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W. A. RAY

2,084,654

CONTROL APPARATUS

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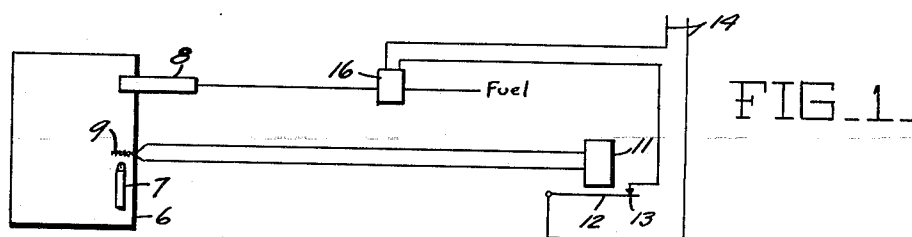


FIG. 1

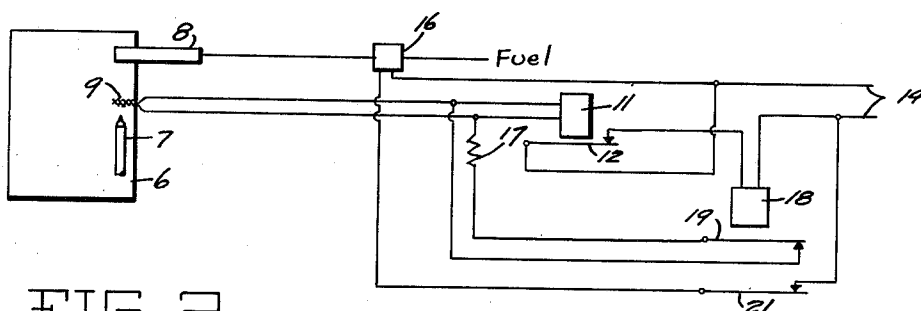


FIG. 2

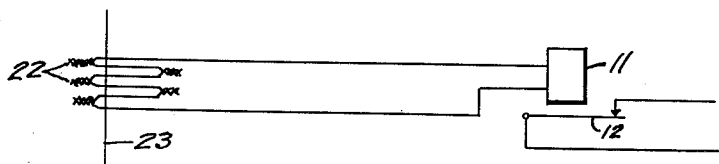


FIG. 3

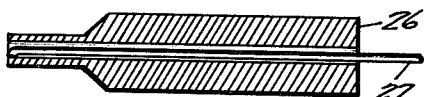


FIG. 4

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CONTROL APPARATUS

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Application January 14, 1935, Serial No. 1,748

9 Claims. (Cl. 175—320)

This is in part a continuation of my copending case Serial Number 746,247 filed September 29, 1934.

I have discovered that a thermocouple can be utilized to energize a device such as a relay, to control or operate other devices. For instance, a thermocouple can be placed so as to be responsive to a pilot burner in a furnace and energize a relay controlling a fuel valve for the main furnace burner.

I also provide for a snap action on the control relay armature to avoid contact pitting, an important feature in a relay operated upon such a small energy input as that provided by a thermocouple. If the armature is not brought in to engage its cooperative contact very sharply sparking occurs between the armature and its cooperative contact and the contacts pit. This I obviate by preventing armature movement until the thermocouple has built up a considerable current in a circuit including a resistance and then cutting out the resistance.

In my copending case I have disclosed a combination of a thermocouple and a particular type of relay. In this case I am concerned with the broad combination of a relay energized by a thermocouple.

It is in general the broad object of this invention to provide for utilization of the energy made available by a thermal couple for control purposes and other purposes.

Another object of the invention is to provide a system for utilization of the energy provided by a thermal couple.

The invention includes other objects and features of advantage, some of which, with the foregoing, will be set forth, or will be apparent upon a consideration of the present preferred embodiment of my invention set forth hereinafter.

In the drawing, accompanying and forming a part hereof; Figures 1, 2, and 3 are schematic showings of systems for utilization of my invention.

