Jan. 22, 1963 S. H. WATSON 3,074,181

MODULAR DIAGRAMMING METHOD AND APPARATUS

Filed July 18, 1960 2 Sheets-Sheet 1

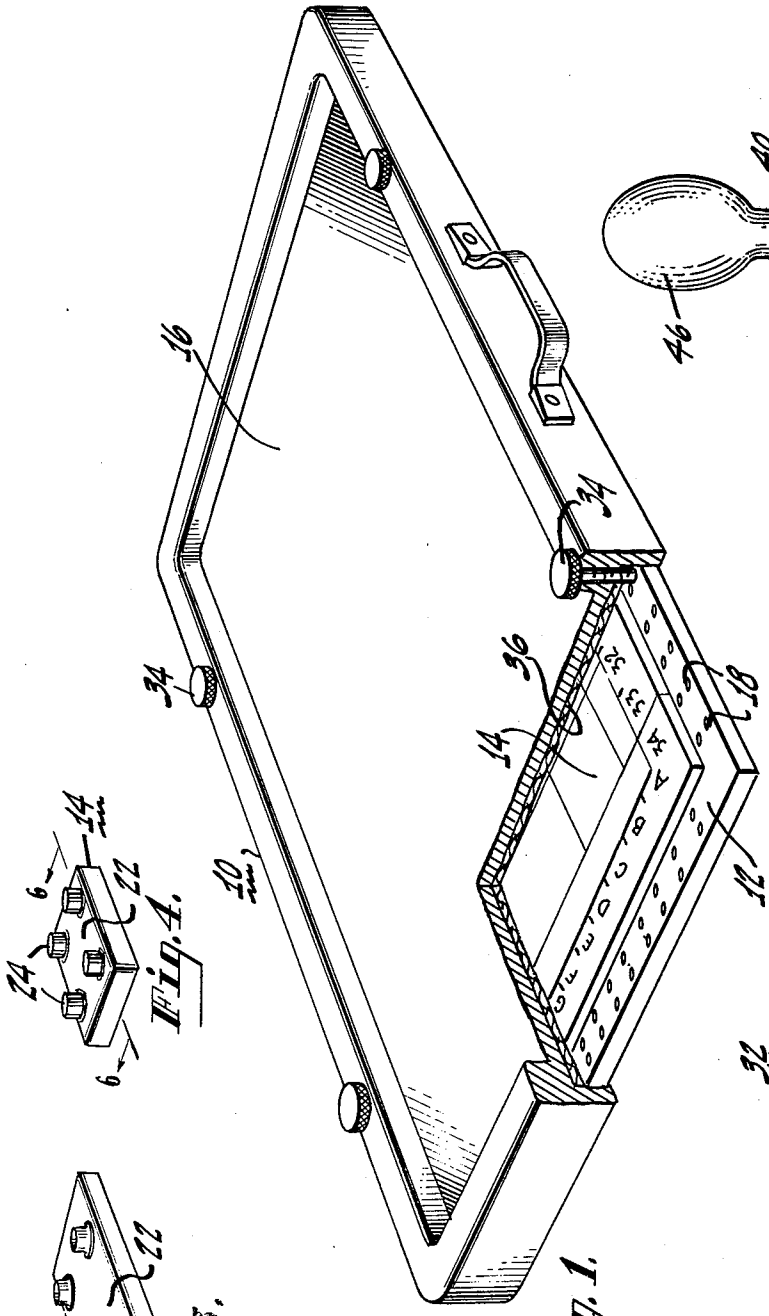


Fig. 1.

Fig. 4.

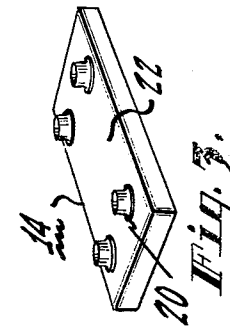


Fig. 3.

Fig. 7.

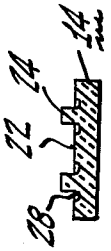


Fig. 6.

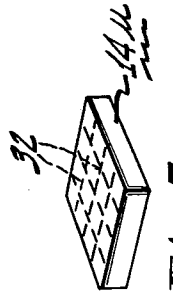


Fig. 5.

