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(54) Perfecting milling drum for scarifier machines

(57) The invention realises a milling drum (1; 100; 200) for scarifier machines which comprises a plurality of annular elements (4, 5) coaxially arranged outside a core (2) connected with the driving shaft of the scarifier machine, supplied with operating protruding elements (6) arranged like a spiral and suitable for shuttering the soil to remove. Said annular elements comprise at least two ending annular elements (3) realised one - piece and one or more intermediate annular elements (4, 5) in between said ending annular elements (3), where at least one (4) of said one or more intermediate annular elements is formed of at least two shells (41) supplied at the ends with radial flanges (411) opposable among them which are united by fastening means (412) in order to render these annular elements (4, 5, 3) integral among them and with said core (2).

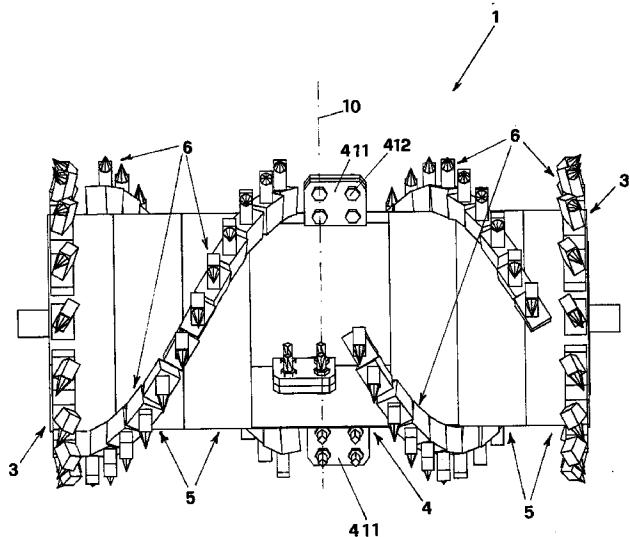


FIG.1

Description

The invention concerns a perfecting milling drum suitable for being used in scarifier machines which are used for the removal of road surfaces.

As it is known, scarifier machines supplied with a milling drum, equipped with a plurality of operating protruding elements, are used in order to realise excavations or for the removal of the asphalt surface which covers the carriageways. The operating elements are placed in contact with the soil to remove and during the rotation of the drum they shutter it, permitting this way its removal.

The scarifier machines are produced in different embodiments which are different, first of all, for the width of the milling drum, on which the kind of working to which the machine can be allocated, depends.

During the execution of the road works, it frequently happens to execute the removal of the soil for stretches of a rather limited width, for example when it is necessary to dig some ditches, for the interment of electric and telephonic cables, of pipes, or others and in this case it is necessary to use scarifier machines supplied with a milling drum of a limited width.

Since the firms which execute the works have not always machines with small - sized milling drums, tractors, mechanical shovels, triads or similars which are equipped applying to them some special milling aggregates which permit to realise small excavations, are often used for a small removal.

Such solutions don't permit high productions and oblige those who choose them to operate in conditions which are often economically not very remunerative.

In the attempt to overcome such inconvenience, scarifier machines so called "universal", in which the milling drum is formed of a fixed part, firmly connected with the driving shaft, are usually used. On this one a removable part, formed of a plurality of rings, is arranged, each ring being formed of a couple of semicircular shells, on which the operating protruding elements, united among them by flanges, are arranged.

In such way the utilizer can realise excavations of a different width, which depends on the number of rings that are arranged on the fixed part.

However the milling drums of the described kind present some inconveniences.

A first inconvenience is that the flanges which connect among them the semicircular shells that form each ring, create an interruption of the flowing of the material which, during the removal, is conveyed along the spirals formed by the operating elements and therefore they create an obstruction that compromises the good performance of the production.

Another inconvenience is that the presence of such fastening flanges prevents the helical flowing of the shuttered material along the drum in between the operating elements arranged on its side surface.

In order to solve such problems, on behalf of the

depositary himself of the present patent, the invention having reference number VI95A000053, in which a scarifier machine, supplied with a milling drum, formed of rings that are axially threaded into the shaft of the milling drum, of a sufficient number to form the wanted digging width, is described, has been realised.

Applying such solution, the utilizer of the scarifier can realise a variable digging width, according to the number of the rings which are used, but such solution presents the inconvenience that it can not always be applied to every kind of machines, since the possibility of reaching laterally the milling drum, in order to put up and take down the rings, is not possible in all the scarifier machines.

Besides, in case of large - sized drums, and given the building form of the scarifier machine, reaching laterally in order to change the composition of the rings always results rather difficulty.

The present invention proposes to overcome all the mentioned inconveniences.

In particular, one of the purposes of the invention is for realising a milling drum of variable width which permits the realisation of excavations of a different width.

Another purpose is for such variation of width of the milling drum could be easily realised particularly on large - sized drums.

A further purpose is for such variation of width of the milling drum could be easily realised even in those machines in which the side access to the milling drum itself usually results difficult or is even prevented.

Another purpose is for the milling drum of the invention permits an easy flowing of the removed material along a propeller formed of the operating elements with which it is supplied.

Not last purpose is for the milling drum of the invention, with any working width it is used, is always supplied of radial shovels suitable for conveying by centrifugal force the removed material on the conveyor belt which moves it away.

The mentioned purposes are achieved with the embodiment of a milling drum suitable for being applied to scarifier machines for the removal of soils, which, according to the main claim, comprises:

- 45 - a core, connected with the driving shaft of said scarifier machine;
- a plurality of annular elements, coaxially arranged outside said core and axially opposite, one close to the other, supplied, on the periphery, with operating protruding elements arranged like a spiral, and suitable for shuttering said soil to remove;
- contrast means suitable for permitting the transmission of the rotation from said core to said annular elements, and it is characterised in that said annular elements comprise:
- at least two ending annular elements realised one - piece, each of them axially contrasting with one or more stopping means outside coupled with said

- core, being at least one of said stopping means fixed to the correspondent end of said core;
- one or more intermediate annular elements in between said ending annular elements, being at least one of said one or more intermediate annular elements composed of at least two shells supplied at the ends with radial flanges opposable among them, being fastening means present in said annular elements suitable for rendering them integral among them and with said core, when said radial flanges are steadily connected among them by fastening means.

According to a preferred embodiment the milling drum of the invention is supplied with five intermediate annular elements which comprise an annular element divided in four shells having the shape of a sector of a circle with a central angle of 90°, which is centrally arranged in comparison with the remaining other four annular elements, being each of them divided in two shells having the shape of a sector of a circle with a central angle of 180°.

The four shells which form the annular element arranged centrally, are connected among them by radial flanges and fastening means.

All the annular elements are arranged one close to the other and force reciprocally in correspondence with side conical surfaces realised on their side surfaces and also in correspondence with the end of said core, suitable for favouring the reciprocal axial blocking when the radial flanges of the shells, which form the annular element, arranged centrally, are fastened.

Advantageously, the drum of the invention presents, compared with milling drums belonging to the known technique equivalent to it, an easier assemblage and disassembly and a greater versatility in preparing the scarifier, according to different embodiments, and such therefore to permit the utilizer a greater flexibility of employment.

The mentioned purposes and advantages will be better pointed out during the description of a preferred embodiment of the milling drum of the invention, given as an example but not as a restriction and represented in the enclosed drawings where:

- fig. 1 shows the milling drum of the invention in a front view;
- fig. 2 shows the milling drum of fig. 1 in which the annular element supplied with radial flanges is without a quarter of the shell;
- fig. 3 shows the milling drum of fig. 2 completely without the annular element supplied with radial flanges;
- fig. 4 shows in an axonometric view the annular element supplied with flanges, exploded in the four shells which form it;
- fig. 5 shows the annular element of fig. 4 in a side view;

- fig. 6 shows the milling drum of fig. 3 without one of the hemishells which form one of the annular elements without flanges;
- fig. 7 shows the milling drum of fig. 6 without one of the side annular elements without said flanges;
- fig. 8 shows the core of the milling drum supplied with two only ending annular elements;
- fig. 9 shows, in an exploded axonometric view, one of the annular elements without flanges;
- fig. 10 shows in a side view one of the ending annular elements represented in fig. 8;
- fig. 11 shows the milling drum of the invention represented in fig. 1 and lengthwise sectioned;
- figs. from 12 to 19 show the composition phases of the milling drum of the invention described according to an executive variant represented in fig. 19;
- fig. 20 shows the milling drum of the invention arranged according to another executive variant.

