



(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
18.06.2014 Bulletin 2014/25

(51) Int Cl.:
E04H 4/16 (2006.01)

(21) Application number: **13197511.2**

(22) Date of filing: **16.12.2013**

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME

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(30) Priority: **17.12.2012 US 201213717621**

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(54) **Automated pool cleaning vehicle with rotating and stationary scrubbing elements**

(57) Disclosed herein is a submersible pool cleaning vehicle (PCV) (20) having both cleaning and scrubbing structures. The PCV includes spaced wheels (30) and several sets of scrubbing members (60,62,64). Each of the scrubbing members includes a plurality of scrubbing elements. The PCV also includes a cleaning brush (42) for dislodging particles. In one exemplary embodiment, the PCV includes a fixed scrubbing member (60) and two

rotating scrubbing members (62,64). The rotating scrubbing members act cooperatively and create a current after dislodging particles and dirt from the pool surface. The rotating scrubbing members direct the current carrying such dislodged material toward the intakes of the PCV so that it can be permanently removed from the pool water.

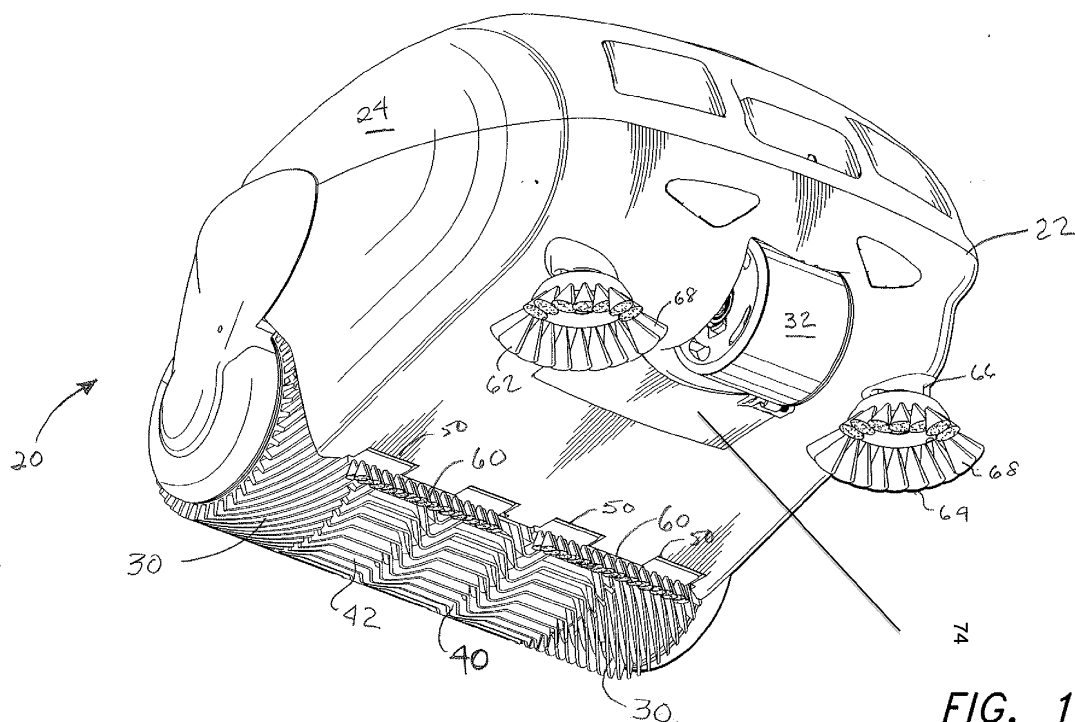


FIG. 1

Description

Cross-Reference to Related Applications:

[0001] This application is related to Applications 13/531,594 and 12/939,079, filed by co-inventor, Wing-kin HUI, for *POOL CLEANING VEHICLE HAVING SIDE VENTS AND DUCTS* *POOL CLEANING VEHICLE WITH ENDLESS LOOP TRACK*, respectively and filed on Nov. 17 & 18, 2008, also respectively. These applications are specifically incorporated herein and are to be used for all purposes consistent with incorporation by reference.

[0002] This application is also related to US 8,225,446 B2 *POOL CLEANING VEHICLE HAVING SIDE VENTS AND DUCTS* and issued on July 24, 2012 is specifically incorporated herein and are to be used for all purposes consistent with incorporation by reference.

[0003] And, finally, this application is related to co-filed application number US 13/717601 filed on December 17, 2012.

Field of the Invention

[0004] This invention generally relates to the field of automated pool products. Particularly, this invention relates to an automated swimming pool cleaning vehicle (PCV) for facilitating thorough cleaning of the pool water and pool surfaces. More particularly, this invention relates to devices and cleaning structure used in cooperation with a PCV having a set of spaced apart wheels and providing structure for cleaning and scrubbing the pool surface.

Background of the Invention

[0005] It is well accepted that submersible automated pool cleaning devices, such as self-propelled pool cleaning vehicles (PCV's) are essential to the proper maintenance of a pool, whether the pool be above or below ground. The typical vehicle includes a housing and drive members. The drive members are attached to the housing usually through connection to a chassis. Drive members include wheels, endless loop tracks and combinations of each. Additionally, vehicles have included two and four-wheel drive vehicles in various combinations and variations. In the case of a belt or endless loop track. The track wraps around the drive and/or idler wheels or rollers.

