[Brief Description of the Drawings]

[Drawing 1] It is drawing which looked at the road which embedded the magnetic nail in the middle of a lane from the low altitude as a road marker.

[Drawing 2] It is the block diagram showing the mounted equipment containing a lane deviation warning device.

[Drawing 3] It is drawing showing the circuitry which arranges two or more magnetic resistance elements in on the permanent magnet of the shape of long and slender rubber, and takes out output voltage from each.

[Drawing 4] It is drawing explaining the calculation approach of the car estimated position (xs and ys) between the car estimated position (xn-1 and yn-1) which one of detection period deltat begins, and the car estimated position (xn and yn) of an end.

[Drawing 5] It is drawing explaining the physical relationship of a car estimated position (xs and ys) and the coordinate (xm and ym) of a magnetic nail.

[Drawing 6] It is drawing explaining how to project a car estimated position (x y) to the location on Rhine where the magnetic nail is located in a line.

[Drawing 7] When projecting a car estimated position (x y) to the location on Rhine where the magnetic nail is located in a line, it is drawing explaining how to project in consideration of the yaw angle phi.

[Description of Notations]

1 Magnetic Resistance Element
2 Resistance Element
3 Permanent Magnet
11 Mileage Detecting Element
12 The Transit Direction Detecting Element
13 Field Detecting Element
13a Waveform-shaping section
14 Location Presumption Section
15 Road Marker Map Memory
16 Location Amendment Section
17 Antenna
17a Reception recovery section
17b Loop-formation coil
17c Loop-formation coil
17d 90-degree phase shifter
17e Hybrid

[Translation done.]

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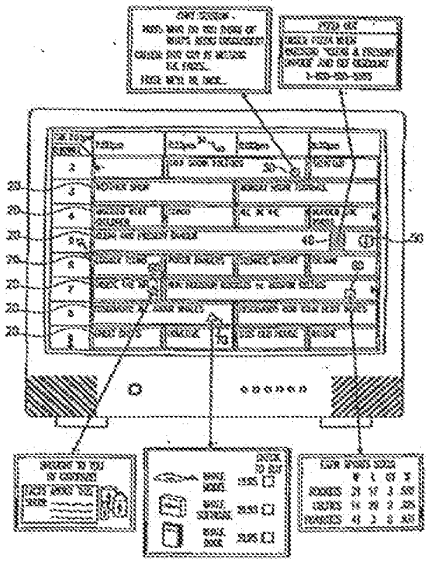
最終頁に続く

(54)【発明の名称】　マルチ・ソース情報の選択ガイドを表示のためのコンピュータ・システム

(57)【要約】
【課題】　複数のビデオ・ソース等からプログラムの選択を効率よく選択できるようにする。
【解決手段】　モニタ画面に内容ガイドが表示され，該内容ガイドは，開始時間とチャンネルとを横縦軸としたグリッド状セル２０として表示される。ユーザがテレビジョン番組等の所望のソースをアイコン３０～８０で選択すると，オンライン・サービスで対応するソース信号がダウンロードされ，ユーザに所望の情報を画面表示する。



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【特許請求の範囲】

【請求項１】　マルチ・ソース情報の選択ガイドを表示のためのコンピュータ・システムにおいて，該システムは，
ガイド・セルを含むグリッドからなる視覚的表示を生じる手段と，
表示されたガイド・セルのアイコンの少なくとも一部に配置する手段と，
表示されたアイコンからユーザが選択できるようにする手段とを備えており，
アイコンに一義的な命令であって，かつセルに表示されたアイコン以外の他の情報に依存する実行可能な命令に，選択されたアイコンがリンクされ，更に，アイコンが表わす複数のあり得る実行可能な動作から該アイコンが弁別することを特徴とするコンピュータ・システム。

【請求項２】　請求項１記載のコンピュータ・システムにおいて，該システムはさらに，
アイコンを選択的にアニメーション動作するように見せる手段と，
アイコンを選択的に３次元状に見せる手段とを備えていることを特徴とするコンピュータ・システム。

【請求項３】　図形情報の表示のためのシステムにおいて，該システムは，
図形イメージを表示する図形表示手段と，
複数のビデオ・ソースからの信号を受取る少なくとも１つのビデオ信号受け取り手段と，
受取った複数のビデオ・ソースの信号から選択して，該ソースの信号を図形表示手段に表示する手段と，
音響を再生する音響再生手段と，
複数の音響ソースから選択して，該選択された音響ソースの信号を音響再生手段へ提供する手段と，
テキストを表示するテキスト表示手段と，
種々のテキスト・ソースから選択して，テキスト表示手段へ選択されたテキスト・ソースの信号を提供する手段と，
獲得された情報が，複数のビデオ・ソース，複数の音響ソースおよびテキスト・ソースの内容の少なくとも一部に関する情報を含むように，少なくとも１つの到来信号から，内容ガイド中に処理されるデジタル情報を獲得する獲得手段とを備えることを特徴とするシステム。

【請求項４】　請求項３記載のシステムにおいて，デジタル情報を獲得する獲得手段が，ビデオ信号受け取り手段に結合されており，獲得手段における獲得が，受取られたビデオ信号の垂直ブランキング・インターバル内に埋設された情報からで行われることを特徴とするシステム。

【請求項５】　請求項３記載のシステムにおいて，該システムはさらに，
グリッド状に表示されるプログラム素材にリンクされて，獲得手段により獲得されたデジタル信号に応答して，表示手段に表示される図形アイコンを生じる処理手段と，
図形的にリンクされたオブジェクトを格納する記憶手段とを備えることを特徴とするシステム。

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【請求項６】　請求項５記載のシステムにおいて，該システムはさらに，処理手段に結合されてオンライン・サービスに接続するためのモデムを備えることを特徴とするシステム。

【請求項７】　請求項５記載のシステムにおいて，該システムはさらに，処理手段に結合されて，表示された図形的にリンクされたオブジェクトをユーザが選択してアクティブ状態にすることができるようにする選択手段を備えることを特徴とするシステム。

【請求項８】　請求項７記載のシステムにおいて，該システムはさらに，処理手段内部に含まれて，選択され格納された表示済みの図形的にリンクされたオブジェクトに関する格納情報に基いて実行される一連のソフトウエア・コマンドを該処理手段に実行させるハイパー・リンク追従手段を備えることを特徴とするシステム。

【請求項９】　図形情報の表示のためのコンピュータ・システムにおいて，
図形イメージを表示する図形表示手段と，
複数のビデオ・プログラム・ソースの信号を受取る少なくとも１つの手段と，
受取った複数のビデオ・プログラム・ソースの信号から選択して，図形表示手段にビデオ・ソースの信号を表示する手段と，
音響を再生する音響再生手段と，
複数の音響ソースから選択して，音響再生手段へ選択された音響ソースの信号を提供する手段と，
テキストを表示するテキスト表示手段と，
種々のテキスト・ソースから選択して，選択されたテキスト・ソースに基くテキストの表示をテキスト表示手段へ提供する手段と，
獲得された情報が複数のビデオ・プログラム・ソース，複数の音響ソースおよびテキスト・ソースの内容の少なくとも一部に関する情報を含むように，少なくとも１つの到来信号から，内容ガイド内へ処理されるべきデジタル情報を獲得する獲得手段と，を備えるコンピュータ・システム。

【請求項１０】　請求項９記載のシステムにおいて，該システムはさらに，
獲得手段により獲得されたデジタル信号に応答して，表示手段に表示される図形的にリンクされたオブジェクトを生じる処理手段と，
図形的にリンクされたオブジェクトを格納する記憶手段とを備えることを特徴とするシステム。

【請求項１１】　請求項１記載のシステムにおいて，アイコンの選択と同時に，物品の注文のための自動接続を行う手段を更に備えるシステム。

【請求項１２】　請求項１記載のシステムにおいて、アイコンの選択と同時に、サービスの注文のための自動接続を行う手段を更に備えるシステム。

【請求項１３】　マルチ・ソースに関する内容の表示のためのシステムにおいて、該システムは、

中央処理装置と、

中央処理装置に結合された表示回路と、

中央処理装置と表示回路とに結合されたハイパーテキスト・リンク・エンジンとを備え、外部資源に対するリンクを提供するため、マルチ・ソースおよびアイコンの少なくとも２つの内容に関するグリッド配置のリスト表示で表示するようにハイパーテキスト・リンク・エンジンが、表示回路へコマンドを与えるように構成されていることを特徴とするシステム。

【発明の詳細な説明】

【０００１】

【発明の属する技術分野】本発明は、電子的娯楽（エンターテインメント）に関する情報を提供する新規なシステムおよび方法に関し、特に、娯楽に関連するサービスを提供する情報プログラムの内容ガイドに関する。

【０００２】

【従来の技術及び本発明の特徴】テレビジョン・ショーなどに関する情報を提供するための、種々のテキスト基準のシステムが、今日利用可能である。しかし、これらの装置および印刷された刊行物は、それらの範囲がある程度限定されている。地方の新聞に見出される情報を取り上げるＶＣＲ＋（登録商標）等のシステムは、ＶＣＲの自動プログラミングをすることができるようにするため、新聞に印刷される操作コードをＶＣＲへ入力することが必要となる、コード基準のシステムを提供する。しかし、このシステムは、現時点では、ユーザとの間の柔軟性のある対話的リンクを実現するものではない。本発明は、テキスト基準の予め印刷された情報のシステムについて、それに勝る著しい改善を提供し、更に、付加的な関連サービスおよび情報をユーザに提供できる機構を提供する。ケーブル・システムにおいて見られるような他のコンピュータおよび電子的手段に基くシステムは、対話性の欠如、および対話的リンクの提供あるいは容易な方法で更新することができる情報の提供能力の欠如等の、色々な他の問題から免れない。

【０００３】本発明によって提供されるコンピュータ基準のシステムは、例えば、多数の電子信号ソースおよび個人により使用されるソースから、色々な種類の情報を表示するための表示機構を取出して、統合化し、提供するパーソナル・コンピュータを提供する。このようなコンピュータ・システムは、主として、距離をおいて見ることが可能な大型スクリーン・モニタを組み込むように設計されるが、本発明は、その用途に限定されるものではなく、実際には、あらゆるサイズのモニタに関して使用することができる。本発明のコンピュータ・システムは、複数のソースからの色々な種類の電子信号をコンピュータ・システムの中央処理装置によって取得することができる、集積されたハードウエアと機能性とを有している。該システムは、再生されかつユーザに対して表示される情報を、解釈し処理する。これらの情報の信号は、アナログ信号あるいはデジタル信号から取得される。信号ソースの幾つかの例は、空中への標準的なアナログ・テレビジョン送信、ケーブル・アナログ・テレビジョン送信、ディジタル・ケーブル・テレビジョン送信、およびデジタルあるいはアナログのいずれかの直接放送衛星である。

【０００４】更に別のディジタル情報は、例えばアナログ・テレビジョン信号の一部として、垂直ブランキング・インターバル（ＶＢＩ）の一部として、あるいは、画像部分に含まれるビデオおよびオーディオ波形の他の部分において、輸送することができる。デジタル・データはまた、中央プロセッサによって、ケーブル・モデム、衛星デジタル・ビデオ送信により、あるいは「統合サービス・デジタル・ネットワーク（ＩＳＤＮ）無線送信を含む標準的な電話回線、ＡＭ／ＦＭラジオ放送、ＣＤ，ＲＯＭ、ＣＤＩ、磁気フロッピなどのデジタル媒体により、得られる。更に別の情報は、ビデオ・カセット・レコーダ、オーディオＣＤプレヤーなどにおいて使用される予め記録されたアイテムから取得することができる。このような情報は、次に、本来のアナログ・フォーマットからデータ・フォーマットに変換されるか、あるいは格納されたデジタル・フォーマットまたは送信用デジタル・フォーマットからデータ・フォーマットに変換され、コンピュータがこのデータ・フォーマットの情報を使用することができる。

【０００５】このような情報を平均的なユーザが使用可能な状態に提示することは、本発明の重要な特徴および利点の１つである。特に、本発明のコンピュータ・システムは、多数の電子信号から情報を取得し、そして、ユーザに対して、該情報の理解が容易でありかつ使用に適するフォーマットで提示できる、統一メカニズム（統一機構）を提供する。例えば、放送テレビジョン信号の場合は、これらの信号は受信された後、動きのあるデジタル図形表示、すなわち動画へ変換され、処理された信号は次に、システム・モニタで表示することができる。このとき、付随するオーディオ信号は、受信されてデジタル・サンプルへ変換される。次いでデジタル・ディスプレイを介して、システムに設けられたアナログ・コンバータへ再生される。当然ながら、信号を視覚的あるいは音響的に提供するために用いられる本発明の信号取得方法および装置、並びにその処理方法は、受信される信号ソースの種類と信号が受信される方法に応じて、変化することになる。

【０００６】デジタル信号ソースの場合は、信号を解釈して表示するため用いられる処理方法は、明らかに、デ

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ジタル情報の種類に依存する。したがって、情報がどのようにデータ・ストリーム内に含まれ、あるいはデータが受取られるコンテキストにどのように存在するかを考慮しなければならない。信号をコンピュータ・システムに到達させるメカニズムは、先に述べたように変化するものであり、従って、本発明を信号の特定の受信方法に関するものに限定するべきではない。

【０００７】オーディオ信号を受取って表示し、あるいはこれを再生することが可能であるどのような複雑なコンピュータ・システムにおいても、エンターテインメントおよび満足な信号の豊富で多岐にわたるソースが存在する。しかし、個々のユーザにとって、存在するプログラムおよび内容の種類からなる広範囲に渡る選択肢から、容易かつ手早く選択することは極めて難しい。従来の試みにおいては、選択が一旦行われると、複雑なコマンドを入れることなく、他の信号／内容ソースに変更すること、あるいは該ソースを調べることは、困難であるかあるいは時間がかかる。異なる手段で送られる内容を探して見つける場合（例えば、テレビジョン放送信号からモデム・データ信号に切換える場合等）、どの素材がユーザにとって興味がありかつ利用できるかを決定するためには、多くの情報ソース即ち「内容ガイド」を調べることが必要となる。

【０００８】従来例のシステムにおいて生じる別の問題は、容易性、すなわち、操作（アクション）をある信号タイプについてユーザにプロンプト指示でき、かつ該操作を別の信号タイプを用いて実行できるようにするための容易性である。この場合の一例は、物品を購入する注文を入れるための電話番号、あるいはワールド・ウェブ・アドレス（世界共通アドレス）等のテレビジョン上の宣伝である。これは、テレビジョン・プログラムの一部分として表示される。従来の操作方法は、ユーザが、電話番号を書き留めて受話器を取り上げ、電話番号をダイヤルし、特定の商品を注文し、そして、クレジット・カード情報あるいは請求書情報をオペレータへ提供している。ワールド・ウェブ・アドレスがテレビジョン・ショーで提供されると、ユーザは、該アドレスの幾つかの表示を得た後、該アドレスの正確なシンタックスを知り、そのアドレスを写し取り、それをウェブ・ブラウザに入力して、このウェブ・ページと通信することができる。

【０００９】

【発明の概要】本発明の利点の１つは、関連する特徴が提供される統合された内容ガイド（ＩＣＧ）にある。この内容ガイドは、複数の信号タイプおよびプログラミングに含まれると共に全体にわたって興味がある内容を探して見つけるための統合された方法を提供し、かつ、このような情報の提供および該情報の信号と共に送られる宣伝情報の提供のための統合された方法を提供する。本発明の更に別の利点は、リンクと、見たり聞いたりするプログラムのコンテキストに保持される関連する情報と、の少なくとも一方を、内容ガイドの一部として使用することができるようにするためのメカニズムである。

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【００１０】

【発明の実施の形態】図１に示されているように、ケーブル・テレビジョンに例として示される従来の表示ガイドは、開始時間１０と現在時間とに基づいて、現在及び未来のショーをリスト表示する。これらガイドの一部は、ユーザが手動スクロールすることが可能であることから、（極めて制限された）対話的手法であると言える。しかし、これらの内容ガイドの形式は、本質的に非常に制限されていることから、ユーザに対して完全に柔軟な手段を提供するものではない。更にまた、情報は、一般に、有意な方法で格納されず、またリンク、すなわち結合関係が提供されることもない。

【００１１】本発明における統合された内容ガイド（統合内容ガイド）は、汎用コンピュータで動作可能なソフトウエア・アプリケーションであり、例えば、テレビジョン、デジタル・サテライト・サービスなどのような多数のサービス、ならびにオンライン・サービス、インターネット・サービス、検索可能なデータベースあるいは他のプログラミング、および情報内容に富んだソースのような他の多様なソースについての内容の利用可能性についての情報を含んでいる。内容ガイドにおける各エントリは、サービスについての情報を個々に含み、あるいは関連するサービス提供についての情報を組合わせることもできる。本発明の内容ガイドは、これらサービスについての記述的情報を含むデータベースを利用している。この内容は、表示される。更に、データベースは、広告グラフィックスまたは特別な関心事のメッセージのような追加の情報、ならびにコンピュータ・システムに特定の動作を実行させるためにアクセスされる埋め込まれた（エンベッデド）コマンドを含むこともできる。追加の情報、グラフィックスあるいは埋め込まれたコマンドの利用可能性を示すための、図形的アイコンその他の手段もまた、ユーザに対して提供される。

【００１２】受取られた信号から、情報が抽出されて中央プロセッサへ提供される。ソフトウエアは、この抽出データを認識してデータベースを形成し、そして、この情報をユーザが追従することができるように図形的な方法で提供する。このような表示と、該表示及び記憶されたデータベース間の対話とを提供することにより、本発明は、コンピュータの制御に使用できる、単一の一貫性のある情報に富む制御フロント・エンドを、有効に統合して提供する。このような制御により、ユーザが、コンピュータ・システムに提供される種々の信号タイプおよび種々のサービスを介して、情報について種々の他の操作を選択しまたは実行できるようになる。グリッド・セル内の情報は、図６に示されるチャット・セッション１０００のようなオンライン・サービス「プログラム」に対するリンクである。また、面白そうなオンライン・グ

ームの選択，あるいは雑誌「タイム（登録商標）」等について入手可能なような検索可能なデータベースへの「リンク」も，作成することができる。

【００１３】本発明においては，データベースは，例えば，コンピュータ・システムの磁気ハード・ディスク・ドライブまたは他の形式のデジタル・メモリ記憶装置に，局部的に格納される。データベースは，しばしば更新されて，更新された内容の情報，更新された広告，その他の情報を含むことになる。このような更新は本発明の重要な利点の１つであり，例えば，広告主が販売促進情報などを更新できると共に，プログラム時間，長さ，内容などの変更を含むプログラム情報を更新することができる。データベースのデジタル内容は，コンピュータが備える複数のデジタル・データ取得システムの内の任意のシステムを用いて，取得されかつハード・ディスク・ドライブに格納される。例えば，このような情報は，放送テレビジョン信号の垂直ブランキング・インターバル内で搬送されるか，あるいはこのインターバルから取得されることが可能である。コンピュータから１つのオンライン・サービスに対してダイアルするモデムを用いて，この情報を更に別に配送することもでき，あるいは，アクティブ状態に保持されるＩＳＤＮ回線を介して提供することもでき，ケーブル・モデムを介して提供することもでき，または固定されたワイド・エリア・ネットワークから，あるいは専用無線チャンネルなどにより提供することもできる。

【００１４】種々の表示モードをユーザが選択することが可能である。これら表示モードはそれぞれ，図２，図３および図４に示されるように，情報の表示の配列を変更する。モード表示の各々は，表示における図形的に別の領域を特徴付けるものと考えられる。特定のプログラムあるいは関心のある１つのアイテムと関連するこれらの領域は，例えば，図２に示される。これらの領域はそれぞれ，セル２０と呼ばれる領域である。１つのセルを，例えば，個々のテレビジョン・プログラムと関連させることができ，また１つのセルがプログラムのタイトルを含むようにすることもできる。デフォルト・モードにおいては，セルは，図２に示されるように，チャンネルに従って（即ち，垂直位置に），かつプログラムの時間スパン（水平位置）に従って，図形的に配列される。これは，一般に，「グリッド・ガイド」と呼ばれ，図１に示されたグリッド・ガイドに類似している。典型的な構成においては，テレビジョン・チャンネル番号（または，個々の局を識別する他のメカニズム）は，表示の左側に最上部から最下部へリスト表示され，日時は，表示の左側から右側へ等しい間隔で表示される。プログラムのリスト表示を含む各セルは，表示上で適切なチャンネルの開始時間と持続時間の座標となるように，表示される。

【００１５】特定のセルを選択あるいは高解度表示するために，配線または無線の遠隔制御装置である，矢印キー，マウスあるいは他の形式のポインティング機構のようなナビゲーション装置を使用してもよい。テレビジョンを選択されたチャンネルに同調させるために，ユーザが遠隔制御装置のボタンを押す等の別の動作をするようにしてもよい。表示を時間的に前に進めあるいは遅らせ，あるいは利用可能なチャンネルを上下させるために，遠隔制御装置にポインタ制御手段を用いてもよい。ある場合には，ボタンを押すと，プログラム・ガイドに含まれる別の情報が現れるようにしてもよい。情報をダウンロードする方法は種々の変更が考えられ，幾つかの従来の方法を採用してもよい。これらの方法は，ＶＢＩからの情報の抽出，インターネットからのバルク・ダウンロード，あるいはローカル・コンピュータによりダウンロードされ格納された他の公知の方法を含むことができる。

【００１６】統合化された内容ガイドおよび格納された関連しているデータベースは，ユーザ用の付加的な図形表示およびナビゲーションのフロント・エンドを提供し，種々の内容ソースを統合化して，内容の提示のため使用されるコンピュータ・システムにエンベッデド制御を提供する。本発明の統合化された内容ガイドは，汎用パーソナル・コンピュータ・システムにおいて展開されるファクトを活用するという点において，独特である。コンピュータの機能性をテレビジョンの内容の環境と共に組合わせることにより，幾つかの付加的な機能的アイテムを可能にしている。

【００１７】特に，図２に示されるように，エンベッデド・アイコン３０，３１，４０，５０，６０，７０，７１，８０は，例えば，ハード・ディスクに局部的に格納されるか，あるいは，ウエブ・サーバからまたは他のソースから個々にダウンロードされる広告グラフィックスに対するリンクを提供することができる。コンピュータ・システムのハード・ディスクに局部的に格納される付加的なビデオまたは音響もまた，あるリンクを高解度表示することによって，ユーザにより表示あるいは再生することができる。リンクを選択した後のこのような情報の表示は，従来の方法で行うことができる。スクリーン上の個々のアイコンを選択することによっても，自動ダイアル・アウトを提供し，かつオンライン・サービスまたはファイル・サーバから情報に対する要求を出すこともできる。このダイアル・アウトは，同様に，選択がビデオ・スクリーン上で行われた後，周知の方法で行うことができる。これは，（例えば，エンベッデド・ブラウザか，あるいは自動的に発される個々のブラウザ・アプリケーションを用いる）表示を含み，また，従来のウエブ・ブラウザ様式あるいは他の種類のサーチ・エンジンを用いて更なる動作を生じるアクティブ・リンクを有するハイパーテキスト・マークアップ行ページ（ｈｔｍｌ）に追従する。

【００１８】図３に示されるような異なる種類のリンクの追従は、ユーザに対する操作のプロンプトを提供する内容プロバイダによって配置されるアイコンである。例えば、政治的なトーク番組は、個々の視聴者からの投票結果を有することができるようにすることができ、これは、特定の質問に対するオートダイヤル・インの投票（応答）を、ユーザにプロンプト指示することにより提供される。パーソナル・コンピュータに配置されかつ従来の大容量記憶装置に格納された補助ソフトウエアを、プログラム内容における個々のアイテムに結び付けることもできる。例えば、ゲーム番組のプレイ・アロング・バージョン（ｐｌａｙ－ａｌｏｎｇ　ｖｅｒｓｉｏｎｓ）をプログラム・ガイド内容と共に送ることもでき、その結果、同じゲームをテレビジョン番組で実演中に、ユーザが家庭で参加してゲームすることができる。

【００１９】更に、予めプログラムされたクレジット・カード情報がシステムに提供されるならば、プログラムのテスト・バージョン、あるいは実際にソフトウエアの完全バージョンのような、アイテムの引き渡しを生じるように、選択を行うことができる。これら要求の全ては、周知の手段によって行われる。しかし、本発明による方法におけるこのような情報の内容ガイドにおける表示は、エンターテインメントのプログラミング情報のコンテキストにおいて提示される、本発明の統合化データベース構成によって行われる。本発明の新規な特徴の１つは、広告および（または）販売促進の機会を設ける手段を提供することができることであり、これは、このような機会が、ユーザの「瞬間的な関心（ｍｏｍｅｎｔ　ｏｆ　ｉｎｔｅｒｅｓｔ）」で容易にアクセスできるからである。瞬間的な関心は、ユーザが内容ガイドのリスト表示に引き付けられる時に生じる。例えば、野球ファンを野球ゲームのリスト表示に引き付ける宣伝を表示すれば、リスト表示により生じる「瞬間的な関心」を増大させることができる。「瞬間的な関心」は、テレビジョンのフレームワーク内のエンターテインメント・プログラミング情報を他のアイテム間に含む本発明のガイドを用いる環境において生じる。

【００２０】種々の表示モード

図２、図３、図４および図５に示されるセルは各々、あるソースから得られる特定の内容についてのある種類の情報を含んでいる。セルの均一な外観を提供することにより、個々の内容およびサービスをアクセスするために必要となる計算ステップのシーケンスは、あるセルに集められて表示され、あるいは、あるセル内に置かれたアイコンによって表示される。ユーザの観点からは、オン・スクリーン・カーソルまたはポインティング・デバイスを特定のアイコン上に置いてからボタンを押すような動作が、必要な動作の全てであるように見える。動作のこのような開始は、リスト表示される内容またはサービスをアクセスする、均等かつ一貫した方法を提供する。このような開始はまた、従来のダブル・クリック法を用いることもでき、あるいは音声でアクティブ状態となるコマンドなどでもよい。しかしながら、実行されるべきある動作を選択する上記した均等な構成は、本発明の重要な特徴である。

【００２１】個々のアイコンまたは１つのセル内の内容を選択すると、種々の動作が行われる。これらの動作は、一般に周知である。しかし、これら動作を内容ガイド中のアイコンへ結び付けることは、本発明において新規である。特に、あるセル内のあるアイコンを選択することにより、あるテレビジョン・プログラムを選択することができ、チューナ装置をあるチャンネルに強制的に同調させることができると共に、個々のソースまたは経路により提供されるビデオおよびオーディオの両チャンネルを選択するために、コンピュータにおける一連の開始コマンドを実行することができる。図２に示される「ＣＨＡＴ ＳＥＳＳＩＯＮ（チャット・セッション）」として示されるアイコン３０が選択されると、個々の対話的なテキスト・ベースのチャット・タイプまたはオーディオ・チャット構成を、ユーザに提供することができる。このアイコンを選択することで、オンライン・サービスのソフトウエア・アプリケーションを開始し、予め格納されたユーザ・ネームをユーザ・ネームのフィールドへ与え、ダイヤル動作を開始してオンライン・サービスへ接続し、実行されるべき接続を提供し、オンライン・サービスへログオンし、データベースから適切なコマンド・シーケンスを取出すことにより自動事項におけるあるチャット・セッションへログオンして実行し、そして、情報が内容ガイドに提供されるこの予めプログラムされたコマンド・シーケンスに継続することによりチャット・セッションへ結合する。

【００２２】図２に示される商品の宣伝または提供を見る場合は、例えば、アイコン４０を選択することにより、国内チェーンまたはローカル・チェーンからピザに注文を入れることができる。次いで、コンピュータにより行われる自動化されたイベント・シーケンスが、データベースから適切な電話番号を取出し、特定の番号をダイヤルし、ピザ・レストランとユーザとが音声で連絡される状況にし、あるいは、その代わりに、ユーザが所望のピザの種類の自動的に選択できるようにする。別の機会即ちアイコンを同様にスクリーン上に提供することもでき、これは、瞬時に更新することができる。これらのアイコンは、機会に基く動作をコンピュータに行わせるために用いられる、目に見える制御手段である。これらの機会は、エンターテインメント・プログラミング・コンテキストおよびユーザの関心事によって決められる。この事例としては、スポーツの点数等のアイテムであり、これにより、データベース・ディレクトリに埋め込まれたすなわち記憶された一連のコマンドをコンピュータが実行できるようにし、そして、最新の点数を得るた

めに装置のコンピュータ・モデム回線から電話呼出を行うようにする。スポーツ関連の記録または商品を選択すると共に、単なる点数ではなく誰が得点したかのような更に詳細な付加的なスポーツ情報を検索するために、更に他のコンテキスト・ベースの関連アイコンを用いることができる。さらに詳細な情報になると、選択されるアイコン８０は他の解説に関するリンクを提供する。このような詳細な情報は、例えば、リーグ中のチームの状況、特定の選手の成績、あるいは他の統計値のような事項である。更に他のアイコンを組い合わせて、これらアイコンに対して３次元的な様相即ち構成を持つこともできる。

【００２３】多重ソースの統合化

本発明の内容ガイドは、多数のソースに対する１つのエントリ・ポイントを提供する。例えば、セルのリスト表示は、個々のテレビジョン・チャンネル内容に限定されることはなく、他のサービス提供物と混成することもできる。一例として上げれば、ユーザは、デジタル衛星伝送、ケーブル・アクセス、および従来の無線放送提供物のいずれかを使用することができる。更に、例えば、Ａｍｅｒｉｃａｎ　Ｏｎ－Ｌｉｎｅ（登録商標；ＡＯＬ）またはＣｏｍｐｕＳｅｒｖｅ（登録商標；ＣＩＳ）〔アイコン９０〕により提供することが可能であるオンライン・チャット・サービスのような、コンピュータに基くテキスト・システムおよびデータベース・システムが提供される。このような提供は、従来の放送チャンネルまたはデジタル衛星チャンネルのいずれかで視聴できる映画のプログラム・リスト表示に続いて行われる。プログラムに関するＵｓｅｎｅｔグループもまた、あるセルに結び付けることができる。また、サーチ可能なデータベースも同様に、図５における「タイム（登録商標）」なる雑誌アーカイブ１０１０等と同じスクリーンに置くことができる。

【００２４】チャット・セッション・セルをクリックすると、指定されたチャット・セッションをアクティブ状態にするのに必要である埋め込まれたコマンドを、コンピュータに実行させ、該チャット・セッションを、図３に示されるような映画セルまたは他のテレビジョン・プログラム・セルに直接結び付けることができる。高解度表示され選択された時、図３に示されるようなビデオ・ウインドウ１００が高解度表示され選択されると、該ウインドウは、コンピュータのテレビジョン部分を当該チャンネルに同調させることになる。これにより、ユーザが、テレビジョン番組に結び付けられるチャット・セッションに、簡単な操作を結合させることができる。これはまた、ユーザがチャット・セッションを選択できる簡素化された機構を提供する。チャット・セッションが例えばある映画に結び付けられる構成を提供することにより、ユーザのアクセスを均一で容易なものにする。更に、多数ソースのこのような統合化の一部として、ある広告主がそのプログラムの一部として、例えば、情報を再タイプする必要なしにユーザにより選択される世界共通のウェブ・ページ等に自動的につながる情報を提供する。

【００２５】本発明の一部であるコンピュータ化されたデータベースを持つことにより、ユーザに関してその使用パターンを知る情報を格納することが可能である。使用パターンを格納するログ・ファイルは、容易に保守される。この情報は、個々のユーザが使用するありそうな設定および選好されるチャンネルおよびプログラムを決めるのにコンピュータによって関連付けられるデータベースを形成するため、ログ・ファイルから情報を検索することにより、コンピュータによって使用することができる。一例をあげれば、あるユーザが４晩つづけてある特定のチャンネルの１０時のニュースを観るならば、コンピュータがこの事実を認識して、このユーザに対して１０時のニュースの直前あるいはちょうど１０時のニュースの時間にスイッチを入れてこのチャンネルに同調するオプションを提供することができる。システムに付加的なコマンドを発することにより、個々のセルの表示の再構成及び再分類を実現することができる。図４により構成される方法で表示を提供するように、コマンドの従来のフィルク・タイプも同様に実現することができる。

【図面の簡単な説明】

【図１】従来例のシステムに使用される表示形式を図形的に表した図である。

【図２】本発明により提供される表示形式の一例を示す図である。

【図３】図２においてあるリンクが追従される時に生じる表示例を示す図である。

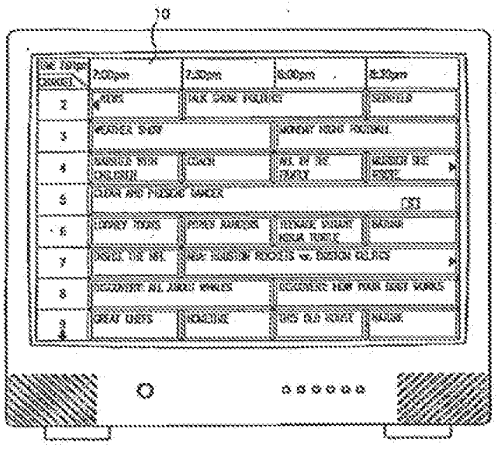
【図４】興味がある表示に基いて再配置が可能であるメカニズムを説明するための表示例の図である。

【図５】可能なテレビジョン内容アイテムおよび非テレビジョン内容アイテムを示す，本発明による表示例の図である。

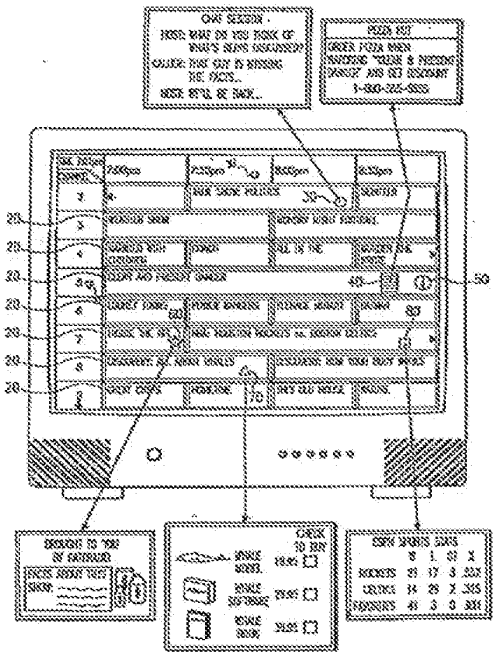
【符号の説明】

１０　開始時間
２０　セル
３０、３１、４０、５０、６０、７０、７１、８０　アイコン
１００　１０００　チャット・セッション
１０１０　雑誌アーカイブ

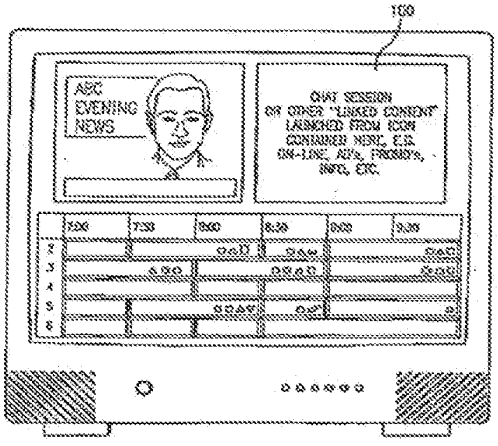
【図1】



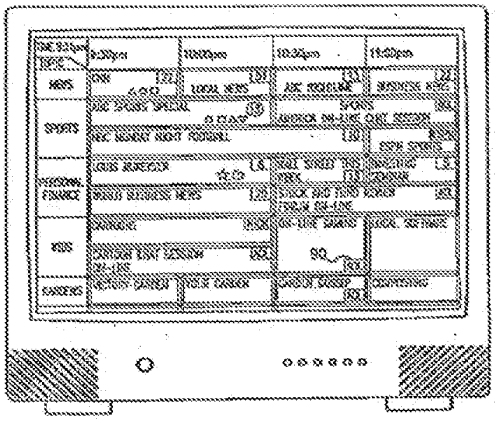
【図2】



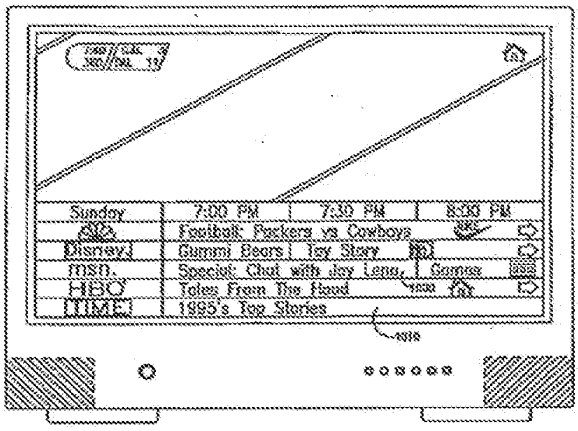
【図3】


ABC
EVENING
NEWS
CHAT SESSION
OR OTHER "LINKED CONTENT"
LAUNCHED FROM ICON
CONTAINED HERE, E.G.
ON-LINE ADs, PREVIEWS,
INFO, ETC.

【図4】



【図5】



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【公報種別】特許法第１７条の２の規定による補正の掲載
【部門区分】第６部門第３区分
【発行日】平成17年6月2日(2005.6.2)

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　Ｇ０９Ｇ　5/00
【ＦＩ】
　Ｇ０６Ｆ　3/14　３７０Ａ
　Ｇ０９Ｇ　5/00　５１０Ｇ

【手続補正書】
【提出日】平成16年8月11日(2004.8.11)
【手続補正１】
【補正対象書類名】明細書
【補正対象項目名】特許請求の範囲
【補正方法】変更
【補正の内容】
【特許請求の範囲】
【請求項１】
　コンテンツ選択ガイドを表示のための方法において，該方法は，
　複数のコンテンツ・ソースからユーザのコンピュータ・システム上に，これらコンテンツ・ソースと関連する記述情報からなるコンテンツ選択情報であって，ユーザのコンピュータ・システム上に表示するためにコンテンツ・ソースからコンテンツを選択するためのコンテンツ選択情報を取得するステップと、
　コンテンツ選択情報を統合して，選択可能なコンテンツの可視表示を生成するステップと、
　該可視表示内に複数の選択可能なガイド・セルを画成するステップであって、各ガイド・セルは、複数のコンテンツ・ソースの１つから得られるコンテンツを指示しており、かつ、ガイド・セルが選択されたときに，該ガイド・セルが対応するコンテンツを表示するように構成されている、ステップと、
　コンテンツの表示以外のアクションを、複数のガイド・セル中の１つのガイド・セルの選択可能部分に関連づけるステップであって、アクションは、タイプを有し、かつ、当該ガイド・セルに関連している，ステップと、
　関連づけられたアクションのタイプを指示するステップと，
　複数のガイド・セル中の当該ガイド・セルの選択可能部分がユーザによって選択されたときに，関連づけられたアクションを実行するステップと
からなることを特徴とする方法。
【請求項２】
　請求項１記載の方法において、タイプを指示するステップは、複数のガイド・セル中の当該ガイド・セルの選択可能部分にアイコンを埋め込むステップを含んでいることを特徴とする方法。
【請求項３】
　請求項１記載の方法において、該方法はさらに、ユーザ入力に基づいて、可視表示を再記画するステップを含んでいることを特徴とする方法。
【請求項４】
　請求項３記載の方法において，再記画するステップは、予め記憶された複数のスキーム

の１つを選択するステップを含んでいることを特徴とする方法。
【請求項５】
請求項１記載の方法において、関連づけられたアクションを実行するステップは、ユーザのコンピュータ・システム上でアプリケーションを実行するステップを含んでいることを特徴とする方法。
【請求項６】
請求項１記載の方法において、可視表示を生成するステップは、複数のコンテンツ・ソースの任意のものによって提供された変更に応答して、可視表示を更新するステップを含んでいることを特徴とする方法。
【請求項７】
複数のコンテンツ・ソースの選択ガイドを表示するためのコンピュータ・システムであって、プロセッサと、プロセッサに接続された表示装置と、プロセッサに接続され、かつソフトウエアを格納している記憶媒体とからなるコンピュータ・システムにおいて，ソフトウエアは、
複数のコンテンツ・ソースから、これらコンテンツ・ソースと関連する記述情報からなるコンテンツ選択情報であって、ユーザのコンピュータ・システム上に表示するためにコンテンツ・ソースからコンテンツを選択するためのコンテンツ選択情報を取得するステップと、
コンテンツ選択情報を統合して、選択可能な複数のガイド・セルからなる可視表示を生成するステップと、
複数のガイド・セル中の１つのガイド・セルに、実行可能な機能と関連づけられたアイコンを埋め込むステップと、
予め格納された複数のスキームの１つにより、ユーザ入力に基づいて複数のガイド・セルを再配置するステップと
を実行するよう構成されていることを特徴とするコンピュータ・システム。
【請求項８】
請求項７記載のコンピュータ・システムにおいて，アイコンと関連づけられた実行可能な機能は，広告を表示する機能であることを特徴とするコンピュータ・システム。
【請求項９】
請求項７記載のコンピュータ・システムにおいて、該システムはさらに、可視表示用のデータを記憶したデータベースを備え、ソフトウエアはさらに、
該データベースに記憶された可視表示用のデータを分析して、パターン・データを生成するステップと、
生成されたパターン・データに応じて、可視表示を自動的に構築するステップと
を実行するよう構成されていることを特徴とするコンピュータ・システム。
【請求項１０】
請求項７記載のコンピュータ・システムにおいて、アイコンと関連づけられた実行可能な機能は，該アイコンに関連づけられたウェブ・サイトへのリンクであることを特徴とするコンピュータ・システム。

PATENT ABSTRACTS OF JAPAN

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G09G 5/00

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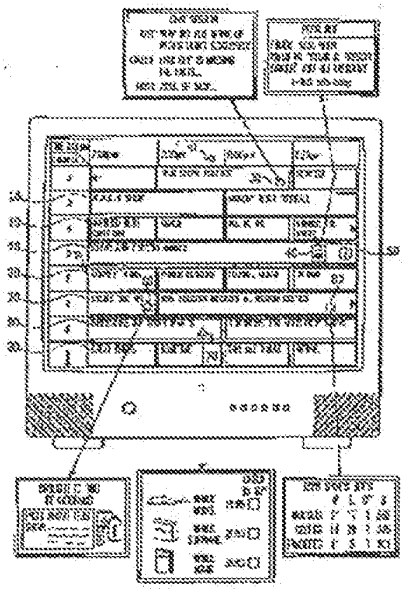
(30)Priority
Priority number : 96 726648 Priority date : 07.10.1996 Priority country : US

(54) COMPUTER SYSTEM FOR DISPLAYING SELECTION GUIDE FOR MULTI SOURCE INFORMATION

(57)Abstract:
PROBLEM TO BE SOLVED: To efficiently make a program selection from plural video sources, etc.
SOLUTION: A content guide is shown on a monitor screen and the content guide is shown as grid-shaped cells 20 which consist of horizontal axes of start times and vertical axes of channels. When a user selects a desired source of television programs, etc., with icons 30 to 80, a source signal that is corresponded to by online service is downloaded and the desired information is shown on the screen to the user.



JAPANESE [JP,10-143349,A]

CLAIMS DETAILED DESCRIPTION TECHNICAL FIELD DESCRIPTION OF DRAWINGS DRAWINGS CORRECTION OR AMENDMENT

[Translation done.]

CLAIMS

[Claim(s)]

[Claim 1] In the computer system for a display of the selection guide of the multi-source information this system The means which produces the visual display which consists of a grid containing a guide cel, and a means to arrange to a part of icon [at least] of the displayed guide cel, it has the means a user enables it to choose from the displayed icon. To the instruction depending on other information other than the icon which is the instruction most important to an icon, and was displayed on the cel which can be executed Computer system which the selected icon is linked and is further characterized by this icon discriminating from the actuation which may have the plurality which an icon expresses, and which can be performed.

[Claim 2] It is the computer system characterized by having the means shown so that this system may carry out animation actuation of the icon selectively further in computer system according to claim 1, and a means to show an icon in the shape of a three dimension selectively.

[Claim 3] In the system for presenting of graphic form information this system A graphic-display means to display a graphic form image, and at least one video signal reception means to receive the signal from two or more video sources, A means to choose from the signal of two or more received video sources, and to display the signal of this source on a graphic-display means, A sound reproduction means to reproduce sound, and a means to choose from two or more sound sources, and to offer the signal of the this chosen sound source to a sound reproduction means, It chooses from a text display means to display a text, and the various text sources. So that a means to offer the signal of the text source chosen to the text display means, and the acquired information may include the information about a part of content [at least] of two or more video sources, two or more sound sources, and the text source The system characterized by having an acquisition means to acquire the digital information processed during a content guide from at least one arrival signal.

[Claim 4] The system characterized by combining with the video signal reception means an acquisition means to acquire digital information, in the system according to claim 3, and performing acquisition in an acquisition means from the information laid underground in the vertical blanking interval of the received video signal.

[Claim 5] It is the system characterized by being linked to the program raw material

with which this system is further displayed in the shape of a grid in a system according to claim 3, answering the digital signal acquired by the acquisition means, and having the processing means which produces the graphic form icon displayed on a display means, and a storage means to store the object linked graphically.

[Claim 6] It is the system characterized by having a modem for this system being further combined with a processing means in a system according to claim 5, and connecting with an on-line service.

[Claim 7] This system is a system characterized by having the selection means a user chooses the object which was further combined with the processing means in the system according to claim 5, and was displayed, and which was linked graphically, and it enables it to make into an active state.

[Claim 8] It is the system characterized by having a hyperlink flattery means to make this processing means execute a series of software commands executed based on the storing information about the object [finishing / the display which this system was further contained inside the processing means in the system according to claim 7, and was chosen and stored] linked graphically.

[Claim 9] A graphic-display means to display a graphic form image in the computer system for presenting of graphic form information, At least one means to receive the signal of two or more video program sources, A means to choose from the signal of two or more received video program sources, and to display the signal of the video source on a graphic-display means, A sound reproduction means to reproduce sound, and a means to offer the signal of the sound source which chose from two or more sound sources, and was chosen to the sound reproduction means, It chooses from a text display means to display a text, and the various text sources. A means to offer the display of a text based on the selected text source to a text display means, So that the acquired information may include the information about a part of content [at least] of two or more video program sources, two or more sound sources, and the text source Computer system equipped with an acquisition means to acquire the digital information which should be processed into a content guide from at least one arrival signal.

[Claim 10] It is the system characterized by answering the digital signal from which this system was further gained by the acquisition means in the system according to claim 9, and having the processing means which produces the object which is displayed on a display means, and which was linked graphically, and a storage means to store the object linked graphically.

[Claim 11] The system further equipped with a means to perform selection of an icon,

and automatic connection for an order [coincidence] of an article, in a system according to claim 1.

[Claim 12] The system further equipped with a means to perform selection of an icon, and automatic connection for the order [coincidence] of service, in a system according to claim 1.

[Claim 13] In the system for the display of the content about the multi-source this system In order to have the hypertext link engine combined with the central processing unit, the display circuit combined with the central processing unit, and a central processing unit and a display circuit and to offer the link to external resources, The system by which a hypertext link engine is characterized by being constituted so that a command may be given to a display circuit so that it may display by the list display of the grid arrangement about the multi-source and at least two contents of the icon.

[Translation done.]

DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to the content guide of the information program which offers the service relevant to amusement especially about the new system and new approach of offering the information about electronic amusement (entertainment).

[0002]

[A Prior art and the description of this invention] The system of various text criteria for offering the information about television show etc. is available today. However, as for these periodicals equipment [periodicals] and printed, those range is limited to some extent. Systems, such as VCR+ (trademark) which takes up the information found out by the local newspaper, offer the system of the code criteria for which it is necessary to input into VCR the operation code printed by the newspaper, in order to enable it to carry out automatic programming of VCR. However, at present, this system does not realize the supple interactive link between users. This invention offers the device in which the remarkable improvement which excels it is offered and a user can be provided with still more nearly additional related service and information

about the informational system by which text criteria were printed beforehand. The system based on other computers and electronic means which are seen in a cable system does not escape other various problems, such as lack of the offer capacity of the information which can be updated by offer or the easy approach of lack of dialogism and an interactive link.

[0003] The system of the computer criteria offered by this invention offers the personal computer which takes out the display device for displaying the information on various classes from the source used by many the electronic signal sources and individuals, integrates, and is offered. Although such computer system is designed so that the large-sized screen monitor which can set and see distance may mainly be incorporated, this invention is not limited to the application and can be actually used about the monitor of all sizes. The computer system of this invention has the hardware and functionality which can acquire the electronic signal of various classes from two or more sources with the central processing unit of computer system and which were accumulated. This system interprets and processes the information which is reproduced and is displayed to a user. The signal of such information is acquired from an analog signal or a digital signal. Some examples of the signal source are the direct broadcast satellites of either standard analog television transmission in the air, cable analog television transmission, digital cable television transmission and digital ones or an analog.

[0004] Furthermore, another digital information can be conveyed as for example, a part of analog television signal in the video contained in the image part as a part of vertical blanking interval (VBI), and other parts of an audio wave. Digital data is obtained by the central processor again by the cable modem, satellite digital video transmission, or digital media, such as the standard telephone line including "integrated service digital network (ISDN) wireless transmission, an AM/FM radio broadcasting, CD, ROM and CDI, and a magnetic floppy. Furthermore, another information is acquirable from the item which is used in a video cartridge recorder, an audio CD prayer, etc. and which was recorded beforehand. Such information is changed into a data format from the digital format which was changed into the data format from the original analog format, or was stored next, or the digital format for transmission, and a computer can use the information on this data format.

[0005] It is one of the important description of this invention, and the advantages that an average user shows an usable condition such information. Especially the computer system of this invention acquires information from many electronic signals, and offers the unification mechanism (unification device) which can be shown in the format which

an understanding of this information is easy and is suitable for an activity to a user. For example, in the case of a broadcast television signal, it is changed into the digital graphic display which has a motion after these signals are received, i.e., an animation, and the processed signal can be displayed with a system monitor next. At this time, it is received and the accompanying audio signal is changed into a digital sample. Subsequently, it is reproduced through a digital display to the analog converter prepared in the system. Though natural, the art will change to the acquisition of signal approach of this invention and equipment which are used in order to offer a signal visually or acoustically, and a list according to the approach by which the class and signal of the signal source received are received.

[0006] The art used in order to interpret and display a signal in the case of the digital signal source is dependent on the class of digital information clearly. Therefore, it must take into consideration how it exists in the context from which information is included in a data stream how, or data are received. The mechanism which makes a signal reach computer system should not change, as stated previously, and it should not limit this invention to the thing concerning [therefore] the specific reception approach of a signal.

