July 15, 1969 A. AKSU 3,456,086

FLUID PRESSURE ACTUATED ELECTRICAL COUPLER SYSTEMS

Filed April 11, 1967

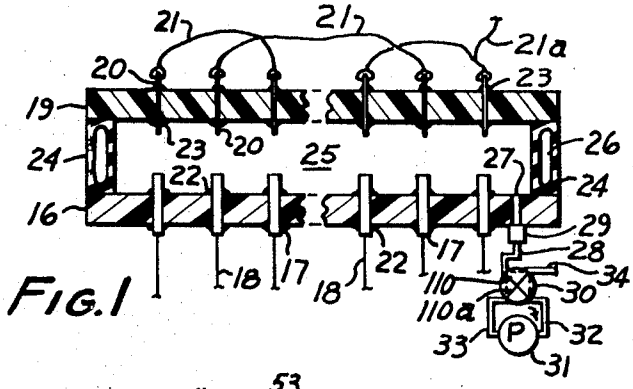

FIG. 1

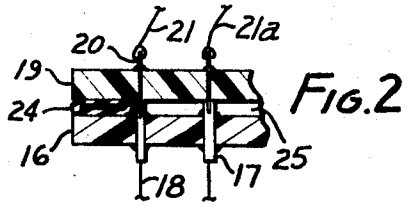

FIG. 2

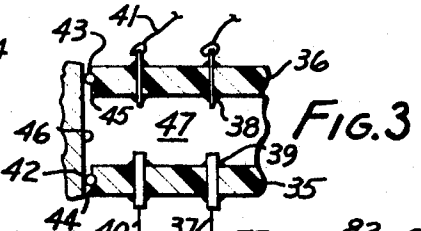

FIG. 3

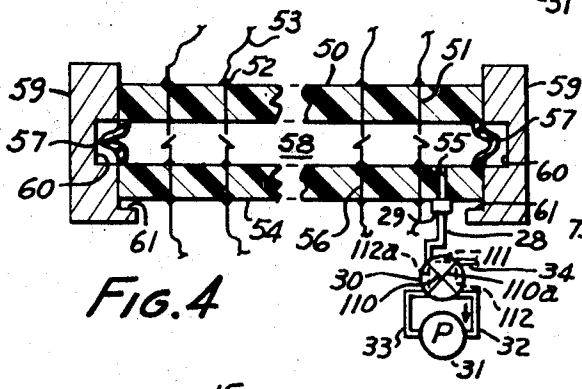

FIG. 4

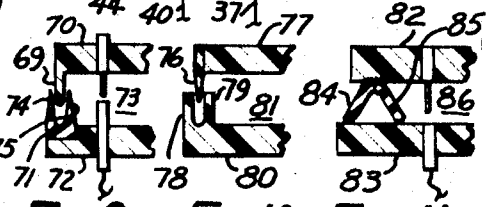

FIG. 9 FIG. 10 FIG. 11

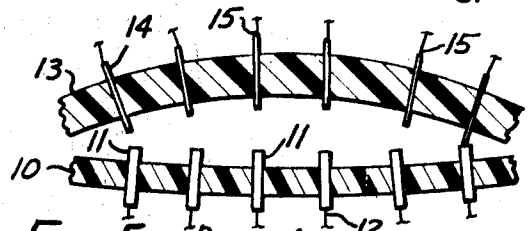

FIG. 5 PRIOR ART

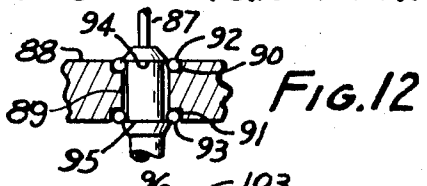

FIG. 12

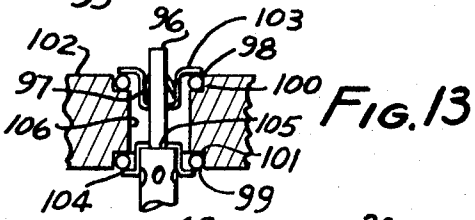

FIG. 13

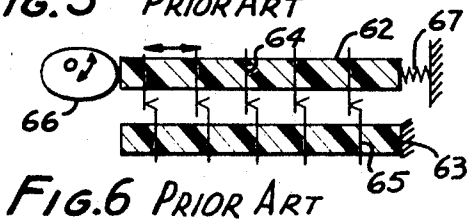

FIG. 6 PRIOR ART

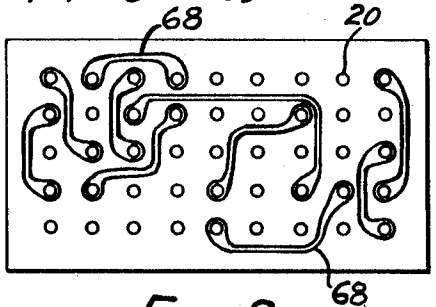

FIG. 8

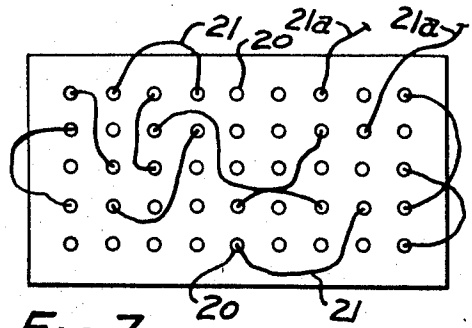

FIG. 7

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3,456,086

FLUID PRESSURE ACTUATED ELECTRICAL COUPLER SYSTEMS

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Int. Cl. H01h 35/24
U.S. Cl. 200—81 17 Claims

ABSTRACT OF THE DISCLOSURE

An electrical connector system according to the present disclosure comprises a first and a second plate each having a plurality of electrical couplers mounted thereto. First seal means is connected between the first and second plates to provide a fluid seal between the plates and to enclose a chamber between the plates. When this assembly of plates and seal is completed, those portions of the couplers which are to be connected to each other are located inside the chamber. Control means is provided for selectively increasing and decreasing fluid pressure within the chamber, thereby relatively to move the plate between a first position wherein the couplers are joined and a second position wherein the couplers are disconnected from each other.

According to one feature of the present disclosure the control means comprises a fluid pressure system communicating through a port into said chamber. Selective means is provided for selectively connecting the port to either the higher or lower pressure portion of the system to selectively increase or decrease the fluid pressure in the chamber.

This invention relates to electrical connector systems for connecting a plurality of electrical couplers together.

Numerous electrical circuits such as may be found in a computer or the like are often simultaneously interconnected by a connector system utilizing patch cords to connect some circuits through connection contacts. The circuits to be interconnected may involve all or only some of the contacts.

