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Fiddler et al.

[11] **3,906,178**

[45] **Sept. 16, 1975**

[54] **ELECTRICAL FLUID SWITCH WITH CROSSING SLIDE CHAMBERS**

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[73] Assignee: **Theodore E. Fiddler,** Birmingham, Mich.

[22] Filed: **Oct. 21, 1974**

[21] Appl. No.: **516,686**

Related U.S. Application Data

[63] Continuation of Ser. No. 345,977, March 29, 1973, Pat. No. 3,845,257, which is a continuation-in-part of Ser. No. 315,106, Dec. 14, 1972, Pat. No. 3,824,356.

[52] **U.S. Cl.** ..... **200/61.86;** 200/153 LA

[51] **Int. Cl.²** **H01H 9/06**

[58] **Field of Search** ..... 200/61.86, 81 H, 153 LA

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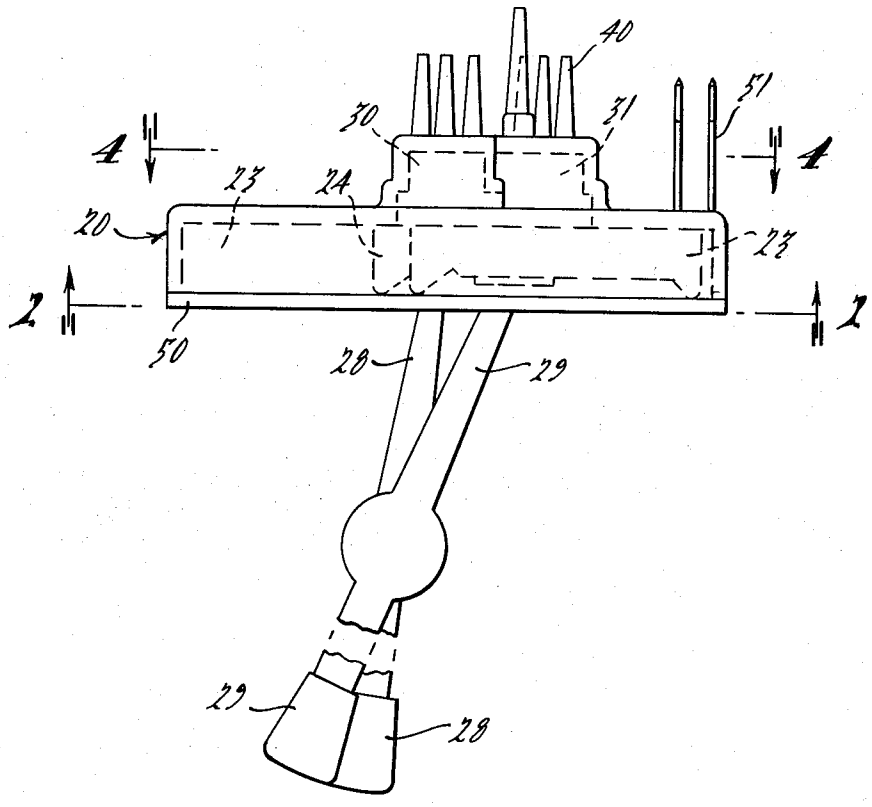
3,637,962	1/1972	Fiddler et al.	200/61.86
3,824,356	7/1974	Fiddler et al.	200/61.86
3,845,257	10/1974	Fiddler	200/61.86

Primary Examiner—James R. Scott
Attorney, Agent, or Firm—William T. Sevald

[57] **ABSTRACT**

An apparatus for controlling electromotive force (EMF) and/or fluid pressure force (FPF) in a system having a case with walls defining at least one slide chamber and one or more intercommunicating cross-slide chambers. The case walls at the chambers carry circuit terminals for connection in the circuits of a system. The circuit terminals may be electrical contacts and/or fluid ports connected in a system by wires and tubes, respectively. The slide and cross-slide carry circuit making and breaking means for connecting and disconnecting circuits in a system. The circuit making and breaking means may be a switch for co-action with the electrical contacts and/or a channel maze for co-action with the fluid ports. The slide carries at least one cam track and each cross-slide carries a cam lying in a cam track. With movement of the slide in one direction each cam track imparts transverse movement to each cross-slide at desired points of travel. The movement of the slide and the transverse movement of the cross-slide actuates the making and breaking means on the slide and/or cross-slide relative to the circuit contacts on the case to open and close circuits as coordinated in the engineering to the position of the slide and/or cross-slide.

