Oct. 16, 1951 F. H. WINTER 2,571,803

ELECTROMAGNET CONTROL MECHANISM WITH TWO ARMATURES

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Fig. 1.

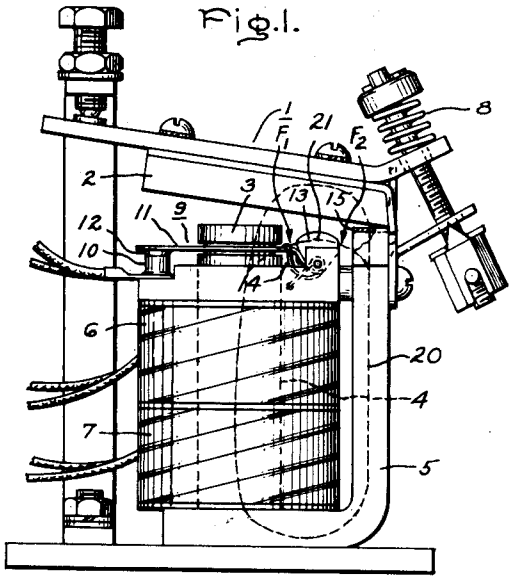


Fig. 2.

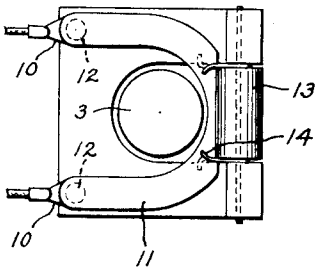


Fig. 3.

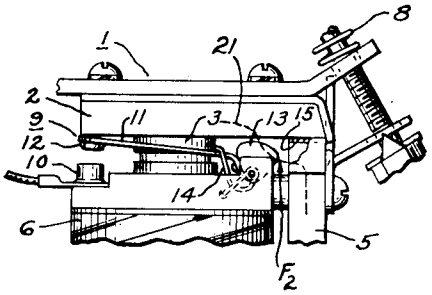
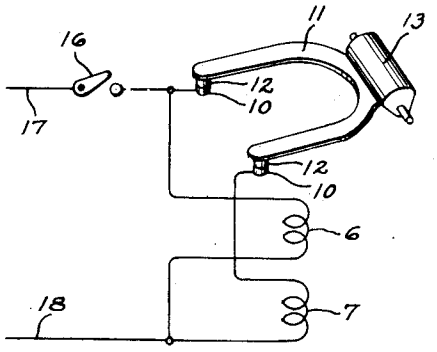


Fig. 4.



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ELECTROMAGNET CONTROL MECHANISM WITH TWO ARMATURES

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1 Claim. (Cl. 175—337)

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This invention relates to electrical devices employing pickup coils, such as direct current relays and contactors and more particularly to a control mechanism for operation of the pickup coil of such a device.

In electrical devices of the type comprising a pickup coil, a holding coil, a flux conductive core and return circuit, and a spring biased movable armature, the function of the pickup coil is to draw the movable armature into such a position with respect to the core and return circuit of the device as to form the best conductive path for a flux set up by electrical currents applied to the device. This position is called the closed position of the armature. The holding coil has considerably less ampere turns than the pickup coil and draws less electrical energy. Although the holding coil when energized produces a flux which adds to the flux produced by the pickup coil and thus aids in bringing the armature to its closed position, the energy required to be imparted to the holding coil is only the energy sufficient to produce a flux which will hold the armature in its closed position once that position is attained. For this reason it is desirable to conserve the amount of energy supplied to the device by disconnecting the pickup coil once the armature is closed and maintaining only the smaller energy supply to the holding coil.

To disconnect the pickup coil in such a device it is conventional to provide a pair of normally closed auxiliary contacts in series with the control power supply of that coil. One of these contacts is stationary and is secured to some part of the relay structure. The other contact is movable and is operated when the armature strikes an arm controlling the auxiliary contact operation.

