Pushmatic panel history

We recently posted about some dangerous electrical wiring that we have seen in houses where we have helped restore fire damage. Today we want talk more about keeping your house safe with electrical panels and breakers. Read on to learn how to find out if your home electrical panel is dangerous. It plays an important part of powering your lights and appliances and is the control panel board to keep your home safe from wiring and fire hazards. As the circuit breaker panel ages and more high power appliances are created, older electrical breaker box brands become less effective at handling electric loads. It is time to check your residential electrical panel to see if the characteristics match any of the following panels and call a residential electrician to perform a panel upgrade. The Zinsco panel is a type of panel board that was installed in the s and was incredibly popular. This type of home electrical panel stopped being installed when there were design issues discovered, yet those that were already purchased at the time of the design issue continued to be installed. As time passed, extreme fire and electrical shock dangers were discovered with this panel. You can identify this panel because it is the only electrical service panel that has thin breakers instead of thicker, push, or round ones. Another defining feature of this panel are the bright colors the breakers contain, including pink, yellow, blue, green, and red. After mass reports of electrical fires starting from Federal Pacific breaker panel boxes, there was investigation performed throughout the s that showed one in four of the Stab-Lok breakers were defective and could not trip to prevent electrical dangers. Federal Pacific Panel Boards with the fire issues will say Stab-Lok on the panel in between the breakers. The breakers themselves will contain red tips as well. While the company is out of business, the panels are incredibly dangerous and need to be changed immediately by a professional residential electrician. While the Edison home electrical panel looks very cool, the panel itself is incredibly dangerous because of its high failure rate. This is one of the oldest panel box types still around because so many different manufacturers continued to produce them since their invention a century ago. The easiest way to spot if you have an Edison type panel is the fuses which will be made of glass and round. The Pushmatic panel board was a widely used circuit breaker panel installed in homes built between and This is a distinctive panel because it is the only electrical panel brand that does not have switches that flip left and right. While the Pushmatic panels are not a huge fire hazard, they are a very old panel that is obsolete after the company went out of business. Finding parts is expensive and difficult and adding new circuits to your home electrical panel is impossible. It is very important to upgrade your electrical service panel as soon as possible if your panel board is on this list. Each of these electrical panels has been outlawed due to the extreme fire and electrical shock risk they present. If your home electrical panel is not on this list but you want to check your panel for safety, please visit Is My Panel Safe? Zinsco or Zinsco-Sylvania Home Electrical Panel The Zinsco panel is a type of panel board that was installed in the s and was incredibly popular. Pushmatic Home Electrical Panel The Pushmatic panel board was a widely used circuit breaker panel installed in homes built between and InspectAPedia tolerates no conflicts of interest. We have no relationship with advertisers, products, or services discussed at this website. We provide Pushmatic circuit breaker identification photographs including of electrical panels and of individual circuit breakers. The article series discusses the history of Pushmatic breakes, gives advice to homeowners whose building is served by a Pushmatic electrical panel, and we discuss both compatability of and concerns when using replacement circuit breakers or used Pushmatic circuit breakers sold by salvage operatoers. Beginning in and continuing to the present we had received occasional field reports on product failures of PushMatic circuit breakers, as wekk as similar, older Bulldog circuit breakers and electrical panels. There may not be sufficient data to reach a solid conclusion about the reliability and safety of this electrical equipment. We had been unable to find independent research reports on this product. However some field reports include a particularly dangerous failure: the breaker may remain ON internally while appearing to have been turned OFF.. That testing remained incomplete. Interestingly, in addition to the anticipated higher failure to trip rates among FPE Stab-lok design breakers Carrier was seeing an unanticipated trip failure rate among certain Murray circuit breakers and certain Challenger circuit breakers, Crouse Hinds circuit breakers. Photo of a Pushmatic electrical panel below is provided courtesy of Matt Steger. Our own personal experience with inspecting and on occasion using ITE Pushmatic circuit breakers and panels did not encounter product failures and our lay opinion was that the product appeared to visual inspection well made. But at InspectAPedia. This web page provides a contact point for inspectors to send field inspection reports, field failure reports, and reports of research, product history, and safety opinions regarding Pushmatic brand and Bulldog brand electrical panels. These products were sold throughout North America. Siemens purchased ITE. An electrical panel bearing the Bulldog brand and found in a home in North America today probably dates from the 's through the 's, though indeed the product label was produced as early as the

mid 's. Greg Bell, a Florida home inspector offers the following additional details, edited and supplemented by DJF. Bulldog or Bulldog-Pushmatic electrical panels use a unique, proprietary type of circuit breaker called a "Pushmatic. There appear to be two major problems with Pushmatic Breakers:. The inspector concludes with an advice paragraph suggesting that the home inspector call for an electrician to shut down the panel power, inspect and check the contacts for rust and corrosion, and proper bus-bar contact. While there appears to be a basis for Bell's claim that the device was mechnical-only in operation, that may not be the case for all versions of the product. Further, from field reports this role of this circuit breaker feature in Bulldog Pushmatic circuit breaker field failure reports is unclear. I worked for ITE Imperial the company name seems incorrect above from until The was an old display that I found and used then which compared the tripping time for both overload and short circuit type faults between the Pushmatic device and others sold at the time. Under all normal circumstances, the Pushmatic breaker operated more quickly under short circuit than any competitive device. Based on the older sales engineers in the office at the time and product literature this was due to the "five turn coil" used in the magnetic portion of the tripping mechanism. I sold literally thousands of these breakers for use on job site temporary power poles since the loadce. This fact also led to the Pushmatic being used on projects where the specification was for bolt-on panels. There was -- for at least a short period -- even a three phase version manufactured. For both the pole pole application, and when used in outdoor residential metering equipment which was very common in Southern California , there were issues associated with dust entering the breaker and not allowing it to reset. Whether it was appropriate or not, the generally applied solution was to spray the breaker with WD Thank you for this report Mr. Rossi, we've added it as you see, but with a troubling reservation:. Patent Infringement [image] case of Westinghouse v Bulldog Electric Products Co - giving us an idea of the age and history of the Bulldog brand. A copy of the court document is at Westinghouse v. Bulldog [web page], At left - a Bulldog circuit breaker patent illustration. This is the earliest patent document we've found - indicating that this version of the circuit breaker was: Patented Mar. On the base 66 is pivotally mounted at 2M a thermal warping element urged toward the base by a coiled tension spring connected in circuit through the pivot hinge at 28 I, or through a flexible jumper, and adapted to warp on overload to the right. Secured to and disposed transversely across and preferably insulated from the warping element is an E-shaped magnetic material piece which, together with the magnetic material plate mounted upon the pedestal , forms a magnetic circuit with the ther- 30 mal element forming a single turn coil to provide the magnetomotive force. A bracket 2M is rigidly secured to warping element by rivets , there preferably being insulation between the element and the brackets. An arm is pivotally connected to bracket 2M by a pin 2OB-and is provided with a lock washer which maintains arm 20; in any desired preset position, relative to the element. A pin 20l A hook M3 on the upper end of latch holds the breaker pawl 81 firmly when the breaker is in the on position, or in its normal 0 position. When an overload occurs, the warping element moves to the right, due to thermal forces, or magnetic forces, or a combination of both forces. This motion is magnified by the leverage ratio 50 provided by the lever latch moving the hook end thereof to release the pawl Home inspectors encountering a Pushmatic or Bulldog brand electrical panel should warn consumers that. We will continue to collect data, credit contributors, and report the results. And we would appreciate hearing from professionals, home inspectors, electricians, engineers, regarding their opinion on what is sound, professional, unbiased advice that protects consumers without making unsupportable claims in this matter. In addition to the most recent comments shown at the end of this article we post here some useful remarks from earlier readers. I have the Bulldog pushmatic in my rustic cabin. It has never given me any problems and looks to be in good condition. Is there a breaker available for the Bulldog? I will eventually be replacing the Bulldog panel but need to get up and running quickly. Sorry to say that although I grew up admiring Bulldog Pushmatic electrical panels, based on the infdormation given here I'd replace the panel now rather than wait. Otherwise you may end up with either an unreliable patch-job or you may have to buy an external main switch that could instead have been part of your new replacement panel. Our home was built in the late 60's. There is a Bulldog Push-matic, Electri-Center panel. How do i find the total ampage. My insurance company wants to know. There are two switches that say 30amp on both sides, then there are 6 more that say From just your note it sounds as if the panel you describe is obsolete. You will also want to review the safety and performance questions discussed above. If you elect to replace the panel, we ask you to consider preserving the old one intact and to contribute it for testing. You can contact me for shipping information to D. Carrier, and independent electrical engineer who is conducting circuit breaker testing if you decide to do so. When the water heater cuts in, I can hear a buzzing sound from 30A circuit breaker? In addition, this breaker is difficult to reset if I use it to shut off hot water heating. I'm

