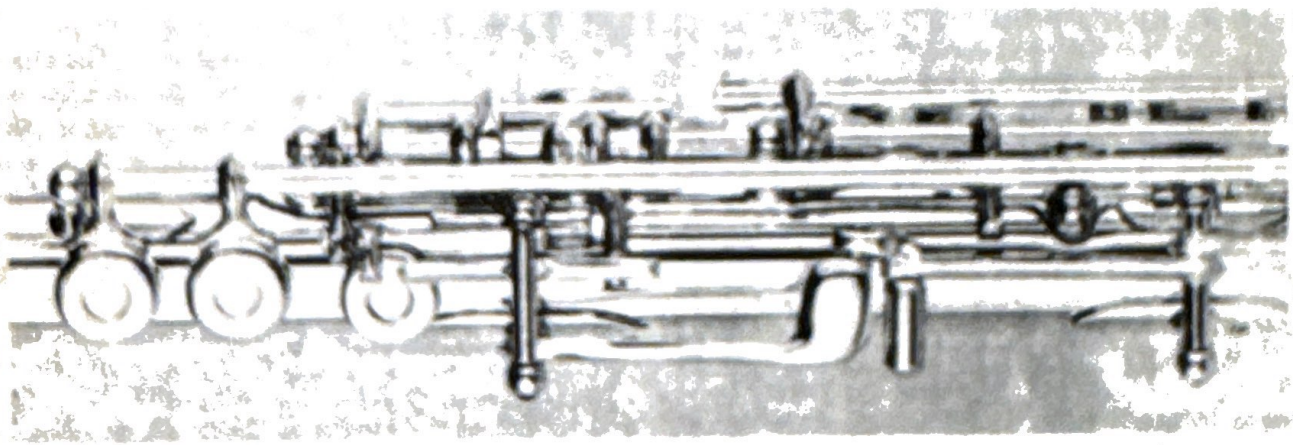
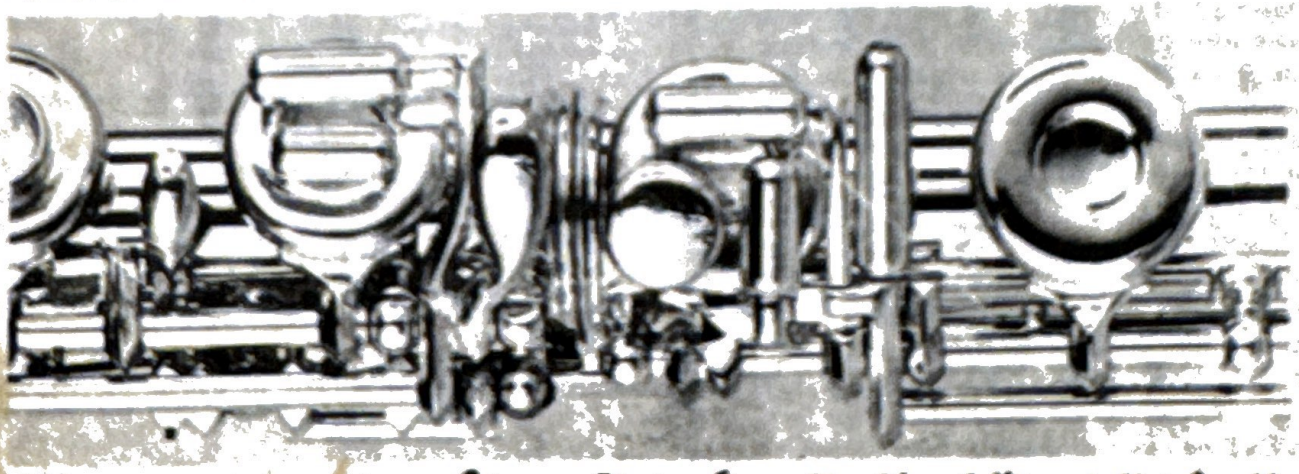
The Murray Flute

Articles and Photographs from Armstrong News, the Amis Newsletter, The Instrumentalist, The Music Journal, the Galpin Society Journal.

W.T. Armstrong Prototype I made by Jack Moore 1971.





Cover Photo from the Newsletter of the Am. Mus. Inst. Soc. June 1972

VOLUME 1 ISSUE 4 July 15, 1971

Armstrong News

W. T. ARMSTRONG COMPANY ELKHART, INDIANA

THE MURRAY FLUTE — A CHALLENGE FOR ARMSTRONG

All employees at such well known flute shops as William S. Haynes, Verne Q. Powell and W. T. Armstrong literally owe their jobs to one man, Theobald Boehm of Munich. Boehm was a great lover of the flute and was considered a fine player in his day.

Not to be overlooked was his great ability as an inventor. These two talents led him to develop the flute that is used throughout the world, a flute that Boehm himself describes in the Dayton C. Miller book "The Flute and Flute Playing", that someday would be improved upon. Boehm took it as far as possible, sadly reflecting that a few notes were not "true" and required far too much compensation on the part of the player. This flute and legacy was left to us with the invention of the Boehm system flute in 1847, and to this day it remains practically unchanged.

In 1948, a young flutist in the Royal Air Force Band began to question some of the scale finger combinations that Boehm had invented. Realizing that there were indeed "problems" with the basic overtone series afforded when playing upon the standard Boehm Flute, Alexander Murray set about to rectify, if possible, these problems. With the help of the English flute maker, Albert Cooper, Murray changed his flute into an open D Sharp flute. Having mastered this obstacle, he little by little added such things as a split F Sharp, open G Sharp, until finally he had accomplished seven major changes on the Boehm. By now, Alexander Murray had grown in stature as a flutist and had been elevated to the solo flute position of the famed London Symphony Orchestra. Now recognized as one of the world's finest flutists, many other players began to look seriously upon Murray's new flute.

About a year ago, Mark Thomas received a phone call from Murray and a meeting was requested. It was at this meeting that Mark received his first look at the flute Alexander Murray had made. Impressed, but unable to play it, he called in Al Singleton and Jack Moore, along with Joe Elias, for a consultation on Murray's request. Will Armstrong, selected from all other flute makers, built the eighth and final version of the Murray system flute. With mixed emotions, the challenge was accepted, and last month, the model was presented to Murray for approval.

Delighted, Alexander Murray exclaimed, "you have achieved the impossible!" The yeoman's amount of credit in creating this flute must go to Jack Moore, who has spent countless hours thinking of how to put Murray's ideas into metal. Word has quickly spread, and now Armstrong has received many orders from leading flutists for this flute.

Early this month, Mark Thomas was invited to discuss and play upon this flute at a major national flute seminar at The University of Indiana. He accepted and took the builder, Jack Moore with him.

After much discussion with Armstrong president, Carl Burket, it has been decided to build a few of these for the top players who have ordered them and then to "wait and see what developes". As Burket says, "we owe it to the flute world to do this, and we are proud that Armstrong was selected from among many fine flute makers to build this flute."

As Armstrong vice-president Mark Thomas said, "this is a major breakthrough and improvement on the Boehm flute."

The instrument played at the Amis Convention in Washington, April 15-16, 1972, was the second prototype built by Jack Moore. An illustration of this instrument appears in the Music Journal Article.

Harry Moskovitz, John Coltman, Alex Murray

THE MURRAY FLUTE

Since the appearance of Philip Bate's[1] book on the FLUTE with a brief reference to a non-published article in the Instrumentalist, I have received a number of inquiries about my instrument. To solve the problem of answering each one individually, I will try to retrace briefly the steps which led me to my present instrument, to enumerate its advantages and disadvantages, and explain in what way it differs from the standard Boehm flute.

Until 1948 when I joined the Royal Air Force Band, I played on what is the commonest form of the Boehm flute, the closed $g^{\#}$ instrument. At this time I read Boehm's[2] account of his instrument with Dayton Miller's commentary and decided that the open $g^{\#}$ was a more rational system for at least four reasons.

i) The duplicate $g^{\#}$ hole was unnecessary.

ii) The spring of an open key is lighter than one required to hold the key closed.

iii) Top e is greatly improved when correctly vented with the a hole alone, and not the a and $g^{\#}$ holes together as on the closed $g^{\#}$.

IV) One finger one key (pad) on g

I consequently asked a flute repairer to alter my instrument to the open $g^{\#}$ and after a few weeks practice I found the readjustment amply rewarded.

The asymmetrical use of the little fingers, in particular the necessity for maintaining the right little finger down much of the time struck me as undesirable and I experimented with an open $d^{\#}$ by turning the foot-joint until the $d^{\#}$ hole was within reach of my little finger. I unhooked the spring and maintained the key open with an elastic band. The flute became a little unstable to balance but I solved this by sticking a wedge of cork on the body above the right thumb. (I no longer require this crutch, having learned to balance the instrument without it.) I felt that the action of the key was an improvement on the closed $d^{\#}$.

At that time I was fortunate in meeting Albert Cooper, an artist-flute-maker, formerly of Rudall Carte who had left them to begin making flutes on his own. He agreed to construct a new foot join which would convert my flute to open $d^{\#}$.

The $c^{\#}$, d, and $d^{\#}$ holes were placed in line from an axle on the near-side of the flute; the $d^{\#}$ key was closed by both of the other keys. The problem remained, how to trill c-d or $c^{\#}$-d. When the little finger was removed from c or $c^{\#}$, $d^{\#}$ was the note that sounded. In order to circumvent this, a crescent-shaped key was built from the d key around the front of the ring-finger key. (I still use this mechanism on the piccolo) This finger could then close both keys simultaneously when required, giving $d^{\#}$.

Later it was found better to have two parallel rollers so that the ring finger could move easily from d to $d^{\#}$, in the same way as the little finger moves from c to $c^{\#}$ on a flute with two rollers on the foot-joint.

Once above d, the little finger is only required for d an octave higher. This led to the construction of a little finger key for $f^{\#}$, with several advantages. When $f^{\#}$ is fingered in this way, all holes below the $f^{\#}$ hole are open. A good trill for e-$f^{\#}$ is provided with no change of fingering (for $f^{\#}$) and by splitting the a key (so that the b hole can remain open when the $b^{\flat}$ hole is closed) and connecting the lower key to the $f^{\#}$ lever, the correct venting for top $f^{\#}$ is made practicable (comparable to top e on the open $g^{\#}$).

The other notes which needed improvement were those using the small $c^{\#}$ hole. The multiple functions of this hole are:

i) a tone-hole for $c^{\#2}$, 3, and 4

ii) a vent-hole for d^{2}, 3, 4, d^{2} $g^{\#3}$ a^{3} $b^{\flat 3}$.

As Boehm pointed out, some compromise in its size and position is inevitable.

On many flutes the interval $c^{\#}$-$d^{\#2}$ requires careful blowing to produce a whole-tone acceptable to the ear ($c^{\#2}$ has to be flattened and $d^{\#2}$ sharpened, an unhappy juxtaposition of compensations). After several experiments a relatively simple mechanism was devised to

(Continued page 7)

[1] New York, W.W. Norton and Co., 1969

[2] Theobald Boehm, *The Flute and Flute Playing*, 1871. Second English translation, Cleveland, Ohio, Dayton C. Miller, 1922.

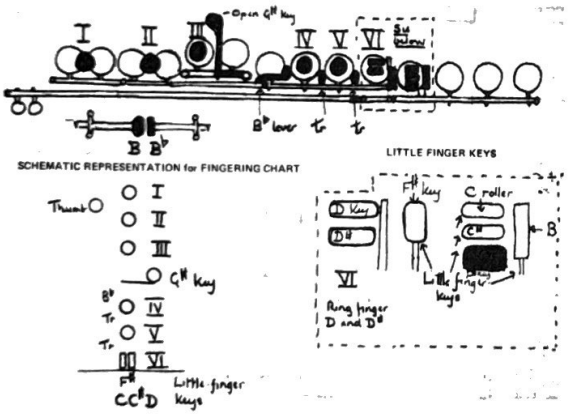
divide the functions between two holes — a large c♯ tone hole and a small d vent. This entailed no change in fingering apart from a reversal of the Briccialdi thumb keys and a return to the more rational order originally used by Boehm (b♭ nearer the head joint).

The necessity in the top octave of putting down the right little finger for top b was obviated by linking the lower trill key to the d key. This automatically closes the d♯ hole when b is fingered normally. The effect on the trills is unnoticeable.

With these slight mechanical and fingering changes it has become possible to construct instruments with the hole placing correctly determined by the use of Boehm's schema, without compensatory shifts of hole position to humor "bad" notes.

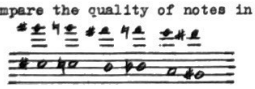
Without the skill, patience and insight of Albert Cooper, this flute would not be in existence. Inevitably he has been inundated with work and has a seven-year waiting list for his instruments. I have been most fortunate in meeting those responsible for manufacturing Armstrong flutes. The foreman, Jack Moore of the Heritage division, accepted the challenge of making a similar flute with certain slight mechanical improvements over my present one (my eighth) which I hope will embody the final form of the Murray flute.

The following is an exact reproduction (in reduced form) of the Schema and fingering chart; also follows his data regarding the above story.



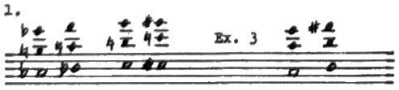
To compare the quality of notes in the top octave.

Ex. 1



Finger high d♯; blow with insufficient speed to sound d♯, try to sound g♯ (low) as fully asppossible. Retaining the same fingering, alternate between the two notes slowly at first, then as rapidly as possible. Keep breath and lip-movements down to the minimum. Repeat with the other notes of Ex. 1.

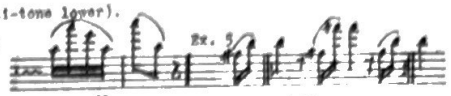
Ex. 2 Ex. 3



(Reproductions continued next column & page 8)

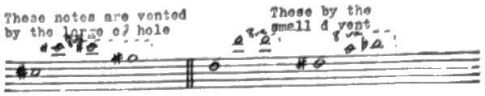
See what "undertones" can be produced from the notes of Ex. 1 in the middle octave. They will probably correspond with the additional notes in Ex. 2 and 3. The ease of sounding of the second octave note detracts from the facility of the top octave causing such combinations as the following to be unduly difficult with normal fingerings. (Compare the same sequences a semi-tone lower).

Ex. 4 Ex. 5



Dvorak 4th William Tell

To note the improvement made by the proper venting, place a small wedge of cardboard over the g♯ hole in Ex. 4, the b♭ hole in Ex. 5.



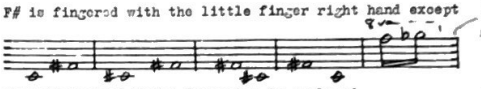
There is no difference in fingering for use of $c\sharp^2$-$d\sharp^2$ mechanism.

The following trills are properly vented.

