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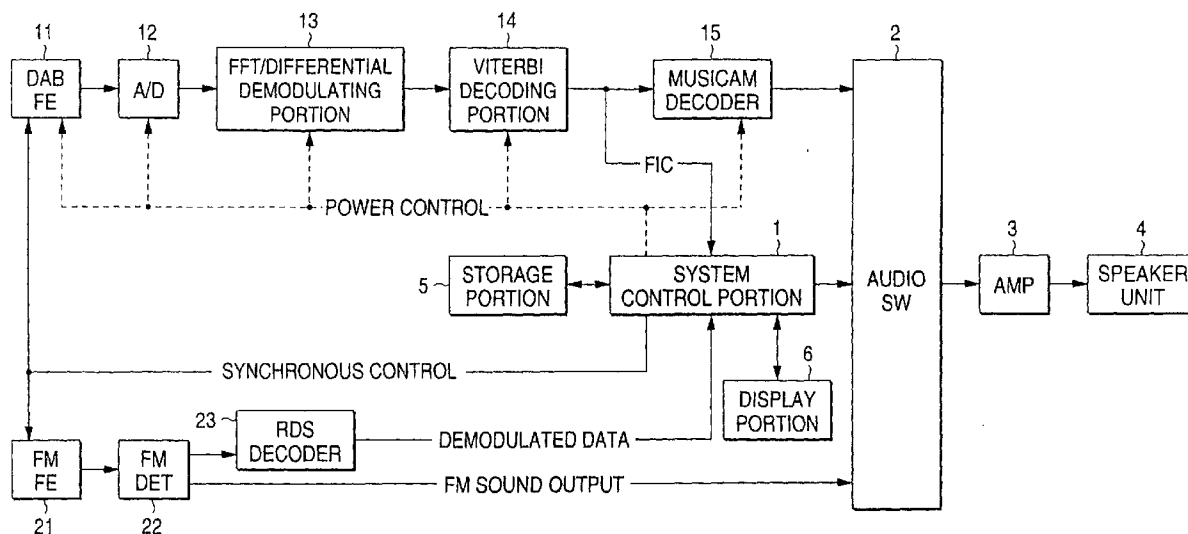
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(54) **Receiver for receiving Digital Audio Broadcast (DAB) programmes, comprising a selection means for selecting a sound signal from several sources**

(57) A receiver which is capable of selecting an audio output of the receiver from audio outputs of a plurality of signal sources is provided. When a digital broadcast receiving portion has been selected as the signal

source, a state of reception of the digital broadcast receiving portion is determined. In accordance with a result of the determination, whether or not the ensemble which is being received has been ended is announced through announcing unit.

FIG. 1**EP 0 961 431 A2**

Description

[0001] The present invention relates to a receiver which is capable of receiving at least digital audio broadcasting (Digital Audio Broadcasting hereinafter called "DAB") which has been put into practical use in Europe.

[0002] As a system for transmitting broadcast wave containing data signals which include digital audio signals and which are formed into a predetermined format and receiving the same, DAB system conforming to Europe Standard (Eureka 147) is known. The DAB incorporates one ensemble which is composed of a plurality of services. Each service is composed of a plurality of components including English and German.

[0003] Fig. 3 shows an example of services of the DAB system such that linking is illustrated which is established among services (three in this case) and components (six in this case) constituting an ensemble 1 and an OFDM signal which is actually transmitted from a DAB station.

[0004] The OFDM signal which is transmitted from the DAB station includes FIC (Fast Information Channel) and MSC (Main Service Channel).

[0005] Each of sub-channels (SubCh 0 to SubCh 63) for constituting the MSC corresponds to each component. The FIC contains information about services which can be used by the ensemble and information about the linkage among the services, components and sub-channels.

[0006] Therefore, in the DAB, when a certain ensemble has been received, information about a plurality of services and components included in the ensemble can be obtained. Thus, switching to another service or component can instantaneously be performed without a necessity of changing the receiving frequency.

[0007] However, the DAB broadcast, which is being widespread, covers a narrow area as compared with the area covered by the FM broadcast at present. Therefore, there are many areas which cannot receive the DAB broadcast. However, the present DAB receivers cannot easily detect the DAB broadcasts which can be received at the present position and whether or not reception can be performed during selection of another signal source, such as a CD. Therefore, a user is required to frequently switch the signal source to the DAB to operate the searching function of the receiver to confirm a state of reception. Thus, there arises a problem of unsatisfactory operability.

