United States Patent

Greanias et al.

[15] **3,641,500**

[45] **Feb. 8, 1972**

[54] VOICE ENTRY SYSTEM

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[22] Filed: **June 30, 1970**

[21] Appl. No.: **51,303**

[52] **U.S. Cl.** ..... **340/152 R**, 179/1 VC

[51] **Int. Cl.** **H04q 9/00**

[58] **Field of Search** ..... 340/152; 235/61.9; 179/1 VC

[56] REFERENCES CITED

OTHER PUBLICATIONS

Information Display, November/December, 1964, "Voice Response and Visual Display Techniques" Auakian et al pp. 12–19 (copy in 340–152, 154).

Primary Examiner—Donald J. Yusko

Attorney—Hanifin and Jancin and Isidore Match

[57] **ABSTRACT**

An arrangement is disclosed for making entries into an information system from a plurality of remote locations by voice communications. The arrangement comprises a speech compression means and an audio buffer means associated with each location, the speech compression means functioning to compress the duration of a message whereby a keyboard operator receiving the voice communications can handle a plurality of locations, the audio buffer means being operative to store the compressed message. There is also associated with each location a word counter which contains a count of the words in a message, a count in a word counter signifying that a complete message is in the audio buffer enabling the locations where that message has been entered to have that message processed. The arrangement includes a sequencing unit which establishes which location can receive processing. The keyboard operator enters the messages into an information-processing system and the results of this processing are then transmitted back to the appropriate locations where they can be printed out or otherwise be availed of.

10 Claims, 30 Drawing Figures

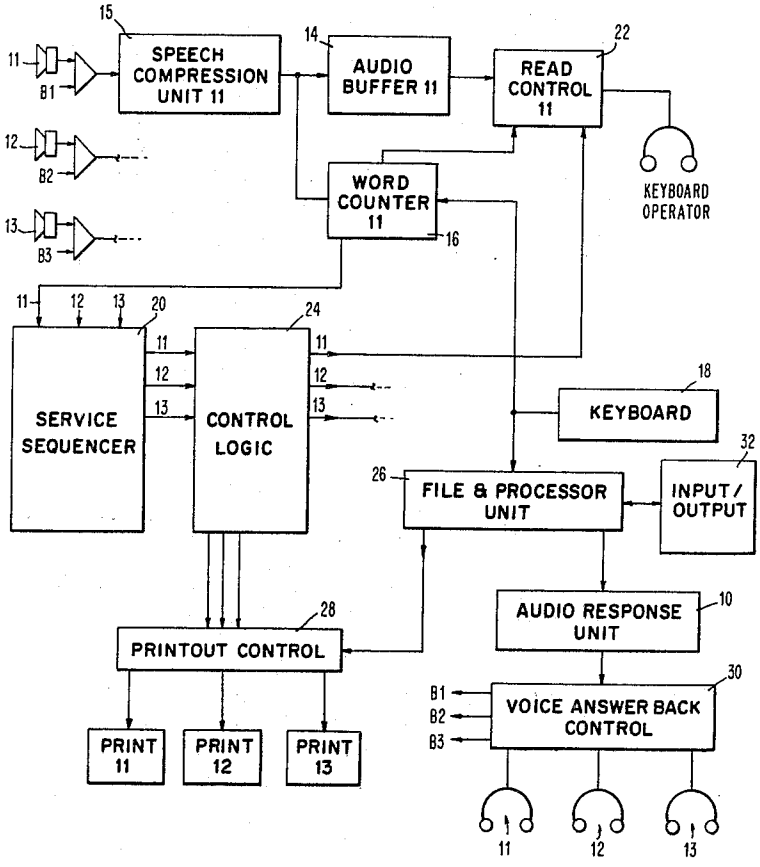
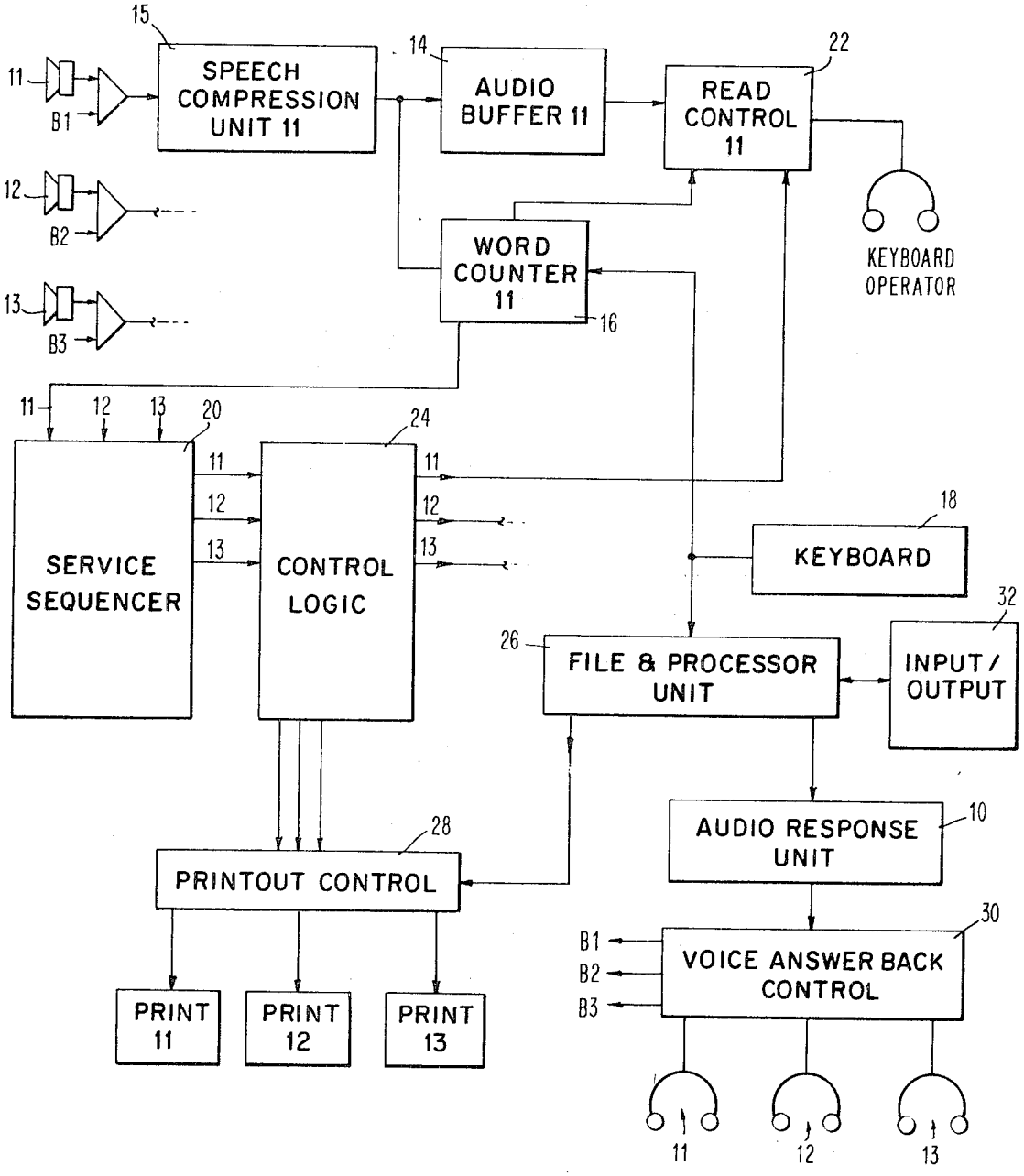


FIG. 1

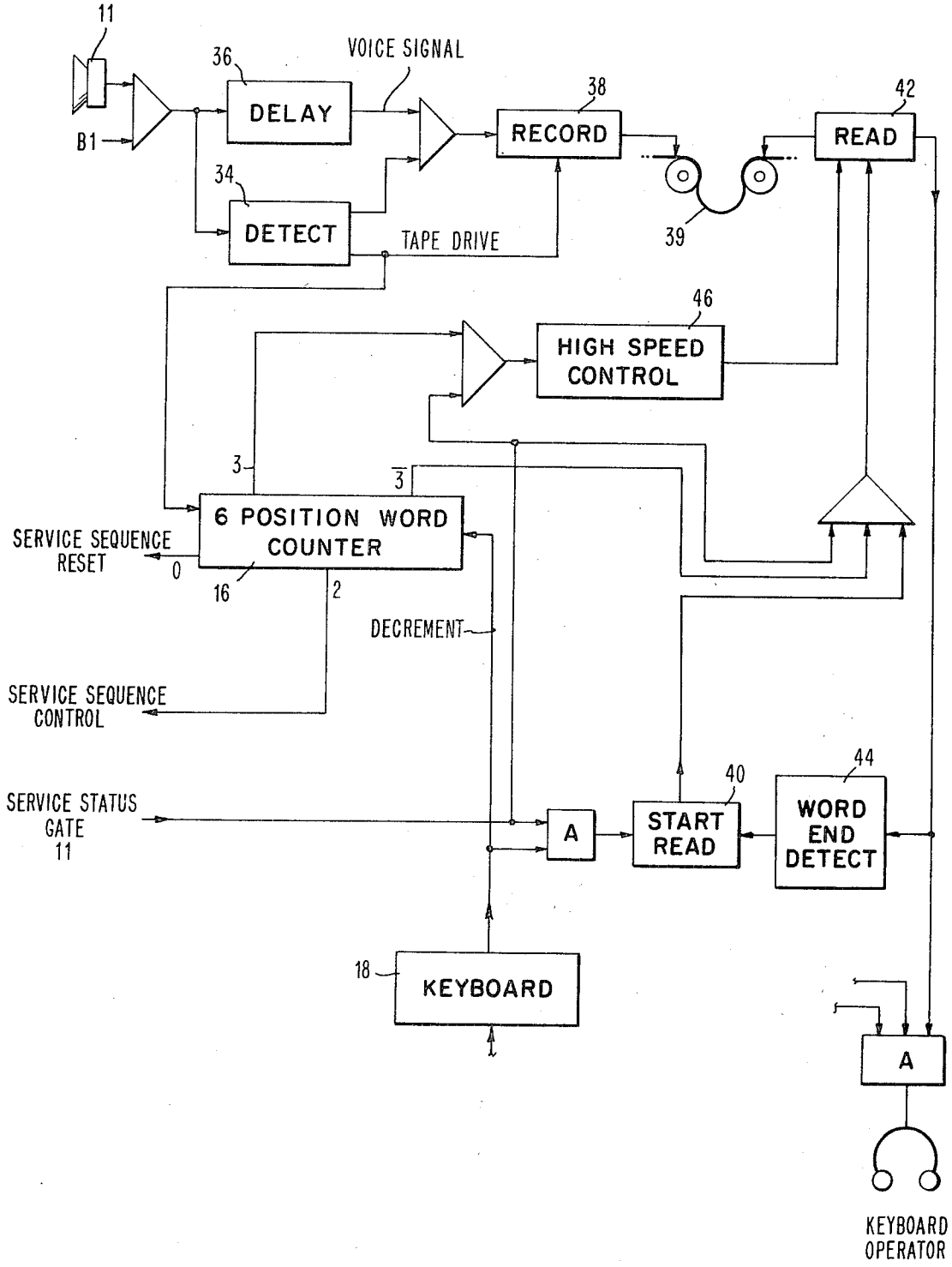


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WILBUR J. LEVINE

BY Isidore Mattel

ATTORNEY

FIG. 2


11
36
VOICE SIGNAL
DELAY
38
RECORD
42
READ
B1
34
DETECT
TAPE DRIVE
39
46
HIGH SPEED CONTROL
3
3
6 POSITION WORD COUNTER
SERVICE SEQUENCE RESET
0
16
2
DECREMENT
SERVICE SEQUENCE CONTROL
SERVICE STATUS GATE 11
A
40
START READ
44
WORD END DETECT
18
KEYBOARD
A
KEYBOARD OPERATOR

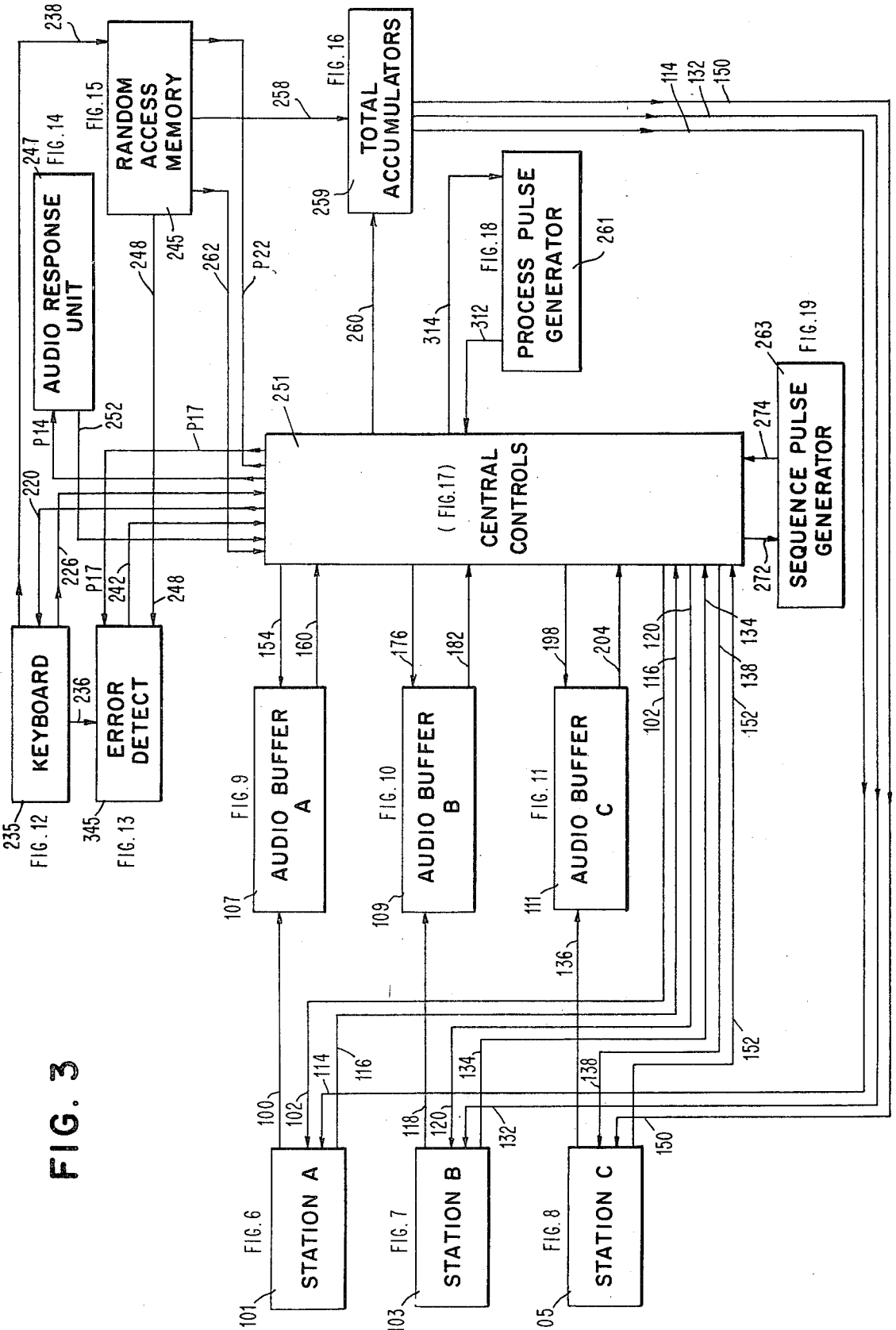

RANDOM ACCESS MEMORY
FIG.15
TOTAL ACCUMULATORS
FIG.16
AUDIO RESPONSE UNIT
FIG.14
PROCESS PULSE GENERATOR
FIG.18
SEQUENCE PULSE GENERATOR
FIG.19
CENTRAL CONTROLS
(FIG.17)
KEYBOARD
FIG.12
ERROR DETECT
FIG.13
AUDIO BUFFER A
FIG.9
AUDIO BUFFER B
FIG.10
AUDIO BUFFER C
FIG.11
STATION A
FIG.6
STATION B
FIG.7
STATION C
FIG.8
238
247
258
259
261
263
245
248
262
P22
260
314
312
P14
252
251
274
220
P17
226
242
272
154
160
176
182
198
204
120
116
102
134
138
152
114
132
150
235
345
107
109
111
136
100
118
101
103
105

