E. A. COUTURIER.

WIND INSTRUMENT.

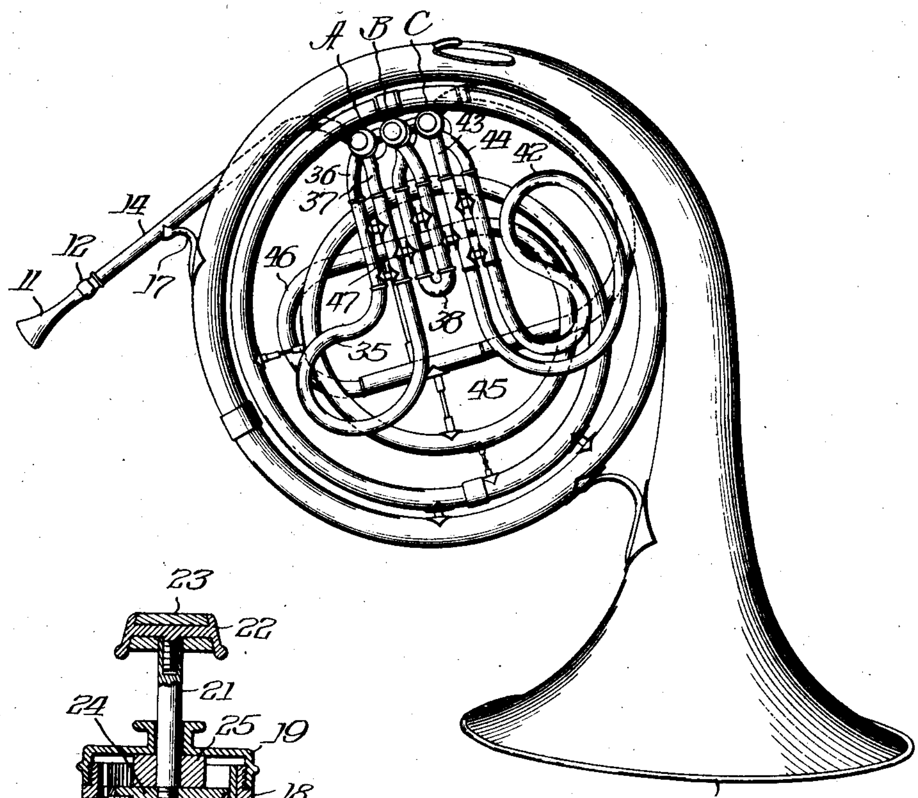
APPLICATION FILED SEPT. 12, 1921.

1,438,363.

Patented Dec. 12, 1922.

2 SHEETS—SHEET 1.

Fig. 1.



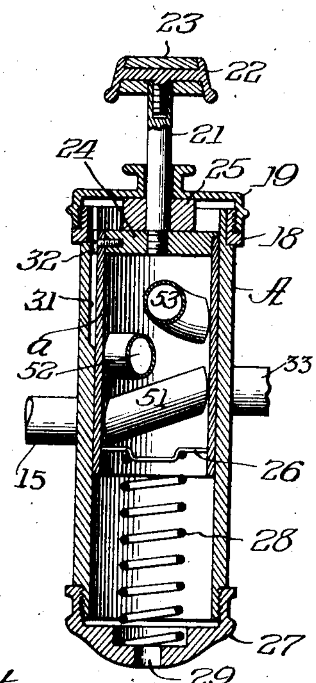
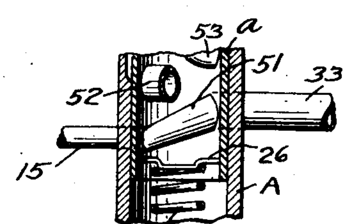


Fig. 2



28 FIG. 11.

Witness:
[signature]

Inventor
Ernest A. Couturier
By Ira J. Wilson Atty.

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2 SHEETS—SHEET 2.

