July 9, 1963 T. M. COLE ETAL 3,097,326

CIRCUIT BREAKER PANELBOARDS

Filed Nov. 12, 1958 2 Sheets-Sheet 1

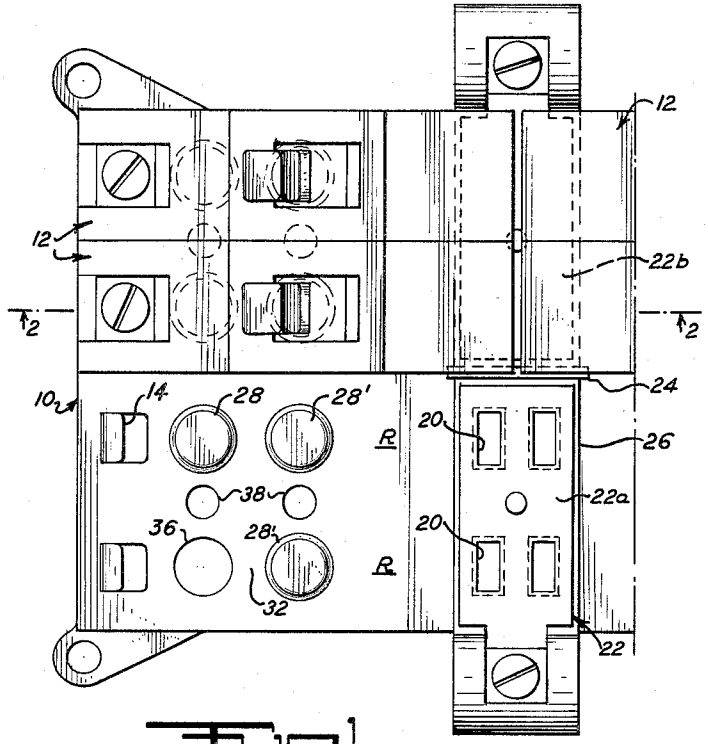

FIG. 1

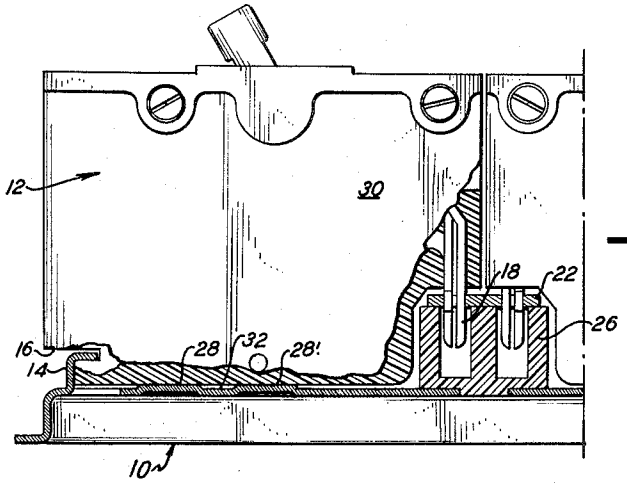

FIG. 2

July 9, 1963 T. M. COLE ETAL 3,097,326

CIRCUIT BREAKER PANELBOARDS

Filed Nov. 12, 1958 2 Sheets-Sheet 2

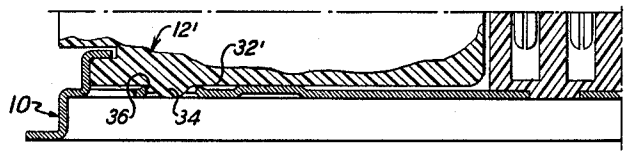

Fig. 3

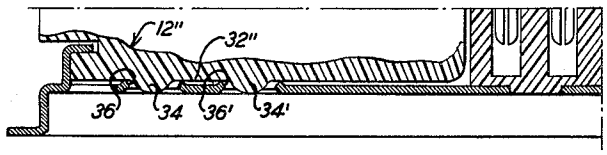

Fig. 4

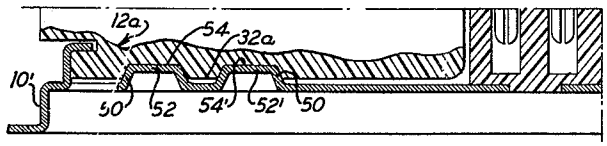

Fig. 5

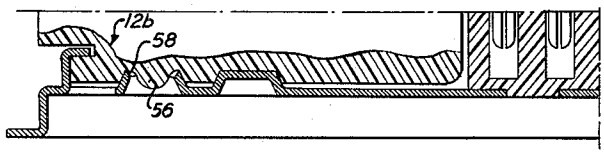

Fig. 6

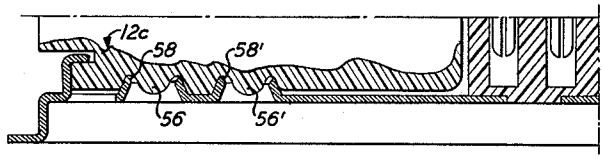

Fig. 7

United States Patent Office 3,097,326 Patented July 9, 1963

3,097,326

CIRCUIT BREAKER PANELBOARDS

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15 Claims. (Cl. 317—119)

The present invention relates to improvements in circuit breakers and circuit breaker panelboards, particularly of the plug-in type.

Panelboards are generally manufactured as highly flexible units of modular design so as to receive circuit breakers of any desired ratings requisite for the installation, within a wide range of ratings, and the circuit breakers themselves are physically interchangeable in the panelboard, regardless of rating within a broad range. In wiring such a panelboard, a circuit breaker should be selected to protect each branch circuit corresponding to its wire gauge. In such panelboard a circuit breaker may trip frequently due to circuit overloading, and to avoid the resulting inconvenience the user may be tempted to substitute a heavier circuit breaker in the space occupied by the replaced breaker. The original purpose of the circuit breaker may be thus defeated and the replacement heavier breaker will not trip when a sustained excessive current is carried by the thus improperly protected branch-circuit wire.

It is accordingly the primary aim and object of the present invention to provide improved circuit breakers and improved panelboards therefor which are constructed to prevent the easy, indiscriminate later substitution of circuit breakers of heavy ratings in place of the previously installed circuit breakers of lower ratings. Pursuant to this object of the present invention, it will be seen that the illustrative panelboard described in detail below includes circuit breaker receiving regions each of which is readily converted during initial installation of the panelboard to receive circuit breakers of selected