20 The milling drum of the invention, in the variant visible in figs. 1 and 11, where it is indicated as a whole with 1, comprises a core 2 connected with the driving shaft of a scarifier machine not represented in the figures, on which, outside and coaxially, a plurality of annular elements is arranged comprising:

- two ending annular elements 3 realised one - piece, one of which is represented in details in fig. 10;
- five intermediate annular elements in between said ending annular elements 3, which are divided in an annular element 4 centrally arranged, being two annular elements 5 arranged on each side of it.

35 Outside said annular elements 3, 4 and 5, a plurality of operating protruding elements is applied, each of them indicated as a whole with 6, which are arranged like a spiral and that are suitable for shattering said soil to remove with whom they come in contact.

40 Said annular elements 3, 4 and 5 are rotated by said core 2 by contrast means which are formed of a tang 7 which crosses the whole length of the core 2 and which mates in through seats realised on each of said annular elements 4 and 5 and besides, as fig. 11 shows with particular evidence, they are arranged one close to the other in correspondence with inclined surfaces 8 conjugated among them.

45 Considering said lateral annular elements 5, fig. 9 shows that each of them is formed of two semicircular shells 51, while the central annular element 4, as figs 4 and 5 in particular show, is formed of four shells 41, each of them corresponding to a quarter of a circle, which are connected among them by radial flanges 412 belonging to them by through bolts 411.

50 As it has already been said and according to fig. 11, the axial stability of the annular elements 3, 4 and 5 among them and compared with the core 2 when the milling drum is formed, is guaranteed by the reciprocal axial shrinkage in correspondence with said inclined

surfaces 8, that is realised when the shells 41, which form the central annular element 4, are reciprocally fastened by the already said bolts 412 which clamp the flanges 41.

In particular each ending annular element 3 axially forces against the conical ring 31, visible in fig. 12, fixed by screws 311 to the core 2.

Besides, as figs. from 2 to 8 show, all the side annular elements 5 and also the ending annular elements 3 are axially connected among them by connecting pivots 19 which favour also the transmission of the couple by the core 2.

It can be observed that the central annular element 4 is supplied, on the side surfaces of the shells 41 which form it, with inclined slots 420 supplied with a lateral opening 421, each of them suitable for receiving a pivot 19 when said shells 41 are radially coupled with the core 2 according to the direction 415 visible in fig. 2.

The connection of the side annular elements 5 happens instead, as fig. 6 shows, by axial shifting, according to the direction 515 of each shell 51.

The milling drum of the invention, represented in fig. 1, presents therefore, after the assemblage, a symmetrical configuration compared with the transversal axis 10, which can be obtained beginning from the configuration represented in fig. 8 where on the core 2 two ending annular elements 3 are present.

Coupling axially and according to the directions 515, the shells 51 of the side elements 5 among them and with the ending elements 3, inserting each pivot 19 in the corresponding hole 19 opposed to it, it is possible to pass through the configurations represented in figs. 7, 6 and 3, finishing radially coupling, according to the direction 415, the shells 41 which comprise the central annular element 4.

The clamping of the bolts 412 unites the flanges 411 and axially forces, according to the directions opposed among them 515, the shells 41 of the central annular element 4, against the shells 51 of the side annular elements 5, in correspondence with the inclined surfaces 8, obtaining the axial clamping of all the annular elements among them and to the core 2.

The milling drum can also be realised according to a different configuration, for example that one represented in fig. 19, in which it is indicated with 100, being this configuration suitable for realising an excavation having a width 70, smaller than the length of the core 2.

In order to realise such configuration, some stopping elements formed of distance rings, indicated as a whole with 9 and represented in particular in figs. 13 and 14, which are arranged outside the core 2 in the zones without the presence of the annular elements, are used.

Said distance rings, each of them indicated as a whole with 9, and formed of two hemirings 91 which axially mate one close to the other, by the contact in correspondence with contrast inclined surfaces 92 conjugable among them and present in each of them,

are coupled in order to realise such composition, beginning from the configuration represented in fig. 12, where both said ending annular elements 3 are moved to one side of the core 2, on the free zone 20 of the core 2 itself, as figs. from 13 to 16 show.

The assemblage of one or more distance rings 9 determines, as fig. 16 shows, the position of one of the ending annular elements 3 and then, as fig. 17 shows, the further ending annular element 3, opposed to the previous one, is moved towards the centre in the core 2 in order to arrange another couple of distance elements 9 as figs. 17 and 18 show.

The milling drum is therefore formed, as fig. 19 shows, of an only central annular element 4 and of a couple of ending annular elements 3, where said annular elements are symmetrically arranged, compared with the transversal axis of the drum.

The distance 70 in between the ending annular elements 3 forms, as it has just been said, the working digging width of the milling drum.

Also in such a case, the clamping of the flanges 411 of the shells 51, which form the central annular element 4, determines the axial shrinkage of all the coupled elements on the core 2 which discharges itself on the inclined surface 312 of the conical rings 31 arranged at the ends, assuring the stiffness of the milling drum so formed.

In both these embodiments, each one realising a different digging width, the radial flanges 411, present in the central annular element 4, act as conveyor blades which, during the rotation of the drum, send by centrifugal force the shuttered material, removed by the operating elements 6, on the conveyor belt, not represented in the figures, which conveys the material carried away from the working area.

It can also be observed that only this central element 4 is supplied with said conveyor blades and therefore the material shuttered and removed by the operating elements 6 can freely move along the spirals according to which the operating elements 6 are arranged, without finding obstacles as vice - versa it happens for the milling drums with modular sections belonging to the known technique. It is possible to obtain even the configuration represented in fig. 20 where the through drum is indicated with 200 and where it can be observed that the annular element 4, supplied with the flanges 411 which act as conveyor blades of the removed material, is not centrally arranged, but it is placed close to one of the ending annular elements 3. Therefore it can be no longer called "central annular element".

Changing opportunely the number of the annular elements, and also their position, being understood that the ending annular elements 3 should always be present because they define the thread of the digging, it is possible to form milling drums with different shapes in order to realise a different digging width.

It is important to observe that the replacement and

the shifting of the different annular elements is facilitated by their shell configuration, being those shells relatively not very heavy and however of a lesser weight than the embodiments belonging to the known technique, they permit the operator the assemblage and the disassembly with less effort, less danger and more rapidly.

This particular embodiment permits therefore to change easily the width of the milling drum, even in those machines in which the drum is hardly reachable on a side by the presence of obstructing elements. Indeed in the drum of the invention the replacement of the annular elements is easily realised intervening frontally under the core which supports the annular elements supplied with the operating elements.

Also the purpose for blades suitable for conveying the centrifugal force of removed material during the working of the soil, without their hindrance in the shifting of the removed material along the propellers, defined by the operating elements of the drum, are present in the milling drum of the invention, is achieved.

Therefore it is possible to comprehend that the milling drum of the invention achieves all the prearranged purposes.

In the executive phase some modifications can be introduced in the milling drum of the invention, such as, for example, realising annular elements divided in a number of parts different from that one described, or realising annular elements, each of them of a different width.

However said modifications and possible others, based on the same idea of solution described, are to be considered protected by the present patent.

Claims

1. Milling drum (1; 100; 200) to be applied to scarifier machines for the removal of soils comprising:

- a core (2) connected with the driving shaft of said scarifier machine;
- a plurality of annular elements (4, 5) coaxially arranged outside said core (2) and axially opposite, one close to the other, supplied, on the periphery, with operating protruding elements (6) arranged like a spiral and suitable for shuttering said soil to remove;
- contrast means (7) suitable for permitting the transmission of the rotation from said core to said annular elements (3, 4, 5) **characterised in that** said annular elements comprise:
- at least two ending annular elements (3) realised one - piece, each of them axially contrasting against one or more stopping means (9, 31), outside coupled with said core (2), being at least one of said stopping means fixed to the correspondent end of said core (2);
- one or more intermediate annular elements (4,

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5), in between said ending annular elements (3), at least one (4) of said one or more intermediate annular elements being formed of at least two shells (41) supplied at the ends with radial flanges (411) opposable among them, being fastening means (19) present in said annular elements (4, 5, 3), suitable for rendering them integral among them and with said core (2), when said radial flanges (411) are steadily connected among them by fastening means (412).

