Sept. 5, 1967 F. B. FLOYD ETAL 3,339,307

REMOTELY CONTROLLED RACING CAR GAME

Filed April 30, 1964 5 Sheets-Sheet 1

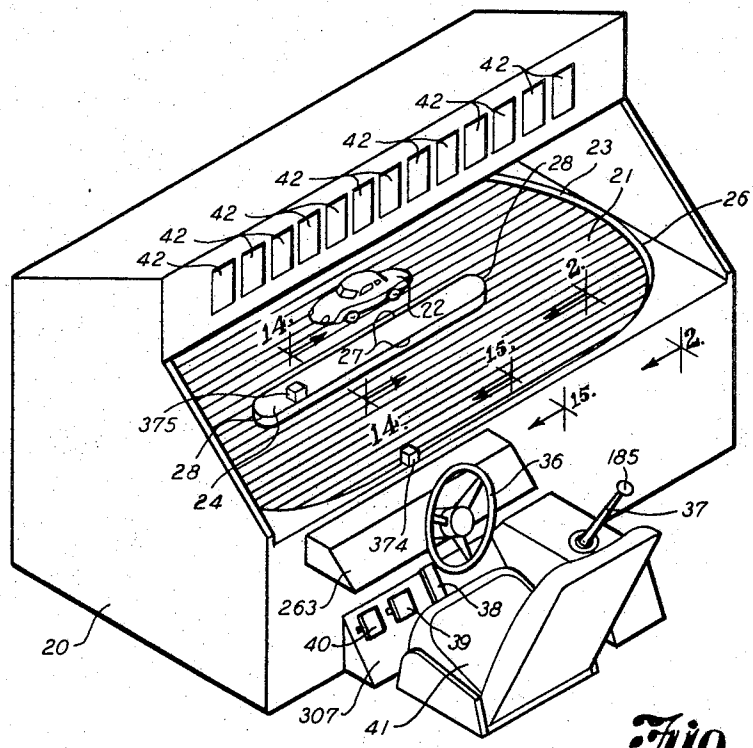


Fig. 1.

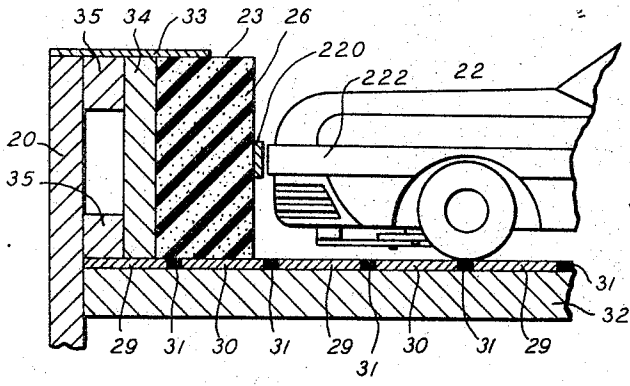


Fig. 2.

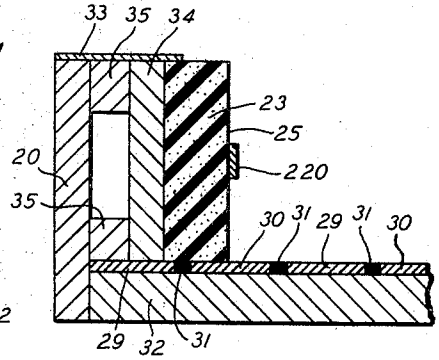


Fig. 15.

INVENTORS.
FRANCIS B. FLOYD
AUBREY E. RICHARDSON

BY

Alfred R. Fuchs
ATTORNEY

Sept. 5, 1967 F. B. FLOYD ETAL 3,339,307

REMOTELY CONTROLLED RACING CAR GAME

Filed April 30, 1964 5 Sheets-Sheet 2

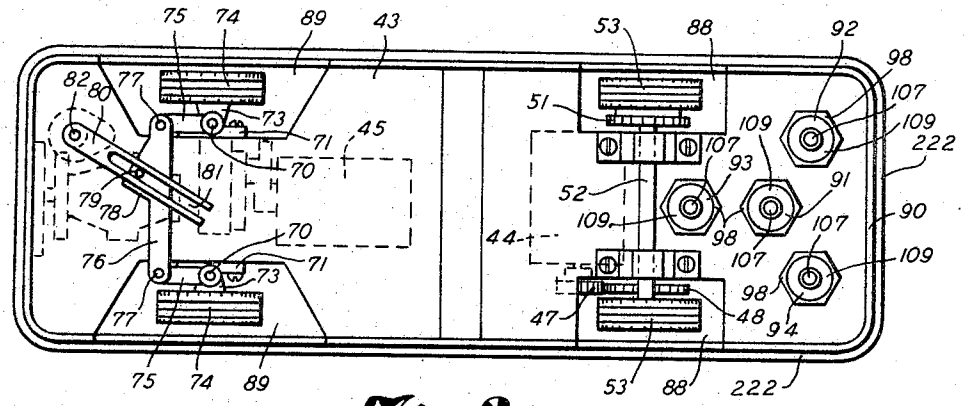


Fig. 3.

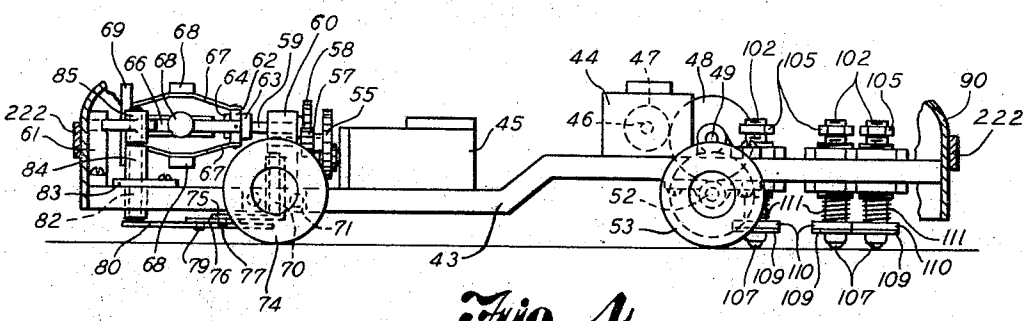


Fig. 4.

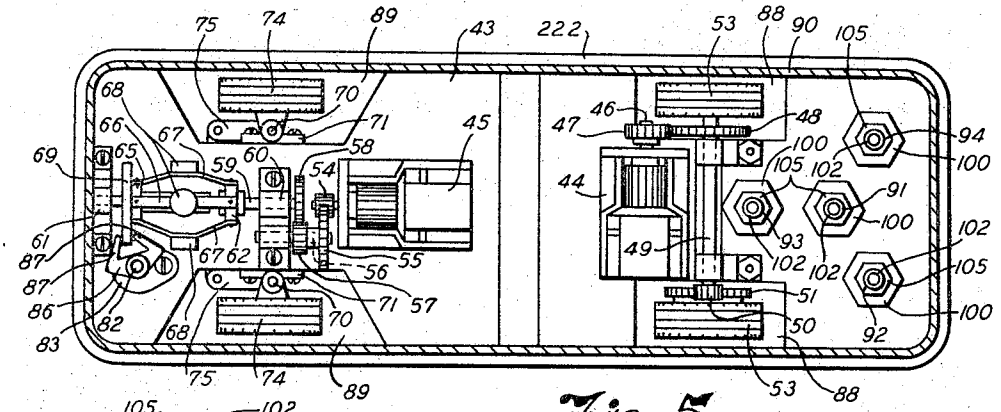


Fig. 5.

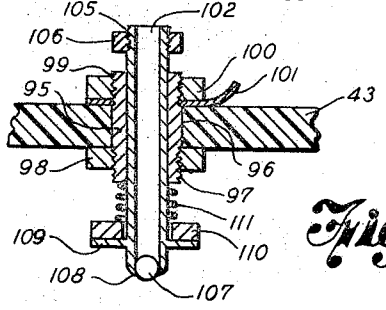


Fig. 6.

INVENTORS.
FRANCIS B. FLOYD
AUBREY E. RICHARDSON

BY

Alfred R. Fuchs

ATTORNEY

Sept. 5, 1967 F. B. FLOYD ETAL 3,339,307

REMOTELY CONTROLLED RACING CAR GAME

Filed April 30, 1964 5 Sheets-Sheet 3

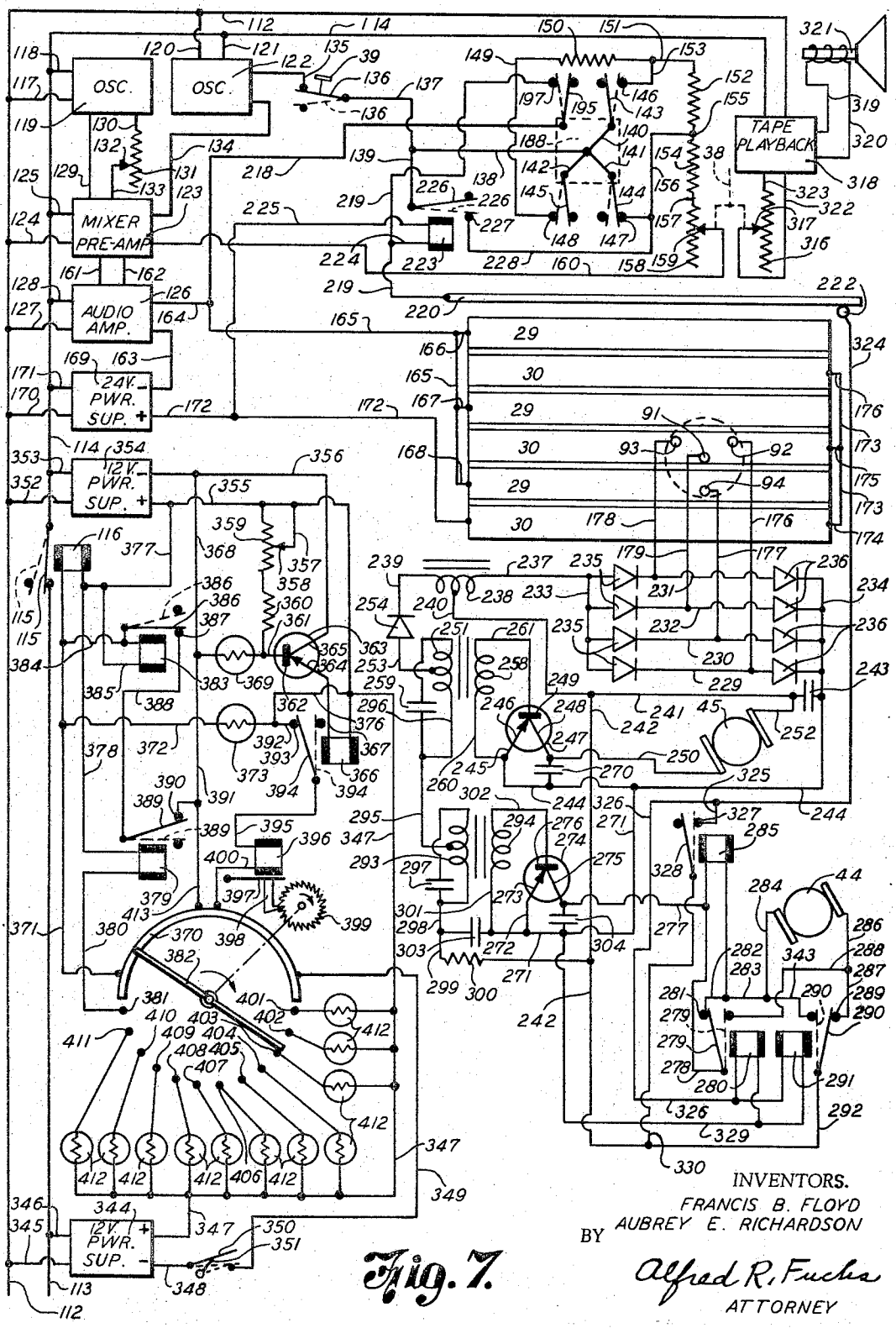


Fig. 7.