2 Claims, 10 Drawing Figures



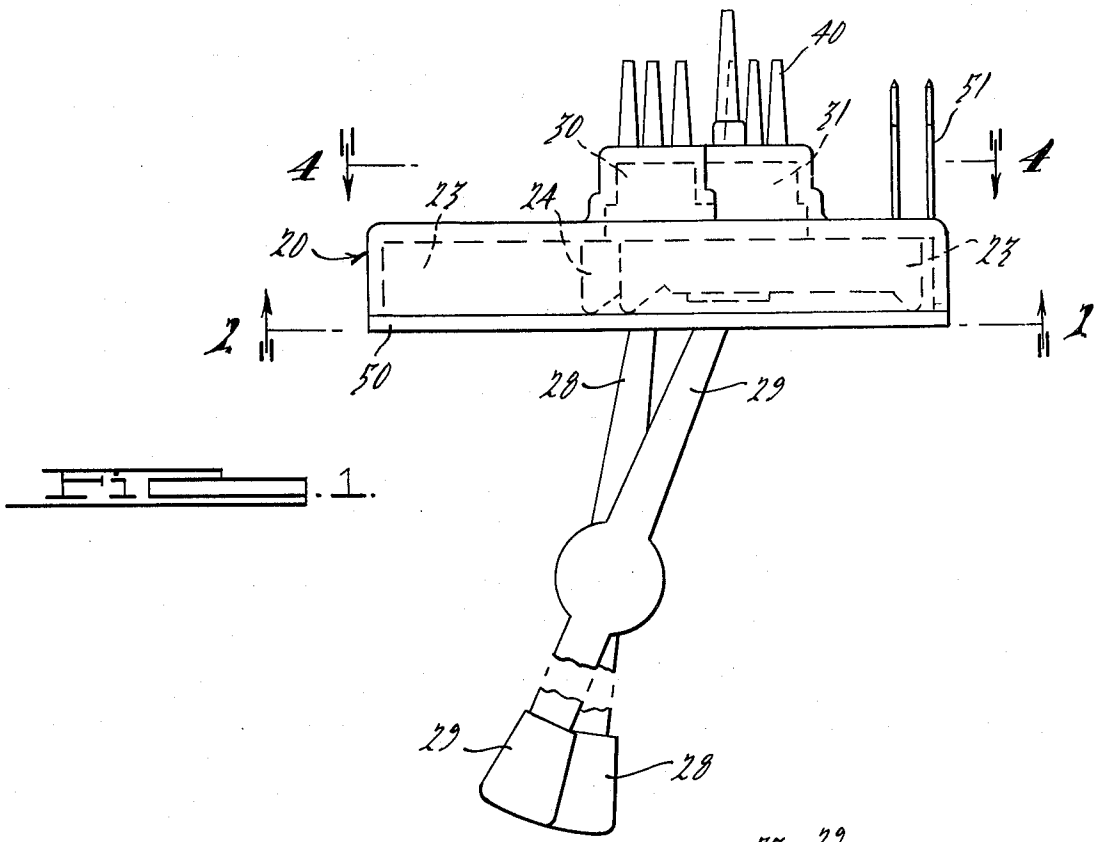


FIG. 1.

