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VERIFICATION OF TRANSLATION

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hereby declare as follows:

FA(87)

1. I am a translator and am familiar with both the English and German languages.
2. I am the translator of the documents attached hereto and certify that the following is a true translation of European Patent Application No 94105358.9 to the best of my knowledge and belief.

Dated this 12th day of February 1996

Joachim R. Büchner
Signature of Translator

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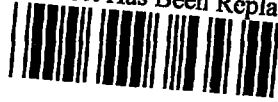


A Wire Retainer for Wiring Layouts in Low-Voltage
Circuits of Electrical Apparatus

The invention relates to a wire retainer for wiring layouts in low-voltage circuits of electrical apparatus, comprising a base provided with fastening means and at least two legs joined with the base, between which legs a continuous channel accommodating the wires is defined, the channel being open on one side over its entire length and forming a wire insertion opening, with spring-elastic wire hold-back means accommodated in the channel being associated with the channel, and with these wires normally situated in a position confining the free passage cross section of the channel and/or of the lateral wire insertion opening.

When low-voltage circuits of electrical apparatus are wired, e.g., in switchboxes, luminaires, etc., but also on circuit boards or switch panels and the like, the electrical wires extending between the various connection points of the circuit elements are either assembled into often prefabricated cable harnesses or are laid out individually. It has been known in practice to fasten cable harnesses to the substrate by means of clips, wire-pack clips, retaining straps, and the like to obtain a mechanically stable structure of the apparatus. Also relatively long wires which are laid out individually require support and retention at intermediate points in order to establish well-defined wire paths and to ensure that there is no undesired mobility of the conductors as this would cause unacceptable conditions during operation of the apparatus. In industry, there exist a large number of dissimilar wire retention means for wires also in the form of round and flat cables which are configured, e.g., as clips or in the form of U-shaped straps between the legs of which the individual conductors are retained. Strips, tabs or lid-like parts are moulded onto the extremities of the legs and, acting as hold-back means for the wires, after insertion of the wires into the channel, are either locked in a special operation or snap on automatically to close the wire-insertion opening to an extent such that the conductors can no longer exit from the channel.

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It is a common feature of these known wire-retaining means that they are configured so that the wires are pressed into the wire-accommodating channel through the insertion opening by a movement perpendicular to their longitudinal direction.

With the growing rationalisation of the manufacture of equipment, there exists the desire to have automated wiring without need for resorting to prefabricated cable trees. For this purpose, one employs a wire-laying tool which, controlled by a program, is moved by a robot along a predetermined placement path between the connection terminals to be interconnected and which, on this occasion, continuously runs the wire paid out from a reel from one point of connection to the next. If the arrangement of the connection points necessitates wires of increased lengths, wire-retainers must be provided at intermediate points of the laying path, as indicated above, and these retaining means are stationary and the wires must be placed into them.

The wire retainers known so far require either that the wire-laying tool perform its own operation of placing the wires into the wire retainers, which usually requires additional placement motions oriented perpendicular to the direction of laying, or the wires, after having been laid out, must be inserted by hand into the wire retaining means the wire hold-back means of which may also have to be closed by hand afterwards.

It is therefore the goal of the invention to create a wire retainer for wiring work in low-voltage circuits of electrical apparatus, which retainer is suitable for fully automated assembly of the wiring, particularly by using a wire-laying tool moved along a predetermined path in such a way that it does not retard the wire-laying process.

In order to solve this problem, the above-specified wire retainer according to the invention is characterised in that the channel is designed so that a tool protruding through the insertion opening and moving in the longitudinal direction of the wire can pass through the channel over its entire length and that the legs delimiting the channel and/or the wire hold-back means are configured so as to yield temporarily in spring-elastic fashion to the tool passing through.

This design of the novel wire retainer achieves that the wire-laying tool can pass through the wire retainer during the laying motion along the

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predetermined placement path in a simple way, and, as a rule, without need for changing its speed. After passage of the wire-laying tool and insertion of the respective wire into the channel during that passage, the temporarily elastically yielding hold-back means return to their original position in which the wire is securely held without need for additional measures, especially manual measures, for this purpose. In addition, if necessary, wires can be inserted manually through the insertion opening and are retained as safely.

In one embodiment, the wire retainer may comprise at least one holding member which at least partially extends beyond the wire-insertion opening and is configured and/or supported in spring-elastically yielding fashion. This hold-back member may be a flexible tongue mounted on the side of the wire-insertion opening, and, in a preferred embodiment, the arrangement is such that one such flexible tongue is provided on either side of the channel. The extremities of the two tongues may either terminate in closely spaced relationship or overlap each other. Particularly simple conditions result if each of the tongues is configured as an upright thin platelet which by the passing tool can be pushed aside like a swing door or bent and which returns to its initial operational state under the influence of its intrinsic elasticity.

In order to ensure orderly distribution of the retained wires, the channel can have at least one pocket-like widened portion the inner width of which is smaller than, or equal to, the outer diameter of the wires. The wires are clamped into this pocket-like widened portion; they are situated in a row in side-by side relationship or one on top the other. The wire-laying tool itself can insert the wires from the channel into the pocket-like widened portion, with the wire-laying tool performing a small lateral movement for this purpose.

It is also possible to subdivide the channel in the longitudinal direction by at least one separator member protruding from the bottom so that there is obtained a double channel or a multiple channel in which the various wires and wire groups are retained separate from each other.

The wire retainer is a single-piece member made from an insulating plastic, e.g., polyethylene or polyamide; its shape can be to a large extent



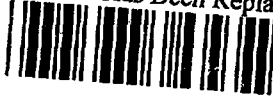
adapted to the respective requirements of the intended use. Thus, the channel can extend through a moulded part which is joined with the base and comprises the legs, with the moulded part having substantially the shape of a plate oriented transversely to the longitudinal direction of the channel.

In other embodiments, the legs delimiting the channel are configured as elongated wall members so that the wires are supported and retained laterally over an extended length.

It also proved to be advantageous to have the wire retaining means comprise spring-elastic clamping means for the wires placed into the channel, with the clamping means adjoining the channel on at least one face. These clamping means have the effect that, when the wire-laying tool enters from the front face, the tool passes first through the clamping means which, immediately after passage of the wire-laying tool, apply themselves automatically and clampingly to the inserted wire and retain the same in its position before the wire-laying tool has run through the channel proper and, hence, releases the wire portion situated in the channel.

In a practical embodiment, the clamping means can comprise at least one spring-elastic clamping clip which extends over the height of the channel and, together with a facing clamping clip or an abutment defines a point of clamping. At this point of clamping, wires which were inserted in succession are retained in precise order and superposed relationship in a row, which implies the advantage that at least over sections close to the wire retainer, there are obtained equally long and equally configured wire placement paths for the individual wires. If the wires were arranged in side-by-side relationship or without order, bending of the common placement path on the horizontal plane would result in different placement paths which would pose difficulties to programming the wire-laying tool or would cause undesirable wire crossover.

