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(71) Applicant: **PIONEER ELECTRONIC CORPORATION**
Meguro-ku Tokyo-to (JP)

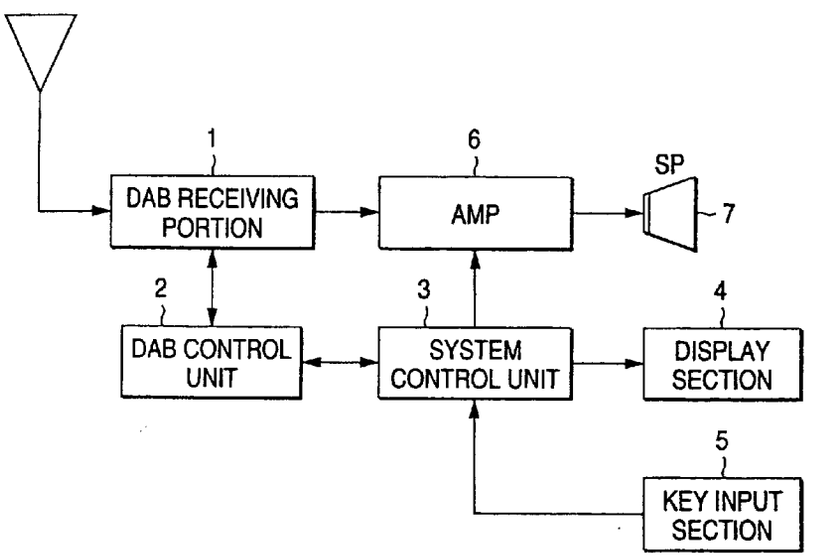
(72) Inventors:
- **Toki, Katsuhiko, Pioneer Electronic Corporation**
  Kawagoe-shi, Saitama (JP)
- **Miyake, Takashi, Pioneer Electronic Corporation**
  Kawagoe-shi, Saitama (JP)
- **Abe, Mikito, Pioneer Electronic Corporation**
  Kawagoe-shi, Saitama (JP)

(74) Representative: **Haley, Stephen**
Gill Jennings & Every,
Broadgate House,
7 Eldon Street
London EC2M 7LH (GB)

(54) Receiver for receiving Digital Audio Broadcast programmes comprising a means for selecting a service from a plurality of preselected services

(57) A digital broadcast receiver for receiving a digital audio broadcast which transmits a digital signal indicating identification information of each of services which constitute an ensemble together with audio information of the digital audio broadcast, the digital broadcast receiver having a structure when a service required by a user is selected, a determination is first made whether or not the ensemble which is being received is able to select the service, and the service is selected when the service can be selected.

FIG. 1



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Description

[0001] The present invention relates to a digital broadcast receiver, and more particularly to a receiver for receiving digital audio broadcasting (hereinafter called "DAB") which has been put into practical use in Europe.

[0002] As a system for transmitting broadcast waves 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. Therefore, a user which has selected a certain ensemble is able to obtain information about a plurality of services and components. Therefore, instantaneous switch to another service or component is permitted without a necessity of changing the frequency which is being received.

[0003] As one of methods of using a DAB receiver for receiving the foregoing broadcast, use of preset channels is known. The FM receivers put into practical use permits easy selection of a broadcast station required by a user by providing a plurality of preset channels. Each preset channel is provided with a corresponding storage region. When the user has performed predetermined operations, information of each of required broadcast stations is stored in the storage regions.

[0004] For example, a usual FM broadcast in which data information or the like is not multiplexed is usually structured such that frequency digital audio is stored in the preset channel. A data multiplex broadcast, such as the RDS in which data information is multiplexed, is usually structured such that PI (Program Identification) codes are usually stored together with frequency data.

[0005] When a broadcast station stored in any one of the preset channels is received, a user instructs (channel-recalls) a required channel. When the instruction has been issued, a usual FM receiver changes the tuned frequency to stored frequency data. An RDS receiver changes the tuned frequency to stored frequency data. Then, whether or not the received broadcast station is the same as the stored broadcast station is determined by comparing the stored PI code corresponding to the preset channels and the PI code received by the channel recall with each other.

