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WIND MUSICAL INSTRUMENT WITH HELICAL FREQUENCY DETERMINING MEANS

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Fig. 1.

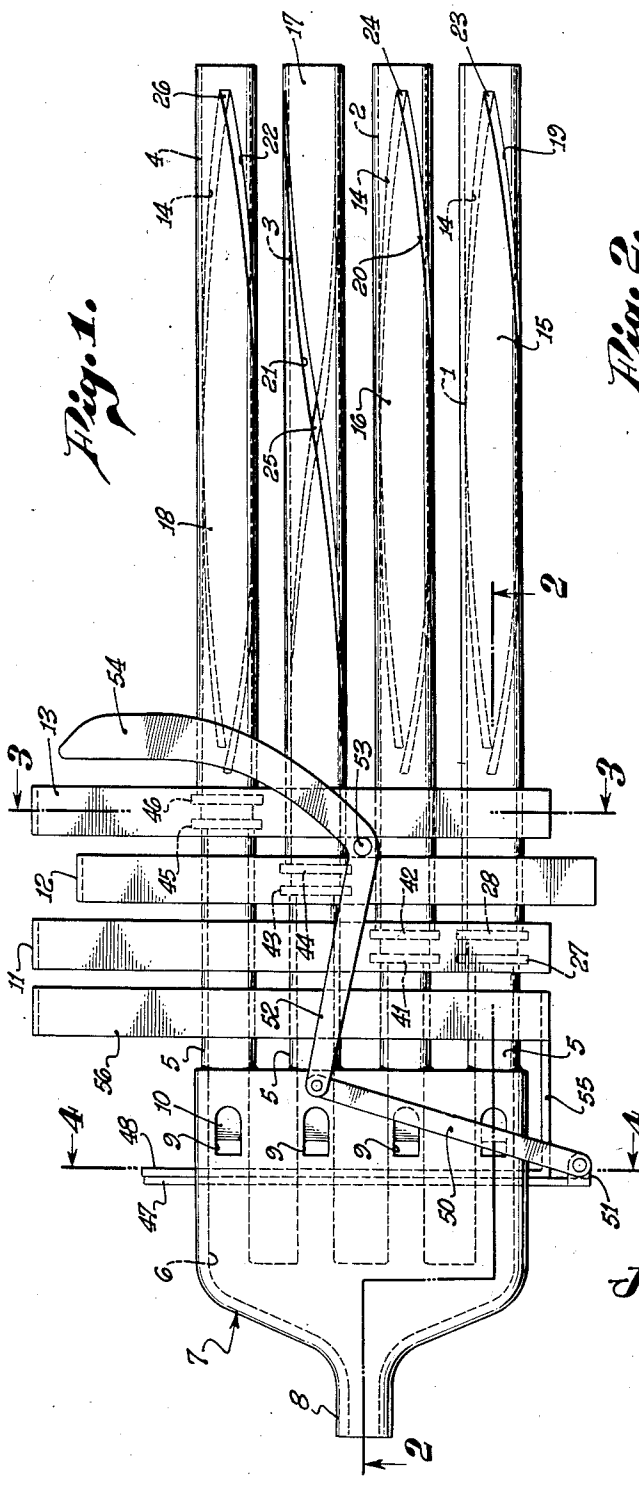

Fig. 2.

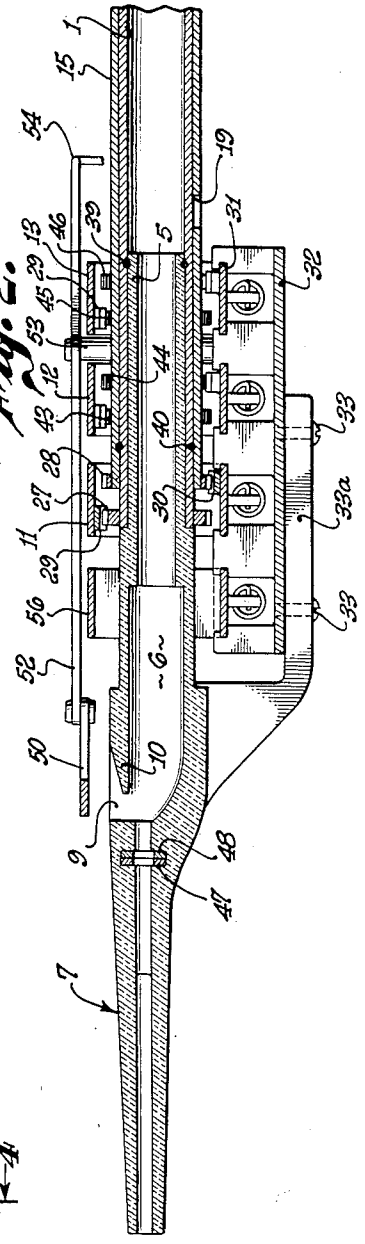

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Fig. 3.

