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(54) **DISHWASHER PUMP APPARATUS WITH A SOUND ABSORBING LAYER**

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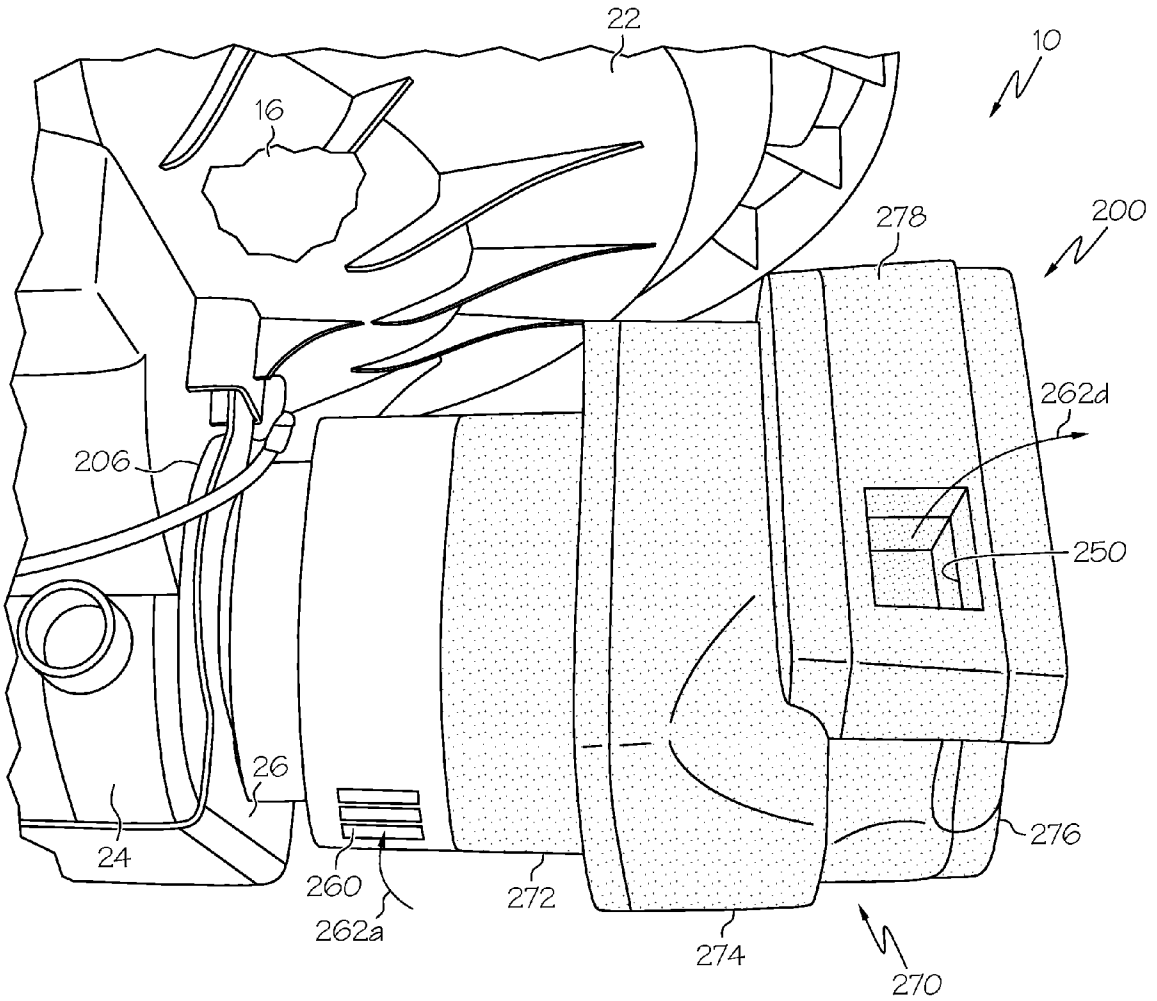
(57) **ABSTRACT**

A dishwasher pump apparatus includes a liquid pump member, a motor operably connected to the liquid pump member and a cooling fan configured to cool the motor. The cooling fan includes an outer fan housing. Example dishwasher pump apparatus can further include an outer sound absorbing layer at least partially encapsulating at least one of an outer motor housing and the outer fan housing. Further examples, the outer fan housing can include an exhaust portion defining an exhaust path. An inner sound absorbing layer can line an inner area of the exhaust portion.



