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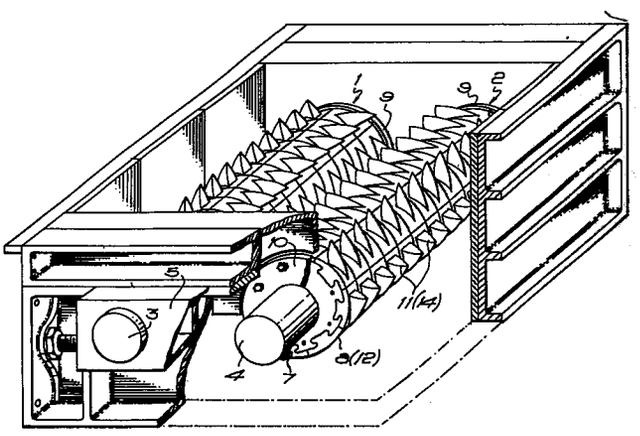
(54) Comminuting apparatus.

(57) The invention relates particularly to roller crushers, in which there is a need to positively locate crusher members such as teeth on the contra-rotating rolls. Hitherto, teeth have been formed on an annular disc, and the disc secured to a roll body or shaft by welding or by pouring concrete down aligned lobes on the discs. Such constructions are effective in locating the teeth against movement relative to the roll body or shaft but make extremely difficult the task of removing the teeth when worn or damaged to an extent requiring their replacement. The object of the invention is to avoid such difficulties, which objective is met by a construction of roll comprising a body portion in the periphery of which are formed a number of parallel longitudinal grooves (6), a number of tooth bearing members (8, 12) each having a surface to fit closely the periphery or part of the periphery of the body, and each having at least one projection (7) from that surface of a shape adapted to fit the shape of a groove, and abutment means (9, 10) at each end of the body, whereby the tooth bearing members are a sliding fit on the body and are located in their operative position by the abutment means, the engagement of the projections in the grooves and the abutting side-by-side relationship of adjacent tooth bearing members.



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COMMINUTING APPARATUS

This invention relates to comminuting apparatus, and is particularly concerned with rolls of apparatus generally referred to as roller crushers, where two contra-rotating rolls are each provided with crushing members e.g. teeth on their peripheries.

It is obviously important that the crushing members on each roll are effectively prevented from movement relative to the roller, as this would seriously detract from the crushing action. Thus it is known to provide a solid shaft or a drum with spaced annular discs formed with teeth at their peripheries, and to weld or bolt the discs to the drum or shaft. It is also known to provide a square sectioned shaft with a series of discs having a central hole to fit the shaft, the centre hole extending to lobes, and with concrete run down the aligned lobes to lock the discs to the shaft. With such constructions, any wear or damage to, particularly, the teeth on the discs, occasions considerable time being spent in the removal of the existing discs from the shaft or drum and hence the apparatus being out of commission for considerable periods of time. Equally, such apparatus cannot readily be modified to suit different crushing

requirements, again because of the problem of removing one set of discs and their replacement by discs of a different tooth profile or disc diameter.

The object of the present invention is to provide a roll for a so-called roller crusher which avoids the above disadvantages.

According to the present invention, a roll for a roller crusher comprises a body portion in the periphery of which are formed a number of parallel longitudinal grooves a number of tooth bearing members, each having a surface to fit closely the periphery or part of the periphery of the body, and each having at least one projection from that surface of a shape adapted to fit the shape of a groove, and abutment means, at each end of the body, whereby the tooth bearing members are a sliding fit on the body and are located in their operative position by the abutment means, the engagement of the projections in the grooves and the abutting side-by-side relationship of adjacent tooth bearing members.

The tooth bearing members can be annular and formed with teeth at the outer periphery and a number of projections on their inner periphery corresponding to the number of grooves in the roll

body. It is however preferred that the tooth bearing members are segmental, and formed with a number of dovetail-like projections corresponding to the number of dovetail-like grooves in part of the roll body periphery occupied by the segmental tooth bearing members. Thus, for example, eight grooves can be provided, equally spaced around the periphery of the roll body at 45° centres, and eight segments provided, each with one projection to fit one groove. Equally, for example, two segments each extending over 180° of the shaft or drum periphery could be provided, each having four projections to fit the four grooves in the 180° of the roll body periphery occupied by each such sector.