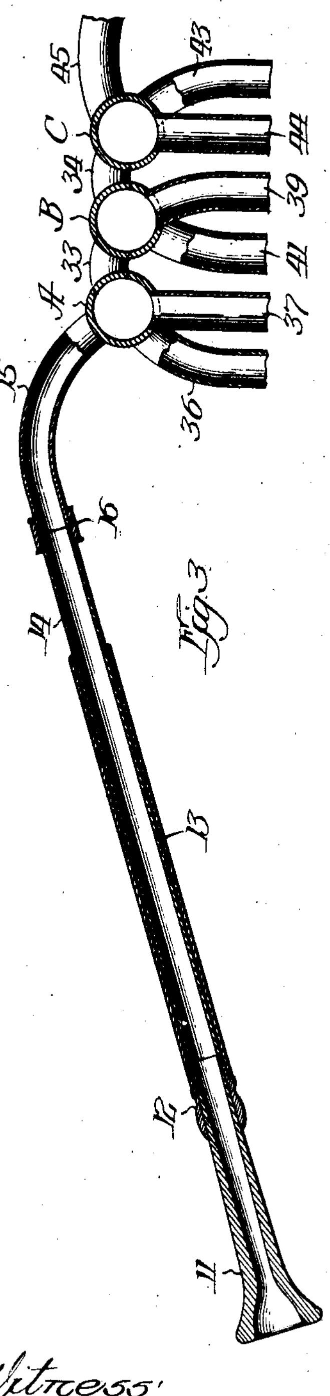

Fig. 3

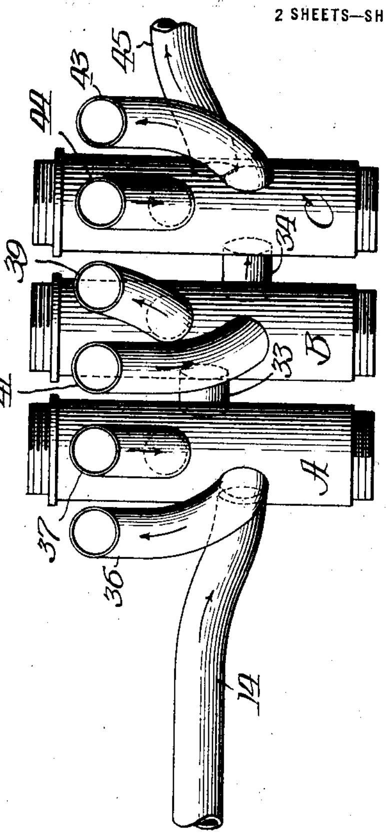

Fig. 10

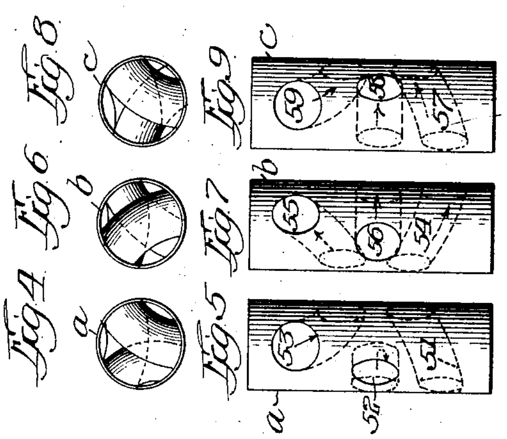

Fig. 4 Fig. 5 Fig. 6 Fig. 7 Fig. 8 Fig. 9

Witness:
Geo. C. Dorsor

Inventor
Ernest A. Couturier
By Ira J. Wilson Atty.

Patented Dec. 12, 1922. **1,438,363**

UNITED STATES PATENT OFFICE.

ERNST A. COUTURIER, OF LAPORTE, INDIANA.

WIND INSTRUMENT.

Application filed September 12, 1921. Serial No. 499,951.

