

June 24, 1941.

G. DEITZ

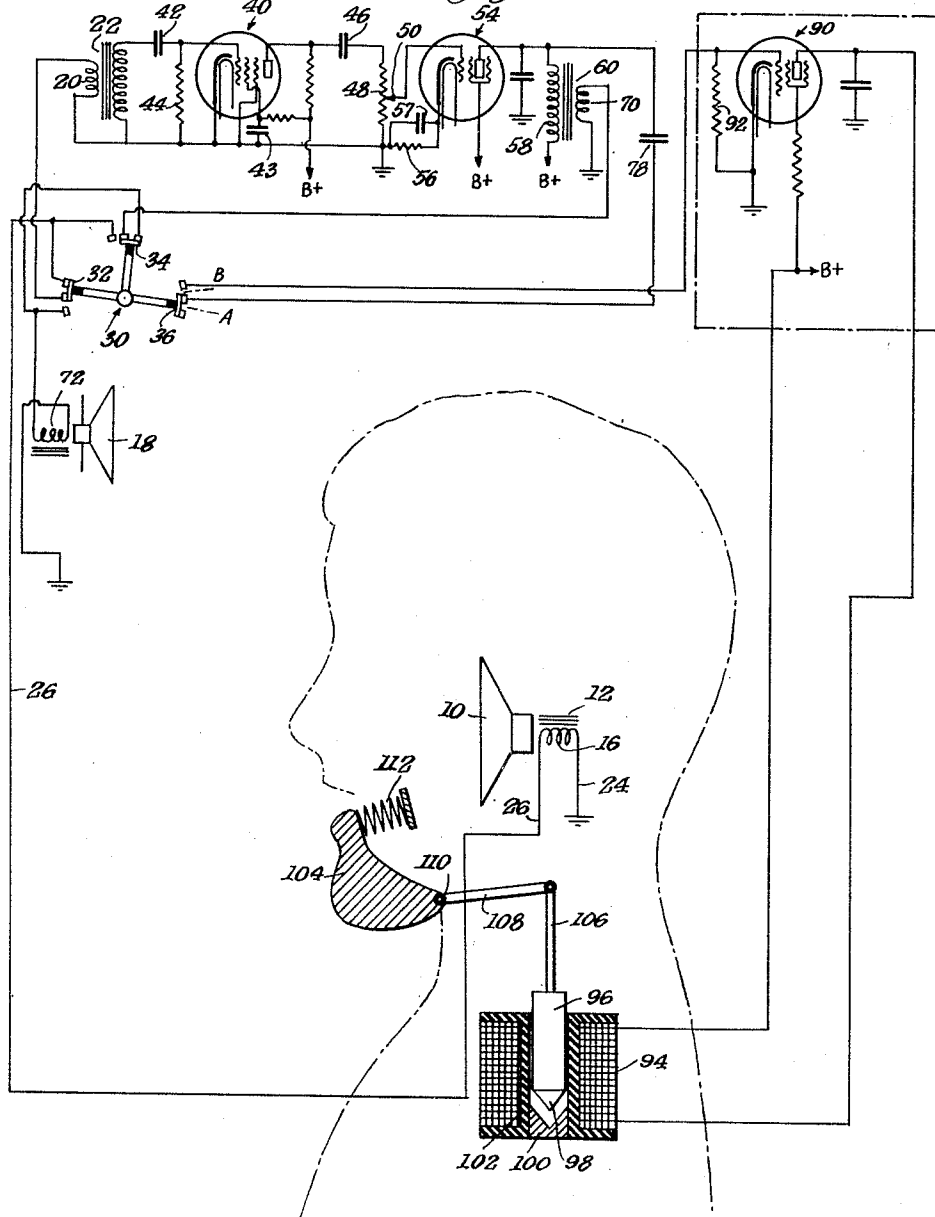
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TALKING DOLL AND ACTION DRIVEN CIRCUIT THEREFOR

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2 Sheets-Sheet 1

Fig. 1.



