4 Sheets—Sheet 1.

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MUSICAL INSTRUMENTS.

No. 181,490. Patented Aug. 22, 1876.

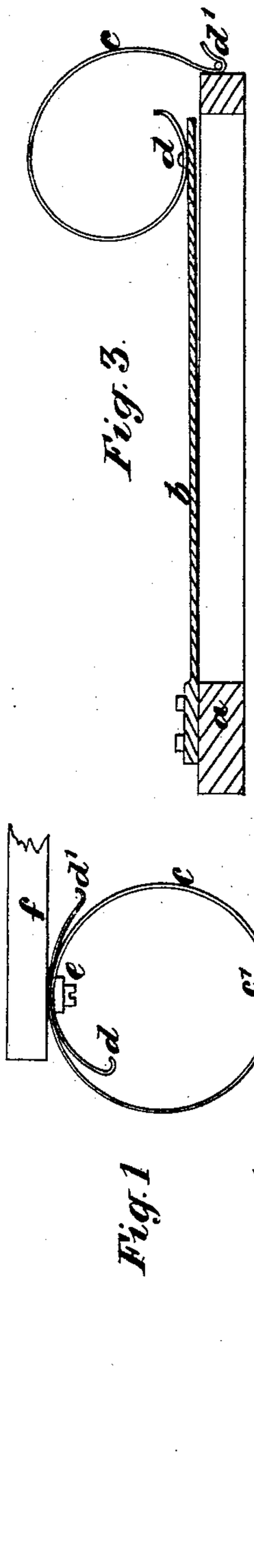

Fig. 3.

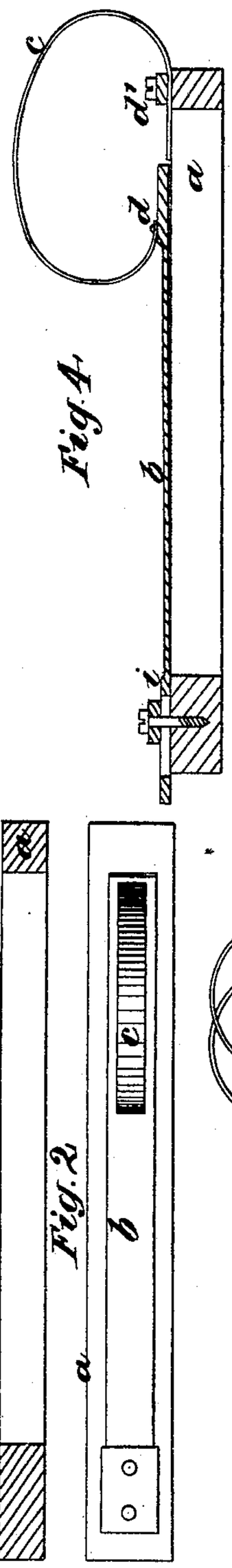

Fig. 4.

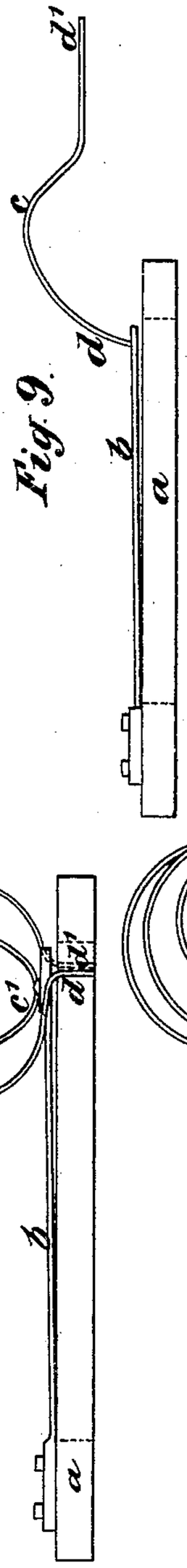

Fig. 9.

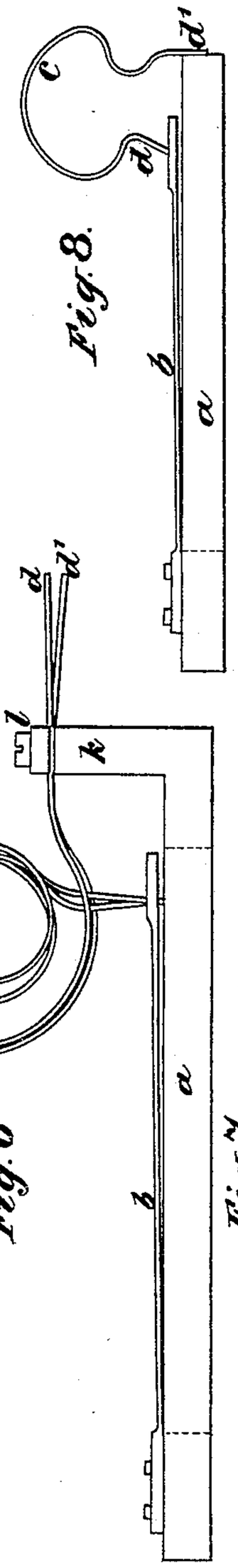

Fig. 8.

