Feb. 27, 1940. A. J. WIER 2,191,637

FRAME SUPPORT

Filed April 22, 1938 2 Sheets-Sheet 1

FIG. 1

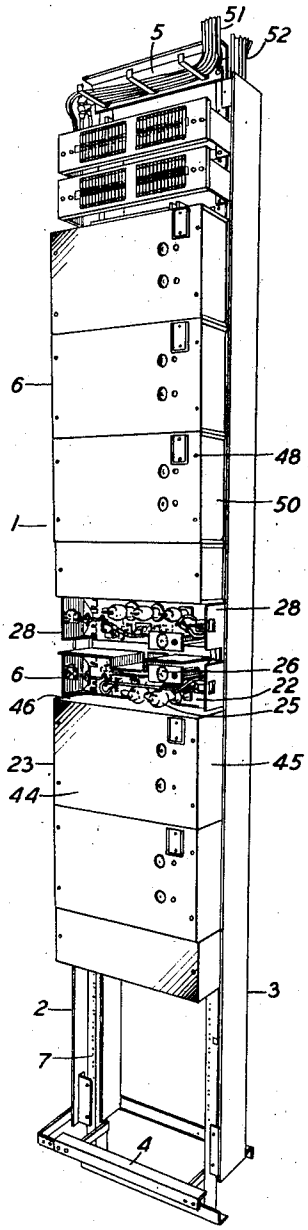


FIG. 2

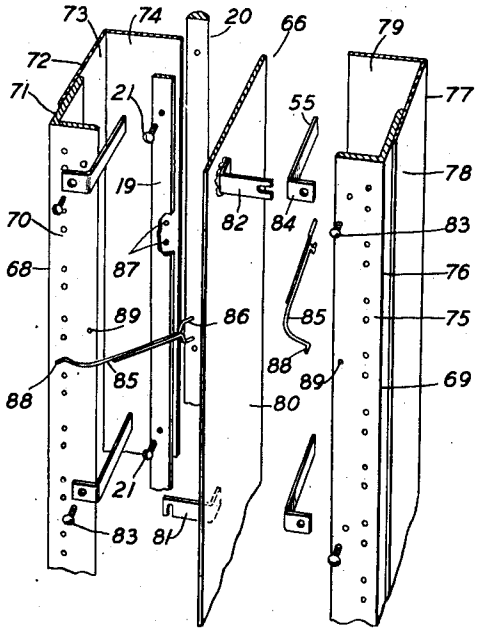
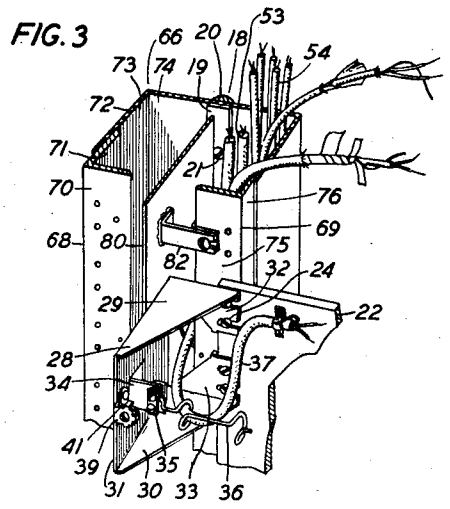


