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May 5, 1970 P. E. OLSON 3,509,904

PANEL BLOCK ASSEMBLY

Filed Dec. 26, 1967 2 Sheets-Sheet 1

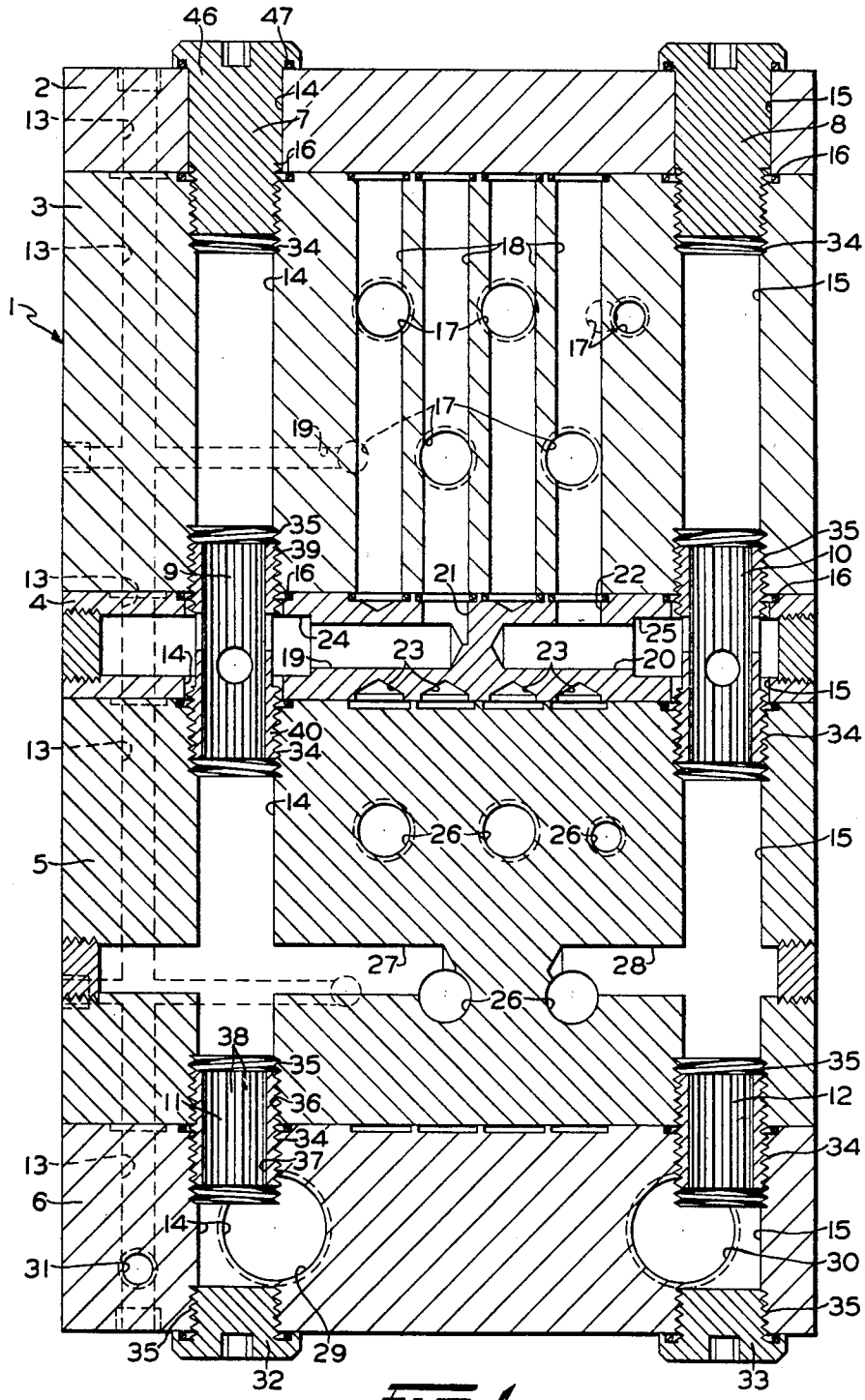


FIG. 1

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PANEL BLOCK ASSEMBLY

Filed Dec. 26, 1967 2 Sheets-Sheet 2

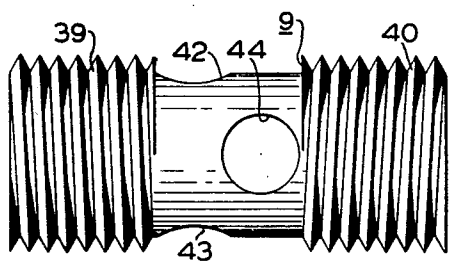


Fig. 2

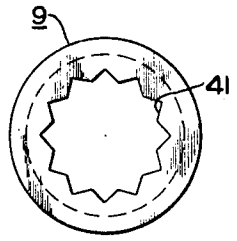


Fig. 3

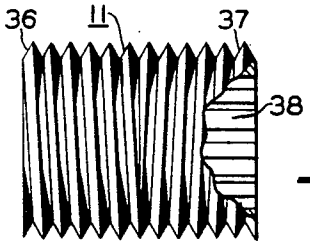


Fig. 4

Fig. 5

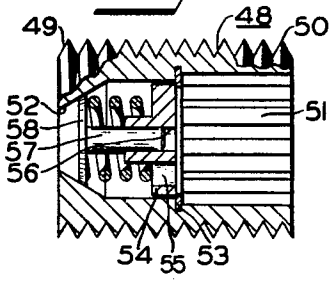
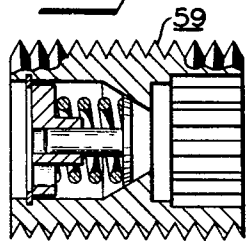


Fig. 6



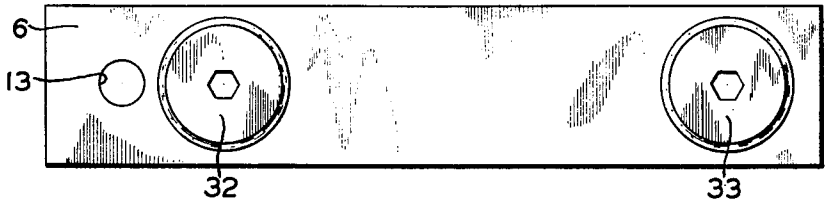


Fig. 7

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PANEL BLOCK ASSEMBLY

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Int. Cl. F16l 39/00
U.S. Cl. 137—269 14 Claims

ABSTRACT OF THE DISCLOSURE

A panel block assembly in which a plurality of panel blocks, each having internally disposed longitudinal through passages, are disposed in longitudinal end-to-end engagement whereby the through passages in each block register with the corresponding through passages in each adjacent block so that the registered passages extending through the assembly of blocks comprises a piping system for a fluid pressure system, the panel blocks being held in end-to-end fluid tight engagement by a plurality of externally threaded tubular connectors, each connector having the ends thereof oppositely threaded and screwed into a pair of correspondingly threaded ends of an axially registered pair of longitudinal through passages of adjacent panel blocks, thereby extending across the junction between the adjacent blocks to provide lateral support for the panel block assembly.

Background of the invention

Heretofore, in assembling in longitudinal end-to-end relationship a plurality of panel blocks having internal fluid passages intercommunicating from block to block to comprise a fluid passage system, it has been propoed to provide through rods extending entirely through the block assembly, the rods being inserted with lateral clearance in the supply and exhaust passages of the panel block assembly, which supply and exhaust passages are comprised of a plurality of longitudinal through passages in each block with the ends of the through passages axially registering from block to block to comprise a supply passage, an exhaust passage and a drain passage extending entirely through the panel block assembly. Since different numbers of panel blocks can be so assembled, it is necessary for the maunfacturer to either stock a large number of through rods of many different lengths or cut the rods to length in accordance with the number of blocks to be assembled in any particular panel block assembly. Moreover, since the diameter of the rods is necessarily substantially smaller than the diameter of the supply and tank passages to provide for free flow of fluid through such passages, and since the rods are centrally disposed in the supply and tank passages out of engagement with the passage walls, the rods provide no transverse support for the panel blocks to inhibit undesired sag or buckling of the assembly during handling and shipment thereof.