FIG. 3

FIG. 4
SEQUENCE FLOW CHART

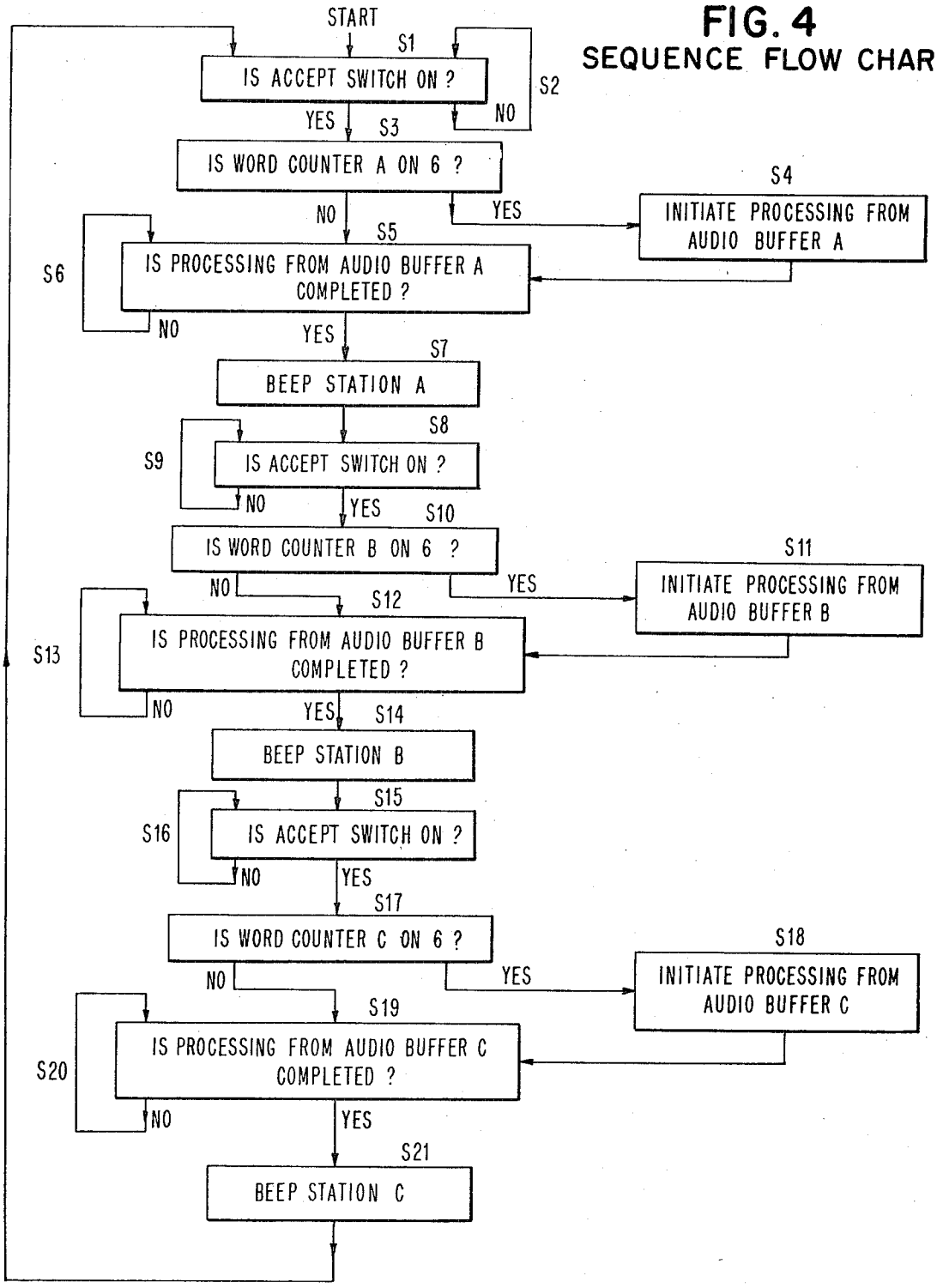


FIG.5
PROCESS FLOW CHART

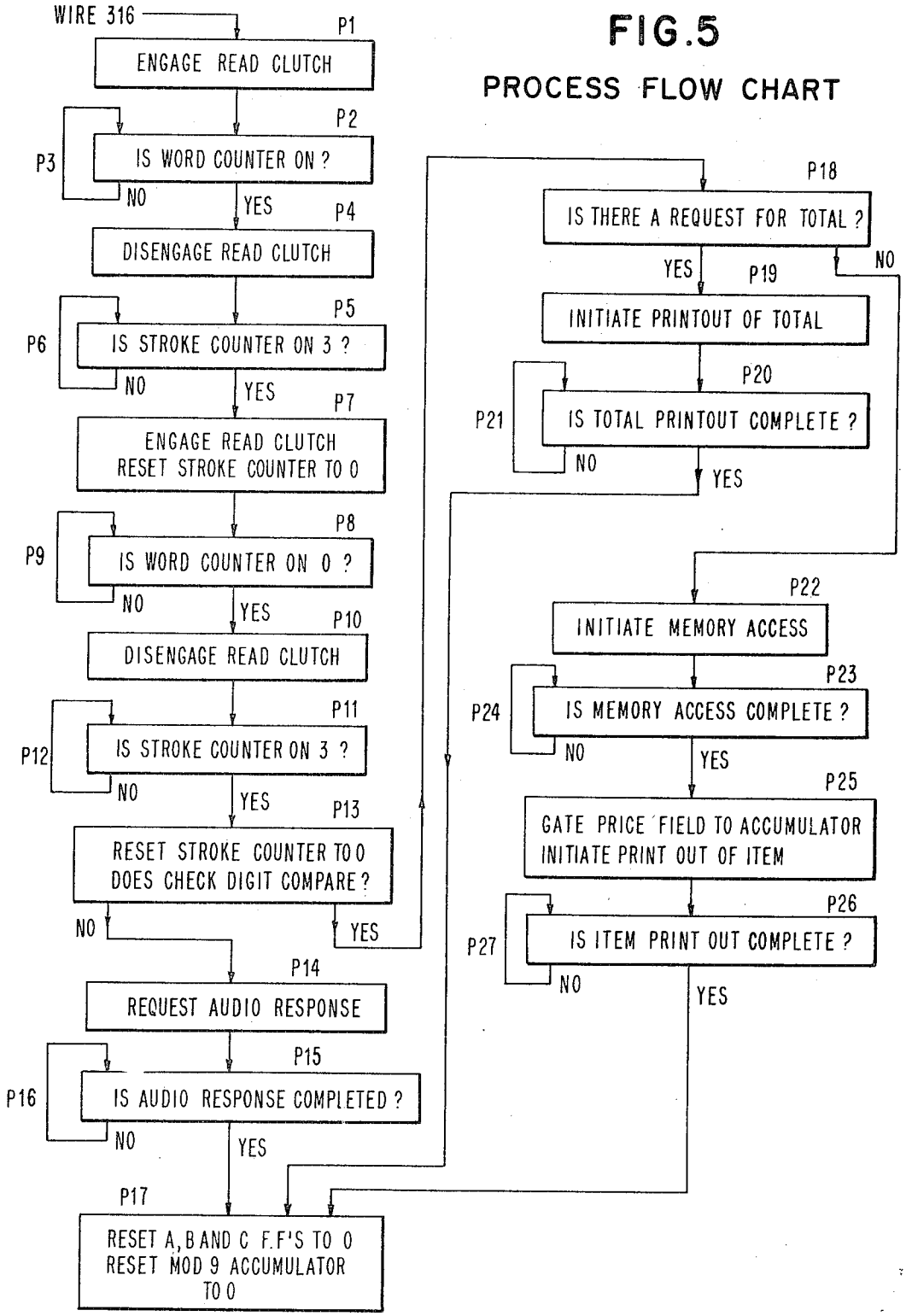


FIG. 6
STATION A

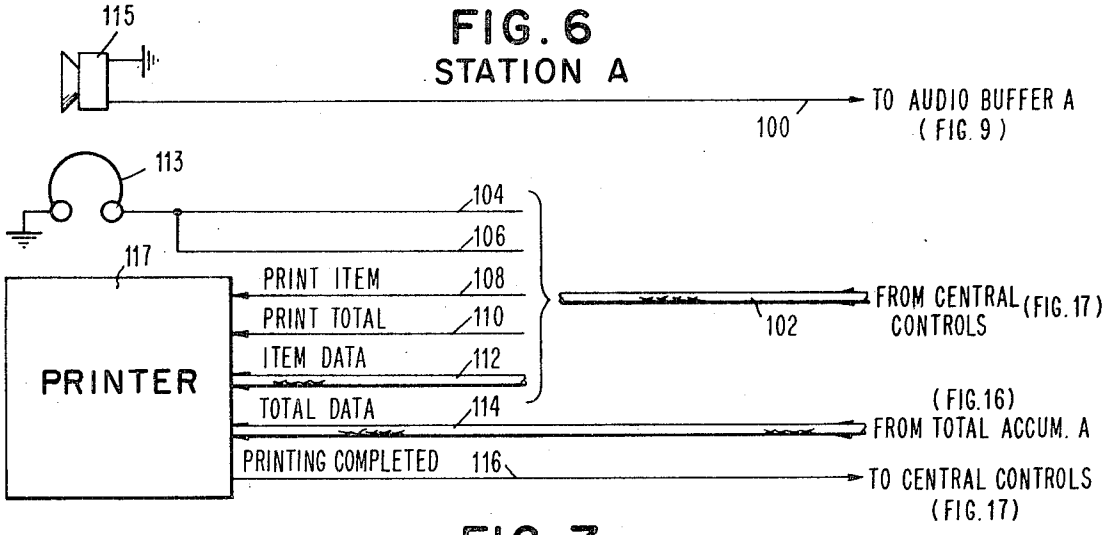


FIG. 7
STATION B

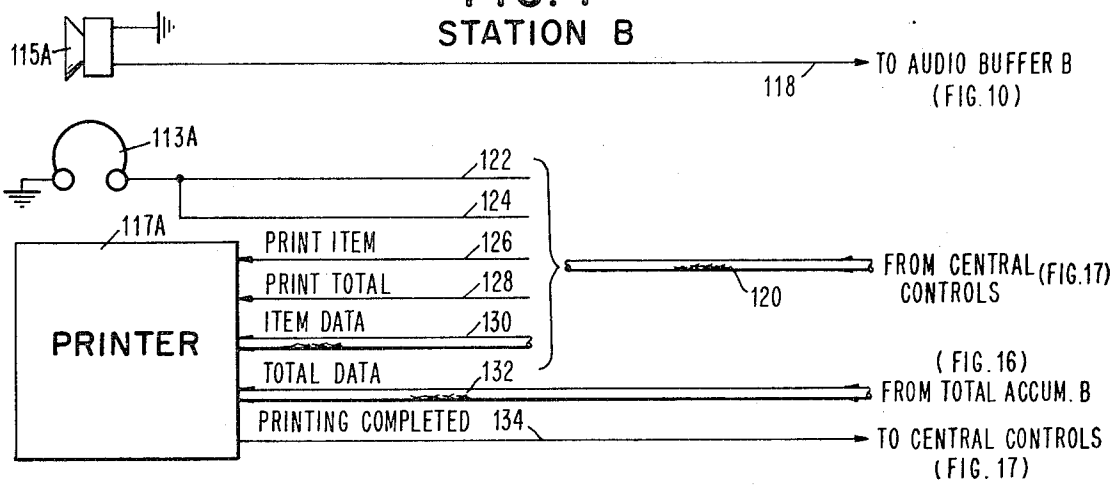
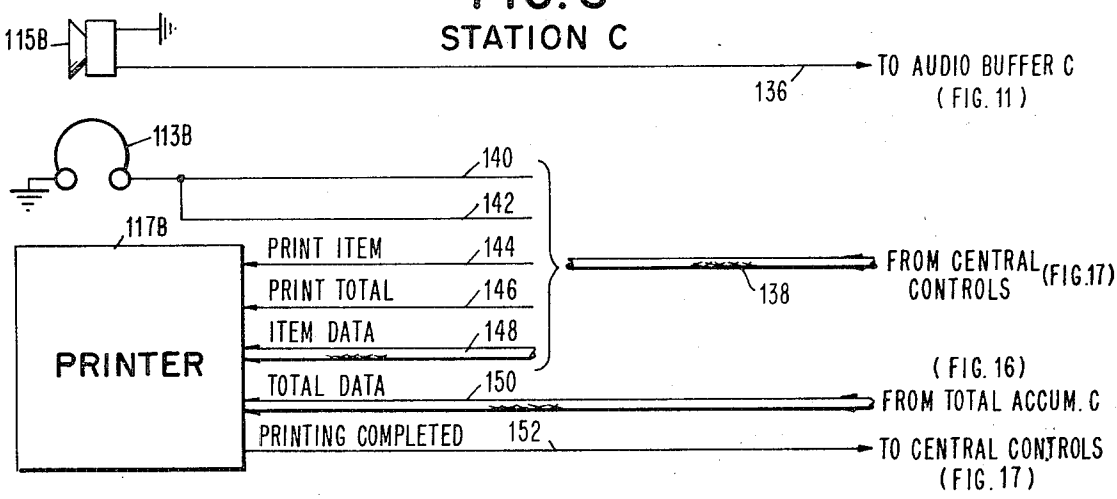


FIG. 8
STATION C



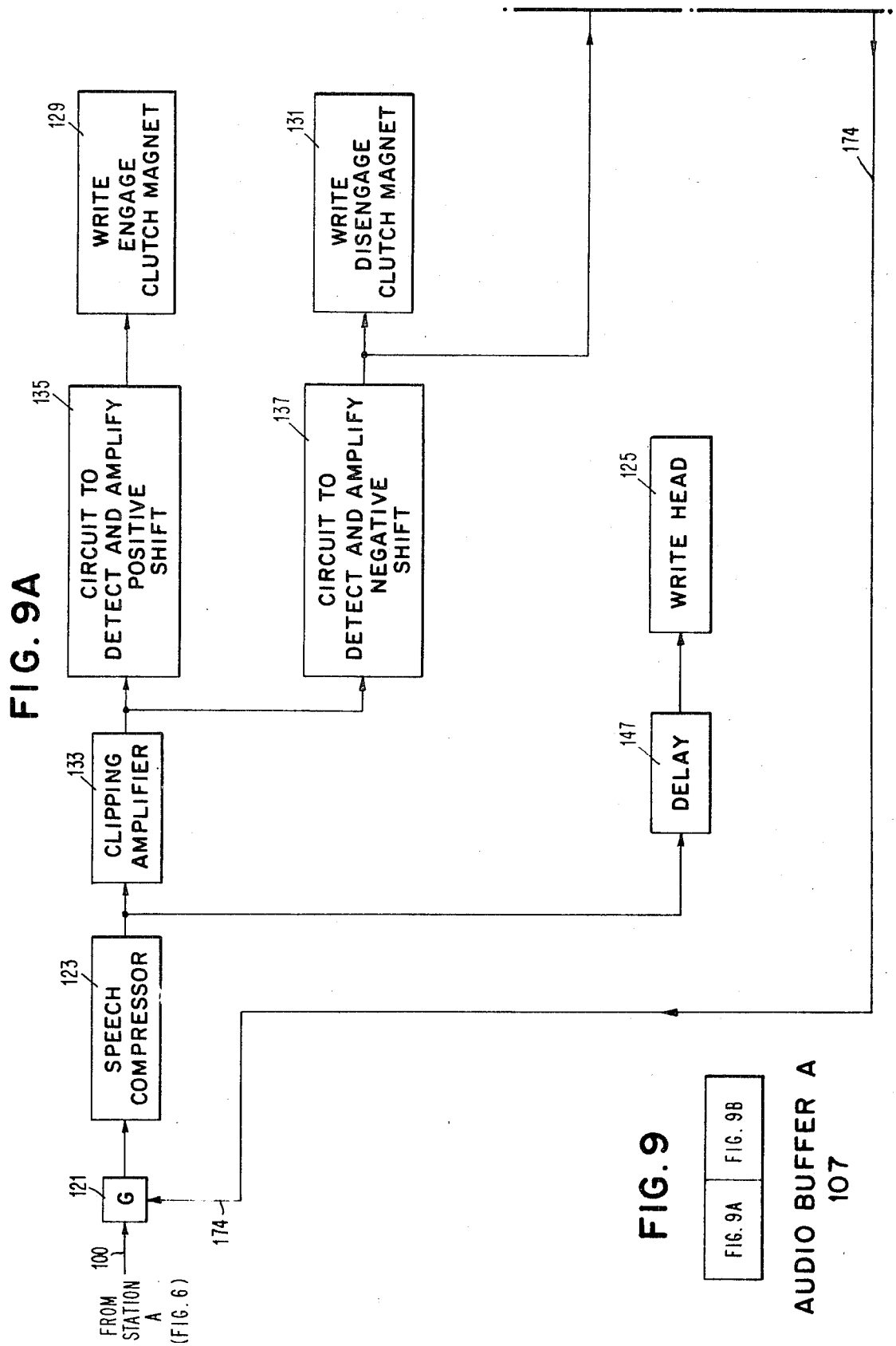
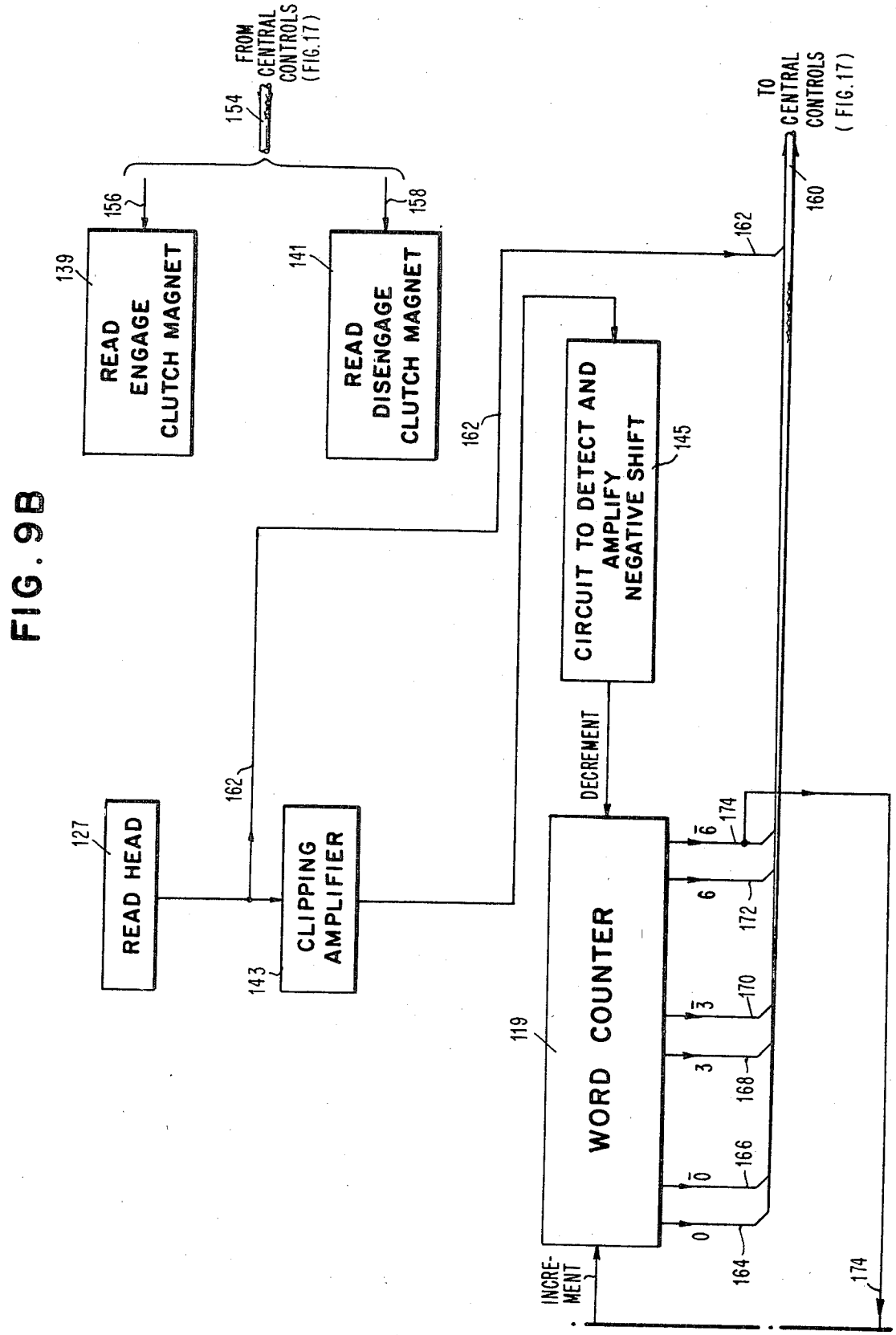


FIG. 9A

FIG. 9

FIG. 9A	FIG. 9B

FIG. 9B


FROM CENTRAL CONTROLS (FIG. 17)
154
156
158
READ ENGAGE CLUTCH MAGNET
139
READ DISENGAGE CLUTCH MAGNET
141
TO CENTRAL CONTROLS (FIG. 17)
160
162
162
CIRCUIT TO DETECT AND AMPLIFY NEGATIVE SHIFT
145
DECREMENT
READ HEAD
127
CLIPPING AMPLIFIER
143
WORD COUNTER
119
$\bar{6}$
6
$\bar{3}$
3
$\bar{0}$
0
174
172
170
168
166
164
INCREMENT
174