INVENTORS.
FRANCIS B. FLOYD
AUBREY E. RICHARDSON

BY Alfred R. Fuchs
ATTORNEY

Sept. 5, 1967 F. B. FLOYD ETAL 3,339,307

REMOTELY CONTROLLED RACING CAR GAME

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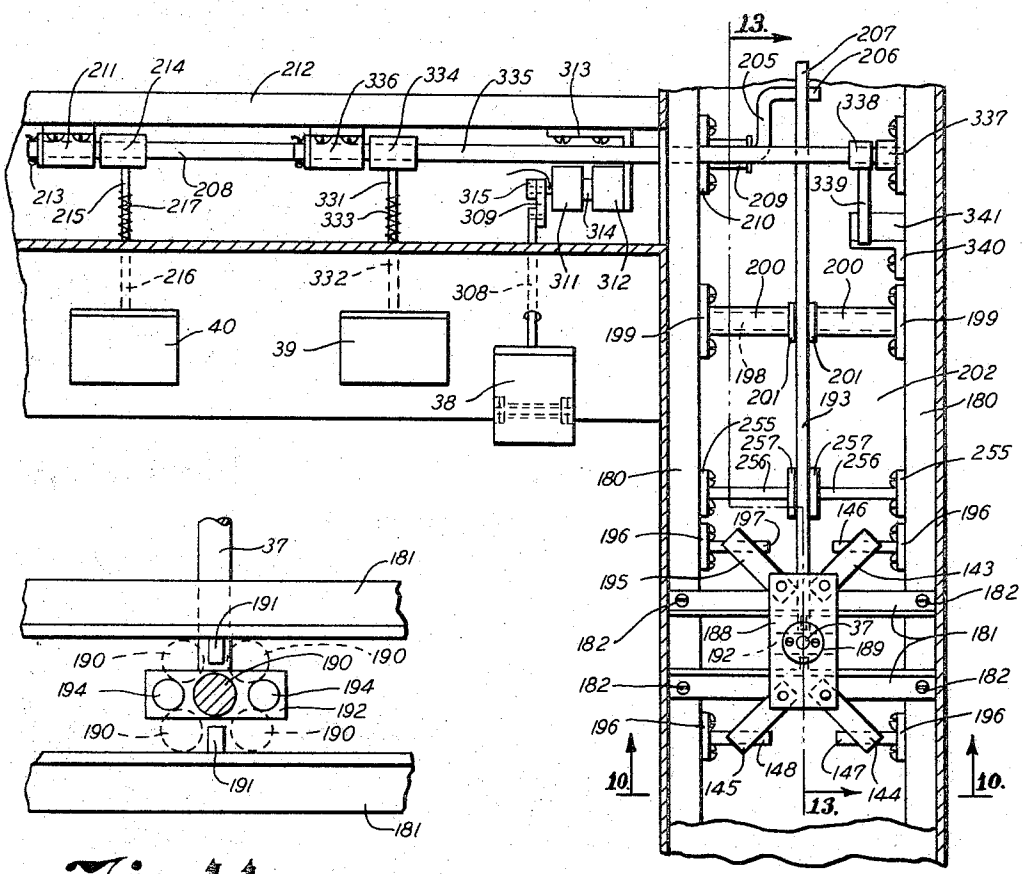


Fig. 8.

Fig. 11.

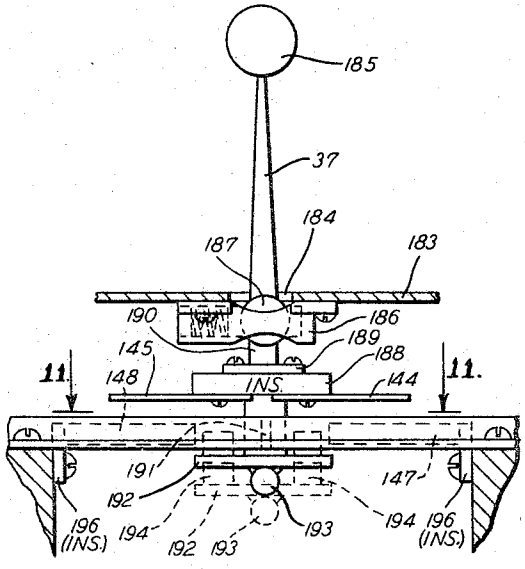


Fig. 10.

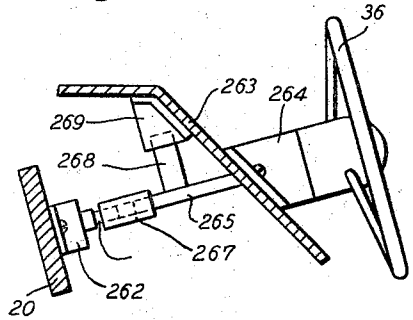


Fig. 9.

INVENTORS.
FRANCIS B. FLOYD
AUBREY E. RICHARDSON

BY

Alfred R. Fuchs

ATTORNEY

Sept. 5, 1967 F. B. FLOYD ETAL 3,339,307

REMOTELY CONTROLLED RACING CAR GAME

Filed April 30, 1964 5 Sheets-Sheet 5

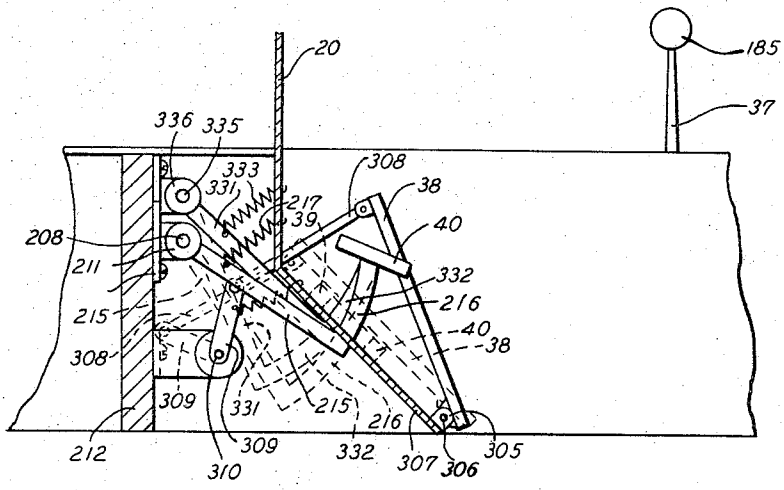


Fig. 12.

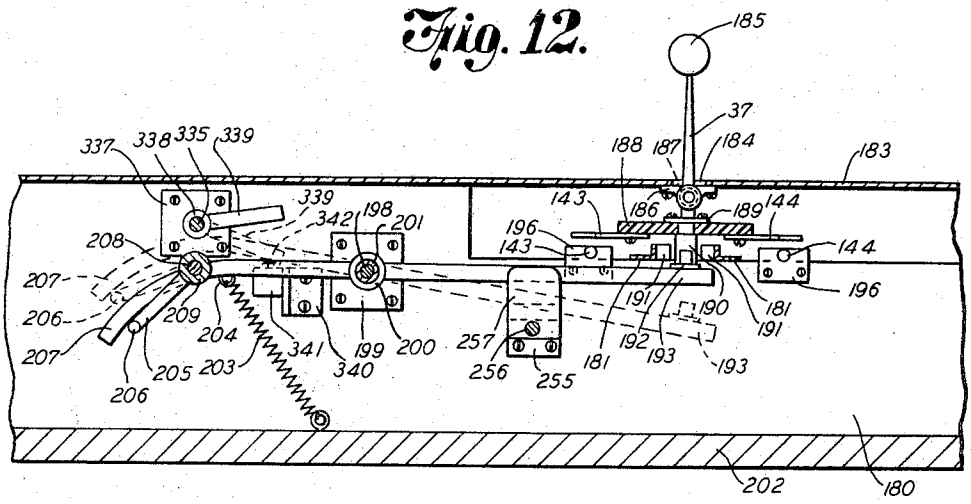


Fig. 13.

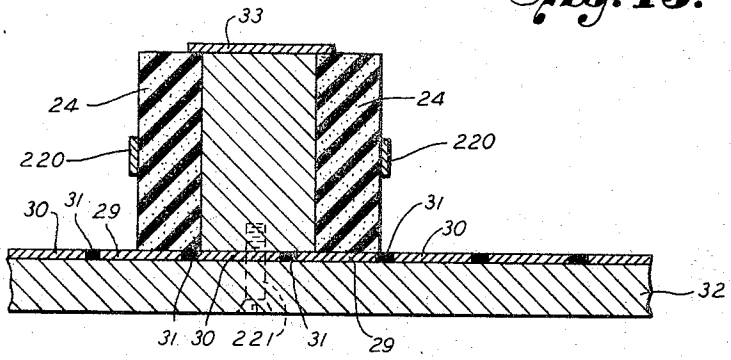


Fig. 14.

INVENTORS.
FRANCIS B. FLOYD
AUBREY E. RICHARDSON

BY

Alfred R. Fuchs
ATTORNEY

United States Patent Office 3,339,307 Patented Sept. 5, 1967

3,339,307

REMOTELY CONTROLLED RACING CAR GAME

Francis B. Floyd, 5039 E. 6th St., Kansas City, Mo. 64124, and Aubrey E. Richardson, 9820 Aberdeen Road, Overland Park, Kans. 66206

Filed Apr. 30, 1964, Ser. No. 363,962
4 Claims. (Cl. 46—244)

Our invention relates to amusement apparatus and more particularly to a remotely controlled racing car game.