[0006] It might be considered feasible to structure the DAB receiver similarly to the process which is performed by the conventional receiver. That is, frequency data of each ensemble which is frequently used by the user is previously stored in each preset channels. Thus, when frequency data is recalled, a required ensemble can easily be selected.

[0007] Since the ensemble of the DAB is composed of a plurality of services, the DAB receiver performs a process for selecting the service required by the user from the services to reproduce the service. Therefore, the following structure convenient for a user can be constituted. That is, information about the service required by the user is stored as well as frequency data to correspond to the preset channels of the DAB receiver. Thus, the channel recall is performed such that an ensemble is selected in accordance with stored frequency data made correspond to the preset channel. Then, a service which is the same as the required service in the selected ensemble is selected so as to be reproduced.

[0008] On the other hand, the DAB sometimes has a structure that the same service (having the same SId (Sid: Service Identifier)) exists in a plurality of ensembles. For example, a state is realized in which a service having the same SId as the SId stored in the preset channel exists in the ensemble which is being selected. When the preset call is performed in a state in which a service different from the stored service is selected by the user, selection is performed in accordance with stored frequency data corresponding to the preset channel though the required service exists in the ensemble which is being received and the service can easily be selected. Therefore, reception of the required service is delayed by the time required to perform the selection.

[0009] The present invention has been made to improve the preset call of the DAB receiver, and therefore an object of the present invention is to provide a digital broadcast receiver which is capable of quickly receiving a service required by a user.

[0010] According to one aspect of the present invention, there is provided a digital broadcast receiver for receiving a digital audio broadcast which transmits a digital signal indicating identification information of each of services which constitute an ensemble together with audio information, said digital broadcast receiver comprising: means for determining whether or not the service having predetermined identification information is selectable by the ensemble which is being received; and means for selecting the service when the service can be selected.

[0011] According to another aspect of the present invention, there is provided a digital broadcast receiver according to the first aspect of the invention, wherein another ensemble is tuned to when the service having predetermined identification information cannot be selected by the ensemble which is being received, and said determining means determines whether or not the service having predetermined identification information can be selected by the tuned ensemble.

[0012] According to still another aspect of the present invention, there is provided a digital broadcast receiver according to the second aspect of the invention, further comprising a storage portion for storing frequency information of ensembles and predetermined identification information which are made corresponding to one another, wherein when the service having predetermined identification information cannot be selected by the ensemble which is being received, frequency information corresponding to predetermined identification information is read from the storage portion, and another en-

semble is tuned to in accordance with read frequency information.

[0013] In the drawings:-

Fig. 1 is a block diagram showing a DAB receiver according to the present invention;
Fig. 2 is a flowchart which is performed by a DAB control unit;
Fig. 3 is a diagram showing a searching order employed when a preset call is performed;
Fig. 4 is a diagram showing a searching order employed when a preset call is performed; and
Fig. 5 is a diagram showing a searching order employed when the preset call is performed.

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

[0015] Fig. 1 is a block diagram showing a DAB receiver according to the embodiment of the present invention. The DAB receiver incorporates a DAB receiving portion 1, a DAB control unit 2, a system control unit 3, a display unit 4, a key input portion 5, an amplifier 6 and a speaker unit 7.

[0016] The DAB receiving portion 1 incorporates an FFT (Fast Fourier Transformation) portion for demodulating a transmitted OFDM wave, a viterbi decoding portion for correcting an error and an audio decoder for decoding compressed sound data to original audio data. Since the foregoing elements have been disclosed in a variety of documents, the structures of the foregoing elements are omitted from description.

[0017] The DAB control unit 2 controls the DAB receiving portion 1 and stores, in a storage portion (not shown), a variety of information data items contained in an FIC (Fast Information Channel) which is demodulated by the DAB receiving portion 1. Information above includes SId information for use in the present invention, Asu (Announcement Support) information and Asw (Announcement switching) information.

[0018] The DAB control unit 2 performs required processes in response to a requirement made by the system control unit 3. The processes include a process required to perform a preset call to be described later.