The roll body may be a one-piece construction, with the parallel longitudinal grooves extending along the length thereof, and whereby with identical tooth bearing annulii or segments, the teeth form aligned rows parallel to the axis of the shaft or drum. It may however be preferable in certain circumstances for longitudinally adjacent teeth to be offset, e.g., so that the rows of teeth are each angularly or helically disposed in relation to the axis of the shaft, or even with the teeth randomly positioned

along the length of the roll.

Thus, in a preferred construction, the invention comprises a shaft, a number of roll body forming annulii adapted to fit on the shaft, each annulus at its periphery being formed with a number of parallel longitudinal grooves, and a number of tooth bearing members of the same length as the annuli each having a surface to fit closely the periphery or part of the periphery of a body forming annulus, and each having at least one projection from that surface of a shape corresponding to the shape of the grooves, each body forming annulus being adapted to be located on the shaft such that the corresponding grooves on longitudinally adjacent annuli, and hence corresponding teeth on longitudinally adjacent tooth bearing members, are offset. Thus, each body forming annulus may have a central bore to receive the shaft, and the bore provided with a keyway to fit a key mounted on the shaft. By strategically positioning each keyway on its annulus, adjacent annulii can be positioned to set the rows of teeth in any required disposition, e.g., in straight rows of teeth in any required angular disposition in relation to the shaft axis, helically disposed along the length of the roll so

formed, or even randomly disposed at the periphery of the roll so formed.

To locate the number of tooth bearing members on the shaft, it is preferred to provide removable abutment means at each end of the shaft but a fixed abutment means could be provided at one end of the shaft, and a removable abutment means at the other. The removable abutment means may be abutment plates secured e.g. by bolts, to the respective end of the roll body, but other means can be provided such as by locking an endmost tooth bearing annulus, or the segments of an endmost tooth bearing annulus, to the roll body. Yet again, the tooth bearing members can be held in position by abutment means in the form of clamping half-rings at each end of the drum or shaft. Preferably, between the roll and an associated bearing housing at one or both ends of the roll body, sufficient clearance is provided to accommodate the length of the tooth bearing members and whereby with segmental tooth bearing members, they can be mounted on and withdrawn from the body without disconnecting the roll from its bearings.

In the form of construction employing a number of roll body forming anulii with offset grooves, the annulii and the tooth bearing members

are again preferably held in position by abutment means in the form of clamping half rings at each end of the shaft. Again, between the roll and the associated bearing housing at one or both ends of sufficient clearance can be provided to accommodate the length of the body forming annulii and tooth bearing members, and whereby the body forming annulii can be moved their own length along the shaft to enable a gap to be formed between any two adjacent annulii to allow the mounting and withdrawing of segmental tooth bearing members, without disconnecting the roll from its bearings.

Wearing plates at each end of the rollers prevent oversize debris falling through the clearance space whilst the machine is working.

With a one-piece roll body or a body formed from a number of annulii, the grooves can be formed by suitable machining. However, the roll body (one-piece or annulii) can be formed by casting. Thus the one-piece body or the annulii may be of a suitable tough material such as mild steel and keyed to an appropriate, relatively small diameter, alloy shaft. In either case, the tooth bearing members are preferably cast from a harder wear and impact resistant tool steel, e.g., a manganese steel.

The teeth on the tecth bearing members may be integrally formed, and when the bearing members are segmental, each segment may be formed integrally with one or more than one tooth. It is equally possible for the teeth to be separately formed and subsequently secured in place. Thus, the teeth may take the form of relatively conventional picks, and the bearing members have secured to them the appropriate number of relatively conventional pick boxes. It is still further possible for the bearing members themselves to serve as the pick boxes, by forming in the bearing members an appropriate number of suitable angled bores to receive the shanks of relatively conventional picks.