To all whom it may concern:

Be it known that I, Ernst A. Couturier, a citizen of the United States, residing at Laporte, in the county of Laporte and State of Indiana, have invented certain new and useful Improvements in Wind Instruments, of which the following is a specification.

This invention relates in general to wind instruments and more particularly to valved instruments, and while the principles thereof are applicable to many types of instruments such as orchestra horns, ballad horns, cornets, trumpets, fluegel horns and alto horns, I have selected for illustrative purposes, a French horn in which the principles of my invention are embodied, as will be later understood.

In instruments of this character, it has heretofore been customary to employ a long mouthpipe which in the ordinary French horn is eighty inches or more in length before it enters the first valve chamber. Obviously, an appreciable amount of time is required for the sound wave produced at the mouthpiece to travel through the mouthpipe to the valve chambers, and consequently, if the valves are manipulated simultaneously with the production of the desired tones at the mouthpiece, the control of the tones by the valves will not be properly timed with respect to the production of the tones and therefore, the resultant tones delivered from the instrument will be more or less imperfect. This lagging of the sound waves between the mouth piece and the valves can be somewhat corrected by an experienced player, who from long practice, is able to partially compensate by his fingering of the valves for the inherent inaccuracies of the instrument, but even prolonged practice is unable to wholly overcome this defect. Another disadvantage of the ordinary instrument of this character resides in the fact that by reason of the long mouthpipe the ports or passages through the valve casings must be of considerable size, since the diameter of the bore of the instrument increases with the increase of distance from the mouthpiece. This large size of the valve passages necessitates a long stroke of the valve, and in the ordinary French horn, if a piston valve (which is the most desirable of the valves for this purpose) is employed, a stroke of approximately three-fourths of an inch in length is necessary to completely change the position of the valve passages with respect to their communicating pipes. Obviously, such a long stroke is very tiresome for the player, and in rapid work it is almost impossible of attainment. If a valve is only partially depressed, as it is very apt to be when speedy manipulation of the valves is required, the partial registration of the valve passages with the connected pipes inevitably results in an imperfect tone.

With a view of obviating such long strokes, it has been the practice to utilize rotary instead of piston valves, and while these valves may be manipulated with a shorter stroke, their action is sluggish and the liability of imperfect tones is not very materially reduced by their use. Furthermore, if all metal operating mechanism is used, the parts will rattle and cause an objectionable clicking when playing. If linen threads are used in lieu of metal parts the threads are apt to break in the midst of a passage, thus rendering the instrument useless as they cannot be quickly replaced.

One of the primary purposes of my present invention is to obviate the defects and disadvantages of instruments of the character above mentioned, and with this end in view, my invention contemplates the provision of an instrument in which a very short mouthpipe, opening directly into the first valve chamber, is used. This short mouthpipe brings the valves very close to the mouthpiece so that when they are manipulated practically simultaneously with the production of the tones, as they naturally are by a player, there is no appreciable lag in the sound waves between the mouthpiece and the valves and the tones produced are pure and perfect instead of being damped or prematurely cut off or abnormally elongated, as they customarily are in the ordinary instrument.

Another feature of my invention resides in the fact that by placing the valves close to the mouthpiece, the bore of the instrument where it enters the valve is not nearly so large as it is in the ordinary instrument, consequently, the valve passages may be made correspondingly smaller and the length of stroke of the valves is correspondingly diminished. By reason of this construction, I am able to employ piston valves, which are most desirable in instruments of this character, and by reason of the small passages, the stroke of these valves may be reduced to a point not to exceed approximately one-half inch in length, thus making them easy to manipulate by the player and extremely speedy in their action.

Another feature of my invention resides in placing the tuning slide beyond the valves, or in other words, between the valves and the bell of the instrument, as distinguished from placing it in the mouthpipe where it has heretofore been customarily located. By this construction, a fixed and invariable length of mouthpipe is maintained and the manipulation of the valves is always in perfect timed relation with the production of the tones instead of being roughly approximated and continually varied by the player in an endeavor to compensate for variations in the length of the mouthpipe resulting from movements of the slide in tuning the instrument.

