July 28, 1964 W. C. POLISI 3,142,222

BASSOON

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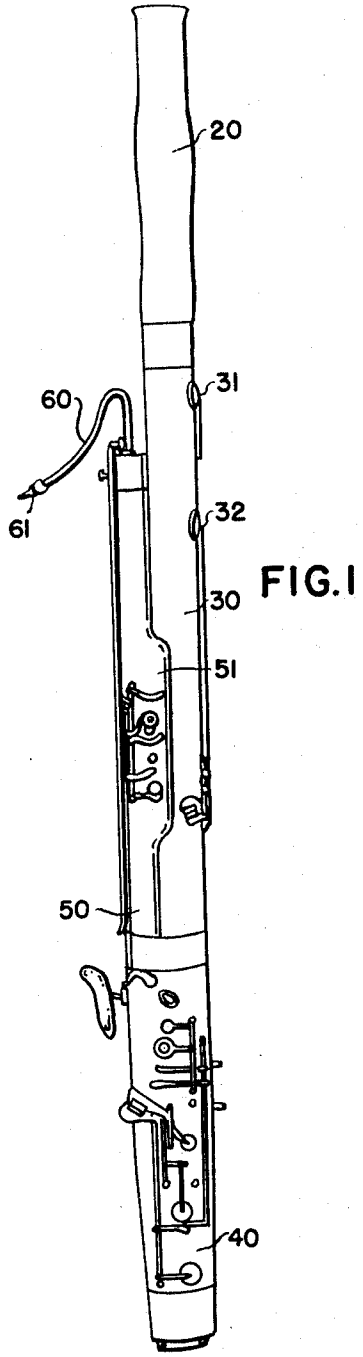

FIG. 1

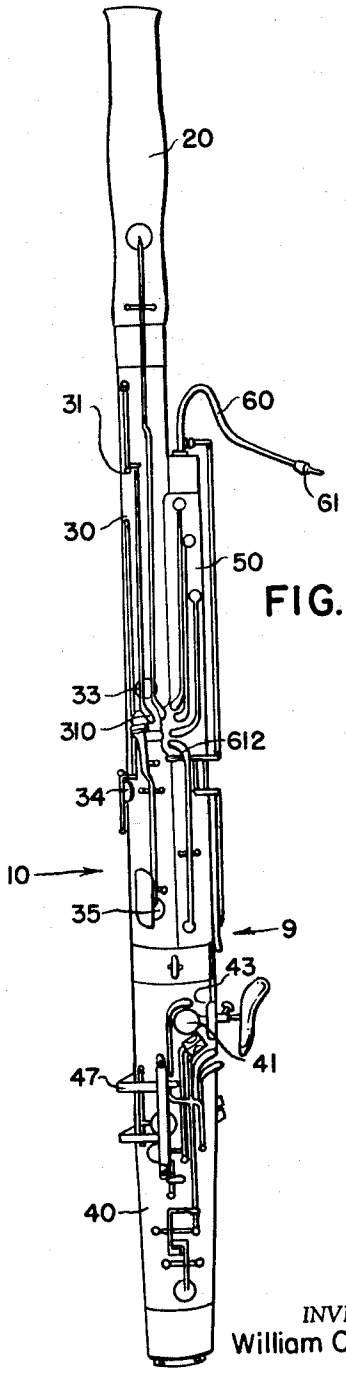

FIG. 2

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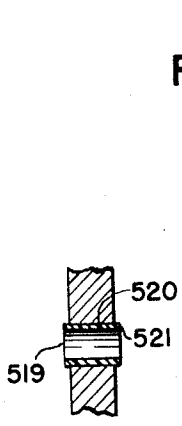


