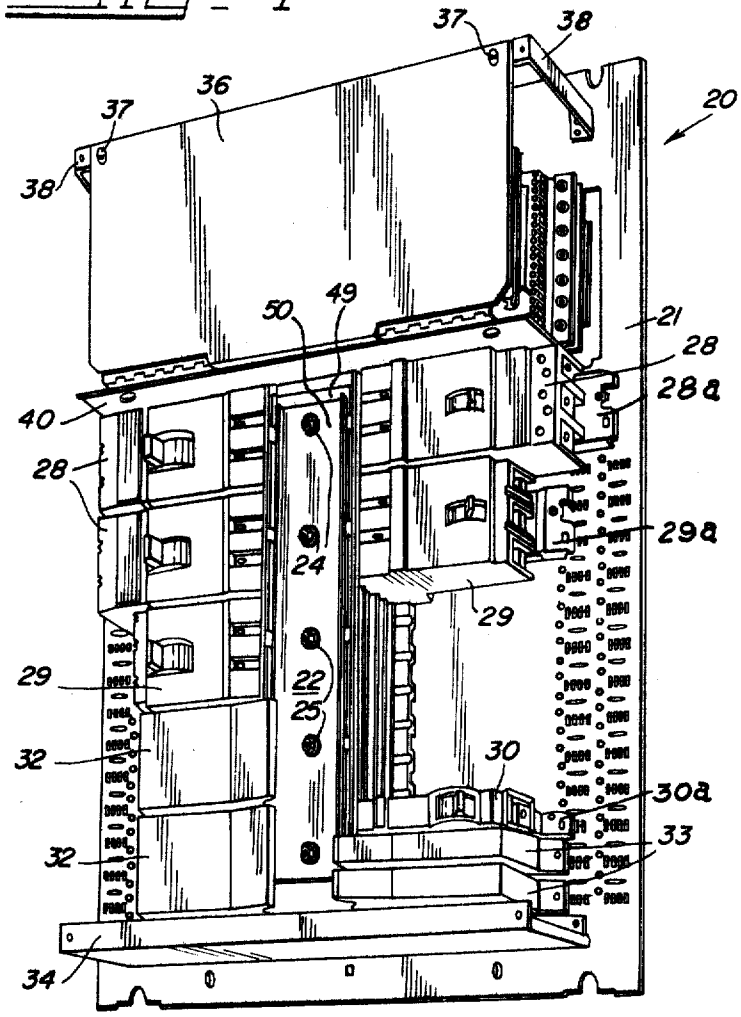
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ELECTRICAL PANELBOARD

