Conventionally, electrical appliances are supplied with power via cables connected to a central source of electrical power. The invention addresses the problem of the cost of supplying power in this way. The problem is solved by employing a central heating system to distribute power to an electrical appliance such as a lamp (IE). The power is distributed in the form of heat using a conventional central heating system. At a radiator, (2) some of the heat energy is then converted to electricity using a thermoelectric device (IA). The electrical energy is stored temporarily in chemical form in a battery (1C) and is fed to an element such as lamps (IE). A switching device (IG) responds to ambient light to switch off the lamp during the daytime. Another switching device (IF) detects the presence of a person and switches the lamp on when not required.
Description

GENERATING ELECTRICAL POWER FROM HEATING SYSTEM
USING THERMOELECTRIC GENERATOR

[0001] This invention relates to a method and apparatus for the supply of power to electrical appliances such as electric lights and seeks to reduce the cost of operating such devices.

[0002] Conventionally, electrical appliances are supplied with power via cables connected to a central source of electrical power such as the mains power supply or a generator. Where room heating is required. Electrical heaters can be used but it is generally considered to be more economical to employ a central heating system by which a fluid is heated in a single heating unit (often referred to as a "boiler") before flowing into spaces to be heated. The fluid can be a liquid such as water or oil which is made to circulate through a system of radiators; or it can be air which passes along ducts and out of vents to mix with and warm the ambient air in the spaces to be heated.

[0003] This invention arose from the realisation that, because electrical appliances are normally installed in spaces which are served by a central heating system, the infrastructure of the central heating system, can be used to distribute relatively low cost energy to the electrical appliances, subject to a suitable interface being included, locally with respect to each appliance to convert the heat energy to electricity.

[0004] According to the invention there is provided a method of supplying electrical power to at least one electrical consumption point characterised in that a central heating system is used to transfer heat energy to a thermoelectric device connected to supply electricity to the said consumption point.

[0005] The consumption point could take any of a variety of different forms. For example it could be a socket or other connector designed to be connected to an electrical appliance; or it could be a mobile phone charging device; or it could be the electrical appliance itself such as a lamp fitting. The invention is considered to have particular benefit for supplying power to light fittings because lighting is almost always required in spaces that are required to be heated. The device could be used as a main source of light or for emergency lighting.

[0006] The conversion of the heat energy to electricity can be performed using a thermoelectric device attached to a radiator or otherwise arranged so that its hot side is heated by the circulating liquid or by the hot air from a vent of a hot air heating duct. The thermoelectric device is used to produce a local source of electricity which is then used e.g. to drive a light source such as a light emitting diode (LED) light source. The thermoelectric device and the consumption point may have a common housing so that they form a single unit. Alternatively they may have separate housings joined by an electrical conductor.
Where a circulating-liquid central heating system is used, it would be possible for the hot side of the thermoelectric device to be located within a central heating radiator so as to be in direct contact with the circulating fluid. However, it is preferred to employ a design that allows the hot side of the thermoelectric device to be held in close thermal contact with an exterior surface of the radiator. This allows the device to be easily retrofitted to an existing central heating system without penetrating. The cold part of the thermoelectric generator is preferably provided with a heat dissipation means, eg an arrangement of heat-conductive vanes or other projections to facilitate transfer of heat to the ambient air. Where the device is not required to be retrofitted, it would be possible to build it into the radiator between a wall of the radiator and a generally conventional arrangement of heat dissipation fins or equivalent.

The invention is of particular value for use in a system where a number of electrical consumption points are needed since the provision of radiators at different locations provides a ready made mechanism for distributing energy to plural positions.

Although light sources and other electrical devices can be switched on and off almost instantly, a characteristic limitation of a conventional central heating system is that it is not possible to heat a room space instantly. Instead, the heating needs to be run continuously, even when the relevant space to be heated is not occupied. This situation can be used to advantage, with the present invention, by incorporating a rechargeable battery at each consumption point. The battery is charged whenever the heat system is operating but lighting is not required. A person detector and associated switch can be used to switch on a lamp only when a person is in the vicinity. It may also be advantageous to employ an ambient light sensor and associated switch to ensure that the lamp is not switched on when the ambient light levels make it unnecessary.

