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(54) Apparatus for circulating coolant in turbocharger

Vorrichtung zum Zirkulieren von Kühlmittel in einem Turbolader

Appareil pour faire circuler un réfrigérant dans un turbocompresseur

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## Description

### BACKGROUND OF INVENTION

#### Field of Invention

**[0001]** The present invention relates to an apparatus for circulating a coolant in a turbocharger, and more particularly to an apparatus for circulating a coolant which prevents factors causing noise made by a coolant flowing into a turbocharger by structurally stopping the coolant from flowing into a hot turbocharger in idling state of a vehicle that is started again.

#### Description of Related Art

**[0002]** When the engine is stopped after a vehicle is driven, the coolant in a turbocharger is evaporated and discharged and the turbocharger keeps hot.

**[0003]** FIG. 1 shows a circulation system of a coolant for a turbocharger according to the related art, in which when a vehicle is started again with a state of hot turbocharger 1, shock waves are generated due to boiling-over of a coolant flowing into the hot turbocharger 1, so resultant vibration is transmitted to a heater core 2 and noise is generated.

**[0004]** In order to reduce the noise, in the related art, an electric water pump was further used to reduce boiling-over of a coolant by reducing the temperature of a bearing housing, by continuously supplying the coolant to a turbocharger for a predetermined time even after an engine is started.

**[0005]** However, there was a problem in the related art in that an electric water pump is additionally used, so the cost and weight are increased. Document EP 0 383 172 A2, furthermore, discloses a fluid cooling system for an engine in which a turbocharger is connected with a cooling circuit by means of a feed line and a return line and a check valve is arranged on the feed line. Document EP 2 557 292 A1 discloses a fluid-cooled engine in which a connecting line is connected with a venting tank at a location that is exposed to fluid coolant. Document US 6 213 062 B1 discloses a cooling system for an engine having a main cooling system for cooling the engine and a sub-cooling system for cooling a supercharger.

**[0006]** The information disclosed in this Background section is only for enhancement of understanding of the general background of the invention and should not be taken as an acknowledgement or any form of suggestion that this information forms the prior art already known to a person skilled in the art.

### SUMMARY OF INVENTION

**[0007]** The present invention has been made in an effort to provide an apparatus for circulating a coolant in a turbocharger which prevents factors causing noise made by a coolant flowing into a turbocharger by structurally

stopping the coolant from flowing into a hot turbocharger in idling state of a vehicle that is started again.

**[0008]** The present invention provides an apparatus for circulating a coolant in a turbocharger as defined in claim 1. Further advantageous embodiments are set out in the dependent claims.

**[0009]** One end of the first coolant line may be connected to the water pump and the other end is connected to the turbocharger, and the first flow resistance member may be formed by having the first coolant line longer than a minimum length between the water pump and the turbocharger. The first flow resistance member may be formed by bending a middle portion of the first coolant line, by bending a middle portion of the first coolant line at two or more positions, and/or by having a highest position of a middle portion of the first coolant line higher than a position of the other end of the first coolant line connected to the turbocharger.

**[0010]** According to the present invention, it is possible to eliminate or reduce the noise caused by the coolant flowing into the turbocharger by structurally stopping the coolant from flowing into the turbocharger at a high temperature, using the first coolant line and/or the second coolant line, when starting again a vehicle.

**[0011]** Further, it is possible to preclude noise from being transmitted to the interior due to shock sound or shock wave transmitted into the engine, even if shock noise due to boiling of the coolant is transmitted to the turbocharger, by connecting the second coolant line to the coolant line for the engine.

**[0012]** It is understood that the term "vehicle" or "vehicular" or other similar term as used herein is inclusive of motor vehicles in general such as passenger automobiles including sports utility vehicles (SUV), buses, trucks, various commercial vehicles, watercraft including a variety of boats and ships, aircraft, and the like, and includes hybrid vehicles, electric vehicles, plug-in hybrid electric vehicles, hydrogen-powered vehicles and other alternative fuel vehicles (e.g. fuels derived from resources other than petroleum). As referred to herein, a hybrid vehicle is a vehicle that has two or more sources of power, for example both gasoline-powered and electric-powered vehicles.

**[0013]** The apparatuses of the present invention have other features and advantages which will be apparent from or are set forth in more detail in the accompanying drawings, which are incorporated herein, and the following Detailed Description, which together serve to explain certain principles of the present invention.