Still another and a very important feature of my invention is the production of an instrument in which the bore or the passage through which the sound waves travel will be of continuously increasing diameter throughout the entire length of the instrument from mouthpiece to bell through the various valves and the valve pipes so that a gradual expansion of the sound waves and an accurate amplification of the tones is produced irrespective of the position of the valves, and consequently, irrespective of any increase in travel of sound waves through the various valve pipes which may be interposed in the sound passage.

Other objects and many of the attendant advantages of my invention will be readily appreciated as the same becomes better understood by reference to the following description when considered in connection with the accompanying drawings.

Referring to the drawings:

Fig. 1 is a side elevation of an instrument embodying my invention;

Fig. 2 is a longitudinal sectional view through one of the valves;

Fig. 3 is a sectional view somewhat diagrammatic in character showing the arrangement of the valves and the pipes connected thereto;

Fig. 4 is an end elevation of the first valve showing the arrangement of the passages therethrough;

Fig. 5 is a side elevation of the valve shown in Fig. 4;

Figs. 6 and 7 are plan and side elevations of the second valve;

Figs. 8 and 9 are similar views of the third valve;

Fig. 10 is a side elevation of the valve casings with the various pipes communicating therewith, and Fig. 11 is an exaggerated view of one of the valve passages.

Referring now to the drawings more in detail, reference character 11 indicates the mouthpiece of the instrument which may be of usual construction, detachably inserted in the receiver 12 carried by a sleeve 13 which embraces and strengthens the mouthpipe proper 14. For convenience, the mouthpipe is preferably made in two sections, the rear section 15 which communicates directly with the first valve casing being rigidly and permanently attached thereto and the two sections being united by a ferrule 16. It will be observed that the mouthpipe communicates directly with the first valve chamber without turns or windings and is very short, being in fact only about one-tenth as long as the usual mouthpipe heretofore employed. This brings the valves close to the mouthpiece and obviates lagging in the sound waves between the mouthpiece and the valves. For strengthening purposes, the mouthpipe is preferably attached by a bracket 17 to one of the larger convolutions of the instrument.

The three valve casings embodied in this instrument are designated on the drawings in their order as first, second, and third valves, by reference letters A, B and C respectively, and the valve plungers or valves therein are designated respectively *a*, *b* and *c*. While the valves differ from each other, as will be evident from Figs. 4 to 9 inclusive, the general construction of all of the valves is similar and I have therefore thought it necessary to illustrate but one of them in detail and have selected valve A for this purpose, which is clearly shown in Fig. 2 to which reference is now made.

The valve casing is tubular in form and its reduced upper end receives a snug fitting ferrule or ring 18 threaded to receive the cap 19 through which the valve stem 21 projects, this stem being equipped at its upper end with a finger piece 22 provided with a tip or button 23 made of pearl or other preferred material. Within the casing the valve proper, or as it is sometimes termed, the "plunger" *a* is adapted to reciprocate and this valve is equipped with tubular passageways by which the sound waves are conducted to the requisite outlets, as will be explained more in detail hereafter. The upper end of the valve is closed by a top 24 into which the lower end of the stem 21 is connected and upward movement of the valve is limited by a buffer block 25 made of cork or other light resilient material. The lower end of the valve is equipped with a bottom 26 between which and a cap 27 threaded onto the lower end of the casing a coiled expansion spring 28 is interposed to normally hold the valve in the elevated position shown in Fig. 2. To facilitate freedom of movement of the valve within its casing, a vent opening 29 is provided in the cap 27 through which air may enter and be expelled from the casing so as to preclude the production of pressure or a partial vacuum in the casing which would retard the action of the valve. In order to maintain the valve in alignment with its ports, in other words, to prevent rotary movement thereof, one side of the casing is provided with a groove 31 adapted to receive the head of a guide screw 32 which travels in the groove during the reciprocatory movements of the valve. It should be evident that this type of reciprocatory valve is direct in action and can be readily manipulated, and since the passages and connecting ports of the valves may be made relatively small, a short stroke of the valves is sufficient to perfectly align the various passages with their respective ports, thereby enabling speedy action of the valve and accurate operation, which insures accuracy of tone.