One way in which the invention may be performed will now be described by way of example with reference to the accompanying drawings of a lighting system constructed in accordance with the invention in which:

**Fig 1** is a schematic block diagram showing a light source constructed in accordance with the invention;

**Fig 2** shows how two or more light sources, like that of Fig 1, may be positioned on respective radiators of a water-circulation central heating system; and

**Fig 3** shows, at 3A and 3B, vertical and horizontal cross-sections through the light source of Fig 1 and through a part of a radiator to which it is attached.

Referring first to Fig 1, there is shown a consumption unit in the form of a light fitting 1. The light fitting includes a thermoelectric generator 1A which is an off-the-shelf component. The electrical output from the generator 1A is passed to a power management circuit 1B which provides a stabilized voltage to charge a rechargeable battery 1C and to power a light emitting diode (LED) driver board 1D which carried
LEDs of sufficient power for illuminating a room or corridor. Power to the LED board is controlled by a movement sensor switch which is of conventional construction and which closes when a person is detected in the vicinity of the switch and for a fixed time thereafter. In series with the switch is another switch which is designed to open when ambient light conditions are sufficiently good to make it unnecessary to provide extra lighting.

[0016] Fig 2 shows a fluid-circulation central heating system in which two light fittings are attached to respective radiators connected to receive hot water from a boiler via flow pipe and to return cooler water via pipe to the boiler.

[0017] Figs 3A and 3B show the physical configuration of one of the light fittings in more detail. It comprises a generally hemispherical housing having vents at top and bottom and a front opening. The housing has recesses on its edge to receive receiving permanent magnets (Fig 3B) by which it is attached to a conventional steel radiator. Its inner surface is formed with a recess that houses the rechargeable battery and lips or recesses that serve to locate the thermoelectric generator, a circuit board and the LED board. Figs 3A and B show that the hot side of the thermoelectric generator is held in close thermal contact with a flat surface of the radiator. Its opposite, cold, side is defined by a finned heat dissipation block. The circuit board carries the power management circuit and the light sensitive switch.

[0018] In a typical configuration, a number of units like that shown in Fig 3 would be attached to radiators spaced along a corridor. Provided the sensor indicated that there was a low level of ambient light, each unit would provide illumination whenever a person entered its vicinity as detected by the sensor.

[0019] It will be appreciated that, because the lighting system provided by the illustrated device uses energy distributed in the form of heat from a central heating system, it can be operated more economically than conventional lighting supplied via a conventional wired distribution system. Of course many modifications can be made to the system without departing from the invention as defined by the accompanying Claims. For example, the housing can be of a different shape, eg elongated, to fit onto flat parts of radiators that are ribbed or otherwise not flat. The housing could be attached to the radiator by means other than magnets eg by clamps or by adhesive, and the "hot" side of the thermoelectric generator could carry a deformable layer of heat conductive material or a heat-conductive adhesive layer to accommodate any imperfections in the shape of the radiator surface and thereby to provide a good thermal contact. In other arrangements, the device could be shaped to fit over a standard cylindrical water pipe forming part of the heating system. Instead of lamps, the device could be designed to provide power to operate an intruder alarm, thermostatic controls for the central
heating system, a battery charger e.g. for mobile and cordless phones and for many other purposes.

[0020] **Definitions**

[0021] In this specification, the following terms have meanings as defined below:

[0022] "Battery" means any cell or group of cells for converting chemical energy to electrical energy and, in the case of a rechargeable battery, for reversing the process by converting electrical energy to chemical energy.

[0023] "Consumption Point" means any device which consumes electrical energy or which acts as a connector or transformer for passing electricity to a device that consumes electricity.

[0024] "Fluid-flow heating system" means a heating system comprising a heat source arranged to heat a fluid, and means for distributing the heated fluid into or through spaces to be heated.

[0025] "Radiator" is a device connected in a fluid-flow central heating system, through which the heated fluid flows and which is designed to transfer the heat from the fluid to surrounding air by conduction, convection or radiation.

[0026] "Thermoelectric device" means any device which has a "hot" part and a "cold" part and which generates an electric potential difference when the hot part is maintained at a higher temperature than the cold part.
Claims

[0001] A method of supplying electrical power to at least one electrical consumption point characterised in that a central heating system is used to transfer heat energy to a thermoelectric device connected to supply electricity to the said consumption point.

[0002] A method according to claim 1 in which the thermoelectric device is held in thermal contact with an external surface of a radiator forming part of the central heating system.