FIG. 3



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FRAME SUPPORT

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FIG. 4

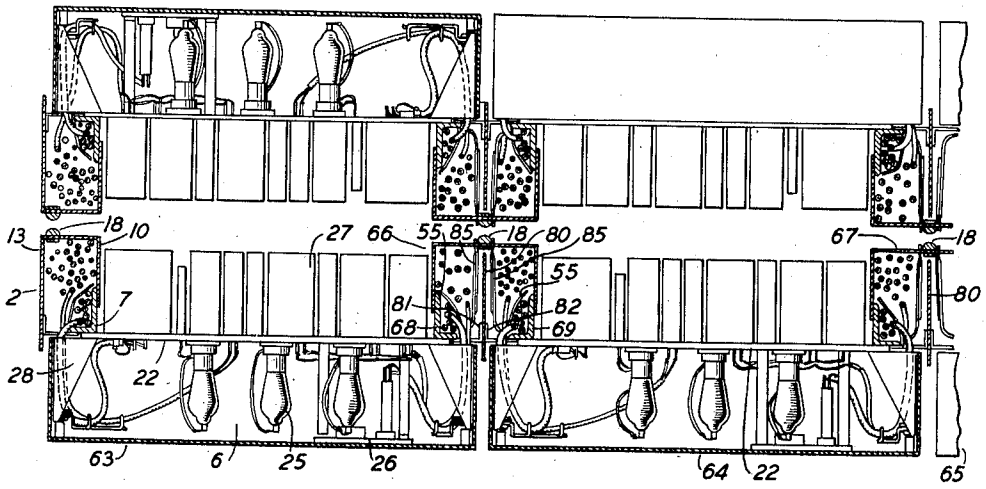
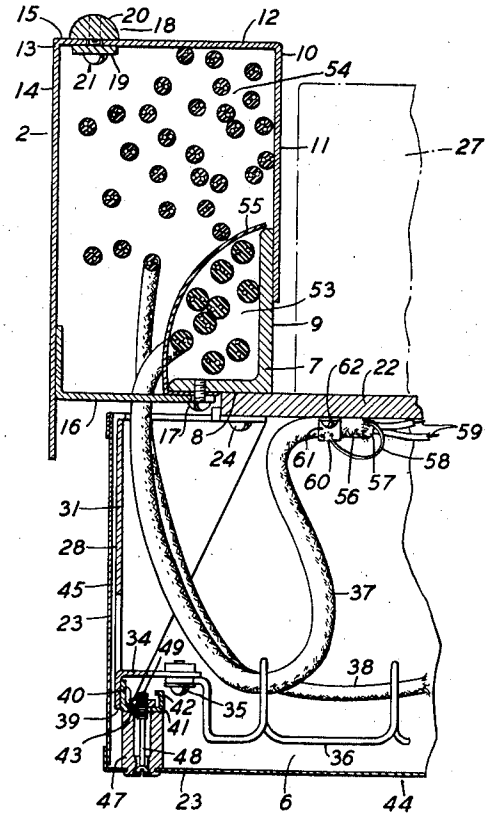


FIG. 5



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2,191,637

FRAME SUPPORT

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Application April 22, 1938, Serial No. 203,531

4 Claims. (Cl. 175—307)

This invention relates to supports for electrical apparatus and more particularly to a frame type support for such apparatus.

The object of the invention is to provide a supporting structure for electrical apparatus parts which will require a minimum amount of floor space, which will support wires and other electrical apparatus parts in required positions and so that there will be no electrical interference between closely associated apparatus parts and which will facilitate the running of wires to the various electrical apparatus parts and maintenance of the apparatus.

A feature of the invention resides in supports for supporting panels of electrical apparatus.

Another feature resides in an electrical shield associated with said supports.

Still other features reside in means for maintaining wires running within the supports separated into required groups and in particular arrangements of apparatus parts all of which features will be subsequently pointed out in the specification.

In the drawings:

Fig. 1 is a view in perspective of a single frame support for apparatus parts and embodying certain features of the invention;

Fig. 2 is a view in perspective of a portion of a post structure which forms part of the support for the apparatus. The post structure is shown in exploded form to more clearly reveal details in the structure. This post structure is used in a multiple frame support;

Fig. 3 is a view in perspective of the post structure shown in Fig. 2 assembled and with portions of apparatus supported on the post and with conductor wires supported within the post;

Fig. 4 is a top plan view, partly in section, of two multiple frame structures arranged back to back; and

Fig. 5 is an enlarged view of a portion of the lower left portion of the structure shown in Fig. 4.

The invention provides a supporting structure for electrical apparatus parts such as are used for instance in terminal stations of carrier telephone systems. In such systems it is common practice to arrange required electrical apparatus parts in groups and to support each group on a separate panel. The panels are supported on a frame comprising spaced upright members. Conductor wires are led to and from the panels and from one panel to another to provide required electrical connections between the apparatus parts supported on the panels and so electrically connect the apparatus parts into the system in the manner required. The conductor wires are usually led up or down the frame to the various panels.

Since a large number of wires is required to provide the necessary conducting leads, it has been common practice to bind adjacently running wires together with cord to form in effect a cable, the wires being fanned out from this cable arrangement as required to meet the various panels. The binding of the wires together is commonly known as sewing and considerable time is required in sewing the wires together. Since the wires are sewed together and form, in effect, a bundle of wires it is difficult to find a required wire in a bundle when it becomes necessary to make changes or repairs. The sewed wire arrangement has been justified, however, to prevent the existence at the back of a frame of a mass of loose wiring.

In this invention due to the particular structure and arrangement of the support, the sewing of the wires is not required. The invention, therefore, provides for this reason economies in cost of production and maintenance.

