United States Patent [19]

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[11] **3,787,811**

[45] **Jan. 22, 1974**

[54] **REMOTE CONTROL SYSTEM**

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[52] **U.S. Cl.** ..... **340/163 R,** 340/171 A

[51] **Int. Cl.** **H04m 11/00**

[58] **Field of Search** ..... 340/171 A; 179/2 A, 20 P

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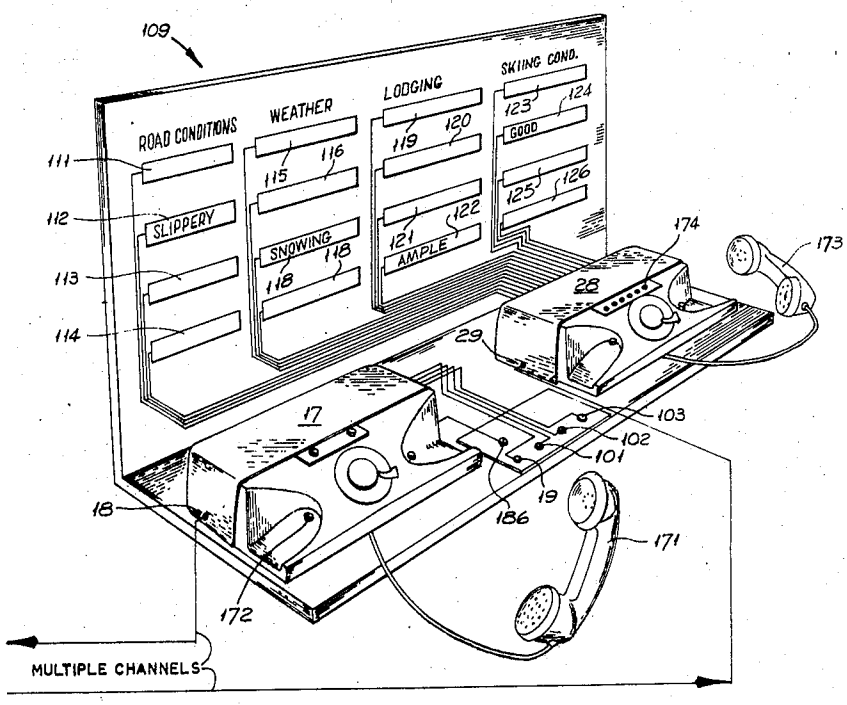
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[57] **ABSTRACT**

A remote control system for a power operated device having a plurality of positions. Telephone system connected and receiving apparatus at an attended station is combined with telephone system connected receiving and transmitting apparatus at the remote station for enabling an operator at the attended station to advance the device to any of its positions and to receive back information from the remote station indicating to the operator the precise extant position of the device.

