March 15, 1966 F. L. GELZHEISER 3,240,902

CIRCUIT INTERRUPTING UNITS WITH HANDLE-TIE STRUCTURE

Filed Aug. 25, 1960 4 Sheets-Sheet 1

Fig. 1

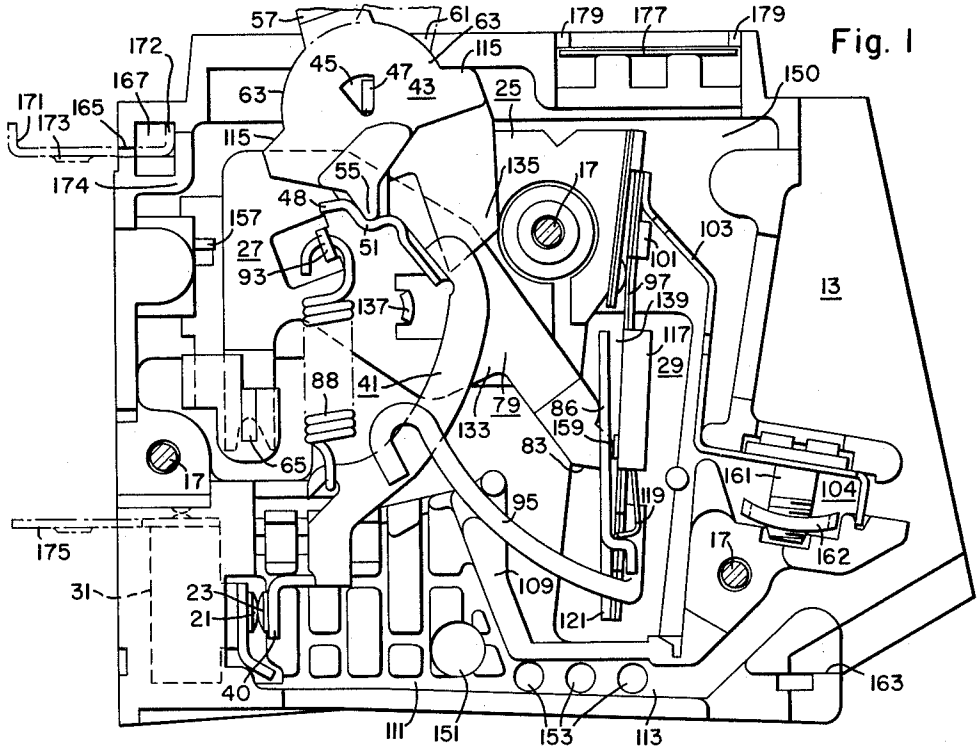
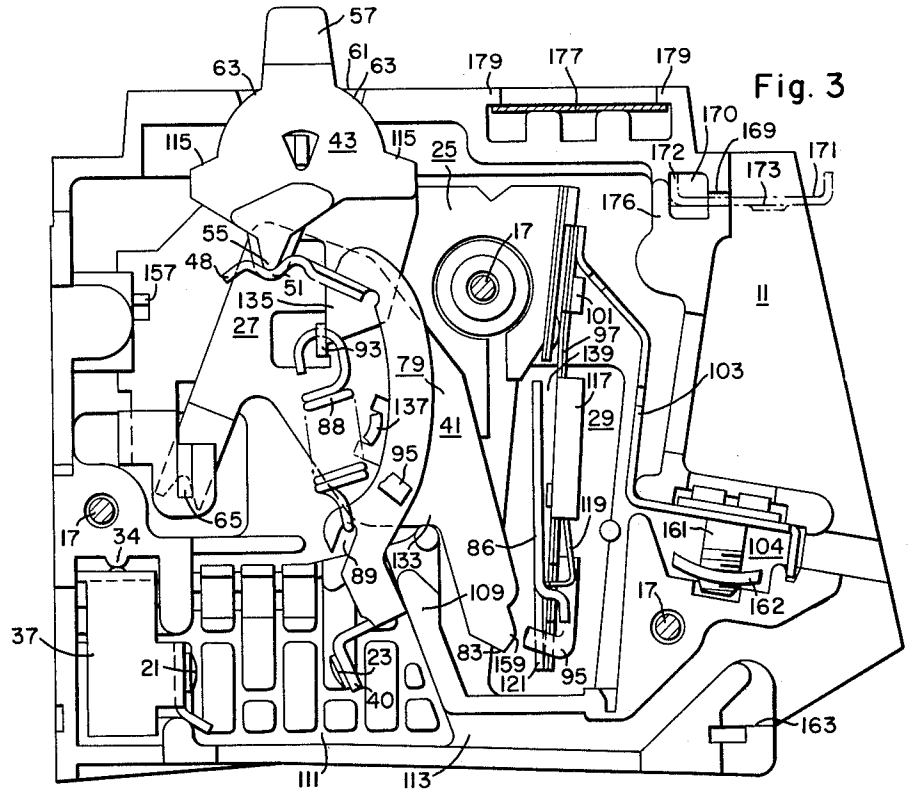


