

June 16, 1964

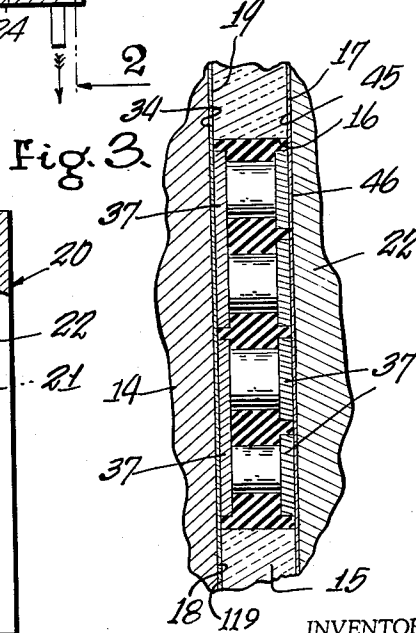
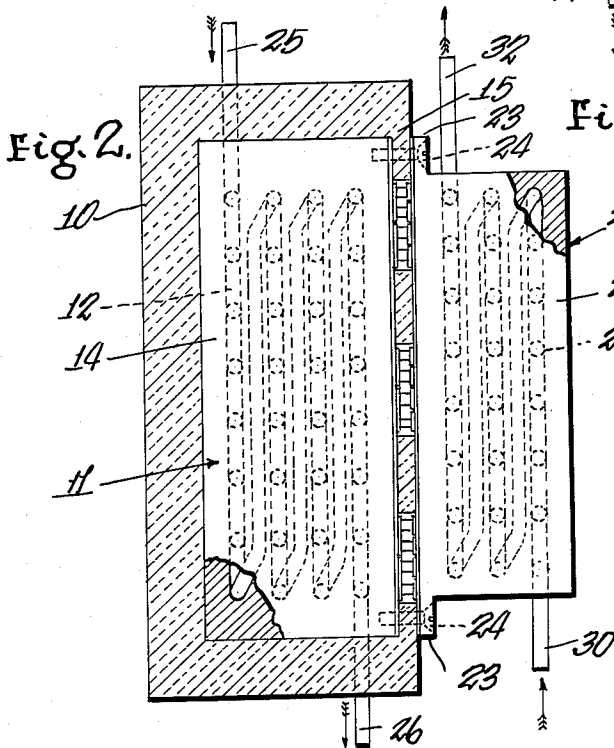
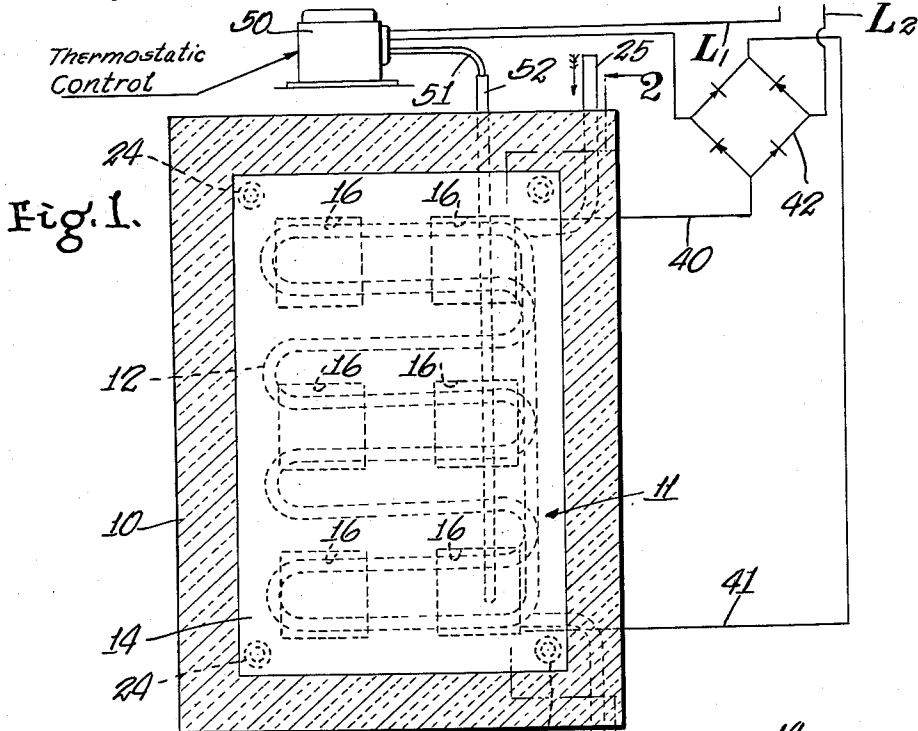
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3,137,141