6 Claims, 13 Drawing Figures



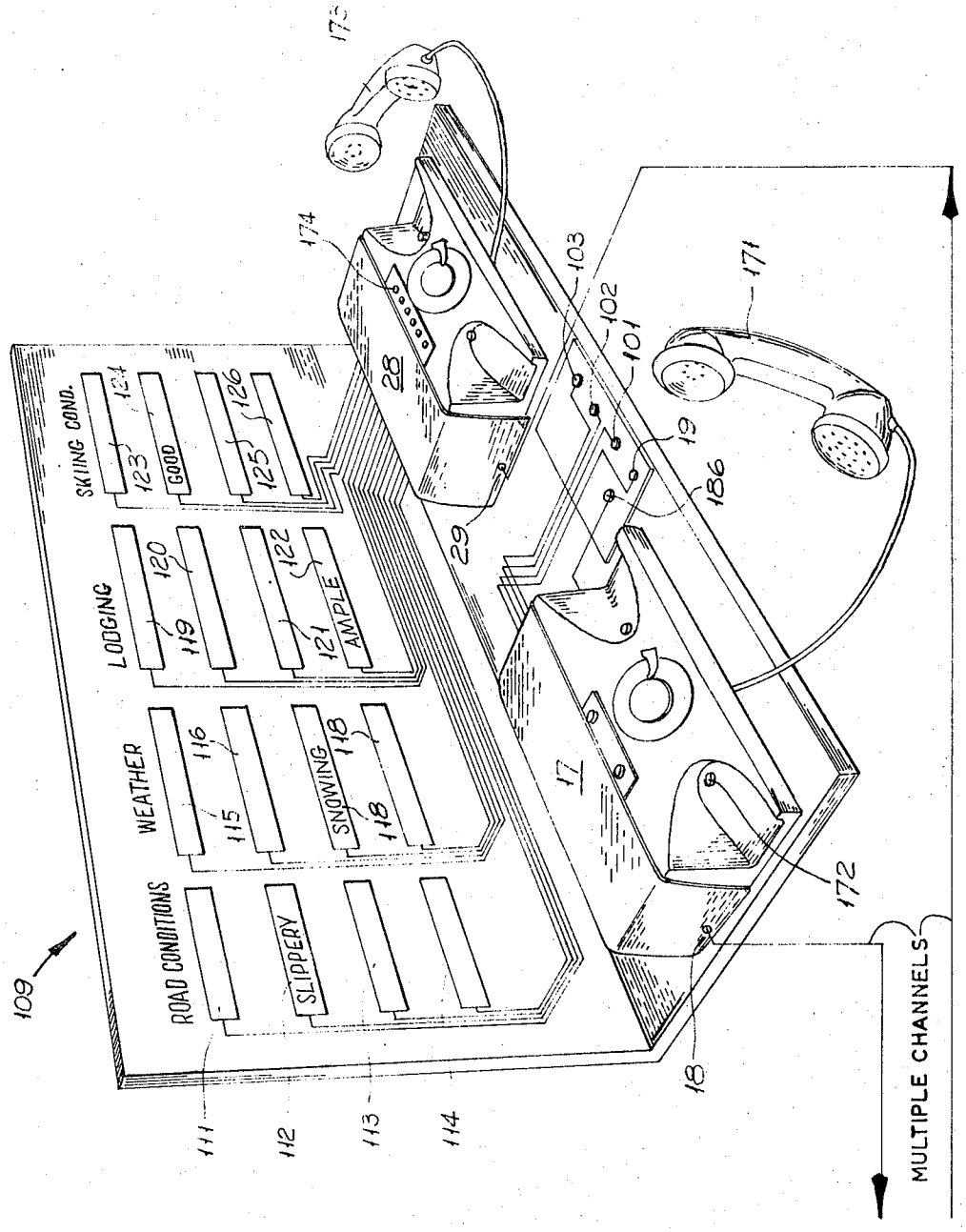


FIG. 1

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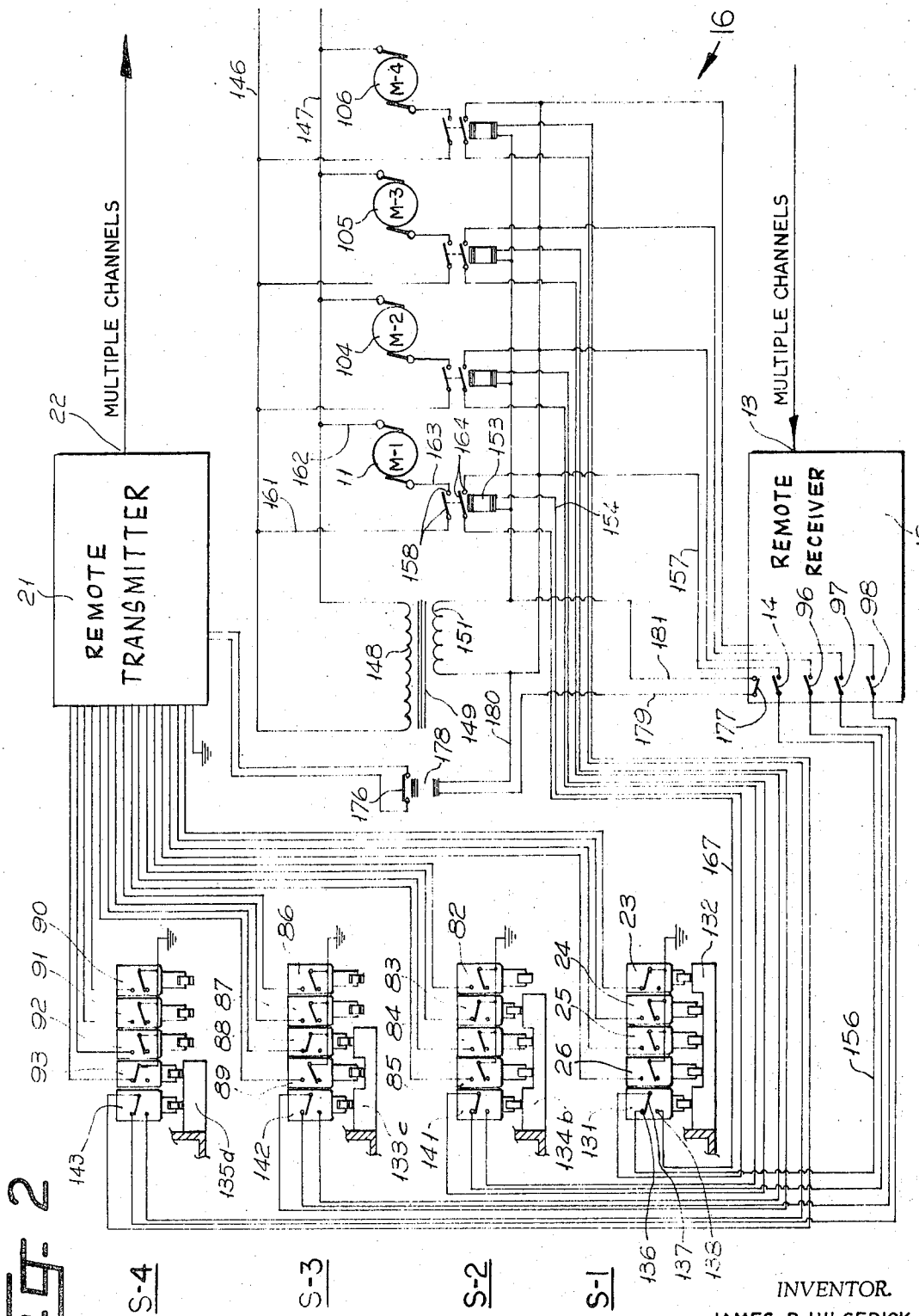


