

Aug. 25, 1964

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3,146,325

ELECTROMAGNETIC CONTACTOR WITH PILOT LIGHT

Filed April 17, 1962

2 Sheets-Sheet 1

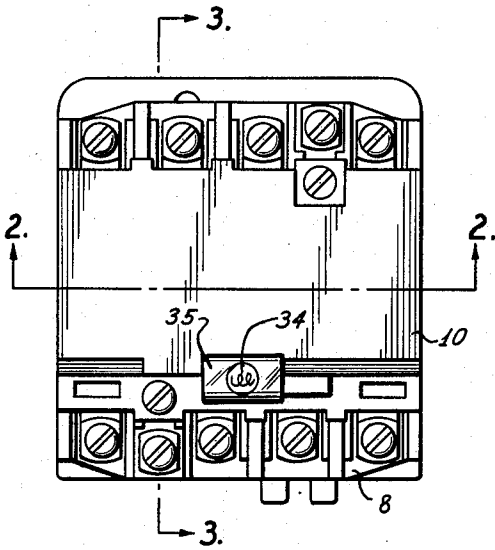


Fig. 1.

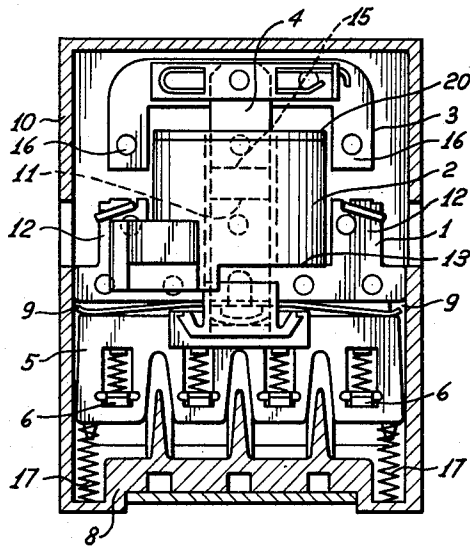


Fig. 2.

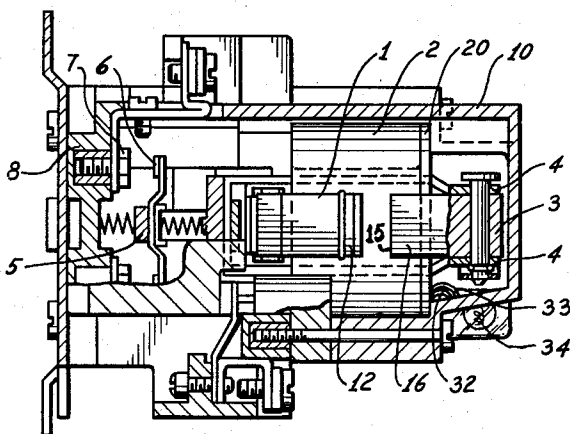


Fig. 3.

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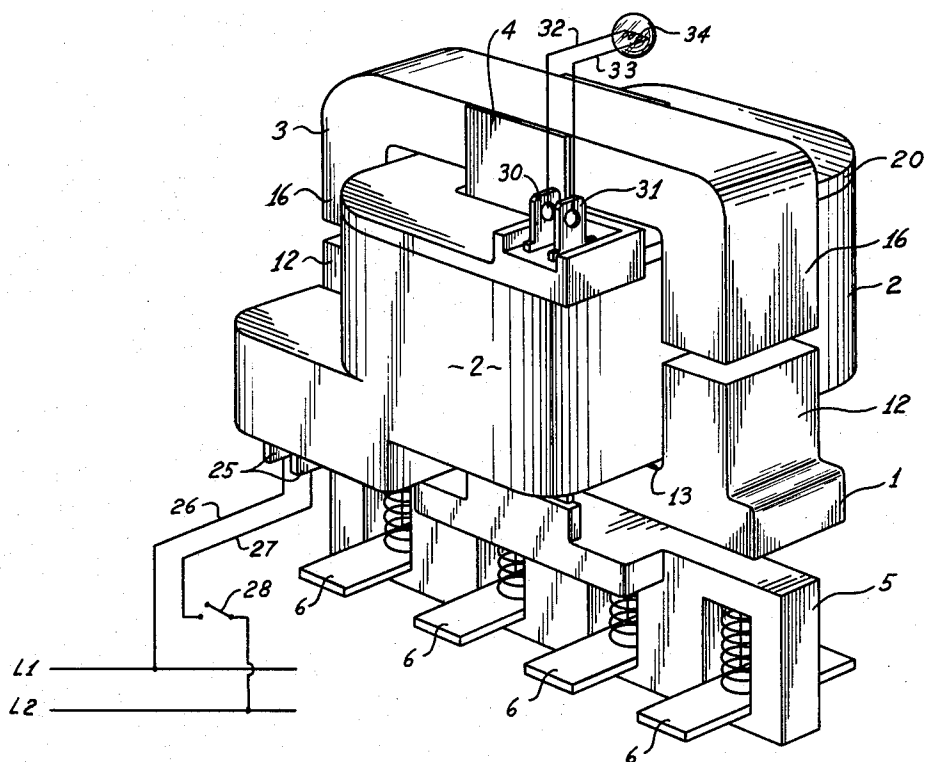


