

[54] DRY SHAVER

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[58] Field of Search 30/42, 43.91, 43.92, 223,
30/224, 346.51

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[57]

ABSTRACT

A shear foil is mounted on a housing and located within the latter is a vibratory system including a cutter unit reciprocable beneath and relative to the shear foil, an electrically energized drive including a vibratory armature and a connection from the same to the cutter unit. The vibratory system has an inherent vibratory frequency. An arrangement is provided for accommodating this inherent vibratory frequency to the frequency of the electric current with which the drive is energized.

10 Claims, 5 Drawing Figures

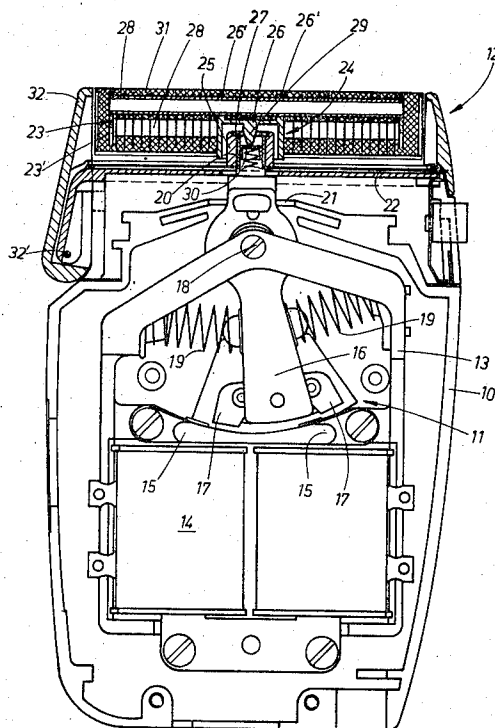


FIG. 1

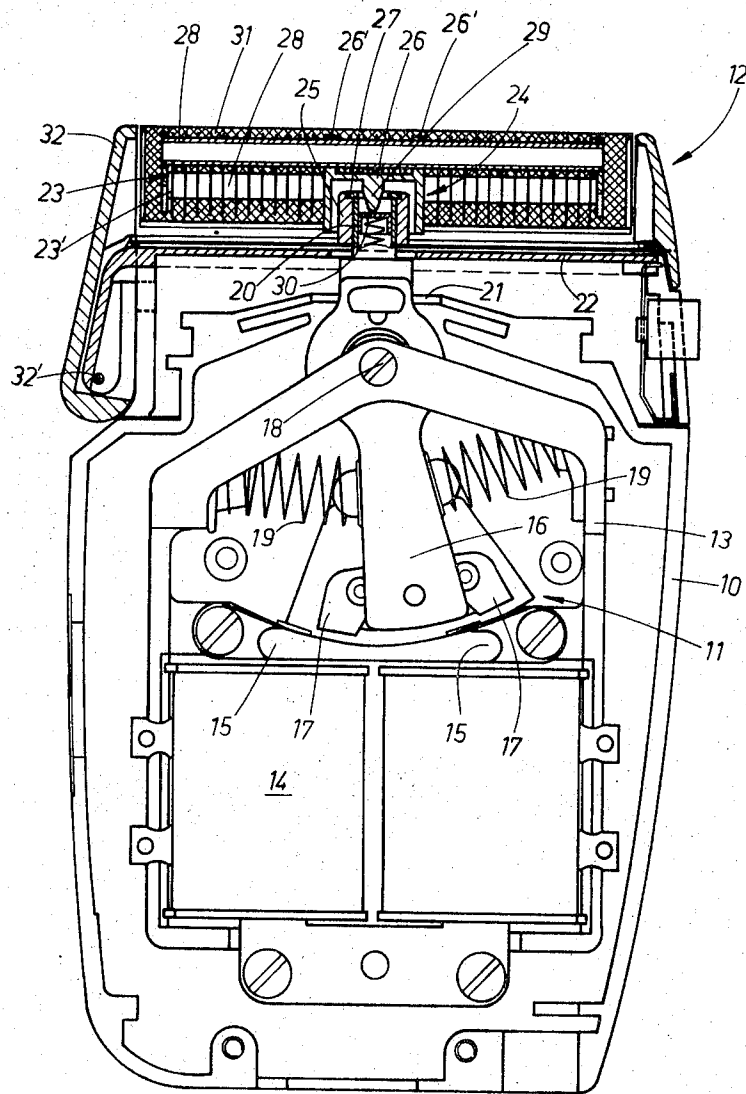


FIG. 5

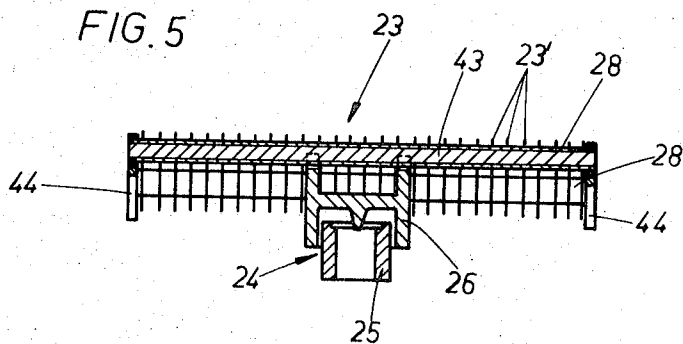


FIG. 2

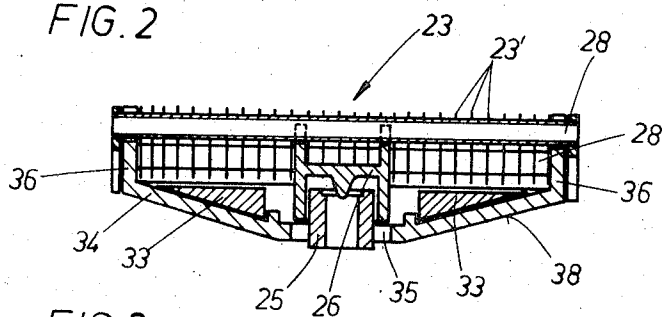


FIG. 3

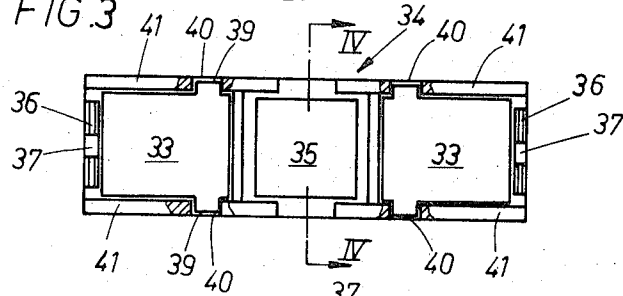
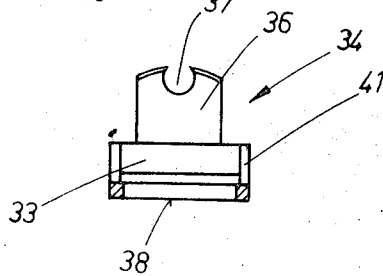


FIG. 4



DRY SHAVER

BACKGROUND OF THE INVENTION

The present invention relates to a dry shaver in general, and more particularly to an electrically operated dry shaver. Still more particularly the invention relates to an electrically operated dry shaver having an arrangement for accommodating the inherent vibratory frequency of its vibratory system to the frequency of the electric current by which the drive is energized, the purpose being to obtain optimum operating conditions even if the dry shaver is to be used with current of different frequencies or cycles. This is done by providing components which are connected with or disconnected from the vibratory system to thereby change the mass of the same and thereby accommodate its inherent vibratory frequency to the frequency of the electric current. However, these known dry shavers require a very complicated and therefore expensive malfunction-susceptible arrangement for connecting these components with and disconnecting them from the vibratory system. Dry shavers of this type use a drive having a vibratory armature which is sealed in the housing. In order to permit a connection and disconnection of the aforementioned components this means that the arrangement for causing this must be so located that it can be accessible and operated from the exterior of the dry shaver housing.

Attempts have been made to achieve the desired results by changing the flexing springs which connect the vibratory armature and cutter unit, replacing them with springs having a different spring characteristic. However, here also the necessary technical requirements are both extensive and expensive; moreover they cannot be carried out by those that are technically unskilled.

All in all, the manner in which the accommodation has been carried out in the dry shavers known from the prior art is not satisfactory. On the other hand, no more satisfactory solutions have heretofore been forthcoming.

SUMMARY OF THE INVENTION

Accordingly, it is a general object of the present invention to provide an improved dry shaver which avoids the aforementioned disadvantages and affords the sought-after improvement.