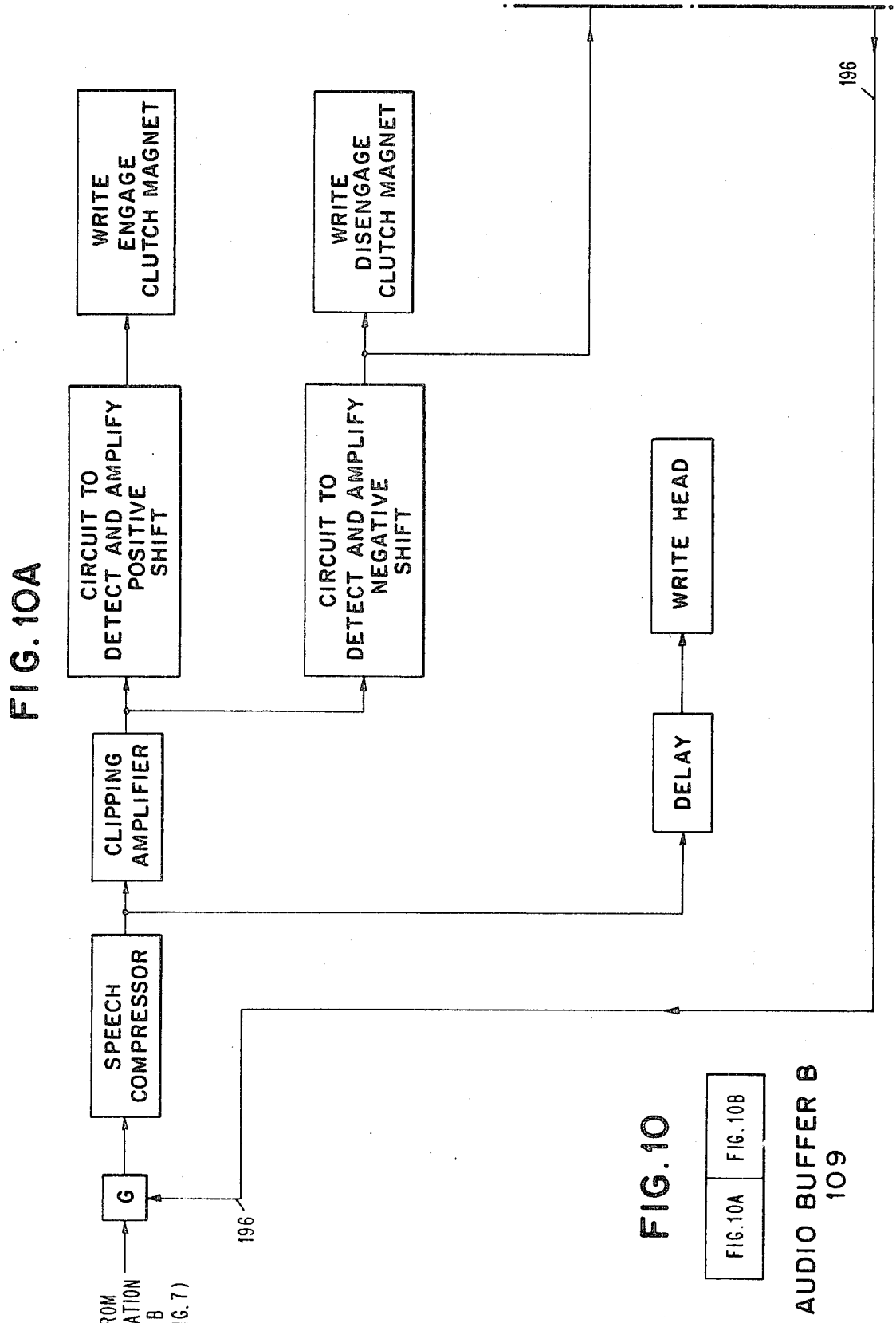


FIG. 10A

FIG. 10

FIG. 10A	FIG. 10B

FIG. 10B

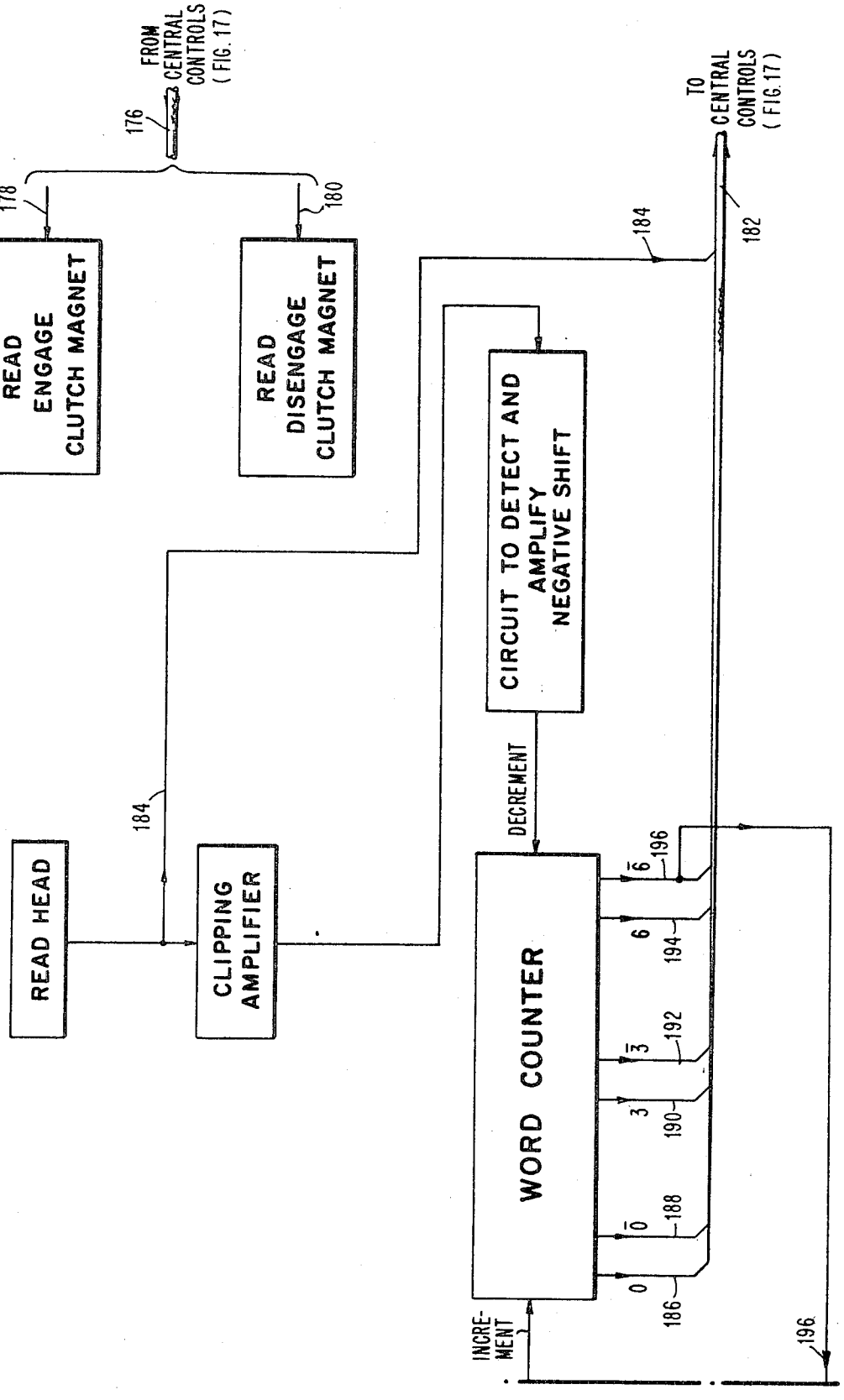

FROM CENTRAL CONTROLS (FIG. 17)
176
178
180
READ ENGAGE CLUTCH MAGNET
READ DISENGAGE CLUTCH MAGNET
TO CENTRAL CONTROLS (FIG. 17)
182
184
184
CIRCUIT TO DETECT AND AMPLIFY NEGATIVE SHIFT
READ HEAD
CLIPPING AMPLIFIER
DECREMENT
WORD COUNTER
196
6
194
3
192
3
190
0
188
0
186
INCRE-MENT
196

FIG. 11A

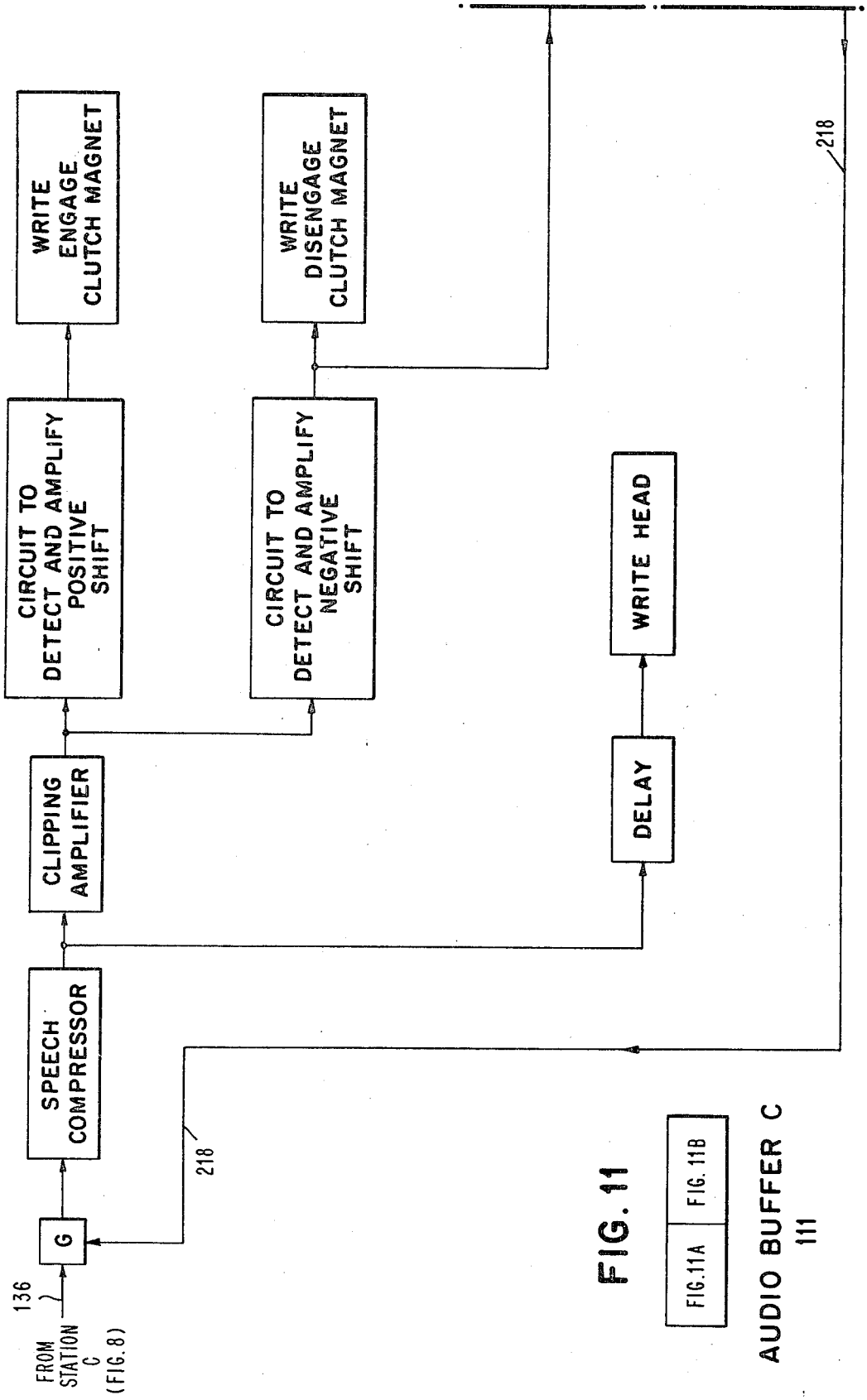


FIG. 11

FIG. 11B

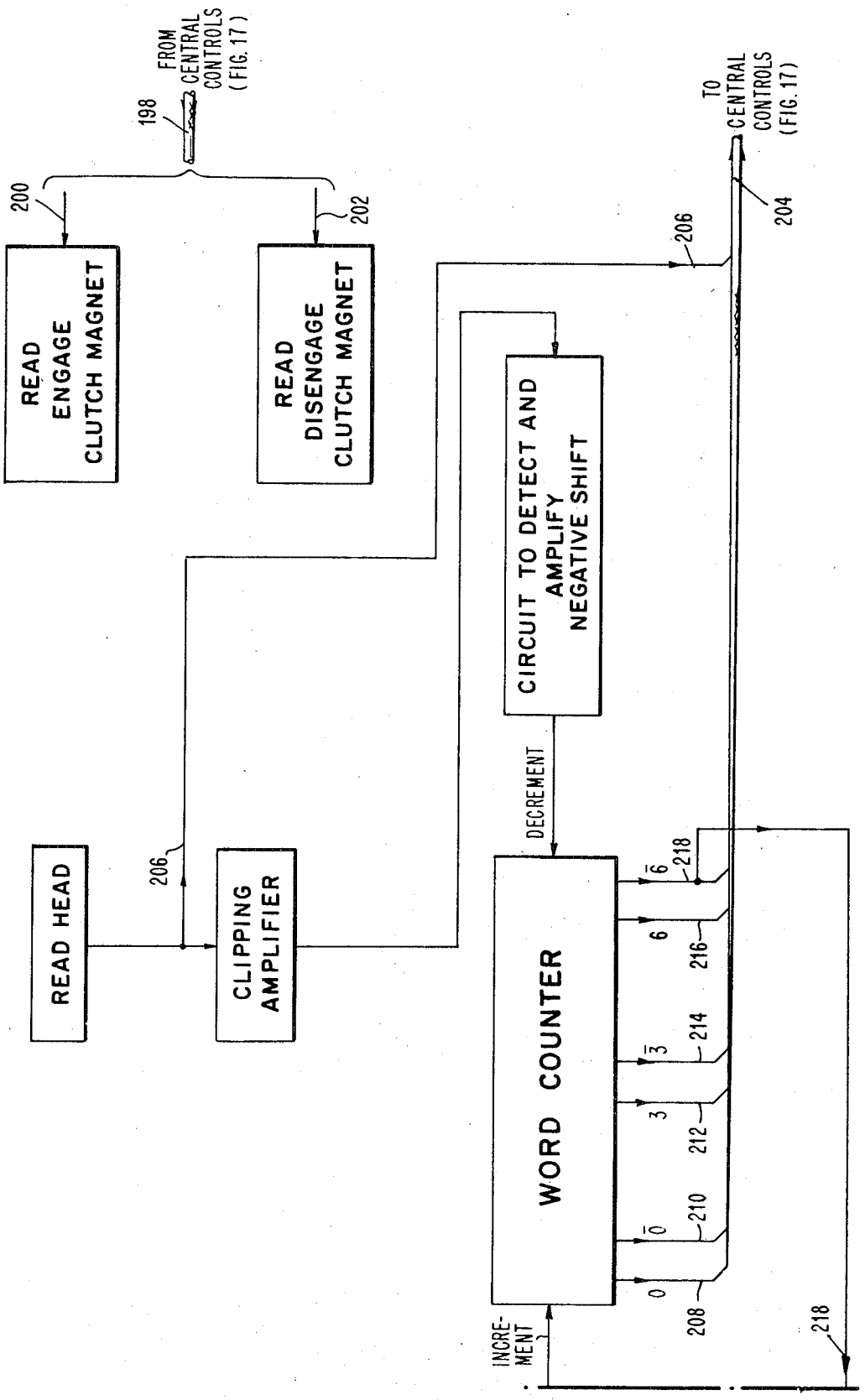
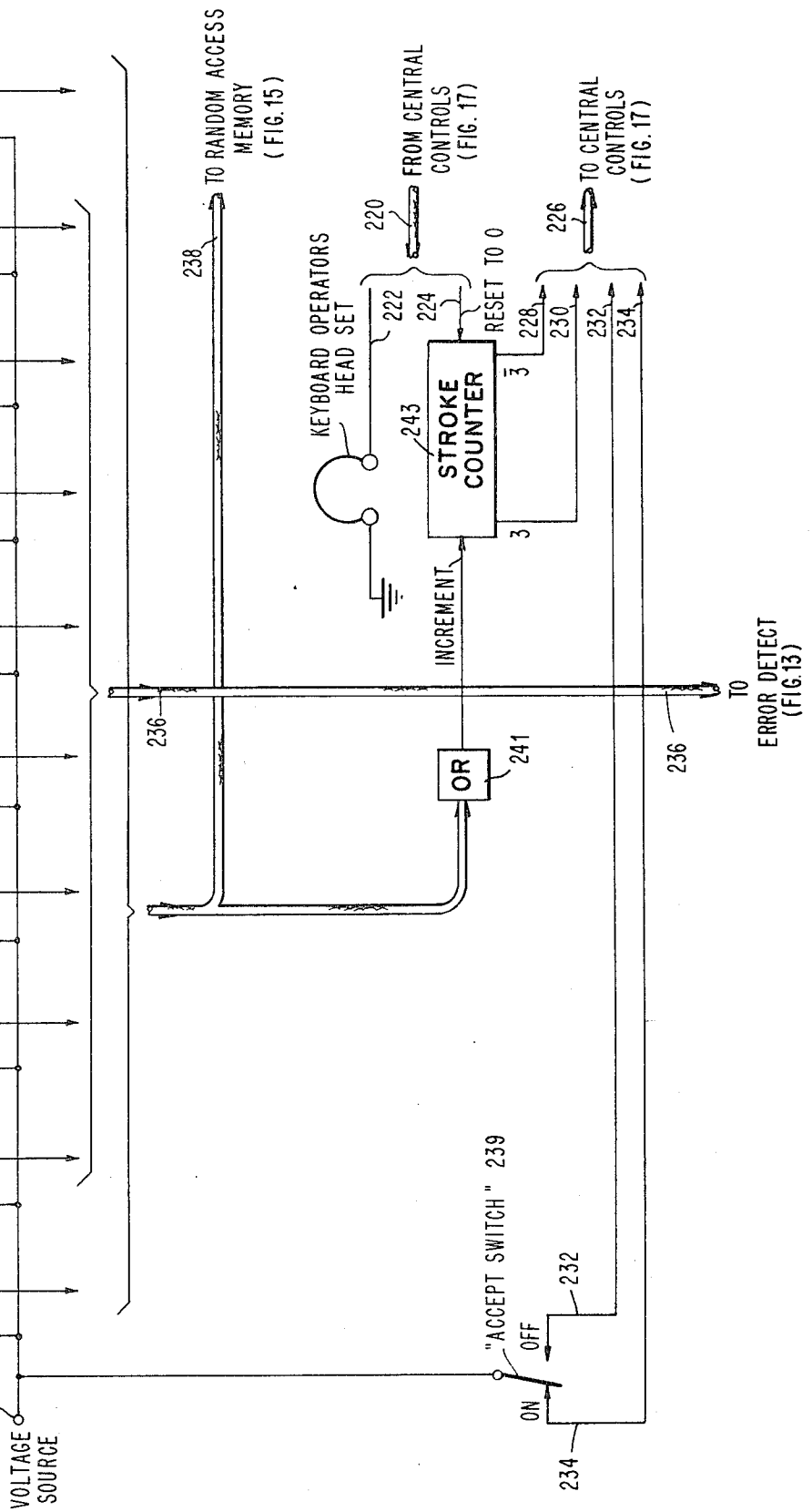

