

CHAPTER XV.

THE LATEST PHASES OF THE DEVELOPMENT OF THE FLUTE.

1827—1889.

NOTE. In the arrangement of the contents of this chapter, no attempt has been made to adhere strictly to the chronological order.

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ETC., 1852.—671. PRATTEN'S "PERFECTED FLUTE."—673. THE WRITER'S SCHEME FOR THE IMPROVEMENT OF THE "CYLINDER FLUTE," 1858.—675. THE DUPLICATE $g\sharp$ HOLE.—676. CLINTON'S "EQUISONANT FLUTE" AND HIS "GRADUATED HOLES," 1855-1862.—677. LETTER FROM TH. BOEHM TO LOUIS LOT.—678. CLINTON'S LAST PATENT, 1863.—679. THE "ROCKSTRO-MODEL," 1864-1877.—684. MR. CARTE'S "1867 PATENT."—685. MR. BARRETT'S MODIFICATION OF THE FLUTE OF 1867.—686. THE "MEDIUM HOLES."—687. THE a ALTO (OR "BASS") FLUTE.—688. THE LATEST IMPROVEMENT IN THE FLUTE, 1889.

561. A Retrospect of certain Improvements effected between 1800 and 1824. A brief recapitulation of the account of the slow and hesitating steps of those excellent pioneers who strove, with some success, to raise our charming instrument from its old anomalous condition, and to dispel the clouds of ignorant empiricism in which it was shrouded for so many years, should be a fitting introduction to the relation of its history during that important period of its career which began in 1827, and may be an aid to the comprehension of the improvements, hereafter described, which have culminated in the almost perfect flute of our own time.

562. We have seen that the first attempt to construct a flute on rational principles, or indeed on any principles whatever, was made by Tromlitz in 1800, and we have seen how soon the idea of a system of open holes was abandoned by its designer, partly, no doubt, through his inability, weakened as he was by age and infirmity, to carry out his invention, but chiefly on account of the prevailing prejudice against any fundamental change in the fingering. The crude and ill-digested scheme, and the timid retention of the veiled notes, will be fresh in the mind of the reader. Three years later we find the worthy Dr. Pottgiesser making bolder efforts in the same direction; efforts that attracted no attention at the time, and that were apparently forgotten for twenty years, during which period the flute-playing public of all nations travelled along the old rugged path, with

its pitfalls of large and small holes, and its impediments of closed keys. A further step in advance had, however, been gained, and although it had led to no practical advantage, a decisive blow had been struck at the veiled notes, and the way had been pointed out for the establishment of a system of open holes and pure notes whenever the master-mind should arise to grapple with the difficulties of the task.

The renewed labours of Pottgiesser, in 1824, must be regarded, in one sense, as a retrograde movement, inasmuch as the complete system of open holes was set on one side, and veiled notes necessarily followed in the train of the evils caused by the closed keys, but the equal diameter of the finger-holes was a distinct and a most important gain. Besides this, Pottgiesser at any rate sought for the theoretically correct positions of the holes, though, as Karl Grenser pointed out, he did not adopt the proper means to find them.

563. It will be remembered that previous to the date of the first of these comprehensive designs, Tromlitz had made several attempts, soon relinquished, to improve the position of the *e* hole and to contrive a convenient open key by which it should be governed. There were also two mechanical contrivances, of later date, which appear to have exercised much influence on the progress of the flute, and which should not be forgotten. These were the open *g*[#] key and its ring connecting it with the *g*[#] hole, invented by the Reverend Frederick Nolan, and the ring-and-crescent-key of Pottgiesser.

A much older, though far more valuable invention, which seems to have fallen out of use for about five-and-twenty years, was the open *c*^{''} hole, governed by the left hand thumb, either directly or by means of the now familiar open key.

564. In "*Caecilia*" (1828) there is an interesting article on the *c*^{''} key, by Gottfried Weber, one of the two able acousticians known as "the brothers Weber." The writer does not appear to have been aware that this key was originally open, and that the only reason for making it a closed one was that the thumb might be free to act on the *b*_b key. He says: 'One finds, on

almost all keyed flutes, a key for *c*^{''} which is opened by the first finger of the right hand, but, although this key is useful, it cannot be denied that its advantages are lost if the note *c*^{''} follows or precedes a note for which the first finger is required. Such passages can only be fingered in the same miserable way as on a flute without the *c*^{''} key. . . . Every flute-player will see at a glance the facilities that would be gained by employing an open hole for *c*^{''} which could be closed by the thumb of the left hand. . . . The thing is so easy and so simple that one feels surprised at its not having been done long ago. . . . It will be said that the open *c*^{''} hole would give rise to difficulties in execution on account of the *b*_b key, but this objection can only apply to such flutes as have the *b*_b key for the left hand thumb, instead of for the first finger of the right hand, which is a far preferable plan. Even on such flutes, the thumb, with practice, can easily use the *c*^{''} hole alternately with the *b*_b key or even at the same time, especially when it is aided by a most simple contrivance."

565. The annexed copies of Weber's engravings will render further description unnecessary, and will show that both the uncovered hole and the open key were similar to those described by Tromlitz.

One cannot help feeling astonished that it should not have occurred either to Tromlitz or to Weber that by making the *b*_b key also an open one, most of the difficulties of execution might have been removed.

FIG. 52.

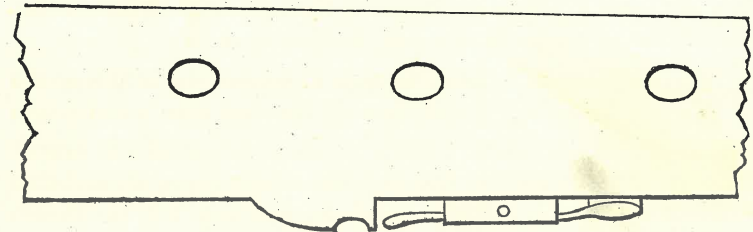
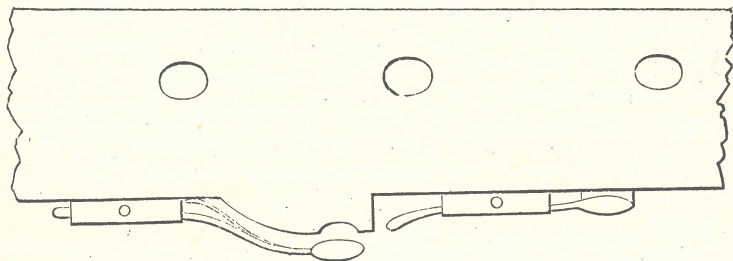
Open *c*^{''} hole for the left hand thumb.

FIG. 52.*

Open c" key for the left hand thumb.



566. Captain Gordon. The first to take up the threads of these improvements, and to attempt to weave them together in a practically useful form, was the celebrated William Gordon, a Swiss by birth, and a captain in one of the regiments of the Swiss Guards of Charles the Tenth. Devotedly fond of music and an ardent lover of the flute, he became, under the guidance of Drouet and Tulou, a most distinguished amateur performer. Fétis relates that while Gordon was with his regiment in Paris, in 1826, he began to attempt the realisation of a project that he had formed for the improvement of the flute. By the end of the following year several flutes had been made, under his direction, by French workmen. These experiments, though imperfect, were sufficiently conclusive in their results to demonstrate the possibility of attaining the desired end. Gordon's widow, in a most interesting letter to Còche, of which I have given a translation in §§618-620, states that in 1830 he achieved success. We are in complete ignorance concerning the nature of the changes which he had introduced at this time, but Madame Gordon says that he had striven "for several years to invent a flute in which increased facilities for execution and extension of compass should be combined with perfect accuracy of intonation."

567. In 1831 we hear of Gordon in London, where two flutes were made under his direction: one by Rudall and Rose, as I

was assured by the late J. M. Rose, whose memory was, however, a perfect blank with regard to the design of the instrument; the other by Cornelius Ward, who, on the ninth page of his previously quoted pamphlet, makes the following statement: "About the year 1831 we constructed a flute under the direction of Captain Gordon, of Charles the Tenth's Swiss Guards, who had been experimenting on this matter for some time. In this flute the apertures were placed consistently with the proper length of tube required for each fundamental note of the chromatic gamut [scale], and the captain contrived a method of acting upon the additional apertures beyond the number of fingers. With this flute he returned to Paris."

Ward used often to talk of the ingenious mechanical contrivances of Gordon, who had constructed with his own hands much of the machinery of the flute which he brought here. Parts of it had, however, been beautifully executed in steel by a Swiss watchmaker under Gordon's direction.