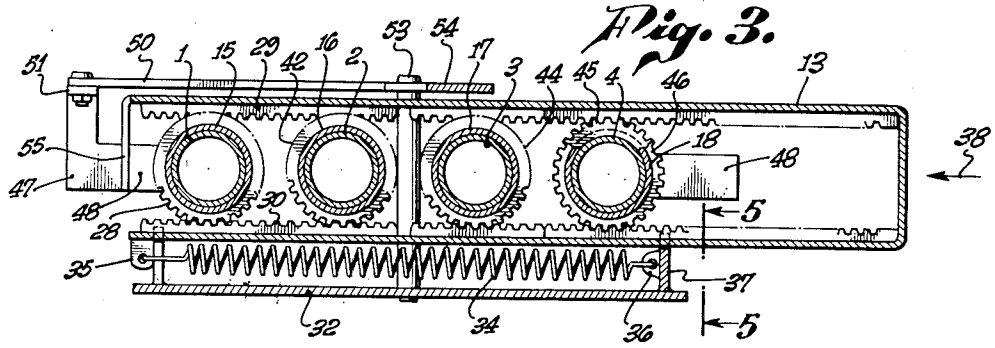


Fig. 4.

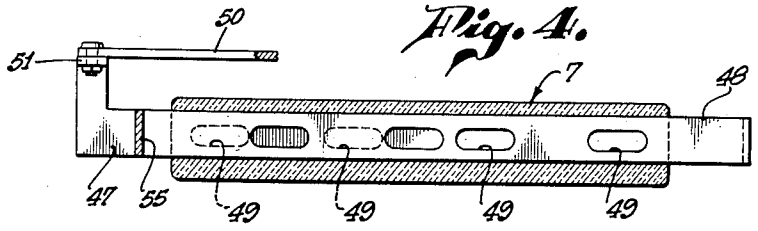


Fig. 5.

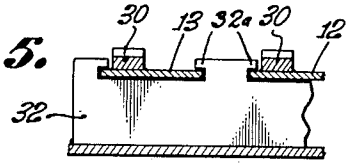


Fig. 6.

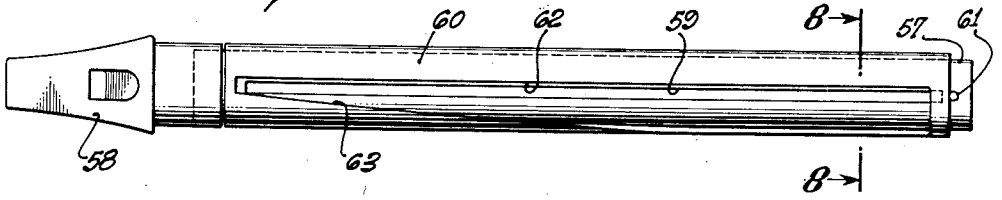
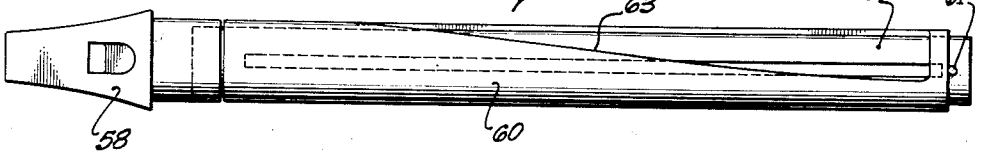


Fig. 7.



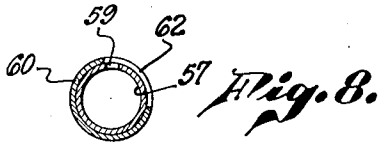


Fig. 8.

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Fig. 9.