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MODULAR DIAGRAMMING METHOD AND APPARATUS

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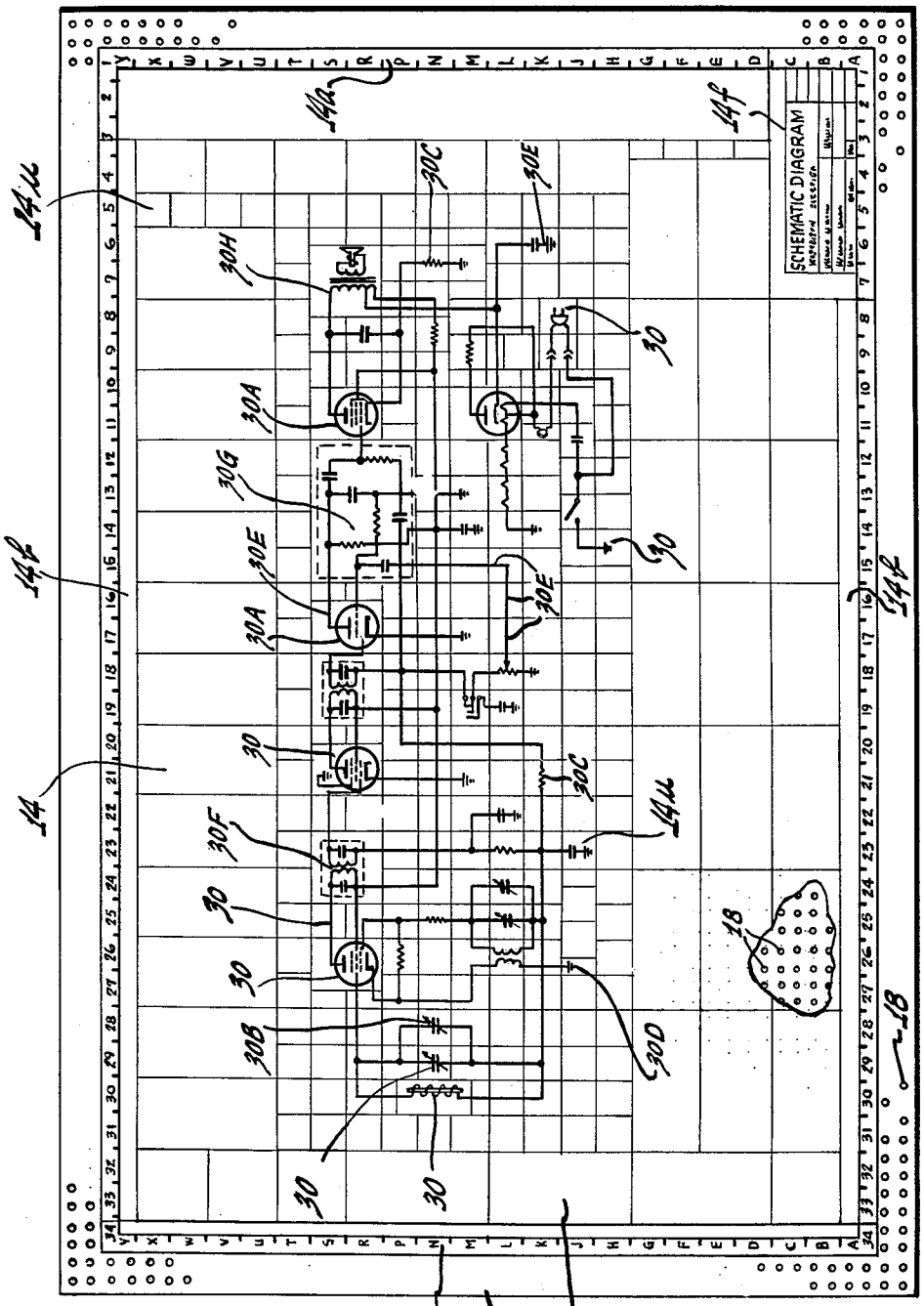


Fig. 2.

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MODULAR DIAGRAMMING METHOD AND APPARATUS

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This invention relates generally to a method of and means for preparing graphic representations, such as schematic drawings, and more particularly to a method of and apparatus for making schematic diagrams by means of graphic representations on modules that are adapted to be oriented to define a substantially continuous surface. The modular diagramming apparatus of the present invention is particularly useful in making schematic diagrams of electrical circuits, computer logic circuits, hydraulic systems and the like.

