

March 17, 1959

R. M. EISENBERG
SIMULATED CIRCUIT BREAKER

2,877,569

Filed March 22, 1957

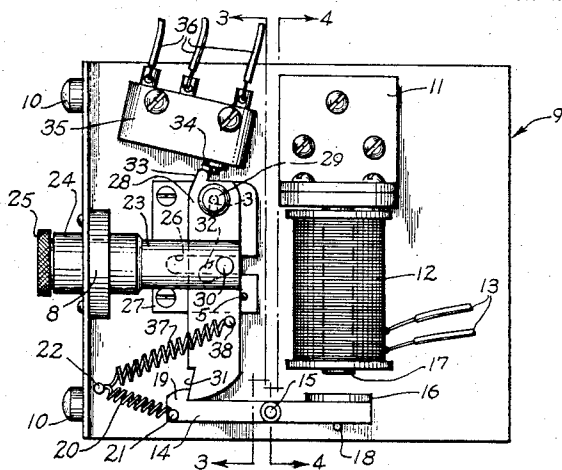


Fig. 1

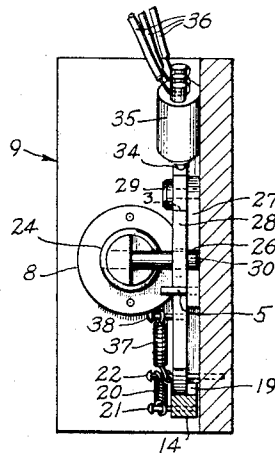


Fig. 3

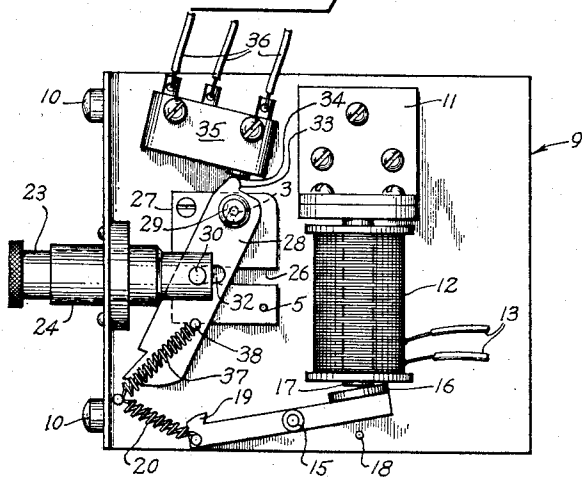


Fig. 2

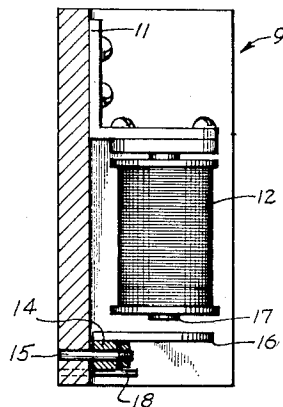


Fig. 4

INVENTOR.
Robert M. Eisenberg.

BY
Donald P. Smith
Attorney

1

2,877,569

SIMULATED CIRCUIT BREAKER

Robert M. Eisenberg, Rockville, Md., assignor to ACF Industries, Incorporated, New York, N. Y., a corporation of New Jersey

Application March 22, 1957, Serial No. 648,476

9 Claims. (Cl. 35—13)

This invention relates broadly to training devices and more particularly to a stationary device to simulate an aircraft for the purpose of training personnel to operate the craft.

Modern aircraft have become so costly that it has been found necessary and desirable to build stationary devices that simulate, with great accuracy, the operation of the craft. Thus when the aerodynamic characteristics of the craft have been electrically built into the simulator, personnel can readily be trained to operate the aircraft without danger of damage to the machine and at a greatly lowered cost per operating hour. The complete cockpit must of course be carefully duplicated including the instruments, controls, motions, audible and visual indications, and electrical operating gear.

The invention herein disclosed relates to a structure for simulating a circuit breaker and, summarily stated, consists of an electromagnet operable in response to a signal from an instructor or from some other portion of the simulator to unlatch a spring biased indicating shaft which releases the same to the breaker open position and simultaneously actuates a switch to connect energy to an audible or visual signal in the field of vision of the instructor or the individual being trained. The subject is thus advised that a circuit, or a plurality of circuits, in the simulated aircraft have failed and he must take appropriate steps to correct the condition in accordance with his training procedure.

