April 5, 1966 R. E. LOCHER 3,244,835

MAGNETIC TRIPPED CIRCUIT BREAKER

Filed May 14, 1963

FIG. 1.

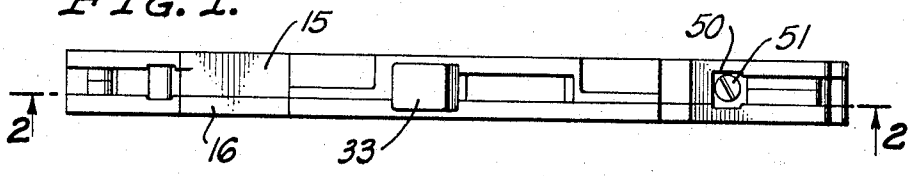


FIG. 2.

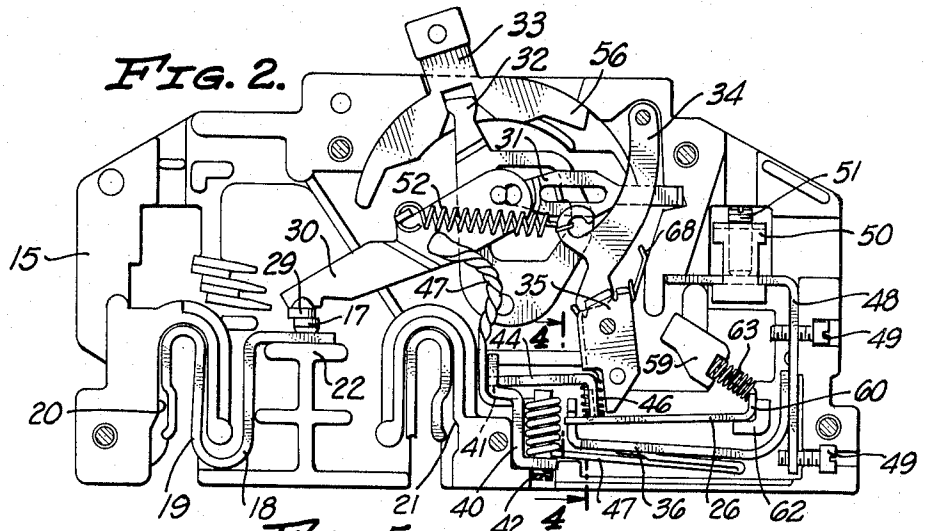


FIG. 5.

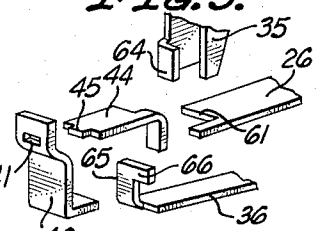


FIG. 4.

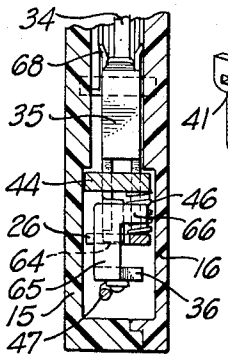


FIG. 7.

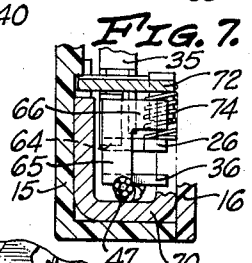


FIG. 3.

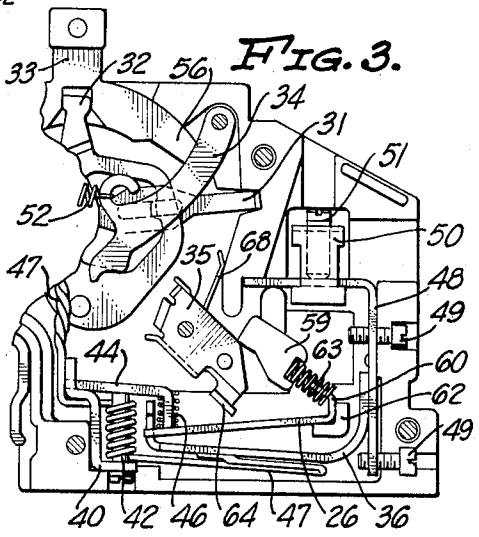
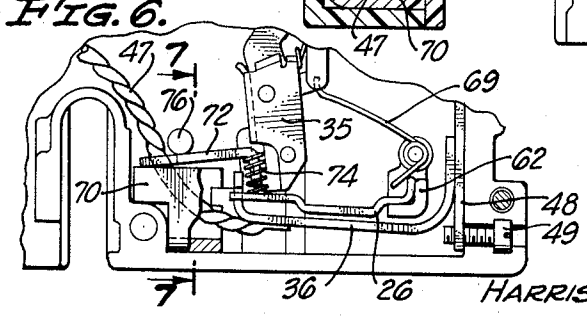


