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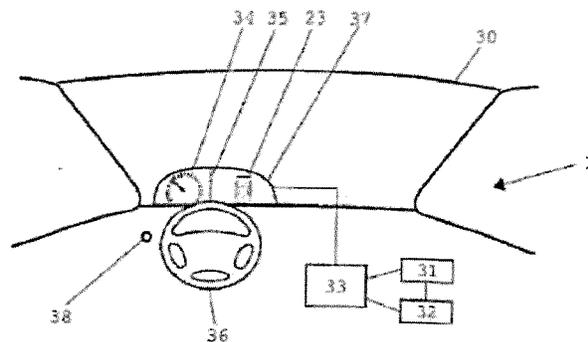
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The following information is taken from the documents provided by the inventor

(54) Display system for vehicles
(57) A display system (1) for vehicles is proposed, which contains a screen (37) and an image generating computer (33) and is connected to information-providing elements (31) of the vehicle and which shows the information on the screen (37) with the aid of at least one pointer and at least one scale. At least one additional marking for showing additional information is displayed on the scale.



Specification

The present invention relates to a display system for vehicles according to the preamble of the main claim.

The advent of new technologies in field of motor vehicles also covers a redesign of the automobile/driver interface, in particular the display technology with screens. Supplementing the hitherto conventional analog indicator instruments, which are easily legible and generally accepted, for example, most newly introduced navigation systems require a screen as graphic output unit. While screens are still mostly used in the secondary instrumentation field (such as in the center console), a tendency towards the complete substitution of analog indicator instruments by a central screen can be observed. Here chiefly display and operation concepts are adopted from information technology.

The use of menu structures known from the field of home computers should be referenced here in particular. The free programmability of the screen has led to a representation of primary drive information, such as the speed of a vehicle, that is a marked change compared to traditional instruments, (e.g., the superposition of digital numbers instead of analog pointer instruments to display speed). However, the superposition of digital numbers requires an increased abstraction ability of the part of the driver, which can keep the driver's attention from other important things (the conversion of a digital number into a graphic value representing it requires a special cognitive power of the driver, which he consequently lacks for other more important things). In addition, there is a danger that due to the superposition of unimportant additional information, display surface on the screen for the representation of particularly important information is replaced. It is therefore desirable to design display systems with screens such that primary driving information can be

understood clearly and furthermore the driver can be provided with useful additional information.

From EP 0 771 686 A2 a display system for vehicles is known, which contains a screen and an image generating computer and is connected to information-providing elements of the vehicle and which shows the information on the screen with, among other things, the aid of at least one pointer and at least one scale. This display system shows respectively relevant information on a screen in a drive phase-dependent manner, for example, the image surface of the tachometer is larger at high speeds, etc. (the importance gradation of relevant driving information is thus shown by its visual dominance, this is achieved with variable area ratios of the image surfaces of individual driving information). This display system thus uses the variability of the screen representation to limit information to the driver in a specific driving situation to the extent of analog pointer instruments. This display system according to the prior art, however, has the disadvantage that useful additional information that could facilitate the safe and economical operation of the vehicle, is thus hidden. Moreover, the driver can be unsettled by the constant change of the size of the image surfaces for individual driving information.

The object of the present invention is to create a display system that has the good readability of analog pointer instruments and, moreover, in an easily understandable manner provides additional information that facilitates the safe and economical operation of the vehicle. This object is attained with a display system according to the main claim.

Because in a display system according to the preamble at least one additional marking is displayed on the scale to represent additional information, on the one hand the standards known to drivers can be maintained by the imitation of analog pointer instruments and, moreover, the possibility of showing

additional information inherent in screen technology can be used. Due to the provision of the additional information on the scale itself, this is in the driver's direct field of view. In contrast to separate instruments for additional information, awareness is thus considerably facilitated for the driver. Moreover, connections between different driving parameters can be clarified to the driver in a very clear and intuitively comprehensible manner (such as by the integration of a marking that displays a braking distance or stopping distance in a display for showing the vehicle speed. While a very high abstraction effort by the driver for recognizing such connections is demanded in the case of separate instruments, the display system according to the invention makes it possible to clarify a connection of this type even to a driver without technical expertise. Thus a particularly safe and economical operation of his vehicle is significantly facilitated even for this type of driver.

