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Kaiser et al.

[11] **3,923,161**

[45] **Dec. 2, 1975**

[54] **SYSTEM OF STRUCTURAL COMPONENTS FOR THE CONSTRUCTION OF SHELFLIKE STRUCTURES IN FRAME RACKS**

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[21] Appl. No.: **493,905**

[30] **Foreign Application Priority Data**

Aug. 24, 1973 Germany 2342866

[52] **U.S. Cl.** **211/117**; 211/176

[51] **Int. Cl.²** **A47F 5/10**

[58] **Field of Search** 211/176, 177, 162, 117, 211/118, 113, 148; 108/109, 111, 64; 24/217, 108

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Primary Examiner—Ramon S. Britts

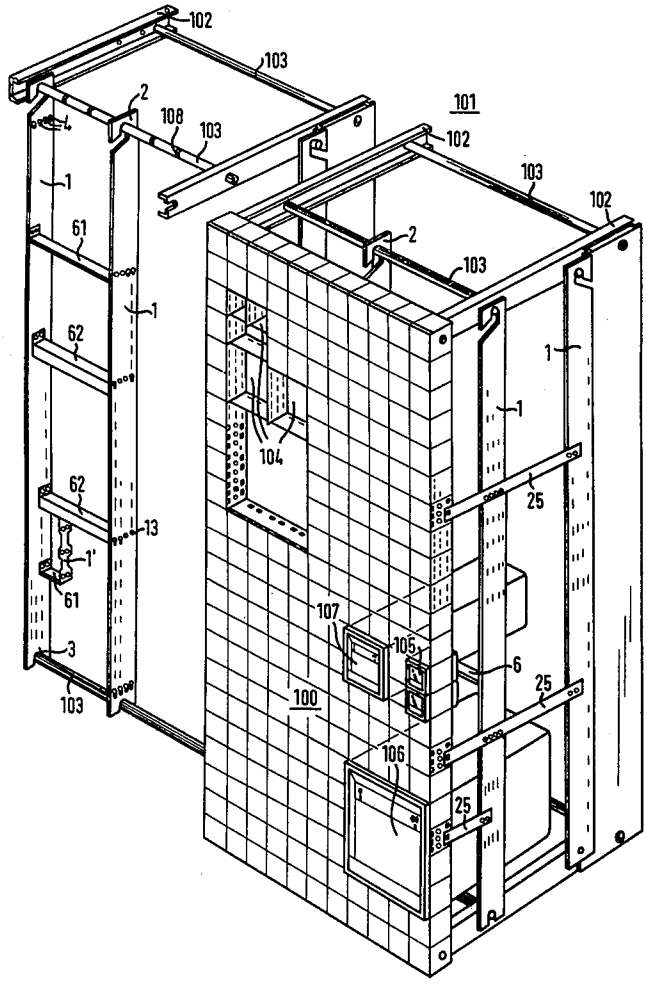
Attorney, Agent, or Firm—Kenyon & Kenyon Reilly Carr & Chapin

[57] **ABSTRACT**

A system of structural components for the construction of shelflike structure in frame racks in which the principal structural components are vertically arranged suspension rails supporting horizontal rails and buttonlike connecting elements joining the suspension and supporting rails without tools.

The system of structural components can be used generally for the construction of shelves, but in particular for the erection of supporting structures behind switchboards in mosaic technology.