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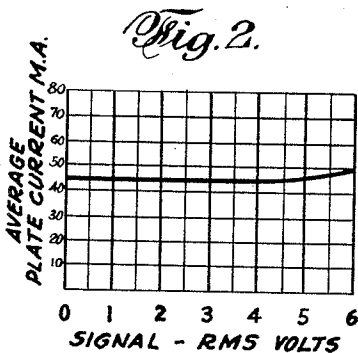
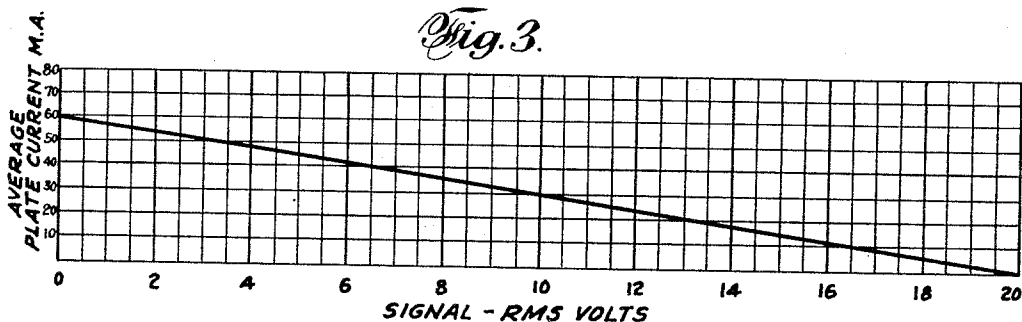
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TALKING DOLL AND ACTION DRIVEN CIRCUIT THEREFOR

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2 Sheets-Sheet 2



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TALKING DOLL AND ACTION DRIVEN
CIRCUIT THEREFORGeorge Deitz, Brooklyn, N. Y., assignor, by mesne
assignments, to Richard E. Beck, Chicago, Ill.

Application October 5, 1939, Serial No. 298,008

8 Claims. (Cl. 46—118)

The present invention relates to so-called living figures having a human, animal or grotesque shape, such as dolls, robots, etc.

The present invention contemplates the provision of such a figure (which for the sake of convenience will hereafter be called merely "doll") which is selectively capable of projecting audio waves transmitted to the doll from a remote point and of picking up audio waves in the vicinity of the doll and transmitting them to the aforementioned remote point. It is to be understood that by audio waves picked up at the remote point or in the vicinity of the doll it is intended to also include sounds originating from recordings, and electrical impulses corresponding to sounds such as are derived from photographic sound tracks and other types of recordings.

The present invention further contemplates the provision of means whereby some member of the doll, such as for instance the doll's jaw, may move in relation to the audio waves picked up at a remote point and subsequently projected by the doll, and the present invention contemplates the simulation of a living creature, by causing the doll to project sounds while simultaneously moving its jaw in definite relation to the sound projected.

The present invention further contemplates the provision of such a device which is comparatively simple to construct and operate, comparatively inexpensive in operation and construction, easy to repair, and not likely to get out of order easily.

Further objects and purposes of the present invention will become apparent from the following description and the drawings in connection therewith in which

Fig. 1 is a sketch of a doll showing the arrangement of a loud speaker and a jaw moving solenoid therein and the circuit for operating the above mentioned speaker and solenoid from a remote point.

Fig. 2 is a graph showing the normal operation of a power-amplifier tube in a standard circuit.

Fig. 3 is a graph showing the operation of the power-amplifier tube in the circuit used in the present invention to furnish the power for moving the doll's jaw.

As stated heretofore, the present invention contemplates the provision within a doll of means for projecting audio waves therefrom and means for picking up sounds within the vicinity of the doll by means located within the doll and

transmitting said sounds to a remote point. It is, of course, to be understood that these means may also be located outside the doll in proximity thereto.

While there are many different types of means for projecting sound which may be located within the doll, it is preferred that a dynamic speaker 10 having a permanent magnetic field maintained by a permanent magnet 12 be utilized. A movable coil 16 designed to oscillate in accordance with sound waves impinging thereon is inserted into the magnetic field. This construction is not new and is well known so that the exact functioning of this type of speaker will not be explained.

While it is possible to use a separate microphone and a separate speaker, it is preferred that the speaker 10 serve both functions since this simplifies the circuit and is more economical. When speaker 10 is used as a microphone, it will be readily apparent to anyone versed in this art that as the coil 16 oscillates because of sound waves impinging on the speaker 10, the coil cuts the lines of the permanent magnetic field set up by the permanent magnet 12 and an alternating current is induced in the coil 16 having a sinusoidal wave form. A similar type of speaker 18 may be located at a remote point, that is at any point outside of the doll, and may be connected through an amplifying circuit to the speaker 10.

While there are various methods of connecting the two speakers together and while there are very many different types of amplifying circuits that can be applied therebetween to amplify the signal, I prefer to utilize the method of connection and the type of amplifying circuit hereafter described.