Fig. 3



CIRCUIT INTERRUPTING UNITS WITH HANDLE-TIE STRUCTURE

Filed Aug. 25, 1960 4 Sheets-Sheet 2

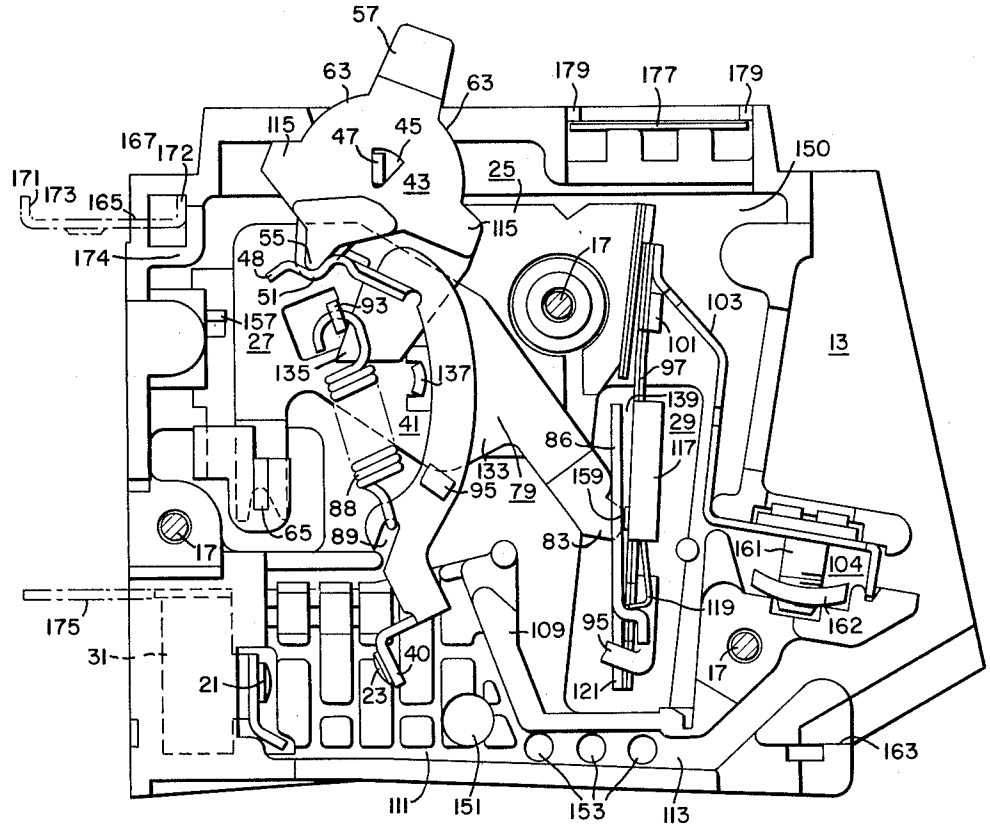


Fig. 2

WITNESSES

John E. Hearley, Jr.