[0019] The system control unit 3 totally controls the receiver. In response to information input from the key input portion 5, the system control unit 3 performs corresponding control in cooperation with the DAB control unit 2. The corresponding control includes, for example, change in the frequency. The system control unit 3 controls the display unit 4 by outputting display information to the display unit 4. The DAB receiver has the foregoing schematic structure.

[0020] The operation of the DAB control unit 2 according to the present invention will now be described. Fig. 2 is a flow chart of the operation of the DAB control unit 2 which performs the preset call according to the present invention. The foregoing flow chart is performed when a preset channel, which must be recalled, has been instructed through the key input portion 5 and thus the system control unit 3 communicated with the instruction has instructed the DAB control unit 2 to perform the foregoing process. Note that the SId of the services required by a user and information about ensembles each having a possibility that the SId is provided are previously stored in the storage portion provided for each of the preset channels.

[0021] When a certain preset channel key has been instructed through the key input portion 5, the DAB control unit 2, in step S1, reads information stored in a memory region corresponding to the instructed preset channel. Specifically, stored SId information is read.

[0022] Then, the DAB control unit 2 determines the ensemble which is being received (step S2). If a determination is made in step S2 that any one of the ensembles is being received, the DAB control unit 2 determines that the ensemble which is being received includes the service having the SId called in step S1 exists (step S3).

[0023] When the ensemble, which is being received, includes the service having the corresponding SId, the required service can be selected and reproduced without a necessity of changing the frequency which is being received.

[0024] To cope with a recall process which will be performed, information about the current ensemble is stored such that the current ensemble is made correspond to the preset channel. Specifically, in step S4, ensemble ID (Ensemble Identifier) of the ensemble which is being received is made correspond to the recalled preset channel so as to be stored in the storage portion. In step S5 frequency information of the ensemble which is being received is made correspond to the recalled preset channel so as to be stored in the storage portion.

[0025] After the foregoing processes have been completed, the service having the required SId is selected and the service is reproduced through the speaker unit 7 in step S6.

[0026] If a determination is made that no ensemble is being received (step 2; No), or if the service having the corresponding SId does not exist in the ensemble which is being received (step S3; No), the operation proceeds to step S7.

[0027] In step S7 information about the frequency of the ensemble, which has been stored to correspond to the recalled preset channel, is read. In step S8, the DAB receiving portion 1 is controlled to tune in to the ensemble indicated with the foregoing frequency.

[0028] When a determination is made that the ensemble can be received at the tuned frequency (step S9; Yes), a determination is made whether or not the service having the required SId exists in the ensemble in accordance with FIC information obtained from the ensemble (step S10).

[0029] If a determination is made that the received ensemble has the required SId, the operation is shifted to step S4. In step S4 the ensemble ID of the ensemble

which is being received is made correspond to the recalled preset channel so as to be stored in the memory to cope with a preset call which will be performed. In step S5 the frequency of the ensemble which is being received is made correspond to the recalled preset channel so as to be stored in the memory.

[0030] After the foregoing process has been performed, the service having the required SId is selected so as to be reproduced from the speaker unit 7 in step S6.

[0031] When a determination is made that the ensemble cannot be received in step S9 or when a determination is made that the required service is not contained in the ensemble in spite of detection of the ensemble which can be received (step S10; N), the reception zone is seek up/down to search another ensemble (step S11).

[0032] When the ensemble which can be received has been detected, a determination is made similarly such that the required service exists by comparing the SId (step S12). If a determination is made that the required service exists, the operation is returned to step S4 so that information about the ensemble having the required service is made correspond to the preset channel so as to be stored in the memory. After the above-mentioned process has been completed, the service having the required SId is selected so as to be reproduced from the speaker unit 7 in step S6.

[0033] If a determination is made in step S12 that the required service does not exist, the required service cannot be received at present. Therefore, the foregoing fact is communicated to the system control unit 3. The system control unit 3 displays the foregoing fact on the display unit 4. The operation for recalling the preset channel is performed as described above.