thinking I should replace that 30A double pole breaker. Good idea? Could this be a wire connection that has loosened due to aluminum wire? Thanks In Advance. Since at least in some circumstances a buzzing circuit breaker is one having trouble tripping, the breaker and circuit it protects may be unsafe; I would switch it off pending inspection and repair by a licensed electrician. If your home has aluminum electrical wiring that is itself a fire hazard that needs proper repair. I would like to replace the pushmatic breaker for the "throw type" I can never tell which breaker it tripped as the flag stays in one position. Is there a replacement brand that you could suggest Thanks. That field observation confirms one of the safety defects discussed for this equipment. Just about any contemporary electrical panel brand preferred by your installing electrician should be acceptable and properly installed should be safer than the equipment you have. We prefer to stay away from specific replacement brand recommendations. My worry is that some replacement breakers may be no safer, or even less safe than the ones we take out of the panel - it depends on the panel brand, model, design. For electrical panels subject to frequent reports of field failures or that have been documented by independent research as having abnormally high failure rates see FPE and perhaps Zinsco it makes more sense to replace the panel. I recently purchased a home with a Bulldog Pushmatic electrical panel. I've read on other sites that there is potential danger in opening the panel as the "bussing" iis usually energized and you could be electricuted. How often has this been known to happen with this type of panel? Oscar, it is indeed true that opening ANY electrical panel that is acting strangely can be dangerous; an electrician was killed when he was removing a panel cover not just opening the door,. And I've rec'd other reports of similar burns and injuries. Similarly, fire inspectors may be untrained in sufficient depth to correctly identify the root cause of an apparently-electrical-system-related fire or injury or death, as are even people in the medical profession see citation 2 below. A related concern with the Pushmatic line is that you can switch a breaker to the "off" position but be unsure that it is really switched off internally. So while it would normally be reasonable to tell the electrician to just switch off the main breaker before working on the panel or replacing it a safer course would be to have the electric company drop power outside - by pulling the meter. On - by mod - looking for a replacement outdoor Pushmatic electrical panel cover. The original one has been lost. The apt building was built in The landlord currently has an aluminum type cover on it. Can a proper replacement be purchased? Anon in my opinion it would be a mistake for the contractor or electrician to replace a pushmatic circuit breaker. If you take a look at the data in the article above, you'll see the it's an unsafe electrical panel. What that means for you is that in the future when there is a panel or breaker failure and a fire, shock, or other loss, you will be blamed. In addition you should inform your customer that the panel is unsafe and should be replaced. You might want to print this article and give it to your customer to read. I have a customer with a push Maddock I believe amp sub panel that needs a 20 amp breaker where can I get it from. Several companies sell replacement electrical panel box covers, William, but Watch out: please read the article above on this page: you will see that Bulldog Pushmatic circuit breakers are not safe. The breaker may, for example, remain "on" internally or elecctrically even when switched "off" - a mistake that can lead to a fire or death. You should replace your Bulldog Electric panel. I have a Bulldog Electric amp box. I need to know if i can get a new cover. Thank you for your opinion, Caesar. You are right to question what you read. However in this case we have - a history of field failure reports. Watch out : cycling some circuit breakers to "exercise" them does not increase safety even though intuitively one might think-so. At lest some brands such as FPE were shown to have a greater chance of jamming and failing to trip after having been switched on- and off. I used to think, as you, that cycling a circuit breaker might "free up" a stuck breaker that's not working. Unfortunately for some designs not only is that not true Pushmatic for one but worse, for other breakers such as FPE, cycling the breaker actually increases the probability that in the event of a future over-current the breaker won't trip. Therefore a blanket "cycle the breaker" trick is not a great idea. Something that sounds good can end up burning down the house or killing someone. Your final advice on always checking for voltage and not relying on the breaker is dead right - I agree, and always suggest the same - but that's for people working on electrical systems. That is not helpful for a homeowner who, in the face of an emergency Junior stuck his hand into the toaster and is getting shocked , is going to rush to switch off the breaker to avoid or stop a fire or shock event - only to find, for some Pushmatics - that switching the breaker off was no use whatsoever. Thanks for the discussion. Lots of opinion and very little evidence here. Rugg While there are some vendors of used and also replacement Bulldog breakers in our opinion you should not buy any of them as they are not reliable, failing to turn off or failing to trip when they should, a significant percent of the time. Nicole In the electrical panel, most likely there will be a breaker that is V or double pole - occupying two slots - that controls your air conditioning equipment. Alternatively, right at the air handler if you mean the indoor AC fan or

close to the outdoor compressor condenser unit if you mean the outdoor condenser unit fan you should find a service switch that can be turned off to shut down the equipment right there. Watch out: One of the Bulldog Pushmatic breaker concerns is that the breaker can fail internally so that even though you push it to try to turn it OFF, it remains ON internally. Let me know if this works for you and if not we'll take it from there. I have an old bulldog circuit breaker and I'm unsure as to where the ac area is located. My ac fan have been on all night and won't turn off so I want to completely shut it off until I can get someone out to look at it. Indeed, Frank, until learning of the Bulldog-Pushmatic failures described here I was a fan of the panel as the physical appearance of the hardware looked to me to be high quality. Unfortunately the breaker failure track record is by now pretty well documented. We agree as well on fuses. A lifetime ago it was an electrician as old as I am now rather old who opined that breakers may be really convenient, but when it came to a really big hazard such as an overcurrent at the mains, he preferred to rely on the old fashioned fuses. Truth is - or opinion is - there are safety drawbacks to just about every electrical safety choice; fuses were pretty reliable at blowing when they ought, but one of the most common safety hazards home inspectors and electrical inspectors find in older homes is over-fusing. It was just too easy to screw in a 20A or even a 30A fuse on what should have been a 15A circuit. Of course someone can install an oversized or wrong-sized breaker, too, but homeowners are far less likely to do that than to screw in a higher-ampacity fuse. I have had trouble with zinco and federal pacific breakers four years. I had a tool too remove stops on buss two install twins very safe and reliable breaker. I am 50 years an inside wirema. Just bought a home in Mission Vejo built in with pushmatic panel breaker system By reading these posts who do I consider would be the actual manufacturer of pushmatic in in order to get breakers? When looking for replacement circuit breakers we're generally limited to the current manufacturers of breakers whose specifications, including not just performance but electrical panel bus connector design, that mean the current, new breakers fit and work properly. This is, of course completely aside from questions of whether one would be smarter to replace the equipment entirely. Great question David - certainly I haven't found that data. Sometimes reviewing for academic studies or patents we can find that data. More are in the References section of our article on these breakers. Thanks for that info Dan. We are currently pricing out a pretty big AF project and when doing a walk through, I found many Bulldog panels installed in the 50s. I need those breaker curves, but more importantly, I doubt any of these breakers have been exercised. So I might need to time the incident energy calculation at two seconds per IEEE and produce an AF label opposed to relying on the curves. In my experience exercising a breaker does not necessarily improve its performance. In fact for FPE Stab-Lok units exercising the breaker can significantly increase the risk of a future jam-type failure. Tests showed a still greater concern: testing a breaker - not in general but ones with a problematic design that led to jamming and no-trip failures - could appear to have acceptable results but leave the breaker jammed so that on a future overcurrent the breaker wouldn't trip under any load. This was found with FPE but I would not assume the problem was unique to that marque. In general in-situ testing is considered very dangerous. Are you considering deciding to leave equipment in place based on visual inspection, testing, or worse, in-situ testing? Greetings, JK in VT. Read thru many comments re: Pushmatics. As a lic. I leave nothing to chance. Just compl. NOTE: All brkrs. Dirt,time,environment worst enemy of all things electrical. Have seen shoddy new installs of non-Pushmatics by inexper. DIY rewiring projects courtesy of local big-box stores. I preferred the Pushmatic for sev. NEVER had one prob. I use newest type brkrs avail. Have doc. The newest mfgd. About the tandem P breakers insertion to older load centers,most have dedicated spaces to accom. Usually at bottom of ea. The latter have cutout notches to accept the P tandems. Not an issue w. P tandems,BTW. To-date, I have discarded many high-current Bulldog Pushmatics from A range. As mentioned before, above,dirt,age,use and environment can be root causes. Not a surprise here. I purposely ran a short-ckt. Cut-out faster than a SQD unit. Summary: Perf. You might be surprised! Then, "off" is def. Good Luck and pls. Thanks for the comments Anon, I (mostly) agree with your opinions, including that the presence or absence of internal trip mechanism components magnetic for example in the product line appears to depend on when the product was made. There are other failure issues that are very serious, including the difficulty with knowing if a breaker is ON or OFF - a dangerous shock risk. Telling people to lubricate a cricuit breaker is an unreliable approacy. In my opinion it's a poor product design or specification that calls for the installer or homeowner to do something that we know perfectly well nobody ever does and nobody is ever going to do - it's "design to fail" in my book. Nobody installing circuit breakers disassembles or lubricates them in residential applications and certainly no homeowner would nor should attempt such a task. Worse, perhaps, some people reading the "lubrication" advice for breakers may try as some readers reported spraying the panel and interior with an arbitrarily chosen