In order to enhance the clamping effect, it is convenient to delimit the point of clamping at least on one side by the clamping edge at a clamping clip or at the abutment. Such a clamping clip and/or abutment can have a funnel-like inwards pointing insertion ramp for the tool; this can be obtained in a simpler way if the clamping clip has a substantially part-cylindrical coiled-in wall section arranged at a support arm joined



with the base or with a leg, with which is joined over at least part of its height. In order to increase mobility, the support arm may be separated from the adjacent leg by a slit which extends over at least part of the leg's height.

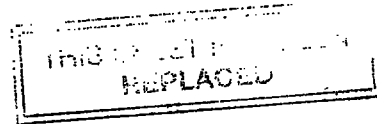
In order to facilitate passage of the wire-laying vehicle, the retaining member, which is arranged on at least one leg, may have on the front face a funnel-like inwards pointing insertion ramp for the tool. Besides that, in order to facilitate the insertion of additional wires by hand, this retaining member, like the aforementioned clamping means, may be configured to have an insertion ramp sloping toward the channel bottom.

The fastening means arranged on the base, e.g., in the form of pins, expanding clips or the like, are conveniently configured so that the wire holder is mounted in non-rotatable fashion and, hence, all the time maintains its alignment required for the passage of the wire-laying tool. Finally, a code, which can be read from the outside and facilitates identification of the respective wire retainer and/or of the individual inserted wires by code recognition means arranged on the wire-laying tool can be provided on the base or on a part joined with the same.

The drawing shows embodiments of the object of the invention. There show:

- Fig. 1, a perspective view of a first embodiment of the wire retainer according to the invention;
- Fig. 2, a plan view of the wire retainer of Fig. 1 to a different scale;
- Fig. 3, a frontal side view, from the left, of the wire retainer of Fig. 2;
- Fig. 4, a side view of the wire retainer of Fig. 2;
- Fig. 5, a side view of the wire retainer of Fig. 4, cut along line V-V of Fig. 2;
- Fig. 6, a perspective view of a second embodiment of a wire retainer according to the invention; and
- Fig. 7, a perspective view of a modified embodiment of the wire retainer of Fig. 6, to a different scale.

The first embodiment of the wire retainer shown in Figures 1 to 5 has a socket composed of two bottom parts 1 each of which bears a moulded-on detent foot 2. The two detent feet 2 facilitate rapid mounting of the wire retainer by press-snap fastening in appropriate bores in the base plate of



the apparatus. At the same time, non-rotatable fixing of the wire retainer is ensured in this way.

The two bottom parts are followed by two facing, spaced legs 3 each of which is moulded onto the full-length strip-like wall portion 4 and, together with the wall portions 4, confines a rectilinear full-length channel 5 to accommodate two wires shown at 6 (Fig. 5). Near the upper edges, onto the two flat legs 3 there are moulded two thin strips 7 which, as shown especially in Fig. 5 (at 80), are inclined inward like a funnel, and define a wire-insertion opening running over the length of the channel 5 on the upper side of the wire retainer. The front faces of the substantially trapezoidal strips 7 (at 70) are inclined inwards like a funnel, whereby an insertion ramp for a wire-laying tool 10, which is shown at 10 and will be described below, is formed.

Following the channel 5, on the two sides of the legs 3 there are provided wire-clamping means, each composed of two part-cylindrical coiled-in clamping clips 11 defining a point of clamping situated symmetrically with respect to the longitudinal plane of symmetry of the channel 5, with the point of clamping extending over the height of the channel. The spacing of the two straight edges 12 is smaller than the diameter of the wires 6 to be inserted so that the same are retained securely in superposed rows between the edges 12 at the respective point of clamping (see Fig. 5).

The two clamping clips 11 are moulded at 14 onto two strip-like support arms 13 which form wall portions of the channel 5 and are moulded to the respective wall portion 4 above the bottom parts 1. In order to increase their hinge-like elastic movability along the fastening strips at 14, they are separated from the support arms 13 by a slit 15 over part of their height, beginning from the bottom parts 1. On the other side, between each of the support arms 13 and the adjacent leg 3, there is provided a separating slit 16 which extends from above to the full-length wall portion 4 and enhances the elastic movability of the legs 3 across the longitudinal central plane of the channel 5.

Finally, at the point of clamping confined by the two vertical edges 12, each pair of clamping clips 11 has insertion ramps 17 which merge downward in funnel-like fashion and facilitate insertion of the wires 6 into



the respective point of clamping and into the channel 5. The edges 12, which delimit the point of clamping, are the vertical corner portions of two brackets 18 moulded onto the respective pair 11 of clips, which are arranged so that together they define an angle 19 or 20 (Fig. 2) of 90° in both sides. The slits 15, 16 extend from below or from above approximately to a common plane 65 which is parallel to the base.

When a wire 6 is laid automatically, its extremity is moved from the left (in Fig. 2) to the front face of the wire retainer by the head of the wire-laying tool 10 moving under program control. The wire-laying head enters into the angle region 20 the confining surfaces of which automatically direct the wire retainer precisely to the wire 6 which is held in the wire-laying head 10. In the course of the advance movement of the wire-laying head 10, the two clips 11 are spread outward in spring-elastic fashion so that, by yielding outwards, they allow the wire-laying head 10 to pass, with the head entering into the angle region 19 directly behind the edges 12 and moving from there into the channel 5 between the support arms 13.

Since the edges 12 extend along the angle line of the two brackets 18, the intrinsic elasticity of the clips 11 automatically returns the same immediately into their initial clamping position (Fig. 2) as soon as the wire-laying head 10 has passed the narrow passage or point of clamping between the edges 12. This achieves that the edges 12 clamp the wire 6 to be laid directly behind the wire-laying head upon passage of the same and retain the wire in friction-locking fashion so that a precisely ordered placement of wires is ensured.

When entering into the channel 5, the wire-laying head 10 impinges on the frontal insertion ramp 70 of the two strips 7; the legs 3 with the strips 7 are pushed aside in elastically yielding fashion and, after passage of the wire-laying head, return into their initial position as per Fig. 2, and this occurs preferably before the wire-laying head 10 enters into the narrow passage or point of clamping between the edges 12 of the second pair of clips 11. Since entry into this narrow passage or point of clamping takes place via the funnel-like tapering angle region 19, the clips of the second pair of clips are likewise spread by yielding sideways in spring-like elastic fashion when the wire-laying head 10 passes. They close automatically behind the wire-laying head, whereby the laid wire 6 is clamped in friction-locking fashion in the precise position also at this extremity of the wire retainer.



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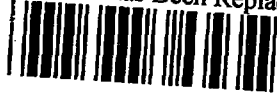
Since the edges 11 on the two front faces of the wire retainer are the edges of brackets 18 enclosing a 90° angle, in the ensuing laying movement of the wire-laying head, the wire can be simply drawn in the axial direction through the wire retainer without that the clips could get caught up in the insulation or could damage the same.

It is ensured by the above-described configuration of the clips 11 and the points of clamping confined between their edges 12 in vertical alignment, that wires 6 which are laid in succession are kept in precise vertical alignment in superposed rows between the edges 12, as shown in Fig. 5. Therefore, all these wires 6 have the same placement path close to the wire retainer; horizontal curves of the wires at a common point of bending can be given the same radius.

