

HARMONICS AND ORGAN PIPES

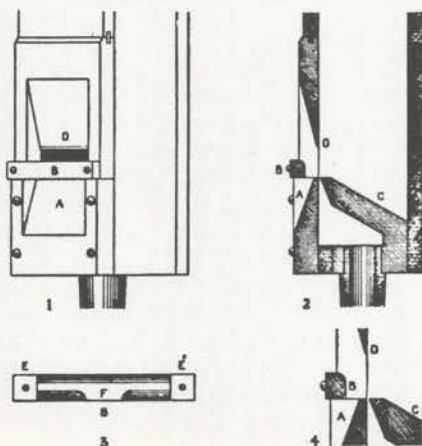


by Dan Barton, Organ Builder
(CONCLUSION)

There are two ways of producing harmonics in flue pipes, raising the pressure and the use of a harmonic bridge. By the use of pressure the voicer first voices the pipe to produce only the fundamental tone on a pressure lower than will be used in the organ. An example is a pipe voiced on 5" pressure, giving only the fundamental tone, will have a harmonic development when sounded on 7" or higher pressure.

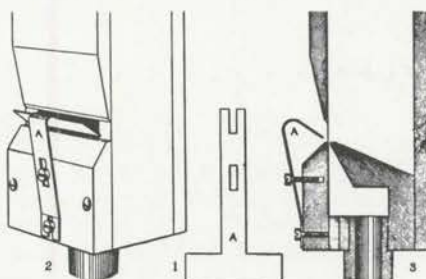
The harmonic bridge is cylindrical in shape. The length and diameter vary with the pitch of the pipe; other factors concerning the size are the dimension of the mouth, the wind pressure and the character of the tone required. The position of the bridge in relation to the mouth and wind stream is a very exacting procedure. The voicer must have a fine sense of tonal quality and a delicate ear. When the proper position is attained the bridge is made permanent by soldering or driving brads or screws through the ears to hold it in position. It can be placed so the pipe will sound its sub-octave as well as its prime tone or it can be placed so the pipe will sound one or more or a complete structure of upper partials. The movement of the wind stream against the bridge intensifies and increases the harmonic development. The pipe is first voiced to speak only the prime tone, then the bridge is added.

On wood pipes of string tone a strip



of hard wood or metal of various shapes is fastened across the mouth. It is called a beard and performs the same function for a wood stop that a harmonic bridge does for metal pipes.

The Fren Harmonique (first used in organs of French design) also performs the same function as the harmonic bridge except it is adjustable and can be used on both wood and metal pipes which have no ears. It consists of a thin brass plate with the bridge mounted at one end. The plate is screwed to the front of the pipes. The screws pass through slots allowing an up-and-down



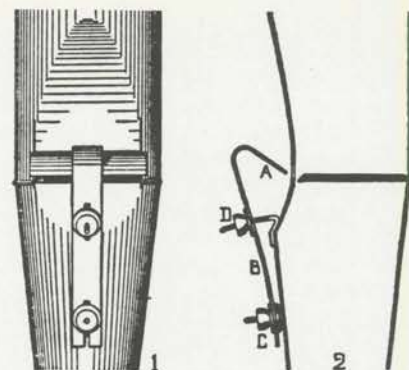
Wooden form of Violin at tenor C. 1 is detail of harmonic bridge (fren harmonique), 2 is front view, and 3 is interior, all of same pine.

adjustment, and by adjusting the upper screw it has an in-and-out adjustment to adjust the proper distance from the mouth. The fact that the organ tuner or finisher, as most prefer to be called, needs only a screwdriver to change or sometimes destroy the exacting work of the voicer makes the Fren Harmonique a very unpopular part of an organ pipe, at least to the voicer.

There are two types of reeds, the closed reed, also called beating or striking reed, is used in pipe organs to cause harmonics in the resonator. With closed reeds the tongue beats against a metal plate alternately opening and covering a hole cut in the plate or shallot. Free reeds are a metal tongue which vibrates inside a rectangular opening without touching its sides, as on a reed organ or harmonica. It is used in some classic organ reed pipes.

In flue pipes, voicing the mouths creates the tonal quality. In reed pipes, the shape and size of the resonator determines the tone quality.

Orchestral String "Double Brass" in wood form at CCC. 1 is front view, 2 is an interior view, 3 is detail of harmonic bridge, and 4 is detail of mouth area where sound waves are originated. A is lower lip, B is the bridge, C is block, D is upper lip. E is used to show ends of bridge for attachment to pipe, and F is harmonic-creating ridge on bridge.



'Fren Harmonique' Bridge
Viola d'Amore pipe at tenor C showing an unusually elaborate bridge: 1 is front view, 2 is an inside view of the same pipe. A and B represent structure of bridge, C bottom attachment, and D adjustable attachment.

The clarinet is rated as having the nearest to a true orchestral tone of any organ stop. The tone consists of the prime tone and the second, fourth and sixth harmonics.

A column of air which is narrow in proportion to its length will produce a larger and stronger range of harmonics than a wider column. An example is the small scale strings in theatre-type organs.

There are exceptions to all rules. The flute tone has no audible harmonics, but they can be induced as in the harmonic flute. The barrel is double length from middle C up, with a small hole bored halfway down the barrel. The hole kills the node, preventing the pipe from speaking the pitch of its total length. A harmonic development is made in the upper half of the barrel. The harmonic flute speaks its prime tone and the first harmonic or octave very distinctly. Large scale diapasons with narrow and high-cut mouths have no audible harmonics; they are used as a foundation stop in both classic and theatre-type unit organs. A small scale diapason with a wider and lower-cut mouth and fitted with a beard has a harmonic development. This combines the diapason and string tones; such a stop, used in classic organs, is the Violone, or Cello.

It is hoped that this discussion of the mysteries of harmonics will increase readers' understanding in areas where available knowledge is often stated in terms so technical that the average organ enthusiast finds the going rough. I have tried to "humanize" the subject through my approach because, after all, organ pipes have some very human qualities; they have bodies, faces, teeth, mouths, tongues, lips, ears, throats, caps, feet, boots, toes — and harmonics.

(Illustrations are from "Dictionary of Pipe Organ Stops" by Stevens Irwin (ATOE), published by G. Schirmer, Inc.)

—Dan Barton, Oshkosh