spray lubricant - a product that may make matters worse rather than better. Also let's keep in mind that absence of evidence [of a product failure] is not evidence of absence [proof that failures are not occurring] - more specifically, one person's observation something like "I've never had a problem" is much too small to be statistically valid. I have a service panel with no manufacturers label and our local building inspector wants us to verify our panel is rated for amps. The house was built in and has a old pushmatic panel with no main breaker, I suspect this was no more than a 50A or 60A panel enclosure. It should be replaced as I will elaborate:. The photo is a bit blurry - I'd like to see a sharper one that lets me see the ampacity of the circuit breakers. You might even see "Pushmatic" on some of the breaker labels. An electrician would take a look at the size of the mains or main wires entering the panel from the electric meter: that will give the limit on the ampacity of this enclosure. Watch out : Also as you noted and as I can see, there is no main breaker and there are more than 6 breakers with no main - another reason this panel is considered unsafe and should be replaced. In an emergency need to turn off all electrical power to the building, having to switch more than six breakers was considered unsafe. In addition there is no second-level protection at the building should one of the breakers jam and refuse to open in event of an over-current. You'll find that the smallest capacity component is the limiting factor. Try the search box just below, or if you prefer, post a question or comment in the Comments box below and we will respond promptly. Note: appearance of your Comment below may be delayed: if your comment contains an image, web link, or text that looks to the software as if it might be a web link, your posting will appear after it has been approved by a moderator. Apologies for the delay. Just ask us! Search the InspectApedia website. Comment Form is loading comments Tel: Email: info carsondunlop. Carson Dunlop Associates' provides extensive home inspection education and report writing material. The text is intended as a reference guide to help building owners operate and maintain their home effectively. Field inspection worksheets are included at the back of the volume. A walk in time with Walker Electric Load Centers and more. Wenatchee Home Inspection. In the world of home inspections we see some older load centers panels. On a recent home inspection I ran into a Walker Electrical panel. The Walker Electrical Co. Circuit Breaker Company, of Atlanta, Georgia. ITE also is known for their famous Bulldog Pushmatic load centers. Walker Electric Co started back in , with Ralph Walker as president. This is why you can find Walker Electric load centers with Bulldog Pushmatic breakers due to the association of these companies. Walker Split Bus Load Center. Here above we have an old Walker Split-bus load center. You can see here in this photo the bolt on bus system used in these panels, much like its Bulldog counterpart. The only difference is this is not the push button breaker pushmatic. Like many older panels the main issue is age. You will not be able to upgrade this panel to meet some of the new requirements for AFCI's. Walker Load Center with Pushmatic Breakers. Legend from the Walker Load Center. Old promotional from ITE. This is important in how the breaker will handle a short circuit. From Bussmann-, If a fault current exceeds a level beyond the capability of the protective device, the device may actually rupture, causing additional damage. Thus, it is important when applying a fuse or circuit breaker to use one which can sustain the largest potential short-circuit currents. The interrupting rating of most branch-circuit, molded case, circuit breakers typically used in residential service entrance panels is 10,A. Please note that a molded case circuit breaker's interrupting capacity will typically be lower than its interrupting rating. Larger, more expensive circuit breakers may have interrupting rating of 14,A or higher. From the NEC Equipment intended to interrupt current at fault levels shall have an interrupting rating at nominal circuit voltage sufficient for the current that is available at the line terminals of the equipment. Equipment intended to interrupt current at other than fault levels shall have an interrupting rating at nominal circuit voltage sufficient for the current that must be interrupted. In addition to the interrupt rating they might be more prone to failure than a new breaker. ITE became famous because of their innovative circuit breaker. Enter the BullDog. The Pushmatic breaker by Bull Dog dates back to This is how Walker, Bulldog and ITE all become associated and why you will find these three names on equipment by them. Wenatchee Home Inspection In the world of home inspections we see some older load centers panels. From Bussmann- "A protective device must be able to withstand the destructive energy of short circuit currents. On this basis and pending further research we consider these products questionable with conflicting opinions that currently deserve a warning but not a condemnation. Rust in this box indicates evidence of water intrusion at some point, but no moisture was present at the time of the inspection. My thoughts are you have already determined there is a problem where none exists by even pushing that comment into the report with no justification. I would suggest instead that you verbally mention they are hard to update at the panel if there are no spaces left for breakers and that they are more expensive but certainly see no reason to frighten anyone. They are simply indicative of most likely older wiring which you will look at in

the panel anyway and may indicate lack of grounding which you also will be on the lookout for during your inspection. I said I would need to research it. The first narrative is the results of my research. I was surprised that with all the updated wiring the panel box was not upgraded as well. My conclusion was that the panel box had no rust during the upgrade, which took place about six months ago. Therefore there must have been a moisture issue following the upgrade. No you should stick with rusted enclosure, outdated and can,t find parts for them as there is not enough info to warrant what you are saying in your report. Listen to Bob and recommend an upgrade. I would address only what can be viewed in your photos, that is, the rust and deterioration to the panel. Pros, cons, experience, opinions, etcâ€¦. Great narrative, easy to understand without being alarming. I can work with this experienced information. Thanks Jeffrey. I have one in my house. Works great no problems with it. Yes, it is old but it works. Replacement breakers are available at anywhere from bucks an amp. I came across one today that was double taped, cracked breakers, no main disconnect, no front panel door and 2 feet from the shower in a bathroom. Below is the narrative explaining the ITE Pushmatic panel. Alsoâ€¦ Rust in this box indicates evidence of water intrusion at some point, but no moisture was present at the time of the inspection. Your thoughts? I would pursue update recommendation based on the property needs. Pros, cons, experience, opinions, etcâ€¦ Great narrative, easy to understand without being alarming. Some of that narrative has I would take out but it is a good one to build on. Nice to here imput from you C Lambert. I see we have something in common. Picture please! I would love to see this one put on defects for Aug. InspectAPedia tolerates no conflicts of interest. We have no relationship with advertisers, products, or services discussed at this website. The article series discusses the history of Pushmatic breakes, gives advice to homeowners whose building is served by a Pushmatic electrical panel, and we discuss both compatability of and concerns when using replacement circuit breakers or used Pushmatic circuit breakers sold by salvage operatoers. Watch out : A particular Pushmatic hazard we have observed is breaker internal jamming such that when the breaker was pushed to switch to the OFF position the breaker remained "ON" internally, risking fire or fatal electrical shock to building occupants or to electrical workers. It is opined by some electricians that because the breakers were "grease fed" a "lack of maitnenance" over time led to the jamming or made the breakers "difficult to operate". The circuit breakers also lack an internal magnetic trip mechanism that is considered a safety feature and that is widely used in many other circuit breaker designs. Instead the breaker relies solely on an internal thermal trip mechanism, typically a bi-metallic spring. Other Pushmatic hazards included a design that made it too easy for DIY'ers to tap a circuit directly onto the panel's bus bar without proper overcurrent protection, and a failure to perform reliably when installed outdoors. Owners of residential buildings never perform maintenance and rarely even examine their electrial panels and circuit breakers. OPINION: as a building contractor performing electrical work, later as a home inspector, later as a researcher and journalist, I was disappointed to have to tag Pushmatic panels as "unsafe" they are because physically the original equipment was in my view built with high quality materials and workmanship. And other electctricians cited the reliability of a bolt-on load center that was a design not used in other less-costly electrical panel brands. However the very real safety hazards of Pushmatics derive from a combination of design and age and are at the very least documented in field reports presented in this article series. This patent history, roughly in order from oldest to newest, gives both product and feature historical details of the Pushmatic circuit breaker and panel design and ownership. Cited below on this page at year Patented Nov. A principal object of the invention is to provide, for circuit breakers, novel-forms of holding devices which may be calibrated, as desired by the operator, to release the circuit breaker at various overload amperages. More specifically, there are provided holding devices including fulm crumed holding levers connected to thermal warping elements by variable connections which constitute the calibration means, the connections being varied to vary the effects of the warping elements on the holding elements. Still further objects of the invention will be readily apparent to those skilled in the art upon reference to the following detailed description of embodiments of the invention, the same to be read in connection with the appended drawing. Referring to the drawing, it will be seen that Figs. In Figures 1 and 2, there is shown a device which consists of a U-shaped thermostatic or bimetallic warping element , whose legs are connected respectively to a contact element of a breaker and to a line. A bracket is rigidly secured to warping element by rivets and is insulated therefrom. An arm is slidably mounted in an elongated slot of bracket , 0 being clamped to the latter by a washer and a screw tapped into arm The other end of arm is grooved, at so as to receive the edge of a latch pivotally secured at its lower end to foot by rivet The upper end of. Under overload conditions the warping element moves to the right. This motion is transmitted through arm to latch , moving hook end to release pawl The different positions of arm in latch

