May 12, 1964 J. DUNSBEE 3,132,715

NOISE REDUCING ENCLOSURES

Filed May 18, 1962

Fig. 1.

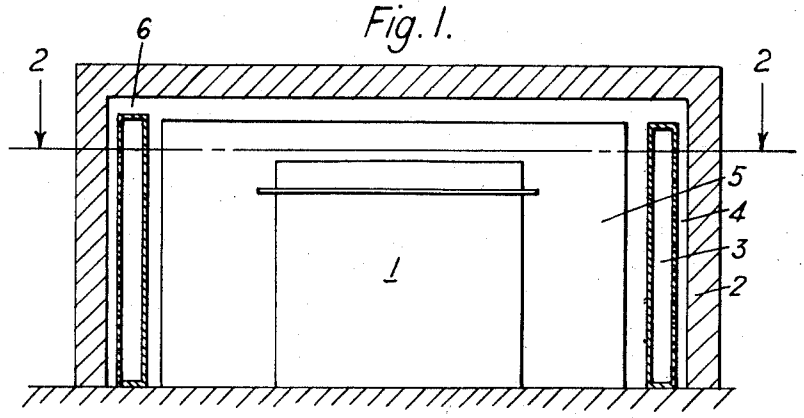
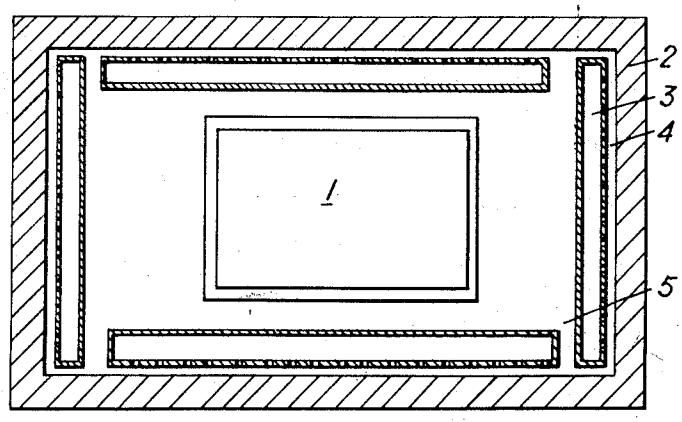


Fig. 2.



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United States Patent Office 3,132,715 Patented May 12, 1964

3,132,715

NOISE REDUCING ENCLOSURES

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Filed May 18, 1962, Ser. No. 195,701
Claims priority, application Great Britain June 1, 1961
6 Claims. (Cl. 181—33)

This invention relates to noise reducing enclosures.

It is often required to minimize the noise emanating from an apparatus such as a machine or an electrical transformer and for this purpose it is known to place the apparatus in an enclosure. The reduction of noise intensity achieved by the use of a simple enclosure is a function of the mass of the enclosure and the frequency of the noise and therefore, to reduce the intensity of low frequency noise, for example a frequency of one hundred cycles per second for transformer noise, an enclosure of large mass must be provided. It has been proposed to reduce the noise intensity further by including sound absorbing material within the enclosures but at low frequencies the space required, either partially or nearly completely filled with absorbent material, to give an appreciable reduction in the noise intensity is excessive and necessitates the provision of a much larger enclosure.

It is an object of the present invention to provide a noise reducing enclosure suitable for use with low frequency noise sources or noise sources containing low frequency noise in their spectrum in which a reduction in the low frequency noise intensity is obtained without requiring an excessive increase in the size or mass of the enclosure.

According to the present invention there is included within a noise reducing enclosure at least one resonant absorber tuned to include the objectionable frequencies of the noise source, each said absorber being positioned with its mass side facing a side of said enclosure and separated therefrom by a narrow passage. The expression "mass side" as used herein with reference to a resonant absorber means that side of the absorber which forms or contains the acoustic mass.

Said passage may be freely connected to the remainder of the space within the enclosure.

Said absorbers may extend over the greater part of the inside surface of said enclosure.

On embodiment of the present invention will now be described by way of example with reference to the accompanying drawings in which:

FIGURE 1 is a sectional elevation of a transformer noise reducing enclosure in accordance with the invention, and

FIGURE 2 is a sectional plan of the enclosure shown in FIGURE 1, the section being taken on the line 2—2 in FIGURE 1.

Referring now to the drawings, a transformers **1** is enclosed within a brick enclosure **2** which includes four shallow resonant absorbers **3** tuned to resonate at a frequency of one hundred cycles per second, this being the predominant frequency of transformer noise.

