March 19, 1946. P. T. RUSSELL 2,396,722

ACOUSTICAL APPARATUS

Filed Dec. 9, 1936 3 Sheets-Sheet 1

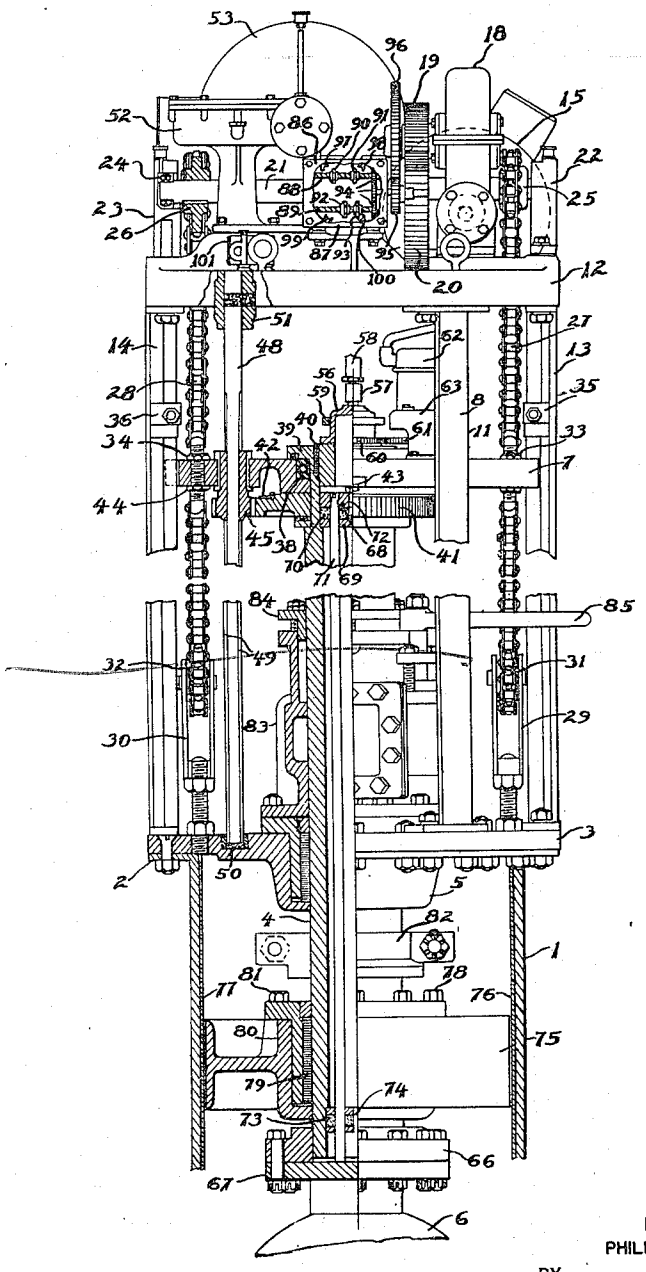

FIG. 1

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ACOUSTICAL APPARATUS

Filed Dec. 9, 1936 3 Sheets-Sheet 2

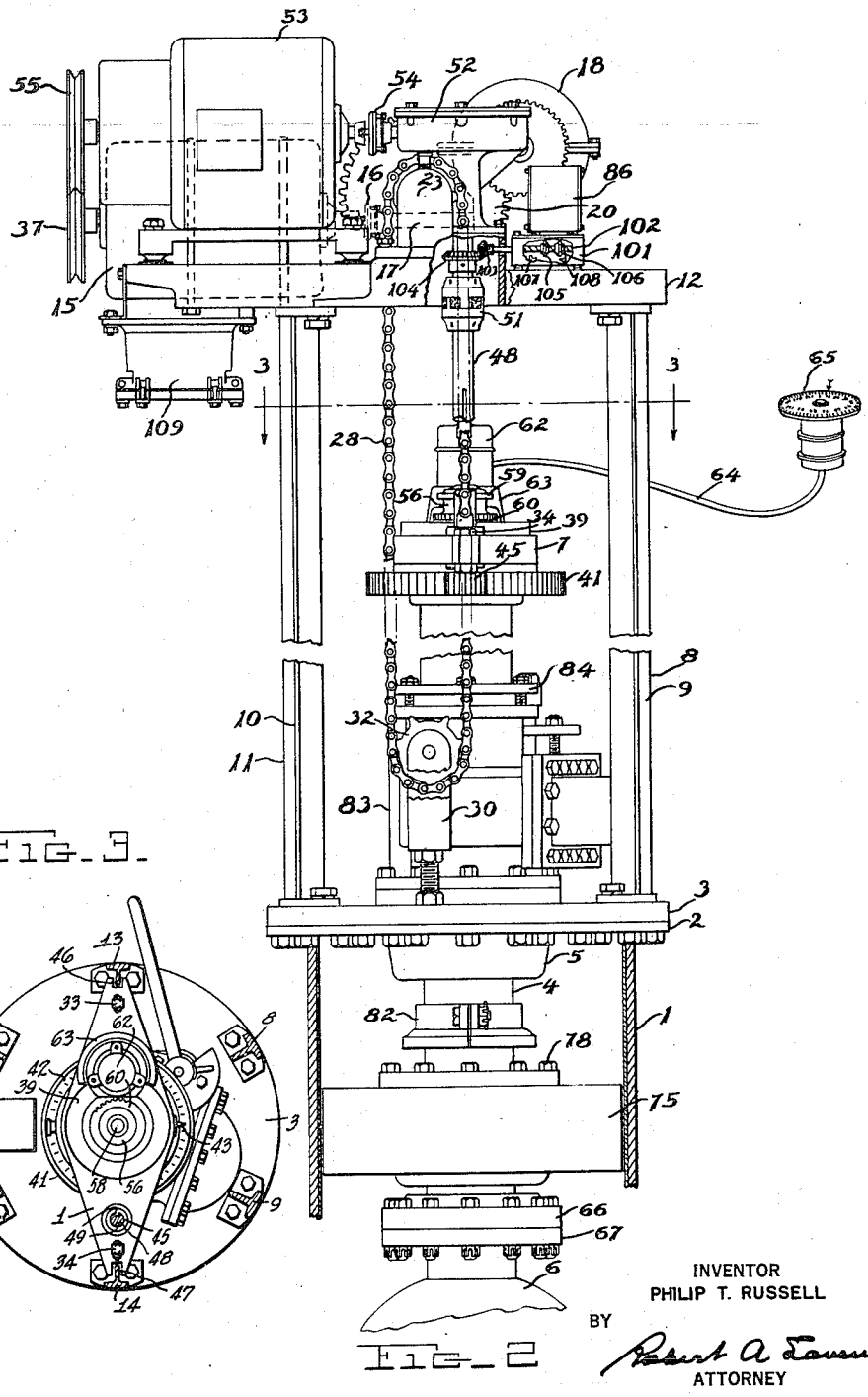

FIG. 3.

