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Zhong

(54) WATER COOLING PAPER SHREDDER

(76) Inventor: **Fengqiang Zhong**, Guangzhou (CN)

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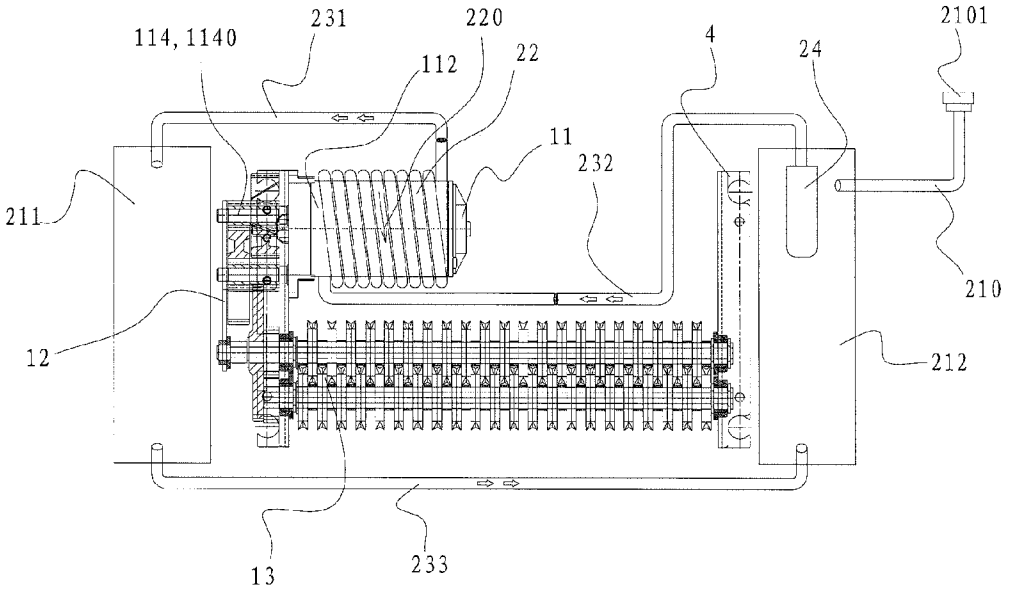
(57) **ABSTRACT**

The invention discloses a water cooling paper shredder which includes a power management unit; and a shredding mechanism. The shredding mechanism comprises a motor, a conveying mechanism and a pair of shredding rollers, the motor being powered by the power management unit, torque of the motor being transferred by the conveying mechanism to the pair of the shredding rollers, thus causing shredding action of the shredding rollers. A heat dissipation device is provided on the motor to conduct heat outside of the motor itself. The temperature of the stator portion can be reduced effectively by means of water cooling and finally, causing temperature reduction within the motor. Therefore, the paper shredder can be cooled with high efficiency.



