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(54) **AUTOMATIC COOLING MECHANISM FOR ELECTRICAL DEVICE**

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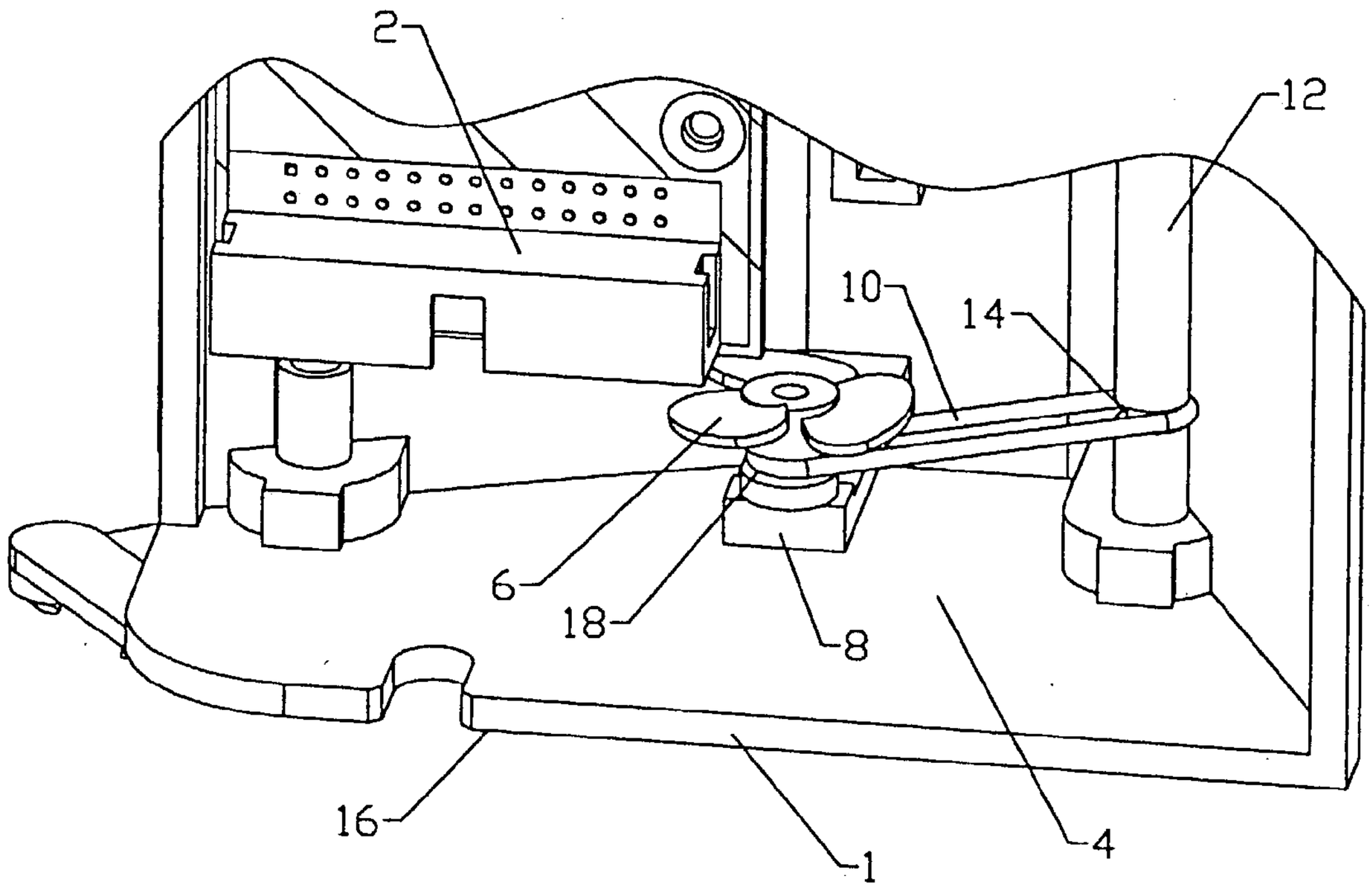
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(57) **ABSTRACT**

The present invention provides an automatic cooling mechanism for an electrical device having a high-temperature element and a rolling shaft. The mechanism includes a fan mounted within the electrical device and a transmission mechanism connected between the fan and the rolling shaft for transmitting rotational kinetic energy from the rolling shaft to the fan to rotate the fan for reducing the temperature of the high-temperature element.



