May 26, 1942. N. C. PICKERING 2,284,016

WIND MUSICAL INSTRUMENT

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Fig. 1

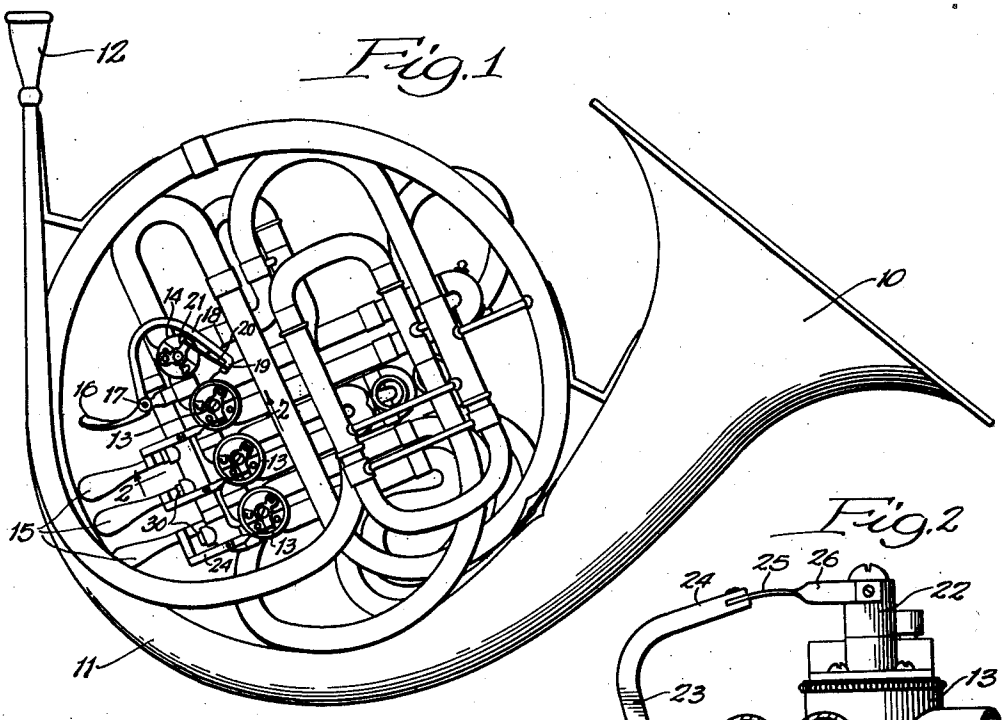


Fig. 2

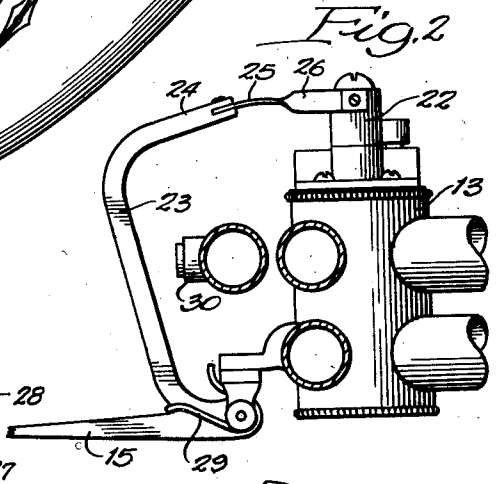


Fig. 3

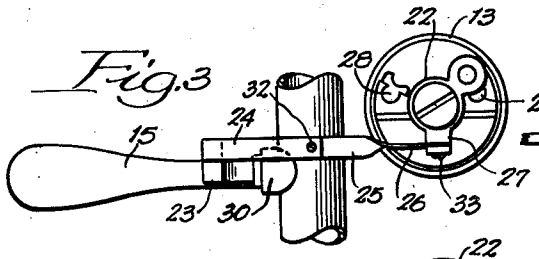


Fig. 4

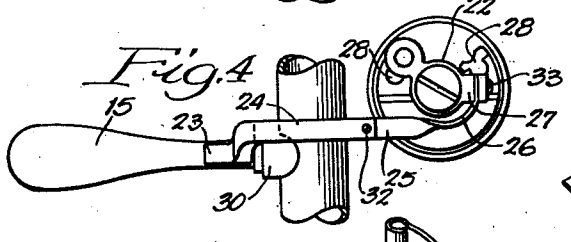


Fig. 5

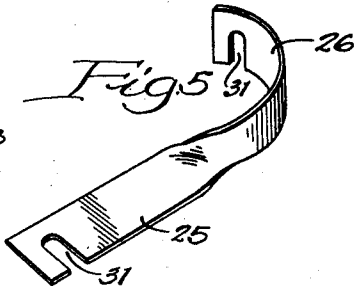


Fig. 7

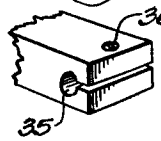
