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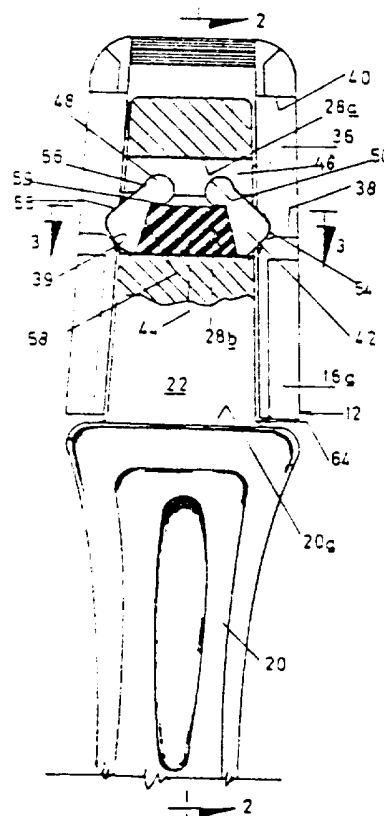
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Zimbabwe(51) International Patent Classification Int. Cl.<sup>4</sup> E02F 9/28

(54) Title: TEETH FOR USE WITH EARTH MOVING EQUIPMENT

(57) Abstract:

A shanked solid tooth carries a pair of fastening members in a transverse slot in the shank. A rubber or neoprene block is located between the fastening members to urge them outwardly. The tooth is in use received in an "U"-section adapter that is secured to the bucket and has openings in its arms. When the shank is inserted into the adapter, the fastening members are moved inwardly and they spring outwardly to hold the shank in the adapter. The rear ends of the fastening members are rounded and are received in recesses in an abutment member to that butts against the rear of the slot. To remove the shank, the abutment member is struck transversely to the shank with a hammer blow which has the effect of breaking the fastening members so that they may be removed to facilitate removal of the shank.



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(56) References cited: US 4501079  
US 2951300DE 3415260  
DE 2930804

COPY

This invention relates to sacrificial teeth for use with earth moving equipment such as a bull-dozer, grader or ditcher.

#### BACKGROUND TO THE INVENTION

5 There are two main types of such teeth. There is a tooth which is largely hollow and which releasably fits on to an adapter in the form of a point. Such a tooth is hereinafter called a "hollow tooth". A second type of tooth has a solid working end and a  
10 root section that is secured to, for example, a bucket. Such a tooth is hereinafter called a "solid tooth".

A hollow tooth is generally fitted on to the adapter and is secured thereto by a fastener comprising a  
15 pin which passes through the point and is engaged by apertures in ears on the tooth which run alongside the adapter. Thus the adapter will be the inner part and the tooth will be the outer part fitting thereon.

20 Solid teeth are generally in one of two forms. In one form, the root section is divided horizontally into two root parts between which is received the bucket and the root section is secured to the bucket



by suitable fastener. This type of tooth is hereinafter called a "split solid tooth". A second form of solid tooth has a root section which fits into an adapter, in the form of a tooth socket, secured to the bucket. The root section has a transverse passage therethrough, and the adapter has a pair of side apertures which, when the root section is home in the adapter, register or substantially register with the passage. The fastener is located within the passage and projects into the said side apertures to retain the root section within the tooth socket, the latter being the outer part surrounding the root section which constitutes the inner part. The latter tooth is hereinafter referred to as "a shanked solid tooth".

Originally solid teeth were split solid teeth and these were attached by being bolted on to the bucket. This is fairly satisfactory. However after the bucket has been used for some time, the threads on the bolts are burred over and generally sand and dirt packs on to the tooth making it extremely difficult to remove the bolts. To remove a worn tooth, therefore, it is usual to cut the bolts with an oxy-acetylene cutter. This means that the earth moving equipment, which is a substantial and

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expensive piece of equipment has to be taken into the workshop to have the worn teeth cut off and to replace them with new teeth. As can be appreciated this is costly in down time of the equipment and  
5 there are difficulties in the cutting operation. Alternatively the oxy-acetylene cutter and necessary gas bottles have to be taken into the field which in practice was not satisfactory.