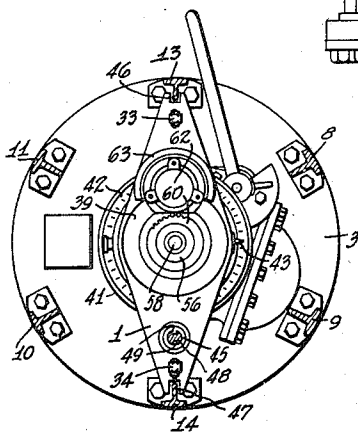

FIG. 2

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ACOUSTICAL APPARATUS

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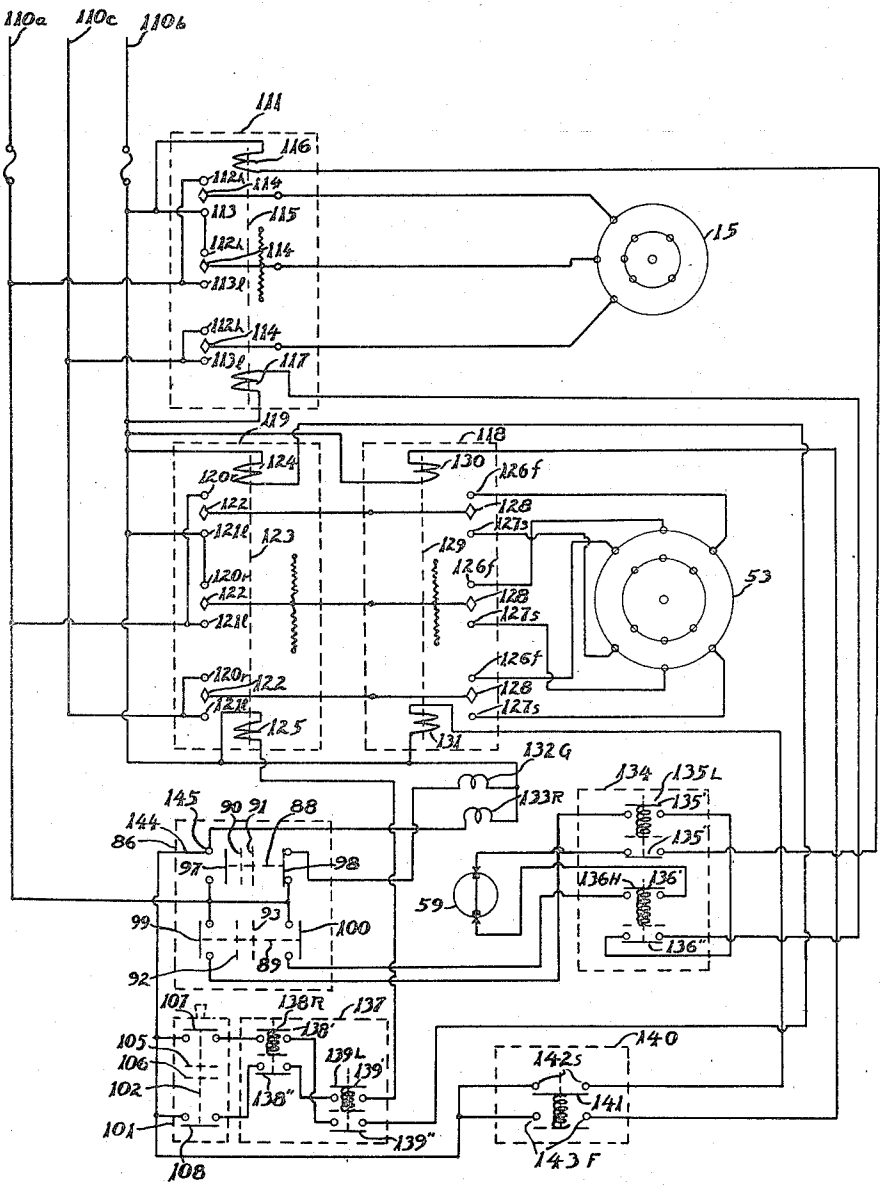

Fig. 4

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UNITED STATES PATENT OFFICE

2,396,722

ACOUSTICAL APPARATUS

Philip T. Russell, Mount Rainier, Md.

Application December 9, 1936, Serial No. 114,918

44 Claims. (Cl. 181—0.5)

(Granted under the act of March 3, 1883, as amended April 30, 1928; 370 O. G. 757)

My invention relates to acoustical apparatus and more particularly to such an apparatus wherein the acoustical instrumentality for receiving and/or transmitting sound energy is mounted for effective translatory and/or rotational movement to thus enable the extension, retraction or rotation of said instrumentality to desired points within a fluid medium, the movements of said instrumentality being remotely controlled from stations which are advantageously located and the rotational and translatory positions of the instrumentality being remotely indicated at these stations.

Subaqueous acoustical apparatus heretofore known and installed for use on either naval or commercial vessels has been wholly inadequate in that it has been cumbersome in construction, lacked flexibility and speed of movement, and, insofar as I am aware, has never been susceptible of remote control. It is of course essential that the acoustical instrumentality of such an apparatus have flexibility and speed of movement and be susceptible of remote control if it is to be of any practical value as a navigational aid or of any use to commanders of naval vessels for strategic or tactical purposes.

My invention seeks to obviate the deficiencies inherent in the prior art devices, this desideratum being attained by the provision of an acoustical apparatus wherein the acoustical instrumentality for receiving and/or transmitting sound energy is mounted upon a vertical shaft which extends through the cover of a sea chest and is movable with respect thereto while maintaining the fluid-tight integrity thereof. The acoustical instrumentality is preferably, although not necessarily, of an electro-mechanical type and as such is capable of directively transmitting and/or receiving a supersonic beam of high frequency sound energy. When in use the acoustical instrumentality is positioned entirely below the keel of the vessel and when not so employed can be raised until it is housed in the aforementioned sea chest within the vessel to thus protect the instrumentality and prevent its offering any parasitic resistance to the vessel's movement.

For imparting translatory and rotary movement to the acoustical instrumentality I employ among other things a plurality of electric motors mechanically coupled to the vertical supporting shaft, the energization, speed and direction of rotation of which is controlled by an electrical system or circuit operable from stations located remotely at advantageous positions on the vessel. Limit switches of any suitable construction are properly associated with the electrical system and the movable parts of the apparatus so as to automatically limit the translatory and rotational movement of the acoustical instrumentality. Means are also provided for indicating at a remote point the position of the acoustical instrumentality in its translatory path of movement as well as its relative rotational position with respect to the vessel.

With the apparatus of my invention I attain a flexibility and speed of movement of the acoustical instrumentality hitherto unknown to the prior art and all of which is accomplished by remote control. Thus with my apparatus I am enabled to hoist or lower the acoustical instrumentality at a speed at least as great as 3 inches per second and rotate the same in azimuth at speeds of one or four revolutions per minute or more if desired. The operations of hoisting and lowering the acoustical instrumentality are possible of accomplishment when the vessel's speed is thirty-five knots or less and rotation thereof is feasible with the instrumentality in its extended position when the speed of the vessel is thirty-five knots or less. My acoustical apparatus operates satisfactorily in all respects even though the vessel is rolling or pitching in a heavy seaway and its operation is in no wise impaired when the apparatus is inclined at an angle of 45° to its normal position by this rolling or pitching. It is thus seen that I provide an acoustical apparatus which is eminently suited for facilitating and safeguarding navigation during fog or other conditions of low visibility and for determining the direction and distance of aids or obstructions to navigation. Furthermore, my apparatus is of great strategic and tactical value to commanders of naval vessels since its use permits not only the effective detection of a hostile vessel within the theater of operations but also the ascertainment of its direction and distance.

In the light of the foregoing, it is an object of my invention to provide an acoustical apparatus wherein the acoustical instrumentality for receiving and/or transmitting sound energy is mounted for effective translatory and/or rotational movement to thus insure flexibility and speed of movement of the said instrumentality under all operating conditions.

It is another object of my invention to provide an acoustical apparatus wherein the acoustical instrumentality for receiving and/or transmitting sound energy is mounted for effective translatory movement and wherein the means for imparting movement to the instrumentality is rendered inoperative upon the completion of a pre-

determined movement of translation by the instrumentality.

It is another and further object of my invention to provide an acoustical apparatus wherein the acoustical instrumentality for receiving and/or transmitting sound energy is mounted for effective rotational movement and wherein the means for imparting movement to the instrumentality is rendered inoperative upon the completion of a predetermined movement of rotation by the instrumentality.

It is another and further object of my invention to provide an acoustical apparatus wherein the acoustical instrumentality for receiving and/or transmitting sound energy is mounted for effective translatory and rotational movement and wherein the means for imparting movement to the instrumentality is rendered inoperative upon the completion of predetermined movements of translation and rotation by the instrumentality.

It is another and further object of my invention to provide an acoustical apparatus wherein the acoustical instrumentality for receiving and/or transmitting sound energy is mounted for effective translatory and/or rotational movement and wherein means are provided for remotely indicating the position of the instrumentality in its translatory and/or rotational paths of movement.

It is another and further object of my invention to provide an acoustical apparatus wherein the acoustical instrumentality for receiving and/or transmitting sound energy is mounted for effective translatory and rotational movement and wherein the means for imparting rotational movement to the instrumentality is operable to accomplish its intended function only upon the completion of a predetermined movement of translation by the instrumentality.