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FIG. 1



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ELECTRICAL PANELBOARD

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FIG. 2

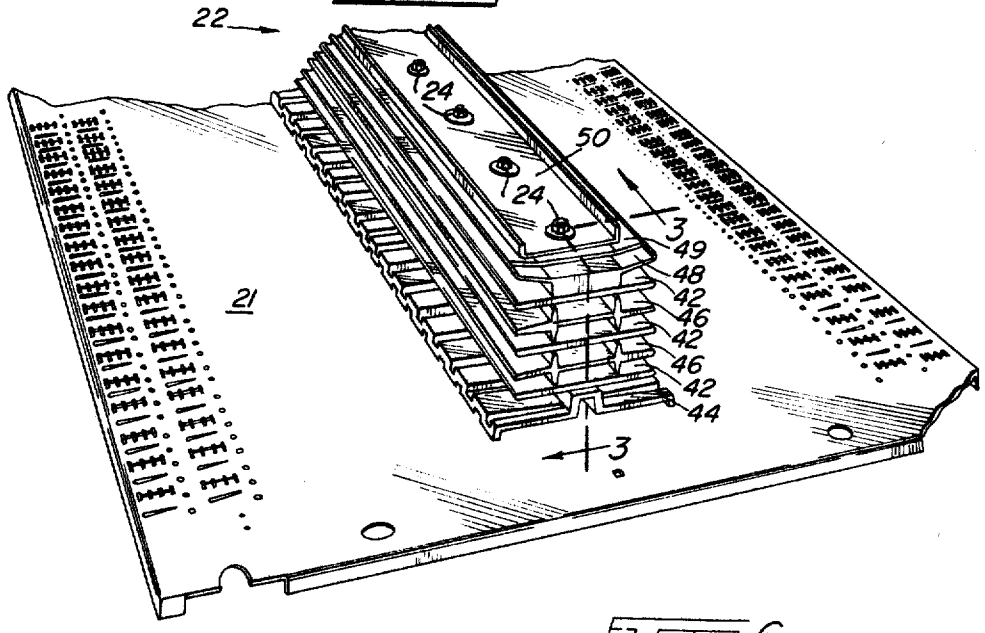


FIG. 7

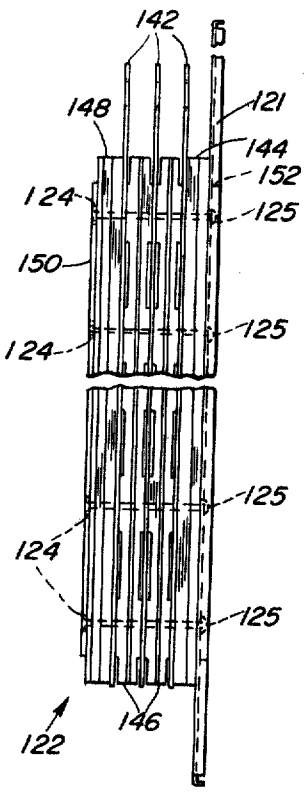
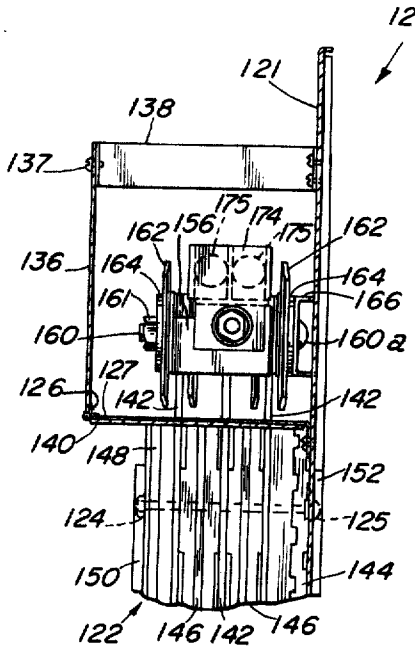


