

[54] ROTARY HORN TREMOLO UNIT

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22

[56]

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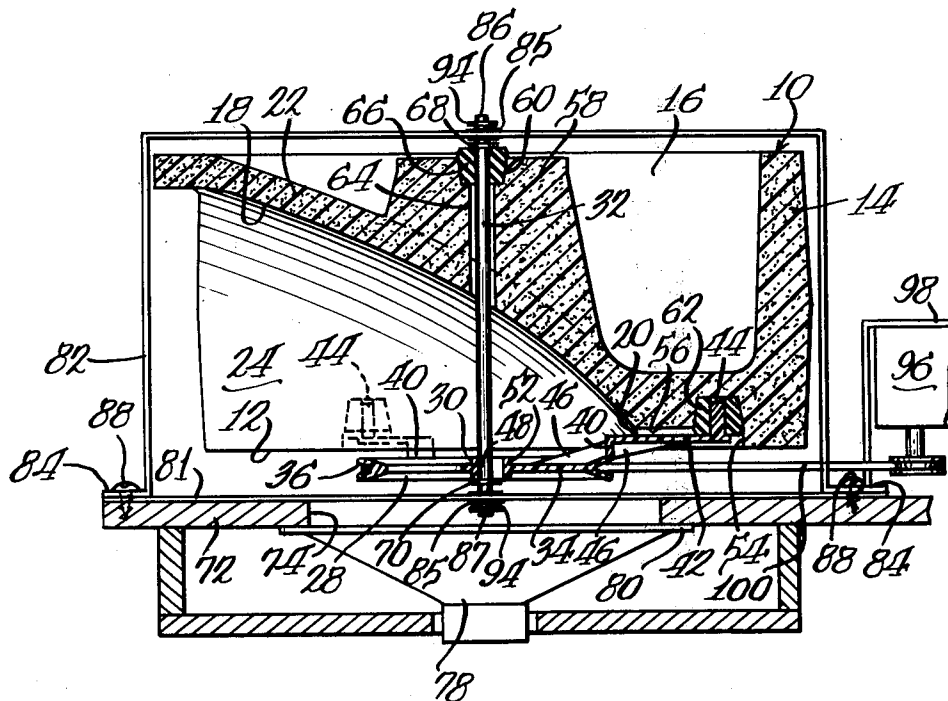
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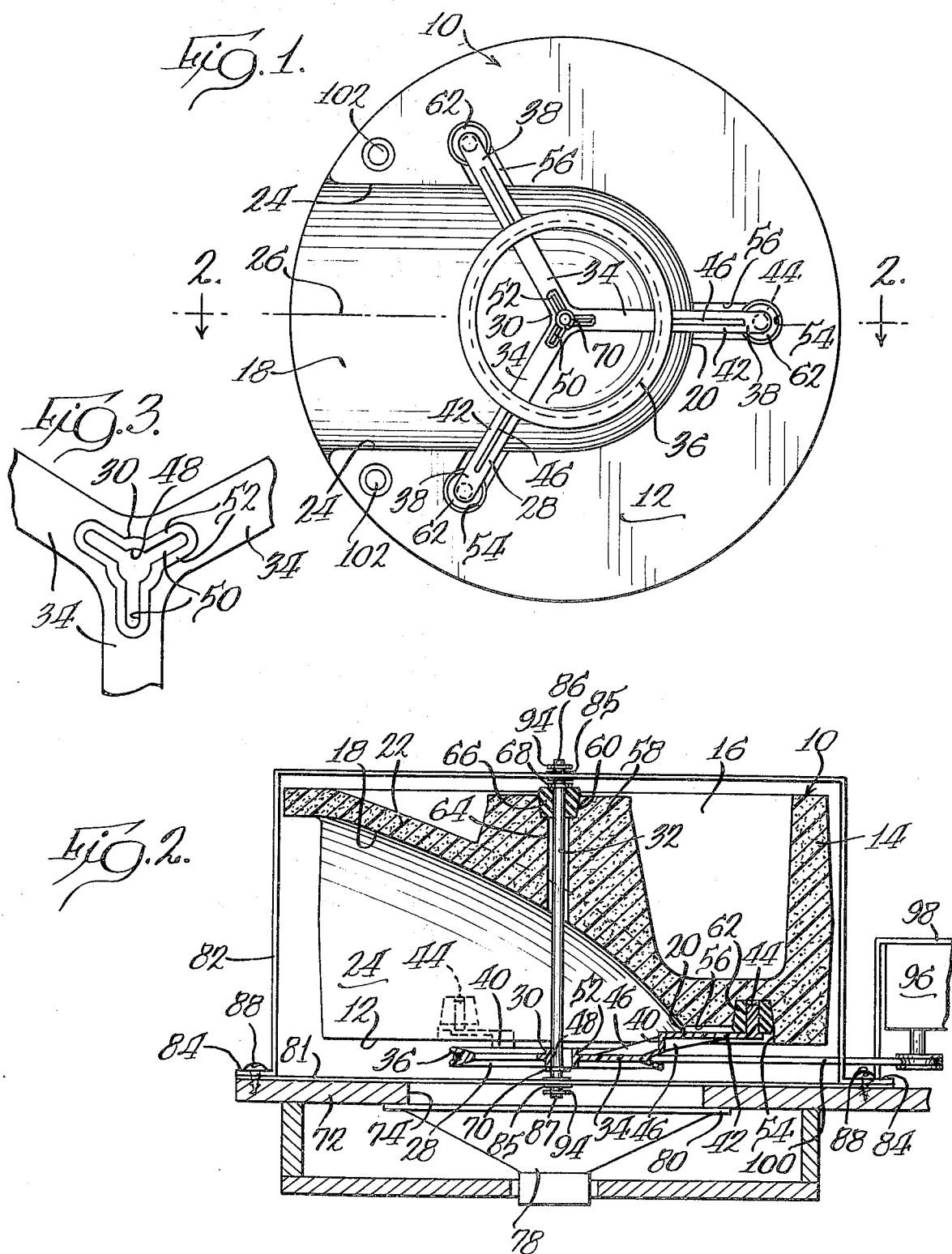
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ABSTRACT