FIG.4

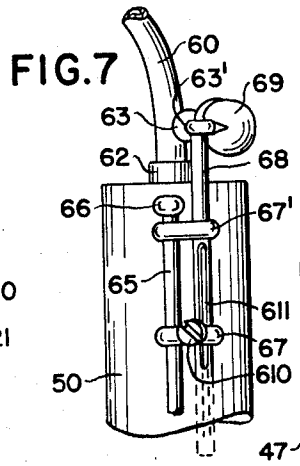


FIG.7

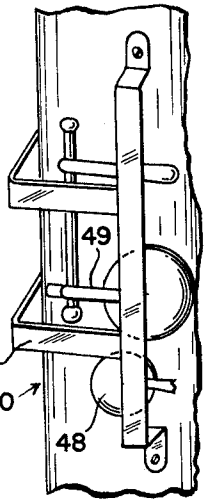


FIG.8

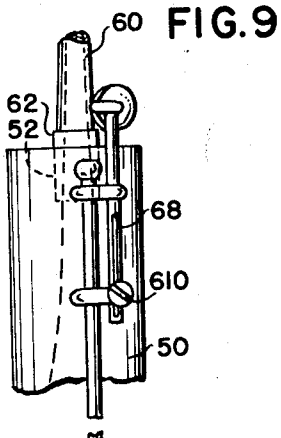


FIG.9

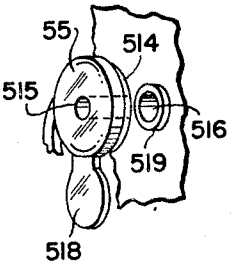


FIG.5

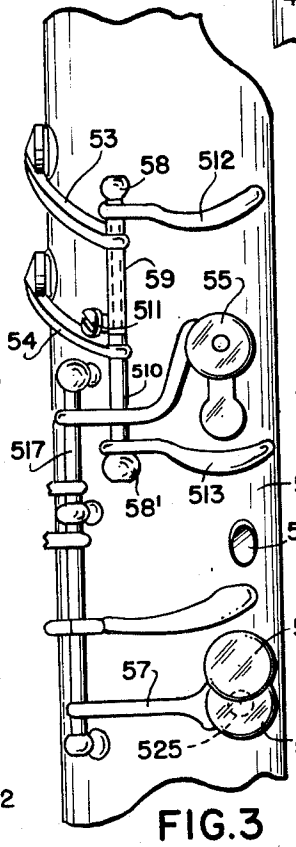
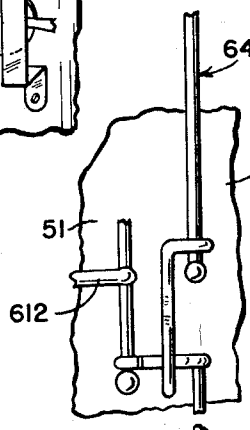
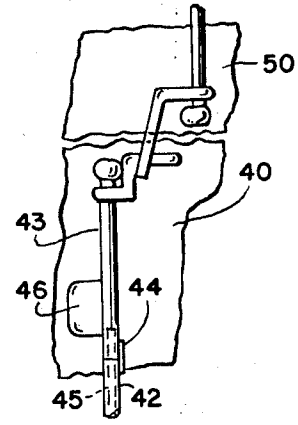


