

(No Model.)

E. S. RITCHIE.

SONOMETER.

No. 322,010.

Patented July 14, 1885.

Fig. 1.

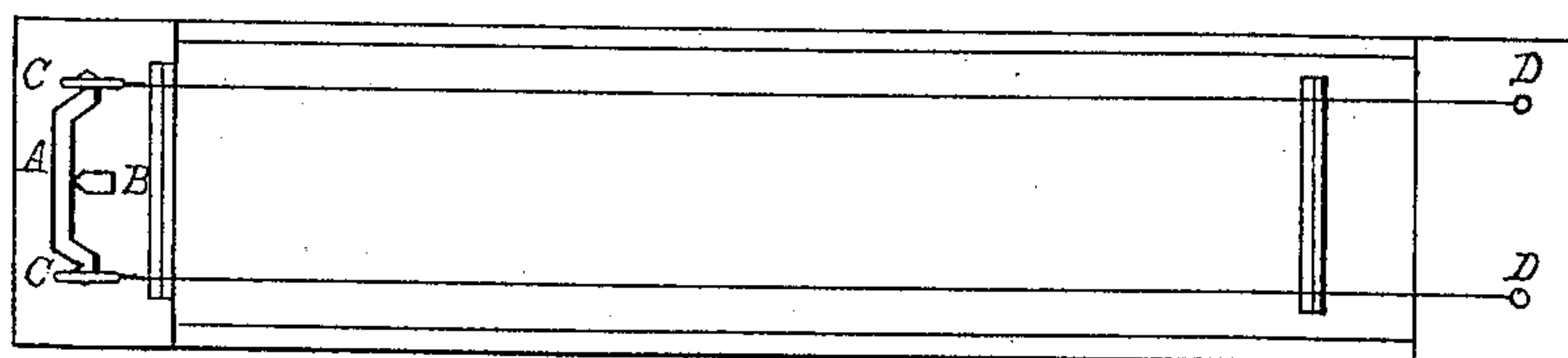


Fig. 2.

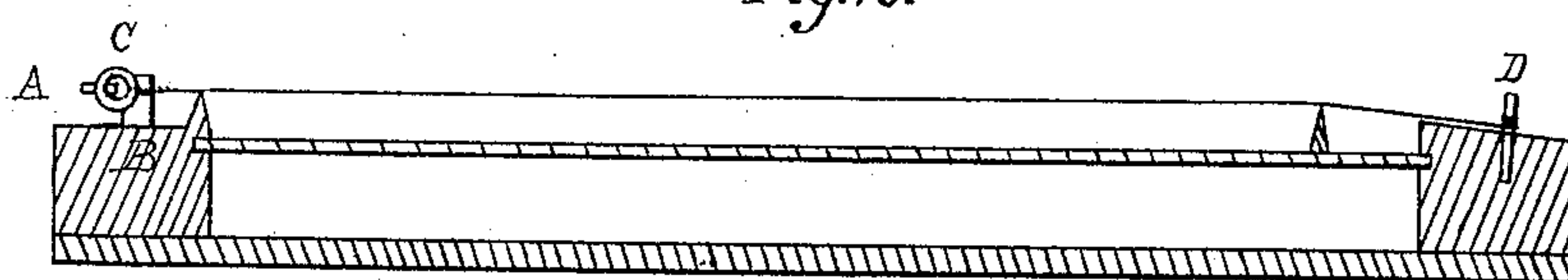


Fig. 3.