It is another and further object of my invention to provide an acoustical apparatus wherein the acoustical instrumentality for receiving and/or transmitting sound energy is mounted for effective translatory and rotational movement and wherein the means for imparting translatory movement to the instrumentality is operable to accomplish its intended function only when the said instrumentality has attained a predetermined angular position.

It is another and still further object of my invention to provide an acoustical apparatus wherein the acoustical instrumentality for receiving and/or transmitting sound energy is mounted for effective translatory and rotational movement and wherein a travelling bearing is provided to insure unrestricted rotation of the instrumentality when it is in its extended and operative position.

These and other objects and many of the attendant advantages of this invention will be readily appreciated as the same becomes better understood by reference to the following detailed description when considered in connection with the accompanying drawings wherein:

Fig. 1 is a view in partial cross-sectional elevation showing the manner of mounting the acoustical instrumentality for effective translatory and/or rotational movement as well as all appurtenant parts and mechanisms essential for effectuating the desired movement, the view being broken near its middle portion so as to make possible a complete showing of the acoustical apparatus:

Fig. 2 is a view in side elevation of my acoustical apparatus as seen from a position to the left of Fig. 1;

Fig. 3 is a plan view of certain parts of my acoustical apparatus taken on the line 3—3 of Fig. 2; and

Fig. 4 shows schematically the control circuit for the electric motors which are designed to effect movements of the acoustical instrumentality.

Turning now to Figs. 1, 2 and 3 of the drawings, there is shown depicted therein at 1 a sea chest to the flange 2 of which the sea chest cover 3 is bolted or secured in any other suitable manner. A tube or shaft 4 extends through the bearing 5 in the sea chest cover and has mounted at one end thereof an acoustical instrumentality 6 for transmitting and/or receiving sound energy, the said instrumentality being preferably, although not necessarily, of an electro-mechanical type. The remaining end of the tube or shaft 4 is rotatably mounted on a travelling yoke or support 7 in a manner to be described more particularly hereinafter. Four vertical structural members 8, 9, 10 and 11 serve to support a motor assembly and are bolted to the sea chest cover 3 at their lower ends and to the top platform or motor base casting 12 at their upper ends. Two additional vertical structural members 13 and 14 similarly secured provide guides for the travelling yoke or support 7 in its translatory paths of movement.

For hoisting and lowering the yoke or support 7 there is provided an electric motor 15 of suitable design and rating which is connected by means of a coupling 16 and a shaft 17 to a worm reduction gearing within a housing 18. A hoisting and lowering pinion 19 is driven directly from the reduction gearing within the housing 18 and meshes with the hoisting and lowering gear 20 keyed to the cross shaft 21. Pillow blocks 22 and 23 equipped with self-aligning bearings, one of which is shown at 24, support the cross shaft 21 on which are rigidly mounted two sprockets 25 and 26 for driving the hoisting and lowering chains 27 and 28. Yokes 29 and 30 are adjustably secured to the seachest cover 3 and rotatably support the idler sprockets 31 and 32 which likewise mesh with the chains 27 and 28 respectively. The chains 27 and 28, as shown, are connected at their adjacent ends to the yoke or support 7 by means of adjustable connections 33 and 34 provided for this purpose. Furthermore, the chains are adjusted so that they will be loose enough to run freely and yet tight enough so that any inclination of the apparatus caused by list or pitch of the vessel will prevent their striking against adjacent parts thereof. About one inch above the upward limit of travel of the yoke or support 7 there are bolted to the structural guide members 13 and 14 rubber bumpers or equivalent shock absorbers 35 and 36. Similar shock absorbers not shown are mounted about one inch below the lower limit of travel of the yoke and secured to the structural guide members 13 and 14 in a like manner. These bumpers are installed to cushion the impact of over-travel in case of failure of the limit switches or possible error in operating the apparatus by hand for which purpose the pulley 37 connected to the motor 15 is provided. The manner of operation of the hoisting and lowering mechanism is believed to be apparent. Thus, for example, if the motor 15 is energized to rotate in a direction such that the acoustical instrumentality 6 will be moved from its housed position within the seachest to its extended and operative position, power will be transmitted through the coupling 16, shaft 17, reduction gearing within the housing 18, hoisting and lowering pinion 19, and hoisting and lowering gear 20 to the cross shaft 21 to cause rotation of the same. The chains 27 and 28 meshing with their respec-

tive sprockets and secured to the yoke or support 7 insure movement of the shaft 4 with the acoustical instrumentality 6 to the desired position. Upon the completion of the desired movement, the energization of the motor 15 is automatically interrupted in a manner which will be pointed out more in detail hereinafter. If now the motor 15 is again energized but in such a manner as to cause a direction of rotation thereof which is opposite to that previously assumed it is evident that the acoustical instrumentality 6 will be retracted from its extended and operative position to a housed position within the seachest, the energization of the motor being again automatically interrupted upon reaching the latter position.

Within a cavity of the yoke 7 there is contained a roller bearing 38 which supports the weight of the tube or shaft 4 and its component parts. The upper race of the bearing fits into a casting 39 which as shown is screw-threaded into engagement with the upper end of the shaft 4 and there locked in position by a set screw 40 or other suitable means. A training gear 41 for rotating or training the shaft 4 is rigidly secured thereto in any suitable manner. A dial 42 graduated in degrees from 0° to 360° is adjustably attached to the gear 41 for cooperation with the pointer 43 to indicate the angle of train or relative bearing of the acoustical instrumentality with respect to the vessel at the apparatus. The dial is adjustably mounted on the gear 41 so that any arbitrary position of the acoustical instrumentality 6 may be taken as the zero angle of train or point from which initial excursions of rotation are made. The adjustable dial may, if desired, be positioned with its zero graduation opposite the pointer 43 when the sound active face of the acoustical instrumentality 6 is facing forward and making an angle of 90° with the keel of the vessel. Any other adjustment of these parts, however, may be made as desired. A suitable bearing 44 within the yoke 7 supports a training pinion 45 which meshes with and drives the training gear 41. The machined grooves 46 and 47 in the yoke 7 which accommodate the vertical structural guides 13 and 14 respectively prevent rotation of the yoke thereby insuring effective communication of the torque delivered by the training pinion 45 to the training gear 41 with ensuing rotation of the tube or shaft 4.

A training shaft 48 is provided with two keyways 49 running the full length of the path requisite for hoisting and lowering the acoustical instrumentality, this shaft as shown being splined to the training pinion 45 in all positions of adjustment of the latter. At its lower end the shaft 48 is supported by a suitable bearing 50 positioned within the sea chest cover and at its upper end is connected by means of a flexible coupling 51 to a worm wheel reduction gearing within the housing 52. A plural speed electric motor 53 of suitable design and rating for rotating the shaft 4 is connected by means of a coupling 54 to the reduction gearing within the housing 52 and like the hoisting and lowering motor 15 is provided with a pulley 55 for hand operation. The manner of rotating the shaft 4 and its attached acoustical instrumentality 6 is believed to be apparent. Assuming that it is desired to rotate the shaft 4 in a clockwise or right-handed direction as viewed from the upper side of the yoke 7, the motor 53 is energized to give the desired direction of rotation of the shaft 4 and power is transmitted therefrom through the reduction gearing within the housing 52, coupling 51 and shaft 48 to the training pinion 45. Since the training pinion 45 at all times meshes with the training gear 41, it is evident that the shaft 4 can be trained to any desired angular position so long as the motor 53 is energized. For reasons that will be set forth at greater length hereinafter, it is desirable under certain circumstances to limit the angle of train of the acoustical instrumentality in both of its directions of rotation, the manner of accomplishing which will likewise be explained subsequently.

On the casting 39 there is fixedly mounted a terminal casting 56 with a terminal tube 57 for accommodating the electrical wiring which extends from the cable 58 through the shaft 4 to the electro-mechanical, acoustical instrumentality 6. The terminal casting 56 supports at its upper end an annular switch 59, the function of which will be pointed out more in detail hereinafter, and at its lower end a gear 60 which meshes with and drives a gear 61 of a synchronous transmitter 62. The transmitter is supported by a metallic casting 63 which is bolted to the yoke or support 7. A cable 64 connects the synchronous transmitter 62 to a synchronous receiver 65 positioned at a remote and advantageous position on the vessel from which the apparatus as a whole may be controlled, the receiver serving to indicate the position or angle of train of the acoustical instrumentality. It is thus seen that the arrangement of the parts of my apparatus makes possible a direct observation of the angle of train or relative bearing of the acoustical apparatus at the apparatus by means of the dial 42 and pointer 43, as well as at a remote station through the synchronous transmitter 62 and receiver 65 which are adjusted to duplicate or repeat the readings of the dial and pointer.

