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2,491,876

FLUID COOLED RESISTOR

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FIG.1.

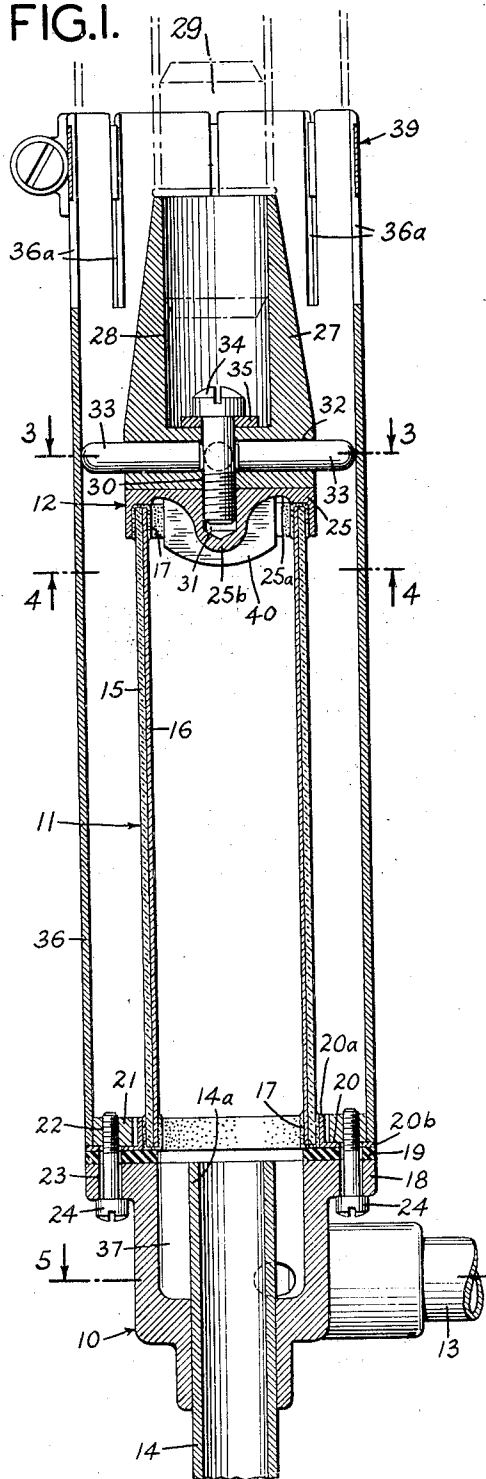


FIG.2.

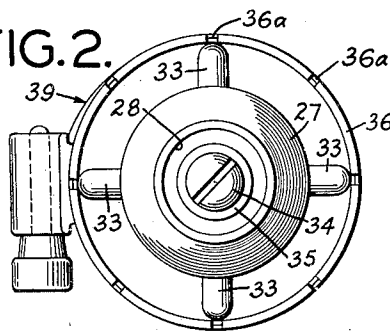


FIG.3.

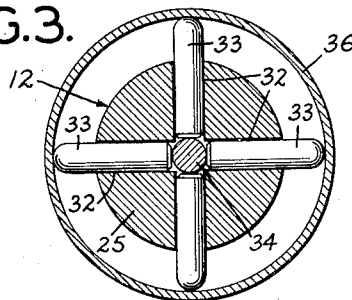


FIG.4.

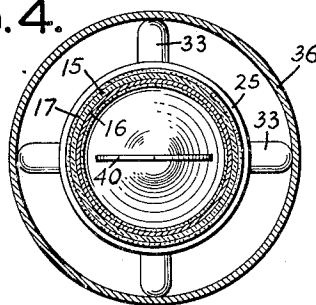
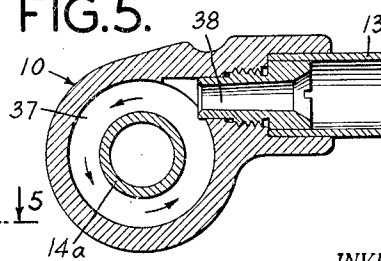


FIG.5.



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FLUID COOLED RESISTOR

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4 Claims. (Cl. 201—65)

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This invention relates to a resistor construction of the fluid-cooled type.

An object of this invention is to provide a fluid-cooled resistor construction wherein various hot points caused by air spaces on the surface of a resistance coating are avoided. A further object is to impart a whirling movement to the fluid as it travels along the resistance coating in order to avoid such hot spots.

The invention accordingly consists in the features of construction, combinations of elements, and arrangements of parts as will be exemplified in the structure to be hereinafter described, and the scope of the application of which will be indicated in the following claims.

In the accompanying drawing in which is shown one of the various possible embodiments of this invention,

Figure 1 is a longitudinal sectional view of the resistor construction as assembled for operation;

Figure 2 is a top plan view looking down into the resistor construction shown in Figure 1;

Figure 3 is a transverse sectional view taken along the line 3—3 of Figure 1;

Figure 4 is a transverse sectional view taken along the line 4—4 of Figure 1; and

Figure 5 is a transverse sectional view taken along the line 5—5 of Figure 1.