THERMOELECTRIC WATER COOLERS

Filed April 19, 1962

2 Sheets-Sheet 1



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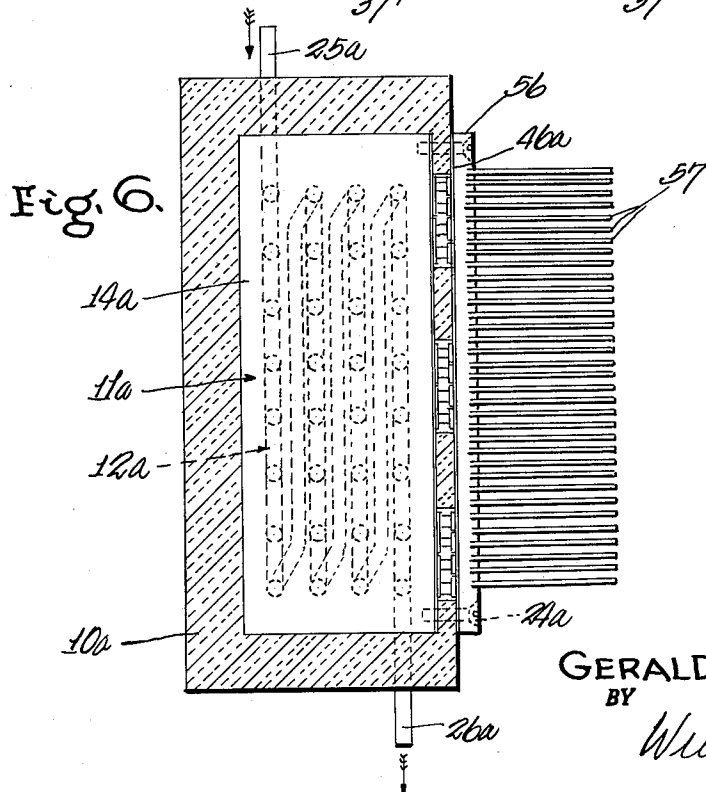
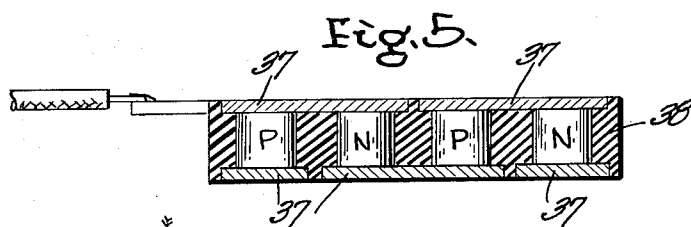
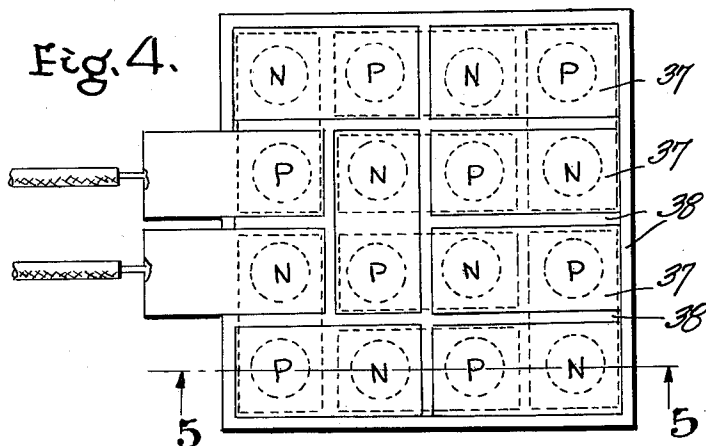
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THERMOELECTRIC WATER COOLERS

Filed April 19, 1962

2 Sheets-Sheet 2



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3,137,141

THERMOELECTRIC WATER COOLERS

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6 Claims. (Cl. 62—3)

My invention relates to thermoelectric water coolers and the principal object of the invention is to provide new and improved coolers of this type.

Many years ago it has been found that when an electric current is passed through a thermoelectric couple, one junction is heated and the other junction is cooled. This effect is called the Peltier effect and named after its discoverer, Jean Peltier.

My invention utilizes the Peltier effect in a water cooler construction of efficient design so as to eliminate the necessity of the usual compressor-condenser construction now common in commercial and domestic water coolers. Elimination of these parts will greatly prolong the life of a water cooler since moving parts, such as in a compressor and motor, are no longer necessary.

