Sept. 10, 1968 C. E. ANDERSON 3,400,730

PRESELECTIVE CONTROL OF REMOTELY LOCATED ELECTRICALLY OPERATED APPARATUS

Filed Aug. 27, 1965 3 Sheets-Sheet 1

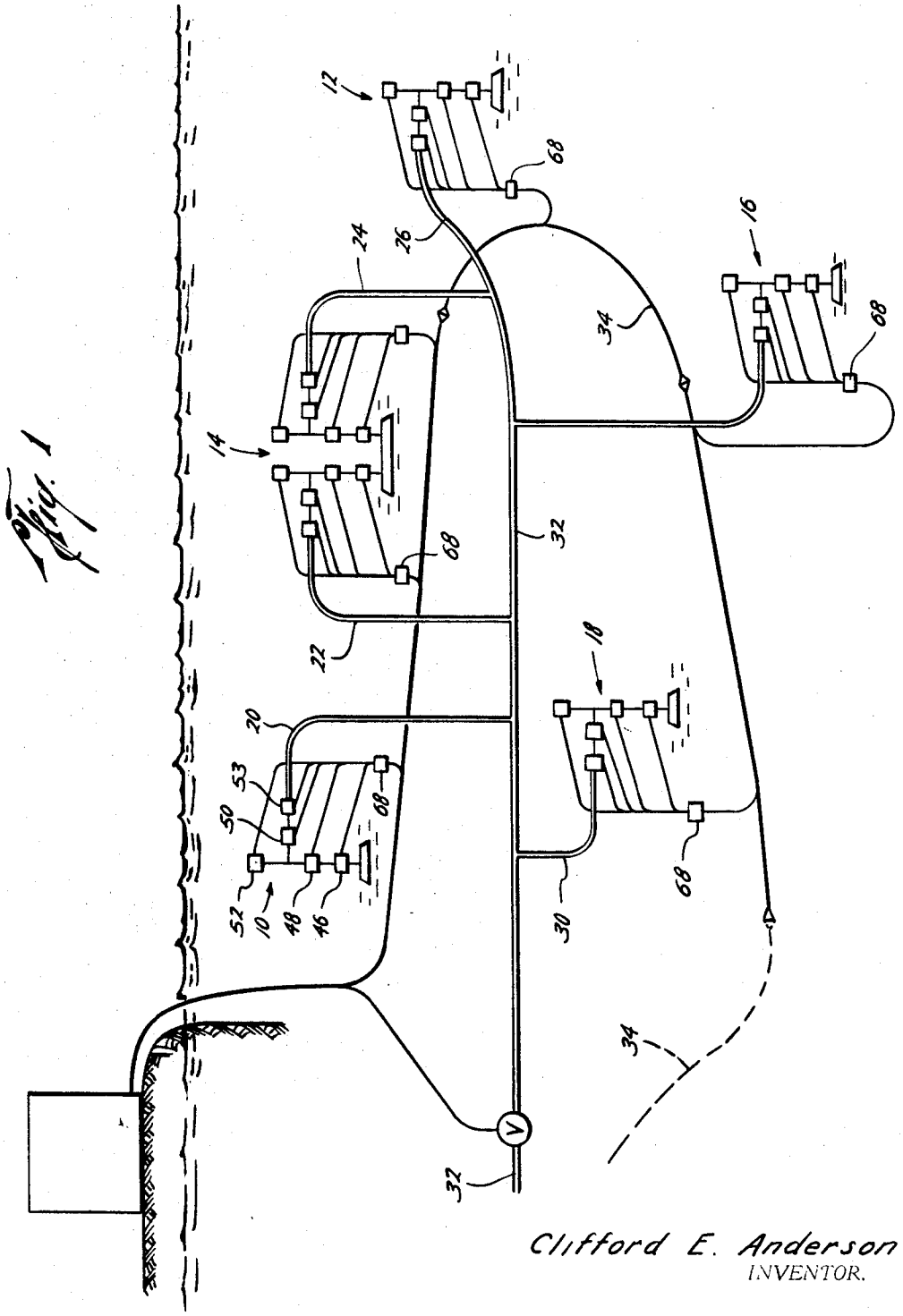