Fig. 4.

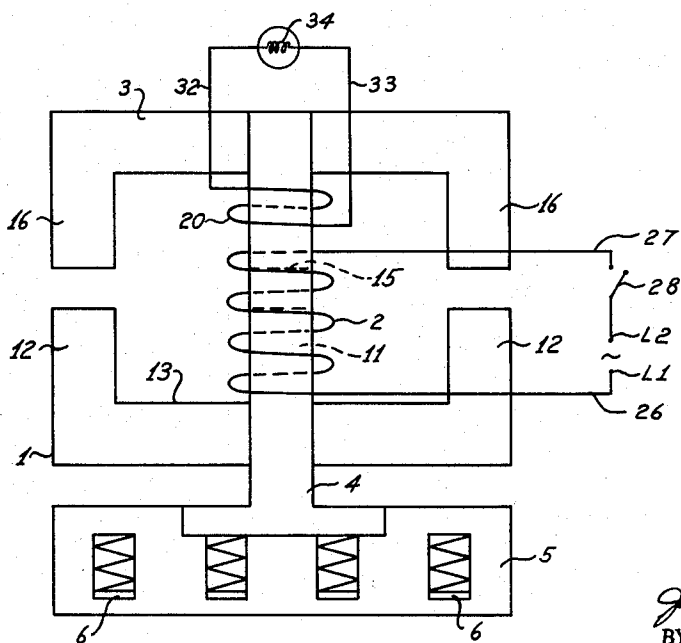


Fig. 5.

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**ELECTROMAGNETIC CONTACTOR WITH
PILOT LIGHT**

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Filed Apr. 17, 1962, Ser. No. 188,204
2 Claims. (Cl. 200-87)

This invention relates to electro-magnetically operated circuit control mechanisms and pilot devices therefor, and particularly to means for providing an alternating voltage source for the pilot devices which means is operative only during the energization of the electromagnet of the controller.

For the purposes of illustration, the invention is described herein as embodied in an electric contact device or starter for electrical equipment and employing an electric pilot light which, while lighted, indicates that the contactor has closed a circuit to the equipment.

Heretofore, in electro-magnetically operated starters, the normal practice has been to provide a pilot light for indicating, while lighted, that contacts of the contactor are closed and the power circuit controlled thereby is energized. For this purpose, a pilot light is connected in parallel with the magnetic motor coil of the starter. However, in such prior structures, even though the magnetic coil fails, the pilot light continues to be energized.

Again, such a magnetically operated contactor sometimes fails to function due to sticking of the armature operated by its magnetic motor coil, but the pilot light gives no indication of this malfunctioning.

In accordance with the present invention, the pilot light source of power is such that, if the magnetic motor coil of the contactor fails, the pilot light is deenergized and extinguished, thus indicating the failure. If the armature sticks in open position, the voltage supplied to the pilot light is reduced with resultant dimming of the pilot light indicating the improper functioning of the armature.

