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PATENT SPECIFICATION

DRAWINGS ATTACHED

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COMPLETE SPECIFICATION

Improved Valve Structure for Musical Wind Instruments

I, PETER SIMON PROLL, a citizen of the United States of America, of 246 Pomona Avenue, Newark 12, United States of America, do hereby declare the invention for which I pray that a patent may be granted to me, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to musical wind instrument, especially toy instruments. More particularly, it relates to improvements in the valve structure of instruments having manually controlled valves and return springs for restoring the valves to normal, unoperated, i.e., undepressed, position after they have been operated by being depressed. The term "valve" is used herein in its ordinary sense in the musical instrument art to mean the movable member whose movement determines the note being played.

The present conventional valve and spring structure used in such instruments is relatively expensive to make, and time-consuming, and therefore expensive, to assemble. Consider, for example, the usual trumpet. It has a number of valve cylinders, in each of which is slidably received a plunger valve. A separate return coil spring is also provided for each plunger. Usually, the return spring is disposed between the inner face of the plunger and some fixed step against which the spring is compressed when the piston is moved inwardly. The plunger and the spring, being separate parts, are made individually, thereby increasing manufacturing costs. Furthermore, it is quite difficult and time-consuming to assemble the separate plunger and spring into the instrument. In the assembled instrument, the coil springs must normally be under some degree of compression to hold the plungers reasonable firmly biased to unoperated position. It will be seen therefore that the assembly operator is faced with the difficult task of placing the separate pieces in position to be assembled, and holding them so. Since the compressed coil spring is tending to return to its uncompressed state, if the operator releases his grip on the spring the parts fly apart. Various specially constructed jigs and fixtures can help somewhat in overcoming these assembly difficulties, but it nevertheless remains a time-consuming operation.

The present invention, whose scope is defined in the appended claims, substantially eliminates the foregoing problems by making the valve plunger and its return spring as one integral homogeneous unit of moulded plastics material. By this means the cost of making the parts is substantially reduced and the assembly operation is considerably simplified.

As a further refinement of the invention, a number of the individual integral plunger and spring units may be formed connected together as a single integral homogeneous moulding of plastics material, which can be assembled as a unit into the instrument.

Particular embodiments of the invention are further described below with reference to the accompanying drawing, in which:

Figure 1 is a side elevational view partially in section of a toy trumpet embodying the invention;

Figure 2 is a sectional view taken on line 2-2 of Figure 1;

Figure 3 is a fragmentary view, corresponding to part of Figure 2, but showing the valve depressed to its maximum operated position;

Figure 4 is a detail view of a modified integral valve and return spring in accordance with the invention;

Figure 5 is a sectional plan view of another modified form of the invention in

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which a number of the integral valve and spring units are formed as an integral composite;

Figure 6 is a fragmentary sectional elevation of an instrument having assembled therein the integral multiple valve composite of Figure 5;

Figure 7 is a view similar to Figure 4, showing an integral valve and spring unit with a modified form of spring; and

Figure 8 is a similar view, showing still another modified form of spring.

Still referring to the drawing, and particularly Figures 1, 2, and 3, the reference numeral 1 designates a musical instrument in which the invention is embodied. A toy trumpet has been shown for illustrative purposes, but it will be understood that the invention can readily be employed in other types of musical wind instruments which include valve plungers and return springs. However, the invention is particularly useful for toys, since the reduced costs flowing from its use are most important with inexpensive instruments.

The body 2 of the toy instrument is made up of two separately formed complementary halves 2a and 2b. These can be fabricated of any desired material, for example, a moulded synthetic resin, and are adhesively secured together to form the instrument body. The instrument includes a mouthpiece 3 into which the player blows. Communicating with the mouthpiece is a downwardly extending air passage 4 which leads to a known type of integral plastic reed unit 5. Reed unit 5 comprises a series of differently tuned reeds 6. When air is blown (upwardly in Figures 1 and 2), past any one of the reeds 6, the latter sounds a particular note dependent on the predetermined physical characteristics of the reed.