A rotary horn tremolo unit having improved mounting and driving means resulting in positive drive and lower cost. Also an improved plastic hub structure minimizing cracking of the plastic when the hub is mounted tightly on a metal shaft.

3 Claims, 3 Drawing Figures





ROTARY HORN TREMOLO UNIT

This is a continuation of application Ser. No. 277,098 filed Aug. 1, 1972 now abandoned.

BACKGROUND OF THE INVENTION

A representative rotary horn tremolo unit is shown in U.S. Pat. No. 3,174,579 dated Mar. 23, 1965, to D. J. Leslie. A curving, deflecting horn surface is situated in front of a speaker to deflect the sound waves generated by the speaker through a right angle to project them in a direction roughly normal to the axis of the speaker. The horn is rotated on the axis of the speaker to project the sound directly once per revolution through a cabinet opening or to the front of the cabinet, depending on the orientation of the speaker and the horn.

As shown in U.S. Pat. No. 3,174,579 and representing present practice, the rotating horn is mounted resiliently on a shaft which is journaled for rotation in bearings and mounts a pulley which is belt-driven by a motor. The transmission of rotational force from pulley to horn is by means of a separate resilient link.

Finally, in the course of devising the present invention, a difficulty was encountered of press fitting a molded rigid plastic hub upon a steel shaft, in that the coefficient of expansion of rigid molded plastics is about six times that of steel, and under environmental changes, the hub is very apt to split.

SUMMARY OF THE INVENTION

The present invention contemplates a tremolo horn wherein the coupling between the horn and its driving means and bearings is highly resilient to damp out any motor-derived or bearing-derived rumble.

The device is notably light and inexpensive both in its parts and its assembly. Other than the usual motor, belt and frame, it consists basically of two molded parts, some bushings or cushions and a shaft. These members go together simply and quickly and provide for a simple mounting for rotation. Also, novel provision is made for eliminating the likelihood of splitting as discussed above.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a front elevation of the tremolo horn unit of this invention;

FIG. 2 is a horizontal section taken along the line 2—2 of FIG. 1 looking downwardly in the direction of the arrows showing associated cabinetry, the motor and speaker; and

FIG. 3 is an enlarged plan view of the hub of the spider of FIG. 1.