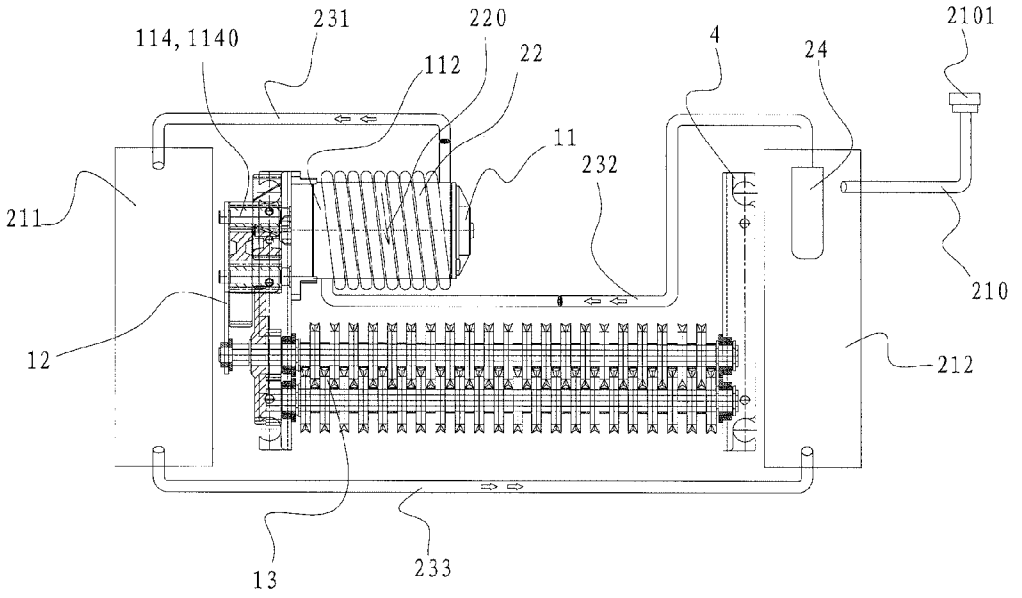


Figure 1

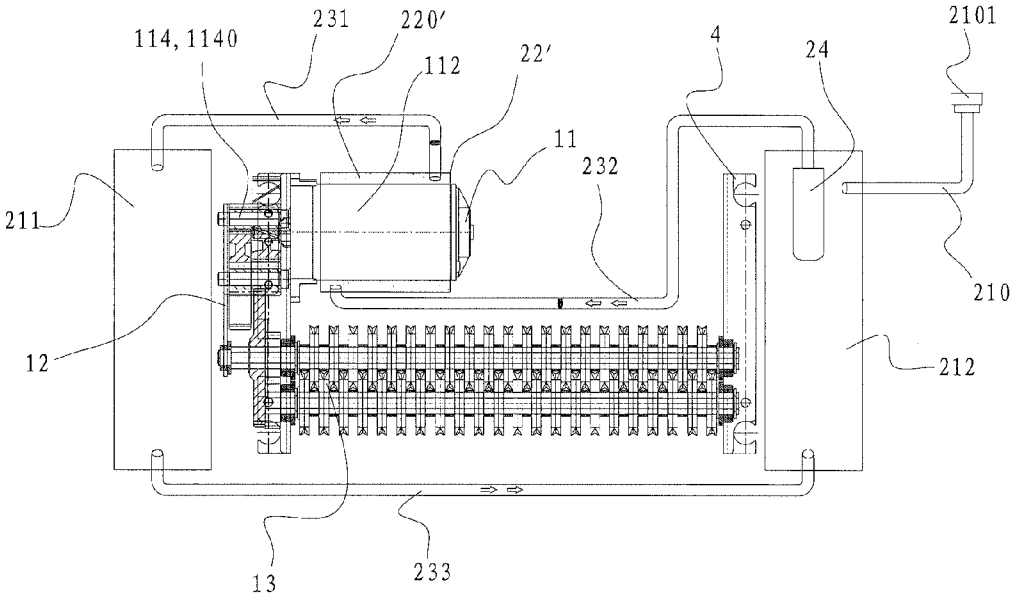


Figure 2

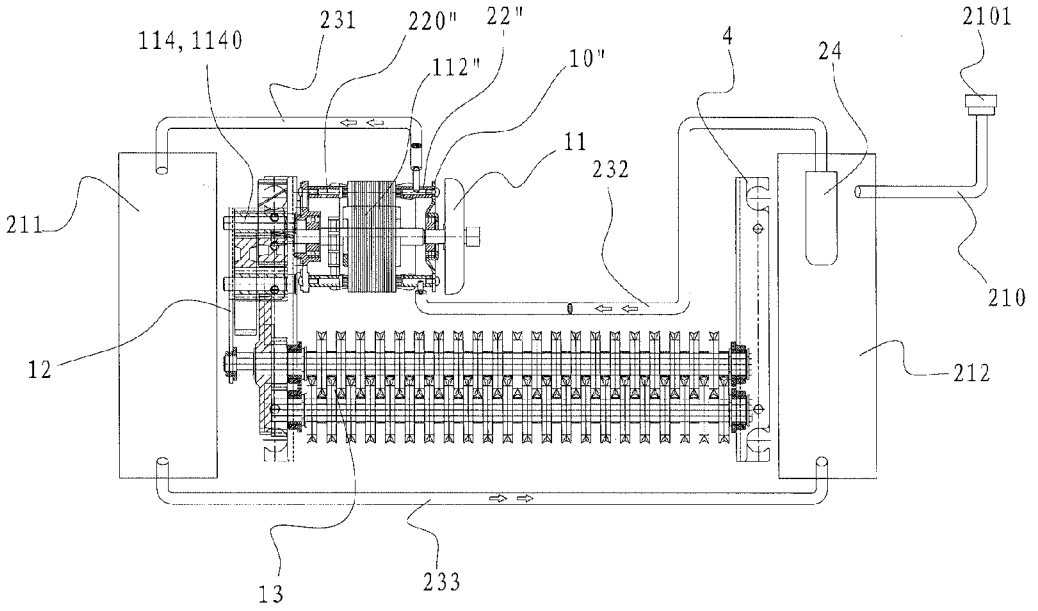


Figure 3

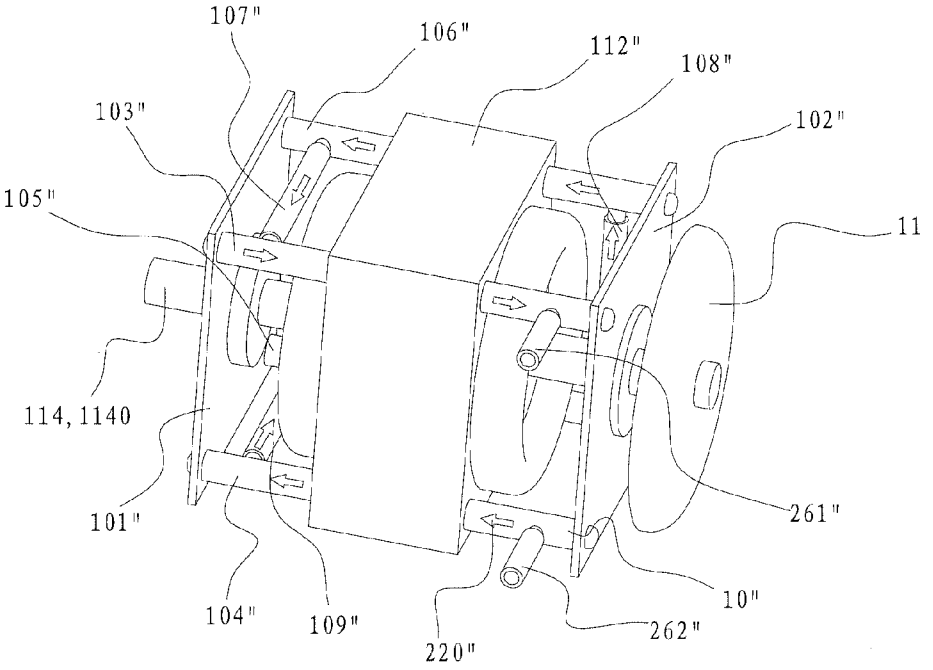


Figure 4

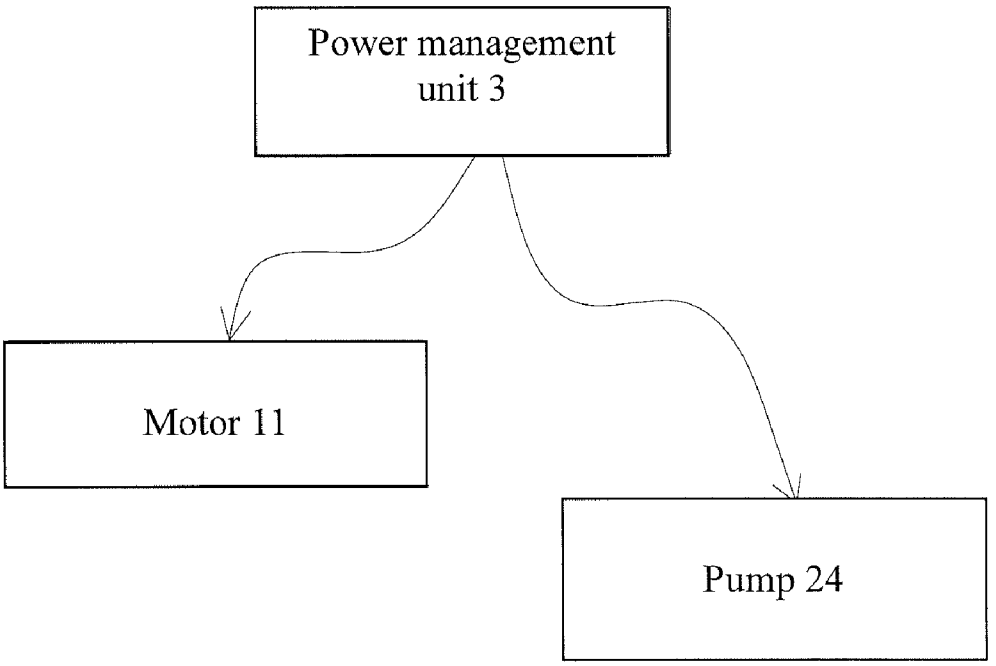


Figure 5

WATER COOLING PAPER SHREDDER

FIELD OF THE INVENTION

[0001] The invention relates generally to a water cooling paper shredder.

BACKGROUND OF THE INVENTION

[0002] Paper shredders have been increasingly gaining popularity. Among components of a paper-shredding mechanism of a typical paper shredder, the motor and conveying roller provided with a cutter thereon are particularly important components. Comparatively, corresponding control circuits and enclosure are simple in construction. Improvements to paper shredders are extremely limited due to their long time existence in the marketplaces. Many manufacturers have been continuously developing their new products to stand in the market. However, improvements are relatively