More particularly it is an object of the present invention to provide such an improved dry shaver in which the inherent vibratory frequency of the vibratory system can be accommodated to the frequency of the electric current by which the drive of the dry shaver is energized, with simple means and by persons having no technical expertise.

In keeping with these objects, and with others which will become apparent hereafter, one feature of the invention resides in a dry shaver having a housing, a shear foil in the housing, a vibratory system provided in the housing and including a cutter unit reciprocable beneath and relative to the shear foil, an electrically energized drive including a vibratory armature, and springs connecting the armature and cutter unit and being flexible in direction of reciprocation of the latter having an inherent vibratory frequency. Means is provided for accommodating the inherent vibratory frequency to the

frequency of the electric current by which the drive is energized by varying the mass of the cutter unit.

In dry shavers the cutter unit is invariably readily accessible, being located directly beneath the shear foil and becoming quite rapidly clogged with cut-off beard stubble. To be able to remove this beard stubble the cutter unit must of course be accessible. This is accomplished by removably mounting the shear foil in the housing, usually in a separate head portion carrying the shear foil and which can be removably connected with the housing itself. Thus, the cutter unit is readily accessible and, since the present invention proposes to accommodate the inherent vibratory frequency of the vibratory system to the frequency of the electric current by varying the mass of the cutter unit, this presents no problem when the latter is readily accessible. This, in turn, means that the necessary adjustments can be made in a very simple manner without requiring any technical knowledge or expertise, and by the user himself.

Evidently, the mass of the cutter unit may be either increased or decreased, depending upon the particular requirements of a given situation.

It is advantageous if the cutter unit, which has a plurality of cutter blades and carriers for the same, is provided with mass-varying components which can be connected with and disconnected from the cutter unit, advantageously from the carriers thereof. The mass of the cutter unit may be accommodated to the highest frequency of electric current by which the dry shaver is to operate, and may be varied so as to accommodate it to a lower current frequency by adding the mass-varying components to the cutter unit. In order to obtain a uniform mass distribution in all circumstances, it is advisable to provide the mass-varying component in a holder which surrounds the vibratory arm engaging the cutter unit from below and which can be clamped onto the cutter unit from below or be removed in the same manner. This makes it possible to specifically predetermine the position of these components symmetrically with reference to the axis of oscillation so that no imbalance will occur. At the same time it assures that the connection of the components with the cutter unit by a person who is either unskilled or careless will not result in the development of imbalances and the concomitant problems resulting therefrom. It is particularly advantageous if the holder has two spaced end walls provided with recesses which can be clampingly engaged carriers of the cutter unit when the end walls are introduced between respective pairs of spaced cutter blades of the cutter unit. This eliminates separate connecting means which otherwise would have to be provided for the purpose of connecting the holder to the cutter unit, and it is now merely possible to push the holder from below onto the cutter unit until it couples with the same. To remove the holder it is only necessary to withdraw it from the cutter unit, and for this purpose it is advantageous if the holder itself is of a synthetic plastic material having at least some resiliency so that it can yield when it is pushed onto or pulled off the cutter unit. Nylon could be such a material, and of course many others are known in the art.

It has also been found advantageous if the components themselves are mounted symmetrically to the center plane of the holder, being accommodated in recesses of side walls of the holder. For this purpose they need then merely be inserted between these side walls

and can be made to snap into recesses provided in these side walls. This means that in a very simple manner a stable connection of the components with the holder is achieved, preventing the components from moving relative to the holder. The bottom wall of the holder, extending from the spaced end walls of the latter, is advantageously conically depressed in the direction towards a central opening of the bottom wall through which a coupling element can extend for coupling the cutter unit with the vibratory arm of the vibratory armature. Such construction makes it possible for the end walls to be relatively low and therefore stable without, on the other hand, significantly reducing the space in the interior of the holder which is available for accommodating these components.

The carriers for the cutter blades of the cutter unit can be made hollow, and in this case it is possible to so configure the mass-varying components that they can be accommodated in the interior of the carriers without requiring the holder mentioned above.

