Nov. 20, 1956 M. D. LICHTENSTEIN 2,771,537

THERMAL FLOOR COVERING

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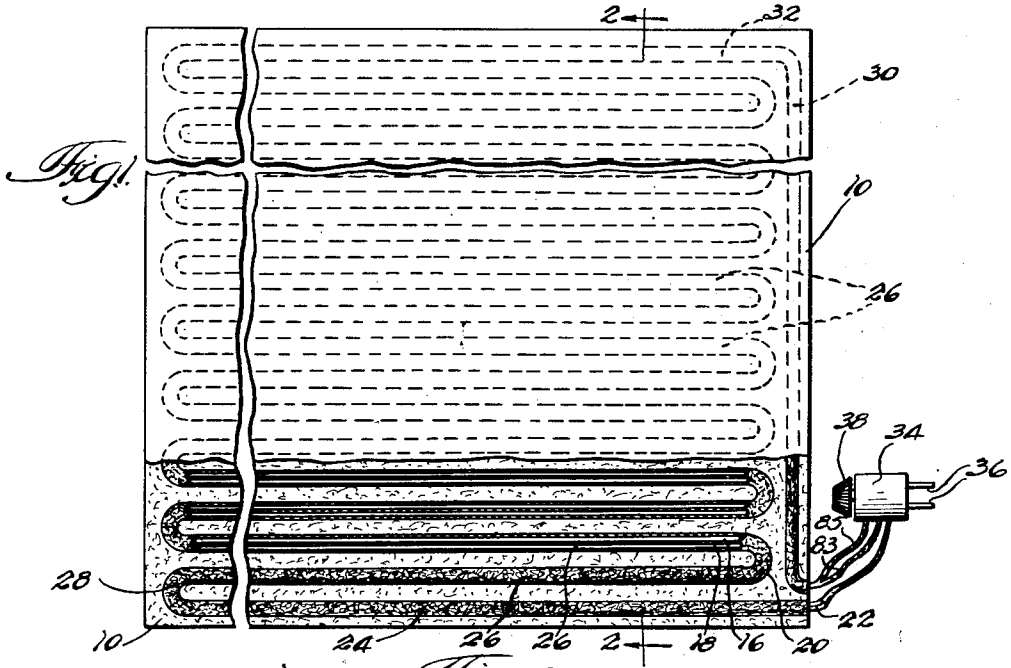


Fig. 1.

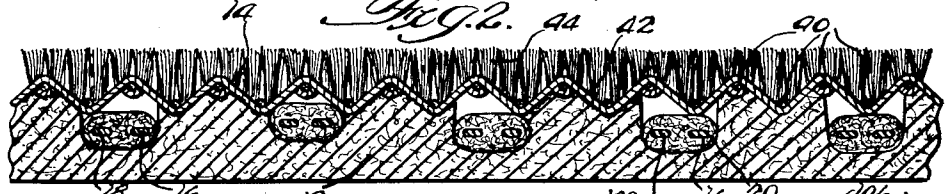


Fig. 2.

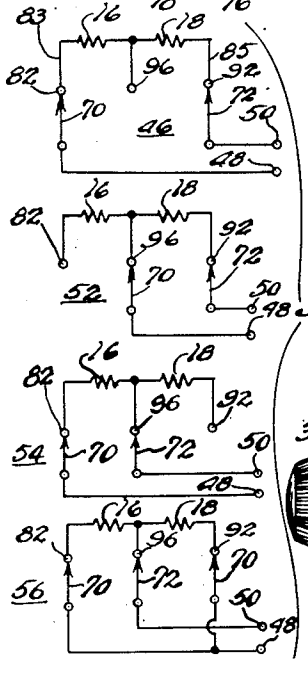


Fig. 3.

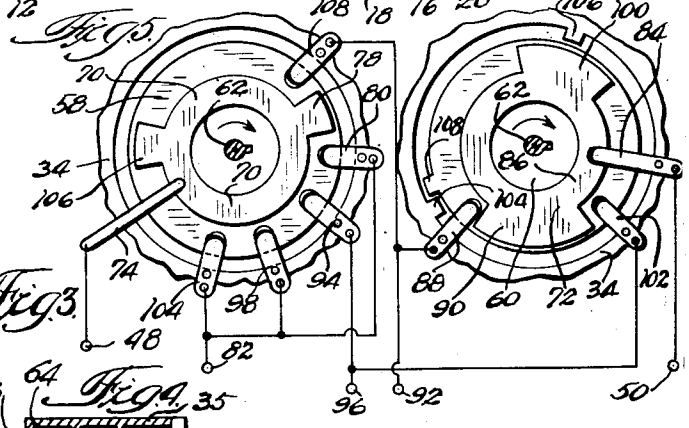


Fig. 5.

