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(54) **Rear view mirror for vehicles**

(57) A vehicle rear view mirror (10) has a composite surface including a primary reflecting surface (11) which may be planar and formed therewith a secondary or auxiliary mirror section (14), that has an arcuately curved reflecting surface, in a corner area of the primary mirror so as to be effectively non-obstructing in normal use of the primary mirror, but of sufficient size and configuration as to produce a reflected image of a relatively large angular field of view in a horizontal plane with respect to that of the primary mirror. The auxiliary mirror is integrally formed with the primary mirror and may be on the front or rear thereof.

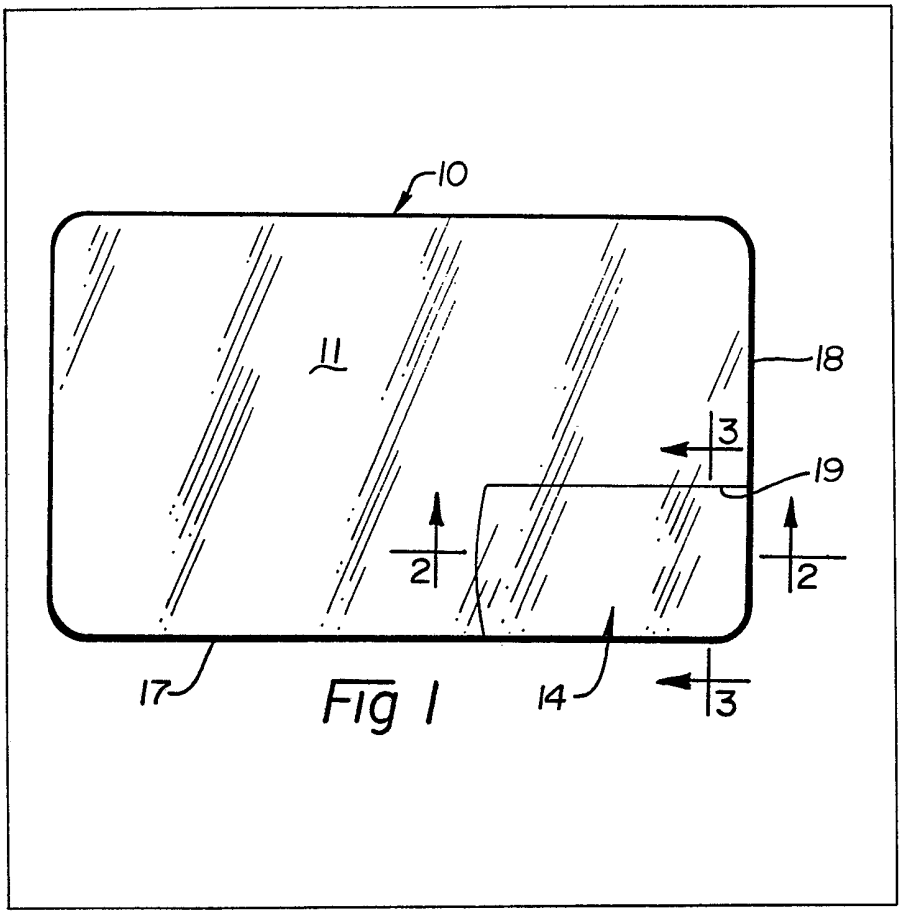

Fig 1

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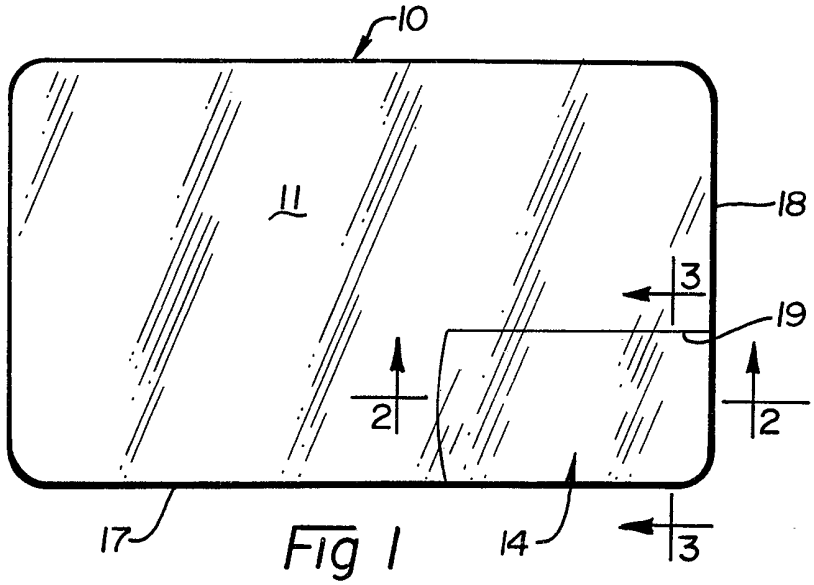