vary the throw of latch ' and therefore the device can be calibrated to release at various overload amperages, which can be indicated by graduations along a surface of bracket Serial No. A pin on the outer or free end of arm , rides freely in a circular slot of a latch pivotally secured to a foot by a rivet A hook on the upper end of latch holds a breaker pawl firmly when the breaker is in its "On position or in its normal Oif" position. When an overload occurs, the warping element moves to the right. This motion is transmitted through arm to latch , moving the hook end thereof to release pawl The different angular positions of' arm about pivot vary the throw of end of latch and therefore the device can be calibrated to release at various overload amperages. To indicate these amperages, latch can he graduated along the edge of elongated slot For reset, pawl presses downward on end of latch forcing it to the right, when pawl is in normal position, the end of latch again snaps back to its normal position. In Figures5 and 6 there is shown a device which consists of a U-shaped thermostatic or bimetallic warping element , whose legs are connected respectively to a contact element of a breaker and to a. A bracket is rigidly secured to warping element by rivets , there being insulation , between the element and the bracket. A sector is rigidly fastened to bracket by rivets , and is provided with an arcuate slot in which rides a pin rigidly connected to arm , which may be fixedly positioned radially within the linfits of arcuate slot in sector The latter is pivotally connected to latch by pin provided with a lock washer Latch is pivotally connected at one end to foot by rivet and its other end is provided with a hook ' which holds pawl firmly, when the circuit breaker is in either "On or normal "Oil Under overload conditions, the thermal element moves to the right. This motion is transmitted through arm to latch , moving the hook end to release pawl The different angular positions or arm about pivot vary the throw of end of latch and therefore the device can be calibrated to release the pawl at various overload amperages. For reset, pawl presses downward on end of latch forcing it to the right. When pawl is in normal position, the end of latch again snaps back in normal position. In Figures 7, 8, and 9, there is shown a device which consists of a U-shaped thermostatic or bimetallic warping element , whose legs are connected respectively, to the contact element of a breaker and to a line. An arm of insulation, and doubly grooved on its edges at is slidably connected to warping element and is rigidly secured to a slidable by rivets , being insulated from arm by insulation The slidable arm is doubly grooved on its edges to receive the sides of latch The latter is pivotally connected to a. The upper end of latch is provided with a hook which holds pawl firmly when the circuit breaker is in either On or normal positions. This motion is transmitted through slidable arm to latch , moving hook end to release pawl The different positions or slidable arm vary the throw of latch and therefore the device can be calibrated to release at various overload amperages. These can be indicated by graduations along a surface of latch , substantially as shown. Now having described various embodiments of the invention, selected by way of example, reference will be had to the appended drawing which determines the scope of the invention, it being understood that, except as set out in the claims, the invention is not to be limited to the embodiments disclosed. We claim: 1. In a controlling device of the character described, latching means in the nature of a lever, thermally responsive mean also in the nature of a lever, and affected by changes in circuit conditions, and a connection between the means whereby the latching means will be released by the effect of such changes on the thermally responsive means, the connection being movable so as to vary the leverage ratio of bothof the means so that the release-causing effect of such changes on the latching means can be varied. Ina controlling device of the character described, latching means in the nature of a lever, thermally responsive means also in the nature of a lever, and thermally affected by changes in circuit conditions, and a connection between the means whereby the latching means will be released by the efiect of such changes on the thermally responsive'means, the connection being movable so as to vary the leverage ratio of one of the means so that the release-causing effect of such changes on the latching means can be varied. In a controlling device of the character described, latching means in the nature of a lever, thermally responsive means also in the nature of a lever and thermally affected by changes in circuit conditions, and a connection between the means whereby the latching means will be re- ,leased by the effect of such changes on the thermally responsive means, the connection being movable so as to vary the leverage ratio of the first mentioned one of the means so that the release-causing effect of such changes on the latching means can be varied. In a controlling device of the character described,'latching means in the nature of a lever, thermally responsive means also in the nature of a lever and thermally affected by changes in circuit conditions, and a connection between the means wherebythe latching means will be released by the efiect of such changes on the thermally responsive means, the connection being movable so as to vary the leverage ratio otthe' second mentioned one of the means so that the release-causing effect of such changes on the latching means can be varied. In a controlling device of the character described, latching means in the nature of a lever,

thermally responsive means thermally affected by changes in circuit conditions, and a connection between the means whereby the latching means will be released by the effect of such changes on the thermally responsive means, the connection being movable so as to vary the leverage ratio of the holding means so that the release-causing effect of such changes on the latching means will be varied. In a controlling device of the character described, latching means, thermally responsive means in the nature of a lever and thermally affected by changes in circuit conditions, and a connection between the means whereby the latching means will be released by the effect of such changes on the thermally responsive means, the connection being movable so as to vary the leverage ratio of the second mentioned means so that the release-causing effect of such changes on the latching means will be varied. This patent is cited by. Frank and Joseph Messing, Detroit, Mich. OCR text may contain errors Description: March 31, Patented Mar. This application relates to circuit breakers, and discloses a novel holding means forv breaker trip pawls or levers, useful as a substitute for holding means of the character disclosed in Pat- 5 cut No. Details of the constructions shown will be understood upon reference to the following detailed descriptive matter which relates to the appended drawing. In this drawing,. Figures 1 and 2 show novel holding means for breaker trip pawls or levers, useful as a substitute for a holding means like the one shown at , 2III3 of Patent No. On the base 66 is pivotally mounted at 2M a thermal warping element urged toward the base by a coiled tension spring connected in circuit through the pivot hinge at 28 I, or through a flexible jumper, and adapted to warp on overload to the right. Secured to and disposed transversely across and preferably insulated from the warping element is an E-shaped magnetic material piece which, together with the magnetic material plate mounted upon the pedestal , forms a magnetic circuit with the ther- 30 mal element forming a single turn coil to provide the magnetomotive force. A bracket 2M is rigidly secured to warping element by rivets , there preferably being insulation between the element and the brackets. An arm is pivotally connected to bracket 2M by a pin ZOB-and is provided with a lock washer which maintains arm 20; in any desired preset position, relative to the element. A pin 20! A hook M3 on the upper end of latch holds the breaker pawl 81 firmly when the breaker is in the on position, or in its normal 0 position. When an overload occurs, the warping element moves to the right, due to thermal forces, or magnetic forces, or a combination of both forces. This motion is magnified by the leverage ratio 50 provided by the lever latch moving the hook end thereof to release the pawl For use in a circuit protective breaker havl5 ing means normally tending to move parts into release condition when they are in reset condition and a pawl which when held prevents such action of the means, a holding means for said pawl including a circuit current controlled ther- 20 mally responsive element which deflects by warping on overload into pawl releasing position and is mounted to move bodily regardless of deflection, and a circuit current controlled magnet for moving the element bodily and instantaneously 25 I into pawl releasing position on an overload of suficient magnitude to operate the magnet. For use in a, In a circuit protective device, a circuit current controlled delayed action holding element, and a magnet carried by and forming part of the element for causing instantaneous movement of the element on overload, the element being so mounted that it may move bodily in accordance with stresses exerted. A holding and releasing means for a circuit breaker part comprising a thermally responsive element, movement amplifying means positively connecting the element to the breaker part whereby overload warping or return cooling of the element will cause amplified movement of the breaker part, the current in said element providing a magnetic force auxiliary to the thermal force for releasing the breaker, the element being mounted to move bodily regardless of deflection in accordance with magnetic forces created by the current flowing through it. A holding and releasing means for a circuit I breaker part comprising a thermally responsive bimetal element, movement amplifying means positively connecting the element to the breaker part whereby overload warping or return cooling of the element will cause amplified movement of the breaker part, and means responsive to the current flowing in said element for creating a magnetic force which assists the thermal warping force for causing release movement of said element and thereby releasing the breaker, the element being mounted to move bodily regardless of deflection in accordance with magnetic forces created by the current flowing through it. A holding and releasing means for a circuit breaker part comprising a circuit current controlled element constructed to deflect itself with a delayed action to release position on a circuit fault and to deflect itself automatically to holding position thereafter, and mounted on a pivot hinge so as to be movable bodily to and from release and holding position regardless of deflection, and means operating on a circuit fault and against an adjustable resistance for causing instantaneous movement of the element bodily to release position. A holding and releasing means for a circuit breaker part comprising a circuit current controlled element constructed to deflect itself with a delayed action to release position on a circuit fault and to

