Jan. 13, 1970 N. A. J. BRATTBERG 3,489,440

TIGHT LEAD-THROUGH INLET FRAME DEVICE

Original Filed March 9, 1964

FIG.1

PRIOR ART

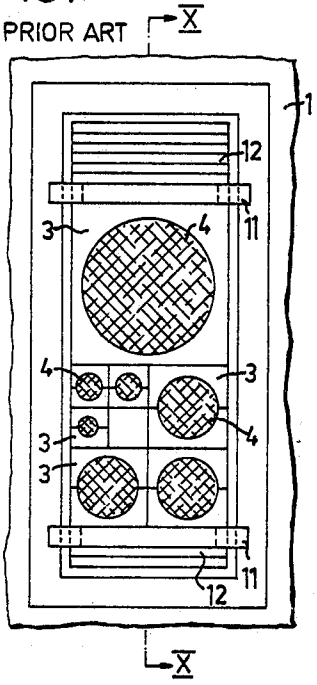


FIG.2

PRIOR ART

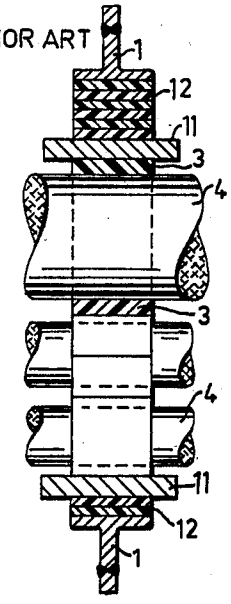


FIG.3

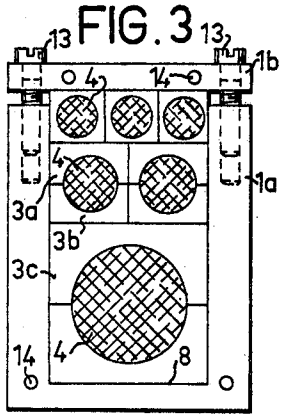


FIG.4

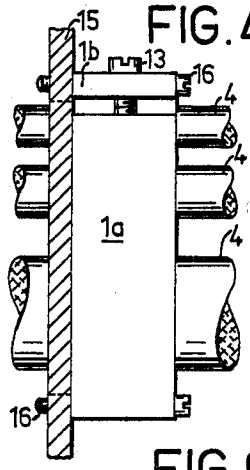


FIG.5

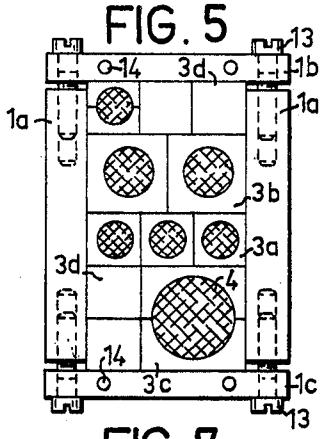


FIG.6

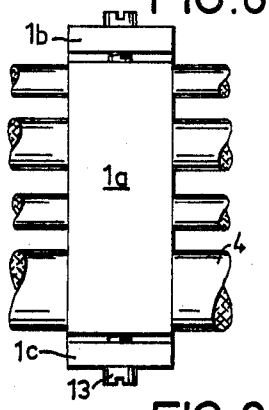


FIG.7

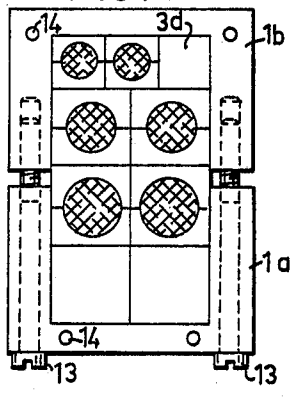
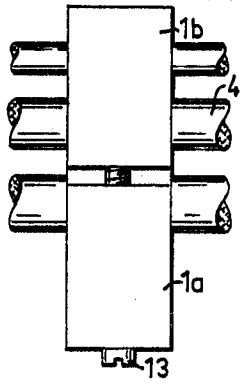


FIG.8



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TIGHT LEAD-THROUGH INLET FRAME DEVICE