Fig 1

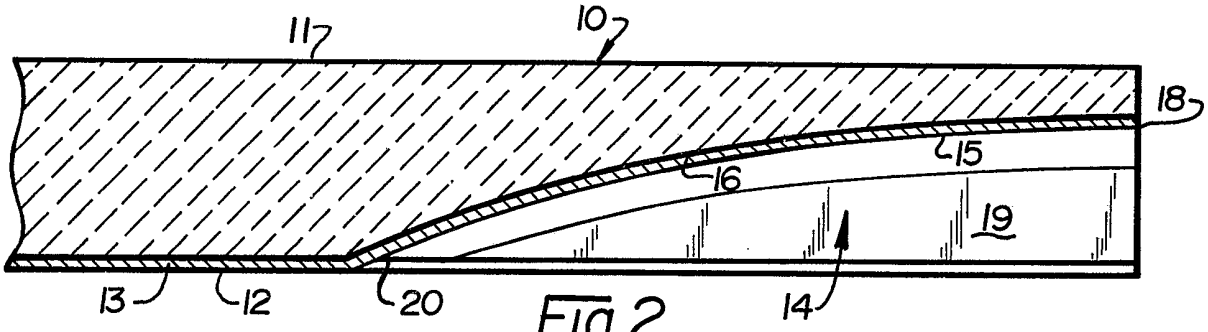

Fig 2

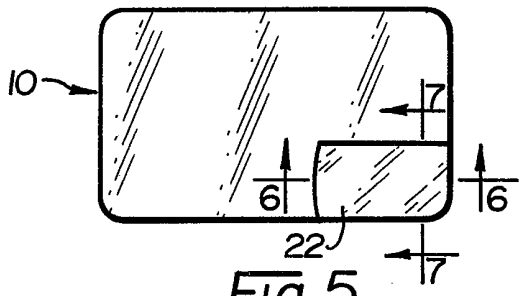

Fig 5

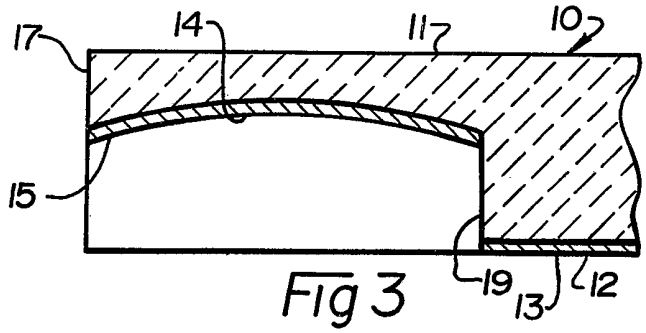

Fig 3

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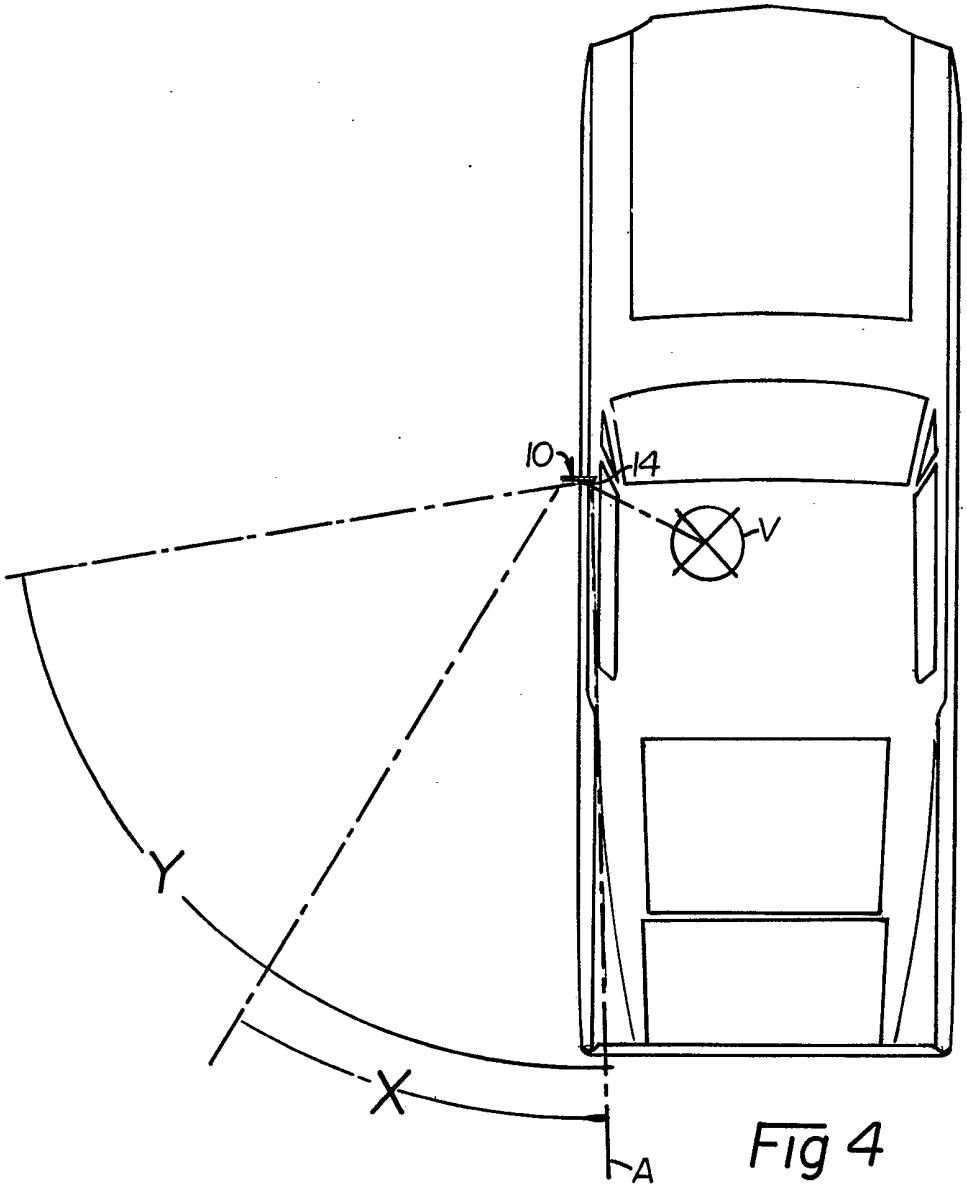

Fig 4

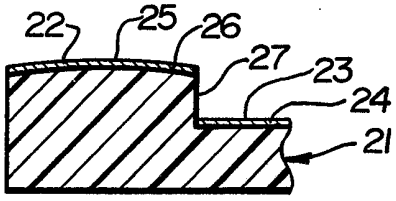

Fig 7

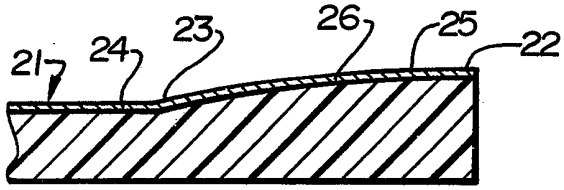

Fig 6

SPECIFICATION

Rear view mirror for vehicles

BACKGROUND OF THE INVENTION

Vehicle mirrors as conventionally provided comprise a planar reflecting surface of sufficient area to meet the normal requirements for establishing a field of view with respect to the vehicle operator. These mirrors may be either installed in the interior of the vehicle for rearward vision through a window at the back of the vehicle or attached to the side door panels at either side for primarily enlarging the field of view in a sideward or lateral direction. This invention is directed primarily to the exterior mounted side view mirrors that are attached to the doors of the vehicle or may be mounted on the front fender. While the objective of such auxiliary mirrors in the form of a side mounted type is to enlarge and enhance the lateral directed field of view with respect to the vehicle operator, the mirrors presently available and on the market remain inherently incapable of providing the optimum field of view with a positive reference to the vehicle itself.

