

2,921,385

3 Sheets-Sheet 1



FIG 1

Jan. 19, 1960

S. HAMILTON

2,921,385

REMOTE QUESTION-ANSWER APPARATUS

Filed April 25, 1955

3 Sheets-Sheet 2

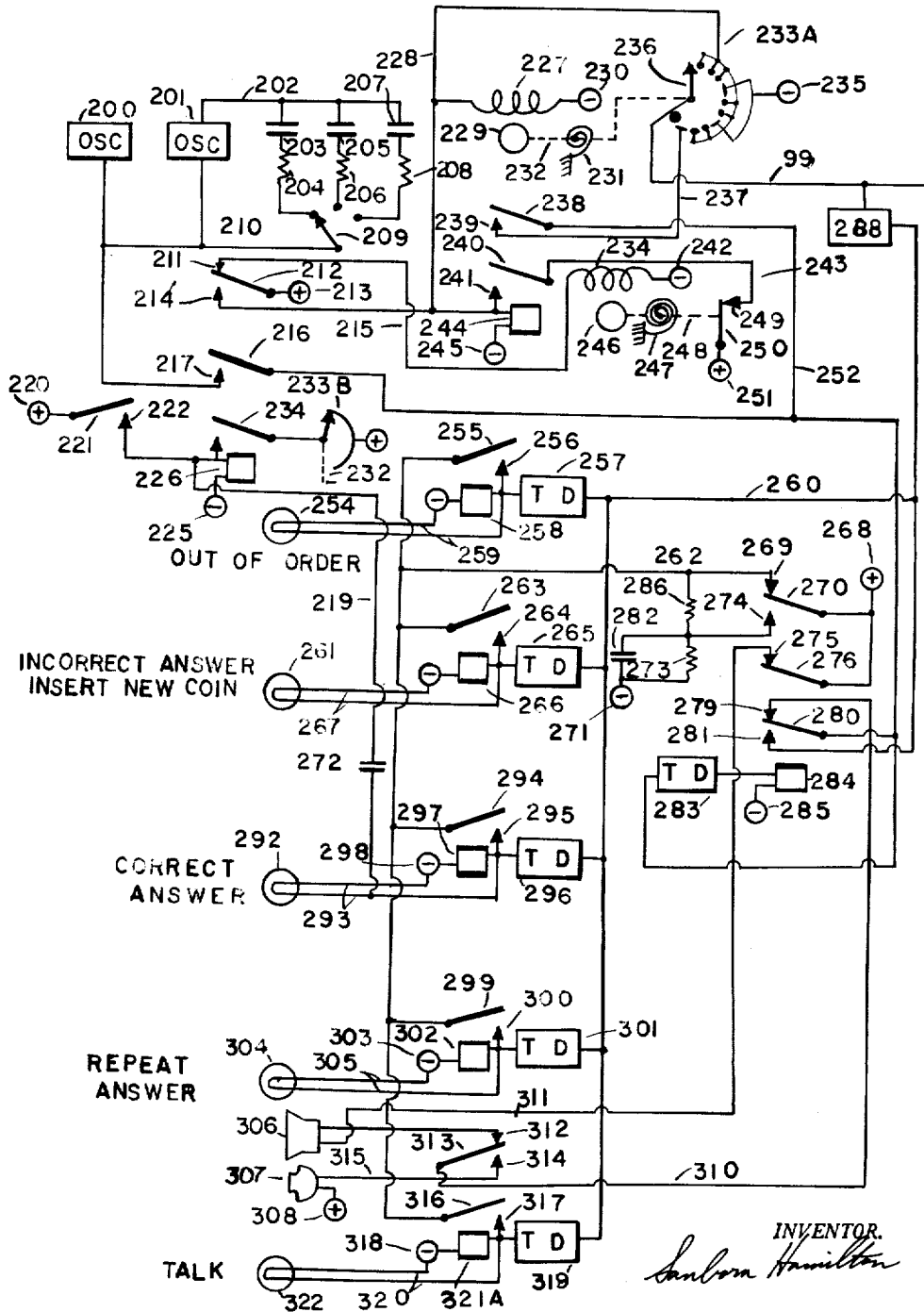


FIG. 2

Jan. 19, 1960

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REMOTE QUESTION-ANSWER APPARATUS