FIG. 2

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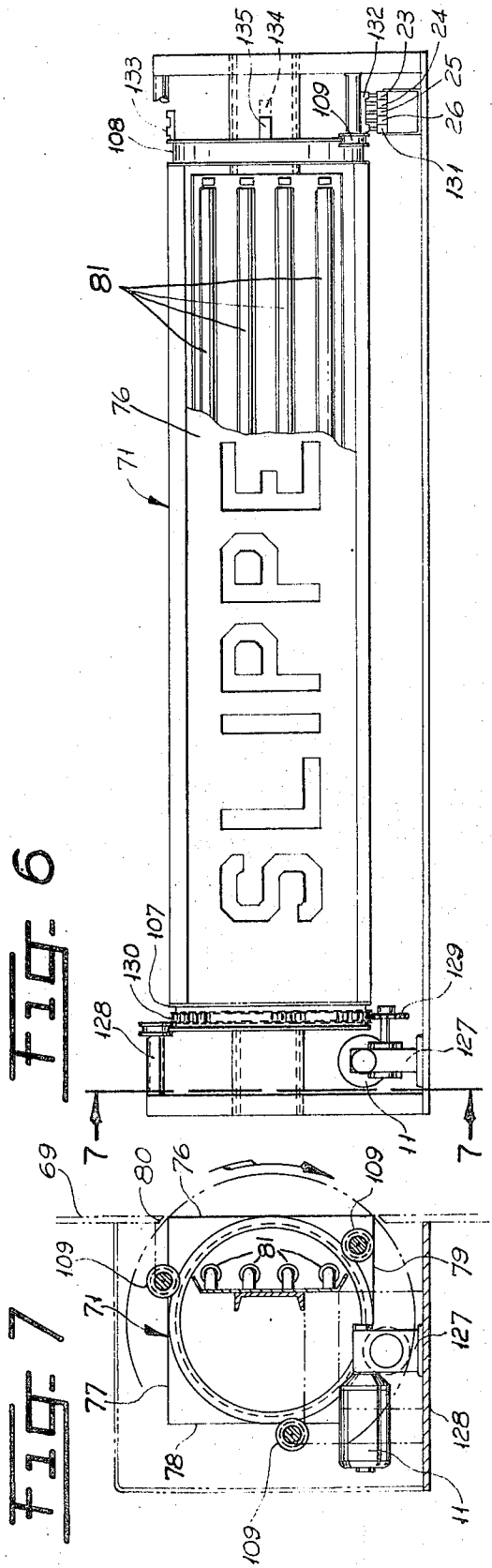
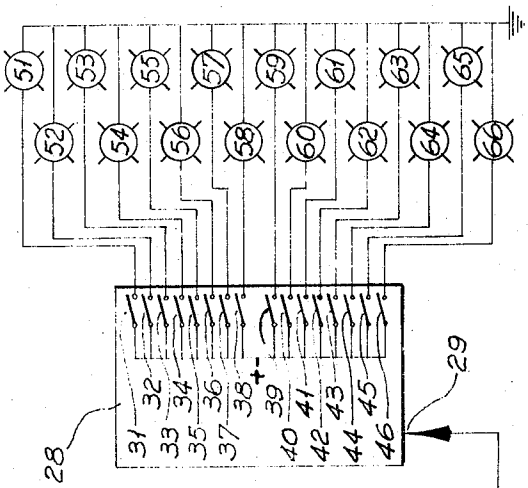


