

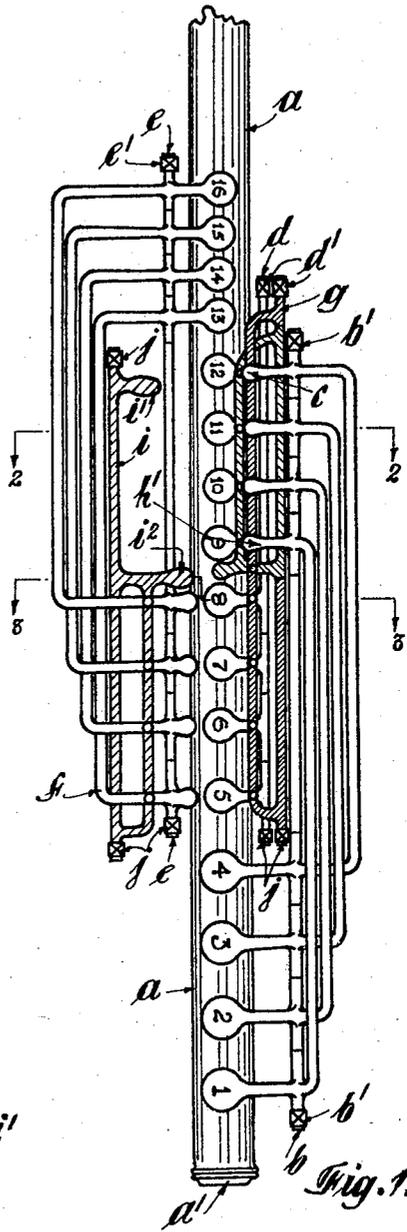
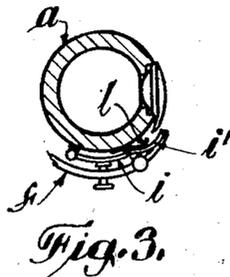
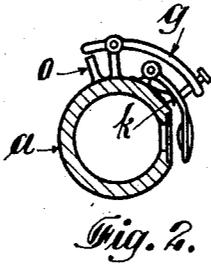
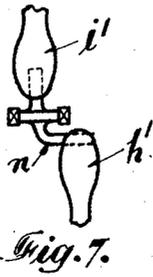
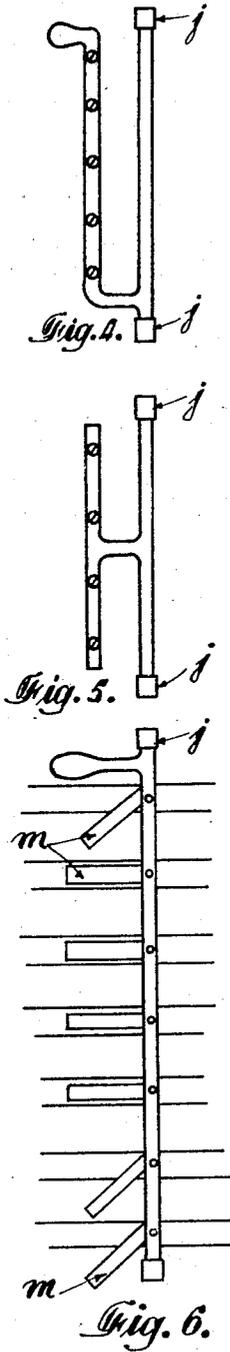
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J. W. McAVOY

WOOD WIND AND LIKE MUSICAL INSTRUMENT

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UNITED STATES PATENT OFFICE.

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WOOD-WIND AND LIKE MUSICAL INSTRUMENT.

Application filed February 17, 1926, Serial No. 88,896, and in Great Britain April 3, 1925.

This invention relates to wood-wind and like instruments such as flutes, oboes, bassoons, saxophones, and other instruments which comprise a wind channel provided with tone-holes adapted to be closed by pads carried on levers operated by the player's fingers.