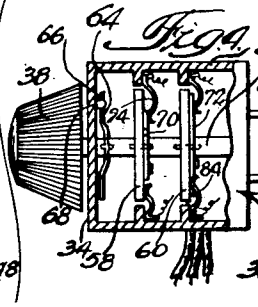


Fig. 4.

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THERMAL FLOOR COVERING

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2 Claims. (Cl. 219—46)

This invention relates to a floor covering and more particularly to an improved floor covering incorporating a source of heat therein.

It is a principal object of this invention to provide an improved method and apparatus for room heating. Certain problems have been universally recognized in the heating and ventilating industry, some of which are of long standing, others having originated with modern architecture and home planning. The effect of convection forces on the air within a room or other enclosed space concentrates the warm air in the upper regions of the room, while the floor area may be substantially below a comfortable living temperature. This has been recognized as a basic physical phenomenon and has been coped with in part by the positioning of hot air vents or radiators as close to the floor as possible. In addition to this ever present problem, modern architecture is, in many instances, providing living quarters constructed on footings which maintain the floor level only a short distance above the ground. As the ground will generally be relatively cold and damp, this produces additional undesired loss of heat through the floor areas of such living quarters. Other home constructions now utilize a single concrete slab poured directly onto the ground, in which event the slab will generally be cold and damp unless expensive precautions are taken to prevent this condition. One method which has been proposed for maintaining the floor area at a more desirable temperature is the inclusion of heating coils within such a concrete slab and passing hot water or steam through said coils. Such panel heating overcomes the detrimental effects of convection at least in part, but clearly cannot be installed in any existing structures without great expense and is not satisfactory in many new structures.

It is, therefore, a further object of this invention to provide an improved system of room heating which may be either independent of existing facilities or combined therewith as an integrated unit.

It is another object of this invention to provide an improved floor mounted heating unit which is readily susceptible to repair, maintenance or replacement.

It is still another object of this invention to provide a floor covering incorporating a heating unit therein which can be cleaned, removed or stored conveniently when desired.

It is another object of this invention to provide an improved floor covering which incorporates a source of thermal energy as well as insulates against the loss of heat through the adjacent floor area.

It is another object of this invention to provide an improved floor covering incorporating a heating source therein, said heat source being controllable over a substantial range of temperature and also being operated from available commercial power sources.

It is another object of this invention to provide a floor covering and heating device which can be used in conjunction with existing heating systems, such as forced air, hot water or steam, or can be used as the sole source of heat during marginal periods when small quantities of heat are required.

It is another object of this invention to provide an improved floor covering and heat source whereby rooms may be individually varied in temperature from a predetermined ambient level, said ambient level being dictated by the central heating system.

Further and additional objects of this invention will become manifest from a consideration of this specification, the accompanying drawing and the appended claims.

In one form of this invention a conventional pile fabric rug is provided in conjunction with an electric heating element and a foam rubber base. More particularly an electric heating element having two separate conductors capable of providing various degrees of heat is permanently secured between a sponge rubber base and a pile fabric covering with the base fused into the interstices of the fabric.

For a more complete understanding of this invention reference will now be made to the accompanying drawing wherein:

Fig. 1 is a diagrammatic plan view of one embodiment of this invention shown partially in section;

Fig. 2 is a vertical sectional view taken on the line 2—2 of Fig. 1;

Fig. 3 is a group of electrical schematic diagrams indicating the manner in which various degrees of heat are available from the embodiment of Fig. 1;

Fig. 4 is a diagrammatic view partially in section of the switch of the embodiment shown in Fig. 1; and

Fig. 5 is a partial view of portions of the switch shown in Fig. 4, illustrating the relative positions of the various contacts on the wafers thereof.