FIG. 6



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ELECTRICAL PANELBOARD

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FIG. 3

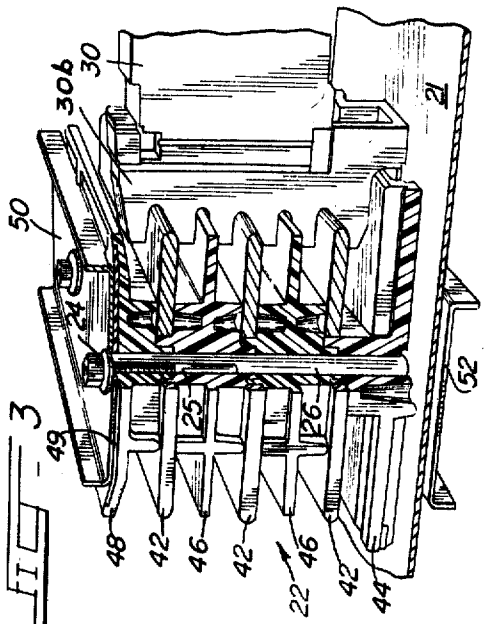


FIG. 8

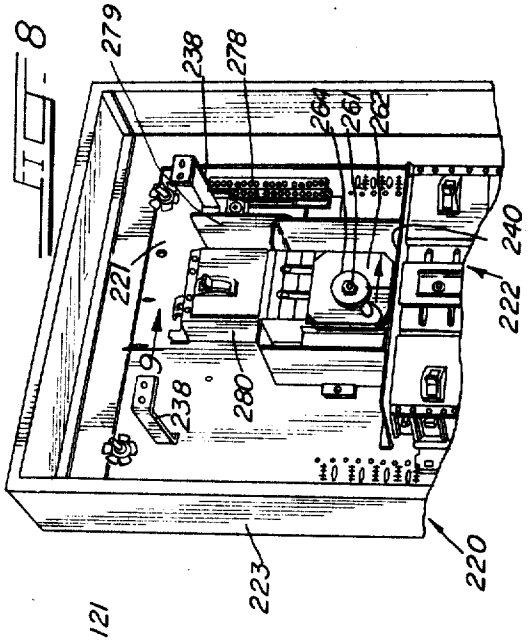
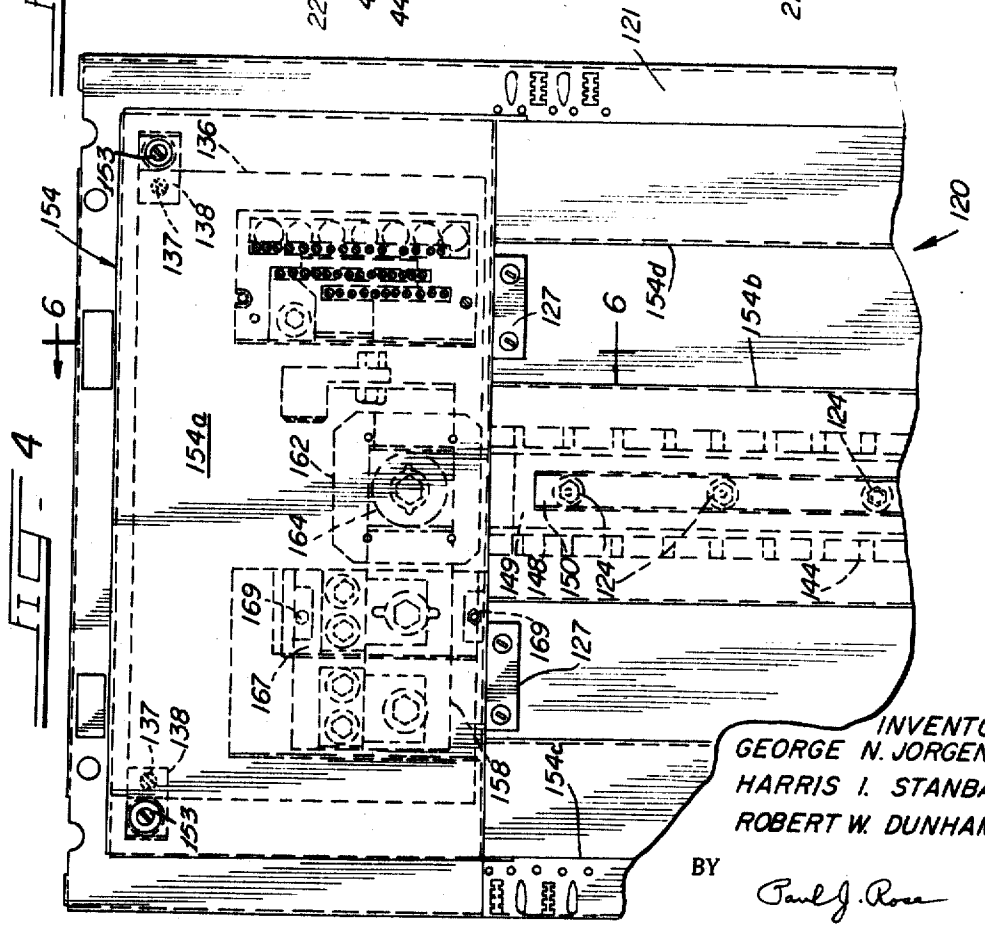


FIG. 4



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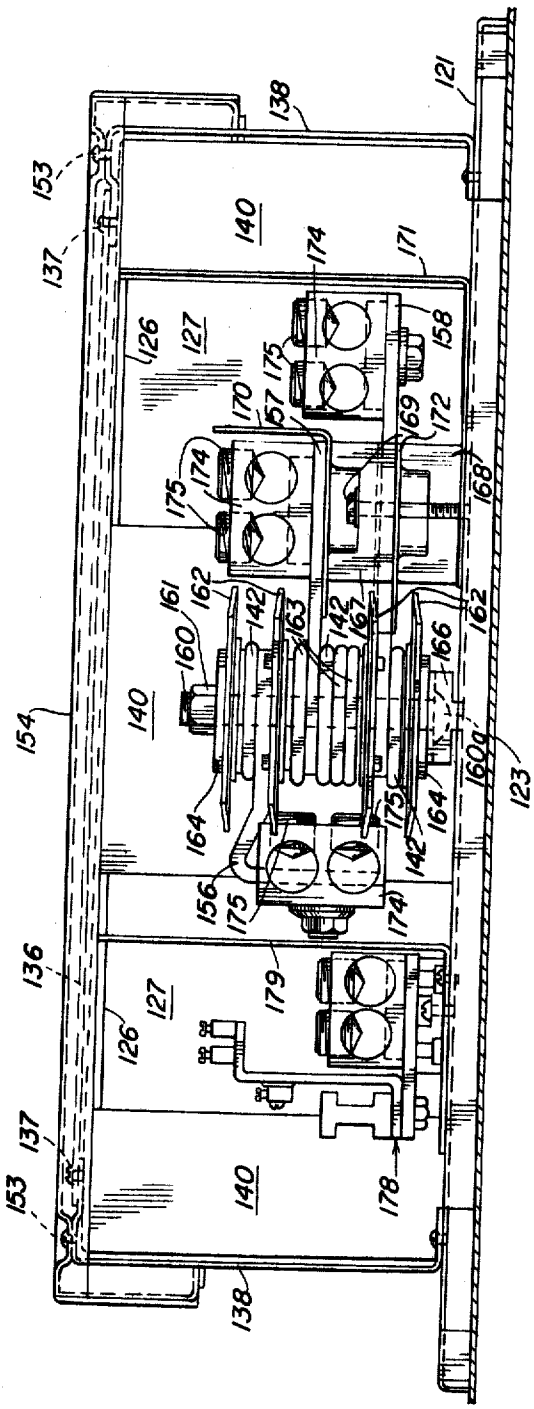
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FIG. 5



