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Hartman

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[54] **SYSTEM FOR EXPANDING AND RETRACTING TELESCOPING SEATING ROW SECTIONS**

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[51] **Int. Cl.** **H02p 5/46**

[58] **Field of Search** 318/85, 74, 467; 52/9, 52/10

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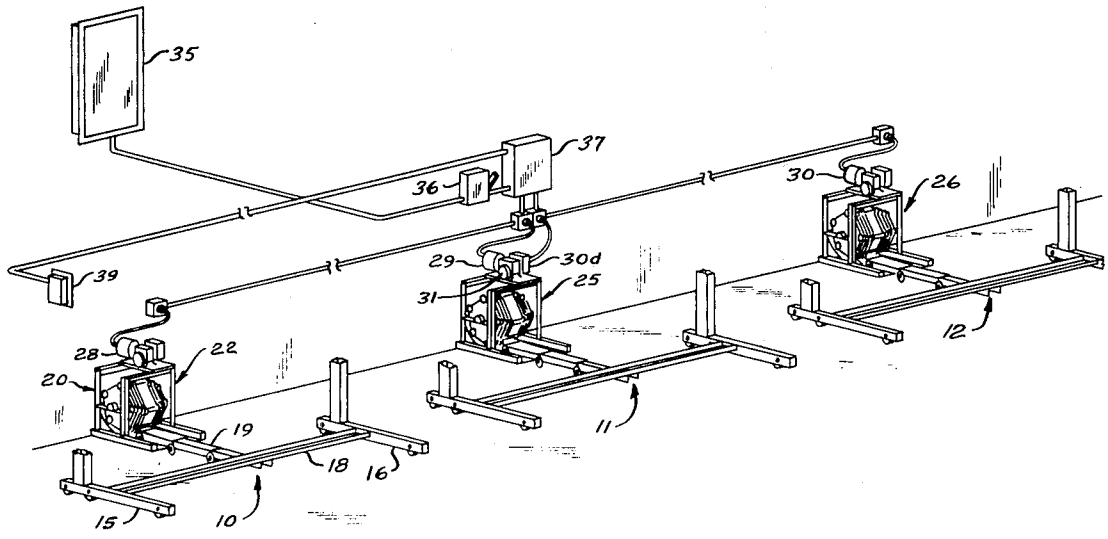
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[57] **ABSTRACT**

An improved system for controlling the extension and retraction of telescoping seating row systems wherein an electrical motor drives an advancing and retracting mechanism. A separate motor is provided for each independent seating unit, which may comprise one or more seating sections. All motors are controlled in parallel by a master control motor, and the sections extend and retract synchronously and in parallel as a unit. A system is also disclosed for programming the operation of a predetermined number of rows, less than the entire section.