Heretofore, substantially all schematic diagrams for electrical circuits, hydraulic systems, architectural drawings and the like, were made by hand by skilled draftsmen. The manual preparation of these schematic diagrams required the expenditure of much time, energy and expense to make them suitable for reproduction purposes. Also, it was relatively difficult to make erasures and changes in inked drawings by prior art means.

Accordingly, it is an object of the present invention to provide a novel method of and apparatus for making schematic drawings, which method and apparatus will overcome the aforementioned disadvantages of the prior art.

More particularly, it is an object of the present invention to provide a novel method of and apparatus for preparing, with the aid of modular units, schematic drawings which lend themselves to facile reproduction.

Another object of the present invention is to provide novel, modular diagramming apparatus for making schematic diagrams in a minimum of time and with a minimum of expense.

Still another object of the present invention is to provide novel, modular diagramming apparatus by means of which one can make schematic diagrams without the use of drafting instruments and paper and with little or no drafting skill.

A further object of the present invention is to provide novel, modular diagramming apparatus for making schematic diagrams quickly, accurately and of a quality suitable for reproduction by most of the conventional reproducing means.

Still a further object of the present invention is to provide novel, modular diagramming apparatus for making schematic diagrams which readily lend themselves to copying, as in the photostatic process of copying, and from which positive copies can be made directly without the need of first making a negative copy, as in conventional practice.

It is a further object of the present invention to provide novel, modular diagramming apparatus that is relatively simple in structure, very reliable in operation and highly efficient in use.

In accordance with the present invention, the novel diagramming apparatus comprises a relatively large panel and a plurality of relatively smaller modules adapted to be positioned on the panel to form a substantially continuous surface. In one embodiment of the invention, the panel is formed with a plurality of holes that are equally spaced from each other in a regular, square, grid pattern. Each of the modules comprises a sheet or block of material having positioning pins depending from its lower surface. The pins are adapted to engage within the holes in the panel to position the modules on the

panel. A unit module is preferably in the form of a square sheet, but other modules may be rectangular or of any other polygonal form the lengths of whose sides are multiples or submultiples of the length of a side of the unit module. The upper surfaces of the modules have graphic representations, such as symbols, thereon so that any one of a plurality of schematic diagrams may be made by orienting the modules with respect to each other. The symbols on the modules are disposed in a manner such that the modules may be oriented in any one of a plurality of positions depending upon the shapes of the modular units in order to achieve a desired alignment in a desired schematic diagram.

The novel features of the present invention, both as to its organization and methods of assembly and operation, as well as additional objects and advantages thereof, will be more readily understood from the following description, when read in connection with the accompanying drawings in which similar reference characters represent corresponding parts, and in which:

FIG. 1 is a perspective view of one form of novel, modular diagramming apparatus of the present invention, showing the cover partly cut away to expose the panel and some of the modules thereon;

FIG. 2 is a plan view of modules positioned on the panel in a manner to form a schematic diagram of an electronic circuit in accordance with the present invention;

FIG. 3 is an inverted, perspective view of one embodiment of a module showing module positioning pins in the form of eyelets extending therefrom;

FIG. 4 is a similar view of another embodiment of a module showing module positioning pins integral with the body of the module and extending therefrom;

FIG. 5 is a perspective view of a unit module on which are indicated, by dashed lines, the positions that electronic symbols may occupy on the upper surface of the module;

FIG. 6 is a cross-sectional view taken along the line 6—6 in FIG. 4 to show the integral structure of the pins and the module; and

FIG. 7 is an elevational view of a suction producing device for lifting modules from the panel.

Referring, now, particularly to FIG. 1, there is shown modular diagramming apparatus 10 for making any of a plurality of electronic schematic diagrams. While the apparatus 10 of the present invention will be described and illustrated in connection with the making of schematic diagrams in the electronic art, it will be understood that many other types of schematic diagrams, drawings and layouts may be made with this apparatus 10. The apparatus 10 comprises a plate or panel 12, modules 14 positioned on the panel 12, and a cover 16 adapted to be screwed to the panel 12 for transportation purposes.

The panel 12 is formed with a plurality of holes 18 therein. The holes 18 form a regular, square-grid pattern, each hole being equidistant from an adjacent hole in either a vertical or horizontal direction, as viewed in FIG. 2. The holes 18 comprise means for retaining the modules 14 in a fixed position on the panel 12.