Resonant absorbers, which are well known, may be considered to consist of acoustic mass, compliance and resistance and usually comprise a Helmholtz resonator or a panel absorber. A Helmholtz resonator includes a cavity having one or more holes in one side, herein referred to as the mass side since the acoustic mass is formed by the air contained within the holes, the compliance being formed by the space within the cavity and the resistance being formed by the surface roughness of the holes in the mass side or by absorbent material introduced within the cavity. A panel absorber includes a cavity having a mass side formed by an elastic panel or membrane. The acoustic mass may be formed by the mass of the membrane alone or the mass may be increased by adding additional non-elastic mass to the membrane. The compliance is the space within the cavity and the elasticity of the membrane may provide additional compliance and also resistance. Alaternatively, resistance may be formed by absorbent material introduced within the cavity.

The resonant absorber **3** shown in the drawings are of the Helmholtz kind. Each resonator **3** is positioned with its mass side facing a side of the enclosure **2** and is separated therefrom by a narrow passage **4** and is also separated from the transformer **1** by a larger space **5**. The resonators **3** extend over the greater part of the inside surface of each side of the enclosure **2**, a gap **6** being provided between the top of the resonators **3** and the top of the enclosure **2** to freely connect the passage **4** and the space **5** and thereby prevent resonance within the passage **4**.

In operation, noise at a frequency of one hundred cycles per second emanating from the transformer **1** causes resonance in the absorbers **3**. The greatest reduction in noise intensity occurs just in front of the mass side of the resonators, i.e., within the passages **4**, and the sound passing through the wall of the enclosure **2** is therefore considerably reduced.

The noise intensity within the shallow resonators **3** is greater than the noise within the space **5** and some sound is therefor radiated back into the enclosure through the solid sides of the resonators **3**. It is therefore essential that the resonators be positioned with their mass sides facing the sides of the enclosure **2** and spaced therefrom by the narrow passage **4**.

The embodiment described above may be varied in many ways. For example, the resonators **3** may extend over the whole of the inside surface of each side of the enclosure **2** but if as a result of this resonance should occur in the passage **4** the reduction in sound intensity outside the enclosure may not be so great. Also, the Helmholtz resonators may be replaced by panel absorbers. Furthermore, if it is only required to reduce the noise in a particular direction the absorbers may only be positioned adjacent the side of the enclosure facing in that particular direction. If a reduction in the intensity of noise passing through the top of the enclosure is also required a further resonant absorber may similarly be positioned adjacent the top of the enclosure.

It will be appreciated that each of the resonators **3** has been described as a single resonator, but for a large enclosure each resonator would be built up from a number of smaller units. Furthermore, whilst the invention has been described with reference to a transformer noise reducing enclosure it is equally suitable for noise reducing enclosures for other apparatus, such as rotating machinery, the resonant absorbers being tuned to include the objectionable frequencies of the noise emanating from the apparatus.

What we claim is:

1. A noise reducing enclosure for a noise source having included therein at least one resonant absorber comprising a single mass side, said absorber being tuned to include the objectionable frequencies of the noise source, each said absorber being positioned with its mass side facing a side of said enclosure and separated therefrom by a narrow passage.

2. A noise reducing enclosure as claimed in claim 1 in which said passage is freely connected to the remainder of the space within the enclosure.

3. A noise reducing enclosure as claimed in claim 1 in which a plurality of resonant absorbers are provided, said absorbers extending over the greater part of the inside surface of said enclosure.

4. A noise reducing enclosure as claimed in claim 1 in which said resonant absorbers are Helmholtz resonators.

5. A noise reducing enclosure for a noise source having included therein a plurality of resonant absorbers each comprising a single mass side and each being tuned to include the objectionable frequencies of the noise source, each of said absorbers being positioned with its mass side facing a side of said enclosure and separated therefrom by a narrow passage which is freely connected to the remainder of the space within the enclosure, said absorbers extending over the greater part of the inside surface of each side of said enclosure.

6. A noise reducing enclosure as claimed in claim 5 in which said resonant absorbers are Helmholtz resonators.

References Cited in the file of this patent

UNITED STATES PATENTS

2,045,312	Roos et al.	June 23, 1936
2,081,952	Parkinson	June 1, 1937
2,123,358	Grutzner	July 12, 1938
2,502,016	Olson	Mar. 28, 1950
2,619,685	Kjaer	Dec. 2, 1952
2,808,122	Meyers	Oct. 1, 1957

FOREIGN PATENTS

495,755	Great Britain	Nov. 16, 1938
1,150,315	France	Aug. 5, 1957