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Int. Cl. F16l *39/00, 5/00*

U.S. Cl. 285—192 4 Claims

ABSTRACT OF THE DISCLOSURE

A lead-through inlet frame device is mounted around a plurality of electrical lines such as multi-core-cables, insulated wires, etc. secured in a rigid rectangular frame of the device by compressed resilient rubber blocks embracing each line such that the blocks and lines form a tight filling of the frame. The compression of this filling is obtained, and may be released, in that the frame is divided into at least two separate parts being mutually connected by screws extending in the plane of the frame and, thus, at right angles to the electrical lines. When tightening the screw, said filling is compressed between two opposite sides of the frame and the parts of the frame are pressed into mutual abutment so that the compression is limited and well-defined. The frame and/or the filling has a smooth plane surface area in the form of a plane rectangular frame, which surface may be sealingly pressed against a corresponding surface surrounding an aperture in a wall through which said lines pass. The frame is pressed against the wall by screws passing through or into the wall and frame and extending perpendicularly to the screws for compressing the filling of the frame. The rubber blocks are rectangular bodies provided with passages for the individual separate electrical lines and form a modular set to fill entirely said frame. When removing, adding or changing any of the lines, the compression screws are loosened to release the compression, preferably after having removed the device from the wall, and then any blocks and lines may be individually removed or changed. The device seals said wall in an airtight manner even under fairly high pressure. Also flexible and rigid tubes may extend through the device.

This application is a division from my application Ser. No. 350,313 filed Mar. 9, 1964 now United States Patent No. 3,282,544.

Lead-through inlet frame devices for electrical lines such as single or multiple core cables, flexible leads and insulated or even uninsulated conductors are normally made for one single line only so that the number of inlet frame devices required is equal to the number of lines to be passed through. Particularly, if a plurality of lines should be passed close to one another through a wall, considerable difficulties arise and render difficult mounting and demounting of the frame devices and the lines, for example when a line has to be added or replaced. Such difficulties may be avoided to a large extent by inlet frame devices of the type shown in FIGS. 1 and 2 disclosing prior art, see for instance U.S. Patent No. 2,732,226.

The known inlet frame device shown in FIGS. 1 and 2 forms prior art and comprises a metal frame **1**, two clamping pressure plates **11** therein which are movable in one and the same direction in the plane of the frame of the device, resilient clamping blocks **3** and resilient filling plates **12**. For each individual line, a pair of blocks **3** is provided, every block having a semi-circular (semi-cylindrical) recess adapted to the diameter of the line to be clamped. One pair of such blocks **3** normally has a

square cross-section or contour. Similar square or semi-square resilient blocks having no recess may be used as filling blocks within the area between the pressure plates **11**. The sides of all blocks **3** and **11** to be inserted into the inlet frame device may be dimensioned in accordance with a modular system as may be seen by way of example from FIG. 1. The inlet frame device may be made tight and the lines may be clamped between the associated blocks **3** by moving the two pressure plates **11** towards one another by means of an adjustable screw clamp or similar means. By this procedure, spaces occur between the plates **11** and the adjacent sides of the frame **1** so that such spaces have to be filled with the resilient filling plates **12**. Then, the pressure plates **11** are released so that a pressure equilibrium is obtained, and the pressure to which the blocks **3** and plates **12** are subjected in the direction of the centre line X—X will have an approximately uniform distribution so that all of said resilient elements are subjected to approximately one and the same unit pressure set up by their own resilience.

It is also known to use one pressure plate **11** only and to press this plate towards the blocks **3** by means of a screw which is approximately co-axial with the axis X—X and extends through a thread hole in one short side of the frame and engages the pressure plate. The spacing between the pressure plate and the associated short side of the frame has to be made tight by being filled with filling plates or bodies which, however, have to be pressed by separate special clamps or the like into tight contact with the walls of the spacing.