Typically, the connector system comprises a plurality of couplers such as pins, mounted on a first plate, which couplers are electrically connected to various circuits to be controlled, and a second plurality of couplers such as sockets, connectible with the first couplers, which couplers are mounted to a second plate. The second couplers are adapted to be interconnected with each other by external wires or patch cords or printed circuitry. The plates are assembled and disassembled so as simultaneously to couple and to de-couple all the electrical coupler pairs.

A force has typically been applied to the edges of the plates in such installations, the force bearing a direct relationship to the number of connector pairs being assembled, because each pin requires a certain specific force to assemble it. In installations where large numbers of coupler pairs are involved, the total resistance of the coupler pairs is quite large. When the force is applied at the edges, it is liable to cause the plates to bow, thereby causing angular or lateral misalignment of the coupler pairs. The misalignment of the coupler pairs causes some of the couplers to bend or even break, thereby rendering the connector system ineffective, and sometimes preventing any assembly at all. It has heretofore been impossible to exert a uniform pressure over the full surface, and so the designer has had to go to more complicated arrangements such as laterally shiftable plates and the like, the complexity of which renders them less desirable.

It is an object of the present invention to provide a simple connector system to overcome the problems of the prior art whereby pressure between the plates supporting

the coupler pairs is maintained substantially uniform over the entire surface area of the plates.

An electrical connector system according to the present invention comprises a first and second plate each having a plurality of electrical couplers mounted thereto. First seal means is connected between the first and second plates to provide a fluid seal between the plates and to enclose a chamber between the plates. The portions of the couplers which are to be connected to each other are located inside the chamber. Control means is provided for selectively increasing and decreasing fluid pressure within the chamber, and thereby relatively to move the plates between a first position wherein the couplers are joined and a second position wherein the couplers are disconnected from each other.

