June 5, 1962 J. F. MARQUIS 3,038,047

AMBIENT TEMPERATURE COMPENSATED CIRCUIT BREAKER

Filed March 17, 1958

Fig. 1.

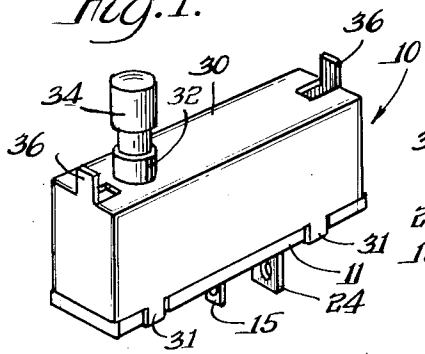



Fig. 2.

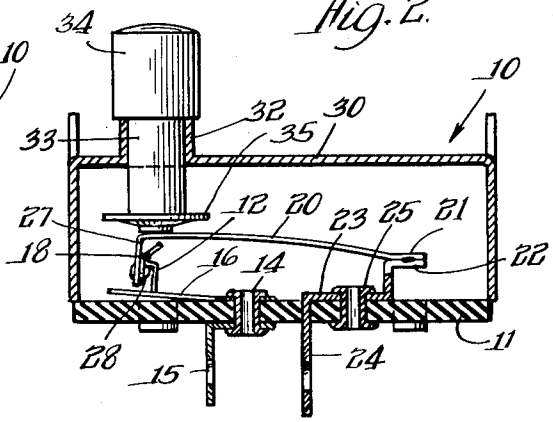



Fig. 5.

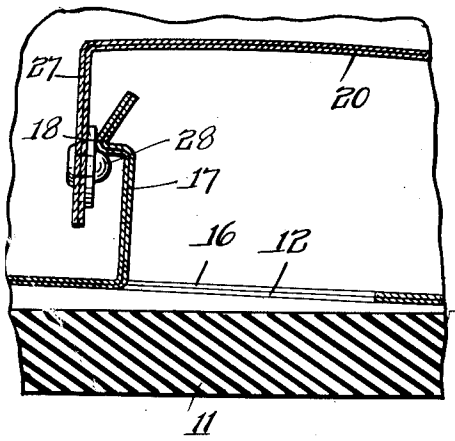
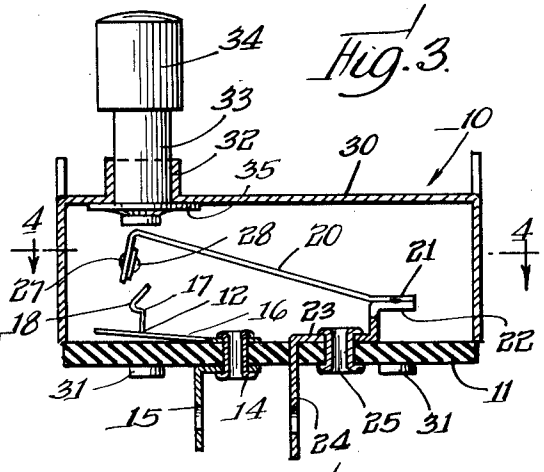



Fig. 3.



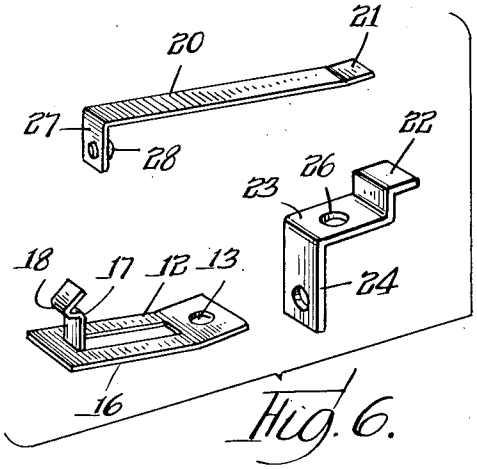
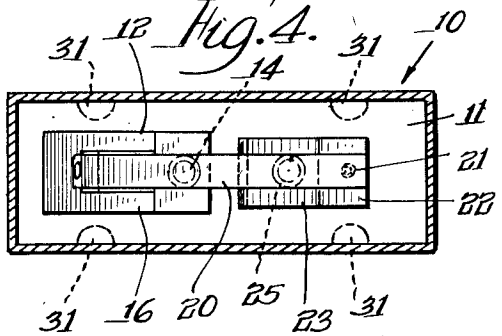