FIG. 6

FIG. 7



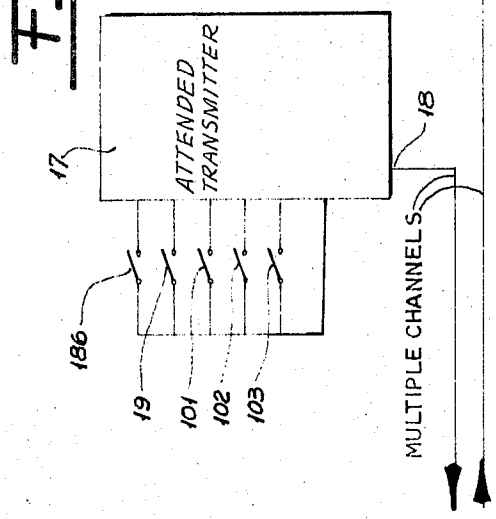


FIG. 8

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REMOTE CONTROL SYSTEM

The invention relates to communication apparatus for controlling at a distance remotely located machinery, equipment, processes and the like.

In many applications there is a need to control the position or condition of one or a plurality of remotely located operating devices each having a plurality of used terminal positions or conditions, and furthermore to send back from such devices information as to the extant terminal position of each. One suggested use of such apparatus is disclosed in this application in the form of a remotely controlled highway sign which may be located on important well traveled highways leading to and through high mountain pass areas wherein the sign will show the condition of the road, whether open or closed, if closed the point where closed, presence and location and depth of snow, need for chains, motel and hotel accommodations and other road conditions and travel information, all of which may be required to be updated promptly as conditions change. In such case the attended station may be at or near the summit of the roadway and the remote sign location in the lowland adjacent the mountainous area where appropriate warning as to road conditions may be given and information as above noted most usefully received.

To accomplish the foregoing effectively, economically, dependably, and with complete and accurate feedback information from the remote station of the precise position of the remotely controlled apparatus, are among the objects of the present position.

The invention possesses other objects and features of advantage, some of which of the foregoing will be set forth in the following description of the preferred form of the invention which is illustrated in the drawings accompanying and forming part of this specification. It is to be understood, however, that variations in the showing made by the said drawing and description may be adopted within the scope of the invention as set forth in the claims.

Referring to said drawings:

FIG. 1 is a pictorial representation of part of the remote control system of the present invention.

FIG. 2 is a schematic diagram of another part of the apparatus.

FIG. 3 is a front elevation of a highway sign depicting one form of application of the present invention.

FIG. 4 is a fragmentary rear elevation of the sign of FIG. 3.

FIG. 5 is a cross sectional view taken substantially on the plane of line 5—5 of FIG. 4.

FIG. 6 is a front elevation on an enlarged scale of one of the sign units.

FIG. 7 is a cross sectional view taken substantially on the plane of line 7—7 of FIG. 6.

FIG. 8 is a schematic diagram of a part of the apparatus seen in FIG. 1.

FIG. 9 is a fragmentary cross sectional view of a portion of one of the sign units.

FIG. 10 is a cross sectional view of the structure shown in FIG. 9 but in a second position.

FIG. 11 is a cross sectional view of the structure shown in FIGS. 9 and 10 but in a third position.

FIG. 12 is a cross sectional view of the structure shown in FIGS. 9–11 in a fourth position.

FIG. 13 is a fragmentary side elevation of the apparatus shown in FIGS. 9–12 as viewed from the plane of line 13—13.