Filed April 25, 1955

3 Sheets-Sheet 3

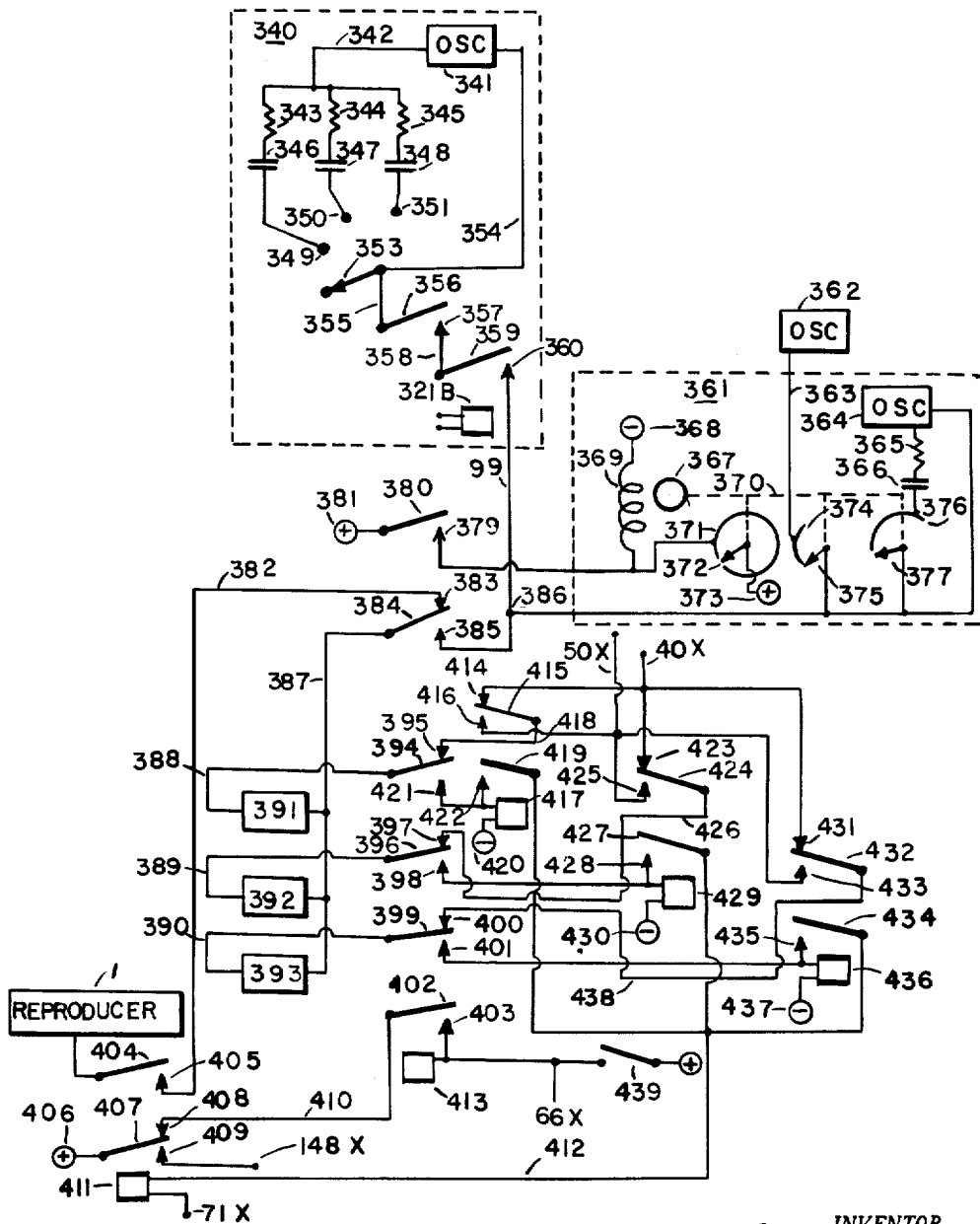


FIG. 3

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2,921,385

REMOTE QUESTION-ANSWER APPARATUS

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Application April 25, 1955, Serial No. 503,434

12 Claims. (Cl. 35—9)

This invention relates to question-answer amusement devices and particularly to remote information and control systems for supervising the player's operation of such device.

One object of this invention is to provide an automatic question-answer amusement system between a main station and the player's substation.

Another object of this invention is to provide operable means for monitoring answers for intellectual evaluation of the player's verbal response.

Another object of this invention is to provide means for telephone connection, disconnection, and communication between a question-answer amusement substation and main station.

Other objects will in part be obvious and will in part be explained hereinafter.

In my application Serial No. 243,118, filed August 22, 1951, now Patent No. 2,826,828, for variable difficulty skill devices, I described a quiz device which contained a roll of paper printed with questions and multiple choice answers. The expense for each of these devices is high since each must be equipped with this paper roll and because each device contained control and computing equipment for automatic control of the device. The system described herein is considered to be an improvement over the means of presenting information described in application Serial Number 243,118. One main station can provide information for a plurality of substations and equipment need not be so extensive at the substation. Also means can be provided for transmitting verbal answers by the player and these answers monitored by an operator for intellectual value thereby providing greater flexibility of expression by the player.

The preferred form of this invention comprises a main station having a tape recorder which transmits questions by telephone line to a substation. The player is located at the substation and by his operation of the device causes the main station to operate automatically and determine the accuracy of his answer. The tape has also tone information for indicating category of recorded speech information and this tone information causes various control circuits to operate thereby maintaining proper selection of information to be transmitted and sustaining automatic control and selection of sequence of events.

A clearer conception of the operation, construction, and further objects of this invention may be had from the following specification when read in the light of the accompanying drawings, in which:

Figure 1 is a schematic of the main station used in conjunction with manual analysis of answers.

Figure 2 is a schematic of the substation.

Figure 3 is a schematic showing the connections to be made for multiple choice answer selection thereby eliminating need for an operator at the main station.

In the apparatus to be described a direct current power source is used for operating relays, speakers, lights, mo-

tors, and microphone. This power source is expressed as a positive symbol and the power return is expressed as a minus symbol. Most power supply terminals have reference numbers. For example in Figure 1 the following terminals are connected to the power source: 42, 51, 56, 70, 74, 136, 142, 145, and 161. In Figure 1 the following terminals are connected to the power return: 7, 9, 13, 20, 26, 38, 55, 62, 84, 93, 95, 97, 102, 112, 126, 130, 138, and 150. In Figure 2 the following terminals are connected to the power source: 213, 220, 251, 268, and 308 and the following terminals are connected to the power return: 225, 235, 242, 245, 271, 285, 298, and 318. In Figure 3 the following terminals are connected to the power source: 373, 381, and 406, and the following terminals are connected to the power return: 368, 420, 430, and 437.