### BRIEF DESCRIPTION OF THE DRAWINGS

**[0014]** The above and other features of the present invention will now be described in detail with reference to certain exemplary embodiments thereof illustrated the accompanying drawings which are given hereinbelow by way of illustration only, and thus are not limitative of the present invention, and wherein:

FIG. 1 is a view illustrating the circulation system of a coolant for a turbocharger according to the related art;

FIG. 2 is a view illustrating a configuration of an exemplary apparatus for circulating a coolant in a turbocharger according to the present invention;

FIG. 3 is a view showing an exemplary first coolant line according to the present invention; and

FIG. 4 is a view illustrating a structure of an exemplary orifice in a second coolant line according to the present invention.

**[0015]** It should be understood that the appended drawings are not necessarily to scale, presenting a somewhat simplified representation of various features illustrative of the basic principles of the invention. The specific design features of the present invention as disclosed herein, including, for example, specific dimensions, orientations, locations, and shapes will be determined in part by the particular intended application and use environment.

**[0016]** In the figures, reference numbers refer to the same or equivalent parts of the present invention throughout the several figures of the drawing.

## DETAILED DESCRIPTION

**[0017]** FIG 2 is a view illustrating the configuration of an apparatus for circulating a coolant in a turbocharger, FIG. 3 is a view showing an example of a first coolant line, and FIG. 4 is a view illustrating the structure of an orifice in a second coolant line 22 according to various embodiments of the present invention.

**[0018]** An apparatus for circulating a coolant largely includes a first coolant line 12 and a first flow resistance member. Referring to FIG. 2, the apparatus for circulating a coolant in a turbocharger of the present invention includes: a first coolant line 12 for supplying a coolant to a turbocharger 20 from a water pump 10; and a first flow resistance member disposed in the first coolant line 12 and increasing flow resistance against the coolant flowing through the first coolant line 12. The first coolant line 12 may be a coolant pipe through which a coolant can flow.

**[0019]** That is, when a vehicle stops traveling, the turbocharger 20 is hot due to high-speed rotation of a turbine and the temperature of the exhaust gases, and when the engine of the vehicle is stopped, a water pump 10 is also stopped and the coolant in a bearing housing is evaporated and discharged by the high temperature of the turbocharger 20.

**[0020]** Then, when the engine 30 becomes idle by starting again the vehicle before the temperature of the turbocharger 20 drops, the water pump 10 operates and starts pumping the coolant, but a head loss in the first

coolant line 12 is increased by the first flow resistance member in the first coolant line 12 and the coolant is prevented from being supplied to the turbocharger 20 through the first coolant line 12.

**[0021]** Accordingly, it is possible to prevent factors causing noise made by a coolant flowing into the turbocharger 20 by structurally stopping the coolant from flowing into the high-temperature turbocharger 20, when starting again a vehicle.

**[0022]** In this process, the coolant cannot flow into the turbocharger 20 with the engine 30 keeping idling, and an increase in temperature of the turbocharger 20 is very small in the idle state even though the coolant cannot flow into the turbocharger, so a problem due to overheating is not generated in the turbocharger 20.

**[0023]** However, when the vehicle travels at a predetermined speed or more, the pumping pressure of the water pump 10 increases and the coolant flows into the turbocharger 20, but in this case, the boiling noise of the coolant generated in the turbocharger is absorbed in the environment noise due to traveling of the vehicle, so it is not a problem.

**[0024]** On the other hand, in the present invention, one end of the first coolant line 12 may be connected to the water pump 10 and the other end may be connected to the turbocharger 20. That is, both ends of the first coolant line 12 are connected to the exit of the water pump 10 and the inlet of the turbocharger 20, respectively, and accordingly, the coolant pumped by the water pump 10 can be supplied to the turbocharger 20 through the first coolant line 12.

**[0025]** FIG. 3 is a view showing an example of the first coolant line 12. Referring to FIG. 3, the first flow resistance member may be formed by having the length of the first coolant line 12 longer than the minimum length between the water pump 10 and the turbocharger 20.

**[0026]** In detail, in the first flow resistance member, the middle portion of the first coolant line 12 is configured to be bent and the length of the first coolant line 12 becomes longer than the minimum length, so the head loss in the first coolant line 12 increases, thereby increasing flow resistance against the coolant. Further, the middle portion of the first coolant line 12 may be configured to be bent at two or more positions. That is, it may be bent at the middle portion in an approximate U-shape. Further, the highest position of the middle portion of the first coolant line 12 may be higher than the position of the other end of the first coolant line 12 connected to the turbocharger 20.