[0034] The process of the search according to the present invention will now be described with reference to the drawings. Figs. 3 to 5 are diagrams showing the process of the search which is performed during the preset call shown in Fig. 2. Note that an assumption is made in Figs. 3 to 5 that three ensembles (each having two services), which can be received, exist in the reception frequency band and a component in service 1 of ensemble 1 is being selected and produced. Moreover, an assumption is made that frequency information of ensemble 2 and SId information indicating a required service (an assumption is made that it is service 2) have been stored in the preset channel.

a. In a case where a required service is contained in the current ensemble:

Fig. 3 shows the operation which is performed when a required service exists in the current ensemble. When preset call has been instructed, a determination is made whether or not the service (that is, the service 2) having the SId stored in the preset channels exists in the ensemble 1 which is being received.

Specifically, the services which are being selected are subjected to a comparison. If the two SId do not coincide with each other, whether or not a next service (the service 2 in the ensemble 1) coincides with the instructed SId is determined. Since the required service 2 exists in the ensemble 1 in the illustrated case, the two SId coincides with each other. Therefore, the DAB receiver selects and reproduces the service 2 in the ensemble 1.

b. In a case where the required service is not contained in the current ensemble:

Figs. 4 and 5 show the operation which is performed when the required service is not contained in the current ensemble. When present call has been instructed, the SId of the ensemble which is being received is subjected to a comparison similarly to the case shown in Fig. 3. If the required service does not exist in the current ensemble, research is performed in accordance with stored information about the ensemble made correspond to the preset channel.

[0035] In this embodiment, information about the frequency of ensemble 2 has been stored in the corresponding memory region of the preset channel. Thus, the reception frequency is changed to the ensemble 2. When the ensemble 2 can be received, whether or not the required service exists in the services which constitute the ensemble is determined.

[0036] Specifically, a determination is made whether or not information about the service which coincides with the instructed SId (the service 2) can be obtained from information of the selected ensemble (the ensemble 2). In the case shown in Fig. 4, the required service 2 exists in the ensemble 2. Therefore, the two SId coincides with each other. Thus, the DAB receiver selects and reproduces the service 2 in the ensemble 2.

[0037] When the required service cannot be selected by using information stored in the corresponding memory region of the preset channel, a search process for continuously changing the reception frequency is performed to determine whether or not the ensemble, which can be received, exists in the reception frequency band.

[0038] In a case shown in Fig. 5, the service 2 registered in the preset channel does not exists in the ensemble 2 when the preset call has been performed. Therefore, the search process is performed. As a result of the search, a determination is made that the ensemble 3 can be received. Also a determination is made that the required service exists in the ensemble 3.

[0039] Specifically, a determination is made whether or not information about the service which coincides with the SId (the service 2) can be obtained from information about the selected ensemble (the ensemble 3). In the case shown in Fig. 5, the required service 2 exists in the ensemble 2. Therefore, the two SId coincide with each other. As a result, the DAB receiver selects and reproduces the service 2 in the ensemble 3.

[0040] If the instructed SId is not detected after the

search has reached the ensemble 3, the required service does not exist in the reception frequency band. Therefore, an error message is displayed on the display unit 4. Moreover, for example, a last service (service 1: a service which is provided before instruction of the preset call) is selected and reproduced.

[0041] As was described above, according to the present invention, when a service having required identification information is selected, a determination is made whether or not the service having the required identification information can be selected in the ensemble which is being received. Therefore, when the same services exist in the current ensemble, the required service can quickly be selected and reproduced. When the present invention is applied to the recall process of the preset channel and the service having required identification information can be selected in the ensemble which is being received, the necessity of changing the frequency, which is being selected, to the frequency of the ensemble stored in the storage portion can be eliminated. Therefore, time required to hear the contents of the service can be shortened.

Claims

1. A digital broadcast receiver for receiving a digital audio broadcast which transmits a digital signal indicating identification information of each of services which constitute an ensemble together with audio information, said digital broadcast receiver comprising:

   means for determining whether or not the service having predetermined identification information is selectable by the ensemble which is being received; and
   means for selecting the service when the service can be selected.

2. A digital broadcast receiver according to claim 1, wherein another ensemble is tuned to when the service having predetermined identification information cannot be selected by the ensemble which is being received, and said determining means determines whether or not the service having predetermined identification information can be selected by the tuned ensemble.

