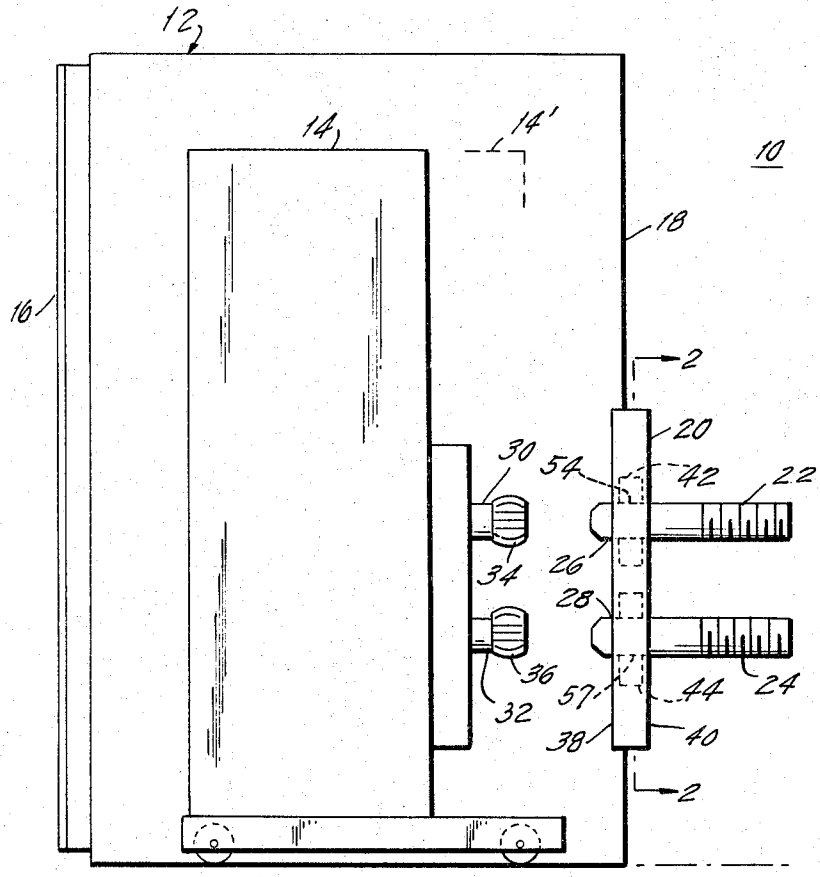
June 27, 1967 C. E. GRYCTKO 3,328,648

COMBINATION PLUG-IN BLOCK WITH CURRENT TRANSFORMERS

Filed April 29, 1966 2 Sheets-Sheet 1

FIG. 1.



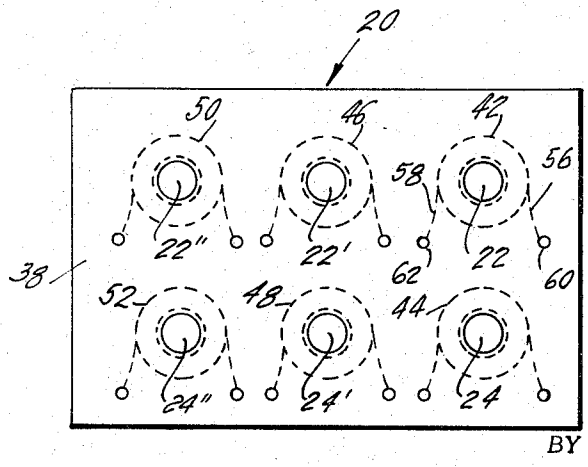


FIG. 2.