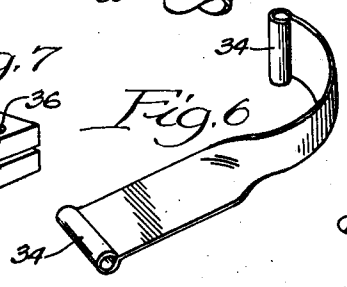


Fig. 6



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Fig. 8

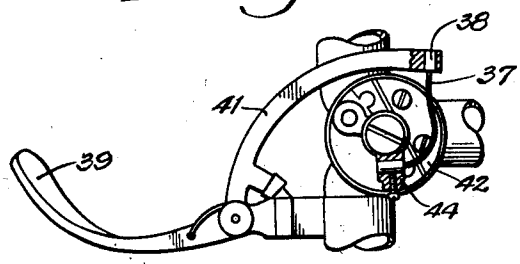


Fig. 9

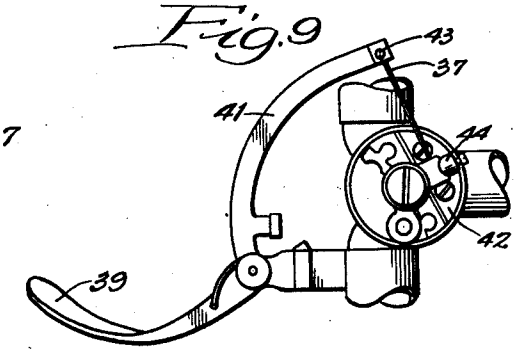


Fig. 10

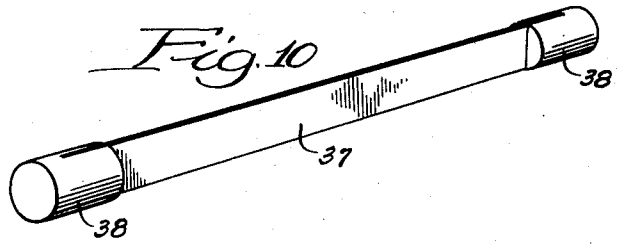


Fig. 11

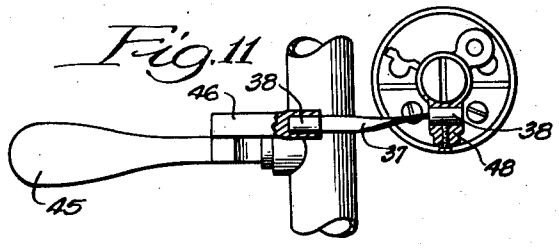


Fig. 13

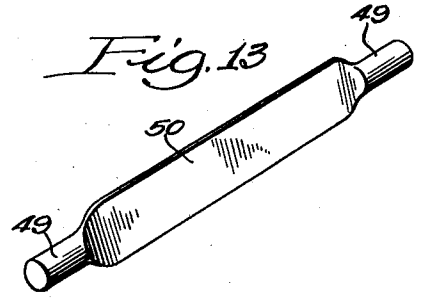
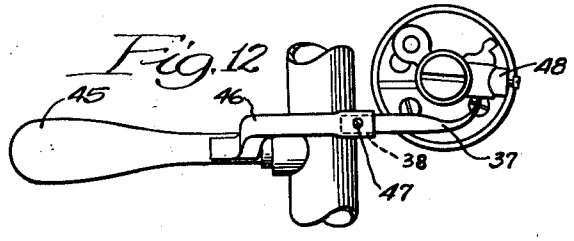