In some circumstances, for instance if the available space so necessitates, a holder may not be usable, or mass-varying components insertable into hollow carriers of a cutter unit may not be employable. In that case it is possible to provide two or more cutter units of different mass, with the cutter units being interchangeable depending upon the mass required. In this case it is advantageous if, assuming for instance that two such cutter units are provided, the cutter unit which is intended to have the lower mass be formed with cutter blade carriers which are hollow in their cross-section, whereas the cutter unit having the higher mass is formed with cutter blade carriers having a solid cross-section. The former would then be used for a lower frequency of electric current and the latter would be used for a higher frequency of electric current. Needless to say, it is not necessary that the mounting arrangement for the cutter blades itself change from one unit to the next as long as the mass is different.

The novel features which are considered as characteristic for the invention are set forth in particular in the appended claims. The invention itself, however, both as to its construction and its method of operation, together with additional objects and advantages thereof, will best be understood from the following description of specific embodiments when read in connection with the accompanying drawing.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a partially diagrammatic vertical section through a dry shaver according to the present invention;

FIG. 2 is a vertical section through a cutter unit of a dry shaver according to the present invention, illustrating one embodiment of the invention;

FIG. 3 is a top-plan view of a detail of FIG. 2;

FIG. 4 is a section taken on line IV-IV of FIG. 3; and

FIG. 5 is a view analogous to FIG. 2 but illustrating a further embodiment of the invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Discussing the drawing in detail, and firstly the embodiment in FIGS. 1-4, it will be seen that FIG. 1 in particular illustrates a dry shaver in which only those components are shown which are essential for an un-

derstanding of the invention. Other components, such as an ON-OFF switch and electrical connections for connecting the dry shaver to a source of electrical energy, have been omitted in order to permit a clearer illustration of the components which are necessary for an understanding of the invention. The dry shaver has a housing 10 of which only one half is illustrated, the other half having been omitted to permit illustration of the interior components. Located in the housing 10 is a vibratory armature drive 11 which is known per se to those skilled in the art, and at the upper end of the housing there is provided a shear head 12 which is releasably connected with the housing and which carries a shear foil 31 which is apertured so that beard stubble will pass through the apertures of the shear foil when the latter is placed against the skin of a user. The drive 11 is mounted in a manner also known from the art in a frame 13 at the lower end of which there is provided a stator 14 which can be connected with a source of electrical energy. The stator 14 has windings out of which extend pole shoes 15; arranged above the latter is a vibratory armature 16 whose pole shoes 17 can move closely adjacent and above the pole shoes 15. A journal 18 is provided which pivotably journals the vibratory armature 16, and the latter is supported at both sides in the direction of movement by flex springs 19 located between the pole shoes 17 and the journal 18. The armature 16 has a vibratory arm 20 extending upwardly of the journal 18 and passing through an opening 21 in the housing and through a base plate 22 of the shear head 12.

On the upper free end of the arm 20 there is carried the cutter unit 23, which is coupled to the arm 20 via a coupling element 24. The drawing shows that the element 24 comprises a sleeve 25 mounted on the arm 20 and an articulated component 26 on which the cutter unit 23 is provided and which is connected with the sleeve 25 in a semi-cardanic manner (i.e., not for universal displacement but only for displacement in two mutually opposite directions). The sleeve 25 is secured to the arm 20 in the illustrated manner, projections 27 of the arm being provided which extend through interior axially extending grooves in the sleeve and which engage in operating position the upper edge thereof. In this manner the cutter unit 23 can be released together with the coupling 24 from the arm 20 at any time this is desired. Of course, another manner of connection could also be chosen. The element 26 is connected via portions 26' with one or more carriers 28 carrying the individual cutter blades 23' of the cutter unit 23 and this connection can also be made releasable when and if desired. The element 26 also abuts with a projection 29 against a spring-loaded pressure element 30 arranged in the interior of the arm 20 as shown in FIG. 1.

The shear head 12 has a shear head frame 32 provided with a cut-out, and the shear foil 31 overlies the cut-out. The manner in which it is connected with the shear head frame 32 is conventional in the art and requires no detailed discussion, especially inasmuch as it is not a part of the invention. The frame 32 in turn can be pivoted from the operating position shown in FIG. 1 about a hinge 32' away from the plate 22, so as to expose and make accessible the cutter unit 23. Naturally it will be understood that the shear head 12 need not be pivoted to the housing in the manner just discussed

but could be otherwise releasably connected with, for instance with the blade 22.