This is in contradistinction to the prior art method of utilizing unmodified aircraft circuit breakers in the simulated device. In order to simulate failure a high current low voltage source is connected across the circuit breaker which results in a high circulating current flowing through the breaker causing it to open, thereby deenergizing the control relay and indicating failure to the instructor. This required a large high current transformer and a relay capable of handling substantial currents. A repeater relay is also needed to energize the failure indicator devices and large diameter copper is necessary to carry the current. The invention as hereinafter described provides a simulated circuit breaker which is of the same size and of identical appearance as a normal aircraft circuit breaker but requires infinitesimal power to operate and includes therein a simple single throw double pole switch thereby eliminating the need for a repeater relay.

It is accordingly a broad object of this invention to improve on the circuit breaker now in use in simulated vehicles.

It is another and more distinct object of this invention to provide a device for simulating circuit breaker reaction to a fault in a circuit.

It is a further and more distinct object of this invention to provide a simulated circuit breaker utilizing a simple electromagnet to actuate the components whereby circuit fault is indicated.

Other and more distinct objects will be in part obvious and in part pointed out in the following specification in which:

2

Figure 1 is a longitudinal elevation of the structure of the simulated circuit breaker showing the parts in their normal position;

Figure 2 is a longitudinal elevation showing the structure in circuit fault position;

Figure 3 is a view taken on lines 3—3 of Figure 1 and looking in the direction of the arrows; and

Figure 4 is a side elevation taken on lines 4—4 of Figure 1 and looking in the direction of the arrows.

Referring now to the drawings wherein like parts are designated by like reference characters, 9 indicates generally a housing for the hereinafter disclosed structure and consists of side walls secured together with bolts 10. Fixed within the housing by angle clamp 11 is an electromagnet 12 having leads 13 connecting to a source of electrical energy (not shown). An armature 14 is pivotally secured on shaft 15 for rocking motion below the electromagnet 12, and has a wear pad 16 secured to one end thereof for cooperation with the core 17 of the magnet, in a well-known manner. A pin 18 is fastened into the wall of the housing and serves to limit the arcuate motion of armature 14 in one direction, substantially as is shown in Figure 1. The other end of armature 14 has a foot 19 formed thereon and a spring 20 stretches between pin 21 fixed in the end of the armature and pin 22 fixed into the housing, for a purpose that will later be explained. A shaft 23 is arranged for sliding motion within elongated bushing 24 having a flange 8 and passing through an armature formed in the side wall of the housing. A button 25 is carried on the end of the shaft and lies on the front face of the structure. This button is adapted to carry any legend to simulate the intended use of this particular circuit breaker. The other end of the shaft has a port formed near the end thereof to pass pin 30. A bracket 27 is secured to the interior of the housing by screws or the like and has bored therein an elongated passage 26 to allow longitudinal motion of pin 30. A beam member 28, formed with a slot 3, is pivotally mounted on shaft 29 and is connected to shaft 23 by the pin 30. The other end of the beam has an offset 31 formed thereon to lockably engage with the foot 19 of armature 14 as is shown in Figure 1. The beam has an elongated aperture 32, shown in dotted outline in Figure 1 and partly in full outline in Figure 2, disposed at an acute angle to the longitudinal axis thereof to receive the pin 30. A cam 33 is formed at the upper end of the beam 28 to cooperate with actuator 34 of a switch 35. Leads 36 connect the switch to an audible or visual signal in the vicinity of the instructor or the subject being trained to advise him of a condition of circuit failure. A tension spring 37 urges between pins 22 and 38 to force beam 28 in a forward direction when the armature removes from interfering relationship with the end thereof.