An optional and desirable feature of the present invention is the provision of a fluid pressure system communicating through a port into said chamber. Selective means is provided for selectively connecting the port to either the higher or the lower pressure portion of the system so as selectively to increase or decrease the fluid pressure in the chamber.

A preferred but optional feature of the present invention is a novel seal for sealing the first and second plates together.

Still another preferred but optional feature of the present invention is a novel seal for sealing the couplers to the plate.

The above and other features of this invention will be fully understood from the following detailed description and the accompanying drawings, in which:

FIG. 1 is a side view partly in cutaway cross-section of the preferred embodiment of a connector system according to this invention;

FIG. 2 is a side view partly in cutaway cross-section of a portion of the connector system illustrated in FIG. 1, shown in a different position;

FIG. 3 is a side view partly in cutaway cross-section of a modification of the connector system illustrated in FIG. 1;

FIG. 4 is a side view partly in cutaway cross-section of another modification of the connector system illustrated in FIG. 1;

FIG. 5 is a fragmentary side view partly in cutaway cross-section of one form of a prior art connector system;

FIG. 6 is a side view partly in cutaway cross-section of another form of a prior art connector system;

FIG. 7 is a top view of the connector system illustrated in FIG. 1;

FIG. 8 is a top view of a modification of the connector system illustrated in FIG. 1;

FIGS. 9, 10 and 11 are side views partly in cutaway cross-section of various modifications of seal means for use in the connector system according to the present invention;

FIG. 12 is a side view elevation partly in cutaway cross-section of an electrical coupler sealed to a plate for use in the connector system according to the present invention; and

FIG. 13 is a side view partly in cutaway cross-section of a modification of the electrical coupler illustrated in FIG. 12.

In FIG. 5 there is illustrated a prior art type of connector system useful with patch cords for manually programing computers and the like. Couplers **11** are mounted on a normally flat plate **10** and are electrically connected via leads **12** to various circuits of equipment to be controlled, such as a computer (not shown). In typical installations, plate **10** is mounted to a fixed location such as a cabinet or panel. Couplers **14** are mounted on a normally flat plate **13** for connection with couplers **11**. The number of couplers on either plate may

vary with the particular installation but a typical installation may include several hundred couplers or even more. Couplers **14** are arranged and disposed on plate **13** so that each coupler **14** will join to a respective coupler **11** on plate **10**. A plurality of electrical conductors **15** are connected between several couplers **14** in such a manner as to provide proper interconnection between the various circuits conected to leads **12** and to provide proper programming of those circuits. By way of example, conductors **15** may be wires or patch cords or even conductive strips fixed to plate **13**.

The problem associated with the connector system illustrated in FIG. 5 is that when the couplers on the two places were joined, the force necessary to engage the coupler pairs was applied to the edges of the plates, causing one or both of the plates to buckle or bow (as shown in exaggerated scope in FIG. 5) when assembling or disassembling the couplers. This is because the outer couplers (not shown) created a resistive coupling force at the edge which caused the bowing. Buckling or bowing of the plates then caused at least some of the couplers to become misaligned, and this sometimes prevented assembly of the pairs, and even bending or breaking of the couplers. Therefore, great care was necessary when assembling or disassembling the connector system illustrated in FIG. 5 to avoid misalignment, bending or breaking the couplers, and sometimes the connections could not be made at all.

FIG. 6 illustrates a prior art type of connector system wherein cams were used to assure proper mating of pin-type couplers with resilient couplers. This shows the extent to which hardware has been complicated to overcome the problem shown in FIG. 5. In FIG. 6 there is illustrated a pair of plates **62** and **63**, each carrying a plurality of suitable couplers **64** and **65**, couplers **64** being of the pin type while couplers **65** ane of the resilient type. A cam **6** is provided for moving plate **62** laterally so as to ensure proper joinder of couplers **64** with couplers **65**. A compression spring **67** may also be mounted to plate **62** so as to provide disengagement of the contacts upon release of the cam.

In the connector system illustrated in FIG. 6, the couplers were joined by laterally moving plate **62** so as to bring pin couplers into contact with resilient contacts **65**, and the couplers pairs were disengaged by revolving cam **66** to its minimum point against plate **62** so as to allow compression spring **67** to move the plate to disengage the coupler pairs.

