Dec. 8, 1959 H. A. SEELE 2,916,580

ELECTRO-MAGNETIC RELAY

Original Filed Aug. 27, 1956

Fig. 1.

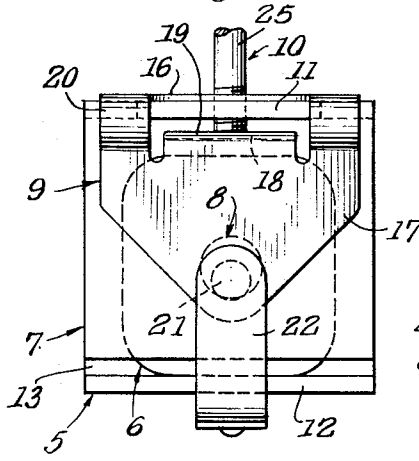


Fig. 2.

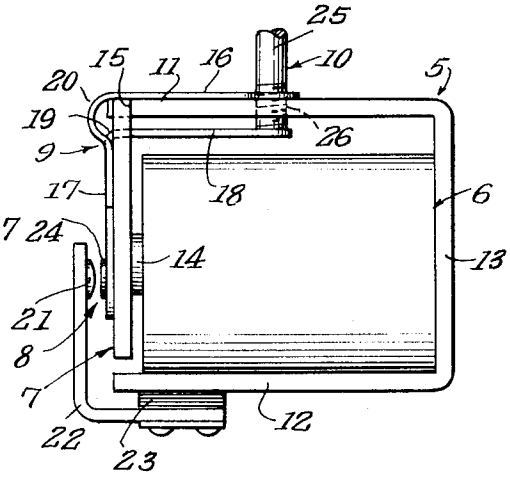
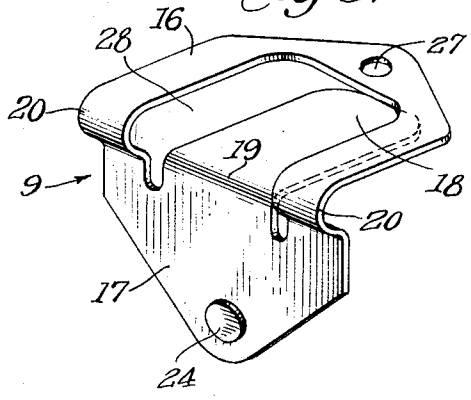


Fig. 3.



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United States Patent Office 2,916,580 Patented Dec. 8, 1959

2,916,580

ELECTRO-MAGNETIC RELAY

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Original application August 27, 1956, Serial No. 606,258. Divided and this application July 29, 1957, Serial No. 674,653

2 Claims. (Cl. 200—87)

This invention relates to an electro-magnetic switch construction and is a division of my pending application, Serial No. 606,258, filed August 27, 1956.

An object of the present invention is to provide an electro-magnetic switch or relay that embodies novel and improved means to mechanically vary a biasing force that acts counter or opposed to the magnetic flux that operates the switch or relay.

Another object of the invention is to provide a switch of the character above referred to that is provided with novel flat-spring means that produces a biasing force and which is controlled to vary such force.

A further object of the invention is to provide a relay of the character referred to that is extremely sensitive to resistance introduced into the electric current passing through the coil thereof, thereby providing a switch or relay that moves between circuit-open and circuit-closed positions in response to small changes in the potential across the relay coil.

The invention also has for its objects to provide such means that are positive in operation, convenient in use, easily installed in a working position and easily disconnected therefrom, economical of manufacture, relatively simple, and of general superiority and serviceability.

The invention also comprises novel details of construction and novel combinations and arrangements of parts, which will more fully appear in the course of the following description. However, the drawing merely shows and the following description merely describes, one embodiment of the present invention, which is given by way of illustration or example only.

In the drawing, like reference characters designate similar parts in the several views.

Fig. 1 is an end elevational view of a resistance-sensitive relay according to the present invention.

Fig. 2 is a side elevational view thereof.

Fig. 3 is a perspective view of a spring member used in the relay construction to normally bias the relay to circuit-open position.

The present resistance-sensitive relay comprises, generally, a frame **5** mounting an electro-magnetic coil **6** and provided with a movable magnetic armature **7**, a switch **8** controlled by said armature, a spring member **9** interconnecting the frame and armature and normally biasing the latter to close switch **8**, and means **10** to mechanically vary the biasing force of the member **9** to vary the sensitivity of response to switch-controlling movement of the armature according to the degree of potential in the coil **6**.

The frame **5** is shown as C- or U-shaped, having opposed parallel arms **11** and **12** connected by a web **13**. In this case, the arm **11** is connected to the spring member **9** and carries the tension-varying means **10**, and the arm **12** carries one terminal of switch **8**. The coil **6** is housed in the frame and is here shown with its fixed core **14** extending toward the open end of the frame between the frame arms **11** and **12**. The armature **7** is shown as

disposed across the open end of the frame and in pivotal engagement, at **15**, with the end of said arm **11**. Normally, said armature has flatwise engagement with the projecting end or pole shoe of the core **14** when the potential in the coil **6** is of such degree as to cause the armature to be attracted toward the core to the pole of the coil **6**.