Referring now to the drawings and more particularly to Figs. 1 and 2, a rug covering **10** is provided which is of laminated construction having a sponge rubber base **12** fused to a pile fabric **14** with spaced electrical conductors **16** and **18** which comprise the heating element **19** disposed therebetween. As shown herein the conductors **16** and **18** are enclosed within a sheath **20** composed of a material such as asbestos which is capable of withstanding relatively high temperatures, although it is contemplated that such a sheath could be omitted as the normal operating temperature of this heating unit will be below a hazardous level. The heating element has two independent heating circuits which terminate in a switch and plug unit **34**. The conductors **16** and **18** are connected together at one end **22** and have a first length **24** which extends along one edge of the floor covering **10** and then doubles back sucessively over the first course **24** with successive lengths **26** in spaced relationship. A knee **28** is formed at each end of the individual length **26** whereby the lengths **26** are all connected seriatim. A transverse heating element length **30** is connected to the free end of the last course **32** of the parallel lengths **26** to form two complete circuits for passing heating current therethrough.

The return length **30** having two independent conductors and the lead-in conductor **22** are connected into the plug and switch unit **34**. The switch unit **34** has a conventional pair of prongs **36** adapted for insertion into a conventional socket which is connected to a commercial source of power. Customarily such a power source will be a 110 volt, 60 cycle supply. Such a source should be capable of delivering power in the order of 1500 watts without overloading the associated circuit protection equipment. A knob **38** is rotatably mounted on the socket **34** and rotation thereof effects switching of the contacts contained within the socket **34** to provide various degrees of heat as desired. The exact nature of the switching will be explained in detail hereinafter.

The pile fabric may be formed in any conventional manner, but as here shown and described comprises a plurality of threads 40 which lie in parallel spaced relationship to form a warp and a plurality of interwoven threads 42 which constitute a weft. The pile or nap 44 may be secured to the warp in any conventional manner either by knotting or merely by frictional engagement between the adjacent threads of the warp and weft. After the complete formation of the laminated unit, the pile is trimmed to form a carpet having a smooth upper surface. In manufacture the complete pile fabric is initially formed after which the grid of electrical heating element is placed thereon generally with the fabric in an inverted position. The conductors may be attached to the fabric by stitching, if so desired, or may merely rest upon the fabric to be secured thereto by the application of the sponge rubber base 12. The base 12 may be applied in any one of a plurality of well-known manners, the most common of which include the spraying of aerated liquid latex whereby the latex is deposited upon the fabric portion of the carpet 14 and is thereafter cured to rigidly engage the interstices of said fabric. In the alternative an aggregate of liquid latex and an appropriate gas such as air may initially be formed in a hopper and deposited upon the fabric base of the rug 14 while said rug is passing under the hopper in an inverted position. After the initial deposition of sponge rubber the entire laminated construction is cured, the exact time and temperature of curing depending upon the material used and the thickness of the deposit. Generally a curing time of the order of five to twenty minutes is required.

The sponge rubber base 12 in addition to supporting the heating element against the rug 14 serves to insulate the element from the floor upon which the carpet rests. Thus, though the floor may be of concrete construction or be exposed to the cold areas under a living quarters, the heat generated in the resistance heating element will not be dissipated downwardly but will warm the pile fabric thereabove, providing a substantial area of contact with the air in the room whereby substantial heat transfer to said air is effected. The air so heated will rise due to convection, thus producing increased warmth in the entire room and especially in the floor area. Because of the large heating area provided, the temperature differential between the heating element and the surrounding air may be small. It is contemplated that the lengths of heating element be placed approximately 4 inches apart in one embodiment of the invention; thus for a 9 x 12 rug, the length of heating element is somewhat less than 350 feet. The individual conductor lengths are shown with a flat cross section in the transverse sectional view of Fig. 2. While this is believed advantageous, round conductors may be employed satisfactorily. In one typical embodiment, a material was used having substantial ductility, a high resistivity, and a high temperature coefficient of resistance. The latter property is desirable in that is provides a degree of thermal regulation where, for any reason, a section or all of the floor area begins to heat excessively. The cross sectional area of the conductors 16 and 18 will depend upon the total resistance required, which is, in turn, a function of the heat desired. In one particular case, four heat levels were required providing energy dissipation at the rate of 1300, 800, 500 and 300 watts respectively.