However, even this complicated arrangement has many inherent problems, because the various springs have their individual resistances and create accumulated lateral loads throughout the system. The accumulated lateral loads cause shrinkage and buckling of the plates which creates a design problem and requires the designer to utilize relatively strong construction materials. Furthermore, the gaps and clearances created by ordinary manufacturing tolerances associated with this type of connector system create severe misalignment of the coupler pairs so that by the time the maximum force is exerted, not all contacts may have been joined.

In FIG. 1 there is illustrated a connector system which at once simplifies the systems of the prior art and overcomes these problems. Sufficient forces will be evenly distributed over the entire surface area of the plate to assure proper alignment of the coupler pairs during assembly and disassembly operations, and the force level can readily be adjusted by a simple pressure setting. The connector system shown in FIG. 1 includes a plate **16** having a plurality of couplers **17** mounted thereto. Couplers **17** are connected via leads **18** to suitable external electrical equipment, such as to circuits of a computer (not shown). A second plate **19** is provided having a like number of couplers **20** mounted thereto and adapted to join to respective couplers **17**. By way of example, couplers **17** may be of the receptacle type and couplers **20** may be of the plug type. The number of couplers in each plate may be any suitable number, for example several hundred or even more, and the couplers are aligned and disposed on the respective plates so that each coupler on one plate will connect with a respective coupler on the other plate. Couplers **20** may be interconnected by suitable wires or patch cords **21** as illustrated in FIG. 7 or by suitable printed circuitry **68** as illustrated in FIG. 8, or may be connected via leads **21***a* to external electrical equipment.

Couplers **17** are sealed to plate **16** by seals **22**. Couplers **20** are sealed to plate **19** by seals **23**. Plates **16** and **19** are preferably constructed from electrical insulating material to prevent short-circuiting between couplers; otherwise each coupler will be insulated from the plate.

A flexible seal **24** is continuously joined to the periphery of both plates **16** and **19** in such a manner as to form an enclosed chamber **25** between the two plates. By way of example, seal **24** may be substantially tube-shaped in its uncompressed condition, containing compressible fluid **26** such as air. The chamber **25** defined between plates **16** and **19** and seal **24** contains the active portions of couplers **17** and **20**, which together form a circuit when joined.

A port **27** provides communication to chamber **25**, and one end of conduit **28** is connected to port **27** by fitting **29**. The other end of conduit **28** is connected to three-way cross-over valve **30**. One of the flow conditions of cross-over valve **30** is shown in solid line, and the other two in dashed lines. Vacuum pump **31** has its inlet connected via conduit **32** to cross-over valve **30** and its exhaust connected via conduit **33** to cross-over valve **30**. Conduit **34** is connected to cross-over valve **30** and is open to the atmosphere.

FIG. 3 illustrates another type of peripheral seal useful instead of seal **24**. Plates **35** and **36** carry like couplers **37** and **38** which are sealed to the plates by seals **39**. Couplers **37** are connected via leads **40** to suitable electrical equipment, such as a computer (not shown), and couplers **38** are connected to suitable wires or patch cords **41** or printed circuitry (not shown) as well known in the art and as in FIG. 1 or to the leads of an external electrical equipment.

Seal rings **42** and **43** are mounted in peripheral recesses **44** and **45** in the edge of each of plates **35** and **36**, respectively. Seal rings **42** and **43** seal against wall **46** of a surroundnig ring, so as to form a sealed chamber **47** between the plates and the wall. Thus, when the plates are moved together by fluid vacuum, seal rings **42** and **43** remain in abutment against wall **46** to provide a fluid-tight chamber.

FIG. 4 illustrates a modification of the present invention utilizing a different kind of coupler, corresponding parts bearing like reference numerals. Plate **50** supports a plurality of pin-type couplers **51** which are sealed by seals **52** to the plate. Couplers **51** may be interconnected by suitable patch cords **53** or printed circuitry (not shown). A second plate **54** carrying port **55** supports a plurality of resilient couplers **56** which do not have sockets but instead a spring-loaded surface adapted to abut a pin. Couplers **56** are positioned such that couplers in adjacent rows are faced in opposite directions, so as to reduce or even eliminate accumulated lateral loads. Couplers **51** are so arranged and disposed on plate **50** as to contact and displace couplers **56** on plate **54**. A fluid system like that of FIG. 1 is provided.