3. A digital broadcast receiver according to claim 2, further comprising a storage portion for storing frequency information of ensembles and predetermined identification information which are made corresponding to one another, wherein when the service having predetermined identification information cannot be selected by the ensemble which is being received, frequency information corresponding to predetermined identification information is read from the storage portion, and another ensemble is tuned to in accordance with read frequency information.

FIG. 1

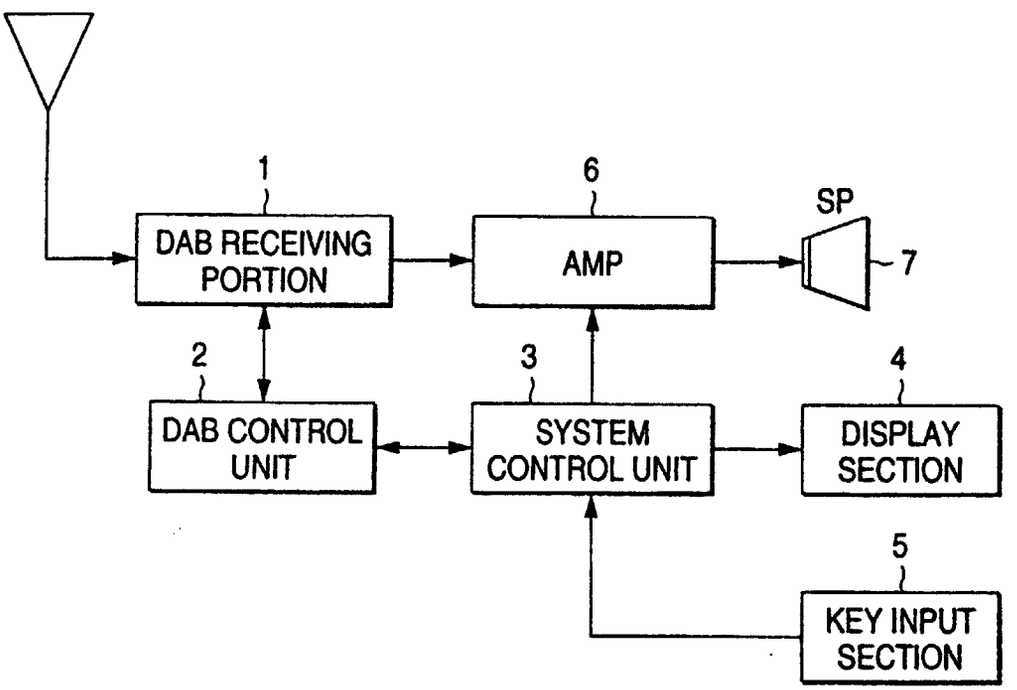

1