The tube or shaft 4 is hollow bored and of a metal which will resist corrosion. A flange 66 threaded and welded to the lower end of the shaft 4 is engaged by and secured to a complemental flange 67 of the acoustical instrumentality 6 to thus support the same. The extreme ends of the tube have a somewhat larger inner diameter than the remaining portion to thus accommodate rubber and metal, or sandwich packing seals at these points. These seals provide supports for the connecting wires passing through the tube to the acoustical instrumentality 6 and also support means for removing from the internal parts of the tube any water that may collect there by reason of condensation. The upper seal includes top and bottom metallic plates 68 and 69 between which there is interposed a rubber section 70. Both top and bottom plates are drilled for entering wires, an air valve, an evacuating conduit 71 and for tightening bolts, one of which is shown in position at 72. Tightening of the bolts causes compression of the center rubber section 70 thus forming an air-tight joint with the inner wall surface of the tube 4. Compression of this center section 70 also forms a fluid impervious seal between it and the various elements which pass therethrough. The seal 73 at the bottom of the shaft 4 is similar in construction and function and is provided with a passageway 74 at its center to insure the entrance of air to the space beneath, whereby any accumulated fluid is caused to pass upwardly through the conduit 71. This conduit is capped at the point where it passes through the top of the upper seal and extends downwardly through the tube 4 and lower seal 73 to a point in line with the bottom of the flange 66. Air introduced under pressure

through the air valve (not shown in the drawings) in the top seal will cause any accumulated fluid up to the level of the bottom flange 66 to be expelled through the conduit 71 when its cap is removed.

When the acoustical instrumentality is extended and subjected to the fluid pressure while the vessel is underway, it is essential that a point of support be provided as close to the center of this pressure as possible. In order to provide this additional support there is shown a travelling bearing 75 which moves within the sea chest on vertical strips 76 and 77, the said bearing having bolted within its body a lignum vitae bearing identified in general by the reference character 78 in which the tube 4 slides and rotates. The lignum vitae segments, one of which is shown at 79, are fitted in accurately dove-tailed slots of the bushing 80, a holding ring 81 threadedly engaging the bushing to thus prevent vertical movement of the lignum vitae segments. In the manufacture of these bearings the lignum vitae segments are inserted in the dove-tailed slots of the bushing, soaked in water and then bored to a diameter which provides sufficient clearance for movement of the shaft 4. Soaking the lignum vitae segments in water simulates the swelling of the wood attending the use of the bearing under actual service conditions and thus insures a proper fit. Downward movement of the travelling bearing 75 is limited by a stop (not shown in the drawings) forming part of the sea chest. When the shaft is hoisted the bottom flange 66 strikes the travelling bearing in its upward movement and carries the bearing to its normal housed position within sea chest with the bearing at rest on the flange 66. When the shaft is lowered for use, the traveling bearing will tend to drop of its own weight. However, accumulation of sea debris may prevent this as will also the pressure of the water with the vessel underway when the acoustical instrumentality emerges beyond the opening in the sea chest. It therefore becomes necessary to provide means for forcing the travelling bearing to its correct position when the acoustical instrumentality is to be projected for use. For accomplishing this I provide a split pushdown clamp 82 which tightly grips the tube 4 and forces the travelling bearing downwardly during the projection of the shaft 4 thus insuring that the bearing will locate itself approximately at its extreme outward position and thereby provide the requisite support for the tube.

Where, however, the sea chest is relatively shallow a clamp as shown at 82 cannot be conveniently employed. In order to insure that under these circumstances the travelling bearing will reach its proper position during the projection of the shaft 4 I have adopted an alternative scheme wherein the pressure exerted by the yoke 7 is used against the tops of pushrods secured to the travelling bearing. These rods pass through suitable stuffing boxes within the sea chest cover. Upward movement of the travelling bearing in this alternative embodiment is produced by the flange 66 striking the bearing.

The bearing 5 within sea chest cover is a lignum vitae bearing similar in construction to the lignum vitae bearing portion of the travelling bearing and, as shown in the drawings, has mounted thereupon a quick closing gate valve 83 with stuffing box 84 included. The stuffing box is so adjusted that the packing therein is compressed to insure a watertight joint and yet permit movement of the tube 4 without excessive friction. The purpose of this valve is to provide a convenient means for closing the opening in the sea chest cover should the shaft or tube 4 be either removed or carried away. A handle 85 for operating the valve is shown in a position to open the same.

For limiting the movements of the acoustical instrumentality 6 in its various excursions of translation and rotation, I provide limit switches which may be constructed in any of several forms. Thus, for example, trigger switches actuated by some movable part or parts of the apparatus may be employed to limit the movements of the acoustical instrumentality. For illustrative purposes, however, I have shown in the drawings limit switches of the so-called travelling nut type for controlling the movements of hoisting, lowering and training of the acoustical instrumentality within certain specified limits.

A limit switch of this latter type for controlling the hoisting and lowering of the acoustical instrumentality as well as for controlling the indicating lights which advise the operator whether or not the acoustical instrumentality is in a retracted or extended position is identified in general by the reference character 86. Within the housing 87 of the switch there are mounted two screw threaded shafts 88 and 89 carrying the travelling hexagonal nuts 90, 91, 92 and 93 which are held against rotation by the cover plate of the housing, the rotation of the shafts being controlled by the pinions 94, 95 and gear 96 which is directly connected to the reduction gearing within the housing 18 as is the hoisting pinion 19. The nuts 90, 91, 92 and 93 control their respective toggle switches 97, 98, 99 and 100 which are incorporated in and form part of the control circuits of the control system to be described hereinafter. The upper nuts 90, 91, and their respective toggle switches 97, 98, serve to control the indicating lights which advise the operator of the position of the acoustical instrumentality; and the lower nuts 92 and 93 with their respective toggle switches 99 and 100 limit the excursions of the acoustical instrumentality in its translatory paths of movement. The manner in which this limit switch operates is believed to be clear. Since each of the hexagonal nuts is held against rotation by the cover plate of the housing 87 which bears against one of its sides, the nut will travel along the screw threaded shaft when the shaft is set in motion. At a specified point the toggle switch controlled by this particular nut will be tripped, thereby producing the required control by opening or closing the proper auxiliary circuit. Since the screw threaded shafts 88 and 89 are driven from the reduction gearing within the housing 18 which also drives the cross shaft 21 for hoisting and lowering the acoustical instrumentality, it is evident that any desired, automatic and complete control of the acoustical instrumentality may be obtained by proper initial adjustment of the travelling nuts along their respective shafts.

A limit switch of the travelling nut type for restricting the rotation of the shaft 4 to any desired number of revolutions in either direction to thus prevent injury to the cable 58 by excessive rotation of the shaft is identified in the drawings by the reference character 101. The screw threaded shaft 102 of this switch is driven by the bevel gears 103, 104 from the same reduction

gearing within the housing 52 that drives the training shaft 48. The travelling nuts 105, 106 which are movable along the shaft 102 control their respective toggle switches 107, 108, which are incorporated in proper relay circuits of the control system to be described hereinafter. Since this limit switch in other respects is identical with switch 86 no further description thereof is deemed necessary.

A connection box 109 is provided with suitable terminals for the necessary ship's connections and with wire connections to the hoisting and lowering, light indicating and training limit switches. It is to be emphasized at this point that the motor platform 12 need not be supported from the sea chest cover 3 in the manner shown in the drawings since it might be equally well supported from any part of the ship's frame as desired. Furthermore, it is not essential that the sea chest have a cylindrical shape. Its cross-sectional area may under some circumstances be rectangular in contour where the construction of the vessel in which it is installed so requires.