ratings. The circuit breakers themselves have structure characteristic of the rating thereof that causes them to be excluded from regions of the panelboard previously characterized to accept circuit breakers of lower ratings. In this way worn out or defective circuit breakers can be readily replaced by others of corresponding ratings. Subsequent modification of the panelboard to adapt a region thereof to receive heavier-rated circuit breakers can be accomplished only with great difficulty or, where special provision is made, through the use of a specialized tool.

Another object of the present invention is the provision of circuit breakers of different rating classifications of generally identical outline having novel characterizing structure corresponding to the rating classifications thereof whereby circuit breakers of corresponding rating will be interchangeable and conversely circuit breakers of one rating will be non-interchangeable with circuit breakers of a higher rating. In accordance with the present invention, the characteristic structure identified with the rating classification of the breakers is different on the breakers of different ratings to provide for the aforesaid non-interchangeability. In accordance with one embodiment of the present invention the characteristic structure identified with the rating classification of the breakers is so arranged as to permit such breakers to be used with standard panelboards having standard circuit breaker receiving regions.

The present invention has application to the two types of circuit breakers which are presently in wide use, namely to those having screw-connectors for both the protected branch circuit and for the bus, respectively, as well as to the plug-in type of circuit breaker usually having a screw connector, commonly for the protected branch circuit, and having a plug-in terminal for the bus of the panelboard. However, more specific aspects of the invention will be recognized as having special application to the type of plug-in circuit breaker having a hook for mechanical retention at the end thereof remote from a plug-in electrical connection.

The nature of the invention and its further features and advantages will be more fully appreciated from the following detailed description of illustrated embodiments thereof, which are shown in the accompanying drawings forming a part of the disclosure of the invention.