William A. Elchik

INVENTOR

Francis L. Gelzheiser

BY

ATTORNEY

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CIRCUIT INTERRUPTING UNITS WITH HANDLE-TIE STRUCTURE

Filed Aug. 25, 1960 4 Sheets-Sheet 3

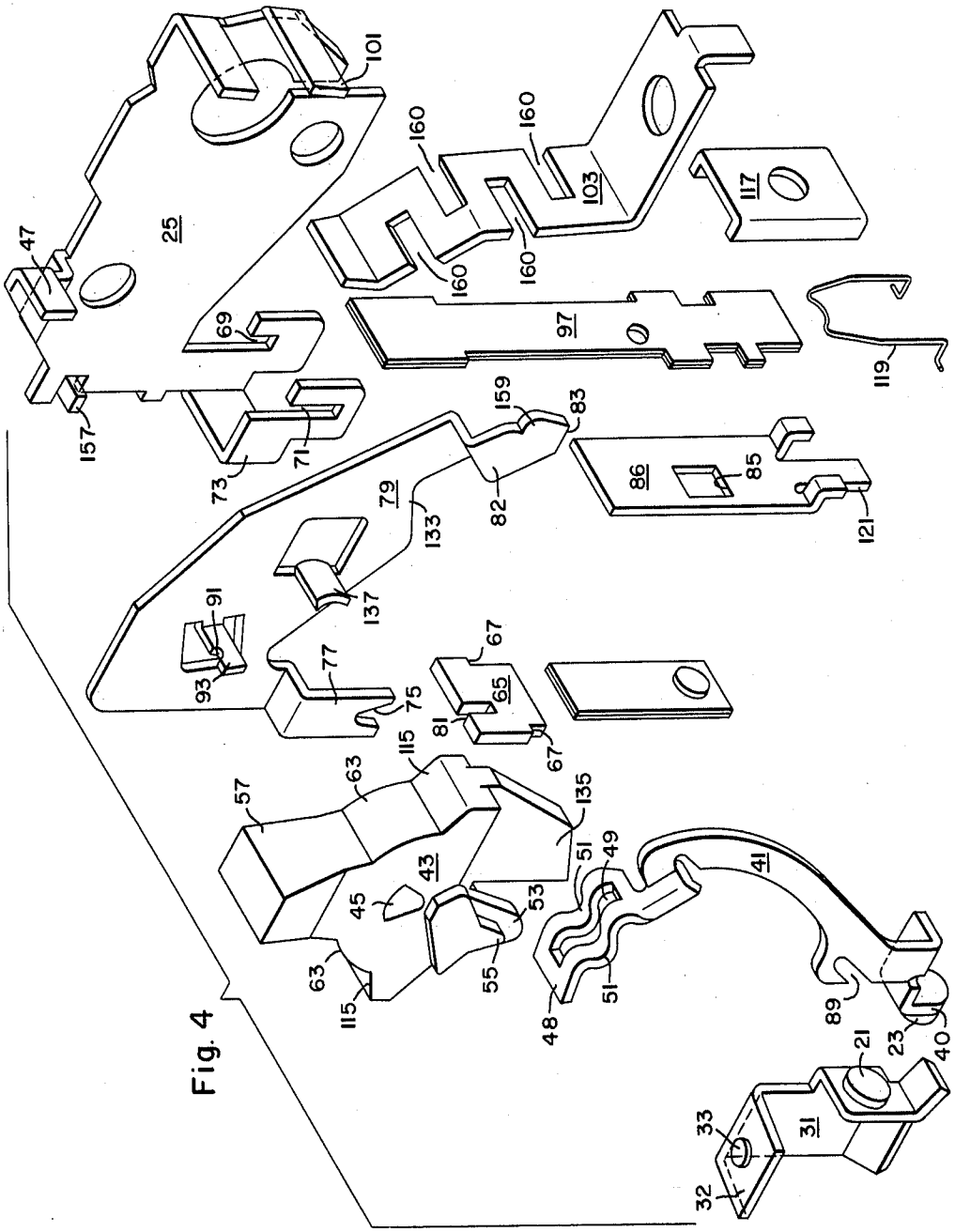

Fig. 4

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CIRCUIT INTERRUPTING UNITS WITH HANDLE-TIE STRUCTURE

Filed Aug. 25, 1960 4 Sheets-Sheet 4

Fig. 5

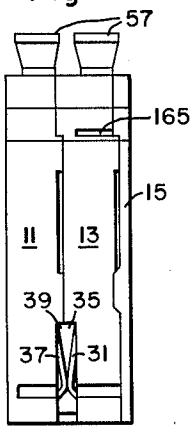


Fig. 6

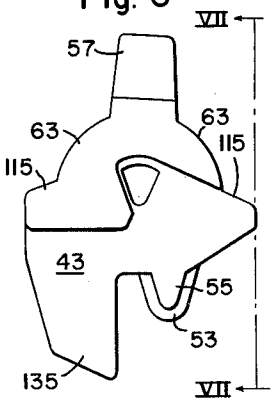


Fig. 7

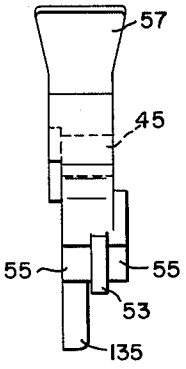


Fig. 10

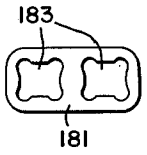


Fig. 8

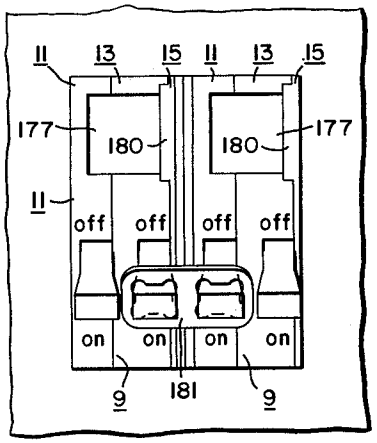
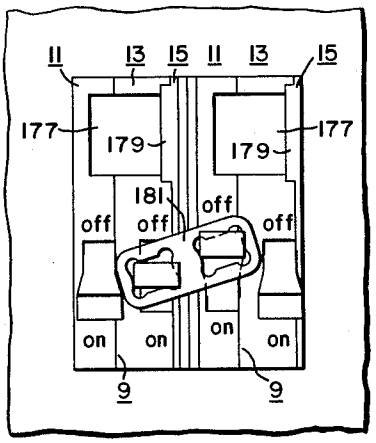


Fig. 9



United States Patent Office 3,240,902 Patented Mar. 15, 1966

3,240,902

CIRCUIT INTERRUPTING UNITS WITH HANDLE-TIE STRUCTURE

Francis L. Gelzheiser, Fairfield, Conn., assignor to Westinghouse Electric Corporation, East Pittsburgh, Pa., a corporation of Pennsylvania

Filed Aug. 25, 1960, Ser. No. 51,963
2 Claims. (Cl. 200—116)

This invention relates to electric circuit breakers and more particularly to manually and automatically operable circuit breakers for controlling small and moderate power electric circuits.

An object of this invention is to provide a circuit breaker embodying improved means for manually operating the movable contact arm to the open and the closed positions.

Another object is to provide a duplex circuit breaker with improved means for exhausting arc gases from either or both of the compartments of the breaker.

Another object is to provide an improved circuit breaker with means for preventing nuisance tripping of the breaker when the breaker is manually operated.

Another object is to provide a circuit breaker with an improved deformable conducting strip for connecting the bimetal of the breaker with one of the terminal structures.

Another object is to provide a circuit breaker with improved means for front-mounting the breaker to a panel.

A further object is to provide a circuit breaker with improved means for attaching the label of the breaker to the insulating housing.

A still further object is to provide two operatively connected circuit interrupting units which operate in such a manner that when one of the units is automatically tripped open, it automatically operates the operating member of the other unit to open the other interrupting unit.

Another object is to provide an improved dependable duplex circuit breaker which is relatively inexpensive and easy to manufacture and assemble.