The above known contsructions as well as other similar constructions have disadvantages which are fairly troublesome in practice. A few only may be mentioned. In most cases practical difficulties arise with respect to the application of tools irrespective of whether a clamp is used for the system shown in FIGS. 1 and 2 or a screw spanner is used for a pressure screw extending in the direction of axis X—X. It should be noted that such clamping has to be carried out when the lines **4** extend through the inlet, and that the lines may be highly rigid and thick. The size and position of the area occupied by the resilient blocks and the lines is not predetermined and depends on the distance through which the pressure plate or plates **11** have been moved during the process of clamping. If the whole of the inlet has to form a constructive unit to be mounted upon a wall, it may be difficult to ensure a fully tight circumferential contact and a satisfying contact pressure engagement everywhere around the rectangular lead-through aperture of the wall, more particularly in view of the indefinite final position of the pressure plate. Such and other disadvantages are still more cumbersome if, later on, one of the lines **4** has to be replaced, for example because it has been damaged or because a line of greater or smaller cross-sectional area has to be used. In limited spaces such as in aircraft and ships, air or pressure tight apparatus boxes, switch boards, distribution boxes, enclosed switchgears etc. where a great number of lines being relatively rigidly lain and fixed pass through the lead-through inlet, said problems will prove difficult.

It is an object of the invention to eliminate a number of said disadvantages and to realise a compact resistant construction.

More specifically the general object of the invention is attained by an improved and more simplified construction for the lead-through by means of which it has been possible to eliminate the clamping pressure plates and the resilient filling plates required for the prior construction.

The improved construction for the lead-through comprises a rectangular frame divided perpendicularly into at least two parts and screws which extend through one of the parts and are threaded into and terminate in the other

part. The aperture within the frame is filled, and at least a part of this filling consists of a modular set of rectangular-section parallelepipedal blocks, four of whose plane faces are parallel to the four sides of the frame, these blocks being at least partially resilient and a plurality of which are divided centrally intermediate two of the plane parallel faces with mutually complementary semi-cylindrical recesses in the juxtaposed surfaces of each of the divided blocks for through-passage of an electrical line. The screws serve to press the frame parts into mutual abutment whereby the filling is compressed between two opposite parallel sides of the frame, the compression being limited by the abutment. The overall structure is provided with a substantially smooth plane surface and means for pressing it onto the wall in a sealing manner such that the surface surrounds all of the electrical lines passing through it and through the wall.

The foregoing as well as other objects and advantages inherent in the improved construction for the lead-through will become more apparent from the following detailed description of several embodiments thereof and from the accompanying drawings wherein:

FIGS. 1 and 2 show the known inlet frame device as seen in the direction of the lines and transversely thereto, respectively.

FIGS. 3 and 4 show an inlet frame device according to the invention as seen in the direction of the lines and transversely thereto, respectively.

FIGS. 5 and 6 show another inlet frame device in accordance with the invention in the same manner as in FIGS. 3 and 4.

FIGS. 7 and 8 show a third inlet frame device in accordance with the invention in the same manner as in FIGS. 3 and 4.

With reference now to the drawings, FIG. 3 is a view of a lead-through inlet frame device seen in the direction of the conductor lines **4** extending through the inlet frame device, and FIG. 4 is a side view of this inlet frame device which comprises a frame composed of a U-shaped portion **1***a* and a yoke **1***b* which can be fixed to the two free ends of part **1***a* by means of two preferably hexagonal screws **13**. The space or area enclosed by said frame forms the lead-through aperture or window of the frame device and is filled with resilient, rectangular parallelepipedic clamping blocks **3***a*, **3***b*, **3***c* of various sizes. The blocks are preferably made of synthetic rubber but may alternatively consist of resilient plastic material, natural rubber or another suitable material. The clamping blocks are arranged in pairs such that the four outer sides of each pair of blocks, such as **3***c*, forms a square and that each individual block has a semi-square form, that is, the cross-sectional side ratio of each single block is 2:1. Each of the two blocks of a pair has a semi-cylindrical recess (semi-circular in cross-section) such that the two recesses of the pair face one another and embrace an electrical line, such as a cable, having a diameter substantially equal to that of the two associated recesses embracing the conductor line. The sides of the blocks are dimensioned in accordance with a suitable modular system so that blocks adapted to conductor lines of different diameters can be joined such that the set of blocks to be provided in the above mentioned aperture of the frame forms a rectangle which approximately corresponds to the rectangular aperture but is larger than the aperture when the blocks are not compressed. Furthermore, semi-square or, preferably, square resilient blocks which have no recesses may be used to fill any empty areas of said rectangle which will not be used to contain electrical lines. For this object it is also possible to use rectangular filling blocks having a side ratio exceeding 2:1 but, nevertheless, in accordance with the modular system of the other blocks.

