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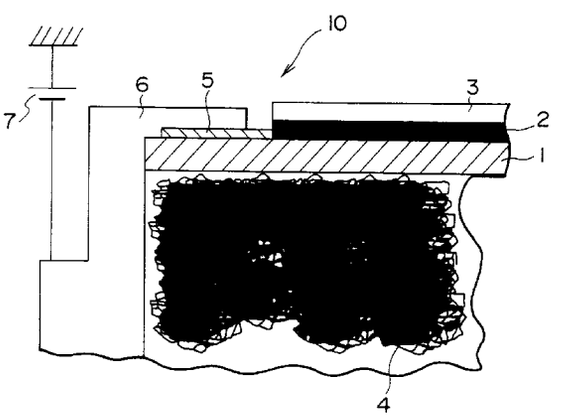
(54) Heat fixing apparatus.

(57) A heat-fixing apparatus for use in an electrophotographic apparatus such as a copying machine. It comprises a substrate roller formed of a material having a heat conductivity of 0.7 kcal/mhk or less, a resistant heat-generating layer provided on the surface of the roller, and a surface coat layer provided on the resistance heat-generating layer. This heat-fixing apparatus has a very high heat efficiency, and can perform heat-fixing of a toner at a low consumption of electric power. In addition, since the heating is carried out rapidly, the rising time is markedly shortened, and it is not necessary to perform pre-heating. In this respect, too, the electric power to be consumed is decreased. Furthermore, since it is a roller-type fixing method, it can effectively cope with high-speed copying. Moreover, because the apparatus has a large strength, the apparatus can be effectively made light in weight.

FIG 1



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Background of the Invention

1. Field of the Invention

The present invention relates to a heat fixing apparatus for use in an electrophotographic apparatus such as a copying apparatus.

2. Description of the Prior Art

As a heat-fixing apparatus in commercial electrophotographic apparatuses, hollow rollers in which a heating source such as a halogen lamp is provided are widely utilized. This fixing apparatus of the heat roller type performs the fixation of a toner by directly contacting a heating surface with the toner on a transfer paper, and the fixation can be performed uniformly and stably in high speed copying. In addition, it has high safety and presents an advantage that the apparatus itself is small sized.

However, in the convention known heat fixing apparatus, an air layer is interposed between the roller surface which is a heating surface and a heat source, and since heating of the surface of the roller is carried out indirectly via the air layer, there is a problem of a low efficiency of heat. Furthermore, it takes time to heat the roller to a certain temperature, and in order to carry out fixation at the same time as the beginning of the copying operation, the electric power should be always supplied.

In order to solve this problem, Japanese Laid-Open Patent Publication No. 242671/1991 provides a flat plate-type heater in contact with a thin heat-resistant belt and proposes a heat fixation apparatus in which the toner is heated and fixed via the belt.

This heat fixing apparatus has an increased heat efficiency as compared with the heat roller fixation type apparatus using the halogen lamp, etc. as the heat source, and the heat fixation can be carried out at a lowered consumed electric power. In addition, it is very useful because the time required to heat the heat resistant belt to a fixed temperature (the rising time) can be shortened. However, since this heat-fixing apparatus employs a belt driving method, it is impossible to avoid the important problem of the deviation of the belt. When the copying is carried out at a higher speed, this problem becomes more marked, and it becomes difficult to carry out fixation uniformly and stably.

An apparatus in which a heat roller itself is made a heat source is provided. A heat-fixation apparatus of this type can cope with high-speed copying, but since a heat pipe is embedded in a roller substrate, or a heat-generating wire such as a Nichrome wire is interposed with an insulation layer and provided in the roller substrate, it is still unsatisfactory in fully improving the heat efficiency and the problem of rising time is not yet improved.

Summary of the Invention

It is an object of the present invention to provide a heat-fixing apparatus which can fully cope with high speed copying, and effectively has improved heat efficiency and an improved problem of the rising time.

The present invention provides a heat-fixing apparatus comprising a substrate roller formed from a material having a heat conductivity of 0.7 kcal/mhk or below, a resistance heat-generating layer provided on the roller surface, and a surface coat layer formed on the resistance heat-generating layer.

Brief Description of the Drawings

Fig. 1 is a view in which principal parts of the heat-fixing apparatus of the invention are shown on an enlarged scale; and

Fig. 2 is a view showing the heat-fixing apparatus of the invention in its used condition.