It is well known that when wires are closely associated one with another in the form of a bundle, certain inductance and capacitance effects are often found present which interfere with or prevent the proper functioning of the system with which the wires form a part. Care has been required therefore in the grouping and bundling together of the wires.

In this invention, means are provided in the structure to minimize the inductance and capacitance effects between rather closely associated wires.

It has been common practice in the mounting of apparatus parts on a panel to rather indiscriminately mount apparatus parts requiring frequent replacement and other parts requiring practically no replacement on the same side of a panel and to have the necessary wiring interconnecting the apparatus parts located on the other side of the panel, the apparatus parts mounted on the one side of the panel having terminals projecting through the panel to the other side (the wiring side). Panels supporting the apparatus parts and the interconnecting wiring are supported in a suitable frame structure. Cables leading to and from the panels are run up or down the back of the frame and are fanned out across the back of the panel. For instance, in the arrangement above mentioned, the apparatus parts are mounted on the front of a panel and the terminals for the parts and the wiring are disposed on the back of the panel, the panel

being supported on a frame. This arrangement makes it necessary to have access to both sides of the frame in order that parts requiring replacement may be replaced. For instance, it has been common practice to mount vacuum tubes and fixed resistances and condensers on the front of a panel and to have the terminals therefor and the necessary connecting wires located on the rear of the panel. In such arrangements in order to replace a burned out tube or other apparatus part that has become worn out or defective, it becomes necessary to go to the front of the support to get at the part requiring replacement and also to go to the rear of the support to get at the wiring. Since in order to make required replacements of apparatus parts it is necessary to have access to both the front and the rear of the supporting structure, aisles have been provided between frame structures. The aisles between the frame structures are to a certain extent lost space since the space is only required in making replacements of apparatus parts.

In this invention all apparatus parts requiring replacement from time to time are supported on the front of the panel, apparatus parts not requiring replacement from time to time but having a relatively long life are supported on the back of the panel and all terminals for the parts and all interconnecting wires between the parts are located on the front of the panel. The cables leading to and from the panels are led to and from the front of the panel. The frame, therefore, may be placed with its back portion against a wall or in back to back relation with another frame. This arrangement makes it unnecessary to provide an aisle space at the back of a frame or between the back portions of two frames. A considerable amount of floor space is therefore saved when the apparatus and supporting frames are arranged in the manner outlined in this invention.

The particular arrangement of the parts on each panel permits the location of wires between associated apparatus parts to be run on the same side of the panel as is occupied by the vacuum tubes. The heat generated by the vacuum tubes is utilized to maintain a dry atmosphere in the vicinity of the wiring between the parts supported on the panel.

To further describe and point out in detail the novel features above mentioned, reference will now be had to the drawings.

The structure shown in Fig. 1 is a single frame 1 comprising spaced upright posts 2 and 3 held in spaced relation by means of a foot-rail structure 4 and a top cross-bar 5. Panels indicated by a general number 6 and supporting various electrical apparatus parts are supported on the posts 2 and 3, the panels 6 extending transversely between the posts and being located one above another. The structure of the panels 6 and related parts and the general arrangement of the electrical apparatus parts thereon will be subsequently described.

The posts 2 and 3 are identical in structure and comprise as shown in Fig. 5 an upright angle-bar 7 extending substantially the full length of the frame 1. The angle-bar 7 has a front wall portion 8 and a rearwardly extending side wall portion 9. Secured to the side wall 9 and extending rearwardly thereof is a wall member 10. The wall member 10 is L-shaped in cross-section and comprises a side wall portion 11 and a rear wall portion 12, the wall portion 12 extending parallel with the front wall portion 8 of the angle-bar 7. A wall member 13 is set in spaced relation with the wall member 10. The wall member 13 has a side wall portion 14 extending parallel with the side wall 11 of the wall member 10 and the side wall 9 of the angle-bar 7 and has an inwardly turned edge portion 15 extending into alignment with the rear wall portion 12 of the wall member 10. The side wall portion 14 of the wall member 13 extends forwardly beyond the plane of the front wall portion 8 of the angle-bar 7. Angle brackets 16 are secured at spaced points to the inner surface of the forwardly extending portion of the wall portion 14 of the wall member 13. The angle brackets 16 extend inwardly from the wall portion 14 and over a portion of the front wall 8 of the angle-bar 7 and are apertured at this point to receive screws 17 which extend into tapped holes provided in the front wall portion 8 of the angle-bar 7. The angle brackets 16 serve to hold the forward portion of the wall 14 spaced from the angle-bar 7. The inwardly turned edge 15 of the wall member 13 and an edge portion of the rear wall 12 of the wall member 10 are frictionally held in alignment by means of a clamp 18 comprising a long flat bar 19 and a half-round bar 20 which are clamped about the aligned edges of the rear wall 12 and the inwardly turned edge 15 by means of screws 21. The screws 21 are provided at spaced intervals along the clamp 18 and extend through apertures provided in the flat bar 19 and into tapped holes in the half-round bar 20. The shank portions of the screws 21 pass between the aligned edge portions of the rear wall 12 and the side wall 13. It will be seen that a substantially hollow post is cooperatively formed by the angle-bar 7, the wall member 10, the wall member 13 and the brackets 16, but that the post structure is not completely closed at all points at the front since the brackets 16 are provided only at spaced intervals. The hollow post structure may be made of metal parts constructed, as above described, or may be made of other suitable material. One of the parts at least and preferably the wall member 13 should be made of metal and suitably grounded in an electrical sense to provide a common electrical ground connection to take off to ground any stray capacitances developed in wires running within the hollow post structure. The wall member 13 and the brackets 16 are made separable from the remaining portion of the hollow post structure to facilitate the running of wires in the hollow post and to permit the building on to the frame support of a similarly constructed frame support, the arrangement and manner of attachment of which will be subsequently described and which has previously been referred to as a multiple frame support.