Fig. 1

Fig. 2

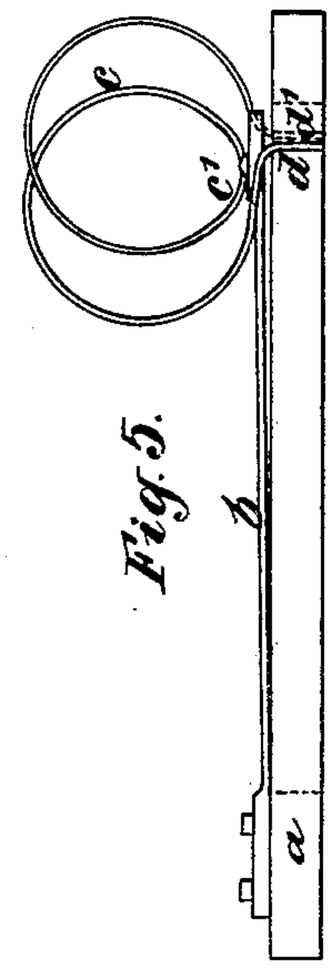

Fig. 5.

Fig. 6

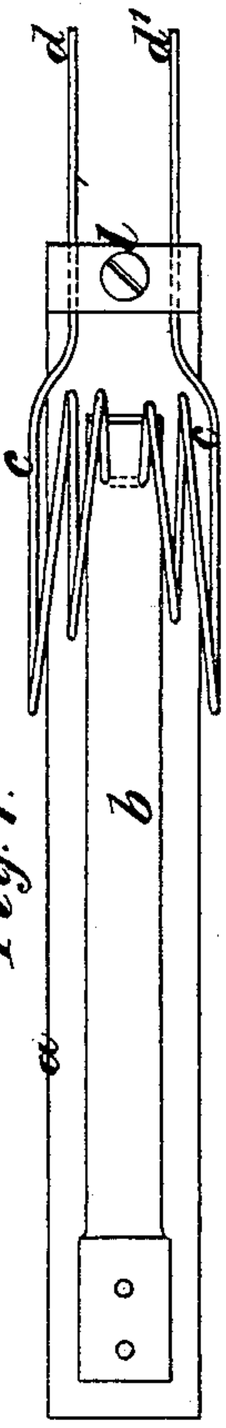

Fig. 7.

Witnesses
Harry Howson Jr
Harry Smith

Hermann Smith
and
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MUSICAL INSTRUMENTS.

No. 181,490. Patented Aug. 22, 1876.