10 Claims, 17 Drawing Figures



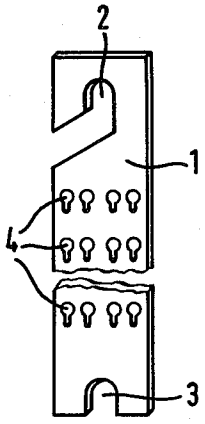


Fig. 1

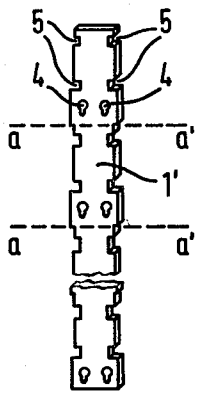


Fig. 2

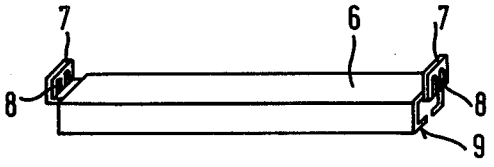


Fig. 3

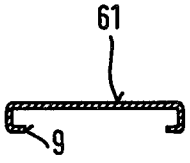


Fig. 4

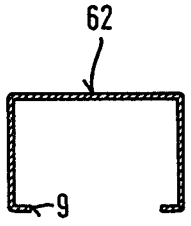


Fig. 5

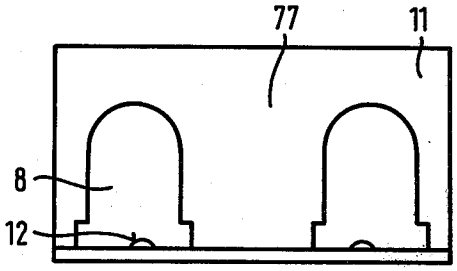


Fig. 6

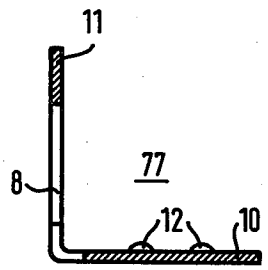


Fig. 7

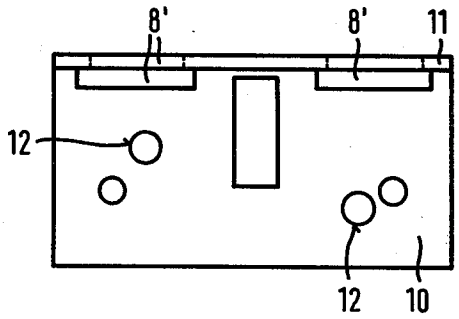