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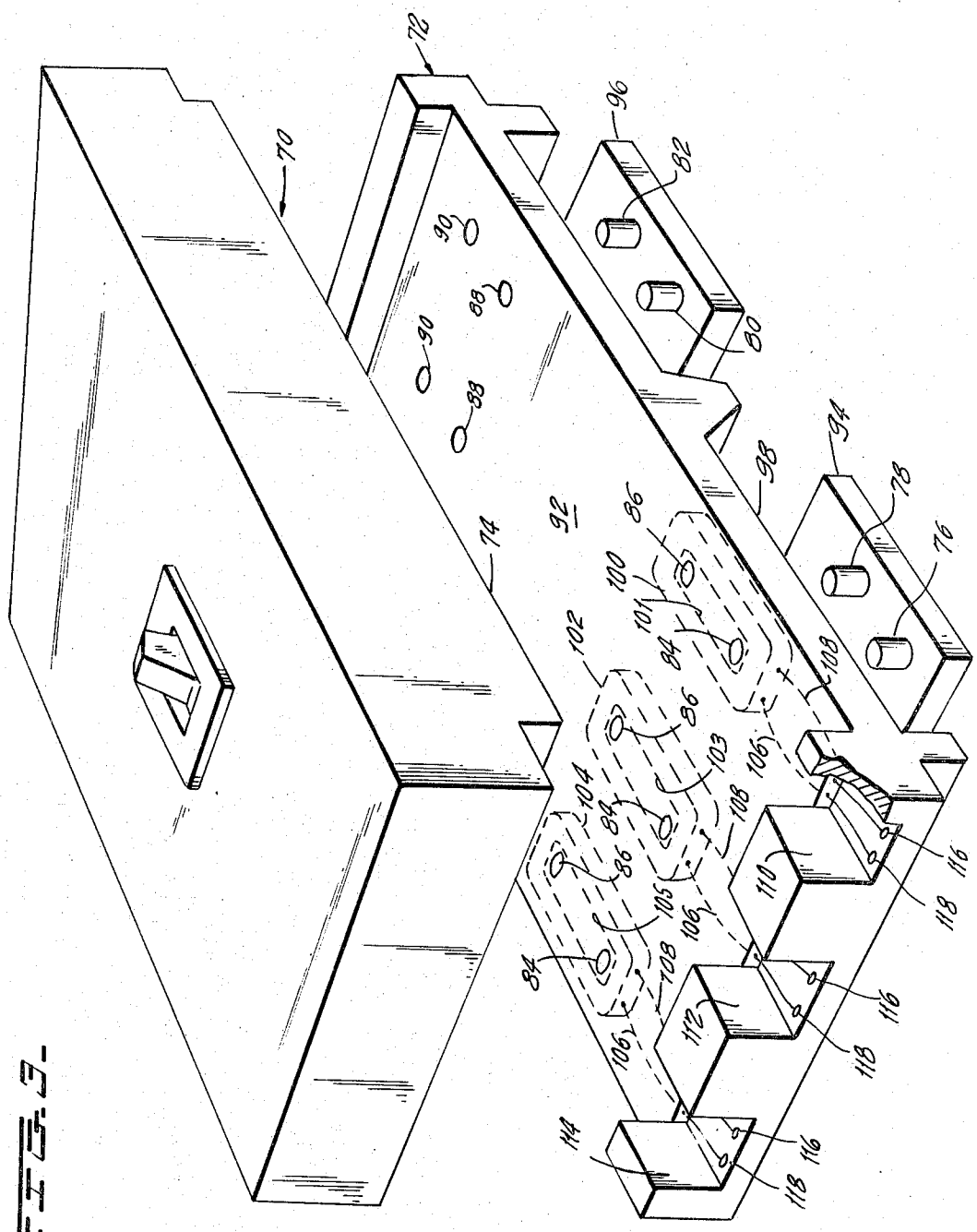

FIG. 7.

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3,328,648

Patented June 27, 1967

3,328,648

COMBINATION PLUG-IN BLOCK WITH CURRENT TRANSFORMERS

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Filed Apr. 29, 1966, Ser. No. 546,361
2 Claims. (Cl. 317—119)

This invention relates to circuit breaker installations and more particularly to the manner in which an insulating mounting block may insulatingly support one or more current transformers with respect to conductors passing through such current transformers and such mounting block in such a manner as to aid in the support of such conductors while at the same time minimize the thickness of the overall mounting block and current transformer combination.

Generally speaking, the instant invention is applicable to at least two types of circuit breaker installations, one of which may be conveniently classified as large drawout circuit breaker installations, the other classified as smaller, molded case circuit breaker installations.

Drawout type circuit breaker installations generally require a circuit breaker cubicle through the rear wall of which passes the conductors of the line being protected by the circuit breaker installation. Customarily, a circuit breaker is movable within such cubicle and includes at least one pair of disconnect contacts which are engageable with the conductors passing through the rear wall of the cubicle when the circuit breaker is moved to the rear of the cubicle by suitable racking mechanism. For inspection and repair, the door of the cubicle may be opened so that the circuit breaker may be completely withdrawn from its cubicle.