[0006] It will be appreciated that a vehicle may also have some combinations of wheels and/or rollers and the vehicle may also be a two or four-wheel drive vehicle. The endless loop track may be fitted over any combination of two or four-wheel drive vehicles. Such tracks have been found to be an effective mean for moving the vehicle around the surface of the pool while the vehicle is submerged.

[0007] Of course, the primary purpose for all PCV's is

to clean the pool and pool water. In order to properly maintain clean pool water, the water itself as well as the pool surfaces must be cleaned and kept clean. It is imperative to keep the pool surfaces free from the buildup of dirt and debris. Once dirt and/or debris is allowed to settle in on the pool surface, algae forms. A large enough build-up of such algae can cause the pool pH to become unbalanced and the pool water unstable, in terms of cleanliness.

[0008] Sometimes drastic efforts caused by "dirty" water result in the entire contents of the pool being drained and starting again. As can be appreciated this is an expensive and time consuming process. Additionally, without thorough cleaning and maintenance, the situation will simply be repeated. There is no guarantee, without proper maintenance methods, that the water will not simply revert to the same "dirty" condition.

[0009] Of special concern in this regard, is the fact that embedded particles can be particular concern. As noted by others, these embedded particles can cause fatal consequences in term of "dirty water" requiring the emptying of the pool for dry cleaning. Clearly, a condition that is primary to avoid.

[0010] Clearly, there is a strong industry-wide need to prevent the buildup of particles in the pool water. There is even a stronger need to prevent the embedding of such particles in the surface of the pool. Cleaning each and every square millimeter of the pool's surface is simply not a practical solution. Therefore, Applicant has developed a structure for using the automated pool cleaning vehicle to remove even embedded particles in the surface of the pool. Additionally, the cleaning structure, in accordance with the invention, facilitates the PCV to thoroughly clean the dirt and debris thus dislodged from the pool's surface. This not only serves the short term goal of keeping the water clean and free from dirt and debris, but also is helpful in accomplishing the long term goal of preventing the buildup of such particles on and in the surface of the pool.

[0011] What is needed is a cleaning structure for a submersible automated pool cleaning vehicle (PCV), which is adapted to clean the pool surface by dislodging dirt and debris from the surface of the pool and further to dislodge even embedded dirt and debris from the surface of the pool using the automated motion of the PCV.

Summary of the Invention

[0012] The sanitizing structure for a Pool Cleaning Vehicle (PCV), in accordance with the present invention, is limited to such a PCV having spaced-apart free-spinning and drive wheels and not drive tracks, which was the subject of an earlier patent specification by the one of the inventors herein. The sanitizing structure herein is a combination of the cleaning member on the PCV chassis, the suction created by the PCV for absorbing dirt and debris through the PCV intakes and the scrubbing members associated with the wheels. The scrubbing mem-

bers may include elements extending from the wheels. In an exemplary embodiment, the elements define a plurality of bristles, which, taken together form a frustoconical shape. The scrubbing members extend from the bottom of the housing and toward the pool surface over which the PCV travels.

[0013] The cleaning member may be a rotating brush attached to the bottom of the PCV housing and may include bristles for dislodging dirt and debris as the PCV moves along the pool surface. As the PCV with the sanitizing structure, in accordance with the invention, moves along the pool surface, the wheels with the scrubbing elements and the bristles on the housing dislodge dirt and debris. Thus, the dirt and debris dislodged by the cleaning and scrubbing members are then sucked up by the PCV through housing intakes, cleaning and sanitizing the pool water.

[0014] It is an object of this invention to provide a PCV with a structure suitable for sanitizing swimming pool water.

[0015] It is an additional object of this invention to provide such sanitizing structure, which is attachable to a PCV and thereby uses automated means to dislodge dirt and debris from the pool surface.

[0016] It is an additional object of this invention to provide such sanitizing structure, which is attachable to a PCV and thereby uses automated means to dislodge dirt and debris embedded in the pool surface.

[0017] In accordance with the objects set forth above and those that will be described hereinafter, the PCV for sanitizing water in a swimming pool in accordance with this invention comprises:

a housing having a bottom and an exterior and an interior and including at least one intake member and a vacuum member for drawing water into the housing through the intakes, the housing including a filter member for filtering water drawn into the housing through the intakes and an outlet for expelling the filtered water back into the pool;

a chassis attached to the housing and being generally within the interior;

drive means attached to the chassis for propelling the PCV throughout the surface of the pool, the drive means including spaced apart wheels for receiving power from the drive means;

a cleaning member attached to the housing;

a first set of scrubbing members extending from the bottom and the scrubbing members being proximate to the intake member;

whereby, as the PCV moves around the pool surface the scrubbing members contact the surface of the pool and dislodge dirt and debris and whereby the vacuum member absorbs the dislodged dirt and debris to facilitate the sanitizing of the pool water.

[0018] In another exemplary embodiment of the PCV, in accordance with this invention, the wheels have scrub-

bing elements and include wheel covers, covering at least a substantial portion of the wheels and the scrubbing elements are embedded in the wheel covers.