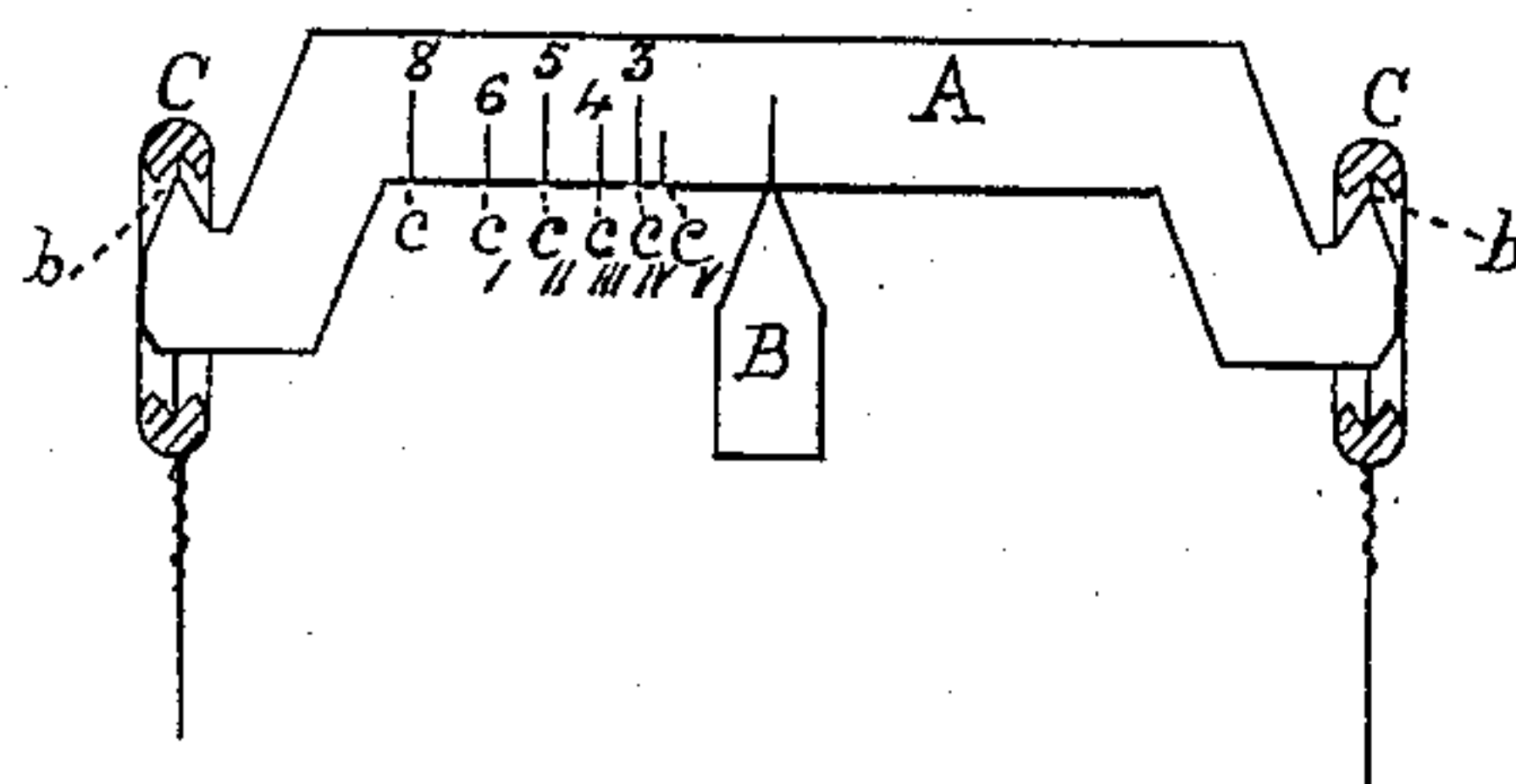
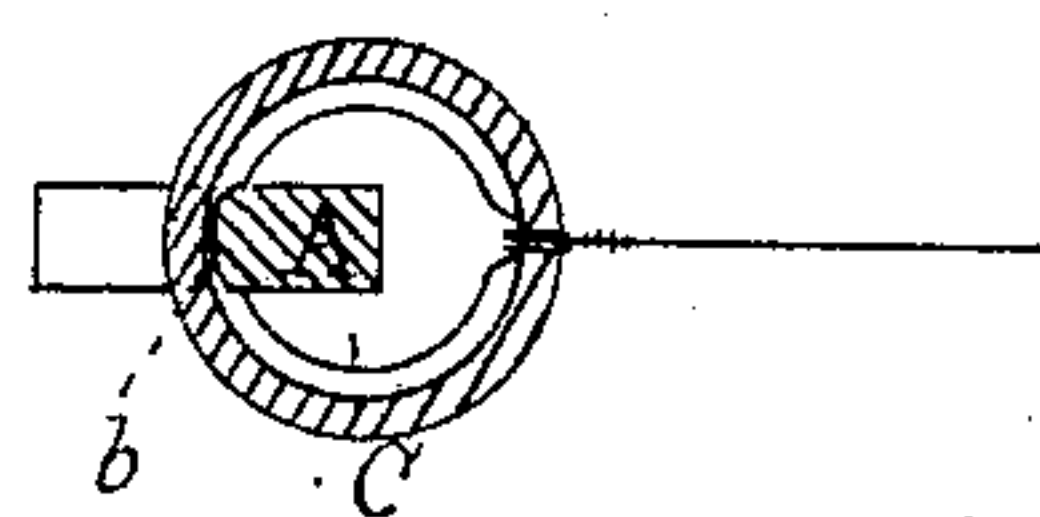


Fig. 4.



Witnesses

John Ritchie.
J. B. Springman

Inventor.

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UNITED STATES PATENT OFFICE.

EDWARD SAMUEL RITCHIE, OF BOSTON, MASSACHUSETTS.

SONOMETER.

SPECIFICATION forming part of Letters Patent No. 322,010, dated July 14, 1885.

Application filed March 14, 1884. (No model.)