The electrical system for controlling the hoisting or lowering and training motors is shown schematically in Fig. 4 of the drawings wherein 110*a*, 110*b*, 110*c* designate the 3-phase mains which serve to supply the alternating current. The hoisting and lowering motor 15, which is of a 3-phase, squirrel cage induction type, is adapted for connection to the current mains by means of the magnetically operated three-pole double-throw switch 111. This switch includes two sets of stationary contacts identified by the reference characters 112*h* and 113—*l* respectively which are adapted to be selectively engaged by the movable contacts 114. These latter contacts are normally spring biased to a position midway between the stationary contacts and are simultaneously moved into engagement with either set of stationary contacts by the armature 115 and the solenoids 116 and 117 cooperating therewith. Thus when the solenoid 116 is energized the movable contacts 114 will engage the stationary contacts 112*h* with the result that the motor 15 will be energized in such a direction as to cause a hoisting or raising of the acoustical instrumentality 6. Conversely, energization of the solenoid 117 results in an engagement of the movable contacts 114 with the stationary contacts 113—*l* with attendant reversal of phase rotation in the motor 15 and hence reversal in its direction of rotation, thus causing a lowering of the acoustical instrumentality 6.

The training motor 53 is a 3-phase squirrel cage induction type provided with separate high-speed and low speed windings, its connection to the 3-phase current mains 110*a*, 110*b*, 110*c* being effected by the magnetically operated 3-pole double-throw switches 118 and 119. The switch 119 is identical in construction and operation with the switch 111 previously described and includes two sets of stationary contacts 120*r*, 121—*l* adapted to be selectively engaged by the movable contacts 122 which are normally spring biased to a position midway therebetween and controlled in their movements by the armature 123 cooperating with solenoids 124 and 125. The sole function of the switch 118 is to insure the connection of the desired winding of the motor 53 in circuit and for accomplishing this purpose includes two sets of stationary contacts 126*f*, 127*s* adapted to be selectively engaged by movable contacts 128 controlled by the armature 129 and cooperating solenoids 130, 131. Since the switch 119 controls the starting and stopping of the motor 53 as well as its direction of rotation and the switch 118 insures the connection of the desired winding in circuit, it is evident that complete speed and directional control of the motor 53 is had.

The limit switch 86 is shown schematically with the screw-threaded shaft 88, the travelling nuts 90, 91 and the toggle switches 97, 98 controlled respectively thereby. The toggle switch 98 when bridging its stationary contacts completes a circuit through an electric lamp 132G located at the remote control panel for indicating when the acoustical instrumentality 6 is housed. Electric lamp 133R similarly located is employed for advising the operator when the acoustical instrumentality has substantially reached its extended or most outward position, the energization of this lamp being controlled by the toggle switch 97 and its cooperating stationary contacts. In the lower portion of the limit switch 86 there are shown schematically the screw-threaded shaft 89, the travelling nuts 92, 93 and the toggle switches 99 and 100 controlled respectively thereby. The switch 100 serves to control the relay circuit which includes the solenoid 116 and the switch 99, the relay circuit which includes the solenoid 117.

A two element push-button station 134 which may be remotely positioned is provided for controlling the energization of the solenoids 116, 117 of the switch 111 and includes a spring biased push-button switch 135L for controlling the downward movement of the acoustical instrumentality and a spring biased push-button switch 136H for controlling the hoisting or upward movement thereof. The switches 135L and 136H include upper and lower movable contacts 135', 135'' and 136', 136'' respectively, the lower movable contacts 135'' and 136'' being normally spring biased into engagement with their stationary contacts.

The limit switch for restricting the rotation of the shaft 4 to any desired number of revolutions in either direction to thus prevent injury to the cable 59 by excessive rotation of the shaft is schematically represented at 101. The toggle switch 107 thereof controls the relay circuit which includes the solenoid 124 and the toggle switch 108 the relay circuit which includes the solenoid 125, the said toggle switches being actuated by the travelling nuts 105 and 106 respectively which are mounted for movement on the screw threaded shaft 102.

For controlling the energization of the solenoids 124 and 125 of the switch 119 there is provided a two element push-button station 137 which may be remotely positioned and which includes a spring biased push-button switch 138R for controlling what may be arbitrarily termed the right-handed rotation of the acoustical instrumentality and a spring biased push-button switch 139L for controlling what may be arbitrarily termed the left-handed rotation of the acoustical instrumentality. The switches 138R and 139L are formed with upper and lower movable contacts 138', 138'' and 139', 139'' respectively, the lower movable contacts 138'', 139'' being normally spring biased into engagement with their stationary contacts.

A single element push-button station 140 which may be remotely positioned serves to control switch 118 and for this purpose includes a single movable contact 141, stationary contacts 143F and stationary contacts 142S with which latter

contacts the movable contact 141 is normally in spring biased engagement.

The precise mode of operation of my invention may best be appreciated by considering the various movements of translation and rotation which the acoustical instrumentality performs in use. Let it be assumed that the acoustical instrumentality is in its housed or raised position as shown in Fig. 1 of the drawings and that it is desired to lower the same to an operative and extended position below the keel of the vessel. In this assumed position the toggle switch 98 of the limit switch 86 bridges its stationary contacts thus closing a circuit from current main 110*a*, switch 98, lamp 132G, current main 110B and thence back to the source. Lamp 132G may be green in color and advises the operator that the acoustical instrumentality is housed within the sea chest. Toggle switch 97 is spaced from its stationary contacts, when the acoustical instrumentality is housed, thus preventing closure of the circuit including the lamp 133R. The toggle switch 99 of the limit switch 86 bridges its stationary contacts while the toggle switch 100 is spaced from its stationary contacts. When it is now desired to lower the acoustical instrumentality to an extended and operative position the switch 135L in the push-button station 134 is depressed resulting in the closure of a relay circuit which extends from current main 110*a* through toggle switch 99, movable contact 135' of switch 135L, lower normally closed movable contact 136'' of switch 136H to relay 117 of switch 111 and thence to current main 110B. The energization of solenoid 117 results in an engagement of the movable contacts 114 with the stationary contacts 113—*l* of the switch 111 with attendant energization of the motor 15 from the current mains 110*a*, 110*b*, 110*c* to cause a lowering of the acoustical instrumentality. Simultaneously with the rotation of the motor 15 the screw threaded shafts 88 and 89 of the limit switch 86 are set in motion and the movable nuts 90, 91, 92 and 93 begin their travel along their respective shafts. Shortly after the motor 15 is set in operation the travelling nut 91 trips its toggle switch 98 to cause an interruption of the circuit including the lamp 132G. Also the toggle switch 100 which was spaced from its stationary contacts while the acoustical instrumentality was in its uppermost and housed position is tripped by its travelling nut 93 to cause the same to bridge its stationary contacts shortly after the beginning of the motor rotation. As long as the switch 135L is depressed the motor 15 continues to rotate and concurrently therewith the travelling nuts 90, 91, 92 and 93 proceed in their movements along their respective shafts 88 and 89. The nut 92 is so adjusted that when the acoustical instrumentality 6 has substantially reached its operative and extended position it will trip its toggle switch 99 to an open position thereby interrupting the current flow in the relay circuit including the solenoid 117 and causing deenergization of the motor 15 by opening of the switch 111. The nut 90 may be so adjusted that shortly before the opening of the toggle switch 99 it trips the toggle switch 97 to a closed position thereby completing a circuit from the main 110*a* through switch 97, a lamp 133R and current main 110*b* to advise the operator that the acoustical instrumentality has reached the desired position. The lamp 133R may for this purpose be a red lamp.

When now the operator has finished his exploration with the acoustical instrumentality 6 and is desirous of retracting the same from its extended position to a housed position within the sea chest, he depresses the switch 136H of the push-button control station 134. As a result thereof a relay circuit extending from main 110*a* through toggle switch 100, movable contact 136' of switch 136H, closed annular switch 59, lower normally closed and movable contact 135'' of switch 135L, and solenoid 116 of switch 111 to current main 110*b* is completed. Energization of the solenoid 116 results in the engagement of the movable contacts 114 with the stationary contacts 112*h* thus causing energization of the motor 15 but in a reversed direction from that previously had because of a reversed phase rotation. As the motor 15 rotates and the acoustical instrumentality moves upwardly toward its housed position, the shafts 88 and 89 rotate therewith but in a direction which is reversed from the one previously described in the downward movement of the instrumentality. Thus the nuts 90, 91, 92, 93 now move toward the right. Hence, shortly after the beginning of the upward movement of the instrumentality the nut 90 trips its toggle switch 97 to an open position thereby interrupting the energization of the red lamp 133R and advising the operator that the instrumentality is no longer in its extended and operative position; also the travelling nut 92 trips its toggle switch 99 to a closed position. The nut 93 is so adjusted that when the acoustical instrumentality has substantially reached its housed position within the sea chest it will operate to trip the toggle switch 100 to an open position with the result that the relay circuit previously described and including the solenoid 116 is interrupted and the motor 15 de-energized. Shortly before the arrival of the acoustical instrumentality at its housed position the travelling nut 91 trips the toggle switch 98 to its original closed position, thereby again reestablishing the lamp circuit which includes the lamp 132G to advise the operator at the remote control panel that the acoustical instrumentality is properly housed.