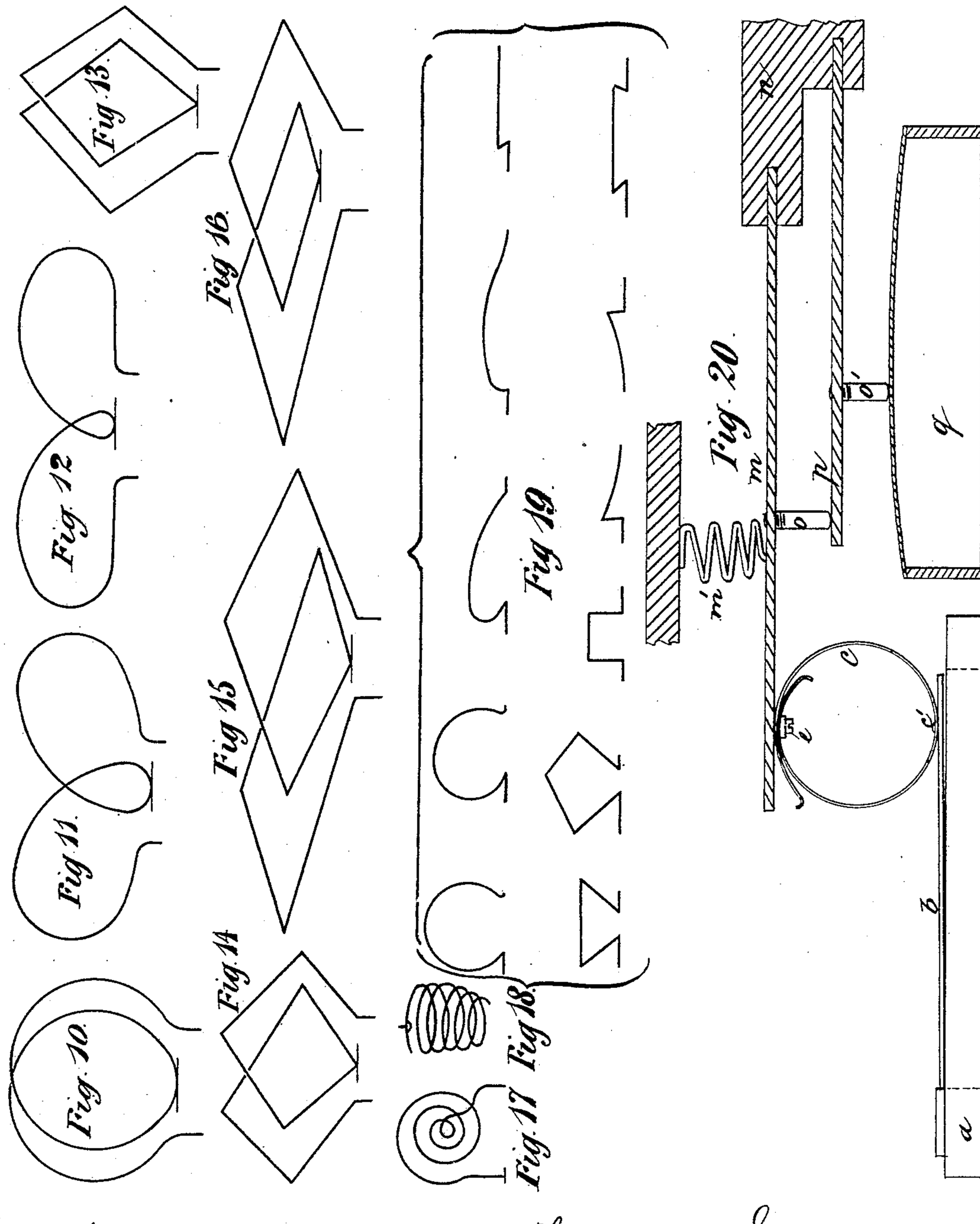

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Fig. 21.

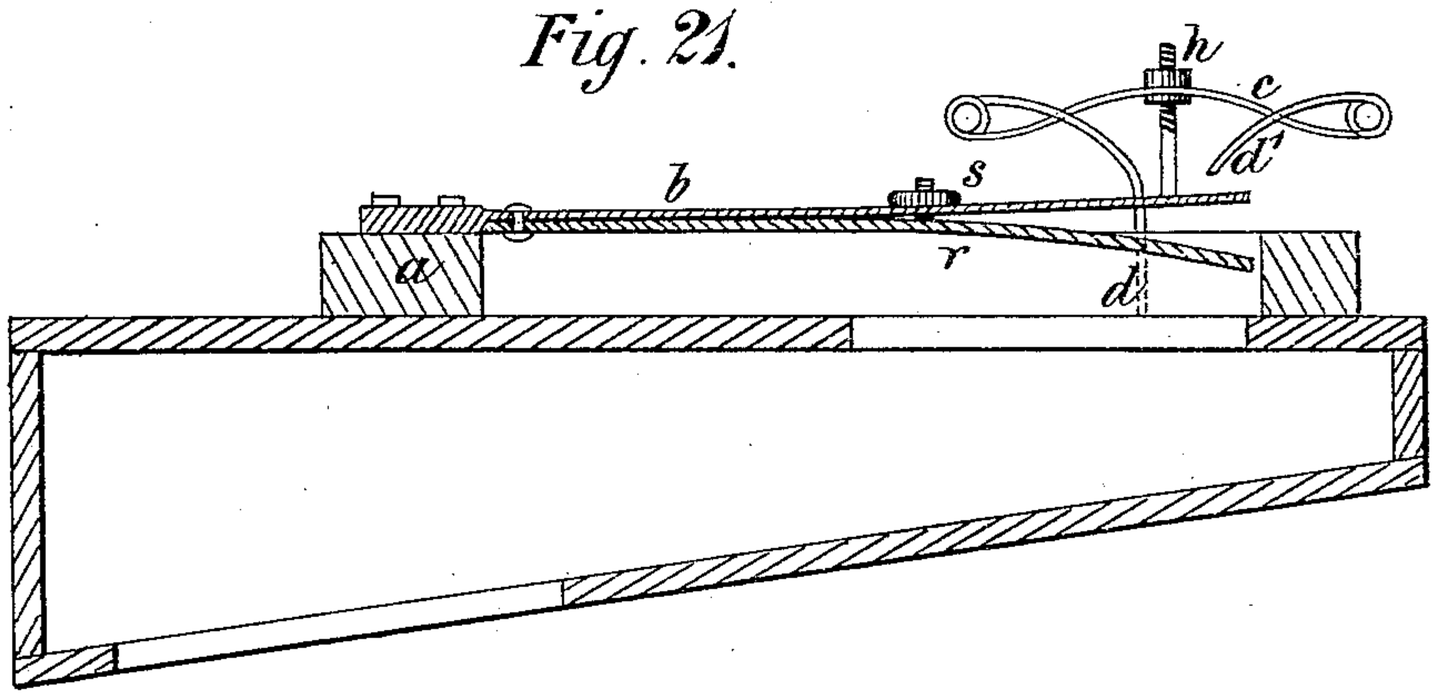


Fig. 22.