[0019] In an exemplary embodiment, the PCV includes a second scrubbing member and at least a second intake member, the second scrubbing member is located proximate to the second intake member.

[0020] In another exemplary embodiment, the second scrubbing member is attached to the bottom of the housing and extends from the housing in a predetermined direction and the second scrubbing member includes rotating bristles, the rotating bristles have a direction of rotation generally perpendicular to the direction from which the second scrubbing member extends from the bottom of the housing.

[0021] In another exemplary embodiment, the wheel covers include a scrubbing element insert made from a material specifically designed for scrubbing pool surfaces.

[0022] In another exemplary embodiment, the PCV includes a third scrubbing member, identical to the second scrubbing member and at least a third intake member, the third scrubbing member is located proximate to the third intake member, the second and third members being spaced apart from each other on the bottom of the housing.

[0023] In an exemplary embodiment, the scrubbing member includes a plurality of scrubbing elements. The scrubbing elements may define a plurality of bristles and the bristles taken together may define a scrubbing element having frusto-conical shape.

[0024] The scrubbing elements may be made from a material specifically designed for scrubbing pool surfaces.

[0025] In an exemplary embodiment, the scrubbing member is easily detached from and re-attachable to the housing.

[0026] In an exemplary embodiment, the cleaning member defines a rotating brush connected to the bottom of the housing adjacent the intakes.

[0027] In an exemplary embodiment, the brush is easily detached from the wheels and easily re-attached to the housing.

[0028] In an exemplary embodiment, the scrubbing members are stationary. In this embodiment, the PCV may include a second scrubbing member mounted on the bottom of the housing, the second scrubbing member rotates and directs water flow toward the intakes. The PCV may include a third scrubbing member mounted on the bottom of the housing, spaced apart from the second scrubbing member, the third scrubbing member rotates and directs water flow toward the intakes.

[0029] In an exemplary embodiment, the second and the third scrubbing members may rotate cooperatively, creating a current flow which directs water toward the intakes.

[0030] It is an advantage of the instant invention to provide a sanitizing PCV, which cleans and sanitizes pool

water in an automated fashion by dislodging particles from the surface of the pool.

[0031] It is also an advantage of the invention to provide detachable sanitizing elements to a pool cleaning vehicle, which can be replaced upon becoming worn.

[0032] It is an additional advantage of the PCV in accordance with this invention to be able to remove long standing stains found in certain pool surfaces without having to resort to manual brushes and the like.

Brief Description of the Drawing

[0033] For a further understanding of the objects and advantages of the present invention, reference should be made to the following detailed description, taken in conjunction with the accompanying drawing, in which like parts are given like reference numerals and wherein:

Fig. 1 is a perspective view of a pool cleaning vehicle having the sanitizing structure in accordance with this invention.

Figs. 2 is a bottom perspective view of an exemplary embodiment of the PCV in accordance with this invention illustrating the embodiment having three scrubbing members.

Figs. 3 illustrates the proximity of the first scrubbing member to the housing intake.

Fig. 4 is a bottom partial perspective view of the PCV illustrating the flow of dirt and particles through the housing intakes.

Fig. 5 is a bottom plan view of the PCV in accordance with this invention illustrating the flow of dirt and particles through the housing intakes.

Detailed Description Of The Invention

[0034] With respect to Fig. 1 there is shown an exemplary embodiment of the submersible pool cleaning vehicle (PCV) having the cleaning structure in accordance with this invention generally denoted by the numeral 20.

[0035] The PCV 20 includes a housing 22 having an exterior 24 and an interior (not shown). Within the interior of the housing is a motor for creating a vacuum effect. The housing 22 includes a conduit terminating at intakes for drawing water into a filter system and an outlet (not shown) for expelling filtered water back into the pool. Such features are well known and are described in the art. For example, US Patent 7,867,389 B2 and US Application 12/100,414 show further details of the above functions, the entire specifications of which are specifically incorporated herein for all purposes.

[0036] The PCV 20 includes a chassis (not shown) generally within the interior of the housing 22. The PCV 20 includes an electrical motor (not shown) which powers drive wheels 30. The PCV 20 includes an additional free-spinning wheel 32. The free-spinning wheel 32 is also mounted on the chassis.

[0037] The wheels, whether drive wheels 30 or free

spinning wheel 32 are spaced apart from one another and in any case, do not form an endless loop. This is in contrast to earlier described inventions in this art where the PCV included a drive track (endless loop) instead of spaced apart wheels. For example, such inventive aspects of cleaning a pool surface under water are described in a related application, namely US Application 12/939,079, the entire specification of which is specifically incorporated herein for all purposes. When the drive motor is activated, the PCV is propelled by supplying rotational power to the drive wheels 30.

[0038] The PCV 20 also includes a cleaning member 40. The cleaning member 40 is mounted on an axle between drive wheels 30 as shown clearly in Fig. 1. In the exemplary embodiment shown, the drive wheels 30 are positioned at the rear of the PCV 20 and a brush roller 42 defining a cleaning member 40 is positioned between the drive wheels 30. Under power, the drive wheels 30 turn the brush roller 42 with sufficient torque to cause the brush roller 42 to dislodge particles and dirt and debris. The brush roller 42 can be easily removed and replaced as needed.