DAB RECEIVING PORTION
6
AMP
SP
7
2
DAB CONTROL UNIT
3
SYSTEM CONTROL UNIT
4
DISPLAY SECTION
5
KEY INPUT SECTION

FIG. 2

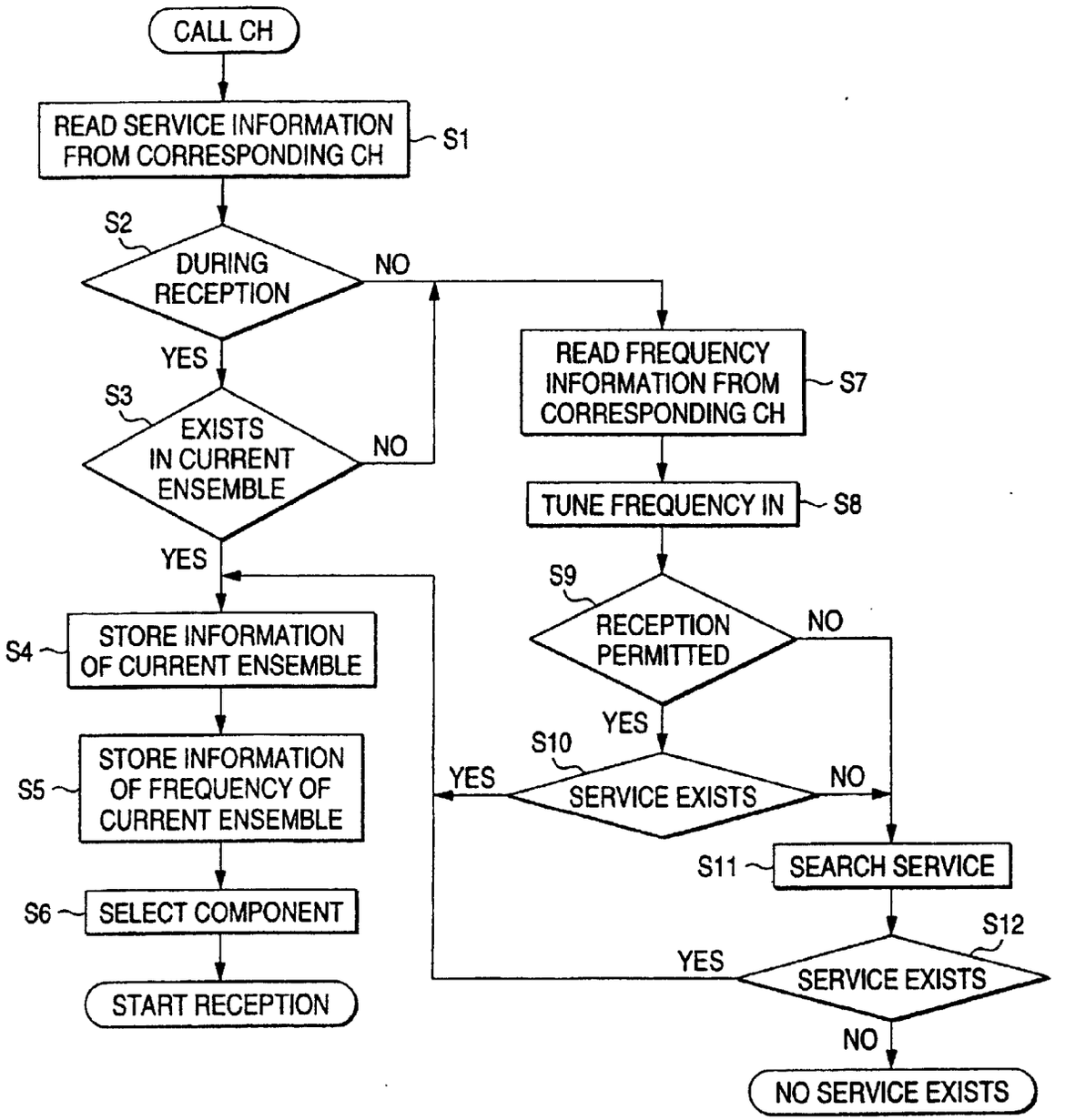

CALL CH
READ SERVICE INFORMATION FROM CORRESPONDING CH
S1
S2
DURING RECEPTION
NO
YES
S3
EXISTS IN CURRENT ENSEMBLE
NO
YES
S4
STORE INFORMATION OF CURRENT ENSEMBLE
S5
STORE INFORMATION OF FREQUENCY OF CURRENT ENSEMBLE
S6
SELECT COMPONENT
START RECEPTION
READ FREQUENCY INFORMATION FROM CORRESPONDING CH
S7
TUNE FREQUENCY IN
S8
S9
RECEPTION PERMITTED
NO
YES
S10
YES
SERVICE EXISTS
NO
S11
SEARCH SERVICE
S12
YES
SERVICE EXISTS
NO
NO SERVICE EXISTS