It is a purpose of our invention to provide means for controlling the operation of a vehicle, preferably a miniature vehicle, over an operating surface from a point remote from the vehicle. The vehicle is preferably a racing car or similar toy vehicle and the controlling means are preferably in the form of operating devices such as are ordinarily used for controlling the operation of an automobile. That is, the operating devices comprise a foot pedal that serves in a similar manner to an accelerator pedal of an automobile, a lever that is operable in a similar manner to a gear shift lever of an automobile, a steering wheel, a foot pedal that operates in a similar manner to a clutch pedal, and a foot pedal that simulates a brake pedal. These various operator controlled devices, are provided for operating controlling means that are located at a point remote from the vehicle, which vehicle operates over an operating surface that is similar in appearance to a race track. While an operating surface is provided that has similarities to a race track, in that it is of an elliptical shape, the apparatus forming the subject matter of our invention can be used to operate a vehicle over a suitably constructed surface of any shape.

It is a purpose of our invention to provide means for controlling the movements of a vehicle over such a surface, which may be of any desired width with respect to the width of the vehicle, and which will control the operation of the vehicle so that it can be driven over the surface in any desired direction with respect to the length of the surface over which it operates. Our invention utilizes means for controlling the steering of the vehicle solely by the controlling means under the control of the operator of the operating devices at the point remote from this surface. In practice in order to provide a compact apparatus that is operable from a point at which the movements of the vehicle over the surface can be readily observed, the operating devices are near the operating surface but are spaced a substantial distance therefrom so that the operating devices are remote from the vehicle in that they are entirely separate from the vehicle and the surface over which the vehicle operates.

More specifically our invention comprises means for remotely controlling the speed and the direction of a vehicle in respect to a surface over which it operates comprising means for producing oscillating currents of two different frequencies, means for independently controlling the amplitude of each of said currents, common means for amplifying both of the independently controlled currents, means on the vehicle responsive to one of the frequencies controlling the speed of the vehicle, means on the vehicle responsive to the other of said frequencies controlling the steering of the vehicle, and means for transmitting said amplified currents to said frequency responsive means.

It is a further purpose of our invention to provide a foot pedal, which serves as an accelerator pedal, for operating one of the independent controlling means for controlling the amplitude of one of the currents from one of the means for producing an oscillating current, and to provide a steering wheel for operating another of

the controlling means. In order to provide more flexibility of the control of the speed of the vehicle, additional means is provided for controlling the amplitude of the current that controls the speed of the vehicle, which means is under control of the lever that is similar in operation to the gear shift lever of an automobile. By providing these devices for controlling the operation of the vehicle by the operator of the apparatus, the illusion is created for the operator of the apparatus, that he is actually operating a vehicle over the surface or track over which the vehicle travels.

It is a further purpose of our invention to provide an operating surface for the vehicle which comprises conducting strips that are on the surface and means insulating adjacent conducting strips from each other, the conducting strips being alternately connected with the output terminals of the amplifying means, and to provide means for supplying direct current for operating the vehicle to the same from a direct current source through said conducting strips, and suitable contact members carried by the vehicle engaging said conducting strips, the opposite terminals of the source of direct current being also connected with the alternate conducting strips, so that two adjacent conducting strips are connected with the opposite terminals of said source.

Inasmuch as the vehicle of our invention is free to travel anywhere over the surface made up of these conducting and insulating strips, a set of contact members is provided on the vehicle, that are adapted to engage with the conducting strips, which are arranged so that at least a pair thereof will always be in engagement with a pair of conducting strips of opposite polarity.

It is a further purpose of our invention to provide rectifying means associated with said contact members and interposed between said contact members and a pair of conductors on the vehicle which are so constructed and arranged that only positive electrical impulses will be transmitted to one of said conductors on said vehicle and only negative electrical impulses will be transmitted to the other conductor on said vehicle, said conductors being part of a receiving circuit on said vehicle.

It is also a purpose of our invention to provide means for driving the vehicle and means for steering the vehicle on said vehicle, comprising a motor for driving the vehicle and a motor for steering the vehicle, responsive to the speed of said last mentioned motor, and means for controlling the speed of each of said motors independently, comprising a receiving circuit on the vehicle including means tuned to each of the frequencies of said oscillating means, each including a winding connected at one end thereof with the base of a transistor which is in one of the motor operating circuits, said transistor being so located in said operating circuit of said motor that the conductively of the transistor controls the current supply to the motor, the arrangement being such that said end of said winding becomes more negative as the amplitude is increased of the particular oscillating current to which the circuit, in which the winding is located, is tuned.

Other objects and advantages of our invention will appear as a description of the drawings proceeds. We desire to have it understood, however, that we do not intend to limit ourselves to the particular details shown or described except as defined by the claims.

In the drawings.

FIG. 1 is a perspective view of our improved remotely controlled racing car apparatus.

FIG. 2 is a fragmentary sectional view on an enlarged scale taken on the line 2—2 of FIG. 1.

FIG. 3 is a bottom plan view of the vehicle used in carrying out our invention.

FIG. 4 is a side elevation thereof the outer shell portion thereof being omitted except for a fragmentary portion thereof shown in vertical section.

FIG. 5 is a top plan view of the vehicle, partly in horizontal section through the shell portion thereof.

FIG. 6 is a detail sectional view of one of the contact members carried by the vehicle on an enlarged scale.

FIG. 7 is a diagram of the circuit connections used in our improved apparatus.

FIG. 8 is a view partly in plan and partly in horizontal section and partly broken away of the operating means for the control for the vehicle.

FIG. 9 is a view in elevation of the steering wheel and operating means controlled thereby, the mounting thereof being shown in section.

FIG. 10 is a section taken on the line **10—10** of FIG. 8 on an enlarged scale.

FIG. 11 is a section taken on the line **11—11** of FIG. 10.

FIG. 12 is a view in elevation of the brake and clutch pedal mechanism, the mounting means therefor being shown partly in section and partly broken away.

FIG. 13 is a section taken on the line **13—13** of FIG. 8.

FIG. 14 is a fragmentary section taken on the line **14—14** of FIG. 1 on an enlarged scale, and

FIG. 15 is a section taken on line **15—15** of FIG. 1 on an enlarged scale.

Referring in detail to the drawings, our remotely controlled racing car game is shown in FIG. 1 as being provided with a casing **20**, within which is provided an operating surface **21** for a vehicle **22**, said operating surface **21** being bounded by a peripheral barrier **23** and being provided with an inner barrier **24**, said peripheral barrier having straight side portions **25** and curved end portions **26** and the barrier **24** having a pair of side portions **27** and end portions **28**, said side portions **27** being parallel to the straight sides **25** of the peripheral barrier and being transversely spaced therefrom and the ends **28** of the barrier **24** being spaced from the curved ends **26** of the barrier **23** so as to provide an elliptical track or runway between the barriers, having similarity to a race track.

The operating surface **21** is made up of alternating conducting strips **29** and **30**, the adjacent strips **29** and **30** being spaced from and insulated from each other by the insulating strips **31** (see FIG. 2). Said conducting and insulating strips are mounted on a horizontal supporting wall **32** of wood or similar electrical insulating material. It will be noted that a multiplicity of the alternating conducting strips **29** and **30** extend lengthwise of the operating surface **21** continuously from end to end thereof. Said conducting strips **29** and **30** and the insulating strips **31** are secured to the supporting surface **32** in any suitable manner, as by means of adhesive.

The barriers **23** and **24** are preferably made of sponge rubber, the barrier **23** being shown in FIGS. 2 and 15 and the barrier **24** in FIG. 14. The strip of sponge rubber that forms the barrier **23** is thicker at the curved ends **26** thereof than along the straight side portions **25** thereof, as will be evident upon reference to FIGS. 2 and 15. The purpose of this is to provide a greater cushioning action for the sponge rubber barrier at the curved ends of the track than at the sides thereof, as it is more likely that a solid blow of the vehicle **22** will be applied to the curved end portions of the barrier than the straight side portions thereof. The sponge rubber cushioning barrier may be mounted in any desired manner, but is shown in the drawings as being mounted on the strips of conducting material **29** that are mounted on the support **32** and as being provided with a metal strip **33** for holding the same in engagement with the conducting strips **29** and **30** and with a wooden backing strip **34** and a spacing member **35** for mounting the same in the casing **20**, the parts being secured together by any suitable securing means, such as an adhesive.

Mounted externally of the casing **20** at a point remote from the vehicle **22** are suitable operating means for the controlling device for controlling the speed and the direction of travel of the vehicle **22**. These controlling devices are preferably arranged and constructed in such a way as to simulate the controlling mechanism of an automobile and comprise a steering wheel **36**, a lever **37**, operating similarly to a gear shift lever, and a plurality of foot pedals. The foot pedals comprise a pedal **38**, which controls the speed of the vehicle and thus is similar in action to an accelerator pedal of an automobile. The pedal **39** is arranged in a similar manner to a brake pedal and serves a purpose similar to a brake in controlling the operation of the vehicle **22**. A pedal **40** is also provided, which serves as a controlling pedal for the movement of the lever **37** in its movements, in simulation of that of a gear shift lever of an automobile, the pedal **40** thus serving in a similar manner to a clutch pedal of an automobile. All these operating devices are mounted in a position convenient to a seat **41**, which is also similar to an automobile driver's seat. The housing **20** is also provided with a plurality of openings **42**, which are provided with suitable indicia and suitable illuminating means for a purpose to be described below.

Referring to FIGS. 3 to 6 inclusive, the vehicle **22** is shown as being provided with a bottom wall **43**, which is preferably of electrical insulated material such as a suitable plastic, upon which are mounted the motors **44** and **45**. Said motors are of the variable speed type and are each provided with a permanent field magnet. The motor **44** is provided with a shaft **46** having a pinion **47** mounted thereon to rotate therewith, which meshes with a gear **48** on a countershaft **49** mounted in suitable bearings on the bottom member **43**, said countershaft being provided with a pinion **50** that meshes with a gear **51**, that is mounted on the live rear axle **52** mounted in suitable bearings on the under side of the bottom member **43** and having the rear wheels **53** mounted thereon to rotate therewith. The pinions **47** and **50** and the gears **48** and **51** thus serve as a reduction gearing between the motor shaft **46** and the rear axle **52**.

The motor **45** is similarly provided with a pinion **54** meshing with the gear **55** on a countershaft **56**, which has a pinion **57** mounted thereon, that meshes with the gear **58** on a shaft **59** that runs lengthwise of the vehicle, said shaft being mounted in suitable bearings **60** and **61** provided on the vehicle body.