The novel features that are considered characteristic of the invention are set forth in particular in the appended claims. The invention itself, however, both as to structure and operation, together with additional objects and advantages thereof, will be best understood from the following detailed description when read in conjunction with the accompanying drawings, in which:

FIGURE 1 is a side elevational view of one of the interrupting units of a circuit breaker embodying the principal features of the invention. The interrupting unit is shown in the closed position;

FIG. 2 is a view similar to FIG. 1 except that the parts are shown in the open position;

FIG. 3 is a side elevational view of the other interrupting unit of the duplex circuit breaker, the parts being shown in the tripped position;

FIG. 4 is an exploded perspective view, on an enlarged scale, of some of the mechanism of the interrupting unit shown in FIGS. 1 and 2;

FIG. 5 is an end view, on a smaller scale, of the assembled duplex circuit breaker;

FIG. 6 is an elevational view, on an enlarged scale, of one of the operating members, showing the other side of the member from that shown in FIGS. 1–4;

FIG. 7 is a view taken along line VII—VII of FIG. 6;

FIG. 8 is an elevational view of part of the cover of a load center or panelboard having adjoining circuit breakers mounted thereon with adjacent handles connected by a handle tie;

FIG. 9 is a view similar to FIG. 8 showing the operating handle for one of the circuit interrupting units in the tripped position; the operating handle of an adjacent interrupting unit being shown in the open or off position; and,

FIG. 10 is an elevational view of the handle-tie seen in FIGS. 8 and 9.

Certain features of the circuit breakers of this invention are described and claimed in the patents to Francis L. Gelzheiser, Pat. No. 3,088,008 and Pat. No. 3,110,786.

Referring to FIG. 5 of the drawings, a duplex circuit breaker indicated generally at **9** includes an insulating housing which is composed of two parts, **11** and **13**, forming two compartments. Each of the parts **11** and **13** is composed of a back portion molded integral with four sides forming an open front. The open front of the part **11** is covered by the back portion of the part **13**, and the open front of the part **13** is covered by a cover **15**. The three housing parts **11**, **13** and **15** are held rigidly together by three rivets **17** (FIGS. 1–3).

The housing parts **11** and **13** form two independent compartments housing two circuit interrupting units which except for a line terminal structure that will be described later, are of substantially identical construction and operation, each, for most applications, operating independently of the other. FIGS. 1 and 2 illustrate the closed and open positions respectively of the circuit interrupting unit housed in compartment **13** (FIG. 5). The tripped position of the interrupting unit of the compartment **11** is shown in FIG. 3. The interrupting units illustrated in FIGS. 1–3 are different units in order to more clearly illustrate front mounting means which will be hereinafter described. Since the operation of both of the interrupting units and all of the parts except those that are specifically mentioned to be otherwise are alike, like parts are shown with like reference characters, and the description of the operation of the mechanism of only one of the interrupting units can be applied, unless otherwise mentioned, to both of the units of the duplex circuit breaker.

Referring to FIG. 1 of the drawings, the circuit interrupting unit shown therein comprises a stationary contact **21**, a cooperating movable contact **23**, a supporting metal frame indicated generally at **25**, an operating mechanism indicated generally at **27** and a trip device indicated generally at **29**.

The stationary contact **21** is welded, or otherwise attached, to a line terminal **31** which has a flange upper portion **32** (FIG. 4) that fits into a slot in the housing part **13**. The line terminal **31** is held firmly in place by a stamped-out portion **33** that biases against a projection **34** that is molded integral with the housing part **13**. A portion of the line terminal **31** protrudes through an opening **35** (FIG. 5) in the housing part **13**. A similar portion of a symmetrically constructed line terminal **37** protrudes through an opening **39** in the housing part **11**. Each of the line terminals **31** and **37** is a part of a separate independently functioning circuit interrupting unit. These terminals are resiliently biased to engage opposite sides of a contact member in a load center when the duplex circuit breaker is mounted in operating position.

The stationary contact **21** cooperates with a movable contact **23** that is welded or otherwise attached to a small flange **40** of a generally C-shaped contact or switch arm **41**. Means for operating the switch arm **41** to the open and closed positions comprises an operating member indicated generally at **43** having a V-shaped opening **45** therein, which opening receives a projection **47** of the metallic frame **25**. The operating member **43** is biased outwardly or upward as seen in FIGS. 1–3, by means to be hereinafter described, to a position wherein the lower edges of the projection **47** pivotally engage the lower side walls of the V-shaped opening **45**. As can be best seen in FIG. 4, the switch arm **41** is bent over at its upper end at **48** and an opening **49** is stamped in the part **48**. Depressions **51** are formed in the part **48** on

opposite sides of the slot 49. When the parts are in operating position, a projection 53 (FIGS. 4, 6 and 7), molded integral with the operating member 43, extends into the slot 49 of the switch arm 41 to position the operating member 43 relative to the switch arm 41, and pivoting portions 55 on opposite sides of the projection 53 of the operating member 43 pivotally engage in the depressions 51 in the switch arm 41. The operating member 43 has a handle portion 57 molded integral therewith which extends through an opening 61 (FIGS. 1–3) in the housing whereby the mechanism may be manually operated to open and close the breaker. Arcuate surfaces 63 on opposite sides of the handle 57 substantially close the opening 61 in all positions of the operating member 43. Motion is transmitted from the operating member 43 to the switch arm 41 when the breaker is manually operated, and, from the switch arm 41 to the operating member 43 when the breaker is automatically tripped open.