The source of power for the pilot light is provided herein by a secondary winding or pilot coil arranged in a closed circuit with the pilot light and in inductive relation to the magnetic motor coil so that an induced alternating voltage is produced in the circuit to the pilot light so long as the magnetic motor coil is energized by alternating voltage from its power source.

Generally, the magnet, armature and coils of contactors and equipment of this type are designed to produce a preselected flux. The magnet coil is modified for producing this preselected flux at the voltage at which the contactor is to operate. Thus the flux density for an entire line of contactors is predetermined for all voltage at which they are to be used. Accordingly, a pilot coil or secondary winding designed for a given flux density, and a pilot device operable by the voltage induced by that flux density, can be provided as a sub-assembly for installation in any one of the starters of the complete line.

Furthermore, since the pilot coil is energized by the flux produced by the motor coil, should the motor coil or its source of voltage fail, the pilot light will be extinguished. Should the armature of the contactor stick in an open position, the flux passing through the pilot coil would thereby be reduced, with consequent reduction of the induced voltage, so that the pilot light would receive less voltage and thus burn dimly, indicating that there is an inadequate source or that the electromagnet contactor itself is malfunctioning.

Since very little wattage is required for such pilot lights, the secondary winding, or pilot coil, can be made in the shape of a relatively small, thin, and flat wafer, and hence can be arranged conveniently at one end or

the other of the motor coil in surrounding relation to a portion of the central pole passing through the motor coil. It can be made substantially coextensive radially with the end of the motor coil, and thus can be used conveniently in structures such as disclosed in the copending application of Joseph J. Gribble and Kenneth Marien, Serial No. 120,725, filed June 29, 1961. For example, the pilot coil can be readily mounted on the pole piece, and held in place by the lid of the casing or container of the electromagnetic contactor or starter therein disclosed.

Various objects and advantages of the invention will become apparent from the following description wherein reference is made to the drawings, in which:

FIG. 1 is a front elevation of a multi-contact contactor embodying the principles of the present invention;

FIGS. 2 and 3 are vertical sectional views taken on the lines 2-2 and 3-3, respectively, in FIG. 1;

FIG. 4 is a perspective view of the electro-magnetic structure of the starter illustrated in FIGS. 1 through 3; and

FIG. 5 is a schematic illustration of the structure of FIG. 4, including a wiring diagram.

Referring to the drawings, the electromagnetically operated control mechanism shown for illustration comprises an electromagnetic contactor including an E-shaped pole piece 1, an electromagnetic winding or motor coil 2, which cooperates with the pole to operate an armature 3 when the motor coil 2 is energized. The armature is provided with suitable arms 4 which extend downwardly through the coil and at their lower end are connected to a contact carrier 5, which thereby is made movable with the armature 3. The carrier carries a plurality of bridging contacts 6 which cooperate with complementary stationary contacts 7 in a well known manner. The contacts 7 are fixed in position within a casing 8, near the bottom thereof.

The casing 8 is arranged to receive the parts described, with the pole piece 1 supported on a suitable shoulder 9 in the casing. A detachable cover, or lid, 10 detachably secured in place by suitable bolts is arranged to bear against the upper end of the motor coil 2 and hold the coil 2 firmly against the pole piece 1 and thereby clamp the pole piece 1 and coil 2 securely in place between the cover 10 and the shoulder 9.

The pole piece 1 is preferably E-shaped, having an inner pole 11 and outer poles 12. The coil 2 is arranged in surrounding relation to the inner pole 11. The E-shaped pole piece has a base portion 13 against which the lower end of the coil bears.

The armature 3 is E-shaped, having a central stem 15 and end fingers 16. The central stem 15 is connected to the arms 4 and is arranged to extend into the motor coil 2 and move endwise therein as the armature moves to open and closed positions.

Upon energization of the coil 2, the armature 3 is drawn downwardly and, through the medium of the arms 4, moves the contact carrier 5 to contact making position. Suitable return springs 17 are provided in the casing and engage the underside of the carrier 5 and urge it yieldably to open position so that in case of a power failure the contacts 6 are automatically opened. The structure thus far described is fully disclosed in the above identified copending application.