Fig. 6.

Fig. 4.




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# AMBIENT TEMPERATURE COMPENSATED CIRCUIT BREAKER

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The principal object of this invention is to provide an improved circuit breaker for protecting an electric circuit, which operates in the fractional and low integral amperage ranges, which will carry rated amperage at above normal ambient temperature, which accomplishes these results without need for extra parts such as heater coils, extra bimetal leafs, etc., which is simple in construction and fool proof in operation, which provides for increasing contact pressure up to the point of opening the circuit, and which provides good contact wiping action.

Briefly, the ambient temperature compensated circuit breaker of this invention includes an insulating base and an enclosing cover suitably secured thereto. It also includes a resilient bimetallic latch member having a first leg secured at one end to the base, a second leg carried at one end by the free end of the first leg, and a contact shoulder on the free end of the second leg. It further includes a resilient blade, preferably of bimetallic blade, carried at one end by the base and having a contact shoulder on its free end. Terminal connections are provided for the latch member and blade for connecting them into an electric circuit, these terminal connections also providing means for mounting the latch member and blade on the insulating base.

The contact shoulders on the latch member and blade normally overlap and resiliently latch and contact each other for completing the electric circuit through the latch member and the blade. The resilient blade resiliently operates against the resilient latching action of the contact shoulders to separate the contact shoulders when permitted thereby for opening the circuit. One of the legs, the first leg, of the latch member operates on an increase in temperature thereof to increase the latching action of the contact shoulders, and the other of said legs, the second leg, of said latch member operates upon an increasing temperature thereof to decrease the latching action of the contact shoulders. The temperature of the second leg of the latch member is more responsive to the current flow in the electric circuit than the temperature of the first leg of the latch member. As a result, the second leg operates principally in response to current flow to open the circuit breaker upon an excess current flow, while the first leg operates primarily in response to ambient temperature conditions to cause opening of the circuit at a higher temperature as the ambient temperature increases. Thus, the circuit breaker of this invention is substantially fully compensated for ambient temperature conditions.

The resilient blade is also preferably formed of bimetal and operates upon an increase in temperature thereof to increase the separating force thereof, the temperature of the bimetallic blade being primarily responsive to the current flow in the electric circuit. After the circuit breaker is opened upon an excess current flow, it may be manually reset by a push button slidably carried by the cover.

Further objects of this invention have to do with the details of construction of the circuit breaker and with the cooperative relationships between the component parts thereof.

Other objects and advantages of this invention will be-



come apparent to those skilled in the art upon reference to the accompanying specification, claims and drawing in which:

FIG. 1 is a perspective view of the ambient temperature compensated circuit breaker of this invention.

FIG. 2 is an enlarged vertical sectional view illustrating the circuit breaker of this invention in closed position.

FIG. 3 is a view similar to FIG. 2 but illustrating the circuit breaker in open position.

FIG. 4 is a horizontal sectional view through the circuit breaker taken substantially along the line 4—4 of FIG. 3.

FIG. 5 is a further enlarged view of a portion of the latch member and blade showing in more detail the cooperation between the contact shoulders thereof.

FIG. 6 is an exploded perspective view of the latch member, blade and terminal connection for the blade.