7 Claims, 3 Drawing Figures



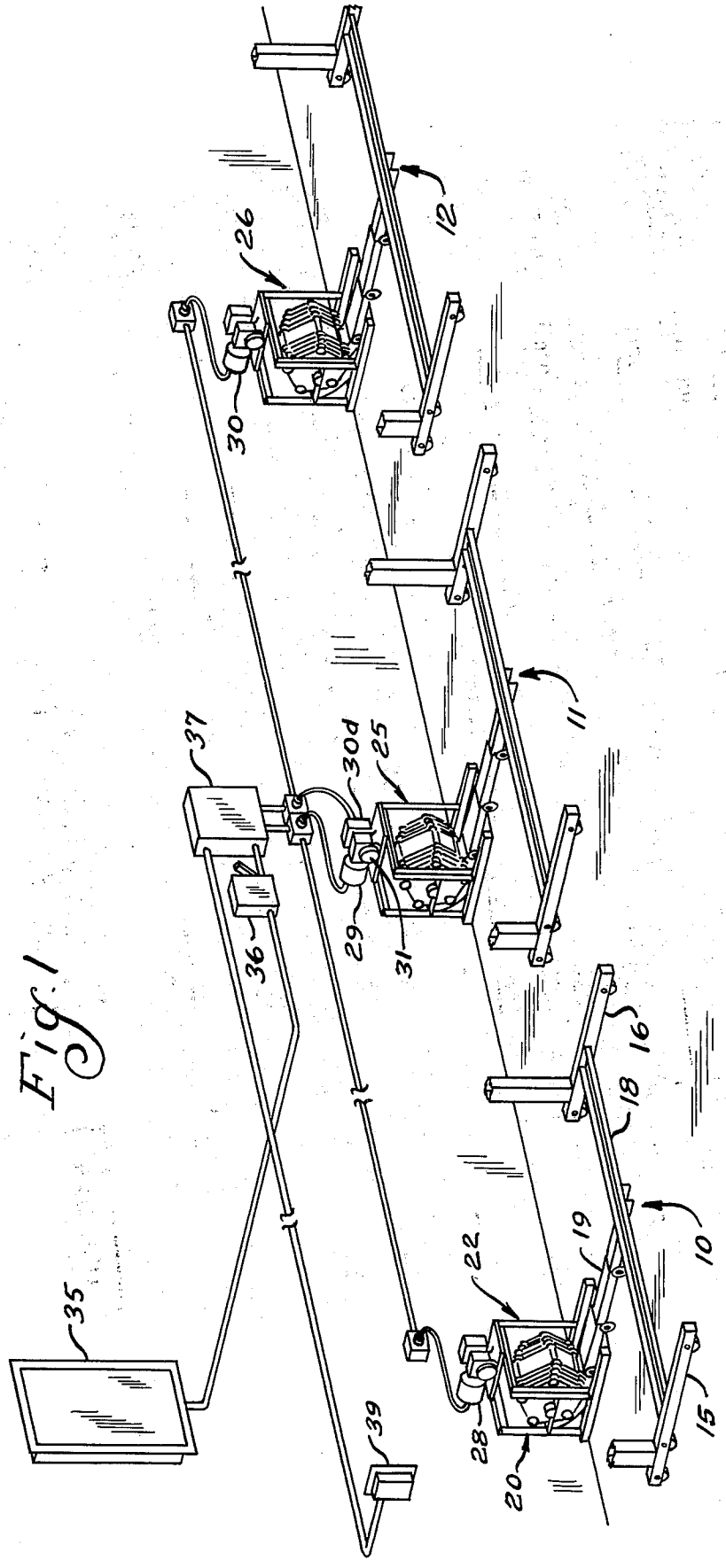


Fig. 1

Fig. 2

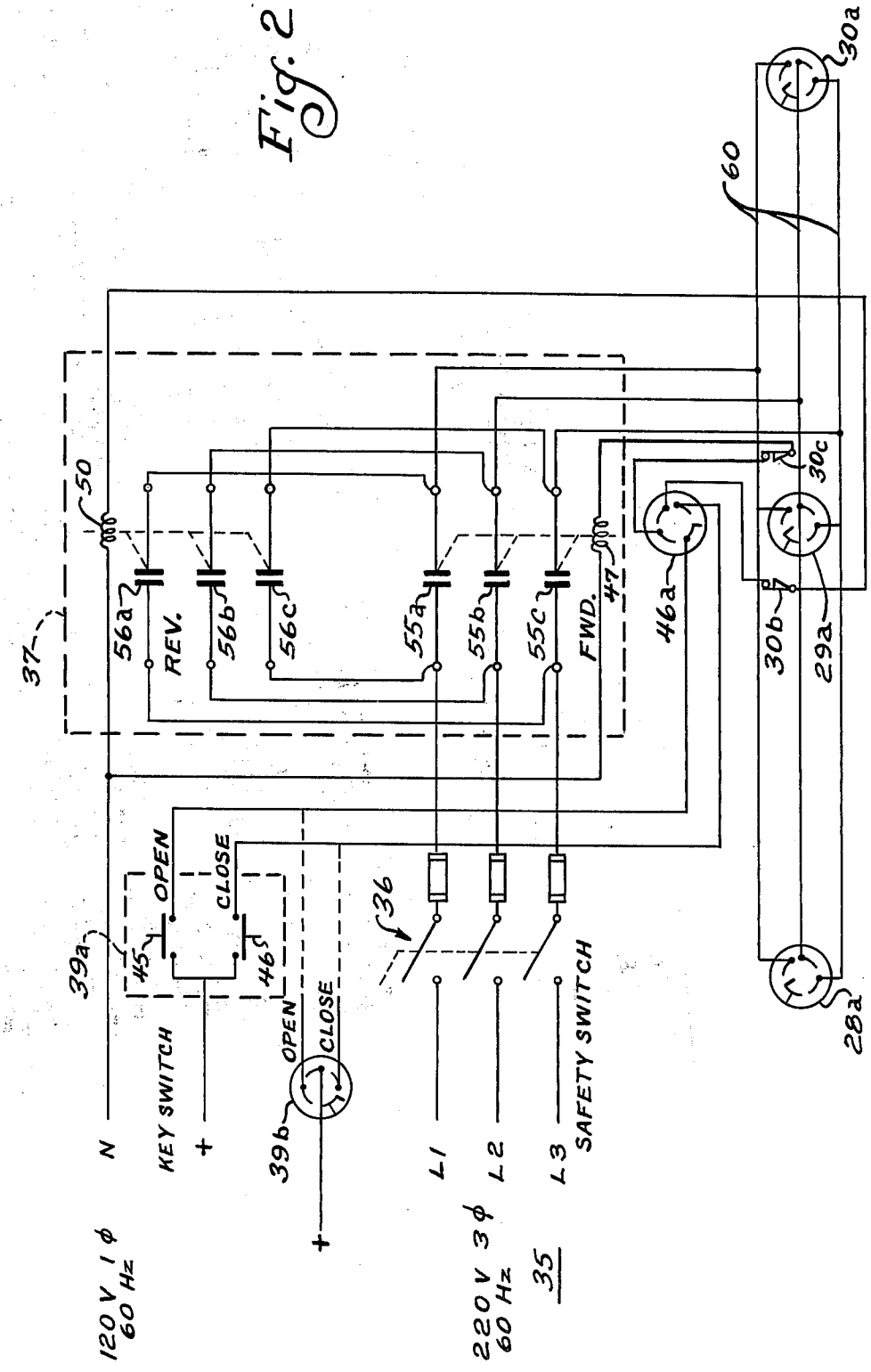
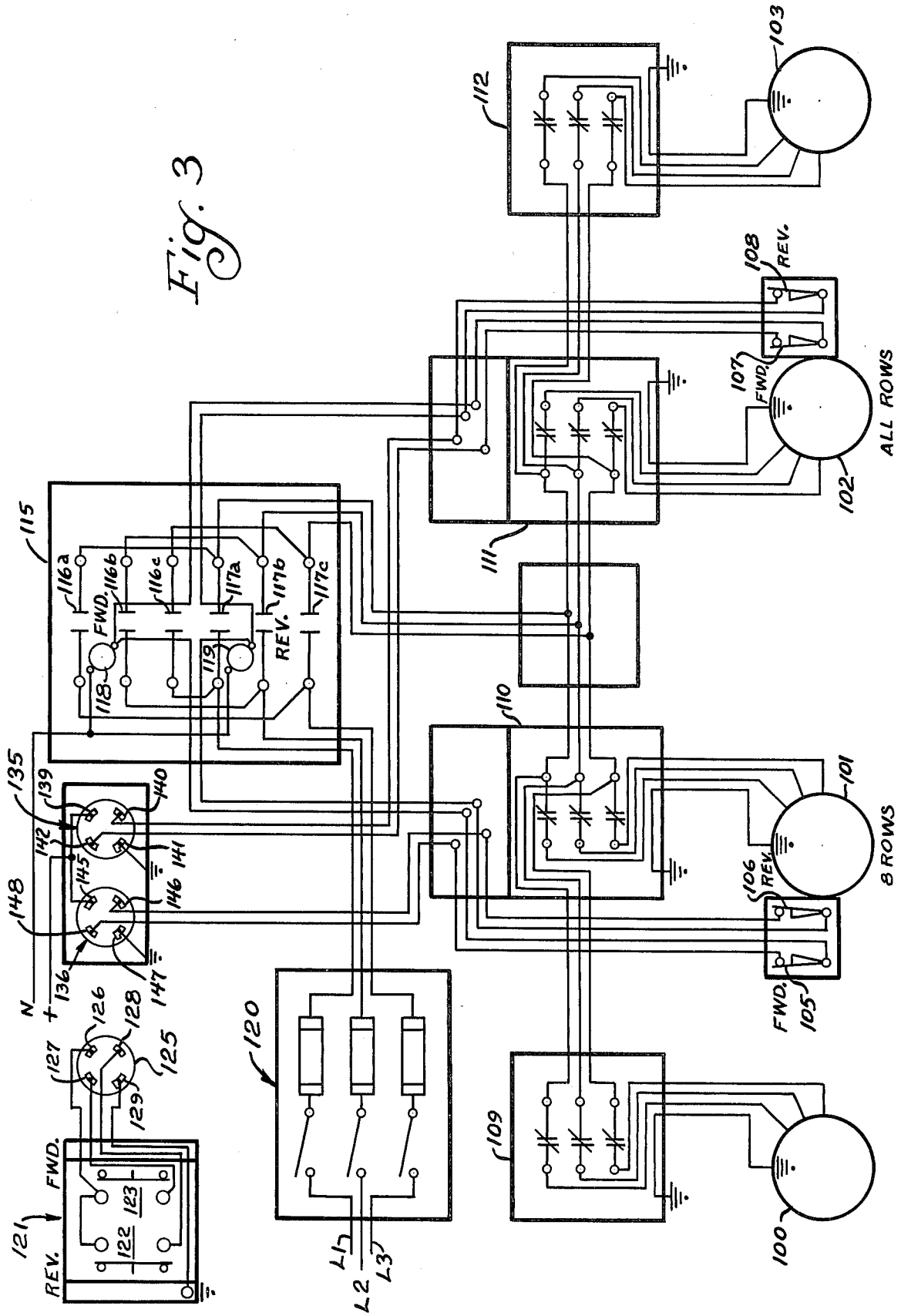

120 V 1 φ 60 Hz
N
KEY SWITCH
+
OPEN
CLOSE
45
46
39a
39b
OPEN
CLOSE
+
37
50
56a
REV.
56b
56c
55a
55b
55c
FWD.
47
36
L1
L2
L3
SAFETY SWITCH
220 V 3 φ 60 Hz
35
46a
60
30a
30c
30b
29a
28a

Fig. 3



SYSTEM FOR EXPANDING AND RETRACTING TELESCOPING SEATING ROW SECTIONS

BACKGROUND AND SUMMARY

The present invention relates to a system for controlling the extension and retraction of telescopic seating systems. These seating systems may be bleachers, platforms of folding chairs or benches, or others; but in any case they comprise a plurality of parallel rows arranged in stepped or tiered relation which telescope or "fold" from an extended (or "use") position to a retracted (or "storage") position.