Each panel 6 comprises a panel board 22 and a cover 23. The panel board 22 extends transversely between the spaced upright post structures of the frame 1 and is secured thereto by means of screws 24, the screws 24 passing through suitable apertures in the panel board 22 and into tapped holes provided in the angle-bar 7. Electrical apparatus parts such, for instance, as vacuum tubes 25 and other parts requiring replacement from time to time are mounted as shown in Fig. 1 on the front face of the panel board 22. Manual controls for certain variable electrical devices may also be

mounted on or extended to the front of the panel board 22. Such variable electrical devices or the manual controls therefor are identified by the number 26. Electrical apparatus parts such, for instance, as fixed condensers and resistances and generally indicated by the member 27 in Fig. 5 are mounted on the back of the panel board 22. The terminals of the parts 27 are extended through the panel board 22 and to the front face thereof so that all wiring between the parts mounted on the panel board 22 is located in front of the panel board 22.

Extending forwardly of the panel board 22 and of the angle brackets 16 and secured to the front face of the panel board 22 by means of the screws 24 are brackets 28 the particular structure of which may be well seen in Fig. 3. The bracket 28 as shown in this figure has triangular shaped upper and lower wall members 29 and 30 and a side wall 31. Foot portions 32 and 33 are provided on the wall members 29 and 30, respectively, to engage the front face of the panel board 22 to which they are secured by means of the screws 24, the foot portions being suitably slotted to receive the screws 24. A portion of the side wall 31 is cut out and bent inwardly to provide a tab portion 34 to which is secured by means of screws 35 a bridle ring 36. The bridle ring 36 extends parallel with the panel board 22 and has two spaced ring portions adapted to receive a conductor wire 37. One or both of the ring portions of the bridle ring 36 may be used to support the conductor wire 37 according to the extent desired for projection of the conductor wire over the front of the panel board 22, or as shown in Fig. 5 one ring portion may be utilized to hold one conductor wire 37 and the other ring portion a conductor wire 38. A small L-shaped arm 39 is secured by means of a rivet or screw 40 to the inner face of the free end of the wall portion 31 of the bracket 28. The arm 39 has an apertured flat portion 41 extending parallel with the tab 34. The apertured flat portion 41 is equipped with lugs 42 extending toward the tab 34 and arranged to form three sides of a square receptacle to receive a nut 43. The lugs 42 are bent inwardly over the nut 43 and in cooperation with the secured portion of the arm 39 and the head of the rivet 40 loosely hold the nut 43 in place. The nut 43 may move slightly in the square receptacle provided by the parts mentioned but cannot fall completely out of place by reason of the lugs 42 and the head of the rivet 40, also the nut 43 cannot turn completely around because the lugs 42 are set too closely to the nut 43 to permit such turning movement. The tapped hole in the nut is maintained substantially in register with the aperture in the arm 39.