Summary of the invention

Therefore, it is an object of this invention to provide in a panel block assembly of the type described, light weight panel block connector means which may be constructed to short standard lengths and, which, when installed in the registering fluid passages in the blocks, effect fluid sealing end-to-end abutment of adjacent blocks and also laterally cooperate with the block elements to inhibit lateral sag or buckling of the panel block assembly during handling and shipment thereof.

In the present invention, this object is achieved by disposing in each of the coaxial junctions of the longitudinal through passages in one panel block with the longitudinal

fluid passages in the adjacent block or blocks, a tubular connector having an externally disposed left-hand thread on one end received in a corresponding left-hand thread in the fluid passage in one panel block, and having an externally disposed right-hand thread on the other end received in a corresponding right-hand thread in the adjacent panel block, the hollow portion of the connector comprising a through passage for passing fluid from one panel block to another. In some instances, the tubular connectors include check valve means internally thereof, where applicable to the particular panel block assembly, or, in the other instances, the wall of the connector may be laterally ported to communicate the interior of the connector with lateral passages within one of the panel blocks being interconnected by the connector.

This and other objects will become more readily apparent in the following description, taken in conjunction with the drawing, in which:

FIG. 1 is a sectional view of a panel block assembly, showing my invention;

FIG. 2 is a side elevational view of one of the panel block connectors of FIG. 1;

FIG. 3 is an end elevational view of the connector of FIG. 2;

FIG. 4 is a side elevational view of another type of panel block connector;

FIG. 5 is a cross-sectional view of yet another type of connector having a check valve means therein;

FIG. 6 is a cross-sectional view of yet another connector showing a check valve means therein; and

FIG. 7 is an end elevational view of the panel block assembly of FIG. 1, taken from the bottom end thereof.

Referring now to FIG. 1 of the drawing, there is shown a panel block assembly, generally indicated at **1** in which a plurality of panel blocks **2**, **3**, **4**, **5** and **6** are held in end-to-end fluid tight assembly by a plurality of connectors **7**, **8**, **9**, **10**, **11** and **12**, with connectors **7**, **8**, **11** and **12** representing one type of connector as shown in hereinafter described FIG. 4, and with connectors **9** and **10** representing another type of connector as shown in hereinafter described FIGS. 2 and 3.

Aside from the connector means hereinafter described in detail, the panel blocks of the assembly of FIG. 1 are generally representative of a number of different types of panel blocks, with panel block **2** representing a cap block, panel blocks **3** and **5** representing two different types of valve mounting blocks, panel block **4** representing a circuit block, and panel block **6** representing a power entry block, all as generally shown and described in the Patent No. 3,158,164, issued Nov. 24, 1964 to B. G. Barton and assigned to the same assignee as the present invention.

All of the panel blocks **2** through **6** are similar in that each includes three end-to-end transversely spaced longitudinally disposed through passages **13**, **14** and **15**, which, when the panel blocks are assembled in end-to-end relationship, as shown, axially register to provide three fluid passages extending through the assembly, with the passages **14** combining to comprise a fluid supply passage, with the passages **15** combining to comprise a tank passage, and with passages **13** combining to comprise a drain passage. With the exception of panel block **2**, the upper ends of each passage **13**, **14** and **15** in each panel block is widened to provide a seat for an O-ring seal **16** to prevent leakage from the passages **13**, **14** and **15**.

Beyond the aforementioned similarities, the panel blocks differ in length, and in the number and location of additional internal passages, depending upon the nature of the valve devices to be connected in the fluid pressure system, the manner in which the valve devices are to be so con-

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nected in the pressure system, and the particular function of the different types of panel blocks.