A collar **62** is mounted on the shaft **59** to rotate therewith, suitable stop collars **63** and **64** being provided on opposite sides of the collar **62**. The collar **62** is thus fixed in posiiton on the shaft **59** lengthwise thereof. A collar **65** is provided on a sleeve **66** that is longitudinally slidably mounted on the shaft **59**. Springs **67** are mounted on the collars **62** and **65**, being fixed to said collars at the ends thereof and bowing out slightly when not under stress, being shown in FIGS. 4 and 5 of the drawings in an intermediate position. Mounted on each of the springs **67** is a weight **68**. Also mounted on the sleeve **66** and secured in fixed position to the collar **65** is a disk **69**. It will be evident that as the speed of the motor **45** is varied, the rate of rotation of the shaft **59** will vary and the weights **68** will be pulled out radially away from the shaft **59** by centrifugal force as the speed of the shaft **59** increases. Such movements of the weights **68** bowing the springs **67** to a greater or lesser extent, dependent upon the speed of the shaft **59**, causing movement of the sleeve **66** and the disk **69** lengthwise of the shaft **59**, in a similar manner to the action of a centrifugal governor.

Mounted on suitable pivots **70**, provided on bearing members **71** on the bottom member **43**, are arms **73** provided with suitable axles on which the front wheels **74** of the vehicle are mounted for free rotation. Also mounted on the pivots **70** to turn therewith are the arms **75** extending forwardly therefrom, said arms **73** and **75** and pivots **70** forming a bell crank lever. A link **76** is pivot-

ally connected with the levers **75** at **77** and is provided with a lateral extension **78** having a pin **79** projecting downwardly therefrom. A lever **80**, which is provided with a longitudinal slot **81** extending inwardly from one end thereof, thus providing a bifurcated portion for said lever **80**, has the pin **79** extending into said slot **81**, said pin being slidable in the slot in said lever **80**.

Said lever **80** is fixed to a vertically extending shaft **82** to turn therewith. A bracket **83** is provided on the bottom member **43** and a bearing sleeve **84** is mounted on said bracket **83**, said shaft **82** being mounted in said bearing sleeve. The hub **85** of a bracket member **86** is keyed to said shaft **82** so that said shaft and said bracket member **86** move together. Mounted on said bracket member **86** is a pair of fingers **87** that are inclined toward each other, as will be obvious from FIG. 5, and engage with opposite faces of the disk **69**. It will be obvious that movements of the disk **69** lengthwise of the shaft **59** will turn the vertical shaft **82** either clockwise or counterclockwise, dependent upon the movements of the disk **69**. The movement of said shaft **82** will turn the wheels **74** in opposite directions, dependent upon the direction of rotation of said shaft through the operating mechanism in an obvious manner. As the movement of the disk **69** is dependent upon the speed of the motor **45**, variation of the speed of said motor will adjust the steering mechanism for the front wheels **74**.

The bottom member **43** is provided with suitable openings **88** to accommodate the rear wheels **53** and **89** to accommodate the front wheels **74**. Mounted on the bottom member **43** in any suitable manner is the body shell **90**, which is preferably made of suitable plastic material that is of an electrical insulating character. Rearwardly of the rear wheels **53** is mounted a group of contact members that cooperate with the conducting strips **29** and **30** to conduct electrical currents to the motors on he vehicle and to other electrical apparatus on the vehicle for controlling the operation of said motors, to be described below. Said contact members comprise a central contact member **91** and contact members **92**, **93** and **94**, which are spaced uniformly from the contact member **91**, and from each other, so that the contact member **91** lies in the center of an imaginary circle, on which the contact members **92**, **93** and **94** are arranged at 120° to each other. Preferably a pair of the contact members **91** and **93** are arranged on the axial center line of the vehicle. The size and arrangement of the contact members **91**, **92**, **93** and **94**, and their spacing relative to the width of the conducting strips **29** and **30** are such that a pair of said contact members will always be in engagement with at least one contact strip **29** and one contact strip **30**.

One of the contact members is shown in detail in FIG. 6. It comprises a threaded tubular member **95**, which extends through an opening **96** in the bottom member **43**, and is provided with threads **97**, with which a nut **98** engages and with threads **99** with which a nut **100** engages. The nut **100** serves to clamp the end of a conductor **101** between the bottom member **43** and the nut **100** and the nuts **98** and **100** cooperate to clamp the tubular member **95** to the bottom member **43**. Slidably mounted in the longitudinal bore of the tubular member **95** is a tubular member **102**, which is threaded at one end thereof, as at **105**, and has a stop nut **106** mounted thereon, said stop nut **106** limiting downward movement of the tubular member **102**. Mounted on the other end of the tubular member **102** is a ball **107**, held in fixed position on the bottom end of said tubular member **102** by necking in the end of the tubular member as shown at **108**. Said tubular member **102** is provided with a flange **109**, upon which a disc-like weight **110** rests. Mounted between the weight **110** and the lower end of the tubular member **105** is a light coil spring **111**, the spring **111** holding the weight **110** in engagement with the flange **109**. The tension on the spring **111** can be varied by adjusting the position of the sleeve **95** by means of the nuts **98** and **100** so as to move the sleeve **95** slightly upwardly or downwardly, as may be found desirable. The weight **110** in cooperation with the spring **111**, serves as yieldable means for holding the balls **107** of the contact members in engagement with the conducting strips **29** and **30** on the operating surface for the vehicle **22**. The weight **110** provides the principal means for maintaining the contact between the ball **107** and one of the conducting strips. The purpose in providing a weight for this purpose is that considerable variation in the position of the bottom **43** of the vehicle relative to the operating surface can be compensated for by movements of the contact member up and down, relative to the bottom **43** of the vehicle, without providing a heavy spring that would cause the ball **107** to bear with too much force on the conducting strips, causing unnecessary wear.

The speed of the motor **45** and thus the steering of the vehicle is controlled by means of the steering wheel **36**, which is remote from the vehicle **22**, while the speed of the motor **44** is controlled by certain switching devices that are controlled by means of the foot pedal **38** and the lever **37**. The brake pedal **39** and the clutch pedal **40** also serve to control the operation of the motor **44**. The control is through certain electrical apparatus, which is shown diagrammatically in FIG. 7.

Line wires **112** and **113** extend from a suitable source of 110 volt alternating current, such as the ordinary house current. The line wire **113** leads to a conductor **114** through a switching member **115**, which moves with the armature of a relay **116**, and is in circuit closing position when the winding of the relay **116** is energized, being biased toward the dotted line position thereof shown in FIG. 7. Connected with the conductors **112** and **114** by means of the conductors **117** and **118** is an oscillator **119**, said oscillator being tuned to a frequency of five kilocycles. Also connected with the conductors **112** and **114** by the conductors **120** and **121** is an oscillator **122**, which is tuned to a frequency of fourteen kilocycles. Said oscillators are each provided with amplifying means interposed between the resonant circuit producing the oscillating current and the output terminals of the oscillator. The conductors **112** and **114** are also connected with a mixer pre-amplifier **123** by means of the conductors **124** and **125** and with an amplifier **126** by means of the conductors **127** and **128**. Leading to the mixer pre-amplifier from the oscillator **119** is a conductor **129**. Also a conductor **130** extends from the oscillator to a volume control, which is shown as comprising a resistance **131**, with which a movable contact **132** engages, to interpose a variable resistance between the conductor **130** and a conductor **133** leading to the mixer pre-amplifier **123**. The volume control comprising said variable resistance, varies the amplitude of the oscillating current fed to the mixer pre-amplifier **123** by the oscillator **119**.

A conductor **134** leads from the oscillator **122** to the mixer pre-amplifier and a conductor **135** extends from the oscillator **122** to a stationary contact with which a movable contact **136** of a switching member engages. Said switching member **136** is biased so as to be normally in a circuit closing position to connect the conductor **135** with a conductor **137**, but is adapted to be moved to the dotted line position shown in FIG. 7 by means of the foot pedal **39** in a manner to be described below. A pair of branch conductors **138** and **139** are connected with the conductor **137**, the conductor **138** leading through the branches **140**, **141** and **142** to the movable contacts **143**, **144** and **145** of switching members that have stationary contacts **146**, **147** and **148** respectively with which said switching members are adapted to engage. The conductor **149** extends from the stationary contact **148** to one end of a resistance **150**, from the other end of which a conductor **151** extends to one end of a resistance **152** and a conductor **153** extends from the stationary contact **146** to the conductor **151**. A resistance **154** is connected serially with the resistance **152** by a conductor **155** and

a conductor **156** extends from the stationary contact **147** to the conductor **155**. From the other end of fixed resistance **154** a conductor **157** extends to a volume control, which comprises a resistance **158**, with which a movable contact **159** engages and from which the conductor **160** extends to the mixer pre-amplifier **123**.

It will accordingly be seen that a variable amount of resistance can be put in the circuit leading from the oscillator **122** to the mixer pre-amplifier **123**, including the three fixed resistances **150**, **152** and **154** and the variable resistance comprising the resistance **158** and movable contact **159**. The volume control that includes the resistance **158** is adjusted to adjust the position of the movable contact member **159** by means of the foot pedal **38**, indicated in dotted line in FIG. 7. Three different ranges of speed of the vehicle **22** can be obtained, depending upon which of the switches **143**, **144** and **145** are closed. Suitable means for closing only one of said switches at a time is provided, which will be described below. When the switch **145** is closed, all the resistances **150**, **152** and **154** will be serially included in the circuit and also the portion of the resistance **158** will be included therein that is between the conductor **157** and the movable contact **159**. Thus the amplitude of the current supplied by the oscillator **122** to the mixer pre-amplifier is variable by the resistance selectively inserted in the circuits by means of the volume control and the switching members **143**, **144** and **145**.

Extending from the mixer pre-amplifier to the amplifier **126** are the conductors **161** and **162**, said amplifier **126** serving to amplify the oscillating current produced by the oscillators **119** and **120**, modified by means of the amplitude controlling means above described, fed to the mixer pre-amplifier **123**. Extending from the secondary winding of the output transformer of the amplifier **126** are the conductors **163** and **164**. The conductor **164** is connected with the negative ends of the secondary of said amplifier and the conductor **165**, that extends through the branch conductors **166**, **167** and **168** to the conducting strips **29**. While only three of said conducting strips **29** are shown in the circuit diagram of FIG. 7, it is to be understood that a multiplicity of said conducting strips **29** is connected with the conductor **165** so that said conducting strips **29** are all connected with said conductor **165** in parallel with each other.

A direct current power supply **169** is provided, which is supplied with alternating current from the conductors **112** and **114** through the conductors **170** and **171**. The conductor **163** is connected with the negative terminal of the power supply **169**, which preferably is a 24 volt direct current power supply, and extends to the opposite end of the secondary winding of the output transformer of the amplifier **126** from that connected with the conductor **164** so as to be connected through said secondary winding of said transformer with the conductor **164**. The positive terminal of the power supply **169** is connected by means of the conductor **172** with the conducting strips **30**, all of said conducting strips **30** being connected to said conductor **172** in a suitable manner, as by means of the conductors **173**, **174**, **175** and **176**. The conducting strips **29** are thus connected with the negative terminal of the power supply **169** and the condutcing strips **30** with the positive terminal of the power supply **169** and the conducting strips **29** are connected with the negative terminal of the amplifier **126** and through the power supply **169** the conducting strips **30** are connected with the positive terminal of the amplifier **126**.