Furthermore, prior art drawout circuit breaker installations normally include some kind of insulating mounting block which forms a portion of the rear wall of the cubicle in which the circuit breaker is housed. The insulating mounting block is provided with apertures and suitable fastening means for maintaining the conductors which pass therethrough in fixed insulating relationship with the remainder of the circuit breaker cubicle and in aligned relationship with the disconnect contacts of the circuit breaker so as to facilitate the connection therebetween. Thus to protect the incoming line, the circuit breaker is racked toward the rear of the cubicle such that the disconnect contacts thereof automatically engage the tips of the conductors passing through the insulating mounting block.

In most drawout circuit breaker installations it has been found desirable to utilize current transformers in combination with the incoming line being protected, the flux linkage between the two assuring that the current tapped off at any time is directly proportional to the current being carried by the main cables. There are many possible uses for the current tapped by such transformers, one important one of which would be monitoring the quantity of current flowing through the circuit being protected.

Generally such current transformers take the form of a cylindrically or conically shaped body having a central aperture passing therethrough such that the main conductor of the line being monitored may pass through the aperture to provide the primary of the transformer. The cylindrically or conically shaped body further includes secondary leads from which the secondary current may be drawn. In the prior art such transformers are generally secured to either one side or the other of the insulating mounting block which forms a portion of the rear wall of the circuit breaker cubicle. From the point of view of safety it has made no difference whether

such current transformers were located on one side or the other of the insulating mounting block; since when the circuit breaker is disconnected from the incoming cables, no current is flowing through the primary of the transformer (i.e., the line being protected) and consequently there is no danger of harm to any one coming into contact with the secondary leads of such transformers.

However, the securement of such current transformers to either side of the insulating mounting block resulted in several disadvantages which the instant invention effectively overcomes. For example, it is apparent that in order to secure such current transformers to either side of the insulating mounting block, some type of securing means must be provided in order to firmly secure the transformers to the block. Secondly, it becomes apparent that when such current transformers are added to either side of the insulating mounting block described, the overall thickness of the mounting block is increased by the thickness of the current transformer which is secured thereto and projects therefrom. The disadvantages discussed above result in additional cost in providing material and labor for securing current transformers to the insulating mounting blocks, and furthermore result in an uneconomical utilization of space caused by the increased thickness of the mounting block and projecting current transformers.

In smaller molded case circuit breaker installations it has been similarly found desirable to utilize current transformers in combination with the incoming line being protected, with the flux linkage between the two being proportional to the current being carried by the line. However, securement of such current transformer to one side of an insulating block which the molded case circuit breaker eventually rests has resulted in disadvantages similar to those encountered with large drawout type circuit breakers. Specifically, in order to secure such current transformers to the cooperating insulating mounting block, some type of securing means must be provided, thus requiring higher costs and additional labor in the field. Furthermore, when such current transformers are added to the insulating mounting block the overall thicknes of the mounting block is increased by the thickness of the current transformer which is secured thereto and projects therefrom.

In contradistinction to the prior art technique of mechanically securing current transformers to an insulating mounting block, the instant invention, as applicable to either drawout type or molded case circuit breaker installations, provides a structure whereby the current transformers are integrally supported within the cooperating insulating mounting block in such a manner as to completely eliminate the need for additional securing means to secure such transformers to the mounting block, while at the same time materially reducing the overall thickness of the combination of mounting block and current transformer.

In accordance with the instant invention the current transformers are encapsulated within the insulating mounting block in such a manner that the central apertures of the current transformers are coaxially aligned with the apertures through the mounting block whereby the conductors which pass therethrough may be securely maintained relative to the current transformers, relative to the insulating mounting block, relative to one another, and relative to the cooperating circuit breaker without the need of additional securing means. Thus the instant invention reduces the cost of parts and installation, while at the same time providing for the most economical use of the space immediately surrounding the insulating mounting block.

As an advantageous feature of the instant invention, the principles suggested thereby may be applied to differ-

erent types of circuit breakers, and more particularly may be applied to both the drawout type and molded case circuit breaker installations discussed above.

Accordingly, it is an object of the instant invention to provide the combination of an insulating mounting block and a current transformer supported within said mounting block for supporting such transformer relative to a conductor which passes through the mounting block and transformer in such a manner as to eliminate the need for additional securing means for securing the transformer to the insulating block, while at the same time minimizing the overall thickness of the combination of mounting block and current transformer.