To all whom it may concern:

Be it known that I, EDWARD SAMUEL RITCHIE, of Boston, (Brookline,) in the county of Norfolk, of the Commonwealth of Massachusetts, have invented a new and useful Improvement in Sonometers; and I do hereby declare the same to be described in the following specification and represented in the accompanying drawings, of which—

Figure 1 is a top view, and Fig. 2 is a transverse section, of a sonometer provided with my invention. Fig. 3 is a top view of the lever and section of the rings and the fulcrum; and Fig. 4 is a section of a ring with an attached string and section of the lever, such as I use in carrying out my invention.

The object of the improvement is to provide for the relative tension upon two strings, so that the tones produced by their vibrations shall be in unison or in accord to produce the musical chords, whether the pitch is high or low. To this end I combine a lever or bar with knife-edges on its ends, against which press grooved rings attached to the strings. On an edge of the lever, which should be in a line with the knife-edges, are V's or grooves, each of which is so situated that the length of the arms of the lever is proportionate to the relative tension on the strings to produce the chord. Thus for unison the tension on two similar strings must be equal and the groove midway between the knife-edges. To produce the chord of the fifth, which requires the strings to vibrate in rapidity, as three to two, the tension must be as the squares of these numbers, as nine to four, and its groove cut so that the length of the arms is in this proportion. Usually I have grooves cut for the chords of unison, the minor and major thirds, the fourth, fifth, sixth, and octave. This lever, made of steel or other metal, is shown in the figures at A; the fulcrum, which is fixed upon the head-block of the sonometer, at B; the knife-edges, at b; its grooves for the fulcrum, at $c_1 c_2 c_3 c_4 c_5$. The grooved ring (shown in longitudinal section in Fig. 3 and in transverse section Fig. 4) has the vibrating string attached and bears against the knife-edge of the lever.

The tension on the strings can be given in the usual manner by twist-pins.

The strings used are best two piano-forte

wires of the same size, to each of which the grooved rings are attached at one end. The opposite end is attached to a twisting-key driven into the head-block and tightened precisely as a wire in a piano-forte. The knife-edges on the lever and the grooved rings are the same as are frequently used for a balance for accurate weighing, and the lever is virtually a balance-beam resting on or against a knife-edge fixed on the head-block, and differs only in having several V's on the inner or what would be the under side of the balance-beam.

In use the V in the middle point being placed against the fixed knife-edge, and tension given by turning the keys, the tension on the wires must necessarily be exactly equal, and their vibrations equal, and necessarily sound in unison. If one of the keys is then turned, the tension would be increased, and by the action of the lever or balance-beam the other wire must have its tension increased by precisely the same amount, their vibrations would again be equal, and the pitch would be higher, but would be in unison. A wire can be tuned to any desired pitch as a piano-forte wire, but the other wire will necessarily give the same tone, and they must be in unison. When the lever is placed with its V on the line marked 5, the distances from it to the knife-edges on the outer ends of the lever being exactly as sixteen to nine, the relative tension of the two wires must always be in this proportion. The number of vibrations per second of time must be as four to three, and they will sound the chord that is known as the "fourth," because it is a law in acoustics that "the number of vibrations per second is directly as the square root of the tension." If the V marked 8 on the lever is placed against the fulcrum knife-edge, which is cut so that the relative lengths of the two arms of the lever are as four to one, the tension must necessarily be in this proportion, and under the same law the vibrations must be as two to one, which must produce the chord of the octave. By tightening the wires or "strings," (as it is customary in works on acoustics to term them,) the pitch will be raised, but the octave will always be given. The other V's are cut to give the relative tension required for the

chord of the third vibrations as five to four; relative lengths of arms, twenty-five to sixteen. For the sixth, vibrations as five to three; lengths, twenty-five to nine.

5 By using two wires the diameters of which are as two to one, their cross-section and consequent density or weight per foot being as four to one, and placing the V on the line marked 8, the larger wire being on the shorter
10 arm of the lever, the number of vibrations will be equal, and they must sound in unison, proving the law that "the number of vibrations per second of a string is inversely as the square-root of its density."

15 It is evident that other forms of bearings upon the knife-edges can be used, and that separate knife-edges can be fixed upon the lever to bear against the fulcrum to produce the same effect. I prefer the forms as described.

20 I claim—

1. In a sonometer, a lever for sustaining the tension of the strings, provided with grooves for a fulcrum at intervals such that the different grooves produce such proportionate tension on the two strings that they shall in vibration 25 sound in chords according to the groove in which the fulcrum is placed, substantially as described.

2. The combination, in a sonometer, of a lever for sustaining the tension of the strings, 30 provided with grooves for the fulcrum at such specified intervals as will produce the different musical chords, and grooved rings attached to the strings and resting against the knife-edges of said levers substantially as described.

EDWARD SAMUEL RITCHIE.

Witnesses:

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S. B. KINGMAN.