[0039] A series of intakes 50 are located in close proximity to the roller 42 for sucking up such loosened matter. Again, this is well understood in the art and the references specifically incorporated above and below provide sufficient basis for understanding these principles.

[0040] The PCV 20, in accordance with this invention, includes a first scrubbing member 60, which comprises two sets of scrubbers as shown. Each set of scrubbers are located proximate the brush roller 42 and the intakes 50.

[0041] The PCV 20 includes second and third scrubbing members, 62 and 64, respectively. Each of these scrubbing members is mounted on a housing support 66, as best seen in Figs. 2 & 4. Scrubbing members 62 and 64 include a plurality of scrubbing elements 68. The scrubbing elements 68 are attached to a rotating platform 70 as best seen in Fig. 5. The platform 70 is mounted on the housing support 66.

[0042] The PCV 20 also includes a free-spinning wheel 32 positioned between the scrubbing members 62 and 64. Additionally, the PCV 20 has another intake 74, located in the bottom of the housing 22 and proximate the free-spinning wheel 32, and the scrubbing members 62 and 64.

[0043] With particular reference to Figs. 2 & 3, there is shown a bottom illustration of the PCV 20 with the PCV 20 in the upside down position. In this view, the cleaning member 40 is clearly seen between the two drive wheels 30.

[0044] The cleaning member 40 in the preferred embodiment in accordance with the invention is a rotating brush roller 42, attached to an axle (not shown) between the drive wheels 30. As the drive wheels 30 move the PCV 20 along the pool surface, they rotate the brush roller 42 so that it dislodges dirt and debris. The brush roller 42 defines a series of peaks and valleys. The brush

roller 42 is made from a material that is specifically designed for dislodging such particles. Additionally, the brush roller 42 is made from an engineering plastic that is both flexible and durable for accomplishing this function.

[0045] The scrubbing members 62 and 64 each include a plurality of scrubbing elements 68. The elements 68 are composed of a series of individual bristles 80. The individual bristles 80 are grouped together and define a particular shape, namely a frustoconical shape. This shape has been found to maximize the amount of dirt and stain that can be removed by the rotating scrubbing members 62 and 64.

[0046] The drive wheels 30 include scrubbing elements 82 mounted over the drive wheels 30. The scrubbing elements 82 define tracks having a pattern of ridges and valleys. As with the cleaning member 40, the pattern of the scrubbing elements 82 is formed to maximize the amount of dirt and stain that is removed from the pool surface contacted by the PCV 20. Likewise, the scrubbing elements 82 are made from a material suitable to perform the functions herein described.

[0047] With respect to Figs. 4 and 5, there is illustrated the flow of the water after dirt and debris have been dislodged by the scrubbing members 62 and 64. As seen, the rotating action of the scrubbing members 62 and 64 in the direction of arrows 90 and 92 causes a current to be created. The current created flows, generally, in the direction of arrows 94. As illustrated, the direction of flow takes the dislodged dirt and debris into the path of the intakes 50. A vacuum motor (not shown) is activated within the housing 22 and a vacuum is created at the intakes 50. The dislodged dirt and debris is sucked up through the intakes 50 and removed from the pool surface and the pool water. In this manner the pool is not merely cleaned but sanitized.

[0048] In an exemplary embodiment, the scrubbing members are made from elastomer. The degree of hardness of the elastomer depends upon the pool surface. On some pool surfaces a harder degree of elastomer is more desirable than on others. By providing a variety of different scrubbing elements, which are easily changeable, the user can customize the PCV for his own particular pool surface.

[0049] Likewise, the scrubbing elements are similarly customizable. For example, a wheel cover may have one type of hardness and the scrubbing element can be imbedded with a specific material that would be best suited for that surface. In this way, a variety of wheel covers and scrubbing elements can be offered to the user to best suit the needs of a particular pool surface.

[0050] The tread on the drive wheels 30 is made from an elastomer. In the exemplary embodiment, the tread on the drive wheels is made from various compounds, both natural and synthetic to satisfy the requirements of moving the PCV and cleaning the underwater pool surface.

[0051] The scrubbing elements in an exemplary em-

bodiment have a circular cross section. The surface is made from a material designed to dislodge dirt and remove stain from a pool surface as the PCV collides with the surface during normal operation. For example, the material for the surface is normally hard, for example an engineering plastic. In an exemplary embodiment, the scrubbing elements include an inner core which is sponge-like and flexible in nature. Additionally, the surfaces of the scrubbing elements are designed to have a rough, but non-abrasive surface suitable for dislodging dirt, debris and removing stains from the pool surface.

[0052] While the foregoing detailed description has described several embodiments of the cleaning structure in accordance with this invention, it is to be understood that the above description is illustrative only and not limiting of the disclosed invention. Particularly, there are varieties of different combinations of scrubbing members and elements, fixed and rotational that are not disclosed specifically herein, but fall clearly within the spirit and scope of the invention herein. Each such combination, although not specifically recited and described above is within the spirit and scope of this invention. It also will be appreciated that PCV in accordance with the invention herein includes a drive structure which is propelled by water flowing through output jets located on the housing. In this embodiment, no motor is required to propel the PCV. Thus, the invention is to be limited only by the claims as set forth below.