Valve mounting panel block **3** includes a plurality of ports **17** opening on either or both of the front or back faces of the block with those ports opening on the front face being relatively disposed for mating with corresponding ports in a valve device, not shown, to be mounted on the front face thereof, and with those ports opening at the back of the panel block being adapted to be for connection with external piping at the back face of the panel block member. Some of the ports **17** each communicate internally of the block with a separate one of a plurality of end-to-end passages **18**, and another of which ports communicates with drain passage **13** by way of branch passage **19**.

Circuit panel block **4** cooperates with valve mounting panel block **3** to communicate selected ones of passages **18** with the pressure and tank passages **14** and **15**, respectively, by way of a pair of aligned transversely disposed passages **19** and **20**, each communicating at one end with the passages **14** and **15**, respectively, and opening at the other end of the circuit block at selected points **21** and **22** of a plurality of points to communicate with the selected ones of passages **18**, the selection depending upon the internal passages circuitry desired. For example, in using the circuit block **4** in panel block assemblies other than that shown in FIG. 1, the passages **19** and **20** may be opened alternatively or additionally at selected ones of points **23** at the lower end of the block to provide direct communication between panel blocks on opposite ends of the circuit block **4**, in the manner illustrated in the aforementioned Pat. No. 3,158,164, with suitable plug means, not shown, inserted in one or both plug receptacles **24**, **25** at the ends of passages **21** and **22**, respectively.

Valve mounting panel block **5** is similar to the above-described valve mounting panel block **3**, and includes a plurality of ports **26** opening at least on the front face of the block for mating with corresponding blocks in a valve device, not shown, to be mounted thereon, some of which ports are individually communicated with the passages **14** and **15** by way of transversely extending branch passages **27** and **28**, respectively.

The combined power entry and power exhaust panel block **6** includes a front opening fluid pressure supply port **29**, a front opening tank port **30**, and a drain port **31**, each port communicating internally with passages **14**, **15** and **13**, respectively. Suitable plugs may be installed in the ends of passages **13**, **14** and **15** at the lower end of block **6**, for example, plugs **32** and **33** as installed in passages **14** and **15**, respectively.

Cap panel block **2** includes no passages other than those described since it serves primarily to close the passages at the upper end of the adjacent panel block **3**.

From the foregoing, it is apparent that the panel blocks **2** through **6** are merely generally representative of a wide variety of panel block types each including internal passages which, when the blocks are disposed in end-to-end relationship, intercommunicate with each other from block to block to provide a piping circuit for a fluid pressure operated system. Thus, any assembly of panel blocks may comprise a wide variety of panel blocks having different internal passage structure interconnecting from block to block in a wide variety of ways, depending upon the desired fluid circuitry and the particular blocks to be assembled in a particular panel block assembly.

Aside from the connector means, the particular panel blocks of the panel block assembly of FIG. 1 are shown and described in copending WABCO Case No. 6397 where the panel blocks are shown held in fluid tight end-to-end relationship by means of a type of panel block connector means not disclosed in the present application.

In the present application, as well as in the aforementioned copending application, the particular circuitry represented by the internal passages in the panel block assembly of FIG. 1 is immaterial to the understanding of the

invention, and, accordingly, a description thereof is omitted, it being understood that the panel block assembly of FIG. 1 is merely representative of a wide variety of such assemblies including different types of panel blocks disposed in different arrangements in accordance with the desired internal circuitry.

From the foregoing description of the various types of panel blocks, it will be apparent that, with the exception of cap block **2**, which is always disposed on one end of any panel block assembly, different numbers of the same or different types of panel blocks may be disposed in a variety of relative positions throughout the length of the panel block assembly, depending upon the particular internal fluid circuitry desired. For example, in some panel block assemblies, the power entry block **6** could be disposed intermediate the ends of the assembly, in which event an additional cap block would be disposed on the lower end of the assembly. However, each of the panel blocks is end-to-end directionally orientated with respect to the ends of any panel block assembly in which it may be installed, that is, each block has a predetermined upper end and a predetermined lower end to provide end-to-end registration of each pressure supply passage **14**, tank passage **15**, and drain passage **13** with the ends of each adjacent supply passage, tank passage, and drain passage, respectively, and to assure that appropriate valve mounting ports **17** and **26** in valve mounting blocks **3** and **5**, respectively, are communicated with the tank, supply and drain passages, as desired in accordance with the planned circuitry.