The annular switch 59, as pointed out hereinbefore, is rigidly connected to and rotates with the shaft 4 with the result that the acoustical instrumentality can only be hoisted or raised when it has attained a predetermined angle of train. As shown in Fig. 4 of the drawings the brushes of the annular switch are in contact with the movable and electrically conductive portion thereof thus permitting the energization of the relay circuit which controls the hoisting of the instrumentality. Such an arrangement is desirable if the sea chest employed is rectangular in cross-section, thus necessitating a proper positioning of the instrumentality prior to its entry therein. Also under certain circumstances it may be desirable to hoist the acoustical instrumentality only when it has attained a predetermined angle of train. It is to be emphasized, however, that the use of the annular switch 59 is not absolutely essential and that it may be omitted where desired, thus enabling a hoisting or raising of the acoustical instrumentality independently of its angle of train.

Suppose now that with the acoustical instrumentality in its extended position it is desired to train the same in what may be arbitrarily termed a right-handed direction at a slow speed, it being assumed that the acoustical instrumentality has been trained to its farthest position in a left-handed direction. It will be observed that with the acoustical instrumentality in its extended po-

sition that the toggle switch 97 is in engagement with its stationary contacts, thus making possible a connection of the current main 110a with the limit switch 101, push-button stations 137, 140 and the switches controlled thereby. In other words, energization of the motor 53 and hence training of the acoustical instrumentality is only possible when the acoustical instrumentality is in an extended and operative position. However, this arrangement is not indispensable and by severing the connection of the conductor 144 to the stationary contact 145 of the limit switch 86 and reconnecting the conductor 144 directly to the current main 110a it is possible to train the acoustical instrumentality in any direction regardless of its longitudinal position.

Since the switch 141 of the push-button control station 140 is normally in engagement with its stationary contacts 142S a relay circuit will be closed from current main 110a through toggle switch 97, contacts 142S, switch 141, solenoid 131 and thence to current main 110b. Energization of solenoid 131 causes the movable contacts 128 of switch 119 to engage the stationary contacts 127s thereof thereby, as a preparatory step, selecting the low speed winding of the motor 53 for subsequent energization.

With the acoustical instrumentality now turned to its farthest position in a left-handed direction and it being desired to cause rotation of the acoustical instrumentality in a right-handed direction, it will first be observed that the toggle switch 107 is bridging its stationary contacts and that the switch 108 is spaced from its corresponding stationary contacts. If now, the switch 138R of the push-button station 137 is depressed a control circuit will be established which extends from current main 110a through toggle switch 97, toggle switch 107, movable contacts 139' of switch 138R, lower movable and normally closed contact 139'' of switch 139L, solenoid 124, and thence to current main 110b. Energization of solenoid 124 results in an engagement of the movable contacts 122 with the stationary contacts 120r of switch 119 with attendant energization of the low speed winding of motor 53 by the current mains 110a, 110b, 110c. Rotation of the motor 53 is accompanied by rotation of the threaded shaft 102 of the limit switch 101 along which the nuts 105, 106 travel. Shortly after the energization of the motor 53 the travelling nut 106 trips its toggle switch 108 to a closed position. The nut 105 is so adjusted that when the acoustical instrumentality has been trained through the desired number of revolutions it will cause a tripping of the toggle switch 107 to an open position thereby interrupting the current flow in the relay circuit including the solenoid 124, and causing de-energization of the motor 53.

If rotation of the acoustical instrumentality in a left-handed direction is now desired, switch 139L of the push-button station 137 is depressed. A relay circuit is at once established which extends from the current main 110a, toggle switch 97, toggle switch 108, lower movable contact 138'' of switch 138R, movable contact 139', solenoid 125 and thence to the current main 110b. Energized solenoid 125 causes the movable contacts 122 to engage the stationary contacts 121—l of the switch 119 thereby reversing the phase rotation of the motor 53 and hence its direction of rotation. The screw threaded shaft 102 of the limit switch 101 now rotates in a reverse direction with the result that shortly after the energization of the motor 53 the travelling nut 105 trips the toggle switch 107 to a closed position. When the acoustical instrumentality has been trained the desired number of revolutions in a left-handed direction the nut 106 by reason of a prior adjustment trips the toggle switch 108 to an open position, with attendant interruption of the relay circuit including the solenoid 125 and consequent de-energization of the motor 53. It is evident that the aforementioned excursions of rotation may be accomplished at a greater speed by depressing the switch 141 of the push-button control station 140 to cause the same to engage the stationary contacts 143F. The engagement of these latter contacts by the switch 141 results in the energization of a relay circuit extending from current main 110a toggle switch 97, switch 141, contacts 143F, solenoid 130 and thence to the current main 110B. Energization of solenoid 130 causes the movable contacts 128 of switch 119 to engage the stationary contacts 126f thereof thus connecting the high speed winding of the motor 53 to the switch 119 preparatory for connection to the current mains 110a, 110b, 110c.

While I have shown and described alternating current motors and an alternating control circuit or system therefore for attaining the ends of my invention I do not desire to be restricted thereto since direct current motors of any suitable design and rating and direct current control systems therefore may be employed to accomplish the ends sought in an equally effective manner.

According to the provisions of the patent statutes I have set forth the principle and mode of operation of my invention and have illustrated and described what I now consider to represent its best embodiment. However, I desire to have it understood that within the scope of the appended claims, the invention may be practiced otherwise than as specifically illustrated and described.

The invention herein described and claimed may be used and/or manufactured by or for the Government of the United States of America for governmental purposes without the payment of any royalties thereon or therefor.

I claim:

1. An acoustical apparatus comprising in combination a partition, a member extending through said partition and movable with respect thereto, said member having an acoustical instrumentality at one end and a support mounted transversely of said member at the other end thereof, said acoustical instrumentality and support being secured to said member so as to be movable therewith, means for guiding said support, a plurality of chains secured to and extending outwardly of said support from both sides thereof, sprockets on each side of said support and in mesh with said chains, an electric motor mechanically coupled to all sprockets on one side of said support and, means operable to energize said motor to thereby impart transiatory movement to said acoustical instrumentality.

2. An acoustical apparatus comprising in combination a partition, a member extending through said partition and movable with respect thereto, said member having an acoustical instrumentality at one end and a support mounted transversely of said member at the other end thereof, said acoustical instrumentality and support being secured to said member so as to be movable therewith, means for guiding said support, a plurality

of chains secured to and extending outwardly of said support from both sides thereof, sprockets on each side of said support and in mesh with said chains, an electric motor mechanically coupled to all sprockets on one side of said support, means operable to energize said motor to thereby impart translatory movement to said acoustical instrumentality, and means for rendering said second mentioned means inoperative upon the completion of a predetermined movement of translation by said instrumentality.

3. An acoustical apparatus comprising in combination a partition, a member extending through said partition and movable with respect thereto, said member having an acoustical instrumentality at one end and a support mounted transversely of said member at the other end thereof, said acoustical instrumentality and support being secured to said member so as to be movable therewith, means for guiding said support, a plurality of chains secured to and extending outwardly of said support from both sides thereof, sprockets on each side of said support and in mesh with said chains, an electric motor mechanically coupled to all sprockets on one side of said support, means operable to energize said motor to thereby impart translatory movement to said acoustical instrumentality, and means mechanically coupled to said motor for rendering said second mentioned means inoperative upon the completion of a predetermined movement of translation by said instrumentality.