2. Milling drum (1; 100; 200) according to the claim 1) **characterised in that** one of said intermediate annular elements (4) is formed of four shells (41), each of them presenting the profile of a sector of a circle correspondent with a central angle of 90°, supplied at each end with one of said radial flanges (411), being each of the remaining intermediate annular elements (5) composed of two shells (51) each of them presenting the profile of a sector of a circle correspondent with a central angle of 180°.
3. Milling drum (1; 100; 200) according to the claim 1) **characterised in that** said fastening means (19), suitable for rendering said annular elements (3, 4, 5) integral among them and with said core (2), are formed of pivots (9) which mate inside of seats (190; 420) realised in the annular elements (3, 4, 5) themselves.
4. Milling drum (1; 100; 200) according to the claim 1) **characterised in that** said annular elements (3, 4, 5) are supplied on the side faces with at least an inclined surface (8) suitable for realising the axial blocking of said annular elements (3, 4, 5) and of said stopping elements (9, 31) among them and with said core (2) when said radial flanges (411) are steadily connected among them by said fastening means (412).
5. Milling drum (1; 100; 200) according to the claim 1) **characterised in that** said stopping means are formed by distance rings (9, 31) outside coupled with said core (2), which axially contrast among them by at least one inclined surface (92; 312) with which each of them is supplied.
6. Milling drum (1; 100; 200) according to the claim 5) **characterised in that** one of said stopping elements is formed of a circular ring (31) fixed at each end of said core (2), being the further stopping elements (9) formed, each of them, of two hemisheells (91) of semicircular shape.
7. Milling drum (100) according to the claim 2) **characterised in that** said annular element (4), supplied with said radial flanges (411), is coupled with

said core (2), being arranged in a direct axial contact with both said ending annular elements (3).

8. Milling drum (200) according to the claim 2) **characterised in that** said annular element (4), supplied with said radial flanges (411), is coupled with said core (2), being arranged in contact directly with one of said ending annular elements (3) and indirectly and by the interposition of one or more further annular elements (5) with the other ending annular element (3). 10

9. Milling drum according to the claim 2) **characterised in that** said annular element (4), supplied with said radial flanges (411) is coupled with said core (2), being included in between a plurality of further annular elements (5) with at least two of them in contact in correspondence with both its side faces. 15

10. Milling drum (1; 100; 200) according to the claim 3) **characterised in that** said seats, suitable for receiving said pivots (19), are hollows (190). Milling drum (1; 100; 200) according to the claim 3) **characterised in that** said seats for receiving said pivots (19) are inclined slots (420), supplied with an opening suitable for permitting the coupling with the correspondent pivot (19), according to a direction which is radial compared with the pivot itself. 20
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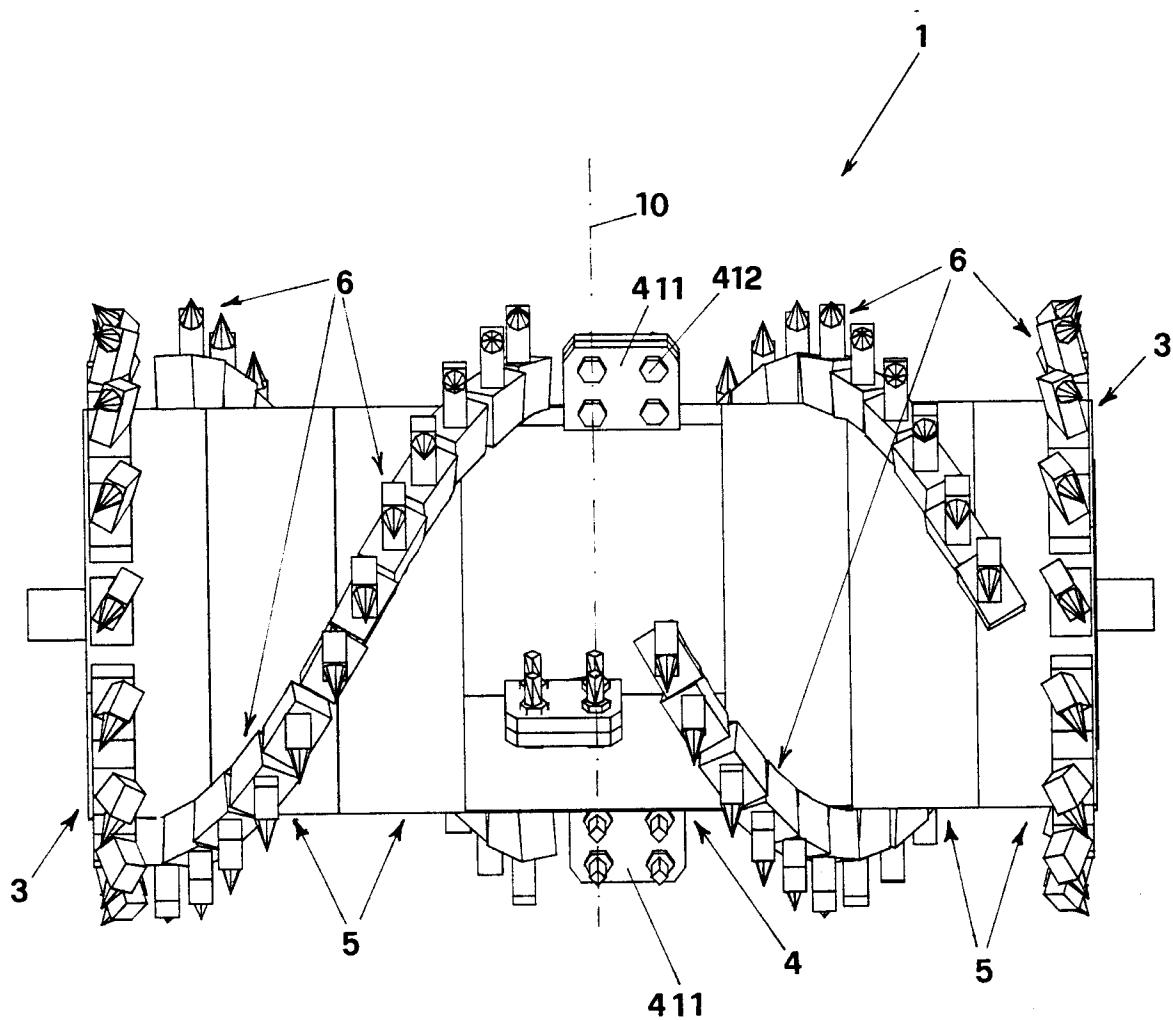