In the accompanying drawings:

FIG. 1 is a top plan view of a panelboard assembly embodying features of the present invention, said assembly having circuit breakers connected therein;

FIG. 2 is a sectional view taken on the line 2—2 of FIG. 1, the circuit breakers being shown largely in elevation;

FIG. 3 is a fragmentary view similar to the bottom portion of FIG. 2 showing a circuit breaker of a heavier rating installed in a panelboard region converted to such rating;

FIG. 4 is a view similar to FIG. 3 showing a circuit breaker of still heavier rating installed in a panelboard region converted to such rating;

FIG. 5 is a fragmentary view similar to the bottom portion of FIG. 2, showing another embodiment of the present invention; and

FIGS. 6 and 7 correspond to FIGS. 3 and 4, respectively, with respect to the embodiment of FIG. 5.

Referring to the drawings, and more particularly to FIGS. 1–4 thereof, there is shown a circuit breaker panelboard **10** having circuit breakers **12** mounted thereon, the panelboard and breakers illustrated being generally of the type shown and described in Patent No. 2,647,225, issued to T. M. Cole et al. on July 28, 1953, and assigned to the assignee herein, and differing therefrom in the respects to be described in detail below. The panelboard **10** illustrated has eight modular spaces or regions R provided for receiving the breakers **12** which are generally standard in that their form and outline are substantially identical, and in that each is provided with a mechanical securing means at one end and a plug-in terminal connection at the other end. These circuit breakers are provided with distinguishing structure which differ according to their respective current rating classifications as will be described in detail below.

The panelboard **10** includes an integral hook **14** in each circuit breaker-receiving region R, and each breaker has a recess **16** that cooperates with hook **14** in the manner of a separable hinge during installation of the circuit breaker. When the circuit breaker is initially being installed, the circuit breaker, as viewed in FIG. 2, slants upward to the right and the hook **14** and recess **16** are engaged in the manner of a separable hinge, and thereafter the circuit breaker is swung downwardly into the assembled position shown. Viewing FIG. 2, the breaker at its lower right corner portion has a plug-in metal terminal **18** that tightly engages a companion slot **20** of a metal bus bar **22** forming part of the panelboard. The bus bar **22** is mounted on a contact block unit **26** of insulation which is suitably secured to the panelboard. In order that the two "hot" outside legs of a three-wire single phase circuit may supply the panelboard, the bus of the panelboard is divided into two parts **22***a* and **22***b*, separated by an insulating projection **24** that is interposed between these bus sections and is integral with unit **26**. A two-pole circuit breaker may be plugged into the two sections of bus **22***a* and **22***b* with the poles of the circuit breaker above and below (as viewed in FIG. 1) the insulating divider **24**. Such twopole circuit breaker naturally

occupies two regions in the panelboard formed to receive two single pole circuit breakers. For present purposes, therefore, two-pole circuit breakers may be treated exactly as if they were two single pole circuit breakers. It will be understood that the panelboard is normally secured within an enclosure or to a suitable support (not shown).

Pursuant to the present invention, at each circuit breaker receiving region R of the panelboard, intermediate hook **14** and slot **20** and aligned therewith, there are provided similar knockouts **28** and **28'** which are sheared so as to be removable only from the bottom side of the panelboard. The way this is accomplished is by shearing the knock-outs incompletely from the sheet-metal panel **10**, using punches engaging the bottom face of the panel, and then pressing the incompletely sheared knock-outs back, nearly into their original places in the panel **10**. The technique of making knock-outs, for conventional purposes, is well known; but the application of knock-outs for controlling the interchangeability of circuit breakers on a panelboard and, more particularly, the provision of knock-outs for this purpose so formed as to be removable only by pressure directed from the bottom face of panel **10**, is an important feature of this invention. These knock-outs may be readily punched out or removed from the bottom side of the panelboard but may not be removed from the opposite or top side of the panelboard and consequently are not removable in the installed condition of the panelboard in which the bottom side thereof is inaccessible. Any desired number of knock-outs may be provided in accordance with the range of circuit breaker ratings to be accommodated at each region. In practice, the knock-outs are left intact, or one or both knock-outs are removed to classify the region according to the rating classification of a mating circuit breaker, a removed knock-out defining an opening to accommodate a projecting portion of a circuit breaker characteristic of the rating of the breaker as will be described in detail below. The knock-outs at each region R are initially in place in the panelboard as supplied, and each region is classified for the desired rating by selective removal of knock-outs at the time of installation of the panelboard, in accordance with the circuit breaker to be mounted in that region.