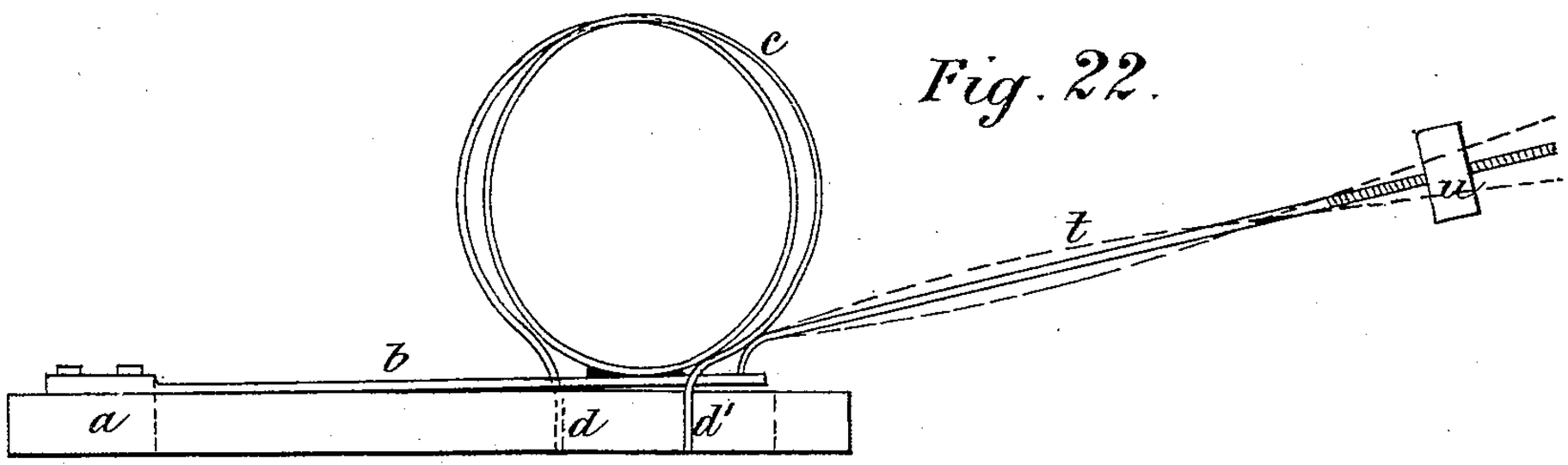


Fig. 23.

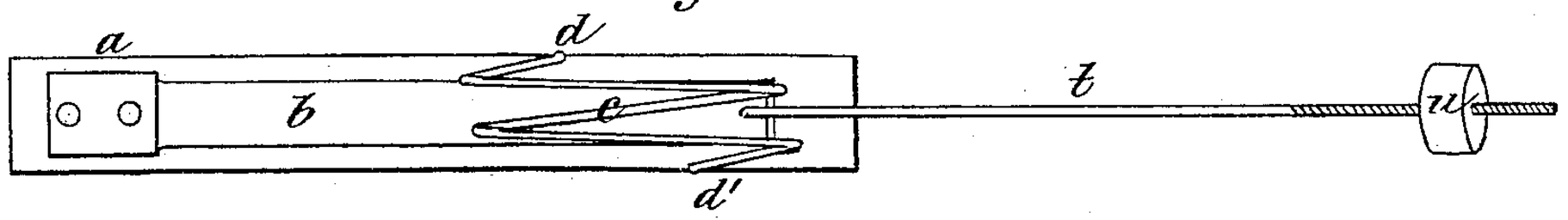
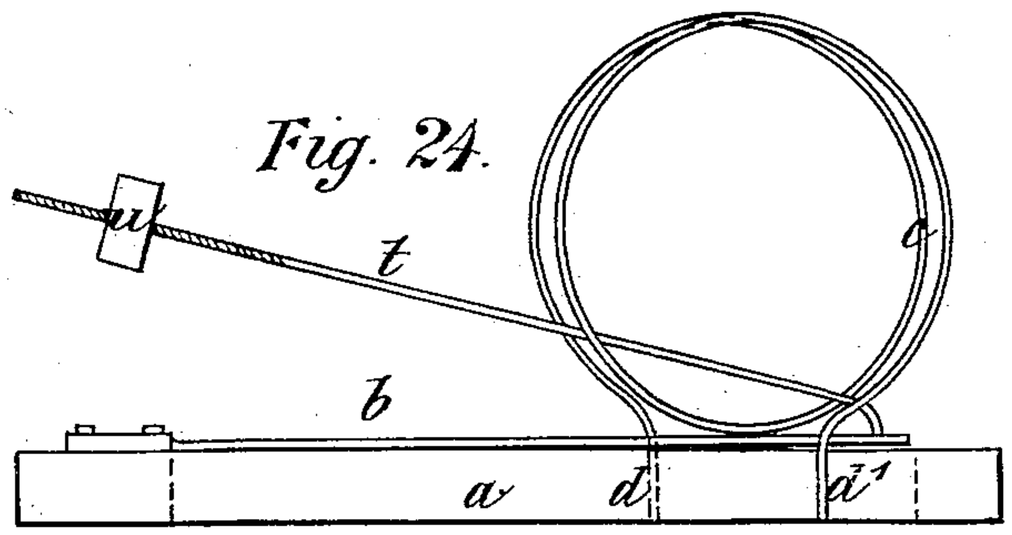


Fig. 24.