Fig. 1

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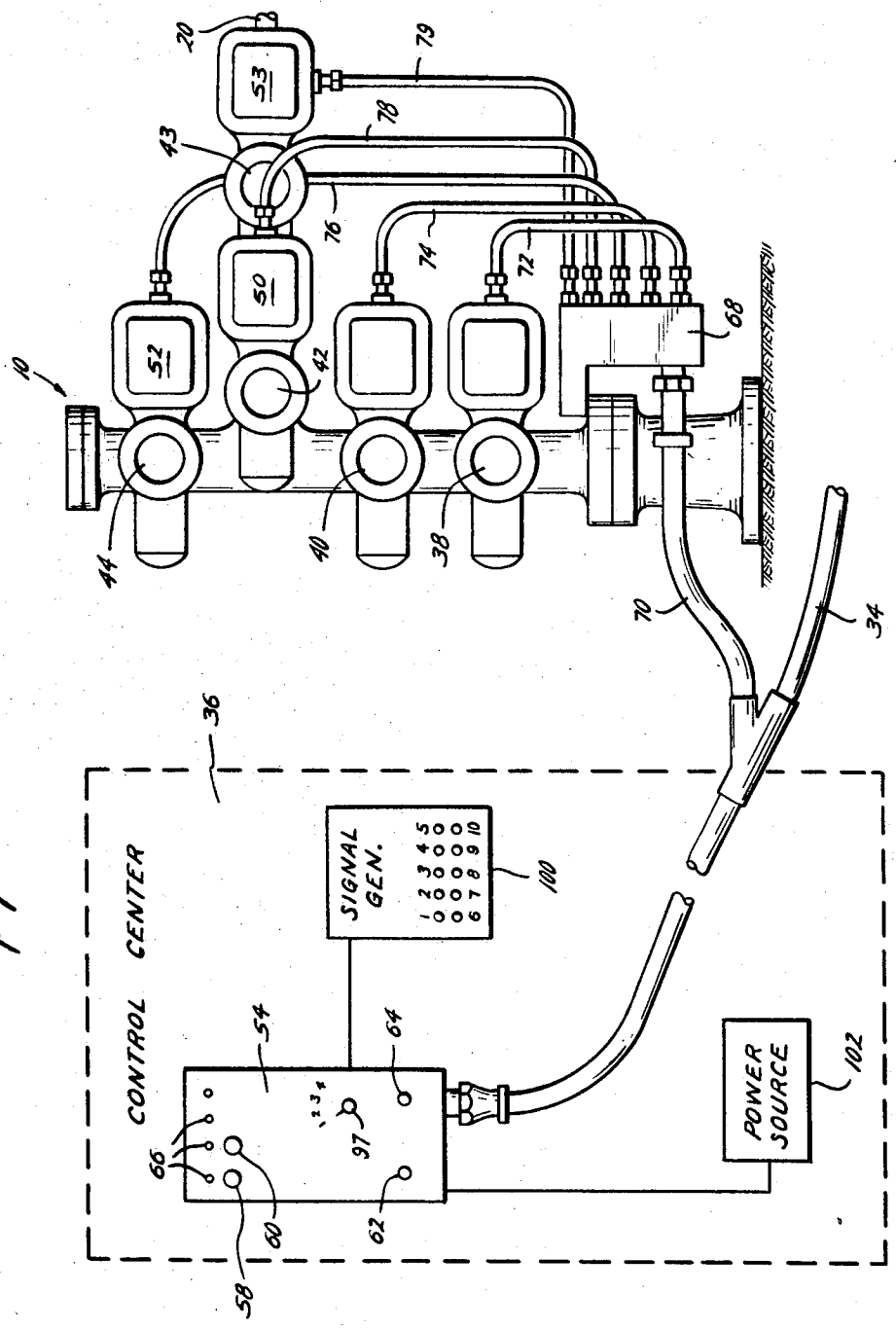


Fig. 2

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Filed Aug. 27, 1965 3 Sheets-Sheet 3