Circuit breaker **12** is basically of conventional construction and outline and the casing **30** thereof has a generally flat bottom wall **32** which is structurally characteristic of the rating classification of the breaker. Thus breaker **12** of the lowest rating classification as shown in FIGS. 1 and 2 (for example for circuit breakers rated at 15 or 20 amperes) has a flat bottom wall **32** free of projecting portions and thus may be used at a region R without knock-out removal, whereby a region is left intact and is thus classified for breakers of such lowest ratings. The breaker **12'** of next higher rating classification, as shown in FIG. 3 (for example 25–45 amperes) has its bottom wall **32'** provided with a projecting portion **34** which is disposed to be received in the opening **36** defined by the removed knock-out **28** (FIG. 2). Thus the region R of the panelboard is classified to the rating of breaker **12'** by the removal of the single knock-out **28**. If desired, an additional rating classification may be accommodated by providing a single projecting portion of a breaker of such classification in position to interfit in the opening defined by the removal of the knock-out **28'**. The breaker **12''** of still higher rating classification as shown in FIG. 4 (for example 50–70 amperes) has its bottom wall **32''** provided with a pair of projecting portions **34** and **34'** which are disposed to interfit in the openings **36** and **36'**, respectively, defined by the removed knock-outs **28** and **28'**, respectively. In this manner the region R of the panelboard is classified to the rating of breaker **12''** by the removal of the knock-outs.

As described above, circuit breakers **12** are mounted on the panelboard by engaging the hook **14** with a recess **16** in the casing of the circuit breaker, and with the bottom wall **32** slanting upward from such hooks. Pushing the breaker and its terminal **18** toward fully installed condition as shown is feasible only if the panelboard has openings to accommodate projecting portions of the circuit breaker. Worn out or deflective circuit breakers can be readily replaced by others of corresponding or lower ratings in the corresponding classified region. Breakers of higher rating classifications will be rejected by the knock-out or knock-outs remaining in place. Accordingly once a region has been classified as described above, thereafter that region is limited against use of a circuit breaker having a heavier current rating.

As aforenoted, the knock-outs are inaccessible for normal removal in the installed condition of the panelboard as this would require practically the complete disassembly of the panelboard assembly to obtain access to the rear of the panelboard for pushing out any knock-outs that would obstruct higher-rated breakers. The easy and indiscriminate conversion of a region to a higher rating and improper breaker substitution in such region is thereby forestalled.

A qualified individual having knowledge of the installation may remove knock-outs in the installed condition of the panelboard to convert a region to a higher classification. This is accomplished through the use of a specialized tool extended through the openings **38** disposed laterally adjacent to the knock-outs, each opening **38** as shown being disposed between a companion pair of knock-outs of adjoining regions R to provide rear access thereto for knock-out removal. For example, a J-shaped tool may be inserted through an opening **38** to pry or drive out the selected knock-out from the rear of the panelboard, that is, from the side thereof that was engaged by the punch used to form the knock-outs. These knock-outs have an inherent slight enlargement at the side of the panel that was supported by the die used to form them, compared to the slightly smaller knock-out dimensions at the side of the panel engaged by the punch, because of the usual clearance between punch and die in sheet-metal practice. This taper in the cross section of the knock-outs means that they can be easily lifted out of position by pressure from what may be called the "punch" side of the panel, whereas removal by engagement from the opposite side is all but impossible. It will be readily appreciated that in the installed panelboard, the rear surface of the panel **10** is prominently inaccessible for conversion of any circuit breaker region to receive circuit breakers of heavier rating classifications.