568. The date 1831, about which Ward seems to have been a little uncertain, is proved by the well-known fact that Boehm made Gordon's acquaintance in London in that year. Boehm states, in a letter to Còche (1838A), that he met Gordon in London in 1832, but this is an error that he, himself, afterwards contradicts in his pamphlet (1847), in which he says that he returned from London to Munich in 1831.

We shall probably never know all the details of the early efforts of Gordon. Boehm says, in the above-mentioned pamphlet: "The *e* hole of his flute was bored lower down and was made larger than usual. It was covered with a key, and in order to avoid the lever for *f* he employed a ring-key. His flute was also furnished with a number of keys and levers, some of which were ingeniously contrived, but they were much too complicated to be of any real use; moreover, the instrument was not constructed on true acoustical principles, and was therefore faulty in tone and intonation."

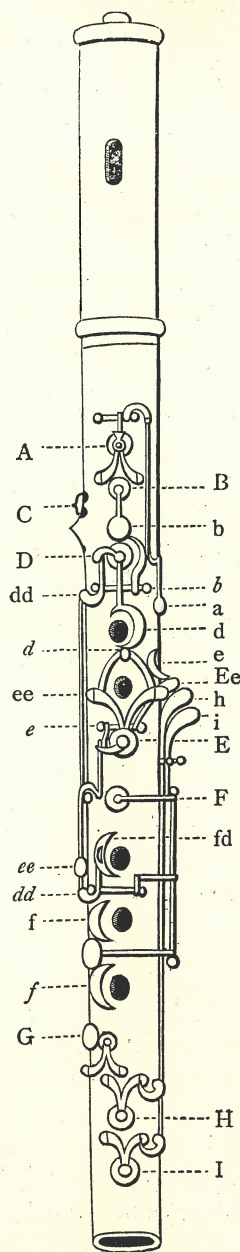
This last assertion is in direct opposition to Ward's positive statement, made three years earlier, that the holes of Gordon's

flute were, according to his judgment, correctly placed. To this opinion Ward always adhered in the many conversations that he and I held on the subject.

569. *Fig. 53* is a reduced copy of an engraving given by Cöche in his splendid *Méthode*, published in 1839. There is a wood-cut, similar to it but not so well executed, in his pamphlet of 1838. The original drawing was sent, in 1838, to Cöche from Lausanne by the wife of Gordon (see her letter in §§618-620). There can be no reasonable doubt as to its authenticity, though it is probably a representation, not of the flute made for Gordon in 1831, but of one afterwards constructed by him on the same principles. Ward asserted emphatically that the engraving of Gordon's flute, as given by Cöche, very closely resembled the instrument that he made under Gordon's direction "about the year 1831."

The diagram is obviously incomplete as well as inaccurate, part of the accompanying explanation is therefore conjectural: Cöche gives none, but it is evident, from certain dotted lines, still remaining in his engraving, that letters of reference were once affixed to eleven of the keys and to the perforations for

FIG. 53.



the left hand thumb, which, being used together, formed the *c*" hole. See §572. The proportions of the tube are certainly incorrectly shown. Had these been as indicated, the tone of the flute could not have been "thin," as Tulou states it to have been. See his remarks in §572.

570. *Gordon's Flute.* A. Closed key of the *d*" hole, opened by *2L* at *a*. B. Open key of the *c*" hole, closed by *1R* at *b*. The axle is at *b*. C. Divided *c*" hole, closed by *thL*. The adjacent projection was intended as a guide for the thumb. See §572.

D. Open key of the *b*" hole, closed by the action of *2L* on the crescent *d* when closing the adjacent *b*" hole. The axle must have been at or near *d*, perhaps under the crescent, and the shank must have passed over *b*. The note *b*" was fingered by the pressure of *1R* on the crescent *fd*, which by means of the two levers *dd*, *dd* and their connecting wire, closed *D*, leaving the *b*" hole open. *D* might also have been closed by *1L*, acting on *b* and *D* at the same time, or by *2L* acting on *d* without closing the *b*" hole.

E. Open key of the *g*" hole. The axle was at *d*, and this must have been the only attachment of the key to the flute. In closing the adjacent *a* hole *3L* pressed one of the arms *e*, thus closing *E*. There were of course two springs, one to keep up the entire piece of mechanism, the other to close the *g*" key. The crescent attached to *e* may have been used for closing *E* while leaving the *a* hole open. The axle *e* must have been underneath, and free from, the shank of the key. At *ee* there was a joint. When the arms were pressed down, *E* was opened by the action of *4L* on the lever *Ee*. Thus *g*" and *g*" were fingered as on the ordinary flute and at the same time the *a* was left unveiled.

ee. Lever for making the shake *g-ab*, or *f-g*, with *1R*.

F. Open key of the *f* hole, connected with the crescents, *fd*, *f* and *f*. The key *F* was closed by pressure on either of these crescents, and the *e*, *f* and *f* holes could be closed, in using the crescents near them, or left open if necessary. The note *f* was fingered by the action of *1R* on the crescent *fd* while closing the adjacent *f*" hole. The *f*" might have been fingered by pressure on *fd* while the hole was left open, or by the action of *2R* or *3R* on *f* or *f*. The invention of the mechanism connected with the key *F* is discussed in §§606-7.

G. Open key of the *a*" hole, closed by *4R*.

H. I. Open keys of the *d*" and *c*" holes. The touches of these keys are at *h*, *i*; *c*" and *c*" were therefore fingered by *4L*.

571. The open key of the *b* hole, and the various methods

of closing it, constituted an entirely new departure and a most important improvement, the value of which may be estimated by the fact that no open-keyed flute is now made without it, or some slightly modified form of it. It will be noticed that, on the flute above described, Gordon abandoned the old ring-key, which Boehm had seen on his earlier instrument, and made free use of the crescent, first employed by Pottgiesser.

Boehm's assertion that the machinery of Gordon's flute was "too complicated to be of any real use," is manifestly refuted by the patent flute of Cornelius Ward, described and figured in §§640-1. Traction-levers similar to those of Gordon were applied by Ward to the open keys of the foot of his flute. Their action is practically perfect, and experience has proved that mechanism of this kind is peculiarly free from liability to derangement. The most complicated part of Gordon's flute was the $g\sharp$ key, but a contrivance almost precisely similar to this, and not one whit less intricate, was applied to the hautboy by the celebrated Lavigne, in our own time. Compared to the ingenious machinery of the hautboy invented by my old friend, the late Mons. Barret, that of Gordon's flute might be pronounced positively simple, and yet Barret's hautboy has been a popular instrument for many years.

It will be seen, in the next section, that Tulou expressed strong disapproval of Gordon's flute, but, notwithstanding his general condemnation, he wrote not one word to imply that he considered the mechanism to be impracticable.

572. Of the fingering of this flute there is no detailed account extant, but that of the first and second octaves is almost self-evident. There was no reason why the notes of the third octave should not have been fingered according to the theoretically correct method described in the last paragraph of §357. The following remarks by Tulou (1835 *circa*) lead to the supposition that they were so fingered, and at the same time show the determined opposition of that great master to the new system: "The first effort," says Tulou, "was made by one of my pupils

named Gordon, a captain in the Swiss Guards of France. I regretted that I could not accord to this zealous amateur the approbation that he hoped to obtain from me, but his flute was, in my opinion, based on false principles, as he had founded his system on the harmonic sounds, which should always be avoided on an instrument pierced with holes, if the true character of its tone is to be preserved.

"The flute should possess a mellow tone in the *piano*, and a full sonority in the *forte*. Gordon's flute had, on the contrary, a thin tone, without roundness, which bore too great a resemblance to that of the hautboy."

An almost incontestable proof that the notes of the third octave of Gordon's flute were fingered with the proper vent-holes, lies in the fact that he used a divided c'' hole. This division could not have been made for any other purpose than to improve the g''' . By the use of the double vent-hole for this note the antinode was established with more certainty, and the note was therefore produced with greater facility than it would have been by employing a single vent-hole of the size of Gordon's finger-holes. This double hole is indispensable on the piccolo.

573. *Scale of the Fingering of Gordon's Flute.* I have ventured to compile a complete scale of the general fingering for this flute, according to what appear to me to have been the intentions of the inventor. In this are shown the actual holes used in the production of each note, as well as the fingers employed in governing the holes.

The small perpendicular braces in the table, show that certain keys are connected together in order that they may be closed by one finger. $2^{\circ}L$ indicates the use of the shake-key for $c''-d''$, $c''\sharp-d''$, etc. The key is opened by $2L$. It is marked A-a in *fig. 53*.

$1^{\circ}L$ indicates the closing of the b' and $c''\sharp$ holes by the action of $1L$ on the keys marked b and D in *fig. 53*.

