

The compounding of friction materials that successfully meet all these requirements is the specialty of some of the anonymous heroes of the automotive industry. The uninitiated might think that, with a stable brake design and evaluation reduced to simple terms, the friction material compounder's job would be routine. This is far from the case. The many influences on brake performance, resulting from variations in vehicle weights, climates, road conditions, vehicle equipment and driving habits, make the engineering of brake lining friction materials a most challenging assignment, and a highly secretive operation. The formula of a brake lining is the well-guarded secret of the supplier, while other brake components are used commonly throughout the industry.

BASIC DRUM AND SHOE BRAKE DESIGNS

For purposes of clarity, all data presented herein applies to a drum and shoe brake of the duo-servo type. (Fig. 1) The two other drum and shoe brake designs generally employed are the two leading shoe type and two trailing shoe type. (Fig. 2) There is also a one leading one trailing shoe type in general use which is not shown.

ORGANIC BRAKE LININGS

All American passenger cars use organic brake linings. There are two organic linings which are classified by their method of fabrication. Organic dry mix is basically a gray-white compound of asbestos, filler materials and powdered resins which is thoroughly mixed, preformed to shape, and placed under heat and pressure until it forms a hard, slate-like board. Then it is cut and bent into individual arcuate segments and attached to the shoe.

Organic wet mix is a compound of asbestos, organic fillers and liquid resins that has a gray-brown color when blended. The compound is processed by any of several different methods which include high pressure extruding, screw extruding, calendaring and other processes. Figure 2 shows a step in the high pressure extruding process. The extruded lining is being removed from a die that has formed it into a long slab that will be compressed to a uniform density under heat and pressure.

Organic linings are generally composed of six basic ingredients. Asbestos, with its high heat resistance and high coefficient of friction in contact with iron and steel, is the basic material.

Friction modifiers, such as the oil of the cashew nut shell, give linings desired friction qualities.

Fillers are a wide variety of materials, such as rubber scrap, which are added to linings to control noise, wear or other brake characteristics.

Curing agents and/or accelerators are added to a lining compound to produce required chemical reactions in the ingredients.

Materials for special effects are added to compounds to improve overall braking performance. They include powdered lead, brass chips and aluminum powders.

Binders, which are predominantly phenolic resins, hold all the other ingredients together and are selected to govern the physical strength of the material at high temperatures.