deflect itself automatically to holding position thereafter,. A holding and releasing means for aicir-' cult breaker D; comprising a circuit current controlled element constructed to deflect itself with a delayed action to release position on a circuit fault and to deflect itself automatically sheaves to holding position thereaften-and mounted on a pivot hinge so as to be. A holdingand releasing meansfor a circuit breaker part comprising a circuit current controlled element constructed to deflect itself with a delayed action to release position on a circuit fault and to deflect itself automatically to holding position thereafter, and mounted on a pivot hinge so as to be movable bodily to and from release and holding position regardless of deflection, and magnetically actuating means operating on a circuit fault for causing instantaneous movement of the element bodily to release position. Means for moving a circuit breaker holding part comprising a circuit current controlled element constructed to deflect itself with a delayed action to move the part into release position on a circuit fault and to deflect itself automatically to move the part into holding position thereafter, and mounted so as to be movable bodily to and from release and holding position regardless of deflection, and means operating on a circuit fault for causing instantaneous movement of the element bodily to release position, the element being positively connected to the part through a movement amplifying connection so that minute movements of the element will positively cause amplied movements of the part. Means for moving a circuit breaker holding part comprising a circuit current controlled element constructed to deflect itself with a delayed action to move the part into release position on a, circuit fault and to deflect itself automatically to move the part into holding position thereafter, and mounted so as to be movable bodily to and from release and holding position,. Patent 2,,, issued May 19, Patent 2,,, issued June 2, Patent 2,,, issued July 27, Frank, William H. Patent 2,,, issued June 1, Patent 2,,, issued July 13, Frank, H. Electrical distribution system. Patent 2,, Patent 2,,, issued February 8, Patent 2,,, issued February 14, Patent 2,,, issued August 5, Patent 2,,, issued November 25, Assignee: Bulldog Electric Prod. Bulldog Electric Products Co. Excerpt: This application relates to electrical distribution systems of the bus duct thype as shown in a prior application, Serial No. Herman, Gottheimer. Patent 2,,, issued September 2, Togesen, Alva A. Patent 2,,, issued November 11, Patent 2,,, issued June 23, Application filed by Bulldog Electric Products Co. Fisher, Lawrence E. Patent 2,,, issued June 30, Patent 2,,, issued February 2, Patent 2,,, issued June 6, Fisher, and Robert L. Patent 2,,, issued February 29, Panelboard of detachably mounted electrical devices. Illustrated above. Patent 2,,, issued January 17, Klein, Simsbury, Conn. Thermal current responsive means have been used for many years in electric circuit breakers to detect abnormal current conditions to cause actuation of the circuit breaker to interrupt the circuit. Such thermal current responsive means have two major advantages over other types of current responsive means such, for example, as magnetic current responsive means. These advantages are: 1 thermal current responsive means have an inherent heat storage characteristic which can be made to match quite closely the heat storage characteristics of the circuit conductors which electric circuit breakers are ordinarily utilized to protect. Secondly, thermal current responsive means can be constructed relatively inexpensively, by use of bimetallic current responsive members, such as an elongated strip of bimetallic material. Thermal current responsive means, however, have a characteristic not shared by magnetic type devices which, although it is a further advantage in some applications, constitutes a disadvantage in certain other applications. This characteristic is the fact that thermal current responsive devices are affected by heat which originates from sources other than the particular heat sources which are primarily intended to affect them. More specifically, such devices are affected by the temperature of the circumambient air referred to hereinafter for convenience simply as ambient temperature. Thus, for example, a circuit breaker including a thermal current responsive means may sometimes trip and disconnect the circuit primarily because the temperature of the surrounding air has increased to a predetermined point, even though the current through the circuit breaker has not reached a level which would ordinarily be dangerous. For this reason, it is customary to advise users of thermal current responsive devices such as circuit breakers, that the device must be derated if used at elevated ambient temperatures. In other words, the user is advised for example that a circuit breaker which is rated at 15 amperes will carry 15 amperes indefinitely at an ambient temperature of 25 C. At an ambient temperature of 50 C. As previously mentioned, such ambient sensitivity is sometimes desirable, for the following reason. The ultimate object of automatic circuit protection is to prevent the conductor which is connected to the protecting device from reaching a temperature which might be dangerous to itself, such as by causing melting, or might be dangerous to adjacent material such as the wire insulation or adjacent building material, so as to possibly start a fire. It will be apparent that if a large portion of the temperature of the conductor is caused by means such as by a high ambient temperature, then the conductor should not be permitted to carry as much current as it otherwise could. Nevertheless, up until a certain danger

point is reached, it is desirable to prevent ambient temperature from unduly restricting the ability of a circuit protective device to remain in the closed condition. For this reason, a. Such ambient compensation means have commonly included the use of supplementary bimetallic strip means which is exposed to the ambient temperature in the same Way that the current responsive bimetallic member is, but which is not exposed to heated caused by electrical current carried by the circuit, or at least not to the same degree as the main current responsive thermal element. Examples of thermal current responsive means including such ambient compensating structures, are shown in the following patents: 2,,, Muller; 2,,, Hulbert. All of such prior art ambient compensating or correcting means for thermal current responsive devices have shared a major disadvantage in common. This disadvantage is that they have added significantly to the cost of such devices. In addition, since they have commonly added more parts and complicated the structure involved, their use increases the likelihood of some difficulty being encountered in the use of the device. A further disadvantage of such prior art structures is 'that since they have ordinarily involved the use of a supplementary bimetallic member which acts contrary to the action of the main current responsive bimetal, the compensating action becomes greater with greater ambient temperatures, without practical limit. The use of such ambient compensating structures over a period of years has made it evident that some means should be used to limit the compensating action. Thus, for example, if the ambient temperature surrounding a circuit protective device increases to extremely high values, such, for example, as because of a fire nearby, it would be desirable for the protective device to operate to a tripped condition for general safety purposes. This would not be possible with prior art ambient compensating schemes. For such reasons, it has been found necessary to include in devices of this type some means for limiting the compensating action provided, so that the compensating means operates over a certain range of ambient temperature, but after a certain predetermined ambient temperature is reached, the compensating means no longer functions. Examples of ambient compensating structures including such limiting means are shown, for example, in the following patents: 2,,, Marshall; 2,,, Dorfman. In accordance with appli-cants present invention, a thermal current responsive device is provided which does not include a separate ambient compensating element, but which exhibits an ambient correcting or compensating action which is virtually indistinguishable from the action of prior art thermal current responsive devices including separate ambient compensating means. This is achieved, moreover, without the use of any more parts than utilized in prior art uncompensated thermal current responsive devices. In brief, the present inventor has discovered that the action of ambient temperature on a bimetallic strip can be distinguished from the action of heat caused by electric current therethrough even though the current passes through the entire length of the bimetallic strip in question. Accordingly, it is an object of applicants invention to provide a thermal current responsive device which is not adversely affected by elevated ambient temperatures, and which does not require the use of a separate ambient compensating means. It is another object of applicants invention to provide an electric circuit protective device including a thermal current responsive means which is not adversely affected by elevated ambient temperatures because of the inclusion of correcting means, and which does not require rence of predetermined current conditions. It is a further object of the invention to provide an electric circuit protective device including a thermal current responsive means which may be readily combined with te-ctive device is provided incorporating thermal current responsive means including an elongated bimetallic strip :and means for heating the bimetallic strip in accordance with current passing through the circuit breaker. Means is also provided connecting the movable end of the current responsive bimetallic strip to a latch member to cause releasing movement of the latch member on the occur- The aforesaid means connecting the bimetallic strip and the releasable latch member is constructed in such a way as to provide a corrective action upon deflection of the bimetallic strip. That is, its motion includes a component which,, When the bimetallic strip is heated solely by ambient temperature, this corrective action is more accentuated than when the strip is heated solely by electric current. Because of this, the assembly exhibits the characteristics of an ambient-compensated thermal responsive means without the necessity for use of a separate ambient compensating bimetallic member. In accordance with applicants invention in one form, the connecting means comprises a rigid member having one end thereof connected to the movable end of the bimetallic strip and having its major portion extending gen erally parallel to the bimetallic strip in the direction toward the fixed end thereof and terminating in a latchactuating portion which is spaced from the bimetallic strip a predetermined distance. The arrangement is such that upon heating of the bimetallic strip due to current passing therethrough, the spacing of the latch actuating portion of the connecting member from the body of the bimetallic strip does not change appreciably, but when the bimetallic strip is heated by ambient temperature, the spacing of the latch actuating portion

