is achieved with a tip assembly according to the following claim 1.

[0013] The features and advantages of the invention will appear more clearly from the following description of some preferred embodiments thereof, with reference to the annexed indicative and non-limiting drawings, wherein:

[0014] - figure 1 shows a perspective view of the tip assembly according to the present invention;

[0015] - figure 2 shows a vertical axial section of the tip assembly;

[0016] - figure 3 shows an enlarged axial section of the central and front portion of the tip assembly;

[0017] figure 3a shows a section similar to the previous one but with the locking key in a pre-introduction position;

[0018] figure 4 shows a perspective view of the tip only;

[0019] figure 5 shows an axial section of the tip;

[0020] figure 6 shows the tip viewed from the back end;

[0021] figure 7 shows a perspective top view of the adapter;

[0022] figure 8 shows a perspective bottom view of the adapter;

[0023] figure 9 shows a side view of the adapter;

[0024] figure 10 shows a perspective view of the locking key;

[0025] figure 11 shows an elevation view of the key;

[0026] figure 12 shows a plan view of the key in home position; and

[0027] figure 13 shows a plan view of the key in use position.

[0028] With reference to the figures, the tip assembly according to the present invention comprises a tip 11, an adapter 41 and a locking key 61.

[0029] The tip assembly basically extends along a longitudinal axis X relative to which it is possible to determine a back portion and a front portion of the tip assembly. Axis X also coincides with the assembly direction of the tip to the adapter.

[0030] Tip 11 is the actual earth moving tool while adapter 41 is the element for attaching the tip assembly to the bucket of an earth moving machinery, such as an excavator, in this case partly represented by a blade 10. While tip 11 is replaced when worn, adapter 41 remains normally attached to the bucket. The locking key 61 tightly secures tip 11 to adapter 41.

[0031] Tip 11 exhibits a front working portion 11' and a back portion 11" for coupling with adapter 41. The coupling between tip 11 and adapter 41 is of the male-female type, the back portion 11" of the tip defining the female portion of the coupling. More in detail, said back portion 11" comprises a pocket 12 open at the back.

[0032] Adapter 41 exhibits a front portion 42, herein-

after referred to as nose, and a back portion 50, called adapter body. Nose 42 is the male portion of the coupling with the tip and is shaped complementary to pocket 12 for introducing therein and geometrically coupling thereto.

[0033] Nose 42 extends from body 50, which exhibits a shape, such as a V shape, for being attached, such as by welding or screwing, to blade 10.

[0034] In accordance with a general embodiment, tip 11 exhibits a hole 16 for seating the locking key 61 obtained in a pair of opposed walls 13, 14 delimiting pocket 12. Correspondingly, nose 42 is crossed by a seat 43 for the locking key 61, said seat extending between two opposed surfaces 47, 48 of said nose and being aligned with hole 16 in tip 11.

[0035] According to the invention, at least one of said opposed surfaces of nose 47, 48, preferably both, exhibits a lowered or recessed zone 49 obtained around seat 43 for the locking key 61. Correspondingly, each wall of pocket 12 facing each surface of the nose exhibiting the lowered zone 49 internally exhibits a relief 18 complementary to said lowered or recessed zone 49. After the introduction of nose 42 into pocket 12, relief 18 matches the lowered zone 49, geometrically coupling therewith.

[0036] In accordance with a preferred embodiment, walls 13, 14 of pocket 12 crossed by hole 16 and surfaces 47, 48 of nose 42 with seat 43 are inclined relative to the longitudinal axis X and converging at the front.

[0037] According to a preferred embodiment, hole 16 in the pocket and seat 43 in the nose extend around a transversal axis Y perpendicular to said longitudinal axis X. Advantageously, relative to the tip assembly at home position shown in figures 1 and 2, wall 13 and surface 47 face upwards, whereas wall 14 and surface 48 face backwards. In other words, considering the longitudinal axis X extending horizontally, the transversal axis Y is substantially vertical. In the presence of multiple tip assemblies next to one another at a short distance therefrom, this arrangement allows a convenient application and removal of the key from the top, that is, without the adjacent tip assemblies being a hindrance to such operations.

[0038] Advantageously, said lowered or recessed zone 49 is defined by a plane portion perpendicular to said transversal axis Y. Correspondingly, said relief 18 emerging from each of the inclined walls 13, 14 of pocket 12 is obtained by a thickening of said walls about hole 16 for the locking key 61, said thickening progressively increasing towards the pocket opening so as to define a plane perpendicular to said transversal axis Y.

[0039] In accordance with an embodiment, nose 42 and pocket 12 exhibit respective opposed side surfaces and walls 54, 15 substantially vertical. Advantageously, each of said side surfaces 54 of nose 12 exhibits, for the full extension thereof, a kerb or guide tongue 55 parallel to the longitudinal axis X. Correspondingly, each of said side walls 15 of pocket 12 internally exhibits a guide groove 22 suitable for receiving said kerb or guide tongue 55 of the nose.

[0040] In accordance with a further aspect of the invention, pocket 12 ends at the front with a plane bottom 20 defining a front stop for nose 42. The latter exhibits a substantially plane front end 53 resting against said plane bottom 20 of the pocket. In other words, pocket 12 and nose 42 take up the shape of a parallelepiped with trapezoidal section of a truncated pyramid.

[0041] Advantageously, said plane bottom 20 of the pocket is surrounded by a peripheral slot or groove 21 suitable for receiving any scrap or residues, for example due to pressing, casting or coating of tip 11. Said groove 21 ensures that adapter 42 always abuts against the stop plane 20, also in the presence of scrap, residues or dirt inside pocket 12. Consequently, hole 16 is always aligned with seat 43. Hole 16 and seat 43 can thus be made in a very accurate manner, without the need of providing for clearance for compensating any misalignment, clearance which would negatively affect the efficiency of locking of the tip to the adapter.