confined due to the very simple structure of known paper shredders. Accordingly, it is inevitable for these manufacturers to lower the price of the shredders in order to gain the profits from the marketplace.

[0003] To reduce costs, manufacturers have made efforts to improve shredding capability of the shredders on one hand; and on the other hand, they adopt inexpensive components. For example, costs will be reduced if plastic enclosure other than a metal enclosure is used to encase the rest of the components of the shredder. Enhancement of shredding performance is typically realized by improving performance of the motor. In doing so however, power consumption of the motor is also increased. According to Joule's Law, it will also cause a dramatic increase of the heat generated by the paper shredder. In particular, the shredders (mainly the motors) currently used in offices, for example, where a high quantity of paper is shredded, the shredders often halt due to overheating, thus decreasing the shredding efficiency. Even for offices where the paper-shredding requirement is low, heat accumulation inside the shredder will make plastic components such as the enclosure and circuit boards melt down eventually. Moreover, electric characteristics of certain electronic elements will also be damaged, and consequently, the lifespan of the shredder will be shortened.

[0004] The applicant has recognized that the drawbacks described above have been ignored by persons of ordinary skill in the art. Furthermore, it has not yet been observed that a cooling technique may be applied to shredders.

SUMMARY OF THE INVENTION

[0005] One embodiment of the present invention is to provide a water cooling shredder which may be capable of realizing rapid heat dissipation, improving shredding efficiency of the shredder, as well as preventing electrical performance and physical components from being damaged due to overheating, thus possibly extending the lifespan of the shredder itself.