FIG. 6.



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MAGNETIC TRIPPED CIRCUIT BREAKER

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This invention relates to electrical switches and, in particular, to a manually and externally operable switch suitable for use as a circuit breaker switch. In general a circuit breaker switch is manually or externally actuable for movement between an open circuit or off condition and a close circuit or on condition and is also automatically movable to another open circuit or tripped condition when certain undesirable conditions exist, the undesired condition usually being excessive current through the switch. After a circuit breaker switch has been tripped or switched to the tripped condition, it is necessary to manually or externally reset the switch to the off condition before it can again be moved to the on condition.

The very essence of a circuit breaker switch is the automatic movement to an open circuit or tripped condition when undesired conditions such as excessive current passing through the switch are encountered. Accordingly, it is a primary object of this invention to provide a new and improved mechanism for automatically moving the switch to an open circuit or tripped condition when such undesired conditions exist. A further object of this invention is to provide such a mechanism which is extremely simple and reliable and one which provides a relatively high operating force. Another object of this invention is to provide such a mechanism which is extremely swift and efficient in responding to a current overload condition.

It is another object of the invention to provide a circuit breaker switch having an electromagnetic tripping mechanism for moving the switch to the open circuit or tripped condition when a current overload condition exists. Another object is to provide such an electromagnetic tripping mechanism which may be readily incorporated into existing switch designs and one in which the additional parts are easily slid into and removed from the switch case.

An object of this invention is to provide a circuit breaker switch having a first tripping mechanism for substantially instantaneously moving the switch to the open circuit or tripped condition in response to a very high current overload passing through the switch and a second tripping mechanism for moving the switch to the open circuit or tripped condition in response to a high current overload passing through the switch for a predetermined period of time.

Another object of this invention is to provide a circuit breaker switch having an electromagnetic tripping mechanism for substantially instantaneously moving the switch to the open circuit or tripped condition in response to a very high current overload passing through the switch and a thermal tripping mechanism for moving the switch to the open circuit or tripped condition in response to a high current overload passing through the switch for a predetermined period of time.

A further object of this invention is to provide in a circuit breaker switch having a manually actuated off-on switch mechanism and an automatic circuit breaking mechanism mounted in a case, the automatic circuit breaking mechanism including a latch movable between a neutral position and a circuit interrupted position to automatically interrupt the electrical circuit, the combination of a latch release member engageable with the latch to hold the latch in a neutral position, a trip member engageable with the latch release member to move the latch release member out of engagement with the latch, an electromagnetic means for causing the trip member to move the latch release member out of engagement with the latch, and means for energizing the electromagnetic means when a current overload passes through the switch.

A still further object of this invention is to provide in a circuit breaker switch having a manually actuated off-on switch mechanism and an automatic circuit breaking mechanism mounted in a case, the automatic circuit breaking mechanism including a latch movable between a neutral position and a circuit interrupted position to automatically interrupt the electrical circuit, the combination of a latch release member engageable with the latch to hold the latch in a neutral position, a first trip member engageable with the latch release member to move the latch release member out of engagement with the latch, a conductor passing through the switch mechanism, electromagnetic means for causing the trip member to move the latch release member out of engagement with the latch including a metal bracket positioned adjacent the conductor so that a current overload passing through the conductor will induce a flux in the bracket, thus causing the bracket to attract the trip member and move it in a direction to move the latch release member out of engagement with the latch, and a second thermal trip member connected to the conductor and engageable with the latch release member to move the latch release member out of engagement with the latch when a current overload passes through the conductor.