For example, when thinner wires are to be laid together with the wires 6 all of which have preferably the same outer diameter, or if it has to be ensured that, for example, in wiring work on a ceiling, the wires 6 in the course of time do not slip out of their clamping holders between the edges 12, the inwardly directed strips 7, which overlay the channel 5, become effective. Their extremities overlay the inner width of the points of clamping between the pairs of edges 12 and in this way ensure form-locking retention of the wires 6 accommodated in the channel 5. Since the strips 7 are bent inwards in hook-like fashion (see Fig. 5), even wire portions, which for some reason were not fixed between the pairs of edges 12 at the points of clamping, are securely held. This is shown in Fig. 5 by two wires 60 which illustrate how the wires can get hooked under the strips 7. The inclination of the strips 7 and the insertion ramps 17 facilitate also vertical insertion of the wires from above.

Figures 6 and 7 show two other embodiments of novel wire retainers which are also distinguished by the fact that they are suitable and designated for automated wire laying by means of the wire-laying head 10 and that they have a channel designed to accommodate wires and configured to be run through over its entire length by the wire-laying head, with the channel-delimiting wire hold-back means being configured to yield to the passing wire-laying tool or wire-laying head in spring-elastic fashion and with the wire-laying tool protruding from above into the channel through the insertion opening.

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The embodiment of Fig. 6 includes a plate-shaped base 21 onto which two locking feet 22 are moulded in axially recessed fashion within U-shaped convex arches 23. The base 21 is integral with a substantially rectangular plate-shaped moulded member 24 through which a channel 25 of approximately trapezoidal cross section for accommodating wires runs. The two sides of the channel 25 are confined by plate portions forming two legs 26 on the ends of which two flexible retaining members in the form of two spring-elastic thin tongues 27, 28 are moulded on both sides of the channel 25. The tongues 27, 28 are thinner than the moulded member 24; therefore, they can be considered thin platelets which are moulded in upright position at their respective roots 27a and 28a, respectively, on the moulded member 24. The two tongues 27, 28 extend beyond the inner diameter of the channel 5 and overlap each other at 29. Since each of them is over its length accessible at 31, 32 via a slit in the moulded member 24, they can yield in spring-elastic fashion sideways like swing doors before the passing wire-laying head 10 and, after its passage, return into the initial position illustrated in Fig. 6, whereby the wire laid down in channel 5 is securely enclosed and retained and the insertion opening on top is closed.

Under the two tongues 27, 28 on both sides of the channel 25 there extend two horizontal, pocket-like recesses 34 configured as slits with parallel sides and a width slightly smaller than the diameter of the wire to be laid.

The various wires 6 are pushed by a slight lateral movement of the wire-laying head 10 into the respective slit at 34 as illustrated in Fig. 6 for one wire 6. This pushing-in is facilitated by the trapezoidal cross section of the channel. The wires 6 are retained in the slits in precise order in side-by-side relationship by friction locking. In principle, it would also be possible to provide corresponding pocket-like recesses in the bottom region of the channel 25 to facilitate vertical arrangement of the wires 6 in a row.

Finally, the embodiment according to Fig. 7 is substantially identical with that of Fig. 6. Identical parts are therefore denoted by the same reference numbers and are not described once more.



In contrast with the embodiment of Fig. 6, here the channel (25) is subdivided in the longitudinal direction into two adjacent partial channels 25a, 25b by means of a pin-like separator member 35 extending upright from the base 21 in order to separate the bundles of inserted wires. The two tongues 270, 280 have the same form. They have the form of two rectangular, elongated, thin strips the front faces of which are close above the separator member 35 at 290 and, hence, together with the separator member, ensure form-locking closure of the two channels 25a, b.

Both tongues 270, 280 once more yield sideways in the form of swing doors in spring-elastic fashion when a wire-laying head 10 runs through the respective channel 25a or b and inserts into the same a wire 6 which is then inserted by a slight lateral movement via the inclined channel wall into the neighbouring horizontal pocket-like recess 34 to be retained therein in friction-locking fashion.

All the wire retainers, of which various embodiments are shown, are produced as a single piece from a synthetic material, e.g., polyethylene or polyamide. Only examples of their fastening means are shown; they may have some other design. As a rule, it must be ensured that non-rotatable fastening of the respective wire holder on its support exists so that the wire-laying tool can find the entry to the channel 5 or 25.

The tongues 27, 28 or 270, 280 of the embodiment of Figures 6 and 7 may be rod-shaped, and it is also conceivable to arrange a plurality of plate-shaped moulded members 24 in spaced relationship upright on a common base.

The wire-laying tool can pass from both sides through the embodiment according to Figures 1 to 5 as well as through the embodiment of Figures 6 or 7 of the novel wire retainer. The hold-back means for the wires laid down in channel 5 or 25 and 25 a,b, respectively, are either form-locking, like the strips 7 (Fig. 1) or the tongues 27, 28 and 270, 280, respectively (Figures 6, 7), or they may be friction-locking like the terminal points between the edges 12 of the elastic clips 11 (Figure 2) or the points of clamping between the walls confining the pocket-like recesses 34 of Figures 6, 7. Since all the pocket-like recesses are upwardly limited by finger-like extensions 36 moulded only onto one end of the associated leg 26, these

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finger-like extensions 36 can be configured to yield in spring-elastic fashion upwards and/or sidewise when the lines are inserted. In the embodiment of Figure 6, they protrude into the channel 25 so that, if necessary, they can be elastically pushed aside by the passing wire-laying tool.

Finally, in the embodiment according to Figures 1 to 5, the channel 5 can be subdivided into at least two parallel subchannels like in Figure 7 by at least one upright separator member in the form of a partition wall.

In order to identify the wire retainers and/or the wires retained in them, the base 1 or 21 and/or a component joined with the same can be provided with a code 40 which can be read by a sensor affixed to the wire-laying head 10. Examples are schematically shown in Figures 4, 7.

Spring-elastic clips 11 are provided on each point 2 of locking of the embodiment according to Figures 1 to 5. However, in principle one may contemplate embodiments in which only one such spring-elastic clip 11 and a movable clamping edge 12 are provided, with the clamping edge cooperating with a stationary, rigid countersupport, e.g., in the form of a matching plate-like extension of the facing support arm 13. Also this countersupport can have at least one clamping edge 12.

Appropriate locking means, of the type of the spring clips 11, may be moulded onto the plate-shaped moulded member 24 of the embodiments of Figures 6, 7.

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Claims

1. A wire retainer for wiring layouts in low-voltage circuits of electrical apparatus, comprising a base provided with fastening means and at least two legs joined with the base, between which legs a full-length channel accommodating the wires is defined, the channel being open on one side over its entire length and forming a wire insertion opening, with spring-elastic wire hold-back means accommodated in the channel being associated with the same, and with these wires normally situated in a position confining the free passage cross section of the channel and/or of the lateral wire insertion opening, characterised in that the channel (5, 25) is designed so that a tool (10) protruding through the insertion opening and moving in the longitudinal direction of the wire can pass through the channel over its entire length and that the legs (3; 26) delimiting the channel and/or the wire hold-back means (7, 11; 27, 28; 270, 280) are configured so as to yield temporarily in spring-elastic fashion to the passing tool.

2. The wire retainer according to Claim 1, characterised in that it comprises at least one holding member (7; 27, 28; 270, 280) which at least partially extends beyond the wire-insertion opening and is configured and/or supported to yield in spring-elastic fashion.