[0007] In any complicated computer system which an audio signal is received and displayed or can reproduce this, the various sources by the abundance of entertainment and a satisfactory signal exist. However, it is very difficult for each user to choose from the alternative which consists of a class of the existing program and content and across which it goes broadly easily and quickly. In the conventional attempt, without putting in a complicated command, once selection is performed, it is difficult to change into other signal /content sources, or to investigate this source, or it requires time amount. In order to determine a raw material which raw material is interested and can use for a user when finding it in search of the content sent with a different means (for example, when switching to a modem data signal from a television broadcasting signal etc.), it is necessary to investigate, many the information sources, i.e., a "content guide."

[0008] Another problem produced in the system of the conventional example is the ease for being able to carry out the prompt directions of ease (action), i.e., the actuation, about a certain signal type at a user, and performing this actuation using another signal type. An example in this case is publicity on television, such as the telephone number for putting in the order which purchases an article, or the world web address (cosmopolitan address). This is displayed as a part of television program. A user writes down the telephone number, takes up an earphone, dials the telephone

number, and orders specific goods, and the conventional operating instructions offer credit card information or bill information to the operater. If the world web address is offered in television show, after a user gets some displays of this address, he can know the exact syntax of this address, that address can be inputted into counterpart picking, and he can input it into a web browser, and can communicate with this web page.

[0009]

[Summary of the Invention] One of the advantages of this invention is in the content guide (ICG) with which the related description is offered and which is integrated. This content guide offers an approach to have been unified for offer of the publicity information which offers an approach to have been unified for finding it in search of the content which is interested over the whole while being contained in two or more signal types and programming, and is sent with offer of such information, and the signal of this information. Still more nearly another advantage of this invention is a mechanism for using at least one side of a link, the related information held at the context of the program seen or heard, and ** as some content guides.

[0010]

[Embodiment of the Invention] The conventional display guide shown in cable television as an example displays the show of the present and the future in a list based on start time 10 and current time as shown in drawing 1 . It can be said that it is the interactive (restricted extremely) technique since it is possible for a user to do manual scrolling as for some of these guides. However, since the format of these content guides is restricted dramatically intrinsically, it does not offer a completely flexible means to a user. Furthermore, generally information is not stored by the significant approach, and a link, i.e., joint relation, is not offered again.

[0011] The content guide (integrated content guide) in this invention integrated is the software application which can operate by the general purpose computer, for example, includes the information about the availability of the database or other programming in which service of a large number, such as television and digital satellite service, and an on-line service, the Internet service, and retrieval are possible, and the content about other various sources like the source which was rich in the content of information. Each entry in a content guide can include the information about service separately, or can also combine the information about related service provision. The content guide of this invention uses the database including the descriptive information about these services. This content is displayed. Furthermore, a database can also contain the embedded command (en BEDDEDO) which is accessed in order to make advertising

graphics or the information on an addition like the message of special concerns, and computer system perform specific actuation. The means of a graphical icon and others to show the information on additional, graphics, or the embedded availability of a command is also offered to a user.

[0012] From the received signal, information is extracted and it is provided to a central processor. Software is offered by the graphical approach so that this extract data may be read, and a database may be formed and a user can follow this information. By offering such a display, and this display and the dialogue between the memorized databases, this invention unifies effectively the control front end which can be used for control of a computer and which is rich in information with single coordination, and offers it. It gets down to such control, and a user minds the various signal type and the various services with which computer system is provided, and can choose or perform other various actuation now about information. The information in a grid cel is a link to an on-line service "a program" like the chat session 1000 shown in drawing 5 . Moreover, the "link" to the database which is available about selection of the online game which seems to be interesting, or a journal "a time (trademark)" and which can be searched can be created.

[0013] In this invention, a database is locally stored in the digital memory storage of the magnetic hard disk drive of computer system, or other formats. A database will often be updated and will include the information on the information on the updated content, the updated advertisement, and others. Such updating is one of the important advantages of this invention, for example, it can update program information including modification of program time, die length, the content, etc. while an advertiser can update sales promotion information etc. Using the system of the arbitration of two or more digital data acquisition systems with which a computer is equipped, the digital content of the database is acquired and is stored in a hard disk drive. For example, it is conveyed within the vertical blanking interval of a broadcast television signal, or such information can be acquired from this interval. It can also provide by the Wide Area Network which could also provide through the ISDN circuit which can also deliver this information still more nearly independently or is held at an active state using the modem dialed from a computer to one on-line service, and could also provide through the cable modem, or was fixed to an exclusive radio channel etc.

[0014] A user is able to choose various display modes. These display modes change the informational array of a display, respectively, as shown in drawing 2 , drawing 3 , and drawing 4 . Each of a mode display is considered that another field is characterized graphically in a display. These fields relevant to one item with a specific

program or an interest are shown in drawing 2 . These fields are fields called a cel 20, respectively. One cel can be related with each television program, and one cel can contain the title of a program. In default mode, a cel is graphically arranged according to the time amount span (horizontal position) of a program according to a channel, as shown in drawing 2 (to namely, vertical position). Generally, this is called a "grid guide" and is similar to the grid guide shown in drawing 1 . In a typical configuration, a television channel number (or other mechanisms which identify each station) is shown in the left-hand side of a display a list table from the topmost part at the bottom, and time is expressed on right-hand side as equal spacing from the left-hand side of a display. Each cel including the list display of a program is displayed so that it may be on a display and may become the start time of a suitable channel, and the coordinate of the persistence time.

[0015] Navigation equipment like the arrow key and mouse which are remote control of wiring or wireless about a specific cel selection or in order to carry out a daylight display, or the pointing device of other formats may be used. In order to make it align with the channel which had television chosen, it may be made to carry out another actuation of a user pushing the carbon button of remote control. In order to advance a display in front in time, to delay it or to make an available channel go up and down, a pointer control means may be used for remote control. If a carbon button is pushed, you may make it another information included in a program guide appear in a certain case. The approach of downloading information can consider various modification, and may adopt some conventional approaches. These approaches can include other well-known approaches which downloaded by the extract of the information from VBI, the bulk download from the Internet, or local computer, and were stored.

[0016] The integrated related database which was stored [which were stored and was content-guided] offers the front end of the additional graphic display for users, and navigation, integrates the various content sources and provides with en BEDDEDO control the computer system used for presentation of the content. The content guide with which this invention was integrated is peculiar in the point of utilizing FAKUTO developed in a general-purpose personal computer system. By combining the functionality of a computer with viewing and listening of the content of television, some additional functional items are made possible.

[0017] As especially shown in drawing 2 , the en BEDDEDO icons 30, 31, 40, 50, 60, 70, 71, and 80 are locally stored in a hard disk, or can offer the link to the advertising graphics separately downloaded from other sources from a web server. The additional video or the sound locally stored in the hard disk of computer system can also be

displayed or reproduced by the user by carrying out the daylight display of a certain link. Presenting of such information after choosing a link can be performed by the conventional approach. Also by choosing each icon on a screen, auto-dial out can be offered and the demand to information can also be advanced from an on-line service or a file server. Similarly, this dial out can be performed by the well-known approach, after selection is performed on a video screen. This follows the hypertext markup line page (html) which has the active link which produces the further actuation using the search engine of the conventional web browser format or other classes, including a display (for example, an en BEDDEDO browser or each browser application emitted automatically is used).

[0018] Flattery of the link of a different class as shown in drawing 3 is an icon arranged by the content provider who offers the prompt of actuation to a user. For example, a political talk program can make it possible to have a vote result from each viewer, and this is offered by carrying out the prompt directions of the vote (response) of auto-dialing inn to a specific question at a user. The auxiliary software which has been arranged at the personal computer and stored in the conventional large capacity storage can also be connected to each item in the content of a program. For example, the play ARONGU version (play-along versions) of a game show can also be sent with the content of a program guide, consequently a user can participate and play the game of the same game during demonstration in a television program at home.

[0019] Furthermore, if a system is provided with the credit card information programmed beforehand, it can choose so that the test version of a program or a turnover of an item actually like the perfect version of software may be produced. These the demands of all are performed by the well-known means. However, the display in the content guide of such information in the approach by this invention is performed by the integration database configuration of this invention shown in the context of the programming information on entertainment. one of the new descriptions of this invention is being able to offer a means preparing the opportunity of an advertisement and (or) sales promotion, and this is because such an opportunity can access easily by a user's "a momentary interest (moment of interest)." A momentary interest is produced when drawn by the user to the list display of a content guide. For example, if the publicity which attracts a baseball fan to the list display of a baseball game is displayed, "the momentary interest" produced by list display can be increased. "A momentary interest" is produced in the environment using the guide of this invention which includes the entertainment programming information within the framework of television among other items.

[0020] The cel shown in various display-mode drawing 2 , drawing 3 , drawing 4 , and drawing 5 includes respectively the kind of a certain kind about the specific content acquired from a certain source of information. By offering an appearance with a uniform cel, the sequence of the count step which is needed in order to access each content and service is displayed by the icon which was collected and displayed on a certain cel, or was placed into a certain cel. From a user's viewpoint, actuation which pushes a carbon button after placing on-screen cursor or a pointing device on a specific icon seems to be all the required actuation. such initiation of operation accesses the content or service shown a list table — equal and the consistent approach are offered. The command which can also use the conventional double-clicking method or will be in an active state with voice again may be used for such initiation. However, the above-mentioned equal configuration which chooses a certain actuation which should be performed is the important description of this invention.

[0021] Selection of each icon or the content in one cel performs various actuation. Generally these actuation is common knowledge. However, it is new in this invention to tie up these actuation to the icon under content guide. While being able to choose a certain television program and being able to align tuner equipment with a certain channel compulsorily by choosing a certain icon in a certain cel especially, in order to choose the video offered according to each source or path, and both the channels of an audio, a series of initiation commands in a computer can be executed. A user can be provided with each interactive chat type or interactive audio chat configuration of the text base if the icon 30 shown as "CHAT SESSION (chat session)" shown in drawing 2 is chosen. The software application of an on-line service is started by choosing this icon. The user name stored beforehand is given to the field of a user name. Start dial actuation, connect with an on-line service, and the connection which should be made is offered. Log on to an on-line service, and by taking out suitable command sequence from a database, log on to a certain chat session in an automatic matter, and it performs. It joins together to a chat session by permuting by this command sequence by which a content guide is provided with information and that was programmed beforehand.

[0022] When seeing the publicity or offer of goods shown in drawing 2 , an order can be put into pizza from a domestic chain or a local chain by choosing an icon 40. Subsequently, the automated event sequence which is performed by computer makes it the situation that dial drawing and a specific number and a pizza restaurant and a user are connected with voice in the telephone number suitable from a database, or a

user enables it to instead choose automatically [the class of desired pizza]. It can also offer on a screen similarly, another opportunity, i.e., icon, and this can be updated in an instant. These icons are control means which are used in order to make the actuation based on an opportunity perform to a computer and which are a foregone conclusion. These opportunities are determined by the concerns of an entertainment programming context and a user. It is items, such as mark of a sport, and thereby, a computer enables it to execute a series of commands which it was embedded to the database directory, i.e., have been arranged, and in order to obtain the newest mark, it is made to perform telephone call appearance from the computer modem circuit of equipment as this case. While choosing sport-related record or goods, in order to retrieve still more detailed additional sport information as if mere not mark but who scored, the related icon of the context base of further others can be used. When it becomes still more detailed information, such detailed information that the icon 80 chosen provides with the link about other descriptions is a matter like the situation of the team for example, in a league, a specific player's results, or other statistics. Furthermore, an aim can be doubled for other icons and it can also have to these icons, three dimension modality, i.e., configuration.

[0023] The content guide of integration this invention of the multiplex source offers one entry point to much sources. For example, the list display of a cel is not limited to each content of a television channel, and can also be mixed with other service provision objects. If it raises as an example, a user can use either digital satellite transmission, cable access and the conventional radio broadcasting offer object. Furthermore, American The text system and database system based on a computer like the online chat service which can be provided by On-Line (trademark; AOL) or CompuServe (trademark; CIS) [an icon 90] are offered. Such offer is performed following the program-listing display of the film to which it can view and listen by either the conventional broadcast channel or the digital satellite channel. The Usenet group about a program can also connect to a certain cel. moreover, "a time (trademark)" — it can put on the same screen as journal archive 1010 grade. [in / similarly / in the database which can be searched / drawing 5]

[0024] If a chat session cel is clicked, a computer can be made to be able to execute the embedded command required to make the specified chat session into an active state, and this chat session can be directly connected to a film cel or other television program cels as shown in drawing 3 . When a daylight display is carried out and it is chosen, and the daylight display of the video window 100 as shown in drawing 3 is carried out and it is chosen, this window makes the television part of a computer align

with the channel concerned. Thereby, a user can combine an easy device with the chat session connected to a television program. This offers the simplified device in which a user can choose a chat session again. By offering the configuration in which a chat session is connected, for example to a certain film, a user's access is made uniform and easy. Furthermore, a certain advertiser provides the web page of the cosmopolitan chosen without the need of re-typing information by the user, as a part of the program etc. with the information connected automatically as a part of such integration of the a large number source.

[0025] By having the computerized database which is a part of this invention, it is possible to store the information which gets to know the activity pattern about a user. The log file which stores an activity pattern is maintained easily. Since this information forms the database related with deciding setting out which each user uses, and which is likely to exist, channel, and program by which a preference is carried out by computer, it can be used by computer by retrieving information from a log file. If an example is given and a certain user will look at the news at 10:00 of the channel of 4 **** attachment ****** specification, a computer can recognize this data and can offer just before the news at 10:00, or the option which puts a switch into the time amount of the news at 10:00 exactly, and aligns with this channel to this user. By emitting an additional command to a system, reconstruction and reclassification of a display of each cel are realizable. The conventional filter type of a command is realizable similarly so that a display may be offered by the approach constituted by drawing 4 .

[Translation done.]

TECHNICAL FIELD

[Field of the Invention] This invention relates to the content guide of the information program which offers the service relevant to amusement especially about the new system and new approach of offering the information about electronic amusement (entertainment).

[0002]

[A Prior art and the description of this invention] The system of various text criteria for offering the information about television show etc. is available today. However, as

for these periodicals equipment [periodicals] and printed, those range is limited to some extent. Systems, such as VCR+ (trademark) which takes up the information found out by the local newspaper, offer the system of the code criteria for which it is necessary to input into VCR the operation code printed by the newspaper, in order to enable it to carry out automatic programming of VCR. However, at present, this system does not realize the supple interactive link between users. This invention offers the device in which the remarkable improvement which excels it is offered and a user can be provided with still more nearly additional related service and information about the informational system by which text criteria were printed beforehand. The system based on other computers and electronic means which are seen in a cable system does not escape other various problems, such as lack of the offer capacity of the information which can be updated by offer or the easy approach of lack of dialogism and an interactive link.

[0003] The system of the computer criteria offered by this invention offers the personal computer which takes out the display device for displaying the information on various classes from the source used by many the electronic signal sources and individuals, integrates, and is offered. Although such computer system is designed so that the large-sized screen monitor which can set and see distance may mainly be incorporated, this invention is not limited to the application and can be actually used about the monitor of all sizes. The computer system of this invention has the hardware and functionality which can acquire the electronic signal of various classes from two or more sources with the central processing unit of computer system and which were accumulated. This system interprets and processes the information which is reproduced and is displayed to a user. The signal of such information is acquired from an analog signal or a digital signal. Some examples of the signal source are the direct broadcast satellites of either standard analog television transmission in the air, cable analog television transmission, digital cable television transmission and digital ones or an analog.

[0004] Furthermore, another digital information can be conveyed as for example, a part of analog television signal in the video contained in the image part as a part of vertical blanking interval (VBI), and other parts of an audio wave. Digital data is obtained by the central processor again by the cable modem, satellite digital video transmission, or digital media, such as the standard telephone line including "integrated service digital network (ISDN) wireless transmission, an AM/FM radio broadcasting, CD, ROM and CDI, and a magnetic floppy. Furthermore, another information is acquirable from the item which is used in a video cartridge recorder, an

audio CD prayer, etc. and which was recorded beforehand. Such information is changed into a data format from the digital format which was changed into the data format from the original analog format, or was stored next, or the digital format for transmission, and a computer can use the information on this data format.

[0005] It is one of the important description of this invention, and the advantages that an average user shows an usable condition such information. Especially the computer system of this invention acquires information from many electronic signals, and offers the unification mechanism (unification device) which can be shown in the format which an understanding of this information is easy and is suitable for an activity to a user. For example, in the case of a broadcast television signal, it is changed into the digital graphic display which has a motion after these signals are received, i.e., an animation, and the processed signal can be displayed with a system monitor next. At this time, it is received and the accompanying audio signal is changed into a digital sample. Subsequently, it is reproduced through a digital display to the analog converter prepared in the system. Though natural, the art will change to the acquisition of signal approach of this invention and equipment which are used in order to offer a signal visually or acoustically, and a list according to the approach by which the class and signal of the signal source received are received.

[0006] The art used in order to interpret and display a signal in the case of the digital signal source is dependent on the class of digital information clearly. Therefore, it must take into consideration how it exists in the context from which information is included in a data stream how, or data are received. The mechanism which makes a signal reach computer system should not change, as stated previously, and it should not limit this invention to the thing concerning [therefore] the specific reception approach of a signal.

[0007] In any complicated computer system which an audio signal is received and displayed or can reproduce this, the various sources by the abundance of entertainment and a satisfactory signal exist. However, it is very difficult for each user to choose from the alternative which consists of a class of the existing program and content and across which it goes broadly easily and quickly. In the conventional attempt, without putting in a complicated command, once selection is performed, it is difficult to change into other signal /content sources, or to investigate this source, or it requires time amount. In order to determine a raw material which raw material is interested and can use for a user when finding it in search of the content sent with a different means (for example, when switching to a modem data signal from a television broadcasting signal etc.), it is necessary to investigate, many the information sources,

i.e., a "content guide."

[0008] Another problem produced in the system of the conventional example is the ease for being able to carry out the prompt directions of ease (action), i.e., the actuation, about a certain signal type at a user, and performing this actuation using another signal type. An example in this case is publicity on television, such as the telephone number for putting in the order which purchases an article, or the world web address (cosmopolitan address). This is displayed as a part of television program. A user writes down the telephone number, takes up an earphone, dials the telephone number, and orders specific goods, and the conventional operating instructions offer credit card information or bill information to the operator. If the world web address is offered in television show, after a user gets some displays of this address, he can know the exact syntax of this address, that address can be inputted into counterpart picking, and he can input it into a web browser, and can communicate with this web page.

[0009]

[Summary of the Invention] One of the advantages of this invention is in the content guide (ICG) with which the related description is offered and which is integrated. This content guide offers an approach to have been unified for offer of the publicity information which offers an approach to have been unified for finding it in search of the content which is interested over the whole while being contained in two or more signal types and programming, and is sent with offer of such information, and the signal of this information. Still more nearly another advantage of this invention is a mechanism for using at least one side of a link, the related information held at the context of the program seen or heard, and ** as some content guides.

[0010]

[Embodiment of the Invention] The conventional display guide shown in cable television as an example displays the show of the present and the future in a list based on start time 10 and current time as shown in drawing 1 . It can be said that it is the interactive (restricted extremely) technique since it is possible for a user to do manual scrolling as for some of these guides. However, since the format of these content guides is restricted dramatically intrinsically, it does not offer a completely flexible means to a user. Furthermore, generally information is not stored by the significant approach, and a link, i.e., joint relation, is not offered again.

[0011] The content guide (integrated content guide) in this invention integrated is the software application which can operate by the general purpose computer, for example, includes the information about the availability of the database or other programming in

which service of a large number, such as television and digital satellite service, and an on-line service, the Internet service, and retrieval are possible, and the content about other various sources like the source which was rich in the content of information. Each entry in a content guide can include the information about service separately, or can also combine the information about related service provision. The content guide of this invention uses the database including the descriptive information about these services. This content is displayed. Furthermore, a database can also contain the embedded command (en BEDDEDO) which is accessed in order to make advertising graphics or the information on an addition like the message of special concerns, and computer system perform specific actuation. The means of a graphical icon and others to show the information on additional, graphics, or the embedded availability of a command is also offered to a user.

[0012] From the received signal, information is extracted and it is provided to a central processor. Software is offered by the graphical approach so that this extract data may be read, and a database may be formed and a user can follow this information. By offering such a display, and this display and the dialogue between the memorized databases, this invention unifies effectively the control front end which can be used for control of a computer and which is rich in information with single coordination, and offers it. It gets down to such control, and a user minds the various signal type and the various services with which computer system is provided, and can choose or perform other various actuation now about information. The information in a grid cel is a link to an on-line service "a program" like the chat session 1000 shown in drawing 5 . Moreover, the "link" to the database which is available about selection of the online game which seems to be interesting, or a journal "a time (trademark)" and which can be searched can be created.

[0013] In this invention, a database is locally stored in the digital memory storage of the magnetic hard disk drive of computer system, or other formats. A database will often be updated and will include the information on the information on the updated content, the updated advertisement, and others. Such updating is one of the important advantages of this invention, for example, it can update program information including modification of program time, die length, the content, etc. while an advertiser can update sales promotion information etc. Using the system of the arbitration of two or more digital data acquisition systems with which a computer is equipped, the digital content of the database is acquired and is stored in a hard disk drive. For example, it is conveyed within the vertical blanking interval of a broadcast television signal, or such information can be acquired from this interval. It can also provide by the Wide

Area Network which could also provide through the ISDN circuit which can also deliver this information still more nearly independently or is held at an active state using the modem dialed from a computer to one on-line service, and could also provide through the cable modem, or was fixed to an exclusive radio channel etc.

[0014] A user is able to choose various display modes. These display modes change the informational array of a display, respectively, as shown in drawing 2 , drawing 3 , and drawing 4 . Each of a mode display is considered that another field is characterized graphically in a display. These fields relevant to one item with a specific program or an interest are shown in drawing 2 . These fields are fields called a cel 20, respectively. One cel can be related with each television program, and one cel can contain the title of a program. In default mode, a cel is graphically arranged according to the time amount span (horizontal position) of a program according to a channel, as shown in drawing 2 (to namely, vertical position). Generally, this is called a "grid guide" and is similar to the grid guide shown in drawing 1 . In a typical configuration, a television channel number (or other mechanisms which identify each station) is shown in the left-hand side of a display a list table from the topmost part at the bottom, and time is expressed on right-hand side as equal spacing from the left-hand side of a display. Each cel including the list display of a program is displayed so that it may be on a display and may become the start time of a suitable channel, and the coordinate of the persistence time.

[0015] Navigation equipment like the arrow key and mouse which are remote control of wiring or wireless about a specific cel selection or in order to carry out a daylight display, or the pointing device of other formats may be used. In order to make it align with the channel which had television chosen, it may be made to carry out another actuation of a user pushing the carbon button of remote control. In order to advance a display in front in time, to delay it or to make an available channel go up and down, a pointer control means may be used for remote control. If a carbon button is pushed, you may make it another information included in a program guide appear in a certain case. The approach of downloading information can consider various modification, and may adopt some conventional approaches. These approaches can include other well-known approaches which downloaded by the extract of the information from VBI, the bulk download from the internet, or local computer, and were stored.

[0016] The integrated related database which was stored [which were stored and was content-guided] offers the front end of the additional graphic display for users, and navigation, integrates the various content sources and provides with en BEDDEDO control the computer system used for presentation of the content. The content guide

with which this invention was integrated is peculiar in the point of utilizing FAKUTO developed in a general-purpose personal computer system. By combining the functionality of a computer with viewing and listening of the content of television, some additional functional items are made possible.

[0017] As especially shown in drawing 2 , the en BEDDEDO icons 30, 31, 40, 50, 60, 70, 71, and 80 are locally stored in a hard disk, or can offer the link to the advertising graphics separately downloaded from other sources from a web server. The additional video or the sound locally stored in the hard disk of computer system can also be displayed or reproduced by the user by carrying out the daylight display of a certain link. Presenting of such information after choosing a link can be performed by the conventional approach. Also by choosing each icon on a screen, auto-dial out can be offered and the demand to information can also be advanced from an on-line service or a file server. Similarly, this dial out can be performed by the well-known approach, after selection is performed on a video screen. This follows the hypertext markup line page (html) which has the active link which produces the further actuation using the search engine of the conventional web browser format or other classes, including a display (for example, an en BEDDEDO browser or each browser application emitted automatically is used).

[0018] Flattery of the link of a different class as shown in drawing 3 is an icon arranged by the content provider who offers the prompt of actuation to a user. For example, a political talk program can make it possible to have a vote result from each viewer, and this is offered by carrying out the prompt directions of the vote (response) of auto-dialing Inn to a specific question at a user. The auxiliary software which has been arranged at the personal computer and stored in the conventional large capacity storage can also be connected to each item in the content of a program. For example, the play ARONGU version (play-along versions) of a game show can also be sent with the content of a program guide, consequently a user can participate and play the game of the same game during demonstration in a television program at home.

[0019] Furthermore, if a system is provided with the credit card information programmed beforehand, it can choose so that the test version of a program or a turnover of an item actually like the perfect version of software may be produced. These the demands of all are performed by the well-known means. However, the display in the content guide of such information in the approach by this invention is performed by the integration database configuration of this invention shown in the context of the programming information on entertainment. one of the new descriptions of this invention is being able to offer a means preparing the opportunity of an

advertisement and (or) sales promotion, and this is because such an opportunity can access easily by a user's "a momentary interest (moment of interest)." A momentary interest is produced when drawn by the user to the list display of a content guide. For example, if the publicity which attracts a baseball fan to the list display of a baseball game is displayed, "the momentary interest" produced by list display can be increased. "A momentary interest" is produced in the environment using the guide of this invention which includes the entertainment programming information within the framework of television among other items.

[0020] The cel shown in various display-mode drawing 2 , drawing 3 , drawing 4 , and drawing 5 includes respectively the kind of a certain kind about the specific content acquired from a certain source of information. By offering an appearance with a uniform cel, the sequence of the count step which is needed in order to access each content and service is displayed by the icon which was collected and displayed on a certain cel, or was placed into a certain cel. From a user's viewpoint, actuation which pushes a carbon button after placing on-screen cursor or a pointing device on a specific icon seems to be all the required actuation. such initiation of operation accesses the content or service shown a list table ---- equal and the consistent approach are offered. The command which can also use the conventional double-clicking method or will be in an active state with voice again may be used for such initiation. However, the above-mentioned equal configuration which chooses a certain actuation which should be performed is the important description of this invention.

[0021] Selection of each icon or the content in one cel performs various actuation. Generally these actuation is common knowledge. However, it is new in this invention to tie up these actuation to the icon under content guide. While being able to choose a certain television program and being able to align tuner equipment with a certain channel compulsorily by choosing a certain icon in a certain cel especially, in order to choose the video offered according to each source or path, and both the channels of an audio, a series of initiation commands in a computer can be executed. A user can be provided with each interactive chat type or interactive audio chat configuration of the text base if the icon 30 shown as "CHAT SESSION (chat session)" shown in drawing 2 is chosen. The software application of an on-line service is started by choosing this icon. The user name stored beforehand is given to the field of a user name. Start dial actuation, connect with an on-line service, and the connection which should be made is offered. Log on to an on-line service, and by taking out suitable command sequence from a database, log on to a certain chat session in an automatic

matter, and if performs. It joins together to a chat session by permuting by this command sequence by which a content guide is provided with information and that was programmed beforehand.

[0022] When seeing the publicity or offer of goods shown in drawing 2 , an order can be put into pizza from a domestic chain or a local chain by choosing an icon 40. Subsequently, the automated event sequence which is performed by computer makes it the situation that dial drawing and a specific number and a pizza restaurant and a user are connected with voice in the telephone number suitable from a database, or a user enables it to instead choose automatically [the class of desired pizza]. It can also offer on a screen similarly, another opportunity, i.e., icon, and this can be updated in an instant. These icons are control means which are used in order to make the actuation based on an opportunity perform to a computer and which are a foregone conclusion. These opportunities are determined by the concerns of an entertainment programming context and a user. It is items, such as mark of a sport, and thereby, a computer enables it to execute a series of commands which it was embedded to the database directory, i.e., have been arranged, and in order to obtain the newest mark, it is made to perform telephone call appearance from the computer modem circuit of equipment as this case. While choosing sport-related record or goods, in order to retrieve still more detailed additional sport information as if mere not mark but who scored, the related icon of the context base of further others can be used. When it becomes still more detailed information, such detailed information that the icon 80 chosen provides with the link about other descriptions is a matter like the situation of the team for example, in a league, a specific player's results, or other statistics. Furthermore, an aim can be doubled for other icons and it can also have to these icons, three dimension modality, i.e., configuration.

[0023] The content guide of integration this invention of the multiplex source offers one entry point to much sources. For example, the list display of a cel is not limited to each content of a television channel, and can also be mixed with other service provision objects. If it raises as an example, a user can use either digital satellite transmission, cable access and the conventional radio broadcasting offer object. Furthermore, American The text system and database system based on a computer like the online chat service which can be provided by On-Line (trademark; AOL) or CompuServe (trademark; CIS) [an icon 90] are offered. Such offer is performed following the program-listing display of the film to which it can view and listen by either the conventional broadcast channel or the digital satellite channel. The Usenet group about a program can also connect to a certain cel. moreover, "a time

(trademark)" — it can put on the same screen as journal archive 1010 grade. [in / similarly / in the database which can be searched / drawing 5]

[0024] If a chat session cel is clicked, a computer can be made to be able to execute the embedded command required to make the specified chat session into an active state, and this chat session can be directly connected to a film cel or other television program cels as shown in drawing 3 . When a daylight display is carried out and it is chosen, and the daylight display of the video window 100 as shown in drawing 3 is carried out and it is chosen, this window makes the television part of a computer align with the channel concerned. Thereby, a user can combine an easy device with the chat session connected to a television program. This offers the simplified device in which a user can choose a chat session again. By offering the configuration in which a chat session is connected, for example to a certain film, a user's access is made uniform and easy. Furthermore, a certain advertiser provides the web page of the cosmopolitan chosen without the need of re-typing information by the user, as a part of the program etc. with the information connected automatically as a part of such integration of the a large number source.

[0025] By having the computerized database which is a part of this invention, it is possible to store the information which gets to know the activity pattern about a user. The log file which stores an activity pattern is maintained easily. Since this information forms the database related with deciding setting out which each user uses, and which is likely to exist, channel, and program by which a preference is carried out by computer, it can be used by computer by retrieving information from a log file. If an example is given and a certain user will look at the news at 1000 of the channel of 4 **** attachment ****** specification, a computer can recognize this data and can offer just before the news at 1000, or the option which puts a switch into the time amount of the news at 1000 exactly, and aligns with this channel to this user. By emitting an additional command to a system, reconstruction and reclassification of a display of each cel are realizable. The conventional filter type of a command is realizable similarly so that a display may be offered by the approach constituted by drawing 4 .

[Translation done.]

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] It is drawing which expressed graphically the display format used for the system of the conventional example.

[Drawing 2] It is drawing showing an example of the display format offered by this invention.

[Drawing 3] It is drawing showing the example of a display produced when the link set to drawing 2 is followed.

[Drawing 4] It is drawing of the example of a display for explaining a rearrangeable mechanism based on an interested display.

[Drawing 5] It is drawing of the example of a display by this invention showing the possible content item of television, and the content item of non-television.

[Description of Notations]

10 Start Time

20 Cel

30, 31, 40, 50, 60, 70, 71, 80 Icon

100 1000 Chat Session

1010 Journal Archive

[Translation done.]

CORRECTION OR AMENDMENT

[Kind of official gazette] Printing of amendment by the convention of 2 of Article 17 of Patent Law

[Category partition] The 3rd partition of the 6th category

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[Procedure amendment]
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[Procedure amendment 1]
[Document to be Amended] Description
[Item(s) to be Amended] Claim
[Method of Amendment] Modification
[The content of amendment]
[Claim(s)]
[Claim 1]
A contents selection guide is set to the approach for a display, and it is this approach.
The step which acquires the contents selection information for choosing contents from the contents source in order to be the contents selection information which consists of descriptive information relevant to these contents source and to display on a user's computer system on two or more contents sources to a user's computer system,
The step which unifies contents selection information and generates the visible display of selectable contents,
It is the step which is a step which forms two or more selectable guide cels in this visible display, and is constituted so that this guide cel may display contents, when each guide cel is directing the contents obtained from one of two or more of the contents sources and a guide cel is chosen,
It is the step which it is the step which relates actions other than the display of contents with the selectable part of one guide cel in two or more guide cels, and action has a type, and relates to the guide cel concerned,
The step which directs the type of associated action,
The step which performs associated action when the selectable part of the guide cel concerned in two or more guide cels is chosen by the user
since — the approach characterized by becoming.
[Claim 2]
The step which directs a type in an approach according to claim 1 is an approach characterized by including the step which embeds an icon into the selectable part of

the guide cel concerned in two or more guide cels.

[Claim 3]

It is the approach characterized by including the step to which this approach rearranges a visible display further in an approach according to claim 1 based on a user input.

[Claim 4]

The step rearranged in an approach according to claim 3 is an approach characterized by including the step which chooses one of two or more of the schemes memorized beforehand.

[Claim 5]

The step which performs associated action in an approach according to claim 1 is an approach characterized by including the step which performs application on a user's computer system.

[Claim 6]

The step which generates a visible display in an approach according to claim 1 is an approach characterized by answering modification offered by the thing of the arbitration of two or more contents sources, and including the step which updates a visible display.

[Claim 7]

It sets to the computer system which consists of a storage which is the computer system for displaying the selection guide of two or more contents sources, and is connected with a processor and the display connected to the processor at a processor, and stores software, and is software,

The step which is the contents selection information which consists of descriptive information relevant to these contents source, and acquires the contents selection information for choosing contents from the contents source from two or more contents sources in order to display on a user's computer system,

The step which generates the visible display which unifies contents selection information and consists of two or more selectable guide cels,

The step which embeds the icon related with the function which can be performed in one guide cel in two or more guide cels,

The step which rearranges two or more guide cels based on a user input by one of two or more of the schemes stored beforehand

Computer system characterized by being constituted so that it may perform.

[Claim 8]

The function which was related with the icon in computer system according to claim 7

and which can be performed is computer system characterized by being the function which displays an advertisement.

[Claim 9]

This system is equipped with the database which memorized the data further for a visible display in computer system according to claim 7, and software is ,

The step which analyzes the data for a visible display memorized by this database, and generates pattern data,

The step which builds a visible display automatically according to the generated pattern data

Computer system characterized by being constituted so that it may perform.

[Claim 10]

The function which was related with the icon in computer system according to claim 7 and which can be performed is computer system characterized by being a link to the website related with this icon.

[Translation done.]

AIR CONDITION DISPLAY DEVICE FOR VEHICLE

Publication number:	JP1018712
Publication date:	1989-01-23
Inventor:	KAKIHARA MASAKI
Applicant:	MAZDA MOTOR
Classification:	
- International:	***B60H1/00;*** **B60H1/00**; (IPC1-7): B60H1/00
- European:	B60H1/00Y10
Application number:	JP19870176387 19870715
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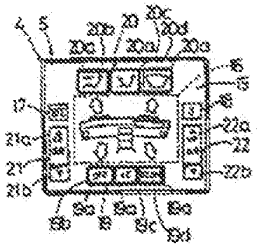
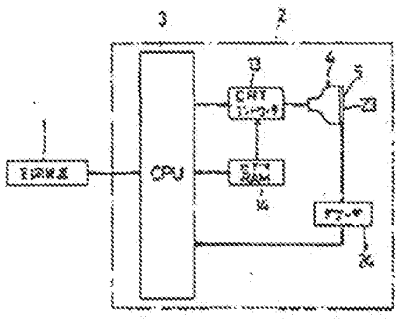
Abstract of **JP1018712**

PURPOSE:To secure the installation space for an operation part of an air conditioner and to improve operability by simultaneously displaying the operating condition of the air conditioner and an operation key portion for operating and controlling the air conditioner on a display screen of an air condition display device. CONSTITUTION:A control device 2 for an air conditioner 1 loaded on a car includes a central processing unit 3 and a display device 4. An image processing data created by the central processing unit 3 is stored in a video RAM 14, and an image is displayed on a display screen 5 of the display device 4 according to the stored data by CRT controller 13. On the other hand, a display portion 15 for displaying the operating condition of the air conditioner 1 is provided at the central portion of the display screen 5, and operation key portions 19-22 of various kinds are displayed on the peripheral edge portion of the display screen 5. Further, the display screen 5 includes a touch sensor 23 for detecting the operation of the operation key portions 19-22 of various kinds. In this arrangement, the operating condition of the air conditioner 1 and the operating condition of every kind are respectively displayed on the display screen 5.





Inventor: Kakihara
Applicant: Mazda Motors

Date of Application: July 15, 1987

CLAIMS OMITTED

3. Detailed Description of the Invention
(Industrial Field of Application)

The present invention relates to an air conditioning display device for displaying the air blowing direction, temperature, and the like of an air conditioner mounted on a vehicle.

Prior Art

Conventionally air conditioner display devices of this type have been of the type disclosed, for example, in JP54-113137, disposing a display panel on which the structure [pattern] of air blown out from the air conditioner is prefigured; by displaying the actual air blow state from the air conditioner on this display panel, a determination can be made at a glance as to whether an air flow [lit, "wind"] is present, the direction of the airflow, and the like.

Problem the Invention Is to Solve

Generally, however, there is a need to control various states of an air conditioner's operation including, for example, the turning on and off of the air conditioner itself, setting of the target vehicle interior temperature, adjustments upward or downward of the air flow by [changing] blower rpm, changing of air blowing direction, and the like; these are normally accomplished by the operation of operating levers or switches.

When the above conventional display panel is placed in the operating space [used] for these operating levers and switches, the operating portion is affected to the extent of the space [needed] for that display panel, resulting in the problem of reducing that space available for the operating levers and switches. However, it is desirable to dispose some type of display means in order to inform the driver of the air conditioner actuation state and increase the operability of the air conditioner.

The object of the present invention is to improve the operating portion for an air conditioning system and the display means for indicating the operating condition of the air conditioning system so that an adequate space may be secured for the operating portion and the operability of the operating portion may be improved at the same time.

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Means to Solve Problem

To achieve such an object, the present invention provides a display device such as a CRT (cathode ray tube) as a display means for displaying the actuation state of an air conditioner, and displays on that display device not only the actuation state of the air conditioner, but also simultaneously the various operating key portions [which serve] as the operating portion thereof, so as to actuate and control the air conditioner by operating those operating key portions.

Specifically, the target of the present invention is an air conditioner display device for displaying actuation states such as the air blowing direction and temperature for an air conditioner mounted on a vehicle.

An operating portion for outputting an operating command signal to the air conditioner is displayed as an operating key portion on that display screen, and the air conditioner is actuation controlled by operating that operating key portion.

Moreover, the above key portion is displayed on the same display-screen as [that for] the display of the air conditioner actuation state.

Operation

In this configuration of the invention, operation of the operating key portion for actuation control of the air conditioner, which is displayed on the display screen of the display device, [results in] actuation control of the air conditioner in response to an operation of that operating key portion. The actuation state of the air conditioner when controlled by the operation of this operating key portion is immediately displayed on the same display device display screen.

In this connection, because the operating key portion for actuation control of the air conditioner is displayed simultaneously with the air conditioner actuation state, the display within the operating key portion display screen eliminates the need for an air conditioner control portion separate from the display device; space can therefore be secured for that operating portion.

The actuation state of the air conditioner is displayed on a display screen, and as the air conditioner is controlled so as to actuate in response to operation of the operating key, the resulting change in actuation state is displayed immediately, so that the actuation state of the air conditioner can be accurately grasped by the actuation state as displayed on the display screen, thereby improving air conditioner operability.

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Embodiment

Below we explain an embodiment of the invention based on figures.

Fig. 3 depicts the overall structure of an embodiment of the invention. 1 is an air conditioner mounted on a vehicle; 2 is a control device for actuation control of the air conditioner 1 – this control device 2 has a CPU 3 and a display device 4 comprising a CRT, and the display device 4 is disposed on the top end portion of the console box 7, disposed contiguous to the center lower portion of the vehicle interior front end instrument panel 6, as shown in Fig. 2. In Fig. 2, 8 is a steering wheel, 9 is a driver's seat, 10 is a passenger seat, and 11 and 12 are respectively the left and right doors.

The above air conditioner 1 is connected to the above CPU 3 so as to be capable of sending and receiving signals. The display device 4 is also connected to the CPU 3 via a CRT controller 13 and a video RAM 14 so as to be capable of sending and receiving signals. Image processing data created by the CPU 3 is stored by the video RAM 14, and an image is displayed on the display device 4 display screen 5 by the CRT controller 13 based on that stored data.

As shown in Fig. 1, an actuation state display portion 15 for displaying the actuation state of the above air conditioner 1 is formed at approximately the center of the display device 4 display screen 5. This actuation state display portion 15 comprises a blower state display portion 16 for respectively displaying at the center portion of the display screen 5 an image of chest blower ports 6a, 6a, defroster blower ports 6b, 6b, foot blower ports (not shown) etc. as shown in Fig. 2, and displaying the air blowing state of each of those blower ports 6a, 6b , along with the air volume thereof, using arrows. The actuation state display portion 15 further comprises a blower temperature display portion 17 at the top end portion of the display screen 5 on the left side of the blower state display portion 16, for displaying the air blower temperature in concrete numerical form; and an air volume level display portion 18 fordisplaying in numerical form the level of air volume (for example the blower RPM) coming from the above blower ports 6a, 6b at the top edge of the display screen 5 on the right side of the blower state display portion 16.

At the same time, various operating key portions 19-22 for actuation control of the air conditioner 1 are displayed generally in the perimeter area of the display screen 5. Specifically, these operating key portions 19-22 include an actuation state switching operating key portion 19 for actuation switching of the air conditioner 1

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which is displayed at the bottom edge portion of the display screen 5 below the blowing state display portion 16 in the above actuation state display portion 15; a mode switching operating key portion 20 for switching the actuation modes of the air conditioner 1, given as different combinations of the blower ports 6a, 6b and the temperature thereof displayed at the top edge of the display screen 5 above the blowing state display portion 16; a temperature control operating key portion 21 for increasing and decreasing the temperature of the air blown out from each of the blower ports 6a, 6b displayed on the bottom edge portion of the display screen 5 at the left side of the above blowing state display portion 16; and an air volume adjustment operating key portion 22 for increasing and decreasing the air volume level from each of the blower ports 6a, 6b, which is formed at the bottom edge portion of the display screen 5 at the right side of the blowing state display portion 16. The above actuation state switching operating key portion 19 comprises three switch operating keys, e.g. an OFF operating key 19b, an ON operating key 19c (the air conditioner operating key), and an economy mode operating key 19d, each surrounded by a framing portion 19a. The mode switching operating key portion 20, similarly, comprises three operating keys 20b-20d, for example ventilation, heat, and defrost, displayed as simplified graphic images, each surrounded by a framing portion 20a.

Moreover, the temperature control operating key portion 21 has an up key 21a and a down key 21b for increasing and decreasing the temperature level; and the air volume adjustment operating key portion 22 has an up key 22a and a down key 22b for increasing and decreasing the air volume level.

As shown in Fig. 3, a touch sensor 23 is attached in a tightly adhered state to the display screen 5 on the above display device 4. This touch sensor 23 has multiple line-shaped transparent electrodes (not shown), respectively parallel to the horizontal and vertical directions of the display screen 5 and disposed so as to mutually intersect. When a portion thereof is touched with a finger, the position of the contacted portion is detected by a matrix signal. The output signal from the above touch sensor 23 is then processed by the decoder 24 and input to the central processing unit 3. When the image operating key portions 19-22 displayed on the display device 4 display screen 5 are pushed (touch operated) from over the touch sensor 23, signals corresponding to those operating key portions 19-22 are detected by the touch sensor 23 and input to the central processing unit 3. The air conditioner 1 is actuated in response to the above operating key portions 19-22,

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and the actuation control state of that air conditioner 1 is displayed in the actuation state display portion 15 of the same display screen 5 of the display device 4.

To explain the air conditioner actuation state on the display screen 5 [more] concretely, when one of the operating portions 19b-19d of the above actuation state changing operating key portion 19 is selectively operated via the touch sensor 23, for example, the display state of the framing portion 19a [around] that selected operating portion 19b-19d is changed, for example, to a reverse display state different from that of the framing portion[s] 19a [around] other operating keys 19b-19d, so as to distinguish the operated state of that switch operating key portion 19, i.e. the operating state of the air conditioner 1.

By selective operation of one of the operating keys 20b-20d of the mode switch operating key portion 20, the display state of the framing portion 20a [around] the selected operating portion 20a-20b is similarly changed, for example, to a reverse display state different from that of the framing portion[s] 20a [around] other operating keys 20b-20d, so as to distinguish the operated state of that switch operating key portion 20, i.e. the operating mode of the air conditioner 1.

When the target set temperature of the air conditioner 1 is changed by operating the temperature adjustment operating key portion 21, that target set temperature is displayed by the blower temperature display portion 17, while at the same time the display color of the arrows in the blowing state display portion 16 is changed in response to the air blowing temperature determined by the above target setting temperature to, for example, a blue color in the low temperature state and to a red color in the hot air state, respectively.

Furthermore, when the target set temperature of the air conditioner 1 is changed by operation of the air volume adjustment portion 22, the selected target air volume is displayed as a number by the air volume level display section portion 18, while the size (length) of the blowing state display portion 16 arrow is increased when the air volume level is raised and decreased when the air volume level is lowered, in response to the above target set air volume.

Next,the operation of the above embodiment is explained. The operating key portions 19-22 for actuation control of the air conditioner 1 are displayed on the display device 4 display screen 5; when these operating key portions 19-22 are operated, their operation is detected by the touch sensor 23; through actuation of the central processing unit 3 by receiving a detection signal from the touch sensor 23, the air conditioner 1 is actuation controlled in response to the operating state of the

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above operating key portions 19-22, and the actuation state of the air conditioner 1 is displayed on the display device 4 display screen 5.

When, for example, any one of the operating keys 19b-19d of the above actuation state switching operating key portion 19 on the display screen 5 is selectively operated, the display state of the framing portion 19a around the selected operating key 19a-19d is changed with respect to the framing portions 19a of other operating keys 19b-19d, and the actuation state of that air conditioner 1 is displayed.

Similarly to the above, when any one of the operating keys 20b-20d of the mode switch operating key portion 20 is selectively operated, the display state of the framing portion 20a around the selected operating key 20a-20d is changed with respect to the framing portions 20a of other operating keys 20b-20d, and the actuation state of that air conditioner 1 is displayed.

The temperature adjustment operating key portion 21 is operated to change the target set temperature [delivered] by the air conditioner 1. By this operation, the above target temperature is displayed as a specific number on the display screen 5 by the blower temperature display portion 17, while the display color of the arrow in the blowing state display portion 16 on the display screen 5 is changed, for example, to a blue color in a lower temperature selection, and to a red color in a warmer temperature selection, in response to the air blow temperature determined by the above target set temperature.

When the target set air volume of the air conditioner 1 is changed, operating the air volume adjustment 22 on the display screen 5 causes a numerical display of that target air volume by the air volume level display section portion 18, while in response to the above target set air volume, the size of the blowing state display portion 16 arrow is increased when the air volume level is set higher and decreased when the air volume level is set lower.

Therefore in this embodiment the display screen 5 simultaneously displays, in addition to the actual air conditioner 1 actuation state, the operating key portions 19-22 for actuation control of the air conditioner 1 thereof, so that even when the above display device 4 is provided, there is no need to provide the display device 4 separately from the air conditioner 1 operating portion, thereby securing adequate space for the operating portion thereof.

Each of the actuation states of the air conditioner 1 is displayed on the display screen 5 and, since the air condition actuation state displayed on the above display

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screen 5 changes immediately in response to the change in the actuation control of the air conditioner 1 which results from the operation of the operating key portions 19-22, the actuation state of the air conditioner 1 can be accurately and quickly grasped by the actuation state [shown] on that display screen 5, thereby enabling an improvement in the operability of the air conditioner 1.

Furthermore, along with the operations to change the target set temperature and target set air volume which form the actuation states of the above air conditioner 1, those target set temperature and target set air volume are more concretely respectively displayed by the blower temperature display portion 17 and the blow volume level display section portion 18 on the display screen 5, while simultaneously the display color and size of the arrow in the blowing state display portion 16 on the same display screen 5 are changed, so that the actual actuation state of the air conditioner 1 can visually be easily grasped at a glance, and an even greater improvement in the operability of the air conditioner 1 can be achieved.

In the display device 4 display screen 5, the operating key portions 19-22 for air conditioner actuation control are distributed around the edge portion of the display screen 5, so that space can be left between the operating key portions 19-22, and this permits the operating key portions 19-22 to be accurately operated.

Note that while a CRT was used for the display device 4 in the above embodiment, a liquid crystal display device, for example, could of course also be used.

Effect of the Invention

As explained above, according to the present invention, simultaneous display of the actuation state of an air conditioner as well as the operating key portions for actuation control of that air conditioner permits space for setting the operation of the air conditioner on a display device display screen using a display within a display screen [as part of] the operating portion of the air conditioner; at the same time, operability thereof can be improved by displaying the actuation state of the air conditioner.