[0003] A method according to Claim 1 or 2 including two or more electrical consumption points as aforesaid.

[0004] A method according to any preceding Claim characterised in that energy is stored at the or each electrical consumption point using a rechargeable battery.

[0005] A method according to any preceding Claim for supplying electrical power to one or more electric light source(s).

[0006] A method according to Claim 5 characterised in that the or each light source is switched automatically dependant on signals from a person detector.

[0007] A method according to Claim 5 or 6 characterised in that the or each light source is switched automatically dependant on signals from an ambient light sensor.

[0008] An electrical energy supply system comprising a liquid circulation central heating system having a heat source and at least one radiator, the system including a thermoelectric device attached to the radiator so as to generate electricity from heat released from it.

[0009] An electrical energy supply system according to Claim 8 characterised in that the thermoelectric device is held in thermal contact with an external surface of a radiator of the central heating system.

[0010] An electrical energy supply system according to Claim 8 or 9 including two or more thermoelectric devices as aforesaid on respective radiators.

[0011] An electrical energy supply system according to any of Claims 8 to 10 characterised in that energy from each thermoelectric device is stored in a rechargeable battery.

[0012] An electrical energy supply system according to any of Claims 8 to 11 characterised by an electric light source connected to receive power from the thermoelectric device and/or the rechargeable battery.

[0013] An electrical energy supply system according to Claim 12 characterised by a person detector, associated with each light source for detecting the proximity of a person and switching means for controlling the light source in dependence on an output from the person detector.
[0014] An electrical energy supply system according to Claim 11 characterised by an ambient light sensor, associated with each light source and switching means for controlling the light source dependant on an output from the ambient light sensor.

[0015] An electrical energy supply system according to any of Claims 8 to 14 characterised by attachment means for attaching the thermoelectric device removably to the radiator.

[0016] An electrical energy supply system according to Claim 15 characterised in that the attachment means is magnetic.

[0017] An electrical device comprising a thermoelectric generator, means for attaching the generator to a room heater, the thermoelectric generator being arranged so that it is in thermal contact with the heater when the device is attached to the heater.

[0018] An electrical device according to Claim17 including a battery connected to be charged by the thermoelectric generator.

[0019] An electrical device according to Claim 17 or 18 including a lamp connected to be powered from the thermoelectric generator and/or the battery.

[0020] An electrical device according to Claim 19 including a person detector connected to control the lamp depending on the presence of a person in a vicinity of the device.

[0021] An electrical device according to Claim 19 or 20 including an ambient light detector connected to control the lamp depending on the level of ambient light.

[0022] A removable device whereby heat from a heating system is utilised to generate electrical power by use of thermoelectric generators for the purpose of lighting.

[0023] A method of supplying electrical power to at least one electrical consumption point, characterised in that a fluid-flow heating system is used to transfer energy in the form of heat to the consumption point and in that a thermoelectric device is employed to convert the energy to electrical form; the electrical consumption point not being a lamp and/or not being removable.

[0024] An electrical energy supply system comprising a liquid circulation central heating system having a heat source and at least one radiator, the system including a thermoelectric device attached to the radiator so as to generate electricity from heat released from it; the electrical consumption point not being a lamp and/or not being removable.

[0025] An electrical device comprising a thermoelectric generator, means for attaching the generator to a room heater, the thermoelectric generator being arranged so that it is in thermal contact with the heater when the device is attached to the heater; the electrical consumption point not being a lamp and/or not being
removable.
FIG 1
### INTERNATIONAL SEARCH REPORT

**International application No**

PCT/GB2009/050535

**A. CLASSIFICATION OF SUBJECT MATTER**

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According to International Patent Classification (IPC) or to both national classification and IPC

**B. FIELDS SEARCHED**

Minimum documentation searched (classification system followed by classification symbols)

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Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

**EPO-Internal , WPI Data**

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

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Further documents are listed in the continuation of Box C

**See patent family annex**

- Special categories of cited documents
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- "&" document member of the same patent family

- Date of the actual completion of the international search
  - 12 February 2010

- Date of mailing of the international search report
  - 22/02/2010

- Name and mailing address of the ISA/
  - European Patent Office, P B 5818 Patentlaan 2
  - NL- 2280 HV Rijswijk
  - Tel (+31-70) 340-2040
  - Fax (+31-70) 340-3016

- Authorized officer
  - Kirkwood, Jonathan
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