A flexible seal **57** which may be formed from a flexible means such as rubber, is continuously connected to the periphery of plates **50** and **54** to define an enclosed chamber **58** between the plates and seal **57**. Guide means **59** contacts and guides the two plates, and carries a recess **60** for lateral expansion and contraction of seal **57**. If desired, shoulder **61** may be provided on guide means **59** to provide a stop for limiting the travel of plate **54**.

Comparison of the prior art systems illustrated in FIGS. 5 and 6 with that of the invention will show how the prior art problems have been reduced or eliminated. In the

arrangement shown in FIG. 6, the plates have a mechanical bias on them either in the form of the camming or in the form of the compression spring. Because of the clearances between the cams and the other moving parts of the engagement mechanism and because of the uneven compression and expansion of the plates due to the accumulated lateral loads, the proper alignment of coupler pairs is difficult to achieve, and the deflection of the contacts varies. Forces applied to the contact points are likely to be too light or too strong, and there is no assurance of contact at all junctions. With the devices illustrated in FIGS. 1 and 4, fluid pressure and fluid vacuum are utilized for applying an even pressure over substantially the entire surface area of the plates, to move them together and apart. The couplers are thereby engaged and disengaged, and the movement is short and axial along the couplers. In FIG. 4 contact springs are arranged so as to prevent accumulation of axial forces alongside the plate due to contact springs, and guide means **59** provides additional guidance for the plates.

In operation of the connector system illustrated in FIG. 1, valve **30** is turned to a first position shown as solid lines **110** and **110***a* in the drawings, to provide fluid communication between chamber **25** and the intake of pump **31**, and between the exhaust of pump **31** and the amosphere. Pump **31** then reduces the pressure in the chamber. The partial vacuum within the chamber creates an even force over substantially the entire surface area of plates **16** and **19**, thereby drawing the plates together. The compressible seal **24** collapses and the various pairs of couplers are joined. The vacuum continues to draw the plates closer, thereby assuring a full electrical contact between the various pairs of couplers.

After full and complete joining of the pairs of couplers as illustrated in FIG. 2, the partial vacuum within chamber **25** may be relieved to the atmosphere by turning valve **30** to a second position, shown as dashed line **111** in the drawings, to bring chamber **25** into communication with the atmosphere through conduit **34**. Likewise, pump **31** may be stopped. The couplers will not become disassembled since there is sufficient friction force to hold them together in a joined position until they are forced apart.

To achieve a dissembly of the mated couplers, the plates may be simply pulled apart. Alternatively, valve **30** may be turned to a third position (shown as dashed lines **112** and **112***a* in the drawings) to provide fluid communication between the exhaust of pump **31** and chamber **25** and between the intake of pump **31** and the atmosphere. Pump **31** then increases the pressure in the chamber. The pressure within the chamber creates an even force over substantially the entire surface area of plates **16** and **19**, thereby pushing the plates apart.

The operation of the connector system illustrated in FIG. 4 is substantially identical to the operation of that illustrated in FIG. 1. The plates are drawn together by a vacuum from pump **31**. They may be mechanically separated or separated by pressure pumped into the chamber.

FIGS. 9, 10 and 11 illustrate different seals which may be substituted for the peripheral seals shown in FIGS. 1 and 4. In FIG. 9 the seal means comprises a rigid flange **69** supported by one plate **70** and a resilient seal **71**, contactible by flange **69** and supported by the other plate **72**. By way of example, flange **69** may be constructed from the same material as plate **70** and may be made integral with it. When chamber **73**, formed between plates **70** and **72**, is partially evacuated to assemble the coupler pairs, the region between lips **75** and **74** of seal **71** assumes a somewhat lower than atmospheric pressure with respect to the pressure at the remote side of lip **74**, thereby forcing lip **74** to seal against flange **69**. Conversely, when chamber **73** is pressurized to disassemble the coupler pairs, lip **75** is forced against flange **69** due to the pressure differential. Chamber **73** is thus sealed during both pressurization and partial evacuation operations of the chamber.