Fig. 8

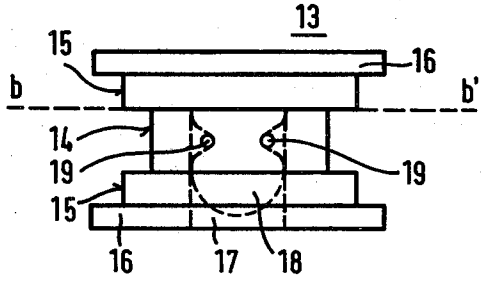


Fig. 9

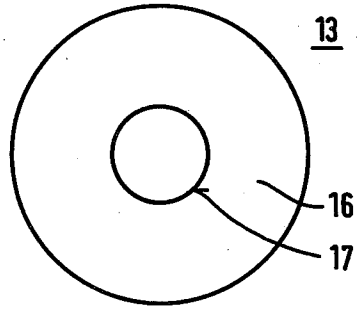


Fig. 10

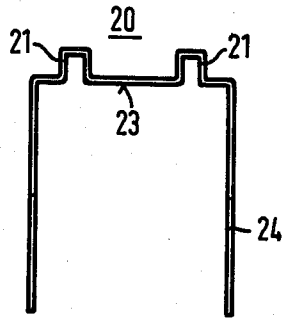


Fig. 11

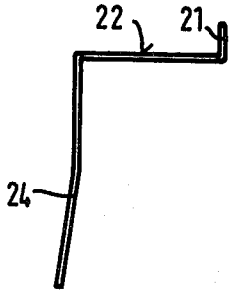


Fig. 12

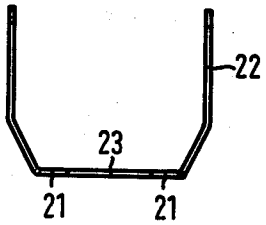


Fig. 13

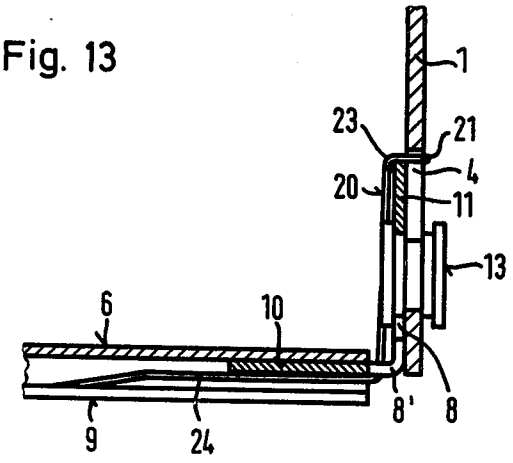


Fig. 14

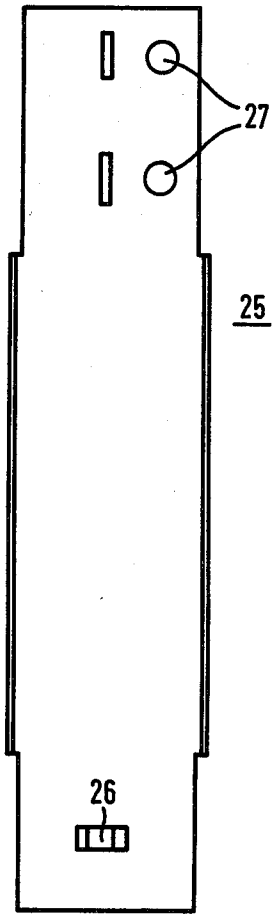
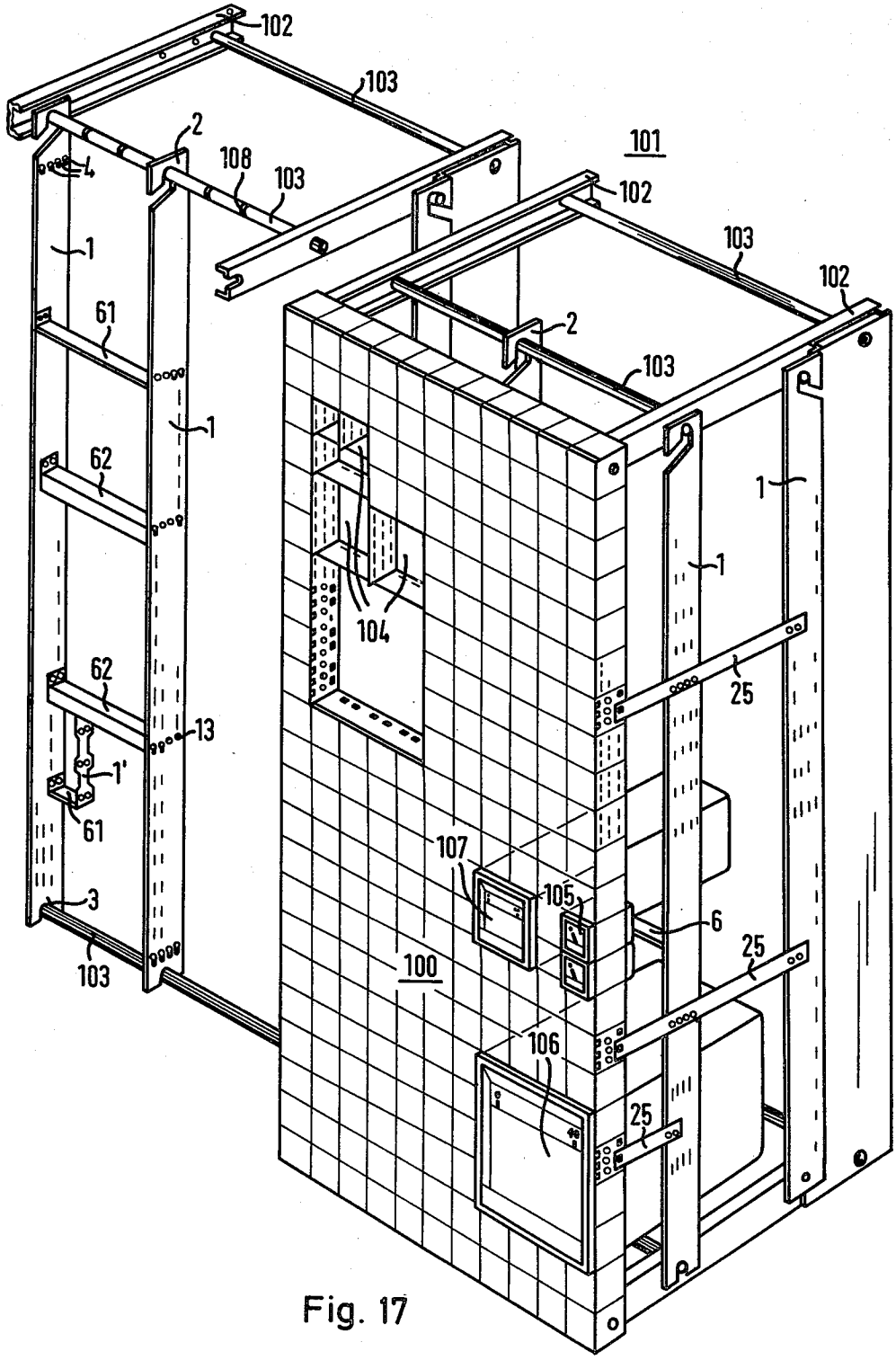