The frame 25 supports an insulating pivot 65 (FIG. 4) having shoulders 67 at opposite ends thereof, which shoulders rest within a slot 69 in the frame 25 and a slot 71 in a projection 73 of the frame 25. A trip member 79 is pivotally supported at one end 77 by means of a bight portion 75 which is pivotally supported in a slot 81 in the insulating pivot 65. The other end 82 of the trip member 79 has a latch point 83 which rests on a ledge 85 on an armature 86 to support the trip member in latched position. The armature 86 is part of the trip device 29 which will be described later.

As best illustrated in FIG. 4, the ends 77 and 82 of the trip member 79 are offset, and disposed in a plane which is parallel to a plane in which the main body portion of the trip member 79 is disposed. A spring 88 (FIGS. 1–3) is connected, under tension, at one end in a slot 89 in the contact arm 41, and at the other end in a slot 91 (FIG. 4) in a projection 93 extending from the trip member 79.

The movable switch arm 41 is connected by means of a flexible shunt 95 (FIG. 1) to the free end of a bimetal 97 which is attached, near its other or upper end, to a projection 101 extending out from the supporting frame 25. A terminal conductor 103 is welded or otherwise attached to the upper end of the bimetal 97 to electrically connect the bimetal to a load terminal structure that is indicated generally at 104. The closed circuit through the breaker extends from the line terminal 31 through the stationary and movable contacts 21, 23, the switch arm 41, the flexible shunt conductor 95, the bimetal element 97, the load terminal conductor 103 to the load terminal structure 104. Since the movable switch arm 41 extends downwardly from its pivot, the arc is established adjacent the bottom of the housing in an arc chamber 111, one end of which is connected by a vent passage 113 to an opening in the end of the housing beneath the load terminal structure 104.

The circuit interrupting unit may be manually operated to open and close the contacts by operation of the insulating handle 57. Movement of the handle 57 clockwise, from the position shown in FIG. 1 to the position shown in FIG. 2, carries the upper end of the switch arm 41 to the left of the line of action of the spring 88 whereupon the spring acts to move the contact arm 41 with a snap action to the open position shown in FIG. 2. A projection 109 molded integral with the housing acts as a limit stop for the movable contact arm during an opening operation. Movement of the operating handle 57 in a counterclockwise direction, from the position in which it is shown in FIG. 2, to the position in which it is shown in FIG. 1 moves the upper end of the switch arm to the right to move the parts to the closed position shown in FIG. 1. Movement of the handle 57 in either direction is limited by the surfaces 115 which strike the housing at either extreme position. The modified knife edge bearings of the projection 47 of the frame 25 within the opening 45 of the operating member 43, and of the pivoting portions 55 of the operating member 43 with the depressions 51 of the switch arm 41, encounter little friction and they, therefore, provide for a smooth operating type of mechanism.

The trip device 29 includes the bimetal 97, a U-shaped magnet 117, the armature 86 which is pivotally supported on the bimetal 97, and a spring 119 which biases the armature in a counterclockwise direction about its pivot. Upon the occurrence of an overload current below a predetermined value, the bimetal element 97 becomes heated, and when it is heated a predetermined amount it deflects to the right as seen in FIG. 1. Due to the engagement of a tail portion 121 of the armature 86 with the bimetal 97, the armature is carried to the right with the bimetal to release the trip member 79.

When the trip member 79 is released, the spring 88 acts to rotate it clockwise about its pivot 65 until it is arrested when a stop portion 133 thereon strikes the projection 109 of the housing. During this movement, the line of action of the spring 88 moves to the right of the pivot 55, 51 of the switch arm 41, whereupon the spring biases the switch arm in opening direction and moves the switch arm so that the line of action of the force exerted by it on the operating member 43 shifts across the pivot 45, 47 and actuates the operating member 43 to the tripped position shown in FIG. 3. In order to provide a visual indication that the breaker has been automatically tripped open, movement of the operating member 43 is stopped in an intermediate position (FIG. 3) when a projection 135, molded integral with the operating member 43, strikes the projection 93 which extends from the trip member 79.

Positive separation of the contacts is assured during a tripping operation by the provision of a projection 137 extending from the trip member 79. If the contacts are slow in opening due to sticking, drag or other reasons, the projection 137 engages the inner edge of the switch arm 41, with a swiping action, to start the switch arm in opening direction.

The interrupting unit is trip-free in that it will automatically trip open even though the handle 57 is held in the closed position.

Before the contacts can be closed following an automatic opening operation, it is necessary to reset and relatch the mechanism. This is accomplished by moving the operating handle 57 clockwise from the tripped position (FIG. 3), slightly beyond the full open position (FIG. 2). During this movement, the projection 135 of the operating member 43 engages with the projection 93 of the trip member 79, and the trip member is moved counterclockwise until the latch point 83 thereon is again supported in the latched position on the ledge 85 (FIG. 4) of the armature 86, which position is shown in FIG. 2.