The invention will now be described by way of example with reference to the accompanying drawings in which :-

Figure 1 is a semi-diagramatic perspective view of a roller crusher in accordance with the invention with part broken away for clarity;

Figure 2 is a vertical section through one of the rolls or Figure 1 showing one construction of teeth bearing member;

Figure 3 corresponds to Figure 2 but shows segmental teeth bearing members;

Figure 4 is a side elevation of a segmental tooth bearing member provided with a pick box to accept a conventional pick;

Figure 5 corresponds to Figure 4 but shows a segmental tooth bearing member formed to serve as a pick box for a conventional pick; and

Figure 6 corresponds to Figure 1 but shows an alternative roll construction.

Figure 7 is a perspective view of one roll body forming annulus.

In Figure 1 comminuting apparatus in the form of a roller crusher comprises two contra-rotating rolls 1, 2, the shafts 3, 4 of which are located in bearings to each end of the apparatus, and the apparatus being provided with drive means for the roll within the housing generally indicated at 5. As is generally indicated in Figure 1 and more particularly in Figures 2 and 3, each roll 1, 2 has a body provided with a number of longitudinally disposed parallel dovetail-like slots 6, and the teeth bearing members are formed with dovetail-like projections 7 to fit in the slots 6. As is shown in Figure 2 the teeth bearing members may be a number of annular rings 8 each formed on its internal periphery with a number of projections 7 to correspond with the number of

slots 6 in the roll body. Thus, with an abutment plate 9 secured to one end of the roll the ring-like teeth bearing members can be slid along the roll from the other end into abutting side-by-side relationship, and when the requisite number of rings have been provided on the roll they are located in place by the securing of a further abutment plate 10 to the opposite side of the roll to the plate 9.

As is generally indicated in Figure 1 and as is shown more particularly in Figure 2, the outer periphery of each ring is formed with a number of integral teeth 11 and the teeth are so formed and located on the rolls that those on the roll 1 face those on the roll 2, and such that when the rolls are located in the machine and caused to rotate, the teeth will grip and crush material falling into the nip of the rolls.

As an alternative to providing a complete tooth bearing ring the tooth bearing members can be segmental. Thus as is illustrated in Figure 3 a number of individual segments 12 are provided, each segment 12 being formed with an integral tooth 11 or indeed more than one tooth if so required, the requisite number of segments being employed to form a tooth bearing ring. Each segment 12 is formed

with a dovetail-like projection 7 to fit in a dovetail-like slot 6 in the roll surface. Here again, with an abutment plate 9 at one end of the roll the requisite number of segments can be slid on to the roll from the opposite end to form the required number of complete rings and the abutment plate 10 secured to the roll to hold the segments in position.

In the form illustrated in Figures 1 to 3 the invention provides for the replacement of the teeth of the rolls considerably more simply and with drastically reduced down time of the machine in comparison with the prior art. Thus the rolls 1, 2 may be removed from the machine, the abutment plate 10 removed, and the rings or segments with worn or damaged teeth simply slid off the roll and replaced by new rings or segments. With the abutment plate 9 repositioned, the rolls can then simply be replaced in the machine. It is equally feasible to allow for removal of the rings or segments with the rolls in-situ. Thus provision can be made for the disconnecting of the abutment plate 10 and for it to slide along the shaft by a distance at least equal to the width of the rings, when in segmental form. With, then, the abutment plate spaced from the end of the roll, the segments

can be slid along the roll body into the gap between the roll body and the plate, and removed.

In the forms of construction shown in Figures 4 and 5, provision is made for the use of conventional point-attack picks as the teeth on the rolls. Thus, as is shown in Figure 4 each segment 12 may have secured to its outer periphery a relatively conventional pick-box 13 in which a point-attack pick 14 is located. In Figure 5 a still further alternative is shown where the segment itself serves as the pick-box, by providing an appropriately shaped bore 15 angularly disposed within the segment and in which the pick 14 can be located. With the constructions of Figure 4 and 5 in any instance where there is only wear or damage to the picks, they can simply be removed and replaced without the removal of the segments from the roll, but there is the retention of the advantage that in any instance where there is wear or damage to both the pick and the segment, the segment can be removed as has been described hitherto.