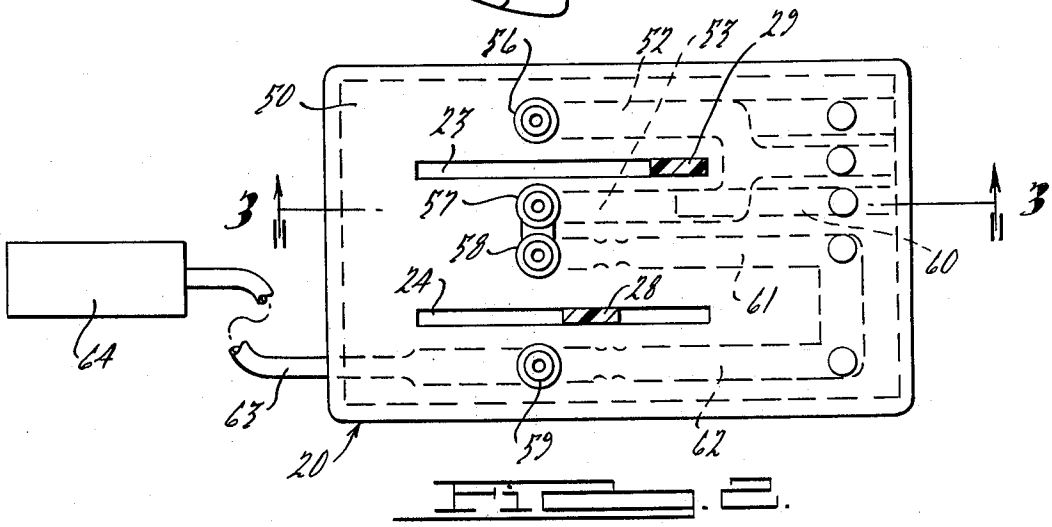


FIG. 2.

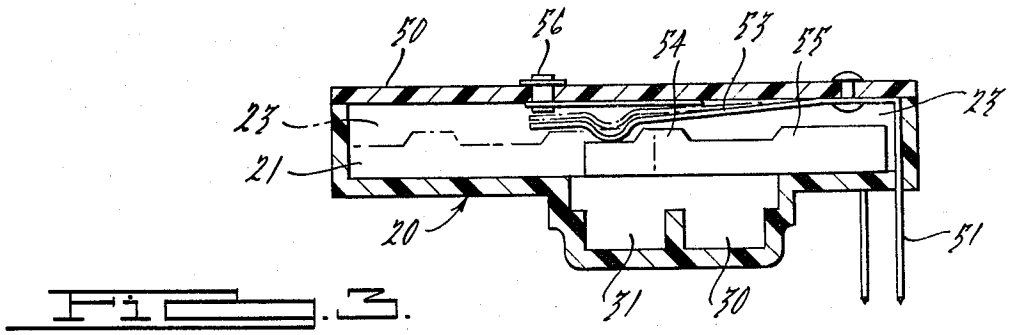


FIG. 3.