With reference to FIGS. 5–7, there is shown a modified form of the present invention which differs from the above described embodiment in the manner to be described in detail below. The panelboard **10'** corresponds to panelboard **10** except that panelboard **10'** is provided with upwardly projecting portions or areas **50** at regions R', the areas **50** being of inverted-cup shape having base portions defined by the knock-outs **52** and **52'** which correspond to the knock-outs **28** and **28'** previously described. Both knock-outs are left in place to classify the region at the lowest rating classification. The knock-out **52** is removed to classify the region at the next higher rating and both knock-outs are removed to classify the region at the highest classification rating in the manner aforedescribed. As previously noted, an additional intermediate rating classification may be established if needed, by removal of only knock-out **52'**.

The breaker **12***a* (FIG. 5) corresponds to the breaker **12** previously described, differing therefrom in that breaker **12***a* has a bottom wall **32***a* provided with a pair of recesses **54** and **54'** which are disposed to interfit with portions **50** in the installed condition of the breaker, so that breaker **12***a* is of the lowest rating classification and the region of corresponding classification has both knock-outs left intact. Breaker **12***b* corresponds to breaker **12'** previously described and is provided with a portion **56** projecting in recess **54** which is disposed to interfit in the

opening 58 defined by the removed knock-out 52 (FIG. 6), but which does not project out of the bottom plane 32*a* of the circuit breaker. Breaker 12*c* corresponds to the breaker 12'' and is provided with portions 56 and 56' projecting in recesses 54 and 54', respectively, which are disposed to interfit in the openings 58 and 58', respectively, defined by the removed knock-outs (FIG. 7), and which similarly terminate within the limit of bottom plane 32*a* of the circuit breaker. Because the portions 56 and 56' do not project beyond the plane of bottom wall 32*a* of the breaker an additional advantage is realized. These breakers may be used with conventional panelboards having flat circuit breaker receiving regions. Thus breakers 12*a*, 12*b* and 12*c* may be used with panelboard 10' to achieve non-interchangeability as described above or may be used with the heretofore known panelboards because of the generally flat casing wall 32*a* which may be seated against the flat area of the circuit breaker receiving regions of a standard panelboard. Consequently a single line of circuit breakers may be used in territories where non-interchangeability is not wanted, and the same line of circuit breakers may also be used with the specialized panelboard of FIGS. 5, 6 and 7. Where this "non-interchangeable" panelboard is used, substitution of an improper breaker will be prevented by a projection of such circuit breaker being obstructed by the knock-out or knock-outs remaining in place. Once each region has been classified, that region is limited against use of a circuit breaker having a heavier current rating. Panelboard 10' advantageously is provided with openings (not shown) corresponding to the openings 38 of panelboard 10 for admitting a special tool to change the classification of a region in the installed condition of the panelboard.

It has been noted that the knock-outs are of tapered cross-section, from the top or accessible face of the classified panelboard panel to the rear, ordinarily inaccessible face. After a knock-out has been removed, it may be desired later to restore any circuit-breaker receiving region from which the knock-outs have been removed to the previous low-rating condition. This may be effected by pushing wedges into openings left by removed knocks, where the wedges are of basically the same form as the knock-outs. Inserted wedges have their exposed tops pushed nearly flush with the panel and thus become substantially inaccessible for removal except by pressure from the rear of the panel. The knock-outs themselves can also be replaced in the panel openings, after removal by error or otherwise. Also, short self-tapping screws inserted from the rear of the panelboards so as to have their heads inaccessible except from the rear of the panelboard may be used to constitute obstructions in openings left by removed knock-outs.

Various additional modifications of the above embodiments of the invention will readily occur to those skilled in the art, and therefore the invention should be broadly construed in accordance with its full spirit and scope.