The operation of this device is as follows:

The simulated circuit breaker is shown in the normal position in Figure 1. When the instructor desires to simulate a condition of circuit failure, or if some other condition of the simulated aircraft produces a circuit failure a signal through leads 13 to electromagnet coil 12 energizes the same thereby attracting one end of armature 14 to pivot the same in a counterclockwise direction about shaft 15 and against the urging of spring 20 thereby releasing the locking engagement of structures 19 and 31 and further releasing beam 28 to the influence of spring 37 which forces it to rotate in a clockwise direction about shaft 29, thereby thrusting shaft 23 into a fully extended position and camming actuator 34 into an upward position. This, at once, advises the student or instructor that the circuit breaker has opened responsive to a condition of circuit failure and the reset shaft 24 extending from the housing awaits the reset operation, together with whatever audible or visual signal may be provided in the op-

3

erator's compartment. In order to reset the structure it is merely necessary to apply thrust to button 25 which rotates beam 28 in a counterclockwise direction about shaft 29 until the actuator 34 is released and members 19 and 31 reengage with one another to hold the circuit breaker 6 until the next cycle of operation. A pin 5 is depended upon to limit the rearward motion of the beam. Obviously if coil 12 is maintained in an energized condition the returning force of spring 20 is overcome and the shoe 19 is held away from interfering relationship with the beam 28, and shaft 24 will again emerge from its reset position under the influence of tension spring 37.

If it is desired to simulate breaker failure manually or if it is desired to turn off the circuit then the button 25 may be grasped and outward thrust applied which thrust is imparted through camming passage 32 at an angle to the longitudinal axis of beam 28 which will cam beam 28 upward removing offset 31 from interfering relation with shoe 19 and thereby permitting the shaft to emerge to the deenergized position and thus actuate switch 34. The breaker may then be easily and quickly reset by forcing shaft 23 inwardly.

It will be seen that I have provided a structure for simulating the action of an electrical circuit interrupter for a stationary aircraft trainer during a training cycle without the necessity for the large current values needed to actuate current responsive devices, with their resultant large heating effects and copper demands. The apparatus described is very realistic in operation and extremely simple to construct and inexpensive to maintain. Great savings over the conventional circuit breakers have been realized through the use of this structure.

It will be realized that this device is of general utility in the field of simulated circuit breakers and is applicable wherever a realistic power panel is desired without necessarily incurring the expense of a complete duplication of power handling equipment. The organization herein disclosed may also be used for remote indication of the operation of a device, for example a circuit breaker located close to its load and operable to transmit a signal to the electromagnet upon circuit failure or overload.

While I have described my invention in certain of its preferred embodiments, I desire that it be understood that modifications may be made and no limitations upon my invention are intended than those which may be imposed by the scope of the appended claims.

I claim:

1. In a stationary aircraft trainer, means for simulating the action of an electrical circuit interrupter during a training cycle, said means comprising an electromagnet, a source of electrical power to energize said electromagnet, an armature supported for pivoting motion in response to pull by said electromagnet, a switch adapted to be connected to failure indicating means, a shaft having a reset button on one end thereof, a pivot pin, a beam having a slot to receive said pin, said beam being pivotally connected to the other end of said shaft and directly engaged and latched against pivotal movement in one direction by said armature, means biasing said armature toward said beam, means urging said beam in said one direction whereby upon energization of the said electromagnet the armature rotates thereby releasing said beam for movement to simultaneously activate the switch and move the shaft to failure position.

2. In a stationary aircraft trainer, means for simulating the action of an electrical circuit interrupter during a training cycle, said means comprising an electromagnet, an armature supported for pivoting motion in response to electromagnet pull on one end, a switch adapted to be connected to failure indicating means, a reset shaft, a beam supported for pivotal movement and pivotally connected to one end of said shaft and normally engaged by said armature, means biasing the armature toward said beam, and yielding means urging said beam and shaft to failure position whereby upon energization of the elec-

4

tromagnet the armature pivots thereby releasing the beam to the influence of the said yielding means to actuate the switch and move the shaft to failure position.

3. A stationary aircraft trainer means for simulating the action of a circuit interrupter during a training cycle, said means comprising an electromagnet, an armature supported for pivoting motion in response to electromagnet pull on one end, a switch adapted to be connected to failure indicating means, a reset shaft, a beam supported for pivotal movement and pivotally connected to one end of the shaft and normally engaged against movement by the other end of the armature, means biasing the armature toward said beam, and a spring connected to the beam and biasing the beam and shaft to a position indicative of circuit interrupter failure whereby upon pivoting of the armature in response to electromagnet pull the spring forces the beam and shaft to failure position to actuate the switch.