of the connecting member from the main body of the bimetallic strip does increase significantly, thereby counteracting the general effect of deflection of the main portion of the bimetallic strip, and providing a corrective action. The invention will be more fully understood from the following detailed description, and its scope will be pointed out in the appended claims. FIGURE 1 is a side elevation view of an electric circuit breaker constructed in accordance with the invention, a part of the insulating casing closest to the observer being omitted to show the internal parts;. FIGURE 3 is a side elevation view of a portion of the circuit breaker of FIGURE 1, the parts being shown in a condition which they assume when the assembly is heated substantially entirely by elevated ambient temperature;. FIGURE 5 is a fragmentary perspective view of a portion of thermal current responsive means of another embodiment of the invention;. FIGURE 7 is a side elevation view of a thermal current responsive means of a fourth embodiment of the invention;. Referring first to FIGURE 1, the invention is shown as incorporated in an electric circuit breaker comprising a generally rectangular insulating casing, including a generally tray-shaped body portion 10 and a generally planar cover, not shown, fitting on the body 10 and closing the side exposed to the observer in FIGURE 1. A stationary line terminal member 11 is mounted in a conforming recess in the casing The line terminal 11 is generally U-shaped and is adapted to receive a blade type stationary terminal, not shown. The terminal 11 includes an integral lug portion 11A carrying a stationary contact 11B thereon. A movable contact 12 is fixedly carried by a contact arm The contact arm 13 is pivotally mounted at a pivot point 13A on an insulating handle 14, which in turn is pivotally supported in the casing 10 on an integral pivotal support or hub A generally U-shaped releasable support 16 is also pivotally supported in the casing body 10 on a pivot pin 17, and a tension type operating spring 18 is interconnected between the contact arm 13 and an anchor point 19 on the handle Rotation of the handle 14 about its pivotal support 15 in the casing moves the pivotal support point 13A of the contact arm 13 back and forth across the line of action of the tension spring 18 and moves the contact arm 13 be tween open and closed circuit positions with respect to the stationary contact 11B with a snap-action. The end 16A of the releasable support 16 remote from its pivotal supporting pin 17 is releasably latched in the position shown in FIGURE 1 by current-responsive means to be described. When the contact arm 13 is in closed-circuit position and the support member 16 is released from the current responsive means, the tension spring 18 acts on it to cause rotation in clockwise direction as viewed in FIGURE 1. Clockwise rotation of the support member 16 moves the anchor point 19 of the spring 18 across the pivot point 13A of the contact arm 13, thereby reversing the bias of the spring 18 on the contact arm 13 and moving the contact arm to automatically-opened or tripped position. This causes the projection 14A of the handle 14 to engage a pin 20 carried by the releasable support member 16, and to rotate the support member 16 counterclockwise about its pivotal support 17 to relatched position as shown in FIGURE 1. It should be understood that the particular operating mechanism utilized may be of any suitable type including a member which is moved to cause automatic opening, and that the particular mechanism illustrated herein is chosen merely as an example. The construction and operation of the mechanism illustrated is more specifically described in co-pending application S. Current responsive means For the purpose of normally restraining the releasable support member 16 and for releasing it upon the occurrence of predetermined conditions in accordance with the invention, current responsive means is provided which will now be described. The current responsive means includes a combined armature-latch member of sheet metallic material 22, which is pivotally supported at 23 in the insulating casing, and is biased for clockwise rotation about its pivotal support by a compression spring The armature-latch member 22 includes a widened portion 25 to enhance its operation as a magnetic armature, in a manner to be described, and an integral bent over latch projection An elongated bimetallic strip 28 is also included which is rigidly attached by suitable means, such as by welding, to an end portion 29A of a terminal strap member The terminal strap member 29 is fixedly attached to the insulating body at an intermediate point by suitable means such as by a screw 30, and includes at its outer end a. For the purpose of adjustably positioning the bimetallic strip 28, a calibrating screw 32 is provided which is threadedly engaged in a nut 33 trapped in a conforming recess in the body The bimetallic strip 28 also carries a generally U- shaped magnetic field piece 34 attached thereto by suitable means such as by welding. The bimetallic strip 28 is connected to the armature latch member 22 by means of an angularly-extending connecting piece The movable end of the bimetallic strip 28 is electrically connected to the movable contact member 13 by means of a flexible conductor The current path through the circuit breaker therefore is from the line terminal 11 to the stationary contact 11B, to the movable contact 12, to the flexible conductor 36, to the movable end of the bimetallic strip 28, to the terminal strap 29, to the load terminal The current responsive means operates to cause release or tripping of the circuit breaker in either one of two ways, depending upon the magnitude of the excess current, that is,

either magnetically or thermally. Magnetic tripping takes place upon the occurrence of extremely high overload currents, such as those of short-circuit value. The magnetic field piece 34 is energized and attracts the armature portion 25 of the armature-latch member 22, and withdraws the latch projection 26 from the portion 16A of the member 16 against the bias of the spring 24, thereby causing tripping. In accordance with the embodiment of the invention shown in FIGURE 5, the sensitivity of magnetic field piece 34 may be greatly increased by the provision of additional turns such as 34A which are between the bimetallic strip 28 and the flexible conductor The addition of the extra coils 34A is made ossible by making the magnetic field piece 34 substantially wider than the bimetallic stri Thermal tripping takes place upon the occurrence of electrical currents 'which are above the normal or rated value of the circuit breaker and below the excessively high or short-circuit values which cause magnetic tripping. Such intermediate overload currents cause warping of the bimetallic strip 28 so as to move the lower end thereof to the right as viewed in FIGURE 1, thereby acting through the means of the connecting mean-s 35, on the armature-latch member 22 to move it to the right to cause tripping. In accordance with the invention, the thermal tripping means comprising the bimetallic strip 28, the latch 22, and the connecting means 35, is so constructed in such a manner that elevated ambient temperatures do not have the adverse eflect upon the thermal tripping characteristics which they do in comparable prior art thermal current responsive devices. Because of the construction provided by the present invention, the thermal tripping means responds with a greater latch-moving action to heating due to electric current than to heating due to elevated ambient temperatures. It is possible, in accordance with the invention to construct a thermal current responsive device which is entirely unaffected by elevated ambient temperatures. In the preferred form, however, the current-responsive means of the invention is slightly sensitive to heating due to ambient temperature action. This is for purposes of safety, since it is desired to allow the circuit breaker to trip if the bimetallic strip is heated due solely to ambient temperature of a sufficiently high degree. In accordance with the invention, the connecting member 35 which connects the movable end of the bimetallic strip 28 to the lat-ch member 22 extends a substantial distance back toward the fixedly mounted end of the bimetallic strip 28, and the end 35A engages the latch member 22 at a point spaced a substantial distance from this movable end. In accordance with a particular embodiment of the invention, it has been found that an adequate ambient correcting or compensating action is obtained which meets all requirements of such devices, including the requirements of the Underwriters Laboratories for ambient compensated circuit breakers, with a construction as follows: Circuit breaker rating 15 amperes; bimetallic strip total length 1. This graph indicates the percentage of derating which is necessary for various ambient temperatures. The line A represents the curve of a prior art breaker of this corresponding type without ambient compensating action. Line B represents the corresponding curve of the above-mentioned embodiment of the present invention. When the ambient temperature is increased to 50 C. In other words, the current-carrying capacity of the circuit breaker incorporating the present invention is much less aflected by ambient temperature than the illustrated prior art circuit breaker. It is not certain that the theory of operation of applicants invention is completely understood. This is because its operation involves the interaction of many factors such as: rate of heat generation by electric current in the various conducting parts; rate of heat exchange of both generated heat and heat from the circumambient air, by conduction, radiation and absorption; friction forces; and deflection versus loading characteristics of the bimetallic member, all of which act over a period of time during which all or most of these factors are acting dynamically. It is applicants hypothesis, however, that the invention operates in accordance with the following principles. It is believed that the basic principle on which applicants invention operates is that there is a difference in the deflecting action of a bimetallic strip of the type illustrated when it is heated by ambient temperature as compared to its deflection when it is heated by the passage of electric current therethrough. Specific-ally, when the bimetallic strip is heated by ambient temperature, it is heated uniformly throughout, and all adjacent parts and parts in contact with it are also heated at substantially precisely the same rate. Thus, all points of the bimetallic strip 28, as well as the magnetic field piece 34, the terminal strap 29, and the flexible conductor 36 all have substantially the same temperature at all times. Accordingly, if the ambient temperature is increased, the temperature of all these parts increases uniformly therewith. When the bimetallic strip is heated by such ambient temperatures therefore, it deflect-s equally throughout its length and assumes a condition closely approximating a segment of a circle, the radius of the circle decreasing as the ambient temperature is increased. When the bimetallic strip 28 is heated by the passage of current therethnough, however, it is not heated uniformly throughout its length even though the current passes through the entire strip. This is because the heat generating, heat storage, and heat

radiating characteristics of the various components involved are different. Specifically, it is believed that when bimetallic strip 28 is heated by current passing therethrough, it deflects more sharply adjacent its fixedly supported end than it does adjacent its movable end. This is believed to be due to several factors such as the fact that the conductor 29 is ordinarily selected to act partly as a heater, whereas the flexible conductor 36 is not. In addition, the magnetic field piece 34 acts as a heat sink and also :as a heat radiator. The net result, therefore, is believed to be such that on current-generated thermal tripping, most of the deflection which operates to move the end 35A occurs in the upper portion of the bimetallic strip Since heating occurs primarily by current, the lower part of the bimetallic strip does not deflect as much as the upper portion, and the net result of the components of movement on the member 35 is such as to move the portion 35A to the right to cause tripping. When deflection occurs primarily because of elevation of ambient temperature, however, the lower portion of the bimetallic strip 28 deflects equally with the upper portion, and the movable end 28A of the bimetallic strip 21 not only moves to the right as viewed, but also changes its angle substantially as it does so. This change of angle tends to tilt the connecting member 35 counterclockwise with respect to its original position, thereby moving the end 35A to the left as viewed. This tilting action tends to offset or counteract the movement of the piece to the right as viewed, and provides a compensating action. In the embodiment of the invention shown in FIG- URE 6, there is illustrated an expedient whereby the compensating action of the assembly can :be further increased by passing current only through the major upper portion of the bimetallic strip The fiorm shown in FIGURES 1 through 5, is preferred for use in applications of relatively low rated breakers, such for example as amperes, and the form shown in FIG- URE 6 is preferred for use in higher rated breakers such for example as amperes. In accordance with this embodiment, a bimetallic strip has a magnetic field-piece rigidly attached thereto at the point A by suitable means such as by welding. The member has an opening or window B through which a portion of the bimetallic strip extends, so that a portion of the bimetallic strip lies in the same plane as a portion of the member An armature piece is hingedly supported on the lower end of the magnetic field-piece and includes a projecting lug A which engages a bent-out tab or lug A of the latch member A coil is wound about the field piece , also encircling the portion of the bimetallic strip that passes therethrough. The other end B of the coil is connected to the flexible conductor The lower end of the bimetallic strip therefore is not in the electrical circuit, which passes from the flexible conductor through the coil to the bimetallic srip , and out the terminal strap The thermaldeflecting and ambient-correcting action of this form of the invention is generally similar to that of FIGURE 6. It will be noted in this connection that the spacing of the lug A from the main body of the bimetallic strip, which controls the amount of latch engagement, is controlled by an extension B which engages the lowest extreme end A of the bimetallic strip Deflection of the lower end of the bimetallic strip , occurs primarily due to ambient-temperature changes, and this permits the lug A to move away from the body of the bimetallic strip, in a correcting direction. Thermal tripping occurs by deflection of the upper portion of the bimetallic strip , which moves the lower assembly to the right as viewed substantially as a unit, to cause tripping movement of the latch In the form of the invention shown in FIGURES , the piece serves also as a magnetic armature, which is attracted to the piece upon the occurrence of sufficient current through the coil Although the invention has been described in connection with particular embodiments, it will be readily appreciated that many modifications thereof may readily be made by those skilled in the art, and it is intended therefore by the appended claims to cover all such modifications as fall within the true spirit and scope of the invention. An electric circuit breaker comprising: a a support, b at least one pair of cooperating contacts supported on said support, and movable between open and closed circuit positions,. An electric circuit breaker comprising: a a support, b at least one pair of cooperating contacts supported on said support and movable between open and closed circuit positions,. An electric circuit breaker as set forth in claim 4 wherein said circuit breaker also includes:. An electric circuit breaker as set forth in claim 7 wherein said coil is connected to said bimetallic strip at a point adjacent the point of connection of said magnetic field piece to said bimetallic strip whereby the portion of said bimetallic strip between said point of connection of said coil and said movable end of said bimetallic strip is not in electrical circuit with said contacts. An electric circuit breaker comprising: a a support, -b at least one pair of cooperable contacts supported on said support and movable between open and closed circuit positions,. Other references: Design, July , p. Try the search box just below, or if you prefer, post a question or comment in the Comments box below and we will respond promptly. Note: appearance of your Comment below may be delayed: if your comment contains an image, web link, or text that looks to the software as if it might be a web link, your posting will appear after it has been approved by a moderator. Apologies for the delay. Just ask us! Search the InspectApedia website. Comment Form is