FIG.3





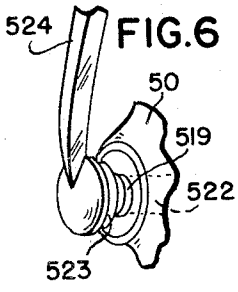


FIG.6

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FIG.10

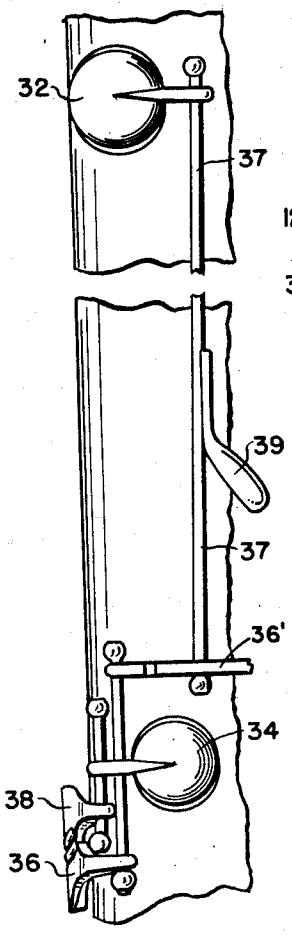

FIG.11

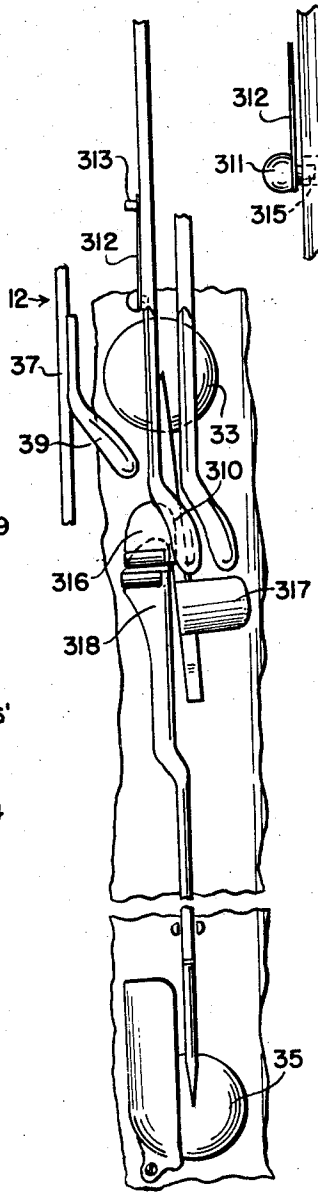

FIG.11a

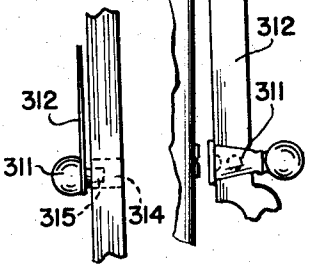

FIG.12

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United States Patent Office 3,142,222 Patented July 28, 1964

3,142,222

BASSOON

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Filed June 13, 1961, Ser. No. 116,801
4 Claims. (Cl. 84—380)

This invention relates to wind instruments, and more particularly is concerned with improvements in the bassoon.

The modern bassoon has become fairly closely standardized in many respects and the differences between bassoons made by different manufacturers do not affect the general structure and mode of operation of the bassoon. The term "bassoon," as employed hereinafter, will thus be understood to relate to the instrument now in common use in orchestras all over the world.

The bassoon comprises five major elements which jointly constitute a folded pipe of an overall length of more than eight feet that tapers from the "bell," from which emanates the sound produced, to the "crook" or "bocal" to which a double reed is attached. The reed is gripped by means of the player's lips. The major element adjacent the bocal is the "wing" or "tenor" joint, that adjacent the bell is the "long joint." The "butt joint" is interposed between the wing and long joints. Its tapering bore is V-shaped. The elements of the conventional bassoon are connected by frictional engagement of conical male and female terminal portions. The connections are made airtight by resilient gaskets, usually made of cork but not restricted thereto. The bocal is a metal tube, but wood is the preferred material of construction of the other major elements.

The instrument has a very wide range and a complete chromatic compass and has found wide acceptance in symphonic musical productions. The many tones of which the bassoon is capable are produced by covering or uncovering holes which are bored at suitably chosen points through the walls of the several major bassoon elements or joints. To select a tone, the player controls some of the holes with his fingers, and others by means of keys which actuate movements of pads of cork toward and away from corresponding holes, and which are spring biased toward the open or closed condition. Operation of the reed by the player influences not only the quality of the sound produced, but also the frequency of the sound generated.

The number of open holes and of holes controlled by keys is very substantially smaller than the number of different notes that can be played on the bassoon, and many notes require complex fingering in which several holes are simultaneously opened or closed. The demands on the manual dexterity of the player are so great that even highly skilled professionals cannot always produce certain desired notes within the compass of the instrument with certainty and with a pleasing tone quality. Interlocking connections between several keys on the instrument somewhat reduce the difficulties, but much reliance is placed on proper embouchure, the operation of the reed. Because of the necessity of shifting fingers between keys for many notes, certain trills and fast passages cannot be cleanly or neatly produced on the best bassoons now in use, even when the instruments are handled by virtuosi. With the above in view; it is to be noted that:

The general object of this invention is an improvement in the mechanical features of the bassoon which facilitate the playing of the instrument.

Another object is the provision of improved key mechanism which reduces the demands for manual dexterity, and permits the convenient playing of fast passages not heretofore properly playable on the instrument.

An additional object is the provision of mechanical devices which reduce the criticality of reed operation.