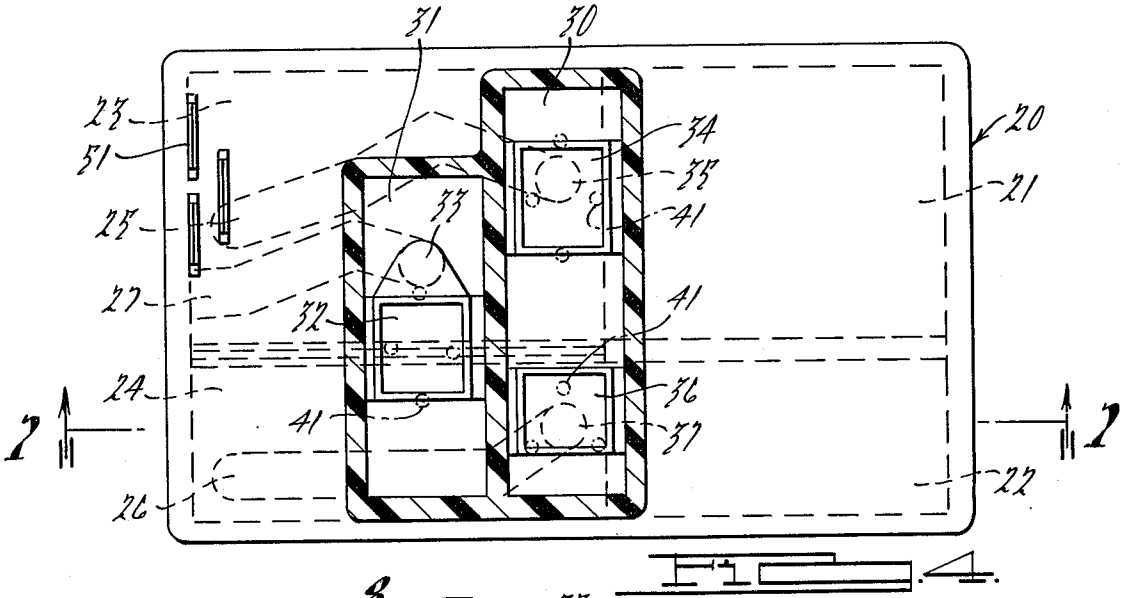


FIG. 4

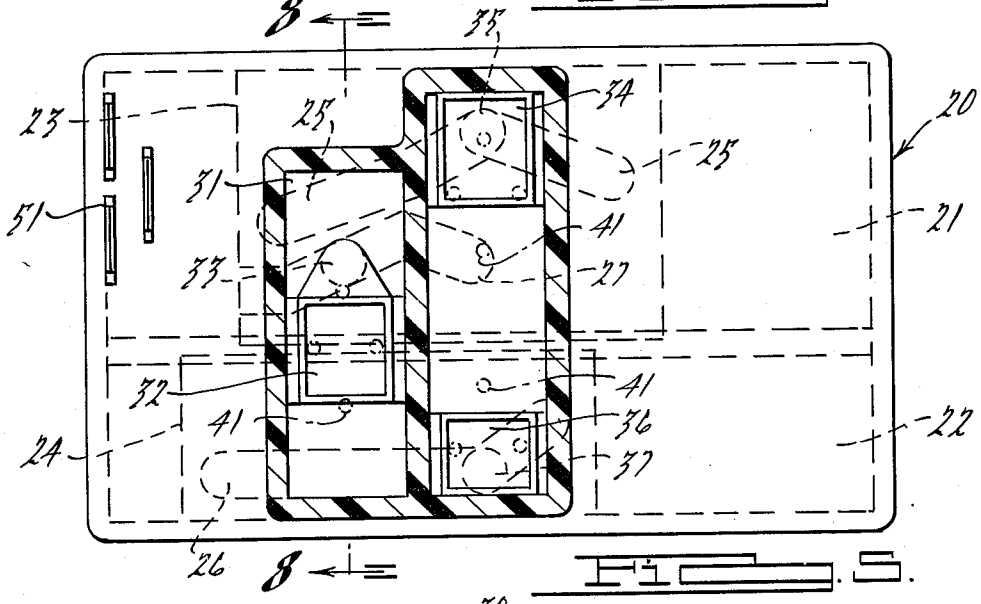


FIG. 5

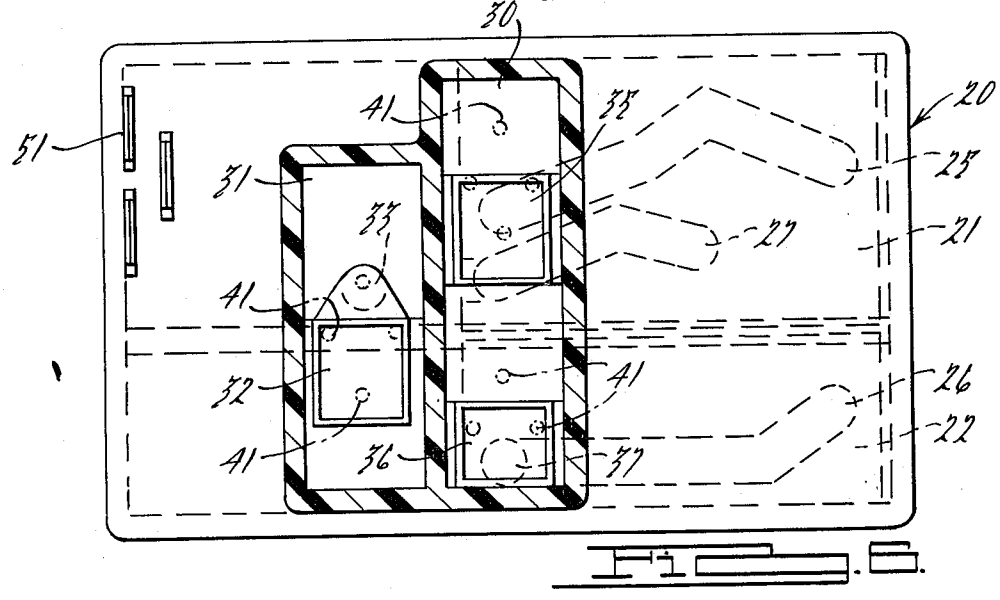


FIG. 6