FIG. 10 illustrates an arrangement similar to that of FIG. 9 except that a resilient flange **76** is mounted to one plate **77** while a pair of flanges **78** and **79** are integrally formed from plate **80**. When chamber **81**, formed between plates **77** and **80**, is partially evacuated, resilient flange **76** seals against flange **79**; and conversely, when chamber **81** is pressurized, flange **76** seals against flange **78**.

FIG. 11 illustrates another modification of a seal between plates **82** and **83** wherein a pair of resilient flange seals **84** and **85** are mounted to plate **82** and contact **83** to form a cavity therebetween. Flanges **84** and **85** maintain a seal against plate **83** during both pressurization and partial evacuation of chamber **86** by sliding along the surface of plate **83** to maintain the seal.

FIG. 12 illustrates a seal for sealing coupler **87** to plate **88**. A passage **89** is provided through plate **88**, and recesses **90** and **91** are provided for receiving O-ring seals **92** and **93**, respectively. Annular shoulders **94** and **95** are provided on coupler **87**, shoulder **94** being smaller than passage **89** so that shoulder **94** may be passed through the passage. Coupler **87** is assembled and sealed to plate **88** by placing O-ring **93** into recess **91** and inserting the coupler into the passage so that shoulder **94** passes through the passage. O-ring **92** is then slipped over shoulder **94** and shoulder **95** is brought into abutment against O-ring seal **93**. O-ring **92** thus provides a fluid seal between shoulder **94** and recess **90** of the plate, while O-ring **93** provides a fluid seal between shoulder **95** and recess **94** of the plate.

FIG. 13 illustrates a modification of the seal and coupler shown in FIG. 12, wherein coupler **96** is provided with a pair of detents **97**. By way of example, detents **97** may be spring-loaded so as to be normally biased to the position shown in FIG. 14. O-ring seals **98** and **99** are received in recesses **100** and **101**, respectively, of plate **102**, and are held in position by eyelets **103** and **104**, respectively. Coupler **96** is assembled to plate **102** by placing O-rings **100** and **101** into their respective recesses, and placing eyelet **104** over a portion of coupler **96** so as to abut shoulder **105** of the coupler. The coupler is then inserted into passage **106**, and eyelet **103** is inserted over the coupler into contact with seal **98**. Eyelet **103** is held in place by detents **97**. O-rings **98** and **99** provide fluid seals between plate **102** and eyelets **103** and **104**, respectively. It is preferred that eyelet **104** provide an additional seal against the coupler such as by a cold-metal seal between eyelet **104** and shoulder **105**. Alternatively, a suitable gasket (not shown) or other sealing material may be placed between shoulder **105** and eyelet **104**.

FIG. 7 is a top view of a connector system according to the present invention wherein wires or patch cords **21** or leads **21***a* connected to external electrical equipment may be connected to couplers **20**, such as illustrated in FIG. 1. The patch cords may be fixed or may be removable so that the electrical connections between various couplers **20** may be altered as desired. In FIG. 8 there is illustrated a printed circuit arrangement wherein a particular program may be permanently placed on the plate and used for its particular function, and used in place of the patch cords. By way of example, the printed circuit may comprise copper strips **68**, physically attached to the plate so as to provide electrical interconnection between connectors **20**.

The present invention thus provides an electrical connector system providing a positive connection, and of desired disconnection, of a plurality of coupler pairs which overcomes the eccentric and unbalanced force problems common in the prior art. The connector system is efficient, easily manufactured and easy to use.

This invention is not to be limited by the embodiments shown in the drawings and described in the description, which are given by way of example and not of limitation.

What is claimed:

1. An electrical coupler system for connecting electri-

cal circuits together, said system having a first and a second plate, a first and a second plurality of electrical couplers mounted respectively to said first and second plates and arranged in pairs, at least one coupler of each pair having a resilient contact portion, said second plurality of said couplers being so disposed and arranged relative to said first plurality couplers that a contact portion of each of said second plurality of couplers is engageable with a contact portion of one of said first plurality of couplers, said plates being movable between a first position wherein each of said plurality of couplers is joined to one of said second plurality of couplers and a second position wherein said first plurality of couplers is separated from said second plurality of couplers, the improvement comprising: a fluid-tight chamber between said plates, those portions of said first and second couplers which join each other being disposed inside said chamber; first seal means peripherally extending around and enclosing said chamber in continuous contact with and providing a fluid seal between said plates; and control means for changing fluid pressure within said chamber to relatively move said plates between their first and second positions, the resulting change in fluid pressure altering the engagement of each coupler pair.