Each reed is disposed at the bottom of a related chamber 7 which opens into a cylindrical valve chamber 10. Formed at the upper end of the valve chamber is an inwardly extending annular rib 11 of substantially triangular cross-section, The lower, sloping inwardly facing surface 11a of rib 11 provides a valve seat.

Loosely disposed within each valve chamber 10 for longitudinal sliding movement is the plunger or piston member 12a of a manually operable valve 12, shortly to be described in detail. Plunger 12a includes a sloping annular valve surface 12b which is normally urged by the valve return coil spring 12c against the sloping or bevelled downwardly facing seat surface of rib 11. Thus the plunger, which constitutes the valve proper, normally seals off the opening defined by the inner, circular edge of rib 11. This opening is the means whereby the valve cylinder chamber 10 communicates with an overlying chamber 13 which terminates at its upper end in a frusto-conical cap 14 having a central opening 14a.

The valve 12 includes an intermediate elongated stem 12d which, as shown, terminates in a disc-like finger piece 12e to be engaged by the player's finger. Stem 12d passes loosely through opening 14a of cap 14. An inwardly extending circular rib 10a supports the lower end of coil spring 12c.

When it is desired to play the note adapted to be generated by any reed 6, the related valve 12 is depressed whereby the plunger valve surface 12b is lowered to open communication between chambers 10 and 13. Thus, air blown into the mouthpiece 3 travels through passage 4 to the underside of reed unit 5 and then upwardly past the red, thereby sounding the reed's note, and through chamber 10 into chamber 13. From chamber 13, the air travels out through the associated cap 14. It also passes to the adjacent chamber 13, each of the latter communicating laterally with the adjacent chamber 13. It will be understood that if the plunger is not depressed, air cannot travel from chamber 10 to chamber 13. Therefore, there will be no air flow past the reed, and the latter will not sound.

The integral one-piece valve 12 will now be described in greater detail. It includes aforementioned finger piece 12e, stem 12d, plunger 12a, and return spring 12c. The latter terminates in upper and lower flat coils 12f, 12g, respectively. The plunger is a thin annular hollow shell. It comprises a frusto-conical upper portion whose sloping outer surface provides the operative valve surface 12b; and horizontally spaced, vertical legs which are separated by ports 12h and which are integral with the upper flat coil 12f. An integral depending rod 12i forming an extension of stem 12d extends from the centre of hollow plunger 12a.

The entire aforedescribed valve 12, comprising the components 12a-12i inclusive, is a single, one-piece article, fabricated by plastic moulding techniques from any suitable synthetic resin such as polyethylene, polystyrene, etc. Thus, manufacturing cost is considerably reduced over prior art methods wherein the parts are formed separately.

Additionally, the time required to assemble the instrument is lessened substantially. As mentioned earlier, the body of the instrument is made of two separate complementary halves 2a, 2b. Each body half has formed therein its semi-circular half of rib 11 and of valve chamber 10 including rib 10a. For assembly, the integral valve units 12 are merely placed in position in one of the body valves, the other body half then appropriately abutted against the first half, and the two cemented together.

The depending rod 12i of each valve unit

is adapted to abut a cooperable integral inwardly extending pin 15 of each valve chamber 10 when the valve is depressed, to prevent complete compression of coil spring 12c. Such complete compression, with adjacent coils contacting each other, would block or impede air flow passing up through the centre of spring 12c to escape outwardly and then upwardly past valve seat 11a from chamber 10 into chamber 13. Ports 12h are needed for this purpose when the coils of spring 12c closely fit the interior of valve chamber 10, so that most of the air is forced to travel up through the centre of the spring. The ports 12h are of any suitable size, shape, and number to permit the necessary flow of air.

Preferably, though not necessarily, the lowermost flat coil 12g of the spring is split (see particularly Figure 5) and before assembly into the instrument is of a larger diameter than the valve chamber 10 so that the spring is firmly held in the valve chamber.

Figure 4 shows a modified form of the invention in which the spring coils are formed integrally with short longitudinally extending lugs 16 adapted to abut the adjacent coil to prevent complete compression of the spring. This arrangement eliminates the need for the depending rod 12i and the pin 15 of Figures 1-3, which perform the same function.