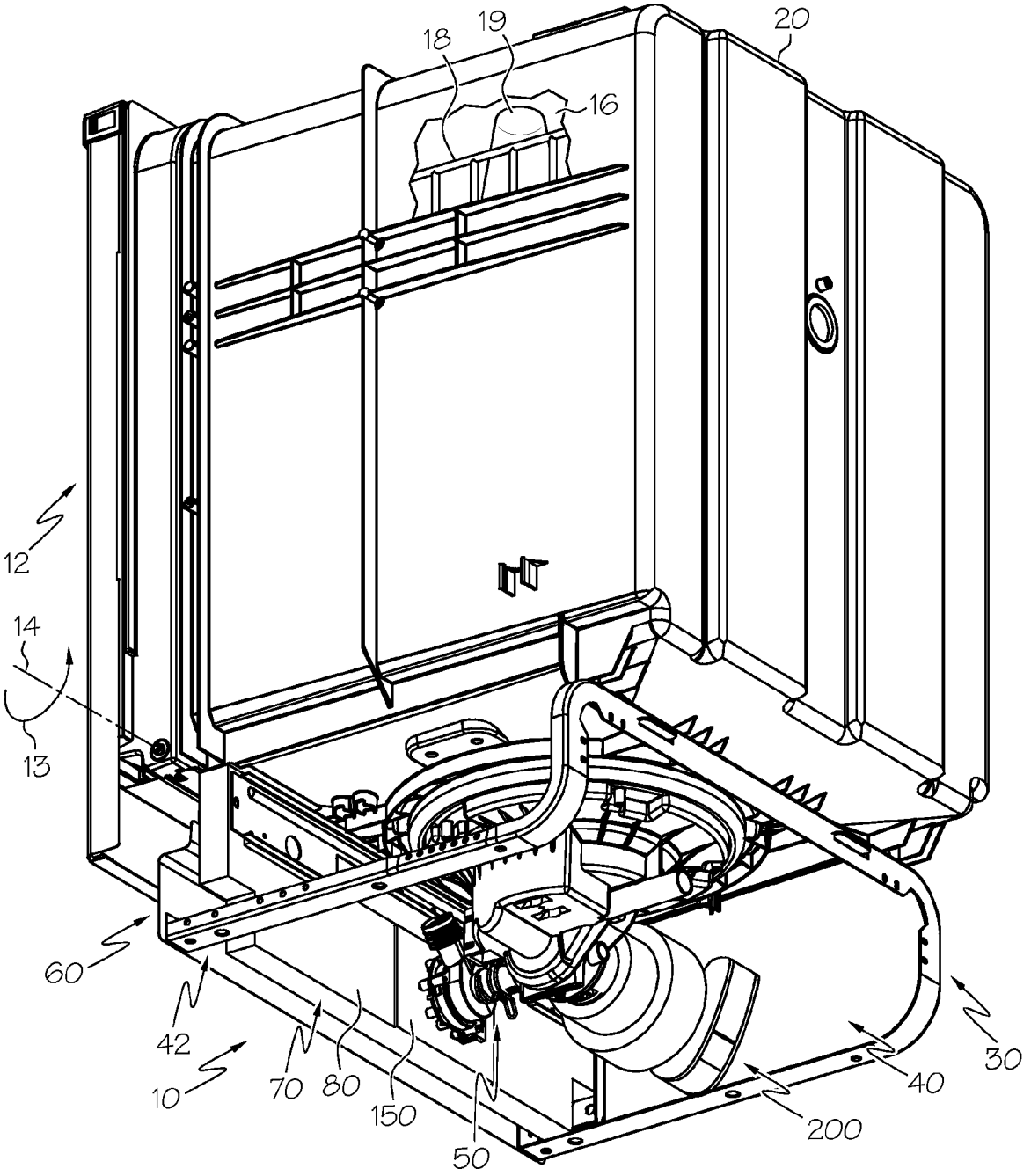


FIG. 1

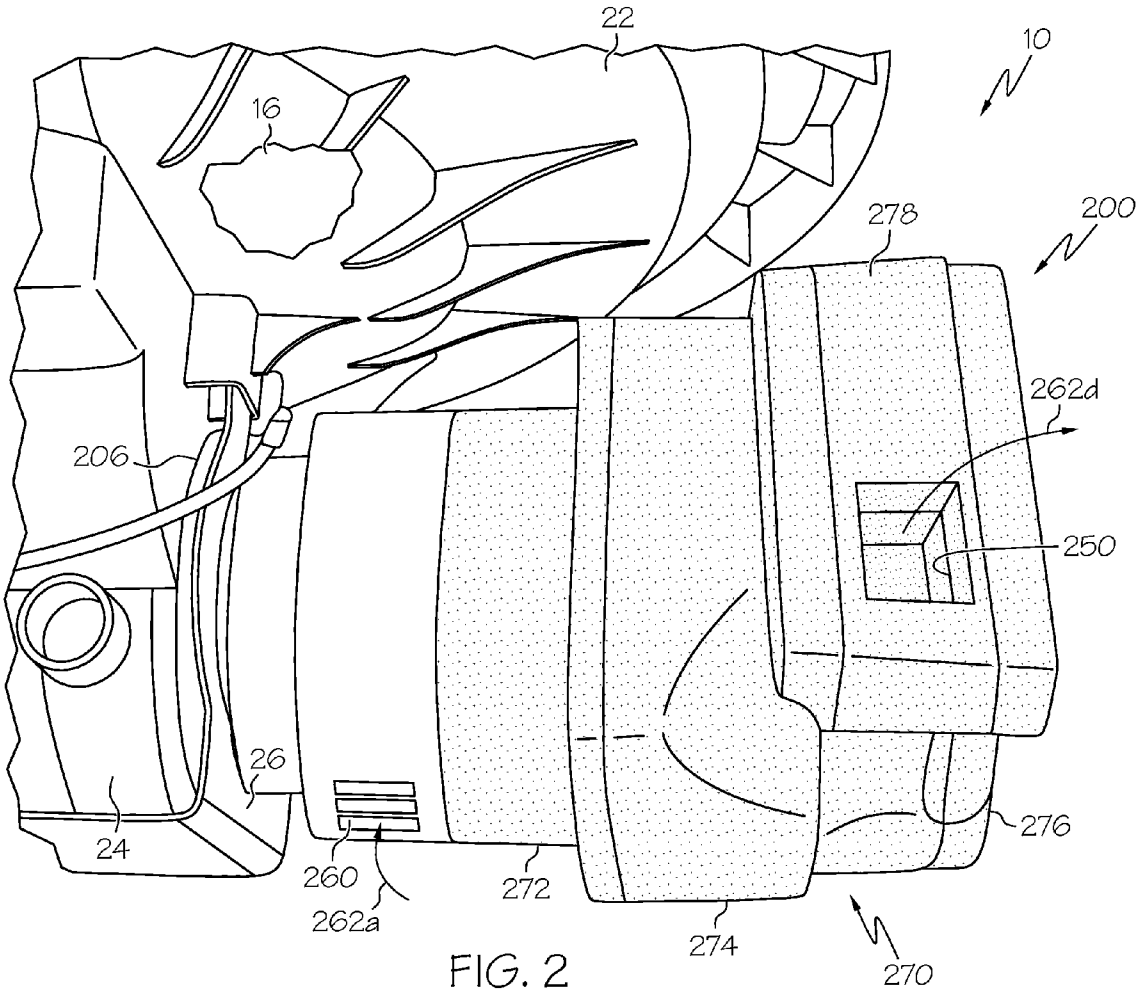


FIG. 2

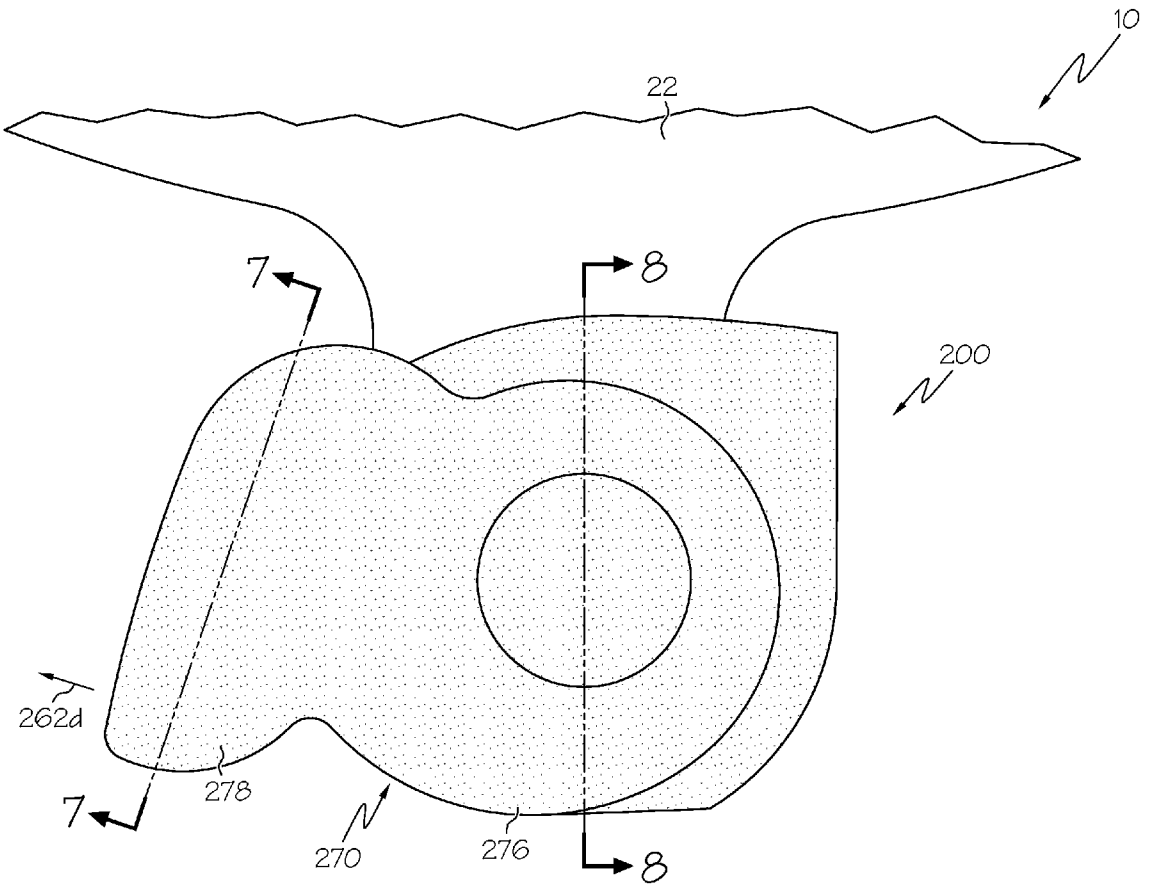


FIG. 3

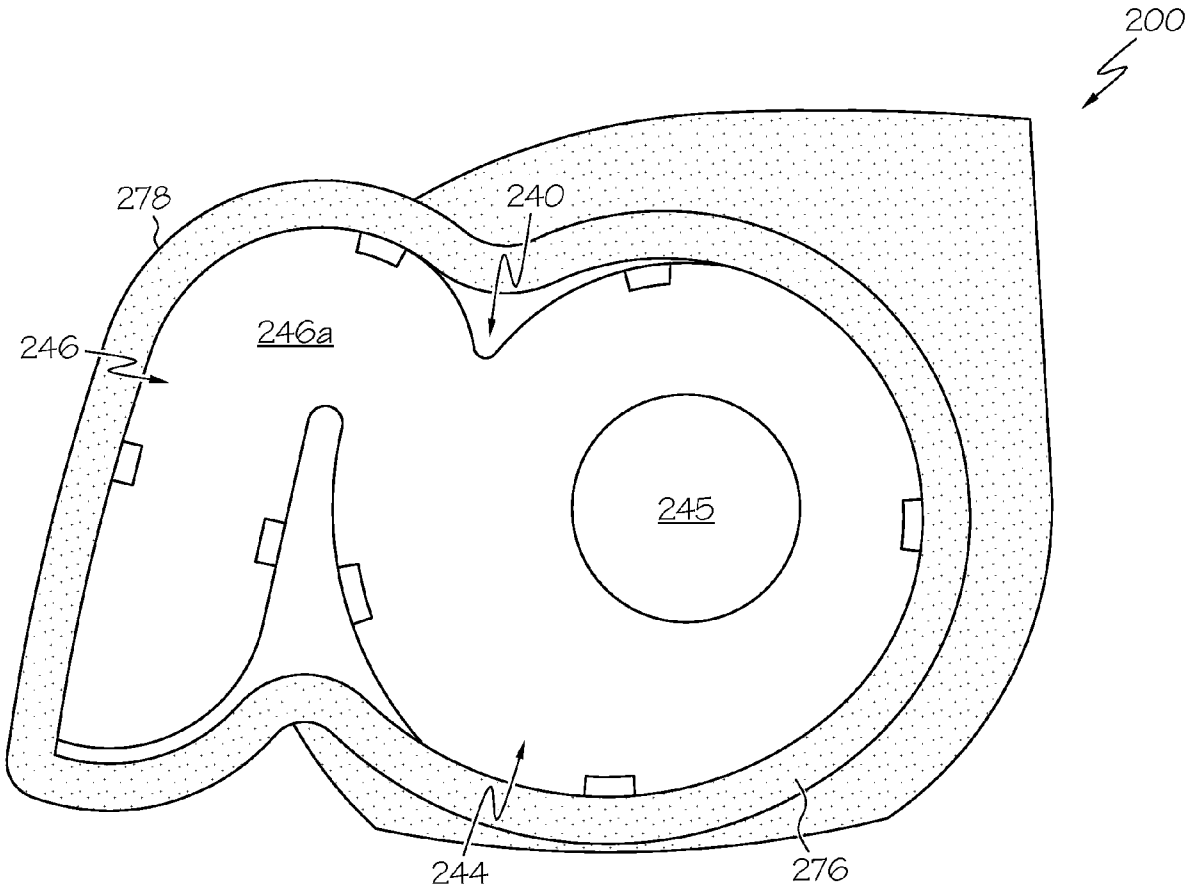