Attempts have been made to improve the performance of such mirrors by providing auxiliary mirror structures that may either be independently mounted on the vehicle or attached to the conventional side mounted mirrors. The usual type of auxiliary mirror heretofore provided comprises a circular segment of a spherical surfaced shell that may be adhesively bonded onto a surface of the primary mirror if the primary mirror is sufficiently large as in the case of truck mirrors. Alternatively, a spherical segment mirror may be mounted exteriorly on the vehicle in independent relationship to any of the other mirrors.

While these spherical segment mirrors provide a large field of view, it will be recognized that such mirrors provide an enlarged field of view through 360 degrees of viewing angle. The disadvantage of this enlargement of the field of view is that the operator of the vehicle is necessarily presented with a vastly distorted peripheral field of view which includes substantial portions that are immaterial from a safety standpoint. It will be readily apparent that such a mirror provides a field of view which includes an extensive and unimportant view of the side of the vehicle and which also extends substantially upwards as well as downwards with respect to the vehicle, and these areas are of no real interest or significance to safe operation of the vehicle.

Accordingly, it will be seen that the circular spherical segment mirrors, as well as others, such as cylindrical convex type which have been devised in attempts to overcome the inherent blind spot that occurs with the standard planar reflecting surface mirrors have not succeeded in achieving this desirable objective. While such mirrors attempt to obtain a field of view adequate for the purposes of the driver, they inherently incorporate and produce a substantially greater area of viewing that tends to detract from their usefulness and accordingly tend to detract and decrease the safety features that were originally attempted to be achieved.

SUMMARY OF THE INVENTION

In accordance with this invention a composite mirror is provided in which the major portion or primary section of the mirror conforms to the usual standards of having a planar reflecting surface for producing a relatively narrow angular field of view in a horizontal plane immediately adjacent to the vehicle when utilized at a side of the vehicle. The composite mirror of this invention has the further objective of enabling the operator to independently view a specified area at the side of the vehicle which includes a lateral angle of substantial extent and optimally approaches a 90 degree angle to the longitudinal axis of the vehicle. Achievement of this objective thus produces a mirror wherein a vehicle operator may readily ascertain the presence of a vehicle in an area which would otherwise not be seen in a conventional planar mirror properly adjusted in accordance with specified standards to view an area which extends angularly outward from a side of the vehicle to only a relatively limited extent.

Accomplishment of this objective is achieved through the combination of a planar mirror surface and a segment of an arcuately curved mirror that is incorporated in a relatively small portion of the area of the planar mirror. This arrangement places the arcuately curved segment in an area with respect to the primary mirror such that the field of view of the primary mirror is substantially unobstructed by the addition of this auxiliary mirror. Specifically, the auxiliary mirror is preferably located in the lower right corner, that is, the side edge next adjacent to the vehicle body as to a mirror mounted on the driver's side of the vehicle whereas a similar type of mirror on the opposite side would have the mirror segment located in the lower left corner. This location and arrangement is for a vehicle having the driver seated on the left side and it will be understood that the arrangement would be appropriately modified for a vehicle having the driver seated on the right side.

This invention illustrates the various techniques providing a composite mirror to effectively obtain and achieve the two distinct and separate fields of view regarding the side areas of a motor vehicle. A technique for providing a mirror incorporating the concepts of this invention is the integral formation of an auxiliary mirror surface with the primary mirror. This integrally formed auxiliary mirror surface may appear either on the exterior or outwardly facing surface of the primary mirror or may be incorporated in the rear surface. The only difference between these two techniques is that the silvering for forming the reflecting surface in one instance is applied to the outer surface whereas in the other it would be applied to the rear surface of the primary mirror.

These and other objects and advantages of the invention will be readily apparent from the

following detailed description of the several embodiments thereof and the accompanying drawings.

DESCRIPTION OF THE DRAWING FIGURES

Figure 1 is a front view of a mirror embodying this invention.

Figure 2 is a fragmentary vertical sectional view on an enlarged scale taken along line 2—2 of Figure 1.

Figure 3 is a fragmentary vertical sectional view on an enlarged scale taken along line 3—3 of Figure 1.

Figure 4 is a diagrammatic plan view of the field of view of the mirror.

Figure 5 is a front view of a modified mirror embodying this invention.