In Figure 1 is shown circuitry at the main station for selecting questions of a selected subject category, difficulty category, and maintaining operations automatic with exception of determination of correctness of answers received, for requesting answer to be repeated, and resetting the substation. Reproducer 1 contains a tape recording and pickup which releases on lead 2 sequential audio signals containing questions in speech form, answers in speech form when operating by verbal answer analysis or answers in tone form when operating in multiple choice tone answer analysis, tone signals signifying subject category of adjacent questions, tone signals signifying difficulty category of adjacent questions, and tone signals signifying beginning and ends of question and answers. Amplifier 3 drives speaker 5 via lead 4 and the amplifier also causes current to flow through light 8 to power return 9. Light 8 goes on whenever a signal appears on lead 2 for indicating source of sound as different or the same as appearing on line 99. Power return point 7 is connected via lead 6 for operation of speaker 5. Input of amplifier 98 is connected to line 99 which interconnects the main station with the substation. Speaker 96 is connected to the output of amplifier 98 and also to power return point 97. Light 94 connects with amplifier 98 for indicating when line 99 carries a signal and is also connected to power return point 95. When the substation is placed in operation for starting a question-answer series then line 99 is momentarily energized with a Start tone which will pass through the filter network of tone discriminator 100 and a positive D.C. signal appears on the output for energizing relay 101. Each tone discriminator in this system functions to provide a positive D.C. signal in response to a tone of the frequency which its filter accepts without attenuation. This can be easily accomplished with use of pi network, tone rectifier, tube, and plate relay. Relay 101 closes momentarily in response to the substation Start tone at which time one of the subject relays 111 or 125 will become energized and will remain closed by a holding current. At the same time that the Start tone is transmitted by the substation there is also a Subject Choice tone which causes a positive D.C. signal to appear on either lead 103 or 129, and since relay 101 is energized at the same time thus one of the subject relays 111 or 125 will close. Tone discriminators 107 and 113 determine the choice of Subject Choice tone for acceptance from the substation and also monitor the Subject Classification tones originating from the reproducer. More than two subjects can be obtained by additional tone discriminators and relays operating on similar principles. When relay 101 is energized relay arm 105 is in contact with 104 for allowing tone discriminators 107 and 113 to monitor Subject Choice tones, arm 108 is in contact with 109 for energizing subject relay 111 and arm 117 is in contact with 118 for energizing subject relay 125. Also arm 143 is in contact with 144 for

energizing start sequence relay 139. When relay 101 closes, momentary start sequence relay closes and remains closed by the holding current flowing from lead 137 through arm 140 and contact 141 until the end of a question occurs. When relay 139 is energized the reproducer motor 149 is energized via lead 148 causing reproduction of recorded information. After the reproducer motor starts rotation relay 101 de-energizes because the Start tone is only momentary and then tone discriminators 107 and 113 monitor Subject Classification tones via arm 105, contact 106 and lead 10. When a Subject Classification tone appears on lead 151 a positive D.C. signal appears on either lead 120 or 127 and relay 80 will become energized if the subject classification is the same as the subject chosen by the substation operator. If arm 128 or 122 is in contact with 114 or 121, and if a positive signal should thus appear through one of these arms then relay 80 has a positive potential applied to one side for indicating that the succeeding question has the same subject category as that chosen by the substation operator. Leads 127 and 120 allow flow of the subject classification signal to pass through its respective subject choice relay when similarity occurs.

Each question may be classified with respect to difficulty. Tone discriminators 11, 18, and 24 monitor reproducer signals on lead 10. The Difficulty Classification tone precedes the Subject Classification tone for each question in the arrangement presented herein. As the Difficulty Classification tones appear on lead 10 the tone discriminators 11, 18, and 24 filter these tones and either relay 12, 19, or 25 energize momentarily. Relay 73 becomes energized when the difficulty category of the question is acceptable as determined by position of wiper 37 with respect to commutators 29, 30, and 31. Wiper 37 is connected with a power return 38 for energizing either lead 28, 15, or 45, depending on the position of wiper 37 with respect to the commutators. If relay 12, 19, or 25 should become energized and if either one of arms 14, 21, or 23 close at the same time that a power return appears on lead 15, 28, or 45, then a power return will appear on line 17 via contacts 16, 22, or 27 and relay 73 will then energize. Relay 73 remains energized via holding contact 75, arm 72, lead 67, contact 63, and arm 64 to its respective power return. This holding current exists until the end of the question at which time relay 83 energizes and lead 67 has its power return removed. If the difficulty category is the same as the required difficulty then relay 73 energizes and the power return remains on lead 17 due to the holding action of relay 73 and if the subject classification is the same as the subject chosen then relay 80 will close and remain closed by the holding action of arm 78 and contact 79. When relay 80 remains closed by this required selection of subject and difficulty then the reproducer is connected to line 99 for transmission of the question. This connection is made via lead 10, arm 77, contact 76 to line 99.

Variable difficulty is maintained for sustaining the difficulty of questions at a ratio of difficulty with respect to the substation operator's intelligence. As substation operators change, the accuracy of answer selection will vary depending upon the intelligence of each operator. As the accuracy of answers changes the frequency of repetition of simple, average, difficult questions will change for sustaining approximately a predetermined ratio of inaccurate and accurate answers. In my application Ser. No. 243,118, filed August 22, 1951, for variable difficulty devices I show a ratio discriminator for rotating a wiper through a first angle for each impulse representing a correct answer and also was shown rotation of commutators through a second angle for each impulse representing an incorrect answer. Rotation of the wiper and commutators is in the same rotary direction but the magnitude of first and second angles differs depending upon the ratio desired. Counter 35 provides rotation of wiper 37 through a specific predetermined angle for each cor-

rect answer. In this first method of determining accuracy of answers by monitoring speech replies from the substation, an operator is located at the main station for analyzing these replies. If the answer is correct then the main station operator presses switch 43 causing a flow of current from power source 42, through arm 43, contact 44, lead 50, to counter 35 and rotary mechanical linkage 34 moves wiper 37. If the answer is incorrect the main station operator presses switch 57 causing a flow of current from power source 56, through arm 57, contact 58, lead 40, to counter 36 and rotary mechanical linkage 33 rotates commutators 29, 30, and 31. The position of wiper 37 provides a power return to commutators 29, 30, and 31 for effecting the difficulty selection of the succeeding question and in effect causes servo control for returning or sustaining the desired ratio. The desired ratio may be adjusted by changing the magnitude of first angle with respect to magnitude of second angle. In my previous application different size ratchet gears were used for obtaining a difference between these angles of rotation. Commutators 29, 30, and 31 are mounted on a common disk which rotates in response to movement of mechanical linkage 33. Stops 32 are located on this disk for preventing movement of wiper 37 from commutator 29 to commutator 32 without first moving through commutator 30.