Brief Description of Figures

OMITTED HERE BELOW

⑲日本国特許庁(JP)　⑫特許出願公開

⑫公開特許公報(A)　昭64-18712

⑤Int.Cl.⁴	識別記号	庁内整理番号	⑬公開　昭和64年(1989)1月23日
B 60 H 1/00	1 0 3	Y-7153-3L Z-7153-3L	

審査請求　未請求　発明の数 1　(全6頁)

⑭発明の名称　車両用空調表示装置

⑳特　願　昭62-176387
㉒出　願　昭62(1987)7月15日

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明　細　書

1. 発明の名称

車両用空調表示装置

2. 特許請求の範囲

(1) 車両に搭載された空調装置の風の吹出し方向や温度等の作動状態を表示する空調表示装置であって、上記空調装置に作動指令信号を出力する操作部が表示画面に操作キー部として表示されていて、その操作キー部の操作により空調装置が作動制御され、上記操作キー部は、空調装置の作動状態の表示と同一の表示画面に表示されるように構成されていることを特徴とする車両用空調表示装置。

3. 発明の詳細な説明

(産業上の利用分野)

本発明は、車両に搭載された空調装置の風の吹出し方向や温度等の作動状態を表示する空調表示装置に関するものである。

(従来の技術)

従来より、この種の空調表示装置として、例えば実開昭63-113117号公報に開示されるものでは、予め、空調装置からの空気の吹出し温度を用いた演算式を記憶し、この演算式に対して空調装置からの実際の空気の吹出し状態を入力することにより、風の有無やその方向等を一括して判断できるようにすることが示されている。

(発明が解決しようとする問題点)

ところで、一般に、車両用空調装置においては、その作動状態を種々の状態に制御する必要があり、例えば、空調装置自体のON/OFF切換え、目標とする室内の温度設定、アウタの切換装置による風量の増減調整、吹出し方向の切換えなどがあり、これらは通常操作レバーや操作スイッチ等の操作により行われる。

そして、これら操作レバーや操作スイッチ等の操作部の配置スペースに対して、上記従来の表示装置を設置すると、その表示部のスペースの分だけ操作部が必要となり、その設置スペースが小さくなるという難がある。そうして、空調装置の作動状態を運転者に報知させて、空調装置の操作性

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を広めるためには、何らかの表示手段を設置するなどの工夫がしい。

本発明の目的は、上記した空調装置の操作システムおよび空調装置の作動状態を示す表示手段に適正な役割を与えることにより、空調装置の操作部の設置スペースの縮小とその操作性の向上とを共に図ることにある。

（問題点を解決するための手段）

この目的の達成のため、本発明の解決手段は、空調装置の作動状態を表示する表示手段としてCRT（カソードレイチューブ）等の表示装置を設け、その表示装置に、空調装置の作動状態のみならず、その操作部としてのある種のキー画面を同時に表示して、その操作キー画面の操作により空調装置を作動制御するようにしたものである。

具体的には、本発明は、車両に搭載された空調装置の風の吹出し方向や温度等の作動状態を表示する空調装置表示装置が対象である。

そして、その表示画面に、空調装置における複合信号を出力する操作部を操作キー画面として表示して、その操作キー画面の操作により空調装置を作動制御するようにしたものである。

また、空調装置の作動状態が表示画面上に表示され、しかも操作キー画面の操作に伴う空調装置の作動制御に応じて、逐一にその作動状態の変化が表示されるため、その空調装置の作動状態をその表示画面上のみ状態によって常時に把握でき、よって空調装置の操作性を向上することができることとなる。

（実施例）

以下、本発明の実施例を図面に基づいて説明する。

第１図は本発明の実施例の全体構成を示し、１は車両に搭載された空調装置、２は該空調装置１を作動制御するための制御装置であって、この制御装置２はCPU（中央処理装置）３と、これでROM（リードオンリーメモリ）からなる表示装置４とを有し、上記表示装置４は、第２図に示すように車両前席のインストルメントパネル５の中央下部に設置されたコンソールボックス６の上面部に設置されている。尚、第２図中、７はステアリングホイール、８は運転席シート、９は助手席シート、１１，１２はそれぞれ左右のドアである。

上記中央処理装置３には上記空調装置１が信号授受可能に接続されている。また、上記表示装置４は中央処理装置３に対してCRTコントローラ１３およびビデオRAM（ランダムアクセスメモリ）１４を介して信号授受可能に接続されており、中央処理装置３で作成した表示用データをビデオRAM１４により記憶するとともに、その記憶データに基づいてCRTコントローラ１３により表示装置４の表示画面上に画像を表示させるようになされている。

上記表示装置４の表示画面５には、第３図に示すように、該表示画面５の中央に上記空調装置１の作動状態を表示する作動状態表示部１５が形成されている。この作動状態表示部１５は、表示画面５の中央部において、第２図に示すおく上部インストルメントパネル５に設ける例えば吹出口５ａ，５ａ，一、デフロスタ吹出口５ｂ，５ｂ、足元吹出口（図示せず）等を模式により、またその空調装置状態にある吹出口５ａ，５ｂおよびそのときの風量の大きさを矢印によりそれ

それ表示する吹出状態表示部１５と、該吹出状態表示部１５の左側の表示範囲５上端部で、空気の吹出温度を具体的に数字で表示する吹出温度表示部１７と、上記吹出状態表示部１５の右側の表示範囲５上端部において、上記各吹出口８a，８bからの風量の大きさレベル（例えばブロワの回転数）を数字により表示する風量レベル表示部１８とで構成されている。

一方、表示範囲５の残り部分には、空調装置１を作動制御する各種の操作キー部１９～２２が表示される。すなわち、この操作キー部１９～２２は、上記作動状態表示部１３における吹出状態表示部１５の下側たる表示範囲５下端部に表示され、空調装置１の作動の開始停止を行う作動状態切換操作キー部１９と、吹出状態表示部１５の上側の表示範囲５上端に表示され、使用する吹出口８a，８bやその温度の組合せ等によって決定される空調装置１の作動モードを切り換えるモード切換操作キー部２０と、上記吹出状態表示部１５の左側の表示範囲５下端部に表示され、上記各吹出口８a，８bから吹き出される空気の吹出温度を昇降させる温度調節操作キー部２１と、吹出状態表示部１５の右側の表示範囲５下端部に配設され、各吹出口８a，８bからの風量レベルを増減変更する風量調節操作キー部２２とを備えてなる。そして、上記作動状態切換操作キー部１９は、例えば各々符号１９aにより示されたOFF操作キー部１９b、ON操作キー部１９c（エアコンディション操作キー部）およびエコノミモード操作キー部１９dの３つの切換操作キー部からなる。また、モード切換操作キー部２０は、同様に、各々符号２０aにより示された吹出方式にて表示される例えば換気、暖房、デフロストの３つの操作キー部２０b～２０dからなる。

さらに、温度調節操作キー部２１は温度レベルを昇降させるアップキー部２１aおよびダウンキー部２１bを、また風量調節操作キー部２２は風量レベルを昇降させるアップキー部２２aおよびダウンキー部２２bをそれぞれ有している。

また、第３図に示すように、上記表示装置４の表示範囲５には透明なタッチセンサ２３が密着状態で取り付けられている。このタッチセンサ２３は、表示範囲５に沿って縦方向および横方向にそれぞれ平行に互いに交差状態で配置された複数の線状の透明電極（図示せず）を有し、その一部を指で触れると、その接触部分の位置をマトリクス信号により検出する。そして、上記タッチセンサ２３の出力信号はデコーダ２４で処理されて上記中央処理装置３に入力されており、表示装置４の表示範囲５に表示された所要の操作キー部１９～２２をタッチセンサ２３の上から押し操作（接触操作）すると、その操作キー部１９～２２に対応する信号をタッチセンサ２３により検出して中央処理装置３に入力させ、その中央処理装置３での信号処理により、上記操作キー部１９～２２の操作に応じて空調装置１を作動制御するとともに、その空調装置１の作動制御状態を表示装置４における同一の表示範囲５の作動状態表示部１３等で表示するように構成されている。

すなわち、この表示範囲５での空調装置作動状態を具体的に説明すると、例えば上記作動状態切換操作キー部１９の各操作部１９b～１９dの１つをタッチセンサ２３を介して選択操作したときには、その選択された操作部１９b～１９dの符号１９aの表示状態を他の操作部１９b～１９dの符号１９aと異なるように例えば反転表示状態に変えて、その切換操作キー部１９の操作、つまり空調装置１の作動状態を認識させる。

また、モード切換操作キー部２０の各操作部２０b～２０dの１つの選択操作により、その選択された操作部２０b～２０dの符号２０aの表示状態を上記と同様に他の操作部２０b～２０dの符号２０aと異なるように例えば反転表示状態に変えて、その切換操作キー部２０の操作、つまり空調装置１のモード状態を認識させる。

また、温度調節操作キー部２１の操作により空調装置１による目標吹出温度が変更されたときには、その目標温度を吹出温度表示部１７により表示するとともに、吹出状態表示部１５における矢印の表示色を上記目標吹出温度により決定される

表示の状態変更にあたって考えた場合、従来では単なる表示の変更にすぎないが、本発明では次のような意味を持つことになる。

すなわち、本発明装置のキー操作手段によりカーソル移動による目標設定値の変更がなされたときには、その目標設定値を履歴レベル表示手段13により数字で表示するとともに、その状態表示手段14の矢印の大きさ（長さ）を上記目標設定値変更にあたって履歴レベルが高いときには大きくし、履歴レベルが低いときには小さくそれぞれ変更するように構成されている。

次に、上記装置例の作用について説明するに、本発明装置1を作動させるための操作キー部15～22が表示装置4の表示画面5に表示されている。この操作キー部15～22を操作すると、その操作キー部15～22の操作がタッチセンサ23により検知され、このタッチセンサ23の検出信号をマイクロ中央処理装置部3の作動により、本発明装置1が上記操作キー部15～22の操作状態にあるかを判断され、同時に、その本発明装置1の作動状態が表示装置4の表示画面5で表示される。

例えば、本発明装置1による目標設定値変更を実行するときには、表示画面5上の履歴選択操作キー部21を操作すると、この操作に伴い、その目標設定値が履歴レベル表示部13により数字で表示されるとともに、上記状態表示部14の矢印の大きさが上記目標設定値変更にあたって履歴レベルの低いときには大きくなり、履歴レベルの高いときには小さくなるようにそれぞれ変更される。

したがって、この実施例の場合、表示装置4の表示画面5上に、本発明装置1の実際の作動状態に加えて、その本発明装置1を作動変更するためのキー部15～22が同時に表示されているため、上記表示装置4を監視する場合であっても、その表示装置4を本発明装置1の操作部と同様に操作する必要がなく、よってその操作部の操作スペースを減少することができる。

また、本発明装置1の作動状態が表示画面5上に表示され、しかも操作キー部15～22の操作される。

例えば、表示画面5上のキー操作手段操作キー部15の各操作部15a～15dを選択操作したときには、その選択された操作部15a～15dの状態15eの表示状態が他の操作部15a～15dの状態15eに対し変えられて、その空調装置1の作動状態が変更される。

また、モード切換操作キー部20の各操作部20a～20dが選択操作されると、上記と同様に、その選択された切換操作部20a～20dの状態20eの表示状態が他の操作部20a～20dと変えられて、その空調装置1のモード状態が表示される。

さらに、空調装置1による目標設定値変更を実行するときには、履歴選択操作キー部21を操作する。この操作により上記目標設定値の表示画面5上の状態設定表示部17により具体的に数値として表示されるとともに、同じ表示画面5上の状態表示装置14における矢印の表示色が上記目標設定値変更により決定される空気の状態設定にあたって

例えば従来装置では単なる色に変更される。

また、空調装置1による目標設定値変更を実行するときには、表示画面5上の操作キー部21を操作すると、この操作に伴い、その目標設定値が履歴レベル表示部13により数字で表示されるとともに、上記状態表示部14の矢印の大きさが上記目標設定値変更にあたって履歴レベルの低いときには大きくなり、履歴レベルの高いときには小さくなるようにそれぞれ変更される。

したがって、この実施例の場合、表示装置4の表示画面5上に、空調装置1の実際の作動状態に加えて、その空調装置1を作動変更するためのキー部15～22が同時に表示されているため、上記表示装置4を監視する場合であっても、その表示装置4を空調装置1の操作部と同様に操作する必要がなく、よってその操作部の操作スペースを減少することができる。

また、空調装置1の作動状態が表示画面5上に表示され、しかも操作キー部15～22の操作

にかかる空調装置1の作動状態にあたって、さらに上記表示画面5上の空調装置操作部状態が変化するため、その空調装置1の作動状態をその表示画面5上の状態色によって瞬時にかつ直感に把握できる。よって空調装置1の操作性を向上することができる。

さらに、上記空調装置1の作動状態である目標設定値および目標設定温度の変更操作において、その目標設定温度および目標設定温度がそれぞれ表示画面5上の状態設定表示部17および履歴レベル表示部13により具体的に表示されるとともに、同じ表示画面5上の状態表示装置14における矢印の表示色および大きさが変更されるので、空調装置1の実際の作動状態を視覚的に一致して容易に把握することができる。よって上記空調装置1の操作性をより一層向上させることができる。

また、表示装置4の表示画面5において、空調装置作動状態の操作キー部15～22が表示画面5の領域内に設けられているので、その

各操作キー等19～22間のスペースを空けることができ、各操作キー等19～22を確実に操作することができる。

尚、上記実施例では、表示装置4としてCRTを用いたが、この他、例えば液晶表示装置を使用してもよいのはいうまでもない。

（発明の効果）

以上説明したように、本発明によると、表示装置の表示画面上に、空調装置の作動状態とともに、その空調装置を作動制御するための操作キー等を同時に表示するようにしたことにより、空調装置の操作部の表示画面内での表示によって空調装置の操作部の設置スペースを縮小することができるとともに、空調装置の作動状態の表示によってその操作性を向上させることができる。

4. 図面の簡単な説明

図面は本発明の実施例を示し、第1図は表示装置の表示画面の正面図、第2図は車室内後部を車室前方から見た斜視図、第3図は制御系の構成を示すブロック図である。

1…空調装置、2…制御装置、4…表示装置、5…表示画面、15…作動状態表示手段、19…作動状態切換操作キー等、20…モード切換操作キー等、21…風量調節操作キー等、22…風向調節操作キー等、23…タッチセンサ。

特許出願人　マツダ株式会社

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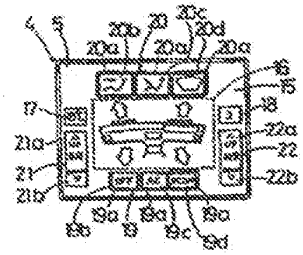
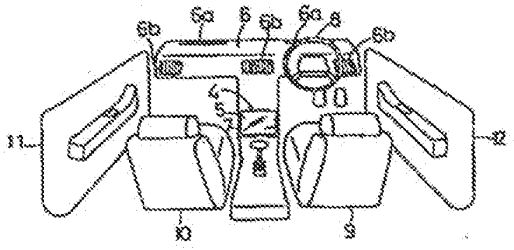
1	空調装置
2	制御装置
4	表示装置
5	表示画面
15	作動状態表示手段
19	作動状態切換操作キー等
20	モード切換操作キー等
21	風量調節操作キー等
22	風向調節操作キー等
23	タッチセンサ

第1図



第2図



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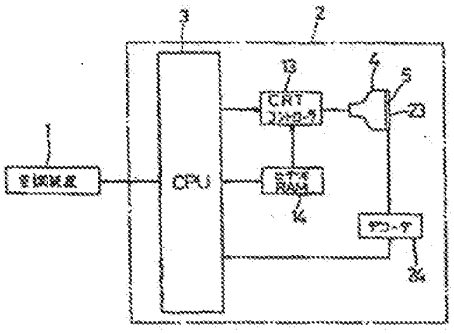
第3図



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VEHICLE SWITCH DEVICE

Patent number: JP5077679
Publication date: 1993-03-30
Inventor: SEKINE MANABU; NAGOSHI SUBO
Applicant: NISSAN MOTOR
Classification:
- international: B60K35/00; B60K37/06; B60R16/02; H01H9/16
- european:
Application number: JP19910270258 19910921
Priority number(s): JP19910270258 19910921

View INPADOC patent family

Abstract of JP5077679

PURPOSE:To provide an easy and reliable access to an intended switch button and lever so that a driver can do without moving his or her eyes while an automobile is running. CONSTITUTION:A touch sensor and an operation detection means are provided for a button so that a layout of a button 52t which is being touched and surrounding buttons is displayed on a headup display device and the button 52t which is being touched is highlighted. When a button is operated, that button 52p is highlighted differently from the touch state.

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B60K 35/00		A 7812-3D		
37/06		7812-3D		
H01H 9/18		B 7928-5G		

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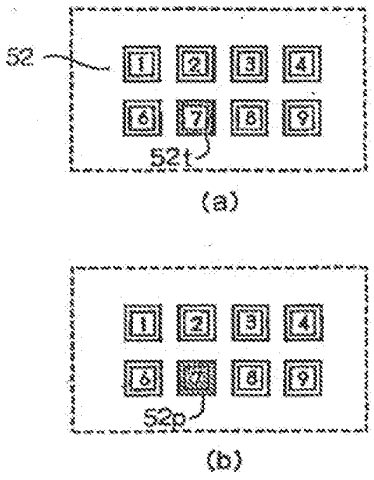
(54)【発明の名称】　車両用スイッチ装置

(57)【要約】
【目的】　運転中ドライバーが視線を移動させなくとも操作するスイッチボタンやレバーに容易確実にアクセスできるようにする。
【構成】　ボタンにタッチセンサと操作検出手段を設けて、タッチ状態のボタン52tとその周辺のボタンのレイアウト図をヘッドアップディスプレイ装置に表示させ、そのなかでタッチ状態のボタン52tを強調表示する。ボタンが操作されたときにはそのボタン52pをタッチ状態時とは異なる強調表示にする。



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【特許請求の範囲】

【請求項1】　スイッチ操作部に設置されたタッチセンサと、このスイッチ操作部の周辺の配置情報を記憶しているメモリと、ヘッドアップディスプレイ装置と、ヘッドアップディスプレイ制御装置からなり、このヘッドアップディスプレイ制御装置は前記タッチセンサからの信号に基づいて、前記スイッチ操作部がタッチ状態にあるときは当該スイッチ操作部の周辺の配置情報をメモリから引き出して、スイッチ操作部およびその周辺の配置情報をヘッドアップディスプレイ装置に表示させるとともに、該表示のなかで前記スイッチ操作部を周辺の配置情報と差別表示させるようにしたことを特徴とする車両用スイッチ装置。

【請求項2】　スイッチ操作部に設置されたタッチセンサと、このスイッチ操作部の操作検出手段と、スイッチ操作部の周辺の配置情報を記憶しているメモリと、ヘッドアップディスプレイ装置と、ヘッドアップディスプレイ制御装置からなり、このヘッドアップディスプレイ制御装置は前記タッチセンサからの信号に基づいて、前記スイッチ操作部がタッチ状態にあるときは当該スイッチ操作部の周辺の配置情報をメモリから引き出して、スイッチ操作部およびその周辺の配置情報をヘッドアップディスプレイ装置に表示させるとともに、該表示のなかで前記スイッチ操作部を周辺の配置情報と差別表示させ、操作検出手段からの信号に基づいて、前記スイッチ操作部が操作状態にあるときは当該スイッチ操作部を前記タッチ状態のときと異なる差別表示をさせるようにしたことを特徴とする車両用スイッチ装置。

【請求項3】　複数のスイッチ操作部にそれぞれ設置されたタッチセンサと、判別回路と、スイッチ操作部の周辺の配置情報を記憶しているメモリと、ヘッドアップディスプレイ装置と、ヘッドアップディスプレイ制御装置からなり、前記判別回路はタッチセンサからの信号に基づいて、タッチ状態にあるスイッチ操作部を特定する情報をヘッドアップディスプレイ制御装置に送り、ヘッドアップディスプレイ制御装置は前記情報に基づいてタッチ状態にあるスイッチ操作部の周辺の配置情報をメモリから引き出して、前記タッチ状態にあるスイッチ操作部およびその周辺の配置情報をヘッドアップディスプレイ装置に表示させるとともに、該表示のなかで前記タッチ状態にあるスイッチ操作部を周辺の配置情報と差別表示させるようにしたことを特徴とする車両用スイッチ装置。

【請求項4】　前記スイッチ操作部が押下又は押し込み型のボタンであることを特徴とする請求項1、2または3記載の車両用スイッチ装置。

【請求項5】　前記スイッチ操作部がスライド式レバーのノブであることを特徴とする請求項1、2または3記載の車両用スイッチ装置。

【請求項6】　前記スイッチ操作部が回転させて操作するノブであることを特徴とする請求項1、2または3記載の車両用スイッチ装置。

【請求項7】　スライド式レバーのノブに設置されたタッチセンサと、ノブの操作検出手段と、前記レバーの位置検出手段と、レバー周辺の配置情報を記憶しているメモリと、ヘッドアップディスプレイ装置と、ヘッドアップディスプレイ制御装置からなり、ヘッドアップディスプレイ制御装置はタッチセンサおよび位置検出手段からの信号に基づいて、前記ノブがタッチ状態にあるときは当該レバー周辺の配置情報をメモリから引き出して、レバー周辺の配置情報をヘッドアップディスプレイ装置に表示させ、該表示のなかで前記ノブをレバー位置に対応する位置に周辺の配置と差別表示させ、操作検出手段からの信号に基づいて、前記ノブが操作状態にあるときは当該ノブを示したレバー位置に対応する位置に前記タッチ状態のときと異なる差別表示をさせるようにしたことを特徴とする車両用スイッチ装置。

【請求項8】　回転式スイッチのノブに設置されたタッチセンサと、ノブの操作検出手段と、前記スイッチの回転角度検出手段と、ノブ周辺の配置情報を記憶しているメモリと、ヘッドアップディスプレイ装置と、ヘッドアップディスプレイ制御装置からなり、ヘッドアップディスプレイ制御装置はタッチセンサおよび回転角度検出手段からの信号に基づいて、前記ノブがタッチ状態にあるときは当該ノブ周辺の配置情報をメモリから引き出して、ノブ周辺の配置情報をヘッドアップディスプレイ装置に表示させ、該表示のなかで前記ノブを周辺の配置情報と差別表示させ、操作検出手段からの信号に基づいて、前記ノブが操作状態にあるときは当該ノブの近傍にその回転方向を表示させるようにしたことを特徴とする車両用スイッチ装置。

【発明の詳細な説明】

【０００１】

【産業上の利用分野】この発明は、操作性を向上させた車両用スイッチ装置に関する。

【０００２】

【従来の技術】車両の運転席周りには図１４に示すように移動機器操作のための様々なスイッチが配置されている。例えばステアリングに設置されたハンズフリー自動車電話用スイッチ１は、図１５のようにステアリングパッド部のスイッチパネル３にプッシュボタン３が並べられ、ボタン操作により電話番号の入力や発着受信の切り換えなどを行なうようになっている。そして操作される毎に、あるいはスイッチオンしているときにスイッチの近傍に設けられたランプ４が点灯する。このとき「ピー」などのトーン音を発するようにしたものもある。なお、これに関する技術として、例えば特開昭５９－３３５４９号、特開昭６９－２２７６３６号公報に記載されたものがある。

【０００３】また、インスルメントパネルに設置された

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車内エアーコントロールスイッチ5の場合は、空調風の吹き出しモードの選択ボタン6のほか、温度設定用のレバー7その他も設けられ、ドライバーが好みの位置にスライドさせて設定できるようになっている。

【0004】

【発明が解決しようとする課題】しかし上記のような従来の車両用スイッチにおいては、それらのスイッチを操作する際、ドライバーは操作しようとしているスイッチを目で探し、あるいは手探りで探しなければならなかった。これはその他のスイッチ、例えばステレオカセット用スイッチ10、テレビ・ナビゲーション用ディスプレイタッチスイッチ11、センターコンソール近傍に置かれた自動車電話用ハンドセット12のダイヤルテンキースイッチ、ラジオ選局スイッチやボリウムスイッチあるいはドアに設置されたパワーウィンドウスイッチ14やドアロックスイッチ15などについても同様である。

【0005】このため、運転中にスイッチ操作を行う際には、スイッチの位置と種類を確認しようとすれば、視線を移動しなければならないとか、極めてわずかな時間内での確認では注目したボタンなどの選択を間違えてしまうという不具合があった。またトーン音を発するものも、正しいボタンを選択している場合には視力によらず操作入力を確認できるが、ボタンが正しく選択されていなければ意味がないことになる。

【0006】したがってこの発明は、運転中ドライバーが視線を移動させなくとも意図するスイッチボタンやレバーに容易確実にアクセスでき、さらには、アクセスしたそのボタンを正しく操作したことを確認することができる車両用スイッチ装置を提供することを目的とする。

【0007】

【課題を解決するための手段】このため各請求項に記載した発明は、図1に示すように、スイッチ操作部20に設置されたタッチセンサ25と、スイッチ操作部の配置情報を記憶しているメモリ30と、ヘッドアップディスプレイ装置45と、ヘッドアップディスプレイ制御装置40を備え、ヘッドアップディスプレイ制御装置40はタッチセンサ25からの信号に基づいて、前記スイッチ操作部20がタッチ状態にあるときは当該スイッチ操作部20の周辺の配置情報をメモリ30から引き出して、スイッチ操作部20およびその周辺の配置情報をヘッドアップディスプレイ装置45に表示させるとともに、該表示のなかで前記スイッチ操作部20を周辺の配置情報と差別表示させるようにしたことを基本構成とする。

【0008】さらには、操作検出手段を備えて、スイッチ操作部が操作状態にあるときはタッチ状態とは異なる差別表示をさせるようにし、あるいはまたスイッチ操作部が複数ある場合には、タッチ状態にあるスイッチ操作部を周辺の他のスイッチ操作部から区別される差別表示をさせるようにした。

【0009】

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【作用】スイッチを指で操作する場合において、指で触れたボタンやノブなどスイッチ操作部20が、その周辺の他の操作部などのレイアウトとともに、ヘッドアップディスプレイ装置45で表示され、とくに触れられてタッチ状態にあるスイッチ操作部が差別表示されるから、ドライバーは運転中前方視野のまま、自分が意図するスイッチ操作部であるかどうかを確認して操作を行なうことができる。

【0010】さらに操作検出手段を設けて、タッチ状態とは区別して表示するようにした場合には、そのスイッチ操作部を確実に操作したことをドライバーは確認することができる。またスイッチ操作部が複数設けられているときには、差別表示されたスイッチ操作部が意図するものでない場合には、興味する周辺のスイッチ操作部も表示されるから、求めるスイッチ操作部が今触れているものからどちらの方向にあるかを容易に知ることができる。

【0011】

【実施例】図2はステアリングに設けたハンズフリー自動車電話のスイッチにこの発明を適用した実施例を示す。ステアリングパッドには、スイッチ操作部としての「0」から「9」までのダイヤルに対応したテンキーボタン52、通話の開始・終了を行うためのプッシュ式の発信受信ボタン54の他、音量調整ボタン58やラジオ選局ボタン58などが設置されて、自動車電話用のスイッチパネル50を構成している。このスイッチパネルからの指令によって無線機60が制御され、図示しないアンテナを介して通話が行なわれる。

【0012】スイッチパネル50のボタン52～58には、指が触れている状態を検知するタッチセンサ25が設けられる。例えば静電センサをボタン表面に配設してタッチセンサ25とする。あるいはこのほか図3に示すように、ばね定数の異なる2種のばね71、72を内蔵し、70で代表されるボタンの微少変位によって突らかいばね71をたわませてボタン裏面点73とオンする第1の接点74でタッチセンサ25を構成するようにしてもよい。なお同図において第2の接点76はさらに強いばね72をたわませてボタン70を押し込んだときオンして、該ボタン70がテンキーボタンであればその数を示すダイアル信号を出力するようになっている。

【0013】この実施例においては、タッチセンサ25に加え、さらにボタンの押圧あるいは押し込みなどのプッシュ操作により選択されあるいはオンしている状態を検出する操作検出手段80を備えている。操作検出手段89としてはボタンの変位を検出してもよく、または圧力センサ、あるいは静電センサをタッチセンサ25と共用して出力レベルの相違を利用してもよい。さらには図3の例では第2の接点75から出力されるダイアル信号を共用することもできる。

【0014】タッチセンサ25と操作検出手段80の出

力は判別回路８５に入力され、タッチ状態か操作状態かの判断およびボタンの特定がなされる。判別回路８５からの信号はヘッドアップディスプレイ制御装置９４に入力される。ヘッドアップディスプレイ制御装置９４にはまたメモリ９３が接続されており、このメモリ９３にはヘッドアップディスプレイ装置４５で表示するボタン形状やステアリングパッド部のボタンレイアウトの情報を記憶させてある。ヘッドアップディスプレイ装置４５はヘッドアップディスプレイ制御装置９４からの指令により、図４のドライバー前面の破線で示すフロントウィンドウの表示領域４６に、車両前方の透過した風景に重ねてボタンレイアウトを表示する。

【００１５】スイッチパネル５０からは自動車電話機能のために信号線が無線機６０へ接続されており、またこの信号線がトーン音発生装置８３にも接続している。さらに音声合成装置８７が判別回路８５に接続し、音声合成装置８７とトーン音発生装置８３の出力がスピーカ８４に入力している。

【００１６】次に、以上の構成による一連の動作を図５および図６に示されるフローチャートに従い説明する。まずステップ１００でボタンに指が触れているかどうかがチェックされる。すなわち、ドライバーが電話発信操作を行うため、指でテンキーボタン６２をなぞり、何れかのボタン５２に触れると、そのボタン６２に設置されたタッチセンサ８５からタッチ検出信号が出される。ステップ１１０で、判別回路８５はタッチ状態にあるボタン５２ｔを判別し、そのボタンがタッチ状態にある旨の情報をヘッドアップディスプレイ制御装置９４に送る。

【００１７】ヘッドアップディスプレイ制御装置９４では、ステップ１１５において、タッチ状態にあるボタンに対応して、記憶情報としての該タッチ状態にあるボタン５２ｔとその周辺に配置されている他のボタンのレイアウトを表す画像データを、メモリ９３から選択して読み出す。そしてステップ１２０で図７のように、前記のタッチ状態にあるボタン５２ｔとその周辺のボタンのレイアウト図をヘッドアップディスプレイ装置４５に表示させる。ここで指が「７」番のボタンに触れているとすれば、図７の（ａ）のように表示に際して、タッチ状態にあるボタン５２ｔとして該「７」番ボタンについては、差別表示としてボタンの輪郭が浮き出て強調表示される。差別表示としては、他より太い輪郭線にするとかあるいは他と異なる色表示や反転表示にすることができる。

【００１８】このとき判別回路８５から音声合成装置８７にも同じ情報が送られ、音声合成装置８７では当該ボタン５２ｔを表す音声、ここでは「なな！」、を合成してスピーカ８４から音声出力する。

【００１９】ドライバーはヘッドアップディスプレイ装置４５の表示、さらに付スピーカ８４の音声から、指が触れているボタンを確認し、操作したいボタンに相違なければ続けてそのボタンをプッシュ操作する。

【００２０】次にステップ１３０では、何れかのボタンが操作状態にあるかどうかがチェックされる。すなわち、ボタンのプッシュ操作がなされると、そのボタンに設置された操作検出手段８０から操作検出信号が出力される。

【００２１】ボタンが操作状態にないときにはスタートに戻って上記が繰り返えされる。また、指が触れているボタンが発信するボタンではない場合には、ドライバーはヘッドアップディスプレイ装置４５で表示されている周辺のレイアウトから、どちらの方向に発信するボタンがあるかが容易に判断できるので、指を移動させる。上述のフローは繰り返しているので、指を移動させ他のボタンに触れるとそれに対応してヘッドアップディスプレイ装置４５で表示される強調表示のボタンが変化する。

【００２２】ボタンが操作され無線機６０へ信号が流れると、同時にトーン音発生装置８３が作動しスピーカ８４から「ピー」音が出力される。

【００２３】ステップ１３０でボタンの操作状態がチェックされ、操作されているときは、判別回路８５はステップ１４０でその操作状態にあるボタン５２ｐを特定し、そのボタンが操作状態にある旨の情報をヘッドアップディスプレイ制御装置９４に送る。

【００２４】ヘッドアップディスプレイ制御装置９４では、ステップ１４５において、前記の操作状態にあるボタン５２ｐとその周辺のボタンのレイアウト図をヘッドアップディスプレイ装置４５に表示させる。この際７の（ｂ）に示すように、操作状態にあるボタン５２ｐ例えば「７」番ボタンについては、タッチ状態にあることを示す前記図７の（ａ）の強調表示と区別される。例えば当該ボタンだけ全面色表示するなど、別の強調表示を行なわせる。

【００２５】そして操作されたボタン５２ｐに対応する数字は、ダイヤルする電話番号としてステップ１５０で無線機６０に登録される。この登録操作が繰り返されて、発信先の電話番号の全数字が登録される。ステップ１６０で電話番号の登録完了が確認されると、次にステップ１７０においてテンキーボタン５２と同様に、通話の開始のための発信／受信ボタン５４がタッチ状態にあるかどうかのチェックをタッチセンサ８５を用いて行なう。

【００２６】発信／受信ボタン５４がタッチ状態にあることが判別回路８５によって判別されると、ステップ１７５に進んで、ヘッドアップディスプレイ制御装置９４は発信／受信ボタン５４周りの画像データをメモリ９３から読み出し、ステップ１８０でヘッドアップディスプレイ装置４５に表示させる。続いてステップ１９０で、発信／受信ボタン５４が操作状態にあるかどうかが操作検出手段８０によってチェックされる。

【００２７】ドライバーが該ボタンをプッシュ操作し、

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操作状態にあることが判別回路８５によって判別されると、ステップ３００でヘッドアップディスプレイ制御装置９４は、タッチ状態を示すのと従前の態様による強調表示を行なうとともに、ステップ２１９で制御部５０は先に登録された電話番号数字を発呼して通話開始となる。またこれらのボタンについても、テンキーボタン５２と同様トーン音や合成音声が併用され得る。

【００２８】以上の構成により、ドライバーはステアリングパッドのスイッチパネル５０に指を持って行けば、指の触れたボタン周辺の様子が目前のフロントウインドに表示されるから、視線を移動させることなく確認するボタンを探索することができ、しかもボタンをプッシュしたときには、それが操作されたことまでフロントウインドの表示で確認することができる。さらには音声合成の出力あるいはトーン音が加わって操作性が向上し、かつ操作の確実性がより高まる効果が得られる。

【００２９】図８は車内のエアーコントロールスイッチに適用した第２の実施例を示す。エアコントロールのスイッチパネル２００には、空調風の吹き出しモードの選択ボタン２０２の他、スライド式のレバー２０３、２０４が設けられて、空調風の温度設定あるいは風量設定を行なうようにされ、レバー位置に対応して空調装置３３の制御がなされるようになっている。

【００３０】吹き出しモードの選択ボタン２０２については、前実施例と同様に、指が触れているボタンとその周辺の他のボタンのレイアウトを表示するようにすればよい。ここではとくにスライド式レバーへの適用について説明すると、レバー２０３、２０４のノブ２０５、２０８には、タッチセンサ２５と操作検出手段８０が前実施例と同様に設けられている。さらにレバー操作部には、スライド経路２０７、２０８内のレバーの位置を検出する位置検出手段２１５が設けられている。この位置検出手段２１５としては、例えばレバー２０３、２０４に関連させて設けたポテンショメータとしてもよく、あるいは空気調和器３２０の制御に用いられる温度設定信号あるいは風量設定信号を流用することもできる。

【００３１】タッチセンサ２５と操作検出手段８０の出力は判別回路３８５に入力され、タッチ状態の操作状態かの判断と、どのレバーであるかの特定がなされる。判別回路２８５からの信号と位置検出手段３１５の信号は、ヘッドアップディスプレイ制御装置２４８に入力される。一方、メモリ３３０にヘッドアップディスプレイ装置４５で表示するノブ形状や、スライド経路２０７、２０８にそった強度目盛２０９あるいは機能表示マーク２１０など、編集情報としてのスイッチパネル２００のレイアウトを記憶させてある。

【００３２】ヘッドアップディスプレイ制御装置３４９は、判別回路３８５からの信号に基づいて、レバーのノブに指が触れている場合に従図９の（ａ）のようにスイッチパネル２００のレイアウトをヘッドアップディスプレイ装置４５に表示させるとともに、位置検出手段２１５からの信号に基づいて、例えばノブ２０５がタッチ状態であれば該ノブを表示されたレイアウトの対応する位置に強調表示させる。

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【００３３】このヘッドアップディスプレイ装置４５の表示によって、触れているノブを持つレバーを確認した後、ドライバーがそのレバーをスライドさせると、今度は同図の（ｂ）に示すように操作状態にあるレバーのノブ２０５がタッチ状態の場合とは異なった強調表示で、移動した新たな位置に表示される。

【００３４】このため、操作にしたがってノブの位置が変化しても、指の触れたノブが周辺のレイアウトと関連させてフロントウインドに表示されるから、ドライバーは自分がどのレバーのノブに触れているか確認できる。そしてレバーを操作すると、目盛をさむレイアウト図の中の対応する位置にそれが表示されるから、その位置までスライドさせたかも視線を移すことなく知ることができる。

【００３５】図１０は車載ラジオカセット用のスイッチに適用した第３の実施例を示す。ラジオカセットのスイッチパネル３００には、カセット操作用のプッシュ式ボタン３０２のほか、音量、音質、あるいは左右バランスの調整のため回転式のボリウムスイッチが設けられ、それぞれ音量調整ノブ３０５、音質調整ノブ３０６、左右バランス調整ノブ３０７がパネル面から突出して配置されている。

【００３６】ここではとくに回転式を特徴とする調整ノブへの適用について説明すると、各調整ノブ３０５、３０６、３０７には前記各実施例と同様にタッチセンサ２５が設けられている。さらにこれら調整ノブを備える各ボリウムスイッチには、その回転角度を検出する回転角度検出手段３１５が設けられている。この回転角度検出手段３１５としては、例えば調整ノブ３０５、３０６、３０７に関連させて設けたポテンショメータとしてもよく、あるいは調整に用いられる各ボリウムスイッチの出力を流用することもできる。

【００３７】タッチセンサ２５の出力は判別回路３８５に入力され、タッチ状態かどうかの判断と、どの調整ノブであるかの特定がなされる。判別回路３８５からの信号と回転角度検出手段３１５の信号はヘッドアップディスプレイ制御装置３４０に入力される。一方、メモリ３３９にヘッドアップディスプレイ装置４５で表示する調整ノブの配置やノブ形状、ノブ周りのマークあるいは目盛など、配置情報としてのスイッチパネルのレイアウトを記憶させてある。

【００３８】ヘッドアップディスプレイ制御装置３４９は、判別回路３８５からの信号に基づいて、例えば音量調整ノブ３０５に指が触れている場合には、図１１の（ａ）のようにタッチ状態にある音量調整ノブ３０５周辺のレイアウトをヘッドアップディスプレイ装置４５に

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表示させるとともに、音量調整ノブ３０６を強調表示させる。

【００３９】このヘッドアップディスプレイ装置の表示によって、触れているノブを確認した後、ドライバーがその調整ノブを回転させると、今度は、同図の（ｂ）に示すようにノブの回転量を示す一方が尖った円弧マーク３１０を表示させ、そしてこの円弧の長さをノブの回転角度に対応させる。

【００４０】この実施例によれば、回転操作するものを手探りで操作するときに、操作しているノブの強調表示に加え、その操作方向が表示されるから操作を間違えることもない利点がある。

【００４１】この他か車両内ではは電動パワーシートの調整スイッチに適用することもでき、ボタン式の場合には第１の実施例に準じた構成で実施することができる。この場合のヘッドアップディスプレイ装置による表示例を第４の実施例として図１３に示す。シートの前後位置調整ボタンと上下位置調整ボタンは、同図の（ａ）のようにシートクッションの側面４００に配置され、上下位置調整ボタン４０１の上半部には上向きマーク４０２、下半部には下向きマーク４０３が描され、前後位置調整ボタン４０５の前半部には前向きマーク４０６、後半部には後向きマーク４０７が描されて、それぞれの半部をプッシュ操作することによってマークが示す方向にシートが調整されるようになっている。

【００４２】この各調整ボタンにタッチセンサが設けられている。そして、例えば上下位置調整ボタン４０１に指が触れている場合には、同図の（ｂ）のように、調整ボタン部のレイアウト図が表示されるとともに、そのなかで上下位置調整ボタン４０１が強調表示される。このヘッドアップディスプレイ装置の表示によって、触れているボタンを確認した後、ドライバーがその上下位置調整ボタン４０１の上半部をプッシュ操作すると、今度は同図の（ｃ）に示すように、同表示の中で上向きマーク４０２が強調表示されて、上方向調整の操作状態にあることが示される。

【００４３】この実施例によれば、座部の下でドアに近接していて視覚による確認ができずに、手探りで行なうしかなかったシートの調整スイッチの操作が、極めて容易に行なえるうえ、シートが移動する方向が目で確認できる利点がある。

【００４４】さらに本発明は、例えばコンソール上に設けられ、使用時に手に取って操作されるリモートコントロールスイッチなどにも適用される。これもボタン式であるから第１の実施例に準じて構成され、各ボタンにタッチセンサおよび操作検出手段が設けられる。そしてヘッドアップディスプレイ制御装置への信号伝達は電波あるいは赤外線などによる。

【００４５】この場合における表示例を第５の実施例として図１３に示す。リモートコントロールスイッチ５０

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０には同図の（ａ）に示されるように多数のボタン５０３が配設され、その中から意図するボタンを探す。ここで指が「Ｃ」のボタンに触れているとすれば、本図のフロントウインドには、同図の（ｂ）のように「Ｃ」のボタンとその周辺のボタン、とくに同時のボタン、がヘッドアップディスプレイ装置によって表示されるとともに、その際、「Ｃ」のボタンの輪郭が強調表示されてタッチ状態にあることが示される。そしてこのボタンが意図したものであってプッシュ操作されると、同図（ｃ）のように「Ｃ」のボタンの輪郭内部が反転表示されるなどタッチ状態とは異なる強調表示に変わる。

【００４６】一方、（ｂ）の表示を見て操作者が意図するボタンは今触れているボタンより左にあると知って、指を左へずらし、「Ｂ」のボタンに指がくると同図の（ｄ）に示すように、この「Ｂ」のボタンを中心とするレイアウト図に変わり、「Ｂ」のボタンの両隣である「Ａ」および「Ｃ」のボタンを含む周辺の配置が表示される。このとき「Ｂ」のボタンはタッチ状態を示す強調表示となる。

【００４７】

【発明の効果】以上のとおり、本発明はスイッチ操作部にタッチセンサを設け、タッチセンサからの信号に基づいて、スイッチ操作部がタッチ状態にあるときはスイッチ操作部およびその周辺の配置情報をヘッドアップディスプレイ装置に表示させるとともに、その際タッチ状態のスイッチ操作部を周辺の配置情報と区別表示させるようにしたから、ドライバーは手探りで触れたスイッチ操作部が自分の意図するものであるかどうかを、運転中前方視界のまま、確認することができる。またスイッチ操作部が多数配置されているなかで触れたものが意図するスイッチ操作部でなかったときにも、表示されている周辺の配置情報からその位置を容易に知り、求めるスイッチ操作部に簡単にアクセスすることができる。

【００４８】さらに、操作検出手段を備えて、スイッチ操作部が操作されたときタッチ状態とは異なる区別表示をさせるようにしたときには、最寄の激しい中で従来のトーン音による確認が困難な状況でも、ドライバーは確実にそのスイッチ操作部を操作したことを目で知り、レから視線を移動させることなしに操作することができ操作ミスがない。上記共通の効果に加え、第１の実施例では音声合成の出力やトーン音がさらに付加されて、スイッチ操作部の確実および操作の確実性がより高まる効果がある。

【００４９】第２の実施例によれば、スライド式レバースイッチでノブの位置が不定の場合でも、表示された周辺の目盛などを含むレイアウトと同期させて、手探りで指の触れたノブがどのレバースイッチのノブであるか確認できる。そしてレバーを操作すると、表示の中のノブ位置も移動するから、どの位置までスライドさせたかも視線を移すことなく知ることができる。

【００５０】第３の実施例ではノブの回転量を示す一方が欠った円弧マークを表示させ、そして円弧の長さをノブの回転角度に対応させるようにしたから、回転ノブを手探りで操作するときに、その回転量を確認でき操作を間違えることもない。

【００５１】第４の実施例によれば、ドライバーが着座したとき直接触ることがまず不可能な場所に設けたシートの調整スイッチの操作が極めて容易に行なえるうえ、シートの移動する方向まで前方視野の中で確認できる利点がある。

【００５２】第５の実施例では、表示パネルに多数のボタンが集約して配置され、運転中の頻繁な視線の移動ではボタンの識別が困難なリモートコントロールスイッチにおいて、指が触れているボタンの近傍のボタンまで容易に認識できる大きさで前方視野内に表示されるから、必要なボタンに迅速に指を持って行くことができ操作性が格段に向上する効果がある。

【００５３】またどの実施例からも明らかなように、ドライバーの視覚による確認ができない場所であっても、指が届く範囲であれば操作スイッチを設置することができることとなるので、車両内のスイッチ配置の設計自由度が増す利点を有する。

【図面の簡単な説明】

【図１】本発明の構成を示す図である。

【図２】本発明の第１の実施例を示す図である。

【図３】タッチセンサの構成例を示す図である。

【図４】ヘッドアップディスプレイ装置による表示部位を示す図である。

【図５】表示動作のフローを示す図である。

【図６】表示動作のフローを示す図である。

【図７】ヘッドアップディスプレイ装置による表示例を示す図である。

【図８】第２の実施例を示す図である。

【図９】第３の実施例におけるヘッドアップディスプレイ装置による表示例を示す図である。

【図１０】第３の実施例を示す図である。

【図１１】第３の実施例におけるヘッドアップディスプレイ装置による表示例を示す図である。

【図１２】第４の実施例を示す図である。

【図１３】第５の実施例を示す図である。

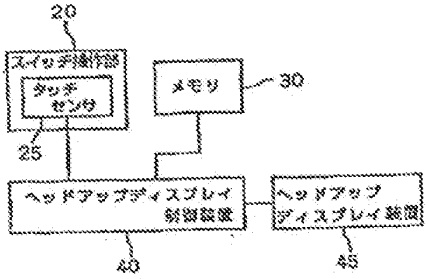
【図１４】運転席周りのスイッチの配置状況を示す図である。

【図１５】従来のスイッチパネル例を示す図である。

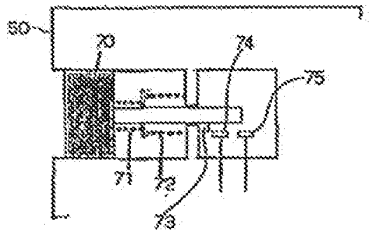
【符号の説明】

２０　スイッチ操作部
２５　タッチセンサ
３０、９５、２３０、３５９　メモリ
４０、９４、２４０、３４０　ヘッドアップディスプレイ制御装置
４５　ヘッドアップディスプレイ装置
４８　表示部位
５０、２００、３００　スイッチパネル
５２　テンキーボタン
５４　発信受信ボタン
５８　音量調整ボタン
５９　選局ボタン
６０　録音機
６２　トーン音発信装置
６４　スピーカ
７０　ボタン
７１、７２　ばね
７３、７４、７５　接点
８０　操作検出手段
８６、３８６、３８５　判別回路
８７　音声合成装置
２０２　選択ボタン
３０３、３０４　レバー
３０６、３０６　ノブ
２０７、２０８　スライド抵抗
２０９　視点目盛
２１０　機能表示マーク
２１５　位置検出手段
２３０　空気調整器
３０５　音量調整ノブ
３０８　音質調整ノブ
３０７　左右バランス調整ノブ
３１０　円弧マーク
３１５　回転角度検出手段
４０１　上下位置調整ボタン
４０２　上向きマーク
４０３　下向きマーク
４０５　前後位置調整ボタン
４０６　前向きマーク
４０７　後向きマーク
５００　リモートコントロールスイッチ
５０２　ボタン

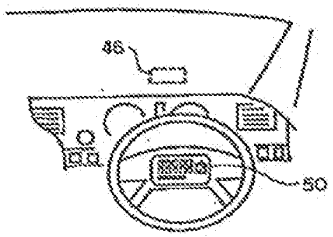
【図1】



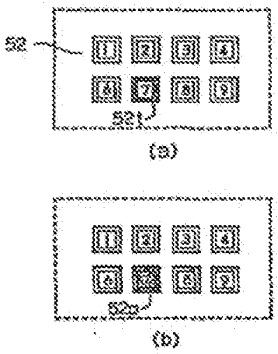
【図3】



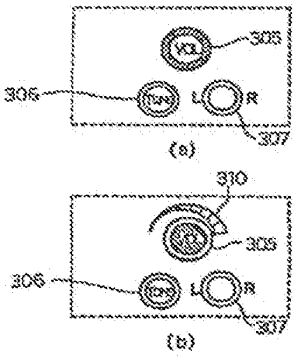
【図4】



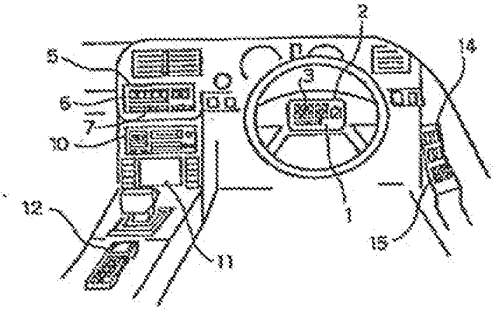
【図7】



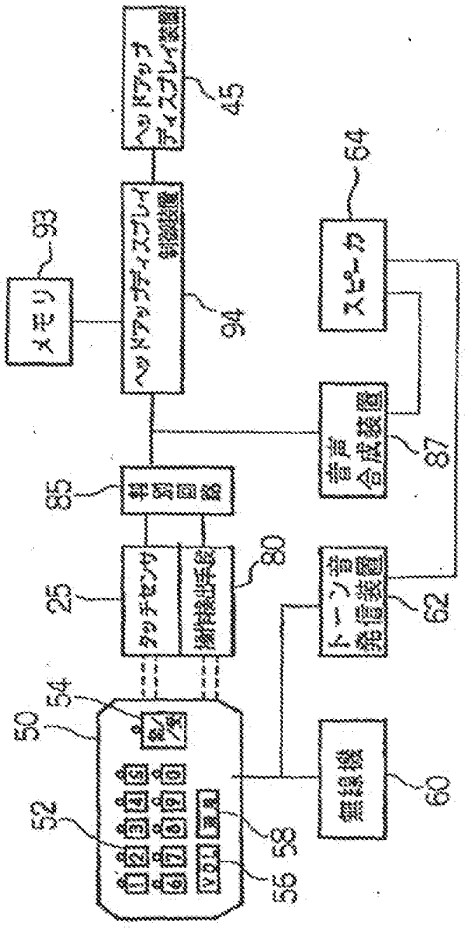
【図11】



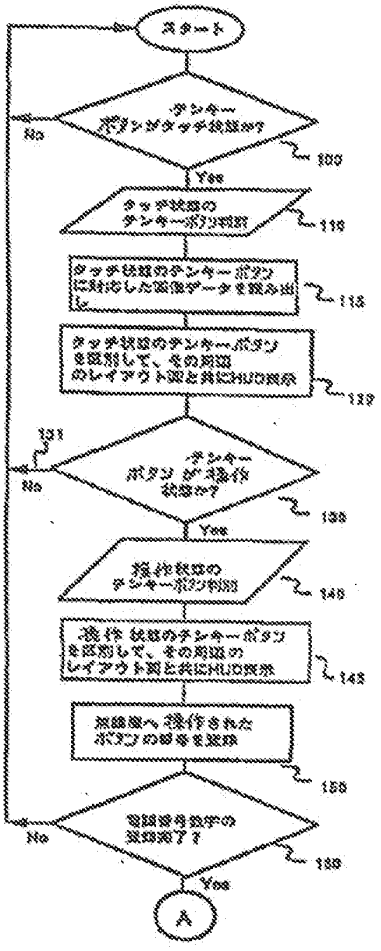
【図14】



【図2】



【図5】



【図6】

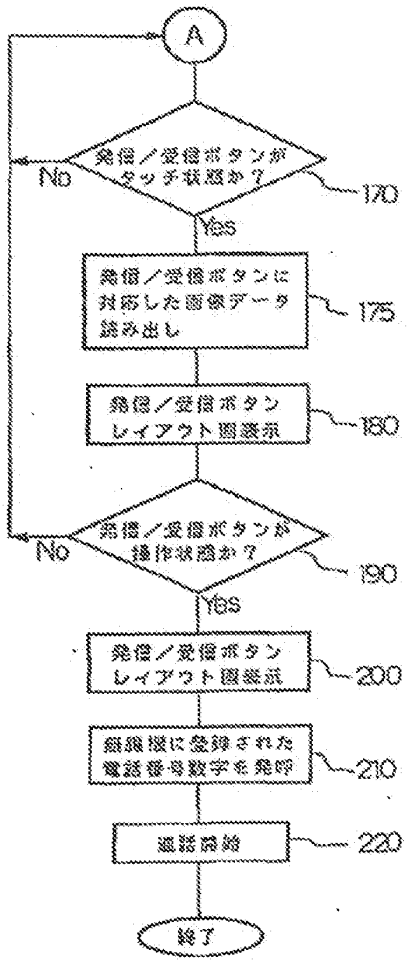
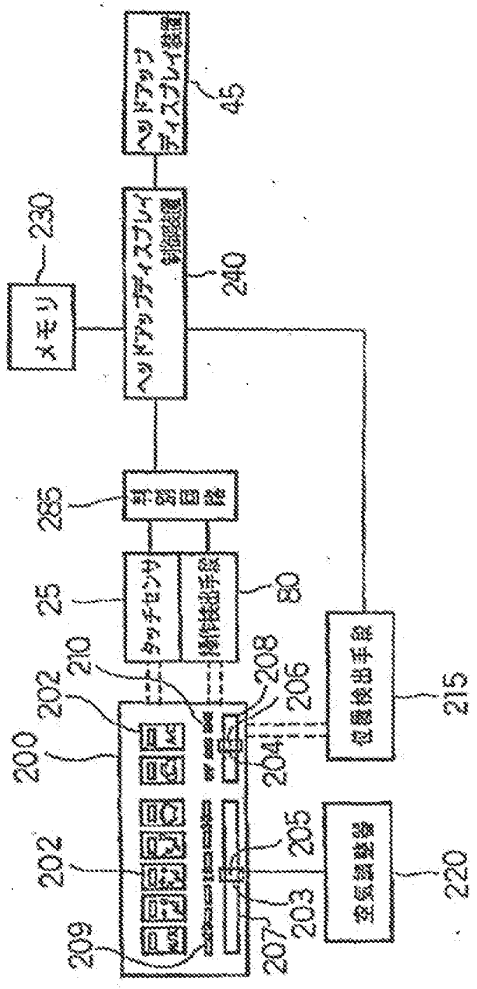
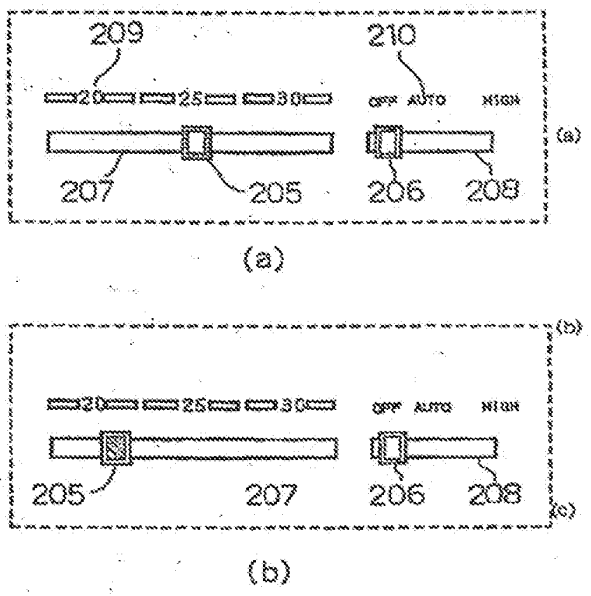


