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F. WENDT ET AL

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TEST STAND FOR INTERNAL COMBUSTION ENGINES

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2 Sheets-Sheet 1

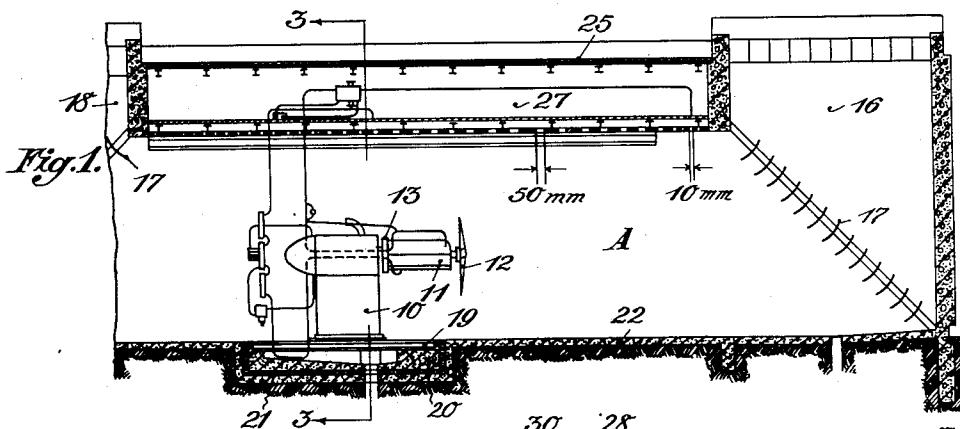
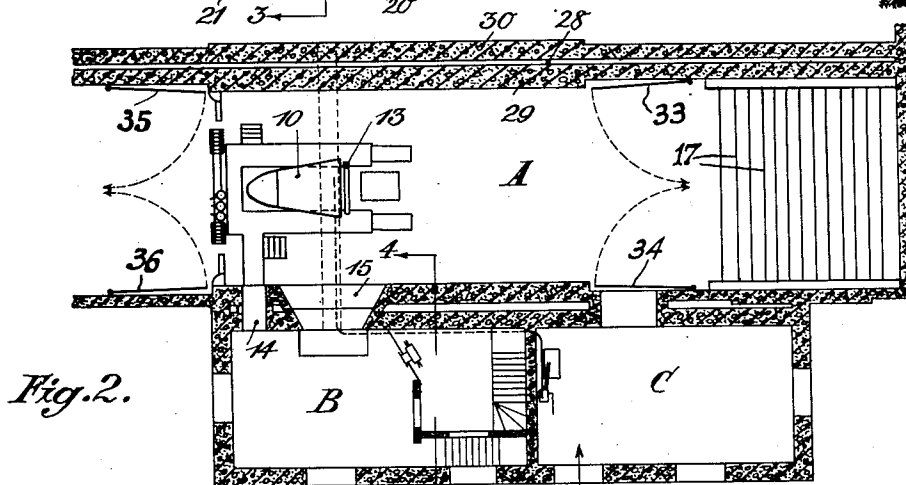
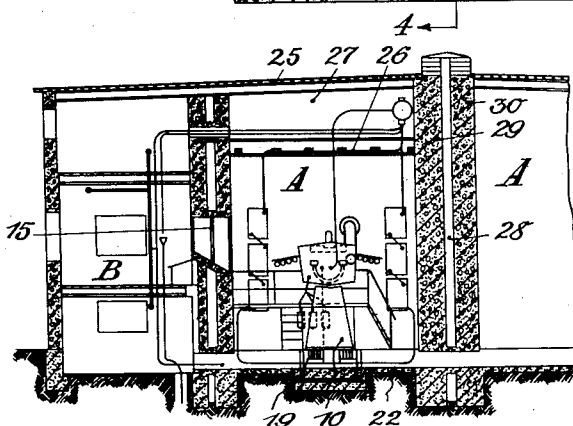
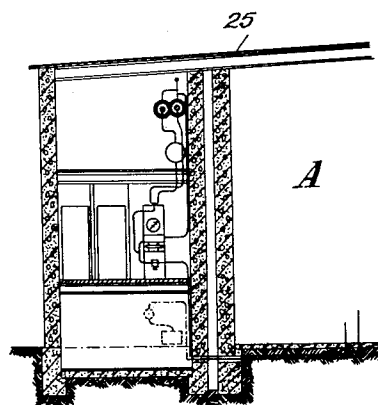


Fig. 3.

Fig. 4.