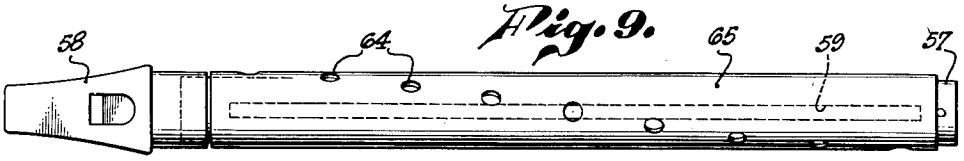


Fig. 10.

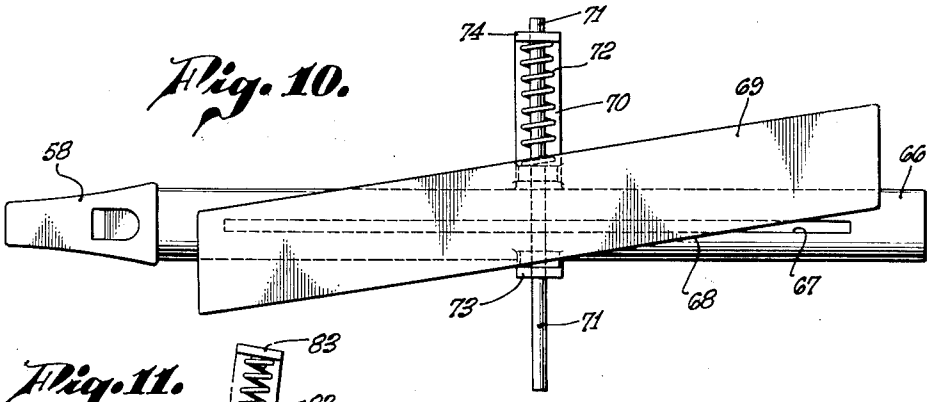


Fig. 11.

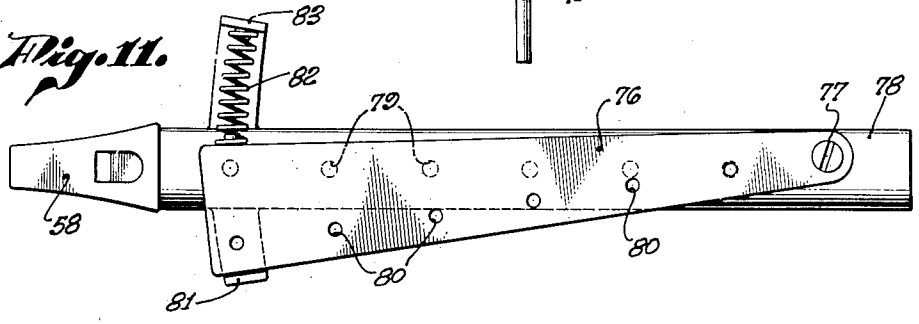


Fig. 12.

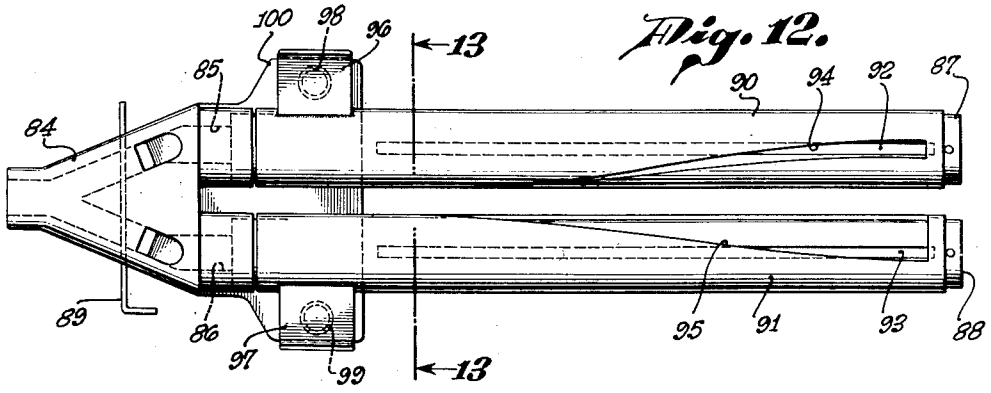
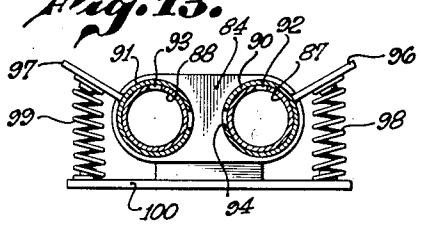


Fig. 13.