FIG. 4

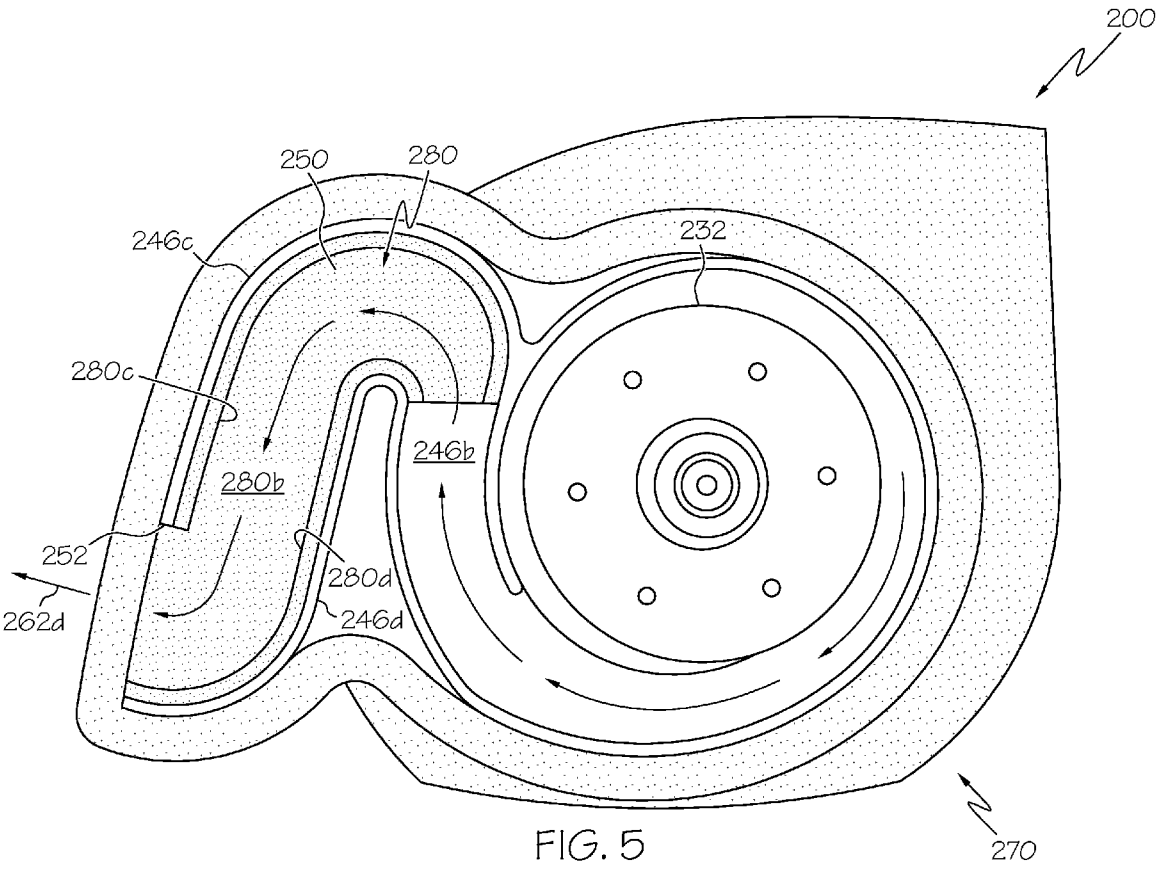


FIG. 5

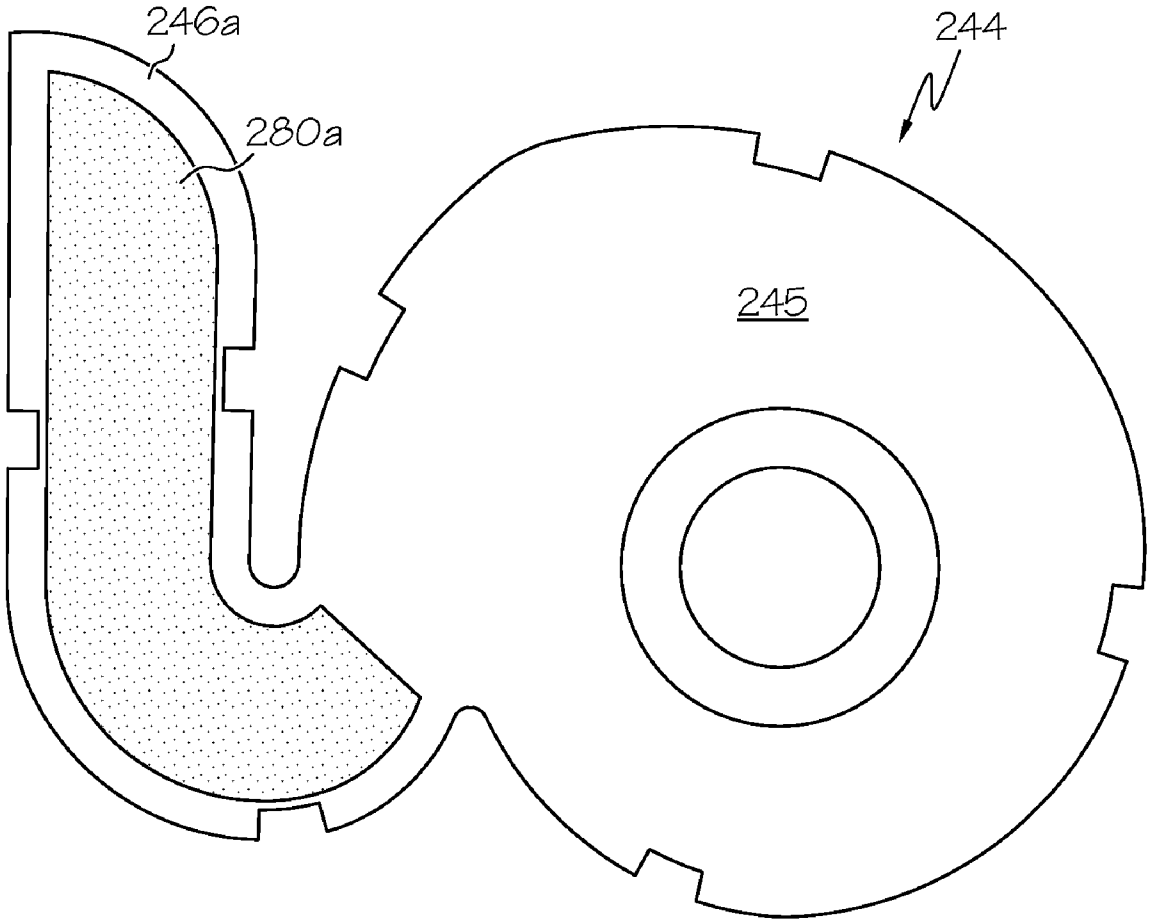


FIG. 6

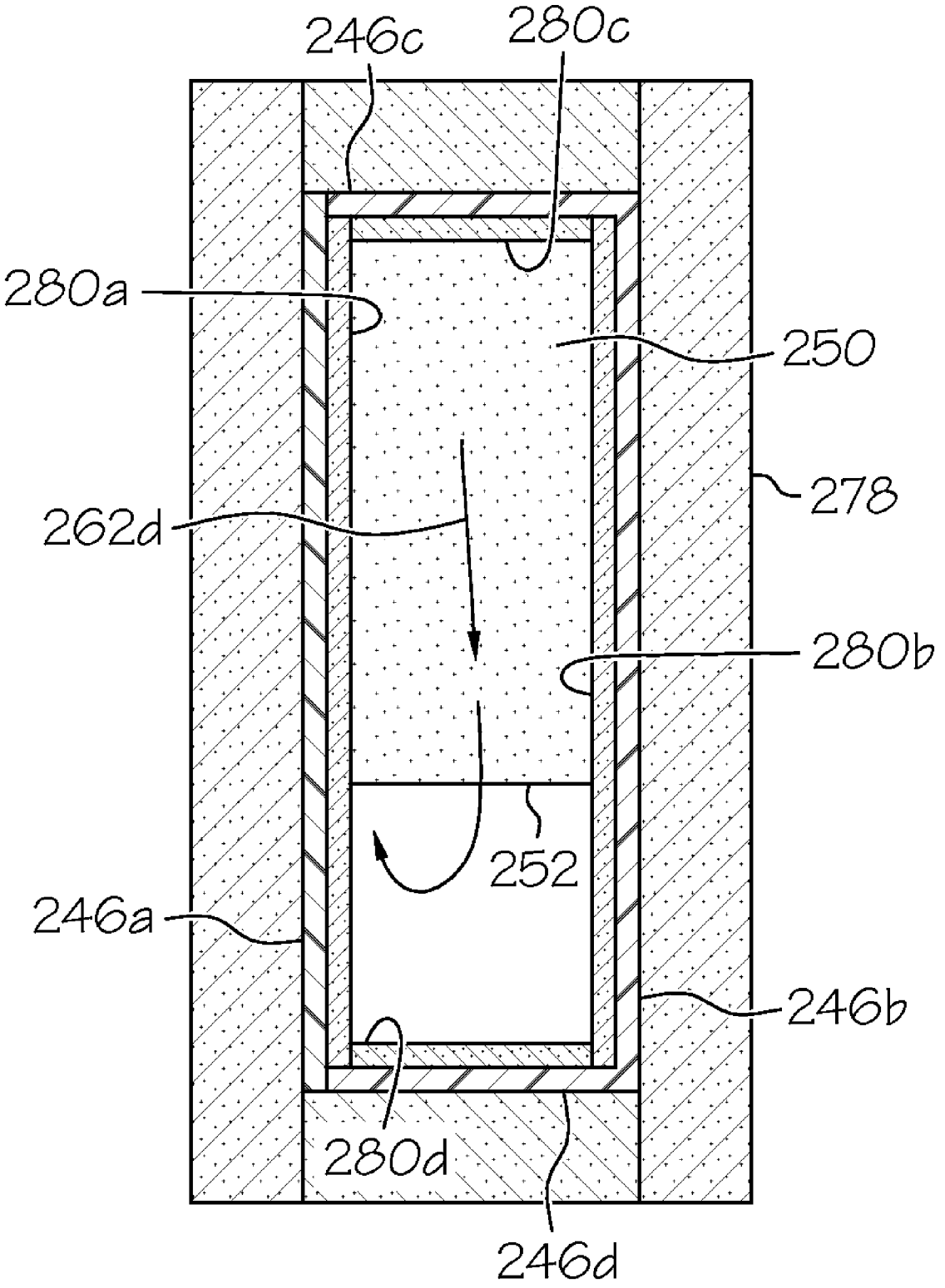