Still another object of this invention is to provide an electrical switch including a case, a fixed contact mounted in the case, a moving contact carried on a contact arm for engagement with the fixed contact, means for moving the contact arm between contact closed and contact open positions, means for biasing the contact arm toward a contact open position when the contact arm is in a contact closed position, means engageable with the biasing means for maintaining the contact arm in a contact closed position in opposition to the action of the biasing means, and an automatic circuit breaking mechanism mounted in the case including a latch movable between a neutral position and a circuit interrupted position, the latch releasing the means engageable with the biasing means when in a circuit interrupted position to automatically interrupt the electrical circuit, a latch release member engageable with the latch to hold the latch in a neutral position, with the latch release member biased into engagement with the latch, a trip member engageable with the latch release member to move the latch release member out of engagement with the latch, an electromagnetic means for causing the trip member to move the latch release member out of engagement with the latch, and means for energizing the electromagnetic means when an overload current passes through the switch.

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. The drawing merely shows and the description merely describes preferred embodiments of the present invention which are given by way of illustration and example.

In the drawing:

FIG. 1 is a top elevational view of the circuit breaker switch;

FIG. 2 is a side elevational view with the cover removed showing the switch in the closed position and taken along the line 2—2 of FIG. 1;

FIG. 3 is a partial view similar to that of FIG. 2 showing the switch in the tripped position;

FIG. 4 is a partial sectional view taken along the line 4—4 of FIG. 2;

FIG. 5 is an exploded view showing certain of the elements which comprise the tripping mechanism;

FIG. 6 is a partial view similar to that of FIG. 2 showing an alternative embodiment of the invention; and

FIG. 7 is a partial sectional view taken along the line 7—7 of FIG. 6.

The switch mechanism is mounted in a case consisting of a body **15** and a cover plate **16**, the cover plate being removed in FIGS. 2, 3, and 6. A fixed contact **17** is mounted on a conductor **18** having a U-shaped buss clip **19** at the other end. Housings **20**, **21** are formed in the body **15** for receiving the buss clip **19**, with the housings being symmetrically positioned with respect to a support boss **22** for the fixed contact. The conductor **18** may be positioned in the body with the fixed contact on the boss **22** and with the buss clip in either of the housings **20**, **21**.

The switch mechanism includes a moving contact **29** carried on a contact arm **30**, a pivot arm **31**, a switch actuator **32**, a finger member **33**, a trigger arm **34**, a latch lever **35**, a latch release member **26**, and a thermal trip member **36**. In addition, the switch mechanism includes a mounting bracket **40** having a slot **41** therein, a vertical post **42** extending upwardly from the bracket **40**, and an L-shaped drop latch **44** having a tongue **45** at one end thereof, which is pivotally and releasably receivable within the slot **41** in the mounting bracket **40**. The bracket **40**, post **42** and latch **44** are made of a magnetizable material, such as soft iron. A coil spring **46** may be positioned circumferentially of the short leg of the L-shaped drop latch **44** to bias the latch away from the bracket **40**. A flexible conductor **47** is connected between the contact arm **30** and the thermal trip member **36**, with the thermal trip member being spot-welded to a conductor **48** fixed in the body by screws **49**. A terminal member **50** is fixed to the conductor **48** for receiving an external wire which is fixed in the terminal by a screw **51**. Further, in extending between the contact arm **30** and the thermal trip member **36**, the flexible conductor **47** is wound in a coil circumferentially of the vertical post **42**.

A toggle or overcenter spring **52** is connected between the contact arm **30** and the trigger arm **34**, with the trigger arm serving as a fixed reference for the toggle spring during normal operation of the switch, as shown in FIG. 2. However, when the trigger arm **34** is released by the latch lever **35** under current overload conditions, the trigger arm is rotated clockwise by the spring **52**, moving the switch to the tripped, open circuit position, as partially shown in FIG. 3. The circuit breaker is reset by moving the finger member **33** to the extreme clockwise position, with an end portion **56** of the finger member engaging the trigger arm **34**.