Witnesses,
Harry Howson Jr
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4 Sheets—Sheet 4.

H. SMITH & J. B. HAMILTON.

MUSICAL INSTRUMENTS.

No. 181,490. Patented Aug. 22, 1876.

Fig. 25

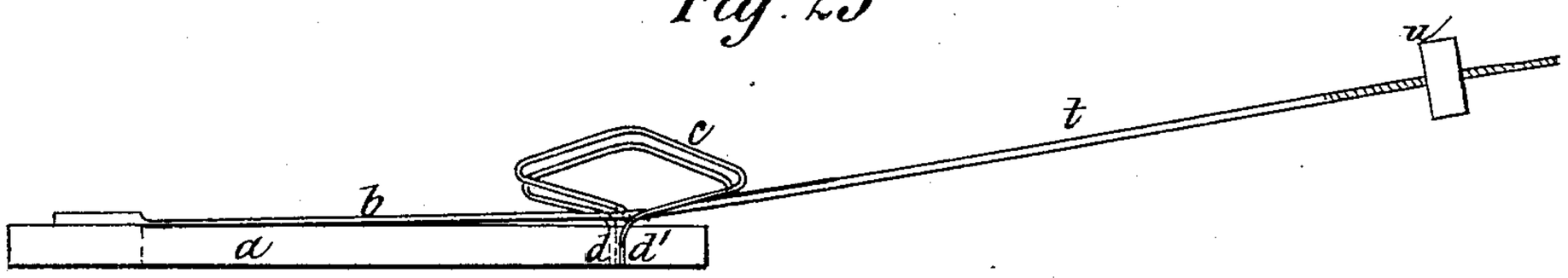


Fig. 26.