Normally, in a given installation of larger size, the system is broken down into a plurality of individual seating "sections" arranged side by side which are similar in structure. Two or more sections may be connected together and driven by a single motor and actuator, in which case, the connected sections are called a "unit" herein.

Heretofore, there have been a number of approaches to providing mechanical power for extending and retracting telescopic row seating systems. One such approach includes a single large motor with a plurality of extension and retraction mechanisms (called "actuators " for short), each associated with a different seating section or unit of the entire system, and with all of the actuators coupled together by means of a single long drive shaft. A single large electric motor is used to power the drive shaft. This is sometimes referred to as the common line shaft type of system because of the need for a large shaft extending the width of all contiguous seating sections for the length of a commonly controlled group and driving all associated actuators in unison.

Another friction system employs a plurality of motors coupled together by a common line shaft the composite of which is attached to the front row beam structure extending the length of a commonly controlled group.

In another control system, a plurality of motors are used, and they are located beneath the forward row of each section, and act independently of one another. This is sometimes referred to as the "floor friction" method of control. This requires a structural truss in the forward row so as to keep all sections straight during expansion and contraction.

In still another system, one used previously by the assignee of this application, individual motors and actuators are used for each seating section, but each motor has its own control mechanism, including a common control switch, magnetic controller, rotation counter and limit switches whereby each motor operates independently of the other. The limit switches are set to different positions, depending upon the lay of the floor and so on, so as to compensate for any tendency on the part of the individual seating sections to move sideways or not to move in a parallel manner.

In the present system a rotation counter with normally-closed forward and reverse limit switches senses rotation of the master control motor only. As used herein, "forward" or "open" refers to extending the seating sections to use position; and "reverse" or "close" refers to retracting the sections to storage position. Single phase power is fed in one path through forward contacts of a control switch actuated by operating personnel, the normally closed forward or "open" contacts of the rotation counter, and the forward coil of the contactor. A similar circuit is used for reverse.

The control switch may be a three-position momentary contact switch (forward, reverse and off) either of the key-operated type or a simple pushbutton type. Further, it may be mounted or of the pendant type.

In operation, when it is desired to open the seating system from a closed position, the operator actuates the control switch and single phase power actuates the forward coil of the magnetic contactor through the normally-closed forward contacts of the rotation counter associated with the master control motor. When the magnetic contactor is actuated, three-phase power is fed simultaneously to all of the motors associated with the telescoping seating row sections; and the sections move out in synchronism until a predetermined extended position is reached, at which time the normally closed forward contacts of the rotation counter are opened, and the magnetic contactor is de-energized. As will be discussed more fully below, a principal feature of the invention is that it enables an operator to extend less than all of the rows, if desired. For example, only eight of perhaps thirty rows will be extended if the operator so desires. To reverse the action or close the seating sections, the operation is similar.

I have found, surprisingly, that even though the seating units are unconnected physically, nevertheless, they move synchronously and in unison so that a single control (namely, the rotation counter) responsive only to the extension and retraction of a single seating unit may be used to control as many as eight or more individual seating sections located side-by-side, each provided with its own drive motor and actuator mechanism. In other words, as long as the individual polyphase (i.e., three phase) motors are operated within their normal design range and below full load current (or torque), the variations in friction, load, floor elevation, and so on from section to section and unit to unit do not impair the synchronous motion of the individual sections to any appreciable extent. This is surprising because it is known that the amount of force necessary to extend or retract the seating units may vary substantially even for two units located side by side and on the same floor, particularly when each unit may include two or three seating row sections. This is because of the varying amounts of friction in each section, and the obstructions or variations from level in the floor, the effect of a gravity bias, the fit of mating parts, and many other things.

In addition, the inventive system permits an operator to actuate a predetermined number of rows for all sections or units, less than the total number of rows. This is accomplished by having more than one motor as a master control motor and using, for example, one master control motor to actuate only eight (of perhaps thirty) rows, and a second master control motor to actuate all of the rows. Alternatively, only one master control motor may be used, but is is provided with a plurality of limit switches on the rotation counter. Each forward switch is set to be opened after a predetermined number of rows is opened. In either case, the operator controls the number of rows that are opened under program control.

The present invention, therefore, enables a system which is significantly more reliable and flexible, yet more simple, than prior commercial systems. For example, with respect to the single line shaft systems mentioned above, it eliminates the need for the long shaft and associated couplings, pillow blocks and hard-

ware in such systems which drive all of the actuator mechanisms in unison. Further, such line shafts have to be made on a custom basis for each installation; any errors in the length of the shaft may cause installation problems and extra expense. These disadvantages are eliminated. Still further, where the installation is long, for example over five sections, a problem has arisen in line shaft systems because of the need to have a shaft large enough in diameter to resist the torsion, bending, whip, etc. encountered during operation in order to eliminate any lag at the ends of a commonly controlled group of seating sections or units. It will be appreciated that line shaft systems require a single large gearmotor which have proved to be expensive in initial, as well as installation and other associated costs.