As shown in Fig. 3, the described embodiment of the invention provides four possible combinations of heating conductors to produce four degrees of heat. The two resistance elements 16 and 18 will normally be of different resistance values whereby the use of either one of the elements independently will produce one predetermined heat level. For example, in a unit designed for 120 volt operation the heating element 16 may be selected to have a resistance of the order of 18 ohms such that 800 watts will be dissipated therein when the resistance is energized. The second heating element may be selected to dissipate energy at the rate of 500 watts, for example, in which event the resistance of element 18 is in the order of 26 ohms. If the contacts forming a part of switch and socket unit 34 are positioned as shown in circuit diagram 46 of Fig. 3, the elements 16 and 18 are connected in series from line terminal 48 through contact 70 to the terminal 82 connected to the free end 83 of conductor 16, the two resistance wires 16 and 18, a conductor 85 connected to the free end of heater 18, terminal 92, and contact 72 to line terminal 50. This circuit presents a resistance of approximately 44 ohms, producing heat dissipation at the rate of about 300 watts. If the switch contacts 70 and 72 are shifted to the position shown in circuit diagram 52 of Fig. 3, heating element 18 is energized alone whereby energy is dissipated at the rate of approximately 500 watts. The heating circuit is completed from line terminal 48 through contact 70, terminal 96, heater 18, terminal 92 and contact 72 to line terminal 50. Upon rotating knob 38 to the fourth position, the contacts 70 and 72 are positioned as shown in circuit diagram 54 of Fig. 3 in which only heating element 16 is connected to the source of power whereby approximately 800 watts is dissipated. The circuit is from line terminal 48 through contact 70, terminal 82, heater 16, terminal 92 and contact 72 to line terminal 50. Circuit diagram 56 illustrates the configuration when the knob is rotated to the fifth position, highest degree of heat available. In this position contact 72 engages the common terminal of the heating elements 16 and 18, while contact 70 engages each of the otherwise free terminals of heating elements 16 and 18, thus placing the heating elements in parallel and providing a total heat dissipation of about 1300 watts.

While the switching for various degrees of heat as herein described may be accomplished by any one of a plurality of familiar devices, one particular device is herein described which is especially well adapted for use with a heated rug or carpet as it is simple in construction, will not consume any substantial space, and is integrally formed with the plug which will normally be in engagement with the wall socket. The knob 38 is fixed to a shaft 62 rotatably mounted in the switch housing 35, said shaft having contact wafers 58 and 60 as well as a spring clip 64 fixed thereto. The spring clip 64 serves as a detent to maintain the desired position of the switch contacts. The spring detent 64 has a small aperture therein which receives a floating ball 66 engageable with a plurality of depressions 68 formed in the switch housing 34. This assembly determines a plurality of positions which the knob 38 may assume. In this embodiment the positions available are five in number, the first being an off position in which neither heating element is energized and the other four being positions of increasing heat as explained with respect to Fig. 3.

As shown in Fig. 5 the wafers 58 and 60 have been positioned in side by side relationship to illustrate the manner in which the various circuits are energized. It will be clear that these wafers are normally mounted in tandem. Each of the wafers is composed of an electrically insulated material such as a phenolic resin and shaped metal plates 70 and 72 are secured to the wafers 58 and 60, said plates having desired coded radial extensions or tabs for completing the various circuits as described with respect to Fig. 3. Various contacts are secured in the housing 35 and are adapted to engage alternately the wafers 58 and 60 or the metal plates 70 and 72 which are secured thereto. Referring specifically to the contact configuration with respect to wafer 58 a spring contact 74 is secured in the housing 34 and engages resiliently a complete annular central portion 76 of the metal plate 70. This spring contact is continuously connected to one of the plug prongs 36 comprising line terminal 48 whereby insertion of the prongs into an appropriate socket connects the metal plate 70 to one

side of the commercial line. As shown in Fig. 5, the plate **70** is isolated from any other electrical circuit but it will be clear that if the wafer **58** is rotated in a clockwise direction the tab **78** extending outwardly from the annular portion **76** of the plate **70** will engage a contact **80** which is mounted in the housing **34** and is in resilient engagement with the wafer **58**. This will apply the incoming line voltage to terminal **82** which corresponds to one of the three terminals of the heating elements as described with respect to Fig. 3.