When the speaker 10 is used as a microphone, that is for the purposes of picking up audible sounds within the vicinity of the doll, the sound picked up causes the coil 16 to vibrate setting up alternating currents therein. These currents are next transmitted to an audio amplifier for the purpose of building up said currents.

The coil 16 is connected to the primary 20 of an input step-up transformer 22 by grounding one side 24 of the coil 16 and by connecting the other side 26 to one pole of a switch 30, which switch 30 may be a rotary switch having three separate segments 32, 34 and 36 designed to move together, each of said segments connecting at one time two poles of the three poles with which said segment is designed to make contact.

It will be seen that when the rotary switch is

in the position illustrated, segment 32 will connect conductor 28 leading from the coil 16 to one end of the primary 20 of the step-up transformer 22. The other end of the primary is grounded as is the other end of the coil 16, thereby completing the circuit through the ground. With the switch in the position illustrated, which will be called position "A" hereafter, it will be seen that the current from coil 16 is impressed upon the primary 20 of the step-up transformer. The alternating current in the secondary of the input transformer 22 is impressed upon the grid of an amplifying tube 40 through a grid condenser of the proper capacity to correspond to that of the tube utilized. As two stages of amplification are used here, the first tube selected is preferably a "C" type amplifier (voltage amplifier) so that an amplified variation of the voltage will be impressed on the second tube. The voltage amplifier selected may be a pentode of the 6C6 type having an indirectly heated cathode and a controlled grid, a screen grid, a suppressor connected with the cathode, and a plate or anode. With this tube, it has been found that a grid condenser 42 having a capacity of .002 to .005 mfd. is preferable. A grid leak of fifteen megohms resistance is connected between the grid and the cathode circuit. The grid is negatively biased because of the high contact potential existing in high Mu tubes (tube 40 is a high Mu tube). The grid, being in the path of the electron stream, picks up a negative charge and is maintained at a constant negative potential. To prevent the tube from becoming blocked as a result of a powerful incoming voltage, the high resistance 44 of 15 megohms is provided to allow excessive charges to leak off.

The connections for the filament and cathode are not shown as they are standard and well known to those versed in the art. The plate of the tube 40 is connected to a source of positive potential (B+) through a resistance of .5 megohm. This may vary according to the tube and preferably should be 100 volts or more. The source of the supply is not shown as this too is well known in the art and may consist of either a battery or a rectifier operating on alternating current. The screen grid may be connected to the same source of supply through a .2 megohm resistance so as to have a relatively lower potential than the plate. A condenser 43 of .01 mfd. capacity or more may be connected between the cathode and the screen grid, this condenser serving to aid the passage of lower audio frequencies through the circuit. The plate of the tube 40 is connected through a .01 mfd. condenser 46 to one end of a potentiometer 48, the opposite end of which is connected to the cathode circuit, the variable arm 50 of the potentiometer being connected to the grid of the tube 54. By moving arm 50, the amount of amplification may be controlled.

The tube 54 is preferably an A-type tube (power amplifier) and delivers a heavy current output. For this purpose, I prefer to provide a pentode of the 25A7G variety. As stated before, the grid is connected through the potentiometer 48 and the cathode is connected to the cathode of the preceding tube through a 600 ohm resistance 56. The 5 mfd. condenser 57 is placed across this resistance to prevent feed back of the current into the first tube 40 which would cause degeneration.

The grid of tube 54 is kept at a negative potential. By means of the inter-electrode ca-

capacity (condenser-effect) between the grid and the cathode, the cathode which is positive, due to the plate current, induces a negative charge on the grid, which charge is maintained across the resistor 58. The screen grid of the tube 54 is connected to a suitable positive potential source. The plate of the tube 54 is connected with the primary 60 of a step-down output transformer 60, the other end of the primary being connected to the source of B supply. A small condenser 68 is connected between the plate and the ground to by-pass any parasitic high frequency oscillations that may occur in the plate circuit.

One end of the secondary 70 of the output transformer 60 is grounded. The other end is connected to the coil 72 of the speaker 18 through the switch 30. It will be seen that when the switch 30 is in position A that the segment 34 will connect the central pole thereof with the outer pole which is connected to one end of the coil 72. The other end of the coil 72 is grounded, thus making a complete circuit between coil 72 and the secondary 70 of the output transformer 60.

From the foregoing, it will be seen that when a signal is received by the speaker 18, it is transmitted to the switch 30 through the amplifier and the tubes 40 and 54 thereof to the speaker 18, thereby delivering an amplified sound at speaker 18.