The circuit interrupting unit is tripped automatically and instantaneously by the electromagnet 97, 117, 86 in response to overload currents above the predetermined value. Upon the flow of current through the bimetal 97, a magnetic flux, which is induced around the bimetal, takes the path of least reluctance through the magnet 117, across an air gap 139, and through the armature 86. When an overload current above the predetermined value occurs, the pull of the magnetic flux is of such strength that the armature 86 is attracted to the magnet 17 and pivots in a clockwise direction about the bimetal 97. This movement releases the trip member 79, and the contacts are opened in the same manner previously described in connection with the thermal tripping operation. The features of the trip device 29 are specifically described and claimed in the aforementioned patent applications of Francis L. Gelzheiser, Serial Nos. 850,650 and 850,651. For this reason, only a brief description of the trip device is given herein.

Improved means are provided for venting the gases formed upon arc extinction. It was previously described with reference to FIG. 5, that the circuit breaker insulating housing comprises two parts **11** and **13** each composed of a back portion molded integral with four sides forming an open front. The interrupting unit housed by the housing part **13** is shown in FIGS. 1 and 2, and the interrupting unit housed by the housing part **11** is shown in FIG. 3. The back portion of the part **13**, which is denoted by the reference character **150** in FIGS. 1 and 2, therefore, acts as a barrier separating the two interrupting units of the circuit breaker. There is an opening **151** in the arc chamber portion of the barrier **150**, and three openings **153** in the vent passage portion **113** of the barrier **150**. The openings **151** and **153** allow the gases which are formed upon arc extinction to pass from the arc chamber **111** and vent passage **113** of one of the interrupting units to the arc chamber **111** and vent passage **113** of the other interrupting unit. Since the two interrupting units of the duplex circuit breaker **9** operate independently, it can be understood that, generally, only one of them will trip or be operated to open at a time. Each interrupting unit, therefore, has the advantage of having a double arc chamber **111** and a double vent passage **113** from which to vent the arc gases which are formed when the interrupting unit is opened either automatically or manually.

A stop portion **157** which is stamped out of and extends from the frame **25**, is provided to prevent nuisance-tripping of the circuit breaker when the breaker is being manually operated. Without the stop **157**, when the breaker is rapidly operated from the closed to the open position, the projection **135**, of the operating member **43**, hits the projection **93**, of the trip member **79**, causing the trip member to rotate in a counterclockwise direction, whereupon a portion **159** of the trip member **79** bears against the armature **86** moving the armature in a counterclockwise direction to a position closer to the magnet **117**. The parts reach this position only momentarily because the tension of the spring **88** operates quickly to pull the trip member back to the normal latched position shown in FIG. 2. The armature is biased back to the normal position shown in FIGS. 1 and 2 by means of the spring **119**. If the trip member **79** returns before the armature **86** reaches its full normal position, then the trip member does not necessarily reengage with the ledge **85** (FIG. 4) of the armature **86** and, the trip member sometimes drops to effect a tripping operation. This nuisance tripping is eliminated by the stop **157** which positively prevents excess overtravel of the trip member **79** so that the portion **159** of the trip member **79** will not engage and move the armature **86** during manual operation of either of the interrupting units of the circuit breaker.

As best seen in FIG. 4, the conducting strip **103** is shaped in such a manner that it will readily deform when a stress is applied at either end. The conducting strip **103** is provided with a number of slots **160** opening on opposite lateral edges of the strip. When the circuit breaker is connected for operation, a load line is inserted into the load terminal structure **104** (FIGS. 1–3) whereupon a screw **161** is turned so that a tapped plate **162** will ride up the screw and apply pressure to the conducting member and to the load conductor in a manner well known in the art.

It is desirable to prevent any unusual stress, which may be applied to the outer end of the conducting strip **103** during a connecting operation, from being transmitted to the bimetal **97** at the inner end of the conducting strip, so that there will be no interference with the calibration of the trip device **29**. For this reason, the slots **160** are provided presenting a tortuous path for the body of the conducting strip **103** to permit the strip to readily deform if for some reason an unusual force is applied to the load or outer end thereof.

When the line terminals **31**, **37** (FIG. 5) are clipped onto a bus bar, they serve not only to electrically connect the breaker to the bus bar, but to also physically support the line-terminal end of the breaker on the panelboard. The other or load-terminal end of the breaker is supported by means of a clip (not shown) that is mounted on the panelboard and that clips over a ledge **163** (FIGS. 1–3). For some applications, it is desirable to mount the breaker, near its front or outer side, to a panel, in which case the ledge **163** and the clip-on type line terminals **31**, **37** cannot be used for support.

Improved means are provided by this invention for front-mounting the circuit breaker to a panel. A slot **165** (FIGS. 1, 2 and 5) in one end of the insulating housing part **13**, provides access to a chamber **167** (FIGS. 1 and 2) within the housing. A slot **169** (FIG. 3) in the opposite end of the breaker and in the housing part **11**, provides access to a chamber **170** within the insulating housing. The slots **165** and **169** are positioned diagonally on opposite ends of the breaker to provide for balanced support. Elongated U-shaped mounting members **171** (FIGS. 1–3) are supported on the circuit breaker **9** by means of the slots **165** and **169**, and the chambers **167** and **170**. An inner leg **172** of each of the mounting members **171** is short enough to permit the mounting member to be hooked through the slots **165** or **169** into position in which position the leg **172** engages the inner ceiling of the chamber **167** or **170** to support the member **171** in place. Tapped openings **173** are provided in the mounting members **171** to receive screws which are first placed through an opening in a panel to thereby front-mount the circuit breaker to the panel. When the circuit breaker is front-mounted to a panel, a modified terminal structure **175** (FIG. 1) is provided for making an electrical connection to the line side of the circuit breaker. The chambers **167** and **170** are isolated from the inside of the circuit breaker by means of insulating barriers **174** and **176** respectively which barriers are molded integral with the circuit breaker housing.