Figure 6 is a fragmentary vertical sectional view on an enlarged scale taken along line 6—6 of Figure 5.

Figure 7 is a fragmentary vertical sectional view on an enlarged scale taken along line 7—7 of Figure 5.

DESCRIPTION OF THE ILLUSTRATIVE EMBODIMENT

Having reference to the drawings, a basic form of the invention is shown in Figures 1, 2 and 3. In Figure 1, a conventionally shaped side view mirror is shown in elevation without the auxiliary supporting or mounting frames or bracket components. Those structural components bear no relationship to this invention other than to provide the necessary support for the mirror in the attachment or mounting thereof on the side of the vehicle. However, since such mounting components are well-known, it is not deemed necessary to illustrate or describe those structures in conjunction with the illustrative embodiments.

The side view mirror includes a primary mirror 10 comprising a flat plate formed from glass or other optically transmissive material having planar front and rear surfaces 11 and 12, respectively. A coating of silvering material 13 is applied to the surface 12 thereof as indicated in Figures 2 and 3. The illustrated primary mirror 10 is of conventional rectangular configuration and may be of the generally conventional size of 7.6 × 12.7 centimeters and mounted with the long axis horizontally disposed. However, it will be understood that the primary mirror size may be otherwise dimensioned.

Integrally formed with the primary mirror 10 is a secondary or auxiliary mirror structure which is generally designated by the numeral 14 and can be best seen with references to Figures 2 and 3. In this illustrative embodiment, the secondary mirror 14 is formed in the body of the glass plate forming the primary mirror and comprises a surface 15 having a generally rectangular configuration in plan view as will be noted in Figure 1. A coating of silvering material 16 is applied to the surface 14 thereby forming the reflecting surface.

The secondary mirror 14 is most advantageously located in a corner area of the primary mirror and is substantially smaller so as to minimize the loss of effective viewing area of the primary mirror. In this illustrative embodiment, the secondary mirror has the exemplary planar area dimensions of 4.8 centimeters in its longer dimension extending horizontally and 2.9 centimeters in its vertical or height dimension with respect to the vertical of the primary mirror. Also, the secondary mirror is preferably located with one of its longer sides adjacent to, or coextensive with, the bottom edge 17 of the primary mirror and its one vertical side adjacent to, or coextensive with, the one vertical side edge 18 of the primary mirror. This vertical side edge 18 is that which is intended to be positioned next adjacent the side of the vehicle on which the mirror is to be mounted. Locating the secondary mirror in this area results in the cavity formed in the body of the primary mirror by generation of the mirror surface 15 being open at both the bottom edge 17 and vertical side edge 18 of the primary mirror. A planar surface 19 defining the other longitudinal side of the secondary mirror is also generated, but the inner side edge of the secondary mirror surface 15 lies in the plane of primary mirror's rear surface 12 defining a juncture line 20.

It will be further noted with reference to Figures 2 and 3 that the secondary mirror surface 15 is a non-planar surface and comprises a segment of a curved surface. This surface in the illustrative embodiment is a spherical surfaced segment having a radius of curvature of the order of 12 centimeters. As previously stated, the one end of this surface segment intersects the rear surface 12 of the juncture line 20 and it will be noted with reference to Figure 2 that the opposite end, at its juncture with the vertical side edge 18, to be displaced about 0.8 centimeters from the rear surface 12 of the primary mirror. This specific dimensional configuration is considered exemplary as providing particularly useful fields of view and resulting in a composite mirror structure capable of achieving the intended objective as explained in further detail hereinafter. It will also be apparent that, while the secondary mirror surface is described as being a spherical surface segment of specific radius of curvature, this radius of curvature may be increased to the extent that it approaches infinity and the surface may effectively be planar, but disposed at an angle with respect to the front and rear surfaces 11, 12 of the primary mirror 10. However, the curved surface is deemed advantageous in that it provides a larger field of view.