(fingering chart--$c\sharp_2$)

Fingering differences

F♯ is fingered with the little finger right hand except



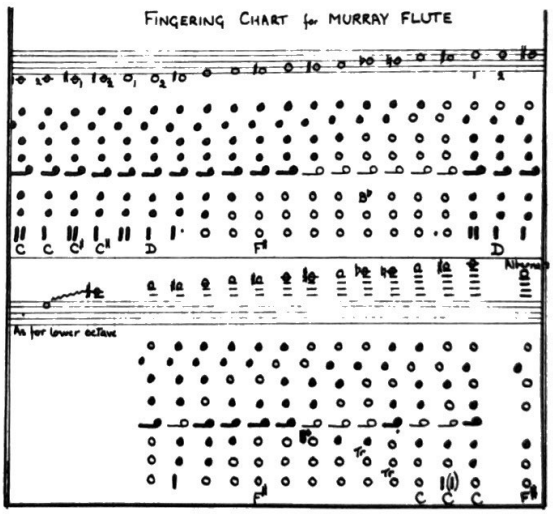
when the normal Boehm fingering is employed.

The little finger is free of the d♯ key except

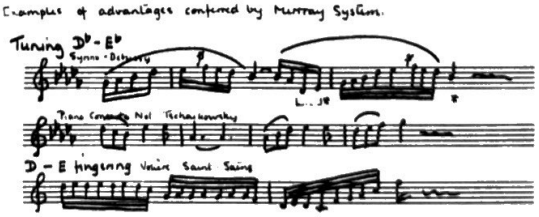
For top c, c♯ and d, the foot keys are employed as on the Boehm flute.

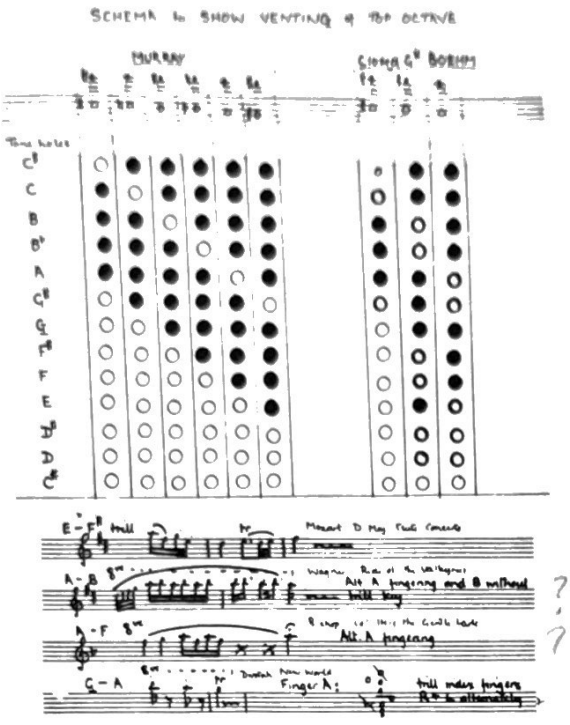
The ring finger d key is employed in F, C, G, D and A major (compare the use of the Briccialdi in flat keys) and in d, a, b and f♯ minor (harmonic).

In the chromatic scale from low c, the c and c♯ are played in the conventional way with the little finger; d and d♯ are played with the ring-finger.



Examples of advantages conferred by Murray System.

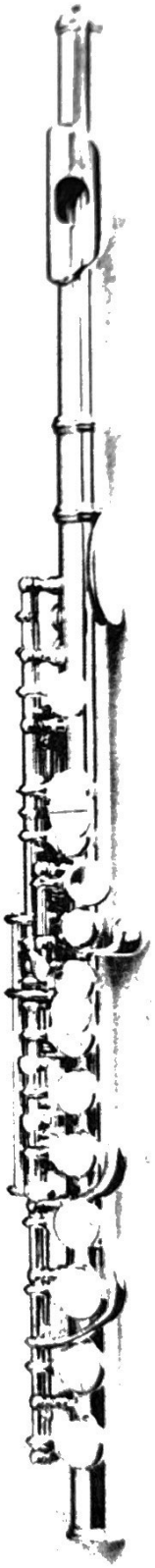




The piccolo on the right is extendeddown to B, but the key is only for appearances. C is the lowest note fingered (this is required in Mozart's Seraglio Overture - there are several C#s in the repertoire) The extra length smooths the response of the upper octave.

The W T Armstrong Prototype of the Murray flute

The W T Armstrong Prototype of the Murray system piccolo



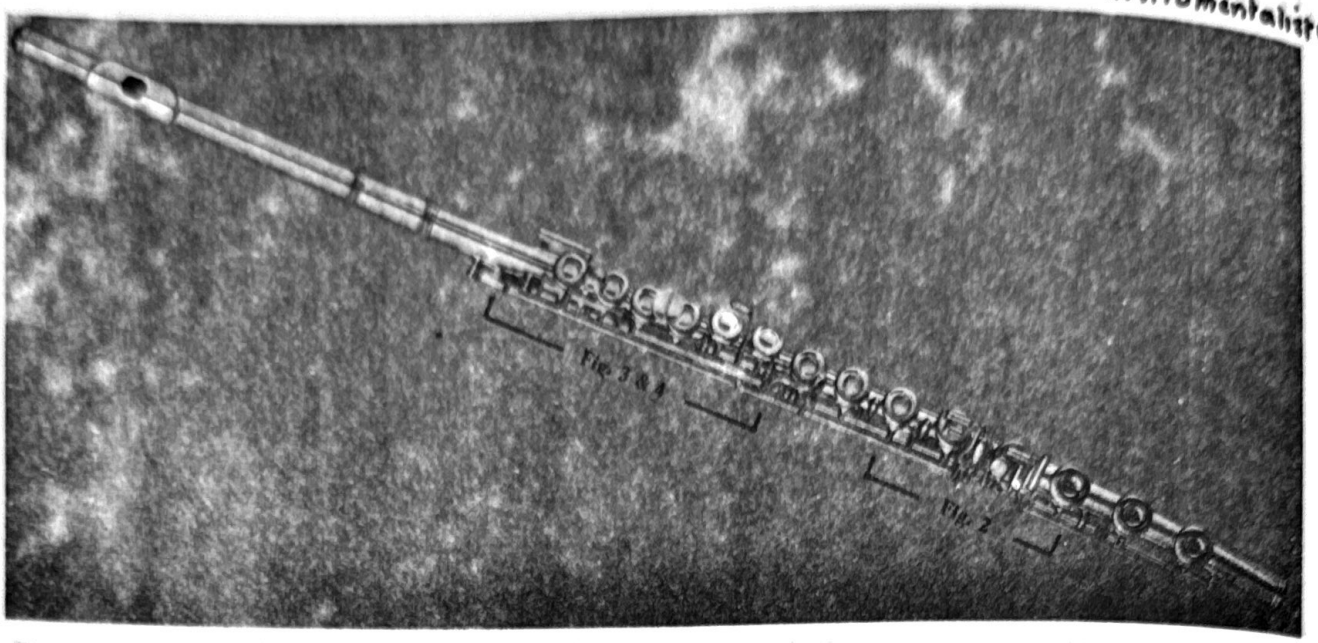


Figure 1 — The Murray flute. The sections that are enlarged for Figures 2, 3 & 4 are identified within the brackets.

The Murray Flute

Walfrid Kujala

In 1948, just after joining the Royal Air Force Band, the young English flutist, Alexander Murray, read Dayton Miller's edition of Boehm's *The Flute and Flute Playing*. Miller's persuasive comments favoring Boehm's open G♯ key[1] inspired Murray to have his closed G♯ flute changed to an open G♯, and within a few weeks "he found the readjustment amply rewarded."[2] He then began to consider the possibility of reversing the D♯ key, for it struck him as illogical to have to keep the right little finger down so much of the time. A makeshift adjustment on his own flute ("turning the footjoint until the D♯ hole was within reach of my little finger, I unhooked the spring and maintained the key open with an elastic band") convinced him that this was an improvement over the closed D♯. Thus, after almost 300 years, this primordial key was about to be converted.

At that time Murray was fortunate in meeting Albert Cooper, an artist flute-maker formerly of Rudall Carte, who was now making flutes on his own in London. He agreed to construct a new footjoint which would convert Murray's flute to an open D♯ and which would allow automatic closure of the D♯ key when fingering low C♯ or C. But, as Murray points out, "the problem remained, how to trill C to D or C♯ to D. When the little finger was removed from C or C♯, D♯ was the note that sounded. In order to circumvent this, a crescent-shaped key was built from the D key around the front of the ring-finger key. This finger could then close both keys simultaneously, when required, to produce a D. Later it was found better to have two parallel rollers, so that the ring finger could move easily from D to D♯ in the same way as the little finger moves from C to C♯ on a flute with two rollers on the footjoint" (the Briccialdi — thumb B to B♭ — principle, see Fig.2).

1. See the preceding article, "A Brief History of Flute Design," to gain a better understanding of the background of Murray's ideas and the terminology used to describe his flute.

2. This and all subsequent quotations are extracted from Murray's unpublished notes or from interviews.

Walfrid Kujala, a member of the Chicago Symphony Orchestra and Professor of Flute at Northwestern University, has been Contributing Editor for Flute Facts since September 1971. He is the author of a method book, The Flutists' Progress.

Solving the Pesky F♯ Problem

Since the D♯ was now all an open-standing key, the little finger was freed from its venting duties for E, F, and F♯. So Murray, following in the footsteps of his English predecessors, constructed a new F♯ lever (see Fig. 2) for the now under-employed little finger. His solution offered the same advantages as the Carte, Brossa and Rockstro F♯ systems. But Murray went one giant step further: he split the A key in the left hand so that the B♭ hole could remain open when the A hole was closed (see Fig.3). He then connected the A key to the new F♯ lever, thus automatically bringing about the correct venting for the top F♯ and making it as stable and responsive as the adjacent high F and G. (The open G♯, in case anyone need be reminded, similarly allows for proper venting of the otherwise fragile high E, and consequently permits a better balanced sound between high E and the Murray F♯. The so-called "split-E" mechanism accomplishes the same thing on a closed G♯ instrument.)

Decompromising the Open C♯

The compromise size and position of the small C♯ hole which Boehm had to adapt for two basic functions — as a tone-hole for C♯[2, 3], and [4], and as a vent-hole for D[2, 3], and [4], D♯[2], G♯[3], and B♭[3] — was the next subject of Murray's experiments. The obvious solution was to divide the functions between two holes, a large C♯ tone-hole in its acoustically correct position (see Fig.3) and a small D vent-hole (see Fig.4). The big problem, however, was to devise a mechanism that would control both holes without changing the traditional Boehm fingering patterns; Murray solved it handily. His final design incorporated a relatively simple but clever mechanism that automatically closed the D vent while closing the large C♯ tone-hole when the D[2, 3, 4], D♯[2], A[3], and B♭[3] were fingered.

With characteristic modesty Murray sums up his work: "With these slight mechanical and fingering changes it has become possible to construct instruments with the holes placed correctly, determined by the use of Boehm's schema, without compensatory shifts of hole position to humor 'bad' notes." Murray gives much credit to Albert Cooper, "without whose skill, patience and insight, this flute would not be in existence."

Proving in Performance

By this time (1955), Alexander Murray had grown in stature as a flutist and had won the post of principal flute in the London Symphony Orchestra, where he performed exclusively on his newly designed flute. Now that he was recognized as one of the world's leading flutists, many other players began to look seriously upon Murray's new flute. In 1967, after 11

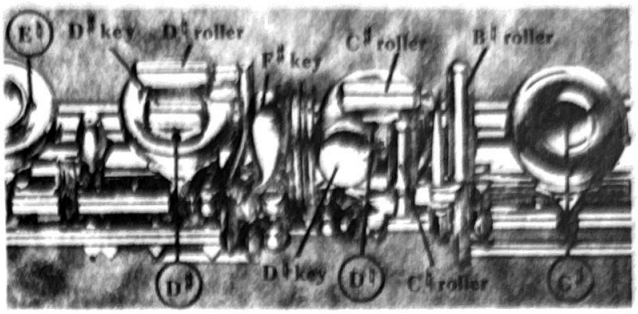


Figure 2 — Right hand detail. See text for explanation of the various keys and rollers. The third finger is in charge of the D♯ key and the D♮ roller, fourth finger operates the remaining keys to the right. Tone-holes are identified by the circled letters (E♮), when closed, gives E♮, etc.).

Figure 3 — Left hand detail, top of flute. Note the split design of the A key. The tone-hole identifications are consistent with those of Figure 2. However, there is some confusion in naming the C♮ tone-hole. Many flutists refer to it as the C♯ hole, because that is the note given when the hole is open. The first finger support is helpful because the flute must be in a somewhat rolled-out playing position. For more details on this, see the first question near the end of the text.

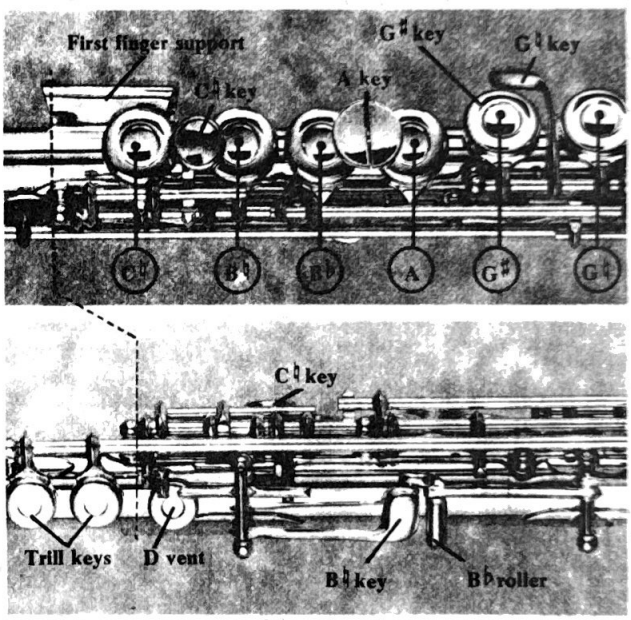


Figure 4 — Left hand detail, rear of flute. Note the position of the automatically controlled D-vent. The B♮ and B♭ thumb keys are in reversed position compared to the more familiar Briccialdi arrangement. This is in keeping with Boehm's own preference when he finally adapted the Briccialdi to his flute. He thought it more logical to go from left to right for a descending half-step.

"...not a revolutionary, but an innovative conservator, carrying Boehm's important work to its logical conclusion."

brilliant years with the LSO, he became Professor of Flute at Michigan State University, where he enjoys an enviable reputation as a teacher, recitalist, and artist-performer in the Richards Woodwind Quintet.

It was my great pleasure to meet Murray shortly after his arrival in East Lansing, and he generously treated me to a private lecture-demonstration of his flute. My astonishment at this new design flute and Murray's technical mastery of it was even greater when I heard him play on some of the one-keyed flutes from his choice collection of 18th and 19th century instruments. His ability to play these older flutes and recorders in such an authoritative, professional manner gave me a strong feeling of reassurance that Murray's thorough, practical knowledge of flute history and acoustics had made him, not a revolutionary, but an innovative conservator, carrying Boehm's important work to its logical conclusion.