FIG. 7

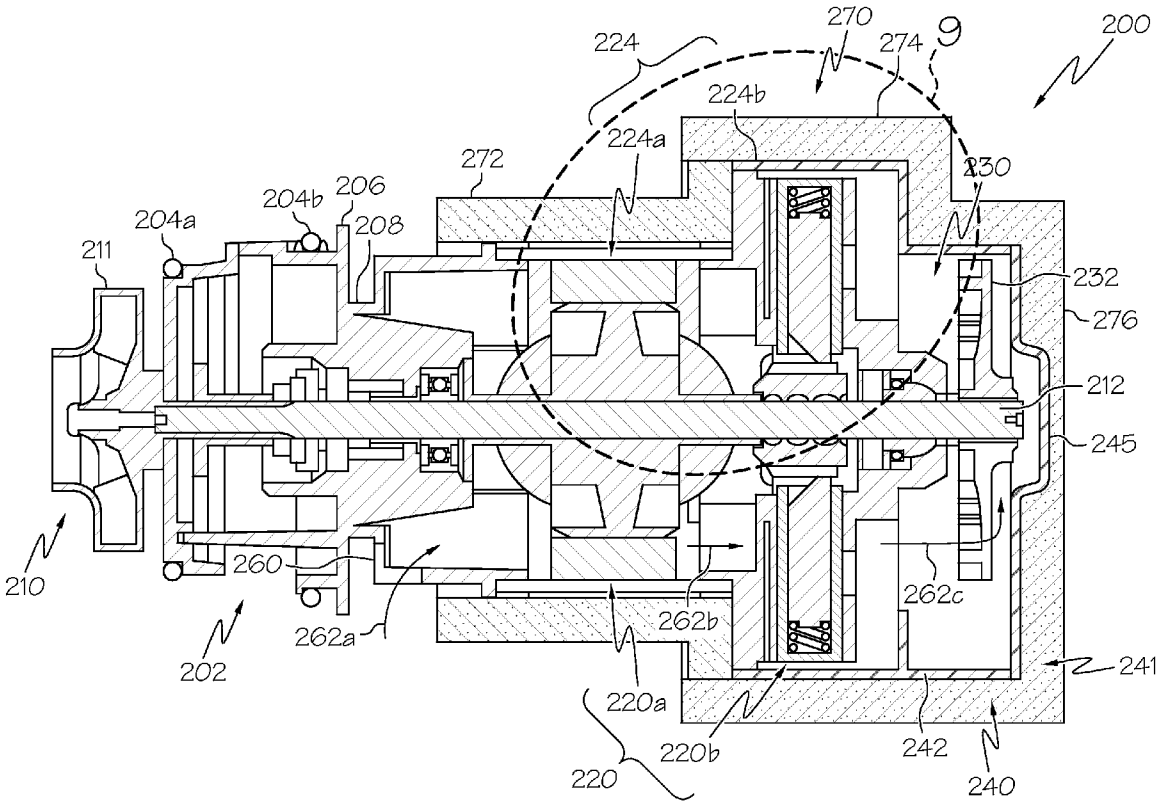

200
270
274
9
224
224b
224a
272
230
204b
206
204a
208
211
232
276
212
245
210
260
262a
262b
262c
202
241
220a
220b
242
240
220

