# United States Patent

[11] 3,602,189


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[21] Appl. No. 58,968
[22] Filed July 28, 1970
[45] Patented Aug. 31, 1971
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[32] Priority July 28, 1969
[33] Japan
[31] 70912/1969


[54] **DEVICE FOR AUTOMATICALLY SOUNDING WIND INSTRUMENTS**

3 Claims, 5 Drawing Figs.


[52] U.S. Cl. ..... 116/137, 46/181, 84/386, 116/24, 116/139
[51] Int. Cl. ..... G01k 5/00
[50] Field of Search ..... 116/137, 139, 142, 142 VP, 142 FP, 58, 67, 24; 46/178, 181; 84/89, 93, 355, 386



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**ABSTRACT:** A whistle is blown by air supplied by a bellows operated by a bellows-actuating cam, by which the sound duration and loudness can be controlled, and the pitch of the sound thus produced is controllably varied by a pitch-control cam, both cams being mounted on the periphery of a spring-operated barrel, whereby whistle sound compositions of great variety can be rendered automatically.

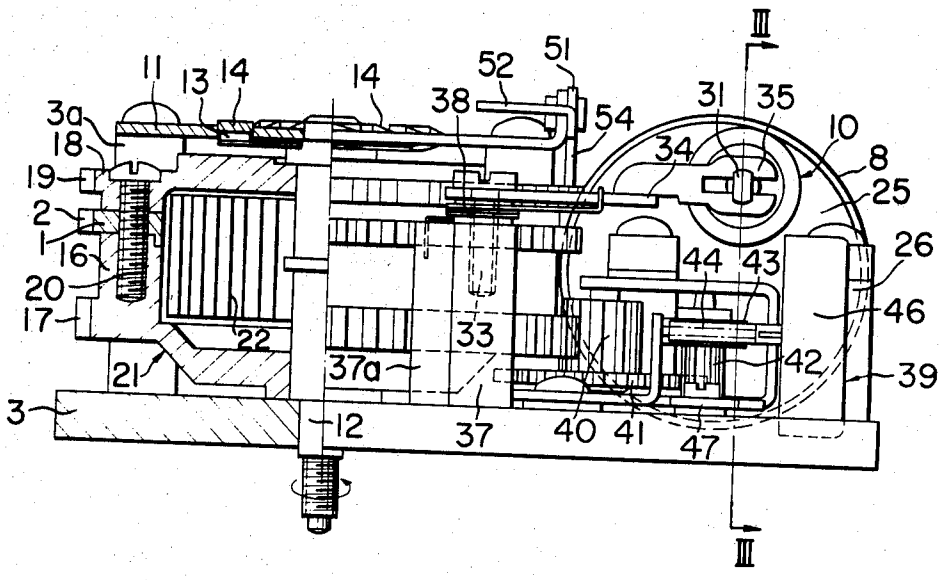



FIG. 1

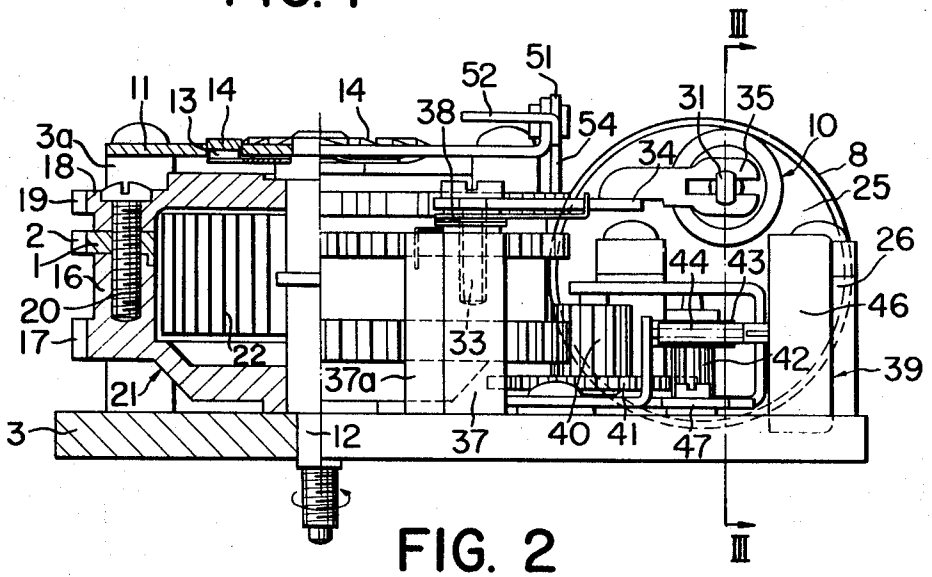

III
11
13
14
14
52
51
38
54
31
35
10
3a
18
34
8
19
25
2
1
16
26
44
43
20
46
17
22
33
42
39
21
37a
3
12
37
40
41
47
III

FIG. 2

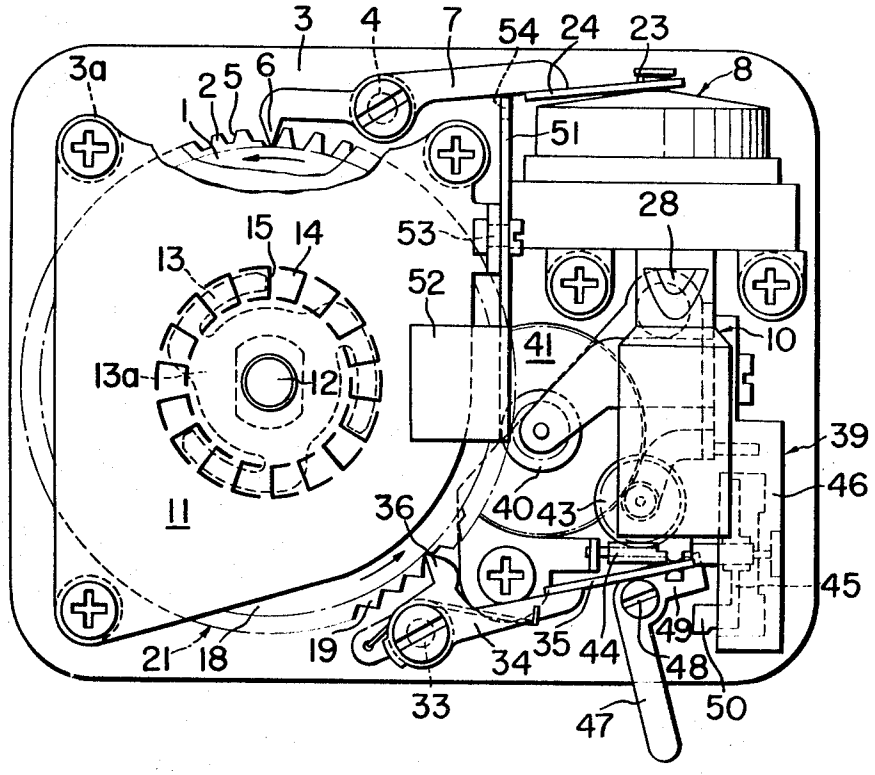

3
4
7
54
24
23
3a
2
5
6
8
1
51
28
15
14
53
13
52
41
10
13a
12
39
46
40
43
36
11
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49
21
18
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50