The present invention provides further advantages in that it enables a manufacturer to assemble and test a system in the factory and be assured that the machines which are shipped will be complete, operate properly, and be ready for use on the job.

With respect to the prior systems using individual motors and rotation counters and control mechanisms for each section, the overall wiring and installation is greatly simplified, the number of components is reduced, and cost is reduced without sacrificing flexibility and while increasing reliability. For example, one installation for which the present invention is intended for use is 160 feet long. There are thirty seating rows; and the total weight of the seating system is 64 tons. It seats 3,200 persons; and opens to 55 feet, while having a depth of 8 feet when closed. Eight separate one H.P. motors are used.

Other features and advantages of the present invention will be apparent to persons skilled in the art from the following detailed description of a preferred embodiment accompanied by the attached drawing.

THE DRAWING

FIG. **1** is a perspective view of a control system for seating row sections constructed according to the present invention with the seating structure removed;

FIG. **2** is an electrical schematic diagram for one embodiment of the system of FIG. 1; and

FIG. **3** is an electrical schematic diagram for a second embodiment of the system of FIG. 1 which programs the number of seating rows to be actuated.

DETAILED DESCRIPTION

Referring first to FIG. **1**, reference numerals **10, 11** and **12** refer respectively to three separate telescopic seating row sections, located side by side. However, the invention is not limited to the use of three sections as illustrated; rather, as many as 10 or more seating sections located side by side may be controlled simultaneously and in unison b, the inventive system. Further, depending on the number of rows per section, one or more sections may be connected to form a unit.

Referring now to the section designated **10**, the major portion of the seating section itself is not shown so as to better illustrate the invention. However, there is included first and second side row frames designated respectively **15** and **16**, each of which is provided with casters or wheels; and they are connected together by means of a power bar designated **18**. These elements comprise a single row frame for one seating row—for example, the first or leading row.

A hinge back chain **19** is connected at one end to the power bar **18**, and is adapted to be coiled around a drum-sprocket generally designated **20** which is an integral part of a reel or actuator means or expansion and contraction means, generally designated **22**. The reel means **22** is described in detail in my U.S. Pat. No. 3,738,612 issued June 12, 1973, for "Advancing and Retracting Mechanism." Other row frames, not shown, may be connected to the one shown; and these would be "opened" or "closed" by action with the one shown, which is controlled by the reel.

Each of the remaining reel means for the other sections of the seating system may be similar. The reel means associated with sections **11** and **12** are designated respectively by reference numerals **25** and **26**. Each of the reel means **22, 25** and **26** are driven by means of separate individual three-phase electric induction motors mounted thereon, and designated respectively **28, 29** and **30**. The motor **29** is referred to as the master control motor or simply master motor because a counter associated with it controls the distribution of power to the other motors, as will be more fully explained within. Thus, the master motor **29** has associated with it a conventional rotation counter identified by reference numeral **30**, having normally closed sets of forward contacts **30***c* in FIG. **2**, and reverse contacts **30***b*. The counter **30** is responsive to the rotations of a gear shaft in a transmission **31** which is driven by the motor **29** and is coupled to the reel **25**; and it opens the normally closed forward contacts **30***c* when a certain number of revolutions have been counted, representative of a predetermined extension of the seating section **11**.

Referring again to FIG. **1**, three-phase electrical power is fed from a power panel **35** into a fused safety switch **36** and thence to a magnetic reversing contactor **37**. A control switch **39** is located remotely from the magnetic reversing contactor **37**, although this is not necessary. The switch **39** may be a key-operated switch as shown at **39***a* of FIG. **2** or a pushbutton; and in either case it may be wallmounted or a pendant. In the illustrated embodiment, a pendant switch is also connected to a receptacle **39***b*.

It will be seen that the key switch **39***a* of FIG. **2** is fed by a single phase power and includes a normally open forward switch **45**, marked "open" and a normally open reverse switch **46** marked "close." The switch **45** is connected to a receptacle **46***a* at the magnetic reversing contactor **37**, for feeding power through a pair of normally-closed limit switch contacts **30***c*, and a forward coil **47** of the contactor. The contacts **30***c* are actuated by a rotation counter associated with the master control motor **29**. Similarly, the reverse switch **46** is connected through the receptacle **46***a* to the normally-closed reverse limit switch **30***b*, again associated with the master control motor, and a reverse coil **50** of the contactor **37**. The motors themselves are not represented in FIG. **2**, but are intended to be plugged into associated three-phase receptacles designated **28***a*, **29***a*, and **30***a*, associated respectively with the motors **28, 29** and **30**. Alternatively, manual switches may be used in place of the receptacles, as seen in the embodiment of FIG. **3** to be discussed.