Subsequently, the shanked solid tooth and its  
10 assembly was provided as described in U S Patent 3 879 367. In this arrangement, the fastening means comprises a rubber/steel key that secures the root section to the socket. This key comprises two steel members extending over the entire length of  
15 the key and having an elastomeric element therebetween. The key is wider than the side apertures and passage in the root. It is compressing the elastomeric element hammered into the side apertures through the socket and through  
20 the passage in the root. When the tooth has worn down, the key is hammered out and the stub of the tooth can be removed.

Another system for securing a shanked solid tooth the bucket comprises a set of pins and tubes.



A disadvantage of both the systems described in the preceeding two paragraphs is that the side apertures and the passage must be accurately dimensioned. Furthermore it is necessary to have at least one  
5 loose part in addition to the tooth. This can cause difficulties in the field as it may be that the contractor has teeth to affix to an earth moving apparatus but does not have available the necessary keys. It is an object of the invention to provide a more  
10 satisfactory fastener key for use with teeth.

#### STATEMENT OF INVENTION

According to one aspect of the present invention there is provided a fastener means for a tooth comprising a pair of fastening members that are  
15 mounted to pivot relative to one another from an inner position to an outer position and biasing means, preferably in the form of an elastomeric block, preferably comprising rubber or neoprene, to bias the members apart into their outer positions.  
20 In use the fastener will be inserted in a passage in the inner part prior to it being received in the outer part as defined above. When the fastening members are in the inner position, the inner part can be received in the outer part and when the



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fastening members are adjacent openings in the outer part, they will be biased outwardly into the outer position so that one engages the sides of the openings and the other will act against a wall in the passage thereby to secure the inner part into the outer part.

Preferably the fastener further comprises an abutment member against which the said fastening members butt in such a way as to be able to pivot relative thereto, preferably the said members are provided with rounded ends and preferably the said abutment member has rounded recesses within which the said ends are received so as to be able to pivot as desired. The said fastening members preferably are provided with a weakness so that when struck

with a blow substantially at right angles thereto the members will tend to break so as to facilitate their removal of the fastener from the tooth and adapter.

Each fastening member which preferably comprises a rounded inner end preferably has a generally triangular projection with an inclined forward portion, the said weakness being provided near the rounded end.



The elastomeric element is preferably generally in the shape of the frustum of a triangle. It is preferably bonded to the said members preferably by being vulcanized thereto.

5 According to another aspect of the invention there is provided a shanked solid tooth having a working end and a root section having therethrough a transverse passage, and within the passage a fastener as set forth above, the arrangement being such that  
10 when the said fastening members are in their inner position, they are wholly or substantially wholly contained within the passage. Preferably the said root section is provided with holding means for holding the fastener within the passage. The hold-  
15 ing members may comprise a pair of retaining walls at the side wall of the passage remote from the working end of the tooth and preferably one end of each of the fastening members is located within the retaining walls, the biasing means tending to  
20 bias the fastening members to pivot relative to one another about the said ends into the said outer positions. Preferably however, the retaining means comprises a projection from the passage and a recess in the elastomeric block into which the projection  
25 is received to prevent movement of the fastener



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transversely to the passage. Preferably too the fastener means further comprises an abutment member which is slidably located against the side of the passage remote from the working end and against  
5 which the said members butt in such a way as to be able to pivot relative to each other.

According to another aspect of the invention there is provided the combination of a shanked solid tooth or hollow tooth with an adapter therefor and a  
10 fastener as set forth above connecting the tooth to the adapter.

Embodiments of the invention will now be described with reference to the accompanying drawings.