Functional objectives achieved by the aforedescribed structural combination of a primary and a secondary mirror 10, 14 are diagrammatically illustrated in Figure 4. In that drawing figure, a side view mirror comprising the primary mirror and secondary mirror is shown mounted on a left side of a vehicle which is diagrammatically shown in top plan view. The respective fields of view that are provided by the reflecting surfaces of the primary mirror 10 and

secondary mirror 14 are diagrammatically shown in Figure 4. These angular fields of view are referenced to a horizontal plane with the field of view for the primary mirror designated X and includes a horizontal angular space extending laterally outward from a base or reference line A which is effectively aligned with the side of the vehicle. Preferably, this limiting line of sight overlaps portions of the side of the vehicle to better provide the vehicle operator V with a reference in determining relative locations of objects that appear within that field. The angular extent of this field of view designated X is effectively of the order of 35 degrees. Consequently, it will be readily seen that the field of view is clearly inadequate to provide an operator, indicated to be located at a position designated V within the vehicle with reflected images of objects or vehicles that may be laterally spaced further forward with respect to the vehicle and are outside the angular field of view designated by the letter X.

It is the objective of the secondary mirror 14 to increase this lateral angular field of view to that which is designated Y in Figure 4. This substantially greater angular field of view in a horizontal plane with the mirror construction utilizing a secondary mirror surface 15 comprising a segment of a spherical segment oriented as previously described, extends from the base line A to substantially a line which will be 80-90 degrees displaced from the side of the vehicle.

An extremely important advantage of the specific structural configuration of the auxiliary mirror 14 of this invention is the presentation of a relatively wide field of view in a horizontal plane of a particularly important area whereas the field of view is limited in its vertical extent to a relatively narrow band. The effective viewing area laterally relative to the vehicle includes a nearly 90 degree horizontal field of view in the region where the operator of the vehicle will be readily able to detect the presence of other vehicles at a position where greater detail is unimportant. This display of a vehicle in the so-called-blind spot area is of substantial advantage in that the field of view does cover an area which would otherwise require the vehicle operator to physically turn his head and directly view that area. In the matter of changing lanes on multilane highways, this is a particularly important feature. Merely checking the primary planar mirror 10 only indicates whether a vehicle is in a substantially rearward position with respect to the operator's own vehicle. There is really no indication in that mirror of the presence and location of a vehicle immediately sideways of the vehicle, but still sufficiently rearward that a person's normal peripheral vision is unable to detect such a vehicle.

A further important advantage of this mirror construction is that the field of view in a vertical plane is relatively limited in its vertical extent, both upwardly and downwardly, and thus the operator is not presented with a substantial amount of extraneous information and detail that is of no concern to his operating decisions. It is only the lateral position of a vehicle in this "blind spot" that is essential for the operator's safe performance and maneuvering of his vehicle. Furthermore, this observation can be accomplished without the disadvantageous head and eye movement that would otherwise be required and could adversely affect the proper and safe control of the vehicle.

A modified form of the mirror embodying this invention is shown in Figures 5, 6 and 7. This modified mirror structure comprises an integrally formed combination of a primary mirror 21 and a secondary mirror 22. The primary mirror 21 may be of the same dimensional configuration described with reference to Figure 1, but may be formed from a material that is not optically transmissive. The front surface 23 of the primary mirror is either formed to directly provide adequate reflectivity or, as is illustrated, is provided with a thin layer 24 of a suitable material capable of producing a high degree of reflectivity. Also, the secondary mirror 22 is formed in a lower corner area of the primary mirror and thus provides the same advantageous viewing of lateral areas as obtained with the Figure 1 embodiment. While the reflecting surfaces 23 and 25 are advantageously provided with a reflective coating, neither the peripheral edges of the primary mirror 21 nor an upper horizontally extending edge surface 27 of the secondary mirror 22 would be provided with such a coating. Preferably, the edge surface 27 would be treated or conditioned to minimize its reflectivity. This would tend to minimize extraneous reflections that could possibly be generated by the adjacent and angularly disposed edge surface 27 and primary mirror front surface 23.

The mirrors of this invention were previously described as being formed from glass. It will be understood that glass was suggested as an appropriate material, but it is also suggested that other materials may be suitable. For example, there are certain plastic materials which possess the desired structural characteristics and, in the case of the Figure 1 embodiment, have the necessary optical transmission characteristics. Plastics may enable a greater economy to be affected in manufacture as they may be better adapted to molding techniques to achieve the necessary smooth surface for purposes of reflection.