In the embodiment of the invention shown in FIG. 2, the modules 14 comprise rectangular sheets or blocks of a material such as plastic. A unit module 14*u* comprises a square sheet of material of unit length. If the unit module 14*u* is one square inch, for example, other modules 14 may be rectangular or polygonal sheets the lengths of whose sides are either integral multiples or submultiples of the length of a side of the unit module 14*u*. Thus, modules 14 may be L-shaped, T-shaped, E-shaped and the like. Since the structure and function of the modules described herein are substan-

tially similar, except for size, the reference numeral 14 will be used herein to designate the modules generally, regardless of their dimensions.

Means are provided to position the modules 14 on the panel 12 in any one of four fixed positions over a point on the panel 12. To this end, one or more pins 20 depend from the lower surface 22 of the module 14, as shown in FIGS. 3 and 4. The pins 20 may be eyelets, as shown in FIG. 3, or dowels glued to the lower surface 22 of the module 14 and disposed so as to be inserted within the holes 18 in the panel 12. The pins 20 are symmetrically disposed with respect to the center point on the lower surface 22 of the module 14, and they are spaced from each other uniformly—the same distance as are the holes 18 in the panel 12. Since the holes 18 are equidistant from each other in vertical and horizontal directions, it will be apparent that the module 14 may be fixedly positioned in any one of four positions over a point on the panel 12.

Referring, now, to FIG. 4, there is shown another embodiment of a module 14 formed with integrally molded pins 24. The pins 24 extend from the lower surface 22 of the module 14. The lower surface 22 is formed with annular grooves 28 about the bases of the pins 24, as can be seen clearly in FIG. 6, to insure a good fit of the module 14 on the panel 12.

Certain ones of the modules 14 are marked with graphic representations, or symbols, 30 which comprise components of the art of the desired schematic diagram to be formed. The modules 14 may be arranged to form a schematic diagram of a five-tube radio receiver, for example, as shown in FIG. 2, by orienting the modules 14 so that their respective symbols 30 are aligned in the desired manner. In the electronic circuit art, for example, the modules 14 may have a number of different electrical symbols 30 thereon so that any of a desired number of possible schematic diagrams may be made.

Thus, for example, certain of the modules may have printed, etched, embossed or otherwise formed thereon visible symbols 30A for electron tubes; others may have formed thereon the symbol 30B for a capacitor; others may have formed thereon the symbol 30C for a resistor; and some may have formed thereon the ground symbol 30D, or merely one or more leads or conductors 30E, either alone or in combination with other symbols. Again, certain modules may have formed thereon a plurality of symbols, such as the coupled, tuned circuits 30F, the network of capacitors and resistors 30G, or the combination of output transformer and loudspeaker 30H. In all cases, however, the conductors or leads 30E extend to one or more edges of the modules on which they appear.

Connections between the symbols 30 on the various modules 14 are accomplished merely by placing appropriate ones of the modules next to each other in abutting relation on the panel 10, since the leads 30E extend to the edges of the modules at one or more predetermined points. For example, these points along any one edge of the module may be spaced one-quarter, one-half or three-quarters of the distance along such edge of the module, as represented by the lines 32 in FIG. 5. With such an arrangement of symbols 30 on the upper surfaces of the modules 14, it is possible to orient each of the modules 14 in any one of four positions at various points on the panel 12 to provide a continuous connection from one symbol 30 on one module 14 to an adjacent symbol 30 on an adjacent module 14. After a desired schematic diagram has been formed by the proper orientation of the modules 14 on the panel 12, any blank spaces on the panel 12 may be filled in with blank modules 14 so that all of the modules 14 form a substantially continuous, planar surface. Positioning pins on the lower surfaces of large-sized modules 14 may be omitted, if desired, because the latter modules will be held in position by the modules 14 that are fixed to the panel 12.

The modules 14 may be formed from white plastic, and the symbols 30 on their upper surfaces may be formed with black paint or ink, for example. Thus, when a desired schematic diagram is formed, it may be photographed or reproduced by any of the known reproduction processes. If the reproduction process to be used in connection with the apparatus 10 requires the formation of a positive print from a negative print, as in photostatic reproduction, for example the modules 14 may be black and the symbols 30 thereon may be formed with white paint or ink. With the latter arrangement, the first photostatic copy of the schematic diagram will be one that has the characteristics of a positive print, thus eliminating the need for first producing a negative print. By using a suitable exposure in the reproduction process, or by the process of light dodging, the intersections between the modules 14 and may be "burned out" or "erased" in the reproduction print.

