(No Model.)

J. P. SMITH.

SUPPORTING SONOROUS DISKS.

No. 451,740. Patented May 5, 1891.

Fig. 1.

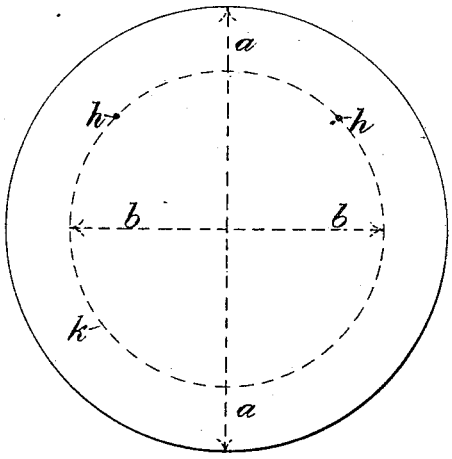


Fig. 3.

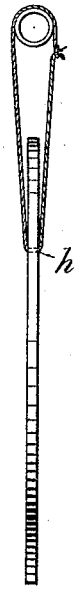


Fig. 2.

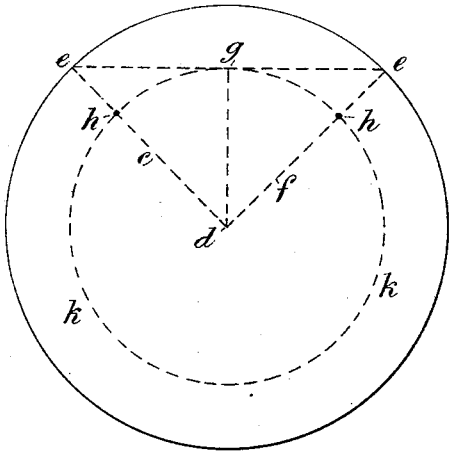
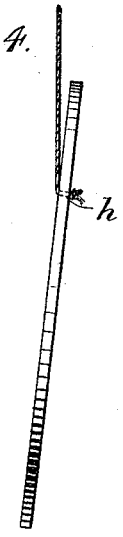


Fig. 4.



Witnesses;-
George Shaw
Richard Skerrett

Inventor;-
Joseph Priestley Smith

UNITED STATES PATENT OFFICE.

JOSEPH PRIESTLEY SMITH, OF BIRMINGHAM, ENGLAND.

SUPPORTING SONOROUS DISKS.

SPECIFICATION forming part of Letters Patent No. 451,740, dated May 5, 1891.

Application filed May 25, 1889. Serial No. 312,133. (No model.) Patented in England March 8, 1887, No. 3,552.

To all whom it may concern:

Be it known that I, JOSEPH PRIESTLEY SMITH, surgeon, of Birmingham, in the county of Warwick, England, a subject of the Queen of Great Britain, have invented certain new and useful Improvements in Suspending or Supporting Sonorous Metallic and Non-Metallic Disks or Plates, (for which I have received Letters Patent in Great Britain, No. 3,552, dated March 8, 1887,) of which the following is a specification.

My invention has for its object so to suspend or support sonorous metallic and non-metallic disks or plates that they will when struck at or near their centers give out a pure long-sustained musical sound; and my said invention consists in suspending or supporting the said disks or plates at the points and by the means hereinafter described.

My invention is applicable to the suspending or supporting of the said disks or plates for various purposes, such, for example, as substitutes for gongs and bells as well as for percussive musical instruments.

I will describe my invention in connection with a circular flat disk of brass or bell metal. In suspending the said disk according to my invention, I make two or more holes in the principal nodal circle of the disk and by means of cords or wires attached to the disk by the holes I suspend the disk in the air. When the disk so suspended is struck at or near its center, it gives out a pure musical sound of greater intensity and persistency than the same plate will yield if differently suspended and struck with the same force.

The disk may be suspended either in a vertical or horizontal position. In order to find the diameter of the nodal circle of the disk and the distance from the center at which the disk is to be suspended or supported, the length of the radius of the disk is multiplied by the decimal fraction .707. The product is the length of the radius of the nodal circle.

I will now describe with reference to the accompanying drawings the manner in which my invention is to be performed.

Figure 1 represents in elevation a sonorous disk or plate having holes *h h* made in the nodal circle *k* (indicated in dotted lines) for suspending or supporting the said disk or plate according to my invention. Fig. 2 represents in elevation a similar disk or plate and illustrates one of the ways of finding the nodal circle *k*, in which circle the holes *h h* are made. Fig. 3 shows the two-holed disk in edge view and illustrates one method of suspending it, and Fig. 4 represents in edge view the two-holed disk suspended in another way. The said Figs. 3 and 4 show one only of the two cords used in suspending each disk.