In the inlet frame device in FIGS. 3 and 4 the set of blocks comprises clamping blocks **3***a*, **3***b*, **3***c* of different sizes for conductor lines of different diameters, respectively, the non-compressed relaxed set of blocks covering an area slightly exceeding that of the frame aperture such that the set of blocks shown in the non-compressed state projects beyond the free ends of the U-shaped frame part **1***a*. In a direction parallel to the yoke **1***b* and of the bottom portion of the U-shaped part **1***a*, the width of the block set should not, however, considerably exceed the width of the frame aperture to avoid the necessity of forcing the blocks into the space between the legs of part **1***a* under appreciable compression of the blocks **3**. The thickest cable is embraced by the pair of blocks **3***c*, and the finest cables or leads are embraced each by a pair of blocks **3***a*. After having inserted the blocks and the lines therein into the frame **1***a*, **1***b* the compression screws **13** are tightened to press the yoke **1***b* towards and against the free ends of the two legs of the frame part **1***a* until the yoke is tightly abutting said ends or a gasket inserted between the yoke and said ends. Now, the inlet as a whole forms a constructional unit which is freely movable together with the lines passing therethrough and may be attached into or upon a wall which is provided with a lead-through aperture of similar size and form as the frame aperture limited by the frame parts **1***a* and **1***b*. In this compressed state, the inlet is impermeable to liquids and gases such as water and air which cannot pass through the inlet frame device in the direction of the electrical lines. Such inlet may readily be dimensioned such that it remains impervious even if the difference of the pressures on either side of the frame is considerable and say, of the order of many tens of lbs. (many atmospheres). Furthermore, it is not difficult to seal the joints existing between the inlet frame device and said wall so that liquid, or gas, cannot penetrate said joints, that is, cannot pass around the periphery of the frame to the other side of it.

The frame **1***a*, **1***b* or, if necessary, flanges, projections or eyelets etc. extending from the frame, may be provided with holes or bores **14** extending in the lead-through direction (direction of the electrical lines) so that the frame may be pressed and fixed to a wall **15** by screws **16** passing through the holes **14**, the wall **15** and screws **16** being omitted in FIG. 3. As the final position of the yoke **1***b*, that is the position of the yoke when screwed tightly to the ends of the legs of part **1***a*, is definitely predetermined and unvariable, it is a simple measure to use a rectangular, frame-shaped plane packing or gasket of rubber or of any well-known sealing material between the frame **1***a*, **1***b* of the inlet frame device and the wall. The inner and outer peripheries of such seal may approximately coincide with those of the frame **1***a*, **1***b*. Sealing of the frame against or within a wall may be carried out in another manner. Thus, the block set itself may be used as a sealing means if all blocks at least slightly extend beyond the frame in the lead-through direction thereof with co-planar end surfaces of the blocks and if the aperture of the wall is slightly smaller than that of the frame. In such a case the four edge zones of the periphery of the block set may be pressed directly, for example by screws, against the edge zones of the aperture of the wall, and it is possible to use the same screws **13** for such sealing as for attaching the lead-through inlet frame device to the wall.

The two legs of the frame part **1***a*, and if desired also the yoke or the bottom portion of this part, may be provided with set means such as guiding recesses for the elastic blocks so that two or three or all of the four edges (or pairs of edges) of the set of blocks are located in such recesses. Normally it is simpler and better, however, to use projecting flanges instead of guide recesses, for example such that the set of blocks as a whole cannot be displaced in the frame in the direction away from the wall but, if the set is not compressed, can be displaced towards the wall.