FIG.1

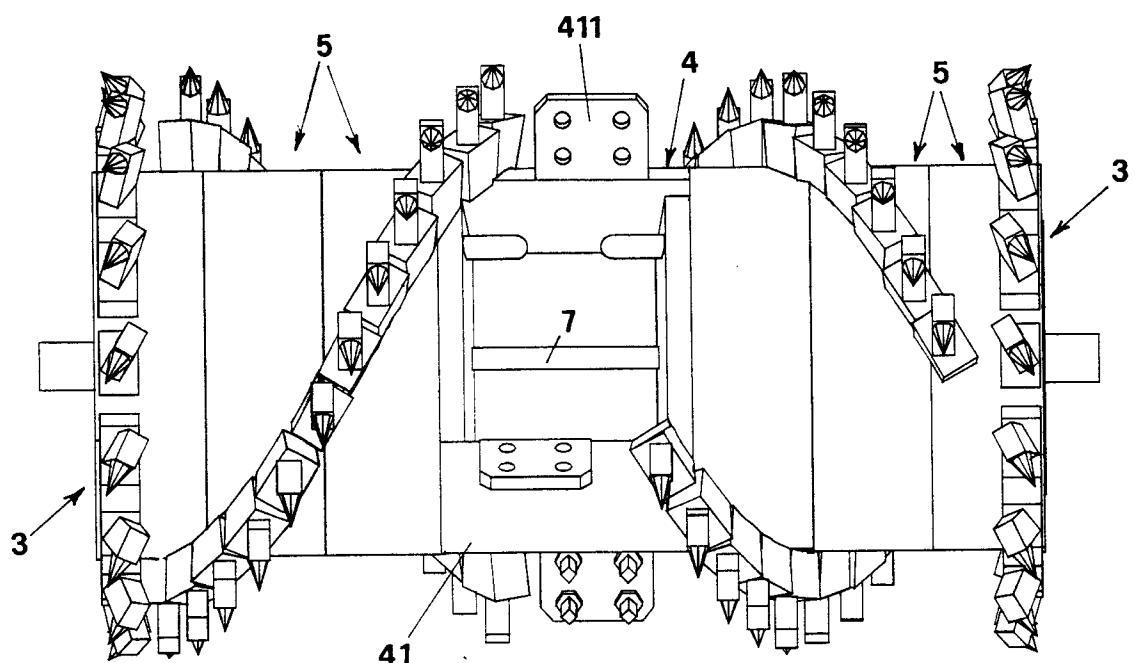


FIG.2

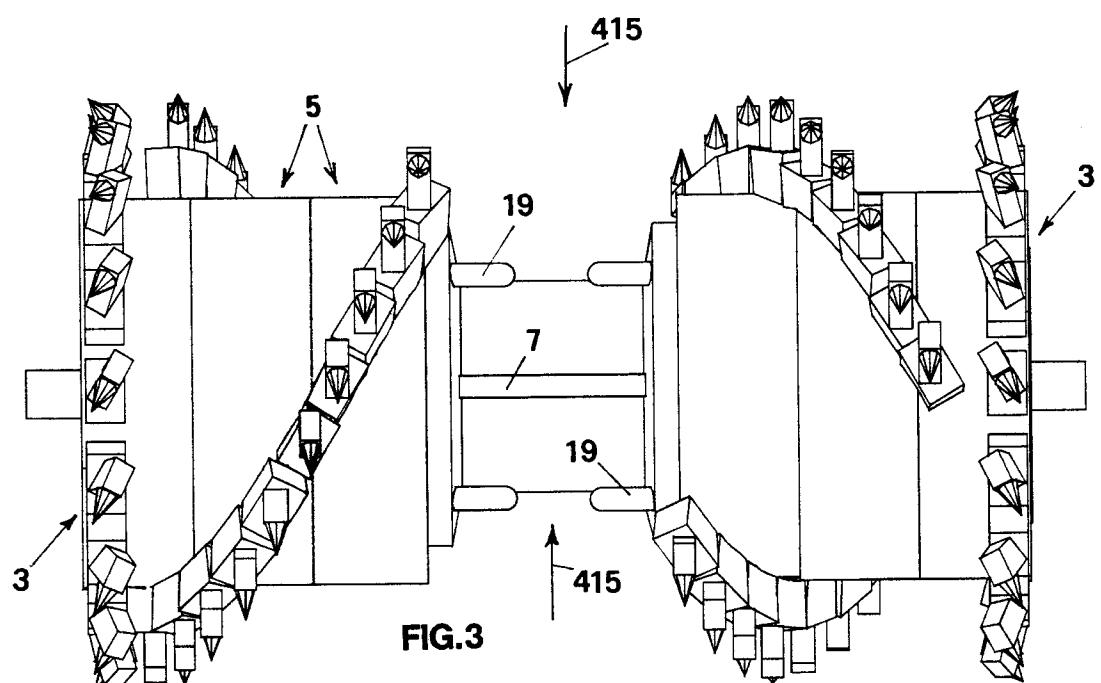
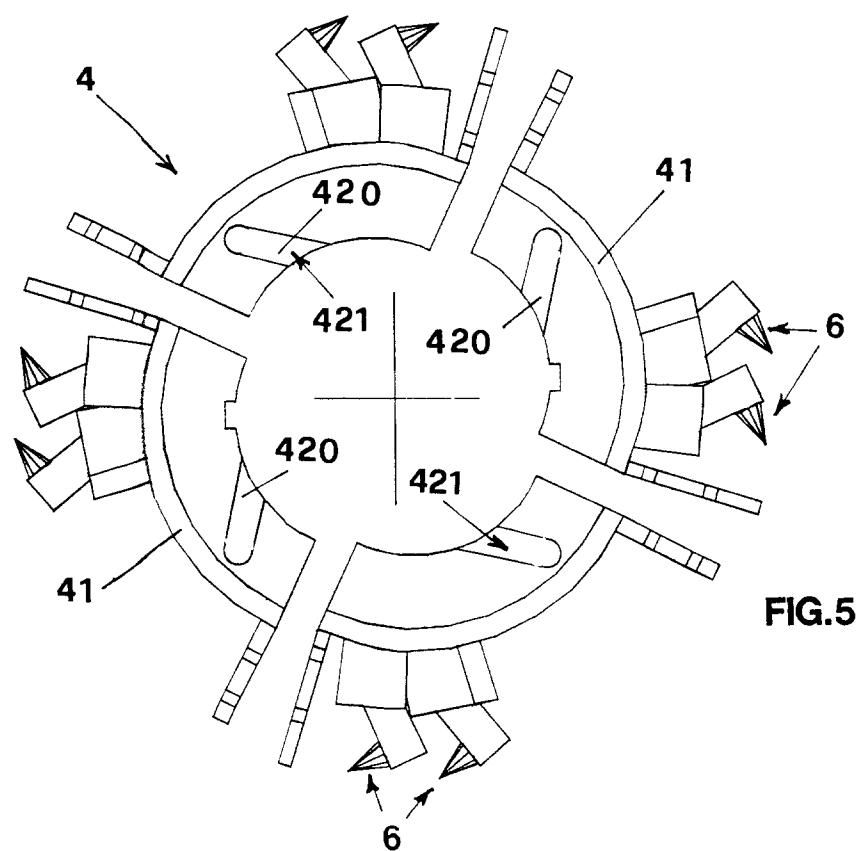
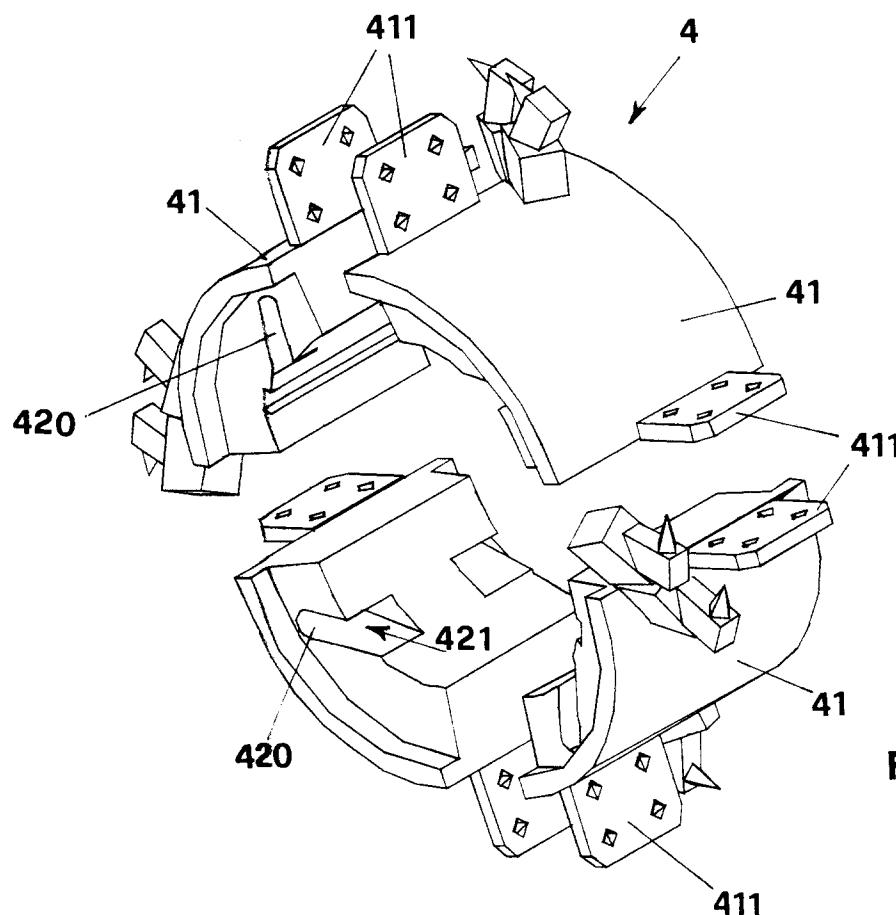