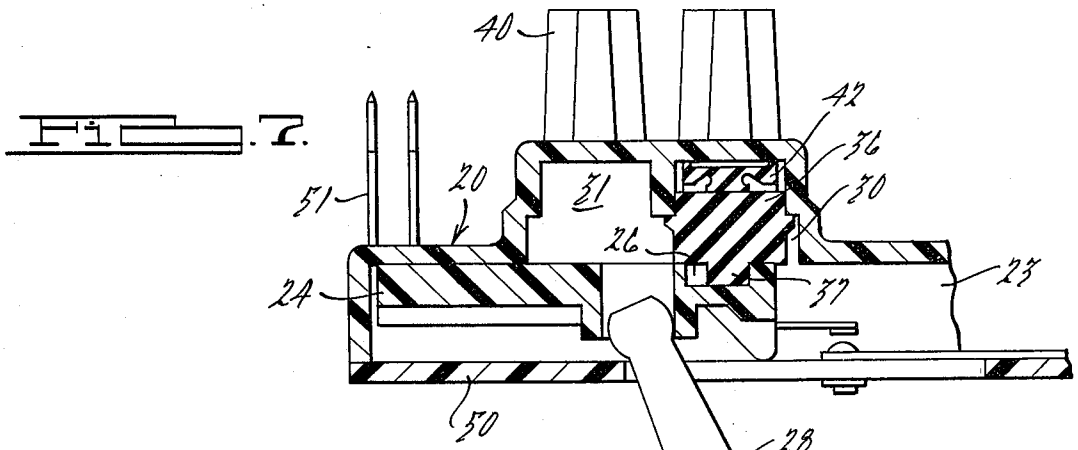


Fig. 7.

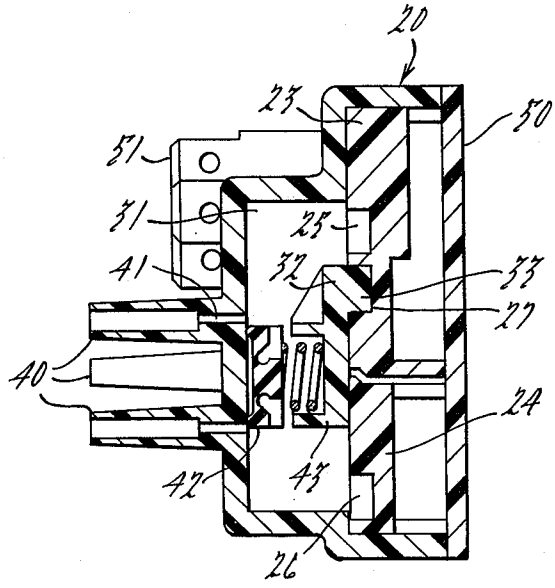


Fig. 8.

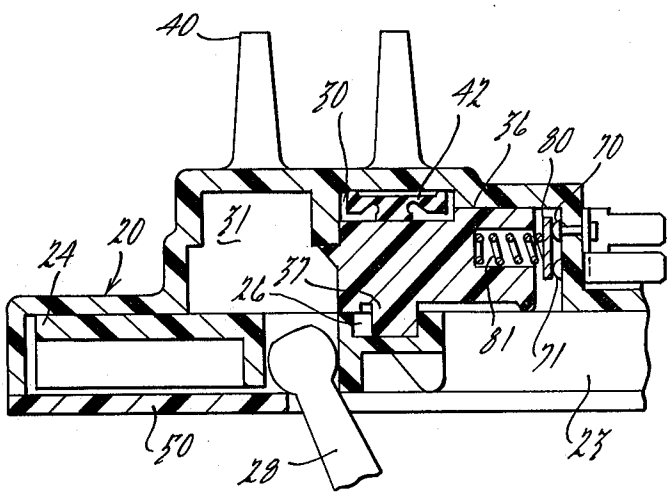


Fig. 9.