In the preferred form shown herein, the latch release member **26** has an open U-shaped portion **60** at one end and a notched section **61** at the other end. The open U-shaped portion **60** is positioned against an L-shaped boss **62** formed in the case **15**, and is slightly pivotal with respect to the boss **62**. One leg of the open U-shaped portion **60** is longitudinally receivable within a cylindrical coil spring **63**, which spring is mounted on a boss **59** formed in the case **15**. The spring **63** serves to bias the latch release member **26** into engagement with the latch **35**. A tongue **64** of the latch lever **35** is positioned in the notch **61** when the circuit breaking mechanism is in the neutral position, as shown in FIG. 2. This engagement of the tongue of the latch lever **35** with the notch **61** of the latch release member **26** maintains the switch in the neutral condition so that it may be used as a switch and actuated from off to on and return as desired.

The preferred embodiment herein provides a primary latch lever release mechanism which will insure a swift and positive movement of the switch to the tripped or circuit interrupted position. When the current through the flexible conductor **47** exceeds a predetermined value, the drop-latch **44** is attracted to the post **42**, moving the latch in a clockwise direction. The clockwise movement of the drop-latch **44** will cause the latch release member **26** to move downward in a counterclockwise direction and out of engagement with the latch lever **35**. When the latch lever **35** is disengaged, the trigger arm **34** is free to rotate clockwise, causing the moving contact to move to the tripped or circuit interrupted position.

The thermal trip member **36**, which is ordinarily a bimetal strip, is provided as a second means for moving the switch mechanism to a tripped or interrupted position. The trip member **36** has an upstanding portion **65** at its free end with an overhanging shoulder **66** positioned for engaging the tip of the latch release member **26**. When the current through the switch exceeds a predetermined value for a predetermined time, the thermal member rotates in a counterclockwise direction to cause the shoulder **66** to engage the latch release member **26** and move the latch release member downward out of engagement with the latch lever **35**. When the latch lever **35** is disengaged, the trigger arm **34** is free to rotate clockwise, causing the moving contact to move to the tripped or circuit interrupted position, as shown in FIG. 3.

The circuit breaking mechanism is reset from the tripped position to the neutral position by manually moving the finger member **33** to the extreme clockwise position. Engagement of the tip portion **56** of the finger member with the trigger arm **34** causes the trigger arm to move to the position shown in FIG. 2. Engagement of the trigger arm with the latch lever **35** causes the latch lever to move to the position of FIG. 2. A spring **68** provides a slight torque urging the latch lever **35** counterclockwise so as to be in position for engagement by the trigger arm during the reset operation. If the latch **44** has been released and the thermal trip member **36** has cooled, the latch release member will be free to move upward and engage the tongue of the latch lever **35** to latch the circuit breaking mechanism.

An alternative embodiment of the tripping mechanism is illustrated in FIG. 6 of the drawing. Herein the latch release member **26** is pivotally positioned against the L-shaped boss **62** by a light spring **69** which provides a slight torque for urging the latch release member upward toward a latch-engaging position.

The tripping mechanism illustrated in FIG. 6 also includes a U-shaped bracket **70** mounted on the casing **15** with the conductor **47** passing through an open central portion thereof. An L-shaped drop latch **72** is pivotally engageable with the top of the U-shaped bracket **70** and a coiled spring **74** may be positioned circumferentially of the short leg of the L-shape to bias the latch away from the bracket. The bracket and latch normally are made of soft iron. A pin **76** is mounted on the casing **15** to limit the movement of the drop latch **72** in the upward direction. The combination of the spring **74** and the pin **76** causes the drop latch **72** to be positioned a consistent distance from the top of the U-shaped bracket **70** each time the switch mechanism is actuated. This arrangement is advantageous in that it insures the same operating conditions each time the electromagnetic bracket is energized.

In actual operation, the alternative embodiment of the tripping mechanism shown in FIG. 6 will function in a similar manner to that shown in FIGS. 2 and 3. During current overload conditions, the excessive current flowing through the conductor **47** will induce a flux in the U-shaped bracket **70** attracting the drop latch **72** and causing it to rotate in a clockwise direction. The clockwise movement of the drop latch **72** will partially compress the spring **74** and cause the latch release member **26** to rotate in a counterclockwise direction, thereby releasing the latch lever **35**.

Although exemplary embodiments of the invention have been disclosed and discussed, it will be understood that other applications of the invention are possible and

that the embodiments disclosed may be subjected to various changes, modifications and substitutions without necessarily departing from the spirit of the invention as defined by the claims which follow.