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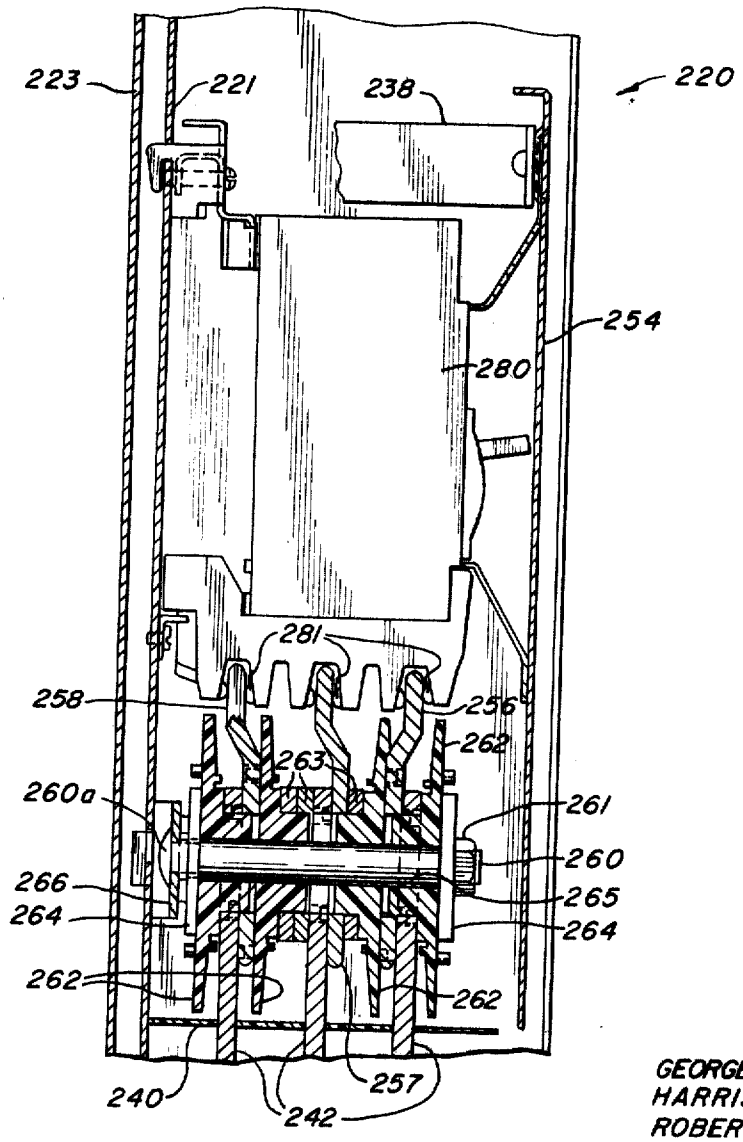
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FIG. 9



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26,737

ELECTRICAL PANELBOARD

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Int. Cl. H02b *1/02*; H02g *3/00*

U.S. Cl. 317—119 18 Claims

Matter enclosed in heavy brackets [ ] appears in the original patent but forms no part of this reissue specification; matter printed in italics indicates the additions made by reissue.

ABSTRACT OF THE DISCLOSURE

An electrical panelboard having a box and three flat bus bars stacked with their flat sides parallel to a rear wall of the box. Electric circuit breakers of various sizes may be plugged on opposite edge portions of the bus bars in various arrangements.

Summary of the invention

An object of the invention is to provide an improved electrical panelboard in which circuit breakers of various ratings and various physical sizes may be readily mounted in various arrangements.

Another object is to provide an improved electrical panelboard which does not require the addition of branch bus bars or connectors when an additional branch circuit breaker is added in the field to a previously installed panelboard.

A further object is to provide an improved electrical panelboard to which additional branch circuit breakers may be added in the field without interruption of power to the panelboard and with adequate safety if reasonable care is used.

Still another object is to provide an electrical panelboard in which the short circuit interrupting rating of each of a plurality of circuit breakers mounted in the panelboard is just as high as the maximum short circuit interrupting rating the circuit breaker has when mounted by itself in a separate enclosure.

A still further object is to provide an electrical panelboard in which each of a plurality of circuit breakers mounted in the panelboard can interrupt a current equal to its maximum short circuit interrupting rating without causing a flashover or other fault.

Another object is to provide an electrical panelboard having an improved arrangement of bus bars and insulators therefor, resulting in less heat generation, better conduction of heat away from the plug-in jaws of circuit breakers on the panelboard, better bracing of the bus bars, a shallower box, and less bus bar material than in former panelboard constructions of similar ratings.

A further object is to provide an improved connector arrangement by which connectors for receiving electrical power cables are electrically connected respectively to bus bars of the panelboard.