After the correct subject and difficulty classification has been selected for transmission, relay 80 remains energized for allowing this transmission to the substation until the end of the question at which time the power return on lead 67 is removed and the holding current through arm 72 and contact 75 ceases. At the end of each question there is provided a tone for signifying the end of the question. Tone discriminator 82 detects this tone and relay 83 becomes momentarily energized and current ceases to flow from arm 64, to contact 63, through lead 67, through arm 72, contact 75 to lead 17. When lead 17 is not energized then relays 73 and 80 de-energize. Therefore when the End of Question tone occurs relay 80 de-energizes and transmission of reproducer information to the substation ceases. Also relay 73 becomes de-energized to be reset depending upon the succeeding difficulty classification of the next question. When lead 67 becomes de-energized by the action of relay 83 the holding current for relay 139 is removed and reproduction ceases. The substation operator then replies to the question received and his reply is heard from speaker 96. The mainstation operator then presses switch 146 causing current to flow from power source 145, through arm 146, to contact 147, lead 148 and relay 139 then becomes energized again. Relay 83 is now in the de-energized position and a holding current keeps relay 139 closed for sustained rotation of motor 149. Speaker 5 provides the correct answer to the reply received, the mainstation operator compares answers and then presses either the correct answer switch 43 or the incorrect answer switch 57. When switch 43 is closed relay 41 energizes. When switch 57 is closed relay 52 energizes. If either relay 41 or relay 52 should close then the holding current through arm 47, through contact 46, through lead 48, through contact 54, through arm 53 to lead 71 will cease and relays 111 and 125 will become de-energized. Relays 111 and 125 have arms 115 and 123 which connect to lead 71 for holding their respective relays until the mainstation operator has graded the substation operator's answer. When the holding current on lead 71 is removed momentarily the question-answer sequence has been completed and relays 111 and 125 have to be reset for allowing the succeeding subject selection.

At the end of the answer provided by the reproducer there is a End of Question Answer tone which is detected by tone discriminator 89 causing relay 92 to become momentarily energized thus deenergizing relay 139 and causing reproducer motor 149 to stop rotation. Relay 131 provides holding action for relay 139 until a

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question has been located of the required subject and difficulty. Arm 134 makes contact with 135 when reproducer is making a search for questions and a power source 136 is applied through arm 140 to reproducer motor 149 for maintaining rotation of the motor independent of operation of relays 83 and 92 until a question is located. When a question of the required subject and difficulty classification has been found relay 80 energizes and arm 81 causes relay 131 to energize thereby causing relay 139 to become responsive to End of Question and End of Question Answer tones for stopping the motor. Relay 131 remains energized until an End of Question Answer tone occurs at which time relay 92 energizes and the holding current through lead 137 is removed and relay 139 de-energizes. When relay 92 energizes: the holding current through lead 91, arm 133, and contact 132 is removed and relay 131 de-energizes. Relay 131 has a slow release of a fraction of a second for allowing relay 139 to de-energize before holding potential is applied via arm 134 and contact 135.

Several kinds of information are desirable for transmission from the mainstation to the substation in addition to speech information. Means are desirable to connect by telephone the mainstation to the substation for placing the substation In Order and Out of Order depending principally on the presence of an operator at the mainstation. If the substation is operated by coin insertion and if there is no mainstation operator present the system would not be operative in this speech answer analysis method and the coin would be wasted. Dial telephone equipment 152 is connected to line 99 for providing means to connect the mainstation to the substation. Tone generators 153, 154, 155, 156, and 157 provide tones of different frequencies for actuating tone discriminators at the substation to indicate to the substation operator the accuracy of answers, availability of the substation for operation, and requests for repeating answers. When an incorrect answer occurs lead 40 is energized and actuates tone generator 153 for sending a tone to the substation via line 99 for indicating this incorrect answer. When a correct answer occurs lead 50 is energized and actuates tone generator 154 for sending a tone to the substation via line 99 to indicate this correct answer. If the mainstation is to be made inoperative its operator may dial the substation and then press the Out of Order switch 158 and tone generator 155 is then energized and a tone is sent to the substation to indicate this availability status. If the mainstation operator did not hear clearly the answer received from the substation he may press switch 159 which causes tone generator 156 to send a signal to the substation for requesting the substation operator to repeat the answer. When it is desirable to place the substation back into commission the substation is dialed by telephone dial equipment 152 and the reset switch 160 is pressed and a signal is then sent by tone generator 157 for erasing the Out of Order indication at the substation. In Figure 3 is shown a more detailed example of a tone generator. Tone generator 361 provides a tone for indicating to the substation the interval at which the substation operator should give his answer. When the End of Question relay 83 energizes current then flows through arm 64, contact 65, through lead 66 to relay 413. Arm 380 of relay 413 then makes contact with 379, current then flows through motor field 369 and motor 367 starts to rotate causing wipers 372 and 377 to move in response to rotation of mechanical linkage 370. Arm 380 closes only momentarily but motor 367 continues to rotate from power originating from power source 373, through wiper 372, to commutator 371. Motor 367 continues rotation until wiper 372 moves through 355 degrees of commutator circumference. From 355 degrees to 360 degrees of circumference to the commutator is open and motor field 369 becomes de-energized until the next actuation of arm 380. Oscillator 362 provides a

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tone of frequency required for resetting the substation. As motor 367 starts rotation wiper 375 makes contact with commutator 374. Then the Reset tone from oscillator 362 is connected to line 99 due to continuity between lead 363, commutator 374, and wiper 375. The substation resets in response to this Reset tone and then wiper 377 moves in such position with commutator 376 for sending a Talk tone to the substation. This Talk tone is generated by oscillator 364 whose frequency is dependent on the values of resistance 365 and capacitor 366. Oscillator 364 may be used with the other tone generators 153, 154, 155, 156, and 157 with different values of RC for introducing a different tone when each generator is operated. The Reset tone is transmitted first and then the Talk tone is transmitted as determined by the position of commutators 374 and 376 with respect to zero time reference. The other tone generators perform in the same manner. First a reset tone is sent and then a tone is sent for indicating information to the substation operator. Tone generator 157 just provides a tone from oscillator 364 for resetting the substation.