**[0027]** That is, the coolant should rise up to a position higher than the position where the coolant flows into the turbocharger 20 in order for the coolant discharged from the water pump 10 to be supplied to the turbocharger 20, so the flow resistance against the coolant flowing through the first coolant line 12 can be more increased.

**[0028]** The present invention may further include a second coolant line 22 for circulating a coolant from the turbocharger 20 to the engine 30. The second coolant line

22 may be a coolant pipe through which a coolant can flow.

[0029] In detail, one end of the second coolant line 22 may be connected to the turbocharger 20 and the other end may be connected to a coolant circulation channel 32 connected between the water pump 10 and the engine 30. The coolant circulation channel 32 may be an inlet pipe. That is, both ends of the second coolant line 22 are connected to the exit of the turbocharger 20 and the engine 30, respectively, so the coolant that has passed through the turbocharger 20 can be circulated to the engine 30 through the second coolant line 22.

[0030] Accordingly, even if shock sound is transmitted to the turbocharger 20, the shock sound is transmitted not to a heater core 40, but into the engine 30; therefore, noise is not transmitted to the heater core 40, so noise is precluded from being transmitted to the interior.

[0031] Further, the present invention may further include a second flow resistance member that is disposed in the second coolant line 22 and increases flow resistance against the coolant flowing through the second coolant line 22.

[0032] FIG. 4 is a view illustrating the structure of an orifice 24 in the second coolant line 22 according to the present invention. Referring to FIG. 4, in the second flow resistance member, an orifice 24 with an inner diameter smaller than the inner diameter of the second coolant line 22 may be disposed at an end of the second coolant line 22.

[0033] That is, the orifice 24 making the channel for coolant smaller is disposed in the second coolant line 22, so the head loss increases not only in the second coolant line 22, but also in the first coolant line 12, and accordingly, the coolant is further prevented from flowing into the turbocharger 20 in idling of a vehicle that is started again.

[0034] For convenience in explanation and accurate definition in the appended claims, the terms "inner" or "outer", "higher" or "lower", and etc. are used to describe features of the exemplary embodiments with reference to the positions of such features as displayed in the figures.

## Claims

1. An apparatus for circulating a coolant in a turbocharger (20) to prevent noise made by a coolant flowing into the turbocharger (20), comprising:

a first coolant line (12) for supplying the coolant to the turbocharger (20) from a water pump (10) driven by an engine (30), and configured to form a first flow resistance member to increase flow resistance to the coolant flowing through the first coolant line (12),  
the apparatus further comprises a second coolant line (22) for circulating the coolant from the

turbocharger (20) to the engine (30) and a second flow resistance member that is disposed in the second coolant line (22) and increases flow resistance against the coolant flowing through the second coolant line (22),  
wherein the second flow resistance member includes an orifice (24) that has an inner diameter smaller than an inner diameter of the second coolant line (22) and is disposed at an end of the second coolant line (22), characterized in that by means of the first coolant line and the second coolant line the coolant is structurally stopped from flowing into the high-temperature turbocharger (20) in an idling state of the engine (30) when a vehicle is started again.

2. The apparatus of claim 1, wherein one end of the first coolant line (12) is connected to the water pump (10) and the other end is connected to the turbocharger (20), and  
the first flow resistance member is formed by having the first coolant line (12) longer than a minimum length between the water pump (10) and the turbocharger (20).
3. The apparatus of claim 1 or 2, wherein the first flow resistance member is formed by bending a middle portion of the first coolant line (12).
4. The apparatus of claim 1 or 2, wherein the first flow resistance member is formed by bending a middle portion of the first coolant line (12) at two or more positions.
5. The apparatus of any of the claims 1 to 4, wherein the first flow resistance member is formed by having a highest position of a middle portion of the first coolant line (12) higher than a position of the other end of the first coolant line (12) connected to the turbocharger (20).
6. The apparatus of claim 1, wherein one end of the second coolant line (22) is connected to the turbocharger (20) and the other end is connected to a coolant circulation channel (32) connected between the water pump (10) and the engine (30).