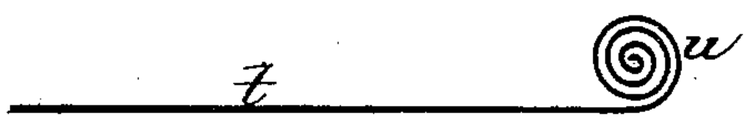


Fig. 27

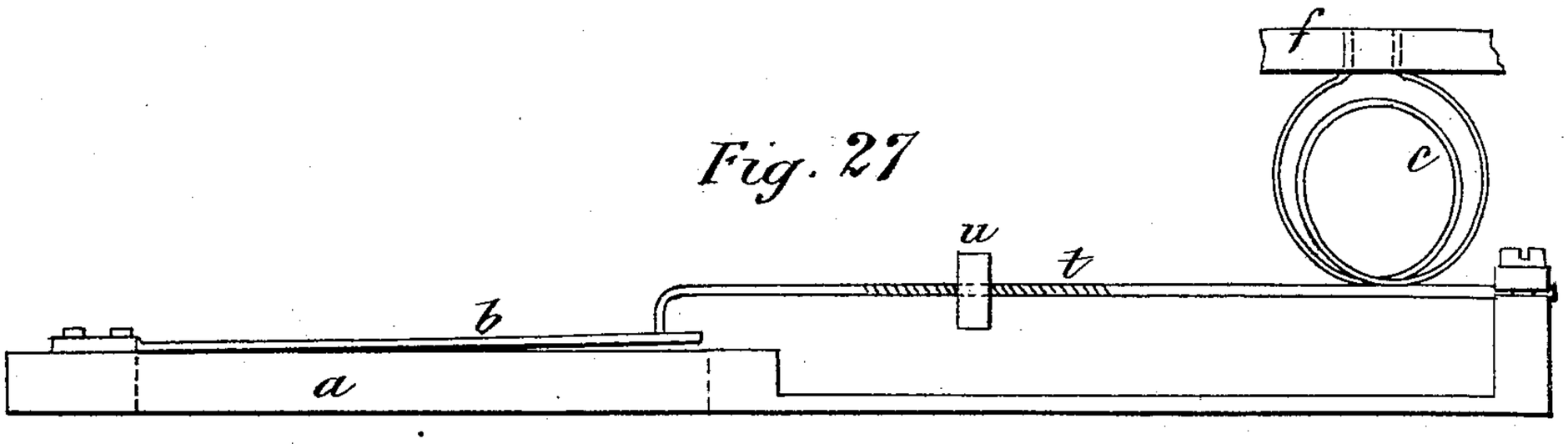
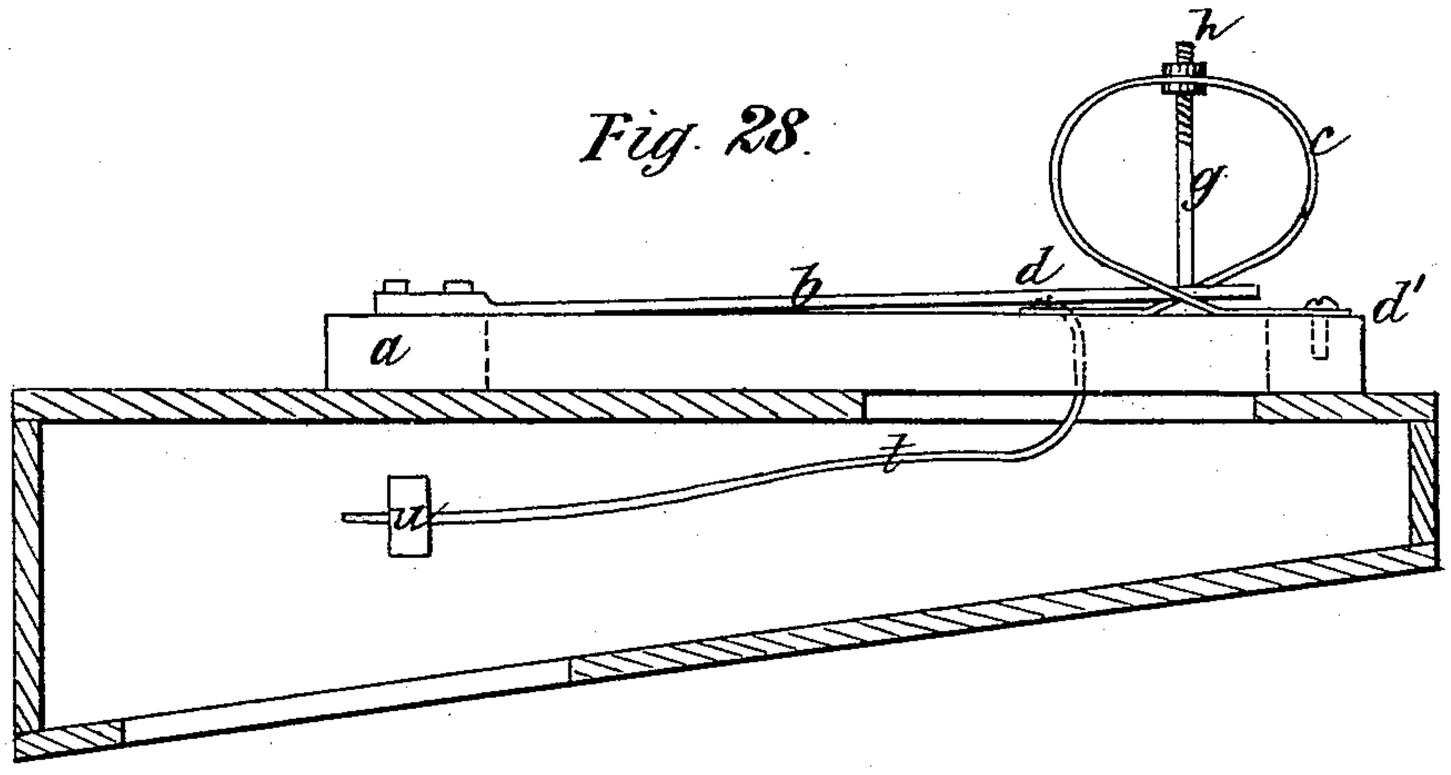


Fig. 28.



Witnesses
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UNITED STATES PATENT OFFICE.

HERMANN SMITH, OF BRIXTON, AND JAMES B. HAMILTON, OF GREENWICH, ENGLAND.

IMPROVEMENT IN MUSICAL INSTRUMENTS.

Specification forming part of Letters Patent No. **181,490**, dated August 22, 1876; application filed June 22, 1876.

To all whom it may concern:

Be it known that we, HERMANN SMITH, of Brixton, in the county of Surry, artist, and JAMES BAILLIE HAMILTON, of Greenwich, in the county of Kent, esquire, both in the Kingdom of England, have invented Improvements in Musical Instruments, of which the following is a specification:

Our invention relates to the reeds and other vibrating portions of musical instruments; and consists in exercising a constraint upon the reed or other vibrating portion, for the purpose of obtaining differences of pitch and variations of qualities, and also in controlling the same by the employment of certain means or devices, as hereinafter described.

The invention is applicable, in one or other of its modifications, to the reeds known as "free reeds," and used in harmoniums, organs, accordeons, concertinas, and instruments of similar kind, also to beating-reeds used in organs, and the vibrating strings, plates, and bars; and in order that our said invention may be fully understood, we shall now proceed more particularly to describe the same, and for that purpose shall refer to the several figures on the annexed sheet of drawings, the same letters of reference indicating corresponding parts in all the figures.

For the purpose of constraint, we attach to a reed one or more flexible and extensible rings or loops of watch-spring or wire or other suitable elastic material, or spring-links or spring-levers, in various forms and combinations. The attachment to the reed may be at any place selected, and will have effect according to that position. It may be affixed by riveting, soldering, clipping, or other modes.