The type of amplifier selected here is what may be generally described as a resistance coupled amplifier and such type of amplifiers are being used more frequently than heretofore because of the fact that it does not distort the signal and that it is relatively inexpensive to construct.

If it is desired that instead of the sound being picked up at 18 and projected through speaker 18 that instead the sound be picked up at speaker 18 and projected through speaker 10, the switch 30 is moved counter-clockwise so that the segments thereof only connect the central pole at each segment with the pole immediately counter-clockwise thereof, and not with the pole clockwise thereof. It will be seen that in this position, called position B, of the switch 30 that if any sound impinges on the speaker 18 and moves coil 16, the current in coil 16 will not be transmitted to the primary 20 of the input transformer 22 because the segment of the switch 30 will not complete the connection therebetween. Instead, if a sound impinges on the speaker 18 moving its coil 72, an alternating current will be set up in coil 72, one end of which is grounded and the other end of which passes through the switch 30 to one end of the primary 20. As stated heretofore, the other end of the primary 20 of the input transformer 22 is grounded. Therefore, there will be a complete circuit formed between the coil 72 of speaker 18 and the primary of the input transformer 20. It will be seen that this current will pass through the amplifier as hereinbefore described and will be impressed on the output transformer 60. It will be seen that as before one end of the output transformer 60 is grounded. The other end passes through the switch 30 through the segment 34 and then to the coil 16 of the speaker 10.

It will be seen, therefore, that by turning the switch sound can be transmitted from speaker 18 to speaker 10 or vice versa, whichever position of the switch is selected.

When sound is transmitted from speaker 18 to speaker 10 and the rotary switch is in position

B hereinbefore described, another result follows.

It will be seen that there is a direct connection through a .002 mfd. condenser 78 to the center pole of the portion of the switch on which the segment 36 operates. In position A, no connection is formed therethrough, but in the position B of the switch 30 the center pole is connected with the grid of a tube in another circuit.

This circuit, which will be called the "action driver circuit," is shown in Figure 1 within the area formed by the broken line. This action driver circuit is not conventional and, therefore, will be described in detail.

When the switch 30 is in position B, a portion of the plate current of tube 54 is impressed through condenser 78 on the grid of tube 90. As this action driver circuit is intended to move the jaw of the doll, it is desirable that it have a very heavy current output. Therefore, it is preferable that an A-type tube be used (power tube). For this purpose, I prefer to utilize a pentode of the type known as the 25L6 (Beam type tube). The cathode of the tube 90 is grounded. The grid and cathode of the tube 90 are connected through a one megohm resistance 92. It is important to note that there is no negative bias on the grid but that the cathode and grid are substantially at the same potential since they are connected together through a relatively low resistance. The screen grid of the tube 90 is connected through a three thousand ohm resistance to a positive potential source (B+).

The plate of the tube 90 is connected through a solenoid 94 to the B+ supply. Inside the solenoid, a plunger 96 is positioned which responds to the current in the solenoid as will be herein-after described. The plunger 96 has its innermost end 98 formed into a point to conform in shape to the plug 100 of the core 102 of the solenoid 94, the purpose of having the point 98 being to provide a relatively shorter gap between the plunger at its farthest position and the plug 100 of the core 102 thereadjacent so that less force will be necessary to move the plunger inward toward the solenoid.

The plunger 96 may be connected with the jaw 104 of the doll through a link 106 pivotally connected with an arm 108 which forms a lever with the jaw 104, said lever pivoted on the pivot 110. It will be seen that when the plunger is released by the solenoid, it will be moved upward by the action of compression spring 112 which forces the jaw downward around pivot 110 raising arm 108 and then the arm 106 and plunger 96. When sufficient current, however, passes through the solenoid 94, it will pull the plunger down against the resistance of the compression spring 112 and close the jaw of the doll. In short, when there is a sufficient amount of current in the solenoid to pull the plunger 96 down, the jaw of the doll will be closed and will only open when that current lessens sufficiently to allow the spring 112 to open the jaw.

The spring is so adjusted that when the current in the plate circuit of tube 90 is at its maximum the doll's jaws are closed.