FIG.3



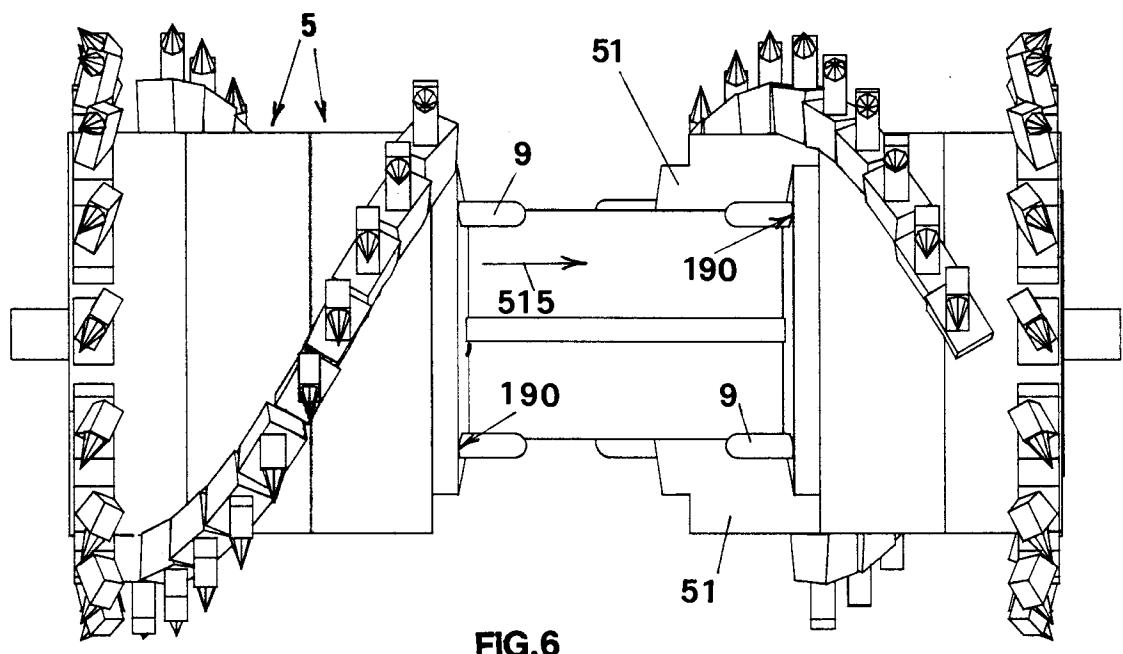


FIG.6

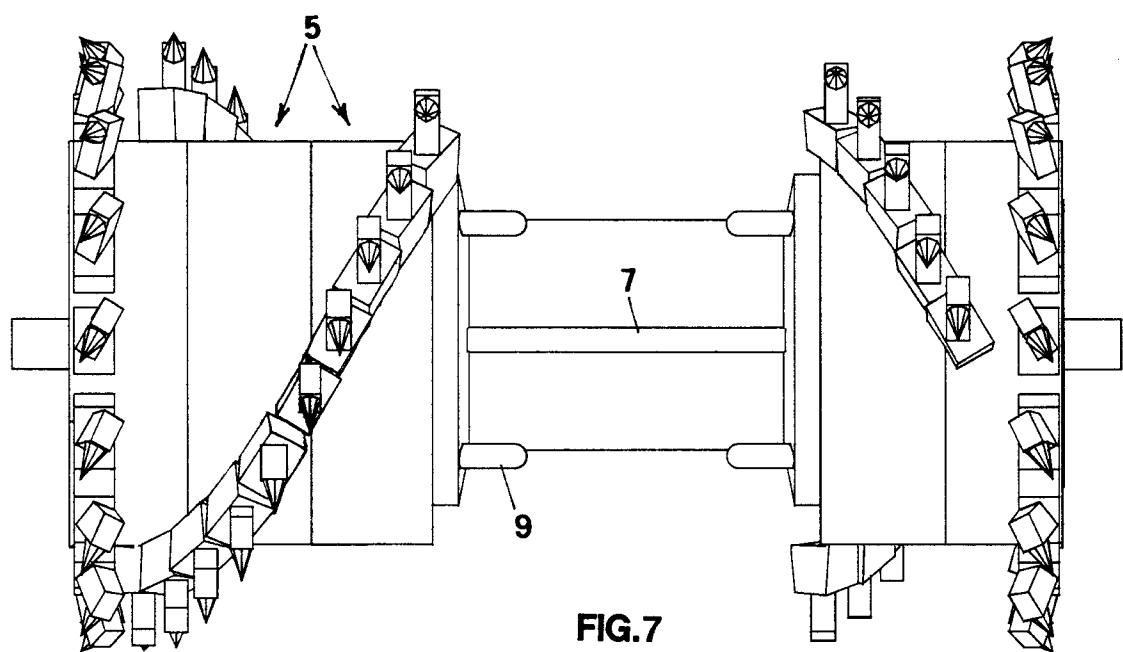


FIG.7

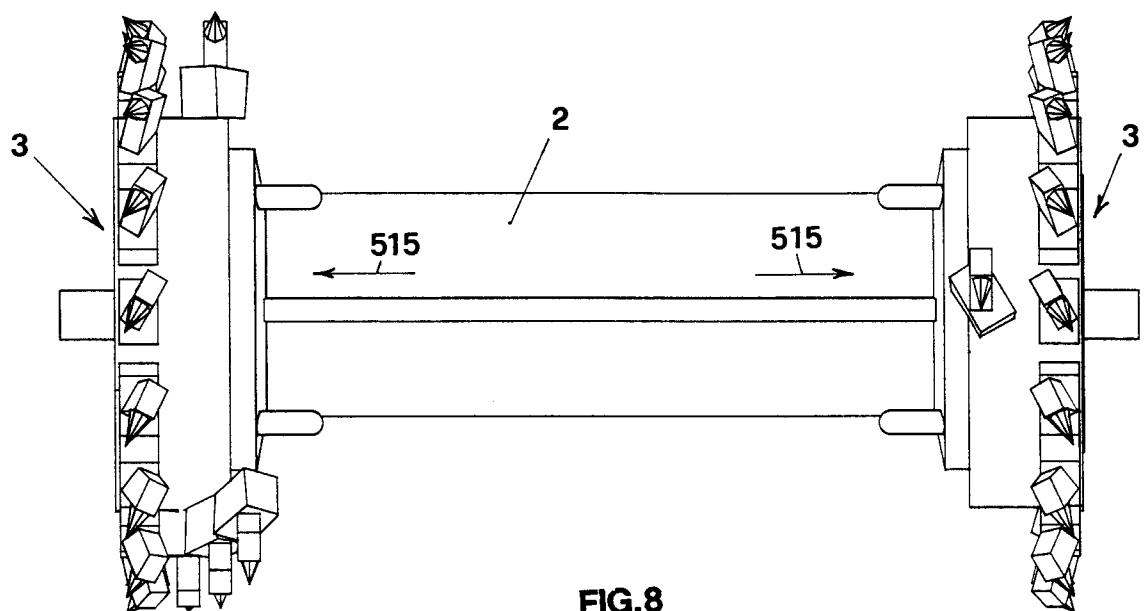


FIG.8

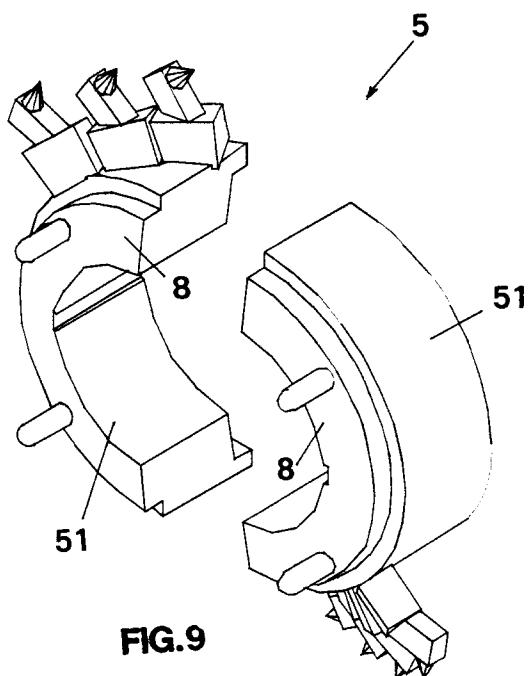