Fig. 15

Fig. 16


102
103
2
108
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101
102
103
102
1
61
2
103
1
62
1
1
104
62
25
13
1'
61
107
105
6
3
103
100
25
106
25

Fig. 17

SYSTEM OF STRUCTURAL COMPONENTS FOR THE CONSTRUCTION OF SHELFLIKE STRUCTURES IN FRAME RACKS

BACKGROUND OF THE INVENTION

This invention relates to structural components in general, and more particularly to an improved system of structural components for constructing shelves or the like.

Shelflike structures are frequently needed in engineering applications for the accomodation of instruments such as measuring and operating devices. Usually, lengths of structural sections are assembled for this purpose to form frame racks and are provided with means for solidly holding these devices in place. Such a construction results in a relatively large amount of labor in joining the individual parts to each other, using screws, welding or other well known fastening methods requiring tools.

The same is true with respect to switchboards or control cabinets in which a multiplicity of indicating, measuring and operating devices is to be accommodated. Particularly in switchboard construction where the front of the board consists of individual elements fitted together in mosaic fashion, such as that disclosed in the German Offenlegungsschrift No. **2,237,831**, a shelflike supporting structure is needed for heavy devices and/or for devices projecting far to the rear. These latter cannot be mounted safely enough because the front panel is not completely mechanically rigid.

Sometimes it is also necessary to mount in or behind a switchboard, units which cannot be mounted in the modular grid of the front panel because of their shape or design.

In view of these various problems, it is an object of the invention to create a system of structural components for the erection of shelflike structures, which system can be used quite generally and which allows the assembly of the individual structural components at the installation site in the simplest possible manner and without the aid of tools.

SUMMARY OF THE INVENTION

These requirements are met by the system of structural components according to the present invention which is herein described as specifically applied to the construction of supporting structures for switchboards (or control panel) instruments or devices.

However, it is also quite feasible to use the system of structural components of the present invention for the erection of shelflike structures for storage purposes or the like.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** shows a first type of vertical suspension rail according to the present invention.

FIG. **2** shows a second type of vertical suspension rail.

FIG. **3** shows a horizontal supporting rail.

FIG. **4** is a cross sectional view of one embodiment of the supporting rail of FIG. **3**.

FIG. **5** is a cross sectional view of another embodiment of the supporting rail of FIG. **3**.

FIGS. **6, 7** and **8** are respectively elevation, plan and cross sectional views of angle pieces used with the supporting rails.

FIGS. **9** and **10** are respectively plan and elevation views of a buttonlike connecting element according to the present invention.

FIGS. **11, 12** and **13** are views of a locking spring.

FIG. **14** is a cross sectional view illustrating the connection between a supporting rail and a suspension rail by means of the angle piece and the buttonlike connecting elements.

FIGS. **15** and **16** are respectively plan and elevation views of brackets to brace the support structure to the switchboard.

FIG. **17** is a perspective view of a switchboard in modularg grid form with a support structure behind it.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

FIG. **1** illustrates a first type of suspension rail **1**, made out of flat strip. Its upper end **2** is shaped so as to form a hook and its lower end provided with a cutout **3**, the purpose of which will be described below in connection with FIG. **17**.

The suspension rail **1** of this first type has rows of openings **4** in the shape of keyholes parallel to its short side arranged, in the illustrated embodiment, in groups of four spaced equal distances apart.