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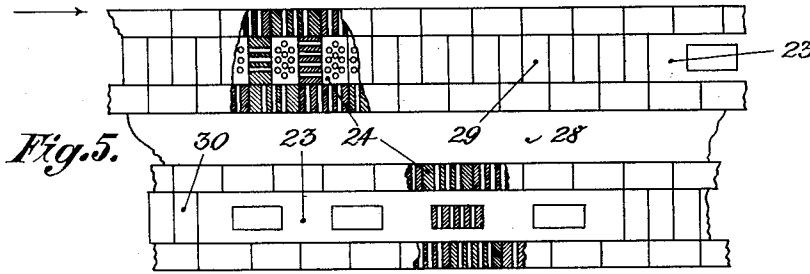
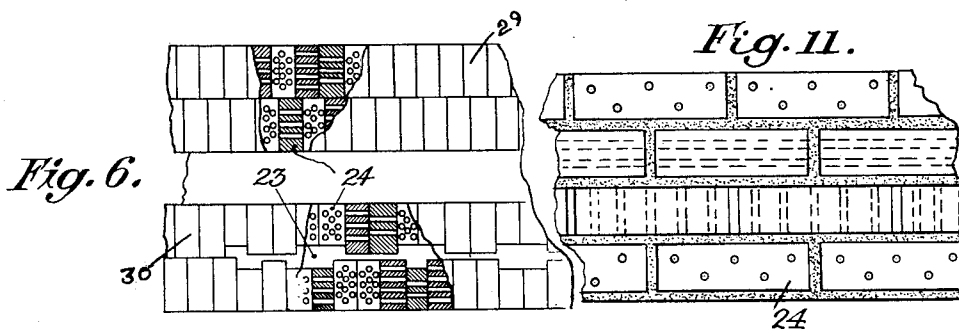
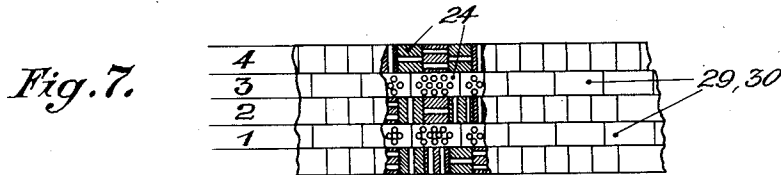
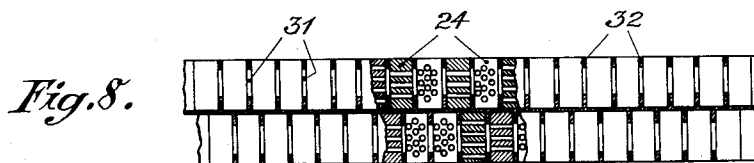
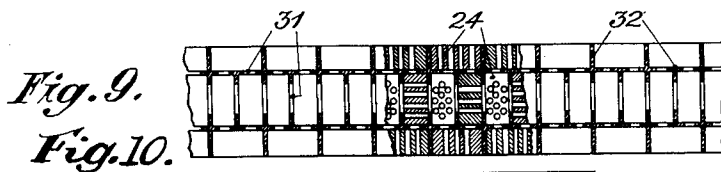
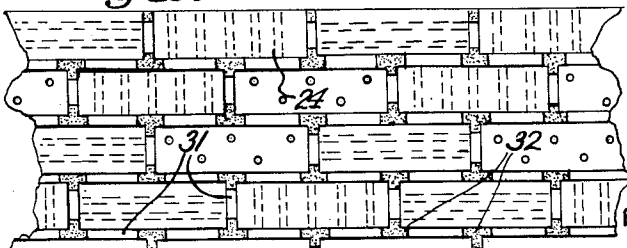
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2 Sheets-Sheet 2



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TEST STAND FOR INTERNAL COMBUSTION
ENGINESFriedrich Wendt, Jakob Haug, Karl Kohlbecker,
and Eduard Seppeler, Berlin, Germany; vested
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17 Claims. (Cl. 72-41)

This invention relates to a test stand for internal combustion engines, especially for airplane engines. The object of the invention is, to prevent mechanical vibrations or sound waves emanating from the engine on the test stand from being transmitted to the floor, roof and surrounding walls of the test stand structure (wind tunnel) so as to prevent the sound waves radiated by the walls of the test stand from causing too great annoyance to the surroundings.

Several embodiments of the invention are illustrated by way of example in the accompanying drawings, in which:

Fig. 1 shows a wind tunnel of a test stand in longitudinal section.

Fig. 2 is a top plan view of Fig. 1.

Fig. 3 is a section on line 3-3 of Fig. 1.