2. A system according to claim 1 wherein said first seal means comprises a compressible seal.

3. A system according to claim 1 wherein said first seal means comprises a resilient seal.

4. A system according to claim 1 wherein said first seal means comprises a body having a wall surrounding said first and second plates, and first and second sealing rings extending between and making a fluid seal between the said plates and wall.

5. A system according to claim 4 wherein each of said first and second sealers is an O-ring.

6. A system according to claim 1 wherein said first seal means comprises a resilient flange mounted to said first plate and a rigid flange mounted to said second plate, said resilient flange being adapted to abut and make a fluid seal with said rigid flange.

7. A system according to claim 1 wherein said control means comprises a fluid port through one of said first and second plates to said chamber, a pump having an inlet and an exhaust, and selectible means adapted to provide fluid communication between said port and the inlet, whereby operation of said pump decreases fluid pressure in said chamber when said selectible means provides fluid communication between said inlet and said chamber.

8. A system according to claim 7 wherein said selectible means is further adapted to provide fluid communication between said port and said exhaust, whereby operation of said pump increases fluid pressure in said chamber when said selectible means provides fluid communication between said exhaust and said chamber.

9. A system according to claim 1 further including electrically conductive strip means mounted to one of said plates and selectively interconnecting couples mounted to that plate.

10. A system according to claim 1 further including second seal means for sealing each coupler to its respective plate.

11. A system according to claim 10 wherein said second seal means comprises a passage through the respective plate, a recess on said plate at one end of said passage, an O-ring in said recess, and abutment means supported by the coupler abutting said O-ring.

12. A system according to claim 11 wherein said abutment means comprises a shoulder on said coupler.

13. A system according to claim 11 wherein said abutment means comprises an eyelet mounted on said coupler.

14. An electrical coupler system for connecting electrical circuits together, said system having a first and a second plate, a first and a second plurality of electrical couplers mounted respectively to said first and second plates, said second pluraliy of couplers being so disposed and arranged relative to said first plurality of couplers that a contact portion of each of said second plurality of couplers is engageable with a contact portion of one of said first plurality of couplers, said plates being movable between a first position wherein each of first plurality of couplers is joined to one of the said second plurality of couplers and the second position wherein said first plurality of couplers is separated from said second plurality of couplers, the improvement comprising: a plurality of passages through each of said plates; a recess on each plate at one end of each of said passages; a shoulder supported by each of said couplers; a seal ring in said recess; and means biasing said coupler in said passage so that the shoulder abuts said seal ring to compress the seal ring in said recess, thereby forming a fluid seal between said coupler and said plate.

15. A system according to claim 14 wherein said bias means comprises a second recess in each of said plates at the opposite end of each passage from the first recess, a second seal ring in said second recess, and abutment means supported by the coupler for abutting said second seal ring.

16. A system according to claim 15 wherein said abutment means comprises a second shoulder on said coupler.

17. A system according to claim 15 wherein said abutment means comprises an eyelet on said coupler.

References Cited

UNITED STATES PATENTS

3,209,089	9/1965	Weissburg.	
3,256,399	6/1966	Palmer	200—83.8

ROBERT K. SCHAEFER, Primary Examiner

H. BURKS, Assistant Examiner

U.S. Cl. X.R.

200—168

PO-1050
(5/69)

UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,456,086 Dated July 15, 1969

Inventor(s) Akin Aksu

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Column 1, line 22, "plate" should read --plates--; Column 3, line 36, "ane" should read --are--; Column 3, line 37, "6" should read --66--; Column 3, line 45, "couplers" should read --coupler--; Column 4, line 44, "surroundnig" should read --surrounding--; Column 7, line 7, after "plurality" read --of; Column 7, line 11, after "said" read --first--; Column 8, line 1, "couples" should read --couplers--; Column 8, line 19, "pluraliy" should read --plurality--

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(SEAL)
Attest:

Edward M. Fletcher, Jr.
Attesting Officer

WILLIAM E. SCHUYLER, JR.
Commissioner of Patents

PO-1050
(5/63)

UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,456,086 Dated July 15, 1969

Inventor(s) Akin Aksu

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