However, the hammer blow of the armature, after a time, does mechanical damage to the auxiliary control. Moreover, a small deviation in the proper spaced relationship of the armature and the control arm results in opening of the auxiliary contacts before the armature is completely closed and therefore the armature fails to close properly.

It is an object of my invention to provide an improved pickup coil mechanism which is simple in construction and reliable.

Another object of my invention is to provide an improved pickup coil control mechanism which requires no readjustment during the life of the relay.

In general, my invention comprises an auxiliary contact means in series with the control power supply to the pickup coil of an electrical device and mechanically connected to an auxiliary contact armature which is responsive, when the main armature of the device is closed, to a

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leakage flux produced adjacent to the auxiliary contact armature and tends to rotate the latter in such a manner as to open the auxiliary contact means, thereby disconnecting the pickup coil from the control power circuit.

For a complete understanding of my invention, reference should be had to the following specification and accompanying drawing wherein Fig. 1 is an elevational view of a conventional direct current relay showing the application of my invention thereto, Fig. 2 is a plan view of an auxiliary contact armature forming a part of my invention, Fig. 3 is a partial side elevational view of the relay of Fig. 1 showing the main armature in closed position and the auxiliary armature contacts in open position, and Fig. 4 is a diagrammatic circuit of the control wiring of the relay shown in Fig. 1.

In carrying out my invention in one form, I provide an auxiliary contact means 9 electrically connected in series with the pickup coil 7 of a conventional direct current relay 1, a spring biased auxiliary contact armature 13 pivotally supported on the relay 1, a movable contact member 11 secured to the auxiliary contact armature 13 and forming a part of the auxiliary contact means 9, and a means for providing a leakage flux adjacent to the auxiliary contact armature 13 when the main armature 2 of the relay 1 is in its closed position, whereby the leakage flux thereby produced rotates the auxiliary contact armature 13 in the direction of the leakage flux thereby opening contact means 9 and disconnecting the pickup coil 7.

For a complete understanding of my invention, attention is directed to Figs. 1, 2, and 4 in order. As shown in Fig. 1, I have used for the purpose of illustrating my invention a conventional direct current relay 1 of the hinged armature type. Such a relay comprises, as shown in Fig. 1, a main armature 2, a pole 3, a core 4, an L-shaped flux conducive member 5, a holding coil 6 and a pickup coil 7. The member 5 and the core 4 and the pole 3 together constitute a magnetizable frame which, together with the main armature 2, define a main air gap between the pole 3 and the armature 2 in its unattracted position. Coils 6 and 7 are both wound about the core 4 which in conjunction with pole 3, main armature 2, and L-shaped member 5, form a low reluctance magnetic circuit for a flux which is produced by passing an electrical current through either or both of coils 6 and 7. The flux necessary to move armature 2 to a closed position against the pole 3 in opposition to the bias of spring 8 on armature 2 is considerably greater than the flux necessary to hold armature 2 in its closed position once that position is attained. Therefore, to close armature 2 both the holding

coil 6 and the pickup coil 7 must be energized to provide the necessary closing energy. However, once armature 2 is closed, energy may be conserved by maintaining current in holding coil 6 only and disconnecting the power supply to the pickup coil 7.

To accomplish the disconnecting of pickup coil 7 when armature 2 is closed, in accordance with my invention, I provide a contact means 9 comprising two stationary contacts 10 secured to relay 1, as shown in Figs. 1 and 2, and a U-shaped movable contact member 11 made of any suitable conducting material and carrying two movable contacts 12. Contacts 10 and 12 form two pair of aligned contacts and are in series in the electrical supply circuit to the pickup coil 7, as shown in Fig. 4. Movable contact member 11 is secured, as by rivets or other suitable means, to an auxiliary contact armature 13 pivotally supported on relay 1 and spring biased as by spring 14 in the contact closing direction of contacts 10 and 12. Interposed in the magnetic circuit on the opposite side of auxiliary contact armature 13 from pole 3 I provide a flux resistant member 15 which may be in the form of a shim, as shown in Fig. 1.