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WIND MUSICAL INSTRUMENT WITH HELICAL FREQUENCY DETERMINING MEANS

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Application January 5, 1951, Serial No. 204,571

9 Claims. (Cl. 84—386)

This invention relates to musical instruments, and particularly to instruments using tubes or pipes, e. g. organs, whistles, or the like.

In such musical instruments, the pitch produced is a direct function of the length of the pipe. In organs, the pipes are of fixed lengths, and there are as many pipes as required by the range of the instrument. Each pipe is permanently tuned to its individual pitch tone.

In other forms of wind instruments, variation in pitch is permitted by varying the effective length of the air passage; for example, in trombones, where telescopic elements are used; or in whistles or saxophones, in which the effective length is determined by aid of openings in the pipe or tube.

It is one of the objects of this invention to provide an instrument in which the pipe length is varied in a simple manner, facilitating the use of the instrument by the performer.

In order to effect this result, the instrument incorporating the invention is arranged to be operated by relative movement of the pipe and a cooperating member that determines effective length; for example, by relative rotation of the parts about the axis of the pipe.

This invention possesses many other advantages, and has other objects which may be made more clearly apparent from a consideration of several embodiments of the invention. For this purpose there are shown a few forms in the drawings accompanying and forming part of the present specification. These forms will now be described in detail, illustrating the general principles of the invention; but it is to be understood that this detailed description is not to be taken in a limiting sense, since the scope of the invention is best defined by the appended claims.

Referring to the drawings:

Figure 1 is a plan view of an instrument incorporating the invention;

Fig. 2 is an enlarged sectional view, taken along a plane corresponding to line 2—2 of Fig. 1;

Figs. 3 and 4 are enlarged sectional views, taken along planes corresponding to lines 3—3 and 4—4 of Fig. 1;

Fig. 5 is a fragmentary sectional view, taken along a plane corresponding to line 5—5 of Fig. 3;

Fig. 6 is a plan view of another embodiment of the invention, shown with the effective length of the pipe as a minimum;

Fig. 7 is a view similar to Fig. 6, but illustrating a position in which the effective length of the pipe has been increased;

Fig. 8 is a sectional view, taken along a plane corresponding to line 8—8 of Fig. 6;

Figs. 9, 10, 11, and 12 are views, similar to Fig. 6, of modified forms of the invention; and

Fig. 13 is a sectional view, taken along a plane corresponding to line 13—13 of Fig. 12.

In the form of the invention shown in Figs. 1 to 5, inclusive, four pipes 1, 2, 3, and 4 are arranged in parallel relation (see Fig. 3). These pipes may be either open or

closed at the ends. They are rotatably telescroped over the hollow extensions 5 of a mouthpiece 7. These extensions lead to the air passages 6 (Fig. 2) that are in communication with the interior of the mouthpiece 7. The mouthpiece 7 has a narrow end 8 for reception between the lips of a performer. The air for operating the device may be obtained from mechanical sources as well, such as from pumps, or the like, often used for organs. Each of the passages 6 is provided with a transverse opening 9 (Fig. 2). One edge of opening 9 may be formed by a reed 10.

The pitch tone of a pipe, such as pipes 1, 2, 3, and 4, is determined by its effective length. This effective length, in turn, is determined by the position of a through aperture in the pipe communicating with the outside atmosphere. Thus, for example, in a simple whistle structure, several apertures are formed along the length of the whistle. If there is a clear opening near the mouthpiece, the pitch tone is relatively high. As the openings are closed in succession, the effective length of the pipe increases, with a corresponding reduction in pitch tone.

Pipes 1, 2, 3, and 4 are arranged so that their effective lengths can be varied by appropriate manipulation of a plurality of keys 11, 12, and 13.