Other objects and many of the attendant advantages of this invention will be readily appreciated as the same become better understood by reference to the following detailed description of a preferred embodiment when considered in connection with the accompanying drawing wherein:

FIG. 1 is a front view of a bassoon forming a preferred embodiment of my invention;

FIG. 2 shows the same instrument in a back view;

FIG. 3 is an enlarged detail of a portion of the bassoon of FIG. 1;

FIG. 4 shows a portion of the same wall of the bassoon in enlarged axial section;

FIG. 5 illustrates an expanded portion of a detail part of FIG. 3 in a lateral view;

FIG. 6 shows in enlarged detail a detail of a key arrangement of the instrument of FIG. 1;

FIG. 7 shows a portion of the wing joint of the bassoon of FIG. 1 together with an adjacent portion of the bocal on a larger scale;

FIG. 8 shows a portion of the butt joint of the bassoon of FIGS. 1 and 2 in a view corresponding to that of FIG. 2 but on an enlarged scale;

FIG. 9 is a fragmental enlarged view of the same embodiment taken in the direction of the arrow **9** in FIG. 2;

FIG. 10 shows the instrument in another enlarged fragmentary view taken in the direction of the arrow **10** in FIG. 2;

FIG. 11 shows a portion of the long joint of the bassoon in a view corresponding to that of FIG. 2, but somewhat enlarged;

FIG. 11*a* shows a detail of FIG. 11 on a further enlarged scale; and

FIG. 12 is a lateral detail view of the device of FIG. 11 on the scale of FIG. 11*a* and taken in the direction of the arrow **12**.

Referring now to the drawing in detail wherein like numerals refer to like parts throughout and initially to FIGS. 1 and 2, there is seen a bassoon of a basically known type, usually described as the German or Heckel system. The five basic elements are shown in the assembled condition in which the instrument is played with the bell **20** extending upwardly of the instrument. The lower end of the bell **20** is engaged in a mating terminal opening of the long joint **30**, the outer and inner diameters of which taper toward the butt joint **40** and has a flap **51** which overlaps the long joint **30**. Terminal portions of the long joint **30** and the wing joint **50**, not visible in the drawing, are sealingly inserted in two juxtaposed openings of the butt joint **40**.

The free end of the wing joint **50** carries the crook or bocal **60** in a manner seen in more detail in FIGS. 7 and 9. A double reed **61** attached to the free end of the bocal **60** is gripped between the player's lips. The wall thickness of the upper end of the wing joint **50** is very much greater than that of the attached bocal **60**, but the internal bores constitute a continuously tapering conduit. The outermost portion **52** of the bore in the wing joint is radially enlarged and substantially cylindrical in shape. It receives a cork gasket **62** mounted on the lower end of the bocal. The gasket **62** is cylindrical when in the relaxed condition and has a larger outside diameter than the conduit portion **52**. The bocal **60** is thus axially slidable in the conduit portion **52** of the wing joint, and firmly held in the axially adjusted position by the resilient frictional engagement of the gasket **62** with the internal cylindrical wall of the wing joint bore **52**.

Axial movement of the bocal **60** varies the overall length of the internal conduit of the bassoon, and thus also the pitch of the instrument. The bassoon of my

invention is capable of being tuned over the entire required range of approximately ⅛ of an interval by axial adjustment of the position of the bocal. This permits a more convenient and finer tuning adjustment than the conventional tuning method which involves interchange of bocals of different length for relatively coarse adjustment, and further pitch control by suitable gripping action on the reed.

The bocal **60** has a pin hole **63'** which is drilled in a boss **63** as is conventional. The pin hole cooperates with a key, the so-called piano, crook, or whisper key, by means of which the pin hole **63** may be opened and closed. Since the position of hole **63'** shifts axially during tuning, I make the whisper key of correspondingly adjustable length.

The key includes longitudinally extending linkages **65** rotatably mounted in posts **66** which radially project from the surface of the instrument. The uppermost portion of the linkages **65** carries two laterally projecting and axially spaced lugs **67** and **67'** having axially aligned openings in which an extension rod **68** is movable. The upper end of the extension rod carries a stopper **69** consisting of a rigid metal cover and a resilient cork pad. The resilient pad on the underside of the cover is moved into sealing engagement with the boss **63** by suitable rotation of the linkage **65**. A set screw **610** is threadedly mounted on the lug **67** and projects into an axial groove **611** in the extension rod **68**. When released, the set screw **610** permits the extension rod **68** to be moved axially for proper registry between the stopper **69** and the boss **63** while preventing rotary movement of the rod about its axis.