Detailed Description of the Invention

In the present invention, the resistant heat-generating layer is rapidly heated, and the heat generated from the above layer is consumed for immediately heating the toner via the surface coat layer. Accordingly, as compared with a conventional heat-roller type fixing apparatus, the heat efficiency is markedly high, and furthermore, the rising time is markedly shortened. It is not necessary to carry out preheating in order to maintain the fixing temperature.

Because the heat-fixing apparatus of the present invention basically employs a heat roller method, it can fully cope with high speed copying, and enables fixation to be carried out uniformly and stably.

In the present invention, the above substrate roller is formed from a material having a heat conductivity of 0.7 Kcal/mhk or below. This fact effectively prevents escape of the heat generated from the resistance heat generating layer to the substrate roller side and makes it possible to further increase the heat efficiency.

The present invention will be described in detail on the basis of specific examples shown in the attached drawings. Fig. 1 is a view showing the principal parts of the heat-fixing apparatus of the invention on an enlarged scale, and Fig. 2 is a view showing the heat-fixing apparatus of the invention its used condition.

Referring to Fig. 1, the heat-fixing apparatus of the invention generally shown as 10 consists of a hollow substrate roller 1, a resistance heat-generating layer 2 covering the surface of the roller, and a surface coat layer 3 provided on the resistance heat-generating layer 2.

The substrate roller 1, as stated above, is formed

of a material having a heat conductivity of 0.7 kcal/mhk or less. Above all, it is preferably formed from a highly rigid, an electrically high insulating, and a high heat-resistant non-metallic material. Examples of such material may include heat-resistant glass, imide resins such as polyimide, phenolic resins such as bakelite, and aromatic polyamide resins such as aramide.

A heat insulating material 4 is preferably filled in the inside of the substrate roller 1. By this, the heat generated from the resistance heat generating layer 2 is almost consumed for the heating of the toner via the surface coat layer 3, and therefore, the heating efficiency is further increased. Examples of such heat insulating agent include a fibrous insulating material such as glass wool, rock wool and ceramics fibers, a powdery insulating material such as a diatomaceous earth warming material and a perlite warming material, and a multicellular heat insulating material such as a foaming glass warming material and a ceramic foam.

The resistance heat generating layer 2 is composed of a metal or alloy which generates heat by supplying a fixed amount of electric power. Such metal or alloy is known. For example, silver/palladium, ruthenium oxide, nickel and Nichrome/tungsten may be preferably used. The thickness of the resistance heat generating layer 2 may be adjusted to a suitable thickness according to the material, electric power and the fixing temperature to be prescribed.

This resistance heat-generating layer 2 is usually provided easily on the surface of the substrate roller 1 by such means as screen printing.

The above resistance heat-generating layer 2 may be provided only on the effective fixing surface of the substrate roller 1. For example, an electrode layer 5 is connected to one end portion thereof, and an electroconductive flange 6 (for example, composed of a copper-type alloy) is placed so that it contacts the electrode layer 5. By connecting an electric power supplying source 7 to the flange 6, a current is supplied to the resistance heat-generating layer 2 to generate heat. In this case, an adhesive, if require, having electroconductivity and heat resistance is provided, and the flange 6 may be fixed to the substrate roller 1 by adhesion. As the electrode layer 5, a metal having high electroconductivity, such as silver, may be used effectively.

The surface coat layer 3 is provided to prevent toner offset. Usually, heat-resistant materials having good mold releasing property may be used. Examples include fluorine-containing resins such as polytetrafluoroethylene (PTFE), perfluoroalkyl ether resins (PFA), and polytetrafluoroethylene/hexafluoropropylene copolymerized resin (FEP). PTFE is especially preferred. To further increase the toner offset property, a conducting agent such as carbon black may be dispersed in the surface coat layer 3 to adjust its resistance value to 10^4 to 10^5 ohms/□.

The thickness of the surface coat layer 3 may generally be adjusted to 10 to 20 μm. If the thickness is too large, the heat efficiency may be decreased.

As shown in Fig. 2, the heat-fixation apparatus 10 is provided within the electrophotographic apparatus facing a pressure rubber roller 11, and between these rollers, a transfer paper 12 having a toner image is passed. The toner on the paper 12 is contacted with the heat-fixation apparatus 10 to heat it whereby the toner image is heat-fixed.