[0042] According to another aspect of the invention, besides the lowered zones 49 of the nose and corresponding reliefs 18 of the pocket, tip 11 and adapter 41 exhibit further coupling portions shaped to penetrate each other when said tip and adapter are assembled. In particular, such reciprocal penetration is advantageously realised at the level of the surfaces of abutment of the tip on the adapter along the longitudinal axis X.

[0043] For example, body 50 of the adapter exhibits at the front a peripheral edge 51 substantially plane that surrounds nose 42 and that defines a shoulder or support stop for tip 11. Advantageously, at least one side of said peripheral edge, preferably two opposed sides, exhibits a breakage 52 wherein there is inserted a respective complementary tooth 19 which extends in continuation from at least one, preferably two opposed, of the walls delimiting pocket 12. In other words, the junction line of the tip to the adapter is a broken line.

[0044] According to a further aspect of the invention, hole 16 in pocket 12 and seat 43 in nose 42 exhibit respective back surfaces 16a, 43a substantially plane. Similarly, the locking key 61 exhibits a back surface substantially plane 62 resting on said back surfaces of the hole and of the seat. In other words, the coupling between the back surface 62 of the locking key, tip 11 and adapter 42 is a coupling between plane surfaces.

[0045] More in detail, the locking key 61 exhibits a back portion 64 defining said back surface 62, a front portion 65 defining a front surface 63 and an intermediate portion 66 made of elastic material. Said intermediate portion 66 is suitable for allowing an introduction by compression of the locking key 61 in the adapter seat. In other words, the transversal section of seat 43 in nose 42 is lower than the transversal section of the central portion 67 of key 61 intended for seating into said seat. Only by a compression of the intermediate portion 66 that allows moving the front 65 and back 64 portions close to each other, key 61 is introduced into seat 43.

[0046] Advantageously, the intermediate portion 66 of

the locking key 61 is made of elastomeric material, such as rubber. The two front and back portions of the key can for example be made of steel.

[0047] In one embodiment, hole 16 and seat 43 exhibit respective front surfaces 17, 44 that extend parallel to the transversal axis Y. Advantageously, the front surface 44 of the seat is rear relative to the front surface 17 of hole 16 so as to define a step 45 (at the top) and an undercut 46 (at the bottom) therewith.

[0048] Relative to the transversal axis Y, which substantially coincides with the main axis along which key 61 extends, the latter exhibits end portions 68 respectively interacting with said step 45 and with said undercut 46 so as to axially constrain key 61 into seat 43. Advantageously, said end portions 68 protrude at the front beyond the central portion 67 so as to define respective steps 69 therewith.

[0049] According to a preferred embodiment, the back portion 64 of the locking key 61 exhibits a rectangular cross section, whereas the front portion 65 exhibits a substantially semicircular cross section. Moreover, each end portion 68 ends with a chamfer 70 acting as seat for an easy introduction of key 61 into seat 43. It should be noted, moreover, that the elastic intermediate portion 66 exhibits a longitudinal extension, that is, along axis Y, smaller than the adjacent front 65 and back 64 portions, so as to be protected thereby when the key is pushed into seat 43 or removed from seat 43 with a tool acting on the end portions 68.

[0050] According to an advantageous embodiment, walls 13, 14 of the pocket crossed by hole 16 for key 61 exhibit, at the level of said hole 16, a thickness at least equal to the height extension of said end portions 68 of the locking key 61. Moreover, at least at the top wall 13, said hole 16 defines, with the underlying step 45, a seat for a guided pre-introduction of the locking key 61 in hole 16 of the pocket and in seat 43 in the adapter. In other words, the section of hole 16 is equal or slightly greater than the section of the end portions 68 of key 61, so that an end of the key may be inserted in a guided manner in hole 16 and may remain autonomously resting thereon, that is, without the aid of an operator, as shown in figure 3a. Such guided pre-introduction of the key enables the operator to push the key into seat 43 in an easy manner (the key being already perfectly aligned with the seat) and safely (it is not necessary to use the hands to hold the key into position), for example using a hammer.

[0051] The advantages of the structure of the tip assembly described above are several.

[0052] In the first place, providing for lowered zones, or recessed in the nose, and for corresponding reliefs in the pocket, besides the presence of the side guide kerbs, allows involving all the sides of the nose and of the pocket in the coupling, with a considerable increase of the tearing strength. In particular, the coupling between the reliefs and the lowered zones involves the nose at the seat for the locking key, that is, close to the connection to body 50, where its thickness is larger. Even in the event of a

large reduction of the side coupling, for example due to the wear of the guide kerbs, the connection between the reliefs and the lowered zones ensures a constant and high tear strength due to the mechanical strains the tip assembly is subject to.

[0053] The effect of reciprocal penetration between the tip and the adapter and therefore a stronger coupling is further increased by the connection between the break-ages in the adapter body and the complementary teeth that extend from the tip.

[0054] The presence of the lowered zones and of the reliefs in the pocket has the further effect of increasing the rest surface of the locking key to the back surface 16a of hole 16. Such increase of rest surface allows the corresponding increase of the resistance to the extraction of the tip from the adapter to prevent possible breakage due to an excessive pressure on the tip portion in contact with the key.

[0055] The presence of the plane contact surfaces between the locking key, the hole and the seat in the nose allows both having a wide rest surface of the key to the tip and to the adapter, to the advantage of the locking efficacy, both preventing any rotation of the key due, for example, to the vibrations it is subject to. Such undesired rotations could, in fact, cause a progressive extraction of the key from the seat thereof due to the presence of a compressible portion in the key.

[0056] Moreover, the key thus configured allows a single position of introduction in the hole and in the seat and thus an always correct snapping of the front step of the key in the undercut of the adapter.

[0057] Moreover, it should be noted that the locking key is sized so that the elastic intermediate portion compresses not only during the introduction in the seat thereof, but it remains compressed also after the introduction. Such compression, along with the presence of the marked front steps, allows avoiding any risk of accidental extraction of the key, for example due to the impact with items or debris while the machinery is working.