4. An acoustical apparatus comprising in combination a chamber open at one end, a member extending through the end wall of said chamber and movable with respect thereto, said member having an acoustical instrumentality at one end and a support mounted transversely of said member at the other end thereof, said acoustical instrumentality and support being secured to said member so as to be movable therewith, a travelling bearing interposed between and in contact with said member and the side wall of said chamber, means for guiding said support, a plurality of chains secured to and extending outwardly of said support from both sides thereof, sprockets on each side of said support and in mesh with said chains, an electric motor mechanically coupled to all sprockets on one side of said support and means operable to energize said motor to cause the same to extend or retract the said instrumentality from or to within said chamber.

5. An acoustical apparatus comprising in combination a chamber open at one end, a member extending through the end wall of said chamber and movable with respect thereto, said member having an acoustical instrumentality at one end and a support mounted transversely of said member at the other end thereof, said acoustical instrumentality and support being secured to said member so as to be movable therewith, a travelling bearing interposed between and in contact with said member and the side wall of said chamber, means for guiding said support, a plurality of chains secured to and extending outwardly of said support from both sides thereof, sprockets on each side of said support and in mesh with said chains, an electric motor mechanically coupled to all sprockets on one side of said support, means operable to energize said motor to cause the same to extend or retract the said instrumentality from or to within said chamber, and means for rendering said second mentioned means inoperative upon the completion of a predetermined movement of translation by said instrumentality.

6. An acoustical apparatus comprising in combination a chamber open at one end, a member extending through the end wall of said chamber and movable with respect thereto, said member having an acoustical instrumentality at one end and a support mounted transversely of said member at the other end thereof, said acoustical instrumentality and support being secured to said member so as to be movable therewith, a travelling bearing interposed between and in contact with said member and the side wall of said chamber, and means operable to impart movement to said support.

7. An acoustical apparatus comprising in combination a chamber open at one end, a member extending through the end wall of said chamber and movable with respect thereto, said member having an acoustical instrumentality at one end and a support mounted transversely of said member at the other end thereof, said acoustical instrumentality and support being secured to said member so as to be movable therewith, a travelling bearing interposed between and in contact with said member and the side wall of said chamber, means operable to impart movement to said support, and means for rendering said first mentioned means inoperative upon the completion of a predetermined movement of translation by said instrumentality.

8. An acoustical apparatus comprising in combination a partition, a member extending through said partition and movable with respect thereto, a support, one end of said member being rotatably mounted on said support, an acoustical instrumentality secured to said member at the other end thereof, a gear secured to said member and in meshing engagement with a second gear rotatably mounted on said support, a shaft splined to said second mentioned gear, a plural speed electric motor mechanically coupled to said shaft, means operable to selectively energize said motor to cause the same to rotate at one of a plurality of speeds and means for rendering said first mentioned means inoperative upon the completion of a predetermined movement of rotation by said instrumentality.

9. An acoustical apparatus comprising in combination a partition, a member extending through said partition and movable with respect thereto, a support, one end of said member being rotatably mounted on said support, an acoustical instrumentality secured to said member at the other end thereof, a gear secured to said member and in meshing engagement with a second gear rotatably mounted on said support, a shaft splined to said second mentioned gear, a plural speed electric motor mechanically coupled to said shaft, means operable to selectively energize said motor to cause the same to rotate at one of a plurality of speeds, and means mechanically coupled to said motor for rendering said first mentioned means inoperative upon the completion of a predetermined movement of rotation by said instrumentality.

10. An acoustical apparatus comprising in combination a partition, a member extending through said partition and movable with respect thereto, a support, one end of said member being rotatably mounted on said support, an acoustical instrumentality secured to said member at the other end thereof, an electric motor mechani-

cally coupled to said member, and means operable to energize said motor to thereby impart rotary movement to said acoustical instrumentality.

11. An acoustical apparatus comprising in combination a partition, a member extending through said partition and movable with respect thereto, a support, one end of said member being rotatably mounted on said support, an acoustical instrumentality secured to said member at the other end thereof, an electric motor mechanically coupled to said member, means operable to energize said motor to thereby impart rotary movement to said acoustical instrumentality and means for rendering said first mentioned means inoperative upon the completion of a predetermined movement of rotation by said instrumentality.

12. An acoustical apparatus comprising in combination a partition, a member extending through said partition and movable with respect thereto, a support, one end of said member being rotatably mounted on said support, an acoustical instrumentality secured to said member at the other end thereof, means operable to impart rotary movement to said member, and means controlled by said member for indicating the magnitude of rotation of said instrumentality at a remote point.

13. An acoustical apparatus comprising in combination a partition, a member extending through said partition and movable with respect thereto, a support, one end of said member being rotatably mounted on said support, an acoustical instrumentality secured to said member at the other end thereof, means operable to impart rotary movement to said member, and means for rendering said first mentioned means inoperative upon the completion of a predetermined movement of rotation by said instrumentality.

14. An acoustical apparatus comprising in combination a chamber open at one end, a member extending through the end wall of said chamber and movable with respect thereto, a support, one end of said member being rotatably mounted on said support, an acoustical instrumentality secured to said member at the other end thereof, a travelling bearing interposed between and in contact with said member and the side walls of said chamber, means for guiding said support, a plurality of chains secured to said support and meshing with sprockets on each side of said support, an electric motor mechanically coupled to all sprockets on one side of said support, a gear secured to said member and in meshing engagement with a second gear rotatably mounted on said support, a splined shaft in sliding engagement with said second mentioned gear, a second electric motor mechanically coupled to said shaft, means operable to selectively energize said first and second mentioned motors to cause the same to rotate in either one of two directions whereby to impart either translatory or rotary movement to said instrumentality in either one of two directions, and means for rendering said second mentioned means inoperative upon the completion of predetermined movements of translation and rotation by said instrumentality.

15. An acoustical apparatus comprising in combination a chamber open at one end, a member extending through the end wall of said chamber and movable with respect thereto, a support, one end of said member being rotatably mounted on said support, an acoustical instrumentality secured to said member at the other end thereof, a travelling bearing interposed between and in contact with said member and the side walls of said chamber, means for guiding said support, a plurality of chains secured to said support and meshing with sprockets on each side of said support, an electric motor mechanically coupled to all sprockets on one side of said support, a gear secured to said member and in meshing engagement with a second gear rotatably mounted on said support, a splined shaft in sliding engagement with said second mentioned gear, a second electric motor mechanically coupled to said shaft, means operable to energize said first and second mentioned motors, and means mechanically coupled to said motors for rendering said second mentioned means inoperative upon the completion of predetermined movements of translation and rotation by said instrumentality.

16. An acoustical apparatus comprising in combination a chamber open at one end, a member extending through the end wall of said chamber and movable with respect thereto, a support, one end of said member being rotatably mounted on said support, an acoustical instrumentality secured to said member at the other end thereof, a travelling bearing interposed between and in contact with said member and the side walls of said chamber, means for guiding said support, a plurality of chains secured to said support and meshing with sprockets on each side of said support, an electric motor mechanically coupled to all sprockets on one side of said support, a gear secured to said member and in meshing engagement with a second gear rotatably mounted on said support, a splined shaft in sliding engagement with said second mentioned gear, a second electric motor mechanically coupled to said shaft and means operable to selectively energize said first and second mentioned motors.

17. An acoustical apparatus comprising in combination a partition, a member extending through said partition and movable with respect thereto, a support, one end of said member being rotatably mounted on said support, an acoustical instrumentality secured to said member at the other end thereof, means operable to impart translatory movement to said support and rotary movement to said member, and means for remotely indicating the position of said instrumentality as well as its magnitude of rotation.

18. An acoustical apparatus comprising in combination an acoustical instrumentality, means operable to impart translatory and rotary movement to said instrumentality and means for remotely indicating the translatory position of said instrumentality as well as its magnitude of rotation.

19. An acoustical apparatus comprising in combination an acoustical instrumentality, means operable to impart translatory and rotary movement to said instrumentality in either of a plurality of directions and means for rendering said first mentioned means inoperative upon the completion of predetermined movements of translation and rotation by said instrumentality.