The reversing magnetic contactor **37** includes a first set of three forward contacts designated respectively **55***a*, **55***b* and **55***c* which are normally open and connected respectively in lines L1, L2 and L3 of the three-

phase power fed from the safety switch **36.** The forward contacts **55***a*, **55***b* and **55***c* are actuated or closed when the forward coil **47** is energized, and they are opened when that coil is deenergized. Similarly, the contactor **37** includes a set of three normally open reverse contacts designated respectively **56***a*, **56***b* and **56***c*. The contactor **37** also includes wiring for reversing the three phases actually fed to the three-phase distribution system generally designated by reference numeral **60** which feeds all of the receptacles **28***a*, **29***a* and **30***a*, and hence the motors, in parallel.

In operation, the system is actuated by the control switch **39,** whether it is a key switch as at **39***a* of FIG. **2** or a pendant switch connected to the receptacle **39***b*. Assuming that the seating system is in a retracted or closed position, the limit switch **30***c* is closed and the limit switch **30***b* is open. When an operator closes the switch **45,** single phase power is coupled through it to the normally-closed, forward limit switch **30***c* associated with the rotation counter (denoted **30**d in FIG. **1**) which is responsive to the master control motor **29,** and then to the forward coil **47** of the magnetic reversing contactor **37.** When the coil **47** is energized, the contacts **55***a*, **55***b* and **55***c* are closed, thereby coupling three-phase power to the parallel distribution system **60,** and energizing all of the individual motors simultaneously and in parallel. The individual motors thereupon extend their associated seating row sections in unison and in parallel until such time as the forward limit switch **30***c* is opened. This action de-energizes the coil **47** which, in turn, opens the contacts **55***a*–**55***c* of the reversing contactor **37** to de-energize the drive motors including the master control motor and all associated slave motors. Operation in reverse is similar, initiated by closing the switch **46,** for example, thereby energizing the reverse coil **50** of the contactor **37** until the reverse limit switch **30***b* opens, indicating that the seating sections are in a retracted position.

It will be observed that the power distribution system **60,** extending from the reversing contactor **37** to all of the drive motors does not have any voltage on it during quiescent states; and this is considered to be an important advantage from a safety viewpoint. It will be observed that significant flexibility in controlling the extension and retraction of individual bleacher sections is afforded by the present invention. For example, if it is desired not to extend a section associated with a slave motor, that motor may simply be unplugged. Further, control over the operation of individual sections may be effected by selective operation of individual motors, including the master control motor. This is useful during installation and later during re-alignment if the sections or units need re-alignment due to hitting objects, etc.

Turning now to the embodiment of FIG. **3,** there is shown a schematic diagram for a system which permits row programming—that is, the operator has a choice as to how many seating row sections will be opened or closed when he actuates the system. For example, he may have the option of opening all of the rows or a lesser number, such as eight.

In this embodiment, there are four motors designated respectively **100, 101, 102** and **103.** When it is desired to open eight rows, the motor **101** will be used as the master control motor; and in this case, the remaining motors **100, 102** and **103** will be used as slave motors. When it is desired to open all of the rows, the motor **102** will be used as the master control motor, and the remaining motors **100, 101** and **103** are slaved to it. Associated with the motor **101** is a conventional rotation counter having a forward limit switch **105** and a reverse limit switch **106.** Similarly, the motor **102** is provided with a rotation counter having a normally closed forward limit switch **107** and a normally closed reverse limit switch **108.**

Each of the motors **100–103** receives power through an associated manually-operated switch, as distinguished from the receptacles of the embodiment of FIG. **2**; and these are designated respectively **109, 110,** 111, and **112.** These switches are also conventional, and they are actuated by a special tool or implement which is carried only by operating or maintenance personnel so as to minimize interference with the system operation by students or the like.

Power is fed to the switches **109–112** from a magnetic reversing contactor **115** having three normally open forward contacts **116***a*, **116***b* and **116***c*, and three normally open reverse contacts **117***a*, **117***b* and **117***c*.

The contactor **115** also includes a forward coil **118** for actuating the contacts **116***a*–**116***c* when energized and a reverse coil **119** for actuating the reverse contacts **117***a*–**117***c* when energized.

Power is fed to the contactor **115** from the lines L1, L2 and L3 through a fused safety switch generally designated by reference numeral **120.**

Turning now to the upper left-hand corner of FIG. **3,** reference numeral **121** generally designates a control switch having a pair of normally-open pushbutton switches **122** and **123** respectively, the contacts of which are connected to a plug **125.** The plug **125** includes a first terminal **126** which is connected in common to one terminal of each of the switches **122, 123.** It also includes a second terminal **127** connected directly to the other terminal of switch **123,** a third terminal **128** which is directly connected to the other terminal of switch **122,** and a fourth terminal **129** which is grounded.

The plug **125,** depending upon the number of rows it is desired to be extended may be connected to one of two receptacles designated respectively **135** and **136.** If it is desired to open all of the rows, the plug **125** is connected to the receptacle **135** so that motor **102** becomes the master control motor. If it is desired to open only eight rows of the system, the plug **125** is connected to the receptacle **136,** and in this case, the motor **101** becomes the master control motor, and the motor **102** is a slave motor, the contacts **107** and **108** being inoperative to affect the system.