In such an instrument, the number of tone-holes and consequently of pad levers, exceeds that of the fingers available and some fingers have therefore to control more than one pad lever. This is done in various ways, as by changing the position of the fingers as necessary, by coupling two or more pad levers directly or otherwise, the coupled levers working together by long levers to control the distant holes directly or by couplings, and/or by duplicate holes and/or levers.

A disadvantage of these methods, as usually applied, is that the simplest fingering is based on some one major diatonic scale, all other scales requiring less or greater departure from the simple fingering. In some cases it is found convenient to use two or more instruments with the same fingerings, but of different pitches, to meet the difficulties which arise in playing in all keys on a single instrument, and the music requires to be written to correspond with the pitch of the instrument employed.

Other disadvantages are that full control of certain levers is lost when the fingers concerned are required for operating other levers, movement of a finger from lever to lever hampers the facility of execution, independent action of some levers is impossible, certain sequences of notes are impracticable in fairly quick time, there is some loss of tone, the work of the fingers is very unevenly distributed, and transposition of music to a pitch other than that written for, is difficult.

The main objects of my invention are:—

1. To provide means by which the higher holes can be held closed when the fingers are required for the individual control of the lower holes, the higher holes becoming in their turn, subject to individual control when the collective action on them is withdrawn.

This allows of the adoption of a simple and regular chromatic fingering so that, for example, any series of eight consecutive holes (in an instrument for which all eight fingers are to be used for the said control of

the tone holes) shall be controlled each by a different finger, and requires that each of the higher holes above-named be provided with control by a pad-carrying lever operated to close the hole against the tension of a spring, and that at least one multiple control lever be fitted to be brought into use as required for the simultaneous actuation of the levers governing the said higher holes.

2. To provide the said means in such manner that a piece of music written, say in the key of C, can be played, without material change of the fingerings for the written notes, as if written in the key of D flat, of B, or at some still higher or lower pitch.

This requires firstly, that certain of the pad levers be provided with control from two points, only one of which is used in any one position of the hands for playing; secondly, that the finger contacts for the individual controls be placed in at least two series or "manuals" the contacts in each manual being in the same order and relative positions as their respective associated holes (this arrangement of the contacts being also preferable for object (1).), thirdly, that the multiple control levers shall each be provided with means for adjustment so as to vary their control according to what particular individual control levers are to be actuated; and fourthly, that all the holes be closed only by pad-carrying levers.

According to the invention, after each tone-hole which so requires has been provided in any customary manner with individual and independent control by a pad carrying lever (normally off-standing), and any hole which so requires provided with a second point of control (so being controllable from two points) and the finger contacts arranged so as to allow of the chromatic fingering earlier described, one or more multiple control levers, hereafter called "bar" levers, is/are fitted in any convenient manner to the body of the instrument, and each such bar lever is adapted for actuation to engage directly with, and operate together, those levers which individually control a series of consecutive holes, to close those holes; the bar levers are held normally in or out of action by springs.

Contact between bar lever and opposing levers is direct or by adjusting screws, and, in the case of an instrument required to be available for the transposition described, one

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or more of such adjusting screws is made so as to be withdrawable so far that no such control can be had—or the same result is obtained by having the bar lever fitted with one or more movable arms which can be turned into or out of contact with the arms of the opposing levers. One bar lever may be fitted to operate another. A special lever may be fitted to prevent two bar levers being depressed at the same time. No bar lever is constructed or placed so as to be necessarily operated in or by the closing or opening of any hole except in the manner indicated and illustrated.

The invention may be applied to instruments varying in shapes, sizes, number of tone holes, number of fingers to be used, and by its means any instrument can, if required, be made available for the transposition described. It is necessary however, that the pad levers be controlled as described independently, and for the full benefit of the invention, that the finger contacts for the operation of the pad levers be arranged as indicated, in regular manuals.

It will be sufficient to describe the invention in its particular application to one form of instrument only.

The accompanying drawing illustrates the invention, applied to a flute with 16 holes which are intended to be controlled by eight fingers and the left thumb.

Fig. 1 is a diagrammatic plan of the lower part of the flute, the tone holes being arranged in a straight line for clearness, and the control levers, with their attendant parts, being shown in the flat for facility of explanation. Holes such as vent holes and duplicate holes are not shown, their control not affecting or being affected by any of the levers here described.