In order to find the nodal circle let the vertical line *a*, Fig. 1, be the diameter of the disk and the horizontal line *b* the diameter of the nodal circle, then the ratio of the line *b* will be to the line *a* as 7.07 is to ten or as .707 is to unity.

In Fig. 2 another way of finding the nodal circle is illustrated. Let *c* be a radius struck from the center *d* of the disk to its periphery *e*, and let *f* be another radius struck from the center *d* of the disk to its periphery *e* at right angles to the radius *c*. Join *e e* by the chord *g* and bisect the chord *g*. The line joining the point of bisection of the chord *g* and the center *d* is the radius of the nodal circle *k*, in which the suspending-holes *h h* must be made. The area of that portion of the disk inclosed by the nodal circle is equal to one-half the area of the whole disk.

The sonorous disks or plates to be suspended according to my invention may either be metallic or non-metallic. When metallic disks are employed, bell-metal is used, preferably, and when non-metallic disks are employed glass is used, preferably.

Although I have only described my invention in connection with a flat disk of brass or gun-metal—that is, a disk having parallel sides—yet my invention is applicable to the suspending or supporting of sonorous disks or plates which are not flat, and disks or plates the sides of which are not parallel—such, for example, as disks or plates having circular corrugations concentric with the center or having one flat side and the other corrugated or diminishing in thickness from the center to the margin, or the reverse. Other things being equal, the musical note produced varies in a definite relation to the diameter and thickness of the disk, namely: With a given thickness a number of vibrations per second varies inversely as the area of the

disk—that is, as the square of its diameter. Thus if we have two disks of the same thickness, the one ten inches diameter the other five inches diameter, then the area of the smaller is one-fourth the area of the larger, and its vibrations are four times as rapid. The note given by the smaller is therefore two octaves higher than the note given by the larger. With a given diameter the number of vibrations per second varies directly as the thickness of the disk. Thus if we have two disks equal in diameter, the one twice as thick as the other, the vibrations of the thicker are twice as rapid as those of the thinner. The note of the thicker one is one octave higher than that of the thinner. By means of these rules if we know the note of any given disk we can calculate the dimensions necessary for a disk which shall give any other note.

To sharpen the note of a disk I place it in the lathe and reduce its diameter more or less by taking a little off the edge. It may also be sharpened by taking a little off the surface near the edge.

To flatten the note of a disk I take a little off the surface near to the center of the disk. It is best, however, to tune the disk by sharping rather than by flatting the notes, for in the case of bell-metal the resonance is impaired when the surface of the metal is removed.

Although no particular ratio between the diameter and thickness of the disk suspended according to my invention is necessary, yet I prefer to employ disks the thickness of which is to the diameter about as one to fifty.

The disks may be suspended by means of cords passed through the holes *h h* and carried upward in a divergent manner, as represented in Fig. 3, or the cords may be simply knotted on one side of the disk, as represented in Fig. 4. In the latter case the plate or disk will hang in a slightly-oblique position, so that its upper edge is not in contact with the cord; or, instead of passing the cord through the holes *h* in the disk, small hooks or eyes or headed pins may be screwed or otherwise fixed in the said holes, and the disk suspended by passing the cord under the hooks or headed pins or through the said eyes; but I prefer to suspend the disk by the methods represented in the drawings.

There may be more than two points of suspension, and in this case the disks may be suspended in a horizontal position, but the vertical position is preferable.

The disks are sounded by striking them at or near the center with a hammer or mallet the surface of which is padded with leather, india-rubber, or other soft material. The disks may be employed singly or any number of disks may be arranged together, and they may be conveniently struck by hand in the manner before described or by mechanism, such as is employed in percussive musical instruments.

Although I prefer to employ cords for the suspension of the sonorous disks made of vegetable or animal fiber—such as hemp or silk—yet cords of other organic materials may be employed—such, for example, as gutta-percha and india-rubber—or metallic wires may be employed for suspending the disks.

Having now particularly described and ascertained the nature of my invention and the manner in which the same is to be performed, I declare that I claim as my invention—

A sonorous disk or plate having a series of perforations *h h* in its nodal circle *k* and freely suspended by flexible cords engaging such perforations, substantially as described.

JOSEPH PRIESTLEY SMITH. [L. S.]

Witnesses:
GEORGE SHAW,
RICHARD SKERRETT.