A more detailed description of the operation of the "action driver circuit" will now be given. It is of the utmost importance to note that the tube 90 operates with no grid bias on the grid of that tube. This has an effect on the tube's operation which will now be explained. With no bias on the grid of the tube 90 and no signal incoming, the current in the plate circuit will

be at the tube's maximum since, as said before, there will be no negative grid bias to hinder the flow of electrons from the cathode to the plate. Normally, therefore, the current passing through the solenoid 94 will be at a maximum and will, therefore, pull the plunger 96 to its lowermost position, keeping the mouth of the doll closed.

When, however, a signal is impressed through the amplifying system onto the grid 90 of the tube, a different result occurs.

Any further positive impulses impressed on the grid of the tube would have little or no effect as the tube is already operating at its maximum plate current and making the grid positive would not materially change the plate current. On the other hand, making the grid negative would have a material effect on the plate current because it would retard the flow of electrons from the cathode to the plate and would, therefore, lower the current in the plate circuit of the tube 90. The current in the coil of the solenoid 94 would then be lessened and the pull on the plunger would also be lessened so that the spring 112 would open the jaws of the doll as it pulls the plunger upward.

It is important at this point to note to what current variations the plunger 96 will respond. Because of its inertia, it will not move in synchronism with the audio frequency vibrations of the electric current. Therefore, if the current in the solenoid consisted of audio frequency vibrations about a fixed average current the jaw of the doll would not respond at all, as the jaw would move too slowly to respond to the audio frequency vibrations and, if the average current was fixed and stationary, the jaw of the doll would be stationary, too.

Even if it were feasible to make the jaw vibrate at audio frequency, it would not be desirable as the eye could not follow the movement. A much slower movement of the jaw is sought.

The present invention takes advantage of the fact that the amplitude changes of speech vary much more slowly than do the crests and troughs of sound vibration. The jaw of the doll is made to vary with the variation of the amplitude of sound, that is with the sound envelope, not with the variation of each individual vibration of sound. This is accomplished by causing the plate current of the tube 90 to vary with the effective voltage impressed on its grid.

The foregoing will be more readily understood from an examination of Figs. 2 and 3. Fig. 2 shows the relation of the average current in the plate circuit to the effective voltage of the impressed signal on the grid of the tube.

Fig. 2 shows the relation between the RMS signal volts impressed on the grid and the average plate current output when the grid of the tube is biased (in this particular type of tube to eight volts negative), the almost horizontal line on Fig. 2 across the graph representing the average current in the plate. While with an incoming signal varying at audio frequency the plate current rises and falls above and below the level of the line shown in Fig. 2, the average of the peaks and troughs is that indicated by the substantially horizontal line of Fig. 2. Since, as stated hereinbefore, the plunger of the solenoid could not rise and fall with the crests and troughs of the audio frequency cycle, it would follow the average plate current and would, therefore, remain absolutely stationary. When the tube is used along the line shown in Fig. 2,

it operates as an ordinary audio amplifier because the audio frequency crests and troughs of the input signal are reproduced in amplified form in the plate circuit along the line of Fig. 2 and the crests and troughs are equally amplified so that there is no distortion of the impressed signal. As explained, however, such non-distortional amplification would have no effect upon the jaw moving mechanism described herein which responds only to changes in the average plate current. It, therefore, becomes necessary that the tube be operated along the characteristics which would cause distortion of the signal so that there would not be a uniform average current in the plate circuit but that the average plate current in the circuit would vary, and it is preferred to make the plate current vary in the plate circuit inversely as the signal RMS volts increase.

It is found that the tube 90 when operated without any grid bias produces a plate current of sixty milliamperes when no signal is incoming. When a signal fluctuating at audio frequencies is impressed on the grid of this tube, it is found that the plate current falls off in exact proportion as the signal RMS voltage increases. That characteristic of the present circuit has been shown in Fig. 3 and it will be noted that, when the signal RMS voltage is 20, there is an almost complete stoppage of plate current. The explanation of the falling line illustrated in Fig. 3 is that the positive portion of the incoming signal sinusoidal wave has little effect upon the plate current as the plate current is already at a maximum and the tube will not, because of its characteristics, give a greater plate current even if the grid is made more positive. On the other hand, the negative portion of the sinusoidal wave of the incoming signal causes a proportionately amplified drop of the current in the plate circuit. It will be seen, therefore, that only the negative portion of the sinusoidal wave is amplified, therefore, as the signal RMS voltage increases the plate current will decrease proportionately.

As explained in connection with Fig. 3, the action driver circuit herein described which has no negative bias on the grid will respond to an incoming audio frequency signal in two distinct ways. One aspect of the current in the plate circuit will be an audio frequency fluctuation therein corresponding in distorted fashion to the audio frequency vibrations of the signal. The other phase of the current in the plate circuit will be the fluctuation of the average plate current in accordance with the fluctuation of the signal RMS voltage impressed on the grid of tube 90.

