into (*a*) aural, which can be inserted in the ear canal, and (*b*) superaural, which seals the external edges of the ear canal

The aural type, placed into the ear canal, *varies considerably both in design* and material Materials used are rubber, soft or hard plastic, wax, and cotton ("Swedish wool") Rubber and plastic types are popular because they are easy to keep clean, inexpensive and give good performance

Since ear canals vary in size, these inserts come in several sizes In some cases an individual will require a different size plug for each ear It is important that ear plugs be fitted individually by proper personnel (Fig 19–14) Plugs must fit properly and remain correctly seated (Fig 19–14 inset), as even the slightest leakage will lower the attenuation by as much as 15 dB (decibels) in some frequencies

Custom-molded hearing protectors made of silicone rubber, if properly molded and correctly used, generally prove more comfortable than do prefabricated inserts Soft plastic plugs give more comfort than hard types and hold their shape better than rubber types Their attenuation properties are comparable with those of rubber or hard plastic

Wax protectors vary in form from plugs of pure wax to impregnated cotton, cellular plastic foam, or paper They have certain drawbacks, however, as they tend to lose their effectiveness during the workday This is mainly caused by jaw movements which change the shape of the ear canal and break the acoustic seal between ear and insert In dirty areas, wax protectors may be objectionable from a sanitary standpoint, as they must be shaped by hand, wax protectors should be used only once While the initial cost may be low, the expense of frequent replacement can become an important consideration

Cotton inserted in the ear is a poor choice as a noise suppressor, because of its low attenuating properties (2 to 12 dB depending on frequency) and the disadvantages associated with hand-formed protectors The safety professional should discourage both workmen and employers from improvising any kind of inserts other than approved devices

The superaural type depends on sealing the

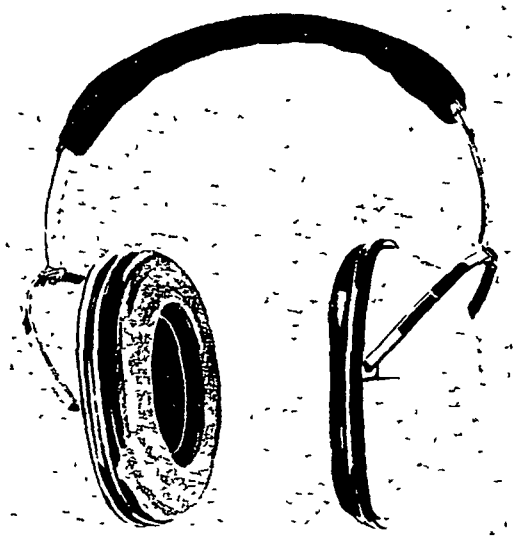


FIG 19–12 —Fluid-filled, cushion-type muff



FIG 19–13 —Earmuffs being worn around noisy equipment