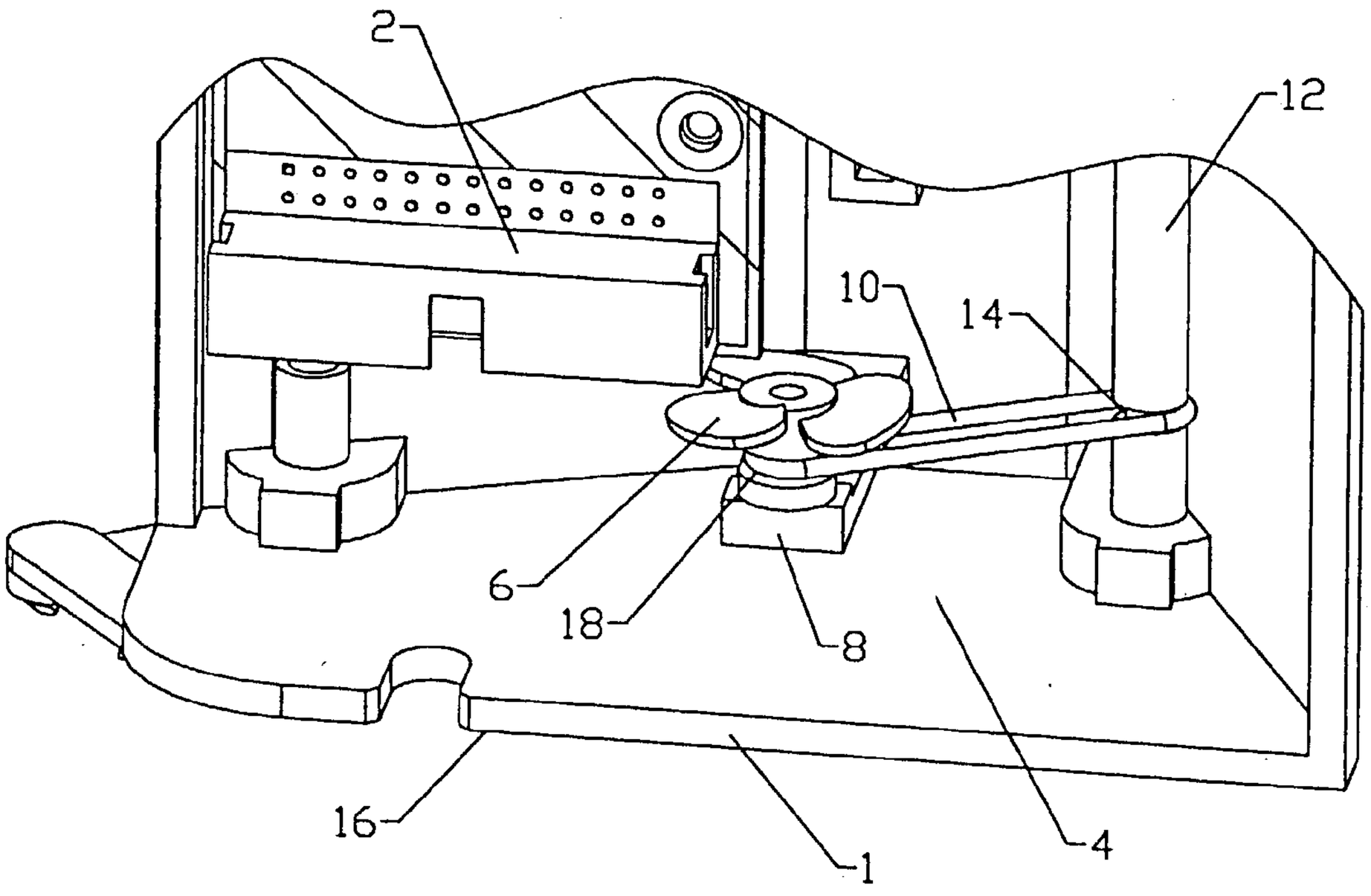



Fig 1

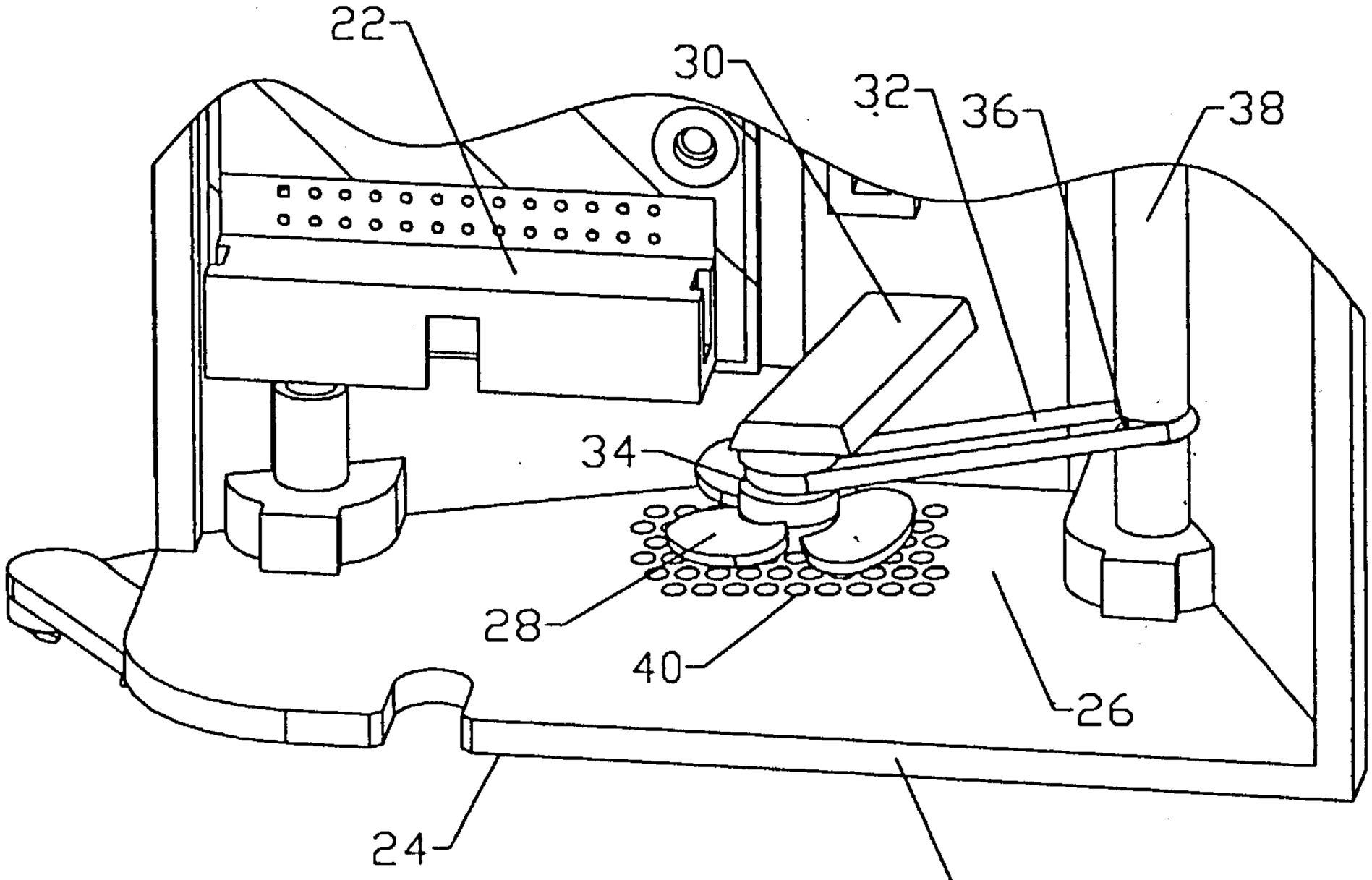



Fig 2

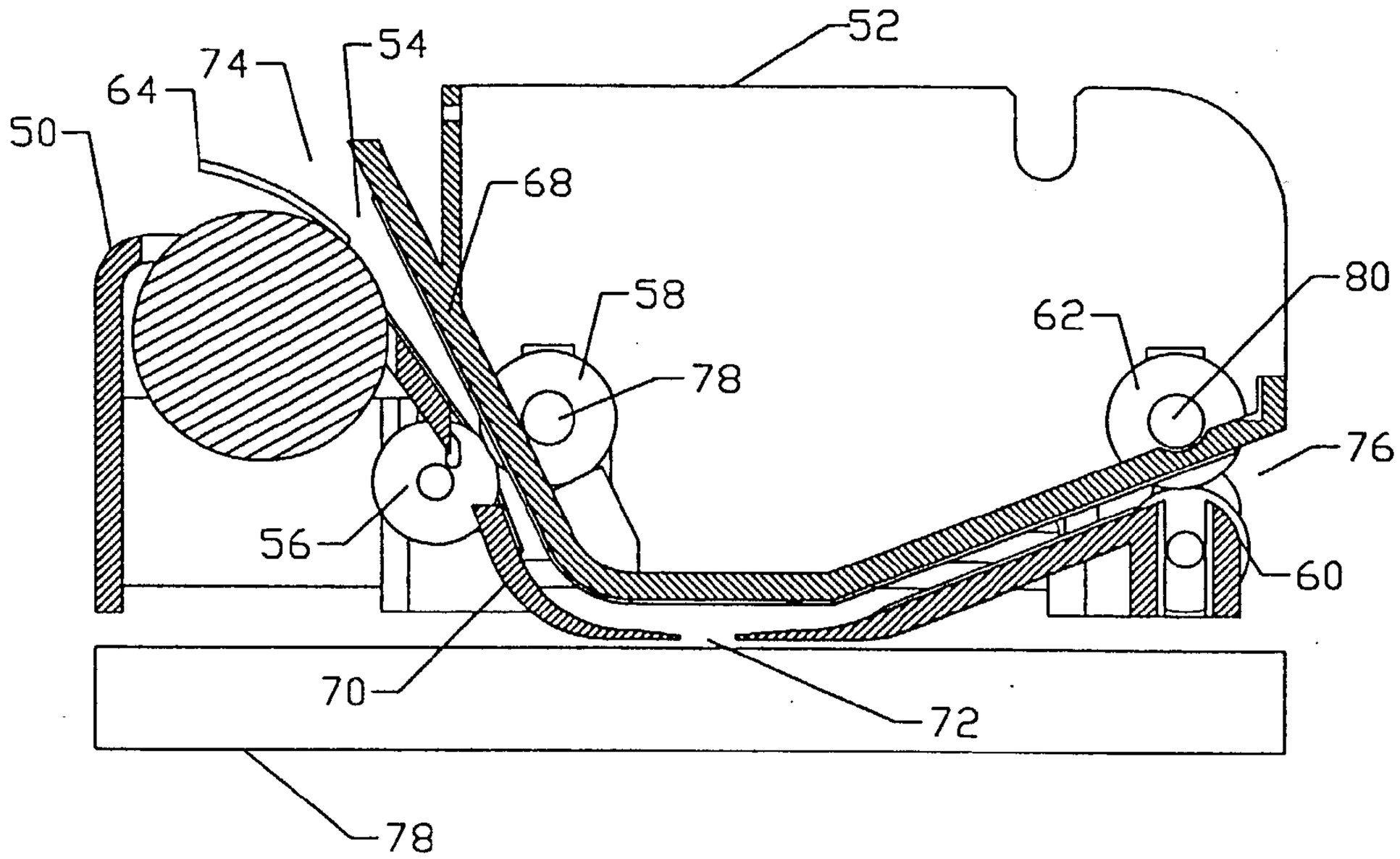



Fig 3

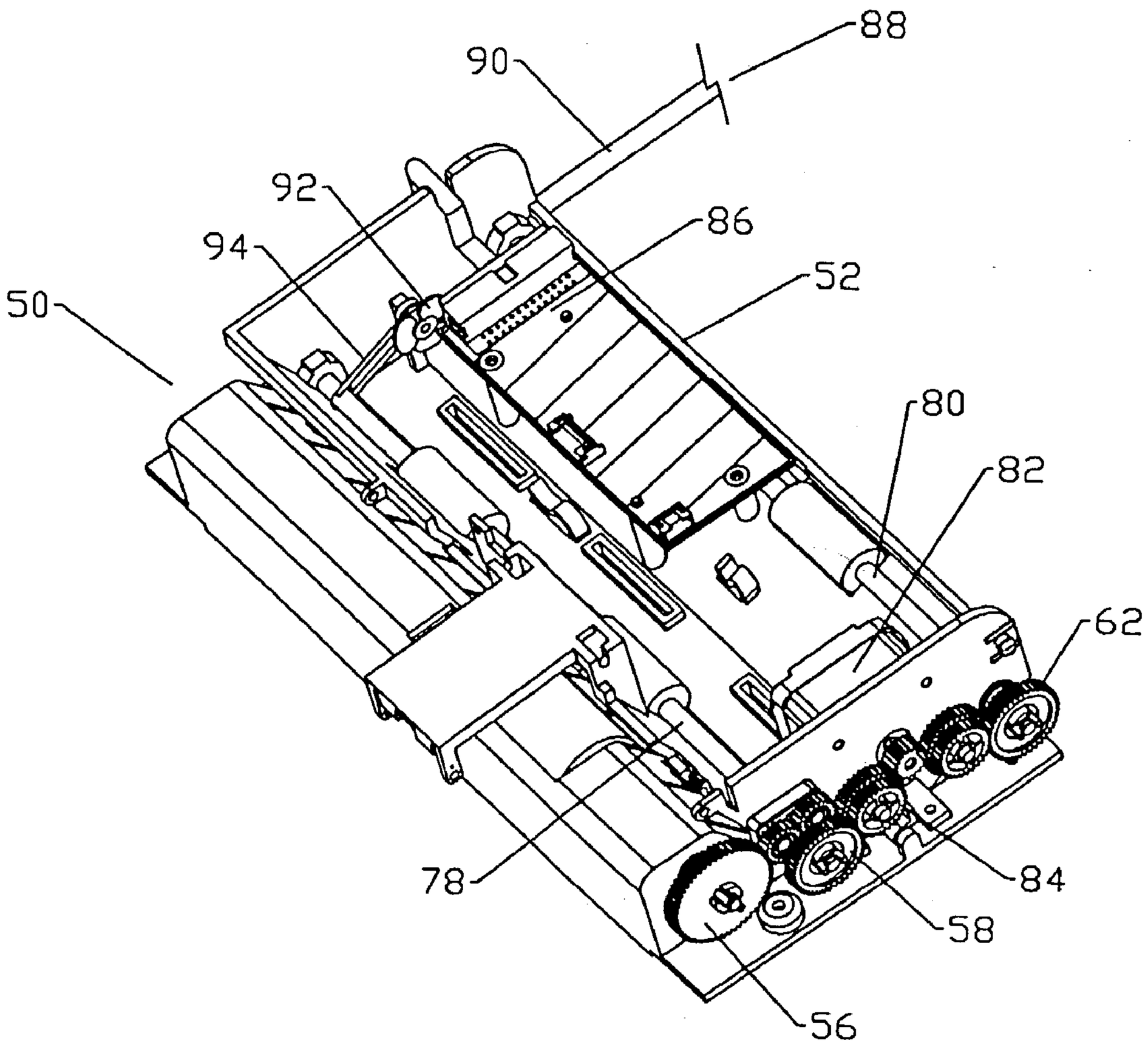



Fig 4

# AUTOMATIC COOLING MECHANISM FOR ELECTRICAL DEVICE

## FIELD OF THE INVENTION

[0001] The present invention relates to an automatic cooling mechanism, and more particularly to an automatic cooling mechanism for an electrical device.

## BACKGROUND OF THE INVENTION

[0002] Today's electrical devices are required to have high integrations and high performances. Accordingly, some of the electrical elements are often have high temperatures. For example, an automatic document feeder (ADF) is developed to be used with a flatbed scanner. The ADF can automatically feed document sheets one by one to the flatbed scanner to be scanned. However, most of the ADFs are asked to have reduced volumes and increased document-feeding speeds. As a result, a lot of heat is generated by the elements such as the print circuit board of the ADF. Cooling elements made of aluminum or copper, etc . . . are often used to reduce the temperature. However, the cooling effects are limited. The effect of a cooling cream is also limited. Furthermore, the cooling cream must be coated on the surface of the high-temperature uniformly, otherwise many problems may happen.

[0003] A more efficient method is to use a fan to cool the high-temperature element. However, conventional fan is equipped with a motor. The additional motor will also generate heat to increase the temperature within the electrical device. Furthermore, the additional motor will increase the cost.

[0004] It is then attempted by the applicant to deal with the above-mentioned problems.

## SUMMARY OF THE INVENTION

[0005] An object of the present invention is to provide an efficient cooling mechanism for an electrical device.

