A Configuration of Taillights and Brakelights

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●IN the course of preparing a pictorial review of signal lighting in connection with the celebration of the 50th anniversary of the founding of the Illuminating Engineering Society, the writer came to the realization that although brakelights have been in use for more than three decades, it is still common practice to depend upon a difference in intensity to distinguish them from taillights. This is a situation that certainly warrants consideration.

The apparent intensity, or brilliance, of any signal light is determined by at least five variables, as follows:

1. The luminous intensity of the light.
2. The distance of the light from the observer.
3. The transmissivity of the atmosphere.
4. The brightness, or luminance, of the background.
5. The state of dark adaptation of the observer's eyes.

Every one of these varies without respect to the significance of the signal, as follows:

1. Although no numerical values are at hand, the variation in the normal luminous intensity of brakelights from make to make and model to model appears to be about the same as the average distance between the luminous intensity of the brakelights and taillights used on the same cars. This variation in design is aggravated by differences in transmittance of covers, differences in voltage at the sockets, differences in cleanness, and differences in degree of lamp deterioration.

2. The distance to the signal light affects the apparent intensity in accordance with the inverse square law. But the driver must estimate the distance, which is itself frequently changing, from a combination of binocular stereopsis, chiefly effective at distances less than 100 ft; apparent size, somewhat complicated by variations in actual size; and intervening objects, these, of course, being always in apparent motion and changing.

3. When the air is clear the effect of atmospheric transmissivity is small, but when there is even a little fog in the air this effect may become the most serious one. Atmospheric transmissivity reduces the apparent intensity in accordance with an exponential factor, which frequently becomes so large that even the high intensity of headlights does not make them visible at desirable distances. Nevertheless, when the atmospheric transmissivity drops, a driver soon has no indication of the position and movements of vehicles ahead of him except what he gets from their signal lights.

4. The effect of background brightness, including the influence of other bright lights in the field of view, is a matter on which the psychologists can speak more appropriately than the writer.

5. The state of dark adaptation also is a matter for psychologists to appraise, but if the estimate of absolute intensity varies with these conditions as the minimum perceptible illumination does, the effect may be measured by a factor of 100 or even 1, 000.

It would be difficult to find a criterion for differentiating two signals which would be obscured by as many irrelevant conditions as is an intensity difference. It is a dependable signal only if the observer sees the transition in intensity at the instant the brake is applied.

The weakness of the arrangement has evidently been sensed by some designers, because there have been efforts to make a distinction on the basis of color. If a color distinction were well carried out, it would certainly be much more dependable for normal observers than the intensity distinction. Some vehicles, notably busses, have been equipped with red tail lights and yellow brakelights. But this appears to be the reverse of good signal practice, which recognizes yellow as an ordinary warning and red as a signal indicating more than usual danger. At the time when this practice was most common, there was no standardization in the colors used, with the result that every hue from a purplish red to a light yellow was to be seen on the rear of motor vehicles.

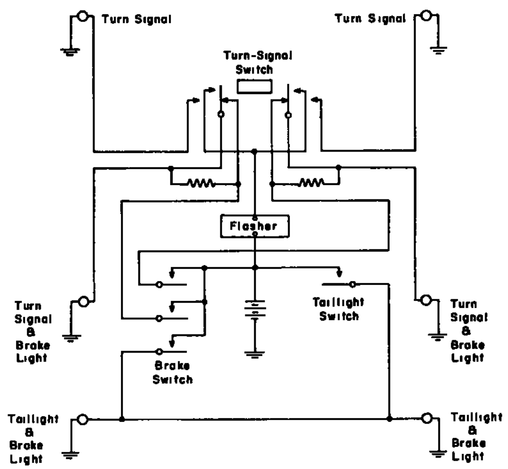

Figure 1. Circuit for vehicle signal lights providing for dual two-light brake signals.

This difficulty could have been corrected by sound standardization of the colors but the red-green confusing protanopes and deuteranopes would still have been able to see only signals of different intensities.

Before the introduction of flashing lights as turn signals it would have seemed practicable to consider a flashing signal as an indication of braking. However, the use of flashing lights for turn signals is now well established. While it is theoretically possible to have two different flash characteristics, it would be necessary to keep them strictly standardized if they were to be sufficiently distinctive for all car operators to recognize at once which signal was being shown.

There remains the possibility of differentiating taillights and brake signals by giving the brake signal a distinctive configuration. The simplest configuration which seems applicable is that of two lights, one directly above the other. If these were placed in the center of the rear of the car with the taillights remaining in their present outboard positions, they would be distinctive both by day and by night. In the daytime the middle position would be evident because the rear of the car would be visible. At night, the complete configuration, including the taillights, would be a flattened diamond-shaped figure with its long axis horizontal.

The central location of the brakelights has, however, the disadvantage that the brake signal is more likely to be obscured by an intervening automobile than it is if the brake signal is given in an outboard position as at present. Moreover, the inclusion of any lights, other than those required for license plate illumination, in the rear center of the car would involve design problems that probably would not be welcomed by those responsible for the appearance of automobiles.

An alternate configuration is a long horizontal rectangle. Such a configuration could readily be made available in some cars by merely including the turn signal lights along with the taillights in the braking signal. To make the two light idea an instinctive one for drivers, it would be desirable to use it by day as well as by night. It also seems desirable to design the system in such a manner that the turn signal and brake signal can be given simultaneously. This can be accomplished by undulating the turn-signal light, instead of completely occulting it, when the brake signal is being given. There is no reason why the lamps and lenses for both these lights cannot be housed, as they sometimes are at present, within a single hood, provided the separation between the two lights is adequate.

The proposed use of a two-light configuration on both sides of the rear of cars and trucks as a brake signal would have an additional merit if the distance between the two lights is standardized. It would give drivers at night one standard distance by which to judge both the distance of the vehicle ahead and its rate of braking. For this reason the vertical separation of the lights should be carefully standardized on the basis of laboratory and road tests. At the same time it would be desirable to include some study to determine the optimum characteristics for the undulating of the turn signal when it is combined with the brake signal.

Figure 1 shows a possible circuit for actuating the rear signals in accordance with this proposal.