Fig. 2 is a cross sectional elevation on the line 2, 2 of Fig. 1.

Fig. 3 is a cross sectional elevation on the line 3, 3, of Fig. 1.

Figs. 4, 5 and 6 are plans of modified forms of bar lever, and Fig. 7, is a plan of a detail part hereinafter described.

Referring to Figs. 1 to 3, *a* is the tubular body of the flute which has 16 tone-holes, and 16 pad levers, each such lever, and any combination, of any operating lever with a pad lever, working independently of every and controlling one hole and no more. The holes and pad levers are, for ease of explanation, numbered 1 to 16 from the lower end *a*¹ of the instrument, that is, the end furthest from the mouth-hole.

As will be seen pad levers 1 to 4 (inclusive) are pivoted on an axle *b* carried in bearings *b*¹ and are coupled to extensions *c* pivoted on the same axle and arranged in the order shown with their free ends respectively adjacent the pad levers 9, 10, 11, 12. Pad levers 5 to 12 (inclusive) are pivoted on an axle *d* carried in bearings *d*¹. Pad levers 13 to 16 (inclusive) are pivoted on an axle *e* carried in bearings *e*¹ and coupled to auxiliary levers, or extensions *f*, also pivoted on the axle *e* and arranged in the order shown, with their free ends respectively adjacent to the pad levers, 5, 6, 7 and 8.

The couplings shown (extensions) may be used; if auxiliary levers are used in place of any such extensions each engages directly with, and directly operates, one pad lever, and has no further action of any kind.

Pad levers 5 to 8 (inclusive) with the auxiliary levers or extensions *f* are to be operated by the player's right fingers, and pad levers 9 to 12 (inclusive) with the auxiliary levers or extensions *c* are to be operated by the player's left fingers; in all cases the operating arms agree respectively in order and relative position with their associated holes and fingers.

To complete the control described, the invention is applied, and consists in the addition of the three bar levers *g*, *h* and *i*, *g* and *h* placed on one side, and *i* on the other side, of the line of holes. Each bar lever comprises a bar portion lying lengthwise with the axis of the instrument, and an angular portion at each end pivoted to pillars or brackets *j*, on the body of the instrument.

The bar levers *g* and *h* are mounted on a common axis. The bar lever *h* on one side of the line of holes lies over pad levers 9—12, so that when depressed by a finger piece extension *h*¹ at one end, said pad levers are all depressed thereby leaving the left hand fingers free to operate the adjacent arms *c* and control holes 1, 2, 3 and 4 without restraint. The longer bar lever *g* on the same side of the line of holes lies over the shorter one *h* and continuous over pad levers 5—8, so that on its being depressed all the holes 5—12 inclusive are closed and at least seven fingers are set free. Bar levers *g* and *h* are normally held out of action, i. e. in the raised position, by suitable springs, suitable stops *o* (Fig. 2) limiting the extent of their rise.

For the purpose of illustration bar lever *i* is shown as placed under the arms of levers *f* and on the other side of the axle from their free arms, and by a strong spring is normally kept pressed against those levers so as to close holes 13, 14, 15 and 16. This lever has finger pieces *i*¹ and *i*² for control by the left thumb and/or the right index finger, and, when by pressure on these extensions the action of the bar lever is taken off lever *f*, the free ends of *f* and their connected pad levers, rise and the holes 13, 14, 15 and 16 can then be closed by finger action as in other cases.

As illustrated in Fig. 2 each pad lever is adapted to be raised clear of the hole by a small spring *k*. The spring shown is of the

ordinary ribbon type, but any type of spring may be used for any lever described in this specification.

At each point when a bar lever crosses the levers which are to be operated by it an adjusting screw is provided which makes contact between bar lever and opposing levers and may be adjusted to vary, or equalize the pressure of the bar lever on the opposing levers, any such screw may, for the purpose of transposition described later, be withdrawn so far that there can be no contact between the bar lever and the opposing lever concerned.