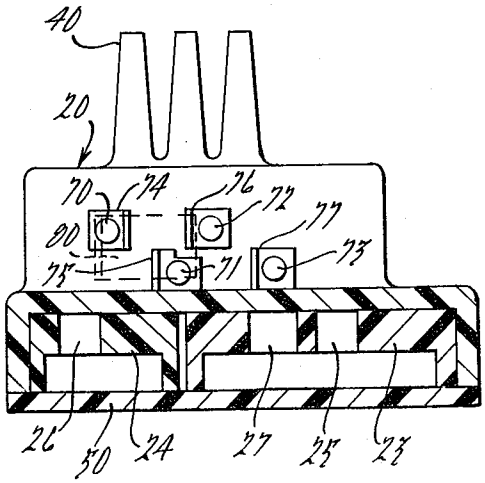


Fig. 10.

ELECTRICAL FLUID SWITCH WITH CROSSING SLIDE CHAMBERS

This application is a continuation of application Ser. No. 345,977, filed Mar. 29, 1973, now U.S. Pat. No. 3,845,257.

Application Ser. No. 345,977 which is a continuation-in-part of our application Ser. No. 315,106 filed Dec. 14, 1972, now U.S. Pat. No. 3,824,356. The applicants are the patentees in U.S. Pat. Nos. 3,637,961 and 3,637,962 for control devices.

BACKGROUND OF THE INVENTION

Control programs for applying EMF and/or FPF in systems are becoming more complicated and use more circuits while the space allotted to the control devices is becoming smaller. Thus the control devices are being called upon to handle more circuits and to be reduced in size. Also, the programs are becoming more varied in many uses so that the control device is also called upon to be adaptable to handle many variations in programs in numerous systems.

SUMMARY OF THE PRESENT INVENTION

With the foregoing in view, it is an object of the invention to provide a control device which is reduced in size, which has capacity for controlling more circuits in a system, and which may be varied to suit various programs in many systems.

An object of the invention is to provide a case having a slide with relative motion and multiple positions between the slide and the case and a cross-slide with relative motion and various positions between the cross-slide and the case.

An object of the invention is to use the movement of the slide to actuate movement of the cross-slides so that they move with coordinated action.

An object of the invention is to provide cam tracks on the slide and a cam on each cross-slide lying in one of the cam tracks to impart movement to each cross-slide in conjunction with movement of the slide.

An object of the invention is to provide cam and cam track actuation between a slide and cross-slides so that a portion of the programmed control of the circuits may be engineered into the cam tracks.

An object of the invention is to provide cam and cam track actuation and program control so that the control device can be easily changed in its manufacture to suit the demands of each customer by changing the cam tracks.

An object of the invention is to provide a control device that has an increased number of circuit connections providing more selection for the user and reduced size so that less space is occupied by the device.

These and other objects of the invention will become apparent by reference to the detailed description of the illustrated embodiments of the invention taken in connection with the accompanying drawings.

DESCRIPTION OF THE DRAWINGS

FIG. 1 is a top plan view of a control device embodying the invention indicating internal parts in broken lines and showing nipples at the FPF ports and an EMF terminal strip.

FIG. 2 is a back elevational view of the device of FIG. 1 as seen from the bottom of FIG. 1, with the operating levers shown in cross-section, additionally showing an electric cord and connector, and showing internal electrical leads in broken lines.

FIG. 3 is a cross-sectional view of the device taken on the line 3—3 of FIG. 2, showing the slide and EMF contacts in elevation and indicating a changed position of the slide in broken lines.

FIG. 4 is a cross-sectional view of the device seen in FIG. 1 taken on the line 4—4 thereof, showing the cross-slides, and indicating the cams on the cross-slides, the cam tracks behind the cross-slides and the slide chambers in the case in broken lines and indicating the FPF ports by phantom broken lines.

FIG. 5 is a view similar to FIG. 4 showing the cam tracks, cams and cross-slides in different positions upon changed position of the slides.

FIG. 6 is a view similar to FIGS. 4 and 5, showing the same parts in different positions.

FIG. 7 is a cross-sectional view of the device seen in FIG. 4 taken on the line 7—7 thereof, showing the slide in cross-section and the cross-slide and cam in elevation, and showing the operating lever in elevation and broken away.

FIG. 8 is a cross-sectional view of the device seen in FIG. 5 taken on the line 8—8 thereof showing the slide, cross-slide, cam, nipple, port and channel maze in cross-section.

FIG. 9 is a view similar to FIG. 7 showing an embodiment of the invention having EMF contacts actuated by the cross-slide; and

FIG. 10 is a side view of the device seen in FIG. 9 taken from the right side thereof, partly in cross-section and partly in elevation, showing the spaced disposition of the EMF contacts and terminals on the case.