The remote control system of the present invention comprises briefly a power operated device 11 (see motors in FIG. 2) having at least two positions; a remote receiving apparatus 12 having an input 13 and an output switch 14 controlled by a command signal received at input 13, switch 14 being connected in a power control circuit 16 to energize device 11; an attended transmitting apparatus 17 having an output 18 connected to input 13 and a command switch 19 for controlling the generation of a command signal at output 18; a remote transmitting apparatus 21 having an output 22 providing multiple frequency channels and a plurality of switches 23, 24, 25 and 26 for selectively controlling the channel at its output 22, switches 23–26 being mounted for operation by device 11 in its several positions; an attended receiving apparatus 28 having a multiple channel input 29 connected to output 22 and having a plurality of output switches, here shown sixteen in number and identified by reference numerals 31 to 46 which are selectively controlled by the frequency channel received at input 29; and a plurality of indicators 51–66, here sixteen in number corresponding with and being connected to switches 31–46, and functioning to indicate the extant position of device 11.

As hereinabove noted the remote control system of the present invention is here embodied in a highway sign 68 having a face board 69 and four rotary sign members 71, 72, 73 and 74 which may be rotated behind openings in the face board 69 so as to present different messages on the sign members depending upon their rotational position. As best seen in FIG. 7 each of the sign members is formed as a right angled parallelogram having sides 76, 77, 78 and 79 each carrying an appropriate message and which may be successively moved into position in the adjacent opening or window 80 in the face board 69. Sides 76–79 are here formed of translucent material for illumination by fluorescent lamp tubes 81 mounted interiorly of the sign member. Accordingly in this arrangement 16 different messages may be presented at the face of the sign and four banks S1, S2, S3, and S4 of four switches each are used to sense the appearance at the face of the sign of the 16 signs presented by the four rectangular sign members. Bank S1 is composed of switches 23–26 heretofore referred to and banks S2, S3 and S4 are composed of similar switches 82–93. These 16 switches 23–26 and 82–93 are connected to 16 inputs of remote transmitting apparatus 21 to thereby control the transmission from output 22 of 16 different channels. Attended receiving apparatus 28 is capable of receiving any of these 16 different frequency inputs and effecting the closure of output switches 31–46 in accordance with the input frequency received.

In keeping with the above arrangement of four rotary signs, remote receiving apparatus 12 is constructed for multiple channel input at its input 13 for receiving multiple channel command signals from attended transmitting apparatus 17; and is provided with four output switches 96, 97 and 98 in addition to switch 14 hereinabove identified. These switches 96–98 and 14 are selectively controlled by particular frequency command signals received at input 13. The present apparatus is designed to provide four such command signals from the attended transmitting apparatus 17. The latter is

constructed for multiple channel output, with the number of channels at least equal to the number of actuators **11**, and the output channels are selected and controlled by closure of command switches **101, 102, 103** and **19** above identified. Thus, the four switches **101, 102, 103** and **19** will control four remote power operated devices **104, 105, 106** and **11** heretofore identified and which each control the position of one of the four sided sign members **71, 72, 73** and **74** and the 16 combinations thus provided are sensed by switches **23–26** and **82–93,** transmitted by apparatus **21** to receiver **28** which then controls the energizing of the 16 indicators **51–66.** These indicators may be conveniently provided in the form of electric lamps used to illuminate 16 signs **111–126** provided in a console **109** at the attended station.

Each of the remote power operated devices here comprises the combination of an electric motor **11, 104–106** which is connected to drive one of the rotary sign members **71–74,** the latter being journaled for rotation in the support housing **128** of the highway sign **68.** As best seen in FIGS. **6** and **7,** motor **11** is connected through a gear head **127** to a sprocket **129** enmeshed with a drive chain **130** mounted circumferentially around one of a pair of cylindrical channels **107** and **108** mounted at the opposite ends of each of the rotary sign members **71–74.** A plurality of circumferentially spaced rollers **109** carried by housing **128** are mounted to provide coaxial rotary support for channels **107** and **108.**