The arm 20, the armature 16, the springs 19 and the cutter unit 23 together form a vibratory system having an inherent vibratory frequency. It will be assumed for purposes of explanation that the inherent vibratory frequency of this system is so chosen that it will be 60 cycles in normal operation that being the number of cycles at which electrical current is supplied for operation of the drive in many countries. However, in order to make the novel dry shaver usable for electric current with a different frequency, that is with a different number of cycles such as the 50-cycle current which is used in the European countries, the inherent vibratory frequency of the vibratory system must be made variable so that it can be accommodated to the lower number of cycles. According to the present invention this is achieved by increasing the mass of the cutter unit 23 and thereby accommodating the inherent vibratory frequency of the vibratory system to the 50-cycle current.

FIG. 2 shows an embodiment in which a holder 34 is provided, having a plurality of mass-varying components 33. These components and the holder 34 can be connected with the cutter unit 23 by placing beneath the latter the cutter unit 23 as shown in FIG. 2, and coupling it to the cutter unit 23. Thus, when it is desired to convert the system of FIG. 1 from 60-cycle operation to 50-cycle operation, that is to accommodate its inherent vibratory frequency to the 50-cycle frequency of European electrical current, the holder 34 with the components 33 will be connected with the cutter unit 23 as shown in FIG. 2; conversely, if it is desired to reconvert from 50-cycle current to 60-cycle current, the holder 34 with the components 33 will be disconnected from the cutter unit 23.

It is clear that such a change-over must be made simple and foolproof if it is to be carried out by the average user of such a dry shaver, that is a person having little or no technical knowledge or skill. According to the present invention this is achieved by configuring the holder 34 in a frame-like manner and providing it with a central opening 35 through which the coupling 24 can extend. The holder 34 also has longitudinally spaced end walls 36 each of which can be inserted between two adjacent individual cutter blades 23' of the unit 23 and each of which is provided with a cut-out 37 (see FIG. 4) by means of which it can be secured to the center carrier 27 of the unit 23 by exerting sufficient pressure for the carrier 27 to snap into the two recesses 37.

The holder 34 also has a bottom wall, identified with reference numeral 38 as shown in FIG. 2. Extending from the end walls 36 bottom wall 38 is conically depressed to the opening 35, so that the available space within the confines of the holder 34 increases towards the middle thereof, affording more room for the components 33 which, as FIG. 3 shows most clearly, can be inserted with end portions 39 into cut-outs 40 of side walls 41 of the holder 34 and which are located at opposite sides of the opening 35.

It will be appreciated that if the holder 34 is to be connected to or disconnected from the cutter unit 23 it is merely necessary to remove the shear head 12 with its frame 32, making the cutter unit 23 accessible. Now, the cutter unit 23 is disconnected from the arm 20 and, if the holder 34 is to be connected with the cutter unit

23, it is placed beneath the cutter unit and is pressed onto the same until they are coupled in the manner discussed above via the recesses 37. Conversely, if the holder 34 is to be disconnected from the cutter unit 23, then it is merely necessary to pull the two apart. To facilitate a snap coupling connection or disconnection of the holder 34 with the cutter unit 23 it is advantageous if the holder 34 is of a synthetic plastic material (for instance nylon, polyvinylchloride, or the like) which has sufficient resiliency to permit snap coupling connection or disconnection.

Coming to the embodiment illustrated in FIG. 5 it will be seen that here the holder 34 of FIGS. 1-4 has been omitted. Instead, the cutter unit 23 is provided with holders 28 for its individual cutter blades 23', which holders 28 are hollow and tubular in configuration. The mass-varying components 43 are so configured in this embodiment that they can be received in the hollow tubular carriers 28, filling the interior thereof. Evidently this omits the holder 34 which is not necessary in this embodiment and of course a change-over to accommodate the system to a different electric current frequency is effected by removing the components 43 from the interior of the carriers 28.