Still another object is to provide an electrical panelboard having improved safety means for preventing contact between a metallic interior trim panel and bus bars of the panelboard and also between the interior trim panel and input power line connectors of the panelboard when mounting the interior trim panel on the panelboard while the panelboard is energized.

Brief description of the drawings

FIG. 1 is a perspective view of an electrical panelboard constructed in accordance with the invention, a mounting pan assembly being shown and a box, an interior trim panel, and an exterior trim panel of the panelboard being omitted;

FIG. 2 is a fragmentary perspective view of the lower portion of the mounting pan assembly of FIG. 1, certain parts being removed;

FIG. 3 is a fragmentary perspective view, certain parts being sectioned as generally indicated by the line 3—3 of FIG. 2 and a portion of a single-pole circuit breaker being included;

FIG. 4 is a fragmentary front view of an electrical panelboard substantially identical to that of FIG. 1 but having narrower bus bars, a mounting pan assembly and an interior trim panel being included, and a box and exterior trim panel of the panelboard being omitted;

FIG. 5 is a top view of the mounting pan assembly and interior trim panel of FIG. 4;

FIG. 6 is a fragmentary sectional view taken generally along the line 6—6 of FIG. 4, the interior trim panel being omitted;

FIG. 7 is a side view of the mounting pan and bus bar assembly of the electrical panelboard of FIGS. 4, 5, and 6;

FIG. 8 is a fragmentary perspective view of an electrical panelboard constructed in accordance with the invention and having a main circuit breaker through which electrical power is fed to bus bars of the panelboard, an interior trim panel and an exterior trim panel being omitted; and

FIG. 9 is a fragmentary sectional view taken generally along the line 9—9 of FIG. 8 and including an interior trim panel.

Description of the preferred embodiments

FIG. 1 shows an electrical panelboard **20** constructed in accordance with the invention, a box and certain trim panels being omitted. The panelboard **20** includes a mounting pan **21** having a stack **22** of elongated flat bus bars, insulators, and clamping members secured thereto by a plurality of nuts **24** threaded respectively on a plurality of bolts **25** extending through the stack **22** from the rear of the mounting pan **21**.

For purposes of illustration, three relatively large three-pole circuit breakers **28**, two relatively small three-pole circuit breakers **29**, and one relatively small single-pole circuit breaker **30** are shown mounted on the mounting pan **21**, along with two fillers **32** having a width of three pole spacers and two fillers **33** having a width of one pole space.

An end barrier **34** is secured to the mounting pan **21** adjacent the lower end thereof as viewed in FIG. 1. A safety panel **36** is disposed in spaced relationship to the upper end portion of the mounting pan **21** as viewed in FIG. 1. The panel **36** is hinged at its lower end as shown and is normally secured adjacent its upper end by a pair of screws **37** to a pair of spaced brackets **38** secured to the mounting pan **21**. The bus bars of the stack **22** extend through suitable openings in an insulating sheet **40** and into the space between the panel **36** and the mounting pan **21**, as in the manner shown in FIG. 6 for the embodiment of the invention illustrated in FIGS. 4, 5, 6, and 7.

The stack **22** of bus bars, insulators, and clamping members is more clearly shown in FIG. 2 and includes three elongated flat bus bars **42**, a rear insulator **44**, two intermediate insultors **46**, a front insulator **48**, a front insulating sheet **49**, and a front clamping member **50**.

As shown in FIG. 3, a rear clamping member **52** is provided on the rear side of the mounting pan **21**, and each bolt **25** is provided with an insulating sleeve **26**. The holes provided in each of the three bus bars **42** for the reception of the bolts **25** and sleeves **26** are larger than the sleeves **26** and receive internesting portions of respective pairs of the insulators **44**, **46**, and **48**, as shown in FIG. 3.

Each of the three-pole circuit breakers **28** and **29** is provided with three sets of plug-on jaws which are not shown but which are like three sets of jaws **281** of a main circuit breaker **280** of FIG. 9. The plug-on jaws of the circuit breakers **28** and **29** plug respectively on edge portions of the bus bars **42**. The single-pole circuit breaker **30** is provided with only one set of plug-on jaws which plug on the edge portion of one of the bus bars **42**. The circuit breakers **28**, **29**, and **30** are plugged onto the bus bars **42** by moving them in a direction parallel to the mounting pan **21** and are held in mounted position by suitable brackets secured to the mounting pan **21**, such as the brackets **28a**, **29a** and **30a** of FIG. 1.

Each of the circuit breakers **28**, **29**, and **30** is provided with a shroud portion, such as a shroud portion **30b** (FIG. 3) of the circuit breaker **30**, which is provided with a plurality of recesses respectively receiving edge portions of the three bus bars **42** and the two intermediate insulators **46**.