#### SHORT DESCRIPTION OF THE DRAWING

15 In the drawings:-

Figure 1 is an underplan view partially in section of a shanked solid tooth of the invention in position in an adapter socket, the side of the bucket and the cover plate being omitted for  
20 clarity,

Figure 2 is a section on line 2 - 2 of Figure 1,

Figure 3 is a section on line 3 - 3 of Figure 1,





Figure 4 is an end view of a tooth of the invention in its adapter,

Figures 5 and 6 are detail underplan views of the root section of other solid shanked teeth of the invention, and Figures 7 and 8 are respectively a side view of the rear of a hollow tooth of the invention and a section on line 8 - 8 of Figure 7

DESCRIPTION OF THE PREFERRED EMBODIMENT.

Referring now to Figures 1 and 2 there is shown a solid shanked tooth 10, an adapter in the form of a tooth socket 12 for receiving the tooth 10 as will be described, and a fastener 14 for retaining the tooth 10 in the adapter. The adapter socket 14 comprises a "U"-shaped member, the arms 16 of which are welded to the bottom plate 18 of a bucket (not shown).

The tooth 10 has a spade-shaped working end 20 terminating in an inner or rear wall 20a from which extends a root section 22 which is received in the socket 14. The root section 22 has a transverse passage 24 therethrough. The passage 24 is defined by a recess having a base 26 and transversely extending plane side walls 28a and 28b. The passage is of increased width at its upper ends to form aligned platforms 30 having end walls 32. A steel



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plate 34 rests on these platforms 30 to form a cover for the passage 24.

The adapter socket 14 has a pair of aligned side apertures 36 formed by "U"-shaped cut-outs in the arms 16 and the plate 18. The side apertures 36 have longitudinally spaced end walls 38 and 40. The inner corner 39 of each wall 38 is rounded for the purpose which will become apparent. When the root section 22 is honed in the socket 14, these apertures 36 are adjacent to the passage 24.

The fastener means 12 comprises a pair of aluminium fastening members 42, an elastomeric, rubber or neoprene, trapezoidal block 44, and an abutment plate 46. The block 44 is in the shape of the frustum of an isosocles triangle. It serves as a biasing means for the members 42 as will be described. The abutment piece 46 which runs along the length of and slidably abuts against the side wall 28a of the passage 24 remote from the working end 20 of the tooth 10. The fastening members 42 run generally in the direction of the root portion 22. The ends 48 of the fastening members 42 adjacent the abutment plate 46 are rounded and are received within semi-circular recesses 50 in the



aboutment plate 46. The outer sides of the fastening members 42 have generally triangular projections 52 in shape each having its forward end wall 54 which is slightly rounded and which is inclined as will be described for the purposes that shall emerge and straight rear side wall 55. There is a neck or line weakness 56 between the outer ends 48 and the thicker portions of the projections 52. The inner surfaces 58 of the fastening members 42 are flat over most of their length and butt against the sides of the block 46 which are vulcanized to these surfaces. At the junctions 59 between the ends 48 and the projections 52 and the ends 48 and the surfaces 58 only a very small radius or none at all, exists.

A low narrow longitudinally extending stud 60 is centrally located standing up from the base 26 of the passage 24. A longitudinal groove 62 is provided in the block 44 and this receives the stud 60. The engagement of the stud 60 in the groove 62 prevents the fastener 12 from moving transversely in the passage 24.

The elastomeric block 44 serves as a biasing means tending to bias the fastening members 42 to pivot relative to one another about their rounded ends 50



each from an inner position (shown in chain lines in Figure 1) when the block is compressed, to an outer position (shown in full lines) when the block 44 is in its rest position.

5 When the fastening members 42 are in their inner positions, they lie substantially wholly within the passage 24. When the fastening members 42 are in their outer positions, the projections 52 project beyond the passage 24 to lie between the end  
10 walls 38 and 40 of the side apertures 36. The forward ends of the fastening members 42 however are wholly contained within the passage 24.

The forward end 54 of each projection 52 engages the wall 40 of the aperture closer to the working end 20  
15 of the tooth.