loading comments Bennett can be contacted in New Jersey at or Cell: , or by email to: afullhouseinspectionco gmail. Messing, Joseph. Patent 2,,, issued March 31, Tel: Email: info carsondunlop. Carson Dunlop Associates' provides extensive home inspection education and report writing material. The text is intended as a reference guide to help building owners operate and maintain their home effectively. Field inspection worksheets are included at the back of the volume. Priority date. Remember Me? Education Advanced Search. Page 1 of 2 1 2 Last Jump to page: Results 1 to 65 of Thread: Pushmatic Panels. Jody Humbert Guest. Pushmatic Panels Is there a reason that a pushmatic panel would be considered defective just because it is a pushmatic? I had a realtor call and ask me if I defect all pushmatic panels. I replied that as long as it passes my inspection minimum amperage, properly grounded, no double taps, proper wire size and breakers I do note that replacement breakers can be more expensive than today's circuit breakers. I also had an electrician try to tell a client that I missed the call on a Bulldog amp split bus panel. He said it was only 60 amp largest breaker listed in panel for main lighting and basically called it a "glorified" 60 amp panel. This electrician had 32 years experience. Any thoughts on Pushmatics? Thanks for any replies. From the old board, Sprayed Panels. Miller Guest. Re: Pushmatic Panels. Originally Posted by A. Jerry Peck Construction Litigation Consultant Originally Posted by Jody Humbert. Is there a reason that a pushmatic panel would be considered defective just because it is a pushmatic? Originally Posted by Speedy Petey. Just because no AFCIs are available does not mean they are obsolete or "defective". Codes are not grandfathered so there is no mandatory reason to have to install AFCIs. Why would they need to "be upgraded to the safety standards required of current installations"?? That would be a service change IMO. If a renovation is done that is another story. Pushmatics were very good breakers in their day and you can still get replacements. About the only thing I don't like is that very old ones, or ones that are in a harsh environment, have the tenancy to not reset. I have never had an issue where they would not trip or shut off. If they are still in good physical shape, there is no renovation is being done, and an upgrade is not required, I would suggest that no action be taken. And yes, I would sign my name it it. Re: Pushmatic Panels Panels are a tough one because when they stop functioning propelry they still 'work' as far as most are concerned. It's really one of the only things in a house that isn't obvious when it should be replaced. Re: Pushmatic Panels If they are obsolete why aren't home insurance companies demanding that these breakers be replaced like they do with knob and tube wire in order to get house insurance? Originally Posted by Raymond Wand. If they are obsolete why aren't home insurance companies demanding that these breakers be replaced like they do with knob and tube wire in order to get house insurance? SP: And everyone knows that your signature carries an enormous amount of weight. Kyle Kubs Guest. I would not ever and never will recommend a Pushmatic for replacement based solely on it's age. Thats a ridiculous concept to me. Exactly what is the life expectancy of an electrical panel anyway? Can anyone tell me? You really feel the need to rush out and put AFCI's on certain circuits, personally I think they are a huge scam put a small sub panel coming off the Pushmatic and install those few circuits on the sub. Home Inspectors also need to be rational, not to mention educated. People don't need to rush out and replace everything in their house that is just old. A defect is a defect but old is not necessarily a defect. My opinion. Worth what you paid for it. James Foy Guest. Re: Pushmatic Panels On an older house that I was not inspecting--an electrician said that over the years of service, the push-matics were very reliable and he would only replace them if necessary. If you did a renovation, there is no prohibition in the NEC to using AFCI's in an equipment service panel that was located after the main service panel, as long as it was properly sized. Jim Katen Guest. Re: Pushmatic Panels Some things to consider: 1. I've seen several that were installed in the '80s and one that was installed new in -- though I suspect it was new old stock. Does anyone know when they stopped producing Pushmatic panels? The research that I've seen on older electrical equipment found that old breakers generally continue to work well even after 50 years of service, FPE and certain other troublesome brands excepted -- they generally performed poorly from the get-go though. However, old Pushmatic breakers like all old breakers are obsolete in one other important regard. Their current interrupt rating is at least half that of modern breakers. If I owned a home with a Pushmatic panel, I'd want to install a new replacement breaker in the main position s. That way if the utility sent a high voltage fault my way, the panel wouldn't blow up. I really like the Pushmatic design. The breakers were very reliable and the panels were stout and roomy. Besides, how many other residential panels could boast bolted bus bar connections besides Frank Adam, which was pretty much gone by the mid '50s? Re: Pushmatic Panels Typically, these panels end up in the FYI section of my report. IMO it's my responsibility to point out my clients these panels cannot be updated to modern safety standards, and that to do so is more expensive than in the case of a newer panel which can accept AFCI breakers. If either of these conductor types are present,

you know that there's a good chance that there is deteriorated branch circuit wiring wiring downstream of the panel, that this wiring is going to continue to deteriorate, and that AFCI breakers are going to provide meaningful additional protection. For me that's still an FYI, but it's going to include additional explanation of my concerns. This is similar to the difference between taking a used car to the mechanic to deal with a specific problem and taking the same car in to have it evaluated before you buy it, in the first case your question is "What do I need to do to fix this radiator leak? This produces a very different set of assumptions about your responsibilities to your clients and the sort of recommendations and supplemental observations you need to be making. As home inspector you can be absolutely certain that you're going to get these sorts of calls unless you ask your clients what their remodeling plans are when you encounter a hundred amp service, or alert them in no uncertain terms to the possibility that "functional" knob and tube wiring is unacceptable to the insurance company, or fail to point out the maintenance and safety implications of older branch circuit wiring you observed in the service panel - including the fact that AFCI protection becomes increasingly important as wiring ages. Re: Pushmatic Panels How many of you who do not call obsolete equipment what it is in your reports would install the same worn-out crap in your own houses? Re: Pushmatic Panels 1 Jim Katen and myself are Home Inspectors and have been for many years, although both of us have extensive hands on, practical experience in the electrical fields, unlike most home inspectors. Show me evidence of just one panel that is "Worn out" If the AFCI argument is all you have, it's a pretty weak argument in my opinion, especially here in NJ where the "requirement" for AFCI was struck from the codes right from the beginning. As Jim said, they were produced into the eighties. You call this old and worn out? Inspectors have an obligation to protect there clients, from real dangers and from wasting excessive money because they were sent into a frenzy by an inspector myth with no validation at all. KK: And with that statement, out the window goes all the credibility you may have mustered. Originally Posted by Kyle Kubs. Documented proof, to back up any of your statements Bill King, engineer at the U. Consumer Product Safety Commission CPSC, , indicates that if safety proponents do not deal with the issue of older residences and the inherent aging wiring systems, then the fire, fatality, injuries, and property losses have great potential for catastrophe. Homeowners generally upgrade construction components including roofs, windows, furnaces, and even electrical circuit breaker boxes or fuse panels. However, the remainder of the electrical wiring system is out of sight and unfortunately out of mind all too often. Wiring concealed in walls and their branch circuits are typically neglected and hardly ever are replaced Lardear, p. While you may not consider it important to inform your clients that a component is 1 old, 2 no longer produced, 3 impossible to upgrade to current NEC standards for wiring protection, and 4 hard to find expensive replacement breakers for, some of us do. Where you might permit your family to live in a house with an FPE, Zinsco, or Bulldog panel, most of us would not. The majority disagrees with you, if the AFCI argument is all you have, it's a pretty weak argument in my opinion, especially here in NJ where the "requirement" for AFCI was struck from the codes right from the beginning. How many of you who do not call obsolete equipment what it is in your reports would install the same worn-out crap in your own houses? Electrical Forum - pushmatic electrical panel Who in the world is talking about installing them now??? We are talking about existing installations. It would seem to you that you should call out a 30 year old Chevy for replacement because it is old and obsolete, even though it may be a classic and in fine shape. Oh wait, I forgot, it is "defective" because there are no air bags, right? A good analogy would be this: Even though the tires on your old wreck vehicle are still inflated and appear from a distance to be reasonbly functional, they also have 70K miles on them and no tread. Yes, they will keep the wheels isolated from the pavement, and assuming that you have good wheel bearings they will also roll. Are they functionally obsolete? Should you drive on them? Originally Posted by James Foy. To follow your analogy, just replace the old tires with new tires or really good used tires --unless the vehicle is a Zinsco sp? Or maybe the thinking should be that a worn out Yugo should be scrapped, and a worn out American muscle car your pick: mustang, charger, camaro, GTO could be rebuilt, and some newer parts could be used to replace the worn out parts. In any case the parts should not be abused or taken beyond their accepted limitations. Re: Pushmatic Panels Your analogy tires is a replacement item that wears out over time, analogous to the breakers. Worn out tires do not require replacement of the car, just because the car is old. The car analogous to the enclosure. I think you're talking about a replaceable wear item as opposed to an enclosure, because, by the time the enclosure needs replacing, it is also probably time to replace the wiring. Or did I miss the recommendation for replacing the wiring of a house of a certain age? Mind you, I'm in the desert area of California and there are 40 and 50 year old cars out here with little or no rust and original paint jobs, inspectors in our more humid areas may have different experiences with the boxes. I had hoped this site was a bit better than the "other"