3. The wire retainer according to Claim 2, characterised in that the retaining member has a flexible tongue or strip (27, 28; 7) mounted on the side of the wire-insertion opening.

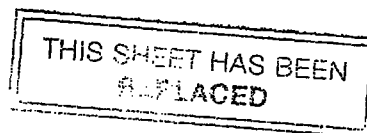
4. The wire retainer according to Claim 2, characterised in that one flexible tongue or strip (27, 28; 7) is arranged on each side of the channel (5, 25).

5. The wire retainer according to Claim 4, characterised in that the two tongues (27, 28) are configured so that their extremities overlap.

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6. The wire retainer according to Claim 4 or 5, characterised in that each of the tongues (27, 28; 270, 280) is configured as a thin, small upright platelet.
7. The wire retainer according to any one of the preceding claims, characterised in that the channel (25) has at least one pocket-like recess (34) the inside diameter of which is less than, or equal to, the outside diameter of the wire.
8. The wire retainer according to any one of the preceding claims, characterised in that the channel (25) is subdivided in the longitudinal direction by at least one separator member (35) protruding upright from the bottom.
9. The wire retainer according to any one of the preceding claims, characterised in that the channel (25) extends through a moulded part (24) which is joined with the base (21), contains the legs (26), and has substantially the shape of a plate extending perpendicular to the longitudinal direction of the channel.
10. The wire retainer according to any one of the preceding claims, characterised in that it has spring-elastic clamping means (11) adjoining the channel (5) on at least one front face for wires (6) inserted into the channel.
11. The wire retainer according to Claim 10, characterised in that the clamping means comprise at least one spring-elastic clamping clip (11) which extends over the height of the channel (5) and, together with an oppositely disposed clamping clip (11) or an abutment, delimits a point of clamping.
12. The wire retainer according to Claim 11, characterised in that the point of clamping is delimited at least on one side by a clamping edge (12) on a clamping clip (11) or the abutment.

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13. The wire retainer according to Claim 11 or 12, characterised in that a clamping clip (11) and/or the abutment has a funnel-shaped inwards pointing insertion ramp (20) for the wire-laying tool (10).
14. The wire retainer according to any one of the Claims 11 to 13, characterised in that the clamping clip (11) comprises a substantially part-cylindrical coiled wall section.
15. The wire retainer according to Claim 14, characterised in that the part-cylindrical coiled wall section is situated on a support arm (13) joined with the base (1) or with a leg (3) with which it is joined over at least part of its height.
16. The wire retainer according to Claim 15, characterised in that the support arm (13) is separated from the adjacent leg (3) by a slit (16) which extends over at least part of the leg's (3) height.
17. The wire retainer according to any one of the Claims 2 to 16, characterised in that the retaining member (7) provided on at least one leg (3) has on its front face a funnel-shaped, inwards pointing insertion ramp (70) for the wire-laying tool.
18. The wire retainer according to any one of the Claims 2 to 17, characterised in that the retaining member (7) which is arranged on at least one of the legs (3) and/or, optionally, the clamping means (11) are provided with an insertion ramp (8; 17) inclined toward the channel bottom, for the wires.
19. The wire retainer according to any one of the preceding claims, characterised in that the base (1) has an aperture communicating with the channel (5) (Figure 2).

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20. The wire retainer according to any one of the preceding claims, characterised in that the fastening means (2) arranged on the base (1, 21) are designed to be nonrotatable.

21. The wire retainer according to any one of the preceding claims, characterised in that a code (40) which can be read from the outside is arranged on the base (1, 21) or some part joined with the same.

22. The wire retainer according to any one of the preceding claims, characterised in that it is made as a single piece from a synthetic material.

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Abstract

A wire retainer for connecting wires in low-voltage circuits of electrical apparatus has a full-length channel (5) configured in a moulded part for accommodating the wires. The channel is designed so that a wire-laying tool, which protrudes through a lateral wire-insertion opening and can be moved in the longitudinal direction of the wire, can travel over the entire length of the channel, with legs (3) and/or wire hold-back means (7), which delimit the channel laterally, being configured to yield temporarily in spring-elastic fashion to the passing tool.

(Fig. 1)

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A WIRE RETAINER FOR WIRING LAYOUTS IN LOW-VOLTAGE CIRCUITS OF ELECTRICAL APPARATUS

ABSTRACT

A wire retainer for connecting wires in low-voltage circuits of electrical apparatus has a full-length channel (5) configured in a moulded part for accommodating the wires. The channel is designed so that a wire-laying tool, which protrudes through a lateral wire-insertion opening and can be moved in the longitudinal direction of the wire, can travel over the entire length of the channel, with legs (3) and/or wire hold-back means (7), which delimit the channel laterally, being configured to yield temporarily in spring-elastic fashion to the passing tool.

Fig. 1

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WIRE RETAINER FOR CONNECTING WIRES IN LOW-VOLTAGE CIRCUITS OF
ELECTRICAL APPARATUS

Field of the Invention: The invention relates to a wire retainer for connecting wires in low-voltage circuits of electrical apparatus, having a base provided with fasteners and having at least two legs joined to the base, between which legs a continuous channel receiving the wires is defined, which is open on one side over its length, forming a wire insertion opening, and to which spring-elastic hold-back means for wires received in the channel are assigned, these wires normally being in a position that defines the free through cross section of the channel and/or of the lateral wire insertion opening.

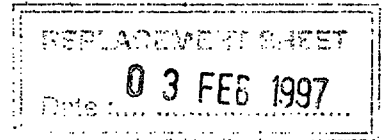
Background: In the wiring of low-voltage circuits, e.g. to about 220 to 340 V, of electrical apparatus, such as in switchboxes, luminaires or fixtures, etc., but also on circuit boards or circuit panels and the like, the electrical wires extending between the various connection points of the circuit elements are either assembled into often prefabricated cable or wire harnesses, or placed individually. It is known in the industry to fasten cable harnesses to a substrate by means of

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holding rings, group holders, retaining strips, etc., in order to attain a mechanically stable apparatus design. Also, relatively long wires that are placed individually require support and retention at intermediate points, in order to define precisely defined wire paths and to assure that no undesired movability of the wires occurs, which leads to unacceptable shifting of lines when the apparatus is in operation. In the industry, there is a large number of versatile wire holders for wires, including those in the form of round and flat cables, which are embodied for instance in clip form or in the manner of U-shaped bows, between whose legs the various wires are retained. Straps, tabs or lidlike parts are formed onto the free ends of the legs, acting as hold-back means for the wires after the placement of the wires in the channel by locking in place either in a single operation or snapping together automatically, in order to close the wire insertion opening enough that the wires can no longer escape from the channel.

It is a feature common to these known wire retainers that they are formed such that the wires are pressed into the channel receiving them through the insertion opening in a motion oriented transversely to their longitudinal direction.