DESCRIPTION OF A PREFERRED EMBODIMENT

The horn of the present invention is essentially a cylindrical drum 10 formed of a foamed plastic such as polystyrene, for instance, and may be molded of polystyrene beads in conventional fashion. It has a front, generally plane circular surface 12, a skirt 14 and an open or reentrant back 16. The horn 18 proper consists of a sloping valley formed in the front surface 12 extending angularly on a concave arc from a point 20 well to one side of the central axis of the drum to the opposite periphery of the drum, terminating the thickness of the floor 22 of the valley above the back edge of the drum skirt. The valley is bounded by nearly parallel vertical walls 24 equally distant from a plane 26 which includes the axis of the drum.

The assembly also includes a molded spider 28 formed of a rigid thermoplastic material. The spider consists of a central hub structure 30 adapted to be press fitted on a shaft 32 and three spokes 34 extending out from the hub at 120° and supporting an integral belt pulley 36. Free ended flat legs 38 are molded with an offset 40 from the face of the pulley to be offset from the plane thereof and extend radially outward as at 42 to terminate in pins 44 projecting laterally from the ends of the legs 38 to parallel the axis of the spider. The pins are of substantially less diameter than the width of the ends of the legs. The offsets 40 and legs 42 align with the spokes 34 and are stiffened by appropriate gussets 46.

The hub structure 30 is designed to avoid cracking of the spider at the hub due to the difference in coefficient of thermal expansion between the plastic of which the spider is made and the steel shaft 32. To this end, a hole 48 is formed through the hub to accommodate the shaft 32 closely, and radial, bifurcating slots 50 are formed in the spokes 34 to extend to and intersect the hole. The slots and hole are surrounded by flanges 52 on each side to strengthen the hub structure.

The coefficient of thermal expansion of most suitable, rigid thermoplastic materials is on the order of six times that of steel. Thus, as the ambient temperature drops to the low end of the anticipated normal range, there is a relative expansion of the shaft within the hub. In a press fitted assembly, this relative expansion frequently causes the hub to crack and break. With the illustrated slots 50, the relative expansion can occur and effect a slight spreading of the slots or the forked ends of the spokes, so changing the stress from a stress in tension to a stress in flexure. The flexural stress can be distributed over an appreciable length of fork leg, determined by the length of the slots, to fall comfortably within the elastic limit of the plastic material. Thus, the length of the slot will be determined by the elastic limit of the plastic material and the anticipated ambient range of temperature. This same structure, of course, accommodates the assembly to manufacturing tolerances to ensure always a snug fit between the parts without overstressing the fork legs beyond their elastic limit.

The front surface 12 of the drum has three circular tapering pockets 54 molded therein spaced at 120° intervals with respect to the axis of the drum to conform to the positions of the spider pins 44. Two of these lie on opposite sides of the horn 18 and the other lies back of the horn. Shallow channels 56 are molded into the surface 12 of the drum to extend from the pockets 54 to the horn on radial lines.

On the back side of the drum, a boss 58 is formed on the under side of the curved horn surface centrally of the drum extending approximately to the plane defined generally by the free edge of the skirt 14. A bottom pocket 60 like pockets 54 is formed in the boss 58 on the axis of the drum. The depth of the pockets 54 is greater than the length of the pins 44.

The spider has resilient soft neoprene tubular tapered cushions 62 fitted over the pins 44 which conform externally to the pockets 54. The cushions are of a length greater than the length of the pins and the depth of the pockets to the channels 56. The spider is mounted to the face 12 of the drum with the cushions fitted into the pockets. In this assembly, it will be appreciated that the legs 42 of the spider are recessed within the channels

52 formed in the top surface of the drum and the pulley 28 stands outwardly of the front surface of the drum because of the offset 40 in the spider legs. By virtue of the length of the cushions, the ends of the pins 44 are spaced from the bottoms of the pockets and the legs 42 are spaced above the floors of the channels 56 so there is no direct contact between the spider and drum.