$4^{\circ}L$ indicates the opening of the $g\sharp$ key by the action of $4L$ on the lever Ee (*fig. 53*). By retaining the old fingering for g and $g\sharp$ Gordon caused a practical, though only occasional, departure from the system of open keys.

$1^{\circ}R$ indicates the opening of the $g\sharp$ key by the action of $1R$ on the

lever *ee* (fig. 53). \circ indicates the use of a crescent without the closing of the hole near it.

574. NOTE. The notes with sharps or flats must be taken as the equivalents of the corresponding notes with flats, sharps or naturals.

Fingers.	Holes.
2*L -	d''
1L -	c''#
thL -	c''
2L -	b
3L -	a
	a''#
1R -	e
2R -	f#
3R -	e
4R -	d''#
4L -	d''
	c''#

The notes e'' to e''' inclusive would have been fingered in the same way as those from e' to e'' .

575. The second method of fingering $f''\#$ and f'' will be seen to have caused the veiling of the notes, but it was not necessary except for the sake of facility in rapid alternations of e and $f\#$. The use of the crescent alone, by 3 R, prevented any difficulty in such passages, when of moderate quickness, as 3 R was able to press the crescent an instant before the raising of 1 R

and $2R$, and thus cross-fingering, such as that described in §374, was practically avoided. By the use of the crescent, without the closing of the hole near it, the alternation of $c\sharp$ and $f\sharp$ was rendered easy, and neither note was veiled.

The first fingering for $g\sharp$ and $g''\sharp$ had, of course, all the evil qualities of that for the same note on the old flute, that is, it gave rise to frequent cross-fingerings of a most objectionable kind. The second fingering for these notes could only have been useful to those persons who were unable to make a shake with $4L$.

The second fingering for $a\sharp$ and $a''\sharp$ was useful in playing $f'\sharp$ and $f''\sharp$ (with the fourth fingering) in connection with $a\sharp$ or $a''\sharp$.

The third fingering for $a\sharp$ and $a''\sharp$ would have been indispensable, as rapid alternations of $g-a\sharp$ and $g\sharp-a\sharp$ would have been almost impossible without it.

The second and third fingerings for d'' were also indispensable, especially in the shakes $c''-d''$ and $c''\sharp-d''$. The key of the d'' hole resembled, in its effect, the key of Capeller, described in §521.

The ordinary fingering for the d''' was the same, in principle, as that of the d''' of the old flute, giving the harmonic *twelfth* of g' , aided by the $c''\sharp$ hole.

If the notes from $d'''\sharp$ to $g'''\sharp$ were fingered as I suppose, and as there is every reason to believe that they were, they would have been theoretically correct: practically they would have been too sharp. See §§357 to 359.

The advantages of the double vent-holes, in certain circumstances, have been explained in §572. It will be seen that they could have been employed for all the notes above $d'''\sharp$.

The a''' was the harmonic *seventeenth* of $f'\natural$, aided by the $a\sharp$ and $c\sharp$ holes as vent-holes. The opening of the $g\sharp$ hole would have tended to facilitate the production of the note, but would not otherwise have made much difference.

The fingerings given for $b'''b$ would have been probably the only means by which the note could have been produced. Both

the methods suggested would have been derived from a''' , the opening of the $b\flat$ hole raising the note to a rather flat $b'''b$. The opening of the d'' hole would have tended towards the improvement of the note, in pitch, as well as in tone and facility of production.

The fingering for b''' would have given the harmonic *seventeenth* of g' , assisted by the correct vent-hole and that next below it.

The c''' would have been the sixth harmonic (the *twenty-first*) of d' with the correct vent-holes. The opening of the e' hole in addition to these would perhaps have facilitated the production of the note.

576. *A Flute stated by Boehm to have been made under Gordon's direction.* The drawing, of which *fig. 54* is a copy, was first published, in the year 1846, in Clinton's Flute-school. Clinton was on friendly terms with Boehm at that time, and no doubt he obtained the original from him. In 1847 a similar engraving appeared in Boehm's pamphlet, previously quoted, accompanied by a declaration, of which the following is a close translation: " . . . Mr. Gordon came to Munich and he admitted that his instrument was defective in comparison with mine. He then completely rejected his system, and began to try another, in which he used to some extent my positions of the holes, but only a portion of my key-mechanism, as he hoped to be able to contrive mechanism of a more simple kind, and at the same time to retain much of the old fingering.

"I placed my workshop and my workmen at his disposal, and at the end of a year, after having entirely spoiled two flutes by his continual attempts to improve them, he completed the flute represented in *fig. 1* [*fig. 54* of this book], with which he left Munich. . . . He published a scale of the fingering, with a lithograph of his flute, in 1834, and this he gave to me."

It is evident that the drawing published with Gordon's scale of fingering was not a representation of the flute to which Boehm alludes, as he implies, but of that shown in *fig. 53*. It is also evident, assuming the partial accuracy of Boehm's narrative, that Gordon did not finally abandon the completeness of

his open-keyed system, even if he did so for a time. I am not aware that Boehm ever ventured to impugn the authenticity of the engraving published by Cöche.

577. The chief points of difference between the flute here represented and that figured by Cöche were as follows:

The *d''* key of Capeller was abandoned.

The *c''* hole had no key.

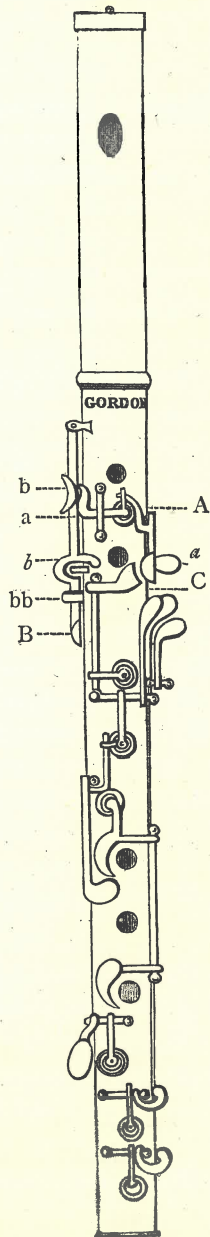
The *c''* hole had a closed key, A, similar to that of Ribock, which was opened by the pressure of *thL* on the lever *a*, and also by 2 *L* or 3 *L* on the lever *a*.

The *b* hole was at the back of the flute and was governed by the open key B. This was closed by the action of *thL* on the crescent *b*. The small arm *b* may have been intended as a means of closing the key by the action of 2 *L*, either with or without the closing of the adjacent *b* hole, but it is difficult to see how it could have worked, and still more difficult to imagine any other use for it. The projection *bb* was evidently a guide to keep the long key from swerving. The smaller projection beneath the curve in the stem of the key appears inexplicable. It was no doubt connected with some piece of mechanism at the back of the flute.

The *a* hole was governed by a simple open key which was closed by the pressure of 3 *L* on the plate C.

The *g* key differed little from that of the ordinary flute, but it had the shake-lever of *fig. 53*.

FIG. 54.



The crescent for 2*R*, and the connection of the crescent of the *f* hole with the *b* key, were discarded.

578. The *b* must have been fingered on this flute in precisely the same manner as on the second flute of Pottgiesser, see §544, the *a* being made by the closing of the thumb-key.

The flute above described was, in many respects, obviously far inferior to Gordon's earlier one, yet the finger-holes appear to have been fairly well placed, and their equality of diameter, which formed such an important feature in the earlier instrument, seems to have been preserved. It will be observed that, on this flute, Gordon departed in two instances from the system of open holes that he had previously established, but there is no discernible reason why the correct vent-holes should not have been employed for all the notes of the third octave.

579. Theobald Boehm. During a visit of Boehm to this country in 1831, he played several solos in public, on a flute with small holes made by himself in Munich. He had then been engaged in the manufacture of flutes for more than twenty years. In his pamphlet of 1847 he tells us that he had been trained in mechanical pursuits by his father, who was a goldsmith, and he continues: "I was able to make easily a copy of a four-keyed flute by Grenser for my own use, and I played upon it in 1810. A desire for a better instrument grew in proportion to my progress in flute-playing. As in addition to my appointment as first flute [at one of the Royal Theatres] in Munich, from 1812 to 1817, I had my business, and was equipped with the necessary tools, I made, according to the best patterns of the time and my own notions, flutes for myself and others, many of which are still in existence. Thirty-five years ago I applied to my flutes a new kind of springs; linings to the sockets; cork-covering to the [pins of the] joints; a moveable *embouchure* of gold, and many other things now generally used." He does not tell us that the linings of the sockets and the cork-covered pins were well-known before he began to make them, or that the sliding gold plate of the mouth-hole was invented by his old

teacher Capeller, the first flutist of the Court orchestra at Munich: see §§521-2.