H-I site I used to frequent. I guess not. Re: Pushmatic Panels Matt The problem is the insurers are not backing up their claims with actual statistics. They have become a code authority superceding legislated authorities. Obsolote or saftery concern take your pick. Originally Posted by Matt Fellman. Latent safety issue versus immediate safety issue. And, like everything with insurance, statistics. Originally Posted by Jerry Peck. You can add good information to this board, but if your skin it too thin to take comments and criticisms, then I hope you wear armor instead of leaving. Originally Posted by ken horak. Had it been posted in the correct place it would have been addressed more prompt. Not everyone goes to the new members introduction area looking for questions. Sean Murphy Guest. I am a licensed electrician in 3 states, was a Forman for a large electrical shop just a hind it is the third largest in the country , and I use to teach electrical code. Now that I have validated my expertise I will explain why all home inspectors and electricians should recommend changing these panels. It is not as easy to do that on newer panels because they no longer have screw holes tapped into the bussing, someone would have to actual drill a hole and tap it. To the other electrician who said the panel is fine - would you tell people that the old style fuse boxes are ok or would you recommend upgrading to a newer system? One of the reasons why they stopped making the fuse systems was to prevent "Joe Home Owner" from bypassing the protection and replacing the fuse that keeps blowing with a higher amp fuse or a nickel pennies use to fit some of the spaces too. I agree AFCIs do not make any panel obsolete and I personally believe that they were added to the code by the company that first started making them Just my opinion though. Originally Posted by Sean Murphy. Ok I have read a few of the statements about these Pushmatic or Bulldog panels. Re: Pushmatic Panels I did not say unsafe is said obsolete. However; if a breaker was missing from those type of panels some one could mistakenly land a wire on the screw sitting on the busing. That being said, it would still be dumb to do but the NEC is filled stuff trying to prevent dumb people from doing dumb things, as weel as, helping the sales of companies owned by the member of the code writing board Re: Pushmatic Panels I did not say unsafe I said obsolete. Re: Pushmatic Panels Interesting stuff Sean, it's always nice to hear from someone with real world experience. Your reasoning and info is really just and example of why a 50 year old panel is obselete. As an HI I don't jump up and down and demand it be replaced but I sure make my buyers aware of how much technology has improved over the last 50 years. Ultimately, it all comes down to any person't risk tolerance. They just need the tools to make that decision Welcome to the board Interesting stuff Sean, it's always nice to hear from someone with real world experience. Re: Pushmatic Panels I really don't get some of the hostility throughout this post. I fail to see what these so-called electricians are pissing about. Concentrating on 'the panel' is folly. I've seen plenty of older panels that looked Ok. Nonetheless it is, 30,40,50 years old. Replace it. Most of the time the panel itself isn't the real problem or liability. The wiring and DIY alterations are usually much more of a problem. If the client is going to have an E come in and fix the problems, then change the panel at the same time. If the panel is old now, what will it be when the client sells? From an HI perspective it is important to provide our clients with useful info so they can make decent decisions. At least around here, new home purchase often times means at least some rehab. Older boxes are typically full and don't have space for 5 more circuits. I did a house last week with an old pushmatic box. My report states, replace. The panel was full, no open slots, inside looks like a bowl of spaghetti, had a few scorch marks. Overall looked Ok, breakers went on and off solid, box wasn't rusty. While I'm doing the HI, client is talking about adding this, changing that. So where is he going to tie in all those new circuits? However as HI, part of what a client pays us for is to address the worst case scenario for them. An old panel comes under worst case scenario. If we don't address such concerns who will? The electricians? Apparently not the ones on this thread. Join Date Oct Location michigan Posts Re: Pushmatic Panels Speedy Pete is absolutly correct in this thread. Bob Smit, County Electrical Inspector. Originally Posted by bob smit. Speedy Pete is absolutely correct in this thread. Ron Bibler Guest. Re: Pushmatic Panels Off subject I don't remove these covers on these panels. Best Ron. JPG Re: Pushmatic Panels The screw raises and lowers the whole panel guts, breakers and all. It compensates for panels mounted too deep in the wall. By this I mean a fraction of an inch. Re: Pushmatic Panels Imagine my utter lack of surprise, a municipal employee who posts a barely one sentence blanket statement with a spelling error that addresses pretty much nothing. That's really great backup for SPete. Originally Posted by Markus Keller. Imagine my utter lack of surprise, a municipal employee who posts a barely one sentence blanket statement with a spelling error that addresses pretty much nothing. Re: Pushmatic Panels Pushmatic breakers lack the magnetic trip component that is part of current manufacture breakers. This means the breakers take longer to trip when there's a short as opposed to an overload. So, not only is the panel design obsolete but the basic breaker design itself is as well. There's a place for this old stuff if

you like to wax nostalgic about old electrical gear - it's hanging in your collection of antiques. Cute, unique, and oddball are hardly rational criteria for selection of something meant to protect people and equipment. Good in their day, yeah. As good as anything currently manufactured, absolutely not. As to Speedy, he's a pretty knowledgeable guy and doesn't need endorsements for his comments to have credibility. And, this is probably one of the few things I'd disagree with him on. Definitely due for a blanket party. Re: Pushmatic Panels Tanks guys Perhaps I don't have all the education the rest of U have So shoot ME. As far as the 'only one line blanket statement', maybe u scoffers should look at some of the other threads I have responded to. Don't pick on Speedy or I'll throw another one out on U priima donnnaas Re: Pushmatic Panels Gosh Bob, eyes ain't got know colege edumcation tat all, an' youse gotya too ofem? Eyes only pult wire back 50 yars ago. Bob, not to worry, we all pick on each other from time to time, just means you've been accepted into the sandbox with them once they've kicked sand in your face. Second, do you have any information or documentation on this about Pushmatics? I am genuinely interested. Re: Pushmatic Panels Hmmm, municipal worker complains about the public who pay his salary, puffs his chest about how qualified he is and threatens retaliation for not complying with his statements AND has not stated any self-reasoned thoughts on the thread. Imagine that. They really must all go to the same training school. The attitudes are just textbook. Sorry, can't help myself from slamming muni employee's when given the opportunity. Stacey Van Houtan Guest. Re: Pushmatic Panels As the length and content of this thread indicates this is not a black and white issue. We are in

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a new era of litigation. Not only are buyer sueing HIs but sellers as well, the most reasent case i am aware of was over 1 million and the selle won. I don't think that I would use obsolete on my report for this component. Becuase obsolete means: worn out and no longer in use. In our opinion it would be prudent to have a licensed electrician evaluate the panel s prior to closing. And upgrade to a panel with current safety functions. Originally Posted by Stacey Van Houtan. Not all bulldogs are worn out and many are still in use. Compare archaic. Page 1 of 2 1 2 Last Jump to page:. Bookmarks Bookmarks Google Digg del. Sponsored Links. All times are GMT The time now is PM. All rights reserved. InspectionNews Web Hosting. All Rights Reserved. Use of any index or listing Software for the purpose of constructing a mailing list, creating promotional materials or producing a printed or electronic catalog of any kind is expressly forbidden without the prior written permission of InspectionNews.