FIGS. 4 through 7 illustrate an electrical panelboard **120** constructed in accordance with the invention, an exterior trim panel being omitted and only a rear wall portion of a box **123** being shown in FIG. 5. The panelboard **120** includes a mounting pan **121** having a stack **122** of elongated bus bars, insulators, and clamping members secured thereto by a plurality of nuts **124** threaded respectively on a plurality of bolts **125** extending through the stack **122** from the rear of the mounting pan **121** as best shown in FIG. 7. The stack **122** includes three elongated flat bus bars **142**, a rear insulator **144**, two intermediate insulators **146**, a front insulator **148**, a front insulating sheet **149** (FIG. 4), a front clamping member **150**, and a rear clamping member **152** all substantially identical to but narrower than the corresponding parts of the stack **22** of FIGS. 1 through 3.

The bus bars **142** are longer than the insulators **144**, **146**, and **148** and project beyond them as shown at the upper portion of FIG. 7, the projecting portions of the bus bars **142** extending through suitable openings in an insulating sheet **140** (FIG. 6) and into a compartment housing the connectors for connecting power to the bus bars **142**, the compartment being defined by the mounting pan **121**, the insulating sheet **140**, and a safety panel **136** pivotally mounted adjacent its lower edge as viewed in FIG. 6 by a pair of hinges **126** mounted respectively on a pair of sheet metal brackets **127** secured to the mounting pan **121**. The safety panel **136** is normally secured adjacent its upper end by a pair of screws **137** to a pair of spaced brackets **138** secured to the mounting pan **121**.

Also secured to the brackets **138** by a pair of screws **153** is an interior trim panel **154** (FIGS. 4 and 5) including an upper portion **154a** which normally covers the safety panel **136**, a central panel portion **154b**, and a pair of spaced side panel portions **154***c* and **154***d*. The spaces between the central panel portion **154b** and the side panel portions **154c** and **154d** afford access to the handles of circuit breakers (not shown) mountable on the mounting pan **121** in electrical engagement with the bus bars **142** in the same manner the circuit breakers **28**, **29**, and **30** are mounted on the panelboard **20** of FIG. 1. A lower portion (not shown) of the interior trim panel **154** is secured to an end barrier similar to the end barrier **34** of FIG. 1.

Three terminal straps **156**, **157**, and **158** (FIG. 5) are electrically connected respectively to the bus bars **142** by means of a single-bolt joint including a bolt **160** and nut **161**. The bolt **160** is provided with an insulating sleeve (not shown). The end portions of the bus bars **142** are interleaved between four insulators **162** centered on the bolt **160**. Three spacers **163** are provided and are centered on the bolt **160** in the positions shown, one spacer **163** engaging the terminal strap **157** and two spacers **163** together engaging the center bus bar **142**. Two spring washers **164** are provided on the bolt **160** respectively adjacent the nut **161** and a head **160a** of

the bolt **160**. Also provided on the bolt **160** between the head **160a** and the adjacent spring washer **164** is a generally U-shaped bracket **166** the leg portions of which have tongue portions protruding into appropriate slots in the mounting pan **121** and the bight portion of which has a square hole for receiving a square portion (not shown) of the bolt **160**. The bracket **166** thus prevents the bolt **160** from turning.

The terminal straps **157** and **158** are supported respectively by a pair of stacked insulating base members **167** and **168** secured to the mounting pan **121** by a pair of screws **169**. An L-shaped insulating sheet **170** is provided, one leg portion thereof being secured between the terminal strap **157** and the base member **167**. An L-shaped insulating sheet **171** is provided, one leg portion thereof being secured between the base member **168** and the mounting pan **121**. An insulating sheet **172** is disposed between the two base members **167** and **168** and bent partially around the terminal strap **158**.

Each of the terminal straps **156**, **157**, and **158** has a connector body **174** secured thereto, each connector body **174** being provided with a pair of holes for respectively receiving a pair of electrical power conductors (not shown) and a pair of clamping screws **175** for respectively clamping the conductors.

A neutral wire connector assembly **178** is secured to the mounting pan **121** and shielded by an L-shaped insulating sheet **179**.

FIGS. 8 and 9 illustrate an electrical panelboard **220** constructed in accordance with the invention, an exterior trim panel being omitted and a portion of an interior trim panel **254** being shown only in FIG. 9. The panelboard **220** includes a mounting pan **221** secured to a rear wall portion of a box **223**. A stack **222** of elongated flat bus bars, insulators, and clamping members is secured to the mounting pan **221**, the stack **222** being identical to the stack **122** of the panelboard **120** of FIGS. 4 through 7.

