

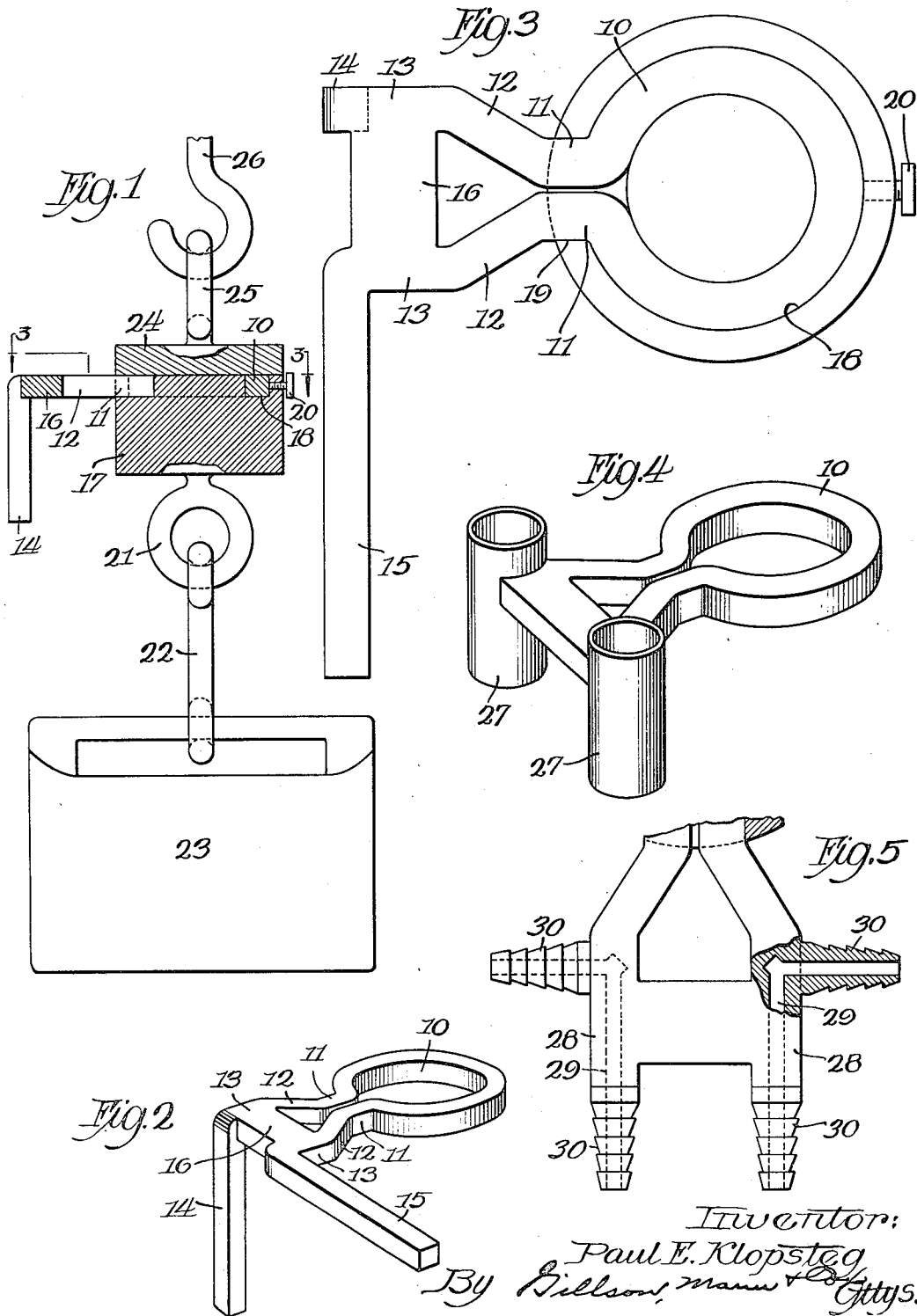
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THERMOELECTRIC DEVICE

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UNITED STATES PATENT OFFICE

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THERMOELECTRIC DEVICE

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The principal object of this invention is to provide a device that will generate thermoelectric currents of considerable amperage and, when properly associated with a core, will develop powerful magnetic forces.