FROM CENTRAL CONTROLS (FIG. 17)
198
200
202
READ ENGAGE CLUTCH MAGNET
READ DISENGAGE CLUTCH MAGNET
TO CENTRAL CONTROLS (FIG. 17)
204
206
CIRCUIT TO DETECT AND AMPLIFY NEGATIVE SHIFT
READ HEAD
CLIPPING AMPLIFIER
DECREMENT
WORD COUNTER
6̄
6
3̄
3
0̄
0
218
216
214
212
210
208
INCRE-MENT

FIG. 12
KEYBOARD 235



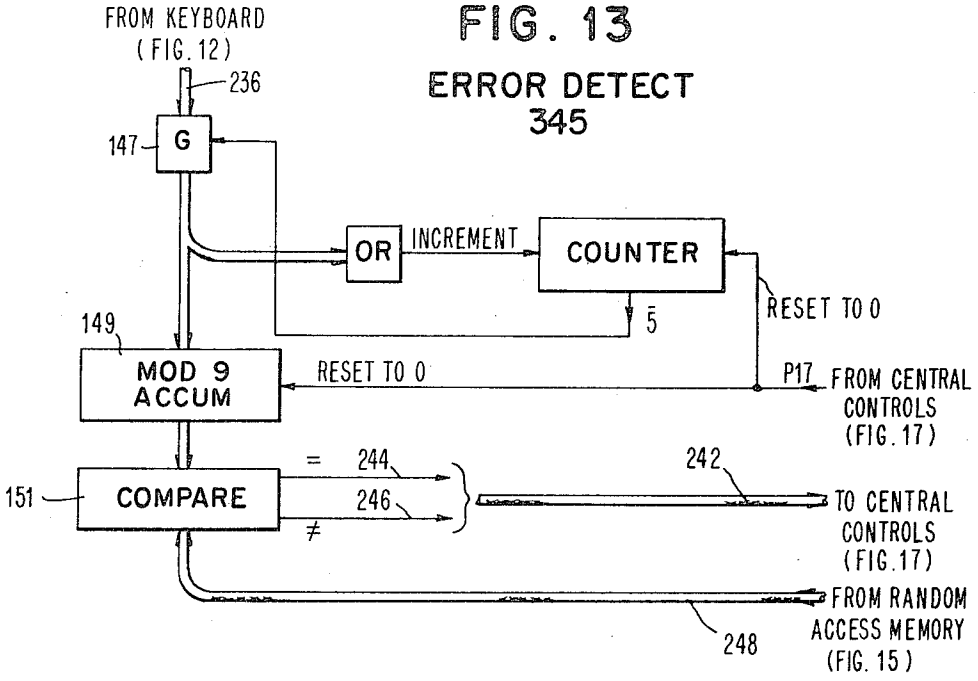


FIG. 13

ERROR DETECT
345

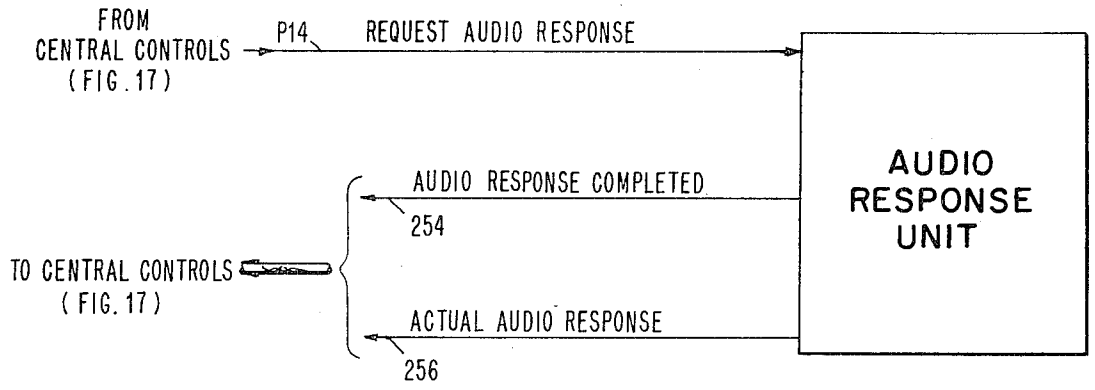


FIG. 14

AUDIO RESPONSE UNIT
247

FIG. 15

RANDOM ACCESS MEMORY 245

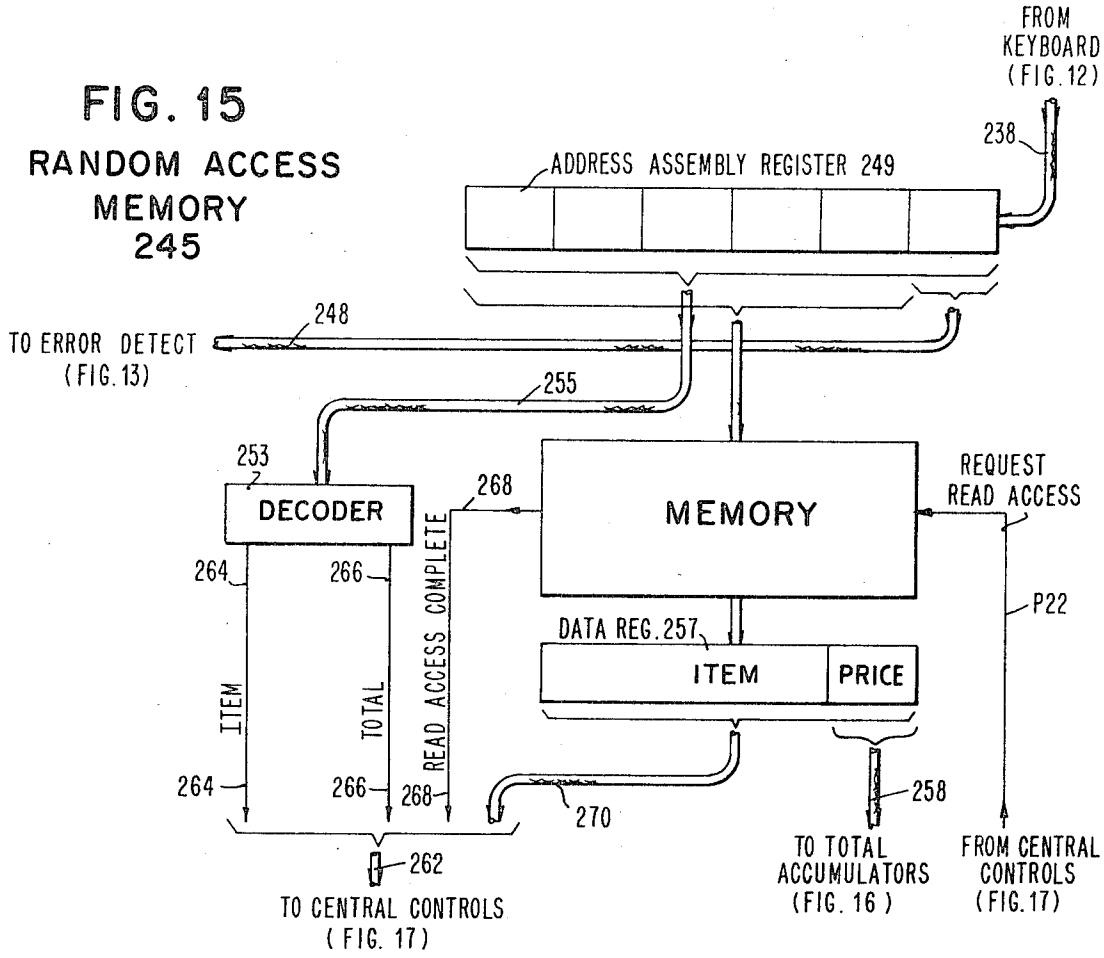


FIG. 16

TOTAL ACCUMULATORS 259

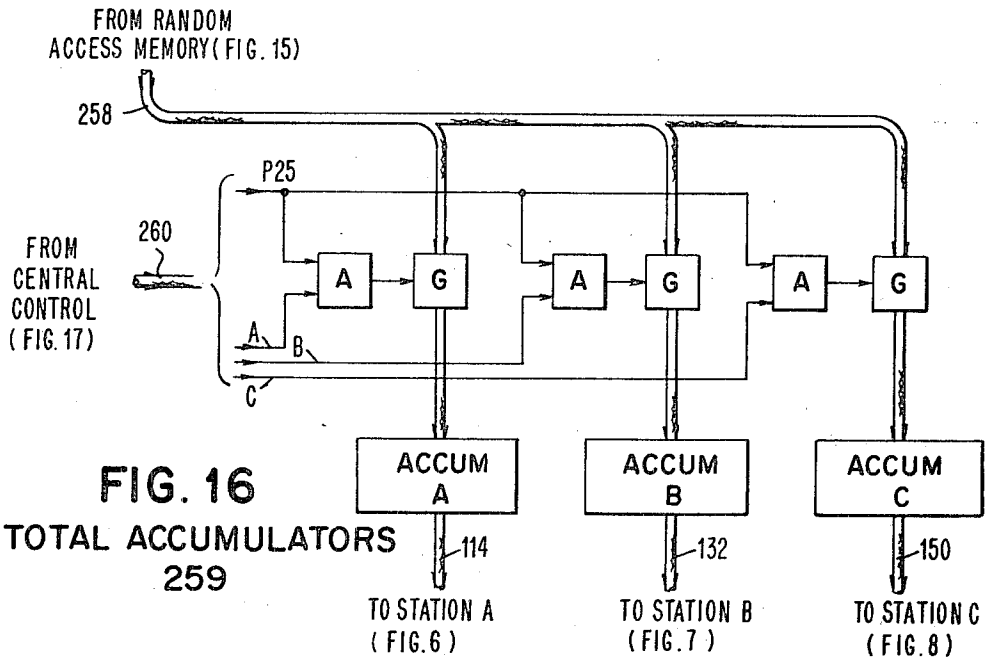


FIG. 17

CENTRAL CONTROLS 251

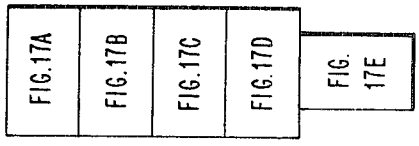
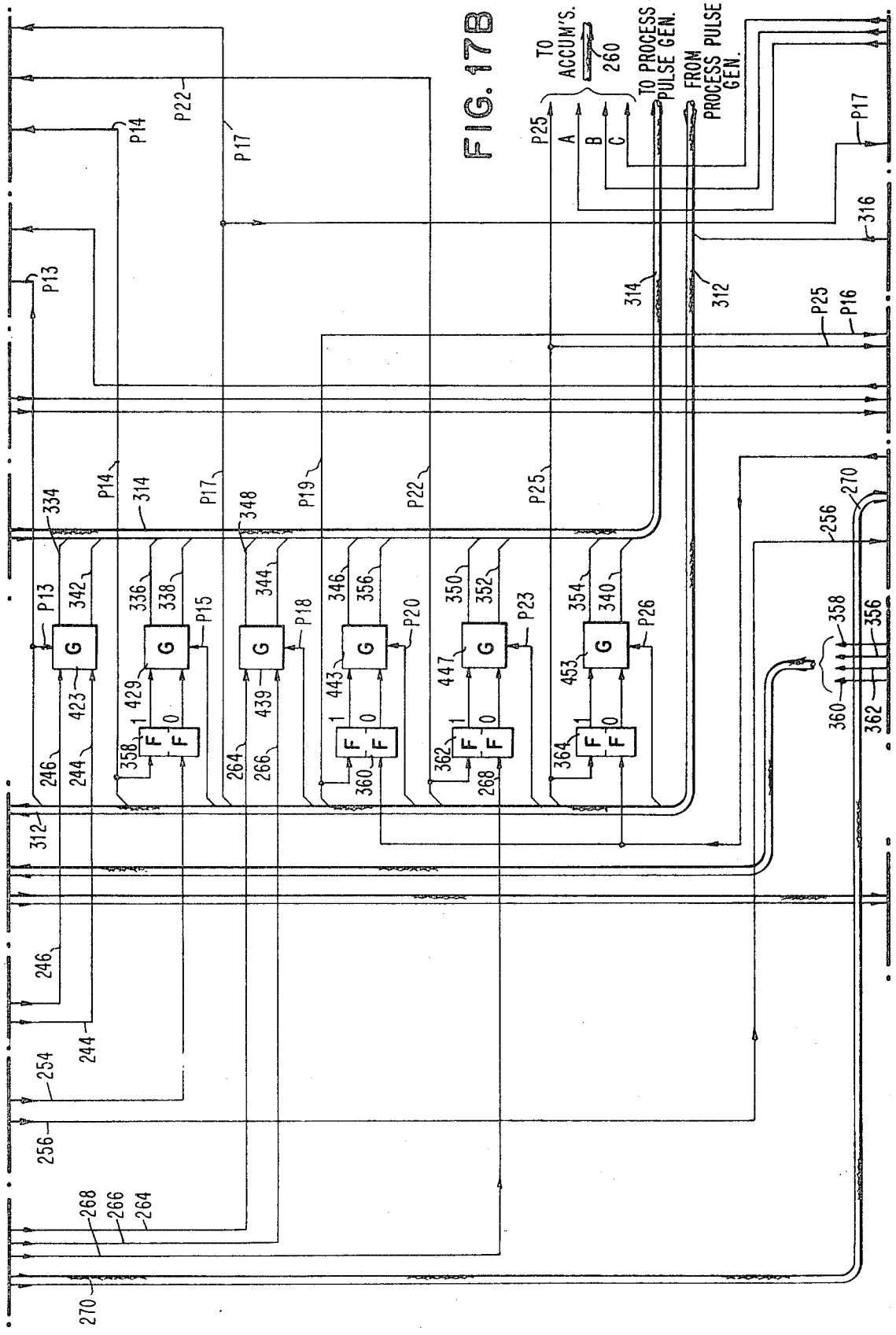


FIG. 17B


TO ACCUM'S.
260
TO PROCESS PULSE GEN.
FROM PROCESS PULSE GEN.
P25
A
B
C
P22
P14
P17
P13
P19
P18
P15
P20
P23
P26
P16
G
F
0
1
246
244
254
256
268
266
264
270
312
314
316
334
342
336
338
344
346
356
350
352
354
340
348
358
360
362
364
423
429
439
443
447
453
270

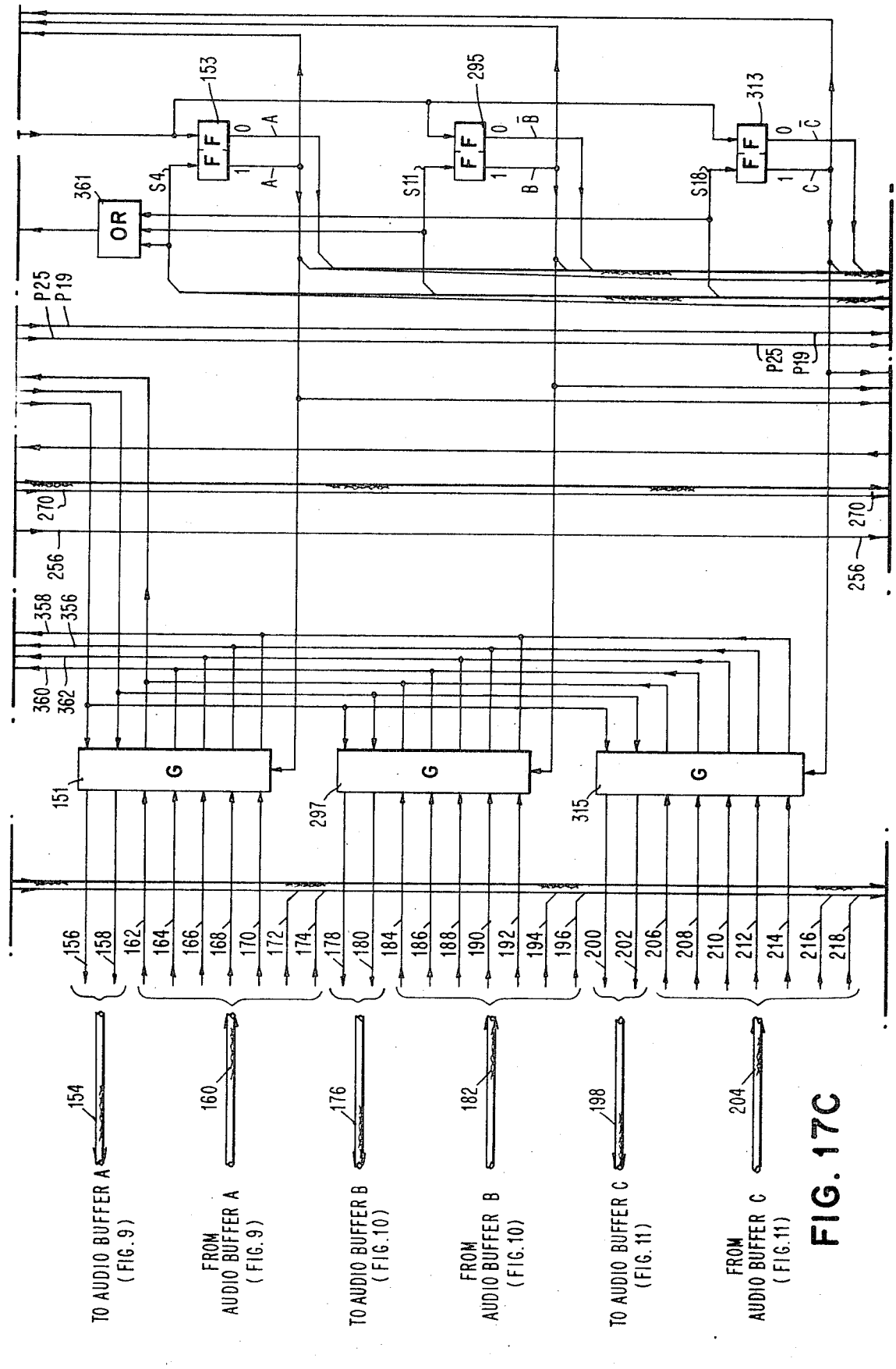
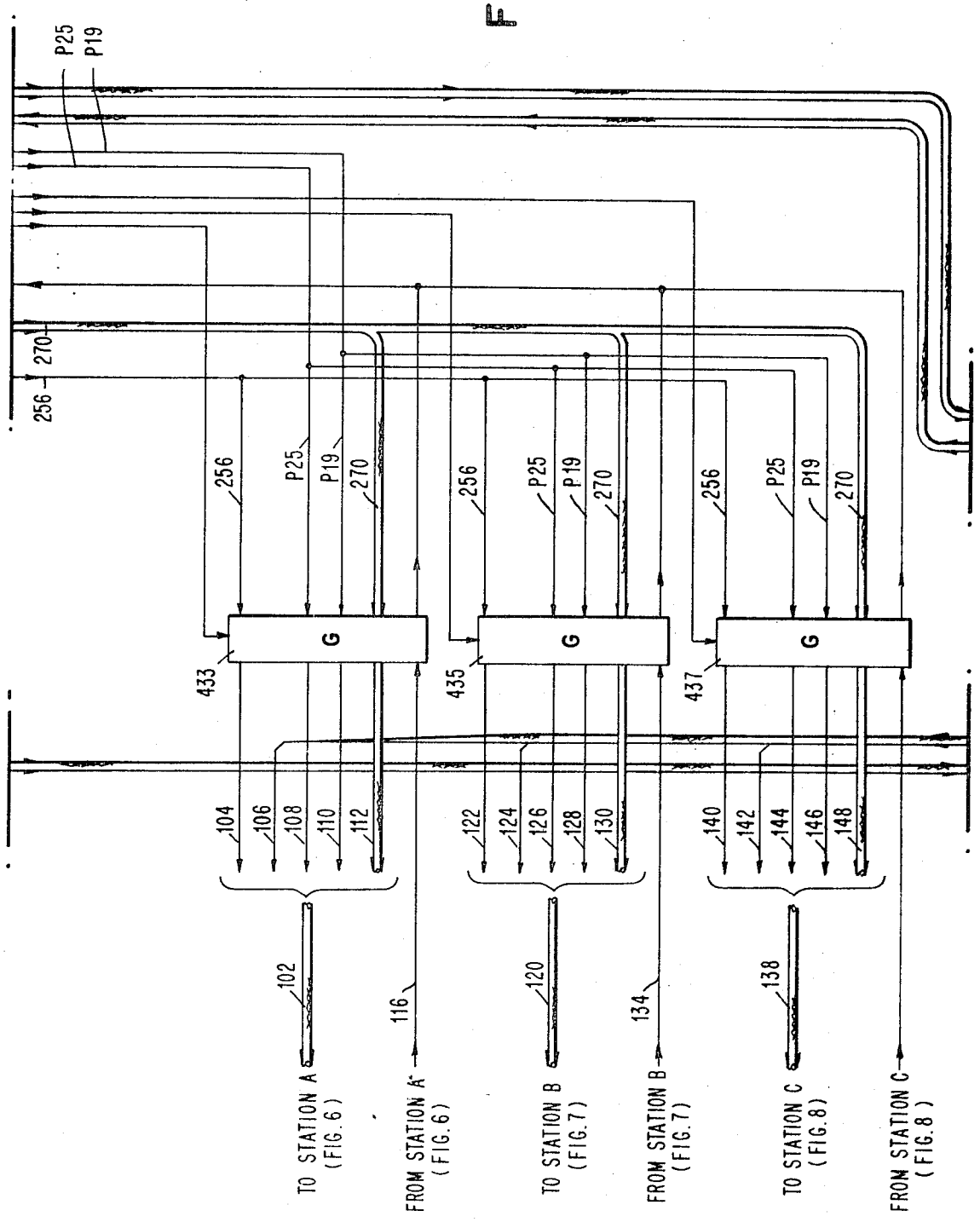