580. Boehm says that in 1818 (in the English edition the date is given as 1828) he was established in his "well-fitted shop and began to make some machines for facilitating the construction of a better sort of key-mechanism than any that had been previously used." The improved mechanism turns out to have been nothing more than the "pillars" for the support of the keys, which had been commonly used in France for many years.

While engaged in attempting to improve the mechanism of the flute, Boehm made the interesting discovery that if the axle of the key did not go straight through the balls of the two pillars, the key would not work properly, and before the end of the year he "had made a flute which was generally approved on account of its quality of tone, its intonation, its elegance and its solidity."

"On one of these improved flutes," he continues, "constructed, however, on the old system, I performed in Paris and in London in 1831. In the last mentioned place I was struck with the powerful tone produced by Nicholson, then in his prime. This was due to the large size of the holes of his flute . . . but it required all his extraordinary skill and his excellent *embouchure* to hide the faulty intonation and the inequality of the tone which were the result of the improper positions of the holes. At that time I saw M. Gordon, an amateur, who had in Paris, and afterwards in London, made many attempts to improve the flute."

581. With Boehm's expressed opinion of Gordon's flute, as made by Ward, the reader is already acquainted. Leaving, for the present, further discussion of the pamphlet of 1847, it is necessary to refer to the letter written by Boehm to Cöche, previously quoted, wherein this statement appears: "I know M. Gordon very well. . . . I first met him in London six [seven] years ago, and he had then a flute which differed in construction from other flutes, but which was false in its intonation and practically almost useless. He found out that I was

staying in London, and he came to consult me on the subject of flutes because he was aware that I was a manufacturer. I had already made in London the model of my new flute, and I showed him all that I had done."

582. Boehm's "Patent Flute." We will now refer to another letter of Boehm's, dated Munich, March, 1843, the following extract from which is printed in a small pamphlet by Clinton (1852 *circa*): "The first model I made at my friend Mr. Wolf's, in 1831, proves that I wanted to preserve as many notes in the old way of fingering as seemed feasible."

Boehm seems to have been particularly reticent with regard to the details of the flute that he made at Wolf's during his stay in London, which he says he showed to Gordon. Fortunately Mr. Carte has preserved a prospectus, issued by Gerock and Wolf (1832), which he has kindly placed at my disposal, and which contains a "*Scale and Description of Boehm's newly-invented patent Flute, manufactured and sold by the patentees only, Gerock and Wolf.*"

The following extract, the wood-cut, *fig. 55*, and the scale of fingering, are copied from this prospectus, which also contains examples of passages facilitated in execution by the mechanism of the right hand.

583. . . . "The patentees, Messrs. Gerock and Wolf, having availed themselves of the valuable assistance of Mr. Boehm, principal Flutist to the King of Bavaria, distinguished not only as a Musician, but for uncommon powers of mechanical invention, have succeeded in perfecting a Flute devoid of those inaccuracies of intonation universally complained of in Flutes of the usual formation; and are enabled, confidently, to invite the attention of the Musical World to their new Patent Flute; in which, by a slight alteration in the form and arrangement of the Keys, the following important results are obtained: namely,

"FIRMNESS, EQUALITY, and RICHNESS of tone, which have never been altogether combined in any other description of Flute.

"Simplicity of mechanism as regards the FINGERING.

"Facility in FILLING; producing sweetness and freedom up to the highest C; and unexampled capabilities for the more delicate graces of expression which belong to a finished style of execution.

584. "It will accordingly be found that the whole construction of the newly-invented scale of this Flute, tends to a more complete indentification with the natural scale of the harmonic succession of sounds, insomuch as by means of the simple F key, as exhibited in the annexed drawing, the hole for the note E is placed in its natural situation, which gives to it all the power of the E \flat and D.—Besides which advantages, its peculiar formation has influence upon several of the high notes, which become better in tune thereby, and more pure, easy, and clear in tone; giving at the same time a facility on several shakes, or trills, which could never be made upon the Flute before.

"In all passages of Music, likewise, where the notes preceding or following the F \sharp require the G \sharp Key to be opened, or the sixth hole to be closed with the third finger of the right hand, there is a difficulty on the common Flutes in gliding to or from the F \sharp Keys, and a partial unstopping of the intermediate holes, which produces a sound between the respective notes, and requires the skill and practice of a first-rate professional artist to surmount the difficulty in such passages of Music as are affected thereby; which difficulties and inaccuracies are also obviated by the newly invented F Key as described in the figure subjoined."

At the place marked with an asterisk (*fig. 55*) it is evident that there must have been a joint, though none is indicated in the original engraving. The key of the *g* hole was, of course, an open one.

585. *Boehm's "Patent Flute."* It will be seen that the upper part of this flute, from *g* \sharp inclusive, differed little from the corresponding part of the ordinary eight-keyed flute. The *g* \sharp and *a* holes were, however, situated lower down than

usual, the *a* hole, if we may judge by the engraving, being considerably below its true place. We have seen that these two holes had been placed in approximately correct positions long before the date of Boehm's "patent flute": the *g* \sharp hole by Tromlitz in 1786, and the *a* hole by Pottgiesser in 1803.

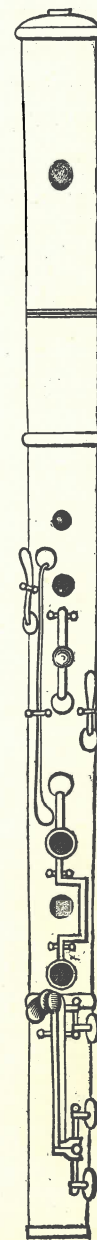
The only feature, in this part of the instrument, which could possibly be regarded as novel, was the application to the *a* hole of an open key similar to one of those which Tromlitz placed over the *e* hole in 1786. See §476. The notes *a'*, *b'*, *a''*, and *b''* were of course veiled as on the old flute.

586. The holes of the foot-joint, if the engraving is to be trusted, were shockingly ill-placed, and the arrangement of the keys was more inconvenient than usual. Here, then, there was certainly no improvement.

The four open holes for *e*, *f*, *f* \sharp and *g* were no doubt more correctly placed than on the ordinary flute, but there was nothing new in their change of position, for Pottgiesser, as the reader is aware, effected this improvement in 1803, and he at the same time discarded the two closed keys for *f*, as Tromlitz had previously done.

It will be observed that the holes of Boehm's flute were unequal in size; a retrograde step, as on Pottgiesser's flute of 1824 all the holes, but the lowest three, were of equal diameter. As well as can be judged from the drawings (*figures 53 and 54*), Gordon appears to have avoided this error, excepting in the instance of the duplex *c''* \flat hole.

FIG. 55



The discussion of the mechanism for closing the *g* hole may be conveniently deferred, and we will now proceed to examine the published table of fingering.

587. "Scale of Notes affected by Gerock and Wolf's Newly Invented Flutes."

588. The *e'* and the *e''* of this flute should have been equal in strength and quality of tone to the best notes of the scale. The fingerings given for *c''* and *c'''* were in common use, and would have been neither better nor worse than on the ordinary flute,

but the old fingering for these notes $\left| \begin{array}{cccccc} \circ & \circ & \circ & \bullet & \bullet & \bullet \end{array} \right|$ would have been lost on account of the low position of the *a* hole.

The first fingering for *d''#* would have given the harmonic *fifteenth* of *d''#*. The use of the *c''#* hole as a vent-hole was most improper; the note would have been too flat, and its tone would have had a nasal quality.

The second fingering for *d''#* was in general use on the old flute; it was better than the other, though not good. It gave the harmonic *twelfth* of *g''#*.

The fingering for *e'''* may be a misprint; as here shown it would give the harmonic *fifteenth* of *d''#*, insufficiently sharpened by the opening of the *a* hole. If really fingered in the manner shown, it must have been horribly flat and much worse than the *e'''* of the one-keyed flute. It is possible that the *e* hole may have been intended to be open, and then the note would have been, of course, a harmonic *fifteenth* of *e'*, assisted by the proper vent-hole. A close resemblance to the improper fingering will be observed beneath the shake on *e'''*.

The *f'''* is of the true type, being the harmonic *fifteenth* of *f'* aided by the *b \flat* hole, the true vent-hole. The opening of the *a'* hole would not have caused much difference. This note must have been at least three-quarters of a tone higher than the *e'''* as given above. The fingering for *f'''#* is correct.

It will be apparent that the *g'''*, though fingered with the proper note-hole, had the same vent-hole as the *f'''#*, namely the *b* hole. This fingering must have rendered the note nearly a quarter of a tone too flat, as compared with the *f''' \natural* and the *f'''#*.