I claim as my invention:

1. In a circuit breaker switch having a manually actuated off-on switch mechanism and an automatic circuit breaking mechanism mounted in a case, the automatic circuit breaking mechanism including a latch movable between a neutral position and a circuit interrupted position to automatically interrupt the electrical circuit, the combination of:

a latch release member pivotally mounted adjacent one end thereof and engageable with said latch adjacent the other end thereof to hold said latch in a neutral position;

a first trip member engageable with said latch release member adjacent said other end to move said latch release member out of engagement with said latch;

electromagnetic means disposed at and beyond said other end for causing said first trip member to move said latch release member out of engagement with said latch;

a second thermal trip member disposed in general parallel alignment with said latch release member and spaced from said electromagnetic means and engageable with said latch release member to move said latch release member out of engagement with said latch; and

means for energizing said electromagnetic means and said thermal trip member when a current overload passes through said switch, including means for connecting said second thermal trip member in the electrical circuit with a conductor connected in series with said second thermal trip member and passing through said electromagnetic means.

2. In a circuit breaker switch having a manually actuated off-on switch mechanism and an automatic circuit breaking mechanism mounted in a case, the automatic circuit breaking mechanism including a latch movable between a neutral position and a circuit interrupted position to automatically interrupt the electrical circuit, the combination of::

a latch release member engageable with said latch to hold said latch in a neutral position;

a mounting bracket;

a trip member having an L-shape, said trip member being pivotally mounted to said mounting bracket adjacent the end of the long leg of said L-shape and having the end of the short leg of said L-shape engageable with said latch release member to move said latch release member out of engagement with said latch;

a coil spring engaging said trip member, surrounding the short leg of said L-shape thereof, and engaging said latch release member when said latch is in a neutral position and a circuit interrupted position;

electromagnetic means on said mounting bracket for causing the short leg of said L-shaped trip member to engage said latch release member and move same out of engagement with said latch; and

means for energizing said electromagnetic means when a current overload passes through said switch.

3. In a circuit breaker switch having a manually actuated off-on switch mechanism and an automatic circuit breaking mechanism mounted in a case, the automatic circuit breaking mechanism including a latch movable between a neutral position and a circuit interrupted position to automatically interrupt the electrical circuit, the combination of:

a latch release member engageable with said latch to hold said latch in a neutral position;

a mounting bracket;

a first trip member having an L-shape, said trip member being pivotally mounted to said mounting bracket

adjacent the end of the long leg of said L-shape and having the end of the short leg of said L-shape engageable with said latch release member to move said latch release member out of engagement with said latch;

electromagnetic means on said mounting bracket for causing the short leg of said L-shaped trip member to engage said latch release member and move same out of engagement with said latch;

a second thermal trip member positioned below said latch release member and having an upstanding portion extending above said latch release member and an overhanging shoulder extending laterally from said upstanding portion engageable with said latch release member to move said latch release member downwardly and out of engagement with said latch; and

means for energizing said electromagnetic means and said thermal trip member when a current overload passes through said switch.

4. In a circuit breaker switch having a manually actuated off-on switch mechanism and an automatic circuit breaking mechanism mounted in a case, the automatic circuit breaking mechanism including a latch having a depending portion and movable between a neutral position and a circuit interrupted position to automatically interrupt the electrical circuit, the combination of:

a latch release member having a notch at one end thereof and the depending portion of said latch engageable with said latch release member and within said notch to hold said latch in a neutral position;

a mounting bracket;

a first trip member having an L-shape, said trip member being pivotally mounted to said mounting bracket adjacent the end of the long leg of said L-shape and having the end of the short leg of said L-shape positioned adjacent the depending portion of said latch when in a neutral position and engageable with said latch release member to move said latch release member out of engagement with said latch;

electromagnetic means on said mounting bracket for causing the short leg of said L-shaped trip member to engage said latch release member and move same out of engagement with said latch;

a second thermal trip member positioned below said latch release member and having an upstanding portion extending above said latch release member and through the notch therein, said upstanding portion having an overhanging shoulder engageable with said latch release member adjacent said notch to move said latch release member downwardly and out of engagement with said latch; and

means for energizing said electromagnetic means and said thermal trip member when a current overload passes through said switch.