Fig. 12



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Patented May 26, 1942

2,284,016

UNITED STATES PATENT OFFICE

2,284,016

WIND MUSICAL INSTRUMENT

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Application August 27, 1941, Serial No. 408,417

12 Claims. (Cl. 84—390)

This invention relates to wind musical instruments and more particularly to operating means for the valves of French horns and like instruments having rotary valves.

In French horns and the like it has been the usual practice to connect the operating levers to the valves by means of string wrapped around the valve rod and connected at its opposite ends to the operating lever. One disadvantage of the use of string is that it tends to wear and break easily. It is, furthermore, difficult to replace broken strings in connections of this type and the wrapping of the string around the valve rod creates a certain drag interfering with free operation of the valves.

One expedient which has been employed to overcome these disadvantages is the use of linkage connecting the valve lever to the valve in place of string. Such linkage, however, must necessarily be relatively complicated in order to produce the desired valve movement and the pivots have a tendency to wear rapidly, creating noise and improper valve operation.

The present invention has for one of its objects to provide a musical wind instrument in which the valves are operated by an extremely simple mechanism having a minimum of moving parts, having no pivots, which can easily be replaced, and which will provide an improved feel or touch for the valve operating mechanism.

Another object of the invention is to provide a musical wind instrument in which the valves are connected to the operating lever by a flexible spring strip.

Still another object of the invention is to provide a musical wind instrument in which the valves are operated through spring strips having a predetermined normal curvature to bias the valve in one direction. Due to the fact that the effective leverage of such strips on the valve changes in different positions of the valve, the feel of the valve can be controlled by varying the amount or direction of the spring bias to obtain any desired condition.

The above and other objects and advantages of the invention will be apparent from the following description when read in connection with the accompanying drawings, in which:

Figure 1 is a side view of a French horn embodying the invention;

Figure 2 is an enlarged side elevation with parts in section of one of the valves;

Figure 3 is an enlarged end elevation of the valve on Figure 2;

Figure 4 is a view similar to Figure 3 with the parts in a different position;

Figure 5 is a perspective view of a spring;

Figure 6 is a perspective view of an alternative spring construction;

Figure 7 is a partial perspective view illustrating the manner of connecting the spring of Figure 6;

Figures 8 and 9 are views similar to Figures 3 and 4 of another construction;

Figure 10 is an enlarged perspective of a spring;

Figures 11 and 12 are views similar to Figures 3 and 4 of still another construction; and

Figure 13 is an enlarged perspective of another type of spring.

The horn shown in Figure 1 comprises a bell 10 connected through the usual tubing 11 to a mouthpiece 12. Three finger valves 13 are provided in the tubing for controlling alternative connections therethrough to vary the pitch of the instrument and a thumb valve 14 is provided to change the length of the tubing through the valves 13 to vary the key. The valves 13 are operated by finger levers 15 and the valve 14 is operated by a similar thumb lever 16. As seen in Figure 1, the thumb lever 16 is pivoted at 17 on an axis parallel to the axis of the valve 14 and has an extension 18 extending at one side of the valve axis. At its end the extension 18 is turned up as indicated at 19 for connection to a leaf spring 20 which is connected to the valve rod by means of an arm 21 extending laterally therefrom. When the thumb lever 16 is depressed, the end 19 thereof will go toward the valve, pushing on the spring 20 to rotate the valve so as to move it from one position to another. During this operation, the spring will curl around the valve axis and will be flexed laterally to turn the valve. As shown, the valve turns through substantially one hundred twenty degrees (120°), although this may vary with different valves.