The bracket 28 and the nut and holding arrangement thereon above described are provided on each end of the panel board 22 and serve to hold a removable cover 23 in place over the apparatus parts supported on the front face of the panel board 22. The cover 23 is in the form of a box, open on one face and comprising a front wall 44, end walls 45 and upper and lower walls 46. Secured to and extending inwardly of the front wall 44 and in line with the arms 39 on the brackets 28 are cup-shaped members 47 the bases of which are reduced in diameter to project through apertures in the front wall 44 of the cover. The bases of the cup-shaped members 47 are spun over against the outer face of the front wall 44 of the cover 23 to hold the cup-shaped members in place. The base of the cup-shaped member 47 is drilled and tapped to accommodate a bolt 48 having an enlarged male threaded end 49 on the shank portion. The threaded end 49 on the bolt 48 engages the nut 43 loosely supported in the arm 39. When the bolts 48 are screwed into the nuts 43 the cover is tightly held in place against the panel board 22. Since the nuts 43 are movably supported in the arms 39 but are maintained substantially in line with the apertures in the arms 39, the bolts 48 will readily find the nuts 43 when the cover is being applied and the bolts 48 are turned. The cup-shaped member 47, as above mentioned, is drilled and tapped in its base portion to receive the threaded end 49 of the bolt 48. This arrangement permits ready insertion of the bolt 48 in the cup-shaped member 47 but prevents accidental dislodgment of the bolt 48 from the cup-shaped member 47 when the bolt is withdrawn from the nut 43. When the bolt 48 is withdrawn from the nut 43 and the threaded end of the bolt is brought into engagement with the tapped hole in the base of the cup member 47 the bolt 48 may be used as a handle to facilitate placement or removal of the cover. The brackets 28 in addition to serving as supporting means for the bridle rings 36 and as supporting means for the nuts 43 for holding the cover 23 in place, also serve as guiding means for the cover when the cover is being applied or removed. For instance, lateral and vertical movements of the cover 23 are limited by the particular form and location of the brackets 28 so that striking of apparatus parts mounted on the panel board 22 by the cover 23 is prevented. The brackets 28 shown in Fig. 1 are of slightly less width than the smaller covers. They can be made in larger widths, however, for the larger covers or two brackets of the smaller width may be provided at each end of a panel board 22. On Fig. 3 for instance the bracket 28 is much narrower than the panel board 22 and is applied to the upper left corner of the panel board. In this case another bracket 28 would be applied to the lower left corner of the panel board and corresponding brackets 28 would be applied to the right end of the panel board. This arrangement would take care of a cover of larger size such as shown at 50 in Fig. 1. Four bolts 48 would be required in this case to hold the cover in place, each of the bolts 48 entering a nut 43.

The posts 2 and 3 shown in Fig. 1 and constructed, as shown in Fig. 5, in addition to serving as supports for the panel boards 22 also serve as enclosures for wires leading to and from the apparatus supported on the panel boards 22. Incoming wires 51 are led longitudinally of and within the post 2 to required panel boards 22. At the position of the panel boards the wire is led through the open front portion of the post and between the walls 29 and 30 of the bracket 28 to the front of the panel board. Outgoing wires 52 are led longitudinally of and within the post 3 from the panel board 22. Some of the wires carry higher potentials than the others and it is advantageous to have the higher potential wires separated from those of lower potential. As shown in Fig. 5, for instance, the higher potential wires 53 are arranged in a group in one corner of the post 2. The lower potential wires 54 are loosely arranged in the remaining area of the post 2. In order to hold the higher potential wires 53 in the required corner of the post 2 fingers 55 are provided at spaced intervals in the post. The fingers 55 are made of material sufficiently flexible to permit manual bending of the fingers about a

group of wires 53 but sufficiently stiff to retain the form in which they are set. Rather soft wire or band iron, for instance, may be used for the material of the fingers 55. The finger 55 is anchored at one end to one arm of the angle-bar 7 and is bent in an arc about the group of wires 53 and extends over to the rearwardly extending end of the wall 9 of the angle-bar 7. An opening is provided in the anchored end of the finger 55 to receive the screw 17 and this end of the finger is clamped by means of the screw 17 between the bracket 16 and angle-bar 7 of the post structure. The reason for making the finger 55 of material sufficiently flexible to be manually bent to required form is to facilitate the running of the wires within the post structure and to permit ready access to the wires confined in the corner portion of the post when repairs or alterations are required.

It will be seen that the posts 2 and 3 used in the supporting structure for the electrical apparatus serve as enclosures for a large number of wires and that the wires are loosely arranged in the posts, that means are provided to hold one group of wires separate from the other wires and that no sewing of the wires is required.