Having thus described our invention, what we claim as new and desire to secure by Letters Patent is:

1. A circuit breaker panelboard having means for securing a circuit breaker thereon in a circuit breaker mounting region, said panelboard including a sheet metal component having a plurality of distinctively positioned and mutually separated knock-outs in each said region said knockouts in each region being disposed closely adjacent to a circuit breaker that may be mounted in such region and each of said knockouts being received in an opening in said sheet metal component and fully closing off said opening and being formed so as to be easily displaceable only by access to the concealed or back face of said component, said knock-outs being selectively displaceable to classify said region according to the rating classification of a mating circuit breaker and said panelboard being arranged to inhibit access to the rear of said component.

2. A circuit breaker panelboard having means for securing a circuit breaker thereon in a circuit breaker mounting region, said panelboard including a sheet-metal circuit-breaker support panel having a front surface for affording circuit breaker support and having a plurality of distinctively positioned displaceable rating classification knock-outs in each said region, said knock-outs each completely filling a separate opening in the support and being formed for displacement from said panel only by pressure from the rear of said circuit-breaker support panel to classify said region according to the rating classification of a mating circuit breaker.

3. A circuit breaker panelboard having means for securing a circuit breaker thereon in a circuit breaker mounting region, the circuit breakers that may be mounted being of different rating classifications with the circuit breakers of lowest rating classification having no rating-classification projections and circuit breakers of higher-rating classifications having distinctive classifying projections, said panelboard having a sheet metal component having a front readily accessible surface and a rear surface that is relatively inaccessible, said component being provided with a pattern of distinctively positioned and mutually separated displaceable rating classification knock-outs in each said region, said knock-outs in each region being respectively contained in and completely filling individual openings in said component and being edge-locked against displacement by front-applied pressure and being selectively displaceable by rear applied pressure to accommodate a corresponding pattern of distinctive projections of the circuit breaker which projections are characteristic of the rating thereof as aforesaid, said panelboard region when all its knock-outs are retained being thus classified for circuit breakers of the lowest rating classification and said region being adapted to circuit breakers of higher ratings by removal of corresponding knock-outs, respectively, each said region rejecting circuit breakers of high ratings having projections obstructed by retained knock-outs.

4. A circuit breaker panelboard having a panel and means for securing a circuit breaker thereon in a circuit breaker mounting region, said panel being provided with a pattern of individual mutually spaced rating classification knock-outs in said region, said knock-outs each filling a respective opening in said panel and being of decreasing cross-section from the top to the bottom surface of said panel and thereby being removable by pressure from the bottom side only of said panel to define a corresponding number of openings to accommodate a circuit breaker having distinctive projections only in places from which knock-outs have been removed and each said region rejecting circuit breakers having projections in places obstructed by retained knock-outs.

5. A circuit breaker panelboard having a panel and means for securing a circuit breaker thereon in a circuit breaker mounting region, said panel being provided with a distinctively positioned pattern of mutually separated rating classification knock-outs in said region each completely filling a separate opening in said panel and being formed to be selectively removable from the bottom only of said panel to make selected openings available for distinctive projections of circuit breakers characteristic of the rating thereof, said region rejecting circuit breakers of heavier ratings having projections obstructed by retained knock-outs, and means providing for critically limited access to the rear of said panel from a position at the top side of said panel whereby the latter may be reclassified in the mounted condition thereof, said last mentioned means comprising openings disposed in proximity to but separated from said knock-outs for access thereto by a hook-like tool insertable therein.

6. A circuit breaker panelboard in accordance with claim 4 wherein said panel includes a portion in said region that is elevated from the portion of said panel against which the circuit breaker is to be secured, said pattern of knock-outs being disposed in said elevated portion.

7. In combination, a circuit breaker and a panelboard having a panel on which said circuit breaker is mounted, said panel having a circuit-breaker region containing a pattern of rating classification openings a rating classifying element associated with each of said openings, said elements being of tapered cross-section and individually filling and extending through respective ones of said openings, the larger cross-sectional end of each of said elements being substantially flush with the exposed face of the panel, said elements being accordingly readily removable from said panel only when engaged from the rear of the panel for classifying said region according to the rating classification of the circuit breakers mounted in said region, said circuit breaker having a distinctive formation characteristic of the rating thereof to be received and mounted in said classified region, said region rejecting circuit breakers of heavier ratings having a different distinctive formation obstructed by said elements.