The ambient temperature compensated circuit breaker of this invention is generally designated at **10**. It includes a base **11** formed of insulating material, such as Bakelite or the like. A latch member **12**, formed of conventional bimetal, is provided at one end with a hole **13** through which a rivet **14** extends for securing the latch member **12** to the base **11** and to a terminal connection **15**. The high expansion side of the bimetallic latch member faces upwardly while the low expansion side faces downwardly. A first leg **16** of the latch member **12** is bent upwardly from the base **11** so that upon an increase in temperature of the first leg **16**, it may bend downwardly in response thereto. The free end of the first leg **16** is provided with an upwardly extending leg **17** which is preferably struck from the leg **16**. The free end of the second leg **17** is provided with a contact shoulder **18**. The high expansion side of the second leg **17** faces outwardly while the low expansion side faces inwardly so that upon a temperature increase in the leg **17**, it bends or flexes inwardly, that is to the right as illustrated in FIGS. 2, 3 and 5. The cross-sectional area of the second leg **17** is smaller than the cross-sectional area of the first leg **16** and, accordingly, the second leg **17** offers more resistance to current flow than the first leg **16**. In this way, the second leg **17** is primarily responsive to current flow through the latch member **12** while the first leg **16** is primarily responsive to ambient temperature conditions. The relative responses of the second leg **17** and the first leg **16** to current flow conditions and to ambient temperature conditions, respectively, may be selected by appropriately selecting desired cross-sectional areas.

A resilient blade **20** which is also preferably formed of conventional bimetal is secured at one end **21**, by spot welding or the like, to a bracket portion **22** of a terminal connection **23** having an extension **24** extending through the insulating base **11**. The terminal connection **23** is provided with a hole **26** through which a rivet **25** extends for securing the terminal connection **23** to the insulating base **11**. The resilient bimetallic element **20** is pre-bent so as to extend upwardly as illustrated in FIG. 3. The high expansion side of the bimetallic blade **20** faces downwardly while the low expansion side faces upwardly. The free end of the bimetallic blade **20** has a downwardly extending portion **27** which carries a contact shoulder **28**, in the form of a rounded contact riveted thereto. When the bimetallic blade **20** is pushed downwardly to the position illustrated in FIGS. 2 and 5, the contact shoulder **28** on the blade **20** overlaps and resiliently latches and contacts the contact shoulder **18** on the latch member **12** and the contact shoulders are normally resiliently held in this latching contacting

position. The cross-sectional area of the bimetallic blade **20** is so selected as to offer resistance to current flow therethrough. As a result, the temperature of the bimetallic blade is primarily responsive to the current flow therethrough.

A cover **30**, formed of sheet metal or the like, encloses the blade **20** and latch member **12** and rests against the insulating base **11**. The cover **30** is held in place on the base **11** by ears **31** extending through slots in the base **11** and being bent over the bottom of the base **11**. The cover **30** is provided with a sleeve portion **32** in which is slidably mounted a plunger **33** having a button **34**. The plunger **33** and button **34** are preferably formed of insulating material, such as Bakelite or the like. The inner end of the plunger **33** is adapted to engage the blade **20** for latching together the contact shoulders **28** and **18**. The inner end of the plunger **33** is preferably provided with a push-on clip **35** to prevent removal of the plunger from the cover.