In accordance with the present invention, connector means **7** through **12** are disposed within the tank passage **15** and supply passage **14** to hold adjacent blocks in fluid tight end-to-end relationship with the appropriate longitudinal through passages disposed in block-to-block registration, and to simultaneously provide lateral support for the entire panel block assembly.

To adapt the panel blocks for cooperation with the connectors to effect the aforementioned results, the upper ends of the supply passages **14** and tank passages **15** in all the valve mounting blocks, such as blocks **3** and **5**, and also the power entry block **6** are provided with a right-hand thread **34**, and the lower ends of the same passages in the same panel blocks are provided with left-hand threads **35**, so as to provide a plurality of pairs of oppositely threaded passages, each pair comprising coaxially disposed oppositely extending left-hand and right-hand threads.

Referring now to FIG. 4, there is shown an enlarged view of the short threaded connector **11** disposed in the supply passage **14** and extending across the junction between valve mounting block **5** and power entry block **6**, which connector comprises a tubular member having exteriorly disposed left-hand threads **36** on one end screwed in the left-hand threaded end **35** of supply passage **15** in valve mounting block **5**, and externally disposed right-hand threads **37** on the other end thereof screwed into the right-hand threads **34** in the supply passage **14** of power entry block **6**. The interior diameter of the connector passes fluid from the power entry block **6** to the valve mounting block **5** and includes a plurality of equally spaced axially extending grooves **38** providing a polygonal cross-sectional configuration for axially receiving a correspondingly shaped conventional hex nut, not shown, which, when inserted through passage **14** of power entry block **6** and axially inserted in connector **38**, is rotated to simultaneously screw both ends of the connector into the corresponding left-hand and right-hand threads, as above-described, thus disposing power entry block **6** in end-to-end fluid tight engagement with valve mounting block **5**. Similarly, short threaded connector **12**, identical to the above-described short threaded connector **11**, is installed in tank passage **15** between the power entry block **6** and valve mounting block **5**.

Referring now to FIGS. 2 and 3 of the drawing, there is shown on an enlarged scale one of the long threaded

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connectors **9** of the two long threaded connectors **9** and **10** of FIG. 1 for interconnecting in fluid tight end-to-end engagement valve mounting block **3**, circuit block **4**, and valve mounting block **5**, with the circuit block **4** disposed therebetween. Long threaded connector **9** is basically similar to the above-described short threaded connector **11** in that it comprises a tubular member having an externally disposed left-hand thread on the upper end **39**, an externally disposed right-hand thread **40** on the lower end thereof, and a plurality of internally disposed axially extending grooves **41** suitable for engagement with the correspondingly shaped hex nut, not shown, axially insertable therein to install the connector in the panel block assembly in the manner above-described, and to facilitate passage of fluid from circuit block passage **20**. However, since the circuit block **4** is relatively short in the longitudinal direction of the panel block assembly, thus limiting longitudinal through passages **14** and **15** to a length insufficient to accommodate an adequate number of threads in the ends thereof necessary to provide adequate lateral support, the passages **14** and **15** are unthreaded and of sufficient diameter to axially freely receive therein the long threaded connector having a length greater than that of the short threaded connectors **11** and **12**, so that the left-hand threads **39** and the right-hand threads **40** are received into left-hand threads **35** and right-hand threads **34** in blocks **3** and **5**, respectively, thus disposing valve mounting blocks **3** and **5** in end-to-end fluid tight engagement with the opposite ends of circuit block **4**.