[0008] The DAB broadcast has a structure that a plurality of services can be contained in one ensemble. However, there arises a problem in that the user cannot easily detect the following fact: a user cannot easily detect whether or not another service contained in the ensemble can be selected by changing the service after an arbitrary service which is being selected and listened by the user is ended and whether or not the ensemble has been ended.

[0009] In view of the foregoing, on object of the

present invention is to provide a receiver which permits a user to easily detect whether or not a certain digital broadcast can be received at the present position during selection of another signal source. Another object of the present invention is to provide a receiver which enable a user to easily detect whether or not an ensemble which is being selected has been ended.

[0010] According to a first aspect of the present invention, there is provided a receiver comprising: selection means for selecting output sound of the receiver among a plurality of output sounds of signal sources; announcing means; and a control unit for controlling at least either of the selection means or the announcing means, wherein a digital broadcast receiving portion is included as one of the signal sources, and when output sound of the digital broadcast receiving portion is being selected, the control unit determines a state of reception of a signal, which is being received by the digital broadcast receiving portion, and announces whether or not the digital broadcast, which is being received, has been completed through the announcing means in accordance with a result of the determination.

[0011] According to a second aspect of the present invention, there is provided a receiver according to the first aspect of the invention, wherein the control unit incorporates changing means for changing reception frequency and changes the reception frequency to search another digital broadcast when a signal source different from that selected by the digital broadcast receiving portion is being selected.

[0012] According to a third aspect of the present invention, there is provided a receiver according to the second aspect of the invention, wherein the control unit announces whether or not at least one digital broadcast can be received through the announcing means in accordance with a result of the search.

[0013] In the drawings:-

Fig. 1 is a block diagram of a first embodiment of the present invention;

Fig. 2 is a flow chart of the operation which is performed by a system control unit 1; and

Fig. 3 is a diagram showing a service of a DAB system.

[0014] An embodiment of the present invention will now be described with reference to the drawings.

[0015] Fig. 1 is a block diagram showing a receiver according to the embodiment of the present invention. The receiver incorporates a DAB receiving portion for receiving a digital broadcast and an FM receiving portion as signal sources. Moreover, the receiver incorporates a system control unit 1, a selection means 2, an amplifier 3, a speaker unit 4, a storage portion 5 and a display portion 6.

[0016] Moreover, the DAB receiving portion incorporate a DAB-FE (a front end for the DAB) 11 for tuning in to a DAB station under control of the system control unit

1; an A/D converter 12 for converting a received analog signal into a digital signal; an FFT (Fast Fourier Transformation)/difference demodulating portion 13 for demodulating the transmitted OFDM wave to demodulate the difference; a viterbi decoding portion 14 for correcting an error; and an audio decoder (a musicam decoder) 15 for decoding compressed audio data (musical data) to original audio data. Since the specific structure of each element has been disclosed in a variety of document, detailed description is omitted here.

[0017] The FM receiving portion incorporates an FM-FE (a front end for the FM) 21 for tuning in to an FM station under control of the system control unit 1; an FM detector 22 for amplifying an intermediate-frequency (IF) signal to detect a composite signal from the amplified signal; and an RDS decoder 23 for extracting an RDS signal from the detected composite signal to demodulate the RDS signal. Also the foregoing structure has been disclosed in a variety of documents. Therefore, the foregoing units are omitted from description. The RDS decoder 23 outputs decoded digital data to the system control unit 1.

[0018] The system control unit 1 controls a tuning operation of the DAB receiving portion and the FM receiving portion. Moreover, the system control unit 1 reads the foregoing FIC information item from the DAB receiving portion to store a variety of information data items contained read data in the storage portion 5.

[0019] Information to be stored includes information about services which can be used by an ensemble, information about the linkage among the services, components and sub-channels, information (a PI code, an FI (frequency information) list) about FM stations, Asu (Announcement support) which is information indicating whether or not a specific program is supported and Asw (Announcement switching) which is information for determining start of a specific program.