The electric circuit to be protected is connected to the terminal connections **15** and **24** so that the latch member **16** and the blade **20** are connected in series in the circuit. When the plunger **33** is depressed, the resilient blade **20** is positioned downwardly and the contact shoulders **28** and **18** resiliently latch and contact each other for completing the electric circuit through the latch member and blade. The current flow through the blade **20** and the second leg **17** of the latch member **12** operates to heat the same and as the temperature of the blade **20** increases, the force tending to move the blade **20** upwardly is increased. As the temperature in the second leg **17** increases, the contact shoulder **18** tends to move away from the contact shoulder **28**. When the temperatures of the blade **20** and the second leg **17** increase, as the result of an excess current flow therethrough, the resilient latching and contacting action of the contact shoulders **18** and **28** are decreased to a point where the resilient force of the blade **20** overcomes the same to separate the contact shoulders **18** and **28**, as illustrated in FIG. 3. Thus, the circuit is broken upon an excess current flow therethrough. As the ambient temperature of the circuit breaker increases, the first leg **16** of the latch member is flexed downwardly in accordance with the ambient temperature condition, and this downward flexing of the first leg **16** causes the latch shoulder **18** to engage with more force, the latch shoulder **28**. As a result, when the ambient temperature of the circuit breaker is high, the temperatures of the bimetallic blade **20** and the second leg **17** of the latch member must be higher to separate the contact shoulders **18** and **28**. In this way, the first leg **16** of the latch member **12** operates substantially completely to compensate for changes in ambient temperature conditions so that the circuit breaker will open at substantially predetermined current flows therethrough regardless of ambient temperature conditions. By reason of this construction, it is also seen that contact pressures between the contact shoulders **18** and **28** increase up to the point of opening the circuit, which provides for full current carrying capacity until the circuit is quickly opened. Because of the latching and contacting relation of the contact shoulders **18** and **28** a good contact wiping action therebetween is also provided. When the circuit breaker is opened, in the manner described above, it may be reclosed by manually positioning the reset button **34**.

While for purposes of illustration, one form of this invention has been disclosed, other forms thereof may become apparent to those skilled in the art upon reference to this disclosure and, therefore, this invention is to be limited only to the scope of the appended claims.

I claim as my invention:

1. An ambient temperature compensated circuit breaker comprising, an insulating base, a resilient bimetallic latch member having a first leg secured at one end to the base, a second leg carried at one end by the free end of the first leg and a contact shoulder on the free end of the second leg, a resilient blade carried at one end by the base and having a contact shoulder on its free end, and terminal connections for the latch member and blade for connecting them into an electric circuit wherein the temperature of the latch member is affected by the current flow through the electric circuit and by ambient temperature conditions, said contact shoulders on the latch member and blade normally overlapping and resiliently latching and contacting each other for completing the electric circuit through the latch member and the blade, said resilient blade resiliently operating against the resilient latching force of the contact shoulders in a direction to separate the contact shoulders when permitted thereby, one of said legs of said latch member operating upon an increase in temperature thereof in a direction to increase the latching force of the contact shoulders, and the other of said legs of said latch member operating upon an increase in temperature thereof in a direction to decrease the latching force of the contact shoulders.

2. An ambient temperature compensated circuit breaker comprising, an insulating base, a resilient bimetallic latch member having a first leg secured at one end to the base, a second leg carried at one end by the free end of the first leg and a contact shoulder on the free end of the second leg, a resilient blade carried at one end by the base and having a contact shoulder on its free end, and terminal connections for the latch member and blade for connecting them into an electric circuit wherein the temperature of the latch member is affected by the current flow through the electric circuit and by ambient temperature conditions, said contact shoulders on the latch member and blade normally resiliently latching and contacting each other for completing the electric circuit through the latch member and the blade, said resilient blade resiliently operating against the resilient latching force of the contact shoulders in a direction to separate the contact shoulders when permitted thereby, one of said legs of said latch member operating upon an increase in temperature thereof in a direction to increase the latching force of the contact shoulders, and the other of said legs of said latch member operating upon an increase in temperature thereof in a direction to decrease the latching force of the contact shoulders, and the temperature of said other leg of said latch member being more responsive to the current flow in the electric circuit than the temperature of said one leg of said latch member.