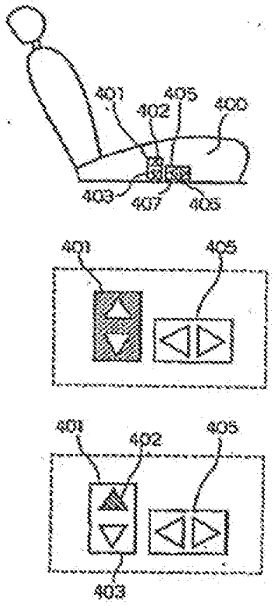
図8


ヘッドアップディスプレイ装置
45
メモリ
230
ヘッドアップディスプレイ制御装置
240
判断回路
285
タッチセンサ
操作検出手段
25
60
202
210
208
206
200
204
202
205
209
207
203
位置検出手段
215
空気調整装置
220

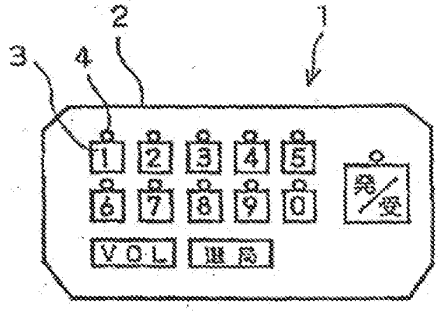
[図9]


209
210
20
25
30
OFF
AUTO
HIGH
207
205
206
208
(a)
(b)
(c)

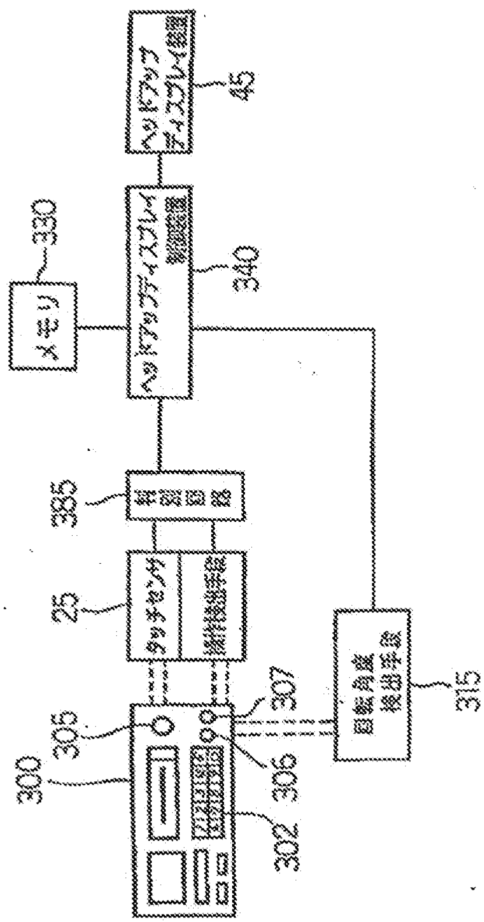
[図12]


401
402
405
400
403
407
408

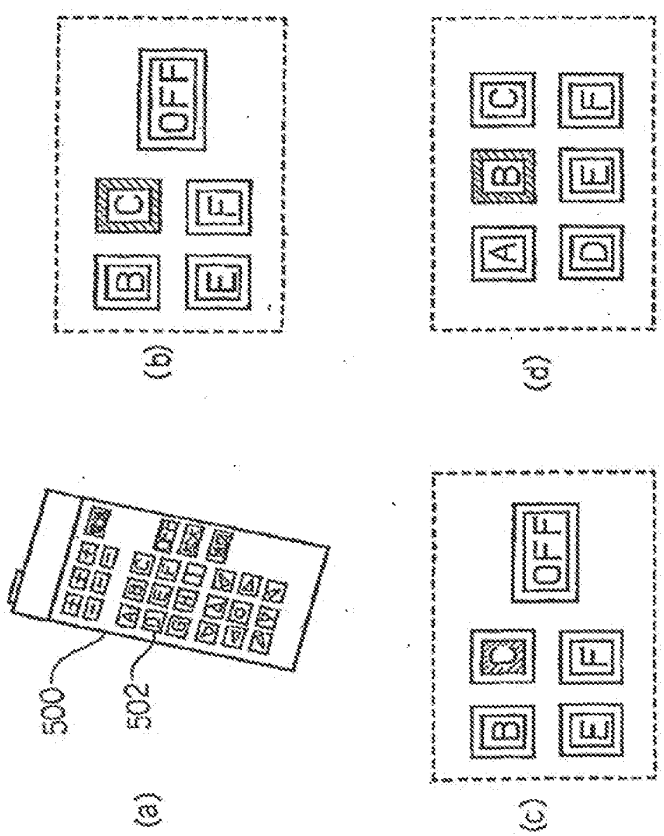
[図16]


1
2
3
4
1
2
3
4
5
6
7
8
9
0
発/受
VOL
選局

【図10】


ヘッドアップディスプレイ装置
45
メモリ
330
ヘッドアップディスプレイ制御装置
340
判別回路
385
タッチセンサ
操作検出手段
25
回転角度検出手段
315
300
305
306
307
302

(第1図)



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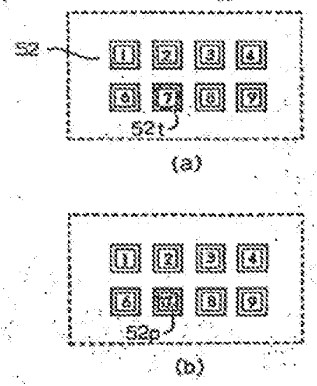
(54) Title of the Invention Vehicle Switch Device

(57) [Abstract]

[Purpose] To provide an easy and reliable access to an intended switch button and level so that a driver can use it without moving his or her eyes while driving.

[Constitution] A touch sensor and an operation detection means are provided for a button so that a layout of a button 52t that is being touched and surrounding buttons are displayed on a head-up display device and the button 52t that is being touched is highlighted. When a button is operated, that button 52p is highlighted differently from the touch state.

[See source of the drawing]



[Specification]

[Scope of the Claims]

[Claim 1] A vehicle switch device comprising of a touch sensor installed in the switch operation unit, a memory storing configuration information around the switch operation unit, a head-up display device and a head-up display control device, characterized such that this head-up display control device reads based on the signals from the said touch sensor the switch operation unit and its surrounding configuration information from the memory if the said switch operation unit is in a touched state, in order to display the switch operation unit and its surrounding configuration information in the head-up display device, while the said switch operation unit in the display is distinguished from its surrounding configuration information.

[Claim 2] A vehicle switch device comprising of a touch sensor installed in the switch operation unit, an operation detection means of the switch operation unit, a memory storing configuration information around the switch operation unit, a head-up display device and a head-up display control device, characterized such that this head-up display control device reads based on the signals from the said touch sensor the switch operation unit and its surrounding configuration information from the memory if the said switch operation unit is in a touched state, in order to display the switch operation unit and its surrounding configuration information in the head-up display device, while the said switch operation unit in the display is distinguished from its surrounding configuration information and based on the signals from the operation detection means, the said switch operation unit in an operation state is displayed differently from the switch operation unit in a touched state.

[Claim 3] A vehicle switch device comprising of respective touch sensors installed in multiple switch operation units, a discrimination circuit, a memory storing configuration information around the switch operation unit, a head-up display device and a head-up display control device, characterized such that the discrimination circuit sends information specifying the switch operation unit in a touched state to the head-up display control device based on the signals from the touch sensors, the head-up display control device reads based on the signals from the said touch sensor the switch operation unit and its surrounding configuration information from the memory if the said switch operation

unit is in a touched state, in order to display the switch operation unit and its surrounding configuration information in the head-up display device, while the said switch operation unit in the display is distinguished from its surrounding configuration information.

[Claim 4] The vehicle switch device as described in Claims 1, 2 or 3 wherein the said switch operation unit is a pressed or push type button.

[Claim 5] The vehicle switch device as described in Claims 1, 2 or 3 wherein the said switch operation unit is a slide type lever knob.

[Claim 6] The vehicle switch device as described in Claims 1, 2 or 3 wherein the said switch operation unit is a knob operated by rotation.

[Claim 7] A vehicle switch device comprising of a touch sensor installed in the slide type lever knob, a knob operation detection means, a position detection means for the said lever, a memory storing configuration information around the lever, a head-up display device and a head-up display control device, characterized such that the head-up display control device reads the configuration information surrounding the lever from the memory based on the signals from the touch sensor and the position detection means if the said knob is in a touched state, in order to display the lever surrounding configuration information in the head-up display device and displays the said knob distinguished from the surrounding configuration at the position corresponding to the lever position, and when the said knob is in an operation state based on the signals from the operation detection means, the knob is displayed differently from that in the touched state at the position corresponding to the new lever position.

[Claim 8] A vehicle switch device comprising of a touch sensor installed in the rotary type switch knob, a knob operation detection means, a rotation angle detection means for the said switch, a memory storing configuration information around the lever, a head-up display device and a head-up display control device, characterized such that the head-up display control device reads the configuration information surrounding the knob from the memory based on the signals from the touch sensor and the rotary angle detection means if the said knob is in a touched state, in order to display the knob surrounding configuration information in the head-up display device and displays the said knob distinguished from the configuration information around the knob and if the said

knob is in an operation state based on the signals from the operation detection means, its rotation direction is displayed near the knob.]

[Detailed Description of the Invention]

[0001]

[Industrial Field of Application]

The present invention relates to a vehicle switch device with improved operational properties.

[0002]

[Prior Art] Various switches are arranged around the driver seat in the vehicle for the operation of the loaded instruments as shown in Figure 14. For example, in the hands-free automobile telephone switch 1 installed at the steering wheel, push buttons 3 are arranged on a switch panel 2 on the steering pad portion as shown in Figure 15 so that input of telephone numbers and switching send/receive can be executed by button operations. Whenever the buttons are pressed or switches are turned on, lamps 4 installed near the switches are lighted. In this case, a tone such as "beep" sound may be generated. Similar technologies are disclosed in the following patents: Kokai JP No. S59-32540 and Kokai JP No. S59-227535.

[0003] In the case of a car interior air control switch installed in the instrument panel, besides air control blow mode selection buttons 6, levers 7 for humidity setting are also installed so that a driver can set at a desirable position by sliding.

[0004]

[Problems to be Solved by the Invention] However, with the aforementioned conventional vehicle switches, when operating such switches, a driver must search for switches to be operated by the naked eye or must check by hand. This is the same for other switches: stereo/cassette switches 10, television navigation display touch switches 11, dial ten-key switches of car telephone handsets 12 placed near the center console, radio station selection switch and volume switch or power window switches 14 installed on the door, and door lock switch 15.

[0005] For this reason, when operating switches while driving or when checking the positions or types of the switches, the disadvantages are that the eyes must be moved and that an error may be made in a very short time so that intended buttons may not be

selected. When generating a tone, if a correct button is selected, the advantage is that the operational key input can be confirmed without visual checking, but if a correct button is not selected, this is meaningless.

[0006] The purpose of the present invention is to provide a vehicle switch device with which a driver can easily and safely access intended switches and levers without moving the direction of the eyes and furthermore, the fact whether the accessed button is properly operated can be checked.

[0007]

[Means for Solving the Problem] For this purpose, the invention disclosed in various claims, as shown in Fig. 1, comprises of a touch sensor 25 installed in the switch operational unit 20, a memory 30 storing configuration information of the switch operational unit 20, a head-up display device 45, and head-up display control device 40. The head-up display control device 40 has a basic configuration such that based on the signals from the touch sensor 25, configuration information surrounding the switch operation unit 20 is read from the memory 30 if the aforementioned switch operation unit 20 is in a touched state, to display the configuration information in the switch operation unit 20 and its surrounding areas in the head-up display device 45, while the said switch operation unit 20 is displayed differently from the surrounding configuration information.

[0008] Moreover, an operation detection means is installed so that if the switch operation unit is in an operation state, it is displayed differently from that in a touched state. Alternatively, if there are multiple switch operation units, the switch operation units that are in a touched state are displayed differently from the other surrounding switch operation units.

[0009]

[Actions] When the switches are operated with the fingers, the switch operation unit 20 including the buttons and knobs that have been touched with fingers is displayed in the head-up display device 45 as well as layouts of surrounding other operation units. In particular, the switch operation unit that is in a touched state is displayed differently so that the driver can check whether the intended switch operation unit is selected while keeping the visual direction straight while driving in order to perform the operation.

[0010] If an operation detection means is further installed to display it differently from the touched state, the driver can check whether the switch operation unit is definitely operated. In addition, if multiple switch operation units are installed, and if the switch operation unit that was displayed differently from the intended one, the surrounding switch operation units are also displayed, thus, one can easily determine in which direction the switch operation unit is positioned from the one that has been touched.
[0011]
[Examples] Figure 2 shows an example of application of the present invention to the switch for a hands-free car telephone installed on the steering pad. A car telephone switch panel 50 in the steering pad is composed of ten-key buttons corresponding to the dial from "0" to "9" as a switch operation unit, a push type sending/receiving button 54 to execute start and end telephone connection, and a volume control button 56 and a radio station selection button 58. With a command from this switch panel, a radio machine 60 is controlled and a connection is made via an antenna that is not shown.
[0012] At respective buttons 52 through 58 in the switch panel 50, a touch sensor 25 is installed to detect the status when the fingers are in contact. For example, a capacity sensor is pasted on the button surface to be used as a touch sensor 25. Alternatively, as shown in Figure 3, two kinds of springs 71 and 72 having different spring constants are mounted and a touch sensor 25 is configured such that a soft spring 71 is bent by a slight dislocation of a button represented by 70 to turn on the button side contact point 73 with the first contact point 74. In this figure, the second contact point 75 turns on when the stronger spring 72 is bent to push the button 70. If the button 70 is a ten-key button, a dial signal representing the number is output.
[0013] In this example, in addition to the touch sensor 25, an operation detection means 80 is also installed in order to detect the selected status or an on status by push operation by pressing or pushing the button. As an operation detection means 80, a dislocation of the button can be detected, or a pressure sensor or a capacity sensor is used along with a touch sensor 25 to detect a difference in the output levels. In the example shown in Figure 3, the dial signal output from the second contact point 75 can also be used.
[0014] The outputs from the touch sensor 25 and from the operation detection means 80 are entered into a discrimination circuit 85 wherein either a touched state or an operation

state is determined and a button is specified. The signals from the discrimination circuit 85 are input to the head-up display control device 94. A memory 93 is connected to the head-up display control device 94, and the shape of the button displayed in the head-up display device 45 and the button layout information at the steering pad section are memorized in this memory 93. The head-up display device 45 displays a button layout overlapping with the landscape view at the front of the vehicle at the display site 46 of the front window indicated by the broken line in front of the driver in Figure 4 in response to the command from the head-up display control device 94.

[0015] From the switch panel 50, signal lines are connected to the radio machine 60 for car telephone functions, and in addition, the signal lines are also connected to the tone transmitting device 62. Additionally, a voice synthesizer 87 is connected to the discrimination circuit 85 for the outputs from the voice synthesizer 87 and from the tone transmitting device 62 to be input to a speaker 64.

[0016] A series of actions in the aforementioned configuration will be explained with reference to the flowcharts shown in Figure 5 and Figure 6. At Step 100, whether the fingers are in touch with a button is checked. That is, in order to execute connection transmission operations, when a driver traces the ten-key button 52 and touches one of the buttons 52, a touch sensor 25 installed on that button 52 transmits a touch detection signal. At Step 110, a discrimination circuit 85 determines a button 52t in a touched state and sends such information so that the button is in a touched state to the head-up display control device 94.

[0017] At Step 115, in response to the button in the touched state, the head-up display control device 94 selects and reads from the memory 93 image data expressing the layout of the buttons 52t in the touched state and other surrounding buttons as configuration information. At Step 120, as shown in Figure 7, a layout image of the button 52t that is in the touched state as mentioned above and the surrounding buttons is displayed on the head-up display device 45. If a finger touches the button "No. 7", when displaying as in Figure 7 (a), the "No. 7" button as the button 52t that is in the touched state is displayed in highlight by tracing the outline of the button as a discrimination display. As a discrimination display, a thicker outline than the others can be used or a different color display or a reversed display can be used.

[0018] The same information is sent from the discrimination circuit 85 to the voice synthesizer 87 and a voice expressing this button 52t, "nana", is synthesized in the voice synthesizer 87 and the voice is output from the speaker 64.

[0019] The driver confirms that the finger is touching the button based on the display on the head-up display device 45 and from the voice from the speaker 64, and if it is not different from the button to be operated, the driver continues with a push operation.

[0020] At the next Step 130, the button that is in an operation state is checked. That is, when a push operation is performed for the button, an operation detection signal is output from the operation detection means 80 that has been set on that button.

[0021] When the button is not in an operation state, it is returned to the start and the abovementioned processes are repeated. If the button that a finger is touching is not the intended button, the driver can easily determine in which direction the intended button is to be found from the surrounding layout displayed in the head-up display device 45 and moves the finger. Since the aforementioned flow is repeated, when the driver moves the finger and touches the other button, the highlighted button displayed in the head-up display device 45 changes in response to the touch.

[0022] When the button is operated and a signal flows to radio machine 60, simultaneously a tone generation device 62 operates to output a "beep" sound from the speaker 64.

[0023] At Step 130, the operation state of the button is checked. If it is in an operation state, the discrimination circuit 85 specifies the button 52p that is in an operation state at Step 140 and an information carrying a message that that button is in an operation state is sent to the head-up display control device 94.

[0024] The head-up display control device 94 displays at Step 145 a layout image of the button 52p in the said operation state and its surrounding buttons in the head-up display device 45. In this case, as shown in Figure 7(b), the button 52p in an operation state, "No. 7" button is distinguished from the highlighted display of said Figure 7 (a) showing that the button is in a touched state. For example, if another highlighted display appears, only this button is displayed in a color.

[0025] The number corresponding to the button 52p operated is registered in a radio instrument 60 at Step 150 as a telephone number to be dialed. This registration operation

is repeated so that all the numbers of the telephone number of the call destination are registered. When the completion of registration of the telephone number is confirmed at Step 160 similarly as in the case of ten-key button 52 at Step 170, whether the transmission/reception button 54 for starting a connection is in a touched state is checked using a touch sensor 25.

[0026] When the transmission/reception button 54 is determined to be in a touched state by the discrimination circuit 85, the process moves up to Step 175 where the head-up display control device 94 reads image data around the transmission/reception button 54 from the memory 93 to display them in the head-up display device 45 at Step 180. Subsequently, whether the transmission/reception button 54 is in an operation state is checked at Step 190 by the operation detection means 80.

[0027] The driver pushes the button and when the button is in an operation state is determined by the discrimination circuit 85, the head-up display control device 94 displays in highlight in another mode from that in a touched state at Step 200, while the radio instrument 60 calls the telephone number registered in advance at Step 210 to start a connection. For these buttons, tones and synthesized voices similar to those used for ten-key buttons are used.

[0028] With the above-mentioned configuration, when the driver brings a finger to the switch panel 50 on the steering pad, the status around the button that was touched by the finger is displayed on the front window in front of the driver so that the intended button can be searched without moving the direction of the eyes. In addition, when pushing the button, the fact that the button was pushed can be confirmed by the display on the front window. With the addition of outputs from voice synthesis or tones, operation quality is improved and the operation is further secured.

[0029] Figure 8 shows a second example of an application to the air control switch in a car. In the air control switch panel 200, sliding type levers 203 and 204 are installed in addition to the selection button 202 in the air control blow mode in order to set up the temperature of the air control blow or to set up the blow rate. Therefore, an air controller 220 is controlled in response to the positions of the lever.

[0030] Regarding the selection button in the blow mode 202, as in the previous example, it is sufficient if the layout of the button where the finger is touching and other

surrounding buttons is displayed. In particular, the application to the sliding type levers will be explained below. At the knobs 205 and 206 of the levers 203 and 204, a touch sensor 25 and an operation detection means 80 are installed as in the previous example. Moreover, a position detection means 215 for detecting the positions of the levers in the slide paths 207 and 208 is installed in the lever operation unit. As this position detection means 215, for example, a potentiometer installed in relation to levers 203 and 204 can be used. Alternatively, temperature setup signals or blow rate setup signals that are used for controlling air controller 220 can also be used.

[0031] The outputs from the touch sensor 25 and the operation detection means 80 are input to a discrimination circuit 285 in order to determine either a touched state or an operation state, and which lever to be used is specified. The signals from the discrimination circuit 285 and the signals of the position detection means 215 are input to the head-up display control device 240. Layout of the switch panel 200 as configuration information including knob shapes displayed in the head-up display device 45, temperature gauge 209 along the slide paths 207 and 208, or function display marks 210 is memorized in the memory 230

[0032] The head-up display control device 240 displays the layout of the switch panel 200 as in Fig. 9 (a) based on the signals from the discrimination circuit 285 if a finger touches a knob of the lever, while based on the signals from the position detection means 215, it is highlighted at the position corresponding to the layout displaying the knob if the knob 205 is in a touched state.

[0033] After confirming the lever having a touching knob by the display in the head-up display device 45, if a driver slides this lever, the knob 205 of the lever in an operation state is highlighted differently from the case in a touched state as shown in Fig. 9 (b) at a newly shifted position.

[0034] For this reason, although the position of the knob changes with operation, the knob touched by a finger is displayed in the front window in relation to the surrounding layout so that the driver can check which knob of the lever he/she is touching. In addition, when operating the lever, it is displayed at a position corresponding in the layout image including the gauge so that the driver can find out until which position it has been slid without moving the direction of the eyes.

[0035] Figure 10 shows a third example of an application to the switch for car radio/cassettes. In the radio cassette switch panel 300, besides the push type button 302 for cassette operation, a rotary volume switch is installed in order to control sound volume, sound quality or left and right balance, and the respective sound volume control knob 305, sound quality control knob 306, and left and right balance control knob 307 are arranged to be projected from the panel surface.

[0036] Here, the application to rotary type control knobs will be explained. As in the previous examples, touch sensors 25 are installed for each control knobs 305, 306 and 307. In each volume switch having these control knobs, a rotary angle detection means 315 is installed to detect an angle of rotation. As a rotary angle detection means 315, a potentiometer can be installed in relation to the control knobs 305, 306 and 307, or the output of each volume switch used for controlling can also be used.

[0037] The outputs of the touch sensor 25 are input to the discrimination circuit 385 to determine whether it is in a touched state or which controller knob is to be specified. The signals from the discrimination circuit 385 and the signals of the rotary angle detection means 315 are input to the head-up display control device 340. In addition, the layout of the switch panel as configuration information including positions and knob shapes of the control knob, marks around the knob or gauges that are displayed in the head-up display device 45 is memorized in the memory 330.

[0038] Based on the signals from the discrimination circuit 385, the head-up display control device 340, if a finger touches the sound volume control knob 305, it displays the layout surrounding the sound volume control knob 305 in a touched state as shown in Figure 11 (a) in the head-up display device 45, while the sound volume control knob 305 is highlighted.

[0039] After confirming the knob that has been touched in the display in the head-up display device, if the driver turns this control knob, a pointed arc mark 310 showing the amount of rotation of the knob is displayed as shown in Fig. 11 (b), and the length of the arc corresponding to the angle of rotation of the knob.

[0040] According to this example, when operating the rotary operation blindfolded, the operational direction is displayed while the knob operated is highlighted so that the advantage is that there are fewer operational errors.

[0041] Additionally, this invention can be applied to the control switches for electrically operated power seats in a car. In the case of a button type, it can be implemented by a configuration based on the first example. In this case, a display example in the head-up display device is shown in Figure 12 as a fourth example. The seat front and rear position control buttons and the up and down position control buttons are arranged at the side 400 of the seat cushion as shown in Figure 12 (a). An upward mark 402 is indicated on the upper half portion of the up and down position control button 401 and a downward mark 403 is indicated on the lower half portion, a forward mark 406 is indicated on the front half portion of the front and rear position control button 405 and a backward mark 407 is indicated on the rear half portion. When the respective half portion is pushed, the seat is adjusted in the direction indicated by the mark.

[0042] A touch sensor is installed on each control button. For example, a finger touches the up and down position control button 401, as shown in Fig. 12 (b), a layout image of the control button is displayed, while the up and down position control button 401 is highlighted. After confirming the button that has been touched by the display in the head-up display device, when the driver pushes the upper half portion of the up and down position control button 401, the upward mark 402 is highlighted in the same display as shown in Figure 12 (c), and upward control is indicated to be in operation.

[0043] According to this example, in contrast to the conventional operation of seat control switches with blindfolding due to the absence of visual confirmation since it is located below the hip level near the door, the advantages are that an operation becomes much easier and that the direction of the moving seat can be visually checked.

[0044] Moreover, the present invention is applicable to remote control switches that are placed on the console and are operated while holding with a hand. Since this is a button type, a configuration is based on the first example. A touch sensor and an operation detection means are installed on each button and signal transmission to the head-up display control device is done by means of electrical waves or infrared rays.

[0045] An example of display is shown as a fifth example in Figure 13. As shown in Fig. 13 (a), numerous buttons 502 are installed on a remote control switch 50 and an intended button is searched. If a finger touches a "button C", the "button C" and its surrounding buttons, in particular the adjacent buttons, are displayed in the head-up display device as

shown in Figure 13 (b), while the outline of the "button C" is highlighted, indicating that it is in a touched state. If this button is determined to be the intended one and then pushed, the inside outline of the "button C" is reversed as shown in Figure 13 (c), changing to a highlighted state that is different from that in a touched state.

[0046] In contrast, after viewing the display in (b), the driver learns that the intended button is located to the left of the button that is currently being touched, and shifts a finger to the left. When the finger approaches to the "button B", as shown in Figure 13 (d), the display changes to a layout image primarily around the "button B" so that a surrounding arrangement including the "button A" and the "button C" that are adjacent to the "button B" is displayed. In this case, the "button B" is highlighted, indicating a touched state.

[0047]

[Effects of the Invention] As mentioned above, according to the present invention, a touch sensor is installed in the switch operation unit so that based on the signals from the touch sensor, if the switch operation unit is in a touched state, the switch operation unit and its surrounding position information are displayed in the head-up display device, and the switch operation unit in a touched state is discriminated from the surrounding configuration information. Therefore, a driver can check whether the switch operation unit touched is the intended one while driving keeping the eyes straight forward. Even if the switch operation unit that is touched is not the intended switch operation unit among numerous arrangements, its position can be easily determined from the surrounding configuration information displayed so that a desired switch operation unit can be accessed easily.

[0048] When an operation detection means is installed and the operation of the switch operation unit is displayed differently from that in a touched state, the driver can visually confirm the operation of the switch operation unit without moving the direction of the eyes even under such conditions such as when it is difficult to check the conventional beeping tones with loud noises, resulting in fewer operational errors. In addition to the aforementioned common effects, in the first example, outputs of voice synthesis and tones are further added so that searching for the switch operation unit and security of operation are further improved.

[0049] According to the second example, even in the cases of slide type lever switches where positions of knobs are unstable, it is possible to check whether the knob that has been touched belongs to which lever switch in relation to the layout including the displayed surrounding gauges. When operating the lever, the location of the knob displayed changes so that a driver can determine how far that it has been slid without moving the visual direction.

[0050] According to the third example, a pointed arc mark showing the amount of rotation of the knob is displayed and the length of the arc is adjusted to correspond to the angle of rotation of the knob so that when searching for a rotary knob to be operated, the amount of rotation can be checked and operational errors can be eliminated.

[0051] According to the fourth example, when searching for the seat adjustment switches that are installed at such places that it is impossible for a driver to directly see after being seated, they can be easily found and the directions of seat movement can be checked in the front visual field.

[0052] According to the fifth example, in the remote control switches where numerous buttons are installed in a narrow panel so that searching for a button by moving the visual direction is difficult while driving, the button that has been touched by a finger and the surrounding buttons can be displayed in a front visual field such that they can be recognized easily so that it is possible to move a finger to a desired button quickly, markedly improving operational quality.

[0053] As clearly shown in any of these examples, operational switches can be installed in a range of places where fingers can reach even though drivers cannot check visually, thus, the advantage is that the degree of freedom when designing switch positions in a vehicle increases.

[Brief Description of the Drawings]

[Fig. 1] is a diagram showing a configuration of the present invention.

[Fig. 2] is a diagram showing a first example of the present invention.

[Fig. 3] is a diagram showing a configuration example of a touch sensor.

[Fig. 4] is a diagram showing sites of display in the head-up display device.

[Fig. 5] shows a flow of display actions.

[Fig. 6] shows a flow of display actions.

[Fig. 7] is a diagram showing display examples in the head-up display device.

[Fig. 8] is a diagram showing a second example.

[Fig. 9] is a diagram showing display example in the head-up display device in the second example.

[Fig. 10] is a diagram showing a third example.

[Fig. 11] is a diagram showing display example in the head-up display device in the third example.

[Fig. 12] is a diagram showing a fourth example.

[Fig. 13] is a diagram showing a fifth example.

[Fig. 14] is a diagram showing the status of positions of switches around the driver seat.

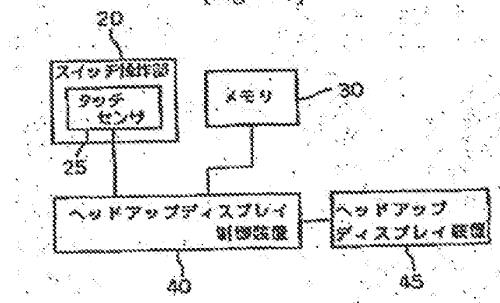
[Fig. 15] is a diagram showing an example of the conventional switch panel surface.

[Explanation of Symbols]

20: Switch operation unit
25: Touch sensor
30, 93, 230, 330: Memory
40, 94, 240, 340: Head-up display control devices
45: Head-up display device
46: Display sites
50, 200, 300: Switch panel
52: Ten-key button
54: Transmission/reception button
56: Sound volume control button
58: Station selection button
60: Radio instrument
62: Tone transmitting device
64: Speaker
70: Button
71, 72: Springs
73, 74, 75: Contact points
80: Operation detection means
85, 285, 385: Discrimination circuits
87: Voice synthesizer
202: Selection button
203, 204: Levers
205, 206: Knobs
207, 208: Slide paths
209: Temperature gauge
210: Function display marks
215: Position detection means
220: Air controller

305: Sound volume control knob
306: Sound volume control knob
307: Left and right balance adjustment knob
310: Arc mark
315: Rotary angle detection means
401: Up and down position adjustment button
402: Upward mark
403: Downward mark
405: Front and rear position adjustment button
406: Forward mark
407: Backward mark
500: Remote control switch
502: Button

[Figure 1]



20: Switch operation unit 25: Touch sensor
30: Memory 40: Head-up display control device
45: Head-up display device

Figure 3

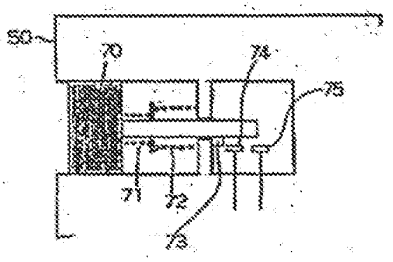


Figure 4

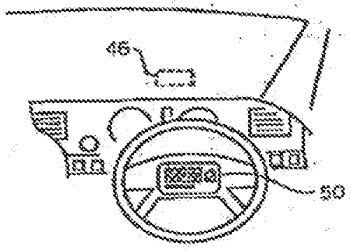


Figure 7

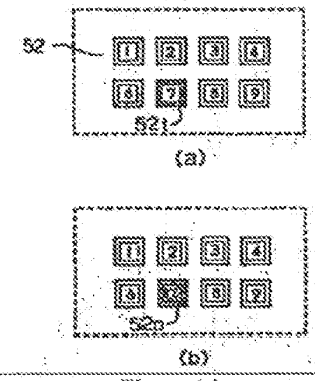


Figure 11

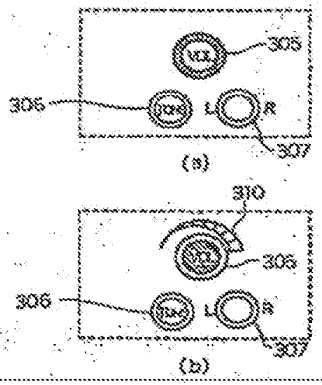
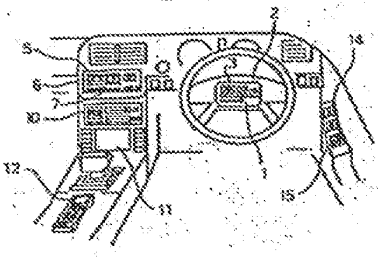
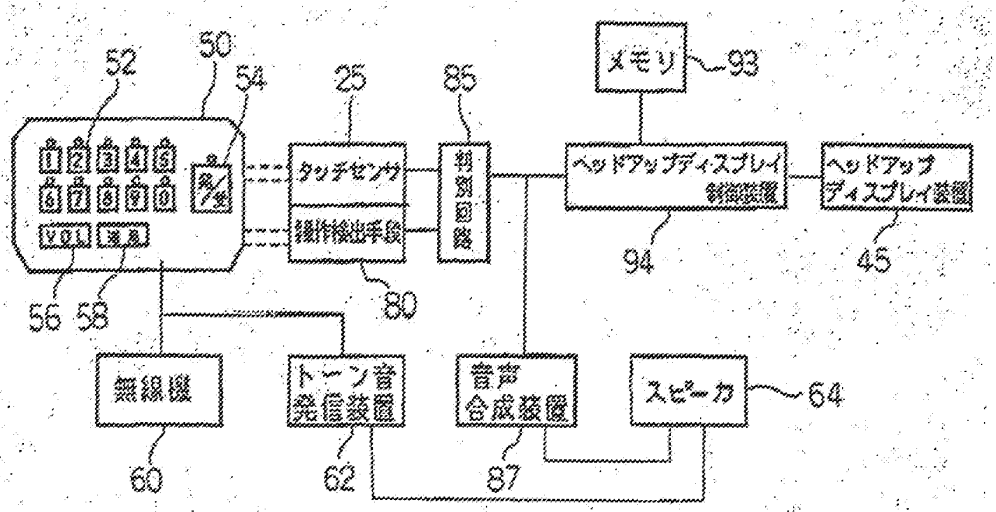


Figure 14

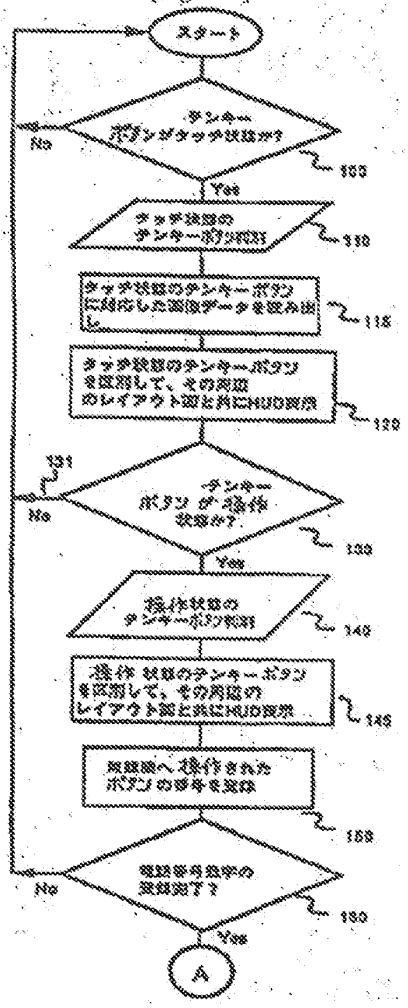


[Fig. 2]

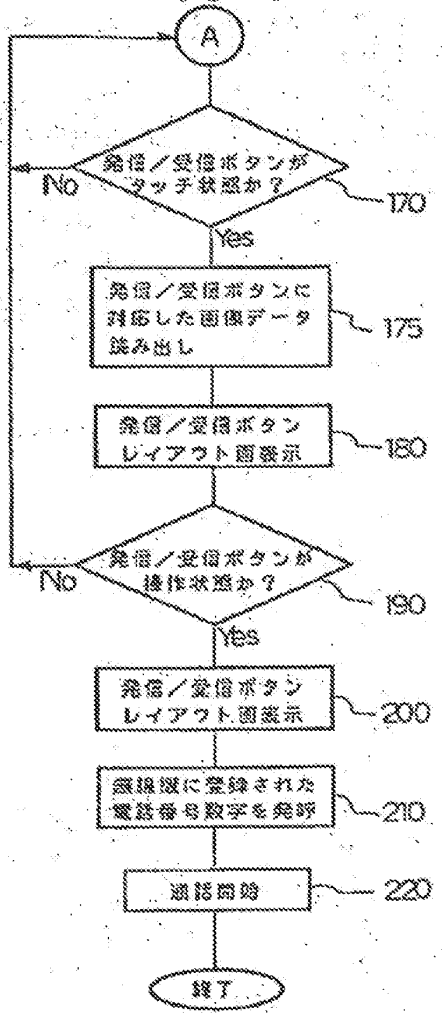


25: Touch sensor 48: Head-up display device 54: Transmission/reception 60: Radio instrument 62: Tone transmitting device
64: Speaker 80: Operation detection means 87: Voice synthesizer 85: Discrimination circuit 93: Memory
94: Head-up display device

[Figure 5]



[Figure 6]



[Fig. 5]

Start

100: Ten-key: Is the button in a touched state?

110: Determination of a ten-key button in a touched state.

115: Reading the image data corresponding to the ten-key button in a touched state.

120: Distinguishing the ten-key button in a touched state

130: Is the ten-key button in an operation status?

140: Distinguish a ten-key is an operation status.

145: Distinguishing ten-key buttons in an operation status, displaying HUP along with the surrounding layout image.

150: Registration of button numbers operated to a radio instrument

180: Registration completed for telephone numbers

[Fig. 6]

170: Are transmission/reception buttons in a touched state?

175: Read image data corresponding to transmission/reception buttons

180: Display a layout image of transmission/reception buttons

190: Are transmission/reception buttons in an operation state?

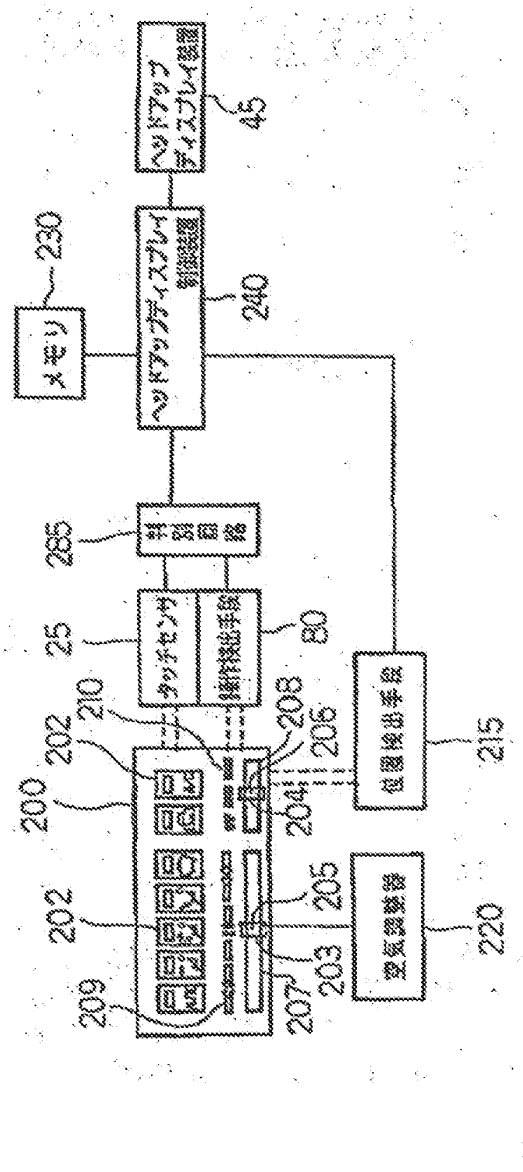
200: Display a layout image of transmission/reception buttons

210: Calling the telephone numbers registered in a radio instrument

220: Start connection

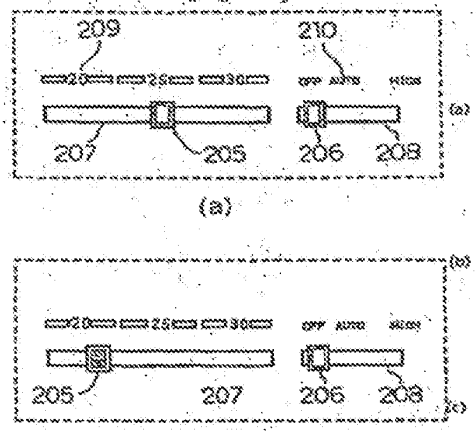
End

[Figure 8]

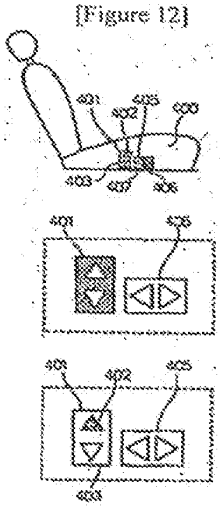


25: Touch sensor
45: Head-up display device
80: Operation detection means
220: Air controller
215: Position detection means
240: Head-up display control device
285: Discrimination circuit

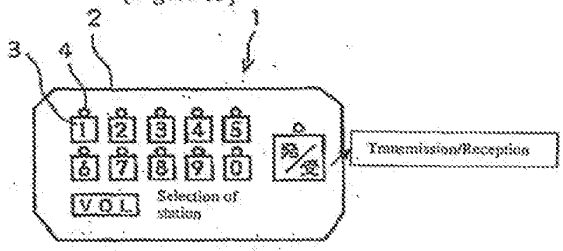
[Figure 9]



[Figure 12]



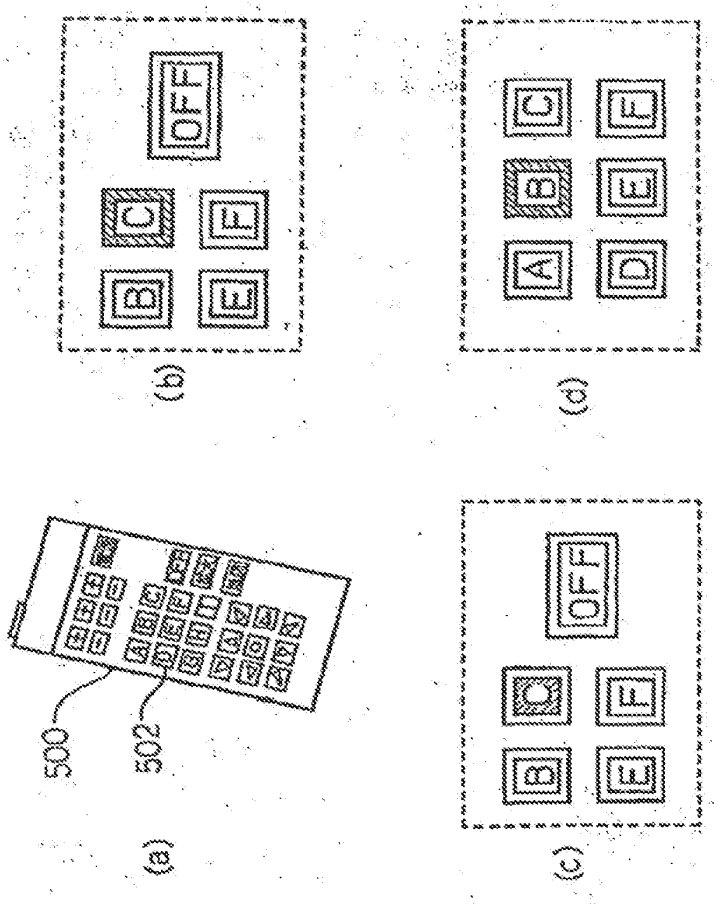
[Figure 15]



[Figure 10]

25: Touch sensor
45: Head-up display device
80: Operation detection means
330: Memory
315: Position detection means
340: Head-up display control device
385: Discrimination circuit

[Figure 13]



DRIVE GUIDE APPARATUS FOR AUTOMOBILE

Publication number:	JP59085599
Publication date:	1984-05-17
Inventor:	TSUJIMURA TSUNETOSHI; ITOU TOSHIYUKI
Applicant:	NISSAN MOTOR
Classification:	
- international:	***G01C21/00; G01C21/20; G05D1/02; G08G1/09; G08G1/0969; G08G1/133;*** G01C21/00; G01C21/20; G05D1/02; G08G1/09; G08G1/0969; G08G1/123; (IPC1-7): G01C21/20; G05D1/02; G08G1/09
- European:	
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⑲ 日本国特許庁 (JP)　　⑪ 特許出願公開

⑫ 公開特許公報 (A)　　昭59—85599

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//G 05 D 1/02		7052—5H	審査請求 未請求

(全 5 頁)

⑤自動車のドライブガイド装置

⑳特　　願 昭57—195134
㉒出　　願 昭57(1982)11月6日

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明　　細　　書

1．発明の名称

自動車のドライブガイド装置

2．特許請求の範囲

(1) 道路地図データを記憶する記憶手段と、この記憶手段に記憶されたデータに従って道路地図を表示する表示手段と、自動車の走行方向および走行距離の検出データから当該自動車の位置を算出する位置演算手段と、この位置演算手段で求められた位置を上記表示手段に表示された道路地図上に付加表示させる位置表示制御手段と、自動車搭載の回線を介してデータサービスセンタとの間でデータ通信を行なうデータ通信手段と、このデータ通信手段によって上記データサービスセンタから受信した各種の道路交通情報を上記表示手段に表示された道路地図上にこれと対応させて付加表示させる道路交通情報の表示制御手段とを備えることを特徴とする自動車のドライブガイド装置。

3．発明の詳細な説明

この発明は、自動車の運転者にその自動車が走行している地点の道路地図データとともに各種の情報を提供するためのドライブガイド装置に関する。

最近、この種の自動車のドライブガイド装置として、道路地図データを記憶する記憶手段と、この記憶手段に記憶されたデータに従って道路地図を表示する表示手段と、自動車の走行方向および走行距離の検出データから当該自動車の位置を算出する位置演算手段と、この位置演算手段で求められた位置を上記表示手段に表示された道路地図上に付加表示させる位置表示制御手段とを備える装置が開発された。

このドライブガイド装置によれば、自車の位置が上記表示手段の表示から一目瞭然にわかり、目的地までの経路等についても極めて容易に確認することができ、不案内な道路でも安心してドライブすることができる等の効果を生じ、実用上極めて有効な装置として大いに注目されている。

また最近では、道路の混雑状況、事故情報、道路工事情報あるいは交通規制情報等の各種の道路

交通情報を総合的に収集して該当地域の運転者に速やかに知らせる目的で、情報収集機関および情報サービス機関のシステム化が行政レベルで進められている。

この発明は上述したような背景のもとになされたものであって、その目的は、道路地図表示上に自車の位置を表示するのに加えて、その道路地図表示上に最新の道路交通情報をも付加して表示できるようにした自動車のドライブガイド装置を提供することにある。