A New Prototype

In 1970 Murray met Mark Thomas, vice-president of the W.T. Armstrong Co. (also a well-known flutist and teacher in his own right), who was immediately impressed with the Murray flute. It was agreed that Armstrong would make a similar prototype flute with certain slight mechanical improvements that would embody the ninth and final version of the Murray flute. Jack Moore of the Heritage division accepted the challenge and, working in close consultation with Murray, completed the prototype in June, 1971. The photographs accompanying this article are of that flute.

Its first formal appearance was at James Pellerite's Indiana University Flute Seminar later that month, where Thomas demonstrated it and led some lively discussions. At the Sewanee (Tenn.) Summer Music Center shortly afterward, Thomas gave another demonstration which also created a stir of excitement.

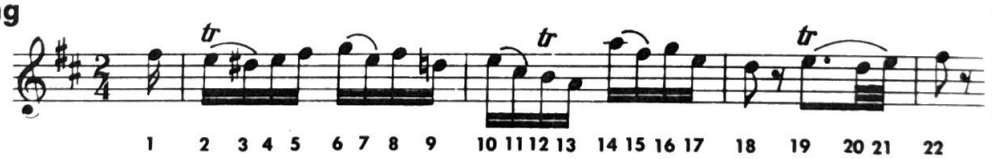
Later, for a two-week period in July, I had the opportunity to live with this prototype, to study it, practice it, and finally demonstrate and explain it for my summer woodwind pedagogy class at Northwestern University. I even managed to work up enough nerve to play it at a few Chicago Symphony concerts and rehearsals at the Ravinia Festival.

Naturally, my finger technique was somewhat inhibited by Murray's open-standing G♯ — although, as a young student I had for a short time "enjoyed" the experience of alternating between an open G♯ piccolo and a closed G♯ flute. On the other hand, although it was very strange at first to play the D♯ without the little finger, that accomodation came very quickly. Meanwhile, by using the forward position of the third finger on the D♮ roller while playing passages in the keys of C, G, D, A and F, I still retained the secure feeling of the customary Boehm D♮ fingering. The alternate D fingering (using the little finger on the D♮ key, Fig.2) was reserved for some chromatic passages.

Right Hand Gains Flexibility

It soon became apparent that my right hand was gaining a kind of freedom and flexibility that it had never experienced previously. There were two important reasons for this, both having to do with the little finger: (1) optimum venting for E and F was automatic, and (2) this freed the little finger for operating the special F♯ lever. In many passages the little finger could be kept on the special F♯ lever without affecting F, E, D, or D♯, thus giving infinitely greater smoothness to scales, arpeggios and trills in the sharp keys. The following example, beginning in the 5th bar of the last movement of the Mozart D Major Concerto, illustrates this technique. The number under each note corresponds to the sequence of fingerings shown in the tablatures (see below).

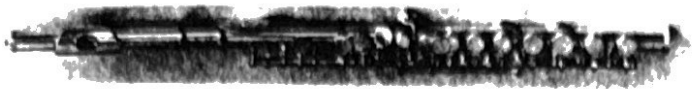
Murray Flute Fingering



♯–F♯ lever
●–D♯ key
●●–trill both keys
■–D♮ roller

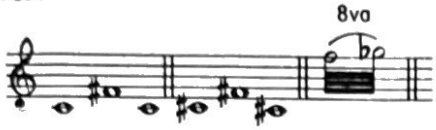
1. ●●● ○○○♯
2. ●●● ●●○♯
3. ●●● ●●●♯
4. ●●● ●●○♯
5. ●●● ○○○♯
6. ●●● ○○○
7. ●●● ●●○♯
8. ●●● ○○○♯
9. ●●● ●●■♯
10. ●●● ●●○♯ *
11. ○○○ ○○○♯ *
12. ●○○ ○○○♯ *
13. ●●○ ○○○♯ *
14. ●●○ ○○○♯ *
15. ●●● ○○○♯
16. ●●● ○○○
17. ●●● ●●○
18. ●●● ●●■♯
19. ●●● ●●○♯
20. ●●● ●●■♯
21. ●●● ●●○♯
22. ●●● ○○○♯

* The little finger F♯ should be omitted - this misled Baasch.



A prototype Murray system piccolo made by Armstrong in early 1972. It embodies all the Murray features except the left hand C♯ mechanism, and is also very unusual in that it goes down a minor third lower than the normal piccolo, to a low B!

The normal Boehm F♯ fingerings are still available on the Murray flute, since there are a few combinations of notes that would be awkward with the Murray F♯ lever:



The following excerpt from Rossini's "William Tell" Overture typifies the problem of the Boehm high F♯, which easily falls down a 5th to B if you happen to misjudge even slightly the embouchure and breath adjustments. The split A key, as pointed out earlier, allows for optimum venting by automatic closure of the A hole, making the high F♯ as stable as the high F♮. You can test this phenomenon in a crude way by inserting a small wedge of cardboard over the A hole of your own flute and sustaining the high F♯ *pianissimo.*

No More Sliding

Another recurring fingering sequence that is markedly improved by Murray's rearrangement of the right hand mechanism is the low C♯ to D♯. On the Boehm flute, the little finger must slide, but on the Murray it is a very simple up and down motion of the little finger. And, for the first time, the trill between low C♯ and D♯ becomes possible.

Despite its obvious advantages, I found Murray's "corrected" open C♯ a bit of a problem in that I tended to play it too flat and with an indecisive tone quality. But I had to assume that this was a natural and temporary overcompensation stemming from my many years of taming the "compromise" C♯. Still, one can't help wondering if it was that thin, veiled quality of the Boehm C♯ that influenced Debussy to choose it for the opening of "The Afternoon of a Faun."

French Model Ruled Out

In studying the close-up photographs of the Murray flute, the reader may wonder about the absence of perforated finger-plates, typical of the "French model" that so many professionals seem to favor. The apparent reasons are that the split design of the A key pulls the left hand second finger too far to the left to allow it to cover a perforated A key and that the Briccialdi-like duality of the right hand third finger-plate likewise makes a perforation impractical there. Thus, 2 of the 5 possibilities are already ruled out. To have only 3 perforated keys would then perhaps be pointless. But the truth is that Murray himself remains unconvinced as to the alleged advantages of the French model, and in fact has marshalled some cogent arguments against it.

Some Frequently Asked Questions About The Murray Flute:

Is it true that the Murray flute has to be held at a more turned-out angle? Yes, and for this reason: The addition of the new left hand C♯ mechanism and the reversal of the footjoint axles shift the weight distribution enough to the rear so that the player must compensate by holding the flute in a more "turned-out" position. This has the effect of shifting the center of gravity forward and to the top, making the flute easier to balance, but in turn requires a compensatory turning in of the headjoint to restore one's normal blowing angle.

Although I can see the many advantages of the right hand open D♯ key, I think it might be too upsetting to relearn my left hand G♯ and G♮ fingerings. Is the open G♯ indispensable to the Murray flute? Although Murray's ideas were originally inspired by Boehm's open G♯ concept, it is a less important feature than some of the others and could therefore be considered optional, just as it is on the Boehm flute. In contrast to Murray's open D♯ key, which conveniently allows two fingering choices for D♮ and gives infinite flexibility to the right hand, the design of the open G♯ key unfortunately does not allow for a corresponding choice of G♮ fingerings in the left hand and is thus more restrictive.

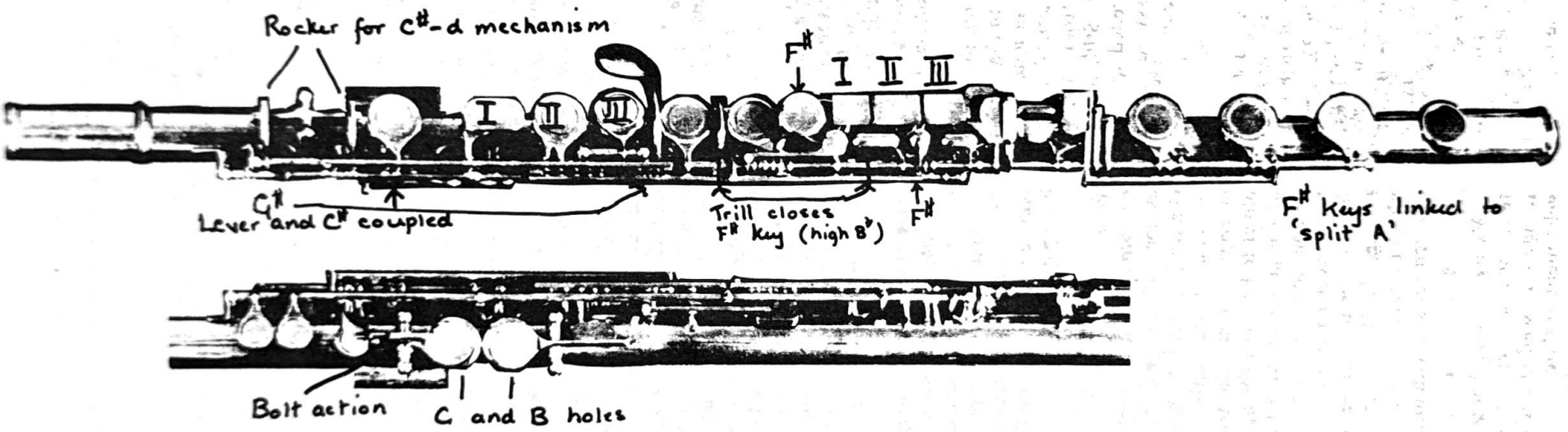
Does any one flute company own exclusive rights to manufacture the Murray flute? No, although Armstrong is as yet the only company considering the instrument on any type of mass scale. It is very difficult to patent an entire instrument; however, a certain new type of key on the Murray flute may ultimately be patented.

What are the chances of the Murray flute winning acceptance among professional players? Despite its evident advantages, the Murray flute will have no chance for wide acceptance among student flutists — from whose ranks the future professionals will emerge — unless the teachers and young professionals of today have the opportunity to thoroughly study and experiment with the new flute. Only if enough serious interest can be developed will the economic risks involved in tooling up and producing the flute for a wider market be justified. In line with this reasoning, the W.T. Armstrong Co. is currently making plans to distribute some hand-made Murray flutes to selected colleges and universities for such study.

My own prediction is that not only will the Murray flute (or some version of it) win acceptance, but that it may very well stimulate renewed invention and development in flute design that would take full advantage of modern technology. ■

Murray Flute by A·K·Cooper, London.

No. I - large tone holes throughout. (1961)



Authors

ALEXANDER MURRAY, flutist, Associate of the Royal College of Music, London, 1947; Premier Prix Paris Conservatoire, 1953; Principal flute, Royal Opera, 1953-55; London Symphony, 1955-66. Member of the Richards Quintet-in-Residence, Michigan State University; faculty, National Music Camp. The first account of Mr. Murray's revised design for the flute appeared in Japan in 1960's. His other interests include linguistics and the Alexander Technique of which he is a qualified teacher. September 1974 appointed Prof. of Flute at the Royal Dutch Conservatory, the Hague, the Netherlands.

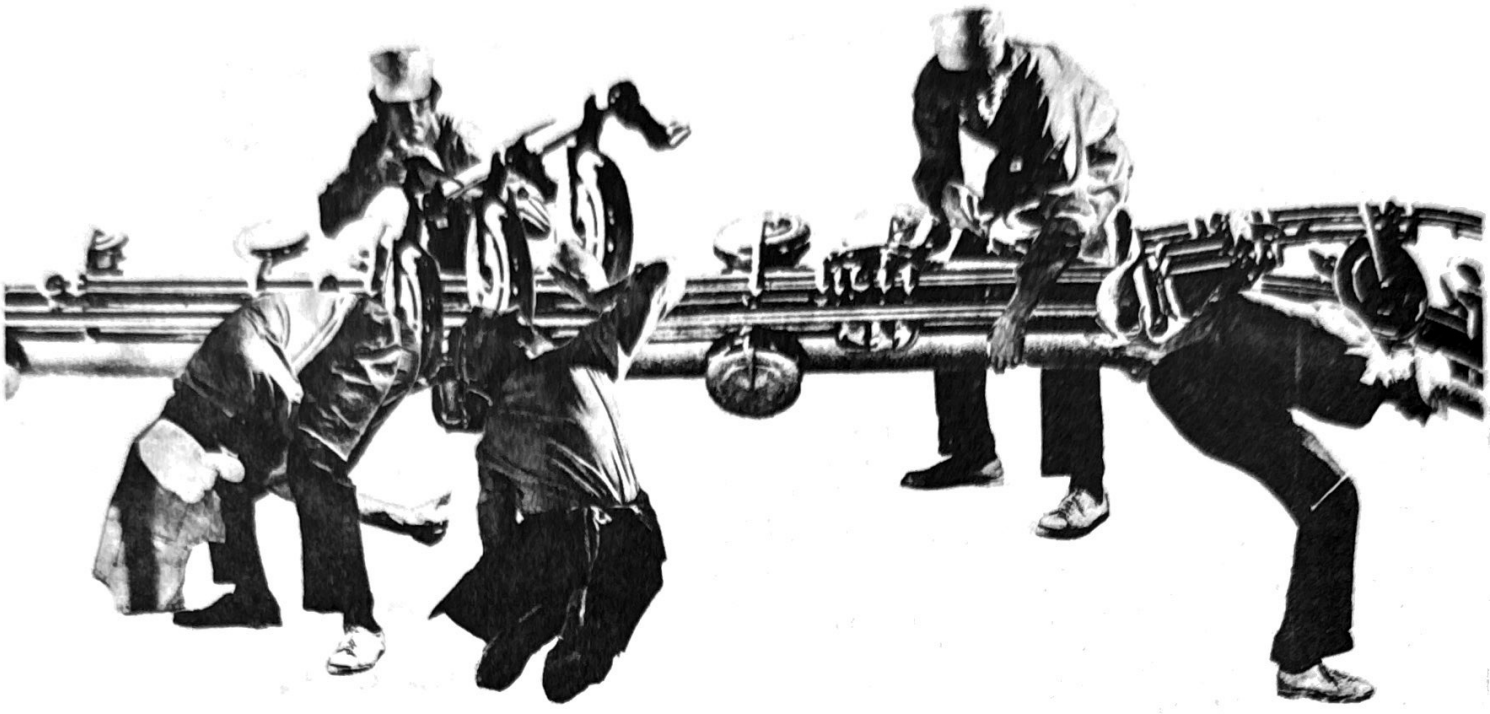
WALFRID KUJALA, Principal Piccolo of the Chicago Symphony Orchestra, appears as soloist with the C.S.O. at the Ravinia Festival on August 11th. Professor of Flute at the Northwestern University School of Music, he is author of *The Flutist's Progress*, a beginner's text. A member of the Board of Directors of the newly formed National Flute Association, Mr. Kujala graduated from Eastman where he studied under Joseph Mariano.

ROBERT J. BAASCH's doctoral dissertation (Columbia, 1952) was on the "Modern Flutes and their Predecessors." As an author, he was columnist for *Woodwind World* ("Bandmaster's Corner") and contributor to *The Instrumentalist* and *Woodwind*. Formerly a faculty member at Columbia and head of the woodwind department of the Long Island Institute of Music, he is presently the Director of Instrumental Music for the Malverne (L.I.) Public Schools and active as a professional flutist and private teacher.