[0006] Another object of the present invention is to provide a cooling mechanism for an electrical device without additional motor.

[0007] According to the present invention, an automatic cooling mechanism for an electrical device having a high-temperature element and a rolling shaft is provided. The device includes a fan mounted within the electrical device and a transmission mechanism connected between the fan and the rolling shaft for transmitting rotational kinetic energy from the rolling shaft to the fan to rotate the fan for reducing the temperature of the high-temperature element.

[0008] The transmission mechanism preferably includes an elastic element. The elastic element is preferable a belt, a rope, etc . . .

[0009] The electrical device preferably further includes a shell structure for receiving therein the high-temperature element.

[0010] The fan may introduce air into the shell structure. Of course, in another embodiment, the air filled within the shell structure is exhausted by the fan.

[0011] The electrical device may further includes a hot-wind exist. The hot-wind exist preferably includes a plurality of holes formed on the shell structure.

[0012] The electrical device may be an automatic document feeder (ADF). The ADF preferably includes a plurality of rollers mounted on the rolling shaft for feeding thereby a document.

[0013] The present invention may best be understood through the following description with reference to the accompanying drawings, in which:

## BRIEF DESCRIPTION OF THE DRAWINGS

[0014] **FIG. 1** illustrates an embodiment of a cooling mechanism for an electrical device according to the present invention;

[0015] **FIG. 2** shows another embodiment of a cooling mechanism for an electrical device according to the present invention;

[0016] **FIG. 3** illustrates an example of an automatic document feeder (ADF); and

[0017] **FIG. 4** shows an embodiment of a cooling mechanism mounted within the ADF illustrated in **FIG. 3**.

## DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0018] The present invention will now be described more specifically with reference to the following embodiments. It is to be noted that the following descriptions of preferred embodiments of this invention are presented herein for purpose of illustration and description only; it is not intended to be exhaustive or to be limited to the precise form disclosed.

[0019] Referring to **FIG. 1**, an electrical device **1** has a shell **16**, a high-temperature element **2**, and a rolling shaft **12**. The high-temperature element **2** is a print circuit board (PCB) or other element that will generate heat during the operation of the electrical device **1**. A cooling mechanism **4** is mounted within the electrical device **1**. The cooling mechanism **4** includes a fan **6**, a transmission mechanism **10**, and a prop **8**. Slots **14** and **18** are formed on the rolling shaft **12** and the fan **6** respectively for receive therein the transmission mechanism **10** so that the fan **6** can be rotated through the rotational kinetic energy transmitted by the transmission mechanism **10**. The transmission mechanism **10** is a belt, a rope, or any other elastic element.

[0020] The fan **6** and the rolling shaft **12** are connected by the transmission mechanism **10**. Accordingly, the fan will be rotated in accordance with the rotation of the rolling shaft **12**. Consequently, a cool wind will blow to the high-temperature element **2** and reduce its temperature.

[0021] The fan **6** is mounted just beside the high-temperature element **2** to blow to the high-temperature element **2** directly. However, the fan **6** can also be mounted at any suitable place to introduce cool air into the shell **16** of the electrical device **1** to reduce the global temperature within the shell **16**.

[0022] In another embodiment, the fan is served as an exhaust blower. Referring to **FIG. 2**, an electrical device **20** has a shell **24**, a high-temperature element **22**, and a rolling shaft **38**. A cooling mechanism **26** is mounted within the electrical device **20**. The cooling mechanism **26** includes a fan **28**, a transmission mechanism **32**, and a prop **30**. Slots

**34** and **36** are formed on the rolling shaft **38** and the fan **28** respectively for receive therein the transmission mechanism **32** so that the fan **28** can be rotated through the rotational kinetic energy transmitted by the transmission mechanism **32**. The transmission mechanism **32** is a belt, a rope, or other elastic element. A hot-wind exit **40** is formed on the shell **24**. The hot-wind exit **40** may be a plurality of holes or any other type of exit for exhausting hot air within the shell **24**.

[**0023**] The fan is mounted on the prop **30** and is facing the shell **24**. During the operation of the electrical device **20**, the fan **28** is rotated in accordance with the rotation of the rolling shaft **38**. Accordingly, the hot air is exhausted and the temperature within the shell **24** is reduced.