The electric power control circuit for the motors is so arranged that the motors will be energized to start rotation upon closure of switches **19, 101–103** at the attended station, FIGS. **1** and **8.** The latter are here constructed as normally open, push to close, switches and it is desired that energization of the motors be continued after momentary closure of switches **19, 101–103** until the sign members arrive at their next terminal position when automatic opening of the power circuit occurs. Consequently, the operator at the home or attended station may successively move any one of the four remote highway sign members to its successive terminal positions by initiating operation of the sign member by momentary closure of the appropriate switch **19, 101–103** for each successive movement of the sign member. This control circuit comprises briefly a double throw switch **131,** see switch bank S1 in FIG. **2;** means **132, 133, 134** and **135** (FIGS. **7, 9-11**) for sensing the four positions of each of the sign members **71–74,** and actuating the double throw switch upon the arrival and departure of the sign member at and from each of its terminal positions. Switch **131** has normally open contacts **136** and **137** which are closed by means **132–135** at each terminal position of the sign member and these contacts **136, 137** are connected in series in the circuit with output switch **14** when the sign member is in each of its terminal positions so that the associated electric motor **11** will be energized to advance the sign member towards its next terminal position. Switch **131** also has a pair of normally closed contacts **137** and **138** opened by means **132–135** at each terminal position and which are connected in parallel across output switch **14** whereby the energizing of the motor will be continued after movement of the sign member from each terminal position and the opening of switch **14** and until arrival of the sign member at its next terminal position when contacts **137** and **138** will be opened by means **132–135.**

As illustrated in FIG. **6** the four position indicating switches **23–26** and motor control switch **131** for sign member **71** are mounted in a longitudinal array in position for selective engagement by means **131–134** here comprising four arms extending longitudinally from channel **108.** These arms are spaced circumferentially from each other at 90° and have cam positions as seen in FIGS. **9–12** for selectively engaging reciprocating actuators on the several switches. Each of arms **131–134** is also provided with a cam portion positioned for engagement with and displacement of the actuator for motor switch **131** so that this double throw switch will be thrown to close and open contacts **136–137** and **137–138** upon arrival of sign member at each of its four terminal positions and to release the actuator for switch **131** upon movement of sign member from its terminal position to provide reversing of the condition of the switch contacts. Additionally, as shown in FIG. **9,** member **135** will close switch **26** upon movement of one sign face **76–79** into window **80** of the sign. In successive terminal positions of the sign member, as seen in FIGS. **10– 12,** arms **133, 134** and **132** will actuate switches **25, 24** and **23** respectively. A similar bank of position switches **82–85, 86–89, 90–93,** and similar double throw motor control switches **141, 142** and **143** are provided, as seen in FIG. **2,** for the other sign members **72, 73** and **74.** Each of the other sign members **72–74** is provided with a set of four switch actuating arms identical in construction to arms **132–135.** Only one of the four arms for each of the other signs is illustrated in FIG. **2** where such arms are identified as **134***b*, **133***c* and **135***d*. The four arms **132–135** in FIGS. **9–12** are for one of the sign units such as sign **71;** and four arms **132, 134***b*, **133***c* and **135***b* shown in FIG. **2** represent one arm from each of the four rotary sign units **71–74.**

A low voltage relay control circuit is preferably incorporated in the power supply to each of the motors. Four such circuits are used for controlling motors **11, 104–106** from switches **14, 96–98** and double throw switches **131, 141–143.** These circuits are identical and a description of one will suffice. High voltage such as the customary **120** volt power supply lines **146** and **147** is applied to the primary **148** of a step-down transformer **149.** The low voltage secondary **151** is connected by conductor **152** to one side of a relay coil **153.** The other side of the coil is connected by conductor **154** to the movable contact **137** of the double throw switch **131.** The low voltage circuit is completed by conductor **156,** switch **14** and conductor **157.** Normally open relay contacts **158** are closed upon energizing of the relay to complete a high voltage connection to motor **11** via conductors **161, 162** and **163.** When the sign member **71** moves to disengage arm **131–134** from switch **131,** switch **131** will throw to disengage contacts **136** and **137** and engage contacts **137** and **138.** Contact **138** is connected through a second set of normally open relay contacts **164** to conductor **157** by means of conductors **166** and **167** so as to maintain the energizing of motor **11** after switch **131** has thrown. A high speed double acting microswitch is used in the present application which will effect a closing of contacts **137** and **138** prior to opening of contacts **164** thus maintaining the operation of the motor after the microswitch has thrown and switch **14** has been

opened. When the sign member arrives at its next terminal position contacts **137** and **138** will be opened to stop the motor. Accordingly it is only necessary in the present operation that the operator at the attended station momentarily close switch **19, 101–103** until the sign member moves away from its terminal position and microswitch **131** throws.