Fig. 4 is a cross section on line 4-4 of Fig. 2.

Figs. 5 and 6 show a form of masonry with asymmetrically arranged acoustic chambers of different cross-sectional sizes, the various layers or courses of bricks being seen from above, partly in plan view, partly in section.

Fig. 7 is an elevation of a wall built up of four courses including these various masonry layers. The form of masonry appearing in Fig. 5 at the top corresponds to the masonry layer having the reference 1 in Fig. 7, the form appearing in Fig. 6 at the top corresponds to the masonry layer having reference 2 of Fig. 7, the layer appearing in Fig. 5 at the bottom corresponding to the masonry layer having the reference 3 in Fig. 7, and the masonry layer shown in Fig. 6 at the bottom corresponding to the masonry layer having references 4 in said Fig. 7.

Figs. 8 and 9 illustrate two other modifications of test stand walls filled up only at the corners with brick-work, Fig. 8 having two courses and Fig. 9 three courses, each view being partly in plan view, partly in section to reveal the construction.

Fig. 10 is an elevation of the structure of Fig. 8, and if the front brick course is removed, said Fig. 10 will serve as an elevation of the structure of Fig. 9.

Finally, Fig. 11 is an elevation of the structure of Fig. 9.

Throughout the views, the references indicate the same or like parts.

In the practice of our invention, we construct an oscillatable stand 10 which is arranged approximately in the middle of the wind tunnel A for measuring the performance of an engine to be tested. The engine 11 with propeller 12 is freely suspended on the oscillatable plate 13 of the stand 10. The values measured on the oscillatable stand are transmitted through suitable conduits to the observation room B, which is connected with the wind tunnel by an en-

trance 14 and a window 15. The air forced through the wind tunnel by the propeller 12 enters through the chimney 16 into the building and is deflected by the guide plates 17 in the direction of the wind tunnel. At the opposite end of the air tunnel similar guide plates 17 are arranged which deflect upwardly the air passing out of the wind tunnel, whereupon the air is discharged into the atmosphere through a second chimney 18. Of course instead of pressure propellers also draught propellers may be used, the air can therefore enter the building also in the opposite direction through the chimney 18. In this case of course the air is discharged into the atmosphere through the other chimney 16.

The wind tunnel A has two pairs of swinging doors 33, 34 and 35, 36 capable of being swung in the direction of the arrow heads to close off the tunnel, but when the tunnel is in use the doors are swung to the sides as shown in Fig. 1.

The oscillating stand 10 may be fixed on a foundation grid 19 made of section iron, this grid may be anchored in a concrete block 20. The foundation grid and concrete block by their combined weight produce the counter movement for the propeller suction or pressure. Furthermore the foundation grid imparts sufficient longitudinal stability to the concrete block. The whole foundation of the oscillating stand may be elastically embedded in pressed peat plates 21. This pressed peat bed, owing to its working capacity and the great specific pressures, absorbs the mechanical vibrations emanating from the oscillating stand, so that these vibrations cannot be transmitted to the other portions of the building floor 22.

The sound waves, produced by the propeller when the engine is being braked and which are transmitted from their place of origin in all directions through the wind tunnel, are completely damped by a special type of masonry of the surrounding walls of the test stand. The type of masonry for the individual successive layers of masonry is illustrated in top plan view and in elevation in Figs. 5, 6 and 7. The damping is attained by forming sound chambers 23 (see bottom of Fig. 5) in the surrounding walls of the wind tunnel. This type of construction may of course be used not only for the double partition wall between two test stands but also for single surrounding walls.

These sound chambers are preferably of different cross-sectional areas and according to a preferred form of embodiment distributed absolutely unsymmetrically throughout the interior of the masonry. In other words, in said Fig. 5, for example, the acoustic chamber 23 is shown as formed by two lateral walls having the width of one brick. Within the chamber there lie four

bricks entirely free and laterally not anywhere in contact with the containing wall, as is clearly evident from the portion shown in section. In the masonry layer at the upper part of Fig. 5 the masonry is carried out without gaps at the point of said acoustic chamber, while more to the right (at the section) the beginning of an acoustic chamber is indicated. In Fig. 6 at the bottom, an acoustic chamber is shown as formed by means of longer and shorter bricks not reaching to the middle of the wall. In Fig. 6 at the top a layer without acoustic chambers is shown. In the individual superposed layers the upper layer is expediently made without gaps in lieu of the acoustic chamber of the lower layer and vice versa. For the masonry according to a further form of the invention honey-comb bricks 24 are used, that is bricks with holes, e. g. of an area of 15-20 mm.² These honey-comb bricks have for their object to cause by reduction of cross-sectional area a strong throttling of the sound waves before they pass into the sound chambers, whereas in the sound chambers themselves there is a sudden increase of the cross-sectional area with the result that the sound waves are destroyed in the interior of the masonry by continuous reflection. Thus, an excellent sound damping from the surroundings of the test stand building is attained.