According to one important feature of the invention, the spring strip 20 may be pre-bent so as to have a tendency to curl toward the valve axis. When the valve is in the normal position shown in Figure 1, the pressure exerted by the spring 20 will be substantially at right angles to the valve axis and will have little or no turning effect on the valve. For large angles, the valve may turn across the right angle position so that when it is in normal position, the spring bias tends to urge it in one direction and tends to urge it in the other direction as it is moved. However, if the thumb lever is rocked, the bias of the spring

will become more effective, tending to turn the valve. By varying the strength and amount of pre-curvature of the spring, the feel of the valve can thus be controlled so that it will open easier toward the end of its movement than at the beginning. It will be understood, of course, that the thumb lever 16 is urged to the normal position shown by means of a spring which may be wound around the pivots 17.

The finger valves 13, as best seen in Figures 2 to 4, have valve rods 22 extending from one end thereof. The finger levers 15 are in the form of bell cranks having extending portions 23 terminating in downturned ends 24 movable generally toward and away from the valve rods 22 as the levers are rocked. The ends 24 of the finger levers are preferably split to receive one end of a spring strip 25 which is twisted intermediate its end to provide a second end portion 26 at right angles to the end 25. The end 26 is connected to a lug or ear 27 extending radially outward from the valve rod 22 so that the valve rod is rigidly connected to the finger lever.

Stops 28 may be provided to limit movement of the valve in opposite directions, the valve normally being held in the position shown in Figure 3 by means of a coil spring 29 urging the finger lever in a counter-clockwise direction, as seen in Figure 2. This is the normal or released position of the parts, it being noted that in this position the end portion 25 of the spring strip is bent slightly due to the position of the lever end 24.

When the finger lever 15 is depressed a thrust will be exerted on the spring strip to rock the valve rod 22 and the valve about its axis. This position of the parts is shown in Figure 4 with the end portion 26 of the spring strip curved around the valve axis and with the valve against the opposite end stop 28. In order to prevent undue strain on the spring strip, a stop 30 may be provided carried by one of the instrument pipes to limit downward movement of the lever portion 23.

The spring strip may be pre-curved if desired, as explained above in connection with the spring strip 20, to provide a biasing force on the valve so as to vary the feel thereof. Preferably the end portion 26 of the strip is curved, as shown in Figure 5, so as to exert a force toward the valve rod 22 when the parts are in the normal position shown in Figure 3. At this time, the biasing force being at right angles to the valve axis has no tendency to turn the valve, but if the valve is turned toward the position of Figure 4, the biasing force becomes more effective to assist in turning the valve. By properly balancing the spring 29 and the spring strip, any desired feel of the valve may be obtained.

As shown in Figures 1 to 5, the spring strip is notched at its ends as indicated at 31 to receive fastening screws 32 in the split end of the lever 24 and similar screws 33 extending into the lugs or ears 27.

Figures 6 and 7 illustrate an alternative method of connecting the spring strip in which the ends of the strip are rolled as indicated at 34 to fit in keyhole shaped slits 35, formed in the ends of the finger lever and valve ear. In assembling the spring in this construction, the ends of the rolled portions 34 are slipped laterally into the slots 35 with the body of the spring projecting out through the narrow portion of the slot. If desired, for additional security, the springs may be clamped into the slots by means of screws threaded into the side thereof.

In the embodiment shown in Figures 8 to 12, a different type of spring is employed, as shown in detail in Figure 10. This spring comprises a flat leaf spring 37, having connected to its ends cylindrical plug members 38. The spring and plug members may be connected in any desired manner, as for example by soldering, to form a rigid assembly.