It will readily be understood that the provision of pick boxes and the formation of bores to receive picks applies equally to a complete ring as it does to the segments illustrated.

In Figure 1 the rolls are so formed that the teeth (whether they be integral or formed by removable picks) are set in straight rows longitudinally of the roll. However it may be advantageous for adjacent teeth in any one row to be offset. Thus as is illustrated in Figures 6 and 7, each roll is formed by a shaft 16 and a number of drum-like annulii 17 adapted to fit the shaft, each annulus at its periphery being formed with a number of parallel dovetail-like slots 6 to receive either a ring 8 or a number of segments 12 forming a ring, each provided with a corresponding number of dovetail-like projections 7. The centre bore 18 of each annulus is formed with a keyway slot 19 to locate it on the shaft 16 and by strategically positioning each keyway on the number of annulii involved, adjacent annulii can be set on the shaft such that the teeth on the ring or the segments on the adjacent annulii are offset. The offsetting can be set to provide straight rows of teeth at any required angular disposition in relation to the shaft axis or to provide rows or teeth that are helically disposed along the length of the roll.

CLAIMS

1. A roll for a roller crusher characterised by a body portion in the periphery of which are formed a number of parallel longitudinal grooves (6), a number of tooth bearing members (8, 12) each having a surface to fit closely the periphery or part of the periphery of the body, and each having at least one projection (7) from that surface of a shape adapted to fit the shape of a groove, and abutment means (9, 10) at each end of the body, whereby the tooth bearing members are a sliding fit on the body and are located in their operative position by the abutment means, the engagement of the projections in the grooves and the abutting side-by-side relationship of adjacent tooth bearing members.

2. A roll for a roller crusher as in Claim 1, characterised in that tooth bearing members (8) are annular and formed with teeth (11) at the outer periphery and a number of projections (7) on their inner periphery corresponding to the number of grooves (6) in the roll body.

3. A roll for a roller crusher as in Claim 1, characterised in that the tooth bearing members (12) are segmental, and formed with a number of dovetail-like projections (7)

corresponding to the number of dovetail like grooves (6) in part of the roll body periphery occupied by the segmental tooth bearing members.

4. A roll for a roller crusher as in any of Claims 1 to 3 characterised in that the roll body is a one-piece construction, with the parallel longitudinal grooves (6) extending along the length thereof, and whereby with identical tooth bearing annulii (8) or segments (12) the teeth (11) form aligned rows parallel to the axis of the shaft or drum.

5. A roll for a roller crusher as in any of Claims 1 to 3 characterised in that longitudinally adjacent teeth (11) are offset.

6. A roll for a roller crusher as in Claim 5, characterised in that the roll comprises a shaft (16), a number of roll body forming annulii (17) adapted to fit on the shaft, each annulus at its periphery being formed with a number of parallel longitudinal grooves (6), and a number of tooth bearing members (8, 12) of the same length as the annulii (17) each having a surface to fit closely the periphery or part of the periphery of a body forming annulus, and each having at least one projection (7) from that surface of a shape corresponding to the shape of the grooves, each

body forming annulus being adapted to be located on the shaft such that the corresponding grooves on longitudinally adjacent annulii, and hence corresponding teeth on longitudinally adjacent tooth bearing members, are offset.

7. A roll for a roller crusher as in Claim 6, characterised in that each body forming annulus (17) has have a central bore (18) to receive the shaft, and the bore is provided with a keyway (19) to fit a key mounted on the shaft, and whereby by strategically positioning each keyway on its annulus, adjacent annulii can be positioned to set the rows of teeth in any required disposition.

8. A roll for a roller crusher as in any of Claims 1 to 7, characterised in that said abutments means (9, 10) at each end of a respective roll are removable.

9. A roll for a roller crusher as in any of claims 1 to 7, characterised in that a fixed abutment means is provided at one end of a roll and a removable abutment means at the other.

10. A roll for a roller crusher as in Claim 8 or Claim 9, characterised in that said abutment means are abutment plates.

11. A roll for a roller crusher as in Claim 8 or Claim 9, characterised in that an

endmost tooth bearing annulus or segments of an endmost tooth bearing annulus are secured to the roll body to serve as the abutment means.