Thus, pipe 1 is provided with a slot 14 which is arranged helically along the length of the pipe. In the present instance, this slot 14 makes approximately a one-half turn around the axis of the pipe. Overlying each of the pipes 1, 2, 3, and 4 are the external relatively rotatable tubular members 15, 16, 17, and 18. These tubular members are telescoped over the inner pipe 1 and are similarly provided with helical slots 19, 20, 21, and 22. These helical slots also extend for about one-half revolution along the peripheries of the corresponding members 15, 16, 17, and 18. However, they are of opposite pitch to that of the slots in pipes 1, 2, 3, and 4.

Obviously, by relative rotation between the pipe 1 and the external member 15, the helical slots may be made to cross at any desired point along these slots, to provide through apertures defined by the edges of the slots. Thus, in the free or rest positions, these slots cross near the right-hand ends of the pipes to form clear apertures 23, 24, and 26, corresponding to the free positions of keys 11 and 13, operating the tubular members 15, 16, and 18. Tubular member 17 is shown as rotated by key 12 to an intermediate position, providing a crossing place 25 of the helical slots 14 and 21. This place 25 forms a through aperture. Accordingly, the pipes 1, 2 and 4 are of maximum effective length, and the pitch tones are correspondingly low; and pipe 3 is of intermediate effective length.

The pitch tone of pipe 1 can be adjusted or varied by providing for relative opposite directions of rotation of pipe 1 and member 15. Similar variations in effective pipe lengths can be effected for pipes 3, 4, and 5. This relative rotation may readily be effected since these pipes 1, 2, 3, and 4 are rotatably supported on the extensions 5, and the members 15, 16, 17, and 18 are similarly rotatably supported on the corresponding pipes.

As this rotation occurs, the point of crossing of the two helical slots 14 and 19 approaches the mouthpiece end of the instrument. This correspondingly decreases the effective pipe length and increases the pitch tone. For any relative angular positions of the two telescoping members, there is only one place where the slots cross.

Appropriate axial stops may be provided to maintain the pipes 1, 2, 3, and 4 of the tubular members 15, 16, 17, and 18 in proper axial relationship. For example, a spring ring 39 (Fig. 2) may be arranged between each pipe 1, 2, 3, and 4 and extensions 5; and a spring ring 40 may similarly be arranged between each member 15, 16, 17, and 18 and the corresponding pipe.

Since the mechanism for relatively rotating the pipe **1** and the outer tubular member **15** is identical with the mechanism for performing this relative rotation in connection with the other pipes, a description of this mechanism for pipe **1** and member **15** may apply, as well, to all of the others.

Thus, pipe **1**, adjacent its left-hand end, is provided with a spur gear **27**. A spur gear **28** of identical pitch diameter, is mounted upon the left-hand end of the outer member **15**. A slidable key **11** is provided, of open frame form. It has upper and lower members straddling these gears. A rack **29** engages gear **27** and is disposed on the lower side of the upper frame member of key **11**. A similar rack **30** is mounted on the upper side of the lower frame member of key **11** and engages the gear **28**. Obviously, as the key **11** is moved downwardly, as viewed in Fig. 1, gear **28** will be rotated in one direction, and gear **29** will be rotated in the other direction.

The key **11**, as shown most clearly in Fig. 5, is mounted for sliding movement in grooves **31** formed in a guide **32**. This guide **32** is mounted beneath the mouthpiece **7** by the aid of the bracket **33***a* joined to the mouthpiece body **7**, and is attached to the bracket by screws **33**. The guide member **32** may be in the form of sheet metal, bent at the sides to provide front and rear guides, as indicated most clearly in Fig. 3. The lower frame members dovetail below the overhanging edges **32***a* of these guides.

The key **11** is urged to the right by the aid of a tension spring **34** anchored at its left-hand end to an ear **35** at the left-hand lower portion of the key. The right-hand end of the spring **34** may be attached to an ear **36** mounted on a post **37** intermediate the guide elements. The ear **35** limits the movement of the key to the right. In this free position, the slots on each pair of telescoping members intersect adjacent the right-hand end of the instrument. When it is desired to reduce the effective length of any of the pipes, a finger may be used to urge the key in the direction of the arrow **38** on Fig. 3.

The slide **11** is intended to operate another set of gears **41** and **42** (Fig. 1) for rotating the inner pipe **2** and the external tube **16**. The same racks **29** and **30**, mounted on the frame of the key **11**, operate these gears. In other respects, the pipe **2** and the external member **16** are constructed and arranged in the same manner as the first set described.