Advantageous further developments of the present invention are given in the dependent claims.

An advantageous further development of the invention provides that the marking can be shown as a mark marking any desired scale point within a range covered by the scale and is contrasted to the scale by shape and/or color. Accordingly, the representation of a display band, either in the form of a bar, a circle sector or a circular ring sector is also possible for marking a specific range. Depending on the required use, it is also possible for the marking to follow the movement of the pointer. Moreover, it is possible for the marking, retaining its position and shape, to be shown in different colors and/or thicknesses, for instance, in order to indicate the relevance of specific additional information. This diversity of imaging possibilities ensures that in the range of the scale any additional information can be conveyed in a form particularly accessible for the driver.

A particularly advantageous further development of the invention provides that the information-providing elements are respectively embodied at least as elements for measuring speed, for measuring rpm, for measuring the inlet manifold pressure, for measuring fuel consumption, for measuring the fuel tank contents, for measuring the power and the temperature of a drive engine of the vehicle, for measuring a distance, for receiving transmitters for traffic control external to the vehicle, etc.. This makes it possible to display known instruments composed of pointer and scale in connection with the embodiments of the markings described above. This also makes it possible to display connections between different parameters particularly easily. Moreover, it is advantageous to connect the display system to an on-board computer, which in turn is connected to the information-providing elements, since this makes it possible to display calculated values, such as mean values, for example, with the aid of markings.

A further advantageous embodiment provides that respectively at least the position, extent, shape or color of the markings represent information on other physical values than the information shown with the aid of scale and pointer represents. This makes it possible to inform even the technically inexperienced driver of the connections between different basic driving parameters in an intuitively comprehensible manner, such as by means of the representation of markings for fuel consumption in a display composed of scale and pointer for the speed of the vehicle.

A particularly advantageous embodiment provides that at least the representation of the scale, the pointer, the marking or other information respectively can be changed by a control device switched by an operator and/or according to the information-providing elements. This ensures that in certain driving situations in which the displays based on scale and pointer are not necessary or are necessary only to a limited

extent, further displays such as, for example, a map according to a navigation system or a parking aid or the operation of a car radio can be shown. It is an advantage hereby that a base setting of the representation of the scale, the pointer and the marking and/or further information can be shown by actuating a reset button, and/or that the markings can be faded out. This ensures that in an emergency situation, for instance, an unsuitable display on the screen triggered by the operator or the information-providing elements can be switched immediately back to a preset base setting. The entanglement in menu hierarchies possible with display systems according to the prior art under some circumstances and a traffic risk associated therewith is thus prevented.

A particularly advantageous embodiment of the display system according to the invention provides that the connection to the information-providing elements can be produced via a standard interface and/or a display method of the scale, the pointer and the marking as well as the output of any information-providing elements can be freely determined by a free programming ability of the image generating computer. This ensures that the display system according to the invention can be used for a plurality of different vehicle types, without a replacement of hardware being necessary. On the one hand, this has a cost-reducing effect; on the other hand, vehicle manufacturers who offer a wide range of different models depending on the equipment variant and destination country can freely program the image generating computer (no high costs are incurred for purchasing or stocking different models).

Further advantageous embodiments are given in the other dependent claims.

Several exemplary embodiments of the present invention are explained below based on figures.

They show:

Fig. 1 a display system according to the invention installed in a vehicle,

Fig. 2 a display according to the invention of the current speed of the vehicle and of additional information,

Fig. 3 a display according to the invention of the current speed of a drive engine of the vehicle and of additional information,

Fig. 4 a display according to the invention of the current fuel consumption of a drive engine of the vehicle as well as additional information,

Figs. 5a, 5b and 5c a display according to the invention for graphic illustration of distances.