[**0024**] The rolling shaft is not reserved for the use of the cooling mechanism. For example, in an automatic document feeder (ADF) for a scanner, the rolling shaft is a part of the sheet-feeding mechanism. Referring to **FIG. 3**, an ADF **50** includes a body shell **52**, a document-feeding path **54** formed on the bottom side of the body shell **52**, and rollers **56**, **58**, **60**, and **62** for urging the document sheet **64** to be moved in the feeding path **54**. The document-feeding path **54** is formed by an inner shell **68** and an outer shell **70**. The document-feeding path **54** further includes a scanning area **72**, which is an opening formed on the bottom of the outer shell **70**. A document **64** is urged by the rollers **56**, **58**, **60**, and **62** to be moved in the document-feeding path **54**. The document **64** enters the document-feeding path **54** from the entry **74** and leaves it from the outlet **76**. The ADF **50** is mounted on a flatbed scanner **100** and the scanning area **72** is aligned to the reading unit (not shown) of the scanner **100**. While the document **64** passes through the scanning area **72**, it will be scanned by the scanner **100**.

[**0025**] Because rollers are necessary for the ADF to transmit document, rolling shafts are necessary to provide rolling kinetic energy to the rollers. For example, rollers **58** and **62** are mounted on rolling shafts **78** and **80** respectively. During operation of the ADF **50**, the rollers **56** and **60** are also rolling since they contact with the rollers **58** and **62** respectively. Accordingly, the document sheet **64** will be transmitted forwardly once it passes the rollers **56** and **58** or **60** and **62**.

[**0026**] Referring to **FIG. 4**, the rotational kinetic energy of the rolling shafts **78** and **80** is provided by a motor **82** through the gear set **84**. The ADF **50** further includes a PCB **86** connected to a power **88** by a wire **90**. While the ADF **50** is operating, both the PCB **86** and the motor **82** will generate a considerable heat. Accordingly, a fan **92** is used to reduce the temperature within the body shell **52** of the ADF **50**. In stead of using an additional motor, the fan **92** is connected to the rolling shaft **78** by a transmission mechanism **94** to obtain the rotational kinetic energy. The transmission mechanism **94** is a belt, a rope or other elastic element.

[**0027**] The present invention can not only be applied on the above-mentioned ADF, but also any other electrical device having a rolling shaft for a specified function. Since no additional motor is needed for the cooling mechanism of the present invention, the cost is reduced. Furthermore, the defect that an additional motor will further increase the temperature of the electrical device is avoided. Accordingly, the present invention is valuable for the industry.

[**0028**] While the invention has been described in terms of what are presently considered to be the most practical and preferred embodiments, it is to be understood that the invention needs not be limited to the disclosed embodiment. On the contrary, it is intended to cover various modifications and similar arrangements included within the spirit and scope of the appended claims which are to be accorded with the broadest interpretation so as to encompass all such modifications and similar structures.

What is claimed is:

**1**. An automatic cooling mechanism for an electrical device having a high-temperature element and a rolling shaft, comprising:

a fan mounted within said electrical device; and

a transmission mechanism connected between said fan and said rolling shaft for transmitting rotational kinetic energy from said rolling shaft to said fan to rotate said fan for reducing the temperature of said high-temperature element.

**2**. An automatic cooling mechanism according to claim 1 wherein said transmission mechanism includes an elastic element.

**3**. An automatic cooling mechanism according to claim 2 wherein said elastic element is a belt.

**4**. An automatic cooling mechanism according to claim 2 wherein said elastic element is a rope.

**5**. An automatic cooling mechanism according to claim 1 wherein said electrical device further includes a shell structure for receiving therein said high-temperature element.

**6**. An automatic cooling mechanism according to claim 5 wherein said fan introduces air into said shell structure.

**7**. An automatic cooling mechanism according to claim 5 wherein the air filled within said shell structure is exhausted by said fan.

**8**. An automatic cooling mechanism according to claim 7 wherein said electrical device further includes a hot-wind exist.

**9**. An automatic cooling mechanism according to claim 8 wherein said hot-wind exist includes a plurality of holes formed on said shell structure.

**10**. An automatic cooling mechanism according to claim 1 wherein said electrical device is an automatic document feeder (ADF).

**11**. An automatic cooling mechanism according to claim 10 wherein said ADF includes a plurality of rollers mounted on said rolling shaft for feeding thereby a document.

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