While any one of the contact members **91**, **92**, **93** and **94** can be in contact with any one of the conducting strips **29** or **30**, in FIG. 7 the contacts **91**, **92** and **93** are shown in engagement with the conducting strip **30**, while the contact **94** is shown in engagement with the conducting strip **29**. The conductors **179**, **176** and **178** are thus connected, in the position of the contacts **91**, **92** and **93** shown, with the positive terminal of the power supply **169** and the conductor **177** is connected with the negative terminal of said power supply **169** and with the negative terminal of the amplifier **126** by means of the contact **94**. As the vehicle **22** may take various angular positions with respect to the length of the conducting strips **29** and **30**, during its travel over the track, various ones of said contacts **91**, **92**, **93** and **94** may be engaged with the conducting strips. However, the arrangement is such that either two of said contacts will be in engagement with one of said conducting strips and the other two with the next adjacent conducting strip, or three of said contacts will be in engagement with one of said conducting strips and one of said contacts with a conducting strip adjacent thereto. It is immaterial which of the contacts is in engagement with which of the conducting strips **29** and **30**, as means are provided in the receiving circuit on the vehicle, of which the contacts **91**, **92**, **93** and **94**, and the conductors **176**, **177**, **178** and **179** are a part, so that there will be one lead extending to the receiving circuit from said contacts, which will only receive negative direct current and negative current impulses from the amplifier **126**, and a lead that will only receive positive direct current and positive current impulses from the amplifier **126**, as will be explained below.

Referring to FIGS. 8, 10, 11 and 13, a frame is shown in FIG. 8 having the longitudinally extending members **180**, between which are mounted a pair of cross members **181** angular in cross section secured thereto in any suitable manner, as by fastening elements **182**. A top plate **183** is mounted on the frame members **180** and is provided with an opening **184** therein, through which the shift lever **37** extends. Said shift lever is provided with the usual knob **185** on the upper end thereof and extends downwardly through the opening, being mounted in a bracket **186** by means of a ball and socket joint **187**, which permits the lever to be tilted in any direction about said ball and socket joint. Below said ball and socket joint **187** a plate **188** of insulating material is secured to said lever **37** by means of a metal plate **189**. The portion **190** of said lever **37** extending downwardly beyond said insulating plate **188** is cylindrical in character and extends between the cross members **181**.

Extending toward each other from the cross members **181** are the lugs **191**, and mounted on a plate **192** on a lever **193** are a pair of transversely spaced upstanding lugs **194**. The lever **193** is adapted to be moved between the full and dotted line positions thereof shown in FIG. 13 in a manner to be described below. When the lever is in the full line position shown in FIG. 13 the lugs **191** and lugs **194** will cooperate to block passage of the cylindrical end portion **190** of the lever past the same. Thus, when the lever is in an upright position as shown in FIG. 11, the lower end portion **190** thereof will be held from passage to any of the dotted line positions thereof shown in FIG. 11 by the cooperation of said lugs **191** and **194**. However, when the lever **193** has dropped to the dotted line position shown in FIG. 13 the lower end portion **190** of the lever **37** is free to move angularly into any one of the dotted line positions shown therefor in FIG. 11, but cannot move straight forward or back because of the lugs **191**.

Mounted on the insulating plate **188**, shown in dotted outline in FIG. 7, are the movable contact members **143**, **144** and **145** and a movable contact member **195**. Said contact members will extend in a horizontal direction, outwardly from the insulating block **188**, being insulated from each other thereby, when the insulating member **188** is in the position shown in full lines in FIGS. 8, 10 and 13. Mounted on suitable brackets **196**, which are secured to the wooden longitudinal frame members **180**, are the stationary contact members **146**, **147**, **148** and **197**, which are adapted to cooperate with the movable contact members **143**, **144**, **145** and **195** upon tilting of the insulating member **188** in the proper direction by means of the lever **37**. Thus when the lever **37** is tilted

toward the operator and toward the left the contact member **145** will engage with the contact member **148**, provided that the lever **193** is in its dotted line position. Similarly, under similar circumstances, the tilting of the lever **37** forwardly or away from the operator and toward the right will engage the contact member **143** with the contact member **146** and movement toward the operator and toward the right will engage the contact member **144** with the contact member **147**, while movement of the lever **37** forwardly or away from the operator and toward the left will engage the contact member **195** with the contact member **197**. The positions of the lever **37** as above described, will correspond, respectively, to the low gear, second gear, high gear and reverse position of the gear shift lever of an automobile. It will also be noted that when the lever **193** is in the full line position shown in the drawings and the downward extension **190** of the lever **37** is in any one of the dotted line positions shown in FIG. 11, it can not move out of such dotted line position unless the lever **193** is dropped to its dotted line position.

The lever **193** is mounted on a pivot member **198**, which extends between the brackets **199** mounted on the longitudinal frame members **180**, having spacing sleeves **200** mounted between said brackets **199** and the bearing **201** provided on said lever **193** for holding said lever in proper position between the frame members **180**. A bottom wall **202** extends between the frame members **180** and a coil spring **203** extends between said bottom wall **202** and an ear **204** on the lever **193**, which tends to hold the lever in its full line position. A pair of brackets **255** mounted on the frame members **180** have a bar **256** fixed thereto and extending between the same, on which a pair of spaced upstanding guide plates **257** are mounted in fixed position, said lever **193** operating between said guide plates **257**.

Means is provided for moving said lever **193** to its dotted line position, comprising a crank **205**, which has a transverse portion **206** engaging the downwardly bent end portion **207** of the lever **193** and adapted to move it from the full line positon thereof shown in FIG. 13 to the dotted line position thereof shown in FIG. 13. Said crank is provided on a shaft **208**, which is mounted in a bearing **209** having a base **210** mounted on one of the frame members **180**. Said shaft **208** is also mounted in a bearing **211** mounted on a frame member **212** and is held from endwise movement in said bearing by means of a cotter pin **213**. Said shaft **208** has mounted thereon to turn therewith the hub portion **214** of a lever **215** that is provided with an upwardly directed portion **216** terminating in the foot pedal **40**. A spring **217** extends between the lever **215** and a portion of the housing **20**, said spring tending to hold the foot pedal **40** in the raised position thereof. Depression of the foot pedal **40** will move the lever **215** to the dotted line position shown in FIG. 12, swinging the shaft **208** clockwise as viewed in FIGS. 12 and 13, thus swinging the crank **205** clockwise and raising the transverse end portion **206** thereof and along with it the end **207** of the lever **193** to move it to the dotted line position shown in FIG. 13. Thus the pedal **40** acts in a similar manner to an automobile clutch pedal, in that it has to be operated each time that the lever **37** is to be moved from one position to another through the full line position thereof shown in FIGS. 10, 11 and 13, or to move it into the full line position thereof, which is the position in which all of the movable contacts of the switching means provided on the insulating member **188** are in open circuit position.

Referring to FIG. 7, it will be noted that a conductor **218** extends from the conductor **164** to the movable contact member **195** and that a conductor **219** extends from the stationary contact **197** to a conducting strip **220**. Such conducting strips **220** are mounted on the barriers **23** and **24**, extending the full length thereof, the barrier **24** being shown as being mounted between a top plate **33** and the conducting strips **29** and **30** and being secured to the member **32** by a suitable securing element **221**. The strips **220** extend continuously around the central barrier **24** and around the peripheral barrier **23** and are all connected with conductor **219**. A contact member **222** is mounted on the shell of the vehicle **22** and is adapted to engage with the contact **220**, being indicated at **222** diagrammatically in FIG. 7. The contact strip **222** extends entirely around the body of vehicle **221**.

In order to provide for completion of the circuit between the oscillator and the mixer pre-amplifier when the lever **37** is moved to the position to engage the movable contact **195** with the stationary contact **197**, a relay **223** is provided, the winding of which is connected with the conductor **219** by means of a conductor **224** at one end thereof, while the other end thereof is connected with the conductor **172** by means of the conductor **225**. As the conductor **218** is connected with the negative terminal of the power supply **169** through the conductors **164** and **163** and with the positive terminal of said power supply through the conductor **172**, the relay will be energized whenever the contact **195** is engaged with the contact **197**. The contact member **226** moves with the armature of the relay **223**, being normally biased toward open circuit condition as shown in FIG. 7, but being moved to the dotted line position thereof upon energization of said relay **223** to move into engagement with a stationary contact **227**, from which a conductor **228** extends to the conductor **156**. Accordingly, when the relay **223** is energized, the circuit will be completed to the mixer pre-amplifier **123** from the oscillator **122** through the conductor **135**, the movable contact member **136**, the conductor **137**, the conductor **139**, the movable contact member **226**, the conductor **228**, the conductor **156**, the resistance **154**, the portion of the resistance **158** between said resistance **154** and the movable contact **159**, and the conductor **160**.

The receiving circuit on the vehicle **22** comprises conductors **229**, **230**, **231** and **232** connected, respectively, with the conductors **176**, **177**, **178** and **179**. Interposed between the conductors **233** and **234** and said conductors **229**, **230**, **231** and **232** are the diodes **235** and **236**, said diodes being so positioned in the circuit that only negative current and negative current impulses can pass from the conductors **229**, **230**, **231** and **232** and thus from the contacts **91**, **92**, **93** and **94**, to the conductor **233**, and only positive current and current impulses can pass to the conductor **234** from said contacts **91**, **92**, **93** and **94**, through the conductors **229**, **230**, **231** and **232** to the conductor **234**. In the position shown, the contact **94** being in engagement with the conducting strip **29**, the circuit will be from said conducting strip **29** through the conductor **177** and conductor **230** to the conductor **233**, and from the conducting strip **30** through the conductors **176**, **178** and **179** and the conductors **229**, **231** and **232** to the conductor **234**. It will accordingly be seen that no matter what ones of the contacts **91**, **92**, **93** and **94** are in engagement with the conducting strips **29** and **30**, a circuit will be established between a contact strip **29** and the conductor **233** and between a contact strip **30** and the conductor **234**.