[0020] The system control unit 1 also controls the selection means 2. Basically, when a user instructs a DAB broadcast, audio output from the DAB receiving portion is selected as the output from the receiver. When an FM broadcast is instructed, audio output from the FM receiving portion is selected as the output from the receiver. An output from the selection means 2 is amplified by the amplifier 3 so as to be output through the speaker unit 4.

[0021] Moreover, the system control unit 1 turns on/off a power source for each of the portions which constitute the DAB receiving portion. A DAB indicator, to be described later, is provided for the display portion 6. The DAB receiving portion has the above-mentioned schematic structure.

[0022] The operation of the system control unit 1 according to the present invention will now be described. Fig. 2 is a flow chart for controlling the DAB indicator. The foregoing flow chart is periodically executed after a power switch for the apparatus has been switched on until the power switch for the apparatus is switched off. That is, the DAB receiving portion is operated in accordance

with the control of the power source which is performed by the system control unit 1 even in a period in which another source, such as the FM broadcast, is being selected. Thus, the DAB receiving portion supplies, to the system control unit 1, information required to control the DAB indicator.

[0023] When the power switch for the apparatus has been switched on, the system control unit 1 controls the power source for the DAB receiving portion to be turned on so as to turn on the DAB receiving portion. Then, the system control unit 1 determines whether or not the source selected by the user is the DAB (step S1). The selected source is the signal source which is selected by the selection means 2. When the DAB is set as the selected source, demodulated sound of the DAB receiving portion (an output of the musical decoder 15) is output from the speaker unit 4 through the selection means 2.

[0024] When the selected source is the DAB, a determination is made that the DAB receiving portion is able to receive a DAB ensemble at the frequency to which the DAB receiving portion has been tuned in (step S2). In this embodiment, the determination is made in accordance with whether or not an error rate of the FIC portion of the signal received by the DAB receiving portion is lower than a predetermined value.

[0025] When the error rate of the FIC portion is lower than a predetermined value (step S2; reception permitted), a control signal for turning the DAB reception indicator is output to the display portion 6 (step S3). When the display portion 6 has received the control signal, the display portion 6 turns the DAB indicator in the display portion 6 on. As a result of the foregoing control, a fact that the ensemble, which is being received, has not been ended is announced to the user.

[0026] If the error rate of the FIC portion is higher than a predetermined value (step S2; reception inhibited), the operation proceeds to step S4. Thus, a control signal for turning the DAB indicator off is output to the display portion 6. When the display portion 6 has received the control signal, the display portion 6 turns the DAB indicator off (step S4). As a result of the foregoing control, a fact that the ensemble, which is being received, has been ended is announced to the user.

[0027] If a source (for example, a signal received by the FM receiving portion) different from the DAB has been set as the selected source (step S1; another source), the system control unit 1 determines whether or not the DAB ensemble can be received at the tuned frequency set before the switch of the source (step S5).

[0028] When the DAB ensemble cannot be received, the system control unit 1 controls the DAB-FE (the front end for the DAB) 11 to change the frequency which must be received. Then, the system control unit 1 searches whether or not a DAB ensemble, which can be received, exists in a reception frequency band assigned to the DAB (step S6).

[0029] When a determination is made as a result of

the search performed in step S6 that the ensemble, which can be received, exists, that is, when the error rate of the FIC portion of the received ensemble is lower than a predetermined value (step S7; exists), the operation is shifted to step S8 to turn the DAB receiving indicator on. As a result of the foregoing control, a fact that a DAB can be received at the present position is announced to the user.

[0030] If a determination is made that an ensemble which can be received in the reception frequency band (step S7; not exist) does not exist, the operation is shifted to step S9 to turn the DAB receiving indicator off. As a result of the foregoing control, a fact that the DAB cannot be received at the present position is announced to the user.

[0031] If a determination is made in step S5 that the DAB ensemble can be received at the tuned frequency set before switching of the source, also the operation of the system control unit 1 is shifted to step S8 to turn the DAB reception indicator on. As a result of the foregoing control, a fact that a DAB can be received at the present position is announced to the user.

[0032] When the DAB has been set as the selected source (step S1; DAB), the system control unit 1 does not perform a special process, such as the ensemble search which is performed in step S6. The reason for this lies in that when the selected source is the DAB, there is a possibility that the user maintains the frequency. Therefore, whether or not the search is performed must be decided by the user.