The tooth 10 can easily be fitted into the socket 12 by feeding the root section 22 into the mouth 64 of the socket 12 until the rear walls 55 of the projections 52 engage the mouth. Further inward pressure  
20 will cause the walls 55 to swing the fastening members 42 inwards compressing the block 44 so that the fastening members 42 move into their inner positions enabling the root portion 22 to move into the

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socket 12. When the root portion 22 has homed into the socket 12 and the rear wall 20a butting against the mouth 56 of the socket 12, the projection 52 will be opposite the apertures 36. The block 44 will  
5 now bias the fastening members 42 outwardly into their outer positions so that the projections 52 enter the apertures 36 and the front walls 54 engage the rounded inner edge 39 of the end wall 38.

The root portion 22 will now be firmly held in place  
10 in the socket 12, rearward movement being inhibited by the engagement of the rear wall 20a of the working end 20 with the socket 12 and forward movement being inhibited by the engagement of the walls 54 of the fastening members 42 and the walls 38.

15 It will be noted that the angle of the front face of the end wall 54 is so chosen that any resultant force tending to remove the root portion 22 from the socket 12 will run directly along the length of each fastening member 42 through the centre of the por-  
20 tion 48 (or slightly inside it) on to the abutment plate 46. Very substantial compressive forces, which are in excess of any forces which would normally be encountered in practice, can thus be absorbed by

the fastening members 42 so that the possibility of the tooth 10 being pulled out of the socket 16 is virtually non-existent.

Furthermore the shape of each of the front walls 54  
5 and the rounded shape of the end wall 38 are such that forces emanating from the end wall 38 will not tend to pivot the fastening members 42 either inwardly or outwardly but will only be conveyed directly down the length of the fastening members as  
10 mentioned above.

When the working end 20 of the tooth 10 has worn down, the tooth 10 must be taken out of the socket 14. To do this, the fastener 14 must be removed which is effected by a sharp hammer blow being  
15 struck against the abutment plate 46 transversely the root section. This will tend to move the abutment plate 46 relative to the fastening members 42 and in turn to cause these to fracture along the lines of weakness 56. This is ensured because of  
20 the narrow neck and the sharp junctures 59 which latter form stress points. Also the elastomeric block 44 will tend to tear along a continuation of the groove 62. When this happens, the parts of the fastener 14 can simply be pushed out of the pass



age 26. The root portion 22 of the tooth 10 can now  
be removed from the socket 12, possibly with the  
assistance of a hammer blow on the inner end 68 of  
the root portion 22. A new tooth is now attached  
5 in the manner described above.

It will be noted that only hand pressure is needed  
to insert the root portion 22 into the socket 12  
unless excessive dirt remains in the socket. Then a  
light hammer blow would be all that is necessary for  
10 the purpose.

DESCRIPTION OF MODIFIED SOLID SHANKED TEETH OF THE  
INVENTION.

In a modified arrangement of the invention, as shown  
in Figure 5, a tooth 68 is provided wherein the  
15 abutment plate is omitted. Here the rounded ends 70  
of the fastener members 72 butt directly against the  
side wall 74 of the root section 76, which wall 74  
is removed from the working end of the tooth 68.

A stud 78 which is similar to but larger than the  
20 stud 60 holds the fastener in position. This stud 78  
can be broken on striking the fastener with a hammer  
and further blows will move it from the passage 76.



In a further tooth 80 of the invention (see Figure 6), the projection 60 from the base of the passage is omitted and narrow rims 82 from the side wall 84 bear against the rounded ends 86 of the fastening members 88. The rims 82 or one of them will break off when the fastener 88 is struck by a hammer blow as described above to permit removal of the fastener.

The teeth 68 and 80 are identical to tooth 10 other than for the features set out above.

DESCRIPTION OF A HOLLOW TOOTH OF THE INVENTION.

As shown in Figures 7 and 8, a hollow tooth 90 has a hollow rear end 92 in which is received an adapter 94 in the form of a point. A transverse passage 96 is provided in through the adapter and in this is received a fastener 98.

The fastener 98 is a separate loose item but which is substantially identical to the fastener 12 including fastening members 100, having outer projections 102, and an elastomeric block 104 therebetween to which the members are vulcanized. The rounded ends of the members 100 are received in rounded recesses in an abutment plate 106. The inner end of the block 104 is also vulcanised to the





abutment plate 106 thus creating a complete unit which holds together during normal handling.