The second wafer **60** is also shown in its initial position with a spring contact **84** in engagement with the central annular portion **86** of the plate **72**, the contact **84** being connected to terminal **50**, the other of the two prongs **36** which engage the commercial supply. As illustrated, the conducting plate **72** is isolated from any other circuit whereby the heating element is not energized when the switch is in the position shown. If the wafer **60** is rotated in a clockwise direction along with the wafer **58**, said wafers being keyed to the common shaft **62**, spring contact **88** mounted in the housing **34** engages the tab **90** extending radially outwardly from the annular portion **76** of plate **72**. Thus, a circuit is completed from the incoming line to terminal **92** completing the series circuit as shown in diagram **46** of Fig. 3 and traced with respect thereto. If the shaft **62** is shifted to the next position clockwise tab **78** engages resilient contact **94** and tab **90** remains in engagement with contact **98**. Thus a circuit is completed between terminals **92** and **96** corresponding to the situation illustrated by diagram **52** of Fig. 3 in which only heater **18** is energized. If the shaft **62** is again shifted one clockwise position, tab **78** engages contact **98** and a second tab **100** extending radially from plate **72** engages resilient contact **102**. Thus a circuit is completed between terminals **82** and **92** as illustrated in diagram **54** of Fig. 3 energizing only heater **16**. If the shaft **62** is shifted to its fifth and last position the tab **78** engages contact **104** and a second tab **106** engages contact **108** placing terminals **82** and **92** in a common circuit with the incoming line. At the same time tab **100** remains in engagement with contact **102** placing the two heating elements in parallel and completing the circuit as illustrated in diagram **56** of Fig. 3. A system of stops is provided on wafer **60** to limit the rotation of the shaft **62**. Stops **104** and **106** are fixed in housing **35** and engageable by stop **108** which is a radial extension of wafer **60**. Thus a device is herein shown and described utilizing two heating elements uniformly disposed in a floor covering having a sponge rubber base and integrally formed pile fabric in which four degrees of heat are provided with a relatively simple switch construction. All of the diagrams and figures of the drawing are schematic in nature for the purposes of better illustrating the principles involved, and it is believed clear that one skilled in the art may conceive various combinations of fabric, base, and heating elements that will serve particular purposes, while conforming to the basic teaching of this invention.

For example, a more elaborate control may be employed whereby the temperature may be continuously varied throughout a substantial range. Also various carpet and rug constructions may be employed for use in various rooms and under any condition. For example, a carpet of cotton construction may advantageously be employed where the device is to be used in a bathroom, the rug being subject to moisture and requiring frequent cleaning.

Also it is within the scope of this invention to so construct the various elements that they may be separated either for storage or for cleaning. This may be accomplished by securing the fabric to the rubber base only at preselected points with the heating element secured only to the base structure, for example.

Without further elaboration, the foregoing will so fully explain the character of my invention that others may, by applying current knowledge, readily adapt the same for use under varying conditions of service, while retaining certain features which may properly be said to constitute the essential items of novelty involved, which items are intended to be defined and secured to me by the following claims.

I claim:

1. A floor covering comprising a planar pile surface portion, a fabric backing supporting said pile surface portion, a resilient base element secured to said fabric backing, a heating element disposed within said floor covering, said heating element comprising two elongated electrical resistance elements following side by side tortuous paths whereby the area of said planar surface is subdivided into a plurality of small uniform areas, flexible conductor means extending from each of said resistance elements, and switch means terminating said flexible conductors, said switch means comprising a housing, a plurality of wall socket engaging prongs extending from said housing, and a movable switch element mounted in said housing to selectively connect one of said resistance elements to said prongs, both of said elements to said prongs in series, or both of said resistance elements in parallel relationship.

2. A floor covering comprising a planar pile surface portion, a fabric backing supporting said pile surface portion, a resilient base element secured to said fabric backing, a heating element disposed within said floor covering, said heating element comprising two elongated electrical resistance elements following side-by-side tortuous paths whereby the area of said planar surface is subdivided into a plurality of small substantially uniform areas, flexible conductor means extending from each of said resistance elements, and switch means terminating said flexible conductor means comprising a housing, a plurality of wall socket engaging prongs extending from said housing, and a movable switch element mounted in said housing to selectively connect each one of said resistance elements to said prongs.

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