A pair of spaced brackets **238** secured to an upper portion of the mounting pan **221** serve as anchoring means for the interior trim panel **254**, the lower portion of the interior trim panel **254** being secured to an end barrier (not shown) similar to the end barrier **34** of FIG. 1. Three flat bus bars **242** of the stack **222** extend through suitable openings in an insulating sheet **240** and into a single-bolt joint which includes a bolt **260** and a nut **261** and is similar to the single-bolt joint of FIG. 5 having the bolt **160**. However, the three terminal straps **156**, **157**, and **158** of the panelboard **120** in FIG. 5 have been replaced in the panelboard **220** respectively by three offset conducting straps or main breaker connectors **256**, **257** and **258** which are maintained in electrical engagement respectively with the bus bars **242** by the bolt **260** and nut **261**.

Also associated with the bolt **260** are four insulators **262**, three spacers **263**, and a pair of spring washers **264** identical respectively with the insulators **162**, spacers **163**, and spring washers **164** of the panelboard **120** of FIGS. 4 through 7. An insulating sleeve **265** is provided on the bolt **260**. The bolt **260** is kept from rotating by a bracket **266** in which a head **260a** of the bolt **260** is received, tongue portions of the bracket **266** being received in appropriate slots in the mounting pan **221**. A neutral wire connector assembly **278** (FIG. 8) shielded by an insulating sheet **279** is secured to the mounting pan **221**. Electric power is fed to the bus bars **242** through a main circuit breaker **280** mounted on the mounting pan **221** and having sets of jaws **281** plugged respectively on the main breaker connectors **256**, **257**, and **258**.

The arrangement of the bus bars in a stack and the plugging of circuit breakers directly on the edge portions of main bus bars rather than on separate branch bus bars results in a panelboard in which ranch circuit breakers of different ratings may be mounted readily in various combinations and arrangements. Thus, for example, with a panelboard of this invention, a 100-ampere circuit

breaker may be readily mounted opposite a 200-ampere or a 400-ampere circuit breaker, and additional circuit breakers may be readily mounted in a previously installed panelboard without bolting additional branch bus bars to the main bus bars. Further, additional circuit breakers may be mounted in an energized panelboard with adequate safety if reasonable care is used.

The arrangement of the bus bars and insulators on the panelboard and their cooperation with the shrouds on the circuit breakers result in a short circuit interrupting rating, for each circuit breaker mounted on the panelboard, as high as the maximum short circuit interrupting rating the circuit breaker would have if mounted by itself in a separate enclosure, and also result in elimination of flashover problems on short circuit.

The short current paths from the bus bars to the circuit breakers results in less heat generation, and the solid connection between bus bars, insulators, and mounting pan for the full length of the bus bars results in good heat conduction away from the bus bars. Further, the bus bars are braced against short circuit forces throughout their length.

The bus bar arrangement also results in the use of less bus bar material and in the ability to use a shallower box for the panelboard than in the case of former panelboards of equivalent ratings.

The single-bolt joint at the power input end of the bus bars saves space and hardware and provides an easy means of obtaining necessary electrical clearances. Further, various components of the joint structure may be the same, regardless of whether the bus bars are fed through a main breaker, the bolt, nut, spring washers, insulating sleeve, spacers, bolt-retaining bracket, and joint insulators being usable either in the joint structure of FIG. 5 or in the joint structure of FIG. 9. The single-bolt joint construction also permits the main bus bars to be flat, rather than offset at the joint, thus enabling them to be manufactured to closer tolerances and reducing required box depth.

The hinged safety panel, such as the safety panels **36** and **136**, and the shielding of the bus bars from the front by the front insulator, such as the front insulators **48** and **148**, prevent contact between the interior trim panel, such as the interior trim panel **154**, and any energized parts of the panelboard when a workman is installing the interior trim panel on an energized panelboard. The hinges such as hinges **126** provide a convenient means for swinging the safety panel away from thr power connections to the bus bars and the brackets such as brackets **38**, **138**, and **238** stop movement of the safety panel in a closing direction to prevent it from contacting the power connections.

We claim:

1. An electrical panelboard comprising a generally flat mounting pan, a plurality of elongated flat bus bars mounted on said mounting pan with their flat sides parallel to said mounting pan, said bus bars being spaced from and aligned with each other in a direction perpendicular to said mounting pan, and a plurality of elongated insulators one more in number than the number of said bus bars, said insulators being spaced from and aligned with each other in a direction perpendicular to said mounting pan and being substantially coextensive longitudinally with said bus bars, said bus bars being interleaved between said insulators, each of said bus bars having a pair of exposed opposite longitudinal edge portions, and said bus bars and insulators being in contact with each other in such a manner that each of said bus bars is in direct contact on opposite sides respectively with a pair of adjacent ones of said insulators.

2. An electrical panelboard as claimed in claim **1**, wherein one of said insulators between said mounting pan and an adjacent one of said bus bars has a plurality of portions in contact with said mounting pan and dispersed substantially throughout the length of said one insulator.