FIG. 8

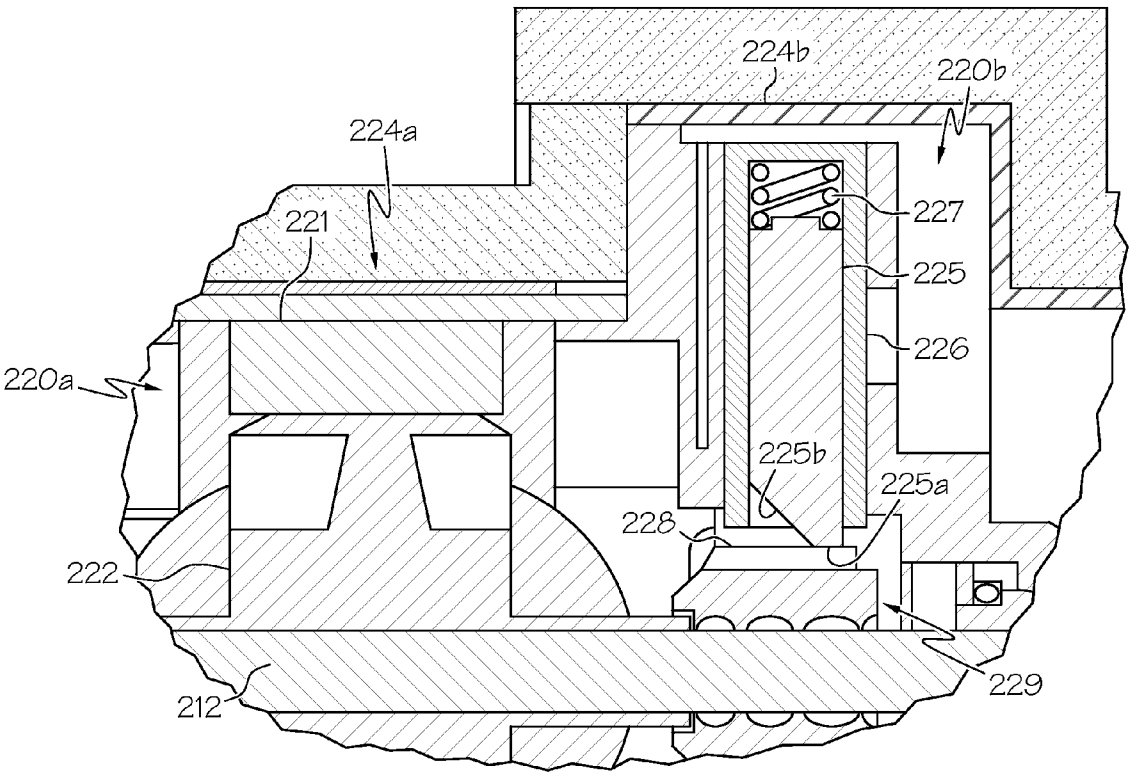


FIG. 9

DISHWASHER PUMP APPARATUS WITH A SOUND ABSORBING LAYER

FIELD OF THE INVENTION

[0001] The present invention relates generally to dishwasher pump apparatus, and more particularly, to dishwasher pump apparatus including a sound absorbing layer.

BACKGROUND OF THE INVENTION

[0002] Conventional dishwashers frequently include a motor cavity located underneath a wash tub. Components located within the motor cavity typically produce sound that may pass to the surrounding environment. One such component can comprise a dishwasher pump apparatus. While a dishwasher pump apparatus can be effective to facilitate dishwasher operation, there is a need to reduce sound typically produced by the dishwasher pump apparatus.

BRIEF SUMMARY OF THE INVENTION

[0003] The following presents a simplified summary of the invention in order to provide a basic understanding of some example aspects of the invention. This summary is not an extensive overview of the invention. Moreover, this summary is not intended to identify critical elements of the invention nor delineate the scope of the invention. The sole purpose of the summary is to present some concepts of the invention in simplified form as a prelude to the more detailed description that is presented later.

[0004] In accordance with one aspect of the present invention, a dishwasher pump apparatus includes a liquid pump member, a motor operably connected to the liquid pump member, a cooling fan configured to cool the motor and an outer sound absorbing layer. The motor includes an outer motor housing and the cooling fan includes an outer fan housing. The outer sound absorbing layer at least partially encapsulates at least one of the outer motor housing and the outer fan housing.

[0005] In accordance with another aspect of the present invention, a dishwasher pump apparatus includes a liquid pump member, a motor operably connected to the liquid pump member and a cooling fan configured to cool the motor. The cooling fan includes an outer fan housing with an exhaust portion defining an exhaust path. The dishwasher pump apparatus further includes an inner sound absorbing layer lining an inner area of the exhaust portion.

[0006] In accordance with still another aspect of the present invention, a dishwasher pump apparatus includes a liquid pump member, a motor operably connected to the liquid pump member, a cooling fan configured to cool the motor and an outer sound absorbing layer. The motor includes an outer motor housing and the cooling fan includes an outer fan housing. The outer fan housing includes an exhaust portion defining an exhaust path. The outer sound absorbing layer at least partially encapsulates the outer motor housing and the outer fan housing.

BRIEF DESCRIPTION OF THE DRAWINGS

[0007] The foregoing and other aspects of the present invention will become apparent to those skilled in the art to which the present invention relates upon reading the following description with reference to the accompanying drawings, in which:

[0008] FIG. **1** is a perspective view of a dishwasher including an example dishwasher pump apparatus in accordance with example aspects of the present invention;

[0009] FIG. **2** is a rear perspective view of portions of the dishwasher and dishwasher pump apparatus of FIG. **1**;

[0010] FIG. **3** is a side view of portions of the dishwasher and dishwasher pump apparatus of FIG. **1** including an outer motor housing and an outer fan housing being at least partially encapsulated by an outer sound absorbing layer;

[0011] FIG. **4** depicts the side view of the dishwasher pump apparatus of FIG. **3** with a portion of the outer sound absorbing layer being removed to illustrate a side member of the underlying outer fan housing;

[0012] FIG. **5** depicts the side view of the dishwasher pump apparatus of FIG. **4** with the side member being removed to illustrate an exhaust path and a fan blade rotor of the cooling fan;

[0013] FIG. **6** depicts an inner surface of the side member of the outer fan housing;

[0014] FIG. **7** is a sectional view of the dishwasher pump apparatus along line **7-7** of FIG. **3**;

[0015] FIG. **8** is a partial sectional view of the dishwasher pump apparatus along line **8-8** of FIG. **3**; and

[0016] FIG. **9** is an enlarged view of portions of the sectional view of the dishwasher pump apparatus taken at view **9** of FIG. **8**.

DESCRIPTION OF EXAMPLE EMBODIMENTS

[0017] Example embodiments that incorporate one or more aspects of the present invention are described and illustrated in the drawings. These illustrated examples are not intended to be a limitation on the present invention. For example, one or more aspects of the present invention can be utilized in other embodiments and even other types of devices. Moreover, certain terminology is used herein for convenience only and is not to be taken as a limitation on the present invention. Still further, in the drawings, the same reference numerals are employed for designating the same elements. The drawings can further include portions illustrated in somewhat schematic form.

[0018] FIG. **1** depicts one example of a dishwasher **10** incorporating a dishwasher pump apparatus **200** in accordance with aspects of the present invention. Dishwasher **10** may include a wash tub **20** configured to receive a wide range of articles for conducting a dishwasher operation. For example, the wash tub **20** may be designed to receive and support articles such as pots, pans, plates, bowls, utensils (e.g., knives, forks, spoons, spatulas, ladles, etc.), glassware, drinking vessels (e.g., cups, mugs, glasses, stemware, etc.) or the like. As shown in the broken away portion in FIG. **1**, for example, the dishwasher **10** may include an inner area **16** configured to receive and support one or more articles, for example, as discussed above. In one example, a dishwasher rack **18** may be positioned within the inner area to receive articles such as the illustrated cup **19**.

[0019] Various wash tubs **20** may be used in accordance with aspects of the present invention. In the illustrated example, the wash tub **20** comprises a side loading tub arrangement although top loading or other arrangements may be incorporated in further examples. The tub **20** can comprise a variety of materials such as plastic, metal, or other material types. The tub **20** includes an opening that may be provided with a closure, such as a dishwasher door **12**. The dishwasher door **12** can be designed to pivot from the closed orientation

illustrated in FIG. **1** to an open orientation (not shown) by grasping a handle and pivoting the dishwasher door **12** in direction **13** about a pivot axis **14**.

[0020] The dishwasher **10** can also include a motor cavity **40** configured to receive one or more dishwasher components therein. For example, the motor cavity **40** can be configured to at least partially receive circulation motors, fluid input motors, or other motors. As shown in FIG. **1**, a drain motor **50** may be positioned within the motor cavity **40**. The motor cavity **40** can be defined at one or more various locations of the dishwasher **10**. For example, the motor cavity may be located above, behind, at a side or other locations of the dishwasher. As shown, the motor cavity **40** can be located at least partially beneath the wash tub **20** of the dishwasher **10**.