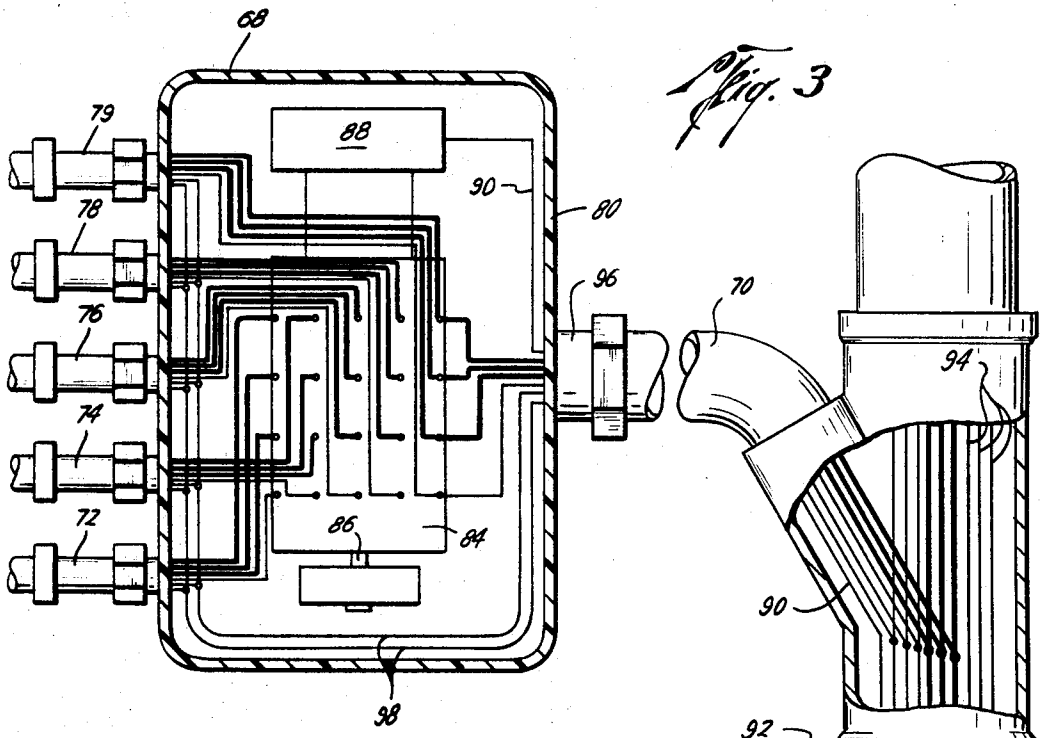


Fig. 3

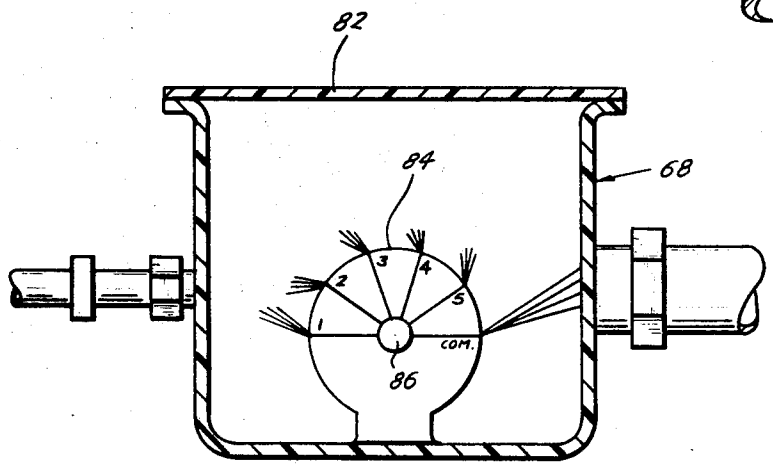


Fig. 4

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3,400,730

PRESELECTIVE CONTROL OF REMOTELY LOCATED ELECTRICALLY OPERATED APPARATUS

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7 Claims. (Cl. 137—236)

ABSTRACT OF THE DISCLOSURE

A control system for selectively operating a plurality of remotely located wellhead valves having electrically energized valve operators. The system includes a single electrical cable having control and operating circuits for a single valve operator and having a stepping switch circuit for each wellhead which is operative to selectively connect the circuitry of any one of the operators to the control and operating circuits of the primary cable.

This invention is directed to the control of remotely located electrically operated apparatus, and more particularly to the control of a plurality of similar electrically operated devices from a distant control station through a single control cable.

The petroleum industry, in its continuous search for new sources of petroleum production, has recently turned to the oceans for the establisment of new petroleum fields, and as a result a number of extremely large petroleum and natural gas reserves have been discovered and are rapidly being developed into extremely high production petroleum sources. Frequently the water in which the oil or gas well is drilled will be shallow and a production platform, including the wellhead assembly of the well, can be positioned above the surface of the ocean. The valves which control the flow of fluid from the wellhead assembly positioned above the surface of the ocean may be adapted for manual operation and control if desired.

Frequently, however, the water is of considerable depth and the wellhead assembly must be placed on the floor of the ocean. The valves of the wellhead assembly, therefor, are especially adapted for undersea service and must be provided with power operators to allow this control from a distant control station. In the past, underwater wellhead assemblies have generally been provided with hydraulic pump and control structure. Hydraulic control of remotely located wellheads proves quite successful if the distance involved between the control station and the wellhead assemblies is not extremely great. For example, hydraulic control systems have been successfully developed for remote control distances in the range of 3,000 feet to 5,000 feet. Over long distances it is necessary to employ hydraulic control line piping of large diameter to keep friction losses in the line within reasonable limits while the operator is energized. It has been estimated that hydraulic piping for an operator five miles distant would require hydraulic control piping five inches in diameter. The expense of a hydraulic control system employing hydraulic piping of this size obviously would be prohibitive even when considering the costs of materials alone.