[0006] In one embodiment, the water cooling shredder of the present invention includes a power management unit and a shredding mechanism. The shredding mechanism may include a motor, a conveying mechanism and a pair of shredding rollers. The motor is powered by the power management unit. Torque of the motor is transferred by the conveying mechanism to the pair of the shredding rollers, thus causing shredding action of the shredding rollers. A heat dissipation device is provided on the motor to conduct heat outside of the motor itself.

[0007] The motor includes a stator portion, on which said heat dissipation device is mounted, and a rotator portion.

[0008] The heat dissipation device includes a metal component, a plurality of conduits, a pump and at least one metal tank for storage of water; a chamber is defined inside the metal component and tightly connected with the stator portion; the conduits are communicated with the metal tank and to the chamber of the metal component so as to define a water circulation circuit; the pump is electrically coupled with the power management unit, and is located at any position along the water circulation circuit so as to provide power to the circuit.

[0009] According to one embodiment of the invention, the metal component is tubular and has said chamber defined therein; the metal component runs across the outer circumference of the stator portion; the metal component has two ends, both of which are connected to the conduits respectively such that the water circulation circuit is defined.

[0010] According to another embodiment of the invention, the metal component is of an annular shape and tightly wraps the outer circumference of the stator portion; a chamber is defined inside of the metal component; the conduits communicate with the chamber of the component at two different locations thereon such that the circulation circuit is formed.

[0011] According to yet another embodiment of the invention, the metal component comprises a plurality of elongated and hollow rods and a plurality of transversal and hollow rods communicating with the plurality of elongated rods respectively; all of the elongated rods are parallel to one another and each of them is disposed in such way that they run across the stator portion; each transversal rod communicates with two adjacent elongated rods; the chamber is defined by all of the elongated and transversal rods together; the conduits communicate with the chamber at two different locations thereon such that the circulation circuit is formed.

[0012] In addition, at least one of the metal tanks is provided with a water supply port. A cover is disposed on the water supply port. The metal tank is disposed within an enclosure of the water cooling paper shredder at a location outside of the shredding mechanism. Alternatively, the metal tank may be disposed on the bottom portion of the enclosure of the shredder or disposed outside of the enclosure.

[0013] Compared with prior art, the invention has the following advantages. According to the invention, a dissipation device is directly mounted on the stator portion of the motor, thus the temperature of the stator portion can be reduced effectively by means of water cooling and finally, causing temperature reduction within the motor. Therefore, the paper shredder can be cooled with high efficiency. The motor will have relative constant work efficiency due to heat dissipation, and the motor will not stop operation during the paper shredding process, thus greatly improving total paper shredding capability. Setting the metal tanks externally further eliminates heat dissipation problems. This will greatly reduce, as much as possible heat remained inside the enclosure of the shredder and therefore, deformation of plastic elements will not occur. Furthermore, electrical performance of the electronic elements will not be influenced, thus extending the lifetime of the shredder.

BRIEF DESCRIPTION OF THE DRAWINGS

[0014] FIG. **1** shows a cross-sectional view of a cooling shredder according to a first embodiment of the invention, an enclosure of the shredder not shown;

[0015] FIG. **2** shows a cross-sectional view of a cooling shredder according to a second embodiment of the invention, an enclosure of the shredder not shown;

[0016] FIG. **3** shows a cross-sectional view of a cooling shredder according to a third embodiment of the invention, an enclosure of the shredder not shown;

[0017] FIG. **4** shows a motor of FIG. **3** in perspective view; and

[0018] FIG. **5** illustrates an electrical connection of a power management unit of the shredder to a pump and the motor.

DETAILED DESCRIPTION

[0019] Various embodiments of the invention will be described below in further detail with reference to the accompanying drawings.