[0021] The dishwasher **10** can be configured to rest on a support surface, such as the floor of a room. In further examples, the dishwasher **10** can be supported by other support surfaces such as a shelf, table top, portion of a cabinet, surface of another appliance, or the like. As shown in FIG. **1**, it will be appreciated that the motor cavity **40** can be at least partially positioned between a portion of the wash tub **20** and the support surface. In addition, or alternatively, the motor cavity **40** may be positioned at one or more other alternative locations in further examples.

[0022] The motor cavity **40** can be provided in a wide variety of ways. For instance, the dishwasher **10** can include a frame **30** configured to support the wash tub **20** to help define the motor cavity. Indeed, the frame **30** is configured to support the wash tub **20** at an elevated position with respect to the support surface to define the motor cavity **40** underneath the wash tub **20**. The motor cavity **40** can provide room for the drain motor **50**, the dishwasher pump apparatus **200** and/or other components of the dishwasher **10**. In addition, or alternatively, the frame **30** can also be configured to support the dishwasher door **12** relative to the wash tub **20**. In such examples, the frame **30** can be designed to withstand forces applied by the wash tub **20** and/or the dishwasher door **12**. The frame **30**, if provided, can be fabricated from various materials capable of supporting components of the dishwasher **10**. For example, the frame **30** may be comprise of metal, plastic, ceramic, composite, and/or other material sufficient to provide support for the wash tub **20** and/or the dishwasher door **12**.

[0023] Dishwasher **10** can further include a cover member **60** configured to substantially cover an access opening **42** into the motor cavity **40**. The cover member **60** can be configured to be removably attached with respect to the frame **30** and/or other components of the dishwasher **10** to permit selective access to the motor cavity **40** by way of the access opening **42**. Access to the motor cavity may be desirable to clean the support surface underlying the dishwasher **10** can also facilitate servicing of the dishwasher components located within the motor cavity **40**. Various structures may be provided to permit selective removal of the cover member **60**. It is still further contemplated that the cover member **60** may be designed to permanently seal off the access opening in still further examples.

[0024] As further illustrated, the dishwasher **10** can further include an optional sound absorbing device **70**. The sound absorbing device **70** can include a sound absorbing element **80** configured to absorb sound originating from components within the motor cavity **40** from being emitted through the cover member **60**. In one example, the sound absorbing element **80** can comprise an acoustical insulation blanket that may be formed from an acoustical insulating mat formed from a fibrous material. In one example, the fibrous material can comprise fibrous polyester configured to provide sound-absorbing properties. Although a wide range of materials may be used, one type of sound absorbing element **80** can comprise a VersaMat® acoustical insulation blanket sold by Owens Corning.

[0025] As further shown, the sound absorbing element **80** can include an acoustical insulation blanket with a first side attached to the cover member **60**. Adhesive strip, hook and loop type fastener or other mechanical fastening apparatus may be used to provide removable attachment of the sound absorbing element to the cover member **60**. The sound absorbing element **80** may also include a wide variety of shapes and sizes depending on the particular application. For example, the sound absorbing element **80** may have cut out areas configured to provide significant coverage over the cover member **60** while providing clearance for frame or other components of the dishwasher **10**.

[0026] The sound absorbing device **70**, if provided, can further include a motor guard **150**. The motor guard **150** can be designed to thermally shield the sound absorbing element **80** from the drain motor **50**. Thus, the motor guard **150** can help protect the sound absorbing element from thermal damage due to heat from the drain motor **50**. In addition, or alternatively, the motor guard **150** can provide a dielectric shield between the drain motor **50** and the sound absorbing element **80**. Thus, the motor guard **150** can act to inhibit, such as prevent, electrical current from passing from the drain motor to the sound absorbing element **80**. Still further, the motor guard **150** can be configured to transmit vibrational energy from the drain motor **50** to the sound absorbing element **80**. For example, the drain motor **50** may engage the motor guard **150** such that vibrational energy from the drain motor **50** is transmitted through the motor guard **150** to the sound absorbing element **80**. Once transmitted, the sound absorbing element **80** can absorb the vibrational energy, thereby inhibiting release of sound from the motor cavity **40**.

[0027] The motor guard **150** can be fabricated from a wide range of materials, sizes and/or configurations to provide the desired thermal shielding, dielectric shielding and/or noise transmission characteristics. In one example, the motor guard **150** can comprise a talc filled copolymer polypropylene although other material types may be used in further examples. The talc filled copolymer polypropylene or other material can be formed as a substantially rigid material with a density of approximately 1.39 g/cm^3, although other material characteristics may be provided in further examples.

[0028] The motor guard **150** can be attached to the second side of the sound absorbing element **80** an adhesive, mechanical fastener or other attachment mechanism. As shown, the motor guard **150** can also be attached such that a portion of the motor guard **150** is positioned between a portion of the drain motor **50** and a portion of the sound absorbing element **80**. As further shown in the drawings, a portion of the sound absorbing element **80** can be positioned between a portion of the cover member **60** and the motor guard **150**.

[0029] The motor guard **150** can cover an area of the second side of the sound absorbing element **80** (e.g., acoustical insulation blanket). In one example, the motor guard **150** can be configured to cover less than the entire area of the second side of the acoustical insulation blanket. For instance, the motor guard **150** can be designed to substantially cover less than about 75% of the area of the acoustical insulation blanket. In

further examples, the motor guard **150** can be designed to substantially cover less than about 50% of the area of the acoustical insulation blanket. In still further examples, the motor guard **150** can be designed to substantially cover less than about 25% of the area of the acoustical insulation blanket. In still further examples, the motor guard **150** can be designed to substantially cover about 20% of the area of the acoustical insulation blanket. Reducing the coverage of the motor guard over the second area can reduce the material costs of the motor guard **150** while still providing desirable thermal shielding, dielectric shielding and/or noise transmission characteristics.

[0030] As discussed previously, the dishwasher **10** can further provide the dishwasher pump apparatus **200** in the motor cavity **40**. It will be appreciated that the dishwasher pump apparatus **200** may be located at least partially or entirely outside of the motor cavity **40** in further examples.

[0031] FIGS. **2-9** illustrate features of the dishwasher pump apparatus **200** in accordance with examples of the present invention. The dishwasher pump apparatus **200** is configured to pump liquid during a dishwasher operation. For example, the dishwasher pump apparatus **200** can comprise a circulation pump configured to pump liquid to a rotating spray arm or other dispensing devices positioned in the inner area **16** of the dishwasher **10**. The dishwasher pump apparatus **200** can be designed to pump liquid during a washing cycle, rinsing cycle, or other dishwasher operation.

[0032] FIG. **8** is a partial sectional view of the dishwasher pump apparatus **200** in somewhat schematic form. As shown in FIG. **8**, the dishwasher pump apparatus **200** includes a liquid pump member **210**. The illustrated liquid pump member **210** comprises a pump rotor **211** that may cooperate with housing portions to form a circulation path. The circulation path may be formed entirely by the dishwasher pump apparatus **200** or may at least partially be formed by portions of the wash tub **20** after connecting the dishwasher pump apparatus **200** to the tub **20**. For example, as shown in FIG. **8**, the dishwasher pump apparatus **200** can include a coupling structure **202** with a pair of O-ring liquid seals **204***a*, **204***b* and a stop flange **206** extending adjacent a mounting groove **208**. As shown in FIG. **2**, the dishwasher pump apparatus **200** can be installed by inserting the pump rotor **211** into an interior area of a circulation pump housing **24** integrally formed with a sump **22** of the wash tub **20**. The pump rotor **211** is inserted until the O-ring liquid seals **204***a*, **204***b* provide a fluid tight seal between the circulation pump housing **24** and the dishwasher pump apparatus **200**. A mounting bracket **26** can then be used to engage mounting grooves **208**. Once secured, the mounting bracket **26** maintains the fluid tight connection between the dishwasher pump apparatus **200** and the circulation pump housing **24**. Thus, as shown in FIG. **2**, structures of the dishwasher **10** and dishwasher pump apparatus **200** allow the dishwasher pump apparatus **200** to be operatively connected to the inner area **16** of the dishwasher **10**.