153
295
313
F F
0
1
A
B
C
361
OR
S4
S11
S18
P25
P19
270
256
358
356
360
362
G
151
297
315
156
158
162
164
166
168
170
172
174
178
180
184
186
188
190
192
194
196
200
202
206
208
210
212
214
216
218
154
160
176
182
198
204
TO AUDIO BUFFER A (FIG. 9)
FROM AUDIO BUFFER A (FIG. 9)
TO AUDIO BUFFER B (FIG. 10)
FROM AUDIO BUFFER B (FIG. 10)
TO AUDIO BUFFER C (FIG. 11)
FROM AUDIO BUFFER C (FIG. 11)

FIG. 17C

FIG. 17D


P25
P19
270
256
G
433
435
437
104
106
108
110
112
122
124
126
128
130
140
142
144
146
148
102
116
120
134
138
TO STATION A (FIG. 6)
FROM STATION A (FIG. 6)
TO STATION B (FIG. 7)
FROM STATION B (FIG. 7)
TO STATION C (FIG. 8)
FROM STATION C (FIG. 8)

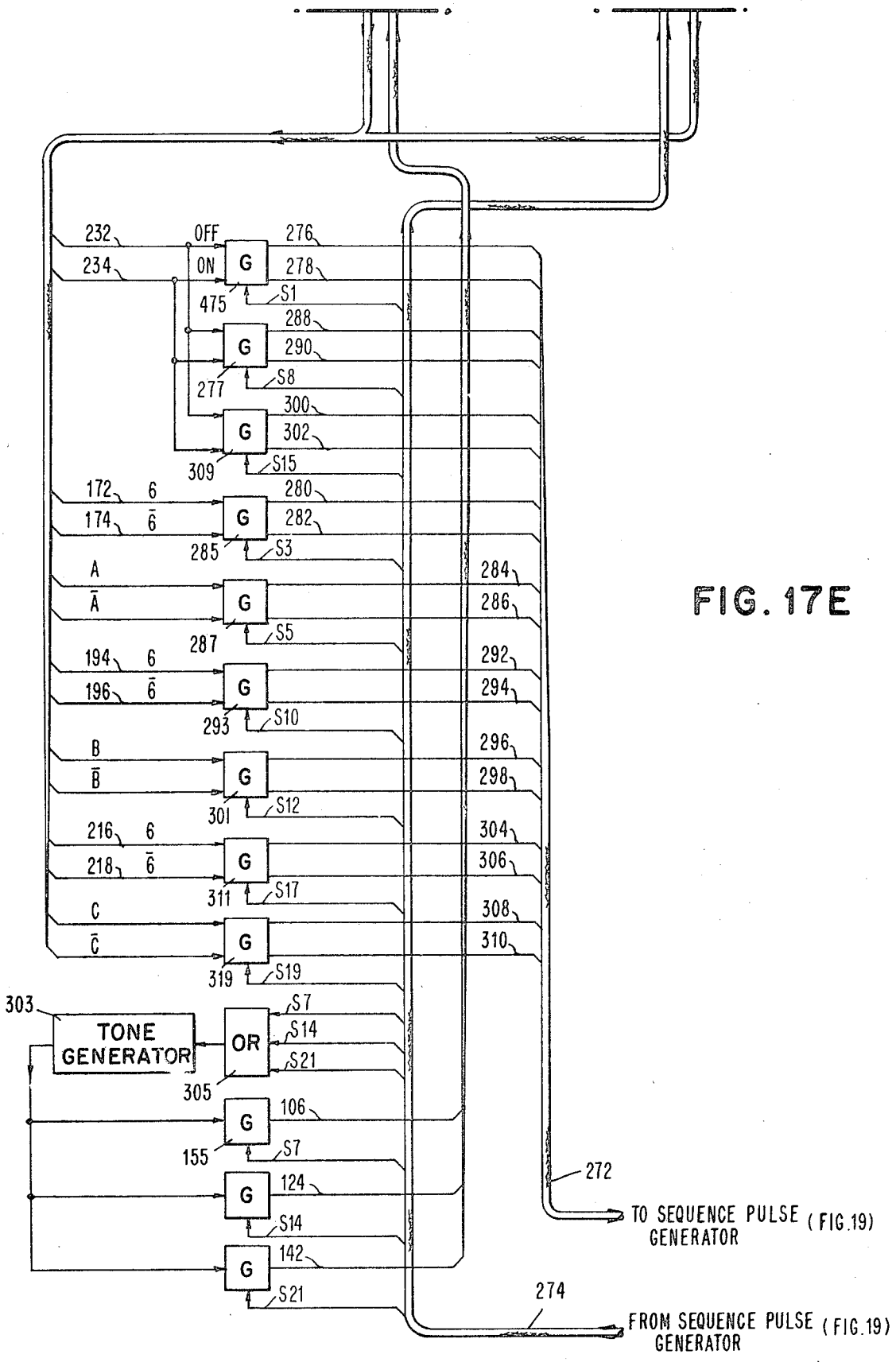

232
234
OFF
ON
G
276
278
475
S1
288
290
277
S8
300
302
309
S15
172
6
174
6̄
280
282
285
S3
A
Ā
284
286
287
S5
194
6
196
6̄
292
294
293
S10
B
B̄
296
298
301
S12
216
6
218
6̄
304
306
311
S17
C
C̄
308
310
319
S19
303
TONE GENERATOR
OR
S7
S14
S21
305
106
155
124
142
272
TO SEQUENCE PULSE GENERATOR (FIG.19)
274
FROM SEQUENCE PULSE GENERATOR (FIG.19)

FIG. 17E

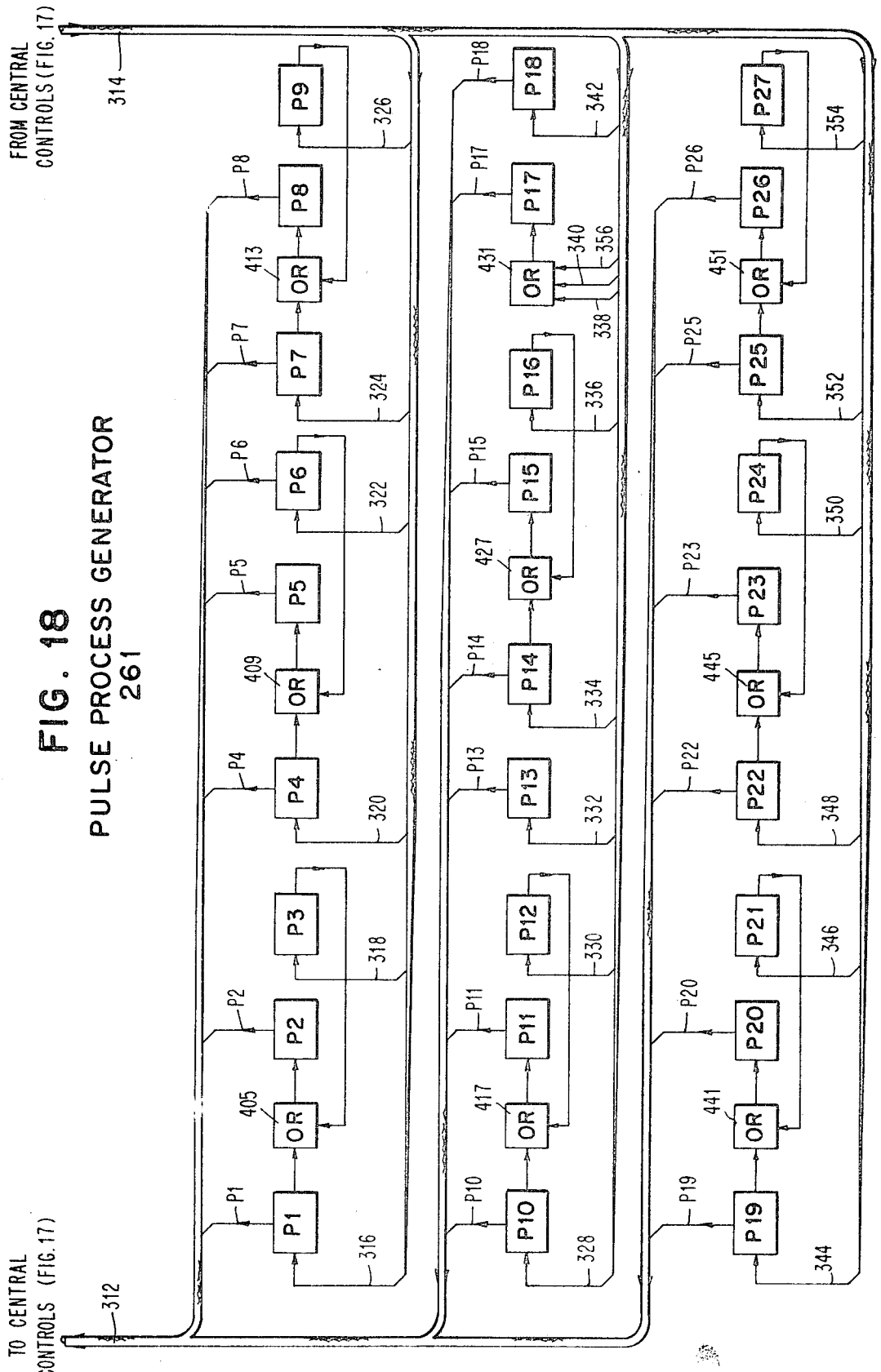
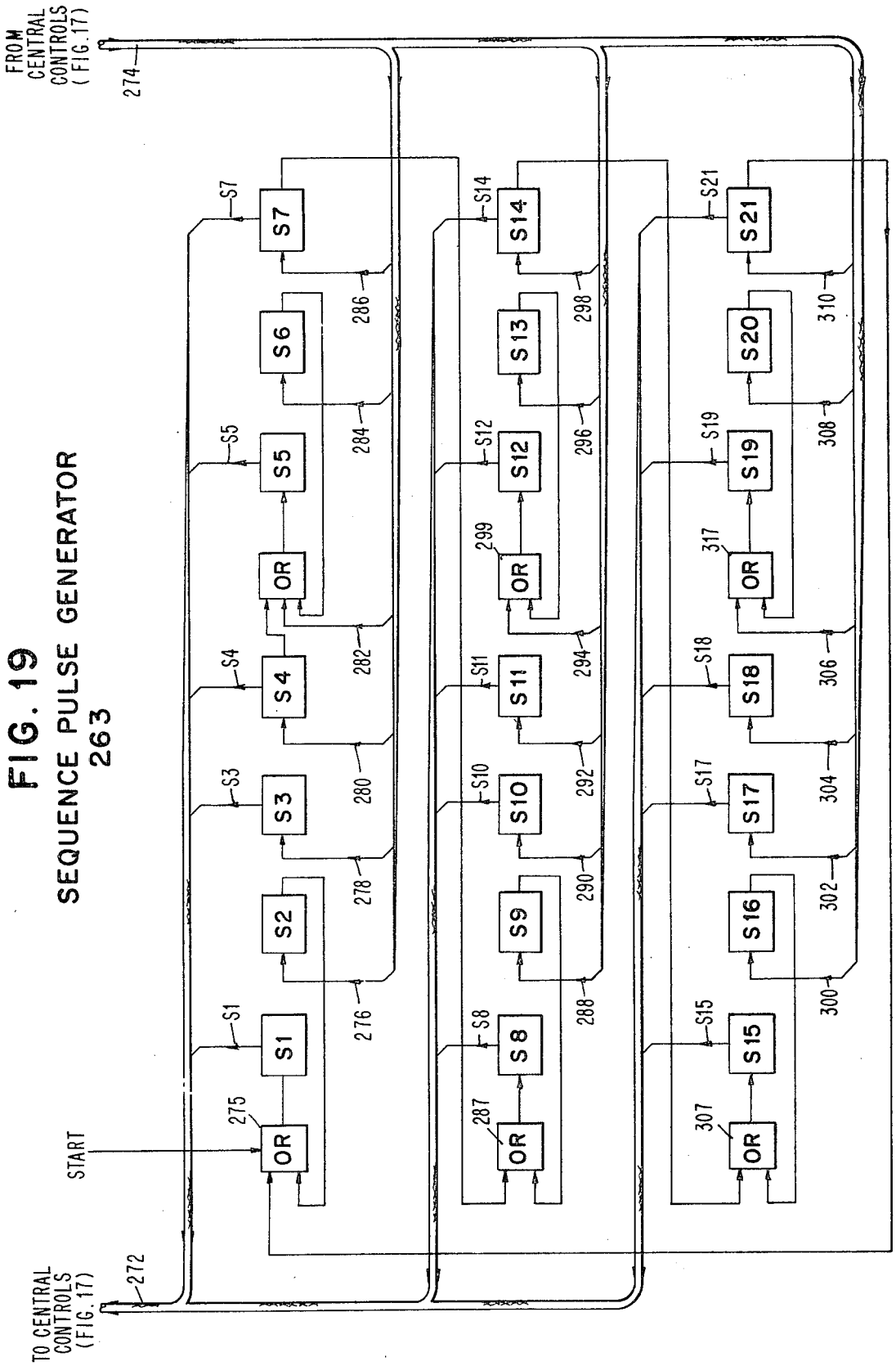

FROM CENTRAL CONTROLS (FIG. 17)
TO CENTRAL CONTROLS (FIG. 17)
PULSE PROCESS GENERATOR 261
312
314
316
318
320
322
324
326
328
330
332
334
336
338
340
342
344
346
348
350
352
354
356
405
409
413
417
427
431
441
445
451
P1
P2
P3
P4
P5
P6
P7
P8
P9
P10
P11
P12
P13
P14
P15
P16
P17
P18
P19
P20
P21
P22
P23
P24
P25
P26
P27
OR

FIG. 18

FIG. 19

SEQUENCE PULSE GENERATOR
263



VOICE ENTRY SYSTEM

This invention relates to voice entry systems. More particularly, it relates to an arrangement for making entry into an information-processing system from remote locations by means of voice communications.

There are many job situations wherein an employee generates or collects information as a byproduct of his principal task and is so occupied by his primary duty that he cannot operate or, perhaps, even learn to operate a conventional keyboard efficiently.

For example, at a supermarket checkout point, the cash register ring up and the bagging of merchandise involves a fundamental inefficiency because each item of merchandise must be handled twice by checkout personnel, viz; a first time to be rung up and a second time to be bagged. The period for bagging a single item is approximately 3 seconds, and the period for ringing up an item is about 2 seconds.

It has been ascertained that digits can be spoken at a rate of two or three digits per second but that a reasonably good keyboard operator can enter at least six digits per second with a ten-key keyboard.

It is thus quite evident that in a situation such as the above-described supermarket checkout example, vastly improved efficiency could be attained if the time consumption were to be essentially reduced to bagging only.

Similar time consumption problems and inefficiencies flowing therefrom obtain in a hospital, for example, at the point of information system data entry.

Accordingly, it is an important object of this invention to provide an arrangement for making entries into an information-processing system from remote locations.

It is another object to provide an arrangement in accordance with the preceding object wherein the users of the information-processing system may work at many different locations which have conventional telephone service, and wherein it would be uneconomical to provide effective key entry devices at each station.

It is a further object to provide an arrangement in accordance with the preceding objects which can be utilized with keyboards or with voice recognition devices.

SUMMARY OF THE INVENTION

In accordance with the invention, there is provided an arrangement for making entries into a processing system, processing the information entries, and providing the results of the processing, the entries being made by voice from a plurality of remote stations, each entry comprising a chosen number of words, and the processing results are provided back to the stations. Included in the arrangement are speech compression means, audio buffer means, a word counter and read control means respectively associated with each of the stations. The speech compression means is operative to compress the duration of the number of words in an information entry. The audio buffer means stores the compressed information entry. The word counter means functions to contain a count of the words of an information entry and the read control means operates to present the stored entry in the audio buffer to the operator of a keyboard which is employed to enter the information entries into an information-processing system where the entries are processed. Provided in the arrangement is a sequencing means, which, in response to states of the word counters, establishes the station whose information entry is to be processed. The information-processing means provides the results of the processing of the information entries to output means such as printers respectively located at each station.