With increasing rationalization of apparatus manufacture, the need arises for performing wiring automatically, without needing recourse to prefabricated cable harnesses. To that end, a wire placement tool is used, which is moved under program control by a robot along a predetermined placement path between the connection points to be connected together, and which in the process carries the wire, supplied to it in endless fashion from a roll, from one connection point to the next. If the arrangement of connection points requires relatively long wire lengths, then as already noted wire retainers must be provided at intermediate



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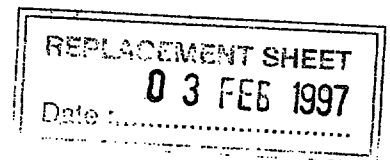
points along the placement path; these wire retainers must be stationary and must be inserted into the wires.

The wire retainers known thus far require either that the wire placement tool undertake its own operation of placing the wires in the wire retainers, which as a rule requires additional placement motions oriented transversely to the placement direction, or the wires, after placement, must be inserted by hand into the wire retainers, whose wire hold-back means may also have to be closed by hand afterward.

The Invention: It is desirable to create a wire retainer for connecting wires in low-voltage circuits of electrical apparatus that is suitable for fully automatic production of the wiring, in particular using a wire placement tool moved along a predetermined placement path, in such a way that it does not delay the wiring process.

Briefly, the channel is designed so that a tool protruding through the insertion opening and moving in the longitudinal direction of the wire can pass through it over its length, and the legs defining the channel and/or the hold-back means are formed so as to yield predominantly spring-elastically to the tool traveling through.

This design of the novel wire retainer means that the placement tool can pass through the wire retainer in its placement motion along the defined placement path in a simple way, without as a rule having to change its speed. After the passage of the placement tool and the insertion of the respective wire into the channel taking place in that passage, the predominantly resiliently yielding hold-back means return to their original starting position, in which the wire is securely held without requiring additional provisions, especially manual ones, for the



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purpose. In addition, however, wires may also be inserted through the insertion openings by hand if needed and are equally securely held.

In one embodiment, it may have at least one holding member, which is formed and/or supported to yield spring-elastically. The holding member may have a flexible tongue supported laterally of the wire insertion opening, and in a preferred embodiment the arrangement is such that one such flexible tongue is located on each side of the channel. The two tongues may be formed with their free ends either ending a short distance from one another or overlapping one another. Very simple conditions result if each tongue is formed as a thin small plate standing on edge, which can be swivelled spring-elastically to the side or bent in a simple way by the tool passing through, in the manner of a swinging door, and which then under the influence of its intrinsic elasticity returns to its effective outset state.

In another embodiment there is a wire retainer for connecting wires of low-voltage circuits of electrical apparatus, to retain said wires in ordered, predetermined position with respect to each other, comprising

a base;

fasteners secured to the base;

at least two legs joined to the base, between which legs a continuous channel for receiving the wires is defined,

said channel being open on one side over its length, and having a wire insertion opening; and

wire holding means for said wires received in the channel, in which wires are normally located in the channel elastic wire hold-back means coupled to the legs; and means for assuring ordered arrangement of the wires in the retainer including

wire clamping means coupled to the base and positioned for engagement with the wires in the retainer, and

wherein the channel is dimensioned and arranged to receive a wire placement tool protruding through the insertion opening moving in the longitudinal direction of the wires and passing through said channel over its length; and

wherein at least one of the legs defining the channel, the wire holding means and the hold-back means are formed to yield spring-elastically to the tool.

In another embodiment there is a wire retainer for retaining connecting wires of low-voltage circuits of electrical apparatus, to retain said wires in ordered predetermined position with respect to each other, comprising

a base;

fasteners secured to the base;

at least two legs joined to the base, between which legs a continuous channel receiving the wires is defined, said channel being open on one side over its length and having a wire insertion opening, said channel being dimensioned and arranged to receive a wire placement tool protruding through the insertion opening moving in the

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longitudinal direction of the wires and passing through said channel over its length;

wire holding means for said wires received in the channel normally located in the channel;

clamping means located laterally adjacent of said channel on at least one face end, for holding the wires placed in the channel in said ordered position in the retainer,

said clamping means having at least one spring elastic clamping bow engageable with at least one of the wires, and a counter element, said clamping bow and counter element extending over the height of the channel,

wherein the clamping bow and the counter element define a clamping point,

said clamping point, at least on one side, being formed by a clamping edge on at least one of the clamping bow and the counter element; and

wherein the clamping bow defined an inwardly directed funnel-like formed portion, said formed portion defining said insertion opening.

In another embodiment there is a wire retainer for retaining connecting wires of low-voltage circuits of electrical apparatus, to retain said wires in ordered predetermined position with respect to each other, comprising

a base;

fasteners secured to the base;

at least two legs joined to the base, between which legs a continuous channel receiving the wires is defined,

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said channel being open on one side over its length and having a wire insertion opening;

wire holding means for said wires received in the channel normally located in the channel;

wherein said wire holding means comprise at least one prong-like extension supported laterally of the wire insertion opening and extending, with spacing, from said base; and

elastic wire hold-back means supported laterally of the wire insertion opening formed on at least one of said legs; and

wherein said channel is adapted to receive a wire placement tool protruding through the insertion opening, moving in the longitudinal direction of the wire and passing through said channel,

said prong-like extension projecting from one of the legs, together with an adjacent portion of said one leg, forming a clamping means for said wires located in the space between the prong-like extension and the leg.

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Drawings:

Exemplary embodiments of the subject of the invention are shown in the drawing.

Fig. 1 is a perspective view of a wire retainer according to the invention, in a first embodiment;

Fig. 2 is a plan view on a different scale of the wire retainer of Fig. 1;

Fig. 3 is a side view of the face end from the left of the wire retainer of Fig. 2;

Fig. 4 is a side view of the wire retainer of Fig. 2;

Fig. 5 is a side view of the wire retainer of Fig. 4, in a section taken along the line V-V of Fig. 2;

Fig. 6 is a perspective view of a wire retainer according to the invention in a second embodiment; and

Fig. 7 is a perspective view on a different scale of the wire retainer of Fig. 6, in a modified embodiment.

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Detailed Description:

The wire retainer shown in a first embodiment in Figs. 1-5 has a base that comprises two flat bottom parts 1, each with a formed-on detent foot 2. The two detent feet 2 permit rapid assembly of the wire retainer by pressure-detent fastening in corresponding bores of the apparatus base plate. Finally, fixation of the wire retainer in a manner secure against relative rotation is assured.

The two bottom parts are adjoined by two spaced-apart legs 3 facing one another, which are formed onto a continuous striplike wall portion 4 between the two bottom parts and which together with the wall portions 4 define a straight continuous channel 5 that serves to receive wires suggested at 6 (Fig. 5). In the region of the upper edges, two thin strips 7 are formed onto the two flat legs 3, and in the manner particularly visible from Fig. 5, these strips, extending obliquely inward in funnellike fashion (at 80), with their free parallel long edges 8, define a wire insertion opening, extending over the length of the channel 5, on the top of the wire retainer. On their face ends, the essentially trapezoidal strips 7 are inclined inward in funnellike fashion (at 70), thereby forming an insertion slope for a wire placement tool suggested at 10 and to be described hereinafter.