20. An acoustical apparatus comprising in combination an acoustical instrumentality, means operable to impart translatory and rotary movement to said instrumentality in either of a plurality of directions, means for rendering said first mentioned means inoperative upon the completion of predetermined movements of translation and rotation by said instrumentality, and means for indicating the position of said instrumentality as well as its magnitude of rotation.

21. An acoustical apparatus comprising in combination an acoustical instrumentality, means

operable to impart rotary movement to said instrumentality in either of a plurality of directions and means for rendering said first mentioned means inoperative upon the completion of a predetermined movement of rotation by said instrumentality.

22. An acoustical apparatus comprising in combination an acoustical instrumentality, means operable to impart translatory movement to said instrumentality in either of a plurality of directions to thus move said instrumentality to either an extended or retracted position, and means operable to impart rotary movement to said instrumentality in either of a plurality of directions only when said instrumentality has substantially reached an extended position.

23. An acoustical apparatus comprising in combination an acoustical instrumentality, means operable to impart rotary movement to said instrumentality in either of a plurality of directions and means operable to impart translatory movement to said instrumentality in either of a plurality of directions to thus move said instrumentality to either an extended or retracted position, said last mentioned means being operable to move said instrumentality to a retracted position only when said instrumentality has attained a predetermined angular position.

24. An acoustical apparatus comprising in combination an acoustical instrumentality, means operable to impart rotary movement to said instrumentality in either of a plurality of directions and means operable to impart translatory movement to said instrumentality in either of a plurality of directions to thus move said instrumentality to either an extended or retracted position, said first mentioned means being operable to impart rotary movement to said instrumentality in either of a plurality of directions only when said instrumentality has substantially reached an extended position and said last mentioned means being operable to move said instrumentality to a retracted position only when the said instrumentality has attained a predetermined angular position.

25. An acoustical apparatus comprising in combination an acoustical instrumentality, means operable to impart rotary movement to said instrumentality, and means for rendering said first mentioned means inoperative upon the completion of a predetermined movement of rotation by said instrumentality.

26. An acoustical apparatus comprising in combination an acoustical instrumentality, means operable to impart rotary movement of either of a plurality of speeds to said instrumentality; and means for rendering said first mentioned means inoperative upon the completion of a predetermined movement of rotation by said instrumentality.

27. An acoustical apparatus comprising in combination an acoustical instrumentality, means operable to impart translatory and rotary movement to said instrumentality, and means for rendering said first mentioned means inoperative upon the completion of predetermined movements of translation and rotation by said instrumentality.

28. An acoustical apparatus comprising in combination an acoustical instrumentality, means operable to impart rotary movement to said instrumentality, means for rendering said first mentioned means inoperative upon the completion of a predetermined movement of rotation by said instrumentality and means for indicating the magnitute of rotation of said instrumentality.

29. An acoustical apparatus comprising in combination an acoustical instrumentality, means operable to impart rotary movement to said instrumentality, means for rendering said first mentioned means inoperative upon the completion of a predetermined movement of rotation by said instrumentality and means for indicating the magnitude of rotation of said instrumentality at a remote point.

30. An acoustical apparatus comprising in combination an acoustical instrumentality, means operable to impart rotary movement to said instrumentality, means for rendering said first mentioned means inoperative upon the completion of a predetermined movement of rotation by said instrumentality, means for indicating the magnitude of rotation of said instrumentality and means for repeating the indication of said indicating means at a remote point.

31. An acoustical apparatus comprising in combination an acoustical instrumentality, means operable to impart rotary movement to said instrumentality, and means for indicating the magnitude of rotation of said instrumentality at a remote point.

32. An acoustical apparatus comprising in combination an acoustical instrumentality, means operable to impart rotary movement to said instrumentality, means for indicating the magnitude of rotation of said instrumentality and means for repeating the indication of said indicating means at a remote point.

33. An acoustical apparatus comprising in combination an acoustical instrumentality, means operable to impart translatory movement to said instrumentality, and means operable to impart rotary movement to said instrumentality only upon the completion of a predetermined movement of translation by said instrumentality.

34. An acoustical apparatus comprising in combination an acoustical instrumentality, means operable to impart translatory movement to said instrumentality, means operable to impart rotary movement to said instrumentality only upon the completion of a predetermined movement of translation by said instrumentality, and means for rendering said first and second mentioned means inoperative upon the completion of predetermined movements of translation and rotation by said instrumentality.

35. An acoustical apparatus comprising in combination an acoustical instrumentality, means operable to impart translatory movement to said instrumentality to move the same from a position of rest to a position outwardly thereof, and means operable to impart rotary movement to said instrumentality only when said instrumentality has substantially reached its outward position.

36. An acoustical apparatus comprising in combination an acoustical instrumentality, means operable to impart translatory movement to said instrumentality to move the same from a position of rest to a position outwardly thereof, means operable to impart rotary movement to said instrumentality only when said instrumentality has substantially reached its outward position, and means for rendering said first and second mentioned means inoperative upon the completion of predetermined movements of translation and rotation by said instrumentality.

37. An acoustical apparatus comprising in combination an acoustical instrumentality, means operable to impart rotary movement to said in-

strumentality and means operable to impart translatory movement to said instrumentality only when the same has attained a predetermined angular position.

38. An acoustical apparatus comprising in combination an acoustical instrumentality, means operable to impart rotary movement to said instrumentality, means operable to impart translatory movement to said instrumentality only when the same has attained a predetermined angular position, and means for rendering said first and second mentioned means inoperative upon the completion of predetermined movements of translation and rotation by said instrumentality.

39. An acoustical apparatus comprising in combination an acoustical instrumentality, means operable to impart rotary movement to said instrumentality, means operable to impart translatory movement to said instrumentality to move the same from a position of rest to a position inwardly thereof and being operative to accomplish the aforesaid function only when the said instrumentality has attained a predetermined angular position.

40. An acoustical apparatus comprising in combination an acoustical instrumentality, means operable to impart rotary movement to said instrumentality, means operable to impart translatory movement to said instrumentality to move the same from a position of rest to a position inwardly thereof and being operative to accomplish the aforesaid function only when the said instrumentality has attained a predetermined angular position, and means for rendering said first and second mentioned means inoperative upon the completion of predetermined movements of translation and rotation by said instrumentality.

41. An acoustical apparatus comprising in combination a partition, a member extending through said partition and movable with respect thereto, said member having an acoustical instrumentality at one end and a support mounted transversely of said member at the other end thereof, said acoustical instrumentality and support being secured to said member so as to be movable therewith, translating means secured to and extending outwardly of said support from both sides thereof, revolvable means on both sides of said support for guiding said first mentioned means, and means operable to impart movement to said first mentioned means whereby to set the support, the member and acoustical instrumentality into motion.

42. An acoustical apparatus comprising in combination a partition, a member extending through said partition and movable with respect thereto, said member having an acoustical instrumentality at one end and a support mounted transversely of said member at the other end thereof, said acoustical instrumentality and said support being secured to said member so as to be movable therewith, at least one chain secured to and extending outwardly of said support from both sides thereof, a sprocket on each side of said support and in mesh with said chain, and means operable to impart movement to one of said sprockets whereby to set the chain, the support, the member and acoustical instrumentality into motion.

43. An acoustical apparatus comprising in combination a partition, a member extending through said partition and movable with respect thereto, said member having an acoustical instrumentality at one end and a support mounted transversely of said member at the other end thereof, said acoustical instrumentality and said support being secured to said member so as to be movable therewith, means for guiding said support, a plurality of chains secured to and extending outwardly of said support from both sides thereof, sprockets on each side of said support and in mesh with said chains, and means operable to impart movement to all sprockets on one side of said support whereby to set the chains, the support, the member and acoustical instrumentality into motion.

44. An acoustical apparatus comprising in combination a partition, a member extending through said partition and movable with respect thereto, said member having an acoustical instrumentality at one end and a support mounted transversely of said member at the other end thereof, said acoustical instrumentality and said support being secured to said member so as to be movable therewith, means for guiding said support, a plurality of chains secured to and extending outwardly of said support from both sides thereof, sprockets on each side of said support and in mesh with said chains, means operable to impart movement to all sprockets on one side of said support whereby to set the chains, the support, the member and acoustical instrumentality into motion, and means for rendering said second mentioned means inoperative upon the completion of a predetermined movement of translation by said instrumentality.

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