A disadvantage associated with remote hydraulic control of underwater wellhead assemblies is the expense involved in the construction of the hydraulic control system. The costs are prohibitive when considering the ultimate design of hydraulic control equipment which will produce sufficient hydraulic pressure to overcome line losses due to the extreme distances involved, and which will develop sufficient pressure at the distant extremity of the line to successfully actuate the hydraulic motor

to move the valve. In addition, separate control lines must be laid between the control facility and each of the fluid motors which are to be operated. Another serious disadvantage inherent in the use of undersea hydraulic operator systems is that the costs involved in maintaining the system are quite high and there is an ever present danger of salt water from the ocean being drawn into the hydraulic system, which might require replacement of the entire hydraulic system because of corrosion if the salt water should remain in the system for any extended period of time.

To overcome the disadvantages of hydraulic systems, electrically controlled power operator devices are being developed for underwater use to operate valves on wellhead assemblies, underwater pipeline valve, blowout preventers and the like. Electric operators may be substituted for the hydraulic operators on production valves of the wellhead assemblies, and may be energized through underwater cables containing sufficient wires for the power circuit of the operator and the various desired control circuitry of the operator. Cables of this nature may contain as many as twelve circuits or more for the control of a single electrically energized power operator. Assuming that a number of production valves of a wellhead assembly are controlled each by an electrically energized power operator controlled from a remotely located control station by means of an individual control cable, it is obvious that the expense involved in providing a separate cable for each of the valve operators would involve considerable expense.

It is envisioned that a large number of undersea wellhead assemblies representing an entire petroleum field may be connected through suitable undersea pipelines to an undersea storage facility. The storage facility would then be connected to one or more pipelines of considerable size which extend to a land based storage, handling and refining facility. In accordance with a primary object of this invention, suitable control equipment at a land based control station may be operative through a single control cable to maintain complete control of the flow of petroleum products from the wellhead assemblies to the land based refining facility. This would greatly reduce handling of the fluid material and result in considerable production costs savings.

Another consideration involved in the development of the instant invention is the inability of present undersea wellhead control systems to place a wellhead in a safe condition when the wellhead has been damaged. It is contemplated that a number of offshore wellhead assemblies may be located on a single platform and may be connected through suitable piping to the respective wells. It is quite possible that a petroleum field control of this nature could be hazardous when considering the possibility of damage by fire or by storms, etc. For example, a fire caused by damage to or failure of one of the wellhead assemblies could spread to the other wellheads on the platform and an entire field could be lost.

It is another object of this invention to provide a novel control system operated through a single control cable for controlling a plurality of remotely located electrically energized mechanical devices, such as blowout preventers, valves, etc.

A further object of this invention is to provide a novel control system for a plurality of remotely located electrically energized devices, wherein one or more of the electrically energized devices may be selectively operated to the exclusion of the other devices.

An even further object of this invention involves the provision of a novel control system for a plurality of remotely located electrically energized devices, which is inexpensive in manufacture and reliable in use.

It is among the several objects of this invention to pro-

vide a novel control system for a plurality of remotely located electrically energized devices which is operative under selective or automatic control to simultaneously place all of the devices in a predetermied safe condition.

Briefly described, the invention comprises a control center which is located in an area which is accessible by operators desiring to control remotely located electrically energized devices. The control center includes source of electrical power for energization of the electrically energized devices and the control circuitry for the devices. An electrical selecting mechanism is positioned adjacent the devices to be operated and is connected to the control center by a single primary electrical cable, having sufficient power circuits and control circuits for energizing and controlling at least one of the electrically energized devices and having an electrical command circuit for the selecting mechanism. Each of the electrically energized devices is connected to the selecting mechanism by a separate secondary electrical control cable, containing sufficient circuitry for energization and control of the mechanical device. The selecting mechanism is responsive through the command circuit to signal generating means located at the control station to selectively connect one or more of the desired electrically energized devices to the power and control circuitry of the single primary cable. After the selection operation has been accomplished, the selected electrically energized device may then be operated through the control and power circuitry of the primary cable to achieve a desired function. The selecting mechanism, depending upon the specific design of the control system, may be operative on command to connect a plurality of the electrically energized devices in parallel with the power and control circuitry of the primary cable to achieve simultaneous selective operation of the devices. For example, when the electrically energized devices are power operators for the various valves of a wellhead assembly it is within the scope of the invention to operate the valves singly or plurally, as desired. The inventions is specifically adapted for the selective control and operation of the valves of a number of wellhead assemblies so that an operator may control the flow of fluid from an entire petroleum field from a single control facility. It is also desired to provide fail-safe control for each of the valves of the wellhead and incorporate in the control system design means for selectively or automatically placing one or more of the valves selectively or all of the valves of every wellhead simultaneously in a predetermined safe condition.