Adjoining the face end of the channel 5, on both sides of the legs 3, wire clamping means are provided, each of which comprise two partially cylindrically rolled-in clamping bows 11, which with mutually parallel formed-on clamping edges 12 define a clamping point located symmetrically to the longitudinal plane of symmetry of the channel 5 and extending over the height of the channel 5. The spacing between the two straight edges 12 is less than the diameter of the wires 6 to be inserted, so that these

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wires are securely held in a row located one above the other i.e. in ordered, or predetermined position relative to each other, at the respective clamping point between the edges 12 (see Fig. 5).

On each face end, the two clamping bows 11 are formed at 14 onto two striplike retaining arms 13 which form wall portions of the channel 5 and are formed onto the respective wall portion 4 above the bottom parts 1. To increase their hingelike elastic movability along the fastening lines at 14, they are each separated from the fastening arms 13, over a portion of their height beginning at the bottom parts 1, by a respective slit 15. On the other side, a separating slit 16 extending from the top is likewise provided between each holding arm 13 and the adjacent leg 3; this slit extends up to the continuous wall portion 4 and increases the elastical movability of the legs 3 transversely to the longitudinal centre plane of the channel 5.

Finally, in the region of the clamping point defined by the two vertical edges 12, each pair of clamping bows 11 has insertion slopes 17, running together in funnellike fashion from top to bottom, which make it easier to insert wires 6 into the respective clamping point and into the channel 5. The edges 12 defining the clamping point are the vertical corner edges of two angle pieces 18 formed onto the respective pair of bows 11; the angle pieces are located such that on each side longitudinally of the channel they form a respective angle 19 or 20 (Fig. 2) of 90° with one another. Finally, the slits 15, 16 extend from below or above approximately as far as a common plane 65, which is oriented parallel to the base.

OPERATION AND PLACING A WIRE

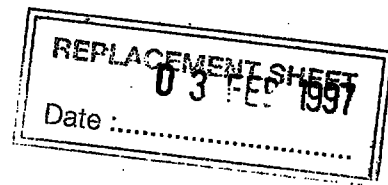
In automatic operation and placing a wire placement of a wire 6, the wire is brought with its free end from the left, in terms of Fig. 2, to the face end of the wire retainer by the placement head of the wire placement tool 10. The tool is moved according to the program. The

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wire placement head enters the angular region 20, by whose boundary faces the wire retainer is automatically aimed exactly at the wire 6 grasped in the wire placement head 10. In the course of the forward motion of the wire placement head 10, the two bows 11 are spread apart spring-elastically, so that yielding to the side, they leave the wire placement head 10, which enters the angular region 19 immediately behind the edges 12 and from there moves between the holding arms 13 and then into the channel 5.

Since the edges 12 extend at the apex of two opposed angle pieces 18, the bows 11 immediately return automatically, under the influence of their intrinsic elasticity, to their outset clamping position (Fig. 2), as soon as the wire placement head 10 has moved through the bottleneck or clamping point between the edges 12. One of the bows 11 forms a counter element for the other, thus clamping the wire 6 therebetween. It is thus achieved at the edges 12, upon passage of the wire placement head, directly engage the wire 6 clampingly from behind and restrain it by frictional engagement, thus assuring an exactly ordered placement of the wire.

The wire placement head 10 entering the channel 5 meets the face-end insertion slopes 70 of the two strips 7; the legs 3 with the strips 7 are elastically yieldingly forced to the side, and after the passage of the wire placement head, they return to their outset position shown in Fig. 2, preferably before the wire placement head 10 enters the bottleneck or clamping point between the edges 12 of the two pairs of bows 11 at the right side of Fig. 1. Since the entry into this bottleneck or clamping point takes place through the angle region 19 which tapers in funnellike fashion, the bows 11 of the second pair of bows, upon passage of the wire placement head 10, are likewise curved open, yielding spring-elastically toward the side. They automatically close behind the wire placement head, whereupon the placed wire 6 is firmly clamped in exactly the



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correct position, by frictional engagement, on this end of the wire retainer as well.

Since the edges 11 on both face ends of the wire retainer are the corner edges of respective angle pieces 18, which form an angle of 90° with one another, upon the further placement motion of the wire placement head, the wire 6 can easily be axially penetrated by the wire retainer, without the bows getting caught in the wire insulation or being able to damage it.

The embodiment of the bows 11 and of the clamping points, oriented vertically and defined by the edges 12, as described assures that wires 6 placed in succession above each other will be retained in rows, one above the other, in an exact vertical orientation between the edges 12, as suggested in Fig. 5. For all these wires 6, the same placement path is therefore applicable in the vicinity of the wire retainer; horizontal bends in the wires at a common bending point can be done with the same radius.

For instance if in common with the wires 6, which preferably have the same outside diameter, thinner wires must be placed, or if it is important to assure that when wiring is installed in the ceiling, for instance, the wires 6 will not in time slide out of their clamping retainers between the edges 12, the inwardly pointing strips 7 that cover the channel 5 come into action. With their free edges, they protrude across the inside diameter of the clamping points between the pairs of edges 12 and thus assure a form-fitting retention of the wires 6 received in the channel 5. Since the strips 7 are bent inward in hooklike fashion (see Fig. 5), even wire segments that for whatever reasons are not held in the clamping points between the pairs of edges 12, will be securely held. This is suggested in Fig. 5 by means of two wires 60, which illustrate how the wires can become

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caught under the strips 7 in the channel 5. At the same time, the inclined position of the strips 7 together with the insertion slopes 17 also enable a vertical insertion of the wires from above.

Figs. 6, 7 show two further embodiments of novel wire retainers, which are likewise distinguished by being suited and intended for automatic wire placement using a wire placement head 10 and by having a channel, intended for receiving wires, which is designed so that the wire placement head can move through it over its length; the hold-back means for the wires define the channel and are embodied to yield predominantly spring-elastically to the wire placement tool or head passing therethrough; the wire placement tool protrudes into the channel from above through the insertion opening.

In the embodiment of Fig. 6, a plate-like base 21 is provided, on which two detent feet 22 are formed, resting in an axially somewhat indented manner in U-shaped outward-bent recesses 23. A shaped part 24 is joined in one piece to the base 21, formed essentially as a rectangular plate that is penetrated transversely by a channel 25 of approximately trapezoidal cross section for holding a wire. The channel 25 is defined on both sides by regions of the plate that form two legs 26, and on both sides of the channel 25 two flexible holding members in the form of two spring-elastic thin tongues 27, 28 are formed onto the ends of these legs. The thickness of the tongues 27, 28 is less than the thickness of the shaped part 24; they can therefore be called thin small plates, which are formed standing on edge on their respective roots at 27a and 28a, respectively, onto the shaped part 24. The two tongues 27, 28 protrude across the inside diameter of the channel 5 and are formed to overlap one another at

29. Since they are each freed over their length at 31, 32 via a slit in the shaped part 24, they can yield to the side in a spring-elastic fashion, in the manner of swinging doors, upon the wire placement head 10 passing through, and after it has passed through, they can return to their outset position shown in Fig. 6, whereupon the wire 6 placed in the channel 5 is securely enclosed and retained, and the insertion opening at the top is closed.

On both sides of the channel 25 below the two tongues 27, 28, pocketlike enlargements 34 begin at the tongues. The enlargements are in the form of slits 34 defined by parallel sides between a portion of the legs 26 and prong-like extensions 36. The width of the slits 34 is selected to be somewhat less than the diameter of the wires to be laid. These enlargements form wire reception slits or pockets 34.