The following Comedy of Errors is from the Music Journals of April and July 1973.

The final article in this collection is a summing up by Philip Bate.

At the time of publication there is not a suitable photo available of the latest Heritage flute which incorporates one more refinement, pioneered by Albert Cooper in the summer of 1973 and executed in Heritage no 1 by Jack Moore in the Spring of 1974. This is a large D trill on top of the flute instead of in the usual position. The C-D C♯D trills are very well in tune. High G-A is easy and high B♭ is sharper than on previous M flutes B remains the same.



BY ROBERT J. BAASCH.

In the November '72 issue of *The Instrumentalist* an article was published entitled "The Murray Flute" in which an instrument developed by Alexander Murray was introduced and alleged to be an improvement on the Boehm flute. The author of the article, Walfrid Kujala, believes that the Murray flute carries out "Boehm's important work to its logical conclusion," and predicts that it will win acceptance among professional players and teachers. The first assumption is completely erroneous, and the second is highly improbable. Because it has attracted some attention, however, particularly in the Midwest, it could mistakenly be viewed as a possible successor to the long-established Boehm flute. This article will examine the Murray flute in the light of Boehm's work and will demonstrate its faults, both mechanical and acoustical.

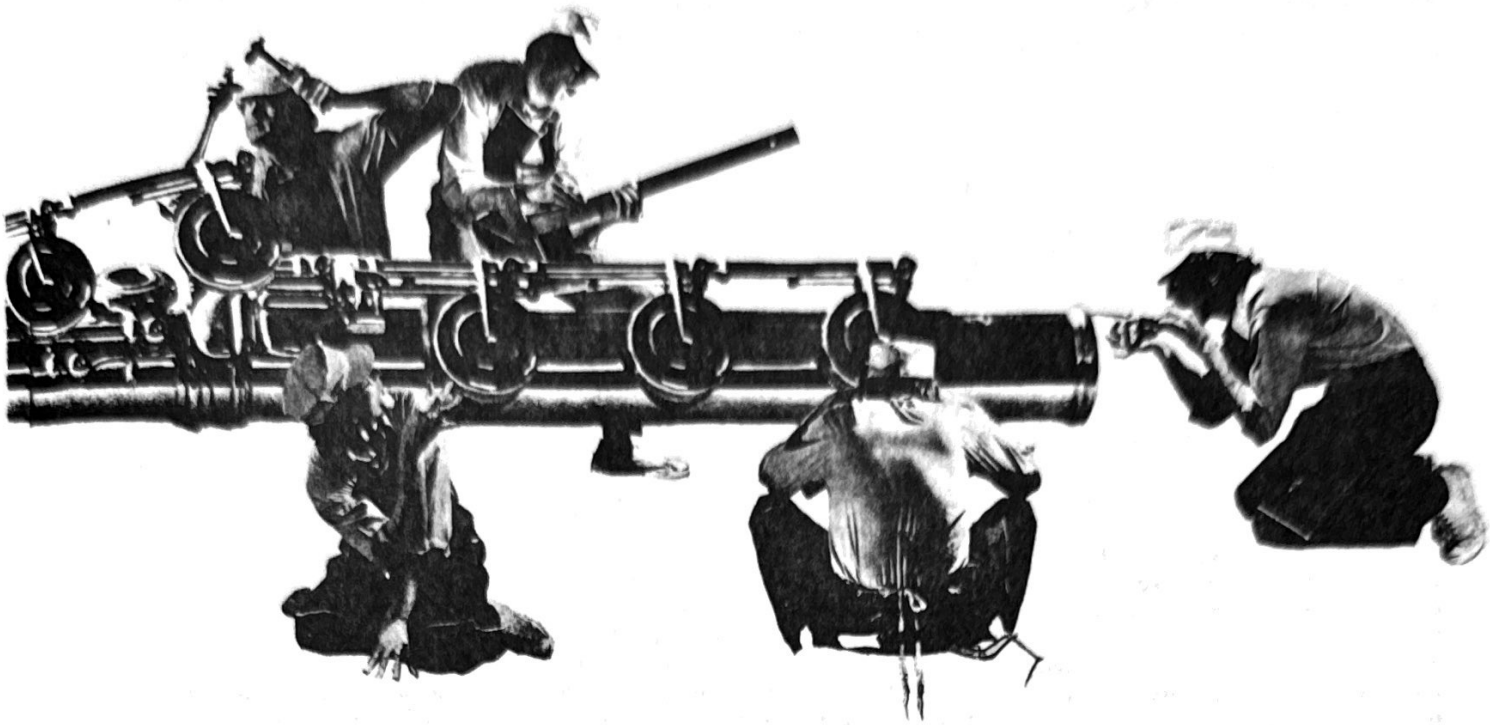
Boehm was guided by a willingness to accept compromise for the sake of simplicity in every aspect of the development and construction of his flute. The bore, the size of each tone-hole, and the key mechanism itself are all compromises. His flute is in almost universal use today because each attempt to improve it (and these attempts have been legion) was forced to give way to the superior quality of simplicity that has characterized the Boehm flute ever since its inception. The Murray flute, like so many before it, is the sad result of too much emphasis placed by "would-be" innovators upon isolated mechanical or technical aspects while losing sight of the simpler basic principles upon which the whole instrument is constructed.

The old-system flute, although an illogical combination of open and closed tone-holes, has been referred to by Rockstro as the "closed system." The Boehm flute has been called an "open-keyed system," yet, this is not a true statement because Boehm employed one closed key — the D# key. It is this key that has confused Murray who has introduced an open D# key on his flute. He can see no logical reason for a closed key, and in the same issue of the magazine mentioned above, in another article, Kujala claims that "Boehm undoubtedly expected even greater resistance to the idea of reversing the granddaddy of the closed keys . . . so he prudently left that alone."

If we regard the Boehm flute as an "open-holed system," not an "open-keyed system," the picture becomes clear. Boehm constructed the key mechanism of his flute of 1847 on the new *principle* of a completely open-holed system. He was totally successful in achieving this goal inasmuch as all of the keys were open when his flute was held in the playing position. Contrary to the beliefs of both Murray and Kujala, Boehm left the D# key closed for one logical reason: in requiring the player to hold the key open with the little finger of the right hand he gained the advantage of greater stability in holding the flute and at the same time established his complete open-holed system.[1]

Use of the little finger in helping to hold the flute is particularly essential for producing a C#, which requires all keys to be open. Boehm also quite logically preferred the open G# key since it was necessary to maintain his open-holed system. The present arrangement of duplicate G# tone-holes eliminates most of the objections to the earlier closed G# with its veiled A, and the various compromise keys as well, and retains the open-holed principle despite a closed G# key.

We are told that Murray was first inspired by learning of Boehm's preference for the open G# key, and began his innovations by having his closed G# flute converted to an open G# model. Because of the reluctance on the part of most players to accept this feature on the Boehm flute, we are informed that this can be optional on the new Murray flute, although its presence is praised quite highly. If the option is chosen, it completely takes away any claim of superiority in producing the high E. Next, the Murray flute was changed



THE MURRAY FLUTE AN IMPROVEMENT?

to an open D# model, supposedly to free the little finger of the right hand for greater flexibility, but a new F# lever was introduced requiring the little finger to go back to work again. The use of this lever creates several apparently unrecognized disadvantages which are not present on the Boehm flute. I will discuss this matter in some detail later in this article.

Ironically, the liberated little finger of the right hand must operate five keys on the Murray flute, including the new F# lever which has been placed both unnaturally and dangerously close to the third finger, whose duties have also been increased inasmuch as it must move back and forth as well as up and down as it searches for the new partially concealed D# key or the roller for D.

When Dayton C. Miller was experimenting with his idea for a platinum flute during the years 1927-33, he was troubled about using the heavy platinum for its key mechanism, not because he was concerned about the weight of the flute in the hands of the performer, but because he was concerned about the acoustical effect of the heavy platinum mechanism upon the flute tube. The additional weight of the added devices on the key mechanism of the Murray flute must cause Miller to turn over in his grave.

The original Boehm flute of 1847 had no Bb thumb lever; this was introduced by Briccialdi in 1849, who had Rudall and Rose construct it for him. Boehm later devised his own Bb thumb lever which he considered more rational than that of Briccialdi since it was placed below the B key rather than above it. Murray moved the B key to the top of the flute, in line with the other keys, but his thumb lever arrangement on the back of the tube is a similar attempt to achieve this more rational movement of the thumb. It is not necessary — Boehm's thumb lever has been rejected because the Bb thumb lever is used basically to lock in a Bb, and the thumb is seldom required to slide one way or the other for a B. When this situation is called for the regular Bb to B fingering is usually used. With the absence of a key under the Murray thumb levers, which could supply additional support, the rather delicate arrangement could be a source of future trouble.

Theoretically, according to Boehm, there should be three additional large tone-holes for the notes C#, D, and D#, but since he did not wish to complicate his system, he made use of the one available finger and devised a single compromise hole to serve all three notes. A few flute manufacturers have offered an optional large C# on the Boehm flute to be used, if desired, for an exposed C# note. Although not a completely new idea, one of the features of the Murray flute is an attempt to make this optional large key function automatically while still retaining the compromise vent for D and D#. This is the only commendable feature I can find on the Murray flute that warrants an attempt at a mechanical change, yet, it falls short of fulfilling Boehm's original idea of possibly having three additional large tone-holes to perfect his theory. I played the Miller gold flute, now being exhibited at the Library of Congress together with the rest of his collection, and it, too, has a large C# tone-hole. The key rubbed against my first finger, and unless I held the finger away from the flute a bit the key could not move. This is undoubtedly the reason why Murray had to add a first finger support to the front of his flute tube. It adds thickness to

(continued on page 22)

THE MURRAY FLUTE

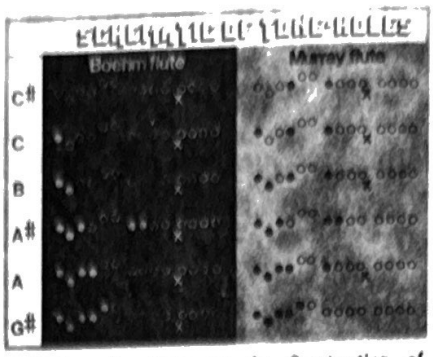
(continued from page 19)

the tube, and destroys the aesthetic feeling of gracefulness one experiences when holding and performing with the modern Boehm flute.

The new F# lever, mentioned earlier, was added to the Murray flute as a means of eliminating the contrary motion of the three fingers between F# and E. With the new arrangement the little finger can remain on the F# lever while executing all of the notes of the lower key mechanism, except G, obviating the use of the third finger for F#. Murray also split the A-A# key combination in the upper key mechanism and connected the A key to the F# lever. In this fashion the A key and the F# key can be held closed while the A# key remains open giving the proper venting for the Boehm troublesome high F#. This all sounds very fine as far as improving the high F#, or in assisting some unpracticed performer in overcoming the contrary motion of the right hand, but what has Murray done to the acoustical requirements of the upper key mechanism? He has destroyed optimum venting for four notes, violated the Boehm open-holed principle, sacrificed proper support of his flute for two notes, and created a situation wherein the little finger of the right hand must constantly move up and down as it tries to keep up with the changing fingering demands (see Schematic).

Boehm's open-holed principle is not an arrangement of keys that assume a particular position under a singular condition, but rather is a method or plan that encompasses the entire flute mechanism and must be present for all notes. If you take the time to reread Boehm's statement in the footnote, keeping this in mind, you will note that he said ". . . the holes immediately below the one sounding should remain open, for the air confined in the lower part of the tube tends to flatten the notes, and renders them less free. . ." Murray cannot claim that his flute may be exempted from the condition stated above for basically it is still a Boehm flute. Buffet, who patented the needle spring, clutch, and hollow sleeve and axle method of extending the key mechanism, Briccialdi, and Godfrey who contrived the five perforated keys, were successful in making contributions to the Boehm flute, but they never gave their names to the flute.

How Murray can accept his violation of the open-holed principle in the upper key mechanism while being obviously aware of the necessity for optimum venting in the lower key



[Boehm, **An Essay on the Construction of Flutes**, edited with the addition of correspondence and other documents by W. S. Broadwood, an original translation by Boehm from his pamphlet of 1847 (London: Rudall, Carte & Co., 1882), p. 20. "It is necessary, for obtaining a clear and strong tone, that the holes immediately below the one sounding should remain open, for the air confined in the lower part of the tube tends to flatten the notes, and renders them less free; therefore the D sharp key remains open for the whole of the scale, excepting (D^2) and thus the little finger of the right hand assists at the same time in holding the flute steadily."

mechanism is a mystery. If this is not enough, his trill fingering for E to F# illustrated in the article under discussion requires the shaking of the first and second fingers of the right hand. This same trill can be produced on the Boehm flute by shaking only the first finger. The slight veiled quality of the alternate F# fingering of the Boehm flute is not noticeable in trills or fast passages, and most players make use of this option when it is expedient. Since this option is also available on the Murray flute, I would safely guess that the Murray trill would not be used when playing the passage illustrated for it is obviously easier to trill with one finger rather than two.

There are other mechanical and acoustical faults inherent in the Murray flute. The foregoing should suffice in proving my point: the Murray flute is neither superior nor equal to the present Boehm flute, and, in fact, is grotesquely more complicated.

The above Schematic is a representation of the fourteen tone-holes on the two flutes under discussion. For the sake of comparison I have included an open G# and a low B for each. The scheme for the Murray flute was obtained from information furnished in the article which appeared in the November issue of *The Instrumentalist*, and from a study of the photographs and fingering chart included. In each case the diagram above is not a fingering chart, for such a simplification would not show the disposition of each tone-hole on the flute. By means of this Schematic the reader may obtain a clearer understanding of the differences in the two mechanisms.

C# **Boehm** — All tone-holes are open. (X) The little finger of the right hand is holding the D# key open thus supporting the flute. Perfection.

Murray — Two tone-holes are closed (X) The little finger of the right hand is holding the F# key and its attached A key closed for support of the flute. A violation of the open-holed principle.

C **Boehm** — All tone-holes below C are open. Same as above. Perfection.

Murray — Two tone-holes below C are closed. Same as above. Imperfection.

B **Boehm** — All tone-holes below B are open. Same as above. Perfection.

Murray — Two tone-holes below B are closed. Same as above. Only one tone-hole is open between the B key and the A key resulting in a veiled quality of sound. Completely unacceptable.

A# **Boehm** — Two tone-holes are closed below the A# (Bb) key (the only compromise in the upper key mechanism of the Boehm flute). Acceptable because three tone-holes are open below the A# key. This compromise can be eliminated by use of either the Bb thumb lever or the frequently used Bb trill key.

Murray — This note cannot be played unless the little finger of the right hand is removed from the F# lever. Depending upon the clutch arrangement it may not be possible to play the regular Boehm fingering (I have shown it, however, in the Schematic above). The Boehm alternate fingering can be used. Imperfection.