The electric power to be supplied to the resistance heat-generating layer 2 is different depending upon the fixation temperature determined by the type of the toner, and the type of the resistance heat-generating layer 2, but usually it may be about 300 to 500 W.

A cleaning rollelr 13 may be provided in contact with the heat-fixation apparatus 10 so that the toner adhering to the surface of the apparatus may be removed. Furthermore, generally a sensor 14 for detecting the surface temperature of the heat-fixing apparatus 10 is desirably provided to control the surface temperature to a proper fixation temperature.

The heat-fixation apparatus of the present invention has a very high heat efficiency, and the toner can be heat-fixed at a low electric power of consumption. Since the heating can be performed rapidly, the rising time is markedly shortened, and it is not necessary to perform pre-heating. In this respect, the electrici power to be consumed is maintained at a low level.

Since the apparatus of this invention is a roller-typefixation method, it can effectively cope with high-speed copying. Furthermore, because the apparatus has a high strength, it is advantageous to make the apparatus lighter.

Claims

1. A heat-fixing apparatus comprising a substrate roller formed from a material having a heat conductivity of 0.7 kcal/mhk or less, a resistance heat generating layer provided on the surface of the roller and a surface coat layer provided on the resistance heat generating layer.

2. A heat-fixing apparatus of claim 1 wherein the substrate roller is composed of a non-metallic material.

3. A heat-fixing apparatus of claim 2 wherein the non-metallic material is a heat-resistant glass, an imide resin, a phenol resin or an aromatic polyamide resin.

4. A heat-fixing apparatus of claim 1 wherein a heat insulating material is filled in the inside of the sub-

strate roller.

5. A heat-fixing apparatus of claim 1 wherein the surface coat layer is formed of a fluorine-containing resin.

6. A heat-fixing apparatus of claim 5 wherein a conductive agent is dispersed in the surface coat layer.

7. A heat-fixing apparatus of claim 5 wherein the thickness of the surface coat layer is 10 to 20 μm.

FIG 1

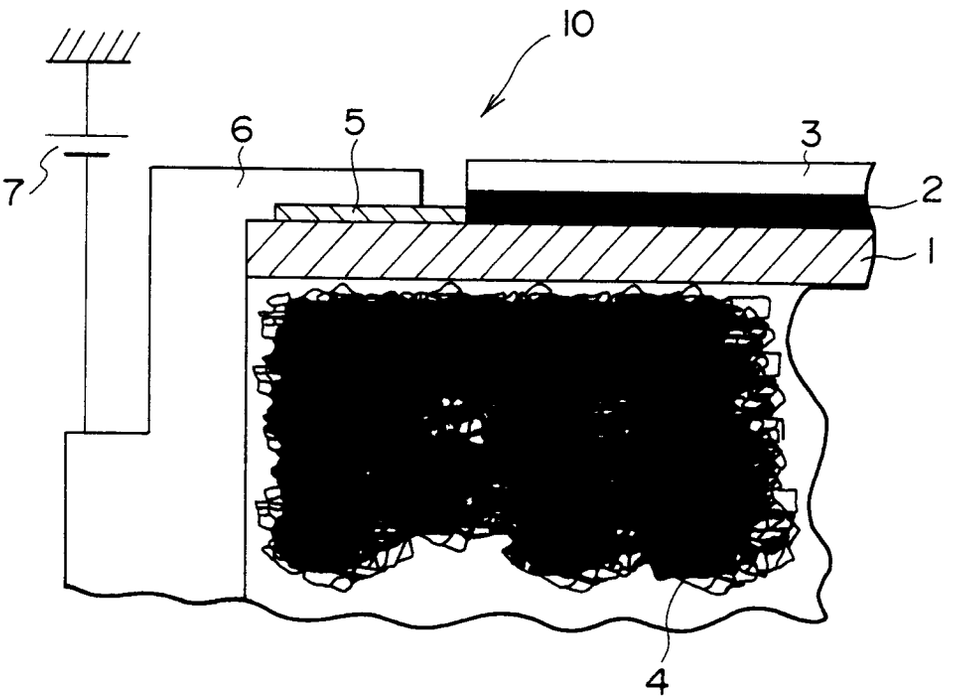

FIG. 2