A cross connection 33 connects valve casings A and B and a similar connection 34 connects casings B and C. Casing A also communicates with the first valve pipe 35 of looped formation, comprising the out-branch 36 and the return branch 37. The second valve pipe 38 communicates through the out-branch 39 and the return branch 41 with valve casing B, and the third valve pipe 42 communicates through the out-branch 43 and the return branch 44 with the valve casing C. From casing C the sound waves are delivered into the coiled amplifying tube 45 which extends across the coils of the instrument and is provided between two parallel portions thereof with a tuning slide 46 telescopically connecting with these portions so that it may be adjusted in or out to tune the instrument. Beyond this second parallel portion 47 the amplifying pipe is coiled upon itself, as will be apparent from Fig. 1 and is gradually enlarged until it finally terminates in the bell 48.

The valves proper *a*, *b* and *c* are provided with ports connected by tubular passages, as will be apparent from inspection of Figs. 4 to 9 inclusive, in which the position and arrangement of the various passages is best shown. The first valve, that is, valve *a*, which is disposed in casing A, is provided with the passages 51, 52 and 53. When this valve is in its normal upper position, as shown in Fig. 2, passage 51 is in alignment with and establishes communication between the section 15 of the mouthpipe and cross connecting pipe 33 leading to the second valve. When the valve is depressed, passage 52 is brought into registration with the mouthpipe and the sound waves are conducted through this passage into the outbranch 36 of the valve pipe 35, thence back through the return branch 37 to the passage 53, the upper end of which is then in registration with the end of the return branch 37 and thence through this passage 53 into the cross-connection 33. Depression of the valve therefore, interposes in the passage through the instrument an additional length of tubing comprising the valve pipe 35 and the passages 52 and 53. The total length of additional tubing interposed is the length of valve pipe 35 plus the length of passage 52 plus the length of passage 53 minus the length of passage 51.

Valve *b* is provided with passages 54, 55 and 56. When this valve is in upper position direct communication between cross connecting pipes 33 and 34 is established through the passage 54. When the valve is depressed, the lower end of passage 55 is brought into registration with the cross connection 33 and the sound waves then travel through passage 55 into the valve pipe 38 through the out-branch 39 and back through the return branch 41 to the intake or left hand end of passage 56 which is then in registration with the mouth of the return branch 41 and through this passage 56 the sound waves are delivered into the cross connection 34.

Valve *c* is equipped with passages 57, 58 and 59. When the valve is in normal upper position the sound waves are conducted directly from the cross connection 34 through the passage 57 to the amplifier pipe 45. When this valve is depressed, the sound waves are conducted from cross connection 34 through the passage 58 to the out-branch 43 of valve pipe 42, thence back thru return branch 44 to the upper end of passage 59, and thence through this passage to the amplifier pipe 45. It will be manifest that depression of any of these valves interposes an additional length of pipe or tubing in the bore through the instrument and by depressing one or more of these valves, the required tones are secured.