3. An ambient temperature compensated circuit breaker comprising, an insulating base, a resilient bimetallic latch member having a first leg secured at one end to the base, a second leg carried at one end by the free end of the first leg and a contact shoulder on the free end of the second leg, a resilient bimetallic blade carried at one end by the base and having a contact shoulder on its free end, and terminal connections for the latch member and blade for connecting them into an electric circuit wherein the temperature of the latch member and blade is affected by the current flow through the electric circuit and by ambient temperature conditions, said contact shoulders on the latch member and blade normally overlapping and resiliently latching and contacting each other for completing the electric circuit through the latch member and the blade, said resilient bimetallic blade resiliently operating against the resilient latching force of the contact shoulders in a direction to separate the contact shoulders when permitted thereby and operating upon an increase in temperature thereof in a direction to increase the separating force thereof, one of said legs of said latch member operating upon an increase in temperature thereof in a direction to increase the latching force of the contact shoulders, and the other of said legs of said latch member operating upon an increase in temperature thereof in a direction to decrease the latching force of the contact shoulders.

4. An ambient temperature compensated circuit breaker comprising, an insulating base, a resilient bimetallic latch member having a first leg secured at one end to the base, a second leg carried at one end by the free end of the first leg and a contact shoulder on the free end of the second leg, a resilient bimetallic blade carried at one end by the base and having a contact shoulder on its free end, and terminal connections for the latch member and blade for connecting them into an electric circuit wherein the temperature of the latch member and blade is affected by the current flow through the electric circuit and by ambient temperature conditions, said contact shoulders on the latch member and blade normally overlapping and resiliently latching and contacting each other for completing the electric circuit through the latch member and the blade, said resilient bimetallic blade resiliently operating against the resilient latching force of the contact shoulders in a direction to separate the contact shoulders when permitted thereby and operating upon an increase in temperature thereof in a direction to increase the separating force thereof, one of said legs of said latch member operating upon an increase in temperature thereof in a direction to increase the latching force of the contact shoulders, and the other of said legs of said latch member operating upon an increase in temperature thereof in a direction to decrease the latching force of the contact shoulders, the temperature of the bimetallic blade being operatively responsive to the current flow in the electric circuit.

5. An ambient temperature compensated circuit breaker comprising, an insulating base, a resilient bimetallic latch member having a first leg secured at one end to the base, a second leg carried at one end by the free end of the first leg and a contact shoulder on the free end of the second leg, a resilient bimetallic blade carried at one end by the base and having a contact shoulder on its free end, and terminal connections for the latch member and blade for connecting them into an electric circuit wherein the temperature of the latch member and blade is affected by the current flow through the electric circuit and by ambient temperature conditions, said contact shoulders on the latch member and blade normally overlapping and resiliently latching and contacting each other for completing the electric circuit through the latch member and the blade, said resilient bimetallic blade resiliently operating against the resilient latching force of the contact shoulders in a direction to separate the contact shoulders when permitted thereby and operating upon an increase in temperature thereof in a direction to increase the separating force thereof, one of said legs of said latch member operating upon an increase in temperature thereof in a direction to increase the latching force of the contact shoulders, and the other of said legs of said latch member operating upon an increase in temperature thereof in a direction to decrease the latching force of the contact shoulders, the temperature of the bimetallic blade being operatively responsive to the current flow in the electric circuit, and the temperature of said other leg of said latch member being more responsive to the current flow in the electric circuit than the temperature of said one leg of said latch member.

6. An ambient temperature compensated circuit breaker comprising, an insulating base, a resilient bimetallic latch member carried at one end by the base and having a contact shoulder on its free end, a resilient bimetallic blade carried at one end by the base and having a contact shoulder on its free end, and terminal connections for the latch member and blade for connecting them into an electric circuit wherein the temperature of the latch member and blade is affected by the current flow through the electric circuit and by ambient temperature conditions, said contact shoulders on the latch member and blade normally overlapping and resiliently latching and contacting each other for completing the electric circuit through the latch member and the blade, said resilient bimetallic blade resiliently operating against the resilient latching force of the contact shoulders in a direction to separate the contact shoulders when permitted thereby and operating upon an increase in temperature thereof in a direction to increase the separating force thereof, said bimetallic latch member operating upon an increase in temperature thereof in a direction to increase the latching force of the contact shoulders.