上記の目的を達成するために、この発明は、上述したドライブガイド装置の構成に加えて、自動車電話の回線を介して外部のデータサービスセンタとの間でデータ通信を行なうデータ通信手段と、このデータ通信手段によって上記データサービスセンタから受信した各種の道路交通情報を上記表示手段に表示された道路地図上にこれと対応させて付加表示させる道路交通情報の表示制御手段とを設けたことを特徴とする。

この構成によれば、自車の走行位置が道路地図上に一旦表示されるのに加えて、周辺の道路の混雑状況とか事故あるいは工事の状況とか交通規制の状況とかが地図表示から容易にわかり、目的地までどのような経路を通ったら良いかを、運転者に非常に有益な案内情報を与えることができる。

以下、この発明の実施例を図面に基づいて詳細に説明する。

第1図はこの発明の第1の実施例を示す。このドライブガイド装置は、全体を制御制御する中央処理装置4と、中央処理装置4に各種の指示入力を与えるための操作部5と、例えばCRTからなる表示器1と、表示器1に表示させるデータが格納される表示データメモリ3と、表示器1を駆動、制御して表示データメモリ3に格納された表示データを表示する表示制御回路2と、所定のデータフォーマットに変換された複数の地域の道路地図データが格納される道路地図メモリ30と、自動車の方位を検出する方位センサ7および走行距離を検出する走行距離センサ8の出力に基づいて該自動車の位置を所定的に算出する位置検算回路6とを備える。

これらの構成は基本的には従来に知られている部分であり、操作部5で表示させたい道路地図の番号を指定すると、道路地図メモリ30に格納されている該当の道路地図データが表示データメモリ3に読み出され、その道路地図データが表示制御回路2によって表示器1に表示される。

また、表示器1に表示された道路地図に対応付けて、自動車の現在位置を操作部5で入力すると、これを受けて中央処理装置4により表示データメモリ3に位置表示のための付加データが書込まれ、これにより表示器1の道路地図表示中に自動車の現在位置が表示される。

さらに、自動車を走行させると、位置検算回路6により出発地点からの位置変化を示す2次元データが求められ、中央処理装置4ではこの位置変化データに基づいて該自動車の現在位置データを更新し、表示データメモリ3における位置表示のデータを更新する。これによって、表示器1の道路地図上における車の現在位置表示が車の走行に伴って変化する。

自動車の現在位置が表示器1に表示されている道路地図からはみ出るようになると、中央処理装置4はその道路地図に隣接する道路地図のデータをメモリ30から読み出して表示データメモリ3にストアし、その新たな道路地図上に自動車の現在位置を示すデータを付加する。このようにして、表示器1には自動車の走行に追随して自動車の現在位置が含まれる地域の道路地図が表示される。

この発明に係るドライブガイド装置は、上記の構成に加えて、自動車電話13の回線14を介してデータサービスセンタ15との間でデータ通信を行なうデータ通信手段として、音響結合器12、変復調回路11、送受制御回路10、受信データメモリ9を備え、また、このデータ通信手段によって上記データサービスセンタ15から受信してメモリ9に格納される各種の道路交通情報を表示器1の道路地図表示上にこれと対応させて付加表示させる道路交通情報の表示制御手段（これ

は主として中央処理装置４のデータ処理によって実現される）を備える。

データサービスセンタ１５は、警察庁や各都道府県警の交通管制センタあるいは各道路公団等から収集される道路の混雑状況、事故、工事、交通規制等の最新情報を所定のデータ形態でファイルしており、通信回線１４を介しての問いあわせにおじ、そのデータを所定のデータ伝送手順に従って所定のフォーマットで電話回線１４に送信する機能を有している。

データサービスセンタ１５にファイルされるデータの形態は、例えば、道路地図メモリ３０の各道路地図データと対応する地図識別番号および当該地図上での位置を示す座標データと、その位置における状況（渋滞、事故、工事、規制等のデータ）を対応付けて符号化したものである。また、データサービスセンタ１５は各地区毎に設けられており、例えば東京地区センタであれば、都内とその近郊のデータを持っている。

データサービスセンタ１５から道路交通情報を

もらうには、自動車電話機１３のダイヤルを操作してデータサービスセンタ１５を呼出し、センタ１５の応答あるいは自動応答装置と通話を行ない、データ通信を開始する旨の合図があってから、電話機１３の送受話器を音響結合器１２にセットする。

すると、データサービスセンタ１５から単位時間あたり所定のビット数で当該情報のオーディオ信号によるデータが自動的に送信される。このデータ信号は電話機１３にて一旦音響信号となり、その後音響結合器１３によって再び電気信号に変換され、その電気信号は変復調回路１１で復調され、元のデータに戻される。なお、このデータ通信を完全に一方向の通話で行なう場合、送話器は１２はマイクのみでよく、変復調回路１１は復調器のみでよい。

通話制御回路１０は、受信したデータについて誤り検出や所定のバッファリング等の処理を行ない、処理された後の道路交通情報、すなわち地図識別番号および当該位置データと各種の状況データを

対応付けたデータとして受信データメモリ９に格納する。

中央処理装置４は、表示データメモリ３にストアされて表示器１に表示されている道路地図の識別に該当するデータを受信データメモリ９から読み出し、その番号の道路地図上の各地点の状況データを所定の記号あるいは文字で表示するための表示データに変換し、それを表示データメモリ３の所定位置（アドレス）に付加書込みする。

すると、表示器１に表示されている道路の地図上に、各地点の渋滞、事故、工事、規制等を表わす道路交通情報が所定の記号やマークあるいは文字で表示される。勿論、先に説明したように自動車の走行に伴って表示される道路地図が変った場合、中央制御装置４はその新たな道路地図について道路交通情報を付加表示するためのデータ処理を行なう。

第２図はこの発明の他の実施例を示すもので、第１図と同一構成部分には同一符号を付しその説明を省略する。

このものにおいて第１図の実施例と異なるのは、自動車電話機１３の回線１４を介してデータサービスセンタ１５とデータ通信を行なう装置が、電話回線１４との接続（図示省略）を介して着脱されるデータ通信装置９０となっている点である。このデータ通信装置９０は自動発信機能を有し、自動車電話機１３のダイヤルを操作してデータサービスセンタ１５に一々接続しなくても、制御盤５の所定のスイッチを押すだけで、自動的にデータサービスセンタ１５との交信（データ通信）が行なわれ、所要の道路交通情報を受け取って装置９０内のメモリに格納する。

このような通信装置９０を用いれば、前記実施例のように音響結合器１２を用いるものに比べ、データ通信の信頼性が向上するとともに、ダイヤリング操作が不要となり、運転中でもデータサービスセンタ１５と通信が行なえるようになる。

以上詳細に説明したように、この発明に係る自動車のドライブガイド装置によれば、表示器に表示された道路地図上に自車の位置が表示されるた

りでなく，それに表示されている道路の混雑状況や駐車、工事の状況あるいは交通規制の状況等が表示されるので、運転者は一目瞭然で自車の位置と周辺の道路交通状況がわかり、目的地までの経路を決める上で極めて有益であり、不慣れな場所でも安心して、かつ不要の時間をかけることなく目的地までの運転が行なえる等，実用上様々な効果をもたらす。

4．図面の簡単な説明

第1図はこの発明に係る自動車のドライブガイド装置の一実施例を示すブロック図、第2図は同じく他の実施例を示すブロック図である。

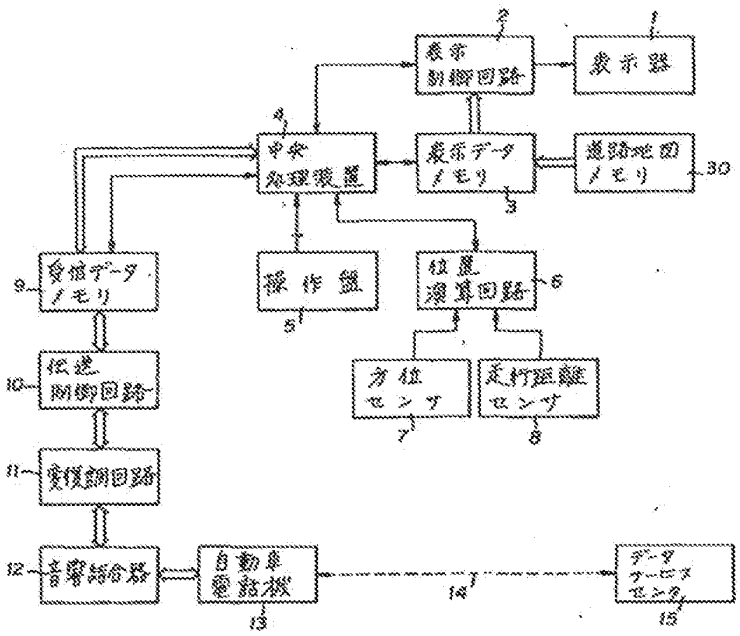
1－－表示器
2－－表示制御回路
3－－表示データメモリ
30－道路地図メモリ
4－－中央処理装置
5－－操作部
6－－位置演算回路
7－－方位センサ
8－－走行距離センサ
9－－受信データメモリ
10－伝送制御回路
11－受信回路
12－－音響制御器
13－自動車電話機
14－－無線回路
15－データサービスセンタ
90－データ通信装置

特許出願人

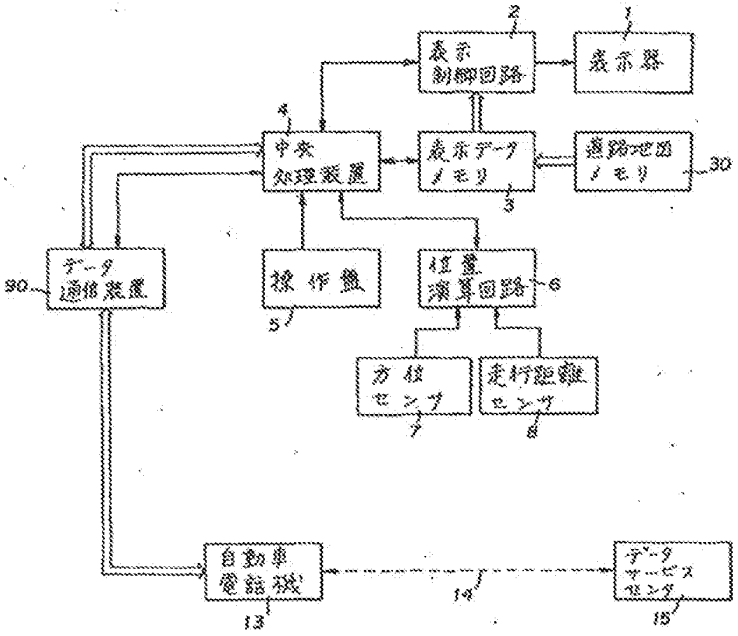
日産自動車株式会社

代理人　弁理士　和　田　成　則

第1図



第2図



RADIO DATA SYSTEM RECEIVER

Patent number: JP63136828
Publication date: 1988-06-09
Inventor: MORI SHIGETO; GO YASUNAO; ARAKI MORIO; KANEKO MICHIHIRO
Applicant: PIONEER ELECTRONIC CORP
Classification:
- international: H04B1/16; H04H1/00
- european:
Application number: JP19860283675 19861128
Priority number(s): JP19860283675 19861128

View INPADOC patent family

Abstract of JP63136828

PURPOSE:To very easily select a desirable program by storing broadcasting stations classified by main types of programs sorted by means of a PTY code in plural memory blocks. CONSTITUTION:When a sweep command is issued to a system controller 9 by operating a key matrix 15, the broadcasting station which can be received is received with a searching function. At this time, a memory control circuit 17 stores the frequency information and the PS code of the receiving station in one of the specified memory blocks of the memory blocks 10a-10n, which are previously classified by the main types of programs, according to the data(numerical value information) obtained by the PTY code decoder 8b of an RDS decoder 8. The system controller 9 displays the name of program type prescribed in the memory 10b on a display 14 and at the same time displays the names of the broadcasting stations by the frequency information and the PS code stored in the memory 10b on the display 14 through an ASCII code conversion tool 9b.

⑲日本国特許庁(JP)　⑪特許出願公開

⑫公開特許公報(A)　昭63－136828

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審査請求　未請求　発明の数 1　(全7頁)

⑭発明の名称　ラジオデータシステム受信機

⑳特　願　昭61－283675
㉒出　願　昭61(1986)11月28日

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明　細　書

1．発明の名称

ラジオデータシステム受信機

2．特許請求の範囲

FM放送波に主信号成分以外のデータ信号を重畳して放送局と共に送出する放送システムを受信する受信機であって、前記データ信号を復調するデコーダと、前記デコーダによって復調されたデータ内容に基づいた分類によって予め定められたメモリブロックに受信した放送局の周波数情報及び放送局名データ情報を少なくとも記憶する制御回路を備え、使用者の操作により前記メモリブロックの1つを呼び出すと共に、前記メモリブロックに与えられた分類名と、前記メモリブロック内に格納された放送局名を表示する表示手段を備えたことを特徴とするラジオデータシステム受信機。

3．発明の詳細な説明

〔産業上の利用分野〕

この発明は、データ信号が重畳されたFM放送を受信するラジオ受信機に関するものである。

〔発明の概要〕

従来自動車で交通情報局識別のためのデータ信号を重畳したシステム(Autofahrer Rundfunk Information：略称ARI)が考案されている。

このARIはFM放送のパイロットトーンである19KHzの3次高調波である57KHzにサブキャリアを持たせて識別信号とし、これをメインキャリアに同波を変調して放送していた。この識別信号はSK信号と称され、受信機はこのSK信号を復調することにより交通情報を供給している放送局の受信を容易にしていた。

しかしARIシステムは交通情報局に関する識別のみを提供するものであり、それ以上のサービスを供給するものではない。

そこで同じ57KHzのサブキャリアにARIの変調と90°異なる位相でバイフェーズコード化されたデータ信号をFSK(Frequency Shift Keying)変調して放送するシステム(Radio Data

System：略称RDSシステム）が提案された。

RDSシステムにおいて伝送されるデータは第1図に示されるベースバンドコーディングにより第2図に示すように各々が26ビットからなる4つのブロックにより1グループが形成されている。

各々のブロックには16ビットの情報ワードと10ビットのチェックワード及びオフセットワードからなり、受信側では情報ワードをデータ処理することにより様々なサービスの状態を受けることが可能となる。

第1図のデータフォーマットに基づいて各部の名称を説明する。

第1ブロックにはプログラム識別情報（PIコード）16ビットが与えられている。このPIコードは

①国別コード（4ビット）

②放送局コード（4ビット）

③プログラム番号コード（8ビット）

の計16ビットにより構成され、その放送局とその国の放送のものか、他局でも同じ放送が行われているか、ローカルの番組のためメジャーな番組ものかの情報をあらかじめ定められた規約に基づいてデータとして送られる。

第2ブロックにはグループタイプコード（4ビット）、バージョンコード（1ビット）の計5ビットによるグループタイプ識別コードが与えられている。このグループタイプ識別コードは、その後に送られるデータにはなが送られているかを識別させるためのものであり、理論的には$2^5=32$通りのグループタイプを識別可能であるが、現在ではグループ0～3の4つのグループに対してバージョンA及びBの2バージョンが定められており、これに未定義のグループを加えて計9つのグループを識別可能にしている。グループによって以後に送られるデータの種類が異なるがここではその説明を省略する。

グループタイプ識別コードに続いて

①交通情報コード（TPコード、1ビット）

②プログラムタイプコード（PTYコード、5ビット）

③放送アナウンスコード（TAコード、1ビット）

④ミュージック／スピーチスイッチコード（M／Sコード、1ビット）

⑤デコーダコントロールビット（Dビット、1ビット）

⑥アドレスビット（2ビット）

が与えられている。

上記データにおいて、TPコードとTAコードは放送中の局が交通情報局であるか、あるいはそれが現在放送中であるかを夫々のコードの組み合わせで示している。

PTYコードは0～31の32種類の番組タイプ（音楽番組，ニュース番組，スポーツ番組など）を識別するものであり、あらかじめ定められた規約に基づいて割当てされており，その一覧を表1に示す。

（以下余白）

表1

NO.	PTYコード	番組タイプ
1	00000	番組なし
2	00001	ニュース
3	00010	時事
4	00011	マンガ
5	00100	スポーツ
6	00101	教育
7	00110	子供向け番組
8	00111	成人向け番組
9	01000	娯楽番組
10	01001	ドラマ
11	01010	ロックミュージック
12	01011	軽音楽
13	01100	シリアスミュージック
14	01101	ジャズ
15	01110	フォークミュージック
16	01111	バラエティ
17～30		未定義
31	11111	緊急放送

M/Sコードは"0"ならばスピーチ，"1"ならば音楽が放送中であることを示している。

DIビットは，送られてくる放送局を識別するデコード情報を与えるものであり，1ビットが与えられているが，これを4回繰り返して送信することにより4ビットの情報（16通りのデコード情報）を得られるようにしている。

アドレスビットは先述したグループタイプにより異なる情報が異なるが，この実施例では後述するPSコードのアドレスを示すものであり，あしくはPSコードの放送中で識別する。

第3ブロックには各局固有識別情報（AFコード）8ビットが2つ与えられている。

このAFコードは放送中の局と同一局名を放送中の各局の周波数情報を伝送する。この周波数情報は100KHz毎に8ビットのデータと対応している。

ナンバー	AFコード	キャリア周波数
0	00000000	87.5MHz
1	00000001	87.6MHz
2	00000010	87.7MHz
・	・	・
・	・	・
・	・	・
204	11001100	107.9MHz

これより上のナンバーに対応する8ビットコードには別の意味が与えられており，例えばAF局が何局を有するかその情報を送っている。このAFコードは25局まで繰返し送信されて，受信局リストとなる。

第4ブロックには放送局名がアスキーコードで送られてくるプログラムサービスコード（PSコード）が与えられている。アスキーコードは1キャラクターに付き8ビットのバイナリーコードで8ビットを1文字とするために，第4ブロックでは2文字分しか伝送できない。RDSにおいては放送局名は8文字で与えるようにしているために，4回のデータを受けとって初めて8文字分のアスキーデータをえることになる。

このときに今送られているPSコードは8文字の何文字目のものかを定めるのが前述した第2ブロックのアドレスビットであり，次の対応を示している。

アドレスビット	文字識別
0 0	1，2文字目
0 1	3，4文字目
1 0	5，6文字目
1 1	7，8文字目

このようにアドレスビットにより現在送られているPSコードの情報が局名の何文字目にあたるかを規定しており，受信・復調器では4回繰返して復調することにより8文字からなる放送局名を識別することが可能となる。

（従来の技術）

上述したRDSシステムを用いて，受信者は現在受信中のラジオ放送がどのような番組内容かをPTYコードによって知ることができ，またPSコードによってその放送局名をディスプレイなどに表示させることが可能となる。

第5図に従来のRDSチューナを用いた一実施例を示す。

図において，アンテナ1からフロントエンド2，およびFM検波回路3を介した信号は，アンプ4で増幅されてスピーカ5から音声出力されるほか，アンプ4の出力はPSコードデコーダ8a及びPTYデータデコーダ8bをそなえたRDSデコーダ8に入力され，RDSデコーダ8で復調した前述のRDSデータは，システムコントローラ9に与えられる。システムコントローラ9はフロントエンド2から受信局の中間周波出力を検波検波して得られるSメータ出力を検出するSメータ検波回路7の出力により受信局の有無を識別するとともに，PLL6にPLLデータを与えて局部の発振周波数を行わせたり或いは入力部11からの指令信号などによって受信バンド帯域内を順次選局する。

10は受信局の周波数情報を記憶するメモリであり，入力部11の操作によって所定のメモリから周波数情報を呼び出してシステムコントローラ9よりPLL6に選局情報を与える。このときの周波数情報やPSコードを利用した放送局名，あるいはPTYコードを利用した番組内容などをP

ＰＴＹコードに対応する文字情報を格納するＰＴＹデータテーブル９ａおよびアスキーコード変換ツール９ｂなどによってキャラクタ情報に変換した後にキャラクタジェネレータ１２および表示ドライバ１３を介してドットマトリクス表示管などよりなるディスプレイ１４に表示させる。

第５図のＲＤＳ受信機によってバンド内を順次受信してＳメータ検出回路７によって放送局のあることを検出すると、ＲＤＳデコーダ８によってＲＤＳコードの第２ブロックからＰＴＹコードを、第４ブロックからＰＳコードを夫々抽出することによりシステムコントローラはそれらの情報をディスプレイ１４に表示し、メモリ１０に局識別情報及びＰＳコードを記憶保持する。

メモリ１０にプリセットされた放送局を入力部１１より呼び出すことによってその放送局が受信され、音声出力されると共にディスプレイ１４にはその番組タイプや放送局名が表示され、聴取者へのサービスとなる。

トされている番組タイプと放送局名をディスプレイ上に表示することを特徴とするものである。

〔発明の実施例〕

第２図にこの発明の一実施例を示す。なお従来技術と同一の部分には同一の符号を付してその説明を省略する。

この実施例ではメモリ１０がａ～ｎの複数のメモリブロックを有しており、夫々のメモリには例えばのメモリテーブルを備えてある。

キーマトリクス１５は従来の入力部１１と局毎のプリセットチャンネル選択キーおよび局識別名キーなどの機能を備えるほかに、第３図に示すようにＰＴＹコードの分類に応じた主要番組タイプ入力部１５ａを有しており、この番組タイプ入力部１５ａのキーの数は、メモリブロックの数と同数になっている。

キーマトリクス１５を操作してシステムコントローラ９に対して局識別名を与えると、局毎のサーチ機能によって受信可能な放送局を受信する。

〔発明が解決しようとする問題点〕

従来のＲＤＳ受信機は、上述したようにプリセットした放送局を呼び出してはじめてその放送局が放送中の番組内容や放送局名を知ることになるが、例えば「ニュースが聞きたい」「どこかでスポーツ中継しているところはないの」というような場合には、すべてのプリセットチャンネルを呼び出すか、順局選局をしながらキャッチした放送局の内容を逐次しながら希望とする放送局を探すことになり、特に移動用の受信機のような運転中の注意力が散漫になるために危険をともない、ある種の社会問題となっている。

〔問題点を解決するための手段〕

この発明は、上述した従来技術のもつ問題点を克服した受信機を提供することを目的とするものであり、本発明によって受信バンド帯域内を順次選局して得られた放送局をＰＴＹコード別に分類して夫々ことなるグループのメモリにメモリし、更にそのグループメモリ内に分類されてプリセッ

このときにＲＤＳデコーダ８のＰＴＹコードデコーダ８ｂによって得られるデータ（放送情報）に応じてメモリ制御回路１７は主要な番組タイプ別にデの分類されたメモリブロック１０ａ～１０ｎの所定のメモリブロックの１つに受信局の局識別情報及びＰＳコードを格納する。例えばＰＴＹコードＮＯ「１」で与えられるニュース番組はメモリ１０ａに、ＰＴＹコードＮＯ「４」で与えられるスポーツ番組はメモリ１０ｂにというようにあらかじめ定めた番組タイプの放送局がプリセットされるようにメモリ制御回路１７がメモリへの書き込み動作を制御する。この結果によりサーチ後の各メモリブロック上にはＰＴＹコードによって分類された放送局情報が格納されたことになる。

プリセットが終了した後に受信者が例えば「スポーツ番組」を聴取したい場合には、キーマトリクス１５の「スポーツ」キーを操作することによって、キーデコーダ１６はメモリ制御回路１７がメモリ１０ｂのメモリ内容を選択するように制御

する。

システムコントローラ9にメモリ10bに格納されている表示タイプ名をディスプレイ14に表示させると共に、メモリ10bに格納されている局数表示情報及びPSコードによる放送局名をアスキーコード変換ツール9bを介してディスプレイ14上に表示する。第4図に表示例を示す。

ディスプレイ上に表示された放送局名及びプリセットキーナンバを見ながら、使用者は更にキーマトリクス15のプリセットチャンネルスイッチを操作することによって、所望の放送局を任意に選局することが可能となる。

もちろんキーマトリクス上の他の表示タイプキーを操作した場合には、対応するメモリブロック上に記憶されている放送局名及び周波数、プリセットチャンネルナンバが表示されるようにする。

〔発明の他の実施例〕

上記実施例ではメモリブロック上に記憶された放送局はサーチ結果に基づいて記憶されて行くが、使用者のソート手段を用いることができる。

〔発明の効果〕

この発明は上記のようにPTYコードによって分類された任意な表示タイプ別の放送局が各々のメモリブロックに格納されるので、使用者はキーマトリクスによって所望の表示タイプを選択してその表示タイプを放送する受信局のみをディスプレイ上に表示させることができるので、所望とする番組を選択するのに極めて有効であり、これまでに無い受信機のサービス機能を受けることが可能となる。

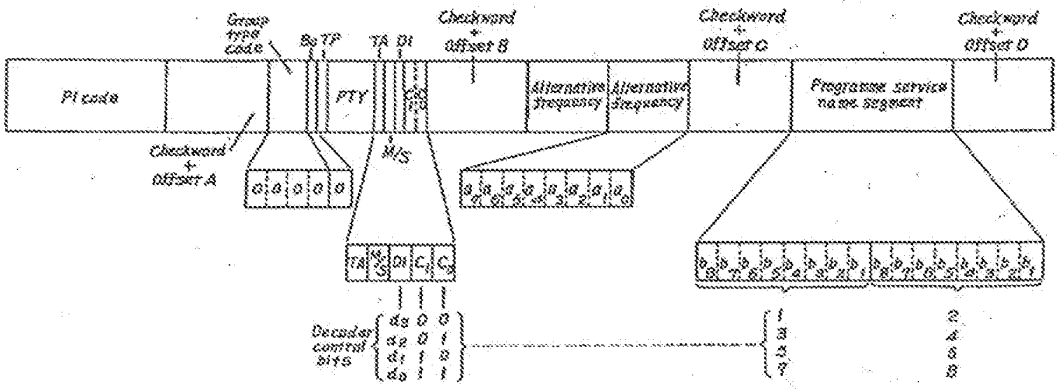
4．図面の簡単な説明

第1図はRDSシステムに用いられる放送データのデータフォーマットを示す図、第2図は本発明の受信機の構成を示すブロック図、第3図は本発明に用いられるキーマトリクスの一実施例を示す正面図、第4図はディスプレイに表示される例を示す正面図、第5図は従来のRDS受信機の構成のブロック図である。

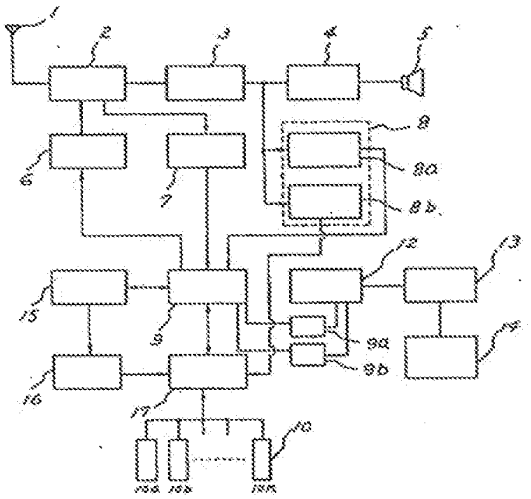
8…RDSデコーダ　9…システムコントローラ　10a～10n…メモリブロック　14…ディスプレイ　15…キーマトリクス　16…キーデコーダ　17…メモリ格納回路

特許出願人
パイオニア株式会社

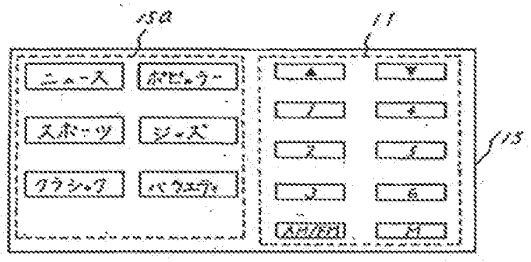
第 1 図



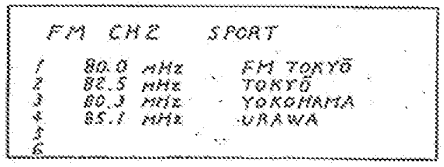
第 2 図



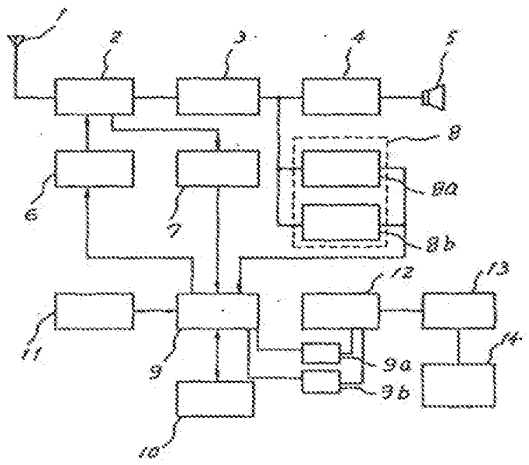
第 3 図



第 4 図



第 5 図



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Applicant: Pioneer Corporation

SPECIFICATION

1. TITLE OF THE INVENTION

RADIO DATA SYSTEM RECEIVER

2. CLAIM

A radio data system receiver for receiving a signal of a broadcast system designed to transmit a data signal other than main signal components together with a broadcast signal, in such a manner as to be superimposed on a FM broadcast wave, comprising:

a decoder operable to demodulate said data signal;

a control circuit operable to store at least information about frequency and broadcast channel name of a received broadcast channel on a predetermined one of a plurality of memory blocks in accordance with a classification based on the content of data demodulated by said decoder; and

display means operable to call up one of the memory blocks in response to a user's operation, and display the classified name allocated into said memory block and the broadcast channel name stored on said memory block.

3. DETAILED DESCRIPTION OF THE INVENTION

[Field of Industrial Application]

This invention relates to a radio receiver for receiving a broadcast wave having a data signal

superimposed thereon.

[Background of the Invention]

Heretofore, a system designed to form a superimposed data signal for identifying a traffic information channel (Autofahrer Rundfunk Information: abbreviated to ARI) has been devised in West Germany, etc.

This ARI has been broadcasted by allowing a subcarrier to be held by a 57 KHz wave, which is a third harmonic wave of a 19 KHz wave serving as a pilot tone for FM broadcasting, to form an identifying signal, and frequency-converting the identifying signal to a main carrier. This identifying signal is referred to as "SK signal". A demodulation side can demodulate the SK signal to facilitate receiving of a broadcast channel providing traffic information.

However, the ARI system is intended to provide only identification data about a traffic information channel but not to provide any other service.

For this reason, a system designed to superimpose onto the same 57 KHz subcarrier a data signal bi-phase coded in a phase different from that of the ARI by 90 degrees, by means FSK (Frequency Shift Keying) and then transmit the data signal (Radio Data System: abbreviated to RDS) has been proposed.

As seen in a baseband coding as shown in FIG. 1, one group of data to be provided by the RDS system is formed of four blocks each consisting of 26 bits.

Each of the blocks comprises a 16-bit information word, and 10-bit check word and offset word, and a receiving side can receive various services by demodulating the information word.

With reference to the data format in FIG. 1, fundamental information will be described below.

16-bit program identification information (PI Code) is allocated into a first block. This PI Code comprises the following total 16-bit codes:

(1) Country Code (4 bits)

(2) Broadcast Coverage or Reach (4 bits)

(3) Program Reference Number Code (4 bits)

, and information about by which of countries a target program is broadcasted, whether the same

program is broadcasted in other country, whether the target program is local or major, etc., is transmitted as data according to a predetermined rule.

A total 5-bit Group Type Identification Code consisting of Group Type Code (4 bits) and Version Code (1 bit) are allocated into a second block. The Group Type Identification Code is provided as a means to identify what data to be transmitted after current data is. While $2^5 = 32$ kinds of group types can be theoretically identified, two versions consisting of versions A and B are set up for four groups consisting of groups 0 to 3, and total 9 groups can be currently identified if undefined groups are added thereto. While a type of data to be subsequently transmitted is changed depending on the groups, its description will be omitted herein.

Subsequently to the group type identification codes, the following codes are allocated:

(1) Traffic Program Code (TP Code: 1 bit)

(2) Program Type Code (PTY Code: 5 bits)

(3) Traffic Announce Code (TA Code: 1 bit)

(4) Music/Speech Switch Code (M/S Code: 1 bit)

(5) Decoder Control Bit (DI Bit: 1 bit)

(6) Address Bit (2 bits)

In the above data, each of the TP Code and TA Code indicates whether a currently-receiving broadcast channel is a traffic information channel or whether the traffic information channel is currently transmitting traffic information, by means of a combination of codes thereof.

The PTY Code is provided as a means to identify 32 kinds of program types consisting of program types 0 to 31 (music program, news program, sports program, etc.), and defined according to a predetermined rule. The list is shown in Table 1.

Table 1

No.	PTY Code	Program Type
1	00000	no program
2	00001	news
3	00010	current events
4	00011	comics
5	00100	sports
6	00101	education
7	00110	program for children
8	00111	program for young people
9	01000	religious program
10	01001	drama
11	01010	rock music
12	01011	light music
13	01100	serious music
14	01101	jazz music
15	01110	folk music
16	01111	variety program
17-30		undefined
31	11111	emergency broadcast

The M/S Code indicates that a speech program is being broadcasted if it is "0", and that a music program is being broadcasted if it is "1".

The DI Bit is provided as a means to provide demodulation information required for demodulating an incoming broadcast wave. While the DI Bit has 1 bit, the DI Bit can be repeatedly received 4 times to obtain 4-bit information (16 kinds of decode information).

While the Address Bit has a function to be changed depending on the aforementioned group types, the Address Bit in this embodiment serves as means to indicate an address of an after-mentioned PS Code. Thus, details of the Address Bit will be described in connection with the PS Code.

Two of 8-bit additional-channel's frequency information (AF Code) are allocated into a third

block.

The AF Code is provided as a means to transmit information about frequency of an additional channel which is transmitting the same program as that of a currently-receiving channel. This frequency information corresponds to 8-bit data at 100 KHz intervals.

No.	AF Code	Carrier Frequency
0	00000000	87.5 MHz
1	00000001	87.6 MHz
.	.	.
.	.	.
202	11001100	107.9 MHz

In this way, each of the 8-bit codes corresponding to the above Nos. is assigned with a different meaning to allow various informations, for example, how many AM channels exist, to be transmitted. This AF Code is repeatedly transmitted up to 25 channels to form an additional channel list.

A Program Service Code (PS Code) for transmitting a broadcast channel name using the ASCII code is allocated into a fourth block. The ASCII code requires an 8-bit binary code per character, and thereby information corresponding to only 2 characters can be transmitted by the fourth block. In the RDS, ASCII data corresponding to 8 characters can be obtained only after data in the fourth block is received 4 times.

During this process, the aforementioned Address Bit in the second block serves as a means to determine to what number character a currently-transmitted PS Code corresponds, and indicates the following correspondence.

Address Bit	Character Order
00	1st, 2nd character
01	3rd, 4th character
10	5th, 6th character
11	7th, 8th character

As above, the Address Bit designates to what number character of a channel name information in a currently-transmitted PS Code corresponds, and a receiving/demodulation side can demodulate a broadcast channel name consisting of 8 characters by repeating a demodulation operation 4 times.

[Prior Art]

By taking advantage of the above RDS system, a listener can learn the content of a program of a currently-receiving radio broadcast according to the PTY Code, and display the name of the broadcast channel providing the program, on a display or the like according to the PS Code.

One example using a conventional RDS tuner is shown in FIG. 5.

In this figure, a signal passing through a front end module 2 and a FM wave detector circuit 3 after being received from an antenna 1 is amplified by an amplifier 4, and output from a speaker 5 in an audio manner. The output of the amplifier 4 is also entered into an RDS decoder 8 including a PS Code decoder 8a and PTY data decoder 8b. The aforementioned RDS data demodulated by the RDS decoder 8 is send to a system controller 9. The system controller 9 determines the presence of a receivable channel in accordance with an output of an S-meter detection circuit for detecting an S-meter output obtained by detecting from the front end module 2 DC components of an intermediate frequency output of a currently-receiving channel, and sends PLL data to a PLL 6 to perform a conventional tuning operation, or instructs to sequentially sweep over the entire receive band in response to a sweeping command signal from an input section 11.

The reference numeral 10 indicates a memory for storing information about frequency of a receivable channel. The frequency information is called from a given block of the memory in response of an operation of the input section 11, and the system controller 9 sends tuning information to the PLL 6. In this process, the frequency information, the broadcast channel name using the PS Code and/or the program content using the PTY Code are converted to character information by use of a PTY data table 9a for storing character information corresponding to the PTY Code, and an ASCII code conversion tool 9a, and then displayed on a display 14 composed of a dot-matrix display tube or the like, through a character generator 12 and a liquid-crystal driver 13

When the RDS receiver in FIG. 5 sequentially sweeps over the entire band, and the S-meter detection circuit 7 detects the presence of a receivable channel, the RDS decoder 8 demodulates RDS codes consisting of the PTY Code from the second block and the PS Code from the fourth block, and the system controller instructs to display the demodulated information on the display 14 and store/hold the frequency information and the PS Code on the memory 10.

The input section 11 can be operated to call the broadcast channel preset in the memory 10 so as to receive the broadcast channel to provide an audio output, and display the program type and the name of the broadcast channel on the display 14. This provides an improved service for a listener.

[Problem to be solved by the Invention]

As described above, in the conventional RDS receiver, only after calling up a preset broadcast channel, a listener can know the content of a currently-broadcasting program of the broadcast channel or the name of the broadcast channel. However, when a listener intends to "listen to news" or "find a broadcast channel transmitting sports program on the spot", the listener has to call up all preset channels or to search a desired broadcast cannel while commanding a sweeping operation and confirming the content of a caught broadcast channel. Particularly, in an in-vehicle receiver, such an operation during driving involves the risk of deterioration in safety due to distraction, and becomes a sort of social issue.

[Means for solving the Problem]

It is an object of this invention to provide a receiver capable of overcoming the aforementioned problem of the conventional technique, wherein a plurality of broadcast channels obtained by sequentially sweeping over the entire receive band according to a sweeping command are classified on a PTY Code-by-PTY Code basis to store them, respectively, on a group of different memories, and display a program type and a broadcast channel name classified and preset in the group of memories are displayed on a display.

[Embodiment of the Invention]

One embodiment of this invention is shown in FIG. 2. In this figure, the same component as that in the conventional technique is defined by the same reference numeral, and its description will

be omitted.

In this invention, a memory 10 has a plurality of memory blocks a to n, and each of the memory blocks has a memory table.

As with the conventional input section 11, a key matrix 15 comprises a preset channel selection key and a sweeping command key. Further, as shown in FIG. 3, the key matrix 15 includes a major program typing input section 15a conforming to a classification of a PTY Code. The number of keys in the program typing input section 15a is set to be equal to the number of the memory blocks.

When the key matrix 15 is operated to issue a sweeping command to a system controller 9, a receivable broadcast channel is received by a conventional search function. During this process, a memory control circuit 17 operates to allow information about frequency and PS Code of the received channel to be stored on a given one of the memory blocks 10a to 10n pre-classified on a major program type-by-major program type basis, depending on data (numerical value information) obtained by a PTY Code decoder 8b of an RDS decoder 8. The memory control circuit 17 controls a writing operation to the memory in such a manner as to allow a predetermined program type of broadcast channel to be preset in a corresponding one of the memory blocks, for example, in such a manner that a news program defined by PTY Code No. 1 and a sports program defined by PTY Code No. 4 are stored, respectively, on the memory block 10a and the memory block 10b. Thus, after one cycle of the search, information about a plurality of broadcast channels classified by the PTY Code is stored on the memory blocks.

After completion of the presetting, when a user intends to listen, for example, to "sports program", the user can operate a "sports" key of the key matrix 15. In response to this operation, a key decoder 16 controls the memory control circuit 17 in such a manner as to select the memory content of the memory block 10b.

The system controller 9 instructs a display 14 to display thereon a program type name defined by the memory 10b and to display thereon information about frequency and a PS Code-based broadcast channel name stored in the memory block 10b through an ASCII code conversion tool 9b.

One example of a screen image of the display is shown in FIG. 4.

A user can further operate a preset channel switch of the key matrix 15 while looking at the broadcast channel names and a preset key numbers displayed on the display, to freely select a suitable broadcast channel.

As will be understood, this receiver is designed such that, if another program type of key on the key matrix is operated, broadcast channel names, frequencies and preset channel numbers stored on the corresponding memory block are displayed.

[Another Embodiment of the invention]

In the above embodiment, the broadcast channels stored on the memory blocks are stored in accordance with a search result, and thereby arranged in the order corresponding to their frequencies. These broadcast channels may be rearranged in the order corresponding to an S-meter output detected by an S-meter detection circuit 7 in such a manner that a broadcast channel having the strongest field intensity is displayed at a top position to allow the displayed data to be used as a criterion of user's judgment during channel selection. For this purpose, in addition to frequency information and PS codes, information about field intensity may be stored in the memory to rearrange broadcast channels in the order corresponding to field intensity. As to a technique for the rearrangement, a field intensity of a preset channel at a top position in the memory is compared with a field intensity of a received broadcast channel, and, when the field intensity of the received broadcast channel is greater than that of the preset channel, the received broadcast channel is placed at the top position in place of the preset channel, and previously stored data are shifted in turn. If the field intensity of the received broadcast channel is greater than that of the preset channel at the top position in the memory, the field intensity of the received broadcast channel is compared with that of a preset channel at the next position in sequence. In this way, the broadcast channels in the memory blocks will be rearranged in the order corresponding to their field intensities, in the last result.

The technique for the rearrangement is not limited to the above technique, but a conventional sorting technique may also be used.

[Effect of the Invention]

As mentioned above, according to this invention, broadcast channels classified on a major program type-by-major program type basis using the PTY Code are stored on a plurality of memory block. A user can select a desired program type using a key matrix to display on a display only receivable channels transmitting the selected type of program. This is significantly effective in selecting a desired program, and is capable of receiving services in a manner that was previously impossible.

4. BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a diagram showing a data format of a broadcast data to be used for an RDS system.

FIG. 2 is a block diagram showing the configuration of a receiver of the present invention.

FIG. 3 is a front view showing one example of a key matrix for use in the present invention.

FIG. 4 is a front view showing one example of a screen image on a display.

FIG. 5 is a block diagram showing the configuration of a conventional RDS receiver.

8: RDS decoder

9: system controller

10a to 10n: memory block

14: display

15: key matrix

16: key decoder

17: memory control circuit

FIG. 3

15a

news pop

sports jazz

classical variety

⑲日本国特許庁（ＪＰ）　⑪特許出願公開

⑫公開特許公報（Ａ）　昭63－136828

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審査請求　未請求　発明の数 1　（全7頁）

⑭発明の名称　ラジオデータシステム受信機

⑳特　願　昭61－283675

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明　細　書

１．発明の名称

ラジオデータシステム受信機

２．特許請求の範囲

ＦＭ放送波に主信号成分以外のデータ信号を重畳して放送局と共に送出する放送システムを受信する受信機であって、前記データ信号を復調するデコーダと、前記デコーダによって復調されたデータ内容に基づいた分類によって予め定められたメモリブロックに受信した放送局の周波数情報及び放送局名データ情報を少なくとも記憶する前記回路を備え、使用者の操作により前記メモリブロックの１つを呼び出すと共に、前記メモリブロックに与えられた分類名と、前記メモリブロック内に格納された放送局名を表示する表示手段を備えたことを特徴とするラジオデータシステム受信機。

３．発明の詳細な説明

〔産業上の利用分野〕

この発明は、データ信号が重畳された放送波を受信するラジオ受信機に関するものである。

〔発明の背景〕

従来西独等で交通情報局識別のためのデータ信号を重畳したシステム（Autofahrer Rundfunk Information：略称ＡＲＩ）が考案されている。

このＡＲＩはＦＭ放送のパイロットトーンである１９ＫＨｚの３次高調波である５７ＫＨｚにサブキャリアを乗せて識別信号とし、これをメインキャリアに周波数変換して放送していた。この識別信号はＳＫ信号と称され、受信機はこのＳＫ信号を復調することにより交通情報を供給している放送局の受信を容易にしていた。

しかしＡＲＩシステムは交通情報局に対する識別のみを供給するものであり、それ以上のサービスを供給するものではない。

そこで同じ５７ＫＨｚのサブキャリアにＡＲＩの位相と９０°異なる位相でバイフェーズコード化されたデータ信号をＦＳＫ（Frequency Shift Keying）変調して送出するシステム（Radio Data

System：略称RDSシステム）が提案された。

RDSシステムにおいて伝送されるデータは第1図に示されるベースバンドコーディングに見られるように夫々が26ビットからなる4つのブロックにより1グループが形成されている。

夫々のブロックには16ビットの情報ワードと10ビットのチェックワード及びオフセットワードからなり、受信側では情報ワードをデータ処理することにより様々なサービスの供給を受けることが可能となる。

第1図のデータフォーマットに基づいて基本的な情報を説明する。

第1ブロックにはプログラム識別情報（PIコード）16ビットが与えられている。このPIコードは

①識別コード（4ビット）
②放送局コード（4ビット）
③プログラム参照ナンバーコード（8ビット）

の計16ビットにより構成され、その放送がどの国の放送のものか、地域でも同じ放送が行われているか、ローカルな番組なのかメジャーな番組なのかの情報をあらかじめ定められた規約に基づいてデータとして送られる。

第2ブロックにはグループタイプコード（4ビット）、バージョンコード（1ビット）の計5ビットによるグループタイプ識別コードが与えられている。このグループタイプ識別コードは、その後に送られるデータには何が送られているかを識別させるためのものであり、理論的には$2^5=32$通りのグループタイプを識別可能であるが、現在ではグループ0～3の4つのグループに対してバージョンA及びBの2バージョンが定められており、これに未定義のグループを加えて計9つのグループを識別可能にしている。グループによって各時に送られるデータの種類が異なるがここではその説明を省略する。

グループタイプ識別コードに続いて

④交通番組コード（TPコード・1ビット）
⑤プログラムタイプコード（PTYコード・5ビット）

⑥交通アナウンスコード（TAコード・1ビット）
⑦ミュージック／スピーチスイッチコード（M／Sコード・1ビット）
⑧デコーダコントロールビット（DIビット、1ビット）
⑨アドレスビット（2ビット）

が与えられている。

上記データにおいて、TPコードとTAコードは放送中の局が交通情報局であるか、あるいはそれが現在放送中であるかを夫々のコードの組み合わせで示している。

PTYコードは0～31の32種類の番組タイプ（音楽番組、ニュース番組、スポーツ番組など）を識別するものであり、あらかじめ定められた規約に基づいて用いられており、その一覧を表1に示す。

（以下余白）

表1

NO.	PTYコード	番組タイプ
1	00000	番組なし
2	00001	ニュース
3	00010	時事
4	00011	マンガ
5	00100	スポーツ
6	00101	教育
7	00110	子供向け番組
8	00111	若人向け番組
9	01000	家庭番組
10	01001	ドラマ
11	01010	ロックミュージック
12	01011	軽音楽
13	01100	シリアスミュージック
14	01101	ジャズ
15	01110	フォークミュージック
16	01111	バラエティ
17～30		未定義
31	11111	緊急放送

M／Sコードは"0"ならばスピーチ、"1"ならば音楽が放送中であることを示している。

D1ビットは、送られてくる放送局を識別するデコード情報を与えるものであり、1ビットが与えられているが、これを4回繰り返して受信することにより4ビットの情報（16通りのデコード情報）を得られるようにしている。

アドレスビットは先述したグループタイプにより異なる意味が異なるが、この実施例では後述するPSコードのアドレスを示すものであり、詳しくはPSコードの説明中で説明する。

第3ブロックには他局周波数情報（AFコード）8ビットが2つ与えられている。

このAFコードは放送中の局と同一情報を放送中の他局の周波数情報を伝送する。この周波数情報は100KHz毎に8ビットのデータと対応している。

ナンバー	AFコード	キャリア周波数
0	00000000	87.5MHz
1	00000001	87.6MHz
2	00000010	87.7MHz
3	00000011	87.8MHz
4	00000100	87.9MHz
・	・	・
・	・	・
・	・	・
204	11001100	107.9MHz

これより上のナンバーに対応する8ビットコードには別の意味が与えられており、例えばAF局が何局存在するかその情報を送っている。このAFコードは25局まで順次送られて、受信局リストとなる。

第4ブロックには放送局名がアスキーコードで送られてくるプログラムサービスコード（PSコード）が与えられている。アスキーコードは1キャラクターに付きバイナリーコードで8ビットを必要とするために、第4ブロックでは2文字分しか伝送できない。RDSにおいては放送局名は8文字で与えるようにしているために、4回のデータを受けとって初めて8文字分のアスキーデータを得ることになる。

このときに今送られているPSコードは8文字の何文字目にあたるかを定めるのが前述した第2ブロックのアドレスビットであり、次の対応をしている。

アドレスビット	文字識別
0 0	1，2文字目
0 1	3，4文字目
1 0	5，6文字目
1 1	7，8文字目

このようにアドレスビットにより現在送られているPSコードの情報が局名の何文字目にあたるかを確定しており、受信・復調部では4回繰返して復調することにより8文字からなる放送局名を復調することが可能となる。

〔従来の技術〕

上述したRDSシステムを用いて、地域毎に現在放送中のラジオ放送がどのような番組内容かをPTYコードによって知ることができ、またPSコードによってその放送局名をディスプレイなどに表示させることが可能となる。

第5図に従来のRDSチューナを用いた一実施例を示す。

図において、アンテナ1からフロントエンド2、及びFM検波回路3を介した信号は、アンプ4で増幅されてスピーカ5から音声出力されるほか、アンプ4の出力はPSコードデコーダ6a及びPTYデータデコーダ8bをもつRDSデコーダ8に入力され、RDSデコーダ8で復調した前述のRDSデータは、システムコントローラ9に与えられる。システムコントローラ9はフロントエンド2から受信局の中間周波出力を検波増幅して得られるSメータ出力を検出するSメータ検知回路7の出力により受信局の有無を識別すると共に、PLL6にPLLデータを与えて周波の選局動作を行わせたり或いは入力部11からの指示信号信号によって受信バンド帯域内を順次探索する。

10は受信局の周波数情報を記憶するメモリであり、入力部11の操作によって所定のメモリから周波数情報を呼び出してシステムコントローラ9よりPLL6に選局情報を与える。このときの周波数情報やPSコードを利用した放送局名、あるいはPTYコードを利用した番組内容などをP

ＴＹコードに対応する文字情報を格納するＰＴＹデータテーブル９ａ及びアスキーコード変換ツール９ｂなどによってキャラクタ情報に変換した後にキャラクタジェネレータ１２及び表示ドライバ１３を介してドットマトリクス表示管などよりなるディスプレイ１４に表示させる。