Other objects and features of this invention will be in part apparent and in part pointed out hereinafter.

The invention accordingly comprises the construction hereinafter described, the scope of the invention being indicated in the following claims.

In the accompanying drawings in which one of various possible embodiments of the invention is illustrated:

FIGURE 1 is a schematic illustration of an offshore petrolemum field including a number of undersea wellhead assemblies interconnected with a fluid flow system and including a control system for remotely controlling the valves of the wellhead assemblies and flow system in accordance with the spirit of the invention.

FIGURE 2 is an elevational view of a wellhead assembly provided with electrically energized operators and illustrating the invention partly in elevation and partly in schematic form.

FIGURE 3 is a plan view of the selecting mechanism having the cover portion thereof removed and revealing the circuitry of the indexing mechanism in schematic form.

FIGURE 4 is an elevational view of the indexing mechanism in section having portions thereof broken away, showing the circuitry of the indexing mechanism in schematic detail.

Referring now to the drawings for a better understanding of the invention, in FIGURE 1, there is illustrated a number of wellhead assemblies which are positioned on the ocean floor. The reference numerals **10**, **12**, **16** and **18** designate single completion units while the reference numeral **14** designates a dual completion wellhead assembly. The single completion wellhead assemblies have one string of production tubing extending to a single production zone from which the petroleum product is taken. The multiple completion unit, as illustrated at **14**, in FIGURE 1, includes two strings of tubing each producing from a different production zone. Each of the strings of tubing in a multiple completion wellhead assembly requires individual valve control for recovery control of the petroleum product from the specific zone of production. It is common practice in the petroleum industry to have as many as three or four producing zones in a single petroleum well. The single completion units are each provided with a flow conduit **20**, **26**, **28** and **30** under suitable valve control and are connected to a suitable main flow conduit or pipeline **32** to transport the petroleum product from the wells to a storage facility, refinery or the like. The multiple completion unit **14** is provided with two flow conduits, **22** and **24**, each of which is connected to the main flow conduit **32**.

For control of the valves of the wellhead assemblies, a single control cable **34** having one end thereof in connection with a control station **36** is laid along the ocean floor closely adjacent each of the wellhead assemblies.

The control cable **34** may be an unbroken sealed cable structure if desired but generally it will take the form of a number of interconnected sealed sections to facilitate ease of handling and simplicity of repair. Each of the sections will be prewired and will have a plug connection constructon at each extremity thereof. The cable sections will be interconnected simply by interfitting the plug ends. The plug ends will of necessity be sealable to prevent sea water from entering the connection either during or following the connection operation. Should any section of the primary cable become damaged, it may be easily and quickly replaced with a similarly wired section of cable by a diver. As illustrated in dash lines in FIGURE 1, additional sections of cable may be added as the system to be controlled expands. The addition of sections of cable to the existing system is limited only by the initial design of the system as will be explained in detail hereinbelow.

With reference to FIGURE 2, the single completion type wellhead assembly **10** is provided with a bottom master valve **38**, a top master valve **40**, two wing valves **42** and **43**, and a swab valve **44**. Each of the wellhead valves **38**, **40**, **42**, **43** ad **44** are provided respectively with remotely controllable electrically energized power operators **46**, **48**, **50**, **52** and **53**. The outlet of the outer wing valve **43** is connected to the flow conduit **20** to transmit fluid from the wellhead assembly to the main flow conduit or pipeline **32**. The specific wellhead assembly structures, as illustrated in FIGURE 2, are intended as illustrative in regard to this invention and are not to be interpreted in a limiting sense. Any one of a number of commercially available wellhead assemblies, valve or valve operator structures or other electrically controlled mechanical devices might be employed without departing from the spirit or scope of this invention.

Within the control station **36** is disposed a control console **54**, to which the circuitry of the primary control cable **34** is connected. The control console **54** is provided with suitable circuitry for controlling the direction of valve operation and also for controlling starting and stopping of the valve actuation as desired. For example, as illustrated in FIGURE 2, the control console includes open and close buttons **58** and **60** respectively which activate the control circuitry for selecting the direction of valve operation. Start and stop buttons, **62** and **64**, are manually depressed to provide manual control of the remotely located valve operators as desired. Generally, however, the start button **62** will be depressed to actuate

the starting circuitry of the selected one of the valve operators for opening or closing the selected valve. The valve operator is generally provided with limit switches which provide automatic stopping of the valve operator when the valve has reached the optimum position. A number of visual indicator lights **66** are provided for positive identification of the position changes which occur in the valves of the remotely located wellhead assembly **10**. The lights **66** may be energized by electrical energy from the power source under control of limit switches and the like which are actuated by the power operator.