[0033] The dishwasher pump apparatus **200** can further include a motor **220** operably connected to the liquid pump member **210**. Various motors can be used in accordance with aspects of the present invention. For example, as shown in FIGS. **8** and **9**, the motor **220** can include an electric motor comprising a first motor portion **220***a* and a second motor portion **220***b*. The first motor portion **220***a* can include a magnet **221** secured to a first outer motor housing portion **224***a* and a rotor **222** secured to a drive shaft **212**. The second motor portion **220***b* can include a pair of graphite brush members **225** that are each movably mounted within a respective sleeve **226**. Respective springs **227** can bias end portions **225***a* of the respective graphite brush members **225** to engage corresponding electrical contacts **228** of a commutator **229** attached to the drive shaft **212**. The graphite brush members **225** can each include a beveled portion **225***b* designed to reduce the area of the end portion **225***a* engaging the electrical contacts **228**. Reducing the area of the end portions **225***a* can be beneficial to reduce the motor noise produced by the engagement between the end portions **225***a* and the respective electrical contacts **228** as the drive shaft **212** rotates.

[0034] As shown in FIG. **8**, the drive shaft **212** operably connects the motor **220** to the liquid pump member **210** to allow rotational energy to be transmitted from the motor **220** to the pump rotor **211** of the liquid pump member **210**. In operation, the motor **220** can provide the power source to permit the liquid pump member **210** to work the liquid when circulation is desired. As further shown in FIG. **8**, in some examples, the motor **220** can include an outer motor housing **224** configured to house at least a portion of one or more motor components. For example, the first motor portion **220***a* can include the first outer motor housing portion **224***a* configured to house the magnet **221** and rotor **222** of the first motor portion **220***a*. As further shown, the second motor portion **220***b* can include a second outer motor housing portion **224***b* configured to house the graphite brush members **225** and commutator **229** of the second motor portion **220***b*. The outer motor housing **224** can be configured to protect the motor components from being damaged during handling and/or other contact the might otherwise occur. In addition or alternatively, the outer motor housing **224** may help electrically and/or thermally insulate the motor components from the surrounding environment. The outer motor housing **224** can comprise various materials such as a polymeric material, metal, resin, composite or combination thereof or other materials suitable for housing motor components.

[0035] The dishwasher pump apparatus **200** can further include a cooling fan **230** configured to cool the motor **220**. The cooling fan **230** can include a tangential fan rotor **232** configured to draw air through an interior area of the dishwasher pump apparatus **200**. In further examples, a centrifugal fan rotor, an axial fan rotor or other types of fan components may be used to produce the desired air flow. The cooling fan **230** can receive power in a wide variety of ways. For example, the cooling fan **230** may be powered by an independent source. In further examples, as shown, the motor **220** can be further operably connected to the fan rotor **232**. For instance, as shown in FIG. **8**, the drive shaft **212** further operably connects the motor **220** to the fan rotor **232** to allow rotational energy to be transmitted from the motor **220** to the fan rotor **232**. In the illustrated embodiment, therefore, the motor **220** simultaneously powers both the liquid pump member **210** and the cooling fan **230** by way of the common drive shaft **212**.

[0036] The cooling fan **230** can further include an outer fan housing **240** configured to house at least a portion of the fan rotor **232** and/or at least partially define an exhaust path **250**. For instance, the outer fan housing **240** can be configured to protect the fan rotor **232** from being damaged during handling and/or other contact might otherwise occur with the fan rotor **232**. As shown in FIG. **8**, the outer fan housing **240** can comprise a shroud **241** including a circumferential portion **242** and a side portion **245** that cooperate to at least partially shroud the fan rotor **232**.

[0037] In addition or alternatively, at least a portion of the outer fan housing **240** may be configured to define an exhaust path. For example, as shown in FIGS. **4-7**, the outer fan housing **240** includes an exhaust portion **246** that at least partially defines an exhaust path **250**. The exhaust portion **246** can be formed by various structural arrangements. For example, the exhaust portion **246** can include first and second opposed walls **246***a*, **246***b* attached to third and fourth opposed walls **246***c*, **246***d*. The walls can be integrally formed together or may be formed separately and then attached together. In the illustrated embodiment, the second, third and forth walls **246***b*, **246***c*, **246***d* are integrally formed together and the first wall **246***a* is configured to be subsequently attached to the third and fourth walls **246***c*, **246***d*. The exhaust portion **246** of the outer fan housing **240** can further define an exhaust port **252** in fluid communication with the exhaust path **250**.

[0038] The exhaust path **250** can include various profiles in accordance with aspects of the present invention. In one example, the exhaust path can extend along a linear path or a curved path. As shown, in one example, the exhaust path **250** can comprise a serpentine-shaped exhaust path **250**.

[0039] As shown in FIGS. **4** and **6**, the outer fan housing **240** can also include a side member **244** including the first wall **246***a* of the exhaust portion **246** and the side portion **245** of the shroud **241**. The side member **244** is configured to be subsequently attached to other portions of the outer fan housing **240** to facilitate assembly of the dishwasher pump apparatus **200**. For example, as shown in FIG. **5**, prior to installation of the side member **244**, areas of the exhaust path **250** and the fan rotor **232** can be exposed. At the appropriate time, the side member **244** may be installed to conceal these areas. The outer fan housing **240** can comprise various materials such as a polymeric material, metal, resin, composite or combination thereof or other materials suitable for housing the fan rotor **232**.

[0040] In further examples, the dishwasher pump apparatus **200** can include an optional outer sound absorbing layer **270** that at least partially encapsulates at least one of the outer motor housing **224** and the outer fan housing **240**. In one example, the outer sound absorbing layer **270** only at least partially encapsulates the outer motor housing **224**. In another example, the outer sound absorbing layer **270** only at least partially encapsulates the outer fan housing **240**. As shown in the illustrated embodiment, the outer sound absorbing layer **270** at least partially encapsulates the outer motor housing **224** and the outer fan housing **240**. Still further, the outer sound absorbing layer **270** can at least partially encapsulate other portions of the dishwasher pump apparatus.

[0041] The outer sound absorbing layer **270** can at least partially encapsulate the outer motor housing **224**. For example, as shown in FIGS. **2** and **8**, the outer sound absorbing layer **270** can include a first portion **272** at least partially encapsulating the first outer motor housing portion **224***a*. The first portion **272** of the sound absorbing layer **270** can extend around a part of the first outer motor housing portion **224***a* or entirely circumscribe the first outer motor housing portion **224***a*. In the illustrated example, the first portion **272** entirely circumscribes the first outer motor housing **224***a*. In addition or alternatively, the first portion **272** can partially or entirely circumscribe the magnet **221** and rotor **222** of the first motor portion **220***a*. In the illustrated example, the first portion **272** entirely circumscribes the magnet **221** and rotor **222** of the first motor portion **220***a*.

[0042] As further shown in FIGS. **2** and **8**, the outer sound absorbing layer **270** can include a second portion **274** at least partially encapsulating the second outer motor housing portion **224***b*. The second portion **274** of the sound absorbing layer **270** can extend around a part of the second outer motor housing portion **224***b* or entirely circumscribe the second outer motor housing portion **224***b*. In the illustrated example, the second portion **274** entirely circumscribes the second outer motor housing **224***b*. In addition or alternatively, the second portion **274** can partially or entirely circumscribe the graphite brush members **225** and the commutator **229**. In the illustrated example, the second portion **274** entirely circumscribes the graphite brush members **225** and the commutator **229** of the second motor portion **220***b*.

[0043] The outer sound absorbing layer **270** can at least partially encapsulate the outer fan housing **240** with a third portion **276** and/or a fourth portion **278**. For example, the third portion **276** of the sound absorbing layer **270** can at least partially or entirely encapsulate the shroud **241** of the outer fan housing **240**. Indeed, as shown in FIGS. **3** and **8**, the third portion **274** entirely encapsulates the circumferential portion **242** and the side portion **245** of the shroud **241**. In addition or alternatively, a fourth portion **278** can at least partially or entirely encapsulate the exhaust portion **246** of the outer fan housing **240**. Indeed, as shown in FIGS. **2**, **3** and **7**, the fourth portion **278** entirely encapsulates the first, second, third and fourth walls **246***a*, **246***b*, **246***c*, **246***d* of the exhaust portion **246**. The fourth portion **278** can also partially or entirely circumscribe the exhaust path **250** defined by the exhaust portion **246**. For example, as shown in FIG. **7**, the fourth portion **278** entirely circumscribes a portion of the exhaust path **250**.