FIG.9

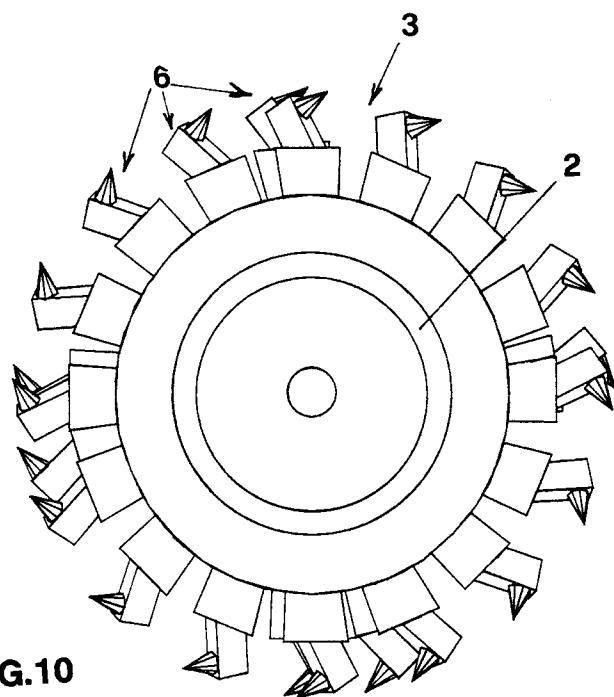
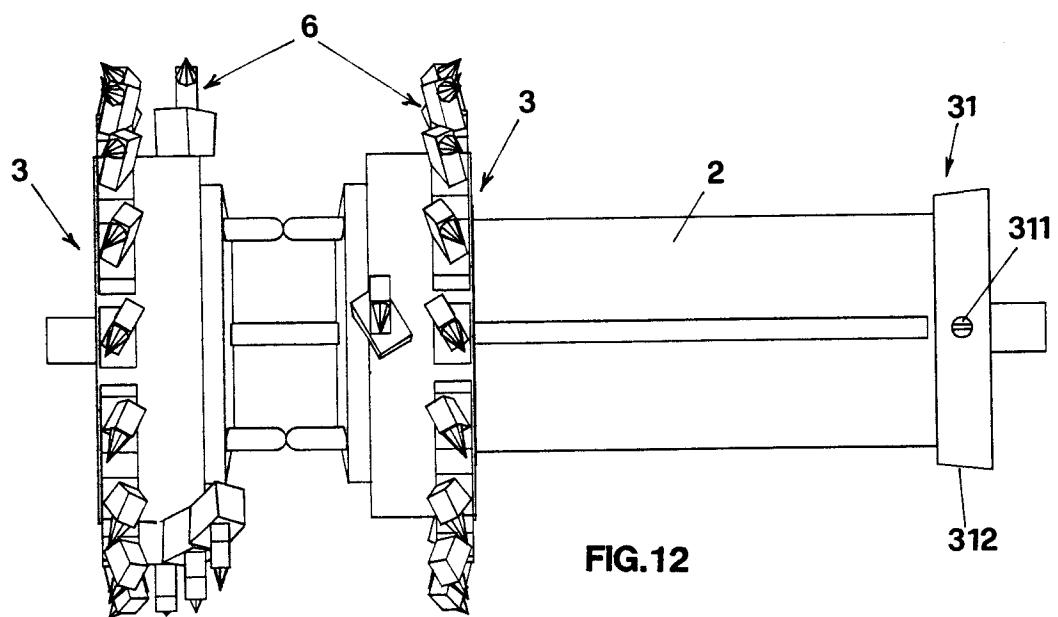
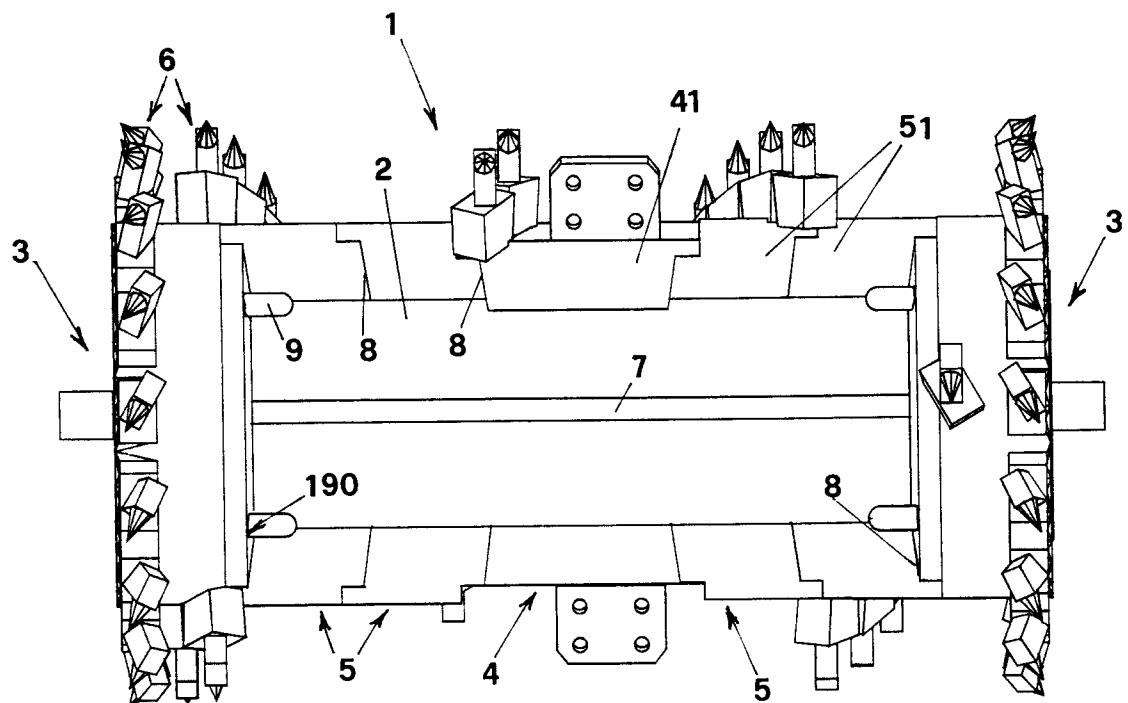
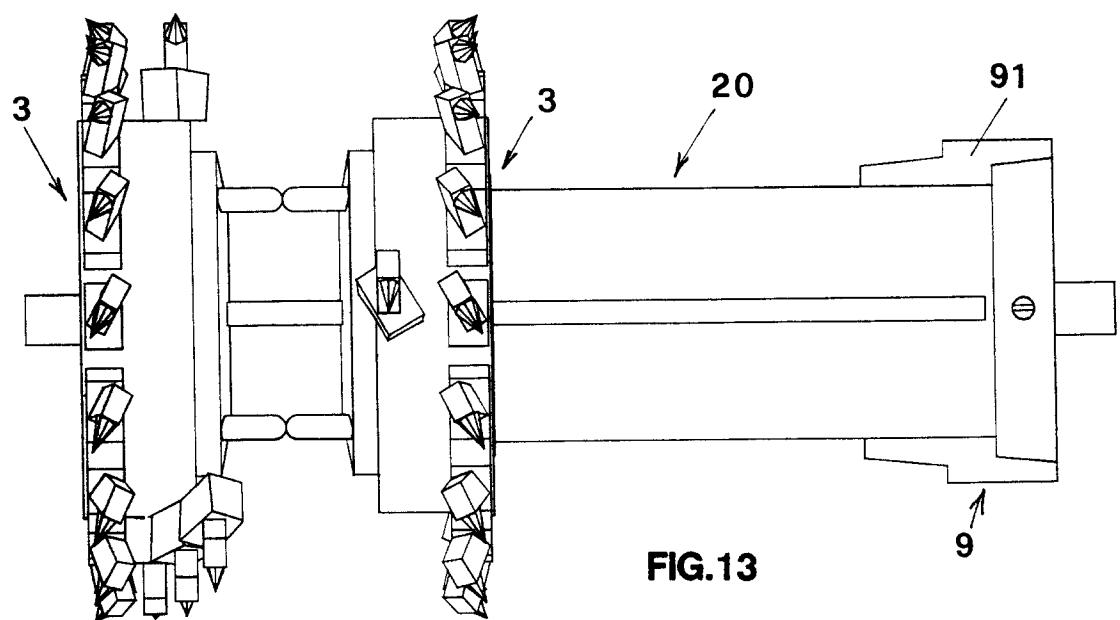