The spring member **9** is shown as made of flat-spring material and is provided with a flat portion **16** that is in flatwise connection with the frame arm **11**, a flat deflectable portion **17**, generally normal to the plane of portion **16** and in flatwise connection with the armature **7**, and a flat tongue portion **18** in general parallelism with the portion **16** and disposed between the frame arm **11** and coil **6**.

As can be seen from Fig. 3, portion **18** may comprise a sheared-out center part of portion **16**. By bending portion **18** relative to portion **17**, along a bend line **19**, and bending portion **16** relative to portion **17**, along curved bends **20** on either end of the bend line **19** but offset relative thereto, an integral spring member is provided that enables varying of the tension between portions **16** and **17** by varying the deflection of portion **18** relative to both portion **16** and the frame arm **11**. Thus, it will be clear that by deflecting portion **18**, which is in the form of a spring arm, the armature **7** is deflected in a direction away from the normal position shown. The degree of bias holding said armature thus deflected may be produced according to the deflection of arm **18**. In other words, if the deflection of the armature is arrested, as by a stop, and the adjusting deflection of arm **18** is continued to cause it to bend relative to the armature, the force necessary to move the armature back to its initial position will be commensurate with the bias on said arm **18**.

The mentioned switch **8** is shown as a terminal or contact **21** carried on a bracket **22** affixed to the arm **12** of frame **5** and, in this instance, insulated from said arm by dielectric insulation **23**, and a second terminal or contact **24** on the armature or on the portion **17** of spring member **9**. Said contacts are opposed and normally engaged to place the bracket **22** and the frame **5**, armature **7** or member **9**, in electrical contact, the member **9**, as above described, being normally so biased as to provide such electrical contact.

The means **10** is shown as a threaded adjusting member **25**, engaged in threads **26** in frame arm **11** or in threads in both said arm and in the opening **27** of portion **16** of spring **9**. The member **25** is so directed as to engage spring arm **18** and to impinge thereon, as shown. Thus, by rotationally adjusting member **25**, the pressure on arm **18** may be eased off or increased, as desired, thereby changing the biasing force holding contacts **21** and **24** engaged.

The electro-magnetic force of coil **6**, as manifested in core **14**, constitutes an attraction that tends to draw the armature to the position shown—in engagement with the magnet core. It will be clear that a greater potential across coil **6** is required to so attract armature **7** and open the switch contacts **21** and **24** if the arm **18** is under considerable flexure or tension, and that commensurately less potential is required under conditions where arm **18** is under lesser tension. Such potential may be varied by a change in the electrical resistance of the circuit supplying coil **6**.

The member **9** may be varied in a minor way by so proportioning the portion **16** that member **25** will pass through the opening **28** that is left in said portion **16** when the arm **17** is sheared therefrom.

The arrangement of the switch may be reversed, opening under bias of the member **9** and closing when the armature is attracted. Also, the relay may have two

switches controlled by the movement of the armature, one opening and the other closing. In other words, a normally-closed switch may be opened when the biasing force of member 9 is overcome by magnetic force and the other switch closed, and vice versa.

While the foregoing has illustrated and described what I now contemplate to be the best mode of carrying out my invention, the construction is, of course, subject to modification without departing from the spirit and scope of my invention. Therefore, I do not desire to restrict the invention to the particular form of construction illustrated and described, but to cover all modifications that may fall within the scope of the appended claims.

Having thus described my invention, what I claim and desire to secure by Letters Patent is:

1. A sensitive electromagnetic relay comprising in combination, an electromagnet coil frame in U shape having opposed first and second parallel arms integral with a connecting web to leave an open end, an electromagnet core having an end against said connecting web and a free end forming a pole, an electromagnet armature of such length as to fit within the open end of said frame with only a small air gap, a switch member comprising sheet material in bent form with a transverse bend line having a portion in flatwise connection with the first frame arm on one side of the bend line and a freely deflectable portion on the other side of the bend line in flatwise connection with the armature lying across and in front of said magnetic pole subject to magnetic attraction thereof, a movable contact carried by the deflectable switch member portion, a stationary contact fixedly secured opposite said movable contact for operative relation therewith, the deflectable switch member portion having two limit positions in one of which said contacts are electrically connected and in the other disconnected, the magnetic attraction of said pole serving to move the armature and deflectable switch member portion from

one limit position to the other, said switch member having a tongue portion integral with the deflectable portion substantially parallel to the flatwise connected portion lying on the opposite side of the bend line from said deflectable portion, and adjustable means for applying pressure to said tongue portion on the surface of the sheet material thereof opposite to the surface of the sheet material which in the deflectable portion thereof lies toward said coil pole for biasing the said switch member deflectable portion away from said pole.

2. In an electromagnetic device having an electromagnetic coil, an electromagnet frame arm extending the length of the coil to form a magnetic return path therefor and a movable armature, an armature biasing unit for compact assembly with the device having integral mutually normal portions composed of resilient bendable material, one of said portions extending along a portion of the length of the frame arm, being secured flatwise thereto, the other of said portions extending along the armature secured thereto flatwise, and a spring arm integrally connected to the portion of the unit secured to the armature, but extending parallel to the frame arm along the coil, and having means for setting the position of the spring arm in relation to the frame for biasing the spring arm.

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