[0058] As already mentioned above, the locking key and the hole in the pocket are sized to allow a resting of the key into said hole through an end portion thereof, already in aligned position with the seat in the nose and without the need of being manually supported.

[0059] Such easiness of assembly of the tip assembly is also due to the presence of the abutment plane on the bottom of the pocket of the tip and of the groove surrounding it. In fact, as already explained above, said plane and said peripheral groove always ensure the same positioning between the tip and the adapter, and therefore a constant and perfect alignment between the hole in the pocket and the seat in the nose.

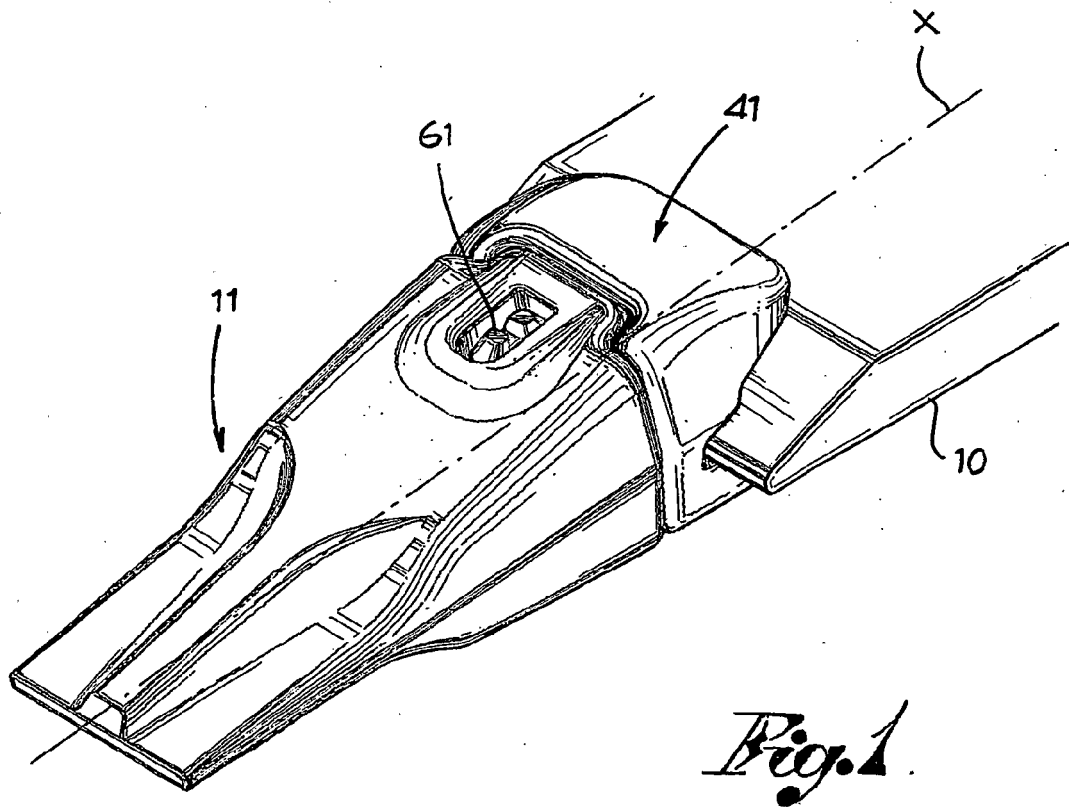
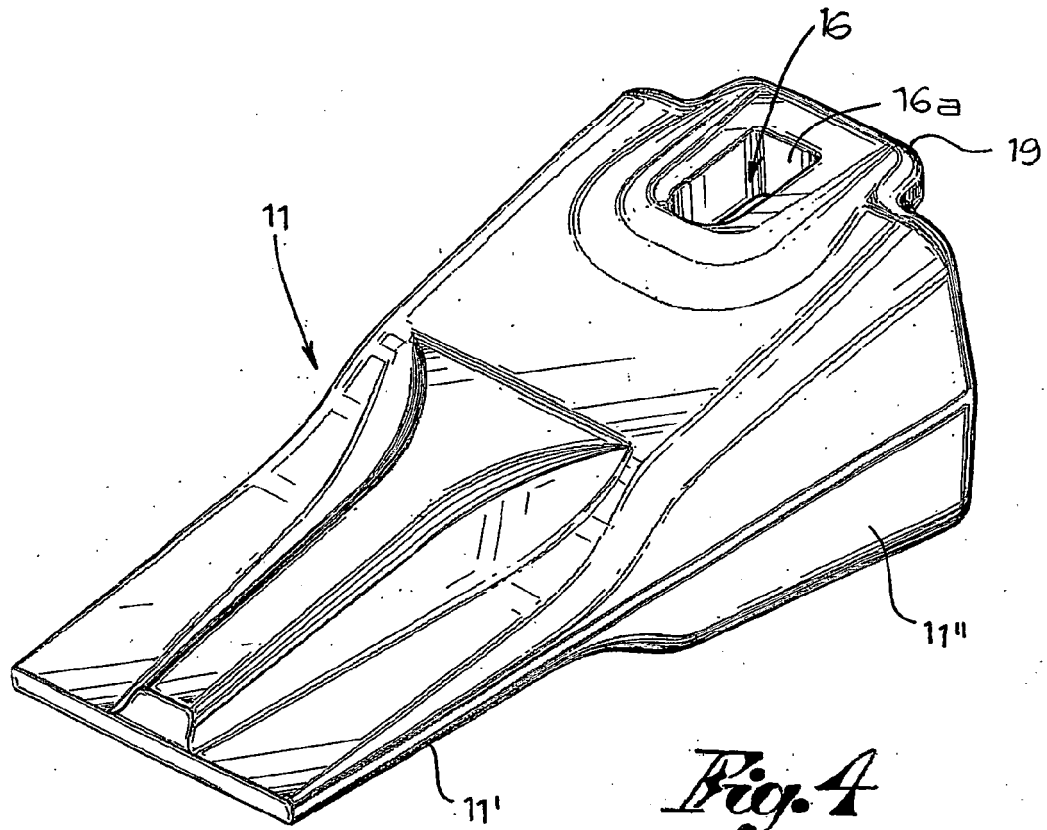
[0060] Finally, it should be noted that the snap-wise coupling between tip and adapter also at the level of the outer contact surfaces imparts a very compact and smooth design to the tip assembly, as if the two elements were a single body. This also allows preventing any earth or other work materials from meeting any hindrances