The whisper key of conventional bassoons of the general type illustrated is operated by means of a lever arm **612** located on the flap **51** of the wing joint **50**. The key is spring biased toward the open position and closed when the arm **612** is depressed by the left thumb of the musician which actuates the several key lever arms arranged for this purpose on the flap **51**.

It is also conventional to connect the linkages **65** of the whisper key or crook key **64** with a normally open key **41** on the butt joint **40**, normally referred to as the "low E key." This interlocking operation of the whisper key with the low E key **41** is necessary because of the particular tone quality of the open low E. To operate the whisper key independent of the E key, the usual bassoon relies only on the lever arm **612**.

It is to be noted that the left thumb of the bassoon player is called upon to operate a multiplicity of keys. In fast passage work, it is particularly difficult, and frequently outright impossible to make use of the whisper key on the known bassoons. To overcome this difficulty, I have modified the interconnecting linkage between the low E key **41** and the whisper key.

The low E key **41** is conventionally supported on an axially elongated connecting rod rotatable in suitable posts. This rod transmits the movement of the E key to the whisper key. I longitudinally divide the connecting rod into two portions. The lower end of the lower portion **42** carries the stopper of the E key which is moved toward a corresponding tone hole in the butt joint by the right thumb of the musician depressing the cover of the stopper and moved away from the hole by a return spring.

The upper end of the portion **42** is of reduced diameter and is journaled in the axial bore of the upper portion **43**. Respective abutment flaps **44** and **45** on the upper and lower rod portions are positioned for engagement when the E key **41** is depressed, but permit the upper rod portion **43** to be rotated independently of the lower portion **42** when a lug **46** fixedly attached to the upper portion **43** and constituting a lever arm is depressed. The upper rod portion **43** is independently spring biased toward mutual abutment of the flaps **44** and **45**. The upper rod portion **43** actuates the whisper key in the usual

manner by means of basically conventional linkages **65** whether rotation of the upper portion **43** is initiated by depressing the cover of the low E key or by depressing the lever arm **46**. In both instances the musician will use his right thumb, a finger much more readily available for additional functions in the operation of a bassoon than the left thumb.

The flap **51** of the wing joint **50** and the novel mechanical devices of my invention mounted thereon are best seen in FIG. 3. The flap **51** and the adjoining portion of the wing joint visible in FIG. 3 are bored with five tone holes partly obscured by the stoppers of corresponding keys.

In descending order, from the bocal end of the wing joint toward the butt joint end, there is seen a high E key **53**, an F hole cover **55**, an open D hole **56**, and a C key **57**. The keys and holes of the wing flap are operated by the second, third, and fourth fingers of the right hand as is usual.

The F sharp key **54** finds its equivalent on conventional bassoons where it is pivotally mounted on the instrument body by means of posts which rotatably support the connecting rod of the key to which the stopper and the actuating lever arm are attached. I provide my bassoon with an additional high E key **53** not found in other bassoons and selectively lockable with the F sharp trill key **54**.

The keys **53** and **54** are mounted on the wing joint **50** by means of two posts **58** and **58'** in which two coaxial and axially contiguous connecting rods **59** and **510** are journaled. The connecting rod **59** is hollow and its end adjacent the rod **510** is axially split. The rod **510** extends into the axial cavity of the rod **59** and may be secured therein against rotation by a clamping screw **511** engaging respective lugs on the split portions of the tubular rod **59**. Lever arms **512** and **513** have respective ends attached to the rods **59** and **510** and free ends approximately aligned in an axially extending row with the cover **55**, the D hole **56**, and the stopper of the C key **57**.

The F sharp key and the high E key may be operated separately when the screw **511** is released, or jointly, when the clamping screw is tightened. Whereas a rapid sequence of F and G in a trill or in a passage can be achieved in the usual bassoon only by complex fingering, the high E key of my invention and its interlock with the conventional F sharp trill key on the wing joint makes such a rapid sequence quite easy.

In the preferred embodiment of the invention illustrated in the drawings the high E hole covered by the high E key **53** is axially aligned with the F sharp trill key, and spaced therefrom 22 millimeters center to center. Both holes are bored radial and parallel. Both corresponding stoppers are spring biased toward the closed position.