As above mentioned, the supporting structure may be used to support electrical apparatus employed in a carrier telephone system. In a system of this type the wires 53 and 54 may comprise insulated conductors surrounded by a metal sleeve serving as an electrical shield for the insulated wires enclosed therein. In some cases the metal sleeve may be enclosed in an outer covering of insulating material. In other cases the metal sleeve may be entirely bare. The metal sleeve in some cases may bear against a common ground wire running parallel with the conductor wires enclosed in the sleeve along with the insulated conductor wires. Assuming merely for the purpose of illustration and not in a limiting sense in connection with this invention that wires of the above-mentioned types are used in the apparatus and that the wires 54 have bare metal sleeves enclosing insulated wires and that the wires 53 have metal sleeves enclosing insulated wires and a common ground wire bearing against the metal sleeve, the post 2 may be used as a common ground conductor between the metal sleeves and a conductor connected to ground. The loose arrangement of the wires 54 in the post structure 2 results in a condition where the bare sleeves of some of the wires are in contact with the post 2 and the bare sleeves of wires not in contact with the post are in contact with the bare sleeves of other wires in contact with the post 2. That is to say that because the wires 54 are not drawn taut in their passage longitudinally of and within the post 2 but are loosely arranged and have inherent curved portions which bring them into contact with other wires at some point or points and that some of the wires lie with their bare sleeves against the metal post 2 each sleeve has either a direct or indirect electrical connection with the post 2. Assuming that the post 2 is connected to a suitable ground the bare metal sleeves of the conductors are ground connected to this ground by way of the post 2. Therefore, any stray capacitances occurring in the mass of wires located in the post 2 are led off to ground through the bare metal sleeves and the post structure. The wires 53 may have an outer covering of insulating material over the metal sleeve or the sleeve may be devoid of any outer covering. In the case where no outer covering of insulating material is provided the metal sleeves are ground connected through the post 2 in the same manner as the wires 54, and some of them by way of the fingers 55. In Fig. 5 the wire 37 is a portion of one of the wires 53 and is shown as having an outer covering 56 of insulating material, a metal sleeve 57, a common ground wire 58 and a pair of insulated conductor wires 59, the metal sleeve 57 surrounding the insulated wires 59 and being in contact with the common ground wire 58. The wire 58 is electrically connected at 60 to a metal strap 61 clamped by means of a screw 62 to the metal panel board 22. The metal panel board 22 is in electrical connection with the post 2 since it is held fast thereto by means of the screw 24.

The frame 1 comprising the posts 2 and 3 as above mentioned is a single frame and as previously pointed out may be disposed with its back portion against a wall since all apparatus parts requiring replacement or adjustment are disposed in the front portion of the frame. In this structure access may be had to the wires in the posts 2 and 3 by removing the wall 14 of the post structure. Removal of the wall 14 may be accomplished by first removing the covers 23 and then loosening the screws 17 and 21. This will permit withdrawal of the wall 14 and the brackets 16 from the rest of the post structure. In such cases where it becomes necessary to bring the wires 53 out of the corner portion of the post 2 the fingers 55 may be manually straightened to permit movement of the wires 53 from normal position.

Fig. 4 shows a development of the single frame above described into a multiple frame and the arrangement of two multiple frames in back to back relation to save floor space. Figs. 2 and 3 are portions of the structure shown in Fig. 4. Certain portions of the structure shown in Fig. 4 are identical with portions of the single frame shown in Fig. 1; also certain portions of Figs. 3 and 5 are identical with portions of the single frame structure and such portions have been described in connection with the description of the single frame structure and with reference to Figs. 3, 4 and 5 of the drawings.

The multiple frame shown in Fig. 4 comprises end frames 63 and one or more intermediate frames 64 arranged side by side and coupled together through adjacent post structures. The number of frame portions entering into the multiple structure is unlimited except for floor space available and the requirements of the electrical system in which the frame is employed. The showing of one end frame 63, an intermediate frame 64 and a portion of a second intermediate frame 65 is sufficient, however, to an understanding of the invention. Each frame comprises spaced posts and panel boards extending transversely between and connected to the spaced posts. The posts at the two ends of the multiple frame are identical in structure with the posts 2 and 3 of the single frame previously described. That is to say the post 2, shown in Fig. 4, is identical with the post 2, shown in Fig. 1, and there would be a post 3 at the other end of the multiple frame shown in Fig. 4 corresponding to the post 3 in Fig. 1. The post 3 is not shown in Fig. 4 since this multiple frame, as above mentioned, may be developed to an indefinite extent and the invention can be clearly understood without showing this part in the figure.

Each end frame in the multiple frame struc-

ture, as shown in Fig. 4, comprises an end post such as the post 2 and an inner post 66, the inner post 66 serving as one of the posts for the end frame 63 and also as one of the posts of the intermediate frame 64.