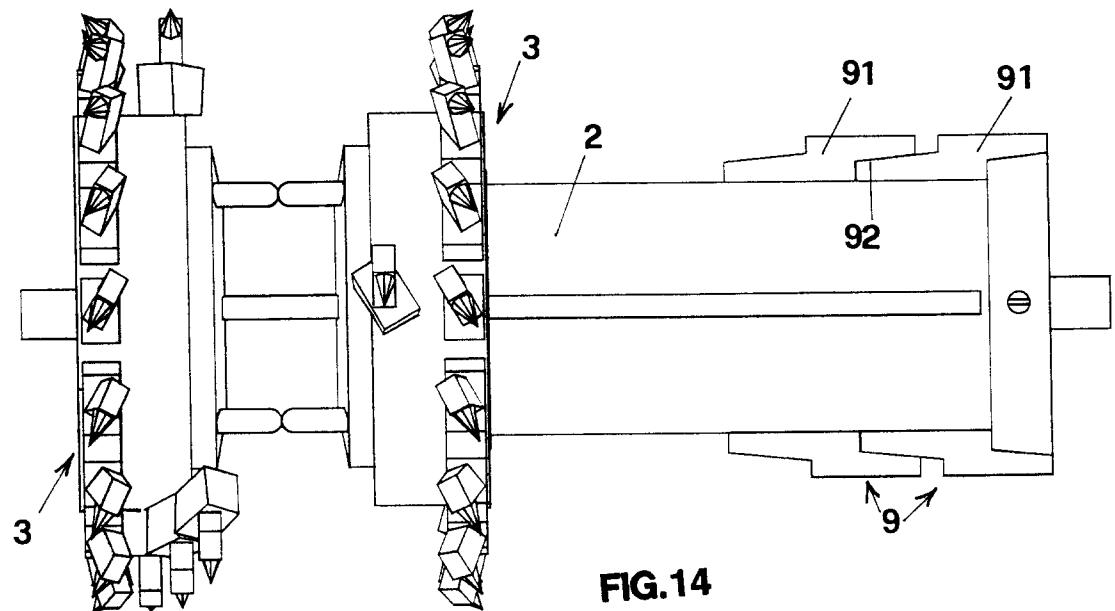
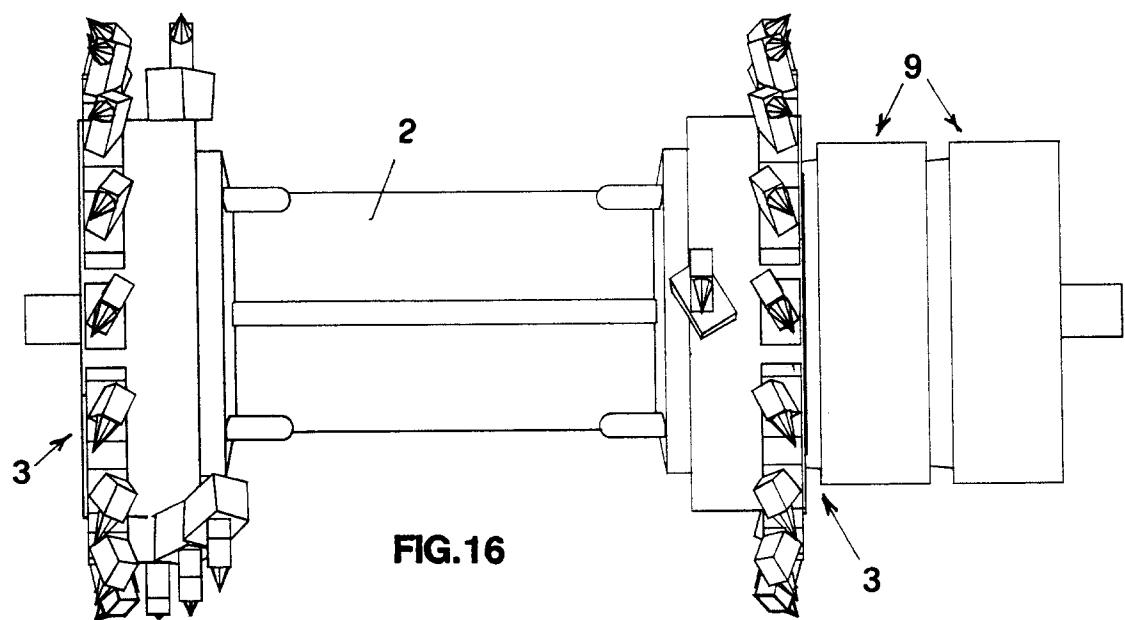
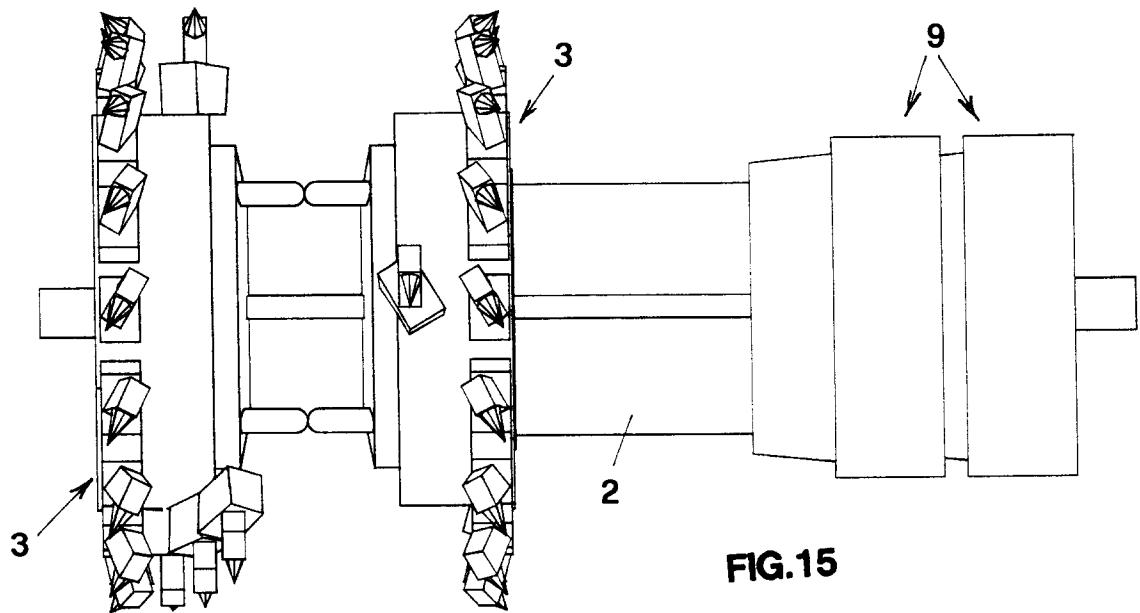
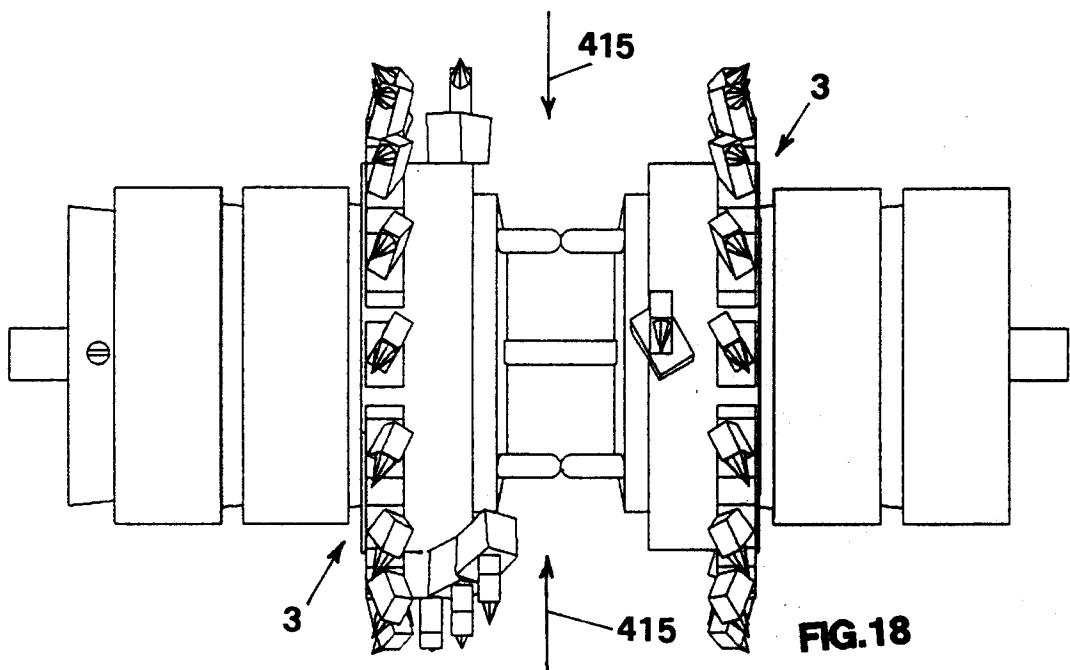
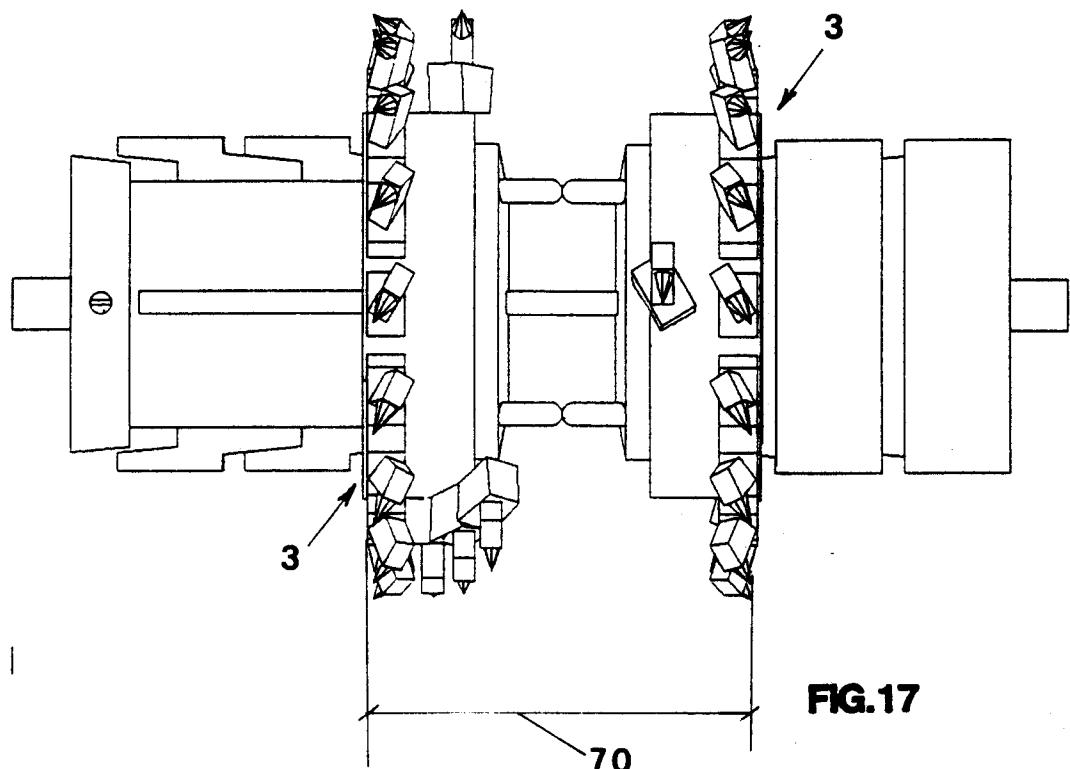