Fig. 1 shows a display system 1 according to the invention with a screen 37 and an image generating computer 33, which is connected to information-providing elements 31 as well as an on-board computer 32. There is a further connection between the information-providing elements 31 and the on-board computer 32. Depending on the embodiment of the display system 1, it is also possible to connect the information-providing systems 31 only via the on-board computer 32 to the image generating computer 33. The screen 37 is attached in the direct field of vision of a driver operating the steering wheel 36. Naturally, it is also possible to project the information generated on the image generating computer 33 directly on the windscreen 30.

The representation of the screen 37 covered in Fig. 1 comprises a round instrument 34 composed of a scale and pointer which is designed based on analog pointer instruments and in its basic form cannot be distinguished outwardly from purely mechanical devices. However, in the present case "round instrument" by no means indicates a limitation to a purely circular shape, any rounded shapes and also ellipsoid designs are also possible. Moreover, on the screen 37 a bar instrument 35 is shown

which likewise is composed of a scale and pointer. By means of a control device, not shown in further detail here, switched by an operator and/or according to the information-providing instruments 31, respectively at least the image of the scale, of the pointer, of the marking or other information can be changed on the screen 37, which is designed, for example, as a high-resolution LCD display and renders possible multicolored images. Thus, for example, by superposition and masking of the shown round instrument 34 and of the bar instrument 35, further information can be shown, such as a scale for showing a stylized image of a vehicle 23. Furthermore, traffic control information can be displayed, which, for example, is supplied by information-providing elements 31 embodied as elements for the reception of transmitters for traffic control outside the vehicle. Of course, information of further information-providing elements 31, such as camera devices or a car radio, can also be displayed.

Moreover, Fig. 1 shows a reset button 38. By pressing this reset button a base setting of the image on the screen 37 can be generated. This is advantageous in particular in situations in which, for instance by manual influence of the information shown on the screen 37, an original image is to be quickly reestablished, for example, in dangerous situations. An entanglement in hierarchies, such as is possible in other display systems that are strongly based on user guidance in computers, is thus ruled out. It is moreover provided that the connection to the information-providing elements can be established via a standard interface. This can take place directly by connection to the image generating computer 33 as well as indirectly, for example, by connection to the on-board computer 32. This means that the image generating computer 33 as well as the screen 37 can be used independently of a specific vehicle type. Furthermore, the image generating computer 33 can be embodied such that the representation on the screen,

such as of pointers, markings and scales, can be programmed completely freely. This ensures that a desired imaging method can be set for a plurality of vehicle types as well as for vehicles of the same type that are intended for a different destination country. This requirement results, for example, from the fact that in the Federal Republic of Germany the speed display is usually in kilometers per hour, in the U.S., however, the speed is displayed in miles per hour.

In principle, the information-providing elements 31 can be embodied as any desired elements, for example, as elements for measuring speed, for rpm measurement, for measuring fuel consumption, for measuring the fuel tank contents, for measuring the power and the temperature of a drive engine of the vehicle, for measuring a distance, for the reception of transmitters outside the vehicle for traffic control, for odometer measurement, as a database with traffic control information, as a database for giving the achievable maximum power depending on the rotational speed and the load situation of the drive engine of the vehicle, sensors for determining external influences, car radio, camera device or installation for speed regulation.

Fig. 2 shows a display according to the invention for the current speed of the vehicle as well as additional information. The pointer for speed measurement 2 shows a current speed 39 of the vehicle on the scale for speed measurement 29. The speed is given in kilometers per hour. Furthermore, an odometer 6 is provided, which counts in kilometer units. This can be embodied mechanically and be readable through a corresponding transparent section of the screen 37, however, it is advantageous to display the odometer 6 as a simulation of a mechanical odometer with the aid of the image generating computer 33 according to a corresponding information-providing element (odometer element).

A marking embodied as a mark for indicating an average speed 3 indicates the

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