The foregoing and other objects features and advantages of the invention will be apparent from the following more particular description of preferred embodiments of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

In the drawing, FIG. 1 is a block diagram which depicts the general organization of the arrangement constituting the invention;

FIG. 2 is a diagram which details certain features of the arrangement of FIG. 1 for a particular application of the invention;

FIG. 3 is a diagram of an illustrative structural embodiment of the invention;

FIG. 4 is a flow diagram of the microprogram effected by the sequence pulse generator of FIG. 3;

FIG. 5 is a flow diagram of the microprogram effected by the process pulse generator of FIG. 3;

FIG. 6 is a diagram of the arrangement at station A;

FIG. 7 is a diagram of the arrangement at station B;

FIG. 8 is a diagram of the arrangement at station C;

FIGS. 9A and 9B taken together as in FIG. 9 depict an illustrative embodiment suitable for use as the audio buffer A in the embodiment shown in FIG. 3;

FIGS. 10A and 10B taken together as in FIG. 10 show an example of an embodiment suitable for use as the audio buffer B of FIG. 3;

FIGS. 11A and 11B taken together as in FIG. 11 show an example of an embodiment suitable for use as the audio buffer C of FIG. 3;

FIG. 12 is a diagram of an illustrative embodiment of a keyboard suitable for use in the system shown in FIG. 3;

FIG. 13 is a diagram of an illustrative embodiment of an arrangement suitable for use as the error detect stage in the system of FIG. 3;

FIG. 14 is a diagram of an arrangement suitable for use as the audio response unit of the system of FIG. 3;

FIG. 15 is a depiction of an arrangement suitable for use as the random access memory stage of the system of FIG. 3;

FIG. 16 is a diagram of an arrangement suitable for use as the total accumulators stage of the system of FIG. 3;

FIGS. 17A to 17E taken together as in FIG. 17 depict an embodiment of the central controls stage of the system of FIG. 3;

FIG. 18 is a diagram of an embodiment of the process pulse generator of the system of FIG. 3; and

FIG. 19 is a diagram of an embodiment of the sequence pulse generator of the system of FIG. 3.

DESCRIPTION OF A PREFERRED EMBODIMENT

The conceptual embodiment which is first described hereinbelow is an application to the supermarket checkout situation. According to the invention, and as shown in this embodiment, the checkout operation is reduced to bagging only of an item with voice communication to a central keyboard operator as the item is bagged, to record the item sold, obtain its current price, and update the inventory records.

It has been mentioned hereinabove that digits can be spoken at a rate of two or three digits per second but that a reasonably proficient keyboard operator can enter more than six digits per second on a ten-key keyboard. It is readily apparent, therefore, that to achieve optimal efficiency, the rate at which digits are presented to the keyboard operator has to be increased. Thus, a feature of the invention resides in the fact that the checkout employee is given a relatively short interval such as approximately 2 seconds to read a four to six digit code number, for example, from an item of merchandise into a headset microphone. The beginning of the interval may be indicated by an audio signal in the headset earphones, and the spoken digits are recorded on audio tape as they are uttered. At the end of this interval, the tape is accelerated and played back to the keyboard operator in a shorter interval such as about 1 second. With this arrangement, the rate of presentation to the keyboard operator is virtually doubled, i.e., about one message or four to six characters per second, and causes the sounds on the tape to rise in pitch.

In connection with the foregoing, it has been found that spoken digits are readily understood when the playback time is six-tenths as long as the recording time. Additional reduction of playback time can be achieved by reducing the periods of silence between words. For conversational speech, these have been estimated to be 10 percent of the speaking time.

For spoken digits, the silence periods are greater, i.e., about 25 percent of the time. Thus, if the 2 second speech interval is reduced 20 percent (from 2.0 to 1.6 seconds) and the playback interval is reduced to 60 percent, a one message per second presentation rate can be achieved without excessive pitch elevation.

If the bagging is effected at a rate of 3 seconds per item, and the keyboard operator's equipment is switched automatically to provide properly phased signal tones and to accept output from successively arranged checkout stations at 1 second intervals, then one keyboard operator can readily handle three checkout stations and the total time required to handle each customer at the checkout station is reduced to the bagging time plus the time required to make change.

Reference is now made to FIG. 1 wherein there is illustrated the inventive concept as applied to the supermarket checkout situation. In the arrangement shown in this FIG., there are shown three checkout stations wherein checkout personnel speak to their respective microphones **11**, **12**, and **13** after they have received an audio signal from an audio response unit **10**. The latter signal could be, for example, the term "ready" for the first item of an order and one or two characters related to the previous item such as the check digit and quantity for subsequent items. Each of microphones **11**, **12**, and **13** are, of course, suitably gated to block out speech during a voice answer back period.

The speech input at each station is applied to a speech compression unit respectively associated with the station. In FIG. **1**, for convenience, there is shown only speech compression unit **15**, which is associated with station **11**, i.e., with microphone **11**. The speech compression units are operative to reduce speech duration. As has been mentioned above, in addition to the elimination of interword silences, such speech compression can be achieved, for example, by braking speech up into successive time slots and then reassembling it, omitting every *n*th time slot sample to achieve a shorter duration without elevating pitch.

A speech compression unit **15** provides inputs for an audio buffer stage **14** and a word counter **16** there being an audio buffer and a word counter associated with each speech compression unit. The function of an audio buffer is to receive the intervals of audio signals that have been retained by a speech compression unit **15** and to assemble these intervals into shorter durations but still intelligible speech. A word counter **16** receives inputs that correspond to interword silence periods detected in the speech compression unit. A word counter **16** is decremented by one by a pulse produced from a keyboard **18** whenever an entry is made by the keyboard operator.

The state of a word counter **16** is employed to control a service sequencer stage **20**, the function of service sequencer stage **20** being to establish the checkout station which is to be operated. The state of a word counter **16** also controls the rate of compressed speech playback from an audio buffer **14** to the headset of the operator of keyboard **18** by controlling a read control stage **22**, a read control state **22** being also provided for each checkout station. With appropriate logic as contained in a control logic stage **24**, the playback rate is increased when a larger number of words is stored in word counter **16** and is reduced when the words stored in word counter **16** are fewer in number. A read control stage **22** is constructed whereby it presents messages to keyboard **18** word by word.

The entries of the keyboard operator made into keyboard **18** go to a unit **26**, legended file and processor. Processor unit **26** suitably contains the description, price and inventory status of the many thousands of items stocked by the supermarket. When an item number designation is entered into file and processor unit **26** and verified therein against its check digit, the price of such item and one or two identifying digits, such as its check digit and quantity, are transmitted to audio response unit **10** and to a printout control unit **28**, which controls respective printers located at each checkout station, there being shown in FIG. **1** respective printers for stations **11**, **12**, and **13**. Printout control unit **28** transmits the descriptive information and price to the appropriate printer, and audio response unit **10** transmits the recorded sound of the selected digits to a voice answer back control stage which in turn transmits these sounds to the appropriate checkout station headset. A signal from voice answer back control stage **30** is also operative to gate out speech from the microphone at the particular checkout station during the voice answer back period.

There is also shown in the arrangement in FIG. **1**, an input/output stage **32**, which can receive an input from file and processor unit **26**. Stage **32** may be, for example, a card or tape reader for entering new items, changing prices, etc., or may be a visual display unit for the keyboard operator's use in certain situations.

Reference is now made to FIG. **2** wherein there is shown in greater detail, particular features of the inventive concept, i.e., more detailed implementations for the speech compression and audio buffer units.

As has been mentioned hereinabove, a speech compression unit is operative to remove interword silences to thereby reduce speech duration. Accordingly, it includes a voice detect device **34** which provides an output gate as long as the average audio level exceeds a fixed threshold. A delay stage **36** is provided to delay the voice input signal for an interval corresponding to the averaging period of voice detect device **34**. When voice detect device **34** is actuated, it advances word counter **16** (FIG. **1**) and gates the audio signal to audio buffer **14**. If audio buffer **14** is chosen to be a tape loop **39**, the audio signal is gated to the write head associated with loop **39** and starts the tape drive for the audio buffer record **38**. In this connection, it may be arranged such that only the tape drive for audio record **38** is operated during record intervals and the length of tape loop **39** is increased as each word is recorded. The size of tape loop **39** corresponds to the state of word counter **16**. When voice detect stage **34** is deactuated, the write head for loop **39** is turned off and the tape drive is halted. The actions of delay stage **36** and detect stage **34** are intended to provide relatively small fixed periods such as about 10 milliseconds of silence on tape loop **39** during the periods of tape start and stop.

Playback begins when service status is imparted to a particular station, suitably by means of a gating or other arrangement. Such imparting of service status occurs when the word counter for that station contains a count, for example, of a chosen number of words and other service requests are not present. With this chosen number count status, in the particular word counter, playback by a read stage **42** is initiated when the enabling of the service status gate actuates a start read stage **40**, which may suitably be a trigger circuit. Playback continues until start read stage **40** turns off in response to a small fixed period of silence that was recorded on tape loop **39** and is detected by a word end detect unit **44**. Reading of the next word begins when start read trigger **40** is actuated by a signal from keyboard **18**. The output of keyboard **18** also decrements word counter **16** and, as long as the keyboard is operated in conjunction with the rate of recording on tape loop **39**, word counter **16** does not attain a count of the chosen number. Such "on-off" playback mode continues until word counter **16** and tape loop **39** returns to their zero states and the service status gate is deactivated.

If the rate of recording on tape loop **39** should exceed the rate of operation of keyboard **18**, the contents of word counter **16** will advance to a count exceeding a given number and, by the action of a high-speed control stage **46**, high-speed reading may be initiated, i.e., the rate of presentation of information to the operator, and continue until word counter **16** is again decremented to a state not exceeding the given number.

It can be appreciated that the playback control arrangement, according to the invention, permits the operator of keyboard **18** to match the audio recording rate on loop **39**. Should the operator fall behind, the system takes control and presents the playback at a faster rate to cause the keyboard operator to increase his rate of keying.

In considering the inventive concept as thus far, it is seen that the invention is characterized by two important capabilities for efficient data entry, viz:

1. Data entry is enabled to be effected in real time by employees that are primarily engaged in another task (bagging in the supermarket example) without the need for any major changes in their primary tasks or for acquiring significant new skills. 2. A natural and convenient mode of communication, i.e., voice, is used for data entry by employing a keyboard operator to translate voiced information into machine code and for enabling the matching of throughput rate of the keyboard operations.

Reference is now made to FIG. **3** wherein there is shown a preferred embodiment constructed in accordance with the principles of the inventive concept and FIGS. **4–19**, which illustrate in more detailed form the components and the operation of the system shown in FIG. **3**.

In FIG. **3**, it is seen that three stations A, B and C, designated **101**, **103** and **105** respectively, are shown by way of example. Since the structures at these stations are the same, reference need only be made to FIG. **6** wherein there is shown the structure of station A to understand the structures at all of these stations.

In FIG. **6**, it is seen that the structure at a station includes a microphone **115**, a telephone headset **113** and a printer **117**. In the supermarket application, wherein a station is a checkout counter, it is assumed, in accordance with this embodiment, that each item is identified by a six digit decimal number. These six digits are spoken into microphone **115** by the employee at the station. The least significant digit is a check digit and suitably chosen to be the modulo nine sum of the other five digits. These six digits, i.e., six audio words, are transmitted through microphone **115** on a line **100** to the audio buffer **107** for station A. Line **100** is arranged to carry an audio tone signal such as "beep," the tone indicating to the operator at the station that he can speak the next six words into his microphone. A line **106** to headset **113** carries an audio response message such as "repeat." This occurs where an error is transmitted, and the worker of the station A is asked to repeat the six words. Printer **117** is arranged in the supermarket application, for example, such that it is caused to print each sales item on a line together with its price and the total amount when all of the items and their prices have been printed. The item data is presented to printer **117** on a cable **112**, and the total data is presented to printer **117** on a cable **114**. When it is desired to print an item, a signal is applied to a line **108**, and the data present on cable **112** is printed as the item and price. When the total tabulation of items is complete, a signal appears on a line **116**. When a signal is applied to line **110**, the total is printed at its proper place, and when the latter printing is completed, a signal again appears on line **116** to indicate that the printing is completed. A chosen six digit number may be utilized by the employee at the station to indicate that a total is requested. Such number, for example, could be 999990. When the latter number is detected, the total is caused to be printed. It is noted that lines **104**, **106**, **118**, **110** and **116** and cable **112** extend from a central control stage **251**, (FIG. **3**), the operation of stage **251** being explained in greater detail hereinbelow.

AUDIO BUFFER

Reference is now made to FIG. **9**, wherein there is shown an audio buffer such as audio buffer **107**, (FIG. **3**), for station A. Here again, each of the respective station audio buffers are the same so that only one is described.

Each audio buffer contains a word counter, such as word counter **119** for audio buffer **107**. Word counter **119** has six output lines respectively designated by the numerals **164**, **166**, **168**, **170**, **172** and **174**, all of these lines terminating in a cable **160**, which goes to central control stage **251** (FIG. **3**). Line **164** is active if the number in counter **119** is zero and line **166** is active if the number in word counter **119** is not zero; line **168** is active if the number in word counter **119** is **3** and line **170** is active if the number in word counter **119** is not **3**; line **172** is active if the number in word counter **119** is **6** and line **174** is active if the number in word counter **119** is not **6**.

Line **174** is also employed, when it is active, to gate the information on line **100** to a speech compressor **123** by activating a gate **121**. With this arrangement, the microphone at a station is effective as long as there is less than a count of six words in word counter **119**. When the count in word counter reaches **6**, line **174** becomes inactive, and further information on line **100** is prevented from entering into speech compressor **123**.

An audio buffer can suitably be a tape unit having a major and a minor tape loop and wherein suitable feed rolls move the tape past a write head **125** and into the minor loop, which provides storage between write head **125** and the read head **127**. Since such an arrangement is well known, no further description or depiction of its structure is deemed necessary. A delay stage **147** is provided to delay the application of the output of speech compressor **123** to write head **125**.

With such tape unit, there is provided a write engage clutch magnet **129** to engage the feed rollers and to latch them closed to move the tape past write head **125**. A write disengage clutch magnet **131** is employed to release the latch imposed by write engage clutch magnet **129** to thereby halt the movement of the tape past write head **125**.

The output of speech compressor **123** is applied to a clipping amplifier **133**, which is effectively operative to produce a positive square wave for each spoken word. The positive shift of the output square wave from clipping amplifier **133** is detected by stage **135**, which is a circuit for detecting and amplifying the positive shift. The negative shift of the output square wave from clipping amplifier **133** is detected in a stage **137**, which is a circuit for detecting and amplifying the negative shift. The output of circuit **135** is applied to write engage clutch magnet stage **129**, and the input of circuit **137** is applied to write disengage clutch magnet stage **131** and to increment word counter **119**.

The read station, i.e., read head **127**, of the audio buffer is also provided with a read engage clutch magnet **139** and a read disengage clutch magnet **141**. As shown in FIG. **9**, the movement of the tape past read head **127** is caused by the activation of a line **156** from central controls **251** (FIG. **3**) and the stopping of the tape is caused by the activation of a line **158** from central controls **251**, lines **156** and **158** being included in a cable **154**. The output of read head **127** is also amplified and square waved by a clipping amplifier **143** and a stage **145**, which is a circuit for detecting and amplifying the negative shift of the output of clipping amplifier **143**, is employed to decrement word counter **119**.

KEYBOARD

An illustrative embodiment of the keyboard **235** (FIG. **3**) is shown in FIG. **12**. The keyboard **235** suitably comprises 10 key contact sets as shown for the digits **0–9** respectively, one contact of each contact set being connected to a voltage source. In addition, keyboard **235** is provided with an accept switch **239**, which an operator can place in the "Off" position if he has to leave the keyboard. When switch **239** is placed in such "Off" position, the system stops after the last item has been processed. The depression of any of the keys **0–9** can increment a stroke counter **243** through an OR-circuit **241**, stroke counter **243**, in accordance with this embodiment, being arranged to count three strokes. The three stroke amount has been chosen as an illustration because it is believed that using a six digit number to identify a sales item is more readily intelligible to a keyboard operator if it is divided into two bursts of three digits. When the keyboard is connected to an audio buffer, as is further explained hereinbelow, the keyboard operator receives a burst of three digits from the buffer. The operator then first keys these three digits into the keyboard, and, after a short interval of time, the operator

receives the next three digits. The manner in which this is accomplished is as follows:

When an audio buffer is first connected to the keyboard, the read engage clutch magnet (FIG. 9, for example) is engaged. When the first three words of the six digit number are counted in word counter 119, the read disengage clutch magnet is operated which halts movement of the tape and the operation of the audio buffer. When the keyboard operator keys in these first three digits, the read engage clutch magnet is again energized, and the last three digits are read from the buffer to the keyboard operator. The key contacts 1–8 (FIG. 12) go via a cable 236 to the error detect mechanism 345 (FIG. 3). All of contacts 0–9 of keyboard 235 go via a cable 238 to a random access memory 245 (FIG. 3).

In the keyboard shown in FIG. 12, it is noted that "ON" line 234 and "OFF" line 232 are part of a cable 226 which extends to central controls stage 251 (FIG. 3). Stroke counter 243 has two output lines, a line 230, which is active when the setting in stroke counter 243 is "3" and a line 225, which is active when the setting in stroke counter 243 is other than "3," lines 228 and 230 also going to central controls 251 as part of cable 226. Stroke counter 243 is reset when a line 224 from central controls 251 and in cable 220 is active. The line 222 is to the keyboard operator's headset and is also in cable 220 from central controls 251.

ERROR DETECT UNIT

Reference is made to FIG. 13 wherein an illustrative embodiment of error detect stage 237 is shown in greater detail. In the operation of this embodiment, the first five digits from the keyboard are transmitted to a mod 9 accumulator 149 through a gate 247 to produce the modulo 9 sum of the first five digits. The latter sum is then compared in a compare unit 151 with the sixth digit, which is provided from random access memory 245 (FIG. 3). If the comparison shows equality, the output line 244 from compare unit 151 to central control 251 is active. If the comparison shows inequality, then the output line 246 of compare unit 151 to central controls 251 is active.

AUDIO RESPONSE UNIT

An illustrative embodiment of this unit is shown in FIG. 14. In this unit, a request for the audio response is made by applying a P–14 pulse (as is further explained in the description of the P-clock (FIG. 18) to the audio response unit. The actual audio response, which may be the word "repeat," for example, appears on a line 256, which is routed back to the associated station operator's headset. A signal appears on a line 254 when the audio response is completed. It is seen in FIG. 14 that lines 254 and 256 are in cable 252, which goes to central controls 251.

The audio response unit suitably contains a tape loop, drum or disk, on which there is present the magnetic sound track of the response word or message, in this case the word "repeat." The latter word or message is delivered over to the output line upon request.

RANDOM ACCESS MEMORY

An illustrative embodiment of the random access memory 245 (FIG. 3) is shown in FIG. 15. In this component, there is provided an address assembly register 249, which receives its input via a cable 238 from keyboard 235 (FIG. 12) and which contains up to six decimals. These digits are entered into register 249, one by one, via cable 238. Thus, it is understood that six consecutive depressions of keys on keyboard 235 will fill register 249, the lowest order digit being the check digit. This check digit is transmitted via cable 248 to error detect unit 245 (FIG. 3).