10 The tooth 90 has ears 110 which lie on either side of the adapter 94. Each ear 110 has an aperture 112 which, when the tooth 90 is homed on to the adapter 94, is aligned with the passage 96.

15 The tooth has internal grooves extending from the ears 110 to the apertures 112, to receive the projections 102 as will be described.

20 In use, the fastener 98 is first placed in the passage 96 and roughly centralised therein. The tooth 90 is now fitted on to the adapter 94 until grooves 114 engage the projections 102. Further pressure will compress the block 104 moving the fastening members 102 into their inner positions until the tooth 90 is homed on the adapter 94. Now the projections spring out under the bias of the  
25 block 104 to engage the apertures 112 and to hold the tooth 90 on the adapter 94. Removal of the fastener 98 is as described with reference to Figures 1 and 2.

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GENERAL

I have found that each of the abovedescribed teeth of the invention can be easily fitted to its adapter. It can be easily removed therefrom as described above when the working end is worn down. Once fitted to its adapter it is held by the fastener firmly to prevent to its removal therefrom.

The invention can be used with advantage on all sizes of teeth from those having a mass of 2 kg. to 70 kg. or even more.

I have further found that the fasteners will be positively held in the passage of the shanked solid teeth so that they cannot be removed therefrom inadvertently. However the fastener can be readily removed as described above. This is because the fastening members break relatively easily and quickly because of two features. First the material of which the fasteners are formed, i.e. aluminium, has a high compressive strength but low strength in shear. Second, as the fastening members have necks or weaknesses, failure takes place relatively easily when a sharp force is applied thereto as described.



Because the  
shanked solid tooth 10 is provided with a fastener  
12 in the passage 24, it will not be necessary to  
25 carry separate fasteners 12 in stock. Of course  
this advantage does not apply with the hollow tooth  
of the invention.

The invention is not limited to the precise  
constructional details hereinbefore described and  
illustrated in the drawings. For example in the  
embodiment of Figure 4, a single rim may engage in a  
5 central slot in the attached plate to hold the  
fastener in position. Suitable means may be  
provided to hold the fastener in the passage of the  
point adapter in the embodiment of Figures 5 and 6.  
This passage may be a groove on a surface of the  
10 adapter rather than a through passage. The  
fastening members may comprise other material having  
high compressive strength, but low strength in  
shear. The invention may also be used with drag  
line shovels and other ground engaging tools.



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CLAIMS:-

1. Fastening means for a tooth comprising a pair of fastening members that are mounted to pivot relative to one another from an inner position to an outer position and biasing means, to bias the members apart from inner positions to outer positions.

2. Fastening means as claimed in claim 1 wherein the biasing means comprises an elastomeric block.

3. Fastening means as claimed in claim 2 wherein the biasing means comprises rubber or neoprene.

4. Fastening means as claimed in claim 1, 2 or 3 further comprising an abutment member against which the said members butt in such a way as to be able to pivot relative thereto.

5. Fastening means as claimed in claim 1, 2, 3 or 4 wherein the said members are provided with rounded ends.



6. Fastening means as claimed in claims 5 and 6 wherein the the said abutment member has rounded recesses within which the said rounded ends are received so as to be able to pivot as aforesaid.

5 7. Fastening means as claimed in any one of the preceding claims wherein the said members are provided with weaknesses so that when struck with a blow at right angles thereto the members break so as to facilitate the removal of the key from the tooth and adapter.

5 8. Fastening means as claimed in claim 7 wherein the each fastening member comprises a rounded inner end and an arm extending therefrom, the arm having a generally triangular enlargement with an inclined forward portion, the said weakness being provided between the rounded end and the said arm.

9. Fastening means as claimed in any one of the preceding claims wherein the elastomeric element is generally in the shape of the frustum of a triangle.



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10. Fastening means as claimed in any one of the preceding claims wherein the block is vulcanized to the said members.