FIG. 3

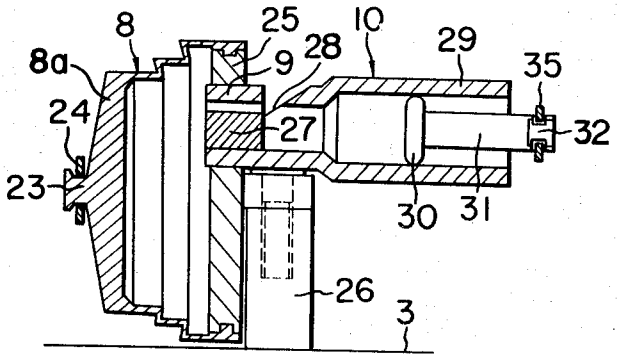



FIG. 4

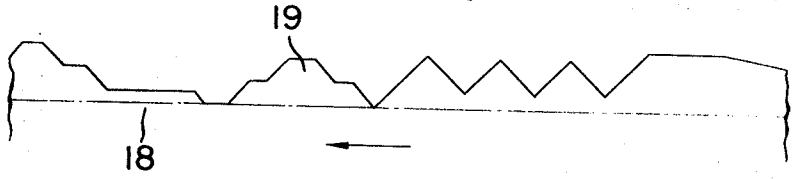
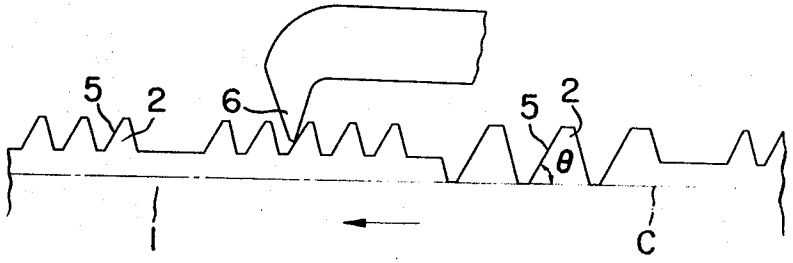



FIG. 5



# DEVICE FOR AUTOMATICALLY SOUNDING WIND INSTRUMENTS

## BACKGROUND OF THE INVENTION

This invention relates generally to sound-producing means, particularly wind instruments, including whistles, and to bellows mechanisms for supplying air for sound production. More particularly, the invention relates to a new device for automatically, sounding wind instruments including whistles for producing simulated sounds such as those of insects, bird calls, etc., which device is of the class wherein the pitch of the sound emitted by a wind instrument is automatically varied by means actuated by a pitch-control cam driven by a power source such as a spring or motor to vary the length of the air column in the vibration chamber in the wind instrument.

In a known device of this class, a valve is provided in the air flow path between a bellows and the wind instrument and operated in opening and closing movements by the tooth profile of a sound loudness-control cam driven together with a sound pitch-control cam, and the bellows is actuated by a separate driving mechanism to supply air stored therewithin to the air inlet port of the wind instrument in accordance with valve, degree of opening of the valve, whereby the loudness of the emitted sound is controlled. At the same time, the time duration of the sound is varied by varying the length in the circumferential direction of the cam teeth. Consequently, the entire device unavoidably becomes very complicated, bulky, and expensive.

## SUMMARY OF THE INVENTION

It is an object of the present invention to provide a device for automatically sounding wind instruments which is not accompanied by the above-described drawback.

More specifically, an object of the invention is to provide a device of the above-described class in which a combination of bellows-actuating means, sound duration-control means, and sound loudness-control means are all incorporated integrally in a single cam-actuated mechanism, whereby the device can be greatly simplified and produced at relatively low cost.

According to the present invention, briefly summarized, there is provided a device for sounding a wind instrument in which there are provided a sound pitch-control cam, a bellows-actuating cam driven together with the pitch-control cam and having numerous cam teeth of a profile in accordance at least with the desired sound duration, a bellows having an actuating head and an air discharge port connected to the wind instrument, which bellows has an elastic characteristic whereby it can be compressed by a force applied at its actuating head but continually tends to return to a normally expanded state, and a lever mechanism having a cam-following part for following the cam tooth profile of the bellows-actuating cam and an actuating part coupled to the actuating head of the bellows, whereby the bellows is compressed in accordance with the cam tooth profile to blow air into and thereby sound the wind instrument.

The nature, principle, and utility of the invention will be more clearly apparent from the following detailed description with respect to a preferred embodiment of the invention when read in conjunction with the accompanying drawing, throughout which like parts are designated by like reference numerals.