The F hole on the wing flap of the usual Germany type bassoon is normally open, and is stopped by placing a finger over it. Playing an F sharp, G, or G sharp note requires the F hole to be partly covered by the finger. The extent of the coverage is critical not only for the pitch of the sound produced, but even more for its quality. Since the flap of the wing joint is not within the field of vision of the player, control of "half hole" coverage is entirely by feel. Even for a highly experienced musician, such an arrangement is not satisfactory, and the purity of the F sharp, G, and G sharp notes produced on the half hole frequently leaves something to be desired.

I overcome the hazards of the partial finger coverage of the F hole by covering the hole with a metal cover **55** and a corresponding cork pad **514**, better seen in FIG. 5, and having respective central holes **515** aligned with the F hole **516**. The cross sectional area of the passage formed by the hole **515** is approximately one half of that of the F hole **516**, but experience has shown that minor variations from a 1:2 relationship are desirable in dif-

ferent instruments for reasons not fully understood, but probably related to the acoustical peculiarities of the bassoon which give every instrument individual minor features not shared by any other bassoon.

The cover **55** is mounted on a rod **517** which is rotatable about a longitudinal axis and spring biased toward a position in which the cover **55** is spaced from the orifice of the F hole **516** as shown in FIG. 5. Movement of the cover toward the orifice is actuated by placing a finger on a tab **518** integral with and laterally projecting from the cover **55**. When the cover **55** is pressed against the orifice of the F hole **516**, perfectly reproducible F sharp, G, and G sharp notes of clear pitch and good tone quality are obtained from the instrument.

As seen in FIG. 5, and further represented in a sectional view in FIG. 4, the orifice of the F hole **516** is formed by an annular raised rim **519** on the wing joint **50**. The rim **519** is an axially terminal portion of a tubular plastic insert **520** which projects outward and inward beyond the wall of the wing joint. The outwardly projecting rim **519** provides leak proof engagement with the cork pad **514** of the cover **55** because of the stress concentration in a narrow area which deforms the resilient cork until no air can bypass the hole **515**.

The inwardly projecting portion **521** of the insert **520**, the axial length of which is but a small fraction of its diameter, does not influence the tone or pitch of the instrument in a significant manner. It deflects the saliva flowing downward along the several portions of the bore of the instrument, and prevents it from running outward through the F hole.

I prefer to install similar saliva tubes in all those holes of the bassoon which are notorious for their saliva discharge on the usual instruments. These holes include the D, C, B, high G, low A, and C sharp holes, but may be provided elsewhere if so desired. Saliva tubes of the type described are not limited in their utility to the bassoon, but are also effective on other wind instruments, and particularly wood winds of the clarinet or oboe type.

The raised outer rim provided in a very simple manner by the saliva tube of my invention is important in those holes of the bassoon in which the closure obtained by a key is least secure because of the unfavorable leverage. In FIG. 6, I show the C sharp hole **522** near the lower end of the wing joint **50**. The projecting rim **519** of the saliva tube inserted in the hole securely prevents air leakage past the pad **523** of the long key **524** which is normally closed, without requiring the key to be equipped with an unduly heavy spring which would make key operation difficult.

Reverting now to FIG. 3, there is seen a key **57**, the stopper of which obscures the C hole **525**. On the conventional bassoon of the German type, the C hole is associated with a key equipped with a ring coaxial with the hole but not instrumental in closing the same. When the hole is covered by the fourth finger for which it is positioned, the ring is simultaneously depressed and actuates stoppers on other tone holes. In the normal playing position of the left hand, covering the C hole requires the fourth finger to be spread relatively far from the third finger.

It is well known that for reasons of anatomy, the fourth finger of the human hand is least capable of independent movement, that is, of movement independent of the adjacent third and fifth fingers. When the fourth finger is spread from the third finger, it becomes even more difficult to perform intricate movements with it. The spacing of the D and C holes on the flap of the wing joint, which cannot be altered for obvious reasons, provides a serious handicap to bassoon players with short fingers, and makes the playing of certain notes difficult even for a musician having fingers of more than average length. This wide spacing of the C and D holes makes it impossible for most children under approximately 14 years of age to study the bassoon, and the short supply of bassoon players of high caliber can probably be attributed to the fact that study of the usual instrument is not available to the very young.