FIG. **2** shows a suspension rail **1'** of a second type, also made out of flat strip, but only about half as wide as the suspension rail **1** of the first type. Its upper end is provided with rectangular recesses **5** which are opposite each other in pairs and extend perpendicularly inward from the long edges. At the lower end of the suspension rail **1'** two openings **4** in the shape of keyholes are provided, in a row. As may be seen from the figure the above-described arrangement of recesses **5** and keyhole-shaped openings **4** repeats over the entire length of the suspension rail **1'**. The latter may be cut off as required along dashed cutoff lines *a—a'*.

FIG. **3** shows a horizontal supporting rail **6** and consists of U-channel material with the long edges bent inward. Its ends are provided with angular extensions **7** bent at right angles to load carrying surfaces. Each of the angular extensions **7** have two cutouts **8** which extend from the corner formed by the angle into the perpendicular leg and into which the buttonlike connecting elements **13** (see FIGS. **9, 14**) can be hung which are captively mounted in the keyhole-shaped openings **4** of the suspension rails **1** or **1'**.

In order to be prepared for different types of loads, the system of structural components includes two types of supporting rails **6**. The supporting rails **61** of a first type are shown in cross section in FIG. **4**. The height of the legs of the U-channel is small relative to the width of the rail. In the supporting rail **62** of the second type which is intended for heavy loads or wide spans, and whose profile is shown in FIG. **5**, the height of the legs of the U-channel approximately matches the width of the rail.

The suspension rails **1'** of the second type (see FIG. **2**) can be hung by means of the recesses **5** into the inward-bent edges **9** of the supporting rails **6**.

The upper opposing pair of recesses **5** of FIG. **2** are for supporting a rail **61** of the first type and the pair below that for supporting a rail **62** of the second type. The spacing between the two pairs of recesses in the suspension rail **1'** of the second type corresponds approximately to the leg height of the U-channel of the supporting rail **62** of the second type.

To be able to produce the supporting rails in a simple manner in various lengths from commercially available sections the angular extensions 7 of FIG. 3 are preferably designed as separate angle pieces 77, as shown in three views in FIGS. 6, 7 and 8.

The angle piece 77 is made out of flat strip material which is stamped and bent to have two legs 10 and 11 of approximately equal length. The leg 10 is inserted into the open end of the U-channel of a supporting rail 6 and spot welded to it. The impressed welding dimples 12 are provided for this purpose.

The cutouts 8 mentioned above in connection with FIG. 3 and which extend, from the corner formed by the bend of the angle piece 77, into the leg, and the shape of which can be seen from FIGS. 6 and 8 are provided in the leg 11. A short part 8' of the cutouts 8 also extends into the leg 10.

The buttonlike connecting element 13 is shown in FIGS. 9 and 10 in two views. It has a cylindrical part 14, the diameter of which is slightly smaller than the inside dimension of the narrow part of the keyhole-shaped openings 4 in the suspension rails 1 or 1'. Adjacent to the center part 14 in mirror image in axial direction are the two cylindrical parts 15, the diameter of which is larger than that of the center part 14 and which corresponds approximately to the inside dimension of the cutouts 8 in the angular extensions 7 or angle pieces 77. Terminating both ends are end flanges 16, the diameter of which is slightly larger than that of the wide part of the keyhole-shaped openings 4.

By slightly tilting the connecting elements 13 they can be "buttoned" into the keyhole-shaped openings 4 where they are captively retained by their end sections in the downward-oriented narrow parts of the keyhole-shaped openings 4. The dimensions of the extensions 8' of the cutouts 8 in the angle pieces 77, which extensions reach into the legs 10, are such that they can be hung from above into an outer part 15 of the connecting elements 13 over the latter's end flanges 16.

If it is necessary to provide round fastening holes, such as in the brackets according to FIGS. 15 and 16, the buttonlike connecting elements 13 may be made of two parts, for example, by making them come apart in a plane *b—b'* perpendicular to the centerline and providing a screw or snap-in connection in a center hole 17 to assemble the two parts. FIG. 9 outlines diagrammatically such a snap-in connection designed using the well known snap fastener principle. The central, spherical extension 18 of the upper part of the element 13 can be seen and is guided in the center hole 17 of the lower part of the element 13 and retained by means of two spring pins 19 driven into the center part 14 parallel to each other and transverse to the centerline.

