THE STORY OF THE DEVELOPMENT AND BACKGROUND OF AIR HORNS FOR LOCOMOTIVE SERVICE

John S. Leslie, President, Leslie Co., Lyndhurst, New Jersey

The first consideration in the development of air horns for locomotive service was to provide an effective warning signal which would afford maximum protection and safety.

For gas rail cars in suburban and branch line service, the Leslie-Tyfon A-75-L (326 cycles/sec.) used alone or as a part of a multi-tone with the Leslie-Tyfon A-75-LL (244 cycles/sec.) proved quite adequate.

However, with the advent of the Diesel road locomotives, it was obvious that a louder horn was required as an adequate warning signal, particularly in view of the higher speeds at which these locomotives were operating.

To increase the sound intensity at the same frequency as the A-75-L would create a much more startling reaction in the average person nearby but would not have a proportional increase in effectiveness at a distance of 1/4 of a mile where the greatest need exists.

It had been well known in the marine field, through experience and test, for a great many years, that the effective range of a ship's whistle could be increased materially without a corresponding increase in objectionable sound at close range by use of lower frequencies.

This can best be illustrated by considering fog horns in lighthouse service which have frequencies as low as 86 cycles per second and a range of audibility of 12 to 15 nautical miles. Or, in the case of large passenger ships whose whistles have frequencies as low as 54 cycles per second with a range of audibility of 15 to 20 nautical miles.

In the latter case, passengers are less annoyed than they were by the earlier, higher pitch steam whistles.

At the other extreme, sirens used on fire engines, ambulances, etc. have frequencies of 1,000 to 5,000 cycles and are extremely startling and annoying nearby but have a relatively short effective range of audibility.

The A-200-L Leslie-Tyfon was the first low pitch (145 cycles/sec.) air horn applied as a locomotive signal and was installed on the Milwaukee steam Hiawathas and the Burlington Zephyrs in 1934 as a signal which would provide adequate, effective warning for locomotives operating at high speeds with minimum objectional effect on crew members, passengers and those living close to the railroad.

In addition, it was a pitch far enough out of the range of all highway signals and average noise levels to be distinctive and recognizable as a locomotive warning whistle.

It was realized that the maximum range of audibility of such a signal under ideal conditions was considerably greater than the required effective range. But, to be audible in a closed car on a stormy, windy night and still create a warning effect, it is necessary to have considerable reserve sound intensity available.

In this connection, it was also known that high frequency, short wave sound is more affected by wind and will not penetrate heavy headwinds as effectively as the longer wave lengths which are characteristic of the lower pitches. Likewise, the high speed of a locomotive has more effect on the carrying power of high notes than low notes and any tests which may be made should take this into consideration.

For intermediate applications, such as switcher service and for lower speeds in passenger service, an intermediate pitch of 218 cycles/sec. as produced by the A-125-L Leslie-Tyfon was developed and has proven quite effective in view of its wide general acceptance.

As long as locomotive whistles have been used, there have been objections raised by some individuals to whose ears their tone was displeasing. And, since no two people hear alike or have the same taste for tone any more than they have the same taste for anything else which they can sense, there will always be some who are dissatisfied.

Various means of overcoming complaints against air horns have been used, from omitting the use of the horn in towns completely, to the shortening of the length of blasts used. The latter method has proved very effective, particularly on one railroad which had its best grade crossing accident record last year in 22 years.

A recent suggestion that has been made and which is a practical and effective way to reduce the sound intensity of single-tone air horns, at certain times, is the restriction of the air supply by use of two operating valves. One will provide full air supply for high speeds and maximum effectiveness. The other will have a restricted orifice and provide a modulated sound for going through towns, particularly at night.

We have developed a two lever operating valve to accomplish the same result by obtaining full opening of the valve with one lever and a restricted opening with the other.

In considering the relative sound intensity of various air horns and whistles, the common but very misleading unit of measurement is the decibel or phon.

Since decibels (sometimes called phons) are based on a logarithmic scale, an increase from 100 to 108 decibels actually represents a 100% increase in sound intensity, although it would appear to be only an 8% increase.

To help overcome the misunderstandings created through the use of decibels, the American Standards Association has adopted a unit of measuring sound intensity known as A.S.A. Loudness Units. These are based on a linear scale and give a true relative comparison of sound intensity. The A.S.A. booklet No. Z24.2 - 1942 "American Standard for Noise Measurement", explains this relationship and includes a very complete table for converting decibels to A.S.A. Loudness Units.

It is generally recognized that most inter-state trucks and buses which use air horns on the highway use the multi-tone type. If the railroads wish, as a result of public opinion, to use chime or multi-tone horns, it would seem advisable to choose a range of frequencies far enough out of the range commonly used in highway signals to assure a sound that will be distinctive and clearly recognized as a locomotive signal.

Since the I.C.C. governs both the railroads and inter-state buses and trucks, they might, at the request of the A.A.R., establish permissible ranges of frequencies for horns used by each group.

Our Company has consistently refused to sell our A-125-L and A-200-L Air Horns for use on trucks and buses, as we consider it an obligation to the railroads and to the public to limit these to locomotive service.

As you know, we are in a position to furnish the railroads both single and chime or multi-tone air horns based on 20 years experience in this field. It is our desire to cooperate with all of the railroads in every way and to help them understand our views on the relative merits of these two types of horns or whistles.

It is possible, for those who wish to do so, to utilize their present A-200-L or A-125-L Air Horns and make them into a chime horn by adding horns of two or more additional frequencies. All of them can be mounted on a base and operated with a single valve either for maximum audibility or as a modulated warning for use in towns.

Whatever decision is reached by any railroad, the maintenance problem should not be overlooked. It stands to reason that the more horns are used the more maintenance will be required. In addition, the problem of adjusting a chime or multi-tone horn so that all units will blow simultaneously is naturally more difficult than adjusting a single-tone horn.

These are some of the reasons for the change over in the past, on the part of many railroads, from multi-tone to single-tone and this past experience should be helpful in the consideration of this question.

A great many sizes, types, and tones of air horns have been applied to locomotives and, in the final analysis, overall results both from the safety record and the general public reaction will determine what is to be ultimately used by American railroads.

Whether or not it will be possible to duplicate the sound of the old-fashioned steam whistle may become a question of personal opinion. It is doubtful that a vibrating diaphragm can be made to sound like a bell type whistle any more than a saxophone using a vibrating reed can be made to sound like a pipe organ.

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