The transmitters and receivers at the attended and remote stations may be connected by telephone lines, microwave communications or the like. The attended transmitting apparatus **17** as hereinabove noted is constructed to provide a multiple channel output with the number of channels at least equal to the number of electric motors or other remote power operated devices to be controlled, and is adapted for use with a plurality of manually controlled switches **19, 101–103** for selectively controlling the channel at its output. One instrument which may be used for this purpose is produced by American Telephone and Telegraph Company and identified as data set **401E** transmitter which has been generally depicted in the drawing. This transmitter while specifically designed to handle business machine equipment has more than enough capacity for present purposes. American Telephone and Telegraph Company data set 401J may be used for the remote receiving apparatus **12.** When these two pieces of equipment are used together as depicted in the drawing, a call initiated from transmitter **17** will be automatically answered by receiver **12** which will initiate an answerback signal to notify the calling station **17** that the receiver **12** is ready for operation. American Telephone and Telegraph Company data set 401H may be used for the remote transmitting apparatus **21** and provides more than enough multi-frequency channels to satisfy present conditions; and American Telephone and Telegraph Company data set 401J may be used for the attended receiving apparatus **28.** These pieces of equipment are described in Bell System Date Communications, Technical Reference Publications, published by American Telephone and Telegraph Company and entitled Data Sets 401A and 401E, April 1966, Data Set 401J Interface Specification, September 1965; and Date Set 401H Interface Specification, March 1969.

Using the above pieces of equipment and telephone line connections, the operation of the remote control system is as follows. When the operator at the attended station wishes to change one or more of the sign members, he lifts the telephone hand piece **171** of transmitter **17** (data set 401E) and dials the telephone number assigned to remote receiver **12** (data set 401J). Upon lifting of the hand set of transmitter **17** the conventional dial tone is heard; and upon completion of dialing the customary ringing signal is heard briefly while receiver **12** is energized to go into a data receiving mode. At this point receiver **12** will send a return signal, a high pitched tone, back to transmitter **17** indicating that receiver **12** is in a data receiving mode. Transmitter **17** may then be placed in condition to transmit command signals by manually raising a data button **172.**

The operator will then lift the hand set **173** of receiver **28** (data set 401J) and dial the number assigned to transmitter **21** (data set **401H**). The operator will hear a momentary ringing signal and an answering back of transmitter **21** indicating that it has been energized. The attendant will then position the data button **174** of instrument **28** so as to place it in its data receiving mode The system is now ready for operation. The operator will now manually close one of the switches **19, 101–103** corresponding with the sign member to be changed. Only a momentary closing of the selected switch need be effected since the relay circuit will take over the energizing of the sign motor after the sign member is advanced away from its last terminal position. When the sign member arrives at its next terminal position the motor will be automatically de-energized and one of the switches **23–26, 82–93** will be closed to transmit a signal corresponding with the exposed sign face to receiver **28** and energize the corresponding sign **111–126** in the console.

In the foregoing described arrangement of the parts, transmitter **21** becomes the "calling party" telephone. Accordingly, after the command has been given to the sign and the sign has changed and transmitted back its position and the attendant hangs up, it is necessry, in a calling party disconnect telephone system, for transmitter **21** to "hang up" in order to terminate the line connection between transmitter **21** and receiver **28.** For this purpose a normally closed relay switch **176** is connected to instrument **21** and functions upon opening to "break" the line connection between instruments **21** and **28.** Control of switch **176** is here effected by an output switch **177** of instrument **12** and which is connected in a series circuit with the transformer secondary **151** and relay coil **178** by conductors **179, 180** and **181.** Closing of switch **177** is controlled by one of the operating channels of instrument **12** and which is in turn controlled by an output channel of transmitter **17** energized by closing of a normally open command switch **186** connected to the input of transmitter **17.** Closing of switch **186** will open switch **176,** and only a momentary opening of this latter switch is required to disconnect the telephone line connection between transmitter **21** and receiver **28.** Accordingly after all signals have been transmitted and return and read as requested, the two hand pieces of instrument **17** and **28** are "hung up" by returning them to their respective cradles and the two telephone lines employed for the transmission and return of information are disconnected. Thus, with the use of the equipment as described, regular telephone lines may be used between the attended and remote stations and the use of the lines confined to the time when command and return signals are actually being transmitted.