In accordance with the present invention, a secondary winding or pilot coil 20 is provided and is arranged in inductive relation to the motor coil 2. In the form illustrated, the pilot coil 20 is in the shape of a relatively flat, thin, annular wafer having the requisite number of turns to provide the voltage necessary for the pilot device at the flux for which the contactor is designed. The motor coil 2 is preferably flat at one end; for example, the end to-

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ward the armature. The pilot coil 20 is preferably flat and co-extensive with that end of the coil 2 and is juxtaposed in face to face relation thereto, so that it can readily be assembled and held in place by the cover 10 of the casing, merely by arranging the cover to bear thereagainst instead of against the end of the coil 2.

Although the coil 20 may be located at any suitable location along the magnetic circuit defined by the pole piece 1 and the armature 3, the coil 20 preferably is arranged so that it surrounds the central stem 15 of the armature at the upper end of the coil 2, as illustrated, or placed at the opposite end of the coil 2 in surrounding relation to the inner pole 11 of the pole piece 1.

Referring next to FIG. 4, the coil 2 is provided with suitable terminal tabs 25 which are connected to external conductors 26 and 27, which connect the coil 2 to an outside source of voltage indicated by lines L1 and L2 through a desired type of switch indicated at 28. The source may be the secondary of a transformer in inductive relation to the power source of the equipment to be controlled.

The pilot coil 20 likewise is provided with terminal tabs, such as indicated at 30 and 31, which are connected in a suitable circuit by conductors 32 and 33 to a pilot device which, in the form illustrated, is an incandescent light bulb 34.

If desired, tabs 30 and 31 may be arranged in a casing 8 so they are accessible through an opening 35 therein, through which the rating of the coils is customarily read, as disclosed in said application.

Referring to FIG. 5, which shows the electro-magnetic portions of the device, the motor coil 2 is energized from the source L1 and L2 by closing the switch 28. Energization of the coil 2 energizes the pole piece 1 causing the armature 3 to be drawn downwardly to close the contacts 6 and 7. The alternating flux produced in the pole piece 1 and armature 3 by the coil 2 induces an alternating voltage in the pilot coil 20, which energizes the filament of the bulb 34. The bulb remains lighted as long as coil 2 is energized.

A filament type bulb is preferred to a gas type bulb as a pilot light because its intensity is greater and it will glow dimly at less than normal voltage. Furthermore, it can be used with green, blue and purple lenses which are not illuminated by ordinary gas-type bulbs.

As mentioned, another advantage is that, if the armature 3 sticks in an open position the flux through the coil 20 is less than when the armature is in the closed position. When the armature is in the open position, the lesser voltage induced in the coil 20 causes the light 34 to glow with much less intensity, thus indicating the malfunctioning of the mechanism.

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Upon the failure of power from the source L1 and L2, the light is extinguished. If the source L1 and L2 is energized inductively from the circuit to be controlled, then the pilot failure may indicate a failure of the controlled circuit.

Having thus described my invention, I claim:

1. An electromagnetically operated control mechanism comprising an armature member, an electrical contact means movable thereby, a magnetic pole member, a magnetic motor coil having an axial passage therethrough, at least one of the members having a portion extending into the passage, said members being in magnetic attractive relation to each other when the motor coil is energized, means for connecting the motor coil to a source of alternating voltage, a magnetic pilot coil in inductive relation to the flux of the motor coil, said pilot coil having an axial passage therethrough, at least one of the members having a portion extending into the pilot coil passage, said motor coil being relatively flat at one end, said pilot coil being a unitary structure in the shape of a thin, flat wafer, said pilot coil being disposed on said end of the motor coil in coaxial relation therewith, the foregoing mechanism being mounted in a casing having a removable cover and being disposed in the casing with said one end of the motor coil facing toward the cover, constraining means in the casing engaging the motor coil and constraining it from movement in a direction away from the cover beyond a predetermined position, abutment means on the cover engaging the adjacent end of said pilot coil and pressing it against said one end of the motor coil when the cover is secured to the casing with the motor coil in said position, and means for detachably securing the cover to the casing.

2. The structure according to claim 1 wherein the pole member is E-shaped and its central stem extends into the passage of the motor coil, the other end of the motor coil is adjacent the base of the pole member, and the armature is E-shaped and its central stem extends through the pilot coil passage.

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