Prior to the present invention, there were in use various types of liquid-cooled resistors wherein a liquid, such as water, was directed along the resistance surface for cooling this surface and thereby increasing the power rating of the resistor. One type of unit comprises a tube having a resistance coating on the inner surface thereof and couplings to direct water through the tube in a steady stream so that it will contact the resistance coating. However, a troublesome factor in the operation of such resistors is the formation of bubbles along the resistance coating resulting in hot spots which may burn out points on the coating to change the characteristics of the resistor. It has been suggested that the fluid, such as water, might be given a helical flow in its passage through the resistance tube to thereby eliminate bubbles and consequent hot spots. The present invention comprises a particular apparatus for effecting this desirable result.

Referring now to the drawing, a base fitting, generally indicated at 10, supports and has secured thereto a resistor tube, generally indicated at 11, sealed at its opposite end by a terminal fitting, generally indicated at 12. The fittings 10 and 12 act as electrical connectors for the opposite ends of the resistance tube 11, and a fluid,

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such as water, is directed through the tube by way of the inlet pipe 13 and outlet pipe 14.

The resistor tube 11 includes a dielectric body 15 formed from any suitable ceramic or glass-like material having a resistance coating 16 applied to the inner surface thereof. The resistance coating 16 is preferably a carbonaceous varnish-like material and may be any suitable plastic binder including an emulsion of finely divided carbon particles. Other resistance coatings made from various metals or wire windings may be used for this purpose. Each end of the resistor tube 11 has a highly conductive coating 17, such as silver or some other highly conductive metal which extends from the resistance coating 16 around the ends of the tube and along the outer surface of the tube. Electrical connections with the resistance coating may be made through the conductive coating 17, as will be described.

The top portion of the fitting 10, as shown in Figure 1, is formed into an annular flange 18 which supports a sealing gasket 19 made from any suitable fibrous material. An annular ring 20, L-shaped in cross-section as viewed in Figure 1, has its cylindrical section 20a soldered to the metallic coating 17 to form a mechanical and electrical connection therewith while its horizontal section 20b rests on the gasket 19. A ring 21 rests on the ring 20 and has threaded holes 22 in registry with holes 23 in the flange 18 of the base 10. The outer casing 36 is preferably connected to the ring 20 to provide a cover for the parts. Screws 24 extending through the holes 22 clamp the ring 21 down on the parts to hold them in assembled relationship. Thus the resistor tube 11 is firmly held in position on the base fitting 10, and a reliable electrical connection is provided between the fitting and this end of the tube.

The terminal fitting 12 includes a cup-shaped metal member 25 fitting over the upper end of the tube 11 as viewed in Figure 1. The cup-shaped member 25 is soldered in this position by a solder connection with the upper metallic coating 17. The terminal fitting 12 also includes a member 27 resting upon the cup-shaped member 25 and having a bore 28 for the reception of a cable connector or the like indicated at 29. As will be seen in Figures 1 and 3, the member 27 has a smaller vertical bore 30 in registry with the threaded bore 31 in the fitting 25. Member 27 also has radial bores 32 extending from bore 30 to the outer surface of member 27.

Spacing rods 33 rest in the bores 32, and a screw 34 extends through bores 30 and 31 to hold the

parts in assembled relationship. Preferably a washer 35 is provided for the screw 34.

When assembled, as shown in Figure 1 with the screw in position, the member 27 is secured to the member 25 to provide the terminal fitting 12, and the spacing rods 33 rest against the inner surface of the outer casing 36. Casing 36 and its ring 21 rest on the gasket 19 and the fitting 10. Accordingly, the resistor tube is held firmly in position within the casing 36 with terminal fittings 10 and 12 at the opposite ends forming electrical connections therewith. Furthermore, water may be circulated through the tube by way of the pipes 13 and 14 in a manner to be presently described.

A cylindrical cavity 37 is formed in the base fitting 10, and the pipe 14 has a projection 14a extending into the cavity. The pipe 13, as shown in Figure 4, fits into the base fitting 10 at right angles to the pipe 14 and is connected with a passage 38 leading into the cavity 37. As best shown in Figure 4, the passage 38 opens into the cavity 37 to one side of the axis of the projecting portion of pipe 14a. More particularly, the opening of the passage 38 is positioned to direct fluid from the pipe 13 in a glancing direction against the surface of cavity 37; this glancing direction might be termed tangential to the periphery of the cavity 37. Accordingly, liquid flowing into the base fitting 10, through the inlet pipe 13 is directed via the passage 38 tangentially against the sides of the cavity to give such fluid a whirling circular motion.