The plug **135** has four terminals: **139** is connected directly to a source of single-phase power; **140** is connected to the reverse limit switch **108**; **141** is grounded; and **142** is connected to the forward limit switch **107** associated with the motor **102.** Similarly, the plug **136** has four terminals: **145** is connected to the source of single-phase power; **146** is connected to the reverse limit switch **106**; **147** is grounded; and **148** is connected to the forward limit switch **105** associated with motor **101.**

The operation of the system of FIG. **3** will now be described. Assuming that the operator wants to open only eight rows, the plug **125** is connected to the receptacle **136.** Single phase power is thus fed through the terminal **145** of receptacle **136** to the terminal **126** of the plug **125** and thence to one terminal of each of the for-

ward and reverse pushbutton switches **122, 123.** If the operator then closes the switch **123,** a circuit is established to feed the single phase power back through the plug **125** (terminal **127**) and the receptacle **136** (terminal **148**) to the forward limit switch **105** associated with the motor **101** (now acting as the master control motor). Thus, the forward coil **118** of the magnetic reversing contactor **115** is energized, and the normally open contacts **116***a*–**116***c* are closed, thereby energizing all of the motors **100–103** (for which the associated manually operated switches **109–112** are closed). The bleacher sections will then open until the forward switch **105** is opened, thereby de-energizing the coil **118.** It will be observed, of course, that the limit switch **105** may be set to any desired number of rows, depending upon the installation. When it is desired to close the bleachers, the reverse switch **122** is closed. Operation is also similar when the plug **125** is connected to the receptacle **135,** except that the limit switches **107** and **108** are now connected in the system, and the master control motor becomes the motor **102.** In this case, the only difference is that the rotation counter is set so that the contacts **107** do not open until all of the rows are extended, and the limit switch **108** is set correspondingly so that it opens only when all of the rows are fully retracted. It will thus be observed that an equivalent way to produce electric row programming of the type just described would be to eliminate the contacts **107,** 108 and have them associated with the rotation counter provided for the motor **101,** these switches merely being set for the extension of a different number of rows; any such number of limit switches may thus be provided, thereby providing greater flexibility in the programming of the extension and retraction of seating row sections.

In summarizing the electric row programming system just described, it will be appreciated that it provides a system having a plurality of seating sections or units with a means of selectively operating the sections or units so as to open or extend for use a predetermined number of rows. At the same time, of course, the operator may choose to select that all of the rows be opened. One or more of the actuating motors may be provided with the master control mechanisms for selective electric row programming; and the feeding of power to the master control motor as well as all slave motors is controlled by that mechanism. Whereas in the illustrated embodiment, operator selection is made by connecting a plug to one of a number of receptacles, thereby selecting the master control motor, equivalent means may equally well be employed such as rotation counters having a plurality of limit switches (both forward and reverse), as described, each set to open at a different extension of the overall system. In this case, the selection could be accomplished by pushbuttons associated with each of the limit switches so as to connect it into the control circuit to the exclusion of the other forward and reverse limit switches. That is, one forward limit switch and an associated reverse limit switch would be selected by the operator.

With two embodiments of the invention explained, still another advantage accrues from the invention. This advantage has particular use in the control of adjacent units where one of the units has a portion removed for some reason, such as to provide access to a door. For example, one or more units may have a full 25 rows; and an adjacent unit may have the first 15 rows removed but containing the upper 10 rows. Heretofore, it has not been practical to interlace the seat boards, risers and floorboards of the ten rows of the cut-away unit with the upper 10 rows of the adjacent full unit even though this is highly desirable for purposes of alignment, safety, aesthetics, etc.

With the present invention, the upper rows of the cutaway unit may be interlaced with the corresponding rows of the adjacent full unit. THe control system may be constructed similar to that shown in FIG. **3** with two separate modes of operation which operate in sequence. That is, in the first mode, the fifteen rows of the full units are extended by a master motor control using a first set of limit switches, as disclosed. After these rows are extended, the motor cuts off to bring the system to a stop, and the operator then connects the control plug into the second mode or pushes a pushbutton switch so that a second set of limit switches operates all units together to open the remaining ten rows in unison. The second set of limit switches may be associated with the same motor or a different one; but in both modes, there is a master motor which controls the movement of all operative units for a given mode of operation.

Having thus disclosed in detail a preferred embodiment of the invention, persons skilled in the art will be able to modify certain of the circuitry and structure which has been illustrated and to substitute equivalent elements for those disclosed while continuing to practice the principle of the invention. For example, the illustrated embodiment discloses a system which opens the seating sections by applying a force to the foremost row. The system could easily be adapted to one wherein the forward links of the reels are anchored and the reels are attached to and travel with the rear seating rows. The latter is known as a forward fold system. It is therefore intended that all such modifications and substitutions be covered as they are embraced within the spirit and scope of the appended claims.