5 11. A shanked solid tooth having a root section which in use fits into an adapter in the form of a tooth socket secured to a bucket, the root section having therethrough a transverse passage, and within the passage a key as claimed in any one of the preceding claims, the arrangement being such that when the said members are in their inner position, they are wholly or substantially wholly contained within the passage.

12. A tooth as claimed in claim 11 wherein the said root section is provided with holding means for holding the fastening means within the passage.

5 13. A tooth as claimed in claim 12 wherein the holding means comprise a pair of retaining walls at the side wall of the passage remote from the working end of the tooth and one end of each of the fastening members is located within the retaining walls, the biasing means tending to bias the fastening members to pivot relative to one another about the said ends into the said outer positions.

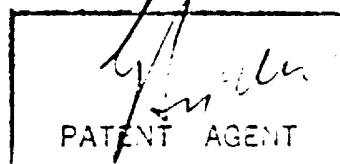


14. A tooth as claimed in claim 12 wherein the retaining means comprises a projection from the passage and a recess in the elastomeric block into which the projection is received to prevent movement of the fastening means in the passage.

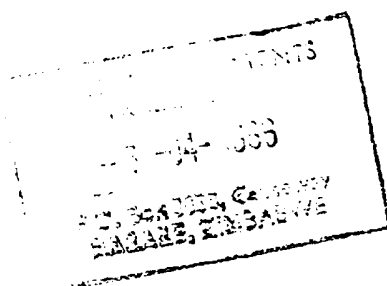
15. A tooth as claimed in claim 11, 12, 13 or 14 wherein the fastening means further comprises an abutment member which is slidably located against one side of the passage and against which the said members butt in such a way as to be able to pivot relative thereto.

16. The combination of a shanked solid tooth or hollow tooth with an adapter therefor and fastening means as claimed in any one of claims 1 to 10 connecting the tooth to the adapter.

DATED this 3rd day of April 1986.