A **Boehm** — All tone-holes below A are open. Same as above. Perfection.

Murray — One tone-hole below A is closed. Same as above. Imperfection.

G# **Boehm** — All tone-holes below G# are open. Same as above. Perfection.

Murray — All tone-holes below G# are open. However, the little finger of the right hand must be removed from the F# lever or an objectionable veiled quality of sound will result. Imperfection.

The little finger of the right hand may be removed from the Murray flute for all of the notes illustrated above. It is not advisable because it will result in the loss of stability in holding the flute, which Boehm recognized when he used one closed key for his open-holed system. □

The Murray Flute

an Improvement

BY ALEXANDER MURRAY.

"In any account of the flute the work of Theobald Boehm commands a chapter to itself. It was he who, through a combination of musicianship, vision and mechanical ability of a high order, fathered the instrument which is used by the great majority of players today, and though modifications and some improvements may have been made since his time, none of these has fundamentally altered the instrument as he left it."

The few slight alterations I have made in the flute do not change the truth of this statement by Philip Bate (*The Flute*, New York: Norton, 1969). Boehm's two basic principles — that the holes should be equal, or nearly so, in size, and that the keys when in repose should be open are the basis for two of the changes I have made. The C#^{2} hole, instead of being small, has been made the same size as the adjoining C^2 hole. An octave key has been added (as in some late Boehm flutes) which functions automatically for D^2, D^3, D^4, D#^{2}, A^3, B^{b3}. The D# key, the only tone hole key (excluding the trill keys) not open-standing, has been reversed in action — when the little finger is removed, the D# hole is open. There are two other small mechanical changes. The A key is split, the lower half connected with an F# lever worked by the little finger of the right hand, and there is an alternate fingering for low D, not employing the little finger on D#, but closing the D# key by means of a roller in front of the ring-finger, right hand.

The differences from the conventional flute may be summarized as follows:

Left hand: Identical in fingering to Boehm's original flute (open G#, reversed thumb-keys).

1) Large C#^{2} (tone hole C#^{2}, C#^{3}, vent hole G#^{3}, C#^{4}).

2) Small D vent hole (D^{234}, D#^{2}, A^3, B^{b3}).

3) Reversed thumb-keys (Original Boehm) working C#^{2} and D vent automatically.

4) Split key under middle finger (for F#^{3}).

5) Open G#.

The right hand has the normal F# fingerings available although these are only used when F# is preceded or followed by C^1, C#^{1} and for F^3-F#^{3} trill.

Changes:

1) Open D# key.

2) D# roller (the D# key can be depressed simultaneously with the ring-finger key).

3) D# trill key is linked to the D# key (facilitates A^3-B^3 — no contrary motion of little finger).

4) Axle of foot joint keys is reversed (on the near side of the body) giving improved mechanical advantage as more keys are employed. Contrast the action of low B on a conventional flute.

5) F# lever, alongside D# key connected to split A key, giving a properly vented F#^{3}.

6) B^b key closes C hole as well.

Advantages:

1) Technical. The advantages of the open G# have been outlined by Boehm. Many of these apply to the open D# — the springing is lighter, the chromatic fingering D, D#, E is simpler, there is no contrary motion of the fingers in playing D-E, the little finger is not locked down in playing D#-E and E^b-F. The flute cannot be gripped between the little finger and thumb (a bad habit which to my knowledge has nearly ruined certain players. One professional acquaintance was unable to play a closed D# without a splint on the little finger. He plays brilliantly on an open D# — retaining his closed G#). The right and left little fingers function symmetrically — the trill F#-G# is accomplished by both fingers moving in the same direction simultaneously. The top octave employs the right little finger for F#, C^4, C#^{4}, and D^4 only.

The relatively slight additional weight of the mechanism is offset by the absence of the additional (duplicate) G#, and of a separate foot joint; the body is in one piece.

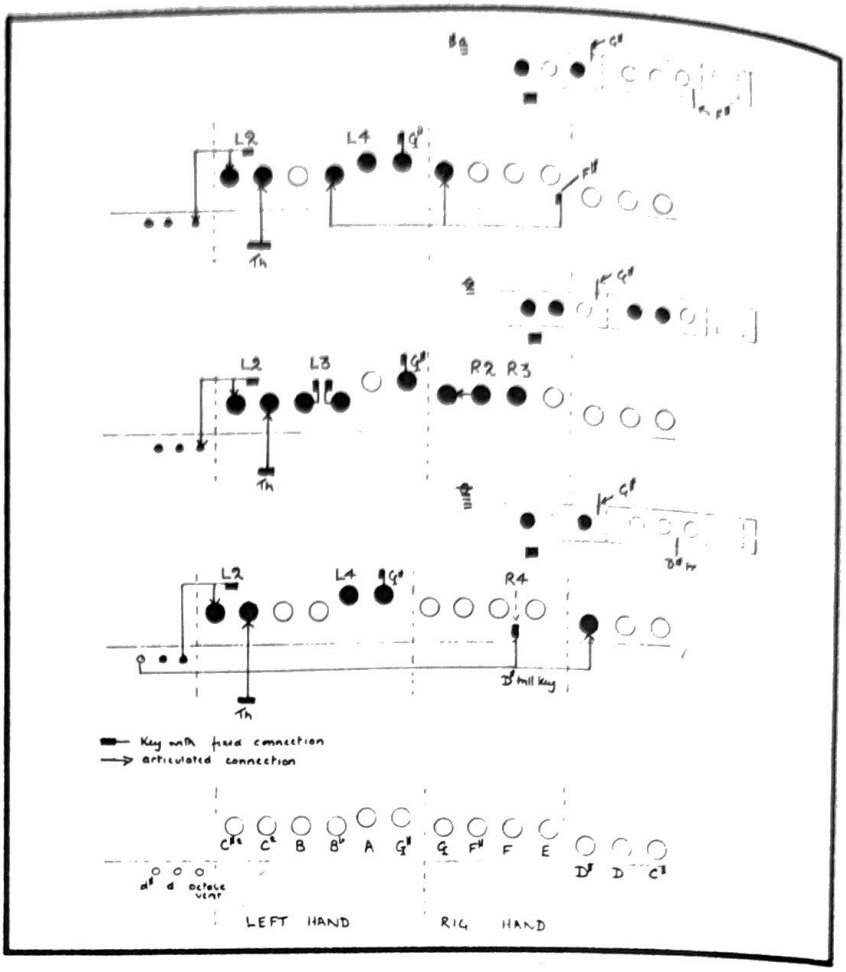
2) Acoustic. Those notes produced by the use of the C# and D vent are better in tune; the F# hole is in its true position (not 1 mm. sharper). The venting of the top octave from D#^{3}-G#^{3} is consistent, E^3, F#^{3}, and G#^{3} are improved in tuning and in relation to their adjacent notes.

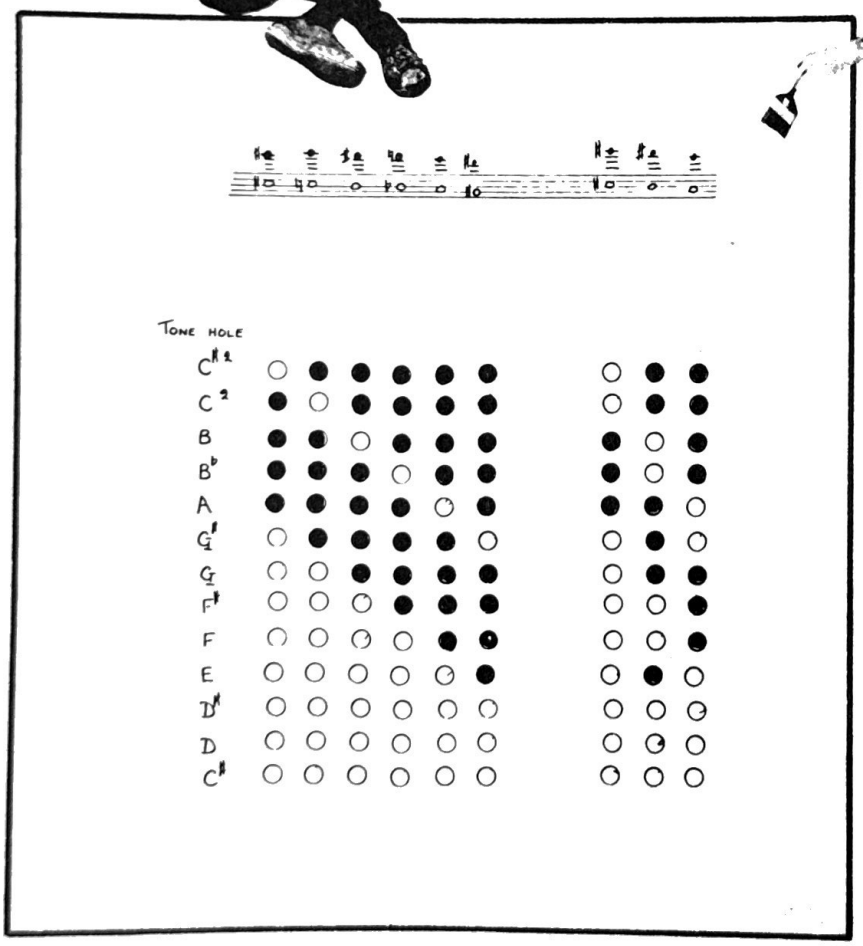
I have had a great deal of assistance in simplifying what was originally a rather complex instrument from Albert Cooper of London, and Jack Moore of Armstrong Heritage Division, both of whom have given unstintingly of their time and skill. The present form of my flute is as different from its first appearance in 1959 as an 1832 Boehm from his flutes of 1860. Those judges to whom I have been

able to demonstrate the instrument thoroughly have been as convinced as I am that by moving one more step in the direction pointed by Boehm we can improve his 98% perfect creation by 1%. I look forward to the day when the remaining 1% has been added.

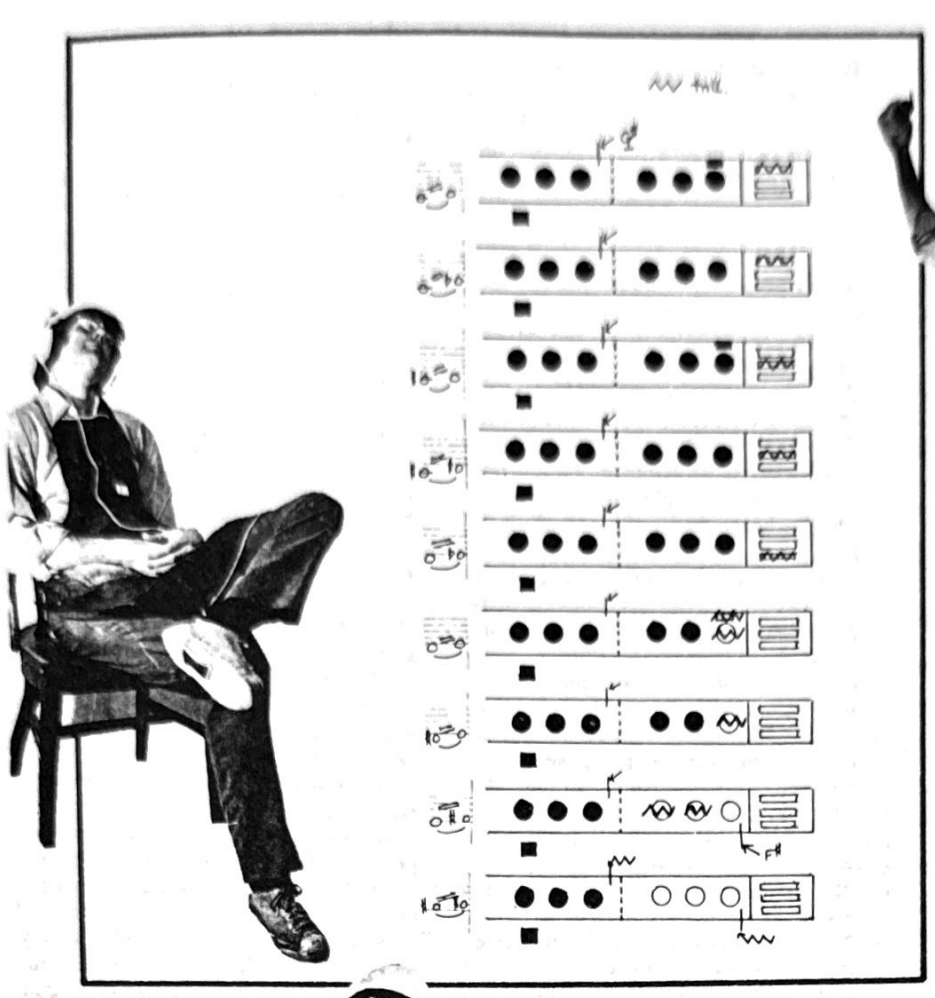
Examples

Ex. 1. Diagram showing the relationship between fingerings and closed holes.
a) F#3. Note that the F# key closes the G and B♭ holes.
b) E3. The third finger, left hand, closes the B and B♭ holes with a "split" key.
c) B3. The right little finger is free; the D# key closes when the D# trill key is depressed. This facilitates movement to and from A3.