In order to facilitate passage of fluid from supply passage **14** to transverse passage **19** in the circuit block **4**, and to facilitate flow of fluid from circuit block passage **20** to tank passage **15**, the long threaded connector is ported at ports **42**, **43**, **44** and **45**, with ports **43** and **44** being oppositely disposed on one axis transverse to the connector axis, and with ports **44** and **45** oppositely disposed on a second axis transversely disposed relative to the connector axis, the second axis being axially displaced along the connector axis relative to the first axis and rotated 90° relative to the first axis. This porting arrangement provides for direct communication of the interior of connector **9** with the circuit block passage **19** regardless of the axial position of the connector when finally installed as shown in FIG. 1.

Referring now to the plug connectors **7** and **8** for connecting the cap block **2** to the valve mounting block **3**, it is seen that each connector comprises a left-hand threaded shaft having a widened head **46** on one end thereof carrying an O-ring seal **47** in a groove on the under side thereof, which shaft is of such length as to be inserted through smooth passage **14** of the cap block **2** in and screwed into left-hand threaded passage end **34** of valve mounting block **3**. It is to be noted that if desired, each of the passages **14** and **15** in cap block **2** could be appropriately threaded to receive a separate connector and a separate plug similar to connector **11** and plug **32** in the power entry block **6**.

From the foregoing, it is apparent that since each panel block, with the possible exception of the cap block **2** as above-described, is provided with identical left-hand threaded and right-hand threaded passages at the lower and upper ends thereof, respectively, any group of panel blocks of the same or different types may be assembled in end-to-end fluid tight relationship in any desired order by use of connectors **11** if no circuit blocks are in the particular assembly, or by connectors **11** and **9** if circuit blocks are so included.

Referring now to FIG. 5 of the drawing, there is shown a tubular connector **48** exteriorly identical to the previously described connector **11**, but interiorly including a check valve means operable, when the connector is disposed in the tank passage **15** of a panel block assembly, to pass fluid unidirectionally.

The ends of the connector **48** include thereon left-hand and right-hand threads **49**, **50**, respectively, to facilitate direct substitution of connector **48** for a short threaded connector, such as previously described connector **12**. The lower end of the through passage includes a plurality of spaced axial grooves **51** terminating substantially centrally of the connector, while the upper end of the through passage comprises a check valve chamber including an axially tapered end **52** serving as a seat for the check valve. A snap ring **53** disposed in the through passage at the ends of the grooves **51** serves as an axial seat for a cylindrical valve guide member **54** having an axially offset through passge **55** to pass fluid from the upper end of the through passage to the lower end thereof, and having an axially disposed throughbore **56** slidably receiving therein one end of valve stem **57** having a check valve member **58** attached to the other end thereof. The check valve is biased into seating engagement with the tapered passage **52** via a spring encircling stem **57** and compressed between the check valve **58** and the guide member **54**.

Referring now to FIG. 6, there is shown a combined tubular connector **59** and check valve assembly identical to that of FIG. 5, except that the check valve assembly and associated check valve chamber are both reversed end for end to provide for direct substitution of the connector **59** for a connector **11** disposed in the pressure supply passage, the reversed position of the check valve member being effected to provide uni-directional flow in the power supply direction in supply passage **14**.

Having now described the invention, what I claim as new and desire to secure by Letters Patent is:

1. In a panel block assembly:

(a) a first panel block having a pair of fluid passages therein, each passage opening at one end of said first panel block;

(b) a second panel block having one end abutting said one end of said first panel block and having a pair of through passages therein, each registering at one end with a different one of said pair of fluid passages in said first panel block;

(c) a third panel block having one end abutting the other end of said second panel block and having a pair of fluid passages therein opening at the abutting end in registration with the other end of each of said pair of through passages in said second block;

(d) a pair of tubular connectors, each extending through a different one of said pair of through passages in said second block with radial clearance and having one end screwed in a left-hand manner in a different one of said pair of fluid passages in said first panel block, and having the other end screwed in a righthand manner in a different one of said pair of fluid passages in said third panel block; and

(e) means on each said pair of tubular connectors engageable by a tool to effect axial rotation of the connector.

2. In a panel block assembly, as recited in claim **1**, in which said means is disposed interiorly of each of said pair of connectors.