The peripheral border of the schematic diagram may comprise two pairs of elongated modules 14*a* and 14*b* arranged to form a rectangle. The modules 14*a* comprise a pair of spaced-apart, vertically disposed modules marked off in zones of unit length designated by the letters of the alphabet. The modules 14*b* comprise a pair of spaced-apart, horizontally disposed modules marked off in zones of unit length designated by numbers. The title block of the schematic diagram may comprise a module 14*f* on which one may write certain required information for the schematic diagram.

It will be apparent, from the foregoing, that it is possible to make any one of a number of schematic diagrams, drawings, lay-outs and the like by means of the apparatus 10 without the use of drafting tools and paper. After all of the modules have been positioned on the panel 12 to form a desired schematic diagram, the assembled modules may be moved by placing the cover 16 over the modules and fastening the cover 16 to the panel 12 by means of screws 34. The screws 34 pass through holes in the cover 16 and are engaged in threaded holes 18 in the panel 12. The inner surface of the cover 16 is lined with a soft material 36, such as velvet, to prevent scratching the modules when the cover 16 is in place. A handle 38, fastened to one edge of the cover 16, is provided to carry the apparatus 10.

Modules 14 may be removed from the panel 12 by means of a suction device 40, shown in FIG. 7. The device 40 comprises a tube 42 having a suction cup 44 fastened to one end thereof and a rubber bulb 46 fastened to the other end thereof. By placing the suction cup 44 over the module 14 to be removed and by squeezing the bulb 46, the module will be caused to adhere to the suction cup 44 for easy removal from the panel 12. Modules 14 may also be removed with one's finger by using adhesive tape wound around the finger with the adhesive side facing out. Hence, by touching any module 14 with the adhesive tape, the module 14 will adhere to the tape for easy removal from the panel 12.

Thus, there has been shown and described modular diagramming apparatus wherein a plurality of modules may be arranged on a panel so that symbols on the upper faces of the modules may be aligned to form a desired schematic diagram or other graphic representation. While the modules have been described as having pins that engage with the mating holes in the panel, it will be understood that the modules may be positioned on the panel by other means, such as by mating slots and ribs, by male and female splines and by magnetic means. If magnetic means are used, the modules and the panel should include magnetic material so that they can be attracted to each other. By providing elongated modules for the peripheral edges of the schematic diagram and by dividing adjacent edges into zones designated by letters and numbers, respectively, it is possible to identify specific modules accurately by a letter-number code. Also, by applying additional codes, one code to identify each module and

another code to identify each of the four positions that the illustrated modules can assume, a print-out from cards or tape may provide complete information from which a diagram may be prepared.

What is claimed is:

1. Apparatus for making schematic diagrams comprising a panel formed with a square grid pattern of regularly spaced holes, a plurality of modules each comprising a rectangular sheet of material of uniform thickness having upper and lower surfaces, pins integral with some of said modules and extending from said lower surfaces thereof, said pins being adapted to fit within said holes for positioning said sheets on said panel, symbols consisting of portions of said schematic diagrams on said upper surfaces of certain ones of said modules, said pins being disposed with respect to the centers of said modules in a manner to position each of said modules in any one of four positions over a point on said panel, a cover adapted to contact and to cover said modules, said cover being formed with apertures adjacent to the periphery thereof, and screw means extending through said apertures and certain ones of said holes to removably fasten said cover to said panel.

2. Apparatus for making schematic diagrams and for transporting them in an undisturbed condition, said apparatus comprising a panel formed with a square grid pattern of regularly spaced holes that define lines disposed at right angles to each other, a plurality of modules each comprising a rectangular sheet of material of uniform thickness having upper and lower surfaces, pins extending from said lower surfaces of some of said modules and being adapted to fit within said holes for positioning said modules on said panel, symbols consisting of portions of said schematic diagrams on said upper surfaces of certain ones of said modules, said pins being disposed with respect to the centers of their respective modules in a manner whereby each of said modules may be fixed to said panel in more than one position over a point on said panel, said modules having abutting peripheral portions and defining a substantially continuous, flat surface when said modules are positioned on said panel in abutting relationship, a cover formed with holes therein, and means passing through said holes in said cover and certain holes in said panel to fasten said cover to said panel.

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