I replace the conventional ring on the C hole by a full stopper **526** equipped with a lateral cover extension **527** projecting toward the D hole **56**. Although the extension **527** is not very wide, barely one half of the diameter of the stopper **526**, it materially reduces the spreading of the fourth finger necessary for closing the C hole. Whereas proper closing of the hole by a finger requires the center of the terminal finger joint to be aligned with the axis of the hole, any portion of the finger touching the rim of the extension **527** will securely close the C hole.

Even very young children can be taught to play my improved bassoon without serious difficulties being caused by the shortness of their fingers. While they may not yet be able to handle the instrument with the fluency of the trained musician, there is nothing which would inherently prevent them from producing all the tones encompassed by the instrument.

The butt joint **40** of the bassoon is adjacent the musician's clothing and it is not an entirely unusual experience to find a loose portion of a coat caught between the instrument body and one of the stoppers which cooperate with holes in the back side of the bassoon. Any foreign body wedged between a key and a tone hole in the instrument of course results in the production of uncontrolled sounds.

To avoid such accidents, I provide a guard **47** on the back side of the butt or double joint **40**. The guard, seen on an enlarged scale in FIG. 8, consists of several flat metal bars vaulting over the covers of the F sharp key **48** and the B flat key **49** which are positioned approximately centrally between the top and bottom ends of the butt joint **40** in the usual manner.

The long joint **30** of my bassoon is approximately ⅛ inch longer than that of the conventional Heckel type bassoon. It is well known that the low register of the commonly used bassoons of this type is sharp, that is, the pitch of the low register is relatively higher than that of the higher registers. This sharpness can be compensated for by proper interaction of the lips with the reed, but this method is difficult and not entirely satisfactory. It makes a complex instrument even more unreliable and difficult to master.

Lengthening the long joint by about ⅛ inch over the normal length overcomes this difficulty, but it requires the holes on other joints to be displaced approximately ⅛ inch in a direction toward the bell, as will be readily appreciated.

The long joint has five tone holes, all operated by means of keys. The stoppers of these keys which obscure the holes are visible in FIGS. 1 and 2. They are in axial sequence from the bell joint **20** toward the butt joint **40**; as follows: The low B natural key **31**, the low C sharp key **32**, the low C key **33**, the E flat key **34**, and the low D key **35**.

Details of the long joint are shown in FIGS. 10, 11, 11*a* and 12. The long joint illustrated has several novel features which permit the bassoon to be operated in a particularly secure and convenient manner.

The C sharp, or D flat, key **32** is conventionally operated by the left fifth finger which depresses an arm **36** of a lever, the other arm **36'** of which acts upon an arm projecting from the connecting rod **37** to which the stopper of the C sharp or D flat key is fastened. The fifth finger also has to operate the E flat key **34** by means of a lever arm **38** adjacent the arm **36**. It is obviously very difficult to play a fast sequence of D flat and E flat tones with the conventional arrangement. A D flat—E flat trill of properly spaced and clearly defined notes is almost impossible to produce.

This difficulty is overcome in the bassoon of my invention by the provision of an arm **39** on the connecting rod **37** which extends from the latter rod in a direction to-

ward the flap 51 of the wing joint 50, and toward the keys which are grouped on the long joint for operation by the left thumb, thus permitting the two notes of a D flat—E flat trill to be produced by two different fingers.

In the playing of the low E on the conventional German type bassoon, the low B natural key 31, the C key 33, and the D key 35 as shown in FIG. 2, are normally open. An E tone produced in this manner has a very bright, open sound. A duller, darker, more mellow E sound is desirable in solo passages for the bassoon in symphonic music. Attempts to produce such a softer sound by means of mutes have not been fully successful. I have been able to modify the bright open E sound by providing an abutment which permits the B, C, and D keys mentioned above to be partially closed by the left thumb normally idle in playing the open E note, and I can thereby modify the sound of the open E to achieve a more pleasant tone.

The B, C, and D keys are normally open and interlocked conventionally in such a manner that the D key 35 may be operated individually or jointly with the C key 33. However, both the C key and the D key are closed when the actuating lever 310 of the B key is depressed. By providing the abutment on the actuating lever 310, I can thus hold all three keys in any desired partly open position when the lever 310 is depressed.

