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Theory & Instructions, The "Butterfly Dream" Sustaining Amp (Rev #4, Feb 12, 2018)

The "Butterfly Dream" Sustaining Amp is a Movable, Mechanical Amplifier and Sound Quality Enhancer For Banjos, Guitars, Mandolins and Other Acoustical Instruments

Overview. The "Butterfly Dream" Sustaining Amp (patent pending) greatly improves "sustain" (sound duration) of notes played on stringed musical instruments, and for that reason **may not be suitable for for playing some fast Bluegrass music** that usually sounds best when sustain is limited. (When the first note played stops sounding before the next note is played.) Like all of our products the design is based on the fact that when musical instruments are played their surfaces are covered with sound surface waves, also known as "Surface Acoustic Waves (SAWS)". On musical instruments these waves are tiny physical deformations on and just below instrument's surfaces which cannot be heard but are analogous to the music being played.

Theory. The Butterfly Dream Amplifier collects these sound surface waves from surfaces primarily by physical contact between the musical instrument and the device's adhesive tape. (And to a lesser extent when air pressure waves of sound impact the device which it converts to surface waves.) After collection the device amplifies the collected surface waves primarily by the physics principle of "constructive interference". This well known general wave principle states that when the same or similar frequencies of waves meet coming from different directions their amplitudes will add (and typically amplify). The device also adds a "timbre characteristic" to the waves by having the waves flow over different materials such as walnut or maple wood veneer and brass foil, which are selected prior to manufacture.

The device converts the collected amplified and timbre modified sound surface waves into air pressure waves of audible sound in the instrument's sound chamber. This is accomplished by this device when sound surface waves "squeeze" the air in diverging air spaces between sets of diverging heavy paper planes containing surface waves of similar frequencies. In the sound chamber these newly created amplified audible musical sound waves mix with the audible sound waves already there to improve the sound with greater volume and improved sound quality (often referred to as "richness"). Sound quality is improved because harmonic frequencies, which are higher multiples of a primary musical note's frequency, (and which are largely considered essential to good sound quality), are also amplified.

Timbre (sound "character") is controlled during manufacture by a selection of musical wood veneers, (typically walnut and maple) with brass foil. Brass foil on the bottom surface of the device, (see Drawing, "Bottom View", Fig 1), adds brightness and beauty to the sound. These materials, plus card stock which is considered to have a "neutral" timbre, are in shapes of modified octagon pairs that are contiguous along one edge. This unusual shape was selected because it offers continuous, amplifying paths to sound surface waves (See Drawing, Figures 3 and 4). These contiguous modified octagon pairs in different materials are connected in an assembly by three steel staples and a spring steel pin. These amplify and control the flow of sound surface waves over and among the modified octagon shapes. Two shapes are folded over staple flats to create amplified audible sound. One end of each staple is hard crimped to the spring steel pin which is directly connected to the surface wave input tape, the main source of the surface waves from the instrument. This hard crimping ensures accurate transfer of surface wave frequencies to the staples. The other ends of the three staples are normal staple points which are in firm contact with the bottom brass foil-covered surface of the lowest contiguous octagon (OVER)

pair which is musical wood veneer. This firm contact ensures that brass timbre-modified sound surface waves are transferred to the staples and then to all diverging octagon shapes that create the audible sound. These two inputs at opposite ends of the staples causes sound surface waves to amplify when they meet on the flats of the staples by constructive interference prior to being transferred to the diverging surfaces that create audible sound. The result is greatly amplified and timbre modified audible sound from the diverging air spaces into the sound chamber of the instrument.

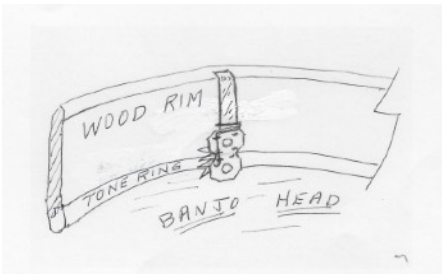
Figures 3 and 4 in the attached drawing illustrate potential advantages of using modified contiguous octagon pairs in the construction of this device. Figure 3 illustrates that a contiguous octagon pair is an angled "figure 8" which can act as a continuous path for surface waves, especially for high frequency waves which are inclined to travel in straight paths and reflect from edges. This angled "figure 8" path also provides amplification at its center where the waves intersect. Figure 4 illustrates how sound surface waves traveling in parallel paths can be amplified when reflected from any beveled edge onto adjacent waves. The angled figure 8 shape of each contiguous octagon pair offers 6 beveled reflections in a single path (Fig 3) which would cause significant amplification from the crossing of parallel waves. Because such amplification occurs for every cycle and on multiple contiguous octagon pairs, amplification and sound duration occurs far beyond the instrument's normal ability without the device.

The final step in creating high quality, amplified and timbre modified audible sound is accomplished in the diverging air spaces which are formed when the top two octagon pairs of paper are folded over their respective staple flats to create two angles of diverging air space between diverging planes of paper containing the same or similar frequencies of sound surface waves (Fig. 2). This configuration causes the surface waves to "squeeze" the air between the planes to create an analogous air pressure wave of audible sound in the manner of a "loudspeaker". This occurs to the greatest extent within the folds of paper containing the staple flats, (represented by wide arrows in Fig 2), but is also believed to occur to a lesser extent in the diverging air spaces external to these folds, (represented by narrow arrows in Fig 2), because nearby diverging planes also contain similar frequencies.

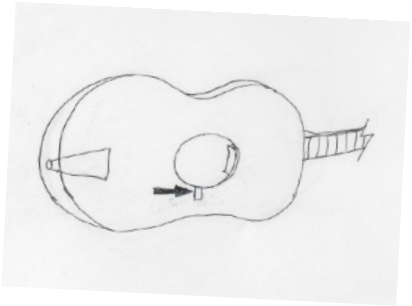
Instructions. Remove the red plastic tape protector strip from the sound surface wave input tape and stick the tape to the instrument as shown in the appropriate sketch below. Note that on all instruments the Butterfly Amp should hang freely by its Sound Wave Input Tape in the sound chamber when the instrument is held in the standing or seated playing position. On a banjo the Butterfly Amp's tape is stuck to the upper inside top of the banjo's wood rim so that its brass foil is facing the player. The tape end can extend up over the bottom of the wood rim. For a brighter and different sound from a banjo it can be taped to a metal coordinator rod. After installation all instruments can be played normally.

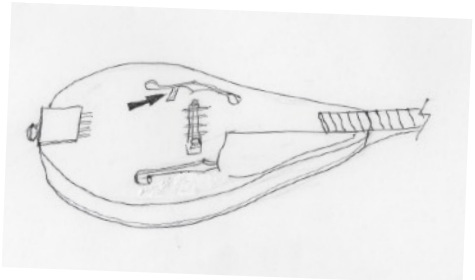
Materials Used (Which May Need Replacement Over Time): Staples are "Swingline" Brand "S.F. 4" "Premium Staples Professional Plus Series"; Tape is 3M Brand #600 clear acrylic tape 1/2 inch wide; (.002" thick). (Note: 3M's "Scotch Brand Gloss Finish Transparent Tape", which is similar and slightly thicker, is widely available in small dispensers, (Look for Red Plaid Packaging), can also be used.

Thank you for your order. Please let us know how well it works on your instrument. *Frank Geiger*



Banjos of All Types


Round Hole Guitars, Mandos, etc.


F- Hole Guitars, Mandos, etc.