第５図のＲＤＳ受信機によってバンド内を順次検索してＳメータ検知回路７によって放送局のあることを検出すると、ＲＤＳデコーダ８によってＲＤＳコードの第２ブロックからＰＴＹコードを、第４ブロックからＰＳコードを夫々復調することによりシステムコントローラはそれらの情報をディスプレイ１４に表示し、メモリ１０に周波数情報及びＰＳコードを記憶保持する。

メモリ１０にプリセットされた放送局を入力部１１より呼び出すことによってその放送局が受信され、音声出力されると共にディスプレイ１４にはその番組タイプや放送局名が表示され、聴取者へのサービスとなる。

（発明が解決しようとする問題点）

従来のＲＤＳ受信機は、上述したようにプリセットした放送局を呼び出して初めてその放送局が放送中の番組内容や放送局名を知ることになるが、予め「ニュースが聞きたい」「どこかでスポーツ中継しているところはないか」というような場合には、すべてのプリセットチャンネルを呼び出すか、検索指令をしながらキャッチした放送局の内容を確認しながら所望とする放送局を探すことになり、特に車載用の受信機の場合運転中の注意力が散漫になるために危険性をともない、ある種の社会問題となっている。

（問題点を解決するための手段）

この発明は、上述した従来技術のもつ問題を克服した受信機を提供することを目的とするものであり、検索指令によって受信バンド帯域内を順次検索して得られた放送局をＰＴＹコード別に分類して夫々ことなるグループのメモリにメモリし、更にそのグループメモリ内に分類されてプリセットされている番組タイプと放送局名をディスプレイ上に表示することを特徴とするものである。

（発明の実施例）

第２図にこの発明の一実施例を示す。なお従来技術と同一の部分には同一の符号を付してその説明を省略する。

この発明ではメモリ１０がａ～ｎの複数のメモリブロックを有しており、夫々のメモリには所定数のメモリテーブルを備えてある。

キーマトリクス１５は従来の入力部１１と同様のプリセットチャンネル選択キー及び検索指令キーなどの構成を備えるほかに、第３図に示すようにＰＴＹコードの分類に応じた主要番組タイプ入力部１５ａを有しており、この番組タイプ入力部１５ａのキーの数は、メモリブロックの数と同数になっている。

キーマトリクス１５を操作してシステムコントローラ９に対して検索指令を与えると、周知のサーチ機能によって受信可能な放送局を受信する。このときにＲＤＳデコーダ８のＰＴＹコードデコーダ８ｂによって得られるデータ（放送情報）に応じてメモリ制御回路１７は主要な番組タイプ別に予め分類されたメモリブロック１０ａ～１０ｎの所定のメモリブロックの１つに受信局の周波数情報及びＰＳコードを記憶する。例えばＰＴＹコードＮＯ「１」で与えられるニュース番組はメモリ１０ａに、ＰＴＹコードＮＯ「４」で与えられるスポーツ番組はメモリ１０ｂにというように夫々のメモリブロックに予め定めた番組タイプの放送局がプリセットされるようにメモリ制御回路１７がメモリへの書き込み動作を制御する。この結果によりサーチ後の後メモリブロック上にはＰＴＹコードによって分類された放送局情報が格納されたことになる。

プリセットが終了した後に使用者が例えば「スポーツ番組」を聴取したい場合には、キーマトリクス１５の「スポーツ」キーを操作することによって、キーデコーダ１６はメモリ制御回路１７がメモリ１０ｂのメモリ内容を選択するように制御

する。

システムコントローラ9はメモリ10bに定められている番組タイプ名をディスプレイ14に表示させると共に、メモリ10bに格納されている周波数情報及びPSコードによる放送局名をアスキーコード変換ツール9bを介してディスプレイ14上に表示する。第4図に表示例を示す。

ディスプレイ上に表示された放送局名及びプリセットキーナンバを見ながら、使用者は更にキーマトリクス15のプリセットチャンネルスイッチを操作することによって、好きな放送局を任意に選局することが可能となる。

もちろんキーマトリクス上の他の番組タイプキーを操作した場合には、対応するメモリブロック上に記憶されている放送局名及び周波数、プリセットチャンネルナンバが表示されるようにする。

〔発明の他の実施例〕

上記実施例ではメモリブロック上に記憶された放送局はサーチ結果に基づいて記憶されて行くので周波数順に並ぶことになるが、これをSメータ検知回路7によって検出されるSメータ出力の大きい順に並び換えを行うことによって、最も電界強度の強い放送局がディスプレイ14の先頭に表示されるようにすることによって、使用者の選局時の判断基準にするようにしてもよい。このためにはメモリ内に周波数情報、PSコードのほか電界強度情報のデータをも格納し、電界強度順に並び変えることにより実現される。並び換えの手段については事前に記憶されている先頭のメモリ位置のプリセット局の電界強度と、受信した放送局の電界強度とを比較して大きければそのメモリ位置に受信した放送局情報を登録して、それまでの記憶されていた情報を順次シフトし、もしも受信した放送局の電界強度が先頭のメモリ位置のプリセット局の電界強度よりも小さいときには、次のプリセット局の電界強度と順次比較して行くことによって、最終的にはメモリブロック内の放送局は電界強度順に並び変えられることになる。

並び換えの手段は上記の手段に限定されることなく周知の種々のソート手段を用いることができる。

〔発明の効果〕

この発明は上記のようにPTYコードによって分類された主要な番組タイプ別の放送局が複数のメモリブロックに格納されるので、使用者はまずキーマトリクスによって所望の番組タイプを選択してその番組タイプを放送する受信局のみをディスプレイ上に表示させることができるので、所望とする番組を選択するのに極めて有効であり、これまでに無い受信機のサービス機能を受けることが可能となる。

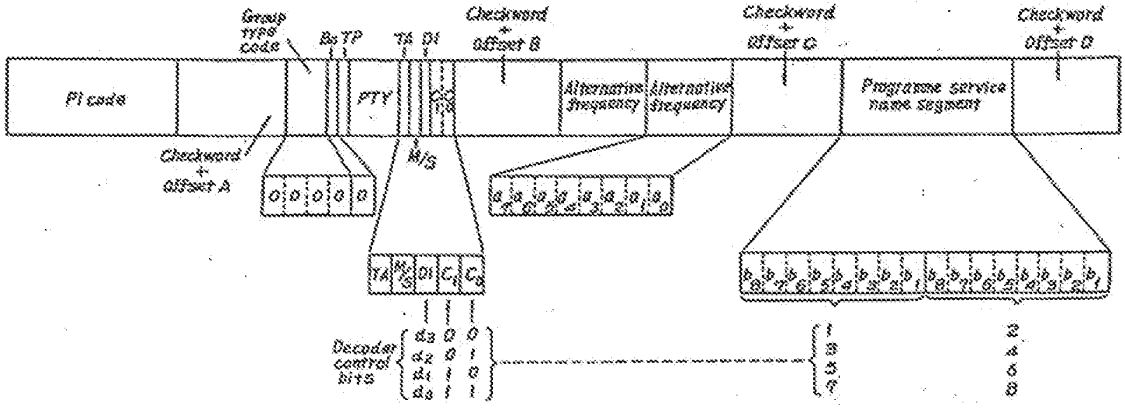
4．図面の簡単な説明

第1図はRDSシステムに用いられる放送データのデータフォーマットを示す図、第2図は本発明の受信機の構成を示すブロック図、第3図は本発明に用いられるキーマトリクスの一実施例を示す正面図、第4図はディスプレイに表示される例を示す正面図、第5図は従来のRDS受信機の構成を示すブロック図である。

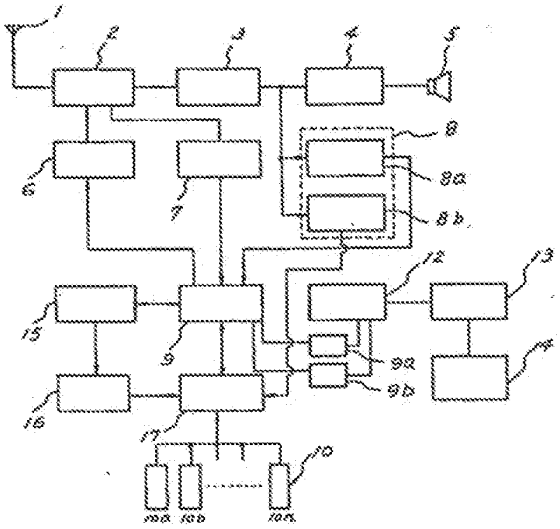
8…RDSデコーダ　9…システムコントローラ　10a～10n…メモリブロック　14…ディスプレイ　15…キーマトリクス　16…キーデコーダ　17…メモリ制御回路

特許出願人
パイオニア株式会社

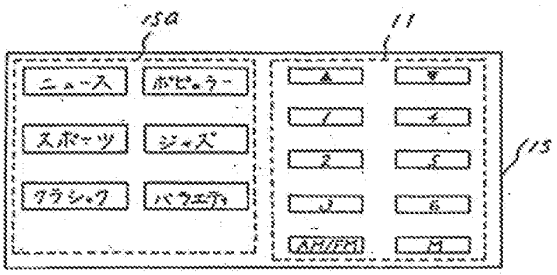
第 1 図



第 2 図



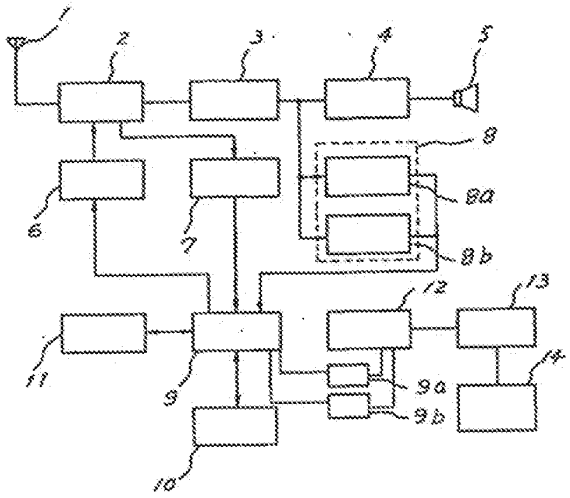
第 3 図



第 4 図

FM CH2	SPORT	
1	80.0 MHz	FM TOKYO
2	82.5 MHz	TOKYO
3	88.3 MHz	YOKOHAMA
4	95.1 MHz	URAWA
5		
6		

第 5 図



Patent Laid-Open Publication No. 63-136828
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Patent Application No. 61-283675
Filing Date: November 28, 1986
Applicant: Pioneer Corporation

SPECIFICATION

1. TITLE OF THE INVENTION

RADIO DATA SYSTEM RECEIVER

2. CLAIM

A radio data system receiver for receiving a signal of a broadcast system designed to transmit a data signal other than main signal components together with a broadcast signal, in such a manner as to be superimposed on a FM broadcast wave, comprising:

a decoder operable to demodulate said data signal;

a control circuit operable to store at least information about frequency and broadcast channel name of a received broadcast channel on a predetermined one of a plurality of memory blocks in accordance with a classification based on the content of data demodulated by said decoder; and

display means operable to call up one of the memory blocks in response to a user's operation, and display the classified name allocated into said memory block and the broadcast channel name stored on said memory block.

3. DETAILED DESCRIPTION OF THE INVENTION

[Field of Industrial Application]

This invention relates to a radio receiver for receiving a broadcast wave having a data signal

superimposed thereon.

[Background of the Invention]

Heretofore, a system designed to form a superimposed data signal for identifying a traffic information channel (Autofahrer Rundfunk Information: abbreviated to ARI) has been devised in West Germany, etc.

This ARI has been broadcasted by allowing a subcarrier to be held by a 57 KHz wave, which is a third harmonic wave of a 19 KHz wave serving as a pilot tone for FM broadcasting, to form an identifying signal, and frequency-converting the identifying signal to a main carrier. This identifying signal is referred to as "SK signal". A demodulation side can demodulate the SK signal to facilitate receiving of a broadcast channel providing traffic information.

However, the ARI system is intended to provide only identification data about a traffic information channel but not to provide any other service.

For this reason, a system designed to superimpose onto the same 57 KHz subcarrier a data signal bi-phase coded in a phase different from that of the ARI by 90 degrees, by means FSK (Frequency Shift Keying) and then transmit the data signal (Radio Data System: abbreviated to RDS) has been proposed.

As seen in a baseband coding as shown in FIG. 1, one group of data to be provided by the RDS system is formed of four blocks each consisting of 26 bits.

Each of the blocks comprises a 16-bit information word, and 10-bit check word and offset word, and a receiving side can receive various services by demodulating the information word.

With reference to the data format in FIG. 1, fundamental information will be described below.

16-bit program identification information (PI Code) is allocated into a first block. This PI Code comprises the following total 16-bit codes:

(1) Country Code (4 bits)

(2) Broadcast Coverage or Reach (4 bits)

(3) Program Reference Number Code (4 bits)

, and information about by which of countries a target program is broadcasted, whether the same

program is broadcasted in other country, whether the target program is local or major, etc., is transmitted as data according to a predetermined rule.

A total 5-bit Group Type Identification Code consisting of Group Type Code (4 bits) and Version Code (1 bit) are allocated into a second block. The Group Type Identification Code is provided as a means to identify what data to be transmitted after current data is. While $2^5 = 32$ kinds of group types can be theoretically identified, two versions consisting of versions A and B are set up for four groups consisting of groups 0 to 3, and total 9 groups can be currently identified if undefined groups are added thereto. While a type of data to be subsequently transmitted is changed depending on the groups, its description will be omitted herein.

Subsequently to the group type identification codes, the following codes are allocated:

(1) Traffic Program Code (TP Code: 1 bit)

(2) Program Type Code (PTY Code: 5 bits)

(3) Traffic Announce Code (TA Code: 1 bit)

(4) Music/Speech Switch Code (M/S Code: 1 bit)

(5) Decoder Control Bit (DI Bit: 1 bit)

(6) Address Bit (2 bits)

In the above data, each of the TP Code and TA Code indicates whether a currently-receiving broadcast channel is a traffic information channel or whether the traffic information channel is currently transmitting traffic information, by means of a combination of codes thereof.

The PTY Code is provided as a means to identify 32 kinds of program types consisting of program types 0 to 31 (music program, news program, sports program, etc.), and defined according to a predetermined rule. The list is shown in Table 1.

Table 1

No.	PTY Code	Program Type
1	00000	no program
2	00001	news
3	00010	current events
4	00011	comics
5	00100	sports
6	00101	education
7	00110	program for children
8	00111	program for young people
9	01000	religious program
10	01001	drama
11	01010	rock music
12	01011	light music
13	01100	serious music
14	01101	jazz music
15	01110	folk music
16	01111	variety program
17-30		undefined
31	11111	emergency broadcast

The M/S Code indicates that a speech program is being broadcasted if it is "0", and that a music program is being broadcasted if it is "1".

The DI Bit is provided as a means to provide demodulation information required for demodulating an incoming broadcast wave. While the DI Bit has 1 bit, the DI Bit can be repeatedly received 4 times to obtain 4-bit information (16 kinds of decode information).

While the Address Bit has a function to be changed depending on the aforementioned group types, the Address Bit in this embodiment serves as means to indicate an address of an after-mentioned PS Code. Thus, details of the Address Bit will be described in connection with the PS Code.

Two of 8-bit additional-channel's frequency information (AF Code) are allocated into a third

block.

The AF Code is provided as a means to transmit information about frequency of an additional channel which is transmitting the same program as that of a currently-receiving channel. This frequency information corresponds to 8-bit data at 100 KHz intervals.

No.	AF Code	Carrier Frequency
0	00000000	87.5 MHz
1	00000001	87.6 MHz
⋮	⋮	⋮
⋮	⋮	⋮
202	11001100	107.9 MHz

In this way, each of the 8-bit codes corresponding to the above Nos. is assigned with a different meaning to allow various informations, for example, how many AM channels exist, to be transmitted. This AF Code is repeatedly transmitted up to 25 channels to form an additional channel list.

A Program Service Code (PS Code) for transmitting a broadcast channel name using the ASCII code is allocated into a fourth block. The ASCII code requires an 8-bit binary code per character, and thereby information corresponding to only 2 characters can be transmitted by the fourth block. In the RDS, ASCII data corresponding to 8 characters can be obtained only after data in the fourth block is received 4 times.

During this process, the aforementioned Address Bit in the second block serves as a means to determine to what number character a currently-transmitted PS Code corresponds, and indicates the following correspondence.

Address Bit	Character Order
00	1st, 2nd character
01	3rd, 4th character
10	5th, 6th character
11	7th, 8th character

As above, the Address Bit designates to what number character of a channel name information in a currently-transmitted PS Code corresponds, and a receiving/demodulation side can demodulate a broadcast channel name consisting of 8 characters by repeating a demodulation operation 4 times. [Prior Art]

By taking advantage of the above RDS system, a listener can learn the content of a program of a currently-receiving radio broadcast according to the PTY Code, and display the name of the broadcast channel providing the program, on a display or the like according to the PS Code.

One example using a conventional RDS tuner is shown in FIG. 5.

In this figure, a signal passing through a front end module 2 and a FM wave detector circuit 3 after being received from an antenna 1 is amplified by an amplifier 4, and output from a speaker 5 in an audio manner. The output of the amplifier 4 is also entered into an RDS decoder 8 including a PS Code decoder 8a and PTY data decoder 8b. The aforementioned RDS data demodulated by the RDS decoder 8 is send to a system controller 9. The system controller 9 determines the presence of a receivable channel in accordance with an output of an S-meter detection circuit for detecting an S-meter output obtained by detecting from the front end module 2 DC components of an intermediate frequency output of a currently-receiving channel, and sends PLL data to a PLL 6 to perform a conventional tuning operation, or instructs to sequentially sweep over the entire receive band in response to a sweeping command signal from an input section 11.

The reference numeral 10 indicates a memory for storing information about frequency of a receivable channel. The frequency information is called from a given block of the memory in response of an operation of the input section 11, and the system controller 9 sends tuning information to the PLL 6. In this process, the frequency information, the broadcast channel name using the PS Code and/or the program content using the PTY Code are converted to character information by use of a PTY data table 9a for storing character information corresponding to the PTY Code, and an ASCII code conversion tool 9a, and then displayed on a display 14 composed of a dot-matrix display tube or the like, through a character generator 12 and a liquid-crystal driver 13

When the RDS receiver in FIG. 5 sequentially sweeps over the entire band, and the S-meter detection circuit 7 detects the presence of a receivable channel, the RDS decoder 8 demodulates RDS codes consisting of the PTY Code from the second block and the PS Code from the fourth block, and the system controller instructs to display the demodulated information on the display 14 and store/hold the frequency information and the PS Code on the memory 10.

The input section 11 can be operated to call the broadcast channel preset in the memory 10 so as to receive the broadcast channel to provide an audio output, and display the program type and the name of the broadcast channel on the display 14. This provides an improved service for a listener.

[Problem to be solved by the Invention]

As described above, in the conventional RDS receiver, only after calling up a preset broadcast channel, a listener can know the content of a currently-broadcasting program of the broadcast channel or the name of the broadcast channel. However, when a listener intends to "listen to news" or "find a broadcast channel transmitting sports program on the spot", the listener has to call up all preset channels or to search a desired broadcast cannel while commanding a sweeping operation and confirming the content of a caught broadcast channel. Particularly, in an in-vehicle receiver, such an operation during driving involves the risk of deterioration in safety due to distraction, and becomes a sort of social issue.

[Means for solving the Problem]

It is an object of this invention to provide a receiver capable of overcoming the aforementioned problem of the conventional technique, wherein a plurality of broadcast channels obtained by sequentially sweeping over the entire receive band according to a sweeping command are classified on a PTY Code-by-PTY Code basis to store them, respectively, on a group of different memories, and display a program type and a broadcast channel name classified and preset in the group of memories are displayed on a display.

[Embodiment of the Invention]

One embodiment of this invention is shown in FIG. 2. In this figure, the same component as that in the conventional technique is defined by the same reference numeral, and its description will

be omitted.

In this invention, a memory 10 has a plurality of memory blocks a to n, and each of the memory blocks has a memory table.

As with the conventional input section 11, a key matrix 15 comprises a preset channel selection key and a sweeping command key. Further, as shown in FIG. 3, the key matrix 15 includes a major program typing input section 15a conforming to a classification of a PTY Code. The number of keys in the program typing input section 15a is set to be equal to the number of the memory blocks.

When the key matrix 15 is operated to issue a sweeping command to a system controller 9, a receivable broadcast channel is received by a conventional search function. During this process, a memory control circuit 17 operates to allow information about frequency and PS Code of the received channel to be stored on a given one of the memory blocks 10a to 10n pre-classified on a major program type-by-major program type basis, depending on data (numerical value information) obtained by a PTY Code decoder 8b of an RDS decoder 8. The memory control circuit 17 controls a writing operation to the memory in such a manner as to allow a predetermined program type of broadcast channel to be preset in a corresponding one of the memory blocks, for example, in such a manner that a news program defined by PTY Code No. 1 and a sports program defined by PTY Code No. 4 are stored, respectively, on the memory block 10a and the memory block 10b. Thus, after one cycle of the search, information about a plurality of broadcast channels classified by the PTY Code is stored on the memory blocks.

After completion of the presetting, when a user intends to listen, for example, to "sports program", the user can operate a "sports" key of the key matrix 15. In response to this operation, a key decoder 16 controls the memory control circuit 17 in such a manner as to select the memory content of the memory block 10b.

The system controller 9 instructs a display 14 to display thereon a program type name defined by the memory 10b and to display thereon information about frequency and a PS Code-based broadcast channel name stored in the memory block 10b through an ASCII code conversion tool 9b.

One example of a screen image of the display is shown in FIG. 4.

A user can further operate a preset channel switch of the key matrix 15 while looking at the broadcast channel names and a preset key numbers displayed on the display, to freely select a suitable broadcast channel.

As will be understood, this receiver is designed such that, if another program type of key on the key matrix is operated, broadcast channel names, frequencies and preset channel numbers stored on the corresponding memory block are displayed.

[Another Embodiment of the invention]

In the above embodiment, the broadcast channels stored on the memory blocks are stored in accordance with a search result, and thereby arranged in the order corresponding to their frequencies. These broadcast channels may be rearranged in the order corresponding to an S-meter output detected by an S-meter detection circuit 7 in such a manner that a broadcast channel having the strongest field intensity is displayed at a top position to allow the displayed data to be used as a criterion of user's judgment during channel selection. For this purpose, in addition to frequency information and PS codes, information about field intensity may be stored in the memory to rearrange broadcast channels in the order corresponding to field intensity. As to a technique for the rearrangement, a field intensity of a preset channel at a top position in the memory is compared with a field intensity of a received broadcast channel, and, when the field intensity of the received broadcast channel is greater than that of the preset channel, the received broadcast channel is placed at the top position in place of the preset channel, and previously stored data are shifted in turn. If the field intensity of the received broadcast channel is greater than that of the preset channel at the top position in the memory, the field intensity of the received broadcast channel is compared with that of a preset channel at the next position in sequence. In this way, the broadcast channels in the memory blocks will be rearranged in the order corresponding to their field intensities, in the last result.

The technique for the rearrangement is not limited to the above technique, but a conventional sorting technique may also be used.

[Effect of the Invention]

As mentioned above, according to this invention, broadcast channels classified on a major program type-by-major program type basis using the PTY Code are stored on a plurality of memory block. A user can select a desired program type using a key matrix to display on a display only receivable channels transmitting the selected type of program. This is significantly effective in selecting a desired program, and is capable of receiving services in a manner that was previously impossible.

4. BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a diagram showing a data format of a broadcast data to be used for an RDS system.

FIG. 2 is a block diagram showing the configuration of a receiver of the present invention.

FIG. 3 is a front view showing one example of a key matrix for use in the present invention.

FIG. 4 is a front view showing one example of a screen image on a display.

FIG. 5 is a block diagram showing the configuration of a conventional RDS receiver.

8: RDS decoder

9: system controller

10a to 10n: memory block

14: display

15: key matrix

16: key decoder

17: memory control circuit

FIG. 3

15a

news	pop
sports	jazz

classical variety

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INTERNATIONAL APPLICATION PUBLISHED UI

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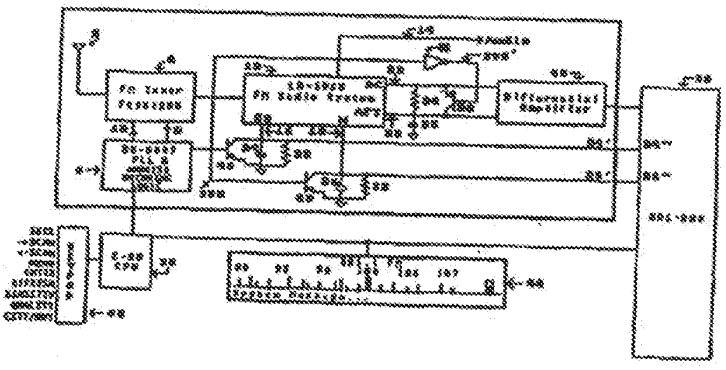

(57) Abstract

A method is described for operating a radio receiver (4, 12) in such a manner as to accurately and rapidly identify unlistenable, very listenable and marginally listenable channels, and display the listenable and very listenable channels along with an indication of their signal strength, noise and quality on a screen (44). A reference value of automatic fine tuning voltage is found for the particular receiver. Capacitors (24, 26) that are charged in accordance with the levels of signal strength, noise and automatic fine tuning voltages are sampled before being fully charged at each channel change, and averages of the respective samples are computed as well as the offset between the average of the automatic fine tuning samples and the reference value of automatic fine tuning voltage. A channel having sample averages not meeting certain criteria is rejected as unlistenable, and, of the others, a channel having a very low average on its noise capacitor is identified as very listenable. Those of the remaining channels that are at least marginally listenable are identified by similar analysis of a second group of samples. The criteria for signal strengths and noise may be varied with ambient temperature, and the criteria for noise can be adjusted on the basis of the noisiest channel or the noise produced when the antenna (2) is grounded. Those channels having the greatest signal strength are associated with tuning buttons (42), and indications of these associations are made on the screen.

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HU	Hungary
IE	Ireland
IT	Italy
JP	Japan
KE	Kenya
KG	Kyrgyzstan
KP	Democratic People's Republic of Korea
KR	Republic of Korea
KZ	Kazakhstan
LI	Liechtenstein
LK	Sri Lanka
LU	Luxembourg
LV	Latvia
MC	Monaco
MD	Republic of Moldova
MG	Madagascar
ML	Mali
MN	Mongolia
MR	Mauritania
MW	Malawi
NE	Niger
NL	Netherlands
NO	Norway
NZ	New Zealand
PL	Poland
PT	Portugal
RO	Romania
RU	Russian Federation
SD	Sudan
SE	Sweden
SI	Slovenia
SK	Slovakia
SN	Senegal
TD	Chad
TG	Togo
TJ	Tajikistan
TT	Trinidad and Tobago
UA	Ukraine
US	United States of America
UZ	Uzbekistan
VN	Viet Nam

RADIO SCANNER AND DISPLAY SYSTEM

Field Of The Invention

This invention is in the field of radio reception and in particular to a system for identifying listenable stations in a band.

Background Of The Invention

Automated tuning systems for radio receivers usually include a button for initiating operation in a seek mode in which the tuning advances to the next listenable station and stops, and a button for initiating operation in a scan mode in which the tuning pauses at successive listenable stations unless the button is activated during a pause so as to lock onto the station being received.

In FM receivers, listenable stations are determined by their signal strength, SS, the amount of super audible noise, N, and the automatic fine tuning voltage, AFT. If the SS is too weak, the station is obviously not listenable, but even if the SS is large enough, the presence of too much noise, such as may occur because of co-channel interference, causes the station to be unlistenable. The AFT voltage indicates that an erroneous or unbalanced intermediate frequency is being produced as, for example, may occur when side currents of a station in another channel are present in the channel to which the receiver is tuned.

Voltages corresponding to SS, N and AFT charge associated filtering capacitors. The AFT capacitor is connected so as to filter the voltage appearing across the parallel circuit of the audio discriminator that is nominally resonant at the intermediate frequency. When tuned to a listenable station, the current charging the AFT capacitor will be minimal (zero in the ideal case), and when tuned to a side current of another station, the current will be large. The manufacturer's circuit recommendation for the LM1865 amplifier FM-IF chip, which is used in illustrative circuits in this document, uses the voltage produced on a capacitor of 4.7μF in response to the charging current of +/-130 microamps, representing a frequency deviation of approximately +/-40,000Hz on a 10.7mHz IF signal, as the acceptable range of listenable stations. Current magnitudes greater than +/-130 microamps indicate unlistenable stations and cause the LM1865 chip to produce a voltage on a Mute/Stop output pin to indicate that a station is invalid. It is the function of the CPU for the associated receiver to interpret the voltage on the output pin and initiate whatever action is necessary.

Generally, very unlistenable signals in a channel like the side currents of a station on an adjacent channel will cause the AFT current, and hence the voltage on the AFT capacitor to swing toward their maximum values. The voltage on the AFT capacitor is fairly reliable at detecting an unlistenable channel where no station is actually transmitting directly on the channel to which the receiver is tuned.

The problem with the prior art version of AFT Mute just described is that it unreliably differentiates listenable and marginally listenable stations from unlistenable stations that are actually transmitting on the selected channel, as occurs with distant co-channel stations and in other situations wherein a station's signal is degraded by interference. Unlistenable stations of this nature may generate a much more modest AFT current. However, the AFT circuit also carries recovered audio and noise which is superimposed on the AFT current. The AFT MUTE/STOP detection circuit must be set broadly enough so it is not triggered by these unwanted signals. Therefore, if the modest AFT current just described is smaller than the broadly set MUTE/STOP detection level, the unlistenable station will be accepted as listenable.

Furthermore, the AFT current level is affected by several factors which have nothing to do with the received station's signal. They are temperature drift, factory misalignment, poor component value selection, and component aging. Because these factors can cause the AFT current to vary widely, independently of the quality of the received signal, its use to evaluate the listenability of a signal received on a channel requires that the range of AFT voltage for an acceptable signal be very large. The so-called AFT Deviation Mute Window, meaning the range of current levels, and hence voltages, for which a station will be considered very listenable or marginally listenable is, as previously noted, typically set at +/-130 microamps (i.e. frequency deviation of +/-40,000Hz) for the

LM1865. The acceptance range of +/-130 microamps is much larger than the modest AFT current generated by distant unlistenable stations. Furthermore, if the AFT circuit is precisely tuned to the I.F. frequency, any station producing an AFT current more than +/- 15 microamps (i.e. frequency deviation of +/-4,500Hz) is generally unlistenable, although prior art FM radio designs generally are unable to illustrate this fact. Thus, an unlistenable station producing 50 microamps of AFT current is well within the acceptance range of +/-130 microamps and therefore would be accepted as listenable, causing this method of using the AFT current for the identification of listenable and marginally listenable stations to be inaccurate.

In addition, the AFT current level has no intrinsic self-zeroing characteristic and thus it can vary widely from one radio to the next, and from one time to another because it is highly dependent upon several factors including the adjustment of the quad-coil, the component values in the quad-coil and AFT circuits, and the temperature of the radio. The quad-coil and AFT circuits are so temperature dependent that the AFT current level can typically fluctuate by as much as +/-80 microamps just because of temperature change of the radio. A station that would be accepted as listenable when the radio is at one temperature may be rejected at another temperature and vice-versa. Because it is usually too expensive to substantially eliminate the effects of these variables, identical radios sitting side-by-side perform differently. In practice, one finds radios that will

reject listenable stations and other radios of the same model that will stop on unlistenable stations.

In conclusion, it can be said that the AFT muting system of the prior art is better than nothing, but barely adequate at best.

In an FM receiver, the intermediate frequency varies with the amplitude of the audio signal being transmitted. In order to limit the effect of these audio variations on the voltage produced on the AFT capacitor, it has been customary to make the charging RC time constant of the AFT capacitor large enough to prevent the lowest audio noise frequency from producing significant voltage fluctuations on the AFT capacitor. Thus, it takes a long time to derive the AFT voltage for each channel and an inconveniently long time to check the AFT voltage of all the one hundred channels in the FM band. If the effect of the audio signal on the AFT voltage is to be substantially eliminated, it would take 16.5 seconds to find all of the listenable channels in a scan mode of operation. Most receivers are designed to actually take only about 9 seconds, but there is some error because a compromise is made between the accuracy of the AFT signal for each channel, by not filtering the super-imposed audio, and the time required to obtain it.

Furthermore, the SS, N and AFT capacitors must be allowed to charge or discharge at each channel change from their present value to a new value and this may require considerable additional time.

Present tuning systems indicate the station that is tuned in and provide several buttons that can be programmed to respectively tune the receiver to selected stations. In some cases automatic programming is provided while scanning a band so that the buttons select stations in accordance with their signal strength. Whereas preprogrammed buttons are useful while the radio is being operated within a given listening area, they are of little advantage when the radio is moved to a different area as in the case of a car radio during a long drive. During such a drive, stations may fade in and out so that the preprogrammed buttons are of no use. The operator must then use the seek or scan modes to obtain a listenable station or use the automatic programming feature, if provided, to reprogram the buttons. For reasons previously set forth, neither seek mode nor scan mode nor the auto programming scan mode, as carried out by the prior art, will accurately distinguish between very listenable and marginally listenable stations on the one hand, and unlistenable stations on the other. And, as also pointed out, different stations may be rejected by different radios of the same model because the components of the AFT circuits have different values within the manufacturing tolerance limits. Narrowing the tolerance limits would significantly increase the cost of the radio.

Even when a given radio is operating in an area within which the respective radio signals received are essentially the same, variations in temperature often change the stations that

are rejected. Changes in temperature also affect the stations that are rejected as the radio is moved from place to place.

In AM radios, a channel is considered to be listenable if the signal strength, SS, and the amount of IF energy passing through a narrow bandpass filter of an IF threshold circuit causes a stop circuit voltage to exceed a predetermined threshold. If the voltage is exceeded, the stop circuit stops the tuning. Both the automatic gain control (AGC) circuit, from which SS is usually derived, and the IF threshold circuit have capacitors that require considerable time to charge so that scanning the AM band to identify listenable and marginally listenable stations takes an inconveniently long time.

A number of prior references teach circuits and systems for tuning in radio signals in an automated manner. Certain of these references show various displays for presenting information associated with a particular station or channel, such as signal strength, for example. These prior references include U.S. 3,575,662; U.S. 3,890,574; U.S. 3,974,452; U.S. 4,040,719; U.S. 4,079,320; U.S. 4,114,104; U.S. 4,123,716; U.S. 4,264,976; U.S. 4,282,602; U.S. 4,317,225; U.S. 4,336,534; U.S. 4,348,666; U.S. 4,365,347; U.S. 4,405,947; U.S. 4,538,300; U.S. 4,580,285; U.S. 4,679,042; U.S. 4,763,195; U.S. 4,780,909; U.S. 4,817,192; U.S. 4,833,728; U.S. 4,881,273; U.S. 5,063,610; U.S. 5,073,975; U.K. patent No. GB 2,089,607, and Japan 1-202030(A).

Summary Of The Invention

This invention applies to both AM and FM radios. An AM or FM radio of otherwise standard construction that is equipped with a tuning system of this invention can discriminate between channels having listenable stations and channels having unlistenable signals more accurately and more quickly than radios of prior art, and can do so at widely different temperatures with the same speed and accuracy. Furthermore, the channels that are accepted or rejected will be essentially the same for all radios of the same design, thereby solving significant radio design and manufacturing problems. A basic radio system incorporating the features as described in this invention would cost no more to design or manufacture than currently available Electronically Tuned Radios, and would have minimal requirements for critical-tolerance components compared to conventional designs. Instead, the tuner design compensates for component variances between radios, for factory misalignments, as well as for component aging and temperature drift. Consequently, in addition to the improved performance that this invention offers, it may also result in radios that are less expensive to manufacture.

The fast tuning features would enable a radio built according to this design, and also incorporating a prior art "best station memory" feature, to scan the entire AM or FM broadcast band as quickly as in one second with a very high degree of accuracy in the acceptance of listenable stations and the rejection of unlistenable channels. Currently available scanning radios that incorporate a "best station memory" feature

take from several seconds to as long as thirty or more seconds to scan the AM and FM broadcast bands, and offer the same unpredictable and inaccurate assessment of listenable versus unlistenable stations as other current state of the art radios.

In addition to the tuning enhancements, this invention provides for a display system which can indicate all the listenable stations that are broadcasting, along with indications of their signal strength, noise, and other factors. The display screen can be designed to be representative of the AM or FM broadcast band so that the indicator for each station will be displayed at the location where it would appear on a manually tuned radio dial in order to provide a familiar format and to aid the user in visually identifying specific stations. The accuracy feature of this invention is valuable because if a user manually tunes channel by channel, what they hear in terms of listenability will be accurately reflected on the display. Another feature is that the listenable stations presented on the display constitute a "tuning list", such that operation of the seek or scan tuning buttons will only select stations which are indicated on the display.

An obvious advantage of the display system occurs with auto radios when the vehicle is driven from one broadcast area to another, and for portable radios which are taken from place to place. The display can portray the listening options available in each area in a way that is far more meaningful than can be achieved by manually tuning the radio, by using seek or

scan buttons, or by using a best station memory feature. It offers complete information of the broadcast band at a glance.

A greater advantage occurs with automobile radios when the vehicle is used for country driving because in the absence of knowledge about the broadcast area, one tunes in a station not knowing if it broadcasts a desired type of program material, not knowing how strong or weak the station might be, and not knowing if there were any better options available. As a result, listeners might spend the entire trip fiddling with the tuning buttons--as soon as they get a station they like, it fades out and they must change stations again. Having a display of the broadcast area provides an instant representation of the listening options and allows the listener to make intelligent choices. Because the display can communicate the situation at a glance, driver safety is improved compared with the alternative of fiddling with the radio which continually draws the driver's eyes off the road. If there are no desirable stations, a mute button could cause the display to continuously scan without any audio until the vehicle arrived at another broadcast area.

An advantage of a display system for a console radio is that it would give discriminating listeners the opportunity to evaluate their listening options and choose a strong, clear station that is broadcasting the desired type of material.

The fast scanning speed makes it possible to build an economical display system radio which has a single tuner for each band, as in conventional radios. The scanning speed is fast enough so that a scan to update the entire display can take place

automatically and unobtrusively during user-initiated tuning operations, or a scan can be initiated by activation of a "display refresh" button and the scan will almost be completed before the user's finger leaves the button.

The invention also defines a dual tuner system which incorporates a second tuner (for each band) to continuously scan the frequency band. In a dual tuner system the display can be continuously updated to reflect changes in the displayed channels, as well as their signal strength and other parameters. The tuners can also monitor the broadcast stations for digital SCA or RDS data such as SCA radio paging data, or RDS information such as the type of program material the station is broadcasting, and present that data on the display. While listening to an audio program a single tuner system can monitor only the tuned-in station for this type of data; a dual tuner system, however, can monitor and present this type of data for both the tuned-in and the non-tuned-in stations, without interrupting the audio program, and therefore can present broadcast information for all stations on the display simultaneously. Therefore, a dual tuner scanning display radio system can denote items of special interest on the display for all stations in the broadcast area, for example, all stations broadcasting the news. A single tuner could also collect and present this data, but the data monitoring time is relatively long (about 1/10 second per station to collect the station's "static" RDS data -- call letters, city, and type of program material, etc.) and of course cannot be performed while listening to an audio program.

This ability to display data for all stations in the band would be of value to broadcasters as well as listeners because it gives lesser known stations the opportunity to inform listeners of the kind of program material they offer.

The tuning enhancement aspects of this invention referenced previously incorporate the following major features. Tuning speed is accelerated by discharging or precharging certain signal parameter capacitors to a desired state on channel changes. Signal parameters of signal strength, noise, and AFT deviation, related to the listenability of a station, are evaluated as soon as 4 ms after channel changes to accept very good stations as very listenable and reject very bad channels as unlistenable. In comparison, prior art designs typically allocate about 70ms to evaluate each channel regardless of how good or bad it might be. In most listening areas those channels which are either very good or very bad represent more than half of all available channels. The fast acceptance and fast rejection of these channels speeds the tuning process because only stations that do not meet either of these criteria need to be subjected to longer measurements. Extrapolation techniques are used to estimate the signal level driving the associated circuits, since the capacitors haven't fully charged by this early stage.

A "dual pass" aspect of this invention offers a side channel elimination feature which also accelerates the tuning process by eliminating stations from further review which can be determined to be side channels of a main station.

Sampling and averaging techniques are used to minimize the influence of signal artifacts and determine precise levels of the underlying signal, especially for AFT which is dominated by recovered audio that is super-imposed on the AFT signal. The precise data arrived at by the sampling and averaging techniques enhances the extrapolation techniques to correctly estimate the signal parameters of the channel being measured. The typical AFT deviation mute circuit in currently manufactured radios has an acceptance window of approximately +/-130μA, representing a frequency deviation of approximately 40,000Hz. The ability to determine a precise level of AFT has allowed the observation that all "good" stations will exhibit almost exactly the same AFT level for a given receiver, plus or minus about one or two microamps. This is because all good stations whose signals are not being interfered with or distorted by the atmosphere will be broadcast and received exactly on their designated frequency. And when that designated frequency is exactly the frequency to which the radio is tuned, zero AFT current will be generated given proper alignment of the radio receiver's circuitry. This observation, in turn, has resulted in the feature of this invention whereby the AFT signal of each channel as it is tuned in is evaluated in relation to the AFT signal (the "nominal AFT") of a station which has been determined to be "very listenable" via an extended measurement with tight acceptance parameters. A reasonable acceptance window based on this invention is approximately +/-30μA, or approximately +/-4800Hz, for the receiver design set forth in this document. That design produces

approximately twice the AFT current as the comparative manufacturer's recommended circuit, which would be approximately +/-15μA for the same frequency deviation. Thus, the design specified by this invention is about ten times as sensitive as the current state of the art. The nominal AFT feature results in all receivers performing the same in the acceptance and rejection of channels since the decision criteria is based on a parameter external to the receiver and which is therefore independent of the receiver's components or temperature, etc.

This invention also offers other features which are described in appropriated locations in this application.

All embodiments of the invention as applied to FM receivers have an initialization procedure that provides a reference value of AFT voltage. This can be done by selecting an empirically determined voltage value in accordance with the ambient temperature, or by searching to find a very listenable station and using its AFT voltage as a reference value, as mentioned previously, or by using both methods together. In evaluating channels as to their listenability, the difference between their AFT voltage and the reference AFT voltage is used rather than the AFT voltage itself as this eliminates the effects of factors previously noted that relate to the radio rather than the received signal. The difference between an AFT voltage and the reference value is hereinafter referred to as the AFT offset. Prior art designs are incapable of precisely determining AFT values because of the dynamic fluctuations of the super-imposed recovered audio, and therefore would not be able to derive a

meaningful AFT offset. This invention arrives at precise AFT values by taking multiple samples and then computing the average of those samples. Taking the average tends to cancel out the super-imposed audio fluctuations and reveal the true underlying AFT current.

In the simplest embodiment of the invention as applied to FM receivers, there is no display and memory buttons are not provided. After finding a reference value of AFT, one or more samples of the voltages on the SS, N and AFT capacitors are taken prior to the time of full charge. If these samples are outside of wide limits, the channel is rejected. All other channels are considered to be listenable.

The channels not rejected may include unlistenable stations because the limits are so wide. Thus, in other embodiments of the invention, the channels not rejected are subjected to further analysis. The first step of this analysis is to identify on the basis of the samples referred to, those stations that are very listenable on the basis of their having virtually no noise. The listenability of the remaining stations cannot be accurately determined at this point, and therefore are further examined by obtaining additional samples and using tighter limits of SS, N and AFT offset so as to eliminate only the worst stations. The latter limits may be varied.

The process just described is designed to permit tuning to stations that are of very poor selected quality because there are times when a person will listen to them, e.g. if it is a broadcast of the "big game" of one's alma mater. At the same

time it is desirable to eliminate really worthless stations. Thus, in accordance with another aspect of this invention, a further analysis may be made of the additional samples of SS, N and AFT offset to determine a quality factor QF. The precise AFT values derived by this invention enable the computation of a QF, which would otherwise not be possible. The radio might offer a user adjustable QF, and stations not meeting the QF setting are omitted from the display and from the tuning list. Although other formulas may be used, the following expression for QF has been found on the basis of much listening to yield results indicated in Table 1 below. The average N, N range, and AFT offset are obtained from successive groups of samples taken after each channel change is initiated.

$$QF = \sqrt{AVG\ N \cdot AFT\ offset} + \frac{N\ range}{2}$$

TABLE 1

QUALITY FACTOR (QF)	RECEPTION
0-1	Best Possible
2-5	Good but Some Static
6-9	Noisy but Listenable
10-19	Very Noisy
20+	Very Poor

The parameters of noise, AFT deviation, and QF are each valuable in discriminating listenable from unlistenable stations. Many invalid channels will exhibit sufficiently high ultrasonic noise levels to reject the channel based on noise. Occasionally, however, a side-channel, image frequency, cross talk channel, or other invalid signal will not have a sufficient ultrasonic noise level to be rejected, but will exhibit a high AFT which will reject the channel. The combination of both noise and AFT deviation into the QF allows the rejection of stations with intermediate noise and AFT levels which would exhibit audible impairment but could not be rejected based on either parameter independently. Additionally, certain interference conditions will cause a valid station to exhibit intermediate to high ultrasonic noise along with low AFT levels, and the QF can be arranged to allow the selection of these stations. A radio designed in accordance with this invention might implement a user-setable QF so that the radio's tuning criteria can be controlled by the listener.

An example of a user-setable QF might be a console radio with a City/Country switch that would have tighter acceptance parameters in the City mode so as to restrict channel acceptance to those with the best listenability.

Another example might be a console radio with a menu operated QF setting mechanism, as suggested by the menu system illustrated in Fig. 36.

A third example might be an auto radio with a City/Highway switch that would have tighter acceptance parameters

in the Highway mode, perhaps including a higher SS threshold. This method of operation would be intended to solve the problem of country driving where stations fade in and out at an annoying rate, causing the listener to constantly fiddle with the tuning buttons to find a listenable station. In this highway mode, only stations good enough to be listenable for at least a few minutes will meet the acceptance criteria.

In any of these embodiments of the invention, any of the stations not rejected can be respectively stored in memory locations associated with programmable memory buttons, respectively, and/or presented on a display. In the latter case, information as to their SS, N, AFT and QF as well as RDS information as to program material etc. can be shown.

In the tuning systems having single tuners, the determination of a reference value for AFT, whether it be done on the basis of ambient temperature or on the AFT of a valid station, or on both, may be made periodically based on duration of time or change in temperature, or may be made at each channel change initiated in the seek or scan modes. In the latter case, the operation is hardly noticeable because it is performed so rapidly.

In what is called a dual pass system, the channels that are not rejected and are not found to be virtually noise-free on the basis of a first group of samples are subjected to a side channel elimination algorithm analysis before they are more thoroughly analyzed for listenability on the basis of a second group of samples of SS, N and AFT. In this algorithm, if a

channel's SS is more than a given %, e.g., 30%, stronger than the SS's of the channels on either side, then both side channels are rejected as being unlistenable. This algorithm may also require that both side channels have noise levels exceeding a minimum in order for both to be considered unlistenable so that a distant, weaker, channel at the frequency of a local station's side channel will not be inadvertently rejected.

When there is only one tuner, the SS and QF values displayed for the tuned-in channel can be updated dynamically but those for the other channels were obtained during the initialization procedure or the last time a scan was performed, so that they may not always be valid. Thus, one may tune to another channel that appears to be very listenable only to find that it has poor quality or in fact is totally rejected by the analysis that is done at each channel change. The display will be updated on this channel change. This situation can be avoided by embodiments of the invention using two tuners, one for listening and the other a scan tuner for analyzing the listenability of all stations in the band in a continuous repeated sequence. This means that the display of such factors as SS and QF values for channels other than the one to which the listening tuner is tuned are also always up-to-date.

A greater advantage of a second tuner is that, for all stations being received rather than just for the tuned in channel, it can be used to bring up on the display coded information that is often broadcast along with the main program. This is referred to as RDS information and may include signals

indicating the type of program being broadcast, e.g. whether it is news, classical music, contemporary music or a sportscast.

A number of aspects of the invention contribute to the speed with which very listenable and listenable stations can be identified by the methods just described.

In the first place, time is saved by the rejection of unlistenable channels and the identification of very listenable channels on the basis of a first group of samples obtained after a change in channel is initiated, because these channels are not subjected to further analysis of a second group of samples. If, for example, sixteen milliseconds are required for further analysis of each channel, and there are seventy-five channels having either no station or a very good station, twelve hundred milliseconds are saved.

The speed with which a channel can be identified as being listenable or not is greatly increased by this invention. In the prior art, voltages as to the signal strength, SS, the noise, N, and the automatic fine tuning, (AFT), are developed on respective capacitors. For each radio design the manufacturer specifies the minimum or threshold voltage required across the SS capacitor, the maximum or limit voltage for the N capacitor, and the maximum value of current, and therefore, voltages for the AFT capacitor. If any of these criteria are not met, the channel is considered to be unlistenable. Previous designs use large value filter capacitors to average out and integrate the SS, N, and AFT signals in order to properly assess them. The bigger the capacitor the more accurate the averaging/integration will be,

but the longer it will take to charge or discharge the capacitors to the new level on each channel change.

This invention provides for clamping each of these capacitors to a respective neutral value on channel changes to minimize the amount of time required to charge or discharge from the previous state to the new state, and to provide for a known charge condition at the beginning of each channel measurement period. Starting with a known charge condition allows for the use of rapid samples and the use of extrapolation techniques as described in this application.

In the prior art, the determination of the listenability of a channel is made by examining at least one of the voltages on the SS, N and AFT capacitors after they are almost fully charged. As noted above, this is necessary to minimize fluctuations and to reduce the effects of noise and the effect of the audio signal on the voltage on the AFT capacitor.

In accordance with this invention, however, the voltages on these capacitors are measured very soon after a channel change is initiated and extrapolated to see what they would be when fully charged. These measurements are made by taking a single sample, or by taking an average of multiple samples, of each voltage. The extrapolation can be conservatively modified to minimize the risk of rejecting a listenable channel that might have experienced a momentary signal fluctuation at the time the samples were taken. The extrapolated values may be used for the final tuning decision in one aspect of this invention. In another aspect, the extrapolated values

may provide an initial acceptance of very good stations and rejection of very bad channels, with a subsequent review of the remaining channels based on additional data samples.