Figure 2 shows the circuitry involving the substation. Line 99 provides a telephone connection to the mainstation. When the substation operator wishes to place his station in operation a coin is inserted and switch 221 arm closes, then current flows from power source 220 through arm 221, contact 222 through line 219 to energize relay 226. When relay 226 becomes energized arm 216 makes contact with 217 then a Start tone and Subject Selection tone are connected with lead 252. Also arm 212 makes contact with 214 causing a flow of current from power source 213 to lead 228 thereby energizing relay 244. When lead 228 is first energized motor field 227 becomes energized causing motor 229 to rotate moving wiper 236 via mechanical linkage 232. Wiper 236 moves across commutator contacts 233A for causing impulses on line 99 for dialing the mainstation. The commutator contacts 233A are connected to the power source from lead 228 and power return 235 for providing impulses in correspondence with the mainstation telephone number. The telephone station selection equipment is not shown herein but may be considered to be typical of that used in most cities. It is generally assumed that this telephone station selection equipment is associated with line 99 between the substation and mainstation. After the mainstation has been dialed lead 228 remains energized for a period of time regardless of immediate use of the substation and the connection to the mainstation is maintained through this period. Lead 228 remains energized due to holding action of relay 244 and its arm 240 and contact 241. When the substation is not used relay 226 remains de-energized and current flows from power source 213 through arm 212, contact 211, through lead 215, through motor winding 234 to power return 242 and timer motor 246 rotates. Timer motor mechanical linkage 248 causes arm 250 and contact 249 to open after an elapsed time that lead 215 remains energized. This elapsed time may be selected for five minutes, and if relay 226 should become energized at anytime within these five minutes then motor winding 234 is de-energized and spring 247 causes mechanical linkage 248 to move back to its zero time position. If the time limit has been reached then current ceases to flow from power source 251 through arm 250, contact 249, through lead 243, arm 240 and contact 241 and then relay 244 de-energizes, lead 228 becomes de-energized and since motor winding 227 becomes de-energized spring 231 causes wiper 236 to return to the starting position and disconnects the substation from the mainstation. After the mainstation is dialed wiper 236 reaches its limit and makes contact with the commutator section connected with lead 237, and in combination with arm 238, contact 239 and lead 252 the substation information receive and talk circuits are connected to the main-

station. Commutator 233B provides a holding current through arm 234 for relay 226. The wiper in contact with commutator 233B is positioned for providing holding current for relay 226 until the dial sequence is completed. Relay 226 is a slow release type which allows the Start and Subject Selection tone to be connected momentarily through arm 216 to line 99 when the dial sequence is completed.

The substation Start tone is produced by oscillator 200 and the Subject Selection tone is produced by oscillator 201. The frequency of Subject Selection tone is determined by the RC value selected by switch 209. Capacitors 203, 205, and 207 in combination with resistors 204, 206, and 208 are for obtaining a predetermined tone from RC oscillator 201 in correspondence with selection frequency of tone discriminators 107 and 113 located at the mainstation. Leads 210 and 202 connect with oscillator 201 for completing the RC loop for causing the oscillator to produce the tone selected by switch 209. As previously explained with respect to tone generators 153, 154, 155, 156, and 157, there is a Reset tone produced by oscillator 362. This Reset tone is detected by tone discriminator 283 causing relay 284 to energize. Relay 284 is a slow release relay of several seconds. When relay 284 becomes energized arm 270 becomes disconnected from contact 269 and the holding current is momentarily removed from line 262 allowing relays 258, 266, 297, 302, and 321 to reset. At almost the same time as the Reset tone occurs, any one of several other tones may occur for causing relay 258, 266, 297, 302, or 321 to energize. When arm 270 moves to contact 274, lead 262 is de-energized only momentarily for allowing resetting of these relays but a holding current is then restored through contact 274 after capacitor 282 charges. Resistors 286 and 273 are determined for providing a momentary drop in voltage on lead 262 as arm 270 moves to contact 274 and for providing, after an interval of a second, approximately the same potential as had existed previously. Resistor 286 is also determined to have appreciably less resistance than resistance of coils of the relays to be reset for allowing capacitor 282 to hold any relay closed momentarily as arm 270 returns to contact 269. When the Reset tone occurs arm 280 makes contact with 281 and lead 260 is then provided with diversified information tones to tone discriminators 257, 265, 296, 301, and 319. If the mainstation operator wishes to place the substation out of order and if no connection is already existing between the substation and mainstation then the mainstation operator dials the substation and telephone equipment 288 is actuated momentarily closing a connection between line 99 and lead 260. The mainstation operator then presses switch 158 and Reset and Out of Order tones are sent to tone discriminators 283 and 257 for resetting previous indicated information and for actuating relay 258 thus energizing leads 259 causing light 254 to indicate. Five lights 254, 261, 292, 304, and 322 are located at the substation and are labeled for indicating status of equipment and procedure of operation. Light 254 is labeled: Out of Order. Light 261 is labeled: Incorrect Answer—Insert New Coin. Light 292 is labeled: Correct Answer. Light 304 is labeled: Repeat Answer. Light 322 is labeled: Talk.