4. A stationary aircraft trainer means for simulating the action of a circuit interrupter during a training cycle, said means comprising an electromagnet, an armature supported for pivoting motion in response to electromagnet pull on one end, a switch adapted to be connected to failure indicating means, a reset shaft, a pivot pin, a beam mounted on said pin and pivotally connected to the shaft and formed at one end to releasably lock with the armature in normal position, means biasing the armature toward said beam, the other end of said beam having a switch actuator formed thereon, and a spring urging the shaft and beam to a position indicative of circuit interrupter failure whereby pivoting of the armature unlocks the beam and shaft to the influence of the spring and said shaft translates to failure position simultaneously with switch actuation.

5. A trainer means according to claim 4 wherein the connection between the shaft and the beam comprises an elongated port formed in the beam at an acute angle with the longitudinal axis thereof, and a pin fixed to the shaft and engaged in the port whereby thrust applied to the shaft in a direction indicative of interrupter failure cams the beam longitudinally to unlock from the armature and actuate the switch.

6. A stationary aircraft trainer means for simulating the action of a circuit breaker during a training cycle, said means comprising a housing, a shaft slidably mounted in said housing and extending through one wall thereof to alternately indicate circuit failure and circuit complete conditions, a pivot pin, a beam pivotally mounted on said pin and connected to said shaft and having one end thereof in the form of a cam, a switch fixed in the path of motion of said cam for connection to an indicator, an electromagnet, an armature pivotally mounted for cooperation at one end thereof with the electromagnet, the respective other ends of the said beam and the said armature having means for interlocking engagement, means biasing said armature toward said beam, and a spring connected to the said beam to move the beam and shaft and to actuate said switch when the electromagnet is energized to pivot the armature and thereby release the beam.

7. A stationary aircraft trainer means for simulating the action of a circuit breaker during a training cycle, said means comprising a housing, an electromagnet fixed in said housing, an armature supported for pivoting motion in response to electromagnet pull on one end, a switch adapted to be connected to failure indicating means, a reset shaft, a beam supported for pivotal movement and having an offset formed at one end thereof to releasably lock with an offset formed on the other end of said armature, resilient biasing means to pivot said beam, means biasing said armature toward said beam, a cam formed on the other end of said beam to actuate said switch during beam rotation, means connecting said beam to said shaft, said connecting means comprising a pin on said reset shaft engaged in an elongated port formed

5

in said beam at an acute angle to the longitudinal axis thereof whereby longitudinal thrust applied to the shaft in a circuit failure direction cams the beam upward to unlock the said respective offsets and said resilient means acts to rotate the beam to actuate the switch.

8. Means in a stationary aircraft trainer for simulating the action of a circuit breaker, comprising a switch adapted to control the operation of an indicator, a beam mounted for pivotal and longitudinal movements to actuate said switch, biasing means to move said beam, a movable armature normally engaging and latching the beam against pivotal movement, means yieldably resisting movement of said armature out of engagement with said beam, an electromagnet to move said armature out of engagement with said beam whereby said biasing means acts to pivot the beam and actuate said switch, and manually operable reset shaft connected to said beam and movable in one direction to move the beam into locking engagement with said armature.

9. Means in a stationary aircraft trainer for simulating the action of a circuit breaker, comprising a switch adapted to control the operation of an indicator, a beam mount-

6

ed for pivotal and longitudinal movements to actuate said switch, biasing means to move said beam, a movable armature normally engaging and latching the beam against pivotal movement, means yieldably resisting movement of said armature out of engagement with said beam, an electromagnet to move said armature out of engagement with said beam whereby said biasing means acts to pivot the beam and actuate said switch, and a manually operable reset shaft connected to said beam and movable in one direction to move the beam into locking engagement with said armature, said shaft and beam having a pin and slot connection whereby movement of the shaft in the other direction moves the beam longitudinally out of engagement with said armature.

References Cited in the file of this patent

UNITED STATES PATENTS

988,093 Hart ----- Mar. 28, 1911

FOREIGN PATENTS

408,782 Italy ----- Jan. 10, 1945