Claims

1. An automated fully submersible pool cleaning vehicle (PCV) (20) for sanitizing water in a swimming pool, the PCV (20), comprising:

a housing (22) having a bottom and an exterior (24) and an interior and including at least one intake member (50) and a vacuum member for drawing water into the housing (22) through the intakes (50), the housing (22) including a filter member for filtering water drawn into the housing (22) through the intakes (50) and an outlet for expelling the filtered water back into the pool; a chassis attached to the housing (22) and being generally within the interior; drive means attached to the chassis for propelling the PCV (20) throughout the surface of the pool, the drive means including spaced apart wheels (30) for receiving power from the drive means; a cleaning member (40) attached to the housing (22); a first set of scrubbing members (60) extending from the bottom and the scrubbing members (60) being proximate to the intake member (50);

whereby, as the PCV (20) moves around the pool

surface the scrubbing members (60) contact the surface of the pool and dislodge dirt and debris and whereby the vacuum member absorbs the dislodged dirt and debris to facilitate sanitizing the pool water.

2. The PCV (20) as set forth in Claim 1, wherein the PCV (20) includes a second scrubbing member (62) and at least a second intake member (74), the second scrubbing member (62) is located proximate to the second intake member (74). 5
3. The PCV (20) as set forth in Claim 2, wherein the second scrubbing member (62) is attached to the bottom of the housing (22) and extends from the housing (22) in a predetermined direction and the second scrubbing member (62) includes rotating bristles (80), the rotating bristles (80) have a direction of rotation generally perpendicular to the direction from which the second scrubbing member (62) extends from the bottom of the housing (22). 10
4. The PCV (20) as set forth in Claim 3, wherein the PCV (20) includes a third scrubbing member (64), identical to the second scrubbing member (62) and at least a third intake member, the third scrubbing member (64) is located proximate to the third intake member; and the second and third members (62, 64) being spaced apart. 15
5. The PCV (20) as set forth in any one of Claims 1 to 4, wherein the scrubbing member (60, 62, 64) includes a plurality of scrubbing elements. 20
6. The PCV (20) as set forth in Claim 5, wherein the scrubbing elements define a plurality of bristles and the bristles taken together define a scrubbing element having frusto-conical shape. 25
7. The PCV (20) as set forth in Claim 5, wherein the scrubbing elements (68) are made from a material specifically designed for scrubbing pool surfaces. 30
8. The PCV (20) as set forth in any one of Claims 1 to 7, wherein the scrubbing member (60) is easily detached from and re-attachable to the housing (22). 35
9. The PCV (20) as set forth in any one of Claims 1 to 8, wherein the cleaning member (40) defines a rotating brush (42) connected to the bottom of the housing (22) adjacent the intakes (50). 40
10. The PCV (20) as set forth in Claim 9, wherein the brush (42) is easily detached from the wheels (30) and easily re-attached to the housing (22). 45
11. The PCV (20) as set forth in Claim 1, wherein the scrubbing members (60) are stationary. 50
12. The PCV (20) as set forth in Claim 11, wherein the PCV (20) includes a second scrubbing member (62) mounted on the bottom of the housing (22), the second scrubbing member (62) rotates and directs water flow toward the intakes (50). 55
13. The PCV (20) as set forth in Claim 12, wherein the PCV (20) includes a third scrubbing member (64) mounted on the bottom of the housing (22), spaced apart from the second scrubbing member (62), the third scrubbing member (64) rotates and directs water flow toward the intakes (50).
14. The PCV (20) as set forth in Claim 13, wherein the second and the third scrubbing members (62, 64) rotate cooperatively, creating a current flow which directs water toward the intakes (50).