[0020] Referring to FIG. **1** which depicts a first embodiment of the invention, a shredding mechanism (as shown with reference numerals **11**, **12** and **13** collectively) and a heat dissipation device (as shown with numerals **211-212**, **22**, **231-233** and **24**) are illustrated. An enclosure of the shredder is not shown in FIG. **1**. FIG. **5** illustrates a schematic electrical diagram common to all of the embodiments. FIG. **5** also illustrates a connection relationship among a power management unit **3**, a motor **11** and a pump **24** of the paper shredding of the invention.

[0021] The shredding mechanism includes a motor **11**, a conveying mechanism **12**, a pair of shredding rollers **13** and a frame **4** for supporting all of these components. The power management unit **3** is connected to an external power supply so as to offer power to the motor **11**. Driven by the power management unit, the motor **11** will result in rotation of the conveying mechanism **12** by a shaft of the motor **11**. Torque of the motor **11** is transferred to the pair of shredding rollers **13** by the conveying mechanism **12**. Accordingly, the rollers **13** begin to rotate when driven by the motor **11** and then perform paper shredding actions. Preferably, the conveying mechanism may be constructed by gear pairs. Alternatively, the conveying mechanism **12** may also be constructed by a conveying belt and a corresponding chain. In the case where additional pairs of shredding rollers **13** are provided in the shredding mechanism, a corresponding number of the conveying mechanisms should be provided so as to transfer torque of the motor **11** to newly added shredding roller **13**. Obviously, a single motor **11** can be used to drive a plurality of shredding rollers **13**.

[0022] The motor **11** includes a stator portion **112** and a rotator portion **114**. The stator portion **112** is of a cylindrical shape due to utilization of a cylindrical core.

[0023] The heat dissipation device includes a metal component **22**, a plurality of conduits (**231**, **232** and **233**), two tanks (**211**, **212**) and a pump **24**. The two tanks **211**, **212** can be mounted respectively at two lateral sides of the frame **4** of the shredding mechanism inside of the paper shredder. Alternatively, they may be installed at the bottom portion of the shredder. As an option, these tanks may also be located at locations outside of the shredder. Locations of the tanks may be designed by one of ordinary skill in the art to meet different heat dissipation effects. Typically, more effective dissipation may be obtained if the tanks **211**, **212** are mounted outside rather than inside of the shredder.

[0024] The two tanks **211**, **212** are used to store water therein such that water can circulate. It is noted that the number of the tanks is not limited to particular embodiments described therein. Rather, one or more tanks may be provided. However, at least one tank such as the second tank **212** of this embodiment should be provided with a water supply port. One end of a tube **210** communicates with the second metal tank **212**. In addition, a cover **2101** is disposed at the other end of the tube **210**. The cover **2101** is connected with the water supply port formed by the tube **210** in a threaded manner, thus facilitating opening of the cover **2101**.

[0025] In this embodiment, the metal component **22** is tubular and has a chamber **220** defined therein. The shape of the metal component **22** may be similar to that of the conduits **231-233**. The metal component **22** runs across the outer circumference of the stator portion **112** of the motor **11** so as to decrease the temperature of the stator **112** of the motor **11** due to the metal material of the component **12**, thus effectively dissipating the heat from inside of the stator **112** of the motor **11**. The metal component **22** has two ends, both of which are connected to the conduits **231** and **232** respectively such that a circulation circuit is defined.

[0026] The conduits (**231-233**) are formed by plural segments, including a first segment **231** one end of which is communicated with the front end of the metal component **22**, while the other end thereof is communicated with the top portion of the first metal tank **211**; a second segment **232** one end of which is coupled with the rear end of the metal component **22**, while the other end thereof is coupled with the top portion of the second tank **212**; and a third segment **233** both ends of which are connected to the bottom portion of the two metal tanks **211**, **212** respectively. The number of the segments of the conduits is determined by number of the metal tanks **211**, **212** and location of the pump **24**. The conduits function as a communicating means and accordingly, the number thereof should not be limited to the embodiment.