Figure 1 represents a longitudinal section of a reed, with a ring of watch-spring applied thereto; and Fig. 2 is a corresponding plan of the same.

a is the reed-frame, and *b* is the reed-tongue, the two together being technically known as the reed. *c* is the flexible and extensible ring, which, in the arrangement shown, is connected to the tongue *b* by a flat clip or staple, *c'*, while its free ends *d d'* are brought together, and held by a clip, *e*, having a suitable support, *f*, above the reed; or one of the free ends, say that at *d*, may be attached to the tongue *b*, while the opposite end *d'* is attached to the frame *a*, as shown in the longitudinal section, Fig. 3; or both the ends *d d'* may be attached to the frame *a*, as shown in the sectional elevation, Fig. 28, in which case the tongue *b* is connected to the ring *c* by means of a screw-pin, *g*, adjustable at the upper portion by nuts *h*.

The ring *e* may be slotted at its ends, if desired, in order to admit of its extension and contraction, and the pin *g*, in lieu of being screw-threaded for the reception of nuts *h*, may be bent so as to form a clip, and thereby hold the ring *c*.

If the reed-tongue is loose, and capable of sliding within its frame, as in the modification, Fig. 4, in which the tongue is slotted at *i*, the watch-spring *c* can be so arranged that the end *d'* shall fill the space in the frame from which the tongue, to a certain distance, has been withdrawn. The shortened spring thus exercises a greater constraint on the motion of the tongue, and the tongue itself is shortened. Consequently, by this combination of effects, great changes of pitch can be produced, and also variations of quality.

It will thus be seen that the watch-spring is capable of being contracted or expanded, and is not restricted to a circular form. It may be an ellipse or loop, or formed of more than one piece, or used as a spring-bar; or several bars or springs may be used together, as in carriage-springs; or one portion being affixed to the tongue, the end or ends may be attached to any suitable independent support when various modifications in the strength of the constraint are desired, or in the curving of the reed to affect the voicing.

When spring-wires are substituted for the watch-springs hereinbefore described, the same principle admits of a great variety of modifications, each kind having its special influence in determining quality and pitch.

The wires may also be either fixed or extensible. When fixed wires are employed, as shown in the elevation, Fig. 5, the wire *c* may be bent into two or more coils, one portion of

the same being attached to the tongue *b* at *c'*, while the ends *d d'* are soldered or otherwise secured to the frame *a*.

When extensible forms are employed, the modification shown in elevation and plan in Figs. 6 and 7, respectively, is a convenient method. In this arrangement a piece of wire of suitable length and section is taken and bent double, and two holes having been drilled in the face of the reed, the free ends of the wire are drawn through, and the bend brought tightly up to the under surface of the tongue. Each half length of the wire is then twisted or curved to any required form, and the free ends *d d'* are secured in grooves formed in supports *k*, which may be either formed on the reeds-frame *a*, as in the example shown in our drawings, or arranged independently of such frame.

The ends *d d'* are maintained in their place in the grooves of the support *k* by means of a cross-bar or plate, L, tightened by screws. This arrangement admits of the substitution of wires of various strengths, and of changing the size of the rings by drawing the wire in the grooves.

Springs or wires of different degrees of strength vary the degree of constraint, and are chosen according to the quality of tone desired to be produced for any particular stop in an instrument. The extensible forms offer greater facilities for tuning without scraping the reeds, merely by lengthening or shortening the rings or springs.

Figs. 8 and 9 are elevations, illustrating two simpler forms of the constraining device *c*, the free end *d'* in the arrangement shown in the latter figure being clipped by adjustable blocks of wood or other suitable material. Figs. 10 and 19 show other modifications in the form of the constraining device *c*. Fig. 20 is a sectional elevation, representing a combination of a ring with a spring-lever arranged for the purpose of showing how the vibrations of the reed may by their means be transmitted to a resonance-box, or to a sound-board, for augmentation of power. The ring *c*, the lower portion of which is attached to the tongue *b* at *c'*, is secured at its upper portion at *e* to one end of a spring-lever, *m*, composed of wood, metal, or other suitable material, and the opposite extremity of which is held in a fixed support, *n*. The spring-lever *m*, which is acted upon by a compressible spring, *m'*, is provided with an adjustable post, *o*, bearing upon a spring-board, *p*, secured to the support *n*, and which transmits its vibrations through the adjustable post *o'* to the resonance-box *q* placed beneath it.

When a series of reeds is arranged in an instrument, each spring-lever *m* has its post *o* pressing upon the spring-board *p*, which is common to the whole series. The vibrations thus received by the spring-board *p* are in their turn transmitted to the resonance-box *q*, by means of a single post, *o'*, common to the whole of the vibrations. If the resistance requires it, extra posts *o'* may be placed as judgment may determine, so long as the purpose be regarded that the resonance of the sound-board be not deteriorated or deadened by numerous points of pressure. When this combination of parts is adapted in an instrument it may often be desirable to keep the resonance-box entirely exterior, in which case the communication will take place through the bottom of the register or box containing the series of reeds by means of the post *o'*, either divided into two portions, one above and the other below the bottom of the box, or passing through a bushed hole direct.