Selected embodiments of the invention are shown in the accompanying drawing, in which

Fig. 1 is a sectional view through a thermoelectric magnet;

Fig. 2 is a perspective view of the thermocouple shown in Fig. 1;

Fig. 3 is a sectional view on the line 3—3 of Fig. 1;

Fig. 4 is a perspective view similar to Fig. 2, illustrating a variant form; and

Fig. 5 is a plan view with parts broken away, illustrating another variant form.

I am aware, however, that the invention may be embodied in other forms without departing from the spirit or essential attributes thereof, and put to a variety of uses, and therefore desire that the specific illustrations and correspondingly specific description be considered as illustrative only and not restrictive, reference being had to the appended claims for the scope of the invention.

The thermocouple illustrated in Figs. 1, 2 and 3 includes a thick rod of metal, having suitable thermo-electric properties relative to some other suitable metal, bent to form a substantially circular loop or coil 10, with the parallel portions 11 lying close together to form a neck, and it will be of no particular detriment to have them in contact. Beyond these portions 11 there are inclined portions 12 leading to other parallel portions 13, beyond which one end portion of the rod is bent downwardly, as indicated at 14, and the other laterally, as indicated at 15. The other element of the thermocouple is a bridge formed by a thick rod 16 of the other metal, having suitable thermo-electric properties relative to the first, soldered between the parallel portions 13.

In Fig. 1 such a couple is fitted to a base block 17 of magnetic material having an annular groove 18 extended through the side of the block at 19. A set screw 20 is provided to clamp the circular loop within the groove.

At the bottom the block 17 is equipped with an eye 21 for cooperation with a hook 22 attached to a weight 23.

Above the block 17 there is a cooperating block 24 of similar material, equipped with an eye 25 cooperating with a hook 26 by which the entire apparatus may be suspended.

In this particular embodiment the long rod of the couple is of copper three-eighths inch square, and the short rod is three-eighths inch by five-eighths inch in cross-section and composed of an alloy of sixty per cent (60%) to seventy per cent (70%) copper, and forty per cent (40%) to thirty per cent (30%) nickel. The rods are connected by hard solder. The blocks 17 and 24 are Norway iron three inches in diameter, and the groove 18 is approximately seven-sixteenths inch wide.

In operation the block 17 with the weight 23 is temporarily supported while a Bunsen burner is applied to the end portion 15, and the end portion 14 is immersed in a cooling liquid. After a short interval the temporary support is removed and the weight suspended solely by the magnet.

When the temperature difference at the two junctions of the thermocouple is approximately 350° the current will be approximately 300 amperes at 10 to 12 milli-volts and the magnet will then sustain approximately 200 pounds.

The selection of metals and proportions of parts above described make a very satisfactory device of extreme simplicity which can be put in the hands of inexperienced students without danger of its being injured. Similar embodiments can also be put to a variety of uses where robustness and dependability are required.

In the form shown in Fig. 4 the end portions 14 and 15 have been omitted, and the parallel portions 13 are equipped with cups 27 soldered thereto; and in operation one of the cups may be filled with relatively hot liquid and the other with a relatively cool liquid. The purpose of such arrangement is to enable bismuth, which has a comparatively low melting point, to be substituted for the alloy of copper and nickel which spans the gap between the end portions 13 of the cop-

per coil 10. By using a liquid at the hot junction the boiling point of which is less than the melting point of bismuth, there can be no possibility of damaging the device by melting of the bismuth. It is of course understood that bismuth is preferable to the alloy of copper and nickel in some instances because of the reduction in cost and increase of electromotive force.

10 It may be noted, however, that when bismuth is soldered to copper the joint is composed of an alloy of tin, lead and bismuth, which has a melting temperature somewhat lower than bismuth.