## Patentansprüche

1. Eine Vorrichtung zum Zirkulieren eines Kühlmittels in einem Turbolader (20), um Geräusche zu verhindern, die durch das Einfüllen eines Kühlmittels in den Turbolader (20) entstehen, aufweisend:  
eine erste Kühlmittelleitung (12) zum Zuführen des Kühlmittels zu dem Turbolader (20) von einer durch einen Motor (30) angetriebenen Was-

- serpumpe (10), und die ausgebildet ist, um ein erstes Fließwiderstandelement zu bilden, um den Fließwiderstand für das durch die erste Kühlmittelleitung (12) fließende Kühlmittel zu erhöhen,  
 wobei die Vorrichtung ferner eine zweite Kühlmittelleitung (22) zum Zirkulieren des Kühlmittels von dem Turbolader (20) zu dem Motor (30) und ein zweites Fließwiderstandelement aufweist, welches in der zweiten Kühlmittelleitung (22) angeordnet ist und den Fließwiderstand gegen das durch die zweite Kühlmittelleitung (22) fließende Kühlmittel erhöht,  
 wobei das zweite Fließwiderstandelement eine Öffnung (24) aufweist, deren innerer Durchmesser kleiner ist als ein innerer Durchmesser der zweiten Kühlmittelleitung (22) und welche an einem Ende der zweiten Kühlmittelleitung (22) angeordnet ist, **dadurch gekennzeichnet, dass** durch die erste Kühlmittelleitung und die zweite Kühlmittelleitung das Kühlmittel, in einem Leerlaufzustand des Motors (30), strukturell an einem Fließen in den Hoch-Temperatur-Turbolader (20) gehindert wird, wenn ein Fahrzeug erneut gestartet wird.
2. Die Vorrichtung gemäß Anspruch 1, wobei ein Ende der ersten Kühlmittelleitung (12) mit der Wasserpumpe (10) und das andere Ende mit dem Turbolader (20) verbunden ist, und  
 wobei das erste Fließwiderstandelement dadurch gebildet ist, dass die erste Kühlmittelleitung (12) länger ist als eine minimale Länge zwischen der Wasserpumpe (10) und dem Turbolader (20).
3. Die Vorrichtung gemäß Anspruch 1 oder 2, wobei das erste Fließwiderstandelement durch Biegen eines Mittelabschnitts der ersten Kühlmittelleitung (12) gebildet ist.
4. Die Vorrichtung gemäß Anspruch 1 oder 2, wobei das erste Fließwiderstandelement durch Biegen eines Mittelabschnitts der ersten Kühlmittelleitung (12) an zwei oder mehr Positionen gebildet ist.
5. Die Vorrichtung gemäß irgendeinem der Ansprüche 1 bis 4, wobei das erste Fließwiderstandelement dadurch gebildet ist, dass eine höchste Position eines Mittelabschnitts der ersten Kühlmittelleitung (12) höher ist als eine Position des anderen Endes der ersten Kühlmittelleitung (12), welches mit dem Turbolader (20) verbunden ist.
6. Die Vorrichtung gemäß Anspruch 1, wobei ein Ende der zweiten Kühlmittelleitung (22) mit dem Turbolader (20) verbunden ist und das andere Ende mit einem Kühlmittel-Zirkulationskanal (32) zwischen der Wasserpumpe (10) und dem Motor (30) verbunden

ist.