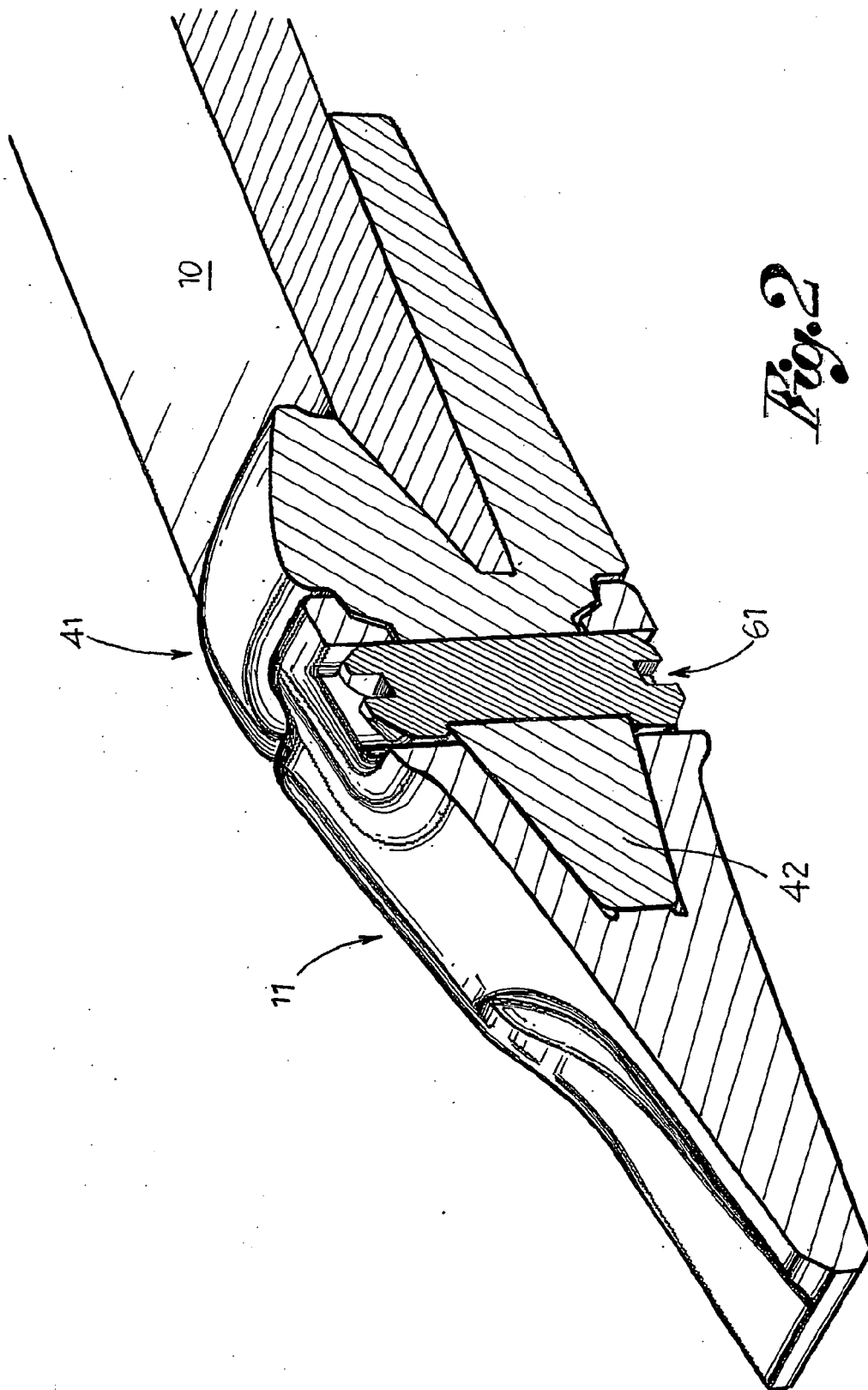
while loading and emptying the bucket.