5. In a circuit breaker switch having a manually actuated off-on switch mechanism and an automatic circuit breaking mechanism mounted in a case, the automatic circuit breaking mechanism including a latch movable between a neutral position and a circuit interrupted position to automatically interrupt the electrical circuit, the combination of:

a latch release member engageable with said latch to hold said latch in a neutral position;

a first trip member having an L-shape with one leg thereof engageable with said latch release member to move said latch release member out of engagement with said latch;

electromagnetic means for attracting the other leg of said trip member and moving said one leg into engagement with said latch member;

a compressed coil spring engaging said trip member surrounding said one leg thereof, and engaging said latch release member;

a second thermal trip member engageable with said latch release member to move said latch release member out of engagement with said latch; and

means for energizing said electromagnetic means and said thermal trip member when a current overload passes through said switch.

6. In a circuit breaker switch having a manually actuated off-on switch mechanism and an automatic circuit breaking mechanism mounted in a case, the automatic circuit breaking mechanism including a latch movable between a neutral position and a circuit interrupted position to automatically interrupt the electrical circuit, the combination of:

a latch release member pivotally mounted adjacent one end thereof and enageable with said latch adjacent the other end thereof to hold said latch in a neutral position;

a first trip member engageable with said latch release member adjacent said other end to move said latch release member out of engagement with said latch;

electromagnetic means disposed at and beyond said other end for causing said first trip member to move said latch release member out of engagement with said latch, said electromagnetic means comprising a U-shaped member with said first trip member located at the open end of the U;

a second thermal trip member disposed in general parallel alignment with said latch release member and spaced from said electromagnetic means and engageable with said latch release member to move said latch release member out of engagement with said latch; and

means for energizing said electromagnetic means and said thermal trip member when a current overload passes through said switch, including means for connecting said second thermal trip member in the electrical circuit with a conductor connected in series with said second thermal trip member and passing through said U-shaped member.

7. In a circuit breaker switch having a manually actuated off-on switch mechanism and an automatic circuit breaking mechanism mounted in a case, the automatic circuit breaking mechanism including a latch movable between a neutral position and a circuit interrupted position to automatically interrupt the electrical circuit, the combination of:

a latch release member pivotally mounted adjacent one end thereof and engageable with said latch adjacent the other end thereof to hold said latch in a neutral position;

a first trip member engageable with said latch release member adjacent said other end to move said latch release member out of engagement with said latch;

electromagnetic means disposed at and beyond said other end for causing said first trip member to move said latch release member out of engagement with said latch, said electromagnetic means comprising a bracket supporting a post with said first trip member pivoted on said bracket for movement toward and away from said post;

a second thermal trip member disposed in general parallel alignment with said latch release member and spaced from said electromagnetic means and engageable with said latch release member to move said latch release member out of engagement with said latch; and

means for energizing said electromagnetic means and said thermal trip member when a current overload passes through said switch, including means for connecting said second thermal trip member in the electrical circuit with a conductor connected in series with said second thermal trip member and wrapped around said post.

8. In a circuit breaker switch having a manually actuated off-on switch mechanism and an automatic circuit breaking mechanism mounted in a case, the automatic circuit breaking mechanism including a latch movable between a neutral position and a circuit interrupted position to automatically interrupt the electric circuit, the combination of:

a latch release member pivotally mounted adjacent one end thereof and engageable with said latch adjacent the other end thereof to hold said latch in a neutral position;

a first trip member engageable with said latch release member adjacent said other end to move said latch release member out of engagement with said latch;

electromagnetic means disposed at and beyond said other end for causing said first trip member to move said latch release member out of engagement with said latch, with said first trip member pivotally engaging said electromagnetic means adjacent one end of said trip member and engaging the latch release member adjacent the other end of said trip member;

spring means disposed between said first trip member and said latch release member for urging said members apart;

stop means in said case for limiting movement of said first trip member away from said latch release member;

a second thermal trip member disposed in general parallel alignment with said latch release member and spaced from said electromagnetic means and engageable with said latch release member to move said latch release member out of engagement with said latch; and

means for energizing said electromagnetic means and said thermal trip member when a current overload passes through said switch, including means for connecting said second thermal trip member in the electrical circuit with a conductor connected in series with said second thermal trip member and passing through said electromagnetic means.

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