The *g'''#* was the same as that of the old flute: it would have agreed tolerably well with the *g'''*.

The *a'''* and the *b'' \flat* were made with the same holes, though not with precisely the same fingers, as in the suggested fingerings for those notes on Gordon's flute, excepting that this flute of Boehm's had no *d''* hole to aid the production of the *b \flat* .

589. The fingering for the shake *d'''-e'''* is that of the ordinary flute. The *c''#* hole answers tolerably well, in a shake, as a vent-hole for both notes.

The shake $d''' \sharp - e'''$ consisted of the unaided harmonic *twelfths* of $g' \sharp$ and a' .

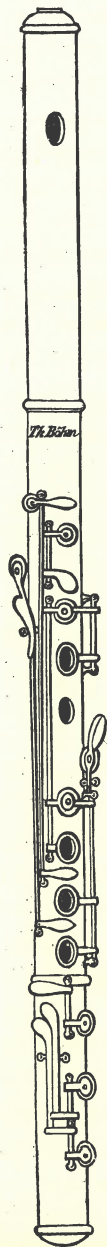
The shake $e''' - f'''$ must be an error: $f''' \sharp$ was probably intended, and as both the e''' and the $f''' \sharp$ would have been too flat they might easily have been rectified by the player.

The fingering given for the shake $f''' - g'''$ might have been passable; that for $g''' \sharp - a'''$ would have been rendered better by the closing of the f hole, as the $g''' \sharp$ would then have been produced as the true harmonic *seventeenth* of e' , vented by the $g \sharp$ and $c' \sharp$ holes.

590. Excepting for the mechanical facilities afforded by the ring-key, Boehm's flute of 1831 must have been far inferior, on the whole, to the ordinary eight-keyed flute, as generally made in England, whether of the Nicholson or any other model. The notes of the third octave, especially, must have been more out of tune on this instrument than on any well-made one-keyed flute, or on any eight-keyed flute ever constructed; in fact, the severe and unjust remarks that Boehm made concerning Gordon's flute would have applied with perfect truth to his own. See §§568 and 581.

Boehm's flute of 1831 has always been considered a failure, the only allusion that he is known to have made to it in after years is that contained in the letter published by Clinton: see §582. No patent was taken out for this instrument, its very title was therefore an imposture.

FIG. 56. (§591.)



591. *A later Flute by Boehm.* With regard to the date of the construction of this flute, Boehm, in the three editions of his pamphlet, writes as follows:

"*Meine neuen Flöten waren im Jahr 1832 längst vollendet.*"

"*Dès 1832 ma nouvelle flûte était achevée.*"

"At the beginning of 1832 my new flute was completed."

The wood-cut, *fig. 56*, is a reduced copy of his engraving. The flute here shown will be observed to bear little resemblance to that of 1831 (*fig. 55*, §585), but, except in the details of the machinery, its similarity to the flute of Gordon (*fig. 53*, §570) is evident. The only departures, on this flute of Boehm's, from the fingering given in §574 are as follows.

592. Boehm, like Tromlitz (1800) and Pottgiesser (1803) used an open $g \sharp$ hole, which he governed by an open key, as Nolan had done, but he employed an absolutely simple key instead of either of the complicated contrivances of Nolan. On the flute now under discussion, the g and the $g \sharp$ of the lower octaves were fingered precisely as they had been fingered on the open-holed flutes of Tromlitz and Pottgiesser. This was, in my opinion, a most valuable improvement, and I think that Boehm was entitled to great credit for having rescued the fingering from probable oblivion, and for having advocated its use in defiance of much opposition.

As the left hand little finger was employed for g , and for all the notes of the first and second octaves below it (thus causing a further, though slight, difference in the fingering), of course Boehm could not have adopted Gordon's undesirable arrangement of the foot-keys, even had he been so disposed, he therefore, perforce, retained the old fingering for the lowest four notes.

The projection behind the d'' key, which has the appearance of a lever for opening the key, was in reality only intended for the attachment of an ordinary flat spring. The key was opened by the action of the first or the second finger of the right hand on the lever between the $f \sharp$ and the $f \natural$ holes. It will be remembered that Capeller's d'' key was used by the first finger of the right hand.

593. The mechanism of this flute was undeniably more simple than that of Gordon's, but the two arms connected with the ring of the $f\sharp$ hole had an action that was extremely objectionable. Although this contrivance was awkward and unmechanical in the highest degree, it remained in use for a few years, to be in its turn superseded by a far better arrangement, described in §634 and §638.

Boehm reversed the position of the original open key for covering the $c''\natural$ hole (see *fig. 52** §565), and applied to it an extra shake-lever, which he unwisely gave to the second or third finger of the right hand, instead of to the first finger as on the old flute. He did not employ the duplex hole for the c'' until about the year 1843. It will be seen, on reference to §§ 668 and 684, that Mr. Carte adopted the original position of the $C\sharp$ keys.

The reader will recollect that the ring-keys of Nolan and Pottgiesser were so contrived that the edge of the ring formed the edge of the encircled hole, but that the crescent of Pottgiesser, adopted by Gordon, left an intervening portion of wood between the edge of the finger-hole and the edge of the crescent. We are in complete ignorance as to the form of Gordon's ring-key, but Boehm, on his earlier flute, appears to have exactly copied Nolan's ring. On the flute shown in *fig. 56* he borrowed and amplified the idea of the intervening rim of wood. The rim is not clearly defined in his engraving, but I am able to speak positively on the point, as I played for some months on a flute similar to the one represented, made by Boehm about the year 1843. On that instrument there were rings of wood, about .05 inch in width, immediately surrounding the holes. Outside those wooden rings were circular grooves into which fell the rings of the keys. Both wood and metal rings were flat at the top.

594. Excepting in respect of equality, that flute was far inferior in tone to the best English eight-keyed flutes of the time. The tuning was extremely defective owing to the improper positions of the finger-holes. As far as my memory serves me, the distance between the $c''\sharp$ hole and the c'' hole was about .3-inch too great, a discrepancy which could not have been

owing to the difference between the pitch of England and that of Bavaria, because the flute under discussion had been expressly made to suit the English pitch, and as far as the a' was concerned the adjustment was correct.

Notwithstanding the apparent simplicity of Boehm's machinery, which was precisely similar to that shown in *fig. 56*, it was constantly out of order. The springs, which were thin, short, flat strips of brass, were especially faulty, and although the instrument in question belonged to my good friend and master, Mr. Carte, who had kindly lent it to me, I took the responsibility of replacing some of them with steel ones. Several of the pillars, which had become loose, I fastened with cement.

The arms for closing the g and b holes were a perpetual source of annoyance, and though they were provided with regulating screws their action was extremely uncertain. It would, in fact, have been difficult to devise a more unsatisfactory piece of mechanism than that employed by Boehm to enable the first finger of the right hand to perform the simple operation of closing two or three holes at the same time.

The keys of Boehm's flutes were sometimes of silver; and sometimes of brass. The long rods were solid, and they worked on the pointed ends of steel screws which passed through the balls of the pillars.

The "crutch," intended to assist the player in holding the flute, is described and figured in §396. Boehm always used and strongly recommended this unnecessary appendage.

595. Boehm writes, in 1847, as follows: "In a few months I had acquired facility in solo and orchestral playing, and in Munich, in 1832, and also in London, where I again played in 1833 and 1836, the correct intonation and the full, equal tone of my flute were at once noticed and appreciated." It is, however, extremely improbable that he had completed a flute, of the kind last described, as early as "the beginning of 1832," nor are there any grounds for believing that the flute on which he played in 1832 and 1833 differed from that shown in *fig. 55*. The

following extracts from *The Harmonicon* and the *Allgemeine Musikalische Zeitung* may be taken together, as fair proof that Boehm did not visit this country in 1833.

From *The Harmonicon* for August, 1833:

"*Foreign Musical Report. Munich.* The Royal *Hofmusik* Böhm has, by his great mechanical talents, given such perfection to the flute, that all the tones of the instrument are rendered equally full, pure and vibrating. Its *pianos* are uncommonly sweet and delicate, and the *fortes* exceed by far the power of an ordinary flute. In addition to these advantages, this new instrument presents an equal facility in all the keys, the most difficult not excepted. Although Mr. Böhm has only practised this new instrument for about six months, his execution upon it is almost as great as on the flute hitherto in use. He is on the point of setting out on a professional journey to England."

From the Leipsic *Allgemeine Musikalische Zeitung* for July 2nd, 1834 (Translation):

"Mr. Boehm of Munich, the inventor of a new flute, is going to Bremen and to Hamburg, and thence to England, at which places he will give concerts, and perform on his new instrument."