I claim:

1. A remote control system comprising:

a remote power operated device having at least two positions;

a plurality of remote switches one for each of said positions mounted for operation by said device in said positions;

a remote telephone system connected apparatus;

an attended telephone system connected apparatus adapted for system-wide selective connection to said remote apparatus and having:

a. an output and a command switch for controlling the generation of a command signal at said output,

b. a receiving means having multiple frequency signal channel input and

a plurality of second outputs selectively controlled by the frequency channel received at its input;

a plurality of indicators connected to said second outputs;

said remote apparatus having:

a. an input connected to receive said command signal and an output controlled thereby, said output being connected to energize said device,

b. transmitting means having a plurality of inputs connected to said switches and an output providing multiple frequency channels controlled thereby and connected to said attended apparatus input whereby the extant position of said device will be shown by one of said indicators.

2. A remote control system as defined in claim **1**:

said remote power operated device comprising a plurality of electric actuators and parts driven thereby and said remote switches being mounted for sensing the positions of each part and being connected to said remote transmitting means for selectively controlling the channel at its output;

said remote apparatus including receiving means having a multiple channel input with the number of channels being at least equal to the number of said actuators and for receiving multiple channel command signals, and a plurality of output switches equal in number to said actuators and selectively controlled by said signals and being connected to energize said actuators;

said attended apparatus including transmitting means having a multiple channel output and a plurality of manually controlled command switches for selectively controlling the channel at said last named output with the number of last named channels and switches being at least equal to the number of said actuators;

said remote transmitting means and said attended receiving means having a multiplicity of channels equal in number to the total number of positions of said parts; and

said indicators being connected and functioning to indicate the extant position of each of said parts.

3. A system as defined in claim **2**, said actuators and parts comprising electric motors and rotary parts driven thereby and said remote switches being positioned for engagement and actuation by said parts to sense the angular positions thereof, said remote switches being connected to de-energize said motors in predetermined positions of said parts.

4. A system as defined in claim **1**:

said remote receiving output including an output switch, an electric power control circuit connected for energizing said device for movement to at least two terminal positions and being connected to said last named switch;

a double throw switch;

means sensing the position of said device and actuating said double throw switch upon the arrival and departure of said device at and from each of said terminal positions;

said double throw switch having normally open contacts closed by said position sensing means at each terminal position and connected in series in said circuit whereby upon closing of said output switch when said device is in each of its terminal positions said device will be energized to advance toward its next terminal position; and

said double throw switch having normally closed contacts opened by said position sensing means at each terminal position and connected in parallel across said output switch whereby the energizing of said device will be continued after movement of said device from each terminal position and the opening of said output switch until arrival of said device at its next terminal position.

5. A system as defined in claim **4**:

said power operated device comprising an electric motor and rotary part driven thereby to a plurality of circumferentially spaced terminal positions;

the plurality of remote switches being equal in number to the number of said terminal positions; and

said position sensing means comprising a plurality of actuator members equal in number to the number of said terminal positions carried by said part and actuating one of said last named switches and said double throw switch in each of said terminal positions.

6. A remotely controlled sign comprising:

an attended transmitting apparatus having an output providing multiple frequency channels;

a plurality of manually controlled switches connected to said apparatus for selecting the frequency channel at said output;

a remote receiving apparatus having a multiple frequency channel input connected to said output and having a plurality of output switches selectively controlled by the frequency channel received at said input;

a sign having a plurality of electric motor driven sign members connected to said output switches and selectively energized thereby; said sign members having a plurality of sign messages thereon individually presented in predetermined positions of said members;

a remote transmitting apparatus having an output providing multiple frequency channels and a plurality of switches for selectively controlling the channel transmitted, said last named switches being mounted for operation by said sign members in said predetermined positions thereof;

an attended receiving apparatus having a multiple frequency channel input connected to said output of said remote transmitting apparatus and having a plurality of output switches selectively controlled by the frequency channel received at its said input; and

a plurality of indicators connected to said last named switches and functioning to indicate the extant positions of said sign members.

* * * * *

UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,787,811 Dated January 22, 1974

Inventor(s) JAMES R. HILGEDICK

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

Abstract, line 3, after "nected" add --transmitting--.

Column 5, line 41, change "1966," to --1966;--.

Column 5, line 43, change "Date" to --Data--.

Signed and sealed this 3rd day of September 1974.

(SEAL)
Attest:

McCOY M. GIBSON, JR.
Attesting Officer

C. MARSHALL DANN
Commissioner of Patents

FORM PO-1050 (10-69)

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