It is another object of the instant invention to provide such a combination of mounting block and current transformer supported therewithin which further serves the function of supportingly aligning conductors which pass therethrough relative to the disconnect contacts provided on the rear of a circuit breaker which cooperates with the conductors passing through such mounting block.

It is another object of the instant invention to provide an insulating mounting block in combination with a current transformer which is encapsulated therein so as to facilitate an integral construction without the need for additional securing means and in a manner which most efficiently utilizes space immediately surrounding such mounting block.

Still another object of the instant invention is to provide such a combination of insulating mounting block and current transformers which may be applied to different types of circuit breaker installations.

Other objects and a fuller understanding of the instant invention may be had by referring to the following description taken in conjunction with the following drawings, in which:

FIGURE 1 is a somewhat schematic side view of a circuit breaker installation embodying the instant invention;

FIGURE 2 is a view taken along the arrows **2—2** of FIGURE 1; and

FIGURE 3 is an exploded perspective view of an alternative embodiment of the instant invention.

Referring to FIGURE 1, there is shown a drawout type circuit breaker installation **10** which includes a circuit breaker cubicle **12** within which is movable a circuit breaker **14** between a first position indicated in solid line in FIGURE 1, and a second position **14'** indicated by the phantom line in FIGURE 1. Cubicle **12** includes a hinged door **16** which may be opened to facilitate the removal of circuit breaker **14** from cubicle **12**.

The rear wall **18** of circuit breaker cubicle **12** includes as an integral portion thereof an insulating mounting block **20** through which the incoming conductors **22** and **24** may pass through apertures **26** and **28**, respectively. Incoming conductors **22** and **24** represent the line which is to be protected from instantaneous fault and/or delayed overload conditions by circuit breaker **14**.

Circuit breaker **14** includes a pair of rear conductors **30** and **32** upon which are mounted the disconnect contacts **34** and **36**, respectively. With the circuit breaker **14** in the position indicated by the solid line drawing, disconnect contacts **34** and **36** are isolated from conductors **22** and **24** such that no current may flow therethrough. When circuit breaker **14** is racked to the position indicated at **14'**, the disconnect contacts **34** and **36** are automatically telescoped onto conductors **22** and **24** such that the line represented by such conductors will be protected from fault condition by circuit breaker **14**. As the details of circuit breaker **14** form no part of the instant invention, and since a variety of circuit breakers well known in the art may fulfill the function of circuit breaker **14**, further discussion of the operation thereof is thought unnecessary in this specification. Furthermore, it is to be noted that although the instant invention is and will be described with respect to a three-phase system, it should be understood that the instant invention is in no way dependent upon a number of phases utilized and may function equally as well with a lesser or greater number.

As noted previously, in many circuit breaker installations it is desirable to utilize current transformers to tap off of the lines being protected. Such current transformers generally take the form of cylindrically or conically shaped bodies having a central aperture passing therethrough such that when the conductor of the line being protected is inserted therein such conductor acts as the primary coil of the transformer configuration. Also, as noted previously, prior art techniques for supporting such current transformers relative to an insulating mounting block such as **20** in FIGURE 1, normally consist of mounting such current transformers on either side **38** or **40** of insulating block **20** such that the current transformers would extend for their entire thickness from either of such sides. Obviously such technique would require additional securing means for supporting the current transformers on side **38** or **40**; would necessarily require the services of skilled laborers to perform such securing operation; and furthermore would increase the overall thickness of the insulating mounting block **20** by the thickness of the current transformers mounted thereon and projecting therefrom.

In accordance with the teachings of the instant invention current transformers **42** through **52** (see FIGURE 2), transformers **42** and **44** which may be seen in the side view of FIGURE 1, are supported within the insulating mounting block **20** such that the major portions thereof lie within the sides defined by **38** and **40** in FIGURE 1. Preferably, transformers **42** and **44** (and **46–52**) are encapsulated within insulating mounting block **20** during the molding thereof such that apertures **54** and **57** in the transformers **42** and **44** are coaxially aligned with apertures **26** and **28** in insulating mounting block **20**. It will become apparent that the encapsulation of current transformers **42–52** within the insulating block **20** completely eleminates the need for any additional securing means for securing such transformers relative to the insulating block, thereby also eliminating the corresponding need for labor, while at the same time substantially minimizing the overall thickness of the combination of insulating block **20** and transformers **42–52**. It should be further apparent that the self-contained integral combination of the current transformers within the insulating block **20** materially aids in supporting the conductors **22** and **24** relative to the insulating block **20** and in maintaining such conductors in proper alignment with respect to the disconnect contacts **34** and **36** of circuit breaker **14**.