The abutment device is seen to some extent in FIG. 11, and in greater detail in FIGS. 11*a* and 12 which show that portion of the lever 310 on which the abutment device is mounted. The latter consists of a stop member 311 supported on a leaf spring 312 which is pivotally fastened to the lever 310 by a screw 313. Pivotal movement of the spring 312 about the axis of the screw 313 thus causes the stop member 311 to move toward and away from the surface of the long joint 30. The lever 312 has two superimposed transverse holes 314 adjacent the stop member 311, and a pin 315 on the latter may be alternatingly engaged with either hole. The holes are differently spaced from the main body of the instrument. When the pin 315 is engaged in one of the holes, the underside of the stop member 311 is approximately flush with that of the lever 310, and the stop member is inoperative. When the pin 315 engages the other hole, the stop member projects downward from the lever and prevents the stoppers of the B, C, and D keys from approaching the corresponding tone holes more closely than approximately 1/32 to 1/16 inch, and the desired mellow E sound can be produced.

The C key on the long joint is conventionally operated by depressing a tab 316 on the one armed lever at the end of which the stopper of the key is mounted. This tab interlocks with the end of the lever 318 which actuates the D key 35 in such a manner that the D key may be operated independently, but will follow movement of the C key. The lever arm of the latter passes under the lever 310 of the B key so that depressing the latter will actuate all three keys simultaneously as described above.

Use of the C key is frequently required, and the conventional tab 316 is relatively difficult of access to the left thumb by means of which it is to be operated. I therefore provide a second tab 317 for the C key lever which projects from the rod of the key toward the flap 51 of the wing joint and may be depressed by the left thumb while the latter also actuates one of the several keys on the flap 51. This additional tab also greatly improves the speed with which the left thumb may be shifted to and from the C key, and thus the overall fluency of the performance.

It should be understood of course that the several novel features of the bassoon illustrated for the purposes of the disclosure may also be employed separately, and in conjunction with other improvements on other wood-wind instruments, or on wind instruments generally. They jointly facilitate fingering and cross fingering, necessary on the bassoon more than on other woodwind instruments, and reduce reliance on the reed for modifying the pitch and sound quality of the instrument. The substitution of mechanical devices the action of which is exactly reproducible and predictable for the reed, uncertain in its operation even for the most expert player, increases the utility of the bassoon as an orchestra instrument. The improvements brought about by this invention also facilitate the teaching of bassoon playing, and may be expected to bring about a general rise in the level of performance on this instrument.

While a preferred embodiment of my invention has been disclosed and illustrated, various modifications as to form, arrangement of parts and use of materials may be made without departing from the spirit and scope of the invention as hereinafter defined by the appended claims.

What I claim is:

1. In a bassoon, in combination, a bocal; a wing joint; a butt joint; a long joint; and a bell joint, said bocal and said joints being formed with elongated bores and connectable in the above order in such a manner that the bores thereof form a continuous elongated conduit tapering from said bell joint toward said bocal, said bocal while connected with said wing joint being movable in the direction of elongation of the bore of said wing joint, said bocal being formed with a pinhole; a whisper key, including connecting rod means movably mounted on said wing joint, extension rod means movable for adjustment on said connecting rod means in the direction of elongation of the bore of said wing joint, means for fixedly fastening said extension rod means to said connecting rod means in the adjusted position, and stopper means mounted on said extension rod means for movement forward and away from said pin hole when said bocal is connected with said wing joint and said connecting rod means moves on the latter.

2. In a bassoon as set forth in claim 1, cylindrical sealing means on said bocal and on said wing joint, said sealing means being substantially coaxial with the respective bores and axially engageable for connecting said bocal and said wing joint.

3. In a bassoon as set forth in claim 1, said rod means constituting elements of a motion transmitting linkage for actuating movement of said stopper means, an element of said linkage being mounted on said stopper means, another element of said linkage being mounted on said butt joint; and first and second actuating arm means on said wing joint and on said butt joint respectively for manual actuation of said stopper means movement when said wing and butt joints are connected.

4. In a basson as set forth in claim 3, an E key movable on said butt joint, coupling means coupling said E key to a portion of said motion transmitting linkage for actuating movement of said whisper key stopper means when said E key is moved, said second actuating arm means being mounted on said portion for actuating said whisper key independently of said E key.

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