12. A roll for a roller crusher as in Claim 8 or Claim 9, characterised in that the abutment means are clamping half-rings secured to the roll body.

13. A roll for a roller crusher as in any of Claims 8 to 12, characterised in that the removable abutment means are spaced from a respective roll bearing housing to provide sufficient clearance to accommodate the length of the tooth bearing segments to allow withdrawal of the segments from the roll without removing the roll from its bearings.

14. A roll for a roller crusher in the form of construction where the roll body is formed from a number of roll forming annulii, characterised in that at least one endmost annulus is spaced from a respective roll bearing housing by the length of the annulus, whereby following removal of an abutment means, each annulus can be moved successively their own length along the shaft to enable the removal of tooth bearing segments.

15. A roll for a roller crusher as in any of Claims 1 to 14, characterised in that the teeth

on the tooth bearing annulii or segments are integrally formed.

16. A roll for a roller crusher as in any of Claims 1 to 14, characterised in that the teeth take the form of removable picks, each located in respective pick boxes located on or formed in the annulii or the segments.

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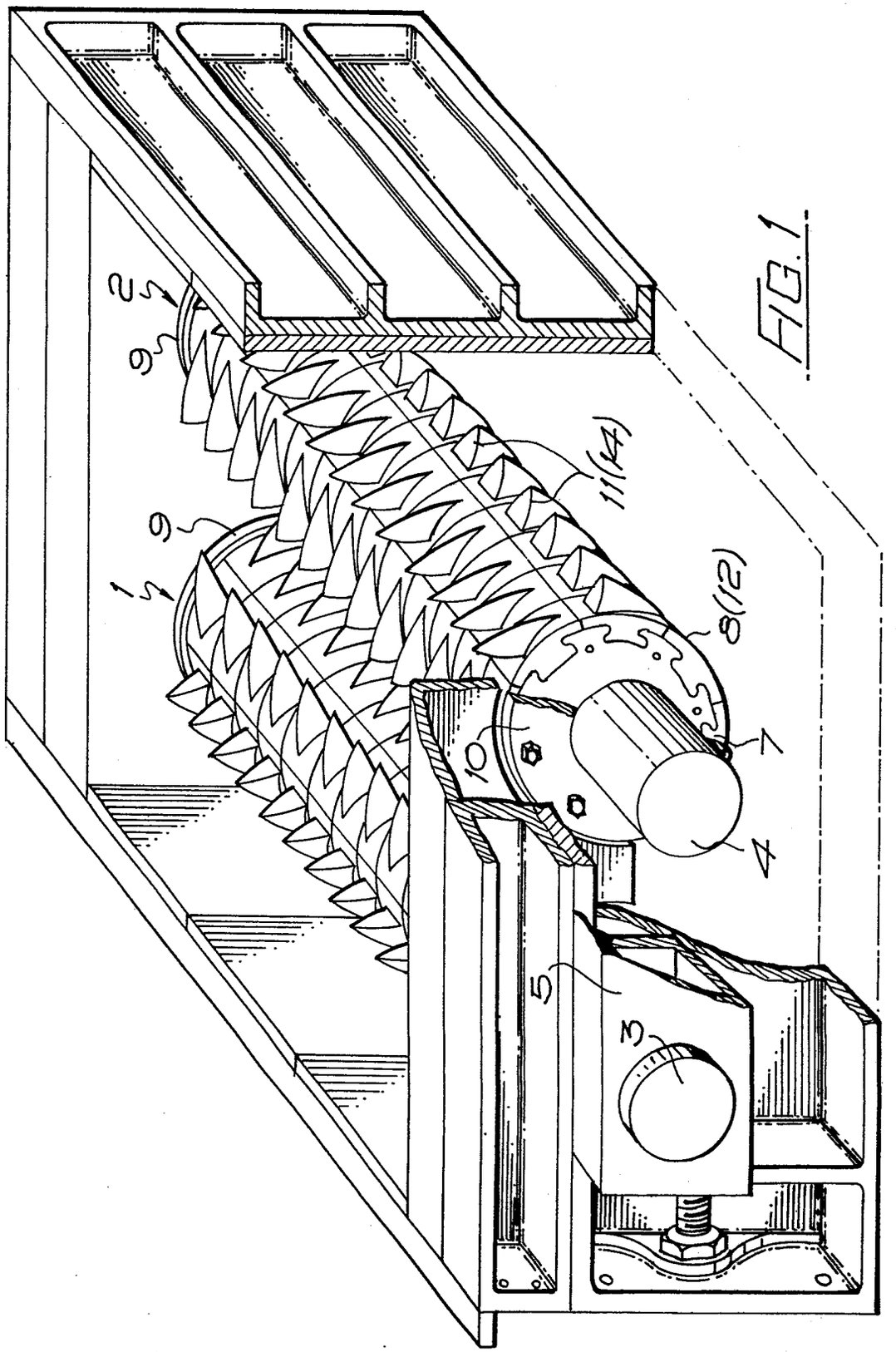