Figures 5 and 6 show another form of the invention, in which a number of the integral valve units 12 are formed as one integral composite 17 integrally joined together at their lowermost, flat coils 12g by connector bars 17a. The integral plural-valve composite of Figure 5 is formed as a single plastic moulding from suitable material, such as polyethylene, polystyrene, etc. In the form of Figure 5, the valves 12 are spaced apart the same distance as the valve chambers 10. The entire plural-valve composite 17 of Figure 5 is itself adapted to be assembled as a unit into the musical instrument. This further reduces assembly time, since the operator handles as one complete unit a number of valves rather than just one valve. In the form of Figures 5 and 6, instead of relying on split lowermost coils 12g to hold the lower ends of the springs in place, the cross bars 17a can be held clamped between opposed portions 18, 19 provided in the instrument body.

Figures 7 and 8 show alternative forms of the invention, in which return springs other than coils springs are used. In Figure 7, the spring comprises outwardly curved spring arms 20. In Figure 8, the spring 21 has a flat serpentine or S shape.

In both Figures 7 and 8, the entire valve shown is a single integral unit, including a lowermost flat portion similar to coil 12g of the previous forms. The valve of Figures 7 and 8 can either be made individually, as in Figures 1-4, or as an integral plural-valve composite unit like Figure 5.

Although the integral one-piece valve has been disclosed as including the integral finger piece 12e, the latter can if desired be formed separately. It could then be secured to the top of stem 12d after the valve is assembled into this instrument. It will be recalled that the cooperating stem extension 12i and pin 15 of Figures 1,3, and the lugs 16 of Figure 4 both limit the valve's downward movement. This will also prevent the stem 12d from being pushed so far down that it does not project above cap 14 while the finger piece is being secured to the stem.

For purposes of illustration, there have been shown and described various specific examples and forms of the invention and its features. It will be understood, however, that the invention and its features can be carried out and applied in numerous other specific embodiments. Different proportions, materials, sizes, shapes can be employed. The invention can be applied to other types of musical wind instruments.

WHAT I CLAIM IS:—

1. In a musical wind instrument having a chamber and a port communicating with the chamber, valve means for opening and closing the port, to permit and prevent respectively the flow of air through the chamber, comprising a valve member movable between a position in which it closes the port and a position in which it leaves the port open and a spring urging the valve member into one of its said positions, the valve member being manually displacable into the other of its said positions against the action of the spring, wherein the valve member and the spring are formed as parts of the same homogeneous, integral moulding of a plastics material.

2. In a musical wind instrument, valve means in accordance with claim 1 and including a stem, also forming part of the same integral moulding, for effecting manual displacement of the valve member.

3. In a musical wind instrument, valve means in accordance with claim 1 or 2, and including, at the end of the spring remote from the valve member, a split ring also forming part of the same integral moulding for engaging the walls of the chamber and firmly holding the spring therein.

4. In a musical wind instrument, valve means in accordance with any of the preceding claims, wherein the spring is a helical coil compression spring and means are provided for preventing complete compression of the spring.

5. In a musical wind instrument, valve means in accordance with claim 4, wherein

is adapted to abut a cooperable integral inwardly extending pin 15 of each valve chamber 10 when the valve is depressed, to prevent complete compression of coil spring 12c. Such complete compression, with adjacent coils contacting each other, would block or impede air flow passing up through the centre of spring 12c to escape outwardly and then upwardly past valve seat 11a from chamber 10 into chamber 13. Ports 12h are needed for this purpose when the coils of spring 12c closely fit the interior of valve chamber 10, so that most of the air is forced to travel up through the centre of the spring. The ports 12h are of any suitable size, shape, and number to permit the necessary flow of air.

Preferably, though not necessarily, the lowermost flat coil 12g of the spring is split (see particularly Figure 5) and before assembly into the instrument is of a larger diameter than the valve chamber 10 so that the spring is firmly held in the valve chamber.