Additionally, this invention provides for faster tuning by permitting the use of smaller (and hence, faster) capacitors, or smaller associated resistors resulting in a faster R-C time constant for the charging or discharging of the capacitors. The ability to use faster charge/discharge circuits is attributable to two factors, the first being the extrapolation procedures in conjunction with the initial and subsequent review procedure, as just discussed. In this context, smaller capacitors and the associated greater signal fluctuation rate can be tolerated for the initial review because it is non-critical in the sense that only the obviously good stations will be accepted, i.e., only those having acceptable SS and AFT and having virtually no noise, and only the obviously bad stations will be rejected, i.e., channels that don't meet the minimum SS threshold, or have noise or AFT levels that "peg the meter".

The second factor permitting the use of smaller capacitors or associated resistors is the scheme of taking the average of multiple data samples, either in the initial or the subsequent review, or in both. The averaging technique statistically adjusts for momentary signal fluctuations and thus accomplishes mathematically what otherwise must be accomplished electrically with larger capacitors.

Greater accuracy in the identification of the listenability of a channel is achieved in accordance with other

aspects of the invention, wherein the SS threshold, the limit of N and the maximum values of AFT toward which the capacitors are considered to be respectively charging are adjusted in accordance with the ambient temperature within the radio.

The assumed limit value for noise can also be set at the voltage produced across the N capacitor when the noisiest channel is tuned in.

Another way to set the assumed limit value for noise is to measure the voltage across the N capacitor when the antenna of the radio is connected to ground.

In AM receivers, tuning stops on a channel when the voltage across a threshold capacitor exceeds a given value. The voltage on this capacitor is derived from a circuit measuring the IF amplitude and the signal strength indicated by an AGC circuit having filter capacitors. Faster operation is attained by charging the threshold capacitor and capacitors that are used in the AGC circuit to neutral values at each channel change.

Brief Description Of The Drawings

Various embodiments of the invention are shown and described herein with reference to the drawings, in which like items are identified by the same reference designation, wherein:

Fig. 1 shows the basic components of a single tuner FM receiver incorporating this invention including the circuits for clamping the SS, N and AFT capacitors;

Fig. 1A is a schematic diagram of a circuit for converting the differential voltage on the AFT capacitor to a unipolar voltage for application to the digital logic circuits;

Fig. 2 illustrates the basic steps of an initialization procedure for selecting a station that provides a reference or nominal value of AFT;

Fig. 2A illustrates the sampling procedure of this invention;

Fig. 2B describes a procedure for balancing the SS and N measurements between tuners in a dual tuner system.

Fig. 3 is a graph illustrating the application of the extrapolation techniques of this invention to the noise limit used in the portion of the flowchart of Fig. 2 that is designed to select the strongest station;

Fig. 4 is a graph illustrating the application of the extrapolation techniques of this invention to the noise limit used in the portion of the flowchart of Fig. 2 that makes a final check on the suitability of the strongest station selected in the first part of the flowchart of Fig 2;

Fig. 5 is a flowchart of the procedure for selecting a station that is to provide the reference value of AFT if a given amount of time has elapsed since the initialization procedure illustrated in Fig. 2;

Fig. 6 is a simplified flowchart illustrating the operation in accordance with the invention of a single tuner FM receiver having no display or memory buttons;

Fig. 7 is a flowchart for the operation of a single tuner FM receiver having memory buttons but no display of listenable channels;

Fig. 7A is an alternative algorithm for use in Fig. 7 in eliminating a station because of noise;

Fig. 8 is a flowchart illustrating operation in accordance with this invention of a single tuner FM receiver in which listenable channels are displayed;

Fig. 9 is a flowchart illustrating the way in which the station tuned in by an FM receiver is monitored;

Fig. 10 is a flowchart illustrating the dual pass operation of an FM receiver in accordance with this invention;

Fig. 11 is a block diagram of an FM receiver incorporating a listening tuner and a scanning tuner in accordance with this invention;

Fig. 12 is a flowchart of the operation of a listening tuner in a two tuner display system of this invention;

Fig. 13 is a flowchart for the calibration of a reference AFT by a listening tuner of a two tuner display system;

Fig. 14 illustrates the sequence of the various flowcharts used by a scanning tuner;

Fig. 15 is a flowchart of the operation of a scanning tuner in a two tuner display system of this invention;

Fig. 15A is a flowchart of the data monitoring cycle of the scanning tuner of a two tuner display system;

Fig. 15B is a flowchart for the averaging of the SS and QF in Fig. 15 to compensate for momentary signal variations;

Fig. 15C is a flowchart for determining whether signal strength of a station is increasing or decreasing;

Fig. 16 is a flowchart for the calibration of a reference AFT in the scanning tuner of a two tuner display system;

Fig. 17 is a schematic diagram of a circuit for sensing temperature;

Fig. 18 is a table of values to be used in connection with Fig. 19.

Figs. 19 and 19A are respective flowcharts for calibrating a reference AFT, the SS threshold, and the N rejection limit in response to temperature;

Fig. 20 is a flowchart for the calibration of a noise rejection limit based on the noisiest channel;

Fig. 21 is a schematic diagram of a circuit for clamping the antenna to ground so as to attain a measure of receiver generated noise;

Fig. 22 is a flowchart for calibrating a noise limit from the measurement attained in the circuit of Fig. 21;

Figs. 23 and 24 are schematic diagrams illustrating connections for commercially available components of a single tuner FM receiver in accordance with this invention;

Fig. 25 is a block diagram of an AM radio utilizing this invention;

Fig. 26 is a flowchart for the operation in accordance with this invention of an AM radio having a single tuner and no display;

Fig. 27 is a flowchart for the operation in accordance with this invention of an AM radio having a single tuner and a display;

Fig. 27A is a flowchart for monitoring the signal of an AM station and updating the display;

Fig. 28 is a flowchart of the operation in accordance with this invention of the listening tuner in a dual tuner AM radio having a display of listenable stations;

Fig. 29 is a flowchart of the operation in accordance with this invention of the scanning tuner in a dual tuner AM system having a display of listenable stations;

Fig. 30 illustrates a display of listenable stations including RDS data;

Fig. 30A illustrates an alternative display of listenable stations broadcasting a specific type of RDS-coded program material.

Fig. 30B illustrates an alternative style of presenting stations broadcasting specific types of RDS-coded program material.

Fig. 31 illustrates a display of listenable stations with statistics for S, N, AFT and QF of tuned in stations;

Fig. 32 illustrates a display showing the listenable station with the numbers of the buttons for the four strongest stations shown at the locations for the respective station;

Fig. 32A illustrates a display similar to Fig. 32 with indicator bars as upward or downward pointing arrows to indicate stations increasing or decreasing in strength;

Fig. 33 illustrates a display showing listenable FM and AM stations;

Fig. 34 illustrates a display in which listenable FM and AM stations are identified by dots;

Fig. 35 illustrates a display in which listenable FM and AM stations are indicated by bars of LCD's;

Fig. 36 illustrates a menu that may be displayed;

Fig. 37 illustrates a display of graphical information relating to a tuned in station;

Fig. 38 illustrates a display of statistics for a tuned in station; and

Fig. 39 illustrates a display with touch entry and voice input for changing stations.

DETAILED DESCRIPTION OF THE INVENTION

Fig. 1 shows the basic elements of an FM radio having a tuning system of this invention. An antenna 2 supplies RF signals to a tuner 4, which by way of example may be an FE3U128A tuner module. A local oscillator and mixer, not shown, within the tuner 4 produce an IF signal that is applied to a phase locked loop (PLL) 6 via a lead 8, and the loop provides a correction voltage via a lead 10 to the tuner 4 so as to control

the frequency of the local oscillator. The phase locked loop may by way of example be a DS-8907.

The IF signal produced by the tuner 4 is also supplied to a means 12 for providing amplification as well as the limiting and discriminating functions necessary to produce an audio signal on an output lead 14. In addition to an audio signal, the means 12 provides at an output 16 a DC voltage SS corresponding to the average amplitude of the RF signal, and at an output 18 a DC voltage N corresponding to the average amplitude of the noise. An AFT DC voltage is produced at an output 20, and a regulated DC voltage is produced at an output 22.

As in the prior art, the SS, N and AFT voltages at the outputs 16, 18 and 20 are respectively applied to one side of capacitors 24, 26 and 28, the other sides of which are connected to ground. Discharge resistors 30 and 32 are connected in shunt with the SS and N capacitors 24 and 26, respectively, so that the voltages across them follow the variations in SS and N, respectively.

And as in the prior art, a resistor 34 is provided for the AFT capacitor 28 which converts the AFT deviation current 20 into a measurable voltage measured in respect to the DC reference voltage 22. The sampling technique described in this application allows the use of smaller values for resistor 34 and capacitor 28 than in prior art designs which results in faster channel changes.

The SS, N and AFT voltages are connected in the prior art to hard wired trip-level circuits which will cause the system

to mute or bypass a channel during the tuning process whenever one or more of them is outside its predetermined respective limit. In this invention, however, they are connected to an Analog-To-Digital-Converter chip 36, such as an ADC 808, that derives digital samples of the voltages under the control of a CPU 38 such as a Z80. The CPU 38 uses these samples to identify the very listenable and listenable channels. Since the AFT voltage on the capacitor 28 can be higher or lower than the DC reference voltage 22, it is coupled to the ADC chip 36 via a differential amplifier circuit 40 which also incorporates a level shifting feature.

The CPU 38 is controlled by a keyboard 42 so as to carry out seek and scan functions by operation on the phase locked loop 6. When these functions are carried out, it may be controlled by the CPU 38 so as to provide vertical bars or other indicia on a display device 44, at the frequencies of listenable and very listenable stations, representing their values of SS. Other keys on the keyboard provide for selection of a menu on the display 44, rescanning to identify very listenable and unlistenable channels and update the display, and for changing the values of signal strength and quality factor to be used in the identification process. In addition, a key may be provided for changing the minimum quality level and signal strength in the identification process depending on whether the radio is being operated in the country or in a city.

In accordance with one aspect of this invention, the speed with which any signals in a channel can be analyzed for

listenability is increased by charging or discharging the SS, Noise, and AFT capacitors 24, 26, and 28, respectively, to a neutral value using transistors 46, 48, and 50, respectively, at the initiation of each channel change by the CPU 38. Toward this end, transistors 46 and 48 are respectively connected in shunt with the capacitors 24 and 26, and transistor 50 is connected in shunt with resistor 34. Upon initiation of a seek or scan function at the keyboard 42, the CPU 38 applies an enabling voltage to the PLL 6 to cause it to simulate a local oscillator frequency for the next channel, and an enabling voltage on lead 395 is applied to respective base electrodes of transistors 46 and 48, and an enabling voltage on lead 395' which is inverted and level shifted by inverter 45 is applied to the base of transistor 50, so as to cause momentary conduction of each. The SS and N capacitors 24 and 26 are completely discharged through the main current paths of transistors 46 and 48 to a source of reference potential, ground in this example, and the AFT capacitor 28 is charged to a predetermined voltage, equivalent to zero AFT current, through transistor 50. In this manner, capacitors 24 and 26 can be quickly charged to the values of the SS and N voltages at terminals 16 and 18, respectively, without waiting for them to discharge via their respective discharge resistors 30 and 32. The AFT capacitor 28 is charged to the voltage at the terminal 22 so that less charging or discharging is required on a statistical basis.

Next is a comparison of the capacitor charge and discharge times in the radio system described in Fig. 1 using the

features of this invention versus the same radio system using the manufacturer's standard circuitry. The standard circuitry for SS charges through an internal LM1865 resistor of 760Ω into a capacitor (24) of 10μF, for a charge time constant of 7.6ms; the equivalent circuit based on this invention charges a 2.2μF capacitor (24) through the same internal 760Ω resistor, and has a charge time constant of 1.67ms, which is a five-fold improvement. The discharge path for SS in the standard design is from capacitor (24) through resistor (30), which is set at 10kΩ. and results in a discharge time constant of 100ms. In the circuit based on this invention the capacitor (24) is shorted directly to ground on channel changes, resulting in a negligible discharge time (<1ms). The N circuit is similarly arranged. In the standard circuit, N charges through an internal 9kΩ resistor into 2.2μF capacitor (26) resulting in a charge time constant of 19.8ms. In the equivalent circuit based on this invention the charge path is via the same internal 9kΩ resistor into 1μF capacitor (26), resulting in a 9ms charge time constant and a two-fold improvement. The discharge path in the standard circuit is from capacitor (26) through resistor (32), which is set at 25kΩ, which would yield a discharge time constant of 55ms except that the discharge time constant is dominated by the fall from the maximum voltage of .8v to below the hard-wired trip level of .6v, and this results in a discharge time constant of 15ms. As with the SS circuit, in the N circuit based on this invention the capacitor (26) is shorted directly to ground on channel changes, resulting in a negligible discharge time (<1ms).

The standard design AFT circuit charges and discharges capacitor (28) through resistor (34). In the standard design resistor (34) is 5kΩ and capacitor (28) is 5μF, resulting in a time constant of 25ms for both charging and discharging. In the equivalent circuit based on this invention the AFT charge path is through resistor (34) set 2.7kΩ to capacitor (28) set 4.7μF, resulting in a charge time constant of 12.7ms for a two-fold improvement; the discharge path for capacitor (28), meaning the path by which the capacitor is set to a neutral level on channel changes, shunts across resistor (34) and results in a negligible discharge time (<1ms). As is obvious from the above, the procedures of this invention of clamping the capacitors to a neutral level on channel changes result in radically faster circuit discharge times. Also, however, the fact that smaller resistor and capacitor components are required because of the sampling and averaging procedures of this invention results in faster charge times as well, which is another factor contributing to the fast tuning speed of this invention.

Reference is made to Fig. 1A for a description of a circuit that can be used for the differential AFT amplifier circuit 40. AFT voltage from the output 20 fluctuates above and below the approximate center point value of the regulated voltage at the output 22. The resistor 34 converts the AFT current to a measurable voltage, and together with capacitor 28, determines the R-C time constant of the AFT circuit. The AFT voltage is measured between circuit leads 20 and 22 via their connections to an operational amplifier 62, which is arranged to measure the

difference between the two voltages. The terminal 20 is coupled via a buffer amplifier 58 and a resistor 60 to the inverting input of an operational amplifier 62, and a resistor 64 is connected between the amplifier's output and inverting inputs. The terminal 22 is connected via a resistor 66 to the non-inverting input of the amplifier 62. A resistor 68 is also connected from the non-inverting input of the amplifier 62 to the junction of resistors 70 and 72, that are connected in series between a point 74 of voltage V_t and ground. The values of the resistors 70 and 72 are such as to apply a predetermined positive bias voltage, 2.5 volts in this case, to the non-inverting input of the amplifier 62. The voltage of circuit lead 20 can be either positive or negative with respect to the DC reference voltage 22, but for reasons of compatibility with the ADC-8O8 36 which expects positive voltages, the output of the operational amplifier 62 is level shifted upward by 2.5 volts via the input coming through resistor 68 so that zero AFT current is represented by the center of the ADC's dynamic range and so that positive and negative voltages in respect to the DC reference voltage 22 can be properly measured by the ADC. Thus, as long as the sum of the AFT voltage at the terminal 20 plus the predetermined positive bias voltage is greater than the regulated voltage at the output 22, the output of the amplifier 62 will always be positive, and the neutral level will be at 2.5 volts.

In the flowcharts to be explained, certain voltage limits and ranges are indicated. It is to be understood that they are just examples and refer to preferred values for the

particular receiver components of Figs. 23 and 24. Other values may be used.

In operating a tuning system of this invention, it is necessary to find a nominal or reference value of AFT. One way to do this is to find a very listenable station and use its AFT voltage as the AFT nominal or reference voltage. Such a station may be found as shown in the flowchart of Fig. 2. Power is turned on, step 86, and at a step 88 the next station is tuned in. The SS, N and AFT capacitors 24, 26 and 28 of Fig. 1 are then momentarily clamped so that they are charged to the neutral voltages previously described.

The next portion of the procedure involves unlistenable station identification. As indicated at step 90, the first step is to obtain the values of a first group of individual samples or the averages of a first group of multiple samples of each of the SS, N and AFT voltages that are developed on the capacitors 24, 26 and 28 within a few milliseconds (ms) after the clamping is released. By way of example, the first group has five samples occurring within 4 ms.

An important aspect of the invention is the averaging of multiple samples to obtain values of SS, N and AFT that are used in the tests of a step 92 that identifies unlistenable channels. Fig. 2A illustrates the sampling and averaging process as applied to the AFT voltage on the capacitor 28. The voltage 91 on the AFT capacitor 28 varies in amplitude, but the average of samples taken during a time period 95 is not affected by the variations as shown by the line 97. This procedure can resolve

the AFT current level to 2 μAmps +/- a 2μAmp ADC rounding error, depending upon the number of samples taken and the duration of the time period during which they are taken. 2μAmps in this design represents approximately 320Hz frequency deviation of the 10.7Mhz IF frequency. The average value 97 is compared to the DC reference voltage 99 to arrive at the AFT offset voltage as used in steps 92' and 134 of Figure 7 and elsewhere. Although not illustrated, the averages of the samples of the voltages across the SS and N capacitors 24 and 26 respectively are less affected by noise and artifacts.

The diamond decision step 92 compares the averages of the SS, N and AFT samples as compared with respective limits. The average for the SS capacitor 24 can be compared with the minimum or threshold value of SS specified by the manufacturer, i.e. approximately .6v in the design of Figures 23 and 24, even though the capacitor 24 is not fully charged because it is about 90% charged. The situation is different in the case of the N samples because of the long charging time constant of the capacitor 26. If, as in the receiver components used as an example, the maximum permissible noise is specified to be such that the N capacitor 26 will be charged to 0.6 v in five time constants, a time constant being the product of the capacitance of the capacitor 26 and resistance in series with it, the noise limit charge curve in the presence of this maximum noise is as shown in Fig. 3. Thus, if the average of the samples of N is above the curve, the station is considered to be too noisy to be listenable. Since the first group of samples are indicated in

the flowchart to occur within 4 ms, which is slightly less than one-half a charging time constant of 9 ms of the components used in the example, i.e. at point 87 in Fig. 3, a station will be too noisy if the average voltage of the first group of samples exceeds .16 v. This is the extrapolation technique previously referred to that permits faster tuning. Additionally however, the noise capacitor is integrating the noise pulses, as indicated by the spikes 89 riding on top of the charge curve. These noise pulses will introduce errors if not accounted for. Taking the average of multiple samples will tend to average out the noise pulses, but since only five samples are taken in this example there could still be an error factor. Since the noise pulses are of approximately constant amplitude regardless of where they occur on the charge curve, the errors will be greatest lower on the curve where the noise pulses represent a greater percentage of the value of the curve. Therefore, samples taken earlier will require a greater allowance for errors than samples taken later. The average value of the first five samples will be about 6% less than the individual sample taken at 4 ms and so will tend to be somewhat conservative in rejecting stations and could represent the error adjustment factor. An additional error adjustment factor could be inserted if desired to more fully compensate for this error condition.

Lastly, the diamond decision step 92 tests to see if the average of the first group of samples of the AFT voltage on the capacitor 28 exceeds a limit. In the circuit described herein the capacitor 28 will not be fully charged when the last

of the first group of samples is taken so that an extrapolation technique such as that used with noise must be used. In this case, however, two noise limit charge curves would be required because the maximum AFT voltage for marginally listenable channels can range up to approximately +3 v or -3 v in relation to the DC reference voltage 22. A 5 TC value of +/-.8v, equivalent to +/- 300μAmps, or to a frequency deviation of 48,000Hz, is indicative of a very bad channel. (The manufacturer's recommended hard-wired trip circuit is set at +/- 130μAmps in a circuit with a 5kΩ resistor 34; the equivalent circuit described in this application has a 2.7kΩ resistor 34 which will cause a channel to generate approximately twice the AFT current in the equivalent circuit. Therefore, +/-300 μAmps (48,000Hz frequency deviation) in the equivalent circuit is approximately equal to +/-130μAmps (40,000Hz frequency deviation) in the manufacturer's recommended circuit.) In the circuit used as an example herein the approximate charging time constant of the capacitor 28 is 12.7 ms so that the first group of samples occur during a time of approximately 0.4 of a time constant at which the absolute value of the charging curves is about 0.27 v. However, since the AFT signal is dominated by the super-imposed audio the extrapolation process must be adjusted to allow for that audio so that stations are not rejected in error. Once the capacitor is at full charge, the audio fluctuates above and below the center point of the AFT level by about .5v. By also extrapolating the charge curve for the super-imposed audio in the same way as just described, an allowance of .17v must be added

to the .27v previously calculated, and thus the actual rejection level will be set at +/-.5v (.27 + .17, rounded up) and is equivalent to +/-185μ Amps. Therefore, if the average of the first group of samples is greater than +0.5v or less than -0.5v, the AFT is too large and the channel is identified as being unlistenable.

As indicated in a step 94, any channel having a station that is not rejected in the diamond decision step 92 is recorded along with its value of SS. A determination is made in a diamond decision step 96 as to whether all of the channels in the FM band have been analyzed, and the procedure just described is repeated until they are.

When all stations in the FM band have been analyzed, limits for N can be calibrated, if desired, as indicated at a step 98 by following the procedures of Figs. 17 through 22 to be described, and the calibrated value used in place of the 0.1 v applied signal in a step 104 to be described.

Whether or not the noise calibration is made, the station having the largest SS is tuned in, step 100, and checked to see if it is consistently listenable by following a more restrictive procedure starting with a step 102. This involves taking second and third groups of equally spaced samples of the SS, N and AFT voltages during successive intervals of 64 ms, computing the respective averages for each group and the SS range for each group. The sampling period of 64ms is used in this circumstance of attempting to find a very listenable station to use as an AFT reference because precision is important at this

step -- if the reference level of AFT is inaccurate, the evaluation of every station in comparison to it will be inaccurate. A sampling period of 64ms is long enough to remove audio down to 15Hz in order to arrive at a pure AFT deviation signal. At other steps, shorter sampling periods might be used for the sake of a faster scanning speed, but at the risk that some AFT measurements might include an error due to the existence of super-imposed audio. The probability of an error is based on the probability of the presence of the very low frequency audio that was not averaged out, along with the relative strength of this very low frequency audio. If there is no very low frequency audio present on the AFT signal at the time the samples are taken, there will be no error. The errors could be reflected in a station being incorrectly accepted or rejected, or in an incorrect QF. The following Table 2 illustrates the design trade-offs between sampling period and scanning speed. The worst case scenario for a scanning radio is a broadcast area with very many stations, as illustrated in the table. The table assumes a listening area with 25 very good stations, 25 very bad channels, and 50 other channels that would require detailed measurements to properly analyze. The aspect of this invention that allows making the acceptance of very good stations and the rejection of very bad channels based on an initial sample or samples minimizes the required scanning time. The portion of the scanning from the following table that is allocated to this initial decision step is just two tenths of a second for the total of 50 channels that would include the 25 very good stations

and the 25 very bad channels. The remaining 50 channels which must be evaluated via an additional set of measurements consume the majority of the time, as indicated. System designers will need to evaluate these parameters to determine the performance parameters of their target system.

Table 2

		64ms	32ms	16ms
Number of Channels				
Very Good	25	.1 sec.	.1 sec.	.1 sec.
Very Bad	25	.1 sec.	.1 sec.	.1 sec.
Remainder	50	3.2 sec.	1.6 sec.	.8 sec.
Total Scan Time		3.4 sec.	1.8 sec.	1.0 sec.
Audio Removed Down to:		15 Hz	31 Hz	62 Hz

Every time a channel change is made the SS, N, and AFT capacitors are clamped and released as described earlier, but reference to this procedure is omitted from intermediate steps in the flowcharts, such as step 100, for the sake of brevity. Flowchart steps that implicitly incorporate the clamping and releasing procedure include: steps 100 and 108 of Figures 2 and 5; step 175 of Figure 10; step 224 of Figures 13 and 16; step 216 of Figure 12; steps 470 and 476 of Figure 27; step 482 of Figure 28, and any other steps that specify a channel change.

Then, in a diamond decision step 104, the strongest channel is rejected if the SS averages for both groups of samples are not greater than the threshold value used in step 92, the SS ranges for the groups are not within 10% of each other, the averages of N for both groups is above the curve of Fig. 4, or the variance between the AFT averages for the groups is greater than .02 v, which is equivalent to approximately ± 2μA or 320Hz

frequency deviation. Since the search is for a stable, listenable, noise-free station, the noise limit at 5 TC (time constants) is reduced to 0.1 v as indicated in Fig. 4 so that the noise limit is much lower than in the step 92.

If the channel having the largest SS is rejected on any of the criteria in the diamond decision step 104, a check is made in diamond decision step 106 to see if another channel has been recorded in memory at step 94. If so, the next strongest station is tuned in (step 108) and examined as in the step 102 and the diamond decision step 104. If no satisfactory station is found, the AFT is not calibrated, step 110, and the range of AFT values used in diamond decision step 92' is increased, e.g. to ± 3 v, in determining the listenability of channels as described in connection with subsequent flowcharts.

If a station passes the criteria of the diamond decision step 104, the average of the AFT averages for the two groups of samples is used, step 112, as the reference value of AFT for the computation of the AFT offset as required in other procedures to be described herein. In a dual tuner system, an optional step 113 can be undertaken at this time to balance the measurements of the two tuners so that both will respond identically to broadcast signal parameters. Step 113 refers to Fig. 2B, which is described next. After both tuners have executed the power up routine of Fig. 2, step 101, the SS average for the calibration station measured by the scanner tuner is subtracted from the same measurement made by the listening tuner in step 103 to arrive at the SS dual tuner balancing factor. In

step 105 this SS balancing factor will be added to all subsequent measurements of SS by the scanner tuner that are described in the flowcharts in this document. An N dual tuner balancing factor is similarly arrived at in step 107, and is used to adjust all subsequent scanner tuner N measurements in step 109.

Now returning to Fig. 2, when this startup calibration procedure has been completed, the radio can shift into its normal operation modes, as indicated in step 111 and which will be described in other flowcharts in detail. In either case, the tuner is tuned to a predetermined startup station, step 114 which may be the station the radio was tuned to when the radio was last powered off.

In view of the fact that there is considerable redundancy in the flowcharts for operating listening and scanning tuners, identical steps and diamond decision steps are designated by the same number and those that differ only slightly are designated by the same number primed.

Whether or not the reference value of AFT found by the initialization procedure of Fig. 2 just described is still valid, depends on the amount of time that has elapsed from the last determination of a reference value. Therefore, after a seek or scan mode of operation is activated in a single tuner receiver or the listening tuner of a dual tuner receiver, the elapsed time is noted, diamond decision step 115 of Fig. 5, and the value of AFT found in the initialization procedure is used, step 116, if the elapsed time is less than some arbitrary amount such as the five minutes shown in the diamond decision step 115. If too much

time has elapsed, the procedure followed to derive a suitable reference value of AFT is shown in Fig. 5. Fig. 5 proceeds from a State 1 to a State 2. It is nearly the same as Fig. 2, but differs therefrom in the following respects.

If the weakest station listed in memory at the step 94 of Fig. 2 is not satisfactory, there is no other station that can be used to provide the reference AFT, but in Fig. 5 there may be another station so that instead of not calibrating AFT as in step 110 of Fig. 2, a search is made, diamond decision step 118, to see if there is a previous calibrated value of AFT stored in the system's memory, in which event it is used, step 120. Although five minutes may have elapsed since the initialization procedure, the procedure of Fig. 5 may have been performed in the meantime in the normal course of seek or scan tuning operations.

Whether or not five minutes has elapsed since the reference AFT was determined by the initialization procedure, the procedure of Fig. 5 may be used if there has been a significant change in temperature. The change in temperature is indicated by a sensor voltage, step 121, and if it does not indicate a given change in temperature since the last reference value of AFT was determined, step 123, whether during initialization or otherwise, the previous reference value for AFT is used, step 125, but if a greater change in temperature has occurred, the procedure of Fig. 5, beginning with the step 88, is followed.

Fig. 6 is a flowchart of the tuning operation in accordance with basic aspects of this invention of an FM receiver having only one tuner and no display or "best station memory"

feature. Each channel is accepted as a listenable station or rejected as an unlistenable station as it is addressed in the seek or scan mode of operation, but the decisions are made more accurately and quickly than in the prior art.

After the seek or scan mode operation is initiated, as indicated by a step 122, the procedure passes from a state 1 to a state 2 so as to attain a calibration of AFT on a very good station in the same manner as indicated by the flowchart of Fig. 5. Unlistenable stations are identified in much the same manner as in Fig. 5. The step 88 for momentarily clamping the SS, N and AFT capacitors and the step 90 for sampling are the same as in Fig. 5, but a new step 124 is added that determines the difference, or offset, between the AFT voltage of a current channel and the reference AFT voltage. No offset could be used in Figs. 2 or 5 because their purpose was to obtain a reference value of AFT for determination of the offset. Therefore only a range of AFT values could be used in Fig. 5, as in the prior art, but in Fig. 6 a diamond decision step 92' is the same as the diamond decision step 92 of Fig. 5 except for the fact that the AFT offset, rather than the AFT voltage itself, is compared with the voltage limits indicated. If a station passes the criteria of the diamond decision step 92', it is accepted and the audio signal is turned on, step 126. Because the selection of acceptable stations is made on the basis of a few samples and rather loose criteria, they may well include stations that are barely listenable or even unlistenable as in the prior art, but unlike the prior art, the same channels are accepted by the same

radio at different temperatures and by different radios of the same basic design.

Fig. 7 is a flowchart that adds further steps to the flowchart of Fig. 6 for distinguishing between listenable and unlistenable stations with greater accuracy. It provides for assigning the strongest channels to memory buttons (push button switches associated with respective memory locations) commonly referred to as "best station memory" buttons, but has no display. Except for adjusting the minimum quality level and SS threshold in accordance with the position of a country driving/city driving switch as optionally indicated at a phantom step 126, the first part of the procedure is the same as in Fig. 6. At a start step 122' seek or scan buttons can be activated as in the step 122 of Fig. 6, but in addition there is a best memory button.

Very listenable stations are now identified. If a channel is not rejected at the diamond decision step 92', a diamond decision step 128 determines whether or not it is very listenable on the basis of its having virtually no noise. Thus, an unlistenable channel is identified in the diamond decision step 92', and a very listenable channel is identified in the diamond decision step 128 on the basis of a very few samples taken in the step 90, therein shown by way of example to occur in 4 ms.

Only a channel that is not rejected in the diamond decision step 92' as being unlistenable or not classified as being very listenable in the diamond decision step 128 is subjected to further sampling and analysis for determining

whether it is listenable or not. Much time is saved because the number of channels subjected to further analysis is reduced. Further samples are taken of SS, N and AFT and the averages of each determined as indicated in a step 130. In this example, 32 samples are taken at 0.5 ms intervals during the next 16 ms. If a quality factor, QF, is to be computed, the ranges of SS and N are found. The offset of the average AFT from the nominal value of AFT is determined in a step 132, and a diamond decision step 134 determines whether the SS average is greater than a given threshold, the N average is less than a given limit, and the AFT average is less than a given limit. The acceptance/rejection values reflect the charge curve, as illustrated in Fig. 3, for the time period when the samples were taken. If an affirmative answer is attained for all three, the channel is considered to be listenable, but if a negative answer occurs, the channel is rejected and the procedure loops back to the step 88 as indicated by the step 93.

Note that in order to be accepted as listenable by the step 134, a channel must be more listenable or better than that required for acceptance by the step 92' because there are more samples which refine the measurement. By example, an average of 0.5 v for the samples taken in this step 130 would be a much lower noise limit than in the step 92', and an AFT offset of 73mv (equivalent to 27μAmps) is much less than the offset of 0.5 v (equivalent to 185μAmps) used in the step 92'.

As a further refinement of the system, station listenability may be analyzed by use of the quality factor

determined by steps 136 and 138 that are shown in dashed lines. This is a mathematical procedure that combines the effects of multiple signal parameters into a single result. This procedure yields better results than would be obtained by depending on any single signal parameter. Stations may be graded into two or more groups based on their respective quality factors, and the gradings may be distinctly indicated by various means on systems with a display unit. A means may be provided for selecting stations of certain gradings, and of rejecting stations of other gradings. The use of QF to accept or reject stations may be done sequentially, following diamond decision step 134, as shown by the solid line in the flowchart, or it may be done in lieu of diamond step 134, as indicated by the dashed line in the flowchart proceeding from step 132 directly to step 136. The quality factor, QF, expression is repeated here for convenience, as follows:

$$QF = \sqrt{AVG\ N \cdot APT\ offset} + \frac{N\ range}{2}$$

Since this is a simple calculation, the associated procedures can be easily provided by one skilled in the art. If, as indicated in a dashed diamond decision step 138, the QF is equal to or greater than a preselected value, the channel is considered to be listenable. Ordinarily, the preselected value would be set at 9, but if noisy channels are not desired, it could be set at 5. A key on the keyboard 42 controls means for varying the value

of the QF used as a criteria for selection of a channel as listenable.

If a channel is rejected as unlistenable at any of the diamond decision steps 92', 134 or 138, the next channel is analyzed beginning at the step 88 as indicated by the step 93, but if a channel is determined to be very listenable by the diamond decision step 128 or listenable by the diamond decision steps 134 or 138, the best stations are assigned to channel selection or memory buttons as immediately described. A diamond decision step 140 determines whether one of the seek or scan tuning buttons, or a best station memory scanning button has been activated. If a seek or scan button has been activated, the audio is turned on, step 142, and the procedure stops. If the best memory scanning button has been activated, the channel is recorded on a tuning list for subsequent loading into a memory location associated with a channel selection button via step 144. Next, diamond decision step 146 determines if the entire FM band has been scanned. If not, the procedure loops back to the step 88. If so, the tuning or memory buttons are respectively associated with the stations in accordance with their SS. Alternatively, only the very good stations having no noise, as determined by diamond decision step 128, could be assigned to the memory or channel selection buttons, but if there are less of such stations than there are channel selection buttons, the remaining buttons could be assigned on the basis of their SS.

The procedures for finding listenable stations as illustrated in Fig. 7 and elsewhere are designed to minimize the

time required to scan the frequency band and make this determination. However, if speed were not an issue the AFT calibration procedures of Fig. 1 or Fig. 5 could be used instead since they essentially are simply more rigorous algorithms for finding a good station.

An important aspect of the invention is the speed with which the channels of a band can be classified as unlistenable, very listenable, or listenable. In addition to the clamping of the SS, N and AFT capacitors 24, 26, and 28, respectively, before they are fully charged, as was explained in connection with Figs. 1, 3 and 4, the speed is contributed to by the fact that unlistenable and very listenable channels are quickly identified on the basis of a first group of a very few samples by the diamond decision steps 92' and 128, respectively, so that these channels do not have to be analyzed on the basis of the second group of samples referred to in the step 130 or in the step 138 if used.

Another factor contributing to the speed of scanning a band of frequencies is that satisfactory values of SS, N and AFT can be attained by averaging the samples taken from a circuit with a smaller filter, rather than by using a larger filter in conjunction with a hard-wired trip circuit as in the prior art. This is especially advantageous in deriving the value of AFT, because in the prior art the AFT filter circuit should be designed to filter out the lowest audio frequency which may be present. The sampling period of 16ms as used in this application is adequate to remove the super-imposed audio down to 62Hz.

Other sampling periods could be selected for either faster or more precise operation as previously described. A large filter capacitor introduces considerable delay. Typical engineering practices in prior art radio design allow 70 ms to evaluate each channel due to this filter. Fig. 2A, previously discussed, shows an AFT signal 91 as it would appear with a reduced low pass filter when the IF signal is modulated with a low audio frequency. This signal is the summation of the audio signal and the more slowly changing AFT signal. The second group of samples are indicated at $s_1 - s_{16}$, and it can be seen that their average will be substantially unaffected by the audio signal as shown by the dashed line 95.

Fig. 7A illustrates a different procedure that can be used in Fig. 7 if the diamond decision step 92' rejects a channel. Certain types of radio interference patterns will cause intermittent ultrasonic noise bursts that are barely detectable audibly, but which exceed the noise rejection limit for a few milliseconds during each burst. A diamond decision step 150 determines whether only the noise N exceeded the limit in the diamond decision step 92'. If not, the channel was rejected for other reasons and the procedure loops back to the step 88 via step 93, but if only N exceeded the limit, there is a slight delay before another sample is taken of the noise, step 152. This additional sample must confirm the continued presence of noise in order for the station to be rejected. Then at a diamond decision step 154 it is determined whether the amplitude of the sample exceeds the amplitude of the curve of Fig. 3 at the time

the sample occurred. If so, the next channel is tuned in, step 93, and the procedure loops back to the step 88. If not, the channel is not considered to be unlistenable because of N and the procedure goes to the diamond decision step 128.

Fig. 8 illustrates the flowchart for the tuning of an FM receiver in which the very listenable and listenable channels are recorded in memory and displayed as shown at 44 of Fig. 1. The FM band is scanned so as to update the display 44 upon request of the operator if such an update has not been done within a given time. Thus a step 122'' differs from the steps 122 and 122' in Figs 6 and 7, respectively, by indicating that a refresh scan button is included with the seek and scan tuning buttons. After finding a nominal or reference value of AFT in going from state 1 to state 2 in a manner such as illustrated in Fig 5, it is determined via diamond decision step 156, whether a scan of the FM band has been made more than a given time previously. Thirty seconds is suggested, but other times could be used. If not, the next station in the existing tuning list is tuned in and its audio turned on (see step 158), so as to enter a state 3 in which the station is monitored as will be explained in connection with Fig. 9. If the allocated time has elapsed since the last scan, the procedure for identifying unlistenable, very listenable and listenable channels described in connection with Fig. 7 is carried out. Very listenable and listenable channels are recorded on a tuning display list and their SS and N values are recorded via step 160. If the QF is used (see step 136 and decision step 138), it is recorded. As

in Fig. 7, a diamond decision step 146 determines whether or not all the channels in the FM band have been analyzed. If not, the procedure loops back to step 88. If so, the display is updated via step 162, with the very listenable and listenable stations found in the most recent scan along with indications of their respective noise levels N and their quality factors, QF, if the latter are used.

It is then determined at a diamond decision step 140 whether a seek or scan tuning button has been activated. If so, the radio is tuned, step 166, to the next listenable or very listenable channel, in reference to the channel that was tuned in at the time of step 122", as determined in the updating procedure. As indicated by a state 3, this station is then monitored as will be described in connection with Fig. 9. However, if a display refresh button has been activated, the scanning process will have cycled the tuner back to the starting channel. Step 164 indicates that the tuning process stop at this point for continued listening at that channel. Implicit in this step is the unstated requirement to turn the audio back on.

Fig. 9 is a flowchart for monitoring a tuned in channel in state 3. As noted in step 168, when a station is tuned in, samples are taken of SS, N and AFT and their averages as well as the ranges of SS and N are computed. The offset of the average AFT is also determined, via step 170, and, if desired a QF is computed, step 172. A determination is made if the station is drifting in step 173 by comparing the SS range to some predetermined value such as 0.2v, and if so the display may be

caused to indicate that fact such as by updating location 511 of Fig. 31 to display the word "Drifting". Updating of the display of SS and N and QF, if used, is performed in step 174. If a station is broadcasting digital data, relative data is presented on the display 44 via step 175. Next, the procedure loops back to step 168. Thus, a tuned in channel is repeatedly updated.

Reference is now made to the flowchart of Fig. 10 for a description of a dual pass method for tuning a single tuner FM radio having a display. During a first pass, the unlistenable and very listenable channels are identified in the same way as in Fig. 8, i.e., by the actions in steps 88, 90 and 124 and the decisions in the diamond decision steps 92' and 128. A diamond decision step 146 causes the procedure to loop back to the step 88 until all the channels of the FM band have been analyzed. Any unlistenable channels detected at the diamond decision step 92' are marked in memory via step 168. The very listenable channel detected in step 128 are assigned the best QF and are also marked in memory, in step 170. These stations are assigned the best QF because an insufficient number of samples have been taken, over an insufficiently long period of time, in order to accurately determine the station's AFT. However, since the station has passed the tests in steps 92' and 128, and therefore is known to exhibit virtually no noise, it is presumed to offer the best listenability and therefore is assigned the best QF. When diamond decision step 146 indicates that the first pass is complete, a second pass is entered.

The purpose of the first step 174 of the second pass is to run a side channel elimination algorithm. The SS of the channels on either side of each listenable channel noted in the first pass are compared with the SS of the listenable channel between them, and if the latter is stronger than both by a certain percentage, > 30% in this case, they are considered to be invalid and are not to be placed in memory. The broadcast energy of strong stations overflows into the adjacent channel frequencies. In this situation the signal energy of the center channel will be substantially stronger than that of the adjacent channels (which
are referred to as "side channels"). Occasionally side channels will not be rejected in Pass #1 because the noise and AFT parameters sometimes fluctuate into the "listenable" range. The intent of this feature is to discover these situations and classify the side channels as unlistenable without subjecting them to the Pass #2 analysis. As stated earlier, this algorithm may be enhanced to require that both adjacent channels possess greater than a certain minimum noise level in order to be rejected as side channels.

Next, in a step 175 the radio is tuned to the next channel which has not been marked in memory as being listenable or unlistenable, and a second group of samples is taken of SS, N and AFT, their respective averages are computed and the ranges of SS and N are derived in step 130', which differs from step 130 by an initial wait state due to the fact that the channel was just tuned in. The offset of the average AFT with respect to the

AFT determined in going from state 1 to state 2 by the procedure of Fig. 5 is calculated in step 132. The diamond decision step 134 then checks to see if the SS > a given threshold, its noise average is < .5v, and its AFT offset is < 73mv. An AFT offset of 73mv is equivalent to an offset of 30μAmps, or a frequency deviation of 4,800Hz. It is to be understood that the voltages used are only examples. Any channel that fails to pass these tests is noted in memory as being invalid, via step 176, and SS and N levels for channels that pass the test are noted in memory, via step 178. If desired, a further sorting out of listenable channels can be effected by computing the QF in step 136 and checking in the diamond decision step 138 as to whether the QF exceed a selected value. If the last procedure is used, the QF's above the selected level are recorded via step 178. A diamond decision step 180 determines whether all channels not marked as invalid at step 168 or marked as valid at step 170 have been analyzed in the second pass. If not, the procedure loops back to step 130. If so, the display is refreshed with indications of listenable channels and their N and QF factors are indicated, via step 162. If the refresh scanning button has been actuated as determined by the diamond decision step 140, the procedure terminates, but if a seek or scan button has been activated, the next station on the tuning list is tuned in, its audio turned on and the tuning procedure enters the state 3, wherein the channel tuned in is monitored in accordance with Fig. 9.

Dual Tuner System

In a dual tuner system of another embodiment of the invention, a listening tuner provides the IF signals for the audio program of the channel that is tuned in and a scanner tuner periodically updates the tuning list and provides RDS information for display. In the block diagram of a dual tuner system shown in Fig. 11, an antenna 182 provides RF signals to a listening tuner 184 and to a scanner tuner 186. An IF amplifier 188, audio amplifier 190, and a loudspeaker 192 are coupled to the listening tuner 184. An IF amplifier 194 is coupled to the scanner tuner 186. Although not shown, the IF amplifiers 188, 194 include limiters and discriminators for deriving the audio signals. A controller 196 for the tuners 184 and 186 includes a CPU (central processing unit) 198, for controlling both a phase locked loop (PLL) 200 for tuning the listening tuner 184, and another phase locked loop 202 for tuning the scanner tuner 186. An analog-to-digital converter (ADC) 204, connected to the CPU 198, is coupled to receive the S, N and AFT voltages derived from the IF amplifier 188, and an ADC 206 that is connected to the CPU 198 is coupled to receive S, N and AFT voltages derived from the IF amplifier 194. RDS information, that may be transmitted along with the channel to which the listening tuner 184 is tuned, is coupled from the IF amplifier 188 to the CPU 198 via RDS means 208. RDS information, that may be transmitted in the channel to which the scanner tuner 186 is tuned, is coupled from the IF amplifier 194 to the CPU 198 via RDS means 210.

A display 212 is controlled by the CPU 198 for presenting both indications of the listenable and very listenable channels identified by the scanner tuner 186 at respective frequencies along the band, and indications as to certain information such as their SS and QF, and any pertinent RDS information.

The arrangement described in Fig. 11 is that of an FM receiver system, but the illustration is intended to convey the general case, and therefore also apply to an AM receiver system, or to a system incorporating both AM and FM receivers. In the AM case, boxes 184 and 188 together, as well as boxes 186 and 194 together, would generally be incorporated in the same physical device, such as a National Semiconductor LM1863 AM receiver system. RDS features are not generally considered for deployment on AM broadcasting systems, and so the RDS decoders 208 and 210 may be unnecessary. In the case of a combined AM and FM receiver, a single CPU 198 could connect to and control the associated PLL, ADC, and RDS subcomponents for both receiver systems, and all of these devices could be incorporated into a single controller as 196. In addition, both listening and scanner tuners 184 and 186 might be constructed into a single physical unit 185, and both listening and scanner IF stages 188 and 194 might be constructed into a single physical unit 189.

Fig. 12 is a flowchart of the operation of the listening tuner 184. Step 214 calls for activation of either a seek or scan tuning button. If either button is activated, the procedure goes from a state 4 to a state 5 so as to find a

nominal or reference value for AFT in accordance with the procedure of Fig. 13, described below. In step 216 the listening tuner 184 is then tuned to the next station on the tuning list displayed on display 212, as a result of the last scan of the scanner tuner 186, and the audio is turned on. The operation of the scanner tuner 186 for identifying listenable stations will be explained by reference to Fig. 15. Data held in memory for the channel which was provided by the scanner tuner 186 is presented, via step 218, on the display 212. Next, as in the case of Figs. 8 and 10, a state 3 is entered wherein the channel tuned in on the listening tuner 184 is monitored as previously described in connection with Fig. 9.

Reference is now made to Fig. 13 for a description of the calibration procedure followed by the listening tuner 184 in going from the state 4 to the state 5 of Fig. 12 to find the nominal or reference value of AFT to be used in the monitoring operation in state 3. The purpose for calibrating AFT by the listening tuner 184 is so that the QF displayed for a station by the scanner tuner 186 is the same as that displayed by the listening tuner when the station is tuned in for listening. This is possible because although the tuners may have different absolute values of AFT, their AFT offsets for a given station will be the same, and AFT offset is predominant in the determination of QF that is performed in accordance with Fig. 9. Although, as will be explained in connection with Fig. 14, the scanner tuner 186 has already found a numerical value of AFT, this value may differ from the value found in Fig. 13 since the

respective components in each tuner section may differ slightly in value. At diamond decision step 220, a determination is made as to whether a predetermined amount of time, such as the suggested 5 minutes, has elapsed since the last AFT calibration of the listening tuner. If not, the previous nominal or reference value of AFT is used, step 222, so as to place the system in the state 5. If, however, more than the given time has elapsed since the last calibration, the listening tuner 184 is tuned, step 224, to the station on the tuning list developed by the scanner tuner 186 in a manner to be explained by Fig. 15 that has the greatest value of SS.

The following is a description by example of the procedure just described. Assume that the scanner tuner is precisely aligned for AFT such that when AFT is calibrated on a very listenable station it measures zero current and zero volts. Next, assume that the listener tuner is misaligned for AFT such that when AFT is calibrated on the same very listenable station it measures +50μAmps and, therefore +135mV. In each tuner, the measured AFT values become the Nominal AFT for computing the AFT Offset of other stations. Now assume that both tuners will tune to a poor station such that when the scanner tuner tunes it in its AFT measures +10μAmps. The AFT Offset for this station for the scanner tuner will be +10μAmps - 0μAmps, and so will be the absolute value of 10μAmps. When the listening tuner is tuned to this same station the AFT will measure +60μAmps, and +60μAmps - +50μAmps equals an absolute value Offset of 10μAmps. This is because in each case what is really being measured is the

difference in transmission quality between two radio signals, and no matter which tuner does the measuring, the difference between the two signals will always be the same.

At this point, the procedure is like that of the last portion of the initialization procedure of Fig. 2 in which, after a brief delay, such as 4.5 ms, two successive groups of samples of S, N and AFT are taken and the respective averages for each group computed (see step 102). Also computed is the range of the values of SS for each group. In diamond decision step 104, a determination is made of whether the SS averages of both groups of samples are greater than a given threshold, the ranges of SS for the two groups are within some percentage like the suggested 10% of each other, and both averages of N are within a given limit. The limit suggested is less than .03v when the 5 TC (time constant) limit is .1v as explained in connection with Fig. 4. Diamond decision step 104 also determines whether the variance between the AFT averages for the two groups is less than a given voltage such as the suggested .01v, equivalent to approximately 3μAmps or a frequency deviation of 480Hz.

When the step 104 indicates that the strongest station has not met the criteria stated therein, it is determined at a diamond decision step 226 whether there are any listenable stations that have passed the criteria in step 104. If so, the next strongest station is tuned in, via step 228, and it is processed as indicated in step 102 and in decision step 104. If there is no other listenable station on the tuning list, it is determined in step 106 whether there is a previous nominal or

reference value of AFT. If so, it is used in step 230. If not, the AFT is not calibrated, and the range of acceptable AFT values to be used in a manner to be explained in the flowchart of Fig. 15 is increased in step 110; in this example the values are doubled. Thus, at the state 5 there is either a nominal value of AFT to be used or the acceptable ranges of AFT are increased.

Reference is made to Fig. 14 depicting the overall operation of the scanning tuner 186. After a reference value of AFT is determined by the initialization procedure at step 111 of Fig. 2, the process enters state 6 of Fig. 15 in which the band of channels is scanned in a manner to be described to select and display listenable channels and certain data relating to their quality. At the end of Fig. 15, the process goes to a state 7 at the beginning of Fig. 15A that monitors listenable stations in a manner to be described for digital data that might be broadcast if such is desired. From the end of Fig. 15A, the process enters a state 8 of Fig. 16 to find in a manner to be described a reference value of AFT. At the end of Fig. 16 the process loops back to the state 6 at the beginning of Fig. 15. There may be an optional delay of arbitrary duration before the state 6 of Fig. 15 is re-entered. Fig. 15A is omitted if digital data broadcast by the stations is not desired.

Reference is made to the flowchart of Fig. 15 showing the scanning cycle of operation of the scanner tuner 186. Optional but desirable features of the invention are shown in phantom diamond step 138, and phantom block steps 126, 136, 244, 253, and 254. The steps of Fig. 15 are similar to those in the

flowchart of Fig. 8, and are identified by the same numerals. Nevertheless, a brief summary is presented here for convenience. The S, N and AFT capacitors 24, 26, and 28, are respectively clamped to reference voltages as previously described, and clamps are released in step 88', which differs from step 88 in that, since this is a scanner tuner, not a listening tuner, its audio output would normally not be connected, and so 88' omits the action item of "Turn off audio". A first group of samples is taken of S, N and AFT voltages and the respective averages attained in step 90. The AFT offset is computed in step 124. If used, step 126 adjusts the minimum SS and QF in accordance with the position of a city driving/country driving switch if present. The value of SS, N and AFT derived from the first group of samples taken in step 90 are subjected to certain loose criteria in step 92'. If the channel does not pass the criteria, in step 93 the next channel is tuned in, and the procedure loops back to step 88.