Tone discriminator 265 detects the Incorrect Answer tone when received causing relay 266 to energize and current to flow through leads 267 for lighting light 261 for an incorrect answer indication. Relay 266 provides a continuation of current flow through leads 267 by the holding action of arm 263 and contact 264 for sustaining the incorrect answer indication until the reset action involving the next information is received. Tone discriminator 296 detects the Correct Answer tone when received causing relay 297 to energize and current to flow through leads 293 for lighting light 292 for a correct answer indication. Relay 297 provides a continuation

of current flow through leads 293 for sustaining the correct answer indication until the reset action involving the next information received. Also when a correct answer occurs capacitor 272 charges and lead 219 becomes momentarily energized causing relay 226 to actuate for sending a Start tone and Subject Selection tone for beginning a new question answer sequence. Tone discriminator 301 detects the Repeat Answer tone when received causing relay 302 to energize and current to flow through leads 305 for lighting light 304 for a repeat answer indication. Relay 302 provides a continuation of current flow through leads 305 for sustaining the repeat answer indication until the reset action involving the next information is received. Tone discriminator 319 detects the Talk tone when received causing relay 321 to energize and current to flow through leads 320 for lighting light 322 for a talk indication. Relay 321 provides a continuation of current flow through leads 320 by the holding action of arm 316 and contact 317 for sustaining the talk indication until the reset action involving the next information is received. Relay 321 also controls microphone 307 and speaker 306 by the position of arm 313. Microphone 307 is connected by lead 315 to contact 314 for allowing speech transmission only when relay 321 is energized at which time arm 313 makes contact with 314 and the speech signal flows along lead 310, contact 279, arm 280, lead 252 and thence to line 99. Speaker 306 is also controlled by relay 321 for cutting off the speaker when in the talk period. The power source for speaker 306 is controlled by relay 284 for cutting the speaker off when information tones are being received. Although relay 284 responds only to the Reset tone, this relay has a slow release of several seconds and therefore cuts out speaker 306 during most of this information tone period.

From the previous description of the mainstation operator answer analysis method a simpler description of sequence of operations may be expressed as follows: when the substation operator first starts operation of his station he places the subject selection switch 209 at the desired position depending on his subject choice. A coin is then placed into his device, relay 226 becomes energized, the mainstation is dialed automatically, tone discriminator 100 detects the Start tone and relay 101 becomes energized and reproducer motor starts rotation. At the same time the Subject Selection tone is detected by one of the subject tone discriminators 107 or 113 and the mainstation memorizes the subject selection by action of holding relays 111 or 125. The mainstation has previously determined the difficulty classification required for succeeding questions as the result of the ratio of incorrect and correct answers of past questions. As the reproducer motor rotates various speech and tone information is reproduced, the tone information is monitored by tone discriminators and when this tone information matches the required selection with regard to difficulty then relay 73 energizes and if the tone information for the same question matches the required subject selection then relay 80 energizes and remains closed by the holding influence of relay 73. When relay 80 is held energized by relay 73 the reproducer is connected to line 99 for transmission of the question to the substation. At the end of the question, relay 83 energizes by an End of Question tone and causes relays 73 and 80 to de-energize for stopping speech transmission to the substation and also the start sequence relay 139 de-energizes for stopping reproduction. The mainstation operator then presses his talk switch 439, talk indicator 322 goes On, the substation operator gives his reply which is monitored by the mainstation operator on speaker 96. The mainstation operator then presses his answer start button and the reproducer sends the answer over speaker 5 which the mainstation operator compares for determining accuracy of the substation answer. The mainstation operator then presses

his incorrect answer switch 57 or correct answer switch 43 and his decision is transmitted by tone generator 153 or 154 to the substation and displayed by light 261 or 292. When the reproducer has finished supplying the mainstation operator with the answer, an End of Answer tone is emitted from the reproducer, then relay 92 energizes momentarily and relay 139 becomes de-energized and reproducer motor 149 stops rotation. If a correct answer occurs the sequence immediately begins again for a new question answer series because relay 226 energizes again. If an incorrect answer occurs then it will be necessary for the substation operator to insert a new coin.

In Figure 3 is shown equipment for multiple choice selection of answers and for automatic means of determining accuracy of answers thereby eliminating the need for an operator at the mainstation unless it is necessary to place the substation equipment out of order. Equipment 340 is located at the substation for selection of an answer. RC oscillator 341 provides tones of a frequency depending on position of switch wiper 353. Contacts 349, 350, and 351 are connected to RC networks having capacitors 346, 347, and 348, and resistors 343, 344, and 345 for obtaining a frequency choice when the circuit is completed between lead 342 and 354. In this multiple choice answer system the substation operator receives a plurality of answers after each question. He then rotates switch wiper 353 to the contact associated with his answer choice. At the end of the question and multiple choice answer transmission period a tone is produced by the reproducer for actuating relay 83 and arm 64 thus providing lead 66X with a power source for causing tone generator 361 to actuate relay 321 at the substation. In this multiple choice answer method the substation "Talk" indicator is re-labeled "Choose answer." Several additional leads are added in this method and they are designated by the symbol X after their reference number. When this "Choose answer" light 322 goes on the substation operator presses switch 356 after his answer selection is made. Arm 359 is in contact with 360 since relay 321B is energized in response to the "Choose answer" tone detected by tone discriminator 319. This answer choice signal then flows over lead 355 through arm 356, contact 357, lead 358, arm 359, contact 360, and over line 99 to the mainstation. Relay 413 is connected by lead 66X and therefore becomes energized when relay 83 closes at the end of speech transmission to the substation. Then arm 384 of relay 413 makes contact with 385 and the answer choice signal from the substation is connected to the input of tone discriminators 391, 392, and 393. At the same time the outputs of these tone discriminators are connected by leads 388, 389, and 390 to arms 394, 396, and 399 of relay 413 and at the same time contact is made with 421, 398, and 401. Therefore when an answer choice signal occurs there will be a D.C. pulse on either one of contacts 421, 398, or 401 and relay 417, 429, or 436 will actuate and remain actuated due to the holding signal on lead 412. Relays 417, 429, and 436 are provided with holding arms 419, 427, and 434 and normally open contacts 422, 428, and 435. When one of relays 417, 429, and 436 become energized a flow of current occurs through current relay 411. This relay also has a time delay for allowing time for relays 417, 429, and 436 to close. When relay 411 energizes, arm 407 disengages from contact 408 and the holding current for relay 413 via lead 410, arm 402, and contact 403 is cut off, then relay 413 becomes de-energized. When relay 411 energizes, arm 407 makes contact with contact 409 and current then flows from power source 406, arm 407, contact 409, lead 148X to the start sequence relay 139 and the reproducer begins transmission again for providing the correct answer to the mainstation apparatus. Reproducer 1 is connected via lead 382, contact 383, through arm 384 to tone discriminators 391, 392, and 393 after