In the case of bar lever *i* (as illustrated), a strong spring is provided to keep the lever normally in the raised position, that is, in action. The lever may however, be constructed to be put into action similarly to *h* or *g*, the axle being placed intermediately of the controlling arm and the arm/arms engaging the opposing levers, or in any other suitable position.

In Figs. 4 and 5 two alternative forms of bar lever are shown.

In the modification illustrated in Fig. 6, the bar lever, instead of being of rigid form as previously described, is provided with arms *m*, preferably of resilient material, any of which may be pivoted so as to be movable into or out of the path of the opposing levers, for purposes of transposition.

It is desirable that the lever *i* (as illustrated) be not depressed at the same time with *h* or *g* and to attain this end a small rocking lever *n* (see Fig. 7) may be provided, having an arm on each side of its axle, one arm placed under and engaging lever *i* and the other arm placed under and engaging lever *h*.

The bar levers may of course, be operated at any point in their length and not only by extensions.

If desired the bar levers may be pivoted at points other than their ends, and any bar lever may be constructed to be operable from any convenient position by a finger contact piece. A fourth lever may be added when required for extending the range of operation of the invention in an upward direction.

The bar levers also make possible the adoption of the regular fingering on a chromatic basis for the whole range of fundamental notes. The finger contacts for the individual controls are laid out in straight sequences, and the action of the fingers on them follows accordingly, that is, one at a time to produce the chromatic scale. For other scales the progression of finger movements varies only with the mode of the scale (major, minor, whole tone, pentatonic, &c) and not with the key, so that all scales in any one mode, being constructed alike, are produced by the same progression of finger action. The tone holes can be placed in

their true positions, and the "veiling" or obscuring of the purity of tone, caused when a closed hole lies below an open hole, is avoided, fork or cross fingering being unnecessary, except on the very highest notes which cannot be fingered on the strict chromatic basis. Execution is rendered easier, all strong springs can be eliminated, and where any is used, as on lever *i*, it is opposed by a strong finger or a thumb. All sequences of notes are playable in quick time, and the composer is freed from the necessity of avoiding certain shakes, turns, and other sequences because of their impracticability; he is, further, not required to vary his written pitch for clarinet music because of any difficulties in execution, nor to write music, say for a G (bass) flute at any but its proper pitch. On the other hand if the composer wishes to make the reading of a piece of music easier for the player, he is at liberty to do so by transposing the written music a semitone higher or lower, making a suitable record thereof, and the player can adjust his instrument and the position of his hands accordingly, the actual pitch produced being the correct one. Thus a complicated passage in key of B or D flat can be written in C and many written flats and sharps, double flats and double sharps, avoided without the necessity for the player having to use a second instrument.

The systems of fingering and transposition, and the bar levers described, which make these systems possible, are applicable to all instruments of the type of flutes, clarinets, oboes, bassoons, saxophones, and so on, and it is therefore not necessary for a player to change his system of fingering in passing from one kind to another.

The construction of instruments according to the invention is simple, there being no clutches, overlapping arms or projections of levers, intermediate levers, rings, cams, springs, cranks, chain connections, or other such contrivance, to combine the action of one pad lever with that of another, and all duplicates holes, double holes, and assistant holes, with their control mechanism, are rendered unnecessary.

What I claim is:—

1. In a wood-wind or like musical instrument having a wind channel provided with tone holes, the combination with said channel of independent levers, suitably mounted on the channel, pads attached to some of said levers and being each so placed that the depression of the pad and lever closes one of the tone holes, means connecting some of said pads and levers to other of said levers not having pads, to effect distant control of tone holes, springs suitably fixed to keep the levers in the raised position, each hole, of a series of consecutive tone holes commencing with that nearest the mouthhole, being thus