FIG.1

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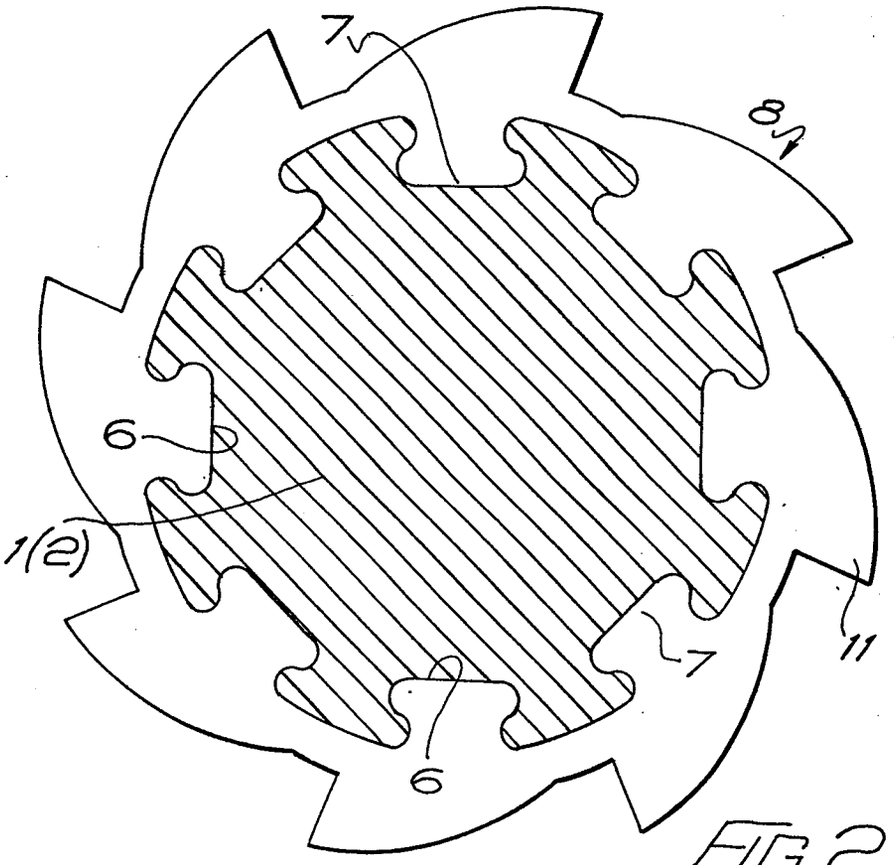