DETAILED DESCRIPTION OF THE ILLUSTRATED EMBODIMENT

Referring now to the drawings wherein like reference numerals refer to like and corresponding parts throughout the several views, the control apparatus for electrical and/or fluid force comprises, FIGS. 1–4, a case 20 having a cavity defining a first slide chamber 21 and a cavity defining a second slide chamber 22. A first slide 23 lies in the chamber 21 and a second slide 24 lies in the chamber 22. Cam tracks 25 and 27 are carried by the slide 23 and a cam track 26 is carried by the slide 24. An operating lever 28 is connected to the second slide 24 and an operating lever 29 is connected to the first slide 23. Movement of the operating levers 28 and 29 moves the slides 24 and 23 in the slide chambers 22 and 21, respectively.

Transverse cavities in the case 20 define cross-slide chambers 30 and 31. A cross-slide 32 lies in the cross-chamber 31. A cam 33 on the cross-slide 32 lies in the cam track 27 of the first slide 23. A cross-slide 34 lies in the top of the cross-shamber 30. A cam 35 on the cross-slide 34 lies in the cam track 25 of the first slide 23. A cross-slide 36 lies in the bottom of the cross-chamber 30. A cam 37 on the cross-slide 36 lies in the cam track 26 of the second slide 24.

Relative to control of FPF, nipples 40 on the case 20 at the cross-chambers 30 and 31 surmount ports 41 in the case 20 at the cross-slides 32, 34, and 36. A channel maze 42 on the cross-slide 32 slides against the wall of the case 20 at the ports 41 and is resiliently pressed thereagainst by a spring 43 FIG. 8. The cross-slides 34 and 36 are similarly housed, formed, and equipped and the case 20 has ports 41 similarly integrated therewith.

Relative to control of EMF, a back wall **50** is mounted on the case **20**, FIGS. **1–3**. A terminal **51** connects to one side of EMF power supply. Spring switch arms **52** and **53** lead directly from the terminal **51**. Cams **54** and **55** on the top slide **23** actuate the switch arms **52** and **53**. Switch contact points **56, 57, 58,** and **59** are carried by the back wall **50**. The switch arms **52** and **53** engage the contact points **56** and **57** respectively when moved by the cams **54** and **55** upon movement by the top slide **23** as indicated by the broken line indication, FIG. **3**. A cross-connector **60** is mounted on the back wall **50**. Switch arms **61** and **62** are connected to the cross-connector **60** and are actuated similarly by the bottom slide **24** by cams as described relative to the top slide against the contact points **58** and **59**. Leads **63** are connected to each contact point **56–59** as illustrated relative to contact point **59**. The leads **63** are accumulated in a plug **64**. The cross-connector **60** may be fixedly connected to the terminal **51** or it may be engaged by the actuation of a switch arm such as the switch arm **53** as shown. Thus the supply of EMF to the switch arms **61** and **62** may be made dependent on the actuation of another switch such as switch arm **53**. This may be programmed in the control system so that an operator-user must first actuate a certain portion of a system before he may actuate another portion. Obviously the terminal **51** may be fixedly connected to the switch arms **61** and **62** rendering them independently operable.

EMF control may also be provided at the cross-slides **32, 34** and **36** as shown in FIGS. **9** and **10** relative to bottom cross-slide **36** and it will be understood that the other cross-slides **32** and **34** may be similarly equipped. Contact points **70–73** lie spaced inside the case **20** in the cross-slide chamber **30** at the cross-slide **36** and have exterior terminals **74–77** respectively for receptacle connection. A contactor plate **80** is carried by the cross-slide **36**. A spring **81** urges the plate **80** toward the contact points **70–73**. Movement of the cross-slide **36** carries the plate **80** relative to the contact points **70–73** to complete and interrupt circuits between the contact points **70–73** as engineered in the design of the system by the spacing and position of the contact points **70–73** and the size and shape of the plate **80** to control EMF in a system.