A label **177** (FIGS. 1–3) having indications on its face, is provided for indicating the rating of the circuit breaker. The label is held in place at the front side of the circuit breaker by a ledge **179** of the insulating housing which overlaps a small part of the face of the label around the entire perimeter of the label. When the breaker is being assembled, the label is slid into the insulating housing part **11** and the insulating housing part **13** is then put in place adjacent the part **11**. As can be best seen in FIGS. 8 and 9, when the cover part **15** is last put in place, a small part **180** thereof extends over a small part of the face of the label **177** and becomes part of the overlapping ledge **179** (FIGS. 1–3) which holds the label in place.

Improved means are provided for simultaneously operating two circuit interrupting units. In normal operation, the duplex circuit breaker **9** (FIG. 5) is plugged onto a bus bar which is at a potential of 120 volts above ground. For servicing certain heavy appliances or loads, 240 volts are supplied by connecting the load to two leads connected in series each of which leads is brought from one interrupting unit of a separate circuit breaker **9**, each of which circuit breakers is plugged onto a bus bar which is at 120 volts above ground so that the two bus bars and the two circuit breakers are at 240 volt potential to each other. In this manner, 240 volt service can be provided when desired. When such service is provided, both of the interrupting units must be simultaneously manually operated to their open and closed positions. For this purpose, a handle tie **181** (FIG. 10) is provided. As can be seen in FIG. 8, two adjacent interrupting units of two adjacent circuit breakers **9** are connected by means of the handle tie **181**. Each of the two openings **183** (FIG. 10) in the handle tie **181**, receives one operating handle **57**, and is so shaped as to permit some play and pivotal movement of the handle

tie relative to the handles. Thus, a lost motion connection is provided between the two handles 57 of the two adjacent circuit interrupting units.

In the past, circuit interrupting units have been provided with a handle tie in order to effect simultaneous manual operation of the units. Moreover, lost motion connections are used that permit the handle of only one of the connected interrupting units to go to the tripped or intermediate position without interference from the handle of the other interrupting unit. My invention, however, provides two circuit interrupting units which are connected in such a manner that movement of one of the handles to the tripped or intermediate position upon the automatic opening of its interrupting unit, will effect movement of the other handle to its open position to thereby open the other interrupting unit which is associated with the said other handle.

As is well known in the art and as was hereinbefore described, when one of the two circuit interrupting units of the circuit breaker 9 is automatically tripped, the handle 57 is carried to the tripped or intermediate position shown in FIG. 3 by the tension in the spring 88 and the movement of the moving switch arm 41. When one of the connected interrupting units shown in FIG. 8 is tripped, the handle 57 of the tripped interrupting unit is moved to its intermediate position. During the start of this movement, a certain amount of free play in the handle tie is first taken up. Once this free play is taken up, the inertia of the moving handle of the tripped unit, plus the tension in the operating spring 88 act, through the handle tie 181, on the handle 57 of the adjacent connected interrupting unit tending to pull that handle to its open or off position. This movement begins under somewhat of a shock condition since it begins abruptly as soon as the free play in the handle tie 181 is taken up. This initial shock plus the remainder of the force which is applied through the handle tie when the handle of the tripped unit moves to its intermediate position, is enough to throw the handle 57 of the adjacent interrupting unit far enough towards its open or "off" position to a point where the spring 88, of the adjacent interrupting unit, will operate to move the mechanism of that unit to its open position.

This dual operation is possible because the handle 57 need only be thrown a relatively short distance before the spring 88 takes over, collapsing to move its associated mechanism to the open position; and because, when the parts are in the closed position, the spring is stretched as much as it is ever stretched during the operation of the interrupting unit, so that the moving forces need not effect a stretching of the spring when they operate to throw the handle 57 this relatively short distance. This dual operation is possible also because the modified knife-edge-type pivots which are provided between the moving parts, provided that very little physical resistance is encountered during operation of the interrupting units.

One of the interrupting units is shown in the closed position in FIG. 1. As the handle 57 is moved in a clockwise direction, it moves the upper end of the switch arm 41 to the left moving the lower end to the right. Only a relatively slight movement of the operating handle 57 will move the parts to a position where the pivot 55, 51 is to the left of a line drawn between the lower spring support 89 and the pivot 47. Once the parts have reached this position, the spring 88 will take over retracting to move the parts to the open position shown in FIG. 2.

Since, when the parts of either of the interrupting units are in the closed position, the spring 88 is stretched as much as it will ever be stretched during the operation of the interrupting unit, there is no overcenter peak which the spring must approach and pass during an opening operation. During movement of the parts from the on or closed position (FIG. 1) to the off or open position (FIG. 2), the spring 88 is never stretched, so that the opening forces need not overcome any increase in resistance of spring tension in moving the parts to the open position.

The parts are shown in FIG. 8 with both of the connected interrupting units in the "on" or closed positions. The parts are shown in FIG. 9 after one of the interrupting units has automatically tripped moving its handle 57 to the intermediate or tripped position, which movement brings the previously mentioned forces into play to effect, through the handle tie 181, movement of the handle 57 of the other connected interrupting unit to the point where the operating spring of the said other unit operates to effect movement of the parts of the other unit to the "off" or open position shown in FIGS. 9 and 2.