the substation answer choice has been made. A D.C. pulse will then occur on either arm 394, 396, or 399 in response to the correct answer provided by the reproducer. If the answer provided by the reproducer is the same as that provided by the substation then a signal appears on lead 50X for actuation of the correct answer relay 41. For instance, if the substation answer choice caused relay 417 to actuate and if this answer was correct a pulse would occur on arm 394, contact 395, lead 418, arm 415, contact 416 to lead 50X. If the substation answer choice caused relay 429 to actuate and if this answer was correct a pulse would occur on arm 396, contact 397, through lead 426, through arm 424, contact 425 to lead 50X. If the substation answer choice caused relay 436 to actuate and if this answer was correct a pulse would occur on arm 399, contact 400, through lead 438, through arm 432, contact 433, to arm 50X. If the answer is incorrect a signal will flow through either one of relays 417, 429, or 436 which is not actuated via contact 414, 423, or 431 and then lead 40X is energized for actuating the incorrect answer relay 52. When relay 41 or 52 is energized then tone generator 153 or 154 sends a signal to the substation for an indication of accuracy of answer selection. At the end of the correct answer tone provided by the reproducer there is also an "End of question answer total sequence" signal which is detected by tone discriminator 89, and relay 92 actuates causing the start sequence relay to de-energize thereby stopping the reproducer. Thus has been shown the multiple choice answer automatic analysis method. Briefly the operation may be described as follows: the substation operator first starts operation of his station when he places the subject selection switch 209 at the desired position depending on his subject choice. A coin is then placed into his device, relay 226 becomes energized, the mainstation is dialed automatically, tone discriminator 100 detects the Start tone and relay 101 becomes energized and reproducer motor starts rotation. At the same time the Subject Selection tone is detected by one of the subject tone discriminators 107 or 113 and the mainstation memorizes the subject selection by action of holding relays 111 or 125. The mainstation has previously determined the difficulty classification required for succeeding question as the result of the ratio of incorrect to correct answers of past questions. As the reproducer motor rotates, various speech and tone information is reproduced, the tone information is monitored by tone discriminators and when this tone information matches the required selection with regard to difficulty then relay 73 energizes and if the tone information for the same question matches the required subject selection then relay 80 energizes and remains closed by the holding influence of relay 73. When relay 80 is held energized by relay 73 the reproducer is connected to line 99 for transmission of the question and multiple choice answers to the substation. At the end of the question and multiple choice speech information relay 83 energizes by an "End of question and multiple choice" tone and reproducer 1 stops due to de-actuation of relay 139. The substation operator then makes a choice of answer, places switch 353 in the desired position and presses push button switch 356. Holding relays 417, 429, 436 at the mainstation perform to memorize the substation answer selection, then the reproducer motor rotates by the action of relays 411 and 139 and provides the correct answer. Answers are compared automatically by relative relay positions and the results are displayed at the substation. After the reproducer sends the "correct answer" tone then an "end of question answer total sequence" tone occurs and relay 92 and 139 operate to stop the reproducer. If the answer is correct relay 226 automatically energizes by a pulse received via capacitor 272 and the question answer sequence begins over again. If the answer is incorrect

then the substation operator will need to insert a new coin.

Various changes and refinements can be made depending on preference of operators and locations. Multiplicity of indication for showing for example degree of accuracy between correct and incorrect answers can be easily provided by additional tone generators, tone discriminators, and lights. Also by addition of a solenoid ejection mechanism connected with capacitor 272 award means can be provided when correct answers occur thereby encouraging intellectual development.

What I claim is:

1. Question answer amusement apparatus at a mainstation comprising question reproducing means, communication transmission means connected with said question reproducing means for transmission of questions to a substation, communication receiving means for receiving answers from a substation, analysing means connected with said communication receiving means for determining accuracy of answers, control means, said control means connected with said question reproducing means for selecting questions of a required category, also said control means connected with said communication transmission means for automatic selection of transmission period for transmission of signals containing question information as produced by said question reproducing means, also said control means connected with said accuracy analysing means, and also said control means responsive to signals received from the substation for maintaining automatic question-answer cycles.

2. Question answer amusement apparatus involving a mainstation comprising control means, communication means, reproducing means, said reproducing means connected with said communication means by said control means during question transmission sequences, said reproducing means responsive to said control means for reproducing questions during question transmission sequences, said reproducing means responsive to said control means for reproducing answers during answer sequences, said reproducing means containing control information for signifying classification of succeeding signals, and said control means responsive to said control signals for selecting a required classification for transmission.

3. Question answer amusement apparatus involving a mainstation comprising control means, communication means, reproducing means, difficulty selection means, said reproducing means containing signal information for signifying difficulty classification of succeeding information, said control means connected with said reproducing means and responsive to said reproducing means difficulty classification signal information, said control means also responsive to signals from said difficulty selection means, and said control means connecting said reproducing means with said communication means in response to correlation between reproducing means difficulty classification signals and said difficulty selection means signals.

4. Question answer amusement apparatus involving a mainstation comprising control means, communication means, reproducing means, said reproducing means containing signal information for signifying difficulty classification of succeeding information, said control means connected with said reproducing means and responsive to said reproducing means difficulty classification signal information, difficulty selection means, manual accuracy switches, said difficulty selection means responsive to said manual accuracy switches proportionally to ratio of incorrect to correct answers, said control means also responsive to signals from said difficulty selection means, and said control means connecting said reproducing means with said communication means in response to correlation between reproducing means difficulty classification signals and said difficulty selection means signals.