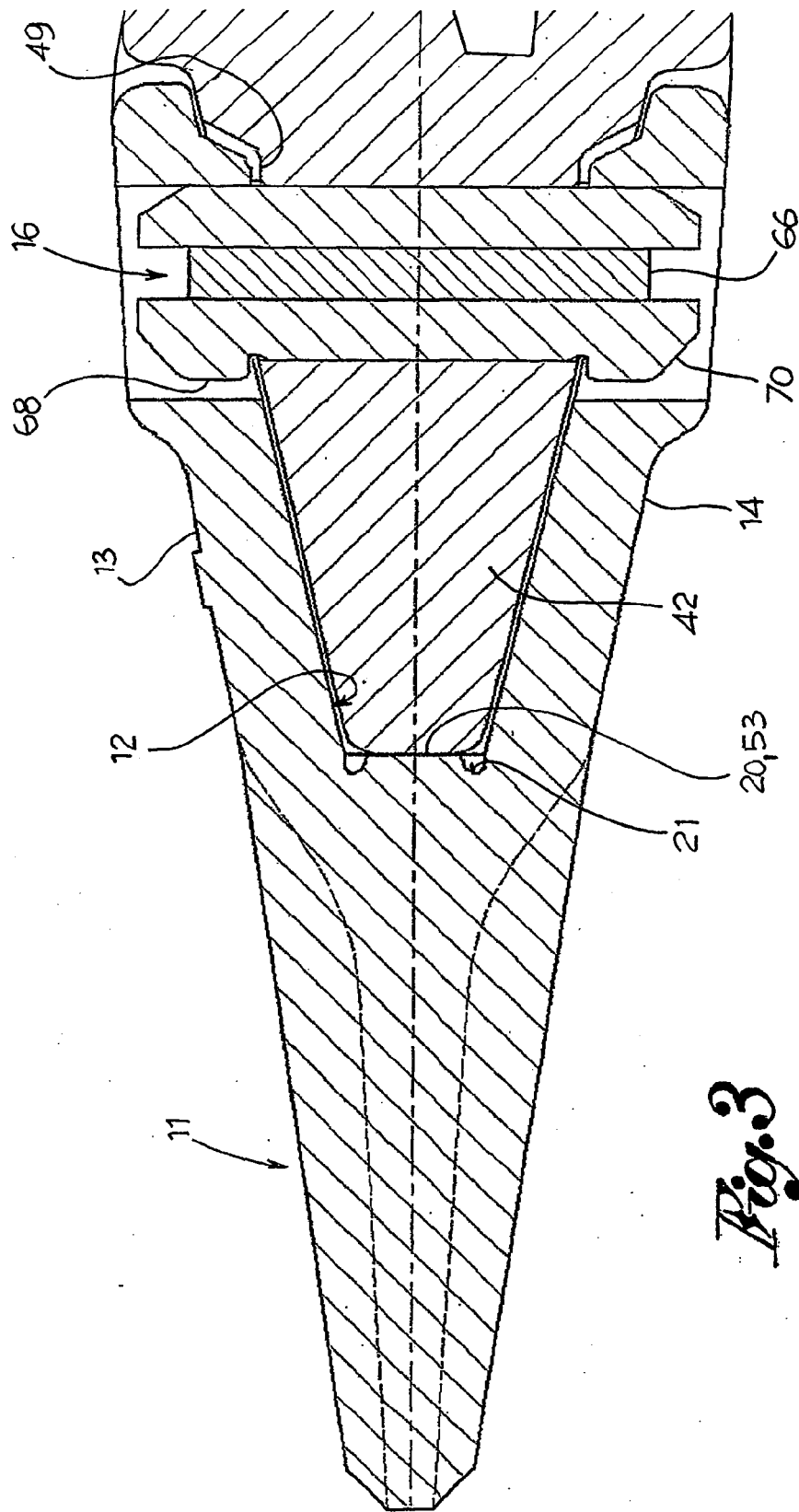
[0061] It is evident that a man skilled in the art may make several changes and adjustments to the tip assembly according to the present invention in order to meet specific and incidental needs, all falling within the scope of protection of the invention as defined in the following claims.