Figures 8 and 9 illustrate the connection of a spring of this character to a thumb valve, the spring being so arranged as to be in tension rather than in compression, as in Figure 1. As shown, the thumb lever 39 has a curved end portion 41 lying beside and movable substantially radially toward and away from the thumb valve, indicated at 42. One of the plugs 38 on a spring 37 is inserted in an opening in the end of the lever portion 41, and is secured therein by a set screw 43. The opposite plug extends into an opening in a radial lug or ear 44 on the valve rod and is similarly held in place. In the normal position of the valve, as shown in Figure 8, the spring is curved around the valve rod and the end of the lever 41 is in its position nearest to the valve. As the thumb lever 39 is depressed, the end of lever 41 moves away from the valve, pulling on the spring 37 and rocking the valve in a counter-clockwise position to the position shown in Figure 2. At this time the spring has been substantially straightened out.

It will be understood that this spring may be pre-bent to exert a rocking force on the valve in much the same way as the springs described above in connection with Figures 1 to 7.

Figures 11 and 12 illustrate the manner of connecting this same spring to one of the finger valves having a finger lever 45 terminating in a down-turned end 46. The end 46 of the lever 45 is formed with a socket to receive one of the plugs 38, which is held in place by a set screw 47, and a lug or ear 48 on the valve rod is formed with a similar socket to receive the opposite plug. In installing the spring, one of the plugs is first placed in the socket and is tightened therein by the set screw. After placing the opposite plug in its socket, the spring is twisted through a ninety (90°) angle and the other set screw is tightened to hold it in place. This gives the spring a ninety degree (90°) angle placed intermediate its ends, so that it can flex in different directions in the same manner as the springs of Figures 2, 3 and 4. It will be understood that this spring may also be given a pre-curvature to create a bias, tending to turn the valve in one direction or the other.

Figure 13 illustrates an alternative spring construction in which the spring is formed from a piece of round stock, flattened intermediate its ends. As shown, the ends of the stick or bar are left cylindrical as indicated at 49, to be received in the sockets in the actuating lever and in the ear on the valve rod. Intermediate the ends, the stick is flattened to form a flat spring strip, as shown at 50. This spring may be used in the same manner and with the same fittings as those shown in Figures 8 to 12.

It will be seen that by the present invention a connection between the operating lever and rotary valve of a French horn or like instrument is formed with no movably connected parts and with no pivotal connections. A spring of this type is extremely simple and will last for a long period of time, since it may be flexed a large number of times without failure. Furthermore, in the event of breakage, the spring strip may be replaced very simply and inexpensively.

A highly important feature of the invention relates to the provision of means for controlling the feel of the valve in operation so that any desired characteristics can be obtained. Preferably, the spring is so adjusted as described above as to enable the valve to be operated with less pressure on the finger and thumb levers during the latter part of the valve movement than during the first movement of the valve. This, however, can obviously be varied as desired, and could be reversed to provide increased resistance to valve travel during the latter stages of its movement simply by reversing the position of the spring. In connection with the finger valves, as shown in Figure 2, a further variation in the feel can be obtained by pre-curving not only the end portion **26** of the spring strip, but also by pre-curving the portion **25**.

While one embodiment of the invention has been shown and described in detail, it will be understood that various changes might be made therein, and that the embodiment shown is not to be taken as a definition of the scope of the invention, reference being had for this purpose to the appended claims.

What is claimed is:

1. In a wind musical instrument having a rotary control valve, means for operating the valve comprising a pivoted lever having one end movable toward and away from the valve, and a flexible spring strip connected at its opposite ends to said end of the lever and to the valve to turn the valve as the lever is moved at least one of the connections being rigid whereby the spring is flexed during operation.

2. In a wind musical instrument having a rotary control valve, means for operating the valve comprising a pivoted lever having one end movable toward and away from the valve, and a flexible spring strip rigidly secured at one end to the lever and at its opposite end to the valve, said spring being curved to exert a resilient force on the valve tending to turn it in one direction.