A similar sound damping effect can also be attained by the type of masonry illustrated in Figs. 8 and 9. In this masonry the honey-comb bricks 24 are laid in such a manner that the holes of the neighbouring bricks extend at right angles to each other, and furthermore the crevices between the inner bricks of the wall are filled with a suitable binding material, such as mortar, lime, preferably cement mortar only at the corners of the bricks, so that the greater part of the crevices between the inner bricks remains unfilled so as to produce for the pressure fluctuations of the air a passage out of the holes in one brick into the holes in the neighbouring bricks extending at right angles to the holes in the first brick. Thus, the sound waves, in being transmitted, have to travel along an exceptionally long path, during which a continual change of direction takes place, so that the sound is considerably damped by repeated reflection before reaching the open. It is to be noted that in each case, whether the holes in the bricks run transversely of the bricks or longitudinally therein, these holes extend fully through said bricks, or from a given surface through to the respectively opposite surface on the other side or end, as the case may be.

As already mentioned, the groups of holes in adjacent bricks may run perpendicularly to each other, so that it is possible to have the groups of holes therein running in a vertical and horizontal direction without leading into the sound chambers 23, but in a general sense in a direction parallel with said chamber. Such a construction is particularly shown in Fig. 6 at the bottom. In order to enable the sound waves to reach the chambers 23 in spite of this arrangement, care is taken for example that the groups of holes in the adjacent brick courses are disposed in a perpendicular direction with respect to the preceding groups of holes and lead into the sound chambers.

The sound damping towards the roof 25 of the wind tunnel is attained by a grid of lattice work arranged in the roof. The laths 26 of preferably approximately 50 x 40 mms. in cross

section and extending transversely to the wind tunnel, are arranged in such a manner, that, from the middle of the wind tunnel towards the inlet and outlet chimneys 16 and 18, the spacing between the individual laths gradually reduces from about 50 to 10 mms. air gap. The air in the space 27 above the lath grid is relatively very tranquil *a—s* compared with the air in the wind tunnel when the stand is in use, which, as in the case of the sound damping by the masonry, is due to the continual reduction in cross sectional area of the passages and the repeated reflection of the sound waves.

In order when two test stands are arranged directly side by side, to insulate as far as possible one test stand from the other against transmission of sound waves and to prevent one stand from influencing the other, the wall separating the two stands is subdivided into two separate walls 29, 30 by an air gap 28 e. g. about 25 cms. wide and open at the top, each wall having its own sound chambers in the manner described above. Thus, the air from one wind tunnel is prevented by the porous honey-combed structure of the walls from being sucked into the walls of the neighbouring stand and from thereby influencing the measurements of the neighbouring stand.

Having now particularly described and ascertained the nature of our said invention and in what manner the same is to be performed, we declare that what we claim is:

1. A testing stand for internal combustion engines comprising surrounding walls built of honeycomb bricks having groups of holes running through the same and being disposed in multiple courses with spaces between mutually facing adjacent portions of the bricks with which groups of said holes in said bricks communicate, while said groups of holes in turn communicate with the interior of said stand.

2. A testing stand for internal combustion engines comprising surrounding walls built of honeycomb bricks of different lengths having groups of holes running through the same and being disposed in multiple courses with spaces between mutually facing adjacent portions of the bricks with which groups of said holes in said bricks communicate, while said groups of holes in turn communicate with the interior of said stand.

3. A testing stand for internal combustion engines comprising surrounding walls built of honeycomb bricks having groups of holes running through the same and being disposed in multiple courses with spaces between mutually facing adjacent portions of the bricks with which groups of said holes in said bricks communicate, while said groups of holes in turn communicate with the interior of said stand, said spaces between the bricks being asymmetrically distributed over the entire interior of the wall of said stand.

4. A double testing stand for internal combustion engines including two closely adjacent cooperating stands separated by means of a partition consisting of two upright parallel brick walls spaced apart so as to have an air gap between them, each of said cooperating stands comprising surrounding walls built of honeycomb bricks having groups of holes running through the same and being disposed in multiple courses with spaces between mutually facing adjacent portions of the bricks with which groups of said holes in said bricks communicate, while

said groups of holes in turn communicate with the interior of said stand.