In the drawings accompanying this specification and forming a part of this application, there are shown, for purposes of illustration, several embodiments which this invention may assume, and in these drawings:

FIGURE 1 is a section through the front of a casing which includes an embodiment of my invention,

FIGURE 2 is a transverse section corresponding generally to the line 2—2 of FIGURE 1,

FIGURE 3 is an enlarged fragmentary sectional view of a portion of the construction shown in FIGURE 2,

FIGURE 4 is an enlarged plan view of a thermoelectric module used in the present embodiment of my invention,

FIGURE 5 is a sectional view corresponding generally to the line 5—5 of FIGURE 4, and

FIGURE 6 is a view similar to FIGURE 2 but disclosing a different embodiment of my invention.

The embodiment of the invention disclosed in FIGURES 1 through 5 comprises a housing 10 which may be formed of any suitable electric and heat insulating material, preferably of the type which is form retaining to provide a desired degree of rigidity. Within the housing 10 is a water cooling member 11 and in the embodiment illustrated the cooling member comprises a water coil 12, preferably copper tubing wound to serpentine formation.

To secure the ultimate in thermal transference, the water coil 12 is cast within a block 14 of material having good thermal conducting properties and of a lower melting point than the material of the water coil. In the event that the water coil is formed of copper tubing, the block may be formed of aluminum. Further, the housing 10 may be cast about the block 14, if desired, and may be provided with a metal jacket (not shown) enclosing all but a wall 15, for support and decorative purposes.

The wall 15 is provided with a plurality of transverse openings 16 extending therethrough which may be rectangular, as seen in dotted lines in FIGURE 1, and spaced in a predetermined rectangular pattern. The wall 15 is preferably formed with flat opposed sides 34, 17, and the rear surface 18 (or righthand surface as viewed in FIGURE 2) of the block 14 is disposed in juxtaposed relation with respect to the side 119 of the wall 15.

Preferably, the surface 18 is machined and/or ground smooth and perfectly flat or as near perfectly flat as is possible in ordinary production practice. For use with thermoelectric modules of the type herein disclosed, the surface 18 is provided with a thermally-conducting electrically-insulating film or coating 19 and at the present time a film produced by an anodizing process is preferred.

A heat dissipating member 20 is secured to the wall 15 and in the embodiment disclosed in FIGURES 1

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through 5 this member takes the form of a water coil 21, preferably copper tubing wound to serpentine formation. To secure the ultimate in thermal transference, the water coil is cast within a block 22 which may be the same material as the block 14.

The block 22 is formed with ears 23 and suitable fastening means engage the ears for the purpose of holding the block 22 in place. At the present time, it is preferred to use screws 24 which pass through aligned holes in the ears 23 and the wall 15 and are threaded into the block 14. The screws are formed of heat insulating material and may be metal screws covered with a nylon or like coating, or the screws may be formed entirely of nylon, Teflon, or the like.

The front surface 45 (or the left hand surface shown in FIGURE 2) of the block 22 is disposed in juxtaposed relation with respect to the side 17 of the wall 15. Preferably, the surface 45 is machined and/or ground smooth and perfectly flat or as near perfectly flat as is possible in ordinary production practice. For use with thermoelectric modules of the type herein disclosed, the surface 45 is provided with a thermally-conductive, electrically-insulating film or coating 46, and at the present time a film produced by an anodizing process is preferred.

The coil 12 has an inlet 25 which is adapted to be connected to a suitable source of drinking water supply (not shown) and the coil has an outlet 26 which may be connected to a cold water storage tank as in usual water cooler construction, and/or to a bubbler (not shown) or other suitable dispensing valve. The inlet 30 of the coil 21 is connected to a suitable source of water and the latter is caused to flow through the coil 21 and outwardly of an outlet 32 to dissipate heat from the block 21.

Within each of the openings 16 of the wall 15 is a thermoelectric means, and such means are preferably disposed thermally in parallel and connected electrically in series, although the reverse may be utilized. A suitable commercially available type of thermoelectric means is manufactured by Ohio Semiconductors, Division of Tecumseh Products Company, and is identified as TA-20. Referring particularly to FIGURES 4 and 5, each module comprises an array of thermoelectric junctions, eight in the particular case illustrated. Each module is preferably rectangular in plan, as seen in FIGURE 4, and of a size to fit within an opening 16 in the wall 14. As best seen in FIGURE 5, each of the array of thermoelectric junctions comprises two dissimilar metals, such as N type bismuth telluride alloy (designated N) and P type bismuth telluride alloy (designated P) the metals being electrically connected in series by copper strips 37 which are insulated from each other as shown by insulation represented by the areas 38 and which may be a suitable potting compound. The strips 37 on the underside of FIGURE 4 are shown by the dotted lines which indicate that the lower strips are of a smaller size than the upper strips, but this is merely to illustrate the disposition of the various strips since in the preferred construction all strips are of the same size.