The bore through the instrument from mouthpiece to bell is of progressively increasing diameter irrespective of the position of the valves. Consequently, each pipe, tube and passage is gradually tapered from its inlet to its outlet end and the ratio of taper is such that the cross sectional area of every transverse section of the bore is greater than the cross sectional area of any section nearer the mouthpiece. The ratio of expansion of the bore, however, is not the same in all lengths of the passage, as will be manifest upon consideration of the passages in valve *a* for instance. In this case, the intake end of the cross connecting tube 33 is larger by a predetermined amount than the delivery end of the mouthpipe. The passage 51 in the valve is designed to provide a gradual enlargement or expansion from its intake end, which is the same size as the delivery end of the mouth-pipe to its outer end, which is the same size as the intake end of the cross connection 33, so that a gradual expansion of the sound waves through this passage is permitted. When the valve is depressed, however, shutting off the passage 51 and cutting in passages 52 and 53 and the valve pipe 35, the same aggregate expansion is provided between the intake end of passage 52 and the delivery end of passage 53. Consequently, while the total expansion through these passages and the valve pipe 35 is the same as the total expansion in passage 51, nevertheless the ratio of expansion is obviously much less since the sound waves must travel through passage 52, valve pipe 35 and passage 53 in order to expand the same amount as they would traveling directly through the passage 51. Each of the other valves and valve pipes are similarly constructed and properly tapered so that irrespective of the position of the valves a continuously tapered conical bore is provided entirely throughout the length of the instrument from mouthpiece to bell. This tapered bore permits a gradual expansion of the sound waves without retardation or restriction at any point in their travel, and the result is that each tone is clear, pure and accurate to an extent which is incapable of attainment in an instrument embodying either restrictions or cylindrical sections in its length.

It is believed that my invention and many of its advantageous features will be understood from the foregoing without further description, and while I have shown and described a preferred form, obviously the invention is capable of embodiment in constructions differing materially from that herein illustrated without departing from the essence of the invention as defined in the following claims.

I claim:

1. A valved wind instrument, comprising a plurality of valves, valve pipes, a short mouth pipe connected with the first of said valves, and a tuning slide disposed in the passage between the valves and the bell of the instrument, the bore of said instrument through the valves and pipes from mouthpiece to bell being of progressively increasing diameter.

2. A valved wind instrument, comprising a short mouthpipe of small bore connected directly with the first valve chamber, valve pipes connected with the respective valve chambers, ported valves in said chambers, and an elongated amplifying tube leading from the last valve chamber and terminating in a bell, the mouthpipe, ported valves, valve pipes and amplifying tube being each of progressively increasing diameter whereby to provide a continuous conical bore through the instrument irrespective of the position of the valves.

3. A valved wind instrument, comprising a plurality of connected valve casings, a valve pipe communicating at both ends with each valve casing, a ported valve in each casing, an amplifying tube leading from the last casing and terminating in a bell, and a short mouthpipe of small diameter communicating directly with the first valve casing, all of the passages through said instrument from mouthpiece to bell being of progressively increasing diameter to provide a conical bore entirely through the instrument irrespective of the position of the valves.

4. A valved wind instrument, comprising a short mouthpipe of small bore connected directly with the first valve chamber, valve pipes communicating with the respective valve chambers, ported valves in said chambers, an elongated amplifying tube leading from the last valve chamber, and an adjustable tuning slide interposed in said tube, all of said elements being constructed to provide from mouthpiece to bell of the instrument a bore of progressively increasing diameter irrespective of the position of the various valves.

5. A valved wind instrument, comprising three valve chambers arranged in transverse alignment, a short mouth pipe connected to the first chamber, a tapered pipe connecting the first and second chambers, a tapered pipe connecting the second and third chambers, a tapered amplifying tube leading from said third chamber, tapered valve pipes communicating with said chambers respectively, and a ported valve in each chamber, each valve having tapered passages disposed transversely thereof and forming portions of a continuously tapered passage extending from mouth piece to bell of the instrument.

6. A valved wind instrument, comprising a plurality of valve chambers arranged in transverse alignment, a short mouth pipe connected to the first chamber, tapered pipes connecting the first and second and second and third chambers, a tapered amplifying tube leading from said third chamber, a valve in each of said chambers, each valve being provided with a plurality of tapered passages, and tapered valve pipes communicating with said chambers respectively, the taper or enlargement of one of said valve passages in each valve being equal to the aggregate taper or enlargement of the other passages in said valve plus the valve pipe with which said last mentioned passages are adapted to communicate.

ERNST A. COUTURIER.