Referring to FIGURE 2, there is shown a front view of the insulating mounting block **20** taken along the arrows **2—2** of FIGURE 1 in which the current transformers **42–52** may be seen in phantom as surrounding the conductors **22**, **24**, **22'**, **24'**, and **22''**, **24''**, respectively. Each of current transformers includes secondary conductors **56** and **58** which terminate in secondary terminals **60** and **62**, respectively, from which the secondary current may be drawn.

With the circuit breaker **14** moved to its connected position **14'**, disconnect contacts **34** and **36** are automatically telescoped onto conductors **22**, **24** of the line being protected. Assuming the breaker to be closed, i.e., with the incoming line defined by conductors **22** and **24** carrying acceptable current values, such conductors **22** and **24** function as the primary for the current transformers **42** and **44** such that secondary terminals **60** and **62** may be monitored to determine the current flow through conductors **22** and **24**.

Turning now to FIGURE 3, there is shown an alternative embodiment of the instant invention in which a molded case circuit breaker **70** will be eventually seated on and secured to an insulative mounting block **72** such that the line and load side contacts (not shown in FIGURE 3) provided on the undersurface **74** of circuit breaker **70** will be mechanically and electrically con-

nected to upstanding conductive studs such as **76, 78** on the line side and **80, 82** on the load side which pass through apertures such as **84, 86,** and **88, 90** provided within the central planar portion **92** of insulative mounting block **72** when conductive bars such as **94** and **96** are secured by suitable fastening means to the underside **98** of insulative block **72.**

As in the case of large drawout type circuit breaker installations it is desirable that current transformers be provided on the line side of the circuit being protected such that the current values flowing therethrough may be continuously monitored. To this end, and in accordance with the teachings of the instant invention, current transformers **100, 102** and **104** (one for each phase of a three-phase system) are encapsulated within the insulative mounting block **72** such that their respective apertures **101, 103** and **105** encompass the respective pairs of apertures **84, 86.** It is noted that such current transformers are completely enclosed within the surfaces **92** and **98** and do not project from either side thereof thus minimizing the thickness of the overall combination.

It will be appreciated that when the conductive bar **94** is secured to the undersurface **98** of mounting block **72,** the upstanding conductive studs **76, 78** will pass through apertures such as **84, 86** and as such will function as the primary for the transformers **100, 102** and **104** when the circuit breaker contacts (not shown) are connected to their cooperating conductive studs.

Current transformers **100, 102** and **104** are provided with secondary leads **106** and **108** similarly encapsulated within the mounting block **72** with connecting portions thereof passing into notched recesses **110, 112** and **114** wherein they may be electrically connected to suitable terminals such as **116** and **118.**

Preferably, the current transformers **100, 102** and **104** and their associated secondary leads **106** and **108** are encapsulated within the insulative block **72** during the molding thereof thereby simplifying the production of the overall assembly. Although a three-phase system has been illustrated in FIGURE 3, it is to be understood that a lesser or greater number of phases may be utilized and furthermore, if desired, current transformers such as **100, 102** and **104** could be similarly provided to surround either more or less apertures such as **84, 86** and similarly could be located around apertures such as **88** and **90** if it were desirable to monitor current flowing in the load side of the circuit.

Although there has been described a preferred embodiment of this novel invention, many variations and modifications will now be apparent to those skilled in the art. Therefore, this invention is to be limited, not by the specific disclosure herein, but only by the appending claims.

What is claimed is:

1. In combination:

a circuit breaker mounting block of insulating material, said mounting block having an aperture therethrough;

a first electrically conductive member extending through said aperture;

a circuit breaker supported on said mounting block, said circuit breaker having a terminal contact connected to said electrically conductive member to permit the flow of current therebetween; and

a current transformer encapsulated within said circuit breaker mounting block, said transformer including an aperture therethrough which encompasses the aperture of said mounting block such that said electrically conductive member passes through the aperture in said transformer in addition to passing through the aperture in said mounting block;

whereby any flow of current between said electrically conductive member and said circuit breaker may be detected by said current transformer.

2. The combination of claim **1,** wherein said circuit breaker mounting block includes a second aperture through which a second electrically conductive member passes, said first and second conductive members being electrically connected to one another; said aperture of said current transformer encompassing both said first and second apertures in said mounting block.

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