The modules are electrically connected in series, the modules at opposite ends of the series relation being connected by conductors 40, 41 to a rectifier 42 (in the event the available power supply is alternating current). The rectifier 42 is shown in FIGURE 1 as connected to lines L1 and L2 extending from a suitable source of electric power, such as the power line normally present for domestic and industrial installations. An electric switch 50 is interposed in one of the lines, such as line L1, the switch being thermostatically controlled by suitable mechanism which is actuated by expansion and contraction of fluid within a bulb or tube 51. The tube 51 is disposed within a conduit 52 which is also cast within the block 14.

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As best seen in FIGURES 3 and 5, the top and bottom of each of the modules present substantially flat parallel surfaces, and as before pointed out the modules have their component parts connected electrically in series. The connecting strips 37, which form the junction between the elements P and N, are so disposed that all the cold junctions are on one side of the module and all the hot junctions are on the opposite side.

Each module is disposed within a wall opening 16 so that its cold junctions are directed toward the block surface 18. The wall 15 is preferably of slightly less thickness than the distance between the opposite flat surfaces of the modules so that when the block 22 is secured in place, the modules are securely clamped between surfaces 18 and 45 of the blocks 14 and 22, with the hot and cold junctions in firm contact with the surfaces 18 and 45 to provide the ultimate in thermal transfer.

In the embodiment disclosed in FIGURE 6, certain construction is similar to that already described and corresponding parts will be identified with the same reference numerals supplemented with the suffix "a."

In FIGURE 6, the block 22 and water coil 21 are omitted and in place of the block a plate 56 is bolted to the block 14a, the plate having an anodized film 46a which engages the hot junctions of the modules. The construction in FIGURE 6 is adapted for air cooling and as shown the plate 56 is formed with a plurality of cooling fins 57 which may either be cast integrally with the plate or formed separately and secured thereto, and may be exposed to a stream of cooling air.

In view of the foregoing, it will be apparent to those skilled in the art that I have accomplished at least the principal object of my invention and it will also be apparent to those skilled in the art that the embodiments herein described may be variously changed and modified, without departing from the spirit of the invention, and that the invention is capable of uses and has advantages not herein specifically described; hence it will be appreciated that the herein disclosed embodiments are illustrative only, and that my invention is not limited thereto.

I claim:

1. A thermoelectric water cooler, comprising a supporting wall having opposed flat side surfaces provided with a plurality of transverse openings therethrough, a cooling member including a water coil cast within a first block of metal and having one end adapted to be connected to a source of water and having its other end adapted to be connected to an outlet for dispensing cooled water, said block having a flat surface held in juxtaposed relation with respect to one side surface of said supporting wall, a heat dissipating member including a water coil cast within a second block of metal and having one end adapted to be connected to a source of water and having its other end adapted to be connected to an outlet for the

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water heated by passage therethrough, said second block having a flat surface held in juxtaposed relation with respect to the opposite side surface of said supporting wall, and a thermoelectric module in each of said wall openings, said modules being disposed thermally in parallel and with all cold junctions held against the flat surface of said first block and all hot junctions held against the flat surface of said second block.

2. The construction according to claim 1 and including thermally-conducting electrically-insulating means between the cold and hot junctions of said modules and the respective flat surfaces of said first and second blocks.

3. The construction according to claim 2 wherein said thermally-conducting electrically-insulating means are anodized films on the flat surfaces of said first and second blocks.

4. A thermoelectric water cooler, comprising a supporting wall having opposed flat side surfaces and a plurality of transverse openings therethrough, a cooling member including a water coil cast within a block of metal and having one end adapted to be connected to a source of drinking water and having its other end adapted to be connected to an outlet for dispensing cooled drinking water, said block having a flat surface held in juxtaposed relation with respect to one side surface of said supporting wall, a heat dissipating member including a metal plate having heat dissipating fins cast thereon and extending laterally therefrom, said heat dissipating fins being disposed within and subjected to the cooling effect of the surrounding air, said plate having a flat surface held in juxtaposed relation with respect to the opposite side surface of said supporting wall, and a thermoelectric module in each of said wall openings, each module having opposed flat cold and hot junctions and said modules being disposed thermally in parallel with all cold junctions held flatwise against the flat surface of said block and all cold junctions held flat wise against the flat surface of said plate.

5. The construction according to claim 4 wherein said supporting wall is formed of electric insulating material to insulate said modules from each other and further including thermally - conducting electrically - insulating means between the hot and cold junctions of said modules and the respective flat surfaces of said block and said plate and bonded to said block and plate.

6. The construction according to claim 5 wherein said thermally-conducting electrically-insulating means are anodized films on the flat surfaces of the flat surfaces of said block and said plate.

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