The third pipe **3**, with its external member **17**, is operated by a pair of gears **43** and **44** connected respectively to the inner and outer members **3** and **17**. The key **12**, of the same structure as key **11**, is guided in the manner described hereinabove. Similarly, the gears **45** and **46** on key **13** are likewise arranged to provide rotation for the inner pipe **4** and the outer member **18**.

Provisions are made for controlling the volume of air passing through the pipes. For this purpose there is a pair of adjacent slides **47** and **48** (Figs. 1, 2, 3 and 4), guided in a transverse slot in the mouthpiece **7**. These slides are provided with apertures **49** capable of being placed in registry across the inlet ends of the extensions **5**.

Operation of slide **47** is effected by a link **50** pivotally connected to the ear **51** at the lower end (as viewed in Fig. 1) of the slide **47**. This link in turn is pivoted to a lever arm **52** mounted on a stationary pin **53** extending from the base of the guide member **32**. The other arm **54** of the lever is in a position to be manipulated by a finger. The other slide **48** is connected, as by the bend **55**, to a key **56** that is guided in the guide frame **32**.

In the form of the invention illustrated in Figs. 6 and 7, a single pipe **57** is provided having a mouthpiece **58** permanently joined to the left-hand end of this pipe. The pipe is illustrated as having a straight slot **59**. Disposed over the pipe **57** is a rotary angularly adjustable member **60** held against axial displacement by the aid of a pin **61** mounted at the right-hand end of the pipe **57**. This member **60** may be manually operated and is provided with a slot **62** having a slanting or helical edge **63**. This slanting edge is intended to overlie the slot **59** to any desired extent. In the position of Fig. 6, the slot **59** is substantially entirely exposed, causing the effective length of the pipe **57** to be a minimum. However, as the member **60** is rotated, the edge **63** becomes active to cover a portion of the slot **59** and causes a corresponding increase in the effective length of the pipe.

Fig. 9 illustrates a form of the invention in which the slot **59** is intended to align with any one of a series of through apertures **64** provided in the outer telescoped member **65**. In this form, the series of apertures **64** are arranged along a helical line. Upon appropriate manipulation of the outer member **67**, any one of the apertures **64** serves to determine the effective length of the pipe in an obvious manner.

In the form of the invention illustrated in Fig. 10, the pipe **66** has a slot **67** arranged lengthwise thereof. The effective length of the pipe **66** is effected by movement of a slanting edge **68** of a slide **69**. This slide **69** carries a post **71**, by the aid of which it may be manipulated for movement transversely of the slot **67**. This post is guided appropriately in the ears **73**, **74**, mounted on bracket **70**, supported on the pipe **66**. The ear **73** serves to limit downward movement of the slide **69** in response to the force of a compression spring **72**.

Manipulation of the bar **71** upwardly causes a corresponding upward movement of the slide **69** and a corresponding decrease in the effective length of the pipe **66**.

In the form of the invention illustrated in Fig. 11, a member **76** is pivotally mounted, as by the aid of a pivot screw **77** on the pipe **78**. The pipe **78** has a series of apertures **79** extending longitudinally of the pipe. Member **76** likewise carries a similar set of apertures **80**. The member **76** is urged downwardly toward a stop **81** by compression spring **82** having its upper end anchored against a bracket **83** mounted on the pipe **78**. In the free position illustrated, the extreme right-hand apertures **79**, **80** are in register, corresponding to a maximum effective length of the pipe **78**. As the member **76** is moved manually in a clockwise direction, succeeding apertures **80**, one by one, move into registry with the corresponding apertures **79**. In this way, the effective length of the pipe **78** is reduced in a step by step manner.

In the form of the invention illustrated in Figs. 12 and 13, mouthpiece **84** is provided with a pair of air passages **85** and **86**, cooperating respectively with the pipes **87** and **88**. A slide **89** extends across these passages to adjust the volume of air passing to the pipes.

Each of the pipes **87** and **88** is firmly mounted on the mouthpiece **84**. Telescoping over these pipes **87** and **88** are respectively the outer members **90** and **91**, similar to the outer member **60** in the form of the invention shown in Figs. 6, 7, and 8. Thus, each of the pipes **87** and **88** is provided with a straight longitudinal slot **92**, **93**. These slots can be covered to any desired extent by the slanting or helical slots **94** and **95** respectively of the aperture in the members **90** and **91**.