- provided with an independent control, and no one of the levers named having effect on more than one hole, and at least one additional multiple or bar lever, suitably pivoted on the channel and having an arm or arms so placed that when the lever is in action it directly operates those independent levers beneath it to close those holes together, a spring for each such multiple closing lever, placed so as normally to keep the lever in the raised position, and adjustable, removable means contacting between the multiple closing lever and the independent levers beneath it, substantially as described.
2. In a wood-wind or like musical instrument having a wind channel provided with tone holes, the combination with said channel of independent levers, suitably mounted on the tube, pads attached to some of said levers and being each so placed that the depression of the pad and lever closes one of the tone-holes, other of the pad-carrying levers being for their distant operation each connected with one of the levers not carrying pads, springs, suitably fixed to keep the pad-carrying arms in the raised position, each tone-hole being thus provided with an independent control, and no one of the levers named having effect on more than one hold, and for the multiple closing of certain of said holes, at least one additional multiple or bar lever, pivoted on the channel and having an arm or arms so placed that when the lever is in action it directly operates those levers which are fitted for the independent control of a series of consecutive holes, included in a series of consecutive holes which commences with the highest hole, to close the holes associated with those levers, a spring for each such multiple closing lever, so placed as normally to keep the lever in the raised position, and adjustable removable means contacting between the multiple closing lever and the independent levers, beneath it substantially as described.
3. In a wood-wind or like musical instrument having a wind channel provided with tone holes, the combination with the channel of independent levers carrying pads for closing the tone-holes, springs normally holding the pad levers "open" means for the independent operation of each of said levers, each tone hole being controlled in this manner, at least one multiple closing lever, each adapted for the direct and simultaneous operation of a plurality of the independent control levers to close a similar plurality of consecutive holes removable adjustable means contacting between the multiple closing lever and the independent levers beneath it, the arrangement in at last two series of tone holes of the control arms, which are directly engaged by the fingers for the individual closing of the holes, being such that the control arms for a section of consecutive holes to any desired number, commencing at the lowest hole are placed in a line, in the same order and relative positions as their respective holes and so that any one is operable by a finger other than that which operates the next one, a similar arrangement of control arms serving for the section of consecutive holes to any desired number commencing at the highest hole, any third series of control arms governing all or a plurality in consecutive series of the remaining holes, and as many as desired of the next consecutive holes already having control in the first and/or second series, the order and positions of the control arms, with respect to their associated holes and the fingers, being similar to those for the first and second series, substantially as described.
4. In a wood-wind or like musical instrument having a wind channel provided with tone holes, the combination with the channel of levers adapted for the independent closing of tone holes, a spring for the pad lever of each hole included in a consecutive series commencing with that nearest the mouth-hole, at least one multiple closing lever, each adapted to operate directly a plurality of the individual control levers to close a series of consecutive holes included in the first named series, finger contact arms for the control of said multiple closing levers by the fingers or thumbs and removable adjusting screw means between each multiple closing lever and the lever beneath it substantially as described.
5. In a wood-wind or like musical instrument, having a wind channel provided with tone holes, the combination with the channel of levers adapted for the independent closing of the tone holes, a spring for the pad lever of each hole included in a consecutive series commencing with that nearest the mouth-hole, at least one multiple closing lever, each adapted to operate directly a plurality of the individual control levers to close a series of consecutive holes of the first named series, finger contact pieces for the control of said multiple closing levers by the fingers or thumbs, at least one of said multiple closing levers having arms at least one of said arms being pivoted and capable of being moved into or out of the path of the opposing independent control lever so as to bring that lever into or leave it out of the operation of a multiple closing lever, substantially as described.
6. In a wood-wind or like musical instrument, having a wind channel provided with tone holes, the combination with the channel of levers adapted for the independent closing of the tone holes a spring for the pad lever of each hole included in a consecutive series of tone-holes commencing with that nearest the mouth-hole, a multiple closing lever, a spring to normally keep said le-

ver in action and said lever being adapted to
operate directly a plurality of the individual
control levers to close a series of consecu-
tive holes commencing at the same hole with
5 the first named series, one or more further
multiple closing levers, spring means to keep
said levers normally out of action for the
similar closing of the remaining holes of the
first named series, finger contacts for said

multiple closing levers, and means pivoted 10
on the channel to prevent the depression of
the first named multiple lever at the same
time with either of the other multiple clos-
ing levers, substantially as described.

In testimony whereof I have signed my 15
name to this specification.

J. W. McAVOY.