A selector mechanism **68** is located adjacent to or positioned on the wellhead assembly **10** and is connected by a branch cable **70** to the single control cable **34**. A number of individual secondary control cables **72**, **74**, **76**, **78** and **79** are connected respectively to the valve operators **46**, **48**, **50**, **52** and **53**. Each of the individual control cables contains sufficient electrical circuitry for energization and control of one of the valve operators for controlling opening and closing movement of one valve.

A selector mechanism **68** is located adjacent to or positioned physically on the wellhead assembly **10** and is adapted responsive to being controlled selectively from the control station **36** to cause selective energization of one of the operators to control movement of one of the valves on the wellhead assembly. The selector mechanism **68** comprises a housing **80** having a water tight cover **82** removably fixed thereon. Within the housing **80** is disposed a rotary stepping switch **84** which is rotated about a horizontal shaft **86** to cause switching of the control circuitry. The stepping switch motor **88** is disposed in driving relation with the stepping switch shaft **86**, and is operative responsive to control from the control center through a command line **90** to induce rotation of the stepping switch **84**.

The selecting mechanism **68** is connected to the primary control cable by means of a branch cable as indicated hereinabove. A sealed connection structure **92**, which may be in the form of a permanent connection or in the form of a water tight plug arrangement, establishes electrical connection between the primary cable **34** and the branch cable **70**. As illustrated in FIGURE 3 the connection between the primary cable circuitry and the branch line circuitry is a parallel type electrical connection except that the command line **90** extends directly from the selector circuitry at the control center to the stepping switch motor **88**. The control center **54** is provided with selecting means **97** which may be manually actuated to select a desired command line for actuating the valve of a selected wellhead assembly. The primary cable **34** includes a number of command lines designated **94** which are connected to the selector mechanism **97** and to respective valve operator selector mechanisms similar to the selector mechanism **68**. For example, assuming that the single primary control cable **34** is employed in the operation of a petroleum field having 50 wellhead assemblies, the primary cable would be provided with 50 individual command circuits, one for each of the wellhead assemblies.

Depending upon the design of the system, a number of initially unused command circuits may be formed into the primary cable **34**. As the system is expanded by adding more of the electrically energized mechanical devices, such as wellhead assemblies, for example, the extra command circuits of the primary cable can be put into use thereby eliminating the necessity of replacing the primary cable as the system is expanded.

The branch cables **70** are provided with the same number of power and control circuits as are present in the primary cable **34** but contain only a single command circuit while the primary cable may have any desired number of command circuits.

The circuitry from the branch cable **70** enters the sealed housing or distribution box **80** by means of water tight connection structure **96**. A portion of the circuitry which is not common to all of the secondary cables **72**, **74**, **76**, **78** and **79** are electrically connected to the stepping switch **84**. The circuits **98** which are common to all of the secondary control cables will by-pass the stepping switch **84** and will be connected in parallel with the secondary cable circuitry.

A signal generator **100** is connected through suitable electrical circuitry to the selector switch structure **97** and is operative responsive to selective manual control by personnel at the control console for causing the selected stepping switch **84** to index to and connect the desired electrically energized operator on the wellhead assembly **10** to the power and control circuitry of the primary control cable **34**. After the individual power operator or operators have been selected the personnel at the control console will manually depress the power on button **62** thereby energizing the power and control structure from a source of electrical power **102** to cause the power operators to open or close the selected valves as desired.

Operation is as follows:

Assuming it is desired to close the valve **43** the personnel at the control console after first depressing the power on button **62** to energize the circuitry would manually manipulate the selector switch **96** thereby connecting the command line **90** to the circuitry of the signal generator **100**. Assuming that the button **5** on the signal generator is the selector button for the outer wing valve of each of the wellhead asemblies which might be connected to the primary control cable **34**, the button **5** will be manually depressed by the personnel at the control console. The signal generator **100** in response to depression of the button **5** will through the command line **90** energize the stepping switch motor **88** thereby causing the stepping switch **84** to move to a predetermined position connecting the circuitry of the secondary control cable **79** with the circuitry of the branch control cable **70**. At this time the control and power circuitry of the electrically energized power operator **53** is electrically connected through the secondary cable **79** the selecting mechanism **68** the branch cable **17** and the primary cable **34** to the control console. The personnel at the control console will then depress the open or close button **58** or **60** depending upon the desired direction of operator rotation thereby energizing the remotely located power operator and causing the same to actuate the desired mechanical device.