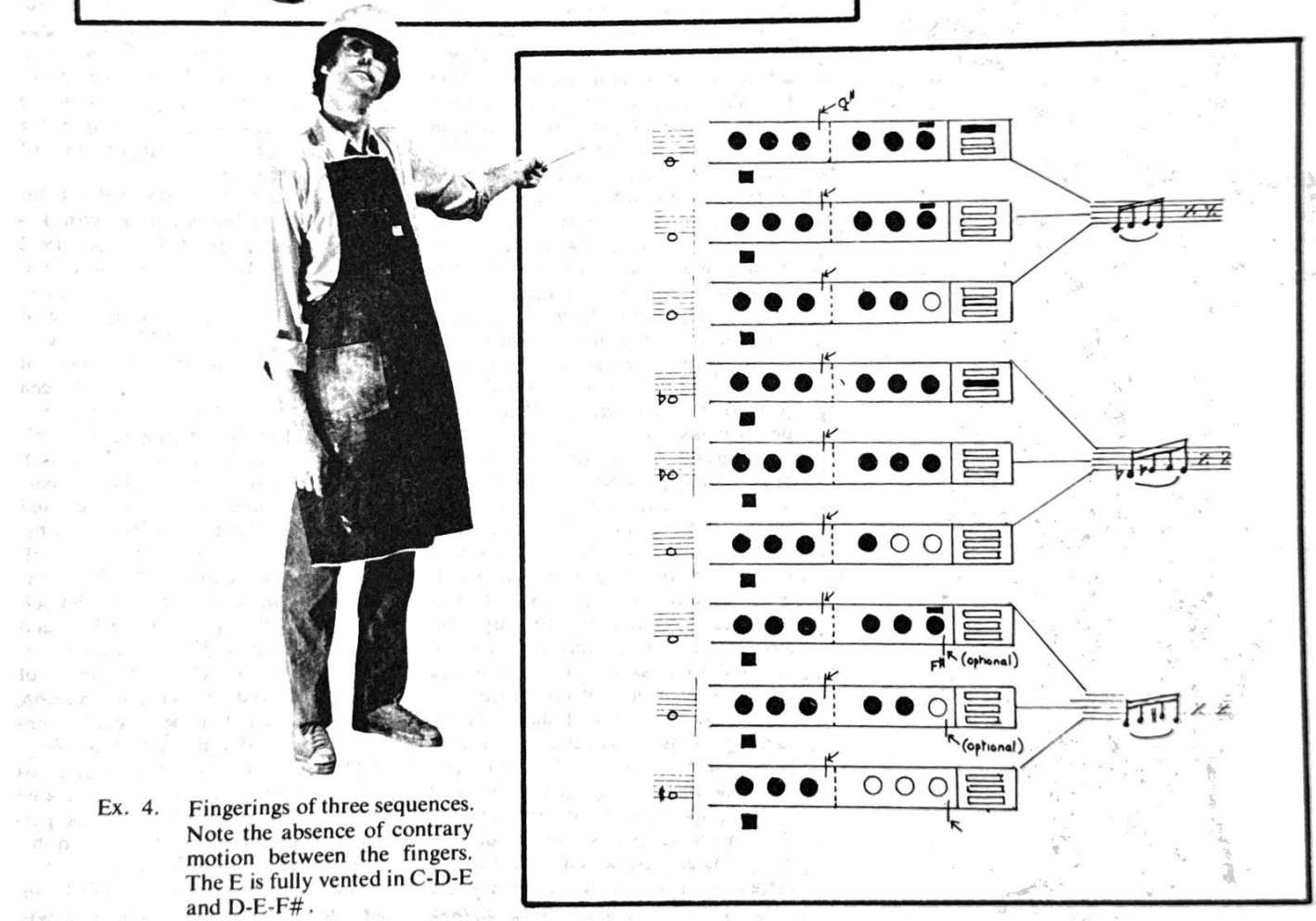




Ex. 2. Schematic representation of the venting of the top octave (D#3-G#3). The lower notes represent the pitch of the vent holes. On the left, the vent holes and tone holes maintain a constant relationship; on the right the doubly vented notes of the conventional flute are shown.



Ex. 3. Fingerings of some trills and tremolos.



Ex. 4. Fingerings of three sequences. Note the absence of contrary motion between the fingers. The E is fully vented in C-D-E and D-E-F#.

BY WALFRID KUJALA

Judging from his academic credentials, one might suppose that Robert Baasch's piece on *The Murray Flute: An Improvement?* (*Music Journal*, April, 1973) had researched his article with the thoroughness and objectivity normally expected of a reputable scholar, and that some new truths might emerge from his apparent painstaking "examination" of the Murray flute. After all, Baasch had earned a doctorate from Columbia with his dissertation on *Modern Flutes and their Predecessors* and had contributed flute articles to several important journals. The reader therefore could hardly dispute his authoritative-sounding observations.

Yet, a careful study of Baasch's April article reveals his shocking disregard for the cardinal rule of scholarly research: *Whenever possible examine and study at first-hand the primary source material* — in this case, the Murray flute itself. This he did not do. Instead, he turned to a secondary source — my recent article, *The Murray Flute* (*The Instrumentalist*, November, 1972), which incidentally was not intended as a definitive study of the Murray flute, but was essentially a critical evaluation, with emphasis on historical background and flute design principles rather than on detailed playing techniques. (It did not even include a complete fingering chart or a schematic of tone holes, since these had already appeared earlier in 1972 in the *Journal of the American Musical Instrument Society*, which Baasch surprisingly overlooked.) Thus, incredible though it must seem, Baasch's approach was much like writing a criticism of a new musical work by studying someone else's analysis of it without ever seeing the score or hearing it performed, or like judging the efficiency of a new type of engine by examining a few photographs and a general description without reference to working drawings, specifications or performance data.

Naturally, this raises the question: Was it really possible for Baasch to examine and play the Murray flute? Indeed it was! Alexander Murray, its designer, personally urged Baasch to do so, but was flatly turned down. It was obvious then that Baasch was reacting emotionally to my *Instrumentalist* article (privately he had referred to it as the strongest attack on the Boehm flute of this century — isn't it quite odd that I should be attacking an instrument that has been so good to me for 36 years?), and this no doubt blinded him to the possibility of further investigation of the Murray flute with proper scientific detachment. Instead, he seized upon the few errors in my article (unfortunately without realizing they were errors), and blew them up out of all proportion to support his fallacious contention that the Boehm flute of 1847 could not be improved on — the implied corollary being that Boehm's flute is sacrosanct and should not be tampered with.

The fact is that others have "tampered" with it — and rather successfully, as Baasch himself admits — by adding the thumb Bb key (Bracciabile), the duplicate G# tone-hole for a closed G# key and the perforated finger plates (Godfroy), so the modern standard version of the Boehm flute is now in some respects further removed from the 1847 version than is the Murray. Furthermore, as I pointed out in my opening article, *A Brief History of Flute Design* of the November 1972 special flute issue of *The Instrumentalist*, English flutists have kept alive with good success other radically modified forms of the Boehm. The irony here is that of all the foregoing innovations, Murray's have by far adhered most closely to Boehm's revolutionary principles of flute construction.

Before proceeding to a point-by-point refutation of Baasch's criticisms, some background information might be helpful to satisfy the curiosity of those readers who understandably may be wondering why Baasch's article appeared in the *Music Journal* rather than *The Instrumentalist*, where it would seem to have been more appropriate. Following is a summary of the odd chain of events culminating in the *Music Journal*'s publication of Baasch's article:

Baasch did originally submit his manuscript to *The Instrumentalist*. His covering letter dated Dec. 26, 1972 contained unusually stringent conditions for its publication, along with an unrealistic deadline for acceptance or rejection — Jan. 15, 1973. Because of the holiday season and the illness of the publisher (to whom it had been sent directly), there was an unavoidable delay in responding to Baasch's submission, and on Jan. 17 Baasch wired his displeasure, withdrew permission to publish his article, and demanded the immediate return of his manuscript. On Jan. 18 Kenneth Neidig, the editor of *The Instrumentalist*, sent a letter to Baasch explaining the previous delay and asking him for a 30-day extension of his deadline. Baasch, in his reply of Jan. 23, agreed to such an extension, though he felt it to be somewhat unreasonable, and at the same time obligingly enclosed more material for his article. Strangely enough, he reiterated that his previous withdrawal of permission to publish contained in his Jan. 17 telegram still stood.

Since it is the wise policy of *The Instrumentalist* to rely as much as pos-

sible on the counsel of their contributing editors, Baasch's article was sent to me on Jan. 25 for my comments and advice. Despite an unusually hectic period of concerts, teaching duties, and out-of-town engagements, I managed to go over Baasch's article in complete detail. On Feb. 12 I wrote an extensive letter to Neidig in which I reviewed point-by-point the relative merits of Baasch's article, and then recommended that the article be published. Here are some pertinent excerpts from my letter to Neidig:

> I appreciate your showing me Baasch's rebuttal article, and I must admit that I probably would have been disappointed had not someone responded with an opposing viewpoint. Baasch obviously studied both of my articles very carefully. It would be nice if all our readers were that thorough.
>
> As you remember, my original article on the Murray flute was much longer, and it became necessary to make some cuts in order to make more room for the other flute articles in the November special issue.

The Murray Flurry

Since my main goal was to review and evaluate the Murray flute and show how it differed basically from the Boehm flute, we felt that we could forego sections that touched too specifically on playing techniques. We agreed that it would be unrealistic to include instructional material for an instrument that was not yet available to the public. For this reason also, we omitted the complete Murray fingering chart, hoping that the detailed photos with their captions, and the descriptions in the text would make clear what the few "new" (but significant) fingerings were.

Unfortunately for Baasch (and perhaps other readers too), the Mozart illustration was misleading in that it's accompanying fingering tablatures were not intended to be construed as an official Murray fingering chart. Rather, its purpose was to show how the Murray right hand mechanism lends itself to a smooth execution of a type of passage which occurs so frequently in baroque and classical music for the solo flute (with its pre-Boehm "simple" F# fingering). The holding down of the 4th finger F# key in the Mozart passage was not for the purpose of balancing the flute, as Baasch infers, but for optimum smoothness of right hand fingering changes without compromising tone quality — roughly similar to the "keeping down of the fingers" in violin lefthand scale technique.

Baasch is quite correct in criticizing the use of the F# key while playing B^1 or B^2 since it can result in a slightly veiled quality on those notes (comparable to that of the F# when played with the right hand 2nd finger), and I agree that the Murray F# key should not be used for the left hand notes so that maximum purity of sound is retained.

> [Then follows a detailed analysis of Baasch's criticisms, the essence of which will be summarized at the end of this article.]

I've reviewed these points that Baasch has raised in some detail here because I want to convince you of the importance of devoting more space in the near future for airing the pros and cons of "improving" the flute. Even though I don't agree with them, I respect Baasch's philosophical arguments. They have merit, and I'm sure represent the thinking of a number of other musicians.

I feel that our readers should be stimulated into thinking more about this question, which has important implications for all woodwind and brass instrument design. Too many musicians and teachers are docile when it comes to questioning — or even understanding — the construction and design of their instruments.

Therefore, I would like to propose the following: (1) Baasch's article should be published in *The Instrumentalist*. (2) I would write a response to his article based essentially on the material I've outlined in this letter. (3) Baasch should be given a copy of my response so that he can write a final counter-rebuttal. (4) All three of the above pieces should appear in the same issue.

In the interest of better continuity, I would also like to suggest that Baasch consider deleting his supplemental pages 6-8 and the accompanying schematic, since I will readily concede his point, and since it is in any case based on misleading information that I would correct in my response. I would further suggest that Baasch might want to extend his earlier remarks on the subject of "Boehm's compromises for the sake of simplicity," since this

(continued on page 72)

MURRAY FLURRY

(continued from page 41)

seems to be the heart of the controversy, and is essentially the issue that readers will be most concerned with.

If you agree with my recommendations, I hope you will get in touch with Baasch as soon as possible, and find out if he would be agreeable to such a course of action.

—Cordially, W. K.

Meanwhile, Neidig received another letter from Baasch dated Feb. 9 in which he peremptorily cancelled the 30-day extension of his deadline, at the same time interjecting remarks about the calibre of *The Instrumentalist* staff and contributing editor. He also stated that he had prepared a second draft of his article and had other plans for it. On Feb. 15 Neidig sent Baasch a copy of my Feb. 12 letter, and in a covering letter in which he fully concurred with my four-point recommendation, Neidig asked Baasch to consider my proposal, and said that "we would be interested in your response." There was no further response.

There was, however, this curious sidelight: To keep Alexander Murray abreast of current developments, I sent a copy of my Feb. 12 letter to him in London where he was on a research leave from Michigan State for the winter quarter. He responded in his characteristic gentlemanly manner by sending Baasch a cordial invitation to meet with him in March when, as luck would have it, Murray would be on tour with the Richards Woodwind Quintet on Long Island not too far from Baasch's home, and Baasch would be welcome to examine and play Murray's flute. Although Murray would have been more than willing to bend his itinerary to accommodate such a meeting with Baasch, it was apparent from the routine excuses in Baasch's letter of refusal (the distance was too great and there was inadequate time in his busy schedule) that he was simply unwilling to face up to the ordeal of "examining a primary source." Interestingly, Baasch also confided to Murray that he had read the copy of my Feb. 12 letter that Neidig had sent him, and he deplored the type of censorship which my proposal contained. This was apparently a reference to my *suggestion* that Baasch *consider* deleting his pages 6-8, since it was based on misleading information that I would be willing to concede and correct myself, thus saving unnecessary argument. (Interested readers may want to consult the June, 1973 *Instrumentalist* in which the Mozart fingering is reprinted and duly corrected.)

To refute Baasch's specific arguments in such a way that the persevering reader will not get needlessly lost, I have quoted key sentences from the article — identifying them by page number, column and line — each followed by my rebuttal. For instance, the first quotation below (18-1-3) is from page 18, column 1, line 3.

18-1-3. *In the Nov. '72 . . . Instrumentalist . . . the Murray flute . . . was introduced . . .* The Murray flute was introduced long before 1972. The first model is over 15 years old, and several more recent hand-made versions are being actively played — for example, Christopher Taylor, recording artist in London and former principal flute of the Royal Philharmonic; Robin Chapman, London Philharmonic piccoloist; and Murray himself, who, while principal flutist of the London Symphony, performed on his flute all over the world and made dozens of recordings with it. Philip Bate described the Murray flute in his 1969 book, *The Flute*,[1] on pages 150-51.

18-1-7. *The author, Walfrid Kujala . . . predicts that (the Murray flute) will win acceptance among professional players and teachers . . . (this is) highly improbable.* Baasch could be right. Predicting is too risky an occupation, and should be limited to the stock market.

18-1-20. *This article will examine the Murray flute . . .* Baasch "examines" a flute he has never seen, and demonstrates (!) its faults.

18-1-24. *Boehm was guided by a willingness to accept compromise for the sake of simplicity in every aspect of the development and construction of his flute.* There is no perfect musical instrument. At best, instruments are compromises, but there is no proven correlation between simplicity and compromise. If Boehm was really willing "to accept compromise for the sake of simplicity," he would have reverted to the 18th century one-keyed flute. After all, a surprising number of contemporary flutists seem to be doing just that.

18-2-8. *. . . while losing sight of the simpler basic principles . . .* Murray's flute is fully consonant with the two basic principles that Boehm adopted: 1, that the holes should be equal, or nearly so, in size (Murray enlarged the C# tone-hole to be equal with the others), and 2, that the keys when in repose should be open instead of closed (Murray converted the last remaining closed key, the D#, into an open one).[2]

18-2-16. *The Boehm flute has been called an "open-keyed system," yet, this is not a true statement because Boehm employed one closed key — the D# key.* Boehm said: "I chose the open keys, as giving the greatest possible ease in playing, since they easily follow the movement of the fingers, and only weak springs are required to raise them quickly. On the contrary, closed keys require strong springs in order that large holes may be stopped airtight, and their motions are contrary to those of the fingers."[3]

18-2-43. *Boehm left the D# key closed for one logical reason: . . . greater stability in holding the flute . . .* This was not Boehm's reason, for he said: "I have retained the three foot keys for C#, D, D#, for the little finger of the right hand in the form already well established."[4] Furthermore, Boehm relied mainly on the left hand crutch for achieving stability: "The crutch should be inserted so that the weight of the flute rests between the thumb and index finger of the left hand, then the movements of the fingers will be much freer than when the thumb is used for holding the flute."[5] In any case, it is by now well known that the right hand little finger is not necessary for balancing the flute. The so-called "Rockstro position" which I analyzed in depth in my book, *The Flutist's Progress*[6], on pages 90-91, is an example of one method of liberating the little finger of unwanted tension. The position that Murray uses is roughly similar to the Rockstro, but he gets a more delicate balance between the right thumb and left index finger, and minimizes the supporting function of the lower lip.