The location of the cams **54** and **55**, FIG. **3**, on the top and bottom slides **23** and **24**, the placement of the switch arms **52, 53, 61** and **62**, FIG. **2**, the positioning of the contact points **70–73**, FIG. **10**, are engineered into the device for the system desired together with the location of the ports **41** relative to the channel maze **42** on each cross-slide **32, 34** and **36** and the channeling and blocking configuration of each channel maze **42**, FIGS. **4–9**, the independency or dependency of the circuits exemplified by the switch arms **52, 53, 61,** and **62**, and the angles and conformation of the cam tracks **25, 26,** and **27**, FIGS. **4–6**, relative to the cams **33, 35,** and **37** on the cross-slides **32, 34,** and **36**.

In operation FPF tubes, not shown, are connected on the nipples **40** between supply and use and EMF circuits, not shown, are connected to the terminals **51, 63,** and **74–77**. When the user swings the lever **29** it moves the top slide between the dotted line positions indicated and the solid line showings of FIGS. **3–6** during which the cams **54** and **55** actuate the switch arms **52** and **53** and the cam tracks **25** and **27** actuate the cross-slides **32** and **34** via the cams **33** and **35** respectively relative to the ports **41**. If the circuit to the switch arms **61, 62** is dependent, this also actuates the cross-connector **60**.

Upon the user swinging the lever **28** it moves the bottom slide **24** between the positions indicated in broken lines FIGS. **1** and **4–6** and solid line positions shown, FIGS. **7–10**, during which like cams **54** and **55**, not shown, actuate the switch arms **61, 62**, FIG. **2**, and the cam track **26** actuates the cross-slide **36** via the cam **37** relative to the ports **41**, FIGS. **4–10**, and also moves the plate **80** FIGS. **9, 10**, relative to the point contacts **70–73**.

It will be understood that due to the interaction between the slides **23** and **24** and cross-slides **32, 34,** and **36** that many EMF and FPF circuits can be controlled in coordination with one another in a very small space and that the device is capable of controlling a large plurality of circuits.

The device and elements shown are exemplary and the scope of the protection of the invention is defined in the appended claims.

We claim:

1. A control device comprising,
a case defining an interior linear slide chamber;
a front wall on said case having an opening therein;
a housing on said front wall overlying said opening in said case front wall defining an interior transverse cross-slide chamber in said housing relative to said linear slide chamber in said case;
a cross-slide in said housing for transverse movement in said housing;
a cam on said cross-slide;
a linear slide in said case for linear movement in said case;
said linear slide having a cam track receiving and engaging said cam on said cross-slide so that linear movement of said linear slide in said case effects transverse movement of said cross-slide in said housing,
means for moving said linear slide;
said housing having a face wall;
FPF ports in said face wall of said housing;
means surmounting said ports for connecting said ports to FPF supply and use;
a channel maze switch-valve on said cross-slide facing said ports for selectably interconnecting and blocking fluid communication between said ports relative to FPF supply and use coordinated with the position of said cross-slide in said housing;
EMF contacts on said housing adjacent said cross-slide,
connector means on said housing connected to said contacts for attaching EMF supply and use lines to said contacts, and
means on said cross-slide facing said contacts for selectably interconnecting and disconnecting electrical communication between said contacts relative to EMF supply and use coordinated with the position of said cross-slide in said housing.

2. A control device comprising,
a case defining an interior linear slide chamber;
a front wall on said case having an opening therein;
a housing on said front wall overlying said opening in said case front wall defining an interior transverse cross-slide chamber in said housing relative to said linear slide chamber in said case;

a cross-slide in said housing for transverse movement in said housing;
a cam on said cross-slide;
a linear slide in said case for linear movement in said case;
said linear slide having a cam track receiving and engaging said cam on said cross-slide so that linear movement of said linear slide in said case effects transverse movement of said cross-slide in said housing,
means for moving said linear slide;
said housing having a face wall,
FPF ports in said face wall of said housing,
means surmounting said ports for connecting said ports to FPF supply and use;
a channel maze switch-valve on said cross-slide facing said ports for selectably interconnecting and blocking fluid communication between said ports relative to FPF supply and use coordinated with the position of said cross-slide in said housing;
EMF contacts in said case adjacent said linear slide,
connector means leading to said contacts for attaching EMF supply and use lines to said contacts,
means on said linear slide facing said contacts for selectably interconnecting and disconnecting electrical communication between said contacts relative to EMF supply and use coordinated with the relative position of said linear slide in said case.

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