## BRIEF DESCRIPTION OF THE DRAWING

In the drawing:

FIG. 1 is a view herein designated as a side elevation, with a part in section, showing one example of a whistle-sounding device according to the invention;

FIG. 2 is a plan view, with parts cut away, of the device shown in FIG. 1;

FIG. 3 is vertical section taken in the plane indicated by line III—III shown in FIG. 1 and viewed in the arrow direction;



FIG. 4 is a fragmentary diagram showing a part of the profile in developed form of a pitch-adjusting cam used in the device; and

FIG. 5 is a fragmentary diagram showing a part of the profile in developed form of a bellows-actuating cam used in the device.

## DETAILED DESCRIPTION

Referring to the drawing, the functional parts of the whistle-blowing device shown therein are mounted as a compact assembly on a baseplate 3. Three stud posts or pillars 3*a* fixed to the baseplate 3 rigidly support a bridge plate 11 parallel to the baseplate, and a drive spring shaft 12 is rotatably supported between and perpendicular to this bridge plate and the baseplate. This spring shaft 12 can rotate in only one direction (the arrow direction in FIG. 1 or counterclockwise as viewed in FIG. 2), being prevented from rotating in reverse direction by mechanism as described below.

A pawl disk 13*a* having three cantilever spring pawls 13 is coaxially fixed to the spring shaft 12 in a position such that the working tooth tips of the pawls 13 are pressed by spring force against one surface (the lower surface as viewed in FIG. 1) of the bridge plate 11. In positions in a circle coaxial with the spring shaft 12 to confront the tooth tips of the spring pawls 13, there are formed in the bridge plate 11 a large number of joggled or raised parts 14 and tooth ledges 15 resembling ratchet teeth. Thus, the tooth tips of the spring pawls 13 engage with these ledges 15, whereby reverse rotation of the drive spring shaft 12 is prevented.

Between the bridge plate 11 and the baseplate 3 and coaxially around the shaft 12, there is provided a rotating barrel 21 comprising a cup-shaped cylinder 16 having gear teeth 17 formed around the outer periphery thereof, a sound pitch-control cam 18 of cap shape having a large number of cam projections or teeth 19 formed on the outer periphery thereof, a bellows-actuating cam 1 of annular shape interposed between the cam 18 and the cylinder 16 and having cam teeth 2 formed on the outer periphery thereof, and screws 20 integrally connecting these barrel parts. These barrel parts 18, 1, and 16 are made of a thermoplastic resin of high resistance to wear.

The rotating barrel 21 houses a sealed-in drive spring 22 of spirally wound ribbon-type disposed around the middle part of the aforementioned drive spring shaft 12 and having outer and inner ends respectively anchored to the inner wall of the barrel 21 and the shaft 12. Furthermore, the barrel 21 is supported around the shaft 12 in a manner such as to permit only rotation of the barrel. Accordingly, when the drive spring shaft 12 is rotated in the arrow direction shown in FIG. 1 to wind the drive spring 22, a torque urging the barrel to rotate in the arrow direction (counterclockwise) in FIG. 2 is applied thereto by the drive spring thus wound.

To one side of the barrel 21, there is provided a bellows assembly comprising a bellows 8 of cup shape with a rim part of maximum diameter at its open end and a disk 25 having an opening for receiving the air-blowing tube 9 of a whistle 10, the rim part of the bellows 8 being secured in an airtight manner around the outer periphery of the disk 25. The disk 25 is rigidly supported with its axis parallel to the baseplate 3 by two pillars 26 fixed to and supported by the baseplate 3, and the bellows 8 is thereby supported with its axis also parallel to the baseplate 3.