[0033] As was described above, according to the present invention, a user is able to easily detect whether or not the ensemble, which is being received, has been ended. If another signal source is being selected, the user is able to easily detect whether or not a digital broadcast can be received at the present position.

result of the determination.

2. A receiver according to claim 1, wherein said control unit incorporates changing means for changing reception frequency and changes the reception frequency to search another digital broadcast when a signal source different from the signal source selected by said digital broadcast receiving portion is being selected.
3. A receiver according to claim 2, wherein said control unit announces whether or not at least one digital broadcast can be received through said announcing means in accordance with a result of the search.

Claims

1. A receiver comprising:

selection means for selecting output sound of said receiver out of a plurality of output sounds of signal sources;

announcing means; and

a control unit for controlling at least one of said selection means and said announcing means; wherein a digital broadcast receiving portion is included as one of the signal sources; and

wherein when output sound of the digital broadcast receiving portion is being selected, said control unit determines a state of reception of a signal, which is being received by said digital broadcast receiving portion, and announces whether or not the digital broadcast, which is being received, has been completed through said announcing means in accordance with a

FIG. 1

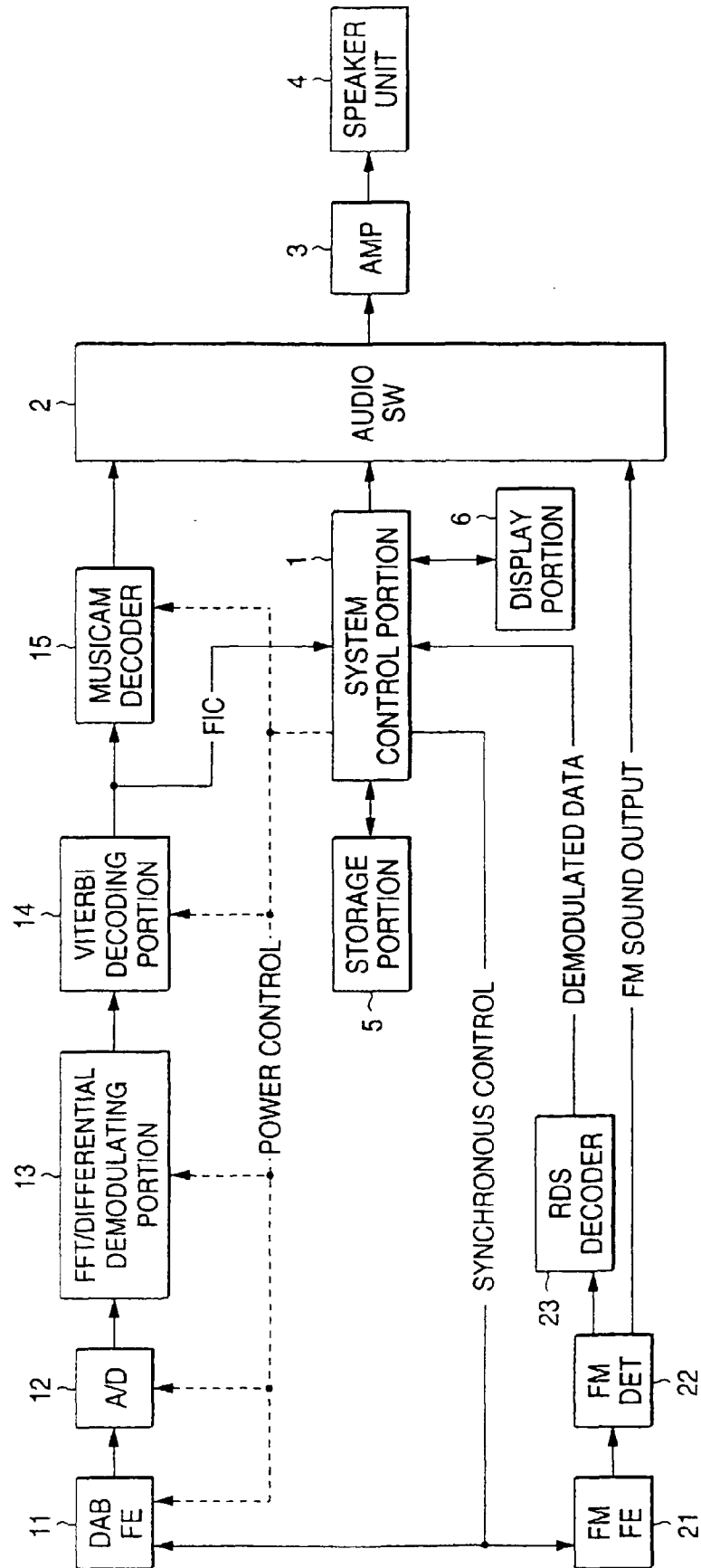


FIG. 2

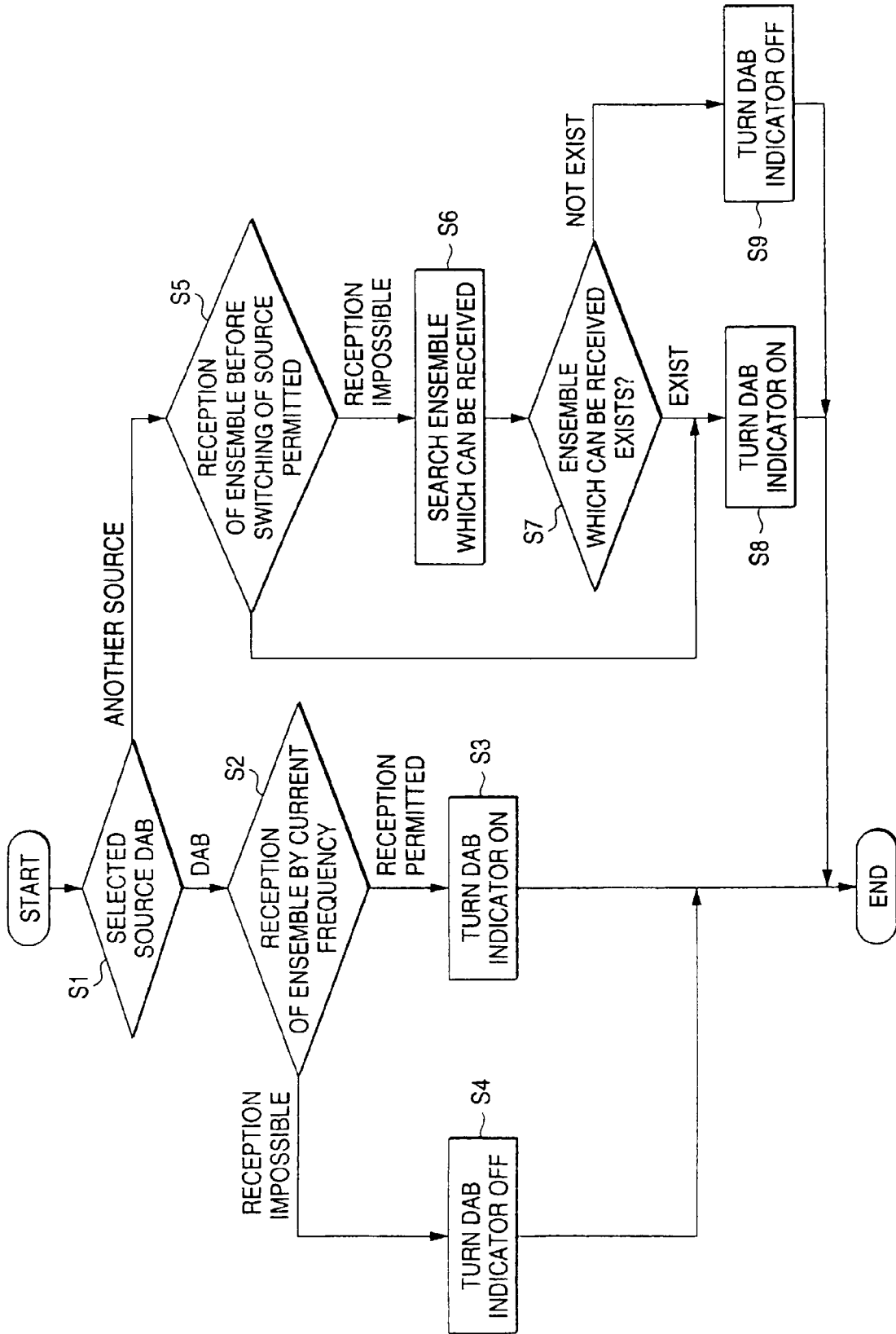
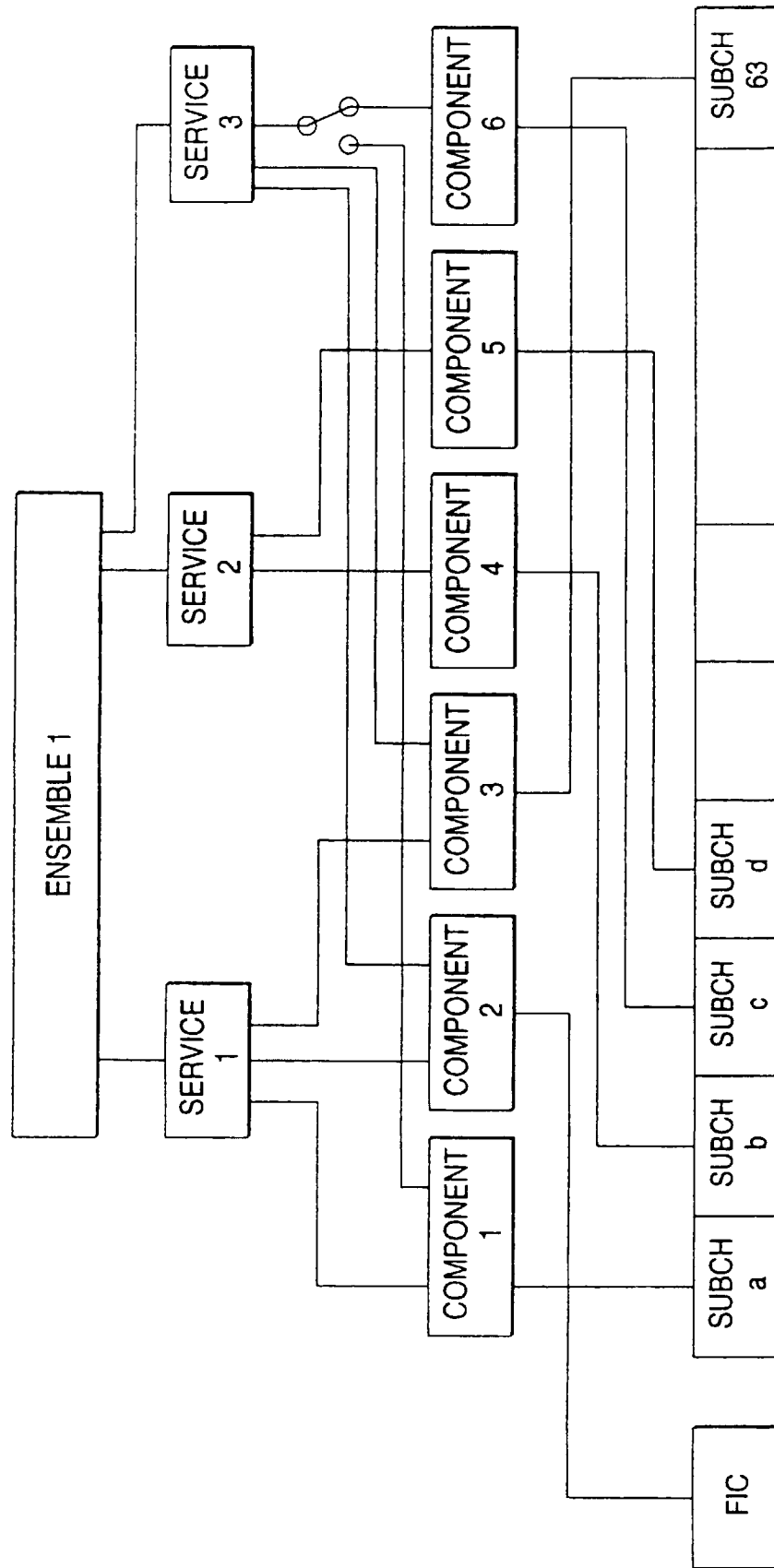


FIG. 3



MSC