Extending from the conductor **233** is a conductor **237**, which is connected with one end of a winding **238** of an autotransformer, from the other end of which winding the conductor **239** extends, and which is provided with a tap **240**, which is provided with branches **241** and **242**. Interposed between the conductor **241** and the conductor **234** is a condenser **243**, which will permit the passage of oscillating current from the conductor **234** to the conductor **241**, but will block passage of direct current from the conductor **234** to the conductor **241**. A conductor **244** extends from the conductor **234** to a conductor **245**, which is connected with the emitter **246** of a

transistor 247 having a collector 248 and a base 249. The collector 248 is connected with a conductor 250, which is connected with one end of the armature winding of the motor 45, the other end of said winding being connected by a conductor 252 with the conductor 241. Thus the transistor 247 is in series with the armature winding of the motor 45 between the positive and negative terminals of a direct current circuit, including the conductors 234 and 233, and thus direct current is supplied to the motor 45 from the power supply 169 through the contact strips 30 and 29 in accordance with the conductivity of the transistor 247.

The conductor 239 is connected with a conductor 253 through the diode 254, the diode 254 being provided to make certain that only negative current impulses will pass to the conductor 253. The conductor 253 is connected with the primary winding 251 of a transformer having the secondary winding 258 at an intermediate point and a condenser 259 is bridged across the terminals of the winding 251, the position of the tap 253 and the capacity of the condenser 259 being chosen so that the circuit in which the winding 251 is located will be tuned to a frequency of five kilocycles. Said circuit will accordingly receive the amplified oscillating current produced by the oscillator 119 and the amplitude of said oscillating current is variable by means of the position of the movable contact 132 of the volume control having the resistance 131. The amplitude of the oscillating current will increase in the secondary winding 258 in accordance with the position of the contact member 132. The secondary winding 258 is connected with the conductor 244 by means of a conductor 260 and with the base 249 of the transistor 247 by means of a conductor 261. The end of the secondary winding 258 connected with the base 249 in the negative end thereof with respect to the emitter 246 and will become more negative as the amplitude of the oscillating current produced by the oscillator 119 increases. The conductivity of the transistor 247 will increase as the base 249 thereof becomes more negative. Accordingly the speed of the motor 45 will be varied in accordance with the position of the movable contact 132 of the volume control, the speed of said motor 45 increasing as the portion of the resistance 131 between the movable contact 132 and the conductor 130 decreases. The condenser 270 is bridged across the conductors 244 and 250 to filter the oscillating current out of the motor circuit.

The position of the contact 132 is controlled by means of the steering wheel 36, the volume control being indicated by the numeral 262 in FIG. 9. Said volume control is mounted on a portion of the housing 20 within a sub-housing 263, upon which a bearing member 264 for the steering shaft 265 connected with the steering wheel 36 is mounted. The volume control operates to cut out resistance when turned in a counter-clockwise direction, and means is provided for turning the operating member 266 of the volume control in response to the movements of the steering wheel 36 either clockwise or counter-clockwise, as may be desired. Said means comprises a rubber tube 267 connecting the steering shaft 265 with the operating member 266 of the volume control 262, the tube 267 receiving and being fixed to the shafts 265 and 266. A flexible connection by means of the rubber tube 267 is provided so that violent movements of the steering wheel 36 by an operator will not damage the volume control 262. In order to prevent turning of the steering wheel 36 beyond the limits of movement of the volume control 262 in opposite directions, a stop finger 268 is provided on the steering shaft 265, which is adapted to engage with one or more stops 269 mounted on the sub-housing 263.

The speed of the motor 45 increases as the steering wheel 36 is turned counter-clockwise, as this reduces the amount of resistance 31 in the circuit for controlling the amplitude of the current produced by the oscillator 119, increasing the amplitude thereof. When the steering wheel 36 is turned clockwise the speed of the motor will be reduced in a similar manner. The adjustment of the parts is such that when the steering wheel 36 is in a position to steer the vehicle 22 straight ahead, the movable contact 132 is in an intermediate position. The springs 64 tend to move the disk 69 forwardly, or toward the left, as viewed in FIG. 5, and the weights 68 as the same move outwardly tend to move the disk 69 toward the right as viewed in FIG. 5 Movement of the disk 69 toward the right will turn the shaft 82 clockwise as viewed in FIG. 5, or counter-clockwise as viewed in FIG. 3. This will cause the steering arm 80 to be moved counter-clockwise in FIG. 3 as the speed of the motor 45 increases, moving the pin 79 along with the link 76 in such a direction as to swing the bell crank levers made up of the arms 73 and 75 clockwise about their pivots 71 as viewed in FIG. 3, turning the wheel 74 shown uppermost in FIG. 3 outwardly and the other wheel 74 inwardly, which will steer the vehicle toward the left as viewed in FIG. 5. Thus turning of the steering wheel 36 counter-clockwise, or to the left, will turn the wheels to the left, and turning of the stering wheel 36 clockwise, or to the right, will cause the wheels 74 to turn to the right, as the springs will move the weight inwardly and the disk 69 forwardly as the speed of the motor 45 decreases.

The receiving circuit on the vehicle 22 is provided with a conductor 271 extending from the conductor 244, said conductor 271 having a conductor 272 extending therefrom to the emitter 273 of a transistor 274 having a collector 275 and a base 276. From the collector a conductor 277 extends to a conductor 278, which is connected with a movable contact member 279, which is mounted to move with the armature of a relay 280 and is normally biased to engage a stationary contact 281. A conductor 282 extends from the contact 281, said conductor 282 being connected with a conductor 283, which connects with the conductor 284 that is connected with one end of the armature of the motor 44. The winding of a relay 285 has its opposite ends connected with the conductors 277 and 283. Connected with the other end of the armature of the motor 44 is a conductor 286, which is provided with branches 287 and 288, the branch 287 extending to a stationary contact 289, with which a movable contact 290 is biased to engage. Said movable contact 290 is mounted to move with the armature of a relay 291 and is moved to the dotted line position thereof shown when the winding of the relay 291 is energized. A conductor 292 extends from the movable contact member 290 and is connected with the conductor 242.

Accordingly, when the movable contact members 279 and 290 are in the position shown in full lines in FIG. 7 the circuit of the motor 44 will be completed from the conductor 234 through the conductors 244, 271 and 272 and through the transistor 274 to the conductor 277, the conductor 278 and contact 279, conductors 282, 283 and 284, to the armature of motor 44 and from the armature of said motor 44 through the conductors 286, 287, movable contact 290 and conductor 242, a portion of the winding 238 and the conductor 237 to the conductor 233, and thus the conductor 284 leads into the armature of the motor 44 from the positive terminal of the power supply 169 through the conducting strip 30 and the conductor 286 extending from the armature of the motor 44 is connected through a conducting strip 29 with the negative terminal of the power supply 169. The motor 44 is variable in speed in accordance with the conductivity of the circuit in which the transistor 274 is interposed.

Means similar to that provided for controlling the conductivity of the transistor 247 is provided for controlling the conductivity of the transistor 274. Said means includes a primary winding 293 of a transformer having a secondary winding 294 and having a conductor 295 connected therewith intermediate the ends thereof, which is in turn connected with the conductor 296 extending from

one end of the primary winding **251**. A condenser **297** is bridged across the terminals of the winding **293**. A conductor **298** extends from one terminal of the primary winding **293** and is connected with a conductor **299**, which is connected with the conductor **242** through a resistance **300**.

A conductor **301** leads from the conductor **271** to one end of the secondary winding **294** and a conductor **302** extends from the other end of the secondary winding **294** to the base **276** of the transistor **274**. A condenser **303** is bridged across the conductors **299** and **271** and a condenser **304** is bridged across the conductors **271** and **277**. The condenser **304** is provided for filtering out oscillating current to prevent its flow to the armature of the motor **44**. The condenser **303** provides a path for the oscillating current from the conductor **299** to the conductor **271** and through the conductor **244** to the conductor **234**. A path is also provided for the oscillating current through the resistance **300**, the conductor **242** and the conductor **241** and condenser **243** to the conductor **234**. The value of the condenser **297** and the position of the tap **295** is such that the circuit containing the primary winding **293** of the transformer is tuned to the frequency of the oscillator **122**.

As the amplitude of the oscillating current produced by the oscillator **122** is increased the negative bias on the base **276** of the transistor **274** is increased in a similar manner to that described in connection with the transistor **247** and the conductivity of said transistor **274** is accordingly increased and the speed of the motor **44** increased as said conductivity increases. The amplitude of the current produced by the oscillator **122** will vary in accordance with the position of the shift lever **37**, as the various positions thereof will put different amounts of resistance made up of the resistances **150**, **152** and **154** into the circuit for controlling the amplitude of the oscillating current produced by the oscillator **122**, and will also vary in accordance with the position of the contact **159** with respect to the resistance **158**, which is dependent upon the position of the foot pedal **38**, which serves a similar purpose to an accelerator pedal of an automobile.

The accelerator pedal **38** is mounted on a pivot ear **305** by means of the pivot member **306**, said pivot ear being provided on the sub-housing portion **307**. A link **308** is pivoted to the upper end of the pedal **38** and is pivotally connected with a crank **309** mounted on a shaft **310** to turn therewith. Said shaft **310** has mounted thereon the volume controls **311** and **312** so that the operating members of said volume controls **311** and **312** will turn in unison with the shaft **310**. The volume control **311** comprises the resistance **158** and the movable contact **159** and depression of the foot pedal **38** will turn the shaft **310** counter-clockwise as viewed in FIG. 12. Such counter-clockwise movement of the shaft **310** will cause movement of the movable contact member **159** of the volume control **311** in a direction to reduce the amount of the resistance **158** that is in the amplitude controlling circuit for the oscillator **122** and thus increase the speed of the motor **44**. The volume control **312** is mounted on a bracket **313** mounted on the frame member **212**, and the volume control **311** is mounted on the volume control **312** by a connecting sleeve **314**, while the shaft **310** is provided with a collar **315** on the end thereof to maintain the crank **309** in engagement with said shaft **310**.

The volume control **312** comprises a resistance **316**, with which a movable contact **317** engages. The conductor **114** and the line wire **112** lead to a tape play-back **318**, which has the output circuit comprising the conductors **319** and **320** leading to a loud speaker **321**. Said tape play-back is provided with a variable speed motor, for driving the tape, the controlling circuit of which includes the conductors **322** and **323** connected with the movable contact **317** and one end of the resistance **316**. Accordingly the portion of the resistance **316** between the conductor **323** and the movable contact **317** will control the speed of the tape play-back motor. The tape play-back is preferably provided with a tape recording of the sound produced by an actual racing automobile in action, and it will accordingly be seen that the speed of the tape play-back and thus of the sound produced by the recording will vary in accordance with the position of the accelerator pedal **38** and thus be variable so that the speed at which the play-back plays the recording will increase as the speed of the vehicle **22** is increased by the depression of the foot pedal **38**, and vice versa.

Means is provided for preventing the vehicle **22** from being stalled against a barrier by providing means for reversing the direction of travel of the vehicle, should this be necessary in order to disengage the same from one of the barriers. Said means includes the conducting strips **220** with which the contact member **222** on the vehicle is adapted to engage. From the contact member **222** a conductor **324** extends and branch conductors **325** and **326** extend from the conductor **324**. The conductor **326** is connected with one end of each of the windings of the relays **280** and **291** and the branch conductor **325** leads to the stationary contact **327**, with which the movable contact **328**, which is mounted to move with the armature of the relay **285**, is adapted to engage upon energization of the winding of said relay **285**.