Figure 4 shows a modified form of the invention in which the spring coils are formed integrally with short longitudinally extending lugs 16 adapted to abut the adjacent coil to prevent complete compression of the spring. This arrangement eliminates the need for the depending rod 12i and the pin 15 of Figures 1-3, which perform the same function.

Figures 5 and 6 show another form of the invention, in which a number of the integral valve units 12 are formed as one integral composite 17 integrally joined together at their lowermost, flat coils 12g by connector bars 17a. The integral plural-valve composite of Figure 5 is formed as a single plastic moulding from suitable material, such as polyethylene, polystyrene, etc. In the form of Figure 5, the valves 12 are spaced apart the same distance as the valve chambers 10. The entire plural-valve composite 17 of Figure 5 is itself adapted to be assembled as a unit into the musical instrument. This further reduces assembly time, since the operator handles as one complete unit a number of valves rather than just one valve. In the form of Figures 5 and 6, instead of relying on split lowermost coils 12g to hold the lower ends of the springs in place, the cross bars 17a can be held clamped between opposed portions 18, 19 provided in the instrument body.

Figures 7 and 8 show alternative forms of the invention, in which return springs other than coils springs are used. In Figure 7, the spring comprises outwardly curved spring arms 20. In Figure 8, the spring 21 has a flat serpentine or S shape.

In both Figures 7 and 8, the entire valve shown is a single integral unit, including a lowermost flat portion similar to coil 12g of the previous forms. The valve of Figures 7 and 8 can either be made individually, as in Figures 1-4, or as an integral plural-valve composite unit like Figure 5.

Although the integral one-piece valve has been disclosed as including the integral finger piece 12e, the latter can if desired be formed separately. It could then be secured to the top of stem 12d after the valve is assembled into this instrument. It will be recalled that the cooperating stem extension 12i and pin 15 of Figures 1,3, and the lugs 16 of Figure 4 both limit the valve's downward movement. This will also prevent the stem 12d from being pushed so far down that it does not project above cap 14 while the finger piece is being secured to the stem.

For purposes of illustration, there have been shown and described various specific examples and forms of the invention and its features. It will be understood, however, that the invention and its features can be carried out and applied in numerous other specific embodiments. Different proportions, materials, sizes, shapes can be employed. The invention can be applied to other types of musical wind instruments.

WHAT I CLAIM IS:—

1. In a musical wind instrument having a chamber and a port communicating with the chamber, valve means for opening and closing the port, to permit and prevent respectively the flow of air through the chamber, comprising a valve member movable between a position in which it closes the port and a position in which it leaves the port open and a spring urging the valve member into one of its said positions, the valve member being manually displacable into the other of its said positions against the action of the spring, wherein the valve member and the spring are formed as parts of the same homogeneous, integral moulding of a plastics material.

2. In a musical wind instrument, valve means in accordance with claim 1 and including a stem, also forming part of the same integral moulding, for effecting manual displacement of the valve member.

3. In a musical wind instrument, valve means in accordance with claim 1 or 2, and including, at the end of the spring remote from the valve member, a split ring also forming part of the same integral moulding for engaging the walls of the chamber and firmly holding the spring therein.

4. In a musical wind instrument, valve means in accordance with any of the preceding claims, wherein the spring is a helical coil compression spring and means are provided for preventing complete compression of the spring.

5. In a musical wind instrument, valve means in accordance with claim 4, wherein

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said preventing means comprises a stop member, projecting from said valve member and also forming part of the same integral moulding, for engaging an abutment in the chamber.

6. In a musical wind instrument, valve means in accordance with claim 4, wherein said preventing means comprises projections formed integrally upon the coils of the spring and each arranged to engage an adjacent coil.

7. In a musical wind instrument having a plurality of chambers each having a port communicating therewith, a like plurality of valve means, each in accordance with any of the preceding claims, for opening and closing the respective ports, all of said valve means being formed as parts of the same homogeneous, integral moulding of a plastics material.

8. In a musical wind instrument, valve means substantially as herein described with reference to any of the Figures of the accompanying drawing.

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