596. In an earlier number of the same journal (Jan. 29, 1834,) there is a highly coloured account of a flute made by Boehm, written by his intimate friend Professor Schafhäütl, a translation of which I append. It will be seen that this article contains no description of the details of the flute so extravagantly praised. It is unaccompanied by any engraving.

"Our distinguished Court Musician, T. Boehm, noted for his flute-playing as well as for his great mechanical genius, has at last contrived to effect a long desired improvement in the construction of the flute, which causes this hitherto imperfect wind-instrument now to rank amongst the most perfect. The well-known Tromlitz flute, in spite of its many keys, has still the principal faults of the old one-keyed flute, namely, inequality in the strength of certain notes of the first and second octaves, and false intonation, as well as difficulty in the production, of

the notes of the third octave. These faults are scarcely possible to be overcome, even by the virtuoso. Then again, the feeble tone of the instrument causes it to be almost useless in the orchestra though it is valuable for solos and for chamber-music. These imperfections have been removed in Boehm's flute, all the notes of which, from *c'* to *b'''*, possess equal strength and purity, as well as perfect intonation. The *piano* tones resemble those of the one-keyed flute; the *forte*, which requires no more effort to produce than the *mezzo-forte* of an ordinary flute, is equal in strength to three Tromlitz flutes loudly played. The *embouchure*, by a special configuration, has been made more convenient in management, and the objectionable hissing, so frequently heard, is entirely removed. [The mouth-hole that Boehm used was of oblong form, though it is not so represented in his engraving; he also used the "excavation" described in §633.]

597. "It is true that the fingering of this flute is quite different from that of the Tromlitz flute, so that anyone accustomed to playing on the latter must begin afresh on the new instrument, but Boehm, although he has only been able to practise on his new flute for about half a year, has already acquired great freedom of execution, and some pupils, whom he has taught to play on the new flute, have gained such facility in playing in all the keys that it is quite astonishing. Owing to Boehm's invention all keys are now equally free from difficulties.

"Boehm makes these instruments of cocus-wood, of box-wood, or of ebony, with silver keys and gold springs. Their appearance is very elegant and tasteful, and the mechanism is simple. This double artist had previously adapted his improvements to some of the flutes of Tromlitz by replacing the knobs with silver pillars screwed into the flute. These not only lighten the action of the keys, but give the instrument a light and pleasing appearance. Attempts were made to copy this improvement in Paris, but the artists there did not succeed. . . . The mechanism from Boehm's workshop is so elegantly designed, and so exactly fitted, that it is, in fact, the sort of work which

one has been accustomed to see only on astronomical instruments. Those who have played upon the improved Tromlitz flutes, made by Boehm, do not care to play upon any others. Boehm's instrument has already been heard at the concerts of the Musical Academy and at one Court concert, and it created universal admiration."

598. The ridiculous claims set up in this most exaggerated "puff" scarcely need refutation, but the reader will no doubt be struck by the resemblance of the article to the advertisement of Gerock and Wolf, particularly in the opening sentences. It seems not unlikely that the flute to which Schafhäutl alludes resembled the flute represented in *fig. 55* as closely as the style of the notice of 1834 resembled that of 1832.

There is no reason to believe that the long deferred visit to England was made prior to 1835. Concerning Boehm's performance in London in that year we have positive evidence, though he does not appear to have given any of his projected concerts. In a letter by Ward, published in *The Musical World*, of March 7th, 1843, occurs the following statement: "In 1835 I heard Boehm perform his fantasia on 'The Green Hills of Tyrol' at the Choral Fund [concert], upon a flute very similar in principle to that which I made for Captain Gordon." We may therefore conclude that the instrument on which Boehm then played was similar to that shown in *fig. 56*, and that his journey was postponed from time to time in order that his flute might be completed to his satisfaction, and that he might have time to practise on it, before he set out.

599. **Gordon and Boehm.** The respective claims of Gordon and Boehm, as inventors, have been discussed *ad nauseam* and with much needless acrimony, but now that we are aware of the efforts of their predecessors in the field of discovery, and that we know how little there was of originality in the main principles of the flutes just described, the question appears invested with but a limited amount of interest, I shall therefore endeavour to confine my observations on the subject within the narrowest compass possible.

That Gordon was the first who succeeded in developing a complete and rational system of open holes, founded on the crude schemes of Tromlitz in 1800 and Pottgiesser in 1803, and in devising mechanism by which that system was rendered practicable, it seems impossible to doubt. The previously quoted statement of Boehm, to the effect that the holes of Gordon's flute of 1831 were ill-placed, is without weight, because by placing the holes of his own flute so far from their true positions, Boehm showed conclusively that he did not possess sufficient knowledge of the subject to enable him to form a correct judgment. Neither can Ward's opinion (quoted in §567), that the holes of Gordon's flute were truly placed, be unreservedly accepted, it being partly open to the same objection, as will be hereafter seen. All that can fairly be said on the subject is that in the distribution of the holes of the flute of 1831 Gordon was guided by what he conceived to be true acoustical principles, and that Ward considered him to have attained his object. Ward informed me that Gordon had determined the positions of the holes by the divisions of the monochord. It will be remembered that Pottgiesser adopted that method.

600. The following account of Boehm's plan of working is transcribed from the English edition of his book, which does not materially differ from the original German as far as this extract is concerned. Having spoken of the defects of the old flute, and considerably exaggerated them, he writes: "The question which now arises—to what extent, and by what means, these defects were obviated in my flute of 1832?—will, as I think, be best answered by an exact description of the acoustical proportions and mechanism of that instrument.

"Though I was, even then, pretty well acquainted with the general laws of acoustics, I could find scarcely any guide for their special application to the construction of flutes; and I was therefore obliged to have recourse to many merely empirical experiments [*sic*] before I determined upon the following proportions of the tube or the column of air as most suitable for my purpose.

601.

	In English feet.	In French metres.
I.—HEAD JOINT.		
Length of the cylinder from the cork to the middle joint	0.4593	0.1400
Width of it	0.0604	0.0184
II.—MIDDLE JOINT.		
Length of the cone	1.1417	0.3480
Width at the upper end	0.0604	0.0184
Width at the lower end	0.0393	0.0120
III.—FOOT JOINT.		
Length of its conical part	0.2624	0.0800
Width at the upper end	0.0420	0.0128
Width at the lower end of this conical part	0.0361	0.0110
Length of the lower cylindrical part	0.1312	0.0400
Width of it	0.0361	0.0110
IV.—Whole length of the column of air	1.9947	0.6080

602. "These proportions being once established, I prepared several tubes, all alike in thickness of wood, 0.0146 ft., and in length, 1.9947 ft., for producing the fundamental note C. The embouchures I made in form of a parallelogram with rounded corners, and placed them at a distance of 0.0557 ft., measured from the centre of the embouchure to the cork stopper.

"After that, I began to cut off from the lower end of one of these tubes, till I obtained C sharp. I then marked the point of section on a second tube, and repeated this operation till I had got all the notes of the first octave. Then I bored in the second tube holes at the points of section which I had marked before, and these holes I made of the largest size at which they could be stopped with the fingers.

603. "All the notes produced in this way were too flat, on account of the holes being smaller than the tube in diameter, therefore I corrected the tuning on a third tube by moving the holes towards the embouchure. Though I obtained in this way the first and second octaves in correct tune, with equal-sized holes, the third octave was still defective; because, to produce

the high notes, it is necessary to open, together with the hole of the fundamental note, the fifth hole above it, as a vent-hole; and as the clearness, free emission, and correct tuning of the high notes depend upon the position of those vent-holes, I was obliged to move again six of the upper holes, and to correct the intonation, thus disturbed, by modifying their size.

"At last, I obtained a tube with fourteen holes, which was very much superior in acoustical proportions to the common flute tube, as all notes from the fundamental C up to the highest B [b] could be produced upon it, equal, free, certain, powerful, and in good tune."

The unsuccessful result of all these experiments is described in §594.