Each intermediate frame comprises spaced posts 66 and 67 and panel boards 22 extending transversely between the posts 66 and 67 and supported thereby. The posts 66 and 67 are identical in structure and are constructed, as shown in Figs. 4, 2 and 3, Figs. 2 and 3 being detail showings of the post structure. Since the posts 66 and 67 are identical in structure, the description of one will suffice for both. The post 66 comprises spaced upright angle-bars 68 and 69 which extend substantially the full length of the intermediate frame. The angle-bar 68 has a front wall portion 70 and a rearwardly extending side wall portion 71. Secured to the side wall 71 and extending rearwardly thereof is a wall member 72. The wall member 72 is L-shaped in cross-section and comprises a side wall portion 73 and a rear wall portion 74, the wall portion 74 extending parallel with the front wall portion 70 of the angle-bar 68. The angle-bar 69 has a front wall portion 75 and a rearwardly extending side wall portion 76. Secured to the side wall 76 and extending rearwardly thereof is a wall member 77. The wall member 77 is L-shaped in cross-section and comprises a side wall portion 78 and a rear wall portion 79, the wall portion 79 extending parallel with the front wall portion 75 of the angle-bar 69. The wall portions 74 and 79 of the respective wall members 72 and 77 extend inwardly toward each other with their inner edge portions in alignment. The aligned edges of the wall portions 74 and 79 of the respective wall members 72 and 77 are frictionally held in position by means of a clamp 18 comprising a long flat bar 19 and a half-round bar 20 which are clamped about the aligned edges of the wall portions 74 and 79 by means of screws 21. The screws 21 are provided at spaced intervals along the clamp 18 and extend through apertures provided in the flat bar 19 and into tapped holes in the half-round bar 20. The shank portions of the screws 21 pass between the aligned edges of the wall portions 74 and 79. It will be seen that a substantially hollow post is cooperatively formed by the angle-bars 68, 69 and the wall members 72 and 77 when the wall members 72 and 77 are clamped in position by means of the clamp 18 but that the post structure is not completely closed at the front.

A removable metal plate 80 is located within the post structure 66 and extends longitudinally through the central portion of the post 66 and in parallel with the wall portions 73 and 78 of the respective wall members 72 and 77. The plate 80 is held in position by means of angle brackets 81 and 82 which are secured to the plate 80 and extend over from the plate 80 to the respective angle-bars 68 and 69 and are secured in place on the angle-bar structure by means of screws 83. The angle bracket 81 extends perpendicularly from one face of the plate 80 and has a portion formed in its free end to hook over the shank portion of a screw 83 supported in the angle-bar 68. The angle bracket 82 extends perpendicularly from the opposite face of the plate 80 and is notched on its free end to receive the shank portion of a screw 83 supported in the angle-bar 69. The angle brackets 81 and 82 are arranged in staggered formation on the plate 80 and the free end of each angle bracket extends over an apertured foot portion 84 of a flexible finger 55 to clamp the foot portion 84 against the associated angle-bar. The plate 80 divides the interior of the post 66 into two compartments and when electrically connected to a suitable ground serves as a common ground for metal sleeves and metal sleeves and associated ground wires of wires running within the compartments. The wires running within the compartments may be, for instance, as explained in connection with the single frame arrangement, insulated wires covered by a metal sleeve, the metal sleeve in some cases being devoid of any outer covering of insulating material and in other cases covered by insulating material and having a ground wire held in contact with the metal sleeve.

In each compartment in the post 66 certain wires required to be separated from the others are held in one corner of the compartment by means of the metal fingers 55, the fingers 55 being anchored at one end to the angle-bars of the post structure and being bent to hold the wires in the required corner portion of the post.