15 In Fig. 5 the end portions 28 of the long rod of the couple are drilled at 29 and fitted with hose nipples 30, whereby steam or other hot fluid may be applied to one end and a cooling fluid may be applied to the other. By such a structure relatively great temperature differences may be produced in the junctions with corresponding increases in thermo-electromotive forces, thermo-electric currents and magnetic effects.

25 I claim as my invention—

1. In a device of the character described, a thermo-electric couple comprising a circular loop of one metal having the end portions thereof connected by a dissimilar metal, and a magnetic core surrounded by said loop.

30 2. In a device of the character described, a rod of one metal bent to form a circular loop with its end portions extended laterally and spaced apart, a short bar of dissimilar metal connecting the end portions, and a magnetic core in the loop.

3. In a device for demonstrating thermo-electromotive force, a base block of material capable of being magnetized and having a flat face provided with a continuous groove therein to form a core and shell of a magnet, an armature block having a flat face to cooperate with the flat face of the base block, and a thermo-electric circuit comprising a single thermo-couple located at one side of, but adjacent to the base block, a coil within said groove, and a conductor extending through said shell and connecting the couple with said coil, all parts of the thermo-electric circuit being of such great thickness and minute resistance that the single couple can produce high amperage within the circuit.

4. In a device for demonstrating thermo-electromotive force, a base block of magnetic material having a flat face provided with a circular groove, a thermo-electric circuit comprising a coil located in the groove and connecting a thermo-couple presenting a hot junction at one side of the base block and a block of magnetic material having a flat face engaging the flat face of the base, all parts of the thermo-electric circuit being of great thickness and minute resistance whereby a single thermo-couple can produce high amperage.

5. In a device for demonstrating thermo-electromotive force, a base block of magnetic material having a flat face provided with a substantially continuous groove therein, a low resistance coil of metal in the groove with the end portions extending to the exterior of said block and connected with a thermo-couple, and a cooperating block of magnetic material having a flat face engaging the flat face of the base block.

6. In an experimental device for demonstrating thermo-electromotive force, a base block, a core extending outwardly from said block, and provided with a smooth flat face, said core being capable of being magnetized, an armature block of magnetic material having a smooth flat face for cooperating with the flat face of said core and a thermo-couple having one of its junctions located outwardly from said core, said thermo-couple comprising a coil of conducting material of low resistance extending about said core, said coil being of large cross sectional area thereby offering minute resistance to the flow of electricity through the same whereby when the "hot" junction of said thermo-couple is heated a current of high amperage will flow through said coil for magnetizing said core for attracting said armature.

7. For use in generating thermo-electricity, a closed electrical circuit including rods of dissimilar metal having thermo-electric properties relative to each other, said circuit being characterized by having a large cross sectional area at any point in the circuit relative to the specific electrical resistance of the metal at that point so that the circuit as a whole offers low resistance to the passage of current, one of the junctions of the dissimilar metals being adapted to be heated to a relatively high temperature to cause a current of high amperage and low voltage to flow through the circuit, a portion of said circuit being in the form of a loop.

8. In a device of the character described, a thermo-electric couple comprising a closed electric circuit, a portion of which is in the form of a circular loop, said circuit including dissimilar metals having a junction spaced from the loop and adapted to be heated to a relatively high temperature to cause a current to flow through the circuit, said circuit being characterized by having a large cross sectional area at any point in the circuit relative to the specific electrical resistance of the metal at that point so that the circuit as a whole offers low resistance to the passage of current.

9. In a device of the character described, a thermo-electric couple comprising a closed electrical circuit, a portion of which is in the form of a circular loop, said circuit including dissimilar metals having hot and cold junctions spaced from each other, means for passing a cooling liquid in heat exchange relation

to the cold junction so that when heat is applied to the hot junction, a current will flow through the circuit, said circuit being characterized by having a large cross sectional
5 area at any point in the circuit relative to the specific electrical resistance of the metal at that point so that the circuit as a whole offers low resistance to the passage of current.

In testimony whereof I affix my signature.

10 PAUL E. KLOPSTEG.

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