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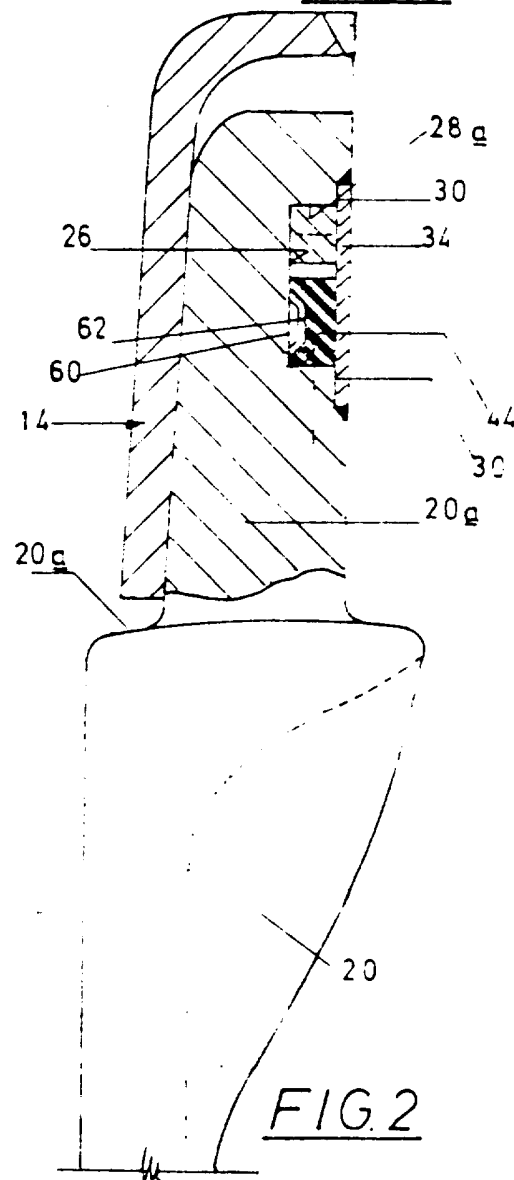
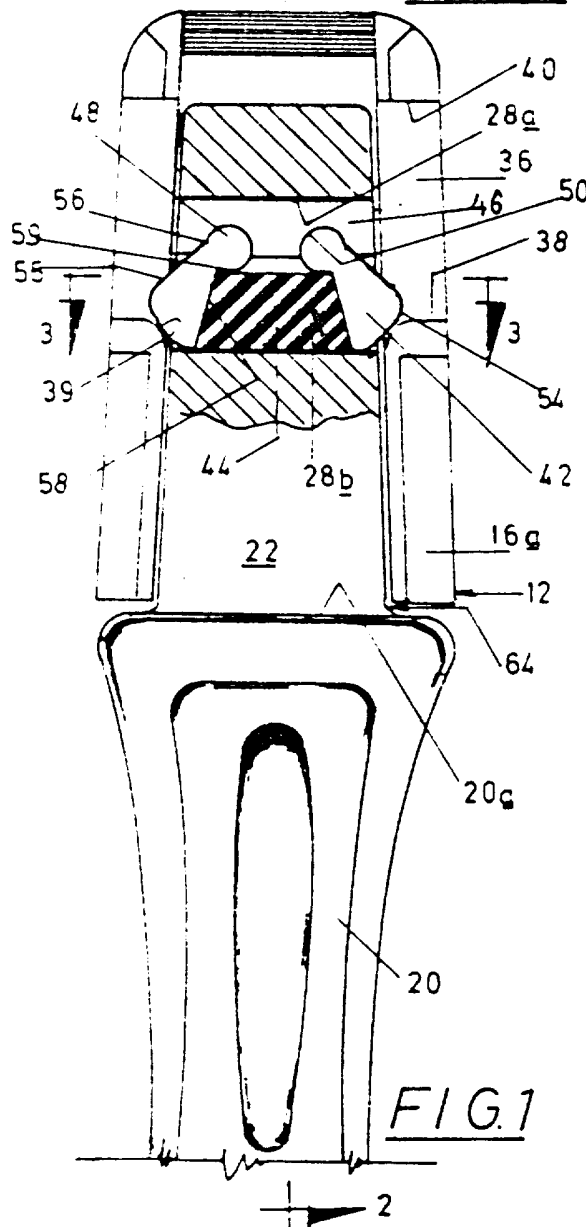
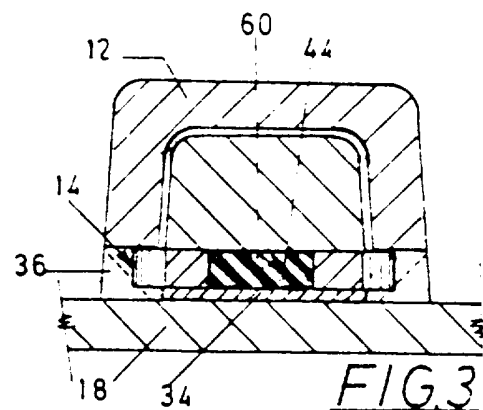
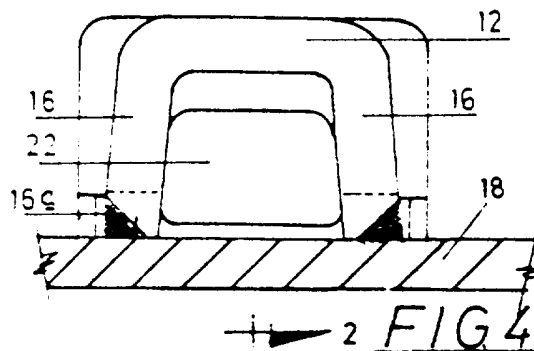