FIGS. 5 and 6 show a similar inlet frame device as FIGS. 3 and 4, respectively, with the exception that the frame is constituted by two parallel yokes **1***b* and **1***c* and two spaced separate legs **1***a*. The legs may be rigidly

interconnected. One of the yokes, e.g. 1*c*, may be unvariably fixed to the legs 1*a* by screws so that the inlet frame device can be used in the same way as that described above and shown in FIGS. 3 and 4. If the set of blocks in its decompressed state extends in the direction of the legs 1*a* considerably beyond the ends of the legs, there is the danger that those blocks which are not guided by the legs will tend to expand laterally, when the set is compressed by the yoke 1*b* so that the lateral sides of the blocks will be clamped between the yoke 1*b* and the free ends of the legs 1*a* because the spacing or gap between yoke 1*b* and said ends is too large. In such case, both of the yokes 1*b* and 1*c* may be released from the legs so that the width of the gap between each yoke and the associated leg end is halved. The use of two yokes has also the advantage that it is not necessary to produce a U-shaped frame part and that the length (height) of the set of blocks in the direction between the yokes may be chosen much greater than if one movable yoke is used.

It is possible to select types of plastic or rubber material such as certain neoprene rubber types, which during compression do not appreciably expand in a direction perpendicular to the direction of pressure.

Besides as may be seen from FIG. 5 lead-through areas may exist which are not required at all or which are provided as spare areas and, therefore, are filled with preferably square elastic blocks 3*d* not embracing an electrical line. All remaining elements of the inlet frame device shown in FIG. 5 may be similar to the corresponding elements in FIGS. 3 and 4 and may serve the same purpose.

FIGS. 7 and 8 show a further lead-through inlet frame device differing from those described above substantially in that the frame is constituted by two U-shaped parts 1*a*, 1*b* the free ends of which oppose one another and may be pressed against one another by pressure screws 13. The frame parts are shown without other guides and set means than the screws 13. It is possible, of course, to provide guides of any type such as set pins, engaging longitudinal portions of the frame parts etc. ensuring that these two parts always remain aligned during and after compression of the set of blocks surrounded by the frame.

What I claim is:

1. A device for mounting around a plurality of electrical lines to support said lines in a pass-through opening in a wall which comprises an assembly of a frame having a rectangular opening, said frame being divided perpendicularly to the plane of the frame into at least two parts connected together in abutting relation by screw means extending through at least one of said frame parts and being threaded into and terminating within another of said frame parts, and a modular set of rectangular-section parallelepipedal filler blocks made from a resilient material filling said frame opening, four of the plane faces of said filler blocks being parallel to the four sides of the frame forming the opening therein, at least some of said blocks being divided centrally intermediate two of said plane parallel faces with mutually complementary semi-cylindrical recesses in the juxtaposed surfaces of each of said divided blocks for through passage of an electrical line, the sum of the areas of said resilient filler blocks when in an uncompressed state prior to tightening of said screw means to draw said frame parts together in abutting relation exceeding the area of the final frame opening whereby said filler blocks become compressed against each other and against all four sides of the frame opening as said screws are tightened, said assembly of frame and filler blocks being provided with a substantially smooth plane surface so as to establish a sealing contact with the surface of the wall surrounding said opening therein, and said parts constituting said frame being provided with openings extending therethrough perpendicular to the plane of said frame for receiving means by which said assembly is fastened in place at said wall opening.

2. The device as defined in claim 1 wherein said frame is constituted by two parts connected together by said screws, one of said parts having a U-shaped configuration which forms three of the four sides of said rectangular frame opening and the other part being in the form of an end yoke which forms the remaining side of said frame opening, said end yoke being provided with unthreaded holes through which said screws pass and the end faces of the legs of said U-shaped part being provided with threaded bores for receiving said screws.

3. The device as defined in claim 1 wherein said frame is constituted by a pair of parallel spaced side members and a pair of end yokes, said end yokes being provided with unthreaded holes through which said screws pass and the end faces at the opposite ends of said side members being provided with threaded bores for receiving said screws.

4. The device as defined in claim 1 wherein said frame is constituted by a pair of U-shaped frame members which are arranged with their openings in confronting relation, and said screws extend through unthreaded bores in one of said U-shaped frame members into threaded bores in the other U-shaped frame member.

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U.S. Cl. X.R.

248—56