It is to be noted that when an audible sound operates the coils of either of the speakers that a sinusoidal current wave is set up in said coil. This sinusoidal wave has two components, one consisting of current changes from a positive peak to a negative peak at audio frequency and conforming to the pitch of the voice, and another component which might be called the amplitude envelope and corresponding with the changes in amplitude of the sound impressed which changes are below audio in the frequency of their occurrence. It is to this latter amplitude envelope that the jaw of the doll will respond and it is to this phase of plate current variation expressed in the variation of the average plate current to which the plunger 96 will respond synchronously. It will thus be seen that

changes in the amplitude of the voice speaking into speaker 18 will cause corresponding changes in the position of the jaw 104 of the doll. This change will be in proportion to the amplitude of the impressed sound reaching speaker 18.

If greater power is desired than that given by the tube 90, a saturable reactor may be connected in the plate circuit of the tube 90.

By the use of a saturable reactor, a large amplification in the current output is produced several times as large as that passing through the plate current circuit of the tube. As such saturable reactors are well known, they will not be described here.

From the foregoing description, it will be seen that a device of the general character described has been provided by which the illusion of a doll speaking may be created and by which a doll can be made to appear both to speak and to listen. This device might be used for advertising purposes and might be controlled by a person concealed at some remote position from the doll so that when anyone speaks to the doll the listener at a remote point might reply and the reply seem to emanate from the doll itself.

It will further be seen that the doll's jaw only operates when the doll appears to be speaking, not when the doll appears to be listening.

While I have described an embodiment of the present invention in specific detail, I do not intend to be limited to the specific details herein set forth, but intend that the scope of the present invention be determined by the claims for it is to be understood that the various values of potential, capacity and resistances used herein and the specific circuits used may be varied in accordance with the specific characteristics of the tubes, solenoids, etc., used without departing from the principle of the present invention. These values may also be varied to determine the tonal qualities of the reproduced sound.

I claim:

1. A doll having a movable part, selective means for transmitting electrical impulses corresponding to audio waves from a distant point to said doll or for transmitting electrical impulses corresponding to audio waves, originating near the doll, to said distant point and means for moving said movable part in synchronism with the amplitudes of said impulses transmitted from the distant point to said doll, said means including a thermionic relay circuit, the current impressed on the plate circuit of which is normally maintained substantially at a maximum.

2. A doll having a movable part, selective means for transmitting electrical impulses corresponding to audio waves from a distant point to said doll, and means for moving said movable part in synchronism with the amplitudes of the impulses, said means including a thermionic relay circuit, the current impressed on the plate circuit of which is normally maintained substantially at a maximum.

3. A doll having a movable part, selective means for transmitting electrical impulses corresponding to audio waves from a distant point to said doll, and means for moving said movable part in synchronism with the amplitudes of the impulses including a thermionic relay having a grid electrode normally at ground potential.

4. A doll having a movable part, means for transmitting electrical impulses corresponding to audio waves from a distant point to said doll and means for moving said movable part in synchronism with the amplitudes of the impulses, in-

cluding a thermionic relay having a grid electrode which is grounded.

5. A doll having a movable part, means for transmitting electrical impulses corresponding to audio waves from a distant point to said doll, 5 and means for moving said movable part in synchronism with the amplitude of the impulses, including a thermionic relay circuit whose plate current is normally at a maximum whereby the average plate current is inverse to the impressed 10 effective voltage on the grid electrode within the operating range of the thermionic relay.

6. A doll having a movable part, means for transmitting electrical impulses corresponding to audio waves from a distant point to said doll, 15 and means for moving said movable part in synchronism with the amplitudes of the impulses, including a thermionic relay circuit having an unbiased grid.

7. A doll having a movable part, means for transmitting electrical impulses corresponding to audio waves from a distant point to said doll, and means for moving said movable part in synchronism with the amplitudes of the impulses, including a thermionic relay circuit having an unbiased grid, whose average plate current is inverse to the effective voltage on the grid electrode within the operating range of the thermionic relay.

8. A doll having a movable part, selective means for transmitting electrical impulses corresponding to audio waves from a distant point to said doll and means for moving said movable 15 part in synchronism with the amplitudes of the said impulses including a grid electrode and a cathode normally maintained at the same potential.

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