Claims

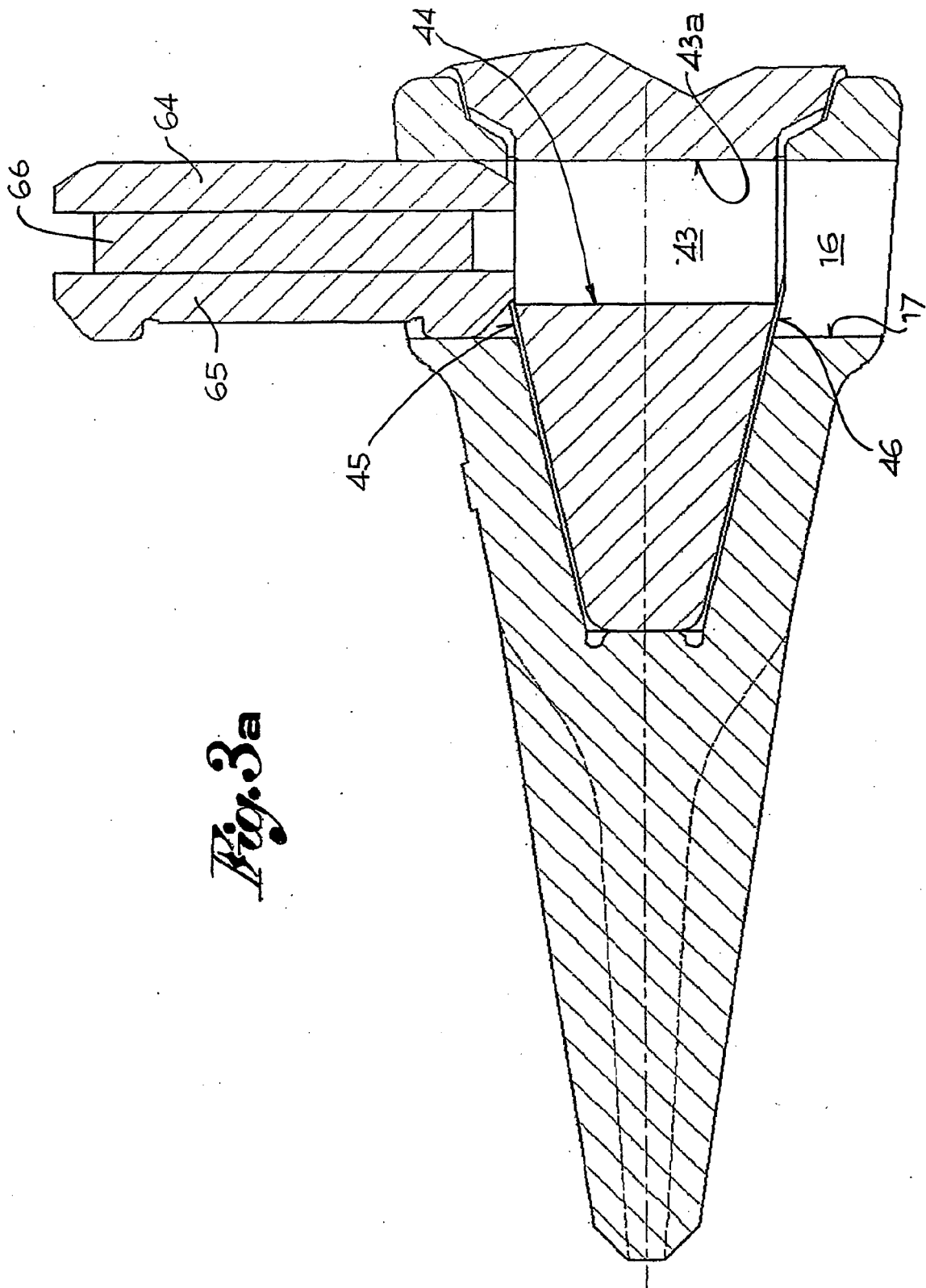
1. A tip for a bucket of an earth moving machinery, having a pocket open at a back end and defined by a top wall, a bottom wall and side walls, wherein said top and bottom walls are inclined and converging towards a front end of said tip, and wherein said top and bottom walls are crossed by a hole (16) suitable for receiving a key for locking the tip to a adapter, **characterised in that** from each of said top and bottom walls, around said hole, there extends a protruding portion towards the interior of the pocket suitable for geometrically coupling with a corresponding lowered zone obtained in the adapter. 5
2. A tip according to claim 1, wherein said protruding portion is obtained from a thickening of the respective wall about the hole for the locking key, said thickening progressively increasing towards the pocket opening so as to define a plane perpendicular to the hole axis. 10
3. A tip according to any one of the previous claims, wherein at the side opposite the opening, said pocket exhibits a plane bottom surrounded by a groove or peripheral slot. 15
4. A tip according to any one of the previous claims, wherein a guide groove (22) is obtained in the inner surface of each of said side walls. 20
5. A tip according to any one of the previous claims, wherein a tooth extends from at least one of the sides delimiting the pocket opening in continuation from the respective wall. 25