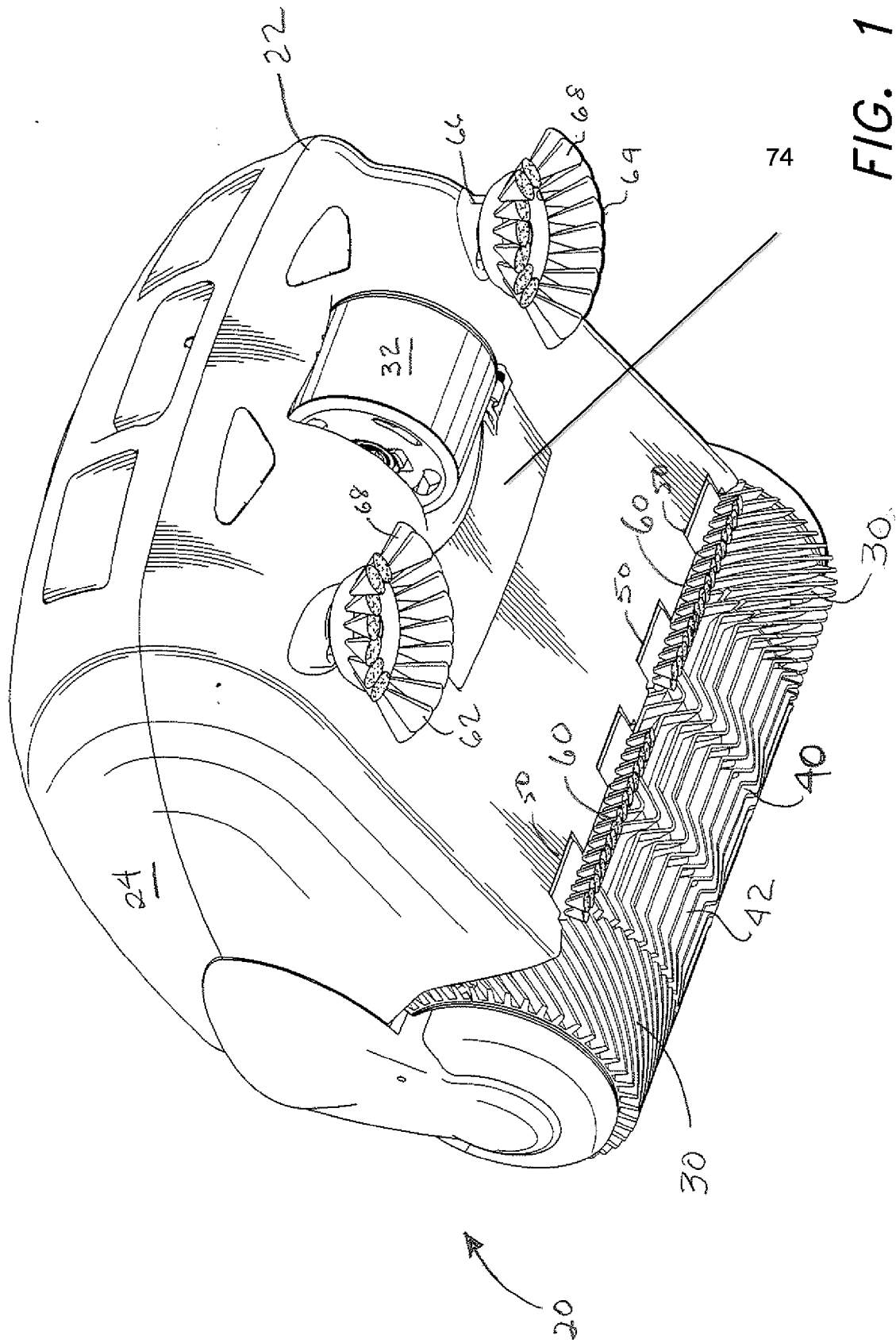


FIG. 1

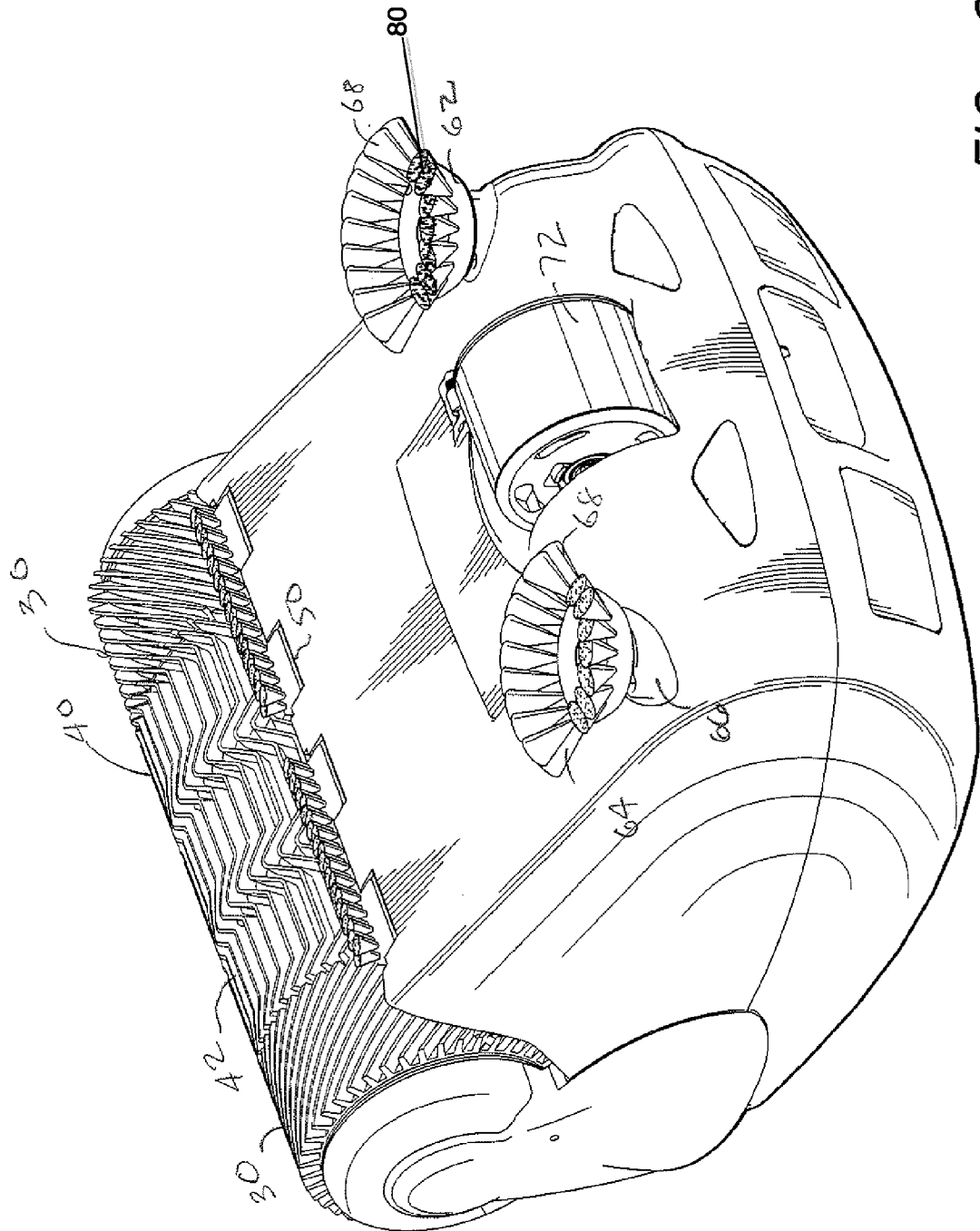


FIG. 2