5. Question answer amusement apparatus involving a

mainstation comprising control means, communication means, reproducing means, said reproducing means containing signal information for signifying subject classification of succeeding information, said control means connected with said communication means and responsive to subject selection signals originating from a substation, said control means also responsive to said reproducing means subject classification signals, and said control means connecting said reproducing means with said communication means in response to correlation between reproducing means subject classification signals and substation subject selection signals for determining choice of question reproduction with respect to subject.

6. In question answer amusement apparatus involving a mainstation comprising information storage-reproducing means, sequence determining means, reproducer drive means, said information storage-reproducing means having questions stored for sequential reproduction, also said information storage-reproducing means having answers stored for sequential reproduction, also said information storage-reproducing means having control signals for indicating beginning and end of an adjacent question or answer, said sequence determining means connected with said information storage-reproducing means and responsive to said reproducer control signals, and said sequence determining means connected with said reproducer drive means for moving information storage-reproducing means through information sequences in response to said reproducer control signals.

7. Question answer amusement apparatus at a mainstation comprising information storage-reproducing means, communication transmission means, communication receiving means, control means, said control means connected with said information storage-reproducing means, said control means connecting said communication transmission means to said information storage-reproducing means during question periods, monitoring means, said control means connecting said communication receiving means with said monitoring means during a first answer period, said control means also connecting said information storage-reproducing means with said monitoring means during a second answer period, manual means for registering accuracy of answers, said control means connecting said manual means with said communication transmission means for indicating results of answers, said control means responsive to control signals from said information storage-reproducing means, and also said control means responsive to said manual means for sustaining automatically sequences of operations.

8. Question answer amusement apparatus at a mainstation comprising information storage-reproducing means, communication transmission means, control means, communication receiving means, discriminating means, said information storage-reproducing means having questions stored for sequential reproduction, also said information storage-reproducing means having answer signals in correlation with each question, said control means connecting said information storage-reproducing means to said communication transmission means during question periods, said discriminating means connected with said communication receiving means and responsive to answer signals from a substation, also said discriminating means connected with said information storage-reproducing means and responsive to answer signals from this reproducing means for establishing correlation between signals for determining accuracy response, and said control means connecting said discriminating means with said communication transmission means for indicating accuracy of answers chosen at the substation.

9. Question answer amusement apparatus at a mainstation comprising information storage-reproducing means, communication transmission means, communication receiving means, control means, discriminating means, said information storage-reproducing means having questions stored for sequential reproduction, also said information

storage-reproducing means having answer signals in correlation with each question, also said information storage-reproducing means having control signals for indicating beginning and end of an adjacent question, said control means connecting said information storage-reproducing means to said communication transmission means during question periods, said discriminating means connected with said communication receiving means and responsive to answer signals from a substation, also said discriminating means connected with said information storage-reproducing means and responsive to answer signals from this reproducing means for establishing correlation between signals for determining accuracy response, said control means connecting said discriminating means with said communication transmission means for indicating accuracy of answers chosen at the substation, said control means responsive to signals from said discriminating means, also said control means responsive to control signals from said information storage-reproducing means, and also said control means responsive to signals from said communication receiving means for sustaining automatically sequences of operations.

10. Question answer amusement apparatus comprising a magnetic tape recorder, communication transmission means, communication receiving means, control means, said magnetic tape recorder having recorded a first tone group for representing answers for associated questions, also said magnetic tape recorder having recorded a second tone group for representing difficulty category of associated questions, also said magnetic tape recorder having associated questions, first discrimination means, said first discrimination means connected with said magnetic tape recorder and responsive to signals of the first tone group, said first discrimination means connected with said communication receiving means and responsive to received tones representing the answer chosen by the substation operator for comparing with signals of the first tone group, ratio integrator, said ratio integrator connected with said first discrimination means and responsive to repetition of correct and incorrect answers, second discrimination means, said second discrimination means connected with said magnetic tape recorder and responsive to signals of the second tone group, also said second discriminator means connected with said ratio integrator and responsive to a deviation signal from the ratio integrator for determining selection of difficulty of succeeding questions for maintaining difficulty of the apparatus at a ratio to the intelligence of the substation operator, said control means responsive to said second

discrimination means, and said control means connecting said magnetic tape recorder with said communication transmission means in response to said signals from said second discrimination means for selecting transmission of questions of required difficulty.

11. Question answer amusement apparatus comprising a magnetic tape recorder, communication transmission means, communication receiving means, control means, said magnetic tape recorder connected to said communication means in response to selection by said control means, said magnetic tape recorder having recorded a first tone group for representing subject category of associated questions, also said magnetic tape recorder having recorded a second tone group for representing sequence sections of questions and answers, discriminating means, said discriminating means connected with said magnetic tape recorder and responsive to said first tone group, also said discriminating means connected with said communication receiving means and responsive to a subject selection signal from a substation, said control means connected with said magnetic tape recorder and responsive to the second tone group, and also said control means responsive to said discrimination means for selecting time of transmission of questions of a required subject choice in synchronization with time of reproduction.

12. Question answer amusement apparatus involving a mainstation and remote substation comprising control means for actuating the mainstation in response to signals from a substation, said mainstation control means responsive to substation signals for commencing a question answer cycle, automatic selection means for switching recorded questions from the mainstation to the substation, speaker means at said substation for producing verbal questions, said speaker means connected with said automatic selection means, answer choice means at the substation for sending player's answer choice to the mainstation, answer correctness determining means at the mainstation responsive to said substation answer choice means, said answer correctness determining means at the mainstation for determining accuracy of answers received, accuracy indicating means, said accuracy indicating means responsive to said answer correctness determining means for indicating accuracy of answers.

References Cited in the file of this patent

UNITED STATES PATENTS

2,562,179	Dorf	July 31, 1951
2,654,163	Reynolds	Oct. 6, 1953