The bellows 8 is made of a rubber material and diminishes stepwisely in diameter from its open end secured to the disk 25 to its closed end 8*a*, which has a relatively large thickness and thereby constitutes a relatively rigid head structure. This head structure 8*a* is provided on its outer central part with a necked or grooved buttonlike part 23, which is engaged by a fork 24 formed on the end of one arm of a lever 7 pivoted on a pivot pin 4 mounted on the baseplate 3 perpendicular thereto.

The lever 7, which thereby can pivot in a plane parallel to the baseplate 3, has an opposite arm having an end in the form

of a cam follower **6** for contacting and following the profile of the aforementioned bellows-actuating cam I. The bellows **8**, which is of elastically flexible nature permitting it to be expanded and compressed, assumes a normally expanded state when free and, therefore, continually exerts a force on the fork **24** whereby the follower **6** is caused continually to follow the profile of the bellows-actuating cam **1**.

The aforementioned whistle **10**, having an air-blowing tube **9** fitted in an aperture in the disk **25**, is of known flute type having a guide piece **27** for forming a narrow slit within the tube **9**, an edge opening **28**, and an air-column tube **29** open at its outer end. The air-column tube **29** is provided therewithin with a slidable piston **30** for adjusting the length of the air column or air vibration chamber within the tube **29** and thereby the whistle sound pitch. The outer side of the piston **30** is fixed to the inner end of a piston rod **31**, the outer end of which extends out of the tube **29** at the open end thereof and has a necked or grooved buttonlike part **32**.

The buttonlike part **32** is engaged with a fork **35** formed on the end of one arm of a lever **34** pivoted by a pivot pin **33** disposed perpendicularly to the baseplate **3** and supported on a pillar **37** fixed perpendicularly to the baseplate. The lever **34**, which is thereby pivoted to rotate in a plane parallel to the baseplate, has another arm with an end in the form of a cam follower **36** to follow the profile **19** of the aforementioned pitch-control cam **18**. The cam follower **36** is continually pressed against the outer periphery of the pitch-control cam **18** by a wound spring **38** disposed around the upper part of the pillar **37** and engaged at its ends respectively with a pillar **37***a* formed integrally with the pillar **37** and the lever **34**.

Accordingly, rotation of pitch-control cam **18** causes oscillatory motion of lever **34** about pivot **33**, whereby, in accordance with the shape and dimensions of projections **19** on the periphery of the cam **18**, piston **30** slides within air-column tube **29** to vary the length of the air column therewithin and thereby to control the sound pitch.

The rotational speed of the rotating barrel **21** is maintained at a substantially constant value, irrespective of the force exerted by the drive spring **22**, by a governor **39**, which is driven at increased speed by power derived from the gear **17** of the barrel **21**. More specifically, the rotation of the gear **17** is transmitted through a speed-increasing gear train comprising a pinion **40**, a gear **41**, a pinion **42**, a worm wheel **43**, and a worm **44** to a governor rotor **45** integrally fixed to the worm **44**.

The governor rotor **45** supports brakeshoes (not shown) which are operated by centrifugal force to expand and contact the internal wall surface of a brakedrum **46** mounted on the baseplate **3**.

When the rotational speed of the governor rotor **45** begins to exceed a predetermined value, the brakeshoes contact the brakedrum **46** to retard the rotation of the rotor **45** and thereby to maintain the rotational speed thereof at a constant value.

A lock lever **47** is pivotally supported by a pivot pin **48** on the baseplate and can be operated manually to hold the rotating barrel **21** indirectly in stopped state. More specifically, one arm of the lever **47** extending beyond the periphery of the baseplate **3** as viewed in plan view can be manipulated manually to cause the tip **49** of another arm of the lever to engage with a projecting lug **50** of the governor rotor **45** to lock the rotor against rotation and thereby to lock the barrel **21**.

A lever **51** is pivotally supported at its middle part by a pivot pin **53** on the bridge plate **11** and supports on the end of one arm thereof a platform **52** for mounting thereon a toy bird or the like (not shown). The opposite arm of the lever **51** is a bent L-shaped arm **54**, the lower end of which is placed in contact with the aforementioned lever **7** for transmitting actuating motion to the bellows **8**. Accordingly, oscillations of the lever **7** cause the platform **52**, and therefore the toy bird or the like, to bob up and down.