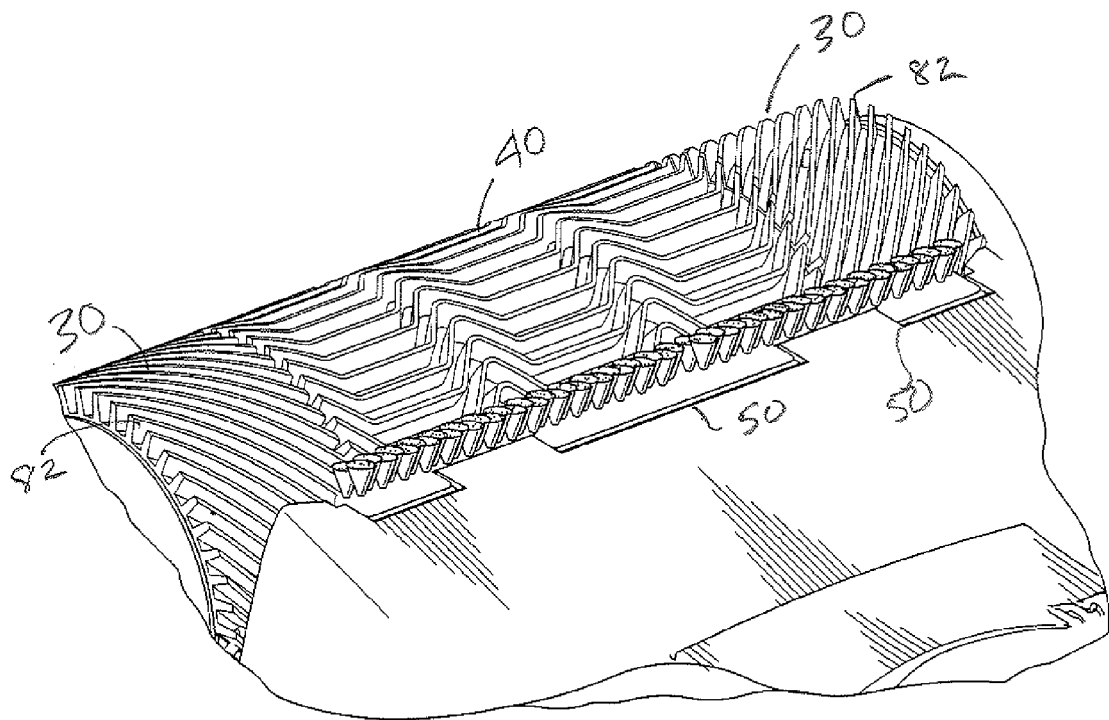


FIG. 3

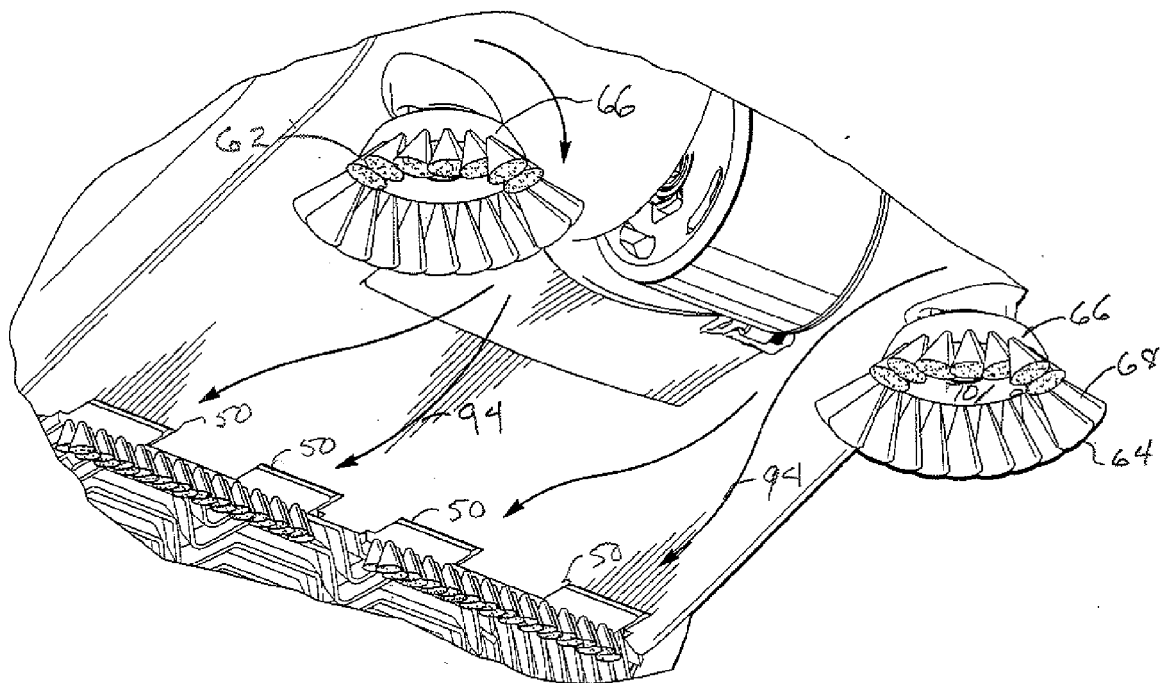
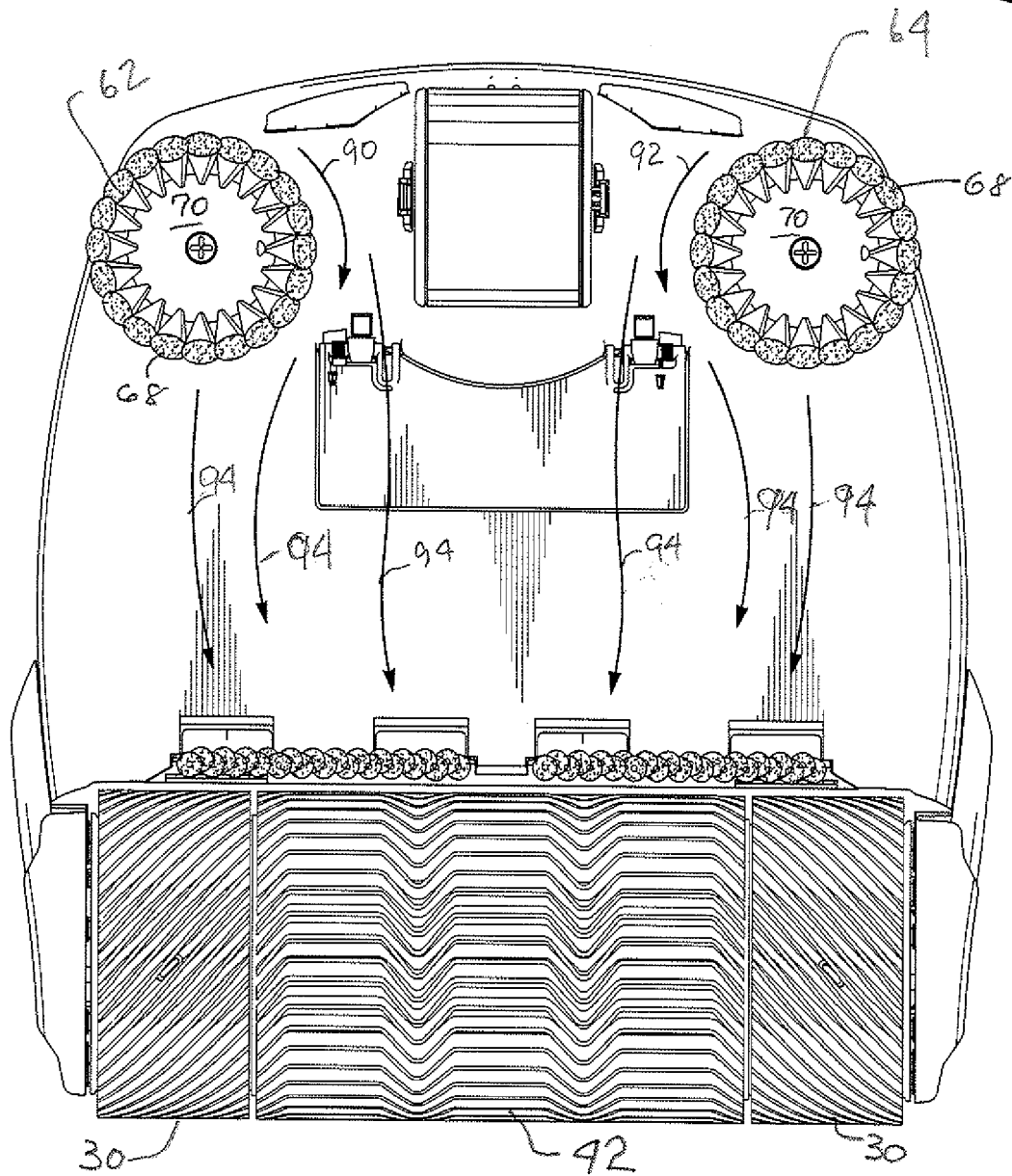


FIG. 4

FIG. 5



REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

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