If a channel meets the criteria of the decision step 92' and is found at decision step 128 to have virtually no noise, it is accepted as very listenable and stored via step 160 in memory along with its values of SS, N and QF. This leaves channels of questionable listenability. Some may be listenable and some not. Those that are listenable are sorted out in step 130'' by taking a second group of samples, determining the averages, and determining the ranges of SS and N samples. Step 130'' differs from step 130 in that, since this is a scanner tuner and the duration of a scan is somewhat irrelevant, step

130'' collects samples over a 64ms period rather than a 16ms period. In step 132 the offset of the average AFT is determined, followed by decision step 134, in which these values of SS, N and AFT offset are compared with criteria indicated. If any criteria are not met, step 93 initiates the next channel being tuned in, via repeating the previously described procedure starting at step 88. If a channel meets all of the criteria of decision step 134, the station is recorded via step 160 in the tuning display list along with the SS and N values. If the QF is calculated via step 136, it is compared with the QF determined by position of the city driving/country driving switch in decision step 138. If the QF is below that selected, step 93 is addressed, but if it is acceptable, step 160 is addressed.

One difference with the flowchart of Fig. 8, compared to that of Fig. 15, is that in step 232 of Fig. 15 an indication is made in memory as to whether any station that has been found to be very listenable or listenable is transmitting data in addition to the audio signal. Next, decision step 146 determines whether all channels of the band have been analyzed. If not, a loopback is made to step 88. Ignoring for the moment the phantom steps, in step 162 the display 212 is refreshed with any new listenable channels, and formerly listenable channels that are now unlistenable are deleted. In addition, in step 162 appropriate indicators for SS, N, and QF are produced for each listenable and very listenable channel.

The scanner tuner 186 is now in state 7 and ready for the data monitoring cycle shown in the flowchart of Fig 15A. The

next station marked with a data flag in step 232 is tuned in via step 234. The action is independent of the channel to which the listening tuner is tuned so that any channel could be selected. The broadcast data from this station is collected in step 236, and data for each channel is stored in a display buffer for that channel via step 238. Old data is deleted. In step 240, the display 212 is updated with any relevant information or special indicators from the channel tuned in. This information could indicate the type of material being broadcast. Decision step 242 checks to see if all channels have been examined. If not, step 234 is readdressed, but if so, the system loops to the state 8.

Additional embodiments of the invention described in the phantom blocks 126, 136, 244, 253, 254, and diamond decision step 138 of Fig. 15 will now be discussed in greater detail. The first of these is step 244 in which an average of the current QF and SS with values obtained during previous cycles is attained in order to present more stable values in the display 212. There are, of course, many ways for deriving a weighted average, but the one illustrated in Fig. 15B has been found to be useful. First, all but the current and two previous values of SS and QF are deleted in step 245. Next, in step 246 the current measurement is multiplied by 1.00, the first previous measurement by .5, and the second previous measurement by 0.25. The products are summed in step 248, and the multipliers are summed in step 250, to produce 1.75. In step 252, the sum of the products is divided by the sum of the multipliers, and the more stable value is shown in the display 212 via step 254. A similar mathematical

process could be applied to obtain a weighted average for any number of measurements instead of just the three measurements indicated in step 244. As noted, this averaging can be used for both SS and QF, as well as N or AFT.

In step 253 of Fig. 15, the strongest of the stations recorded at the step 160 are loaded into memory locations associated with best station memory buttons if provided, and the display 212 is updated so as to indicate the memory button number associated with each station's indicator in the display illustrated in Fig. 32.

A phantom block 254 in Fig. 15 suggests that indications be made on the display 212 as to whether a channel indicated as listenable is increasing or decreasing in SS and for QF, as illustrated in Fig. 32A. Fig. 15C is a flowchart of an embodiment of the invention indicating one way in which this may be accomplished. The weighted average of SS or QF determined in Fig. 15B for the current scan of the FM band is compared with the respective weighted average for the next previous scan of the FM band via step 256. At decision step 258 it is determined whether a difference is less than some given percentage, therein shown as being 10%, for example. If so, step 260 provides for displaying a standard station indicator bar. If not, decision step 262 determines if the later average value is greater than the previous average value. If it is, step 264 causes an upward pointing arrow to be displayed. If it is not, step 266 causes a downward pointing arrow to be displayed as illustrated by station indicators 517 in Fig. 32A.

During a first scan of the band of channels in accordance with Fig. 15, a reference value of AFT is determined by the initialization procedure of Fig. 2 in making its decisions as to the listenability of each channel, but after the procedure of Fig. 15 or of Fig. 15A, if the latter is used, the procedure of Fig. 16 is used to update the reference value of AFT to be used in the next scan of the band of channels. Fig. 16 is state 8 and terminates by returning to state 6 (Fig. 15) and is substantially the same as the procedure for finding a reference value of AFT in the listening tuner as set forth in Fig. 13. In Fig. 13, there is, as indicated by the step 115, no calibration of AFT, if no valid station is found in the loop of steps 102, 104, 226 and 228 and if there is no previous calibrated value as indicated in the step 106. If this occurs in Fig. 16, however, the range of acceptable AFT values used is increased, step 231, in order to accommodate variations in temperature and other factors.

Alternative Way to Find Reference AFT

Reference is made to Figs. 17, 18, 19, and 19A for an explanation of a way of determining the nominal or reference value of AFT in going from state 1 to state 2 in Figs. 6-8 and 10, as well as variations in the SS threshold and N limit on the basis of ambient temperature rather than using the AFT voltage of a very listenable station. Another approach would be to combine the AFT ambient temperature adjustment along with the calibration of AFT on a very listenable station, by the simple

combination of the procedures outlined in this application, as illustrated in Fig. 19A. In addition, the threshold for SS and/or the rejection limit of N may also be varied in accordance with temperature. In the circuit of Fig. 17, the ambient temperature is determined by the voltage at the junction 266 of a resistor 268 and a temperature sensor 270, which may be an LM135, that are connected in series in the order named between a point 272 of regulated DC. voltage $+V_2$ = 9 v and ground. An ADC 274 converts this voltage to a digital value, and the CPU 198 of Fig. 11 provides the value of AFT voltage to be used from the illustrative look-up table of Fig. 18. The percentage variation in the SS threshold and the limit of N can also be provided in the same way.

The procedure for making these determinations is set forth in the flowchart of Fig. 19. At a decision step 276 a determination is made as to whether there has been more than a given change, such as the suggested .05v, at the junction 266 since the last reading. If not, the procedure terminates via step 278, but if so, in step 280 the temperature sensor voltage at the junction 266 is looked up in a stored table illustrated in Fig. 18 to find the value of AFT voltage and the percent change in the SS threshold or the N limit that should be used. In step 282, the AFT voltage is assigned as the value to be used in deriving the AFT offsets. In an alternative system that incorporated both ambient temperature and very listenable station methods for determining AFT, step 282 of Fig. 19 would instead describe a procedure for adjusting the Nominal AFT derived from

a station by an amount specified in a table similar to Fig. 18. This alternative procedure is identified in step 282' in Fig. 19A, which is otherwise the same as Fig. 19. If desired, step 284 provides for deriving the SS threshold from the table of Fig. 18, for use in the various flowcharts. If it is also desired to adjust the N limit used in the flowcharts, this is done in accordance with step 286 and the table of Fig. 18.

Adjustment of Noise Limit

Instead of using a manufacturer's suggested noise limit or the limit determined from temperature in the manner just described, the limit may be calculated in accordance with an aspect of this invention on the basis of the noisiest channel. If implemented at the points in the procedures of Figs. 2 and 5 indicated by a step 98 shown in dashed lines, noise voltage found can be substituted for the 0.1 volt in the subsequent step 104 so as to raise or lower the noise limit curve of Fig. 4. Although the step 98 is not shown in Figs. 6, 7, 7A, 8 and 10, it could be used at such a point in these procedures as to supply the maximum value for the noise limit curves of Figs. 3 and 4 wherever they are used, e.g. in steps 128, 134 and 154, wherever they appear. In the flowchart for this procedure shown in Fig. 20, the highest average value of samples N during a scan is determined via step 288, and the limit of N for the 5 TC value in Fig. 3 is set at an arbitrary percentage such as the 25% less than this value as suggested in step 290. In step 292, the noise rejection limits for the other time constant periods used in the

flowcharts are based on an appropriate proportional value multiplied by the new noise rejection limit. For example, a measurement taken at two time constants would use a noise rejection level of 86% of the new noise rejection limit.

A noise limit can also be calibrated in accordance with another aspect of this invention by measuring the noise with the associated antenna clamped to ground so as to exclude received signals. In a circuit of Fig. 21 for making this calibration, an antenna 294 supplies RF signals to a tuner 296 that is coupled to an IF amplifier 298. A switching device such as a relay or transistor 300 (relay is shown) that is connected from the antenna 294 to a point 302 at ground potential is shown as being operated in response to a voltage produced by an address decoding logic 306 under the control of a CPU 308 that is coupled both to the tuner 296, and the IF amplifier 298.

Fig. 22 is a flowchart indicating the manner in which the CPU 308 of Fig. 21 operates to derive a calibrated noise value. As indicated in step 310, the switch 300 is closed so that the only noise in the receiver is thermally generated. Next, in step 312, samples are taken of the voltage across the N capacitor 26 after a brief delay, and their average is computed. The average is multiplied by the inverse of the percentage of full charge occurring at the end of the time of sampling. By way of example, if the end of the sampling occurs at 1 TC, the capacitor will be 63% charged, and the inverse of this is 1.6. At the time of system design, in step 314 a base level for receiver generated noise is set and a noise rejection

limit suggested. In step 316, the average noise measured with the antenna 294 grounded is subtracted from the base level. The difference is added to the base noise level to obtain the noise rejection limit via step 318. Thus, the noise rejection limit is adjusted in accordance with the actual thermal noise generated by the receiver. If the thermal noise is greater than the base level, the noise limit is increased and vice versa. The new noise rejection limit is used in place of the base level in all of the associated flowcharts or methods of the invention. The switch 300 is then opened via step 322.

Circuit Parameters

Reference is now made to Figs 23 and 24 that show the circuit parameters coupled to the major components including the tuner 4, the phase locked loop 6, the radio system 12, and the ADC 36 of Fig. 1. All parameters except those coupled to the SS, N and AFT output pins, respectively, are suggested by the manufacturer, or are not material to the discussion, and need not be discussed in detail, but for convenience their values or identification are set forth below in Table 3. It will be understood that this is only one embodiment of the invention so that the parameter values as well as the SS threshold, the limit of N and the AFT range may be different in an embodiment using different major components.

TABLE 3

R 328 -	270 ohms	C 332 -	.01 uf
R 330 -	27 ohms	C 334 -	.01 uf
R 338 -	68 ohms	C 336 -	.01 uf
R 344 -	3.3 kΩ	Quad Coil	TOKO K596
R 354/356 -	7.5 kΩ	C 346 -	10 uf
R 360 -	470 kΩ	C 352 -	.01 uf
R 372 -	220 ohms	C 364 -	470 pf
R 376 -	4.7 kΩ	C 366 -	30 pf
R 378 -	100 kΩ	Xtal 362 -	4 Mhz
R 380 -	8.2 kΩ	C 368 -	100 pf
R 384 -	22 kΩ	C 370 -	.01 uf
R 386 -	4.7 kΩ	C 374	1 uf

Ceramic Filter 324	TOKO SK107M2-AO-00
Ceramic Filter 326	TOKO SK207M2-AO-00
AMP 382	LM324

In the SS, N and AFT circuits that are respectively coupled to the PLL 6 of the illustrated radio system, the component values used as well as the values suggested by the manufacturer are as follows in Table 4:

TABLE 4

	Actual	Mfg's Suggested
C 24 (SS)	2.2 uf	10 uf
R 30 (SS)	10 kΩ	10 kΩ
C 26 (N)	1 uf	2.2 uf
R 32 (N)	22 kΩ	22 kΩ
C 28 (AFT)	4.7 uf	5.0 uf
R 34 (AFT)	2.7 kΩ	5.0 kΩ

The actual values of the SS, N and AFT capacitors C24, C26 and C28 and resistor R34 are less than those suggested by the manufacturer because the averaging of samples in the manner previously explained permits smaller values to be used. In the prior art, unwanted signals such as the audio in the AFT circuit

are attenuated by the filtering action of the capacitors so that the capacitors have to be larger.

In Fig. 24, resistors 388, 390, and 391 of 4.7 kΩ are respectively connected in series with the base leads of the transistors 46, 48 and 50 and form the enable circuit that clamps capacitors 24, 26, and 28 on channel changes.

The CPU 38 of Fig. 1 controls the entire radio system via connections to the phase lock loop 6, the display 44, and the ADC 36. The interconnections between these components use standard microprocessor interface design methodologies and are not detailed herein since anyone skilled in the art could develop a suitable design. The essence of the design of this radio is that the CPU 38 effects channel changes by sending a serial digital message via lead Dϕ of data bus 399 of Fig. 23 and Fig. 24 to PLL 6 which will cause PLL 6 to output a tuning voltage to FM tuner 4 such as to cause FM tuner 4 to tune to the desired channel. The CPU 38 implements clamping capacitors 24, 26, and 28 on channel changes by sending either a second or third digital message to PLL 6 which will cause PLL 6 to activate or deactivate, respectively, an output lead 395 which is used to turn transistors 46 and 48 on or off, and output lead 395' which is used to turn transistor 50 on or off, as desired. The CPU 38 reads SS, N, and AFT signal values by activating ADC 36 to receive data over data bus 399 via applying certain combination of values to leads 398, 402, and 406 through intermediate interface logic. Once ADC 36 is prepared in such a manner, CPU 38 sends a digital message to ADC 36 via data bus 399 commanding

the ADC 36 to sample a specific one of its input leads. Alternatively the CPU 38 will apply another combination of values to leads 398, 402, and 406 which will cause ADC 36 to output the digital value of the sample it has just taken on data bus 399, which will be read by CPU 38.

Fig. 25 illustrates the application of momentarily clamping AGC capacitors 418, 420, and a stop threshold capacitor 422 of an AM receiver so as to charge them to neutral values at the initiation of each channel change and thereby save time in tuning from one channel to another, in accordance with one aspect of this invention. Listenable channels can be shown in a display 405.

In the AM receiver shown in Fig. 25, an antenna 406 supplies RF signals to a receiver system 408, herein indicated as being a solid state chip LM1863. The LM1863 also requires additional external components such as coils, resistors, and capacitors according to standard design practices as recommended by the manufacturer, and are not shown. A CPU 410 controls a phase locked loop frequency synthesizer 412 so as to produce a tuning
voltage at receiver 408 that causes a local oscillator (not shown), to generate the frequency required to tune in the selected station, and the loop is completed by coupling the local oscillator output "LO Out" to the PLL 412.

Upon activation of a seek or scan mode, the acceptability of the next channel tuned in is determined on the basis of its signal strength as indicated by a meter out pin 15

of receiver 408, and the presence of a correct IF frequency as indicated by a tuned resonator circuit, not shown. When a desired combination exists, a stop detection circuit stops the tuning action and produces a voltage at pin 8 that is coupled to the CPU 410 via a latch 414. A signal indicative of the signal strength SS appears at a pin 15 and is placed in digital form by an ADC 416 before being applied to the CPU 410. In this particular embodiment, external capacitors 418 and 420 respectively connected to pins 1 and 4 form part of an AGC filter that is necessary to eliminate audio signals from the AGC voltage.

In going from one channel to the next, enough time must be allowed to permit the capacitors 418 and 420 to discharge. Otherwise, the stop action circuit may stop tuning on the next channel in response to the voltage stored on the capacitors 418 and 420 in response to the previous channel. The capacitors must be of adequate size to properly filter the AGC signal to prevent the AGC system from attempting to track the IF signal modulation envelope, which would cause high audio Total Harmonic Distortion (THD). Prior art design is therefore a compromise between tuning speed, which is slow for large value AGC filter capacitors, and THD. A delay of as much as 50 ms is typically provided to permit the discharging to take place.

In accordance with this invention, the delay is avoided by discharging the capacitors 418 and 420 with NPN transistors 422 and 424, respectively, in this example. This is accomplished by the CPU 410 sending an appropriate signal to the bases of the

transistors 422, 424 via an address decoding logic network 426, and coupling resistors 428 and 430. A low value resistor 419 is in series with capacitor 418 and transistor 422 to prevent damage to the LM1863 chip which has no internal resistance at output pin 1. Using the capacitor discharge design specified by this invention, the capacitors may be optimized to perform the filtering function and minimize THD in a system with very fast tuning.

The stop output circuit also requires a filter capacitor 431, in parallel with a resistor 432, in a threshold circuit that is connected to pin 5 of radio system 408, in order to prevent intermittent operation of the stop detector circuit in the presence of modulation peaks which may have passed through the limiting amplifier. Time is also required to discharge this capacitor.

In accordance with the invention, therefore, a PNP transistor 436 is connected between capacitor 431 and a point 438 of regulated DC. voltage V_{reg}. A resistor 434 is connected in series with the main current path of transistor 436 to aid in achieving the desired voltage pre-charge, to be discussed immediately. When a channel change is initiated in a seek or scan mode, the CPU 410 sends a signal via the Address Decoding Logic 426 and a resistor 440 so as to cause the transistor 436 to conduct and establish the voltage on the capacitor 431 at the voltage at the junction of the resistors 432 and 434. The value of the regulated voltage at the point 438 and the values of the resistors 432 and 434 are such that the voltage at pin 5 is

forced to its minimum stop indication voltage when the transistor 436 conducts. If the new channel being analyzed is strong, the stop detector voltage will increase rapidly to a high level so as to trip the stop output station detector on pin 8. If the strength of the new channel is at or just above the stop indicator voltage, the voltage in the capacitor 431 increases rapidly to a point above the minimum stop level and maintains a steady state. If, however, the signal strength of the new channel is below the minimum stop level, only a short delay is required for the capacitor 431 to discharge through the resistor 432.

Reference is now made to the flowchart of Fig. 26 for an explanation of the operation of the AM receiver tuning system of Fig. 25 when a single tuner is used and no display is provided. At a block step 450, a user activates a seek, scan or best station memory scanning button, and at a step 452, the audio is turned off. The transistors 422, 424 and 436 are momentarily made conductive so as to discharge the capacitors 418 and 420 to ground potential, and to charge or discharge the capacitor 431 to the voltage at the junction of the resistors 432 and 434. The receiver 408 is then tuned to the next channel. After a delay such as 10ms to permit the stop threshold circuit to stabilize via step 454, it is then determined at a decision step 456 whether the voltage at the stop output pin 8 indicates that the station tuned to is listenable. If not, the procedure loops back to step 452. If so, a sample is taken of SS voltage at the pin 15 via step 458. Next, at decision step 460 it is determined

whether a seek or scan button has been activated or whether a best station memory scanning button has been activated. If the seek or scan button was activated, the receiver remains tuned to the present channel. If, however, the best station memory button was activated, the channel is loaded into a tuning list along with its SS via step 462. It is determined at decision step 464 whether the entire AM band has been scanned. If not, the procedure returns to step 452. If so, the stations having the greatest values of SS are associated with the memory buttons via step 466.

The flowchart of Fig. 27 is for an AM receiver having a single tuner and a display, such as 405, of listenable stations. It is very much the same as the flowchart of Fig. 26 except for the following. At decision step 468, a determination is made as to whether a given time like 30 seconds has transpired since the last activation of the display refresh button. If not, the next listenable station on the tuning/display list is tuned in and the audio tuned on via step 470. The receiver then enters a state 3A in which the station is monitored as shown by the flowchart of Fig. 27A. In Fig. 27A, a sample of the SS is taken after a brief delay via step 471, and the SS indicator of the tuned in channel is updated via step 473. The process is continuously repeated. Returning now to Fig. 27, step 450' includes a display refresh button rather than a best station memory button. Instead of associating the stronger listenable stations with a few memory buttons, as in step 466 of Fig. 26, the display 405 is refreshed with all listenable stations and

their respective signal strengths via step 472. If at a diamond decision step 474 it is determined that a seek or scan button has been activated, the next listenable station on the tuning list, and hence in the display 405, is tuned in and its audio tuned on via step 476. The system then enters a state 3A in which the signal strength is monitored. If at decision step 474 it is determined that the display refresh button was activated, the audio is turned on and then the system proceeds to the monitoring state 3A.

For simplicity of explanation the systems described in this application have not specifically been described as having both best station memory buttons and a display, however systems designed in accordance with this invention may incorporate both of these features.

Dual Tuner AM Tuning System

Fig. 28 is a flowchart for the operation of the listening tuner 184 in a dual tuner system incorporating the invention. When a user actuates a seek or scan button, the audio is turned off via step 480, and the next listenable channel on the tuning/display list developed by a scanner tuner 186 is tuned in and the audio turned on via step 482. The channel is then monitored in a state 3A as illustrated in Fig. 27A.

Fig. 29 is a flowchart for the scanner tuner 184 of a dual tuner AM tuning system incorporating the invention. Refreshing the tuner/display list may be done whenever desired, because the scanner tuner 184 is not providing the audio signal,

and would normally proceed on a continuous basis. When the refresh procedure as initiated via start step 484, the same procedure is followed as indicated by steps 452', 454, 458, 462' and 472, and decision steps 456 and 464, of Fig. 27, except that step 452' does not specify turning off the audio since this is a scanner tuner which would not normally have a connection to the audio output. After the AM band has been scanned for listenable stations and the display 212 has been refreshed, the procedure returns via step 486 to start step 484.

Additional Procedures

The following additional procedures are indicated by phantom blocks in Fig. 29. In step 488, a more stable indication may be made of the signal strength of the stations shown in the display by averaging a number of SS samples as, for example, in Fig. 15B. Step 490 indicates that stronger listenable stations are loaded into memory locations associated with channel or memory buttons, and the display updated to show the button number associated with a particular station as will be discussed in connection with Fig. 32. Step 492 then calls for indicating in the display whether the SS of a channel is increasing or decreasing in a manner illustrated in Fig. 15C.

Displays

There are a number of ways in which pertinent data can be shown on a display, and it is thought to be well within the

skill of those in the display art to devise means for forming the displays to be described.

In the display illustrated in Fig. 30, the channels having listenable stations are indicated by vertical lines 495 at the frequency of the channel, for example. The number of listenable stations will vary depending upon the sensitivity of the tuner. The height of a line is proportional to the signal strength, SS, of the station, and the station being listened to such as the one at 103.5Mhz (megahertz), is differentiated from the other stations in any suitable manner such as, for example, by its being pulsated on or off or by a different color. Stations which have considerable noise may be indicated by a dashed vertical line 494 or differentiated in some other way. RDS data indicating the type of programming for each listenable station may be derived by the scanning tuner 186 as in Fig. 15A and displayed, step 240, for example, by placing coded indices in circles 493 at the tops of the lines 495. For example, stations broadcasting news, weather, or sports could have codes of N, W, or S, respectively, indicated in association with the station's indicator bar 495. RDS data pertinent to the tuned in station can be derived as at step 218 of Fig. 12 or step 175 of Fig. 9 and shown as at 496 in the top section, and real time RDS data may be shown in the bottom section 498. A menu system, such as that described subsequently in Fig. 36, could be used to select the types of RDS data to be displayed, e.g. to display indicators just for stations broadcasting the news and sports, or perhaps just stations broadcasting jazz, etc. The menu system

could be controlled by standard keyboard mechanisms as indicated by item 42 of Fig. 1, or could be controlled by either a touch entry system or voice response system as described by Fig. 39 to be discussed later. In a similar vein, station indicators could be displayed only for stations of the selected types of program material based upon the RDS digital data transmitted by each station.

Fig. 30A illustrates the radio scanner and display system working in conjunction with radio paging services broadcasting on commercial radio stations via SCA or RDS subcarriers, in which the data stream indicated by 498 carries the paging message.

Fig. 30B illustrates an alternative display mode for displaying listenable stations broadcasting a selected type of program material based upon the RDS digital data broadcast by each station.

In Fig. 31, a horizontal line 500 illustrates the adjustable threshold value of SS. Channels having lesser SS than the threshold value cannot be tuned in. As indicated at 507 the vertical line for the station tuned in is in the form of a hollow rectangle that is wider than the other vertical lines, and the degree to which it is filled in from the bottom, as at 504, may represent its SS. An enlarged view is presented as indicated at 505. Various frequencies of the band may be shown as at 506 and the frequency of the station tuned in, 508, may also be shown. In the lower portion 510, display information as to the values of SS, N, AFT and QF may be shown. A color code may be used to

indicate the QF of the tuned in station, as indicated at 511. The display may also indicate that a station is drifting in accordance with step 173 of Fig. 9 by, for example, displaying the words "Drifting" or similar notation at the site of 511. When a station exhibits virtually no noise as determined via decision step 128 in Figs 7, 8 and 10, a special indication, such as a green color or a solid indicator line, can be made at the vertical SS line for that station.

In Fig. 32, the numbers of the memory buttons 512 are formed at the vertical line representing the SS of a listenable station. For example, the station to which the receiver is tuned is the one corresponding to the memory button M3.

Fig. 32A illustrates a display which utilizes station indicator bars formed as upward pointing arrows 514 or downward pointing arrows 516 to denote stations that are increasing of decreasing in SS according to steps 264 or 266 of Fig. 15C

Fig. 33 illustrates displays of listenable stations in both the FM and AM bands.

Fig. 34 illustrates another way of designating channels with listenable stations along with their values of SS. Instead of vertical lines, spots of light having a brightness or color proportional to SS are formed.

In Fig. 35, the lines are formed by an LCD, whereas other portions of the display may have been printed on the radio's faceplate. The height of the lines on the LCD or their brightness can indicate the value of SS.

Fig. 36 illustrates a display menu that may be brought up on the display 44 of Fig. 1 by depressing the menu key of the keyboard 42. A cursor, indicating which item of the menu will be activated, is indicated by an asterisk *. When the * is opposite FM-SCAN, an image like Fig. 31 is displayed without the values of SS, N, AFT and QF, but they can be displayed if the * is moved down one line. If the * is opposite Plot/Scan, Fig. 37 is displayed in which plots of SS, N and AFT are made as time goes on. From Fig. 37 it can be seen that there is a correlation between N and SS. The actual values of SS, N, AFT and QF are presented in sequence at the lower left, and the height of a lighted area 505 at the right corresponds to SS, as also shown on Fig. 31. In addition, the quality factor QF is indicated in script at the lower right. Yellow is shown as being displayed. In a color display, the actual color could be indicated. Toggling the Enter key causes Fig. 38 to be displayed alternately with Fig. 37 so as to prevent statistics of a tuned in station such as the average values of SS, N and AFT, their respective lows and highs, and their ranges.

Touch Entry and Voice Response Tuning

Fig. 39 illustrates a display screen which is sensitized to fingertip touch, using standardly available products, and arranged such that touching the area on the display where a station's indicator bar is displayed will cause the tuner to tune immediately to that station. Touch entry input devices are available from many manufacturers, and so the operation be

described in general terms, as follows, but will not be described in detail. One standard approach to touch entry devices, as illustrated in Fig. 39, is to apply a touch sensitized transparent plate 518, commonly called a touch screen, on top of the display 212. The touch sensitized plate 518 is associated with input translation circuitry 520, typically supplied by the same manufacturer that supplies the touch sensitized plate, which resolves the detected touch into an x-y coordinate. The x-y coordinate data is made available to the CPU 198 via standard hardware and software interfacing techniques. The software designer of the system creates a translation table that converts the x-y coordinates into the frequency of the station being displayed at the selected site. The CPU 198 then would use standard procedures for tuning to that station.

Fig. 39 also illustrates an alternative voice response tuning arrangement in which a microphone 522 accepts spoken commands, which are translated into machine understandable format by the input translation unit 520, and are then supplied to CPU 198 for action.

Although various embodiments of the invention have been shown and described herein, they are not meant to be limiting. Those of skill in the art may recognize modifications to these embodiments, which modifications are meant to be covered by the spirit and scope of the appended claims.

What Is Claimed Is:

1. A tuning system for a radio receiver comprising:

means for deriving signals indicative of listenable stations in a band;

means responsive to said signals for producing displays at respective locations of listenable stations in the band; and

means for tuning the radio receiver to a selected one of the displayed stations.

2. A tuning system as set forth in claim 1, wherein said means for deriving signals indicative of listenable stations includes:

means for controlling said tuning system so that it tunes in the channels of the band in sequence;

means for providing at least one of SS (signal strength), N (noise) and AFT (automatic fine tuning) signals for each channel; and

means responsive to said SS, N and AFT signals for deriving the signals indicative of listenable stations in the band.

3. A tuning system as set forth in claim 1, wherein said tuning system further comprises:

a scanner tuner including said means for deriving signals indicative of listenable stations in a band;

a listening tuner which includes said means for tuning the radio receiver to a selected one of the displayed stations; and means for controlling said scanner tuner so that it repetitively scans the channels of the band in sequence.

4. A tuning system as set forth in claim 2, further comprising:

means for modifying said displays so that they illustrate the SS of each listenable station.

5. A tuning system as set forth in claim 2, further comprising:

means for modifying said displays so that they illustrate the N of each listenable station.

6. A tuning system as set forth in claim 2, further comprising:

means for deriving from said SS, N and AFT signals a measure QF (quality factor) of the quality of each listenable channel; and

means for modifying said displays so that they illustrate the QF of each listenable station.

7. A tuning system as set forth in claim 2, wherein said means responsive to at least one of said SS, N and AFT signals for deriving signals indicative of listenable stations is adjustable by the listener.

8. A tuning system as set forth in claim 2, further comprising:

means for deriving digital data broadcast by a channel; and

means for presenting said digital data on the display means.

9. A tuning system as set forth in claim 2, further comprising:

a unitized controller means for providing a CPU (central processing unit) function, a PLL (phase lock loop) function, an ADC (analog-to-digital) function, and a display control function.

10. A radio as set forth in claim 2, further comprising:

means for deriving the ranges of SS in two groups of samples, the samples being such that the effect of artifacts on their average is reduced; and

means for indicating that a station is not a reliable source of AFT reference voltage, if the ranges differ by more than a given percentage.

11. A tuning system as set forth in claim 2, wherein said means for tuning the radio receiver to a selected one of the displayed stations may be effected by touching said display means at the respective displayed location of the selected station.

12. A tuning system as set forth in claim 2, wherein said means for tuning the radio receiver to a selected one of the displayed stations may be effected by spoken commands.

13. A tuning system as set forth in claim 6, wherein said means for deriving signals indicative of listenable stations is responsive to QF.

14. A tuning system as set forth in claim 13, wherein said means for deriving signals indicative of listenable stations being responsive to QF is adjustable by the listener.

15. A tuning system as set forth in claim 14, wherein the said adjustable means includes a switch.

16. A tuning system as set forth in claim 14, wherein the said adjustable means includes a display of a menu of selectable choices.

17. A tuning system as set forth in claim 7, wherein said adjustable means includes a switch.

18. A tuning system as set forth in claim 7, wherein said adjustable means includes a display of a menu of selectable choices.

19. A tuning system as set forth in claim 8, wherein said digital data includes the type of program material or other identifying information being broadcast on a channel, and said tuning system further includes means for presenting an indicator representing said identifying information on the display means in an associative manner with said displays at respective locations of the listenable stations in the band.

20. A tuning system as set forth in claim 19, further comprising:

means for selecting which types of said identifying information indicators may be presented; and

wherein said means for tuning the radio receiver to a selected one of the displayed stations is restricted to tuning to stations associated with said selected types of said identifying information.

21. A tuning system as set forth in claim 19, wherein said means for tuning the radio receiver to a selected one of the displayed stations is controlled by touching said display means at the respective displayed location of said associated identifying information indicator for the selected station.

22. A tuning system as set forth in claim 19, wherein said means for tuning the radio receiver to a selected one of stations associated with a displayed identifying information indicator may be effected by spoken commands.

23. A tuning system as set forth in claim 20, wherein said means for selecting which types of identifying information that may be presented is a displayed menu of selectable choices.

24. A tuning system as set forth in claim 20, wherein the identifying information of the selected types is displayed, and indicators for other listenable stations are not displayed.

25. A tuning system as set forth in claim 23, wherein said selecting of types of identifying information from said menu can be effected by touching the display means at the location of the selected choice.

26. A tuning system as set forth in claim 23, wherein said selecting of types of identifying information from said menu can be effected by spoken commands.

27. A tuning system as set forth in claim 24, wherein the identifying information of the selected types is presented in a menu of selectable choices.

28. A tuning system as set forth in claim 9, wherein said unitized controller means includes an RDS (radio data system) decoder function.

29. A tuning system as set forth in claim 3, further comprising:

means for deriving digital data broadcast by a channel, the digital data including radio paging data;

means for selecting radio paging codes from said radio paging data to monitor;

means for monitoring stations broadcasting radio paging codes;

means for presenting the digital data accompanying said selected radio paging codes on the display means when one of said selected radio paging codes is received; and

means to alert the listener when one of said selected radio paging codes is received.

30. A tuning system as set forth in claim 3, further comprising:

means for determining from SS (signal strength) signals for the listenable stations on successive scans of the band by the scanner tuner, whether the SS for each listenable station is increasing or decreasing; and

means responsive to said determining means, for modifying the displays for the listenable channels so as to indicate whether their SS is increasing or decreasing.

31. A tuning system as set forth in claim 3, further comprising:

a unitized tuner stage comprising both the listening tuner stage and the scanner tuner stage.

32. A tuning system as set forth in claim 3, further comprising:

a unitized IF (intermediate frequency) stage comprising both a listening tuner IF stage and a scanner tuner IF stage.

33. A tuning system as set forth in claim 1, wherein said means for tuning the radio receiver to a selected one of the displayed stations may be effected by touching said display means at the respective displayed location of the selected station.

34. A tuning system as set forth in claim 1, wherein said means for tuning the radio receiver to a selected one of the displayed stations may be effected by spoken commands.

35. A tuning system including:

means for providing a voltage representing a characteristic of the reception for each channel tuned to;

an integration or filter circuit including a capacitor coupled to said voltage; and

means for momentarily charging said capacitor to a neutral value when the system operates to tune from a first channel to a second channel.

36. A tuning system as set forth in claim 35, further comprising:

means for deriving one or more samples of the voltage on said capacitor after said momentary charging and before said capacitor becomes fully charged; and

means for determining if a characteristic is acceptable by comparing the value of the sample or the average of multiple samples with the voltage that would be across the capacitor at the time of the samples if a voltage corresponding to a limit for the characteristic were applied to the integration or filter circuit.

37. A radio including:

means for applying a voltage to a capacitor corresponding to a characteristic of signals received in a channel;

means for obtaining samples of the voltage across the capacitor at such times that the effect of artifacts on the average value of said samples is reduced; and

means for deriving said average value.

38. A radio as set forth in claim 37, wherein the voltage across the capacitor represents signal strength (SS).

39. A radio as set forth in claim 37, wherein the voltage across the capacitor corresponds to a noise (N) signal.

40. A radio as set forth in Claim 37, wherein the voltage on the capacitor corresponds to automatic fine tuning (AFT), and the artifact is the effect of audio frequencies.

41. In a radio receiver that supplies at least one of signal strength (SS), noise (N), and automatic fine tuner (AFT) signals to associated capacitors, respectively, for integration or filtering of said signals, said capacitors being connected in a circuit with respective resistors so as to have predetermined respective charging time constants, apparatus for deriving the final integrated or filtered values comprising:

means for indicating the times at which the charging of said capacitors begins;

means for obtaining sample voltages across the respective capacitors at given times after the time when charging begins and before the capacitors are fully charged; and

means for processing the sample voltages so as to obtain via extrapolation indications of the voltages that would appear on the capacitors when they are fully charged.

42. A system for determining whether the signals received by an FM receiver are unlistenable, comprising:

means for deriving a reference value of an automatic fine tuning (AFT) signal of a listenable signal;

means for deriving an AFT signal produced by another station signal;

means for finding the absolute difference between the AFT signal of the listenable signal, and the AFT produced by said another station signal; and

means for identifying the another station signal as being unlistenable if said absolute difference exceeds a predetermined amount.

43. A method for finding a channel having a value of AFT that can be used as a reference value in identifying the listenability of channels in an FM receiver including a tuner, wherein SS (signal strength), N (noise) and AFT (automatic fine tuning) voltages are produced on respective capacitors, comprising the steps of:

tuning the tuner to a channel in the band;

clamping the voltages across the capacitors to neutral values of voltage;

unclamping the capacitors;

obtaining a first group of samples of the voltage on each capacitor and calculating their respective averages;

rejecting a channel for which the average voltage of the SS samples is less than a given threshold or the average of the N samples is greater than a given limit or the average of the AFT samples lies outside a range of values;

tuning in the next channel and repeating the procedure if the channel is rejected;

obtaining second and third groups of samples of SS, N and AFT;

calculating the voltage averages of each of the second and third group of samples of SS, N and AFT, respectively;

determining the voltage ranges of the samples of SS in each of said second and third groups; and

accepting a channel for the purpose of providing a reference value of AFT, if the voltage averages of said second and third groups of SS samples are both greater than a predetermined threshold value, the voltage ranges of SS values of the samples in said second and third groups are within a given percentage of each other, the voltage averages of the samples of N for both groups are less than a given limit and the difference between the voltage averages of the AFT samples of both groups is less than a given voltage, which is less than said given value with which the first group of AFT samples is compared.

44. A method for finding a channel having a value of AFT that can be used as a reference value as set forth in claim 43, wherein the second and third groups of samples are obtained from the strongest station by the addition of the following steps prior to obtaining the second and third groups of samples:

recording a channel in memory along with the average voltage of its SS samples if it is not rejected;

checking to see if all channels of the band have been subjected to the procedure;

tuning to the channel having a station with the greatest average voltage of the SS samples; and

tuning to the channel with the next greatest average voltage of the SS samples and repeating the procedure if the channel is not accepted.

45. A method wherein the reference value of AFT is determined by the steps including:

obtaining an indication of the ambient temperature; and

deriving the reference value of AFT from a table of temperatures and corresponding values of AFT.

46. A method for identifying a channel having a listenable station in an FM receiver having capacitors that are charged by voltages in its tuner for SS (signal strength), N (noise) and AFT (automatic fine tuning) there being respective time constants for the charging of each capacitor, comprising the steps of:

providing a reference value of AFT;

momentarily clamping said capacitors for SS, N and AFT to respective neutral voltage values at a change in channel;

obtaining the value of a first group of individual samples or the average of a first group of multiple samples of the voltage of each of said capacitors so as to obtain an SS average, an N average, and an AFT average;

computing the offset between the reference value of AFT and the AFT value or average; and

rejecting a channel as not having a listenable station if the SS value or average is less than a given threshold, the N value or average is greater than a first limit, or its AFT

offset exceeds a given range, the remaining channels being accepted as listenable.

47. A method for identifying a channel having a listenable station in an FM receiver having capacitors that are charged by voltages in its tuner for SS (signal strength), N (noise) and AFT (automatic fine tuning) there being respective time constants for the charging of each capacitor, comprising the steps of:

providing a reference value of AFT;

momentarily clamping said capacitors for SS, N and AFT to respective neutral voltage values at a change in channel;

obtaining the value of a first group of individual samples or the average of a first group of multiple samples of the voltage of each of said capacitors so as to obtain an SS average, an N average, and an AFT average;

computing the offset between the reference value of AFT and the AFT value or average; and

rejecting a channel as not having a listenable station if the SS value or average is less than a given threshold, the N value or average is greater than a first limit, or its AFT offset exceeds a given range, the remaining channels being accepted as potentially listenable.

48. A method as set forth in claim 47, wherein an accepted channel is identified as very listenable if its N value or average is below a second limit that is less than said first

limit so as to indicate that it has virtually no noise, the remaining channels being accepted as potentially listenable.

49. A method as set forth in claim 47, wherein a channel that has been accepted as potentially listenable is accepted as listenable by:

obtaining the average of a second group of samples of the voltage of each of said capacitors so as to obtain a second SS average, a second N average, and a second AFT average;

computing the AFT offset between the reference value of AFT and the second AFT average; and

identifying said channel as having a listenable station if the second SS average is greater than a threshold value, the second N average is less than a third limit, and the AFT offset less than a given voltage, the remaining channels being rejected.

50. A method as set forth in claim 47, wherein a channel that has been accepted as potentially listenable is accepted as listenable by:

obtaining the average of a second group of samples of the voltage of each of said capacitors so as to obtain a second SS average, a second N average, and a second AFT average;

computing the AFT offset between the reference value of AFT and the second AFT average;

obtaining the quality factor, QF, for a given channel that was rejected in said accepting step; and

accepting said channel if it has a quality factor greater than a predetermined value, the remaining channels being rejected.

51. A method as set forth in claim 47 wherein a channel identified as unlistenable therein is re-examined by:

determining if its identification as unlistenable was only due to noise;

taking another sample of the voltage on the N capacitor if this is the case; and

identifying the channel as being listenable if the voltage of this last sample is not greater than it would be at the time of said another sample if the signal for N were at its maximum value.

52. A method as set forth in claim 47, further comprising the step of:

stopping the procedure on an accepted channel if a seek or scan button has been activated.

53. A method as set forth in claim 47, further comprising the steps of:

recording any channel accepted in said accepting step along with its averages of SS and N samples of the first group;

repeating the procedure until all channels of the band have been analyzed; and

refreshing a display with recorded channels and their respective averages of voltage from the SS and N capacitors if a display refresh button is activated.

54. A method as set forth in claim 47 wherein said display refreshing is effected if the system is a scanner tuner of a dual tuner system.

55. A method as set forth in claim 47, wherein the reference value of AFT is determined by the steps including:

obtaining an indication of the ambient temperature; and

deriving the reference value of AFT from a table of temperatures and corresponding values of AFT.

56. A method as set forth in claim 47, wherein the reference value of AFT is further determined by the steps including:

obtaining an indication of the ambient temperature;

deriving an adjustment value of AFT from a table of temperatures and corresponding values of AFT; and

adding the adjustment value of AFT from the reference value of AFT to arrive at an adjusted reference value of AFT.

57. A method as set forth in claim 47, wherein the first noise limit is adjusted by the steps including:

obtaining an indication of the ambient temperature; and

changing the noise limits by a percentage in a table of temperatures and corresponding percentages.

58. A method as set forth in claim 47, wherein the SS threshold is adjusted by the steps including:

obtaining an indication of the ambient temperature; and

changing the SS thresholds by a percentage in a table of temperatures and corresponding percentages.

59. A method as set forth in claim 47, wherein said first noise limit is the voltage that would appear on the N capacitor at the time of the first group of samples if the charging voltage is determined by steps including:

clamping an antenna of a receiver to ground;

sampling the voltage across the noise capacitor at a given point during its charging;

obtaining an average of any samples;

multiplying the average by a factor such as to attain the fully charged voltage of the noise capacitor;

obtaining the difference between the fully charged voltage and the baseline level for noise of the receiver design; and

adding the difference to the baseline level to derive the charging voltage.

60. A method as set forth in claim 47, further comprising the steps of:

recording accepted channels on a tuning list;

repeating the procedure beginning with the step of momentarily clamping the capacitors to neutral voltages until all channels of the band have been subjected to the procedure; and

respectively associating the channels having the largest average values of SS with memory buttons if a best station memory scanning button has been activated.

61. A method for identifying channels in an FM band having stations that are listenable on an FM receiver having SS (signal strength), N (noise) and AFT (automatic fine tuning) capacitors, respectively, on which SS, N and AFT voltages are produced comprising the steps of:

providing a reference value of AFT;

momentarily clamping said capacitors to respective neutral values;

applying for a given channel the associated SS, N, and AFT signals to said capacitors, respectively;

taking a first group of one or more samples of the voltages of each of said SS, N and AFT capacitors before they are fully charged;

computing the averages of the samples for each capacitor;

computing the AFT offset between the average value of AFT samples and the reference value;

identifying a channel as not having a listenable channel if it fails to meet given criteria for the AFT offset,

and for the averages of the samples for the SS and N capacitors;

identifying and recording in memory as very listenable those of the remaining channels have virtually no noise on the basis of the average of the samples of the N capacitor;

repeating the procedure until all channels of a band have been analyzed;

identifying as unlistenable channels adjacent to a channel that has not been identified as not having a listenable station if the SS of both is less than a given percentage of the SS of the channel to which they are adjacent;

tuning to each of the remaining channels not yet identified as very listenable or unlistenable, each in sequence until all of the remaining channels have been analyzed;

while tuned to each channel, taking a second group of samples of the voltages of the SS, N and AFT capacitors;

computing the respective averages of the second group of samples;

computing the offset of the average of the AFT samples from the reference value of AFT; and

identifying a channel as having a listenable station if it passes criteria as to the AFT offset and the averages of the second groups of the SS and N samples.

62. A method as set forth in claim 61, further comprising the steps of:

computing the ranges for the second set of samples of SS and N;

computing a quality factor QF; and

accepting a channel as having a listenable station if the QF equals or exceeds a given value.

63. A method for rapidly identifying channels of an FM band having listenable stations on a receiver providing SS (signal strength), N (noise), and AFT (automatic fine tuning) voltages on respective capacitors, comprising the steps of:

providing a reference voltage of AFT;

momentarily clamping the capacitors to neutral voltages;

applying for a given channel associated SS, N, and AFT signals to said capacitors, respectively;

obtaining the averages of a first group of one or more samples of each of the SS, N and AFT voltages;

computing the offset between the average of the AFT samples from the reference value of AFT;

rejecting on the basis of the averages of SS and N and the AFT offset not meeting first criteria those channels not having a station that is even marginally listenable;

repeating the procedure beginning with the sampling until all channels of the band have been analyzed;

identifying the non-rejected channels as being very listenable if they have virtually no noise;

obtaining the averages of a second group of samples of each of the SS, N and AFT voltages for the channels that have not been rejected or identified as being very listenable;

computing the AFT offset of the average of the second samples with respect to the AFT reference voltage; and

identifying as having at least marginally listenable stations those channels having SS and N averages and an AFT offset that meet second criteria.

64. A method for rapidly identifying the listenability of channels in an FM band comprising the steps of:-

rejecting channels that are clearly not listenable;

analyzing the remaining channels to identify those that are very listenable; and

analyzing the remaining channels to see if they are at least marginally listenable.

65. In a tuning system for a receiver in which channels of a band are identified as listenable or unlistenable by comparing the strength of the received signal with a threshold value and wherein a city/highway driving switch is provided, the method of comprising the steps of:

determining whether said switch is in the city or in the highway position; and

setting the signal strength threshold at a higher value when said switch is in the highway position than when it is in the city position.

66. A method as set forth in claim 65, wherein the switch is a city/country switch, said method further including the step of:

setting the signal strength threshold at a lower value when said switch is in the country position than when it is in the city position.

67. In a tuning system for a receiver in which channels of a band are identified as listenable or unlistenable by comparing the quality factor with a minimum value and wherein a city/highway driving switch is provided, the method comprising the steps of:

determining whether the switch is in the city or highway driving position; and

setting the minimum value of the quality factor at a higher level when the switch is in the highway position than when it is in the city position.

68. A method as set forth in claim 67, wherein the switch is a city/country switch, and further including the step of:

setting the minimum value of the quality factor at a lower level when said switch is in the country position than when it is in the city position.

69. In a tuning system that repeatedly scans the channels in a band and identifies them in each scan as being listenable if they meet criteria including signal strength, a method of

indicating the channels that are listenable comprising the steps of:

deriving averages of the signal strength of each listenable channel on a current scan with its signal strength in at least one previous scan, and

forming a display at respective locations of the average signal strength of the listenable channels.

70. In a tuning system that repeatedly scans channels in a band and identifies them in each scan as being listenable if they have at least a given quality factor, a method of indicating the channels that are listenable comprising the steps of:

deriving averages of the quality factor of each listenable channel on a current scan with its quality factors on at least one previous scan; and

forming a display of said averages.

71. A method for operating a tuner comprising the steps of:

tuning in the channels of a band and deriving indications as to which are listenable;

forming in response to said indications a display of listenable channels;

tuning the tuner to a desired channel;

periodically monitoring data that may be transmitted on that channel in addition to an audio program; and

forming said data in said display.

72. A method of operation of a receiver having a listening tuner and a scanner tuner comprising the steps of:

repeatedly tuning said scanning tuner across a band of channels;

providing first indications as to which channels are listenable and second indications as to channels that contain data different from the audio signal;

forming a display in response to said first indication of all listenable channels;

forming a display in response to said second indications illustrating the content thereof;

tuning said listening tuner to a desired channel; and

forming a display for this channel of data received therein in addition to the audio information.

73. A tuning system comprising;

a tuner;

means for successively tuning said tuner to each channel in a band;

said tuner having means for providing voltages indicative of the reception characteristics of the received signal of the channel to which it is tuned;

means responsive to said voltages for indicating the channels that are unlistenable; and

means for identifying which of these other channels are very listenable.

74. In a tuning system for a receiver that identifies channels of a band as being listenable or unlistenable on a basis including a noise limit, a method for a deriving voltage for said noise limit comprising the steps of:

tuning the receiver across the band and recording a voltage corresponding to the noise level of each channel;

determining which channel is noisiest; and

deriving the value of the noise limit from the noise voltage for the noisiest channel.

75. In a tuning system for a receiver that identifies channels of a band as being listenable or unlistenable by comparing noise voltage built up on a noise capacitor at each channel change with a noise limit voltage, a method for deriving a noise limit voltage comprising the steps of:

clamping the antenna of the receiver to ground;

sampling the voltage across the noise capacitor before it is fully charged;

obtaining an average of the samples;

multiplying the average by a factor such as to attain the value of voltage the capacitor will have when fully charged;

providing a voltage corresponding to the baseline level of noise for the receiver;

obtaining the difference between the fully charged voltage and the voltage corresponding to baseline noise; and

adding the difference to the voltage for the baseline noise so as to provide the noise limit voltage.

76. In a tuning system where channels are identified as being listenable or unlistenable on the basis of the difference between their AFT voltage and a reference AFT voltage, a method for finding a reference AFT voltage comprising the steps of:

tuning the system across a band of channels;

finding the strongest channel; and

using the AFT voltage of the strongest channel as the reference AFT voltage.

77. In a tuning system where channels are identified as being listenable or unlistenable on the basis of the difference between their AFT voltage and a reference AFT voltage, a method for finding a reference AFT voltage comprising the steps of:

tuning the system across a band of channels;

finding a very listenable channel; and

using the AFT voltage of said very listenable channel as the reference AFT voltage.

78. In a dual tuner radio system, a method of balancing the measurements of SS (signal strength) and N (noise) between the two tuners, comprising the steps of:

calibrating AFT with both tuners upon power up;

subtracting the SS measurement of the calibration station made by the first tuner from the SS measurement of the calibration station made by the second tuner to arrive at an SS balancing factor;