3. In a wind musical instrument having a rotary control valve, means for operating the valve comprising a lever pivoted on an axis at an angle to the valve axis and having one end movable toward and away from the valve axis, and a spring strip twisted intermediate its ends so that its end portions lie at substantially the same angle as said axes, one end portion being rigidly connected to said one end of the lever and the other end portion being rigidly connected to the valve.

4. In a wind musical instrument having a rotary control valve, means for operating the valve comprising a lever pivoted on an axis at an angle to the valve axis and having one end movable toward and away from the valve axis, and a spring strip twisted intermediate its ends so that its end portions lie at substantially the same angle as said axes, one end portion being rigidly connected to said one end of the lever and the other end portion being rigidly connected to the valve, at least one end portion of the strip being curved to exert a resilient biasing force on the valve, tending to turn it in one direction.

5. In a wind musical instrument having a rotary control valve with a valve rod at one end thereof, operating means for the valve comprising a pivoted lever having one end movable toward and away from said valve rod in a path lying at one side of the valve rod, a spring strip secured at one end to said one end of the lever, and means securing the other end of the strip to the valve rod, said means extending radially from the valve rod in a line at an angle to said path and being rigidly connected to the other end of the strip.

6. In a wind musical instrument having a rotary control valve with a valve rod at one end thereof, operating means for the valve comprising a pivoted lever having one end movable toward and away from said valve rod in a path lying at one side of the valve rod, a spring strip secured at one end to said one end of the lever, and means securing the other end of the strip to the valve rod, said means extending radially from the valve rod in a line at an angle to said path and being rigidly connected to the other end of the strip, said strip being curved to exert a force toward the valve rod axis in said normal position.

7. In a wind musical instrument having a rotary control valve with a valve rod at one end thereof, operating means for the valve comprising a lever pivoted about an axis at a right angle to the valve axis having one end movable toward and away from said valve rod in a path lying at one side of the valve rod, a spring strip twisted to provide end portions at right angles, one of said portions being rigidly secured to said one end of the lever, and means rigidly securing the other end of the strip to the valve rod, said means extending radially from the valve rod in a line at an angle to said path and being connected to the other end of the strip.

8. In a wind musical instrument having a rotary control valve with a valve rod at one end thereof, operating means for the valve comprising a lever pivoted about an axis at a right angle to the valve axis having one end movable toward and away from said valve rod in a path lying at one side of the valve rod, a spring strip twisted to provide end portions at right angles, one of said portions being rigidly secured to said one end of the lever, and means rigidly securing the other end of the strip to the valve rod, said means extending radially from the valve rod in a line substantially at a right angle to said path and being connected to the other end of the strip at a point lying in said path when the valve and lever are in their normal position, at least one end portion of the strip being curved to exert a biasing force toward the valve axis in said normal position.

9. In a wind musical instrument having a rotary valve, operating means for the valve comprising a lever pivoted on an axis parallel to the valve axis and having one end movable toward and away from the valve, and a spring strip secured at one end to said end of the lever and at its other end rigidly secured to the valve.

10. In a wind musical instrument having a rotary valve, operating means for the valve comprising a lever pivoted on an axis parallel to the valve axis and having one end movable toward and away from the valve, and a spring strip secured at one end to said end of the lever and at its other end rigidly secured to the valve, and spring means normally urging said end of the lever toward the valve so that the spring strip will be placed in tension to turn the valve from said normal position.

11. In a wind musical instrument having a rotary valve, operating means comprising a part movable generally toward and away from the valve and having an opening therein, connect-

ing means on the valve having an opening therein, and a spring member formed with end portions fitting in said openings rigidly to connect the spring member to the part and connecting means and with a central resilient portion.

12. In a wind musical instrument having a rotary valve, operating means comprising a part movable generally toward and away from the valve and having a cylindrical opening therein, connecting means on the valve having a cylindrical opening therein, and a spring member formed with cylindrical end portions fitting in said openings rigidly to connect the spring member to the part and connecting means and with a flat central resilient portion.

NORMAN C. PICKERING.