For ease of manipulation of these members **90** and **91**, they are provided with radial arms **96** and **97**. Compression springs **98** and **99** urge these radial arms upwardly. In the free position illustrated the two pipes **87** and **88** have maximum effective lengths. The lower edges of these springs are anchored on a bar **100** mounted on the mouthpiece member **84**.

The player can readily manipulate these arms **96** and **97** for effecting appropriate angular adjustment of the slots **84** and **85** with respect to the slots **92** and **93**.

Wherever, in the claims, the term "helically arranged passage" is used, it will be understood that said term may include a series of relatively short separate spaced passages helically arranged with respect to each other as well as a single continuous helically arranged passage.

The inventor claims:

1. In a wind musical instrument: a pipe; said pipe having a helically arranged air passage extending substantially the entire length of and transverse to the pipe; said passage being defined by edges; and means for determining the tone produced by the instrument over substantially the entire playing range of the instrument, comprising a member mounted on the pipe for transverse movement relative to the axis of the pipe and having an edge extending generally longitudinally of the pipe and transverse to the helix defined by said air passage, the edge of the member determining, with the edges of the air passage, the effective length of the pipe by cooperation with successive portions of the edges of said passage upon continued movement of the member.

2. In a wind musical instrument: a pipe having through longitudinal slot means extending along the operative length of the pipe; a member mounted on the pipe and confined for transverse movement with respect to the pipe and slot means, said member having an edge intersecting the slot means at successive positions along the length of the slot means as the member is transversely moved for determining any one of a number of tones throughout the musical range of the pipe.

3. In a wind musical instrument: a pipe having a longitudinal through slot extending throughout the operative length of said pipe; a tubular member mounted on the pipe and confined for rotation thereabout, said tubular member having an edge that overlies the slot to an extent corresponding to the relative angular positions of the pipe and the member for determining any one of an infinite number of tones throughout the musical range of the pipe.

4. In a wind musical instrument: a support, a pipe having a helical through slot extending throughout the operation length of said pipe; means mounting the pipe on the support for rotation about its axis; a member telescoping over said pipe and having a helical through slot of opposite pitch; and means for rotating the pipe and the member in opposite directions for determining any one of an infinite number of tones throughout the musical range of the pipe.

5. In a wind musical instrument: a pipe having a through slot extending throughout the operative length of said pipe having an edge; and a tubular member rotatably mounted on the pipe, and having a second extending longitudinally of the tubular member; one of said edges being slanted to cause any desired portion of the slot to be covered by the tubular member as the angular position between the pipe and the member is altered for determining any one of an infinite number of tones throughout the musical range of the pipe.

6. In a wind musical instrument: a pair of pipes, each having a longitudinal slot extending throughout the operative length of said pipe; tubular members respectively rotatably mounted over the pipes and each having an edge overlying the respective slot; means urging the members to an angular position in which the edges cross the slots near one end of the pipe; and means for independently rotating said members in a direction to vary the place of crossing said edges along the length of the corresponding slots for determining for each pipe any one of an infinite number of tones throughout the musical range of said pipes.

7. In a wind musical instrument: a support; a pair of telescoping tubular members mounted on said support for rotation about a common axis, each of said members having a helically arranged slot of respectively opposite pitch and extending throughout the operative length of said members; and means for causing simultaneous and opposite adjustment of the angular position of said members with respect to said support for determining the longitudinal position of the intersection of said slots.

8. In a wind musical instrument: a support; a pair of telescoping tubular members mounted on the support for rotation about a common axis, each of said members having a helically arranged slot each of substantially one half of one turn, the slots of the respective members having opposite pitch and extending substantially throughout the entire operative length of said members; and means for causing simultaneous equal and opposite adjustment of the angular positions of said members about longitudinal axes for determining the longitudinal position of the intersection of said slots.

9. In a wind musical instrument: a pipe having a through slot extending along the operative length of the pipe, said slot having an edge; a slide mounted on the pipe and having an edge; and means for confining the slide for linear movement transverse to the slot and the pipe; one of said edges being slanting so that the edges intersect as successive positions along the length of the pipe as the slide is transversely moved for determining any one of a number of tones throughout the musical range of the pipe.

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