3. In a panel block assembly, as recited in claim **2**, in which said means comprises a plurality of axially extending grooves in the interior wall of each of said pair of connectors.

4. In a panel block assembly, as recited in claim **1**, in which:

(a) said second panel block includes an additional passage therein communicating with one of said pair of through passages; and

(b) the one connector disposed in said one of said pair of through passages includes port means through the wall thereof communicating the interior of said one connector with said additional passage.

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5. In a panel block assembly, as recited in claim 4, in which said port means includes a pair of oppositely disposed ports.

6. In a panel block assembly, as recited in claim 4, in which:

(a) said port means includes a pair of ports displaced axially of said one connector.

7. In a panel block assembly, as recited in claim 4, in which said port means includes a plurality of ports equally spaced around the circumference of said one connector.

8. In a panel block assembly, as recited in claim 4, in which said port means includes a first pair of oppositely disclosed ports on a first axis disposed transversely of the axis of said one connector, and a second pair of oppositely disposed ports disposed on an axis in a plane disposed perpendicularly to said first axis.

9. In a panel block assembly, as recited in claim 8, in which:

(a) said second axis is displaced relative to said first axis along the axis of said connector.

10. In a panel block assembly, as recited in claim 1, in which:

(a) the end of each said through passage in said second panel block includes a counterbore; and

(b) an O-ring seal is disposed in each counterbore.

11. In a panel block assembly:

(a) a plurality of panel blocks and an additional panel block disposed in end-to-end abutting relationship, with said additional panel block disposed intermediately of a pair of said plurality of panel blocks;

(b) each of said plurality of panel blocks having an upper end and a lower end;

(c) a pair of laterally spaced through passages in each of said plurality of panel blocks and said additional panel block, each pair of through passages in each panel block disposed to axially register with the pair of fluid passages in each adjacent panel block to comprise a pair of fluid passages extending entirely through said plurality of panel blocks and said additional panel block;

(d) the ends of each said pair of fluid passages at the lower end of each of said plurality of panel blocks having left-hand threads;

(e) the ends of each said pair of fluid passages at the upper end of each of said plurality of panel blocks having right-hand threads, forming with said left-hand threads a plurality of pairs of axially aligned oppositely threaded fluid passage ends;

(f) said pair of fluid passages in said additional panel block being smooth and having a diameter larger than the maximum diameter of the left-hand and right-hand threads;

(g) two of said plurality of pairs of axially aligned oppositely threaded fluid passage ends each comprising the lower end of a different one of said pair of fluid passages in one of said pair of said plurality of panel blocks, and the upper end of a different

one of said pair of fluid passages in the other of said pair of panel blocks, each of said two pairs axially separated by a different one of said pair of through passages in said additional panel block; and

(h) a tubular connector in each of said plurality of pairs of axially aligned oppositely threaded fluid passage ends, each connector having its ends oppositely threaded, each end screwed into the correspondingly threaded passage end of the corresponding pair of oppositely threaded fluid passage ends.

12. In a panel block assembly, as recited in claim 11, in which:

(a) each of said connectors includes thereon means engageable by a tool to axially rotate the connector.

13. In a panel block assembly, as recited in claim 11, in which:

(a) said additional panel block includes an additional passage therein communicating with one of said pair of through passages in said additional panel block; and

(b) the one connector in said one of said pair of end-to-end fluid passages in said additional panel block inclues port means through the wall thereof communicating the interior of said one connector with said additional passage.

14. A fluid conduit coupling, comprising:

(a) three conduit members disposed in end-to-end abutting relationship, each conduit member having a through passage axially registering with the fluid passage in the adjacent conduit member;

(b) a tubular connector extending axially through the conduit in the intermediate one of said conduit members with radial clearance and having oppositely disposed threads on its ends, each end screwed into corresponing threads in a different one of the other two of said three conduit members on the opposite sides of the intermediate member;

(c) an additional fluid passage in said intermediate member communicating with said through passage therein; and

(d) port means in said tubular connector communicating the interior thereof with said additional passage means.

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U.S. Cl. X.R.

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