FIG.10









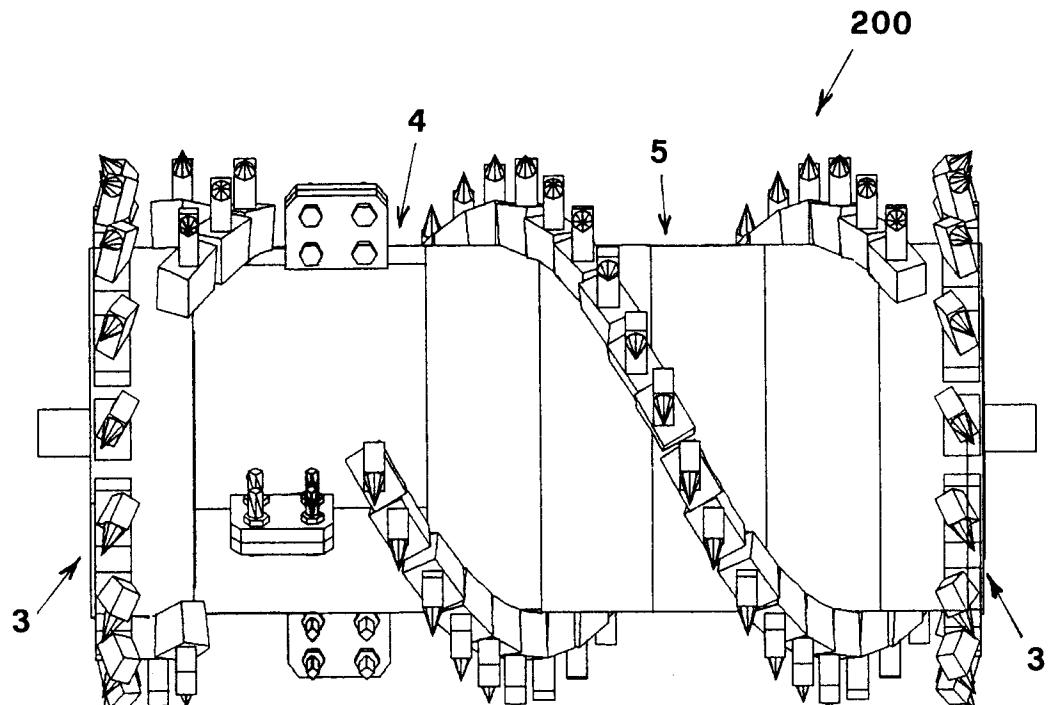


FIG.20

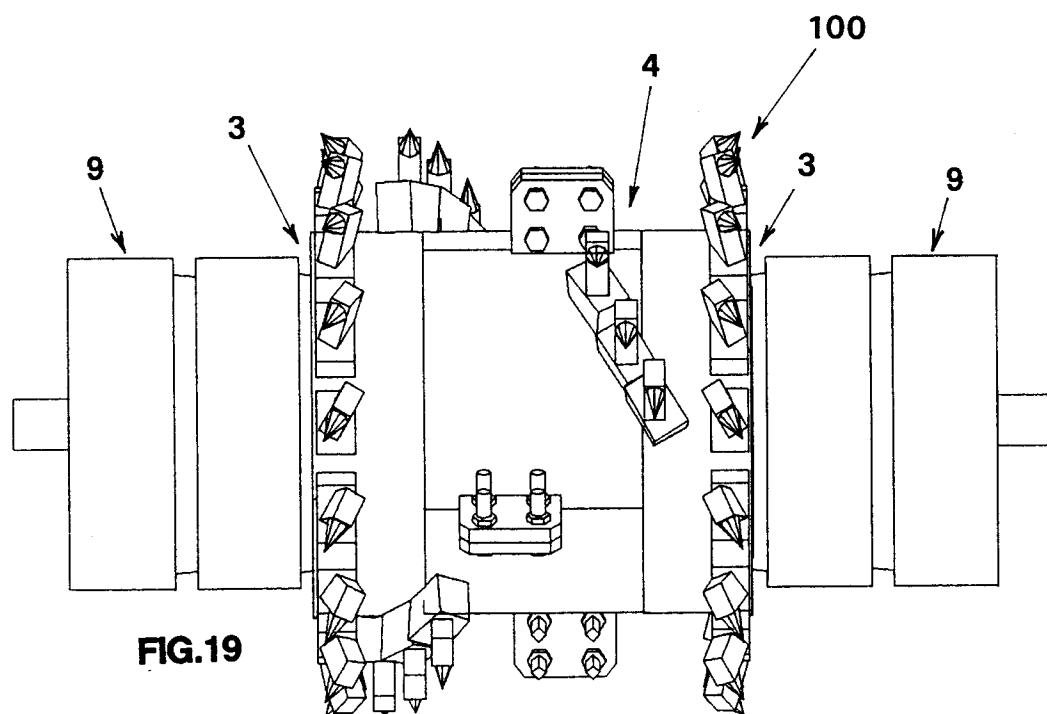


FIG.19