To assist in understanding the operation of my invention, attention is directed to Figs. 1, 4 and 3 in order. As shown in Fig. 1, when no current is applied to relay 1, main armature 2 is biased open by the force of spring 8 and contacts 10 and 12 are biased closed by the force of spring 14. When control switch 16, as shown in Fig. 4, is closed current is supplied to pickup coil 6, which is electrically connected across two control power lines 17 and 18. Closing switch 16 also supplies current to holding coil 7, which is also electrically connected to control power lines 17 and 18 and is in series with contacts 10 and 12 and movable contact member 11.

Once coils 6 and 7 are energized a flux is produced in the magnetic circuit comprising pole 3, core 4, L-shaped member 5 and armature 2. However, while the main armature 2 is still open, or dropped out, as shown at Fig. 1, a leakage flux shunting the main gap and the shim 15 passes through the auxiliary armature 13. At Fig. 1 I have indicated the main flux by a broken line 20, and the leakage flux by a broken line 21. The leakage flux 21 passes into one side and out of the other side of the auxiliary armature 13, so that the flux in a first leakage gap F1 between pole 3 and armature 13 tends to hold the armature 13 in its dropped out position, while the flux in a second leakage gap F2 between the frame 5 and the armature 13 tends to pick up the armature 13. So long as the main armature 2 is dropped out these opposing forces on the auxiliary armature neutralize each other, and the spring 14 ensures that the armature 13 remains dropped out. However, when the main armature 2 picks up, as at Fig. 3, the leakage gap F1 is shunted by the main armature, so that magnetic holding or restraining force on the auxiliary armature 13 is removed. The leakage flux in the gap F2 then picks up the auxiliary armature to open the contacts 10, 12. Thus pickup coil 7 is disconnected from control power line 17 and only the holding coil 6 remains energized.

An advantage of the pickup control above described lies in the fact that the auxiliary contact control is not subject to damage resulting from the striking of the control means by the main armature of the relay as is the case with conventional devices of this type.

Another advantage of my pickup control is that the control is not dependent upon a spaced adjustment of the auxiliary control with respect to the motion of the main armature, which adjustment, if not correct, will cause improper closing of the main armature or improper opening of the pickup control power supply; but rather is dependent upon the elimination or production of a leakage flux inherent in the design of the control mechanism and for which no mechanical adjustment is necessary. Therefore, the necessity of repeated adjustments as a result of continued operation of the device is avoided and the proper control operation made more dependable.

With modifications this device may also be adapted to alternating current devices employing the use of pickup coils.

While I have shown and described particular embodiments of my invention, it will be obvious to those skilled in the art that various changes and modifications may be made without departing from my invention in its broader aspects and I, therefore, aim in the appended claim to cover all such changes and modifications as fall within the true spirit and scope of my invention.

What I claim as new and desire to secure by Letters Patent of the United States is:

An electromagnetic device comprising a U-shaped magnetizable frame and a movable magnetizable main armature pivotally mounted upon one leg of said frame to bridge the open end of said frame, means normally maintaining said main armature in an unattracted position spaced from the other leg of said frame thereby to define a main flux gap, said frame and armature and main gap defining a main flux path, an energizing coil mounted upon said frame and adapted to be energized to attract said main armature to close said gap, an auxiliary armature pivotally mounted upon said frame and positioned to shunt leakage flux from said main gap through a first part of said auxiliary armature and a first leakage gap when said main armature is in said unattracted position, the flux in said first leakage gap holding said auxiliary armature in a predetermined normal position, and a shim of high reluctance material positioned in another part of said main flux path adjacent said auxiliary armature to shunt leakage flux through a second part of said auxiliary armature and a second leakage gap to attract said auxiliary armature from said normal position, whereby movement of said main armature to said attracted position reduces the flux in said first leakage gap and permits said auxiliary armature to move under the influence of the flux in said second leakage gap.

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