6. A locking key for a tip assembly of a bucket of an earth moving machinery, having an elongated body (61) that extends along a main axis (Y), comprising two side portions (64, 65) extending parallel to said main axis from one end to the other of the key and a central portion (66) of elastic material arranged between said side portions, **characterised in that** one of said side portions exhibits a substantially plane outer surface (62). 30
7. A locking key according to claim 6, wherein said side portion exhibits a rectangular cross section. 35
8. A locking key according to claim 6 or 7, wherein the other of said side portions exhibits a substantially semicircular cross section. 40
9. A locking key according to any one of claims 6 to 8, wherein one of said side portions exhibits, relative to said main axis, a central portion (67) from which two end portions (68) extend, transversally protruding from said central portion, at least in the opposed direction relative to the other side portion, so as to define with said central portion respective steps or undercuts (69). 45
10. A locking key according to claim 9, wherein said protruding side portions are obtained in the side portion with semicircular section. 50

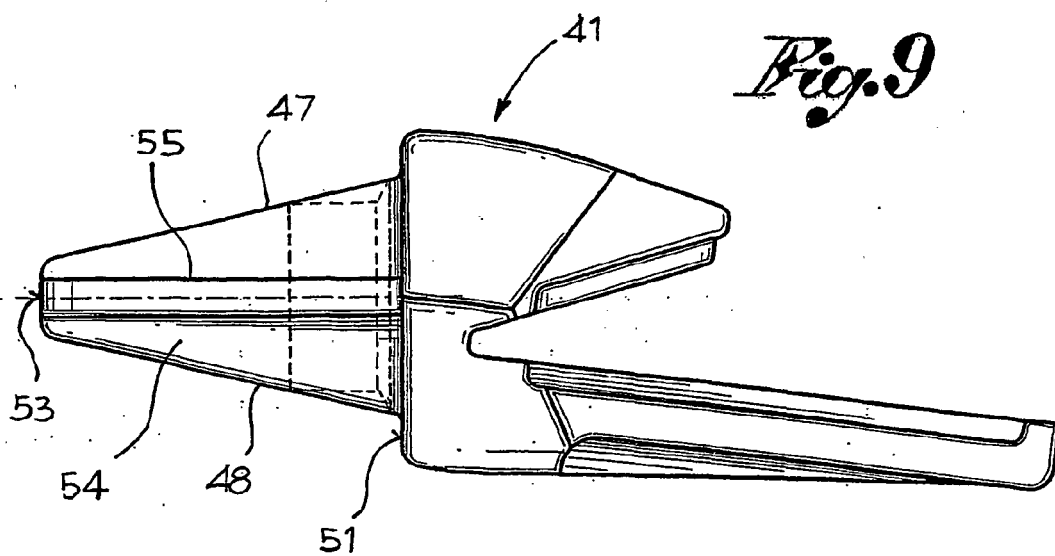
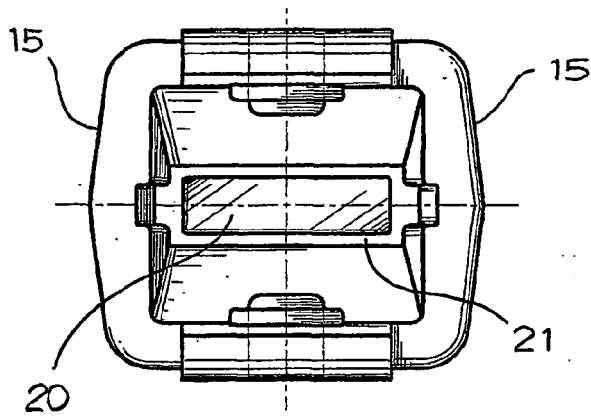
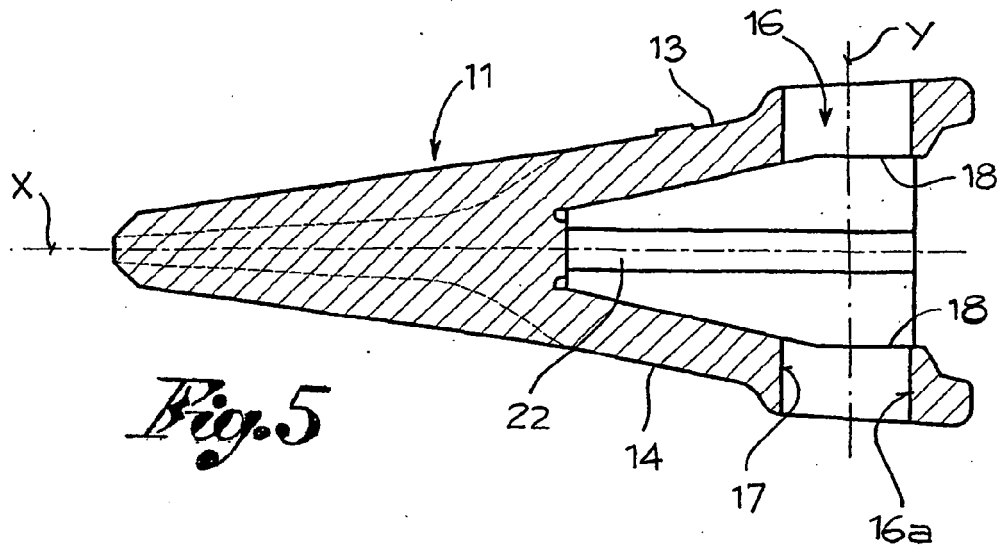