The plate 80 is made removable to permit access to be had to the wires in the post 66. In order to maintain the wires in one compartment separate from those in the other when the plaate 80 is removed, guard members 85 are provided at spaced points in the post. The guard members 85 are curved wire elements which extend substantially from back to front of the post 66 at required points in the vicinity of the space normally occupied by the plate 80. One end of the guard 85 is forked at 86 to enter spaced apertures 87 provided in the rear wall portion of the post, the apertures 87 being located adjacent the space occupied by the bar 19 of the clamp 18. The other end of the guard 85 is curved over toward an angle bar and is provided with a single pin portion 88 to fit into an aperture 89 in the angle-bar. The guards 85 may be arranged in pairs or set in staggered formation along the length of the post 66, half of the number of guards being disposed on one side of the plate 80 and the other half disposed on the other side. One guard 85 for instance is set on one side of the plate 80 and has its forked end engaged in apertures 87 provided in the back wall portion 74 and its pin portion 88 engaged in the aperture 89 in the angle-bar 68. Another guard 85 is disposed on the opposite side of the plate 80 and has its forked end engaged in apertures 87 in the back wall portion 79 and its pin portion 88 engaged in an aperture 89 in the angle-bar 69. The guard 85 is made flexible to permit its being sprung into place and held by spring tension in position. The aperture 89 in the angle-bar 68 is not in direct alignment with the location of the apertures 87 but is offset therefrom due to the difference in width of the wall 70 of the angle-bar and the back wall portion 74 of the wall member 72. The guard 85 does not extend in a straight line from the apertures 87 to the aperture 89 but takes a course substantially parallel with the plate 80 for the greater portion of the length of the guard and then bends toward the angle-bar to a point of meeting with the aperture 89. The straight portion of the guard 85 is made double the cross-sectional area of the curved portion so that when the guard is sprung over to meet the aperture 89 most of the bending action is in the curved portion of the guard. As shown in the drawings the guard 85 may be made of two different lengths of wire extend-

ing in parallel relation through the central portions and being secured together, the longer length extending beyond the shorter one and being curved and terminating in the pin portion 88. The two lengths of wire are spread apart at the end opposite to the pin portion 88 to form the forked end 86. As shown in Fig. 4 one guard 85 extends from the back portion of the post from a point adjacent the left side of the clamp 18 and is sprung over to meet the angle-bar 68, the pin portion 88 being set in the aperture 89 shown in Fig. 2. Another guard 85 extends from the back portion of the post from a point adjacent the right side of the clamp 18 and is sprung over to meet the angle-bar 69. With the guards 85 set in the positions indicated, the wires running through the post will be maintained separated into two main groups even when the plate 80 is removed to gain access to the wires in the post.

In the multiple frame above described, vacuum tubes and other electrical apparatus parts requiring replacement from time to time are mounted on the front face of the panel boards 22. Other electrical apparatus parts such, for instance, as fixed resistances and condensers and not requiring replacement except on very rare occasions are mounted on the back face of the panel boards 22. The multiple frame structure, therefore, may be placed with the back portion against a wall of a building or may be placed back to back with another multiple frame, as shown in Fig. 4, to save floor space. Wires leading to and from the panel boards are led through the hollow post structures. Incoming wires to the panel boards in the end frame 63 are led through the post 2. Outgoing wires from the end frame 63 are led through the left-hand portion of the post 66. Incoming wires to the intermediate frame 64 are led through the right-hand portion of the post 66. Outgoing wires from the intermediate frame 64 are led through the left-hand portion of the post 67.

All local wiring for each panel extends across the front face of the panel boards. Since covers are applied over the front faces of the panel boards, the heat generated by the vacuum tubes is maintained in the vicinity of the wiring to keep the wires dry.

What is claimed is:

1. In a frame for supporting panels of electrical apparatus a hollow post comprising an angle-bar, a wall member L-shaped in cross-section attached to said angle-bar and extending rearwardly thereof, a second wall member spaced from said first-mentioned wall member and having an edge portion aligned with an edge portion of said first wall member and a clamp engaging the aligned edge portions of said wall members, said clamp comprising two rods arranged parallel to each other and screws engaging said rods.

2. In a frame for supporting panels of electrical apparatus, a post structure comprising spaced side walls, a rear wall portion extending angularly from one of said side walls, an edge portion on the other side wall, said edge portion extending angularly from the side wall into alignment with said rear wall portion, a clamp frictionally holding said edge and said rear wall portion in aligned position and said clamp comprising a flat bar and a half-round bar and screws engaging said bars to hold said bars clamped about the aligned edge and rear wall portions.

3. In a frame for supporting panels of electrical apparatus a hollow post comprising spaced L-shaped wall members arranged to cooperatively form two spaced walls and two aligned spaced rear wall portions and a clamp engaging said wall members and holding the rear wall portions in aligned position and completing the rear wall portion of the structure.

4. In a support for electrical apparatus, end frames and an intermediate frame disposed in endwise alignment and comprising panel boards supporting electrical apparatus parts, spaced hollow posts supporting said panel boards and joining said end frames to said intermediate frame and each of said hollow posts comprising wall members L-shaped in cross-section, a clamp frictionally holding edge portions of said wall members in alignment to form a back wall of said post, a plate extending longitudinally of and within the central portion of said post and brackets attached to said plate and removably attached to said wall members.

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