I claim:

1. A system for controlling the extension and retraction of a plurality of telescoping seating row units, each unit including at least one seating row section comprising: a plurality of induction motors, one associated respectively with each of said units, one of said motors being a master control motor; a plurality of actuator means, one associated with each of said motors for moving an associated seating row unit; reversing switch means; means for supplying electrical energy to said reversing switch means; conductive distribution means for coupling said reversing switch means for connecting all of said motors in parallel with said source when said switch means is actuated; limit switch means responsive to the position of said unit associated with said master control motor for generating a first signal when said section is extended to a predetermined position and for generating a second signal when said section is retracted to a predetermined position; and control switch means for selectively coupling power to said limit switch means to energize said reversing switch means selectively to energizing all of said motors in a predetermined direction, said, limit switch means being operative to de-energize said reversing switch means when said units are in either of said positions to generate said first or second signals, whereby when said control switch means is actuated, electrical energy is supplied to all of said motors simultaneously and in parallel, and

said seating units extend or retract synchronously, in parallel and in unison, and said limit switch means associated with said master control motor energizes and de-energizes said reversing switch means.

2. The system of claim 1 wherein said control switch means includes an OFF position, a normally open pushbutton forward switch and a normally open pushbutton reverse switch; and wherein said limit switch means comprises a normally closed forward limit switch for opening when said unit associated with said master motor is extended to a predetermined position, and a normally closed reverse limit switch for opening when said master motor is retracted to a predetermined closed position; and second and third conductive means respectively for connecting said forward pushbutton switch in circuit with said forward limit switch and said reversing switch means, and for connecting said reverse pushbutton switch in circuit with said reverse limit switch and said reversing switch means.

3. The apparatus of claim 2 wherein said reversing switch means comprises a set of normally open forward contacts for coupling three-phase power to said motors in parallel when actuated to drive said motors in a forward direction; a forward coil for actuating said forward contacts; a set of normally open reverse contacts for coupling said three-phase power to said motors in parallel when actuated, and a reverse coil for actuating said reverse contacts when energized; said system further comprising means for connecting said forward limit switch in circuit with said forward coil of said reversing switch means, and means for connecting said reverse limit switch in circuit with said reverse coil of said reversing switch means.

4. A system for controlling the extension and retraction of a plurality of telescoping seating row sections, comprising: a plurality of induction motors, one associated respectively with one or more of said sections moving as a unit, one of said motors being a master control motor; a plurality of actuator means, one associated with each of said motors and connected between the output of said motor and the associated seating row section; control switch means having a forward and a reverse position; magnetic reversing switch means including a set of forward contacts, a forward coil associated with said forward contacts for actuating the same when energized, a set of reversing contacts, and a reverse coil associated with said reversing contacts for actuating the same when energized; means for supplying three-phase electrical energy to said forward and reversing contacts; conductive distribution means for connecting said forward and reversing contacts in parallel to all of said motors; rotation counter means associated with said master control motor and including a pair of normally-closed forward contacts connected in circuit with said forward coil and said forward position of said control switch for opening said circuit when said master motor has gone through a predetermined number of rotations in a forward direction to extend said seating row sections for use, and a pair of normally-closed reverse contacts responsive to the rotation of said master motor and connected in circuit with said reverse coil and said reverse position of said control switch for de-energizing said reverse coil after said master control motor has rotated a predetermined number of times in a reverse direction to retract said seating sections in parallel for storage, whereby when said control switch is actuated, electrical energy is supplied to all of said motors simultaneously and in parallel and said seating sections extend or retract synchronously, in parallel and in unison, and the control mechanism associated with said master motor means energizes and de-energizes all of said motors.

5. A system for electric row programming for controlling the extension and retraction of a plurality of telescoping seating row units, each unit including at least one seating row section, comprising: a plurality of induction motors, one associated respectively with each of said units, at least one of said motors operating as a master control motor whereby said system may operate in a first mode for extending a first predetermined number of row sections for all of said units in a second mode for extending a second predetermined number of rows for all of said units; control switch means for selecting the mode of operation and having a forward and a reverse position for each said mode; reversing switch means for coupling three-phase power to all of said motors in parallel when energized to drive said motors in a forward condition in response to a first signal and to drive said motors in a reverse condition in response to a second signal; limit switch means associated with said master control motor in each mode of operation of said system, each limit switch means being set to generate said first signal for actuating said reversing switch means when a predetermined number of rows is extended; and conductive means for connecting said control switch means in circuit with said limit switch means and said reversing switch means.

6. The apparatus of claim 5 wherein said system includes a first master control motor and a second master control motor, only one of said master control motors being operative at any given time to actuate the remaining motors as slave motors; and wherein said system includes limit switch means associated with each of said master control motors and connected in circuit with said control switch means and said reversing switch means when said system is set to operate in a mode wherein its associated motor is a master control motor for that mode of operation.

7. The system of claim 5 wherein said limit switch means comprises a forward and a reverse-normally-closed limit switch associated with said master control motor for each mode of operation of said system, each forward limit switch opening upon the extension of a predetermined number of rows, and each reverse limit switch opening upon the retraction of the same number of rows as its associated forward limit switch to de-energize said reversing switch means.

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