### Revendications

5. 1. Appareil destiné à faire circuler un fluide de refroidissement dans un turbocompresseur (20) de façon à éliminer le bruit que fait un fluide de refroidissement qui circule dans le turbocompresseur (20), comprenant :
- une première canalisation de fluide de refroidissement (12) destinée à approvisionner le turbocompresseur (20) en fluide de refroidissement en provenance d'une pompe à eau (10) entraînée par un moteur (30), et configurée de façon à former un premier élément de résistance à la circulation de manière à accroître la résistance à la circulation du fluide de refroidissement qui circule à travers la première canalisation de fluide de refroidissement (12) ;  
 l'appareil comprend en outre une seconde canalisation de fluide de refroidissement (22) destinée à faire circuler le fluide de refroidissement à partir du turbocompresseur (20) vers le moteur (30), et un second élément de résistance à la circulation qui est disposé dans la seconde canalisation de fluide de refroidissement (22) et qui accroît la résistance à la circulation du fluide de refroidissement qui circule à travers la seconde canalisation de fluide de refroidissement (22) ;  
 dans lequel le second élément de résistance à la circulation comprend un orifice (24) qui présente un diamètre intérieur inférieur au diamètre intérieur de la seconde canalisation de fluide de refroidissement (22), et qui est disposé au niveau d'une extrémité de la seconde canalisation de fluide de refroidissement (22), **caractérisé en ce que**, grâce à la première canalisation de fluide de refroidissement et à la seconde canalisation de fluide de refroidissement, la circulation du fluide de refroidissement est arrêtée de manière structurelle dans le turbocompresseur à haute température (20) dans un état de régime au ralenti du moteur (30) quand un véhicule est redémarré.
2. Appareil selon la revendication 1, dans lequel une extrémité de la première canalisation de fluide de refroidissement (12) est connectée à la pompe à eau (10), et l'autre extrémité est connectée au turbocompresseur (20) ; et  
 le premier élément de résistance à la circulation est formé en donnant à la première canalisation de fluide de refroidissement (12) une longueur supérieure à la longueur minimum entre la pompe à eau (10) et le turbocompresseur (20).

3. Appareil selon la revendication 1 ou la revendication  
2, dans lequel le premier élément de résistance à la circulation est formé en coudant une partie centrale de la première canalisation de fluide de refroidissement (12). 5
4. Appareil selon la revendication 1 ou la revendication  
2, dans lequel le premier élément de résistance à la circulation est formé en coudant une partie centrale de la première canalisation de fluide de refroidissement (12) en deux endroits ou plus. 10
5. Appareil selon l'une quelconque des revendications 1 à 4, dans lequel le premier élément de résistance à la circulation est formé en donnant à la position la plus élevée de la partie médiane de la première canalisation de fluide de refroidissement, une position plus élevée que la position de l'autre extrémité de la première canalisation de fluide de refroidissement (12) connectée au turbocompresseur (20). 15 20
6. Appareil selon la revendication 1, dans lequel une extrémité de la seconde canalisation de fluide de refroidissement (22) est connectée au turbocompresseur (20), et l'autre extrémité est connectée à un canal de circulation de fluide de refroidissement (32) connecté entre la pompe à eau (10) et le moteur (30). 25