The shaft 32 of the horn assembly extends through a considerably oversized axial bore 64 in the boss 58, through the surface of the horn 18 and through the hub 48 of the spider 28. At its back end, the shaft extends through a resilient cushion 66 identical with the cushions 62 in the pocket 60. Immediately outside the cushion 66, the shaft is annularly grooved and a retaining ring 68 seats in the groove. The shaft also is grooved immediately outside the hub 78 and another retaining ring 70 is seated in that groove to secure the assembled spider and drum together. The shaft bore 64 should not be close fitting so that the contact between the drum and its supporting structure is entirely through the cushions 62 and 66 and the drive from the pulley to the drum is through the cushions 62.

A representative utilization of this device is illustrated in FIG. 2. A baffle 72 has a speaker opening 74 formed therein. A speaker 78 is mounted back of the speaker opening by its flange 80 in appropriate fashion to project its sound forward. The horn is mounted to the other side of the baffle 72 in front of the speaker opening 74. The mounting may consist of a first strap 81 of light metal extending essentially straight across the speaker opening 74 between speaker and drum. A second strap 82 is formed into a bridge of open rectangular shape with outstanding ears 84 at its free ends. The depth and width of the open rectangle are such as to contain the drum comfortably for rotation there-within. The straps have bearings 85 in their centers and the shaft 32 extends outwardly beyond the retainer rings 68 and 70 at each end 86 and 87 through the bearings 85 in the straps to mount the drum for rotation. The straps are secured to the baffle 72 on opposite sides of the speaker opening 74 by screws 88 through their ends.

The drum is secured within the frame defined by the straps 80 and 82 by other retainer rings 94 exteriorly of the frame contained in appropriate grooves in the shaft ends 86 and 87.

A motor 96 may be mounted to a plate 98 attached to the baffle 72 and a belt 100 provided between the motor 96 and the pulley 28 to drive the horn at the desired rate of speed.

The drum 10 as molded is, of course, grossly unbalanced by virtue of the reduced amount of material on that side containing the output end of the horn. To remedy this, small diameter pockets 102 are formed in the face 12 adjacent the free ends of the walls 24. Metal

slugs of appropriate weight are cemented in the pockets 102 to balance the drum for smooth rotation.

We claim:

1. A rotary horn tremolo assembly comprising:

a generally cylindrical body of material defining a sound-deflecting horn surface extending between one face and a peripheral surface thereof;

a support structure;

a metal shaft rotatably mounted on said support structure;

a plastic pulley comprising a hub portion having a hole therethrough receiving said metal shaft in a press fitting manner, a rim, at least three spokes extending between said hub and said rim with a plurality of slots each extending from said hole into one of said spokes to define flexible legs over a portion of the length of each spoke to accommodate an oversize of said shaft relative to said hole and the differential thermal expansion between said metal shaft and said plastic pulley without breakage of said plastic pulley, and an integral support spider formed on said spokes with support legs extending outwardly from said hub in a plane spaced from the plane of said spokes with the free ends of said legs adapted to engage said body in a combined supporting and driving arrangement;

at least three vibration cushioning elements mounted between said free ends of said legs and said body to inhibit transmission of vibration therebetween, and

means for driving said pulley.

2. Apparatus as claimed in claim 1, wherein each of said free ends of said legs of said spider has a pin formed thereon;

said vibration cushioning elements are adapted to be mounted on said pins; and

said body of sound-deflecting material further defines at least three mounting pockets equally spaced from the axis of said body and from each other, said mounting pockets receiving said pins and said vibration cushioning elements.

3. Apparatus as claimed in claim 2, wherein

said mounting pockets are located in said one face of said body and said body further defines an axial bore and a shaft mounting pocket on the other face of said body;

said shaft extends through said axial bore and said shaft mounting pocket;

and further comprising;

a vibration cushioning element mounted in said shaft mounting pocket and adapted to receive said shaft to inhibit transmission of vibration between said shaft and said body.

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