604. In estimating the amount of credit respectively due to Gordon and to Boehm for the arrangement of the fingering of the new flute, it will be well to notice a statement made by Boehm on the subject, printed in the English edition of his pamphlet of 1847. "Mr. Gordon made use of essential parts of my instrument when he constructed his; but he, a gentleman in every respect, always legally [*sic*] acknowledged it." In the French edition the statement is somewhat modified, as follows: "*M. Gordon a fait usage des parties essentielles de mon instrument pour construire le sien; mais il l'a toujours loyalement reconnu.*"

Let us now refer to another statement of Boehm's, which is virtually the same in the German, French and English editions of his book, showing how far Gordon was really indebted to him. I have already said that no copy of Gordon's prospectus is known to exist, but the ensuing quotation from it may be assumed to be correct. "He published," writes Boehm, alluding to Gordon, "also in 1834 an engraved scale for this flute, which he gave to me; and in the letter-press accompanying this scale, he observes, among other things:—'*La suppression des deux clefs de Fa naturel, et leur remplacement par une clef de Fa dièze, est une idée dont l'application offre de grands avantages. L'idée de cette clef de Fa dièze, communiquée par M. Th. Boehm de Munich, a été, avec son agrément, adoptée pour la présente flûte, dont elle complète les*

moyens d'exécution. ('The suppression of the two keys for $f\sharp$, and the substitution for them of a key for $f\sharp$, is an idea of which the application offers great advantages. The idea of this $f\sharp$ key, communicated by Mr. Th. Boehm of Munich, has been, with his consent, adopted on the present flute, thus completing its facilities for execution.')

605. Now, if Gordon had acknowledged having made use of any contrivance of Boehm's besides the one in question, it is not reasonable to suppose that Boehm would have suppressed the information; therefore we have the following syllogism: Gordon loyally acknowledged everything that he borrowed from Boehm. Gordon did not acknowledge that he borrowed from Boehm anything but the idea of the key for closing the $g\sharp$ hole. Therefore Gordon borrowed nothing else from Boehm.

It is clear that in the construction of his flute Gordon freely adopted the ideas of his predecessors, and it is equally clear that it was not to Boehm that he was indebted, except in the instance above mentioned (see the remarks on this subject in §§606-7), and considering the close resemblance between the two flutes, *fig. 53* and *fig. 56*, in the general principles of their construction and fingering, it may be further argued, irrespectively of the direct evidence on the subject, that as Gordon obviously borrowed little from Boehm, much must have been borrowed by Boehm from Gordon.

On comparing the flute, said by Boehm to have been made "at the beginning of 1832," with that said by him to have been made in 1831, one cannot help being struck by the improbability of such a comprehensive improvement having been effected by Boehm in so short a time, unless he had meanwhile received much light from an intelligence far superior to his own. Even if we were to adopt the account of Schafhäutl (§597), and to fix the date of the completion of the flute from the time at which he says Boehm first had an instrument of the new kind on which to practise, which would have been in July 1833, the improbability would not be much lessened. We are thus led irresistibly to the conclusion that Boehm copied the general

design of his flute from Gordon's, but that he altered, and to some extent simplified, the mechanism.

Còche, who seems to have erred on the side of excessive generosity towards Boehm, appends this foot-note to the engraving of Gordon's flute in his *Méthode*. "*La clé du F \sharp , et la clé du Ré, appartiennent à M. Boehm.*" (The key for $f\sharp$, and the key for the shake with $d\sharp$, belong to Mr. Boehm.) Evidently Còche knew nothing of the d key invented by Boehm's instructor, Capeller: see §521.

606. With regard to the mechanism for closing the $g\sharp$ hole, we have curiously conflicting statements by Boehm attributing it to Gordon, see §568, and by Gordon attributing it to Boehm, see §604. We will first examine the statement by Boehm: "The ϵ hole of his flute was bored lower down and was made larger than usual. It was covered with a key, and in order to avoid the lever for $f\sharp$ he employed a ring-key." Although this may appear, at the first glance, to be a very simple recital, it contains an absolute contradiction. The only object of covering the ϵ hole with a key must have been to enable the third finger to close the hole while the first and second fingers remained in their usual positions. The only object of the ring-key must have been to enable the first finger to close the g hole while the third finger remained in its usual position. The impossibility of the correctly placed g and ϵ holes being closed directly, and at the same time, by the first and third fingers of an ordinary hand is manifest, but either one of the above-mentioned contrivances would have been sufficient to effect the desired object, and the combination of the two would have been absurd. We are therefore left to the inevitable conclusion that the two appliances were on different flutes.

607. Leaving further discussion of the key for covering the ϵ hole, which was no doubt similar to that of Tromlitz, we will revert to the declaration of Gordon: "The idea of this key for $f\sharp$, communicated by Mr. Th. Boehm of Munich, has been, with his consent, adopted for the present flute." In order to reconcile this statement with Boehm's I venture to suggest the following

explanation. We can scarcely refuse to accept the evidence of Boehm, namely that the notion of using a ring-key, in order to avoid the necessity for the employment of the old closed *f* key, was originated by Gordon, and it may be assumed that the ring-key was for the purpose of covering the *g* hole. We may easily suppose that Gordon was not satisfied with his contrivance, and it is clear that Boehm was not satisfied with the ring-key that he made for Gerock and Wolf, which appears to have been partly copied from Nolan's open *g* key. It would seem that Boehm then improved upon this arrangement, and contrived the now discarded mechanism shown in *fig.* 56, §591. Gordon appears to have adopted an arrangement somewhat similar to this, employing Pottgiesser's crescent instead of Nolan's ring, and having thus made some use of Boehm's invention, he, following the dictates of his well-known generous disposition and punctilious sense of honour, attributed to Boehm a larger share of credit than was justly due to him.

608. Little remains to be said on the subject of the flute represented in *fig.* 54, §577. It is well-known that Gordon's mind was eventually completely shattered by his misfortunes, we must therefore judge him tenderly with regard to this flute, and it may perhaps be right to consider that when the unhappy gentleman had this instrument made in Boehm's workshop, supposing the representation to be accurate, his reason had already begun to fail; that he had lost courage and faith in his own invention, and that he therefore timourously reverted, in part, to the so-called closed-keyed system, as Pottgiesser had done. It is evident, however, from his published drawing, that this aberration was but temporary, and that he took his final stand on the well-founded system that he had done so much to establish.

We are, in fact, almost driven to the conclusion that Gordon, for the time, "completely rejected his system" (see §576) because Boehm induced him to do so, and that, while the poor gentleman was being thus led off "on a false scent," Boehm was engaged in appropriating the ideas, and modifying the details of

the scheme, that he had persuaded his rival to abandon. See §§598 and 626.

As regards Boehm's assertion, quoted in §576, that his positions of the finger-holes were partly adopted by Gordon, it is so opposed to all the trustworthy evidence at our command that it may be dismissed without further comment. This statement of Boehm's has been expunged in the English translation of his book.

609. Cêche's "*Examen Critique*" (1838A). I am much indebted to the kindness of my friend Mr. Carte for the loan of this exceedingly scarce pamphlet, which forms one of the most valuable and interesting chapters in the history of the modern flute, and which but for a certain tendency to over-estimate the merits of Boehm, is written in a spirit of judicial impartiality. Condensed in the thirty-nine pages of this excellent little treatise is a large amount of useful information. The first part consists of a carefully compiled account of the faults of the ordinary flute, of the French model, with examples of imperfect scales and shakes. The second part contains an account of the advantages of "*la flûte de Boehm*" which the author places in a decidedly favourable light, but it should be explained that the new flute is contrasted only with the small-holed French flutes of the period.

610. In his "*Conclusion*" (p. 18) Cêche writes: "The advantages of the new flute are now generally understood: its simple and elegant mechanism appears, at the first glance, of such real utility, that one is astonished at its not having been devised at the time when keys were first applied to the flute. Some artists have already caused to be constructed, on the same principles, clarionets, hautboys and bassoons which excel those of the old models as much as the new flute excels the ordinary one. Is it not a grand success for the inventor that his discovery, though too new at present to be appreciated at its full value, nevertheless affords promise of such excellent results as to give rise to a desire to apply it to other instruments? This fact is a greater recommendation than all the praises to which my admiration for

the new flute might naturally lead me to bestow upon it if I did not fear being accused of exaggeration or infatuation."

Not the least interesting portion of Côme's pamphlet is a series of letters. Of these I append complete translations. The improvements therein mentioned are described in §§632-4.

611. *Letter from H. Berton to Victor J. B. Côme.*

"SIR,

"I herewith forward to you the copy of my report to the Institute, and I think you will act wisely in publishing the opinion of the signatories of this report on the importance of your work, for not only have you earned the good opinion of your brother musicians in devoting your time and labour to the study and the construction of the new instrument, but composers owe infinite thanks to you for having facilitated the practice of the flute, henceforth freed from hitherto insurmountable obstacles.

"All the notes of the chromatic scale can now be employed at pleasure and without restraint, and we find perfect intonation and equality of tone; perfection of mechanism, which causes no more noise in its action than that of other wind-instruments; the possibility of executing the music of your illustrious master Tulou, and the shakes on all the degrees of the scale of your instrument. These advantages were more than sufficient to induce the Academy to sanction the report with which you have been honoured.