Bo. 3





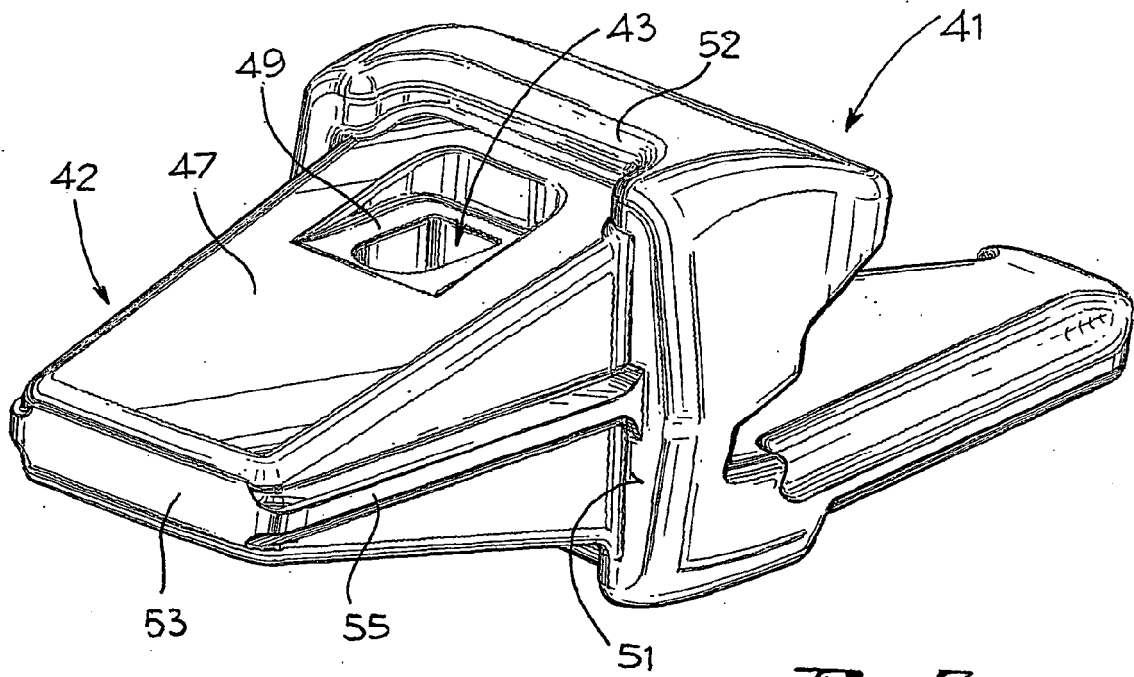


Fig. 7

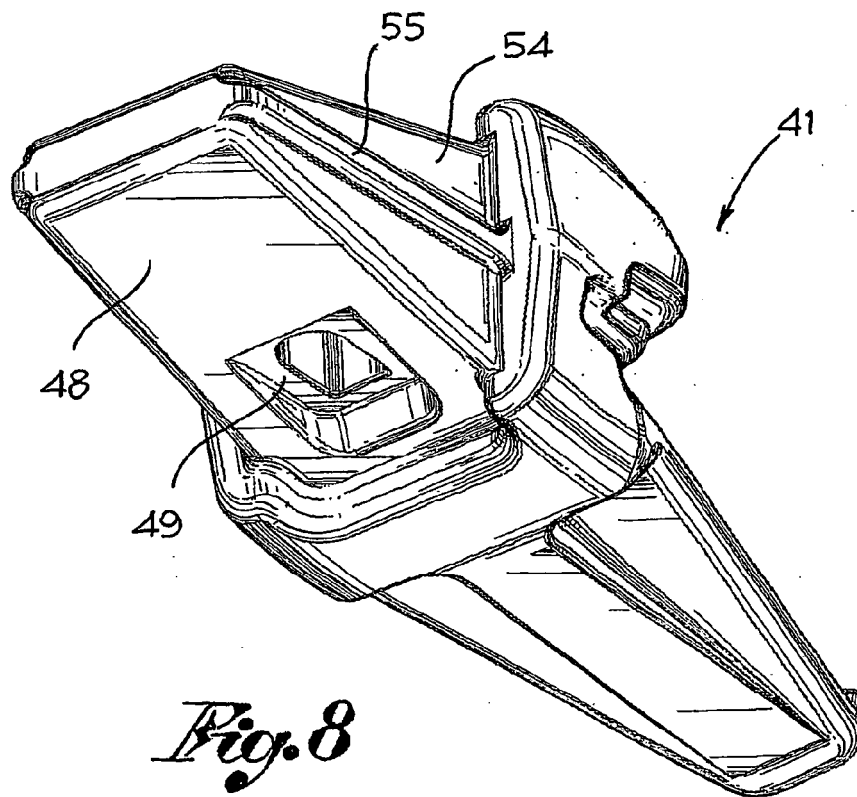


Fig. 8

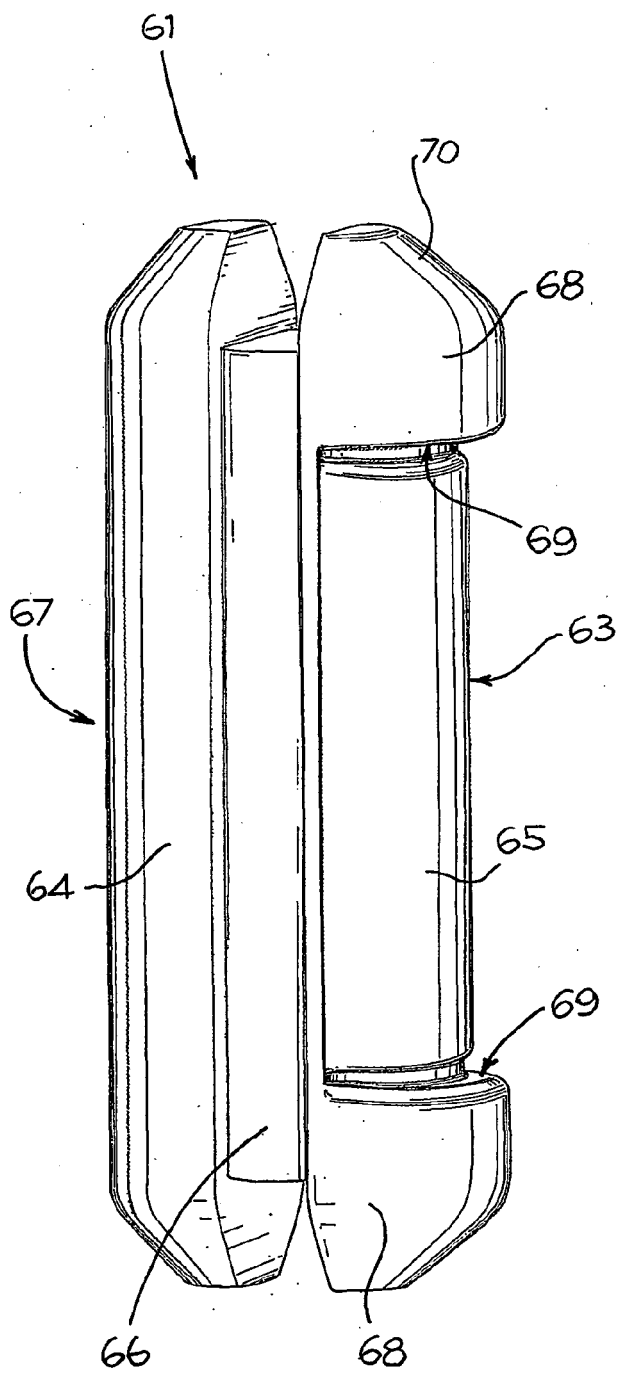


Fig. 10

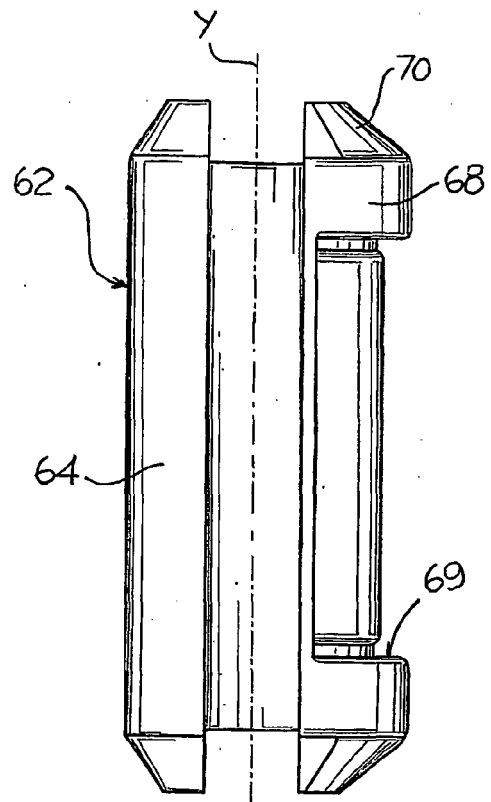


Fig. 11

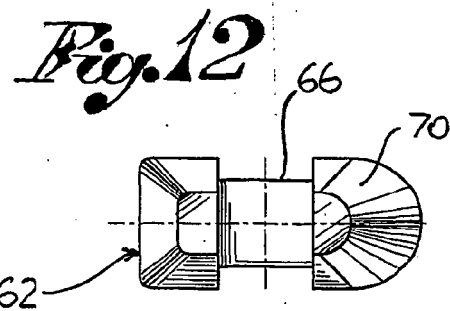


Fig. 12

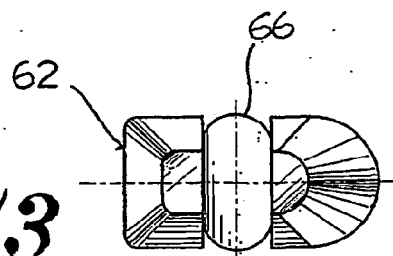


Fig. 13