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.

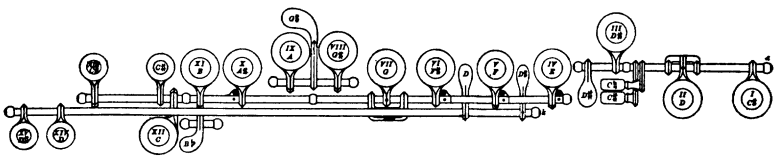

FIG. 1. *Boehm's drawing of his flute.*

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.

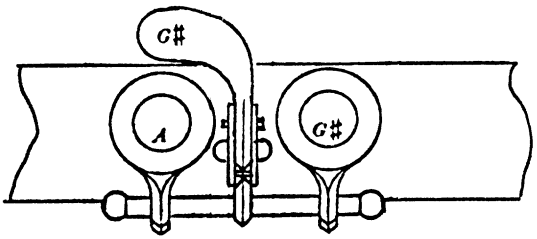

FIG. 2. *Boehm's closed* G♯ *action.*

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.

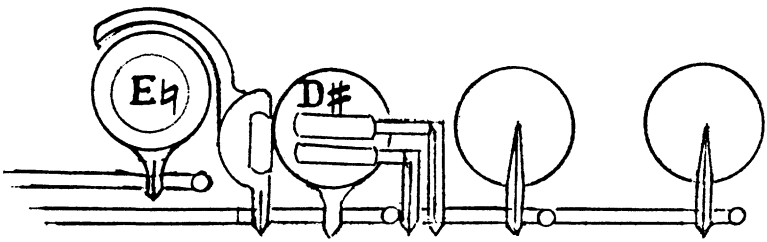

FIG. 3. *Murray's open* D♯ *key, first arrangement.*

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

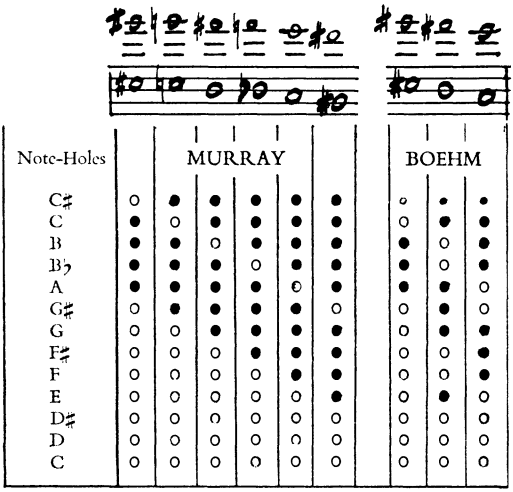

FIG. 4. *Venting of the 3rd octave: Murray and Boehm (closed G♯) compared.*

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

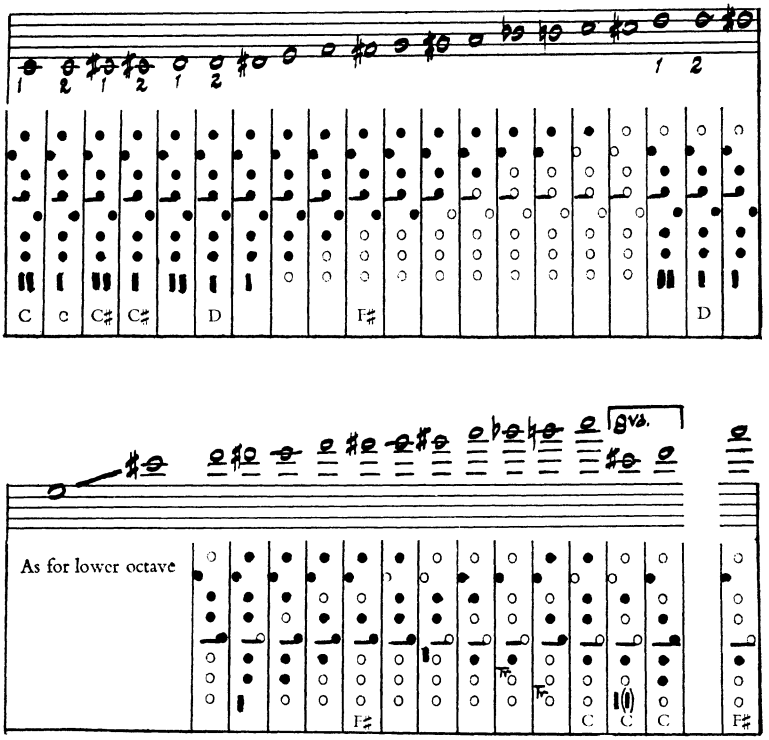

FIG. 5. *Fingering chart for the Murray flute.*

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'.

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.*

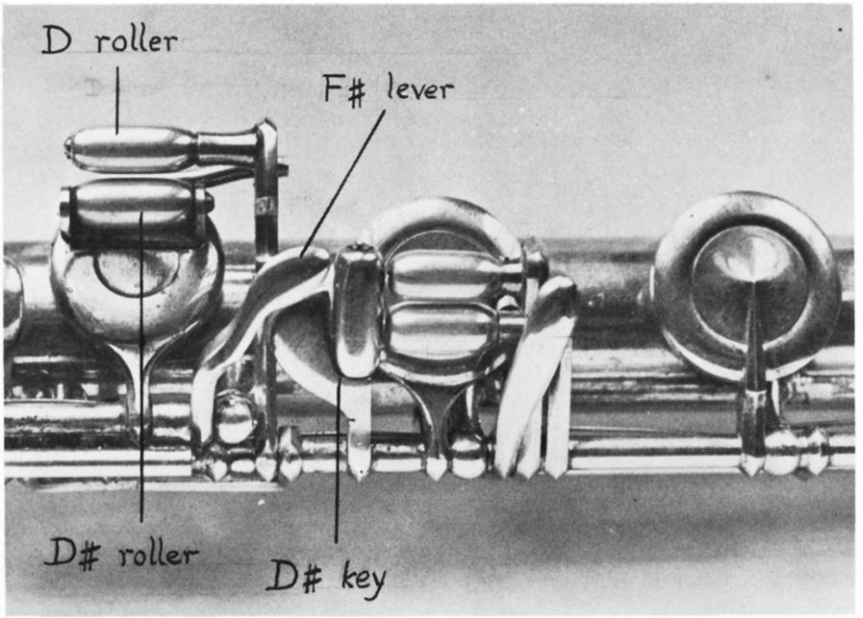

PLATE III

The Murray Flute: detail of right little-finger keys

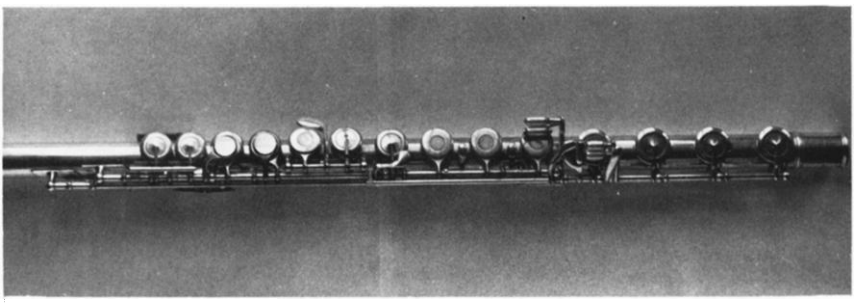

PLATE IV

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