As has been mentioned above, a special digit configuration, such as 999990, can be employed to indicate a request for a total. These digits can be provided to a decoder 253 by a cable 255, and if a total is requested, i.e., the presentation of the combination 999990 to decoder 253, an output line 266 of decoder 253 is active. If a total is not requested, then, of course, an item is to be printed, and a line 264 is consequently active.

A read access of the memory is initiated by the P22 pulse of the P-clock (FIG. 18), which is applied to the line legended "request read access." When the read access is complete, a pulse appears on an output line 268 from the memory. The operation of the read access is to load a data register 257 with the particular item description and its price. The contents of data register 257 are transmitted to central controls 251 through a cable 270 and cable 262, from which they are routed back to a printer at the appropriate checkout station. The contents of the price field in data register 257 are transmitted to an appropriate total accumulator 259 (FIG. 3). In this connection, it is realized that a total accumulator is provided for each station.

TOTAL ACCUMULATOR

An illustrative embodiment of a total accumulator 259 (FIG. 3) is shown in FIG. 16. In this FIG., it is seen that the contents of the price field of data register 257 (FIG. 15) are transmitted via cable 258 to the appropriate station accumulator through an associated gate. The gate is actuated upon the enabling of an AND-circuit by the coincidence of the P25 pulse (P-clock, FIG. 18) and a signal indicating the particular station, viz A, B or C. The outputs of accumulators A, B and C, are transmitted to stations A, B and C through cables 114, 132 and 150.

PROCESS PULSE GENERATOR (P-CLOCK)

The process pulse generator 261 (FIG. 3) is shown in detailed form in FIG. 19. It comprises 27 monostable multivibrators P1–P27. The latter are arranged whereby they are actuated by the respective inputs thereinto. For convenience, the actuated, i.e., astable output of a monostable vibrator circuit is given the same designation as the circuit itself. Thus, for example, the output of monostable multivibrator P1 is pulse P1. The output line of a monostable multivibrator circuit produces a pulse when the circuit goes "OFF," and this pulse can be employed to activate, i.e., turn "On," another monostable multivibrator. The clock pulses P1–P27 are transmitted via a cable 312 to central controls 251 where these pulses are employed to interrogate gates and perform other functions. The lines in a cable 314 come from central controls 251 and are utilized to actuate, i.e., turn "On" certain monostable multivibrators when branching of the microprogram is required.

SEQUENCE PULSE GENERATOR (S-CLOCK)

The sequence pulse generator comprises monostable multivibrators as the timing pulse sources, and are constructed similar to those in the process pulse generator. As seen in FIG. 19, it comprises 21 monostable multivibrator circuits, the pulse output of a circuit having the same designation as the circuit itself. This pulse generator is employed to interrogate the stations (A, B and C in this embodiment) and to determine whether or not any of these stations require processing service. In this connection, when the contents of a word counter in an audio buffer are at 6, the signify that an item can be processed. By "processing," it is meant that the keyboard operator can be connected to the particular audio buffer and key in the six digits to the system. The system will then process the request, whether the latter is for an item or for a total.

CENTRAL CONTROLS 251

An illustrative embodiment of the central controls 251 is depicted in FIGS. 17A–17E, taken together as in FIG. 17. This structure contains most of the logic needed for the operation of the system, all of the units in the system interacting therewith.

In considering the operation of the inventive system, there is first explained the sequence microprogram. For this explanation, reference is made to FIG. 3, i.e., the overall diagram of the embodiment being described; FIG. 4, which is a flow chart of the sequence microprogram; FIG. 19, which shows the sequence pulse generator, i.e., the S-clock; and FIG. 17, which depicts the central controls.

As seen in FIG. 19, the S-clock is started by a start pulse applied to an OR-circuit 275, the output of OR-circuit 275 turning on monostable multivibrator S1 to produce pulse S1. The function of the S1 pulse is to test accept switch 239 (FIG. 12) to determine whether the switch is on or off, i.e., pulse S1 is applied to a gate 475, FIG. 17E. Also applied to gate 475 are lines 232 and 234 from the keyboard, the active state of line 232 signifying that switch 239 is "OFF," the active state of line 234 indicating that switch 239 is "ON." The active state of output line 278 of gate 475 indicates that the switch 239 is "ON," and the active state of output line 276 of gate 275 indicates that switch 239 is "OFF." If switch 239 is "OFF," then the microprogram branches to monostable multivibrator S2. The pulse S2 output is used for delay only, and at its termination, reactuates monostable multivibrator S1 through OR-circuit 477. However, if switch 239 is "ON," then monostable multivibrator S3 is actuated by active line 278 to produce pulse S3.

The function of pulse S3 is to test the contents of the word counter in an audio buffer to ascertain whether or not it is in the "6" state. This is accomplished by applying pulse S3 to gate 285 (FIG. 17E), the input lines to gate 285 being output line 172 of word counter 119 in audio buffer A, the active state of line 172 indicating that the contents of word counter 119 are at "6," and the active state of line 174 indicating that the contents of word counter 119 are not at "6." If the contents of word counter 119 are at "6," then an output line 280 of gate 285 is active, the active state of line 280 being employed to actuate monostable multivibrator S4. The actuating of monostable multivibrator S4 initiates processing from audio buffer A. To effect this initiation, pulse S4 is applied to OR-circuit 361 (FIG. 17), the output of OR-CIRCUIT being applied to a line 316, the active state of which is utilized to actuate monostable multivibrator P1 in the process pulse generator, i.e., the P-clock (FIG. 18). However, if the contents of word counter 119 are not at "6" whereby output line 174 thereof is active, then monostable multivibrator S5 is actuated by the active state of output line 282 of gate 285 (FIG. 17E). Pulse S5 is applied to a gate 287, the input lines to gate 287 being A and $\overline{A}$ respectively, the active states line A and line $\overline{A}$ indicating whether or not the processing from audio buffer A is completed. In this connection, A flip-flop 153 had been set by pulse S4. If output line 284 of gate 287 is active, indicating that processing of audio buffer A is not completed, flip-flop 153 is still in its "1" state. Line 284 actuates monostable multivibrator S6 to produce pulse S6 therefrom, the latter pulse again turning on monostable multivibrator S5 through an OR-circuit 281, pulse S6 being used for delay only. However, if processing from buffer A is complete, i.e., flip-flop 153 is in its "0" state; then output line 286 from gate 287 is active; and the microprogram advances to monostable multivibrator S7. The function of pulse S7 is to connect the tone generator 303 through OR circuit to the headset at station A and to deliver a short beep to inform the operator at station A that he can speak the next six words. In this connection, pulse S7 is applied to gate 155 (FIG. 17F), the output of gate 155 being applied to line 106, which via cable 102 goes to station A.

When pulse S7 terminates, it is applied through an OR-circuit 287 to turn on monostable multivibrator S8. Pulse S8 is again utilized to test the state of switch 239 (FIG. 12).

This is accomplished by applying pulse S8 to a gate 277, the input lines to gate 275 being line 232, which, when active, indicate that switch 239 is "OFF" and line 234, the active state of which indicates that switch 239 in "ON." Output line 288 of gate 275, when active, signifies that switch 239 is "OFF" and the active state of output line 290 of gate 275 indicates that switch 239 is "ON." If switch 239 is "OFF," then active line 288 actuates monostable multivibrator S9, the output pulse S9 being applied through OR-circuit 287 to reactuate monostable multivibrator S8, pulse S9 being used for delay only. If switch 239 is "ON," then the active state of line 290 actuates monostable multivibrator S10 which is employed to test whether the contents of the word counter in audio buffer B are or are not at "6." To this end, pulse S10 is applied to a gate 293, the input lines to gate 293 being line 194, which is the output line from the word counter in audio buffer B which indicates that the contents of the word counter are at "6" and the output line 196 from the word counter in audio buffer B, the active state of line 196 signifying that the contents of this word counter are not at "6." Correspondingly, the output line 292 of gate 293, when active, signifies that the audio buffer B-word counter contents are at "6" and output line 294 of gate 293, when active, signifies that the audio buffer B word counter contents are not at "6."

If the contents in the word counter of audio buffer B are at "6," then the active state of line 292 actuates monostable multivibrator S11, which initiates processing from the audio buffer B by switching to its "1" state a flip-flop 295 to actuate the gate 297. However, if the contents of the word counter in audio buffer B are not at "6," then the active state of output line 294 of gate 293 is applied through an OR-circuit 299 to turn on monostable multivibrator S12, pulse S12 being applied to a gate 301. The input lines to gate 301 are then set output line B and the reset output line $\overline{B}$ of flip-flop 295, the active states of the latter lines respectively signifying that the processing in audio buffer B is not or is completed. If it is not completed, then output line 296 of gate 301 is active to actuate monostable multivibrator S13, pulse S13 being applied through OR-circuit 299 to again actuate monostable multivibrator S12, pulse S13 being used for delay only. However, if processing in audio buffer B is completed, then output line 298 of gate 301 is active to turn on monostable multivibrator S14. Pulse S14 is employed to deliver a beep signal to station B by being applied to tone generator 303 through OR-circuit 305.

When pulse S14 terminates, it is applied through an OR-circuit 307 to actuate monostable multivibrator S15. The pulse S15 is used to test for the state of the accept switch. Such testing results from the applying of pulse S15 to gate 309 (FIG. 17E). The input lines to gate 309 are lines 232 and 234, which respectively, when activated, indicate an "OFF" and an "ON" state of the switch. If the switch is "OFF," then output line 300 of gate 309 turns on monostable multivibrator S16, pulse S16 being applied through OR-circuit 307 to actuate multivibrator S15, pulse S16 being used for delay purposes only. However, if the switch is in the "ON" state, then output line 302 of gate 309 is employed to actuate monostable multivibrator S17, pulse S17 being applied to a gate 311 (FIG. 17E) to test whether contents of the word counter of audio buffer C are or are not at "6." If these contents are at six, then output line 304 of gate 311 is activated to actuate monostable multivibrator S18, pulse S18 being applied to a flip-flop 313 to switch flip-flop 313 to its "1" state to thereby initiate processing from an audio buffer C. In this connection, the "1" output of flip-flop 313 actuates a gate 315 to effect such initiation. If the contents of the word counter of audio buffer C are not at "6," then output line 306 of gate 311 is actuated to provide a pulse through an OR-circuit 317 to actuate monostable multivibrator S19. Pulse S19 is applied to a gate 319 to test for the state of flip-flop 313, the input lines to gate 319 being the set and reset output lines C and $\overline{C}$.

If this test finds that flip-flop 313 is still in its "1" state, then output line 308 of gate 319 is activated to turn on monostable multivibrator S20, pulse S20 being applied through OR-circuit 317 to actuate monostable multivibrator S19, pulse S20 being used for delay purposes only. If the test finds that flip-flop 313 is in its "0" state, then output line 310 of gate 319 is active whereby pulse S21 is applied through an OR-circuit 275 to turn on monostable multivibrator S1 to thereby initiate the sequence cycle for audio buffer A.

It is realized that in this sequence cycle, flip-flop **153** provides the actuating input for gate **151**, which controls processing in audio buffer A. Flip-flop **215** provides the actuating input to gate **297**, which controls the processing for audio buffer B. Flip-flop **313** provides the actuating input to gate **315**, which controls the processing for audio buffer C. Pulses S7, S14 and S21 are utilized to actuate tone generator **303** to provide the beep at the end of a processing cycle at a station.

There are now described the events which ensue during the processing cycle. In this description there are utilized FIG. **17**, i.e., central controls, FIG. **5**, i.e., the process flow chart and FIG. **18**, i.e., the process pulse generator.

It is recalled that the process pulse generator, i.e., the P-clock, is actuated by a pulse on line **316**, which turns on monostable multivibrator P1 to produce pulse P1. Pulse P1 is passed through an OR-circuit **401** and applied to gates **151**, **297** and **315**, the pulse emerging on lines **156**, **178** and **200** from gates **151**, **297** and **315** respectively, the pulse being transmitted to the read clutch in the particular audio buffer, viz, A, B or C via cables **154**, **176** or **198**. As each word is read from an audio buffer, the word counter therein is decremented by one. When pulse P1 terminates, it actuates monostable multivibrator P2 through an OR-circuit **405**. Pulse P2 is employed to test whether the word counter in the particular audio buffer has been counted down to "3." To this end, pulse P2 is applied to a gate **407**, the input lines to gate **407**, viz, lines **356** and **358**, representing the lines from a word counter in an audio buffer which indicate whether or not the contents of the counter are at "3." If a word counter has not been counted down to "3" at this juncture, an output line **318** of gate **407** is active to turn on monostable multivibrator P3, pulse P3 being applied through OR-circuit **405** to again actuate monostable multivibrator P2, pulse P3 being employed for delay only. However, if the word counter is at "3," then output line **320** of gate **407** is active to turn on monostable multivibrator P4.

The P4 pulse is passed through an OR-circuit **403** to gates **151**, **297** and **315**, the P4 pulse appearing on either of lines **158**, **180** and **202**, whereby they are transmitted to audio buffer A, B or C by cables **154**, **176** and **198** respectively. At the audio buffer, the P4 pulse is operative to disengage the read clutch.

At this point, the keyboard operator now has to key in the burst of three words to the keyboard. Accordingly, when pulse P4 terminates, it turns on monostable multivibrator P5 through an OR-circuit **409**, pulse P5 being applied to a gate **411**, the input lines to gate **411** being the lines **228** and **230** from the keyboard. The function of pulse P5 is to ascertain whether stroke counter **243** (FIG. **12**) is or is not at "3." If it is not at "3," then output line **322** of gate **411** is active to turn on monostable multivibrator P6, pulse P6 being applied through an OR-circuit **409** to again actuate monostable multivibrator P5, pulse P6 being used for delay purposes. If output line **324** of gate **411** is active indicating that stroke counter **243** is at "3," then monostable multivibrator P7 is switched on, pulse P7 being passed through OR-circuit **401** to gates **151**, **297** and **315**. Thereby, they procede via cables **154**, **176** or **198** to either of audio buffers A, B or C. The function of pulse P7 is to again engage the read clutch in audio buffer and to reset the stroke counter to "0."

When pulse P7 terminates, monostable multivibrator P8 is switched on through an OR-circuit **413**, pulse P8 being applied to gate **415**, the input lines to gate **415** being **360** and **362** which represent the **0** and $\overline{0}$ output lines of the word counter in an audio buffer. If the contents of a word counter in this situation are not at "0," then output line **326** of gate **415** is active to switch on monostable multivibrator P9, pulse P9 being passed through OR-circuit **415** to again switch on monostable multivibrator P8, pulse P9 being employed for delay purposes. If, however, the word counter is at "0" at this point, then output line **328** of gate **415** is active to switch on monostable multivibrator P10 to disengage the read clutch and to this end, pulse P10 is passed to the read clutch via cables **154**, **176** or **198** respectively.

When pulse P10 terminates, it switches on monostable multivibrator P11 through an OR-circuit **417**. The function of pulse P11 is to test whether stroke counter **243** in keyboard **235** is at "3." To this end, pulse P11 is applied to gate **419**, the input lines to gate **419** being lines **228** and **230**, which are the $\overline{3}$ and **3** output lines of stroke counter **243** (FIG. **12**). If stroke counter **243** is not at "3," then output line **230** of gate **419** is active to switch on monostable multivibrator P12, pulse P12 being applied through OR-circuit **417** to again switch on monostable multivibrator P11, pulse P12 being used for delay purposes. If, however, stroke counter **243** is at "3," then output line **332** of gate **419** is active to switch on monostable multivibrator P13. Pulse P13 is passed through an OR-circuit **421** to appear on line **224**, which resets stroke counter **243** to "0." Pulse P13 is also employed to check compare unit **153** in error detect stage **245** (FIG. **13**). To this end, it is applied to a gate **423**, the input lines to gate **423** being lines **244** and **246**, representing equal and not equal from compare unit **151**. If the output from compare unit **151** shows inequality, i.e., the check digit did not compare whereby line **246** therefrom is active, then output line **334** of gate **423** is correspondingly active to switch on monostable multivibrator P14, pulse P14 being used to request an audio response from the audio response unit. To this end, pulse P14 goes directly to the audio response unit. It is also applied to set a flip-flop **358** to its "1" state. Upon the determination of pulse P14, it switches on monostable multivibrator P15 through an OR-circuit **427**, pulse P15 being applied to a gate **429**, the input to gate **429** being the set and reset outputs of flip-flop **358**. If the audio response has not been completed, then output line **336** of gate **429** is active to switch on monostable multivibrator P16, pulse P16 being applied through OR-circuit **427** to again switch on monostable multivibrator P15, pulse P16 being used for delay purposes only. If, however, the audio response has been completed, then output line **338** of gate **429** is active, the pulse on line **338** being passed through an OR-circuit **431** to switch on monostable multivibrator P17. Pulse P17 is employed to reset the A, B and C flip-flops to 0 and also to reset modulo **9** accumulator **149** in error detect stage **245** (FIG. **13**). To this end, pulse P17 is transmitted directly to modulo **9** accumulator **149** in error detect unit **245** and is applied as a reset input to flip-flops **153**, **295** and **313**.

In testing compare unit **151**, in error detect unit **245**, if it was found that the check digit did compare whereby output line **244** of compare unit **151** is active, then the microprogram branches directly from pulse P13 to pulse P18 by the turning on of monostable multivibrator P18. The function of pulse P18 is to determine whether or not there is a request for a total. To this end, pulse P18 is applied to a gate **439**, the input lines to gate **439** being lines **266** and **264** of decoder **253** in random access memory **245** (FIG. **15**). If there is a request for a total, then output line **344** of gate **439** is active to switch on monostable multivibrator P19. The function of pulse P19 is to initiate a printout of a total. To this end, pulse P19 is applied to gates **433**, **435** and **437**. Thereby, pulse P19 is sent to the particular stations A, B or C through output lines **110**, **128** and **146** respectively. These lines are in cables **102**, **120** and **138**. Pulse P19 is also applied to set a flip-flop **360** to its "1" state.

When pulse P19 terminates, monostable multivibrator P20 is switched on through an OR-circuit **441**. The function of pulse P20 is to test whether the total printout has been completed. Accordingly, pulse P20 is applied to a gate **443** whose input lines are the set and reset outputs of flip-flop **360**. If the total printout is not complete, then output line **346** of gate **443** is active to switch on monostable multivibrator P21, pulse P21 being applied through OR-circuit **341** to again switch on monostable multivibrator P20, pulse P21 being used for delay purposes. If, however, the total printout is complete, then output line **356** of gate **443** is active; and the microprogram branches back to pulse P17, monostable multivibrator P17 being turned on at this juncture through OR-circuit **431**.