FIG. 3

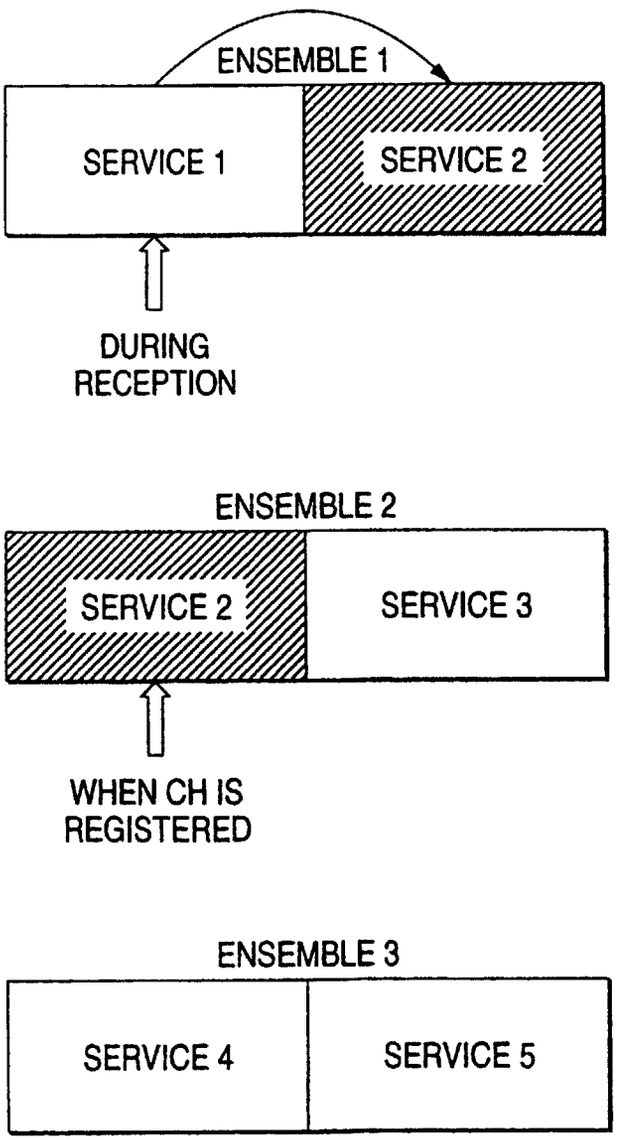

ENSEMBLE 1
SERVICE 1
SERVICE 2
DURING RECEPTION
ENSEMBLE 2
SERVICE 2
SERVICE 3
WHEN CH IS REGISTERED
ENSEMBLE 3
SERVICE 4
SERVICE 5