[0044] In further examples, the dishwasher pump apparatus **200** can include an optional inner sound absorbing layer **280** lining an inner area of the exhaust portion **246** of the outer fan housing **240**. As shown in FIG. **5**, the inner sound absorbing layer **280** can extend from the exhaust port **252** in a direction upstream along the exhaust path **250**. Although not shown, further examples may place the sound absorbing layer **280** in other portions of the exhaust portion **246**. For example, the inner sound absorbing layer may extend from a position spaced away from the exhaust port **252** in a direction upstream along the exhaust path.

[0045] The inner sound absorbing layer **280** can also circumscribe the exhaust path **250** although the sound absorbing layer **280** may only partially extend around the exhaust path **250** in further examples. For instance, as shown in FIG. **7**, the inner sound absorbing layer **280** can include a first portion **280***a* lining an inner area of the first wall **246***a* of the exhaust portion **246** and a second portion **280***b* lining an inner area of the second wall **246***b* of the exhaust portion **246**. Likewise, the inner sound absorbing layer **280** can include a third portion **280***c* lining an inner area of the third wall **246***c* of the exhaust portion **246** and a fourth portion **280***d* lining an inner area of the fourth wall **246***d* of the exhaust portion **246**. It will be appreciated that the inner sound absorbing layer **280** can be designed to absorb sound from the outlet air stream **262***d* as the outlet air stream passes through the exhaust path **250** prior to exiting the exhaust port **252**.

[0046] The outer and/or inner sound absorbing layers **270**, **280** can comprise a wide variety of materials configured to absorb sound energy such as fibers or other insulation. In one example, one or both of the sound absorbing layers **270**, **280** comprise a porous material. In one example, an open-cell

foam and/or closed-cell foam may be used. In one example, an open-cell rubber, closed-cell rubber or other elastomeric and/or polymeric material may be used. Furthermore various porosity sizes may be used in accordance with different aspects of the present invention. In one example, the outer and inner sound absorbing layers both comprise a porous material wherein the average pore size of the inner sound absorbing layer is larger than the average pore size of the outer sound absorbing layer. In one example, at least one of the sound absorbing layers can comprise a chloroprene rubber, flexible closed-cell foam furnished in sheets or blocks having a density range of 0.13-0.23 g/cm^3 available as type C-4305(x) from Inoac Corp of Japan.

[0047] The inner and/or outer layer of sound absorbing material may be attached in a variety of ways to the housings. For example, as shown, the sound absorbing material may be cut in sheets and adhered with adhesive to the outer surface and/or inner surfaces of the housing portions. Various adhesives, epoxy or other attachment mechanisms may be used in accordance with the present invention.

[0048] One example method of operating the dishwasher pump apparatus **200** will now be described. During a dishwasher operation, the motor **220** is energized. The motor rotates the drive shaft **212** which in turn rotates the pump rotor **211** of the liquid pump member **210**. The liquid pump of the dishwasher **10** can then circulate liquid within the inner area **16** of the dishwasher to perform the dishwasher operation. Rotation of the drive shaft **212** also simultaneously rotates the fan rotor **232** of the cooling fan **230**. As shown in FIGS. **2** and **8**, the rotating fan rotor **232** causes an inlet air stream **262***a* to enter an inlet port **260** of the dishwasher pump apparatus **200**. As apparent in FIG. **8**, the air stream passes through the first motor portion **220***a* (see reference number **262***b*) to cool the first motor portion **220***a*. Next, the air stream passes through the second motor portion **220***b* (see reference number **262***c*) to cool the second motor portion **220***b*. Once the air stream has passed through the motor **220**, an exhaust air stream **262***d* passes along the exhaust path **250** from the motor **220**. The exhaust air stream **262***d* then passes exits the dishwasher pump apparatus **200** by passing through the exhaust port **252**. It will be appreciated that noise may be carried by the air stream as it passes through the pump **220**. Such noise can be absorbed by the inner sound absorbing layer **280** prior to exiting the exhaust port **252**. Moreover, noise passing through the outer motor housing **224** and/or the outer fan housing, can be absorbed by the outer sound absorbing layer **270**.

[0049] The invention has been described with reference to the example embodiments described above. Modifications and alterations will occur to others upon a reading and understanding of this specification. Examples embodiments incorporating one or more aspects of the invention are intended to include all such modifications and alterations insofar as they come within the scope of the appended claims.

What is claimed is:

1. A dishwasher pump apparatus configured to pump liquid during a dishwasher operation, the dishwasher pump apparatus including:

a liquid pump member;

a motor operably connected to the liquid pump member, the motor including an outer motor housing;

a cooling fan configured to cool the motor, the cooling fan including an outer fan housing; and

an outer sound absorbing layer at least partially encapsulating at least one of the outer motor housing and the outer fan housing.

2. The dishwasher pump apparatus of claim **1**, wherein an exhaust portion of the outer fan housing defines an exhaust path, wherein the outer sound absorbing layer at least partially encapsulates the exhaust portion.

3. The dishwasher pump apparatus of claim **2**, further comprising an inner sound absorbing layer lining an inner area of the exhaust portion.

4. The dishwasher pump apparatus of claim **3**, wherein at least a portion of the exhaust path is circumscribed by the inner sound absorbing layer.

5. The dishwasher pump apparatus of claim **3**, wherein the inner sound absorbing layer comprises a porous material.

6. The dishwasher pump apparatus of claim **3**, wherein the cooling fan includes a fan rotor and the outer fan housing includes a shroud with a circumferential portion and a side portion that cooperate to at least partially shroud the fan rotor, wherein the outer sound absorbing layer at least partially encapsulates the shroud of the outer fan housing.

7. The dishwasher pump apparatus of claim **1**, wherein the outer sound absorbing layer comprises a porous material.

8. The dishwasher pump apparatus of claim **1**, wherein the cooling fan includes a fan rotor and the outer fan housing includes a shroud with a circumferential portion and a side portion that cooperate to at least partially shroud the fan rotor.

9. The dishwasher pump apparatus of claim **8**, wherein the outer sound absorbing layer at least partially encapsulates the shroud.

10. A dishwasher including the dishwasher pump apparatus of claim **1**, the dishwasher including an inner area configured to receive articles, wherein the dishwasher pump apparatus is operatively connected to the inner area of the dishwasher.

11. A dishwasher pump apparatus configured to pump liquid during a dishwasher operation, the dishwasher pump apparatus including:

a liquid pump member;

a motor operably connected to the liquid pump member; and

a cooling fan configured to cool the motor, the cooling fan including an outer fan housing including an exhaust portion defining an exhaust path, and an inner sound absorbing layer lining an inner area of the exhaust portion.

12. The dishwasher pump apparatus of claim **11**, wherein at least a portion of the exhaust path is circumscribed by the inner sound absorbing layer.

13. The dishwasher pump apparatus of claim **11**, wherein the inner sound absorbing layer comprises a porous material.

14. A dishwasher including the dishwasher pump apparatus of claim **11**, the dishwasher including an inner area configured to receive articles, wherein the dishwasher pump apparatus is operatively connected to the inner area of the dishwasher.

15. A dishwasher pump apparatus configured to pump liquid during a dishwasher operation, the dishwasher pump apparatus including:

a liquid pump member;

a motor operably connected to the liquid pump member, the motor including an outer motor housing;

a cooling fan configured to cool the motor, the cooling fan including an outer fan housing with an exhaust portion defining an exhaust path; and

an outer sound absorbing layer at least partially encapsulating the outer motor housing and the outer fan housing.

16. The dishwasher pump apparatus of claim **15**, further comprising an inner sound absorbing layer lining an inner area of the exhaust portion.

17. The dishwasher pump apparatus of claim **16**, wherein at least a portion of the exhaust path is circumscribed by the inner sound absorbing layer.

18. The dishwasher pump apparatus of claim **15**, wherein the outer sound absorbing layer at least partially encapsulates the exhaust portion.

19. The dishwasher pump apparatus of claim **18**, wherein the cooling fan includes a fan rotor and the outer fan housing includes a shroud with a circumferential portion and a side portion that cooperate to at least partially shroud the fan rotor, wherein the outer sound absorbing layer at least partially encapsulates the shroud.

20. A dishwasher including the dishwasher pump apparatus of claim **15**, the dishwasher including an inner area configured to receive articles, wherein the dishwasher pump apparatus is operatively connected to the inner area of the dishwasher.

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