Figure 4 is a side view partly in section showing details of a thermocouple construction.

In Figure 1 I have shown a thermal device such as furnace 6 provided with means for altering thermal conditions as pilot burner 7 and main burner 8. A thermocouple 9 is placed adjacent the pilot burner and is included in a circuit with a field coil 11 of a relay. This relay has a movable armature 12 carrying a contact 13 completing a circuit from power lines 14 to a solenoid operated valve 16 or other device controlling operation of burner 8.

I have found that the coil 11 is preferably wound so as to have a high space factor to the end that the relay operates upon the low power of the couple. I prefer to wind the coil with a thin metal foil insulated with suitable means or having an insulating oxide film thereon.

To avoid pitting the armature contacts I provide for an armature movement which is definite and positive in action. Thus I place a resistance 17 across field coil 11 (Figure 2) so that armature 12 is moved only after the couple is supplying considerable power. Armature 12 then completes a power line circuit through a coil 18 of another relay which includes a first armature 19 in the shunt circuit of resistance 17. Movement of this armature results in a cutting out of the resistance 17 and in armature 12 being held in with a definite pressure. A second armature 21 is included to operate a control or other circuit.

In Figure 3 I have shown a plurality of thermocouples 22 supported in a member 23. These can be directly in a flame, in a stack exposed only to radiant energy of a flame, or otherwise placed so as to be operable upon a change in a thermal condition. The previous thermocouples 9 can also be thus placed. The structure shown in this figure provides a thermopile in which the couples are connected in a cumulative relationship. With the couples on one side of member 23 in a flame, the couples on the other side are shielded from the direct heat of the flame while subject to the radiant heat of the flame.

An improved couple construction is shown in Figure 4 in which a tube 26 and a wire 27 of dissimilar metals are used. The wire is extended through the tube and is welded adjacent an end thereof. To make the couple responsive the mass of the tube is reduced about the couple so that it heats and cools quickly while the heavy body protects the cold couple junction.

The relay control shown in Figure 2 can be applied to alternating or direct current relays generally to avoid pitting of their contacts irrespective of whether they are energized by a thermocouple or some other source subject to variation, either voltage or current, or both. However, it is particularly and peculiarly adapted to the environment shown. The resistance or impedance of the relay is altered so that one contact is held in very definitely against the other contact, the usual fluctuations occurring being insufficient to permit the relay to open. This is particularly true on the galvanometer type relay.

I claim:

1. In combination a thermocouple, a relay in-

- cluding a field coil in series with said thermocouple, a resistance shunted across said coil, and means responsive to operation of said relay for disconnecting said resistance from shunt connection across said coil.
- 5 2. In combination, a thermocouple, a circuit connected to said thermocouple and including a relay, and means responsive to operation of said relay for lowering the resistance of said circuit upon energization of said relay.
- 10 3. In combination, a thermocouple, a first circuit including a first relay and said thermocouple, and a second circuit including a second relay operable under the control of said first relay to alter the resistance of said first circuit.
- 15 4. In combination, a thermocouple, a first circuit including a resistance, a first relay and said thermocouple, and a second circuit including a second relay operable under the control of said first relay to cut out said resistance.
- 20 5. In combination, a thermocouple, a relay and a resistance connected in parallel with said couple, and means responsive to operation of said relay for cutting out said resistance.
6. In combination with a thermocouple, a relay connected in a circuit with said thermocouple, and means for altering the resistance of said relay circuit upon operation of said relay.
7. In combination with a thermocouple, a relay connected in a circuit with said thermocouple, and means for preventing operation of said relay until the current in said circuit is above a predetermined value.
8. In combination with a thermocouple, a relay connected in a circuit with said thermocouple, and means for lowering the resistance of said relay circuit immediately upon a closing operation of said relay and for raising the resistance upon an opening operation of said relay.
9. In combination with a thermocouple, a relay connected in a circuit with said thermocouple, and means for shifting the resistance value of said relay circuit in accordance with operation of said relay.

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