7. An ambient temperature compensated circuit breaker comprising, an insulating base, a resilient bimetallic latch member carried at one end by the base and having a contact shoulder on its free end, a resilient bimetallic blade carried at one end by the base and having a contact shoulder on its free end, and terminal connections for the latch member and blade for connecting them into an electric circuit wherein the temperature of the latch member and blade is affected by the current flow through the electric circuit and by ambient temperature conditions, said contact shoulders on the latch member and blade normally overlapping and resiliently latching and contacting each other for completing the electric circuit through the latch member and the blade, said resilient bimetallic blade resiliently operating against the resilient latching force of the contact shoulders in a direction to separate the contact shoulders when permitted thereby and operating upon an increase in temperature thereof in a direction to increase the separating force thereof, said bimetallic latch member operating upon an increase in temperature thereof in a direction to increase the latching force of the contact shoulders, the temperature of the bimetallic blade being more responsive to the current flow in the electric circuit than the temperature of said latch member.

8. An ambient temperature compensated circuit breaker comprising, an insulating base, a resilient bimetallic latch member having a first leg secured at one end to the base, a second leg carried at one end by the free end of the first leg and a contact shoulder on the free end of the second leg, a resilient blade carried at one end by the base and having a contact shoulder on its free end, and terminal connections for the latch member and blade for connecting them into an electric circuit wherein the temperature of the latch member is affected by the current flow through the electric circuit and by ambient temperature conditions, said contact shoulders on the latch member and blade normally overlapping and resiliently latching and contacting each other for completing the electric circuit through the latch member and the blade, said resilient blade resiliently operating against the resilient latching force of the contact shoulders in a direction to separate the contact shoulders when permitted thereby, one of said legs of said latch member operating upon an increase in temperature thereof in a direction to increase the latching force of the contact shoulders, and the other of said legs of said latch member operating upon an increase in temperature thereof in a direction to decrease the latching force of the contact shoulders, a cover secured to the base and enclosing the latch member and blade, and a push button carried by the cover for engaging the blade to reset the contact shoulders after they have separated.

9. An ambient temperature compensated circuit breaker comprising, an insulating base, a resilient bimetallic latch member carried at one end by the base and having a contact shoulder on its free end, a resilient bimetallic blade carried at one end by the base and having a contact shoulder on its free end, and terminal connections for the latch member and blade for connecting them into an electric circuit wherein the temperature of the latch member and blade is affected by the current flow through the electric circuit and by ambient temperature conditions, said contact shoulders on the latch member and blade normally overlapping and resiliently latching and contacting each other for completing the electric circuit

through the latch member and the blade, said resilient bimetallic blade resiliently operating against the resilient latching force of the contact shoulders in a direction to separate the contact shoulders when permitted thereby and operating upon an increase in temperature thereof in a direction to increase the separating force thereof, said bimetallic latch member operating upon an increase in temperature thereof in a direction to increase the latching force of the contact shoulders, a cover secured to the base and enclosing the latch member and blade, and a push button carried by the cover for engaging the blade to reset the contact shoulders after they have separated.



**References Cited** in the file of this patent

UNITED STATES PATENTS

| | | |
|---|---|---|
| 1,431,220 | Donle | Oct. 10, 1922 |
| 1,948,938 | Lawton | Feb. 27, 1934 |
| 2,458,804 | Sundt | Jan. 11, 1949 |
| 2,664,480 | Elliott | Dec. 29, 1953 |
| 2,803,721 | Cole | Aug. 20, 1957 |
| 2,897,314 | Cole | July 28, 1959 |

FOREIGN PATENTS

| | | |
|---|---|---|
| 553,109 | France | Feb. 6, 1923 |
| 597,603 | France | Sept. 5, 1925 |