When the contact **222** engages one of the conducting strips **220** the circuit will not be completed unless the contact member **195** has been moved into engagement with the contact **197** by tilting of the insulating plate **188** by means of the shift lever **37** in the proper direction. This cannot be done without first moving the insulating member **188** into a neutral or horizontal position, in which all the contact members mounted thereon are moved to open circuit position. When the contact member **195** is engaged with the contact member **197** the negative terminal of the power supply **169** will be connected, through the conductor **218** and the conductors **164** and **163** with the conducting strips **220** through the conductor **219**, and when the contact member **222** engages therewith the circuit will extend from the negative terminal of said power supply through the conductor **324** to one end of each of the windings of the relays **280** and **291**. A conductor **329** extends from the other end of each of the windings of the relays **280** and **291** to the conductor **271** and through the conductor **244** and the conductor **234** to one of the conducting strips **30** and to the positive terminal of the power supply **169**. Thus the relays **280** and **291** will be energized and the movable contact members **279** and **290** will move to the dotted line positions thereof shown in FIG. 7.

This will break the circuit between the conductors **278** and **282** and make a circuit between the conductor **278** and the conductor **286** and between the conductor **284** and the conductor **292**, through conductor **343** and contact **290**, which will reverse the flow of direct current through the armature winding of the motor **44** and thus reverse the motor. At the same time that the circuit through the conductor **282** from the conductor **278** is interrupted by movement of the contact member **279**, which had short circuited winding of relay **285**, the current flow will be through the winding of the relay **285** from the conductor **277** to the conductor **283** and the winding of said relay will be energized, moving the contact member **328** to the dotted line position shown in FIG. 7.

The engagement of the contact member **328** with the contact member **327** will connect the conductor **325** with the conductor **330**, which is connected with the movable contact **328** and thus with the conductor **242**. The conductor **242** is connected with one of the conducting strips **29** connected with the negative terminal of the power supply **169** through the conductor **240**, a portion of the winding **238**, the conductor **237** and the conductor **233**. The relays **280** and **291** will thus continue to be energized even though the contact member **222** leaves the conducting strip **220**, as the conductor **329** leading to said relays

is connected with the conductor **271** that is connected with the positive terminal of the power supply **169** through the conductor **234** and the conductor **326** leading to the other end of the windings of the relays **280** and **291** is connected with the negative terminal of the power supply **169** in the above described manner, by engagement of the contact member **328** with the stationary contact **327**. This will maintain the circuit to the motor **44** to operate it in reverse as long as the contact member **195** remains in engagement with the contact member **197**, as the relay **223** will continue to be energized and the circuit through the resistance **154** and the volume control having the resistance **154** and the volume control having the resistance **158** will be maintained and the transistor **274** will remain conductive.

However, upon movement of the insulating member **188** to the horizontal position, which is the neutral position of the shift lever **37**, this circuit will be broken, the relay **223** will be de-energized, and the relay **285** will be de-energized so as to cause the contact member **328** to move back to the full line position shown in FIG. 7 because direct current flow through transistor **274** will be halted. In order to again start the vehicle, it will then again be necessary to operate the shift lever to engage one of the contact members **143**, **144** or **145** with its cooperating contact. Thus, by operation of the shift lever, the vehicle can be backed away from a barrier and then, as soon as desired, the control thereof can be again changed to move the vehicle in a forward direction, as de-energization of the holding circuit involving the contact member **328** will de-energize the windings of the relays **280** and **291** and cause the circuit to be re-established in the manner shown in full lines in FIG. 7 so that the motor **44** will be driven in a forward direction.

Should it be desired to halt the vehicle at any time, the brake pedal **39** can be used for this purpose. The brake pedal **39** controls the position of the switch **136** and is shown in FIG. 12 as operating a lever **331** on an upstanding portion **332** of which it is mounted, which lever **331** is normally held in such a position by means of the spring **333** that the brake pedal **39** is in a raised position. Said lever **331** is provided with a hub portion **334**, which is keyed to the shaft **335** mounted in a bearing **336** on the frame member **212** and a bearing **337** on the frame member **180**. The shaft **335** has a collar **338** mounted thereon to rotate therewith, from which an arm **339** extends. Mounted on a bracket **340** on the frame member **180** is a switch **341**, which contains the movable contact member **136**, which is normally biased toward circuit closing position, but which is provided with an operating member **342** that is adapted to be engaged by the arm **339** to open said switch, by moving the movable contact member **136** to the dotted line position shown in FIG. 7, by depression of the foot pedal **39**.

Extending from the line wires **112** and **113** to the 12 volt direct current power supply **344** are the conductors **345** and **346**. Connected with the positive terminal of the power supply **344** is the conductor **347** and connected with the negative terminal of said power supply is a conductor **348**. A conductor **349** is adapted to be connected with the conductor **348** by means of a momentary switch having a movable contact **350** that is normally biased to an open position by suitable spring means **351**. Said switch may be coin operated if desired. Also connected with the conductors **112** and **114** through the conductors **352** and **353** is a 12 volt power supply **354**, from the positive terminal of which extends a conductor **355** and from the negative terminal of which extends a conductor **356**. The conductor **355** has a tap **357** extending therefrom to a movable contact member **358**, which is adjustable along a resistance **359**, which is in series with a resistance **360**, said resistances **359** and **360** being interposed between the conductor **355** and a conductor **361** connected with a base **362** of a transistor **363**, which has an emitter **364** and a collector **365**. The conductor **356** is connected with the collector **365** and the conductor **355** is connected with one end of the winding of a relay **366**, the other end of said winding being connected with the emitter **364** by means of a conductor **367**. Also connected with the conductor **356** through the conductor **368** is a photoelectric cell **369**, said photoelectric cell being interposed between the conductors **368** and **361**. The conductor **349** is connected with an arcuate stationary contact **370**, from which the conductor **371** extends. Said conductor **371** is connected by means of the conductor **372** with one terminal of a lamp **373**, which lamp is mounted in a suitable housing **374** on the barrier **23**, and is provided with suitable means for throwing a beam across the track to the photoelectric cell **369** located in a suitable housing **375** transversely across the track from the housing **374**, the arrangement being such that a beam from the lamp **373** will engage the photoelectric cell **369**. Said lamp having its other terminal connected with the conductor **347** by a conductor **376**, will be energized upon closing of the switch **350**.

The conductor **371** extends to one end of the winding of the relay **116** and the conductors **377** and **378** are connected with the other end of said winding. The conductor **377** connects the last mentioned end of the winding of the relay **116** with the conductor **355** and the conductor **378** connects with one end of the winding of a relay **379**, the other end of which is connected by means of a conductor **380** with a contact member **381**, with which the rotary switching member **382** is adapted to engage. A relay **383** is connected by means of conductors **384** and **385** with the conductors **371** and **377**. The conductor **384** extends to a movable contact **386**, which is mounted to move with the armature of the relay **383** and is biased to have the dotted line position shown in FIG. 7, but upon the relay **383** being energized the movable contact **386** will engage with a stationary contact **387** from which the conductor **388** extends to a movable contact **389**, which is normally biased to engage the stationary contact **390**, from which the conductor **391** extends to the conductor **368**, and thus the conductor **391** is connected with the conductor **356**, extending to the power supply **354**.

The movable contact member **382** is in position so as to connect the arcuate stationary contact **370** and the contact **381**, when operation of the controlling apparatus for the vehicle is started, by closing the switch having the movable contact **350**. When said switch is closed, the relay **116** will be energized and the movable contact **115** will move into position to connect the conductor **114** with the line conductor **113**. The circuit for energizing said relay being from the positive terminal of the power supply **344** through conductors **347**, **355** and **377** to one end of the winding of the relay **116** and from the other end of said winding through the conductor **371** to contact **370** and from contact **370** to conductor **349**, and to the negative terminal of said power supply. At the same time the relay **383** will be energized, moving the contact member **386** to circuit closing position, completing the circuit between the conductors **355** and **356** and the relays **116** and **383**.

A conductor **392** extends from the conductor **376** to the stationary contact **393**, with which the movable contact **394** engages, said movable contact being biased to normally engage said stationary contact **393** when the relay **366** is not energized. A conductor **395** extends from the movable contact member **394** to one end of a solenoid winding **396**, the movable core of which is connected with a pivotally mounted member **397** having a pawl **398** mounted thereon and adapted to engage a ratchet wheel **399**, which is connected with the movable contact member **382** so that said contact member rotates with said ratchet wheel **399**. The plunger carrying the pawl **398** is urged in a downward direction by any suitable means, such as a spring, or by gravity, in a well known manner customary in step by step rotary switches, and is pulled upwardly by the energization of the solenoid **396**. The solenoid **396** is also connected with the contact member

370 by a conductor 400 so that with the movable contact member 394 in circuit closing position the solenoid 396 will be energized, as the conductor 347 is connected through the conductor 376 and the conductor 373, movable contact 394 and conductor 395 with one end of said solenoid, and the conductor 348 is connected with the other end thereof upon closing of the switch 350 through conductor 349, the contact member 370 and the conductor 400.

The energization of the solenoid winding 396 will move the contact member 382 clockwise as viewed in FIG. 7 from a position in which it is engaged with the contact member 381 and the contact member 370 to a position in which it engages with a contact member 401 and the contact member 370. A series of contact members 402, 403, 404, 405, 406, 407, 408, 409, 410 and 411 are provided in the path of a movable contact member 382 to engage successively therewith, to complete the circuit between each of said contact members and the contact member 370.

The switch having the movable contact 350 will only be closed momentarily, being immediately again reopened by the resilient means 351. However, the solenoid 396 will have been energized by such closing of the switch to advance the ratchet wheel 399 one tooth and the movable contact member one step, or in engagement with the contact 401. At the same time the relays 116 and 383 will be energized to close the circuit between the conductors 113 and 114 and to energize the relay 383, whereby the holding circuit is established for the relays 383 and 116. It will be noted that the conductor 380, which extends from the contact member 381, and the conductor 378 are connected with opposite ends of the winding of the relay 379, but it will not be energized to break the holding circuit by movement of the movable contact member 389 to the dotted line position shown in FIG. 7, because the movable contact member 382 has already left the contact 381.