If pulse P18 ascertained that there is not a request for a total, then output line **348** of gate **439** is active to turn on monostable multivibrator P22, pulse P22 being applied to

request a read access from the memory in the random access memory unit 245 (FIG. 15). Pulse P22 is also applied to set to its "1" state a flip-flop 362. When pulse P22 terminates, monostable multivibrator P23 is switched on to OR-circuit 445. The function of pulse P23 is to test the completion of the memory access. Thus, it is applied to a gate 447 input lines to which are the set or reset output lines of flip-flop 362. If the memory access is not complete, then output line 350 of gate 447 is active to switch on monostable multivibrator P24, pulse P24 being used to switch on monostable multivibrator P23 through OR-circuit 445, pulse P24 being used for delay purposes only. However, if the memory access is complete, then output line 352 of gate 447 is active to switch on monostable multivibrator P25. The function of pulse P25 is to gate the price field from the data register 257 in the random access memory 245 (FIG. 15) to the particular accumulator. This is accomplished by applying pulse P25 to gates 433, 435 and 437, the pulse being sent out to the particular station on either of lines 108, 126 or 144 in cables 102, 120 and 138 respectively. Pulse P25 is also applied to set a flip-flop 364 to its "1" state. Pulse P25 also functions to initiate the printout of an item by a line 260 from an accumulator.

When pulse P25 terminates, monostable multivibrator P26 is switched on through an OR-circuit 451, the function of pulse P26 being to test for the completion of the item printout. To this end, it is applied to a gate 453, the inputs to gate 453 being the set and reset outputs of flip-flop 364. If the printout is not completed, then output line 354 of gate 453 is active to switch on monostable multivibrator P27, pulse P27 being used for delay purposes. If, however, the printout is complete, then output line 340 of gate 453 is active to switch on monostable multivibrator P17 through OR-circuit 431.

The following tabulation sets forth the relationship of the operations under the control of the sequence pulse generator (S-clock, FIG. 19). The flow chart for the sequence microprogram is shown in FIG. 4.

Mono Number	Turn "On" conditions	Functions performed when "On"	Function(s) performed when turning "Off"
S1	A start pulse. The timing out of S2. The timing out of S21	The testing as to whether the accept switch in the keyboard is "On" (Fig. 12).	
S1	The "Off" state of the accept switch	Delay	The turning "On" of S1.
S3	The "On" state of the accept switch	The testing as to whether the word counter in audio buffer A (Fig. 9) is at "6".	
S4	The "6" state of the word counter in audio buffer A	The setting of the A flip-flop (flip-flop 153, Fig. 17) to its "1" state. The starting of the process program by turning "On" monostable multivibrator P1.	The turning "On" of S3.
S5	The timing out of S4. The timing out of S6	The testing as to whether processing from audio buffer A is completed by testing for the state of the A flip-flop (flip-flop 153, Fig. 17).	
S6	The "1" state of A flip-flop 153, i.e., processing incomplete at station A.	Delay	The turning "On" of S5.
S7	The "0" state of A flip-flop 153, i.e., processing complete at station A.	The resetting of the tone generator (Fig. 17)	The turning "On" of S8.
S8	The timing out of S7. The timing out of S9	The testing as to whether the accept switch in the keyboard is "On" (Fig. 12).	
S9	The "Off" state of the accept switch	Delay	The turning "On" of S8.
S10	The "On" state of the accept switch	The testing as to whether the word counter in audio buffer B (Fig. 10) is at "6".	
S11	The "6" state of the word counter in audio buffer B	The setting of the B flip-flop (flip-flop 295, Fig. 17) to its "1" state. The starting of the process program by turning "On" monostable multivibrator P1.	
S12	The other than "6" state of the word counter in audio buffer B. The timing out of S13.	The testing for the state of the B flip-flop	
S13	The "1" state of the B flip-flop	Delay	The turning "On" of S12.
S14	The "0" state of the B flip-flop	Is applied to tone generator	The turning "On" of S15.
S15	The timing out of S14. The timing out of S16	The testing as to whether the accept switch in the keyboard is "On" (Fig. 12).	
S16	The "Off" state of the accept switch	Delay	The turning "On" of S15.
S17	The "On" state of the accept switch	The testing as to whether the word counter in audio buffer C (Fig. 11) is at "6".	
S18	The "6" state of the word counter in audio buffer C	The setting of the C flip-flop (flip-flop 313, Fig. 17) to its "1" state. The starting of the process program by turning "On" monostable multivibrator P1.	
S19	The other than "6" state of the word counter in audio buffer C. The timing out of S20.	The testing of the state of the C flip-flop	
S20	The "1" state of the C flip-flop	Delay	The turning "On" of S19.
S21	The "0" state of the C flip-flop	The applying of a pulse to the tone generator	The turning "On" of S1.

The following tabulation sets forth the relationship of the operations under the control of the process pulse generator (P-clock, FIG. 18). The flow chart for the process is shown in FIG. 5.

Mono Number	Turn "On" conditions	Functions performed when "On"	Function(s) performed when turning "Off"
P1	Pulses S4, S11, and S18	The engaging of the read clutch in audio buffers A, B or C	The turning "On" of P2.
P2	The timing out of P1. The timing out of P3	The testing as to whether the contents of the word counter in a particular audio buffer A, B or C is at "3".	
P3	A word counter engaged in the processing cycle is not at "3"	Delay	The turning "On" of P2.
P4	A word counter engaged in a processing cycle is at "3"	The disengaging of the read clutch	The turning "On" of P5.
P5	The timing out of P4. The timing out of P6	The testing as to whether stroke counter 243 (Fig. 12) is at "3".	
P6	The stroke counter is not at "3"	Delay	The turning "On" of P5.
P7	The stroke counter is at "3"	The engaging of the read clutch in either of audio buffers A, B or C.	The turning "On" of P8.
P8	The timing out of P7. The timing out of P9	The testing as to whether a word counter in any of audio buffers A, B or C is at "0".	
P9	The word counter engaged in the processing cycle is not at "0".	Delay	The turning "On" of P8.
P10	The word counter engaged in the processing cycle is at "0"	The disengaging of the read clutch in the audio buffer A, B or C, which is being processed.	The turning "On" of P11.
P11	The timing out of P10. The timing out of P12	The testing as to whether stroke counter 243 (Fig. 12) is at "3".	
P12	The stroke counter is not at "3"	Delay	The turning "On" of P11.
P13	The stroke counter is at "3"	The resetting of the stroke counter to "0". The testing as to whether the check digit compares (Fig. 13).	
P14	The check digit does not compare	The requesting of an audio response (Fig. 17)	The turning "On" of P15.
P15	The timing out of P14. The timing out of P16	The testing of the state of flip-flop 358 (Fig. 17) to check whether audio response is complete.	
P16	The audio response is not complete	Delay	The turning "On" of P15.
P17	The audio response is complete. The total printout is complete. The item printout is complete.	The resetting of the A, B and C flip-flops (flip-flops 153, 295 and 313, Fig. 17) to "0". The resetting of modulo 9 accumulator 149 (Fig. 13) to "0".	
P18	The check digit compares	The ascertaining as to whether there is a request for a total (Fig. 15).	
P19	There is a request for a total	The initiation of the printout of the total	The turning "On" of P20.
P20	The timing out of P19. The timing out of P21	The checking as to whether the total printout is complete (flip-flop 360, Fig. 17).	
P21	The total printout is not complete	Delay	The turning "On" of P20.
P22	There is not a request for a total	The requesting of a read access (Fig. 15). The setting of flip-flop 362 to "1" (Fig. 17).	The turning "On" of P23.
P23	The timing out of P22. The timing out of P24	The testing as to whether the requested read access is complete.	
P24	The read access is not complete	Delay	The turning "On" of P23.
P25	The read access is complete	The gating of the price field of data register 257 (Fig. 15) to total accumulators (Fig. 16). The initiating of the item printout [the setting of flip-flop 364 (Fig. 17 to "1")].	The turning "On" of P26.
P26	The timing out of P25. The timing out of P27	The testing as to whether printout is complete (the testing for the state of flip-flop 364, Fig. 17).	
P27	The printout is not complete	Delay	The turning "On" of P26.

Cable 272 (From sequence pulse generator to central controls)	S1	"On" status of S1
	S3	"On" status of S3
	S4	"On" status of S4
	S5	"On" status of S5
	S7	"On" status of S7
	S8	"On" status of S8
	S10	"On" status of S10
	S11	"On" status of S11
	S12	"On" status of S12
	S14	"On" status of S14
	S15	"On" status of S15
	S17	"On" status of S17
	S18	"On" status of S18
	S19	"On" status of S19
	S21	"On" status of S21
Cable 274 (From central controls to sequence pulse generator)	Line 276	Turn "On" S2
	Line 278	Turn "On" S3
	Line 280	Turn "On" S4
	Line 282	Turn "On" S5
	Line 284	Turn "On" S6
	Line 286	Turn "On" S7
	Line 288	Turn "On" S9
	Line 290	Turn "On" S10
	Line 292	Turn "On" S11
	Line 294	Turn "On" S12
	Line 296	Turn "On" S13
	Line 298	Turn "On" S14
	Line 300	Turn "On" S16
	Line 302	Turn "On" S17
	Line 304	Turn "On" S18
	Line 306	Turn "On" S19
	Line 308	Turn "On" S20
	Line 310	Turn "On" S21
Cable 312 (From process pulse generator to central controls)	P1	"On" status of P1
	P2	"On" status of P2
	P4	"On" status of P4
	P5	"On" status of P5
	P6	"On" status of P6
	P7	"On" status of P7
	P8	"On" status of P8
	11 P9	"On" status of P9
	P10	"On" status of P10
	P11	"On" status of P11
	P13	"On" status of P13
	P14	"On" status of P14
	P15	"On" status of P15
	P17	"On" status of P17
	P18	"On" status of P18
	P19	"On" status of P19
	P20	"On" status of P20
	P22	"On" status of P22
	P23	"On" status of P23
	P25	"On" status of P25
	P26	"On" status of P26
Cable 314 (From central controls to process pulse generator)	Line 316	Turn "On" P1
	Line 318	Turn "On" P3
	Line 320	Turn "On" P4
	Line 322	Turn "On" P6
	Line 324	Turn "On" P7
	Line 326	Turn "On" P9
	Line 328	Turn "On" P10
	Line 330	Turn "On" P12
	Line 332	Turn "On" P13
	Line 334	Turn "On" P14
	Line 336	Turn "On" P16
	Line 338	Turn "On" P17
	Line 340	Turn "On" P17
	Line 342	Turn "On" P18
	Line 334	Turn "On" P19
	Line 346	Turn "On" P21
	Line 348	Turn "On" P22
	Line 350	Turn "On" P24
	Line 352	Turn "On" P25
	Line 354	Turn "On" P27
	Line 356	Turn "On" P17
Cable P14 (From central controls to audio response unit)	P14	Request audio response
Cable P17 (From central controls to error detect)	P17	Reset modulo 9 accumulator
Cable P22 (From central controls to random access memory)	P22	Request read access

While the invention has been particularly shown and described with reference to preferred embodiments thereof, it will be understood by those skilled in the art that the foregoing and other changes in form and details may be made therein without departing from the spirit and scope of the invention.

What is claimed is:

1. An arrangement for making information entries into a processing system, processing said information entries, and providing the results of said processing, wherein said entries are made by voice from a plurality of remote stations and said results and/or suitable operational signals are provided to said stations, said arrangement comprising:

audio buffer means associated with each of said stations for receiving the respective voice information entries from said stations, and for storing said information;

voice reception means for obtaining said stored information and entering it into said processing system;

sequencing means for examining said stations to effect the processing of the information of one of said stations at one time; and

means responsive to said processing system for providing the results of said entries' processing said operational signals to said stations.

2. An arrangement for making information entries into a processing system, processing said information entries, and providing the results of said processing and/or suitable operational signals, wherein said entries are made by voice from a plurality of remote stations, each entry comprising a chosen number of words, and said results and said signals are provided to said stations, said arrangement comprising:

audio buffer means associated with each of said stations for receiving the respective voice information entries from said stations, and for storing said information;

word counter means associated with each of said stations for entering the number of words in a presented information entry;

voice reception means for obtaining said stored information and entering it into said processing system;

sequencing means responsive to each of said word counters for establishing which of voice information entries of said respective stations is to be processed, said establishing being in response to a count of said chosen number in one of said word counters; and

means responsive to said processing system for providing the results of said entries' processing and said operational signals to said stations.

3. An arrangement for making information entries into a processing system, processing said information entries, and providing the results of said processing, wherein said entries are made by voice from a plurality of remote stations, each entry comprising a chosen number of words, and said results and/or suitable operational signals are provided to said stations, said arrangement comprising:

speech compression means respectively associated with each of said stations for compressing the duration of said chosen number of words in an information entry;

audio buffer means associated with each of said stations for receiving said information entries from said speech compression means and storing it;

a word counter associated with each of said stations for counting the words of an entry received by said speech compression means;

a keyboard for entering the information stored in each of said audio buffer means into said information-processing system;

sequencing means responsive to each of said word counters for establishing the station whose information entry is to be processed in response to a count of said chosen number in the word counter associated with said last-named station; and

means responsive to said processing system for providing the results of said entries' processing and said operational signals to said stations.

4. An arrangement for making information entries into a

There follows hereinbelow, a tabulation of the cables and their respective lines appearing in the embodiment represented by the block diagram shown in FIG. 3.

Cable Numbers and Connections	Designations of Lines in Cable	Description
Cable 100 (From station A to audio buffer A)	Line 100	Microphone Output
Cable 102 (From central controls to station A)	Line 104	Audio response
	Line 106	Beep response
	Line 108	Print item
	Line 110	Print total
	Lines 112 (as many as required)	Item data
Cable 114 (From accumulators to station A)	Lines 114 (as many as required)	Total data
Cable 116 (From station A to central controls)	Line 116	Printing completed
Cable 118 (From station B to audio buffer B)	Line 118	Microphone output
Cable 120 (From central controls to station B).	Line 122	Audio response
	Line 124	Beep response
	Line 126	Print item
	Line 128	Print total
	Lines 130 (as many as required)	Item data
Cable 132 (From accumulators to station B)	Lines 132 (as many as required)	Total data
Cable 134 (From central controls to station B)	Line 134	Printing completed
Cable 136 (From station C to audio buffer C)	Line 136	Microphone output
Cable 138 (From central controls to station C)	Line 140	Audio response
	Line 142	Beep response
	Line 144	Print item
	Line 146	Print total
	Lines 148 (as many as required)	Item data
Cable 150 (From accumulators to station C)	Lines 150 (as many as required)	Total data
Cable 152 (From station C to central controls)	Line 152	Printing completed
Cable 154 (From central controls to audio buffer A)	Line 156	Read engage clutch
	Line 158	Read disengage clutch
Cable 160 (From audio buffer A to central controls)	Line 162	Read head output
	Line 164	Word counter output at "0."
	Line 166	Word counter output at "$\overline{0}$."
	Line 168	Word counter output at "3."
	Line 170	Word counter output at "$\overline{3}$."
	Line 172	Word counter output at "6."
	Line 174	Word counter output at "$\overline{6}$."
Cable 176 (From central controls to audio buffer B)	Line 178	Read engage clutch
	Line 180	Read disengage clutch
Cable 182 (From audio buffer B to central controls)	Line 184	Read head output
	Line 186	Word counter at "0."
	Line 188	Word counter output at "$\overline{0}$."
	Line 190	Word counter output at "3."
	Line 192	Word counter output at "$\overline{3}$."
	Line 194	Word counter output at "6."
	Line 196	Word counter output at "$\overline{6}$."
Cable 198 (From central controls to audio buffer C)	Line 200	Read engage clutch
	Line 202	Read disengage clutch
Cable 204 (From audio buffer C to central controls)	Line 206	Read head output
	Line 208	Word counter output at "0."
	Line 210	Word counter output at "$\overline{0}$."
	Line 212	Word counter output at "3."
	Line 214	Word counter output at "$\overline{3}$."
	Line 216	Word counter output at "6."
	Line 218	Word counter output at "$\overline{6}$."
Cable 220 (From central controls to keyboard)	Line 222	Headset
	Line 224	Reset stroke counter
Cable 226 (From keyboard to central controls)	Line 228	Stroke counter output at "$\overline{3}$."
	Line 230	Stroke counter output at "3."
	Line 232	Accept switch at "Off."
	Line 234	Accept switch at "On."
Cable 236 (From keyboard to error detect)	Lines 236 (eight lines)	Input to modulo 9 accumulator
Cable 238 (From keyboard to random access memory)	Lines 238 (10 lines)	Input to address assembly register
Cable 242 (From error detect to central controls)	Line 244	Output of compare unit is equality
	Line 246	OUt of compare unit is inequality
Cable 248 (From Random access memory to error detect)	Lines 248 (as many as required)	Low order digit of address assembly register
Cable 252 (From audio response unit to central controls)	Line 254	Audio response completed
	Line 256	Actual audio response
Cable 258 (From random access memory to total accumulators)	Lines 258 (as many as required)	Input to accumulators)
Cable 260 (From central controls to accumulators)	Line P25 (Pulse P25)	P25
	A flip-flop	A
	B flip-flop	B
	C flip-flop	C
Cable 262 (From random access memory to central controls)	Line 264	Item Total
	Line 266	Read Access Complete.
	Line 268	Item Data
	Lines 270 (as many as required)	

processing system, processing said information entries, and providing the results of said processing, said entries being made by voice from a plurality of remote stations, each entry comprising a chosen number of words, said respective results and/or suitable operational signals being provided to said stations, said arrangement comprising:

speech compression means respectively associated with each of said stations for compressing the duration of said chosen number of words in an information entry;

audio buffer means associated with each of said stations for receiving said information entries from said speech compression means and storing it;

a word counter associated with each of said stations for containing a count of the words of an entry received by said speech compression means;

read control means associated with each of said stations and responsive to its associated word counter and audio buffer means for presenting the entry stored in said audio buffer means word by word;

a keyboard for entering the information presented by each of said read control means into said information-processing system;

sequencing means responsive to each of said word counters for establishing the station whose information entry is to be processed in response to a count of said chosen number in the word counter associated with said last-named station; and

means responsive to said processing system for providing the results of said entries' processing and said operational signals to said station.

5. An arrangement as defined in claim 4 wherein processing results output means is provided respectively associated with each station.

6. An arrangement as defined in claim 4 and further including means for providing an audio signal to said locations to indicate that an entry therefrom can be received by the arrangement.

7. An arrangement as defined in claim 4 and further including means for decrementing the count of words in a word counter as said words are entered into said information system by said keyboard.

8. An arrangement as defined in claim 4 wherein each of said speech compression means include a voice detect component which provides an output in response to an average audio level which exceeds a chosen threshold and a delay component for providing a delay interval for a voice input signal which corresponds to the averaging period of said voice detect device, a word counter being incremented in response to the actuating of said voice detect component.

9. An arrangement as defined in claim 8 wherein an audio buffer means includes a tape loop, a drive for said loop, and write and read heads for said loop, the actuation of said voice detect component causing the gating of said voice signal to turn on said write head and the actuation of said drive, the termination of the actuation of said voice detect component causing the turning off of said write head and the halting of said drive.

10. An arrangement as defined in claim 9 wherein the attaining of said chosen number in a word counter at a particular station and the establishing of said station for processing by said sequencing means causes the actuation of the tape drive and the read head of said station to play back the information on said loop for entry into said system by means of said keyboard.

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