The various wires 6, after placement in the channel 25, are thrust into the respective slit at 34 by a small lateral placement motion of the wire placement head 10, as is shown in Fig. 6 for one wire 6. This insertion is facilitated by the trapezoidal cross section of the channel 25. The wires 6 are retained in the slits, ordered precisely, side by side, in frictional engagement. In principle, it would naturally also be possible to provide corresponding pockets or slots 34 on the bottom side of the channel 25, to enable lining up the wires 6 vertically.

The embodiment of Fig. 7, finally is essentially identical to that of Fig. 6. Identical parts are therefore provided with the same reference numerals and are not described again.

Differing from the embodiment of Fig. 6, the channel 25 here is subdivided longitudinally, by a pinlike separator member 35 protruding upward from the base 21, to form two partial channels 25a, 25b extending side by side, so that the groups of wires placed there can be separated from one another. The two tongues 270, 280 are identical in this case. They take the form

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of two rectangular, elongated, thin strips, which protrude tightly against one another at the face end in the region above the separator member 35, at 290, and thus together with the separator member assure a form-fitting closure of the two channels 25a, 25b.

Once again, the two tongues 270, 280 yield spring-elastically to the side in the manner of swinging doors if a wire placement head 10 is passing through the respective channel 25a or 25b and places a wire 6 in it, which then by a small lateral placement motion is inserted via the inclined channel wall into the adjacent horizontal pocketlike enlargement 34, in which it is held by frictional engagement.

The wire retainers shown in various embodiments are all made in one piece from plastic, such as polyethylene or polyamide. Their fastening devices are shown only by way of example; they may also be formed differently. As a rule, however, it must be assured that fastening of the respective wire retainer on its substrate is done in a manner secure against relative rotation, so that the wire placement tool can gain an entry into the respective channel 5 or 25.

The tongues 27, 28, or 270, 280 in the embodiments of Figs. 6 and 7, respectively may also be in the form of bars, and it is also possible for a plurality of platelike shaped parts 24 to be located, spaced apart from one another, on the same base.

The novel wire retainer, both in the embodiment of Figs. 1-5 and in the embodiment of Fig. 6 or 7, can be penetrated from both sides by the wire placement tool. The hold-back means for the wires placed in the channels 5 and 25 and 25a, 25b are either form-fitting, like the strips 7 (Fig. 1) or the tongues 27, 28 or 270, 280 (Figs. 6, 7), or may also be friction-locking, like the clamping points formed between the edges 12 of the resilient bows

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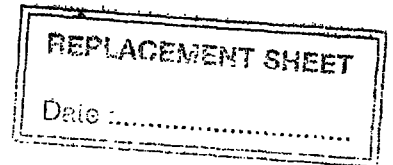
11 (Fig. 2) or the clamping points between the boundary walls of the pocketlike enlargements 34 in Figs. 6, 7. Since these pocketlike enlargements are limited at the top by pronglike extensions 36, which are formed onto the associated leg 26 at only one end, these pronglike extensions 36, upon placement of the wires, may be designed to yield somewhat elastically upward and/or spring-elastically to the side. In the embodiment of Fig. 6, they protrude into the channel 25, so that if needed, they can also be swiveled elastically to the side by the placement tool as it moves through.

Finally, in the embodiment of Figs. 1-5, the channel 5 may also be subdivided into at least two parallel partial channels, similarly to Fig. 7, by means of a separator member standing upright, in the form of a partition.

For identification of the wire retainers and/or the wires retained in them, the base 1 or 21 and/or some part connected to it may be provided with a code 40 that can be read off by a sensor on the wire placement head 10. Examples of this are schematically suggested in Figs. 4 and 7.

In the embodiment of Figs. 1-5, spring-elastic bows 11 are provided at each clamping point 2. In principle, other embodiments are also possible in which only one such spring-elastic bow 11 is provided, with a movable clamping edge 12 that cooperates with a fixed, rigid abutment, for instance in the form of a corresponding platelike prolongation of the opposite arm portion 13. This abutment, too, may be formed with at least one clamping edge 12.

Suitable clamping means, of the kind formed by the spring bows 11, may also be formed onto the platelike shaped parts 24 in the embodiments of Figs. 6, 7.



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In order to assure an ordered arrangement of the retained wires, the channel 25 may have at least one pocketlike enlargement 34, whose inside diameter is less than or equal to the outside diameter of the wire. The wires are firmly clamped in this pocketlike enlargement; they are in a row next to or one above the other. Inserting the wires from the channel into the pocketlike enlargement can be done by the placement tool itself, which for that purpose executes a slight lateral motion if needed.

It is also possible for the channel 25 to be subdivided longitudinally by at least one separator member 35 protruding from the bottom, resulting in a double or multiple channel, in which the various wires or groups of wires are retained separately from one another.

The wire retainer is made entirely in one piece of an insulating plastic, such as polyethylene or polyamide; in its shape, it can be extensively adapted to the requirements of an intended use. For instance, the channel 25 can extend through a shaped part 25, joined to the base 21 and containing the legs 26, which is formed essentially as a plate oriented transversely to the longitudinal direction of the channel.

In other embodiments, the legs that define the channel are in the form of longer wall parts, so that the wires are laterally supported and retained over a greater length.

It has proved advantageous if the wire retainer has spring-elastic clamping means 11, adjoining the channel 5 on at least one face end, for wires 6 placed in the channel. These clamping means have the effect that upon the inward motion of the wire placement tool into the channel, which is done from the face end, the tool first passes through the clamping means, which after the passage of the placement tool immediately press self-clampingly against

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the inserted wire and positionally restrain it, before the placement tool has passed through the channel itself and released the segment of wire located in the channel.

In a practical embodiment, the clamping means may have at least one spring-elastic clamping bow 11, which extends over the height of the channel 5 and, with a clamping bow 11 or an abutment opposite it defines a clamping point. In this clamping point, wires placed successively are retained in a row, located one above the other, in precise order; this has the advantage that of producing wire placement paths of equal length and equal design for the various wires, at least intermittently, in the vicinity of the wire retainer. That is, if the wires were placed side by side or even in unordered fashion, then different placement paths in the horizontal plane would occur at bends in the common placement path, making it difficult to program the placement tool or leading to undesired crossings of lines.

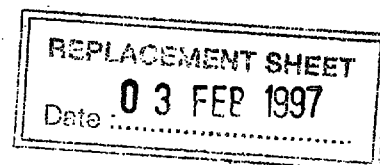
To increase the clamping action, it is practical if the clamping point, at least on one side, is defined by a clamping edge 12 on a clamping bow 11 or on the abutment. One such clamping bow and/or the abutment may also have an insertion chamber 20, pointing inward in funnellike fashion, for the wire placement tool 10, which can be attained in a simple way by providing that the clamping bow 11 has a wall portion rolled inward essentially in partially cylindrical fashion, which wall portion rolled inward in partially cylindrical fashion is located on a retaining arm 13 joined to the base 1 or to a leg 3, with which arm it is joined over at least a portion of its height. To increase the movability, the retaining arm 13 may be separated from the adjacent leg 3 by a slit 16, which extends over at least a portion of the height of the leg 3.