18-3-5. *Use of the little finger in helping to hold the flute is particularly essential for producing a C# . . .* The little finger is not at all necessary if the flute is properly balanced (see above).

18-3-27. *. . . this (the closed G# key) can be optional on the new Murray flute . . .* This merely reflected my own opinion as reviewer. Murray himself would firmly discourage an "optional" closed G#. Additional important citations in Boehm's book advocating the open G# and, by implication, supporting Murray's open D# idea occur on pages 62, 68, and 70-71. Roger Mather has measured the average spring tension of an open key at 22 gr. (the weight required to move the key) and a closed key at 40 gr., which is almost double.[7]

19-1-3. *. . . but a new F# lever was introduced requiring the little finger to go back to work again.* The right little finger is relatively *much* freer than before. It need only be used for the three F#'s, D (occasionally), and low C# and C.

19-1-12. *Ironically, the liberated little finger . . . must operate five keys. . . .* On the most recent prototype of the Murray flute (with a C foot) only two positions of the little finger are required.

19-2-1. *The additional weight of the added devices on the key mechanism . . .* Currently, the Murray flute weighs a scant two ounces more than a standard flute, but as the construction of the instrument is further refined for

production, a new lighter key design will eliminate most of that two ounce gap. Boehm was not above adding new keys to his flute, by the way. On his later models he added an octave-key (schleif-key) which he recommended for improving the control of D#^{2}, D^3, D#^{3}, and A^3. See pages 86-89 in Boehm's book for illustrations of the schleif-key.

19-2-27. *With the absence of a key under the thumb lever, which could supply additional support . . .* The Murray thumb levers do contact the flute body when depressed. There is a felt pad at point of contact.

19-3-30. . . . *Murray had to add a first finger support . . .* The first finger support is optional. Murray himself performs without it. Incidentally, is holding a thick wooden flute unaesthetic? It didn't worry Boehm. And on his silver instruments, Boehm also used a first finger support.

22-1-27 to 38. This paragraph is completely wrong. In fact, the entire list of Baasch's arguments on page 22, including the schematic drawing, are "inoperative" because they are based on erroneous data in my Mozart fingering example which were later corrected. Baasch was well aware of these corrections back in February, two months before his article was published.

22-1-46. *Boehm's statement . . . "the holes immediately below the one sounding should remain open."* Completely true for all Murray fingerings.

22-1-51 to 65. An instrument must have a name to be identified. Murray's first flute was made by Albert Cooper of London. When asked what flute he played, Murray would say, "a Cooper." "Does he make ordinary flutes?," would be the usual reply. Cooper and Jack Moore of Armstrong have contributed at least as much as Murray to his instrument, and Murray would just as soon call it an "Open D# flute." It is odd that the truly Boehm flute is known as the Open G#, whereas Baasch considers his French model to be the Boehm flute. As was pointed out in my *Instrumentalist* article, no flute company has exclusive rights to manufacturing in the Murray flute, although the W. T. Armstrong Co. is as yet the only company considering the instrument on any type of mass scale.

22-2-2. . . . *his trill fingering for E to F# . . . requires the shaking of the first and second fingers of the right hand.* There are many two-finger trills on the Boehm flute which are quite unobjectionable. Trilling E to F# on the Murray is actually very easy, and sounds exceedingly pure because of superior venting. Baasch himself writes at great length on the importance of correct venting.

22-2-20. *There are other mechanical and acoustical faults inherent in the Murray flute . . .* What are they? There are no *other* ones, as Baasch has not yet dealt with a single fault.

22-2-37. . . . *from a study of the photographs and fingering chart included.* Erroneous data, previously cited. Baasch refused the chance to learn the real fingerings published in the *Journal of the American Musical Instrument Society.*

22-3-57. *It is not advisable (to lift the right little finger) because it will result in the loss of stability in holding the flute.* How does Baasch know, having never seen nor played the Murray flute?

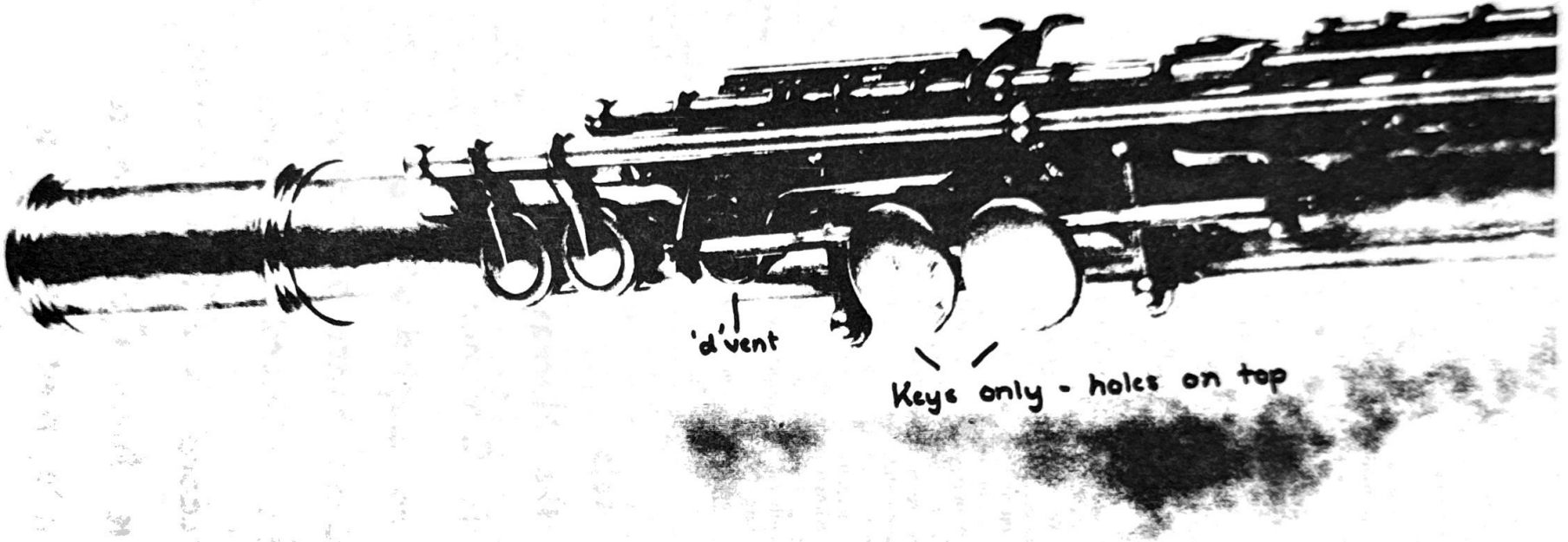
It is sad to have to devote so much space to clear up needless misunderstandings. This is perhaps symptomatic of our age of specialization where we often lack a good rapport between musician, acoustical scientist, instrument maker and educator. But I have always felt that it is the educator who can be the most effective catalyst in cajoling us into doing a better job of working together. I am sorry that Robert Baasch chooses to do the opposite. □

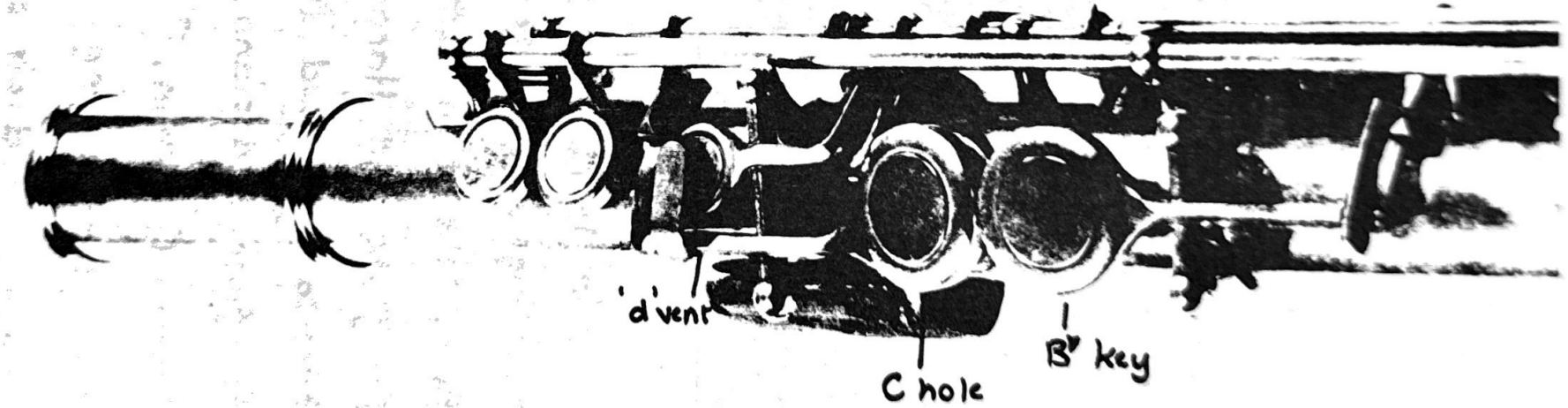
Footnotes:

[1] Philip Bate, **The Flute** (N.Y.: W. W. Norton, 1969)
[2] Christopher Welch, **History of the Boehm Flute** (Second Edition, N.Y.: McGinnis & Marx, 1961), p.3
[3] Theobald Boehm, **The Flute and Flute-Playing** (Second Edition, translated by Dayton C. Miller in 1922, N.Y.: Dover Publications, 1964), pp. 60-61
[4] op. cit., p. 60
[5] op. cit., pp. 111-12
[6] Walfrid Kujala, **The Flutist's Progress** (Winnetka, Ill., Box 12: Progress Press, 1970)
[7] Roger Mather, "Care and Repair of the Flute", **The Instrumentalist**, Jan., 1973

In 1973 the first solo recording was made of the Murray flute. The Bach Partita in C minor for flute and Harpsichord coupled with a hitherto unrecorded Duo Concertante of Czerny for flute and piano. The keyboard player was Martha Goldstein. The record is a Pan recording, the recording engineer is Alan Goldstein, a Peabody graduate on flute, now Professor of Math. at the University of Washington, Seattle.

Details of Thumb-Mechanism on two Cooper Flutes.





Reprinted from the Galpin Society Journal
May 1978

PHILIP BATE

The Alex Murray Flute

IN 1967, whilst collating material for a general book on the transverse flute, I was fortunate in having my attention drawn to experiments which had been carried out during some nine or ten years by Alex D. Murray of the Michigan State University, and which I was bold enough to suggest might point to the ultimate form of the cylinder flute originated by Theobald Boehm. At that time an outline of Murray's work was due for publication in an American journal, but with the permission of the Author and the Editor, I was privileged to write a short advance notice. Work, however, did not cease, and at the present day the Murray flute has reached its 'Mark 8' and is indeed a remarkable instrument. The data and descriptions in the latter part of this note are based on an account kindly furnished by Murray himself.

THE BACKGROUND

The flute in most general use today is commonly termed 'the Boehm,' and is basically that developed by Theobald Boehm in the years 1846–47, with cylindrical bore and a head tapering in a gentle curve rather inaccurately described as 'parabolic'. Boehm's work in designing an almost completely 'open system' flute, and in devising mechanism to control the twelve large holes and one small one that he found necessary, is discussed in his pamphlet *An Essay on the Construction of Flutes* (1847) and his book *The Flute and Flute Playing* (1871), and to understand properly what Murray has now achieved it may be well to look for a moment at these two publications.[1] Fig. 1 reproduces Boehn's own drawing of this mechanism in its final form.

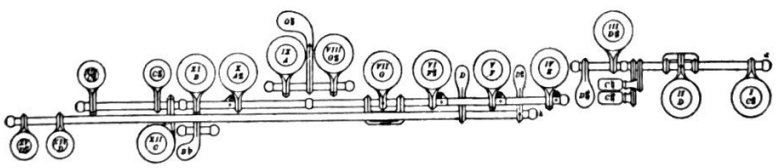


FIG. 1. *Boehm's drawing of his flute.*

It seems clear that while Boehm found an elegant solution to the problem he had set himself and created an instrument that meets the

needs of a majority of players even today, he may not himself have been entirely satisfied. Certainly he had doubts as to the *rationale* of the inverted cone bore of the traditional flute, though he adopted a modified form of it for his first 'open system' design of 1832; and the closed D♯ key for the right little finger he seems to have regarded as unavoidable though it remained a glaring inconsistency in the 'open hole' concept.[2] We disregard here the closed D and D♯ trill keys which constitute a special case, but must note that Boehm found himself obliged for good reasons to reduce and displace the top C♯ hole.[3]

The need to keep the right hand D♯ key open a large part of the time for venting purposes is to many players a nuisance. To many also Boehm's open G♯ key (left little finger) is objectionable, and several arrangements of the G♯ and a mechanism have been elaborated, notably that of Dorus (*c.*1838), one of the lightest in action but not always quite reliable. On the majority of Boehm flutes today the G♯ touch opens a hole for that note alone, while a duplicate hole is covered by a cup rigidly attached to the open-standing A cup so that when the latter is released there is no closed hole immediately below it. Boehm is said to have refused to make flutes with a closed G♯, but it is known that he did construct at least one such instrument to accommodate a favoured customer.[4] To do so he divided the touch lever into two and provided a second fulcrum using only the normal hole. Fig. 2 shows how this was done, but even so this involved a slight re-positioning of the a hole to preserve intonation.

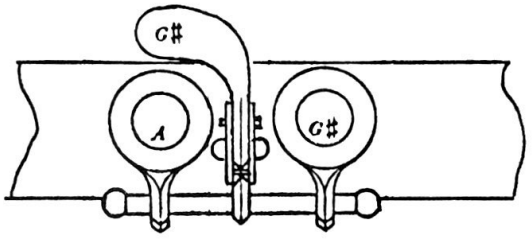


FIG. 2. *Boehm's closed G♯ action.*

After much experiment with authentic Boehm and other well-designed flutes the late Dayton C. Miller concluded that the open G♯ is no more difficult to master than the closed version, and that it has certain minor advantages in some parts of the scale. This, we shall see later, is also the opinion now reached by Alex Murray.

While considering Boehm's basic work we must also look at the B and B♭ arrangements for the left thumb. On the original model of the cylinder flute of 1847 Boehm provided no B♭ thumb lever. About 1849,

however, Briccialdi, a distinguished Italian flautist then living in London, invented a thumb mechanism which is almost universal today, and in that year he had it constructed for him by Rudall and Rose. Soon after Briccialdi's invention Boehm himself designed a B♭ thumb lever on a somewhat different principle, and employing, as he claimed, a more rational movement of the digit in that in passing from B to B♭ the thumb moved *down* the instrument not *up* as with the Briccialdi. Both arrangements included a B–C trill lever for the right forefinger, though Boehm seems to have regarded this as an accessory rather than as a regular part of his system.