The lower face of the member 25, as viewed in Figure 1, is formed into an annular circular groove 25a forming a point 25b at the center thereof. This annular depression in the member 25, facing the bottom of the tube 11, as shown in Figure 1, directs a liquid or fluid which is moving upward along the inner surface of the tube near the upper end thereof toward the center of the tube and downwardly in the general direction of the axis of the tube. A baffle 40 secured to member 25 extends downwardly into the tube as shown in Figures 1 and 4. This baffle tends to slow down the whirling of the water column allowing heavy particles in the water to be carried away rather than being thrown against the coating 16 and held there in a whirling motion by centrifugal force which might abrade the coating.

Accordingly, a liquid, such as water, may be introduced through the inlet pipe 13 at considerable pressure so that when it leaves the passage 38, it strikes the projecting portion 14a of the pipe 14 tangentially, and accordingly assumes a circuitous upward path in a generally spiral direction and at considerable velocity. The liquid continues such upward spiral path along the resistance coating 16 of the tube 11 to thereby cool this surface and hence increase the power rating of the unit. Upon reaching the upper end of the tube 11, the liquid enters the annular groove 25a of the member 25 and is deflected inwardly and downwardly by the shape of the member 25. This provides a countercurrent of liquid which flows in a downward direction generally along the axis of the tube 11 thus to enter the projecting portion 14a of the pipe 14.

Pipes 13 and 14 are so proportional with respect to the pressure of the liquid in the pipe 13, the size of the passage 38 and the size of the tube 11 that a balance may be established and maintained within the tube 11 in which the liquid is continuously maintained in a rushing spiral path from one end of the resistance coating 16 to the

other end thereof. Accordingly, the formation and existence of air or steam bubbles along the resistance coating 16 of the tube 11 is eliminated for all practical purposes because of the centrifugal force of the rushing liquid along the surface.

In this construction it is possible to have both the inlet and outlet connections for the liquid-cooler resistor unit at the same end of the unit although it will be appreciated that the outlet 14 might be located at the opposite end if desired. The outer casing 36 serves as a protection for the resistance unit and is longitudinally slotted at 36a at the upper end portion, as shown in Figure 1, so that it may be clamped by a clamping ring generally indicated at 39 (Figure 2) about a conduit or the outer conductor of a concentric transmission line.

The resistance unit described above may be conveniently installed due to its compact construction and ready adaptability for connection to a water supply or the like. Furthermore connections into a desired electrical circuit may also be conveniently made.

As many possible embodiments may be made of the above invention and as many changes might be made in the embodiment above set forth, it is to be understood that all matter hereinbefore set forth or shown in the accompanying drawing is to be interpreted as illustrative and not in a limiting sense.

What is claimed is:

1. In a resistor construction, in combination, resistor means forming an elongated cylindrical resistance path, a fluid directing structure supported adjacent one end of said resistor means and providing an annular passageway with respect to the axis of said resistance path, fluid supply means for directing fluid along said passageway substantially tangentially thereof to cause a whirling movement of the fluid along said cylindrical resistance path, means presenting an annular concave surface at the end of the cylindrical, resistance path opposite the fluid inlet, whereby the fluid is directed from said path backwardly toward the fluid outlet, and a baffle structure positioned adjacent said concave surface, and adapted to interfere with rotary movement of the fluid passing along said concave surface.

2. In a resistor construction, in combination, means forming a tubular resistance path, means for introducing a cooling fluid at one end of said tube in a whirling path to move along the inner surface thereof to the other end of the tube, means sealing said last-mentioned end of said tube and shaped to direct the fluid back substantially along the axis of the tube toward said first-mentioned end for exit, and a baffle extending into said tube from said sealing means.

3. In a resistor construction, in combination, a cylindrically-shaped resistor member having an elongated cylindrical resistance path on its inner wall, a fluid directing structure supported adjacent one end of said resistor member and providing an annular passageway with respect to the axis of said resistance path, fluid supply means for directing cooling fluid along said passageway substantially tangentially thereof to cause a whirling movement of the fluid along said cylindrical resistance path, means presenting an annular concave surface at the end of the cylindrical resistance path opposite the fluid inlet, and means forming a fluid outlet in the center of said passageway, said fluid being directed from said path

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backwardly by said concave surface through the center of said resistor member to said fluid outlet.

4. In a resistor construction, in combination, a cylindrically-shaped member, resistance means forming a resistance path on the inner surface of said member, a base fitting connected to one end of said member, said base fitting having a cavity therein, the diameter of the end of said cavity positioned adjacent said resistance path being of the same diameter as said resistance path, said cavity being of substantial length, means forming an inlet pipe entering said cavity at the end thereof spaced from said resistance path for directing cooling fluid into said cavity substantially tangentially thereto so as to impart a whirling movement to the fluid before it enters said resistance path, whereby said cooling fluid flows evenly around the wall of said cavity by the time it reaches said resistance path, means at the end of said member opposite said cavity for closing said last-mentioned end of said cylin-

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drically-shaped member, said means having an annular concave surface for directing the fluid passing over said resistance path backwardly through the center of said member, and an outlet member of tubular shape positioned in and extending longitudinally of said cavity, said cooling fluid being exhausted from said cylindrically-shaped member through said outlet member.

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