FIG. 4

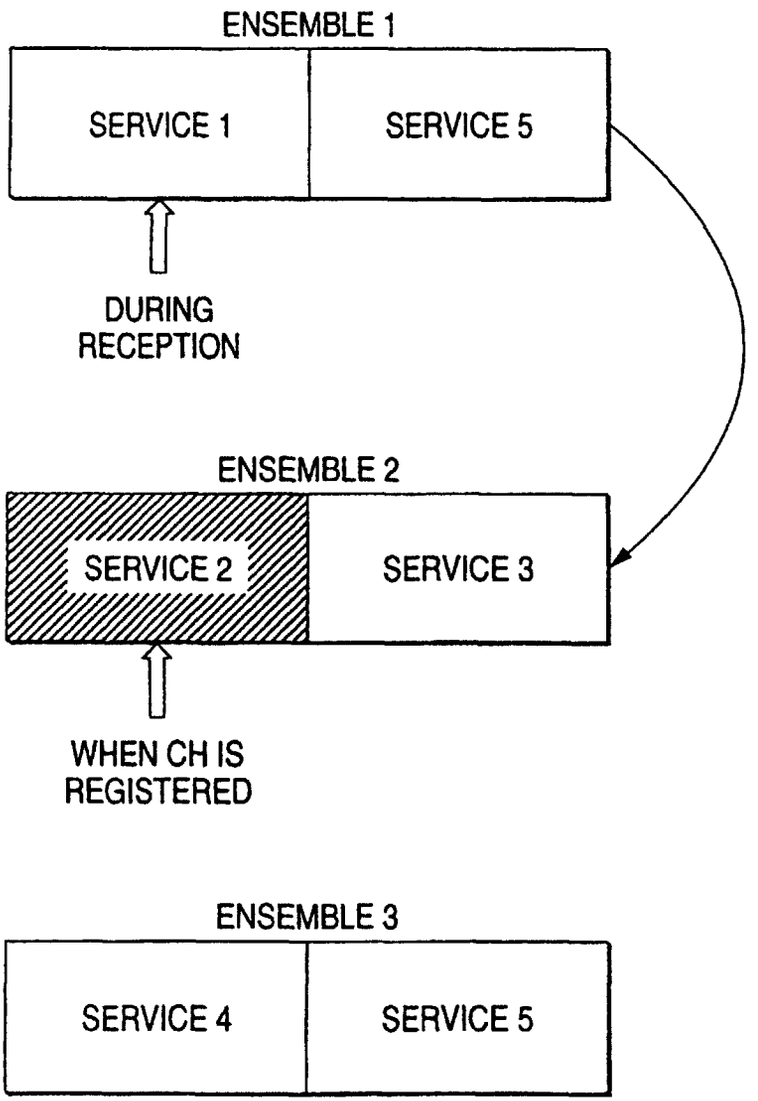
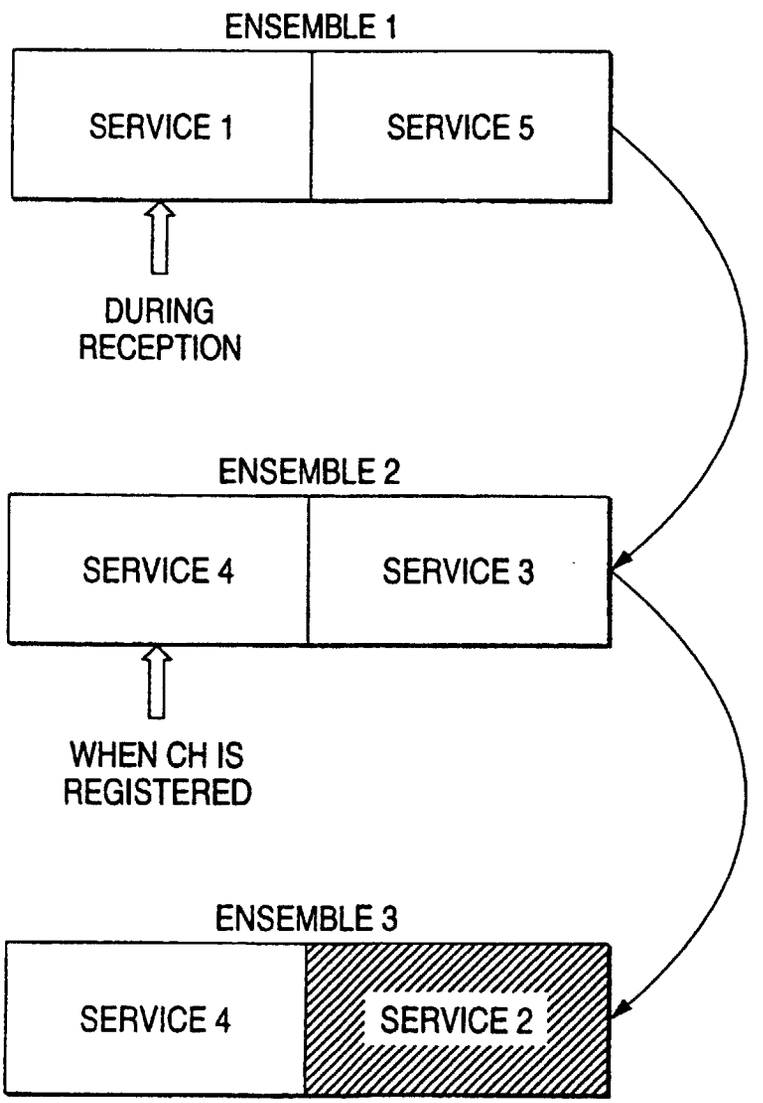

ENSEMBLE 1
SERVICE 1
SERVICE 5
DURING RECEPTION
ENSEMBLE 2
SERVICE 2
SERVICE 3
WHEN CH IS REGISTERED
ENSEMBLE 3
SERVICE 4
SERVICE 5

FIG. 5


ENSEMBLE 1
SERVICE 1
SERVICE 5
DURING RECEPTION
ENSEMBLE 2
SERVICE 4
SERVICE 3
WHEN CH IS REGISTERED
ENSEMBLE 3
SERVICE 4
SERVICE 2