The power supply 354 also has become effective when the contact member 115 has closed the circuit between the conductors 113 and 114 and this causes energization of the photoelectric cell 369. Also the lamp 373, which has become energized upon closing of the switch that is provided with the contact member 350, remains energized because it is connected with the conductor 356 through the conductors 372 and 371, contact 370, conductors 413 and 368 and with the conductor 355 through conductor 376. The beam from the lamp 373 will activate the photoelectric cell so as to cause the terminals thereof with which the conductor 361 is connected to become negative, increasing the negative bias of the base 362 of the transistor and causing the relay 366 to be energized because the conductivity of the transistor 363 will be increased thereby to cause direct current to flow from the power supply 354 through the conductor 355 to one end of said winding and from said winding through the conductor 367 and said transistor 363 and the conductor 356 to the negative terminal of the power supply 354. This will cause the contact member 394 to move to the dotted line position, breaking the circuit to the solenoid 396, which will cause the pawl 398 to drop downwardly one tooth of the ratchet wheel 399. This condition will exist as long as the lamp 373 is directing its beam on the photoelectric cell 369. However, as soon as the beam is interrupted by the vehicle 22 passing between the lamp 373 and the photoelectric cell 369 the contact member 394 will reutrn to the full line position shown in FIG. 7 and the solenoid 396 will be energized to advance the ratchet wheel 399 one tooth and the contact member 383 from one of the series of contacts with which it engages to the next one, such as from the contact 401 to the contact 402, the circuit for energizing the solenoid being from the conductor 355 through the conductors 376 and 392, movable contact 394 and conductor 395 to one end of the winding of solenoid 396 and from the other end of said winding through the conductor 400, contact 370, conductors 413, 391 and 368 to the conductor 356. As soon as the vehicle 22 has passed from between the lamp 373 and the photoelectric cell 369 the winding of the relay 366 will again be energized and the pawl 398 will again drop down into engagement with the next tooth of the ratchet wheel 399.

Electric lamps 412 have one terminal of each thereof connected with a contact member 401, 402, 403, 404, 405, 406, 407, 408, 409, 410 and 411 and the other terminal connected with the conductor 347. A circuit will thus be established through each of said lamps 412 in succession from the power suply 354 through conductors 355 and 347 and from one of said contacts through the contacts 382, 370 and conductors 413, 391, 368 and 356 to power supply 354. Accordingly each of the lamps 412 will be illuminated in succession as the contact member 382 is moved step by step into engagement with the series of contacts with which said lamps 412 are connected. When the lamp 412 connected with the contact member 401 is illuminated the first window 42 at the left end of the housing as viewed in FIG. 1 will be illuminated, and is preferably provided with indicia that indicates the starting of the vehicle around the track, such as the word "start." The contact members from 402 to 411 are engaged successively, and are arranged to illuminate indicia in succeeding windows 42 from left to right in the row shown in FIG. 1, preferably bearing the numerals 1 to 10, indicating the beginning of each lap that the vehicle 22 is making in its travel around the track.

When the vehicle reaches the point on the track at which the beam from the lamp 373 is interrupted following the interruption that started the 10th lap, the contact member 382 will move into position so as to engage the contact 381 and the contact 370. This will cause the relay 379 to be energized as the circuit from the power supply 354 will then be established from conductor 355 through conductors 377 and 378 to one end of the winding thereof and through conductor 380, contacts 381, 382 and 370, and conductors 413, 391, 368 and 356 back to said power supply. Energization of relay 379 will break the circuit to conductor 356 extending from the relays 116 and 383 by movement of contact 389 to the dotted position shown in FIG. 7, halting all operations of the electrical apparatus connected with the conductors 112 and 114, including the power supply 354. To resume operation of the vehicle 22 the switch having the movable contact 350 will have to again be closed.

To begin operation of the vehicle 22, the operator of the apparatus closes the switch having the movable contact 350, which will cause the contact member 382 to move from engagement of the contact 381 to engagement with the contact 401 by operation of the solenoid actuated rotary switch and the contact members 115 and 386 will be moved to their full line position shown in FIG. 7 by operation of the relays 116 and 383. The operator then depresses the clutch pedal 40 and moves the shift level 37 backwardly and toward the left to complete the circuit through the contacts 145 and 148, if he desires to go through the three steps ordinarily gone through in starting a stick shift controlled automobile engine, and then follows with successive alternate operations of the clutch pedal and the shift level to successively connect the contact member 143 with the contact member 146 and the contact member 144 with the contact member 147. He then depresses the accelerator pedal 38 the desired amount to get the desired speed of operation of the motor 44 for propelling the vehicle at the desired speed. This will put the play-back in operation at the same time that the vehicle is put into operation, and will run it at a speed proportionate to the speed of the motor 44. At the same time the operator adjusts the steering wheel 36 as desired to get the desired direction of travel of the vehicle 22, the adjustment of the volume control having the resistance 131 and the movable contact 132 by means of the steering wheel 36, adjusting the speed of the motor

45 to adjust the steering mechanism of the vehicle thereby through the centrifugal force exerted on the weights 68 of the rotatable means driven by the motor 45. As the vehicle travels along the track it will pass between the mounting 374 for the lamp and the mounting 375 for the photoelectric cell, interrupting the beam to the photoelectric cell and operating the ratchet and pawl mechanism to advance the movable contact member 382 into engagement with the contact member 402, to indicate the beginning of lap 1, and successively with the contact members 403 and 411 inclusive, to indicate the beginning of laps 2 to 10 inclusive provided by the indicia in the windows 42. Operation of the vehicle 22 and of the step by step movement of the contact member 382 will continue until the contact member 381 is engaged, which will open the circuit controlled by the relay 379 and halt the operation of the vehicle.

Should the vehicle become fouled by the barrier so that it will be held thereby from forward movement, the clutch pedal 40 can be operated and the shift lever 37 moved to the left and forwardly to close the switch having the movable contact member 195, which will reverse the operation of the motor 44 and drive the vehicle backward away from the barrier. Such movement can be halted by operation of the clutch pedal 40 and movement of the shift lever 37 back into the upright or neutral position and, if desired to halt the backing of the vehicle more rapidly, the brake pedal 39 can be depressed to open the switch 136. Forward movement of the vehicle can then be resumed in the same manner as was originally the case, when the switch having the contact member 350 was first closed.

What we claim is:

1. In an apparatus of the character described, a vehicle and a member having a surface over which said vehicle operates, means remote from the vehicle for independently producing two oscillating currents of different fixed frequencies, independently controlling the amplitude of each of said currents common amplifying means for said oscillating currents, a direct current source, said surface being provided with a plurality of conducting strips extending longitudinally thereof substantially in parallel transversely spaced relationship, means for insulating transversely adjacent conducting strips from each other including insulating strips mounted between said conducting strips, means for connecting alternating conducting strips with the output terminals of said amplifying means and with the opposed terminals of said direct current source, comprising a circuit having its terminals connected with said alternating strips and serially including the opposed terminals of said direct current source and the output terminals of said amplifying means, a pair of variable speed motors mounted on said vehicle, a plurality of current collecting members mounted on said vehicle yieldingly engaging said conducting strips, a receiving circuit having a pair of conductors mounted on said vehicle, rectifying means disposed between said current collecting members and said conductors to provide for only negative current flow to one of said conductors and only positive current flow to the other conductor from said collecting members, means on said vehicle connecting each of said motors with said conductors including a transistor serially connected with said motor and means for independently varying the conductivity of each of said transistors comprising means each tuned to one of said fixed frequencies and responsive to the amplitude of the oscillating current to which it is tuned included in said receiving circuit each comprising a primary and a secondary winding, means connecting the negative end of each of said secondary windings with the base of one of said transistors, a driving connection between a pair of wheels of said vehicle and one of said motors, a steering mechanism for said vehicle and means for adjusting the position of said steering mechanism responsive to the speed of the other motor.

2. Means for remotely controlling the speed and direction of a vehicle with respect to a surface over which said vehicle operates comprising means for producing oscillating currents of two different fixed frequencies, means for independently controlling the amplitude of each of said currents, common means for amplifying both of said independently controlled currents, means on the vehicle responsive to one of said fixed frequencies controlling the speed of said vehicle, means on the vehicle responsive to the other of said fixed frequencies controlling the steering of said vehicle and means for transmitting said amplified currents to said frequency responsive means, the means for controlling the amplitude of the current of said one frequency comprising a plurality of resistances and switching means for selectively interposing said resistances between said one means for producing said oscillating current and said common amplifying means comprising a tiltable member, stationary contacts, contacts mounted on said tiltable member each adapted to cooperate with one of said stationary contacts, manually operated means for tilting said tiltable member and guiding means controlling the direction of tilt of said titltable member to engage only one of said contacts mounted thereon with its cooperating stationary contact at a time.

3. Means for remotely controlling the speed and direction of a vehicle with respect to a surface over which said vehicle operates comprising means for producing oscillating currents of two different fixed frequencies, means for independently controlling the amplitude of each of said currents, common means for amplifying both of said independently controlled currents, means on the vehicle responsive to one of said fixed frequencies controlling the speed of said vehicle, means on the vehicle responsive to the other of said fixed frequencies controlling the steering of said vehicle and means for transmitting said amplified currents to said frequency responsive means, the means for controlling the amplitude of the current of said one frequency comprising a plurality of resistances and switching means for selectively interposing said resistances between said one means for producing said oscillating current and said common amplifying means comprising a tiltable member, stationary contacts, contacts mounted on said tiltable member each adapted to cooperate with one of said stationary contacts, manually operated means for tilting said tiltable member and guiding means controlling the direction of tilt of said tiltable member to engage only one of said contacts mounted thereon with its cooperating stationary contact at a time, said contacts being so related and said guiding means being so arranged that said tiltable member must be moved through a position in which all said contacts are disengaged to move said titltable member from a position in which one of said contacts on said tiltable member is engaged with its stationary contact to a position in which another of said contacts on said tiltable member is engaged with its stationary contact.

4. Means for remotely controlling the speed and direction of a vehicle with respect to a surface over which said vehicle operates comprising means for producing oscillating currents of two different fixed frequencies, means for independently controlling the amplitude of each of said currents, common means for amplifying both of said independently controlled currents, means on the vehicle responsive to one of said fixed frequencies controlling the speed of said vehicle, means on the vehicle responsive to the other of said fixed frequencies controlling the steering of said vehicle and means for transmitting said amplified currents to said frequency responsive means, the means for controlling the amplitude of the current of said one frequency comprising a plurality of resistances and switching means for selectively interposing said resistance between said one means for producing said oscillating current and said common amplifying means comprising a tiltable member, stationary contacts, contacts mounted on said tiltable member each adapted

to cooperate with one of said stationary contacts, manually operated means for tilting said tiltable member, guiding means controlling the direction of tilt of said tiltable member to engage only one of said contacts mounted thereon with its cooperating stationary contact at a time, means for locking said tiltable member against movement, and operator controlled means for releasing said locking means.

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ANTON O. OECHSLE, *Primary Examiner.*

RICHARD C. PINKHAM, DELBERT B. LOWE, *Examiners.*

R. F. CUTTING, *Assistant Examiner.*