FIG. 2

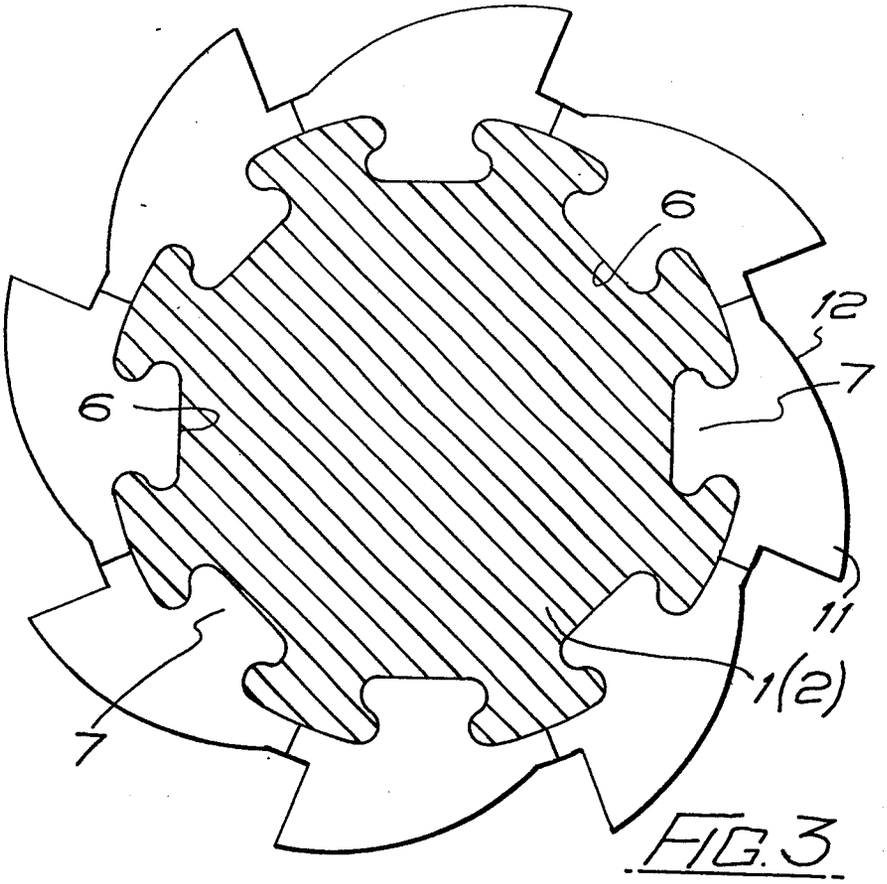

FIG. 3

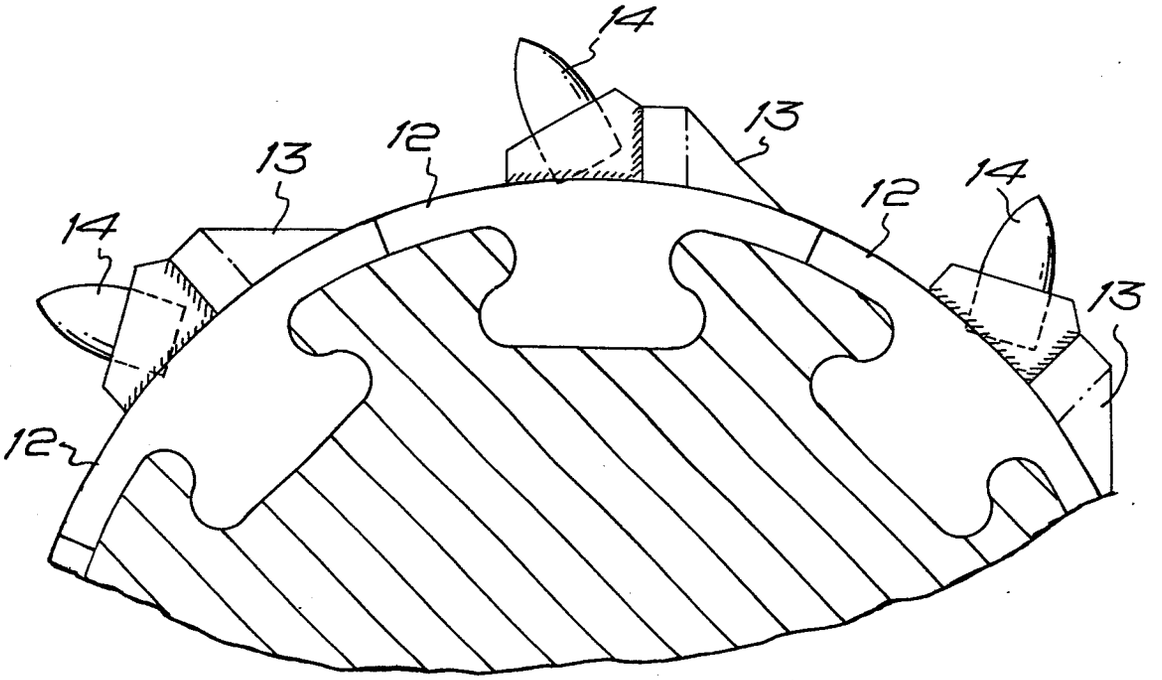

FIG.4

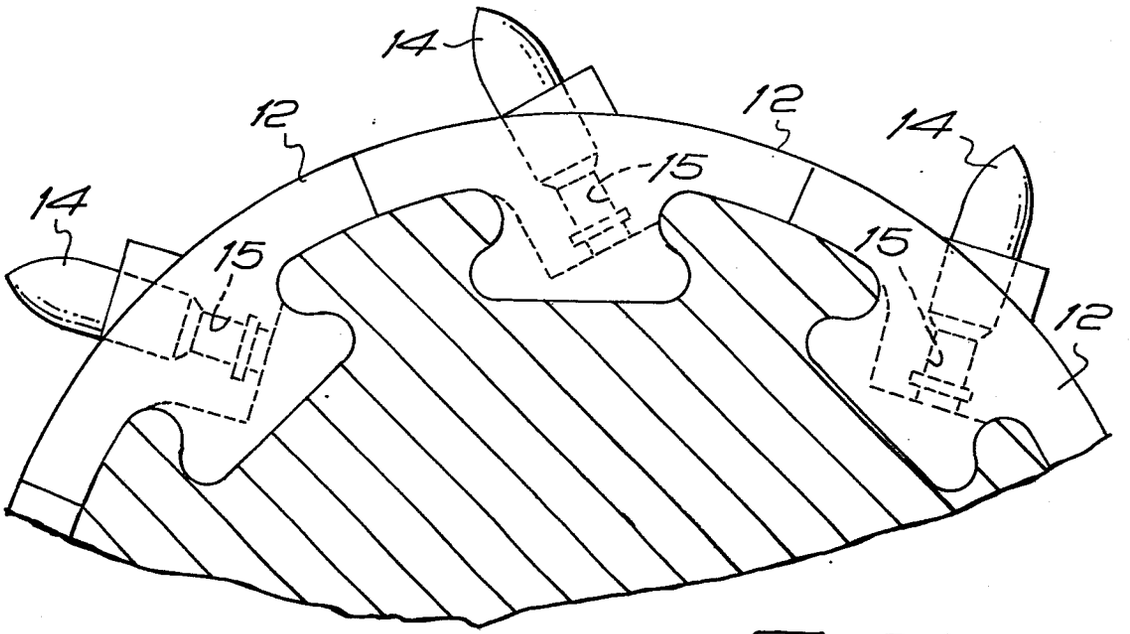

FIG.5

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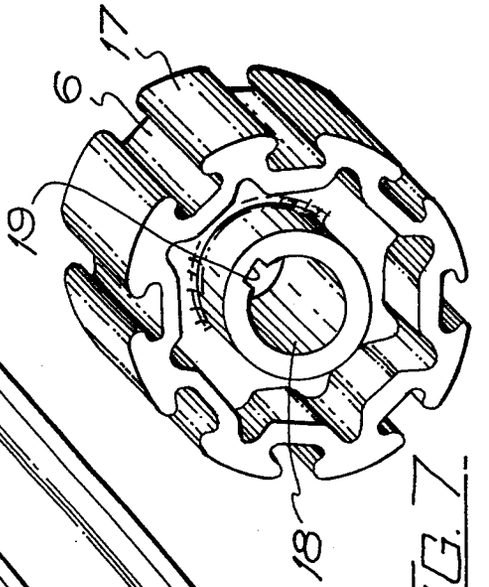

FIG. 7

FIG. 6