From the foregoing description, it is apparent that the invention provides a circuit interrupter with improved means for manually operating the interrupter. The interrupter has two adjacent circuit interrupting units separated by a partition which partition has at least one opening in it to permit arc gases to pass from one to the other of the interrupting units. A stop member is provided in each interrupting unit to limit movement of the trip member in one direction when the unit is manually operated to thereby prevent nuisance tripping of each of the units. Each unit includes a conducting strip that connects the bimetal with the terminal structure which strip is shaped to deform when an unusual stress is applied to one of its ends to thereby preserve the calibration of the trip device. The insulating housing has slots therein that lead into chambers that are isolated from the internal mechanism of the interrupter by insulating means which slots and chambers are adapted to receive mounting plates for front-mounting the interrupter to a panel. A ledge molded integral with the housing is provided to hold a label in place on the housing. The invention also comprises two operatively connected circuit interrupting units which operate in such a manner that when one of the units is automatically tripped open, it automatically operates the operating member of the other unit to open the other interrupting unit.

Since numerous changes may be made in the above described construction and different embodiments of the invention may be made without departing from the spirit and scope thereof, it is intended that all of the matter contained in the foregoing description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

I claim as my invention:

1. In combination, two circuit interrupting units,

(a) each of said circuit interrupting units comprising an insulating compartment, each of said circuit interrupting units comprising an operating mechanism supported within the associated compartment and having a handle extending out of the associated compartment,

(b) each of said operating mechanisms comprising: a stationary contact, a movable contact cooperable with said stationary contact, an operating spring operable to move said movable contact, a latched releasable member, trip means,

(c) each of said operating mechanisms comprising means operable such that each of said handles is manually movable from a first position to a second position to effect a discharging action of the associated spring without a substantial additional charging action to thereby move the associated contacts from a closed position to an open position,

(d) upon the occurrence of an overload current above a predetermined value in either of said circuit interrupting units the associated trip means operating automatically to trip the associated circuit interrupting unit by releasing the associated releasable member to effect a discharging action of the associated spring to effect opening of the associated contacts and movement of the associated handle from

said first position to a third position intermediate said first and second positions,

(e) a lost motion handle tie external of said compartments and operatively connecting said handles, the amount of said lost motion being such that all of said lost motion is taken up before said associated handle reaches said third position, and when either of said circuit interrupting units is automatically tripped the force of the operating spring of the tripped unit operating to move the handle of the tripped unit to the third position with such a force that when the lost motion of said lost motion handle tie is taken up the force of the operating spring of the tripped unit operates through said lost motion handle tie to move the other handle to effect movement of the other handle to said second position to effect opening of the contacts of the other circuit interrupting unit.

2. In combination, two circuit interrupting units,

(a) each of said circuit interrupting units comprising an insulating compartment, each of said circuit interrupting units comprising an operating mechanism supported within the associated compartment and having a handle extending out of the associated compartment,

(b) each of said operating mechanisms comprising: a stationary contact, a movable contact cooperable with said stationary contact, an operating spring operable to move said movable contact, a latched releasable member, trip means,

(c) each of said operating mechanisms comprising means operable such that each of said handles is manually movable from a first position to a second position to effect a discharging action of the associated spring without a substantial additional charging action of the associated spring to thereby move the associated contacts from a closed position to an open position,

(d) upon the occurrence of an overload current above a predetermined value in either of said circuit interrupting units the associated trip means operating automatically to trip the associated circuit interrupting unit by releasing the associated releasable member to effect a discharging action of the associated spring to effect opening of the associated contacts and movement of the associated handle from

said first position to a third position intermediate said first and second positions,

(e) a lost motion handle tie external of said compartments, said lost motion handle tie comprising a member having opening means therein positioned with said handles protruding through said opening means, the dimensions of said opening means being such that said lost motion handle tie operatively connects said handles with lost motion between said handles, the amount of lost motion of said lost motion handle tie being such that when either of said circuit interrupting units is automatically tripped all of the lost motion is taken up before the handle of the tripped unit reaches the third position, and when either of said circuit interrupting units is automatically tripped the operating spring of the tripped unit operating to move the handle of the tripped unit to the third position with such a force that when the lost motion of said lost motion handle tie is taken up the force of the operating spring of the tripped unit operates through said lost motion handle tie to move the other handle to effect movement of the other handle to the second position to effect opening of the contacts of the other circuit interrupting unit.

References Cited by the Examiner

UNITED STATES PATENTS

2,200,981	5/1940	Cook	200—172
2,210,263	8/1940	Sachs	200—113
2,372,778	4/1945	Graves	200—168
2,611,055	9/1952	Webster	200—116
2,618,723	11/1952	Mahaffay	200—168
2,688,673	9/1954	Talbot	200—113
2,701,284	2/1955	Edmunds	200—116
2,703,827	3/1955	Gelzheiser	200—116
2,773,949	12/1956	Edmunds	200—50
2,846,548	8/1958	Christensen	200—172
2,863,969	12/1958	Edmunds	200—144
2,878,332	3/1959	Locher	200—50
2,905,795	9/1959	Platz	200—167
2,942,083	6/1960	Walker et al.	200—144
2,967,917	1/1961	Cole	200—50
3,081,386	3/1963	Koenig et al.	200—116

BERNARD A. GILHEANY, *Primary Examiner.*

RICHARD M. WOOD, *Examiner.*