It will be readily apparent from the foregoing detailed descriptions of the embodiments of this invention that a particular novel and useful mirror is provided for automotive vehicle purposes. The mirror of this invention is specifically designed and inherently capable of providing the substantially increased field of view necessary to eliminate the present blind spot that exists in the case of conventional mirrors having a single, flat, planar surface. The mirror construction of this invention limits the field of view provided by the secondary mirror surface to a specifically defined area that is of exceptional interest to the vehicle operator in ascertaining the presence of an object or vehicle

immediately laterally positioned with respect to his own vehicle. The segment of spherical surface is of considerable advantage in this respect as it provides a slight vertically upward and downward field of view to better form reference or a relationship to the image reflected by the primary mirror for the operator. The angular disposition of the vertical segment with respect to the primary planar mirror surface results in this segment being particularly capable of illustrating the extreme lateral extent of this field of view as well as providing a line of sight in reference with respect to the side of the vehicle. It will also be apparent that a mirror embodying this invention may be constructed to be positioned on either side of a vehicle for providing the advantageous field of view.

CLAIMS

1. An optical mirror comprising

a primary mirror having a reflecting surface that includes a side edge and which is adapted to be normally viewed from a position displaced in laterally outward offset relationship with respect to said side edge, said primary reflecting surface providing a primary angular field of view of predetermined extent in a first plane oriented in generally perpendicular relationship to said side edge and said primary reflecting surface, and

a secondary mirror integrally formed with said primary mirror, said secondary mirror being substantially lesser in dimension that said primary mirror and disposed closely adjacent said side edge of said primary mirror and terminating in spaced relationship to an opposite side edge of said primary mirror to thereby leave a substantial primary reflecting surface area therebetween, said secondary mirror having a reflecting surface providing a secondary angular field of view of predetermined extent in said first plane oriented in generally perpendicular relationship to said side edge and said primary reflecting surface of said primary mirror with the secondary angular field of view being substantially greater than the primary angular field of view provided by the reflecting surface of said primary mirror, said secondary angular field of view being at least partially coextensive with the primary angular field of view and extending beyond the primary angular field of view of said primary mirror only in a direction away from said side edge and across the reflecting surface of said primary mirror with respect to the point of viewing.

2. An optical mirror according to claim 1 wherein said primary mirror has a front viewing surface and said secondary mirror is formed to position its reflecting surface at the front surface of said primary mirror.

3. An optical mirror according to claim 2 wherein each of said primary and secondary mirrors has a reflecting surface formed at a front surface thereof.

4. An optical mirror according to claim 3 wherein the front surfaces of each of said primary and secondary mirrors have a coating of reflective material applied thereto.

5. An optical mirror according to claim 1 wherein said primary mirror has a front viewing surface and is formed from an optically transmissive material, and said secondary mirror has its reflecting surface formed in rearwardly spaced relationship to the primary mirror front viewing surface.

6. An optical mirror according to claim 5 wherein said primary mirror has a rear surface forming a reflective surface.

7. An optical mirror according to claim 6 wherein each of said primary and secondary mirror reflective surfaces have a coating of reflective material applied thereto.

8. An optical mirror according to claim 1 wherein said secondary mirror reflecting surface is oriented with respect to the reflecting surface of said primary mirror such that said planes of the respective angular fields of view are coplanar.

9. An optical mirror according to claim 8 wherein the angular field of view of said secondary mirror includes substantially all of the angular field of view of said primary mirror in said planes.

10. An optical mirror according to claim 9 wherein the respective angular fields of view are coincident at one limiting extent.

11. An optical mirror according to claim 1 wherein the reflecting surface of said secondary mirror is arcuately curved to provide a greater angular field of view than that of said primary mirror reflecting surface in a second plane oriented substantially perpendicular to said first mentioned plane.

12. An optical mirror according to claim 11 wherein the angular field of view of said secondary mirror reflecting surface in said second plane includes the angular field of view of said primary mirror reflecting surface.

13. An optical mirror according to claim 12 wherein the angular field of view of said secondary mirror reflecting surface in said second plane extends beyond the field of view of said primary mirror in only one direction with respect to said first plane.

14. An optical mirror according to claim 1 wherein said secondary mirror is substantially smaller than said primary mirror and is positioned closely adjacent said side edge thereof and an edge perpendicular to said side edge.

15. An optical mirror according to claim 1 wherein said secondary mirror's reflecting surface has a dimension in said first plane that is greater than the dimension thereof in said second plane.

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