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To facilitate the passage of the placement tool through the channel, the holding member 7 located on at least one leg 3 may have on its face end an insertion slope 70, pointing inward in funnellike fashion, for the tool. Moreover, to facilitate the manual insertion of additional wires, this holding member, like the aforementioned clamping means, may be formed with an insertion slope, inclined toward the channel bottom, for the wires.

The fastening means located on the base, which for instance are in the form of protrusions, spreader hoops or the like, are suitably formed such that the wire retainer is secured against relative rotation, and accordingly always maintains its alignment as required for the passage through the channel of the wire placement tool. Finally, a code 40 readable from outside may be located on the base 1, 21 or on some part joined to it, which enables identification of the respective wire retainer, on the one hand, and/or of the various inserted wires, on the other, by means of code recognition means located on the wire placement tool.

Various changes and modifications may be made, and features described in connection with any one of the embodiments may be used with any of the others, within the scope of the inventive concept.



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The claims defining the invention are as follows:

1. A wire retainer for connecting wires of low-voltage circuits of electrical apparatus, to retain said wires in ordered, predetermined position with respect to each other, comprising:

a base;

fasteners secured to the base;

at least two legs joined to the base, between which legs a continuous channel for receiving the wires is defined,

said channel being open on one side over its length, and having a wire insertion opening; and

wire holding means for said wires, received in the channel in which wires are normally located in the channel,

elastic wire hold-back means coupled to the legs; and

means for assuring ordered arrangement of the wires in the retainer including

wire clamping means coupled to the base and positioned for engagement with the wires in the retainer, and

wherein the channel is dimensioned and arranged to receive a wire placement tool protruding through the insertion opening moving in the longitudinal direction of the wires and passing through said channel over its length; and

wherein at least one of the legs defining the channel, the wire holding means and the hold-back means are formed to yield spring-elastically to the tool.

2. The wire retainer of claim 1, wherein the hold-back means are located on at least one of the legs and have,



on its face end, an insertion slope, pointing inward in funnel-like fashion towards said channel.

3. The wire retainer of claim 1, wherein the hold-back means are formed with an insertion slope, inclined toward the bottom of the channel for the wires.

4. The wire retainer of claim 1, wherein the base has an aperture leading into the channel.

5. The wire retainer of claim 1, wherein the fasteners located on the base are formed to be secure against relative rotation.

6. The wire retainer of claim 1, wherein a code readable from outside is located on the base or on some part joined to it.

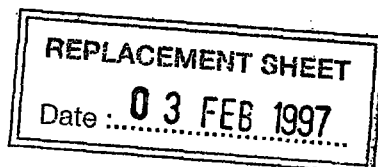
7. The wire retainer of claim 1, wherein said retainer comprises a unitary plastic element.

8. A wire retainer for retaining connecting wires of low-voltage circuits of electrical apparatus, to retain said wires in ordered predetermined position with respect to each other, comprising

a base;

fasteners secured to the base;

at least two legs joined to the base, between which legs a continuous channel receiving the wires is defined, said channel being open on one side over its length and having a wire insertion opening, said channel being dimensioned and arranged to receive a wire placement tool protruding through the insertion opening moving in the longitudinal direction of the wires and passing through said channel over its length;



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wire holding means for said wires received in the channel normally located in the channel;

clamping means located laterally adjacent of said channel on at least one face end, for holding the wires placed in the channel in said ordered position in the retainer,

said clamping means having at least one spring elastic clamping bow engageable with at least one of the wires, and a counter element, said clamping bow and counter element extending over the height of the channel,

wherein the clamping bow and the counter element define a clamping point,

said clamping point, at least on one side, being formed by a clamping edge on at least one of the clamping bow and the counter element; and

wherein the clamping bow defined an inwardly directed funnel-like formed portion, said formed portion defining said insertion opening.

9. The wire retainer of claim 8, wherein said counter element comprises a clamping bow,

whereby said clamping bows, outwardly of said channel, define an inwardly pointing, with respect to the channel, funnel-like entrance region for the wire placement tool.

10. The wire retainer of claim 9, wherein said formed portion of the clamping bow comprises a wall portion which is rolled inwardly in essentially cylindrical shape.

11. The wire retainer of claim 10, wherein the wall portion rolled inward in partially cylindrical fashion is



located on a retaining arm joined to the base or to one of the legs;

and wherein said arm is joined to said wall portion over at least a portion of the height of the wall portion.

12. The wire retainer of claim 11, wherein the retaining arm is separated from the leg by a slit, which extends over at least a portion of the height of the leg.

13. A wire retainer for retaining connecting wires of low-voltage circuits of electrical apparatus, to retain said wires in ordered predetermined position with respect to each other, comprising

a base;

fasteners secured to the base;

at least two legs joined to the base, between which legs a continuous channel receiving the wires is defined, said channel being open on one side over its length and having a wire insertion opening;

wire holding means for said wires received in the channel normally located in the channel;

wherein said wire holding means comprise at least one prong-like extension supported laterally of the wire insertion opening and extending, with spacing, from said base; and

elastic wire hold-back means supported laterally of the wire insertion opening formed on at least one of said legs; and

wherein said channel is adapted to receive a wire placement tool protruding through the insertion opening,



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moving in the longitudinal direction of the wires and passing through said channel,

said prong-like extension projecting from one of the legs, together with an adjacent portion of said one leg, forming a clamping means for said wires located in the space between the prong-like extension and the leg.

14. The wire retainer of claim 13, wherein said wire hold-back means comprises two flexible tongues, each being located on a respective opposite side of the channel.

15. The wire retainer of claim 14, wherein the two tongues are formed with their free ends overlapping one another.

16. The wire retainer of claim 14, wherein each tongue is formed as a thin small plate standing on edge.

17. The wire retainer of claim 13, wherein the clamping means comprises a slit which extends to the space between the respective prong-like extensions and the adjacent portion of the leg, the spacing being less than or equal to the outside diameter of the wires to be received by the retainer, said slit communicating with the channel.

18. The wire retainer of claim 14, further comprising at least one separator member protruding from the bottom and longitudinally subdividing the channel.

19. The wire retainer of claim 13, wherein the channel extends through a shaped portion of the base containing said legs, said prong-like extensions, and said tongues; and

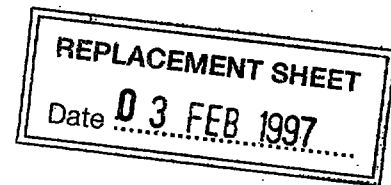


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wherein said shaped portion is formed essentially as a plate oriented transversely with respect to the longitudinal direction of the channel.



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WIRE RETAINER FOR CONNECTING WIRES IN LOW-VOLTAGE CIRCUITS OF ELECTRICAL APPARATUS

ABSTRACT

A wire retaining for connecting wires in low-voltage circuits of electrical apparatus has a continuous channel (5), formed on a shaped part, for receiving the wires. The channel is designed for the passage through it over its length of a wire placement tool protruding through its lateral wire insertion opening and moving in the longitudinal direction of the wire; legs (3) laterally defining the channel, and/or wire hold-back means (7), are embodied as predominantly spring-elastically yielding to the tool passing through.

(Fig. 1)