5. A testing stand for internal combustion engines comprising surrounding walls built of honeycomb bricks having groups of holes running through the same and being spaced apart to form sound damping chambers between mutually facing adjacent portions of the bricks with which groups of said holes in said bricks communicate, while said groups of holes in turn communicate with the interior of said stand.

6. A testing stand for internal combustion engines comprising surrounding walls built of honeycomb bricks having groups of holes running through the same and being spaced apart to form sound damping chambers of different cross sectional areas between mutually facing adjacent portions of the bricks with which groups of said holes in said bricks communicate, while said groups of holes in turn communicate with the interior of said stand.

7. A testing stand for internal combustion engines comprising surrounding walls built of honeycomb bricks having groups of holes running through the same and being spaced apart to form sound damping chambers of different cross sectional areas between mutually facing adjacent portions of the bricks with which groups of said holes in said bricks communicate, while said groups of holes in turn communicate with the interior of said stand, said sound damping chambers being distributed asymmetrically throughout the entire extent of said surrounding walls.

8. A double testing stand for internal combustion engines including two closely adjacent cooperating stands separated by means of a partition consisting of two upright parallel brick walls spaced apart so as to have an air gap between them, each of said cooperating comprising surrounding walls built of honeycomb bricks having groups of holes running through the same and being spaced apart to form sound damping chambers of different cross sectional areas between mutually facing adjacent portions of the brick with which groups of said holes in said bricks communicate, while said groups of holes in turn communicate with the interior of said stand, said sound damping chambers in each stand being distributed asymmetrically throughout the entire extent of the surrounding walls thereof.

9. A testing stand according to claim 1, having the holes or channels in each brick disposed at right angles to those of the adjacent bricks, with the joints between the inner bricks of the wall filled only at the corners thereof with cement mortar so that the partly filled joints and the relatively displaced holes in said bricks form tortuous passages for the sound waves with continual change of direction for the latter from the holes of one brick into the holes of the next adjacent brick.

10. A testing stand according to claim 1, having a ceiling over the stand and a grid of wooden laths extending transversely to said stand and disposed at a distance above said ceiling with the distance between the individual laths gradually decreasing from the middle toward the ends of the stand.

11. A testing stand according to claim 1, having the sound damping chambers of different cross sectional areas, and having a ceiling over the stand and a grid of wooden laths extending

transversely to said stand and disposed at a distance above said ceiling with the distance between the individual laths gradually decreasing from the middle toward the ends of the stand.

12. A testing stand according to claim 1, having the sound damping chambers of different cross sectional areas and distributed absolutely asymmetrically over the surfaces of the walls, said stand also having a ceiling over the stand and a grid of wooden laths extending transversely to said stand and disposed at a distance above said ceiling with the distance between the individual laths gradually decreasing from the middle toward the ends of the stand.

13. A testing stand according to claim 1, having the sound damping chambers of different cross sectional areas and distributed absolutely asymmetrically over the surfaces of the walls, a partition wall separating the stand from a similar adjacent stand, with the partition wall divided into two distinct walls separated by an air gap open at the top, said stand also having a ceiling over the stand and a grid of wooden laths extending transversely to said stand and disposed at a distance above said ceiling with the distance between the individual laths gradually decreasing from the middle toward the ends of the stand.

14. A testing stand according to claim 1, having the bricks laid in such relative positions that the holes of the mutually adjacent bricks extend at right angles to each other, with the joints between the abutting ends of the bricks at the surface of the wall filled with cement mortar.

15. A testing stand according to claim 1, having the bricks laid at right angles to each other so that the holes of the mutually adjacent bricks extend at right angles to each other, with the joints between the abutting ends of the bricks at the surface of the wall completely filled with cement mortar and other sides of the bricks filled with cement mortar only at the corners thereof.

16. A testing stand according to claim 1, having the sound damping chambers of different cross sectional areas produced between the bricks distributed absolutely asymmetrically over the surfaces of the walls said stand also having a ceiling over the stand and a grid of wooden laths extending transversely to said stand and disposed at a distance above said ceiling with the distance between the individual laths gradually decreasing from the middle toward the ends of the stand.

17. A testing stand according to claim 1, having the holes or channels in each brick disposed at right angles to those of the adjacent bricks, with the joints between the abutting ends of the bricks completely filled with cement mortar and the joints between the inner bricks of the wall filled only at the corners thereof with cement mortar, so that the partly filled joints and the relatively displaced holes in said bricks form tortuous passages for the sound waves with continual change of direction for the latter from the holes of one brick into the holes of the next adjacent brick.

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