[0027] In the embodiment of the invention, since the metal component **22** is made of the same material as that of the conduits (**231-233**) and they have similar function, the metal component **22** may be formed integrally with the conduits (**231-233**). In such case, part of the conduit may run across the external circumference of the stator **112** of the motor **11**.

[0028] Because communication function of the conduits (**231-233**), the metal tanks **211-212**, the conduits **231-233** and the metal component **22** together define a circulation circuit through which water coming from the metal tanks **211-212** can be circulated. To improve water circulation, one or more pumps **24** may be supplied. The pump **24** is electrically connected with the power management unit **3** in order to facilitate power control of the shredder. To reduce the number of connection joints among the conduits **231-233**, the pump **24** is preferably located in one of the metal tanks **211-212**, for example the second metal tank **212**. The exit port of the pump **24** is connected to one end which is extended into the second metal tank **212**, of the second conduit **232**.

[0029] Driven by the pump **24**, water is circulated in said circuit. When passing through the chamber **220** of the metal component **22** provided on the stator **112** of the motor **11**, the heat accumulated on the stator **112** of the motor **11** is conducted via the metal component **22** to the water contained in the chamber **220**, thus dissipating heat away by the water. Because the metal tanks **211-212** have a significant large area (it is often the case when the tanks are disposed outside of the shredder), it is easy to make heat inside of the tanks be exchanged with air outside of the tanks, hence temperature inside the tanks being able to be reduced rapidly. Due to water

circulation, the temperature of the stator **112** of the motor **11** is kept constant, thus assuring the motor **11** will work correctly.

[0030] It should be understood by one of ordinary skill in the art that the pump **24** may be connected at any location to the circulation circuit.

[0031] Reference is made to FIG. **2** which illustrates a second embodiment of the invention. The difference with the first embodiment lies in the improvement to the metal component **22'**. In the second embodiment, the metal component **22'** has a shape of sleeve tube which conforms to the external circumference of the stator **112** of the motor **11**. The metal component **22'** is sleeved on the external circumference of the stator **112** of the motor **11**. A chamber **220'** is defined inside the metal component **22'**. Similar to the first embodiment, one end of each first segment **231** and second segment **232** is connected to the metal component **22'** at different locations and accordingly, both the segments **231**, **232** are communicating with the chamber **220'**. Connection joint location of the first segment **231** to the chamber **220'** is different from that of the second segment **232** to the chamber **220'**. Preferably as illustrated in this embodiment, the two connection joint locations are such that they are diametrically located. This will make water contained in the annular chamber **220'** circulated more freely, thus getting more effective heat dissipation. The remaining aspects of this embodiment may be the same as that of the first embodiment.

[0032] FIGS. **3** and **4** show collaboratively the third embodiment of the invention. Similar to the first embodiment, the third embodiment takes some changes to the metal component **22"** so as to adapt shape changes of the motor **11**. More particularly, in this embodiment, a rectangular or square core is equipped on the stator **112'** of the motor **11** and as a result, the stator **112"** takes on rectangular or square shape. Though the metal component **22'** of the first and second embodiments is also adapted to engage with the stator portion **112** of the third embodiment, changes in shape of the rectangular or square stator portion **112"** in the third embodiment is more reasonable in design.

[0033] The stator portion **112"** shown in FIG. **4** is of a square shape and defines four through holes at four corners thereof respectively. A support bracket **10"** is installed on the motor **11**. The support bracket **10"** includes two plates **101"**, **102"** disposed axially at two ends of the stator portion **112"**; and four elongated rods **103"**, **104"**, **105"** and **106"** all of which are disposed in such way that they all extend across the through holes of the stator portion **112'**. Both ends of each elongated rod are secured onto the two plates **101"** and **102"** respectively. Consequently, these elongated rods are parallel to one another. Three transversal rods **107"**, **108"** and **109"** are connected between two adjacent elongated rods respectively. All these elongated and transversal rods are of hollow construction. Two ends of each elongated rod are fastened on the plates **101"** and **102"** respectively. As a result, all these hollow elongated and transversal rods constitute collectively a chamber **220"**. It is therefore that, the support bracket **10"** fixed onto the motor **11** of the embodiment, especially the construction defined by all the elongated and transversal rods **103"-106"** and **107"-109"** have their intended use similar to that of the metal component **22**.