Another embodiment, not illustrated but clearly within the concept of the present invention, proposes that in circumstances where the possibilities of FIGS. 1-4 and 5, respectively, cannot be used or are not desired to be used, the cutter units 23 themselves may provide for a variation in the mass and thereby in the inherent vibratory frequency of the system. Thus, two (or of course more) cutter units 23 could be provided of which one has a greater and the other a lesser mass. For instance, the carriers 28 of the unit desired to have the greater mass could be of solid cross-section and the carriers 28 of the unit desired to have the lesser mass could be of hollow tubular cross-section as in the embodiment of FIG. 5 without, however, the separate components 43. When the system is to be accommodated to electric currents of different frequency the appropriate cutter unit would then be chosen and connected with the arm 20. Particularly in the case of the heavier cutter unit, where the carriers 28 would be of solid cross-section, the carriers together with the end walls 43 could be made of one piece, for instance in a casting procedure. The discussed embodiments make it possible to obtain optimum operating results when the vibratory frequency of the system is changed to be accommodated to the frequency or number of cycles of 50 or 60 cycles, respectively, while at the same time providing for a quadrupled mass or a reduction of the mass by three-quarters of the cutter unit. Theoretically, a usable operating efficiency of the dry shaver can be obtained if the mass of the cutter unit is doubled or halved, but this would be the lower boundary of the usable range.

Naturally, changes can be made in the disclosed embodiments without departing from the concept of the invention. For instance the construction and configuration of the cutter units could differ from what has been illustrated. Equally well, the construction and configuration of the armature 16 and the associated arm as well as of the coupling connecting the cutter unit with the arm could be changed. Finally it should also be mentioned--and this is quite evident--if the frequency of the current by means of which the dry shaver is to be energized should differ from the frequencies dis-

cussed herein appropriate changes in the differential mass values discussed herein can also be made without departing in any sense from the concept of the present invention.

It will be understood that each of the elements described above, or two or more together, may also find a useful application in other types of constructions differing from the types described above.

While the invention has been illustrated and described as embodied in a dry shaver it is not intended to be limited to the details shown, since various modifications and structural changes could be made without departing in any way from the spirit or concept of the present invention.

Without further analysis, the foregoing will so fully reveal the gist of the present invention that others can by applying current knowledge readily adapt it for various modifications without omitting features that from the standpoint of prior art fairly constitute essential characteristics of the generic or specific aspects of the invention and therefore such adaptations and modifications should and are intended to be comprehended within the meaning and range of equivalence of the following claims.

What is claimed as new and desired to be protected by Letters Patent is set forth in the appended claims:

1. In a dry shaver, a combination comprising a housing; a shear foil on said housing; a vibratory system in said housing and including a cutter unit comprising a plurality of cutter blades, said unit being reciprocable beneath and relative to said shear foil, an electrically energized drive including an oscillating arm connected with a lower side of said unit for effecting reciprocation of the same, and including a vibratory armature, and springs engaging said armature and being flexible in a direction of movement of the latter, said vibratory system having an inherent vibratory frequency; and means, comprising releasable elements releasably connected with said unit, to vary the combined mass thereof and thereby change the inherent vibratory frequency of said system, so as to accommodate said inherent vibratory frequency to the frequency of the electric current by which said drive is energized by varying the mass of said cutter unit.

2. A combination as defined in claim 1, said plurality

of cutter blades further comprising carriers for the same; and wherein said releasable elements are connectable with and disconnectable from said carriers.

3. A combination as defined in claim 1, wherein said means comprises at least one holder surrounding said arm and clampingly engageable with said unit.

4. A combination as defined in claim 1, said unit including a plurality of cutter blades, and carriers for the same; and wherein said holder comprises recesses arranged to frictionally receive at least one of said carriers.

5. A combination as defined in claim 1, wherein said holder is of a synthetic plastic material of at least some resiliency.

6. A combination as defined in claim 1, said holder having a pair of spaced parallel side walls provided with depressions; and further comprising elements mounted in said depressions symmetrically with reference to a center plane of said holder.

7. A combination as defined in claim 6, said holder also having a pair of spaced parallel end walls and a bottom wall connecting said end walls and provided with a central opening, said bottom wall being conically tapered in direction from said end walls to said central opening; and further comprising a coupling connecting said unit with said arm and extending through said central opening.

8. A combination as defined in claim 1, said unit including a plurality of cutter blades, and hollow carriers for the same; and wherein said means comprises elements dimensioned for releasable accommodation in the interior of said carriers.

9. A combination as defined in claim 1, wherein said means comprises at least one additional cutter unit similar to the first-mentioned unit but having a mass different from that of said first-mentioned unit and being connected in place of the same with said drive.

10. A combination as defined in claim 1, wherein one of said cutter units comprises a plurality of cutter blades and solid cross-section carriers for the same, and wherein the other cutter unit comprises a plurality of cutter blades and hollow cross-section carriers for the same.

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