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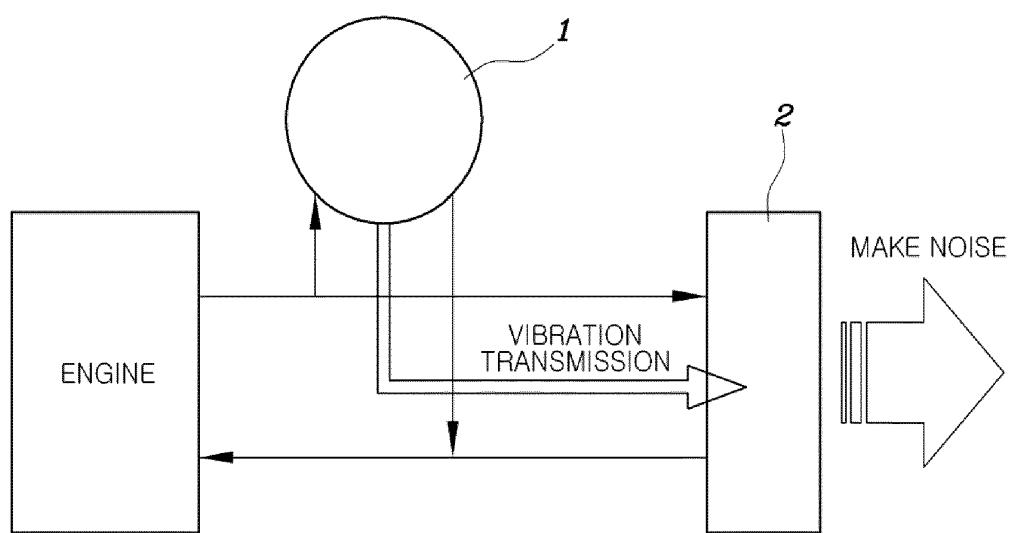
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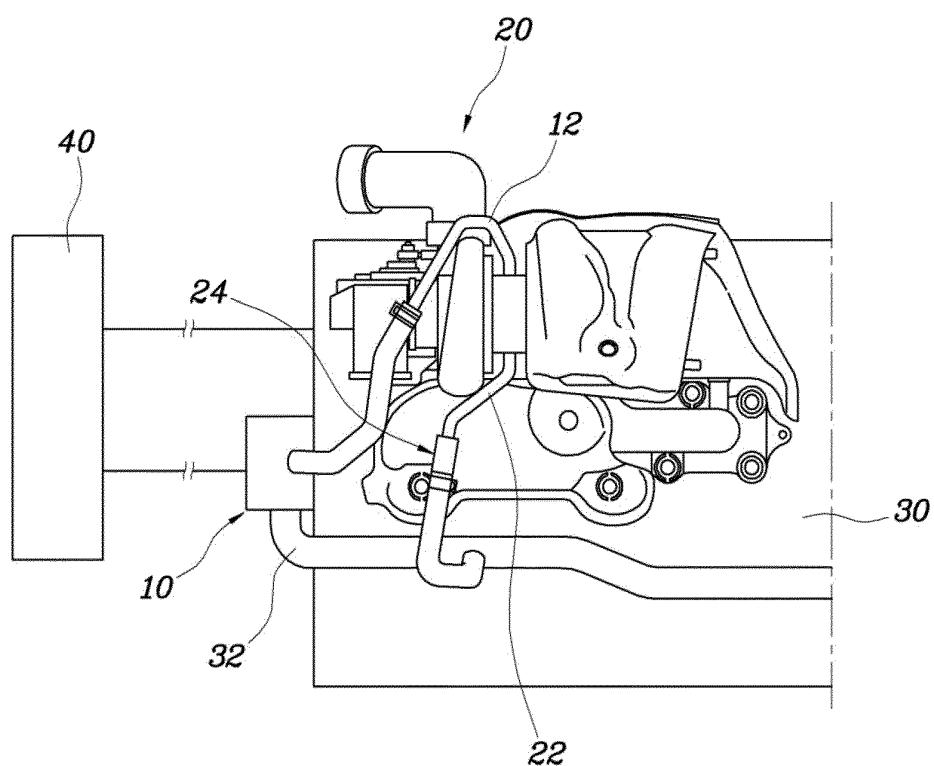
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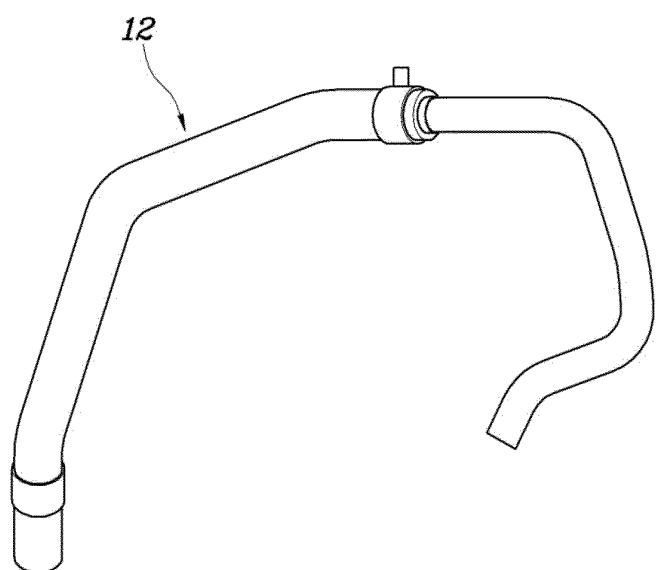
**FIG. 1**



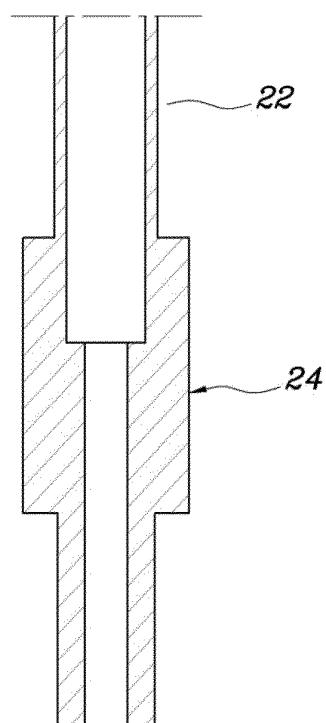
**FIG. 2**



***FIG. 3***



***FIG. 4***



**REFERENCES CITED IN THE DESCRIPTION**

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