As an additional safety feature of the system there may be provided a locking spring 20 as shown in FIGS. 11, 12 and 13. It consists of spring wire in U-shape, with right-angle bends up from the U-plane (see FIGS. 11 and 12). The legs 24 of the locking spring 20 continue as the parts 22, bent at right angles and meeting in the center part 23 after two bends 21 outward and forward in a plane parallel to the legs 24.

FIG. 14 illustrates, in cross section, a connection between a supporting rail 6 and a suspension rail 1. In it can be seen the leg 10 of the angle piece 77 welded to the end of the supporting rail 6, and the vertical leg 11 with one of the cutouts 8 with extension 8'. As already described, the buttonlike connecting element 13 is mounted in the keyhole-shaped opening 4 of the suspension rail 1. The cutout 8, 8' in the leg 11 of the angle piece of the supporting rail 6 is hung into the connecting element 13. The leg 24 of the locking spring 20 lies behind the inwardly bent long edge 9 of the supporting rail 6 with one of its projections 21 engaging, across the upper edge of leg 11, the upper part of the keyhole-shaped opening 4, against whose edge it rests. This effectively prevents any unintentional upwards motion of the supporting rail 6 which would result in the loosening of the connection. For the removal of the spring lock, the spring 20 is gripped in its center part 23 and pulled back so that the projections 21 disengage. The supporting rail 6 can then be unhooked from the connecting element 13.

Since it may sometimes be necessary to brace the switchboard panel to the shelflike supporting structure, brackets 25 of different lengths are provided which, as shown in FIGS. 15 and 16, are equipped at one end with pie-ced tabs 26 for haning into corresponding openings in the bar or angle elements of the switchboard panel, and with holes 27 for connection with the suspension rails 1 or 1' by means of the two-piece, buttonlike connecting elements 13.

In FIG. 17 is illustrated the construction of a switchboard in modular grid form with a supporting structure according to the present invention behind it. The switchboard panel 100, assembled in mosaic fashion from the basic elements according to the aforementioned German Offenlegungsschrift, is mounted to a frame rack 101 which consists essentially of angle frames 102, arranged perpendicular to the plane of the switchboard panel and interconnected through spacers in the form of tubular rods 103 extending parallel to the upper and lower edges of the switchboard 100. Compartments 104 of different modular sizes are left free in the mosaic switchboard 100 for the accommodation of measuring and operating devices such as devices 105, 106, and 107. While the relatively small measuring instruments 105 extend beyond the compartment depth of the switchboard structure only a small amount and require no further support, the relatively heavy instruments 106 and 107 such as recording instruments, project to the rear a distance which is a number of times compartment depth of the switchboard 100, thus making the safe mounting and fastening of the instruments in the non-rigid switchboard 100 questionable.

It is for this reason that a support structure is provided which can be constructed in a plane parallel to and behind the switchboard 100 from the components already described. The suspension rails 1 of the first type disclosed above are shown with their upper hook shaped ends 2 hung into the rods 103 running parallel to the upper edge of the switchboard 100. In order to facilitate spacing to match the modular grid size, the rods 103 have circular grooves or notches 108 into which the hook shaped ends 2 of the suspension rails 1 drop. In order to make sure that the suspension rails 1 are plump, their recesses 3 (see FIG. 1) located at their lower ends are guided along the rods 103 of the frame rack 101 running parallel to the lower edge of the switchboardboard 100. The vertically arranged suspension rails 1 of the first type can have fastened thereto the supporting rails 6 either of the type 61 of FIG. 4 or 62 of FIG. 5 as illustrated. Dividing the rows of keyhole-shaped openings 4 in the suspension rails 1 of the first type into groups of four permits mounting

the supporting rails **6** equipped with the two cutouts **8** in the angular extensions **7** in three different positions in the horizontal plane.