[0034] As described above, the metal component **22** has a chamber **220"**. In this embodiment, two connection tubes **261"** and **262"** are provided on different locations of the metal component **22**. With respect to the first and second embodiments of the invention, the conduits **231-233** may be communicated with the chamber **220"** by connecting the first segment of conduit **231** and second segment of conduit **232** with the connection tubes **261"** and **262"** respectively, thereby forming a complete water circulation circuit. The path along which the water inside the metal component **22** (defined by the support bracket **10"**) flows may be extended by reasonably setting the number of the transversal rods **107"-109"** and interconnection of these rods with the elongated rods **103"-106"**, hence making heat absorption more efficient.

[0035] The conduits described above may be constructed of plastic or metal. The metal tanks may be positioned outside of the enclosure of the paper shredder.

[0036] Summarily, the invention has provided a technical solution for the paper shredder to realize water cooling of the motor. In addition, the motor of the shredder can stably work for a long time thanks to reasonable structure of the shredder of the invention, thus improving total paper shredding efficiency when a large number of papers must be shredded.

1. A water cooling paper shredder, comprising: a power management unit; and a shredding mechanism, wherein the shredding mechanism comprises a motor, a conveying mechanism and a pair of shredding rollers, the motor being powered by the power management unit, torque of the motor being transferred by the conveying mechanism to the pair of the shredding rollers, thus causing shredding action of the shredding rollers; a heat dissipation device is provided on the motor to conduct heat outside of the motor itself.

2. The water cooling paper shredder according to claim **1**, wherein the motor comprises a stator portion on which said heat dissipation device is mounted and a rotator portion.

3. The water cooling paper shredder according to claim **2**, wherein the heat dissipation device comprises a metal component, a plurality of conduits, a pump and at least one metal tank for storage of water; a chamber is defined inside the metal component and tightly connected with the stator portion; the conduits are communicated with the metal tank and to the chamber of the metal component so as to define a water circulation circuit; the pump is electrically coupled with the power management unit, and is located at any position of the water circulation circuit so as to provide power to the circuit.

4. The water cooling paper shredder according to claim **3**, wherein the metal component is tubular and has said chamber defined therein; the metal component runs across the outer circumference of the stator portion; the metal component has two ends, both of which are connected to the conduits respectively such that the water circulation circuit is defined.

5. The water cooling paper shredder according to claim **3**, wherein the metal component is of an annular shape and generally tightly wraps around the outer circumference of the stator portion; a chamber is defined inside of the metal component; the conduits are communicated with the chamber of the component at two different locations thereon such that the circulation circuit is formed.

6. The water cooling paper shredder according to claim **3**, wherein the metal component comprises a plurality of elongated and hollow rods and a plurality of transversal and hollow rods communicating with the plurality of elongated rods respectively; all of the elongated rods are parallel to one

another and each of them is disposed in such way that they run across the stator portion; each transversal rod communicates with two adjacent elongated rods; the chamber is defined by all of the elongated and transversal rods together; the conduits communicate with the chamber at two different locations thereon such that the circulation circuit is formed.

7. The water cooling paper shredder according to claim **3**, wherein the at least one metal tank is provided with a water supply port.

8. The water cooling paper shredder according to claim **7**, wherein a cover is disposed on the water supply port.

9. The water cooling paper shredder according to claim **3**, wherein the metal tank is disposed within an enclosure of the water cooling paper shredder at a location outside of the shredding mechanism.

10. The water cooling paper shredder according to claim **3**, wherein the metal tank is disposed on the bottom portion of the enclosure of the shredder or disposed outside of the enclosure.

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