Assuming that it is desired to operate the valves **42** and **43** simultaneously and that the button **8** on the signal generator **100** will position the stepping switch **84** in a predetermined position aligning the circuitry of both of the secondary cables **78** and **79** with the circuitry of the branch cable **70**, the personnel at the control console, after depressing the power on button **62** to energize the system, would manually manipulate the selecting switch **96** to the position connecting the command line **90** of the selecting mechanism **68** with the circuitry of the signal generator **100**. The personnel at the control console would then depress the button **8** of the signal generator **100** and would, through the command line **90**, cause energization of the stepping switch motor **88** thereby causing the same to rotate to a position aligning the circuitry of the secondary cables **78** and **79** in parallel relation with the circuitry of the branch cable **70**. Either of the buttons **58** and **60** would then be selectively depressed depending upon the desired direction of motor rotation to select either opening or closing movements of the power operators **50** and **53**. Upon depression of the open or closed buttons **58** or **60**, the operators **50** and **53** will be simultaneously energized by the power source **102** thereby causing the same to open or close the valves **42** and **43** as desired. Upon reaching the desired closed or opened position, the power operators **50** and **53** will automatically be stopped in a conventional manner such as by limit switches in the operator circuitry. The limit switches, in addition to stopping movement of the power operators **50** and **53**, will energize the visual indicator light **66** on the control console **54** there-

by giving a visual indication that the valves 42 and 43 have been moved to the desired position. After all of the desired operations have been completed, the entire control system may be deenergized by depressing the "power off" button 64.

It is evident, therefore, that I have produced a normal control system which is operative responsive to selective control from a land based control station through a single primary cable to positively control the positioning of a number of remotely located mechanical devices. The invention is not limited to the control of specific type of mechanical devices. For example if the control system is employed to control the position of various valves and other mechanical devices of an offshore petroleum field, the valves of the various wellhead assemblies or the mechanical devices may be effectively controlled simply by actuation of specific control circuitry at the control station. In addition to control of the valves of the wellhead assemblies, the circuitry of the primary cable may also be adapted for control of the various valves positioned in the flow conduit or pipeline extending from the petroleum field. Other mechanical devices such as blowout preventers, etc. which may be operated by means of a power operator may also be controlled from the main control station through the same primary control cable circuitry. It is also apparent that I have produced a normal control system for remotely controlled electrically energized devices wherein one or more of the devices may be selectively operated to the exclusion of the other devices. It is also apparent, therefore, that I have produced a novel control system for positively controlling a plurality of remotely located electrically energized mechanical devices which is inexpensive in manufacture and reliable in use. It is evident, therefore, that this invention is one well adapted to obtain all of the objects hereinabove set forth together with other advantages which are obvious and inherent from the description of the apparatus itself.

It will be understood that certain features and subcombinations are of utility and may be employed without reference to other features and subcombinations.

This is contemplated by and is within the scope of the claims. As many possible embodiments may be made of this invention without departing from the spirit or scope thereof, it is to be understood that all matters hereinabove set forth are as shown in the accompanying drawings are to be interpreted as illustrative and not in a limiting sense.

What I claim is:

1. A control system for a plurality of remotely located mechanical devices comprising a plurality of electrically energized power operators connected one to each of said mechanical devices and adapted when energized to impart controlling movement to the respective mechanical device, a control station located remotely from the mechanical devices, a source of electrical power, said control station including signal generating means, a single primary electrical cable connected to the source of electrical power and extending from the control station to the vicinity of the mechanical devices, said primary cable having a single power and control circuit therein capable of energizing at least one of said power operators, at least one selecting means connected to the primary cable, said primary cable including a command circuit for each of said selecting means, a plurality of secondary cables each having a single power and control circuit therein and being connected at one end thereof to one of the power operators and having the other end thereof connected to one of the selecting means, said selecting means being responsive to a signal from said signal generating means through the command circuit therefor to selectively electrically connect one or more of the secondary cables to the primary cable for selective exclusive or simultaneous operation of one or more of said mechanical devices.

2. A control system for a plurality of remotely located submerged mechanical devices comprising a plurality of electrically energized power operators connected one to each of said mechanical devices and adapted when energized to impart controlling movement to the respective mechanical device, a control station located remotely from the mechanical devices and including a source of electrical power, a control center located within the control station including electrically control circuitry interconnecting the control center with the source of electrical power, a single primary cable electrically connected at one end thereof to the control circuitry and extending to the vicinity of the mechanical devices, said primary cable having a single power and control circuit for operation of at least one of said power operators, at least one selecting means electrically connected to the circuitry of the primary cable, a plurality of secondary electrical cables each having a single power and control circuit and being electrically connected at one end thereof to the selecting means and at the other end thereof to one of the power operators, said selecting means being responsive to selection at said control center for selectively electrically connecting the power and control circuit of one or more of said secondary cables to the power and control circuit of said primary cable, after one or more of the power operators have been electrically connected through the selecting means to the primary cable the operator or operators are energized by energizing the power and control circuitry of said primary cable.