The spring devices may be supplied so as to obtain a peculiar quality of tone, an example of which arrangement is shown in longitudinal section in Fig 21. In this arrangement a spring-lever, *r*, is employed, which may be either formed in one with or soldered or riveted to the reed-tongue *b*, and regulated, if desired, by a screw and nut, *s*. When this spring is sufficiently thin it excites a tremulousness in the air within the channel, thereby producing a wavy quality of tone. In the example shown in our drawings the spring *r* is represented as placed below the reed-tongue *b*, but it may be placed above the tongue, if desired, and produce similar results by acting on the inflowing current of air.

We further control the pitch and quality of tone by combining with these spring devices a prolongation-rod, having a screw-thread, and provided with an adjustable weight or or weights sliding or screwing to any desired point, or in another modification the rod is coiled upon itself either with or without a weight. The effect of the addition of a prolongation-rod is that, whereas the constraint of the rings greatly raised the reed from its original pitch, the weight, according to its distance on the rod from the tip of the reed, lowers the pitch again to any required degree, at the same time giving a valuable quality to the tone with increased power.

We further, by regulating the position of this weight, are able to cause the whole mass of the tongue, ring, and rod to divide in separate vibrating portions of nodes and segments, and thereby to change the whole tone from fundamental to harmonic. One or more rods may be used for this purpose, and either placed directly forward or in reversed position.

In certain cases, for particular quality, we are also able to cause the rings or springs to break up into nodes and segments by suitable bendings or loadings on the constraining device, or by causing the pressure to be applied at the point which experience determines suitable. It is not necessary in all cases that these devices should be applied parallel to the reed—they may be transversely placed, or at any angle—or that they should be above the reed. They may be so adapted as to be beneath the surface of the tongue within the pipe or channel, and the relative position of any of these may be altered or combined in

different manner to the selected forms, yet with retention of the same power of affecting pitch and quality.

Fig. 22 represents a side elevation of a reed frame and tongue, with its double ring, and combined therewith a prolongation rod and weight, and Fig. 23 is a corresponding plan of the same. *t* is the prolongation-rod attached to the tongue *b* at one end, and screw-threaded at its opposite end, for the adjustment of the weight *u*. The dotted lines in Fig. 22 indicate the nodal division. Fig. 24 shows the weighted rod as applied to a reed-tongue in the reverse direction. In some cases both rods may be combined with one reed-tongue. Fig. 25 is a side elevation of a similar arrangement to that shown in Fig. 22, but with a modified form of ring or loop. Fig. 26 represents a prolongation rod or wire, in which the relation of weight is determined by the coiling of the rod or wire itself. Fig. 27 is a side elevation, illustrating a different relation of the position of the parts of the combination. Fig. 28 is a sectional elevation, showing another combination, in which the weighted rod or wire *t* is arranged within the channel, and the connection of the ring *c* with the tongue *b* is, by means of a screw-pin, *g*, and nuts *h*, as before mentioned. In using the prolongation-rods the angular position of the rod in relation to the tongue has also an influence in addition to that produced by the adjustment of the weight, and particularly so in relation to the development of harmonic tones.

It should also be observed that the deviations of form in the ring or loop—such, for example, as those shown in Figs. 10, 11 and 12, and in Figs. 13 to 16—indicate variations in quality of tone, such as diapason, horn, oboe, trumpet, and others.

The invention is applicable to reeds, both when operated by pressure and by suction, and in either case the wind acting upon the reed may be caused to act also upon the auxiliary devices. The invention is also applicable to other vibrators besides free reeds and beating-reeds—as, for example, to hinged reeds or vibrators, whose pitch does not depend upon their own elasticity; also to piano-strings for adding weight or constraint and for obtaining harmonic tones, and to other vibrating bars or springs acted upon by percussion or friction.

We are aware of the patent of Farmer & Hamilton, February 23, 1875, in which one end of the ordinary piano-string is connected to a reed-tongue, the tension of the wire thus constraining the vibration of the reed. This we do not desire to claim; but

We claim as our invention—

1. The combination of the reed or other vibrating portion of a musical instrument with an elastic spring connected to the vibrating end of said reed, and to the reed-frame, or other object, as and for the purpose set forth.

2. The combination of the reed *b* and the elastic spring *c* connected to the reed, and to the reed-frame, or other object, with the weighted rods *t*, as set forth.

3. The combination of the vibrating reed and the elastic spring connected to the reed and to the spring-lever *m*, with the said spring-lever communicating with the resonance-box *q*, substantially as described.

In witness whereof we, the said HERMANN SMITH and JAMES BAILLIE HAMILTON, have signed our names to this specification in the presence of two subscribing witnesses.

HERMANN SMITH.
JAMES BAILLIE HAMILTON.

Witnesses:
CHAS. MILLS,
47 *Lincoln's Inn Fields, London.*
JOHN JAMES,
47 *Lincoln's Inn Fields, London.*