8. The combination in accordance with claim 7 wherein said openings are provided in a flat portion of the panel against which said circuit breaker is mounted and wherein said elements are of tapered cross-section the larger end of which is exposed but substantially flush with the exposed face of the panel.

9. The combination in accordance with claim 7 wherein said region includes a generally flat circuit-breaker receiving area and areas elevated from said flat area, said pattern of openings being formed in said elevated areas, said circuit breaker being recessed to accommodate the elevated panel areas and said circuit breaker having rating classifying projections disposed to be received in openings devoid of classifying elements.

10. In combination a circuit breaker and a panelboard having a region at which said circuit breaker is mounted, said panelboard including sheet metal means at said region having at least one rating classification knock-out that is edge-locked in an individual opening in said sheet metal means in a manner substantially preventing removal by front-applied pressure and being removable with moderate rear-applied pressure, said knock-out completely filling said opening, said knock-out being selectively retained or displaced from the panelboard for classifying the region according to the rating classification of the mounted circuit breaker, said circuit breaker having a distinctive formation characteristic of the rating thereof disposed for coaction with the knock-out portion of said sheet metal means, said region being rendered effective by any retained knock-out to reject circuit breakers of high ratings having a distinctive formation obstructed by such retained knock-out.

11. In combination, a series of circuit breakers of various rating classifications, and a panelboard to receive said circuit breakers in modular circuit breaker receiving regions thereof, said panelboard having a component providing a pattern of openings in each said region, at least some of said openings being closed by knock-outs, said knock-outs being of tapered cross-section arranged to be removable only from a normally inaccessible side of said component, each of said circuit breakers having a distinctive formation characteristic of the rating classification thereof to be received in a region of corresponding rating classification in the mounted condition thereof, the circuit breakers of different rating classifications, having different formations, with the retained knock-outs being retained in each region of less than the highest rating classification and said knock-outs being effective to reject circuit breakers of heavier ratings classifications.

12. A circuit breaker panelboard having regions for receiving a plurality of circuit breakers, and discrete mounting means identifying the respective circuit breaker receiving regions, said panelboard including means providing at least one hole in each circuit breaker receiving region, and substantially flush-front closures wedged in and extending through and completely filling said holes and thus locked against removal by pressure applied to the front thereof while being readily removable by pressure applied from the opposite face thereof, whereby said panelboard will accommodate certain circuit breakers mounted in said regions where those circuit breakers having rating-classification structure in the region of said holes which conforms to any closures present, said panelboard being effective to reject circuit breakers having rating-classification structure obstructed by closures.

13. A circuit breaker panelboard having means for securing a circuit breaker in a predetermined region thereof, said panelboard including a sheet metal member disposed for selective coaction with circuit breakers of generally identical outline except for distinctive external rating classification structure of certain circuit breakers different from the rating classification structure of other circuit breakers, said sheet metal member having at least one opening therein and one knock-out completely filling said opening and disposed to obstruct the rating classification structure of said other circuit breakers and said knock-out having a front surface substantially flush with the immediately surrounding portion of the sheet-metal member and facing and accommodating said certain circuit breakers when mounted in said region, said sheet-metal member constituting a part of the complete panelboard and arranged with its rear surface relatively inaccessible, and said knock-out having the shear edges thereof keyed to the remainder of the sheet metal member in the sense of being removable by pressure applied only to the rear surface thereof, thereby to accommodate one of said different circuit breakers.

14. A circuit breaker panelboard in accordance with claim 13 wherein a hole is provided adjacent to every knock-out for admitting a specialized hooked knock-out removing tool at the front to apply pressure at the rear.

15. A circuit breaker having a generally flat mounting portion having a recessed region and said circuit breaker having at least one discrete rating-classification projection within the space bounded by the surface of said region and the plane of said generally flat mounting portion, whereby said circuit breaker may be mounted selectively either on a panelboard having a flat circuit breaker mounting surface opposite said region or on a panelboard having a projecting formation complementary to said discrete projection.

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