3. A control system for a plurality of remotely located mechanical devices comprising a plurality of electrically energized power operators connected one to each of said mechanical devices and adapted when energized to impart controlling movement to the respective mechanical device, a control station located remotely from the mechanical devices and including a source of electrical power, a single primary cable electrically connected to said source of electrical power and including sufficient electrical power and control circuitry for energization and control of one of said power operators, said primary cable extending from the control station and having a portion thereof disposed in the vicinity of said mechanical devices, selecting means having the same number of common power and control circuits as said primary cable and being electrically connected to the primary cable circuitry, said primary cable having a command circuit for each selecting means, a plurality of secondary cables interconnected one between the selecting means and each of a plurality of said power operators, each of the secondary cables having the same number of common power and control circuits as said primary cable and being normally disconnected from said primary cable circuitry by said selecting means, said selecting means being energized through its command circuit for selectively connecting the circuitry of one or more of said secondary cables to the circuitry of the primary cable for selective individual or simultaneous operation of one or more of said mechanical devices.

4. A system as recited in claim 3, said selecting means comprising a stepping switch, an impulse responsive motor in driving relation with said stepping switch and adapted upon receiving an electrical signal through said command circuit to cause movement of said stepping switch to a selected position thereby electrically connecting the power and control circuitry of a selected one of said electrically energized devices to said power and control circuitry of said primary cable.

5. A control system for a plurality of subsea wellheads each comprising a wellhead body having a plurality of valves therein for the control of fluid flowing through the wellhead, an electrically energized power operator associated with each of said valves, a control center positioned above the surface of the ocean and located remotely with respect to said wellheads, said control center having a source of electrical power and means for generating an

electrical command signal, a single primary electrical cable having one end thereof connected to said control center and extending to the vicinity of the wellheads, said primary cable having a single power circuit therein and sufficient control circuits for causing the energization of at least one of said plurality of power operators and having a command circuit for each wellhead, a selecting means for each wellhead, said selecting means being connected to the primary cable and being energized by the command signal of said signal generating means, a plurality of secondary electrical cables connected to said selecting means and extending one to each of said power operators, each of said secondary cables having sufficient power and control circuitry for the energization and control of the respective power operator, said selecting means being responsive to a signal from said signal generating means for selectively electrically connecting one or more of said remotely located power operator circuits with said primary cable power and control circuits, said control center including means for energizing and deenergizing said circuits selected by said selective means to cause operation of the selected one of said power operators.

6. A control system for a plurality of remotely located electrically energized devices, comprising a source of electrical power, a control center comprising electrical circuitry, electrical circuitry connecting said control center and said electrical power source, said control center having an electrical pulse signal generating means, a single primary cable having one end thereof connected to the control center and extending to the vicinity of said electrically energized devices, selecting means located adjacent said plurality of devices, and being electrically connected to the primary cable, said single cable having a single power circuit and sufficient control circuits therein for controlling one of said plurality of devices and having a command circuit for energization of said selecting means, a plurality of secondary cables each connecting one of the plurality of devices to the selective means, each of the secondary cables having sufficient power and control circuits for the control and operation of the respective electrically energized device, all of said secondary cable power and control circuits being responsive to electrical pulses received from said signal generating means for selectively electrically connecting one or more of said remotely located devices with said primary cable power and control circuits, said control center including means for energizing and deenergizing the circuits selected by said selective means to cause operation of said devices and means for indicating the condition of said devices.

7. A control system for a plurality of remotely located electrically energized devices, comprising a source of power, a control center comprising electrical circuitry, electrical circuitry connecting said control center and said power source, said control center having signal generating means, a single primary cable having one end thereof connected to the control center and extending to the vicinity of the electrically energized devices, selecting means located adjacent said plurality of devices and being electrically connected to the primary cable, said single cable having a single power circuit and sufficient control circuits therein for controlling at least one of said plurality of devices and a command circuit for controlling said selecting means, a plurality of secondary connecting circuits to each one of the plurality of devices to be controlled, each of the secondary connecting circuits having up to the same number of power and control circuits as said primary cable when required, all of said secondary connecting circuits and control circuits being electrically connected to the selecting means, said selecting means being responsive to said signal generating means for selectively electrically connecting one or more of said remotely located devices with said primary cable power and control circuits, said control center including means for energizing and deenergizing the circuits selected by said selecting means to cause operation of said devices.

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CLARENCE R. GORDON, *Primary Examiner.*