The device of the above-described organization according to the invention is wound and operates in the following manner. The drive spring **22** is wound up in the same manner as the main spring in an ordinary clock or similar clockwork mechanism. That is, lock lever **47** is placed in its locking position, and drive spring shaft **12** is rotated in the arrow direction of FIG. **1** by winding means (not shown) connected to the end thereof opposite the end to which pawl disk **13***a* is fixed thereby to wind drive spring **22**. Reverse rotation of the shaft **12** to cause unwinding of the spring **22** is prevented by the aforedescribed ratchet and pawl mechanism comprising the pawl disk **13***a* with its spring pawls **13** tooth ledges **15**.

The device is then in a state of readiness for its operation, which is started by turning lock lever **47** to its release position, whereupon rotating barrel **21** rotates at constant speed in the arrow direction shown in FIG. **2**.

Accordingly, bellows-actuating cam **1** rotates together with barrel **21**, and cam follower **6** follows the profile of cam **1**. That is, while cam follower **6** is being raised by a bellows-actuating inclined surface **5** of a cam tooth **2**, lever **7** is rotated in the clockwise direction as viewed in FIG. **2** about pivot **4**, whereby bellows **8** is compressed to blow air into whistle **10**, and a whistle sound is generated by edge opening **28**. Then, while cam follower **6** is descending the opposite inclined surface of cam tooth **2**, bellows **8** expands and is returned to its former state by its own elastic force.

Thus, variations in the duration of the sound thus generated can be produced by varying the length of the bellows-actuating inclined surface **5** of the cam **1**. Accordingly, by using this means of controlling the duration of the generated sound in conjunction with the aforedescribed means for controlling the pitch of the generated sound in accordance with the pitch-control cam **18**, it is possible to render sounds of various durations and different pitch in various combinations thereof.

Furthermore, when control of the loudness level of generated sound is required, this control can be accomplished by selectively varying the angles of the slopes $\theta$ (as indicated in FIG. **5**) relative to the datum line (actually an arc) of bellows-actuating inclined surfaces **5** of the pertinent cam teeth **2**. Then, since the rotational speed of the bellows-actuating cam **1** is substantially constant, the speed with which the bellows **8** is compressed is varied, whereby the loudness of the generated sound can be controlled.

Thus, the present invention provides a combination of a bellows-actuating means, a sound duration control means, and sound loudness control means all incorporated integrally in a single cam-actuated mechanism. Whereby blowing device for automatically sounding wind instruments including whistles can be simplified and produced at relatively low cost.

I claim:

**1**. In a device for automatically sounding a wind instrument of the class wherein means for controllably varying the length of the air column in the vibration chamber of said instrument is actuated by a sound pitch-control cam moving at substantially constant speed, the improved combination therewith of a bellows-actuating cam driven together with said pitch-control cam and provided around its peripheral cam surface with numerous cam teeth of tooth profile in accordance with at least respective sound durations, a bellows having an actuating head and an air discharge port connected to said wind instrument, said bellows having an elastic characteristic whereby it can be compressed but continually tends to return to a normally expanded state, and a lever mechanism having a cam-following part for engaging and following said cam tooth profile and an actuating part coupled to said actuating head of the bellows, whereby the bellows is compressed in accordance with the cam tooth profile to blow air into and thereby sound the wind instrument.

**2**. An improved combination as claimed in claim **1** in which said means for controllably varying the length of the air column in the vibration chamber of the instrument is a piston which is slidably operable within said chamber and is connected to a piston rod coupled to and actuated by a lever mechanism actuated by said sound pitch-control cam.

**3**. An improved combination as claimed in claim **1** in which said pitch-control cam and bellows-actuating cam are both formed on the outer cylindrical periphery of a single, hollow rotating barrel rotationally driven by a spring mechanism.