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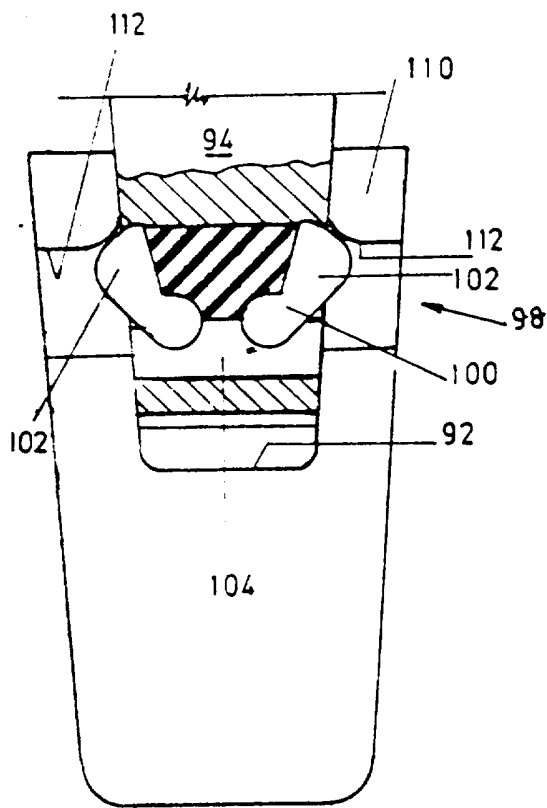


FIG. 8

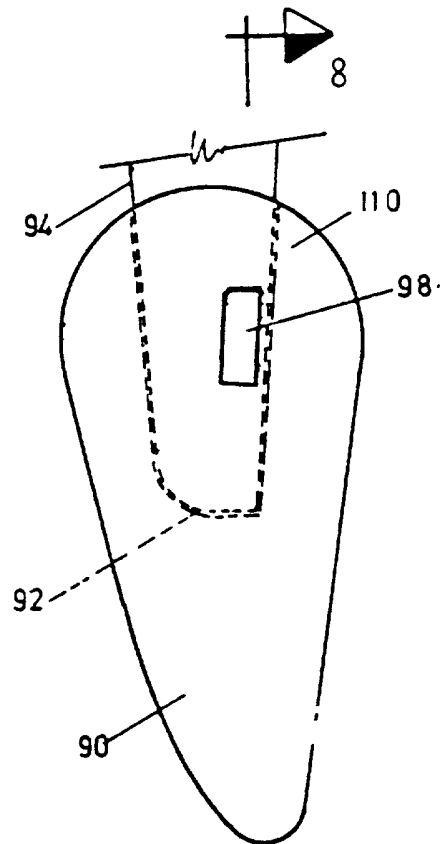


FIG. 7

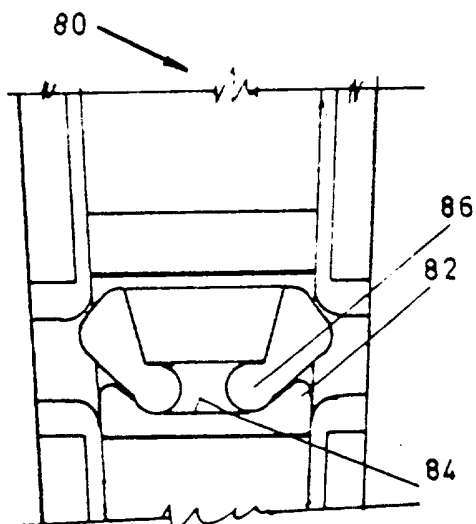


FIG. 6

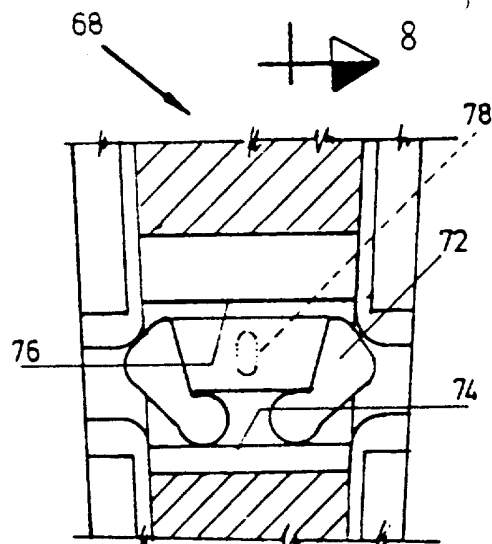


FIG. 5

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