For example, a supporting rail **61** may be fastened in the first two keyhole-shaped openings **4** of a row, as shown in the left-hand part of FIG. **17.** The supporting rail **62** below it is fastened in the second and third openings of the rows, and the lowest supporting rail **62** in the last two openings **4** of a row. The suspension rails **1'** of the second type may be used to divide the sections formed by two adjacent suspension rails **1** of the first type. Rails **1'** have their upper ends suspended from the supporting rails **6, 61** or **62** in the manner described above. Their lower ends which are equipped with the keyhole-shaped openings **4** in groups of two, are connected to shorter supporting rails **61** having their other ends fastened to a suspension rail **1** of the first type. Therefore, the number of combinations in which suspension rails and supporting rails, prepared in lengths to fit the modular grid scale, can be assembled is quite large.

As described above, the button-like connecting elements **13** or hanging techniques are used to attach the parts to each other. No tools whatever are required for assembly. On the right hand side of the switchboard assembly of FIG. **17,** the braces **25** of FIGS. **15** and **16** are shown. The tongues at their front ends engage, as already described, openings in the angle and bar elements forming the switchboard, while their other end is connected to the suspension rails **1** by means of appropriate cutouts.

Thus, an improved system of structural components particularly useful in a switchboard arrangement has been shown. Although specific embodiments have been illustrated and described, it will be obvious to those skilled in the art, that various modifications may be made without departing from the spirit of the invention which is intended to be limited solely by the appended claims.

What is claimed:

1. A system of structural components for the construction of shelf-like structures in a frame rack which includes a rod disposed parallel to the upper edge of the frame rack and a rod running parallel to the lower edge of the frame rack, including structural components which can be arranged vertically and horizontally in the frame rack and can be assembled without the aid of tools, the essential structural components comprising:

a. vertical suspension rails provided with rows of keyhole shaped openings parallel to their short side and including suspension rails of a first type having an upper end designed in a hook shape for hooking on to the rod disposed parallel to the upper edge of the frame rack and having a recess in the lower edge for guidance along a rod running parallel to the lower edge of the frame rack; and

b. horizontal supporting rails of a U-profile with the lateral edges of their legs bent inward essentially parallel to their base and including upwardly extending angular extensions at their ends having at least two cutouts in the portion perpendicular to their load carrying surface; and

c. button like-connecting elements mounted captively in the keyhole shaped openings in the suspension rails into which the cutouts of the angular extension of the supporting rails can be hung.

2. The system of structural components according to claim **1** wherein said suspension rails of a first type have four evenly spaced, keyhole-shaped openings in each row of keyholes.

3. The system of structural components according to claim **1** wherein said suspension rails include suspension rails of a second type having rectangular recesses opposing each other in pairs in the long edges at their upper end for hanging into the U-profile of said supporting rails and having at least two keyhole-shaped openings disposed in one row at their lower end.

4. The system of structural components according to claim **1** wherein said supporting rails include supporting rails of a first kind having a leg height which is short relative to the rail width.

5. The system of structural components according to claim **1,** wherein said supporting rails include supporting rails of a second type having a leg height which approximately matches the rail width.

6. The system of structural components according to claim **1** wherein the angular extensions of said supporting rails are formed of angle pieces having one leg welded to the ends of the supporting rails which are cut off from an extruded section, and another leg provided with the two cutouts extending from the corner formed by the bend of the angle piece.

7. The system of structural components according to claim **1** and further including locking springs having legs which can be anchored inside the U-profile of said supporting rails and two projections of which engage the upper part of the keyhole-shaped openings in the suspension rails across the upper edge of the angular extensions.

8. The system of structural components according to claim **1** wherein the inside diameter of said cutouts is greater than the narrow part of said keyhole openings and said button like connecting elements are formed of a cylindrical center part having a diameter corresponding to the inside dimensions of the narrow part of said keyhole-shape openings, cylindrical outer parts, adjoining the center part in mirror-image fashion and having a diameter corresponding to the inside dimension of said cutouts in the angular extension of the supporting rails and adjacent end flanges whose diameter is slightly larger than that of the wide part of said keyhole shaped openings.

9. The system of structural components according to claim **8,** wherein said buttonlike connecting elements comprise two parts separable in a plane perpendicular to the centerline and held together by connecting means.

10. The system of structural components according to claim **1** and further including bar-shaped braces having placed tongues for hooking into openings in the angle or bar elements of a frame rack and having holes for connection to said suspension rails using said buttonlike connecting elements.

* * * * *