Lastly we must observe that in the original fingering the F♯ produced by lowering the third (or sometimes the second) finger of the right hand is on many instruments slightly flattened or muffled by the unavoidable closing of the E hole below. Boehm compensated for this by placing the F♯ hole a shade above his calculated position, but this has still not satisfied some more critical players and hence such arrangements as the Brossa and Rockstro keys which allow the E hole to remain open for F♯. Rockstro, in fact, with his well-known prejudice against all things 'Boehm', more or less completely revised the cylinder instrument in 1858 on the basis of a different set of calculations from the original, and, incorporating several other ideas of his own, produced a flute that has become the preference of a number of distinguished players.

THE MURRAY FLUTE

The preceding is, I believe, a fair summary of the more important modifications that have been applied to the basic Boehm flute from its advent to the middle of the present century, and it forms the background to the recent labours of Alex Murray and his mathematician colleague Elmer Cole. How he first came to embark on them is, I think, best told in his own words:—

'Until 1945 when I joined the Royal Air Force Band, I played on what is the commonest form of the Boehm flute, the closed G♯ instrument. At that time I read Boehm's account of his instrument with Dayton Miller's commentary and decided that the open G♯ was a more rational system for at least three reasons.

i) The duplicate G♯ hole was unnceesary.
ii) The spring of an open key is lighter than one required to hold the key closed.
iii) Top *E* is greatly improved when correctly vented with the A hole alone, and not the A and G♯ holes together as on the closed G♯ arrangement.

I consequently asked a flute repairer to alter my instrument to the open

G♯ and after a few weeks practice I found the readjustment amply rewarded'.

The flute to which this first modification was made was in fact a good example of the standard American style closed G♯ instrument made by W. S. Haynes, and we may suppose that it was originally built with the A hole in the compensating position, though Murray does not mention this point in his notes. Anyhow, here we have a case of a busy professional who found it worth while to make the first change in his accustomed fingering.

The next point to which Murray directed his attention was the anomaly of the closed D♯ key which Boehm took over from the conventional flute of his time—apparently without demur.[4] To quote again from Murray's notes:—

'The asymetrical use of the little fingers, in particular the necessity for maintaining the right little finger down much of the time struck me as undesirable and I experimented with an open D♯ by turning the foot-joint until the D♯ hole was within reach of my little finger. I unhooked the spring and maintained the key open with an elastic band. The flute became a little unstable to balance but I solved this by sticking a wedge of cork on the body above the right thumb (I no longer require this, having learnt to balance the instrument without it). I felt that the action of the key was an improvement on the closed D♯.

'At that time (1958) I was fortunate in meeting Albert Cooper, an artist-flute-maker, formerly with Rudall Carte and who had left to begin making flutes on his own. He agreed to construct a new foot joint which would convert my flute to open D♯. The C♯, D, and D♯ keys were placed in line from an axle on the near-side of the flute; the D♯ key was closed by both the other keys. The problem remained, how to trill C–D or C♯–D. When the little finger was removed from C or C♯, D♯ was the note sounded. In order to circumvent this a crescent-shaped key was built from the D key around the front of the ring-finger key. This finger could then close both keys simultaneously when required, giving D♮. Later it was found better to have two parallel rollers so that the ring finger could move easily from D to D♯ in the same way that the little finger moves from C to C♯ on a flute with two rollers on the foot joint.'

Fig. 3 is a sketch of the little finger arrangements at the first stage of development. *A propos* the above-mentioned extension of the D key, we may observe that while there are a number of references in the older flute literature to crescentic touch-pieces associated with finger-holes, and, though the cases may not be quite identical, it is interesting to note

that the arrangement seems never to have been wholly satisfactory. The notable example is, of course, that of Gordon's flutes, contrasted with Boehm's 1832 model in which complete rings were employed for similar purposes. In his description of his cone-bore flute of 1852 Rockstro claims to have originated 'the now common crescentic shape of the touch of the D♯ key' partially embracing the ends of the C and C♯ touches. Its objective was to ease the slurring of C♯ and D♯, but in this he was forestalled by Cornelius Ward some ten years earlier.

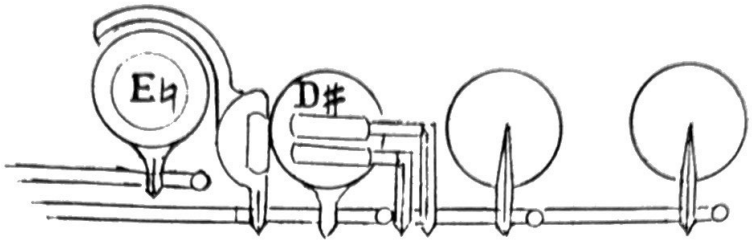


FIG. 3. *Murray's open* D♯ *key, first arrangement.*

Turning back to the Murray model, it is evident that once we have passed D♮ the right little finger is not required again till we come to the same note an octave higher, and it may therefore be given other employment in the interval. Murray thought of the defective F♯ mentioned earlier and, with another little finger touch and linkage to close the G cup, arranged that the F♯ could be sounded from its own hole with all below open. A good trill for E–F♯ is thus secured with no change of fingering for the latter note. Further, by splitting the A key so that the B hole can remain open while the B♭ is closed, and by linking the lower of these to the new F♯ touch, a correct venting for top F♯ becomes possible. This is comparable with venting the top E with the open G♯ key (Fig. 4).

The third part of Murray's work has been concerned with the small top C♯ hole, which, on account of its multiple functions, Boehm was constrained to make small and place in a compromise position. It's uses are:—

i) As a note-hole for *c♯″*, *c♯‴* and *c♯⁗*

ii) As a vent-hole for *d″*, *d‴*, and *d⁗*, *d♯‴*, *g♯‴*, *a‴*, and *b♭‴*.

Murray points out also that on many flutes the interval *c♯″–d♯″* requires much care in blowing if it is to sound an acceptable whole tone, and that both notes have to be 'humoured', one in one direction and one in the

The fingering chart and scheme which accompanied this article have been omitted as they occur in the Amis Journal article.

other. A number of experiments led to a division of function between a well-placed full-size upper C♯ hole and a small *d″* vent. The only change of fingering involved was a reversal of the Briccialdi arrangement and a return to Boehm's more logical one, i.e. B♮ above B♭.

Finally, the closed D trill key, which, together with the D♯ trill, has remained virtually unaltered since Boehm inherited it from Capeller, has been slightly modified. By linking it to the right hand D key the D♯ hole is automatically closed for the normal fingering of top B, thus again leaving the right little finger free. Pl. IV shows the general appearance of the Murray flute in its latest form, and Pl. III details of the right little finger keys on a larger scale. It will be noticed that this example is built down to low B as is now almost universal in America and increasingly popular in England.

To summarise, we may say that although the Murray flute may seem complicated it is in fact both logical and mechanically sound. The multiplicity of touchpieces at the lower end owe their existance to the very fact that the right little finger has been released from its bondage and set free to make use of them. At the cost of very slight changes from the standard fingering in one or two places (Fig. 5) it has become possible to make a flute with hole dimensions and placing exactly according to Boehm's ideal 'Schema'[5] and without the need for compensatory adjustments to humour 'bad' notes. Possibly such an instrument may prove more expensive than the average high quality standard Boehm—indeed as long as the model is being produced 'one off' to special order it must be so—but the research and experiment has been done, and as more flautists begin to appreciate the facilities it offers, the writer, for one, will not be surprised to see it take its place in the catalogues of the best makers, and at a reasonable price.

Let Murray himself have the last word: 'Without the skill, patience, and insight of Albert Cooper, this flute would not be in existance. Inevitably he has been inundated with work and has a seven-year waiting list for his instruments. I have been most fortunate in meeting those responsible for manufacturing Armstrong flutes. The foreman, Jack Moore* of the Heritage division, accepted the challenge of making a similar flute with certain slight mechanical improvements over my present one (my eighth) which I hope will embody the final form of the Murray flute'.

* Jack Moore has been responsible for many major and minor improvements to date. He produced two prototype flutes, fifty school model instruments, many with slight modifications, a Heritage silver flute, shown at the Amis convention Spring 1974, and is currently making a white gold model for the August National Flute Assoc. Meeting.

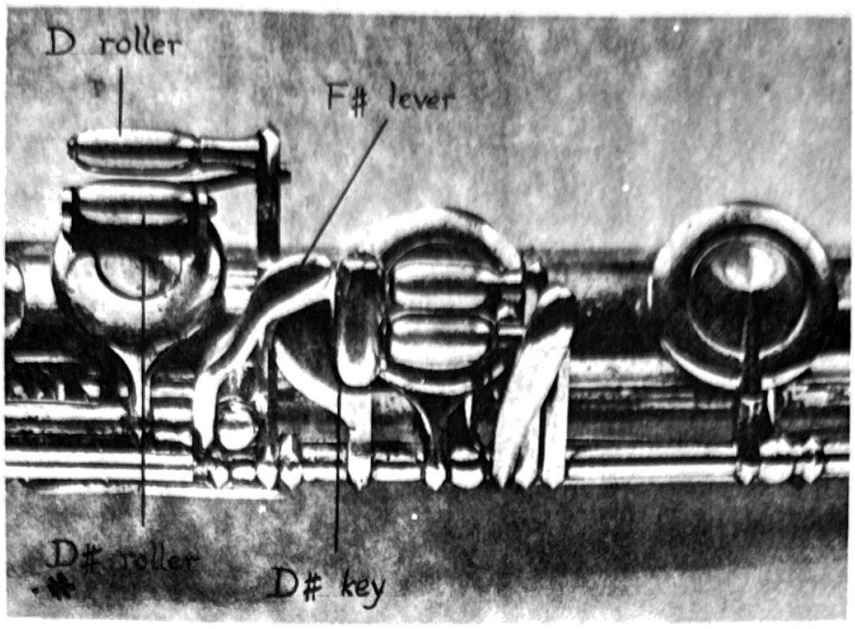


PLATE III

The Murray Flute: detail of right little-finger keys

* At the time of publication the latest instrument by Jack Moore of WT Armstrong omitted this roller.

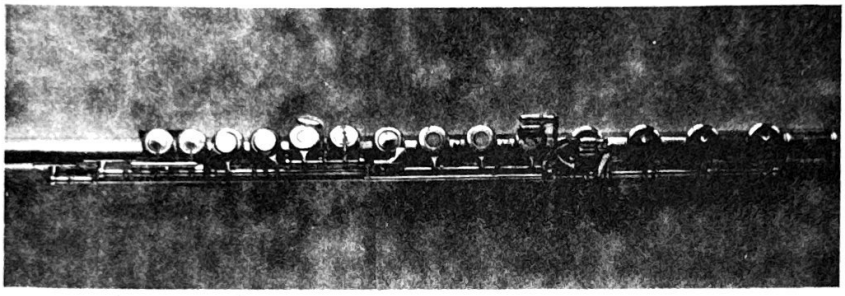


PLATE IV

Flute 160 by A. K. Cooper, London, built to the specification of A. D. Murray ('Mark 8')

NOTES

1 *Ueber den Flötenbau und die neuesten Verbesserung desselben*, Mainz, 1847. *An Essay on the Construction of Flutes* ——, edited with the addition of correspondence and other documents by W. S. Broadwood, London, Rudall, Carte and Co., 1882. This is Boehm's own English version of the preceding. *Die Flöte und das Flötenspiel* ——, Munich, 1871. *The Flute and Flute Playing* ——, Second English edn, revised and enlarged, translated and annotated by Dayton C. Miller, London, Rudall, Carte and Co., 1922. Miller's commentary and Appendices are of the utmost importance.

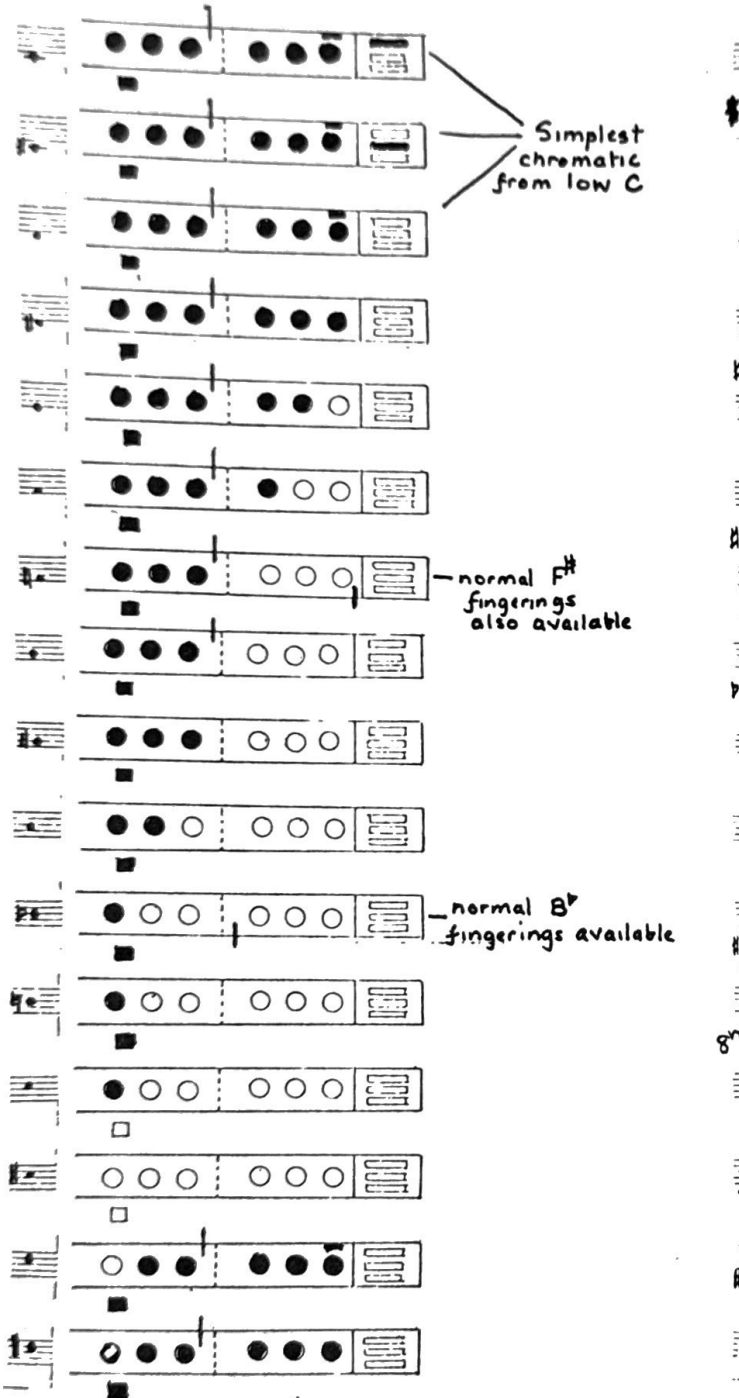
2 *The Flute and Flute Playing*, p. 60.

3 *Op. cit.*, pp. 29, 30 and 37.

4 *Op. cit.*, p. 68. In various Collections there are examples of authentic *Boehm* flutes which show different variations (possibly experimental) from his normal model.

5 *Op. cit.*, pp. 36, 38 *et seq.*

-TABLE of FINGERINGS for OPEN D♯ FLUTE-(Armstrong - Murray)



E² - C♯³ as for lower octave