3. An electrical panelboard as claimed in claim **1**, wherein an intermediate one of said insulators has a relatively thick central portion each of the opposite sides of which engages a resprctive one of said bus bars and a pair of relatively thin opposite edge portions spaced in a direction perpendicular to said bus bars from those bus bars which engage said relatively thick central portion.

4. An electrical panelboard as claimed in claim **3**, wherein said intermediate insulator has an overall width substantially the same as the width of one of said bus bars.

5. An electrical panelboard comprising a generally flat mounting pan, a plurality of elongated flat bus bars mounted on said mounting pan with their flat sides parallel to said mounting pan, means maintaining said bus bars in spaced relation to, and aligned with, each other in a direction perpendicular to said mounting pan, and a single-bolt joint structure through which electrical power may be connected to said bus bars, said single-bolt joint structure including a single bolt and a plurality of conductive straps, said conductive straps having portions interleaved with end portions of said bus bars, and said single bolt extending through said bus bars and conductive straps and maintaining said conductive straps in electrical engagement respectively with said bus bars.

6. An electrical panelboard as claimed in claim **5**, wherein said conductive straps are terminal straps each having an electrical connector secured thereto for receiving a power conductor.

7. An electrical panelboard as claimed in claim **5**, wherein said bus bars are of the same thickness and said conductive straps are main breaker connectors each having opposite end portions offset by a distance corresponding to the thickness of one of said bus bars.

8. An electrical panelboard as claimed in claim **7**, wherein there are three of said main breaker connectors, and including a three-pole main breaker each pole of which is electrically and mechanically connected to a separate one of said three main breaker connectors.

9. An electrical panelboard as claimed in claim **8**, wherein each pole of said three-pole main breaker includes a pair of plug-on jaws plugged on the respective main breaker connector.

10. In an electrical panelboard having an open-front box, a mounting pan secured to a rear wall portion of said box, a plurality of elongated bus bars mounted on said mounting pan, a plurality of power connectors at one end of said mounting pan, means electrically connecting said power connectors respectively to said bus bars, said connectors respectively providing means to receive a plurality of power conductors for supplying electric power respectively to said bus bars, and a trim panel mounted in covering relationship to said mounting pan, bus bars, and power connectors, the improvement comprising a hinged safety panel normally covering only said power connectors and preventing contact of said trim panel therewith.

11. An electrical panelboard comprising a generally flat mounting pan, a plurality of elongated flat bus bars, and a plurality of elongated insulators, said bus bars having their flat sides parallel to said mounting pan and being spaced from and aligned with each other in a direction perpendicular to said mounting pan, each pair of adjacent bus bars having one of said insulators disposed therebetween, said insulators being aligned with each other and with said bus bars in a direction perpendicular to said mounting pan and being substantially coextensive with said bus bars longitudinally thereof, each of said bus bars having an exposed longitudinal edge portion, and said bus bars and insulators being secured to each other and to said mounting pan.

12. An electrical panelboard as claimed in claim 11 including an elongated insulator substantially coextensive with said bus bars longitudinally thereof, aligned with

said bus bars and with said insulators therebetween in a direction perpendicular to said mounting pan and secured to said mounting pan therewith, and disposed on the opposite side of said bus bars from said mounting pan.

13. An electrical panelboard as claimed in claim 11 including an elongated insulator substantially coextensive with said bus bars longitudinally thereof, aligned with said bus bars and with said insulators therebetween in a direction perpendicular to said mounting pan and secured to said mounting pan therewith, and disposed between said mounting pan and an adjacent one of said bus bars.

14. An electrical panelboard as claimed in claim 13 including an elongated insulator substantially coextensive with said bus bars longitudinally thereof, aligned with said bus bars and with said insulators therebetween in a direction perpendicular to said mounting pan and secured to said mounting pan therewith, and disposed on the opposite side of said bus bars from said mounting pan.

15. An electrical panelboard as claimed in claim 14 including a clamping member clamping said insulators and bus bars to said mounting pan, said clamping member being substantially coextensive with said insulators and bus bars longitudinally thereof.

16. An electrical panelboard as claimed in claim 15 including a second clamping member on the opposite side of said mounting pan from said insulators and bus bars, said second clamping member being substantially coextensive with said insulators and bus bars longitudinally thereof, and said mounting pan, insulators, and bus bars being clamped between said clamping members.

17. An electrical panelboard as claimed in claim 11, wherein each of said insulators disposed between a pair of adjacent bus bars has a relatively thick central portion opposite sides of which respectively engage said adjacent bus bars and a pair of relatively thin opposite edge portions each spaced from both of said adjacent bus bars in a direction perpendicular thereto.

18. An electrical panelboard as claimed in claim 17, wherein each of said insulators disposed between a pair of adjacent bus bars has an overall width substantially the same as the width of one of said bus bars.

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U.S. Cl. X.R.

174—99