"I am, yours respectfully,

"H. BERTON."

612.

"INSTITUTE OF FRANCE.

"ROYAL ACADEMY OF THE FINE-ARTS.

"The Permanent Secretary of the Academy certifies that the following is a true copy of the Minutes of the Meeting of Saturday, March 24th, 1838.

"GENTLEMEN,

"At the invitation of the Home Secretary (*Ministre de l'Intérieur*) you have referred to your Musical Section the

examination of the improvements in the manufacture of the flutes, termed *Flutes on Boehm's system*, by M. Côme, professor of the flute at our *Conservatoire* of Music, and author of a *Méthode* written for the purpose of facilitating the teaching and the study of this new instrument. We have considered this examination, and I have the honour to present you with the report, in which your Musical Section has expressed its opinion on the merits of this flute and the *Méthode* of M. Côme.

"The musical instrument to which the name of flute has been given, is undoubtedly of great antiquity, and from the flute of Pan to those in present use, which are called transverse flutes on account of their being held in a transverse position, the form and the mode of execution have continually undergone great changes, and it is certain that the object of these various changes has always been the correction of the inherently faulty intonation due to the evil construction of the old flutes. We consider that the inventor of the new flute has attained this object, and we shall draw your attention to the means that he has employed.

613. "Well-informed persons, whether scholars or musicians, have always considered it almost impossible to construct a flute, which, judged by the laws of acoustics, could be pronounced perfectly in tune throughout its compass, though an instrument might be made to appear so by reason of the skill of the performer, and they have based their opinion on the following facts. The celebrated Charles, your illustrious fellow-member of the Academy of Sciences, a great lover of music and a fairly good flute-player, told us in conversation that he very much regretted having studied the flute rather than the violin, an instrument on which absolutely perfect intonation may be obtained, while on the flute this appeared to him impossible, because of its defective construction in many points. (I) That the *embouchure* presented a great difficulty to be overcome, that of insufflation, for in introducing the column of air within the tube it was not possible to avoid losing a part of it, which passed outside, and thus part of the intensity of the tone, as well as the power of

controlling it with certainty, was inevitably lost. [It will be seen, from this remark, that the illustrious Charles did not quite understand the subject on which he was conversing, or else that his words were imperfectly reported.] (II) That the placing of the holes was, mathematically and acoustically speaking, vicious; for the positions had only been calculated according to the possible extension of the fingers, instead of by the immutable laws of physics. (III) That throughout the whole compass of the instrument there were many uncertain notes, particularly in the lower part of it, while those of the upper part were often too piercing; in fact, that all the sounds of the different registers of the flute did not appear to be of the same family. (IV) That it was impossible to make, on certain notes, the shakes improperly termed cadences. Finally, he considered that notwithstanding the *légèreté* and the sweetness of its tones, the flute would remain an imperfect instrument until the time should arrive when some ingenious man should find the means to correct all these defects, and when skilful and courageous artists should abandon their old habits, and bring out new inventions calculated to foster the culture of the fine-arts.

614. "GENTLEMEN,

"We believe that the wishes of the great physicist have been at last realised, and that all the faults pointed out by him have been remedied. The flute that we have the honour to present to you to-day was constructed on the system of M. Boehm by M. Buffet, junr., one of the most skilful manufacturers of this city. Professor Còche superintended its construction, and he has added new improvements of his own invention.

"Impressed with the excellence of this new discovery, many of our most renowned *virtuosi* desire to apply it to the manufacture of their various instruments, M. Brod to the hautboy, M. Berr to the clarinet, M. Gebauer to the bassoon, etc. This concurrence of artistic approbation is already a proof of the merits of the invention, but that which, as it seems to us, most particularly deserves our encouragement and our praise, is the steadfast tenacity of purpose that M. Còche has shown in

rendering fruitful this excellent invention. He gained the first prize for flute-playing at the *Conservatoire*; his great talent has caused him to be appointed there as professor of the flute. Being then convinced of the importance of this discovery, he has had the courage to devote himself to the study of the new instrument, and to superintend its manufacture, in which he has effected manifest improvements. The *Méthode*, that he has written for this flute, appears to us to be an especially useful work. It seems to be clearly written, and its precepts are always illustrated by excellent examples.

"We consider then, Gentlemen, that in granting your approval to our report, you will perform an act just and useful to musical art, and at the same time confer an honour on M. Còche.

"Signed: CHERUBINI.

PAER.

AUBER.

HALEVY.

CARAFÀ.

BERTON, *Registrar*.

"The Academy adopts the conclusions of this report.

"Certified correct:

"QUATREMÈRE DE QUINCY.

"*Permanent Secretary*."

615. *Continuation of Còche's "Examen."* It is most unlikely that Còche could have been influenced by any feeling of partisanship toward either Gordon or Boehm, for both were personally unknown to him, and in writing to each, as he did, he seems to have adopted the fairest course possible. The following extract, which I translate from his pamphlet, shows conclusively the honourable motives by which he was actuated.

616. "I had received the report of the Institute, giving its sanction both to Boehm's invention and to my modifications of it, when, just as I was about to publish the work which had called forth that report, I became aware that Boehm's right to the

title of inventor was open to dispute. I therefore wished, as a conscientious artist, to form an opinion from precise information, and to render justice to the man who really invented the new flute. I knew well that it was a matter of little importance by whom the flute had been invented, but as I had announced myself as the promulgator of Boehm's system, I did not wish it to be possible for any one to contradict the assertions contained in my work. Consequently I deferred its publication, and I wrote to M. Gordon, in Switzerland, who, in the opinion of several artists, was entitled to be considered the inventor of the flute called Boehm's. M. Gordon being in a condition which prevented his replying to me, his wife wrote me a letter (See No. I. [§618]) which appears to attribute exclusively to M. Gordon the invention of the new flute (See *fig.* 1 [*fig.* 53, §570]). On the receipt of this letter I considered it my duty to write to Boehm, and I explained to him the necessity for giving me information from which I might formulate an opinion."

617. Schafhäutl, in a letter to which I have referred in §631, quotes a passage from Cöche's letter to Boehm, dated May 25th, 1838, of which the following is a translation: "It is said in musical society that the flute which bears your name was invented by one named Gordon, an old pupil of Drouet."

Cöche continues: "Boehm replied (See No. II. [§621]) that the invention was really his, and that his instrument, which was completed in 1832, could not be compared to the experiments that M. Gordon made in Boehm's house in 1834. However, Gordon, in a letter dated Munich, July 15th, 1833 (See No. III. [§624]), speaks of the flute that he had just had made by a skilful workman of Boehm's. In fact, Boehm himself says that before this period Gordon had passed nine months at his house in order to superintend the construction of his flutes. Amid all these assertions I can do no more than place the evidence before the public, and allow them to draw their own conclusions. I considered it a duty towards myself to search for the truth; let others judge of the validity of the claims of the inventors.

"It is evident that in 1827 Boehm was not occupied in making

flutes on the new system, as Iwan Müller positively affirms; Gordon, on the contrary, had already constructed several. He therefore acquires the right to priority of invention, and moreover, he was the first to discover the divisions of the column of air; to employ crescents for the purpose of obtaining the result of several motions by means of one single finger, and to make an excavation to receive the lower lip in order to remove the disagreeable effect produced by the sound of the breath.

"Such are the general principles on which the new flute is constructed. Boehm's modifications consist chiefly in the application of the keys for *f#* and the shake with *d*; in the substitution of rings for the crescents invented by Gordon, and in giving more solidity and simplicity to the mechanism, which, in the beginning, was composed of hooks and steel wire that afforded no security in action."

The reader will observe that Cöche, having been unacquainted with the history of his instrument, has given, both to Gordon and to Boehm, credit for inventions made prior to their first efforts at improvement.

618. (No. I.) *Letter from Madame Gordon to Victor J. B. Cöche.*
"Lausanne, May 20th, 1838.

"SIR,

"It is indeed true that my husband, passionately fond of music, to which he devoted every moment not imperatively claimed by his professional avocations, and not being content with the limited capabilities and the imperfections of the flute, strove for several years to invent a flute in which increased facilities for execution, and extension of compass, should be combined with perfect accuracy of intonation. He succeeded at last, in 1830, the period at which the revolution of July deprived him of his vocation, of his prospects, and consequently of his fortune. With the view of recovering his position, he conceived the idea of turning his new flute to account by playing upon it in the principal cities of Europe. He then intended to obtain a patent for his invention; to establish manufactories, and to introduce this fine instrument to the musical public.

"In 1833 he went to Munich to stay with M. Boehm, whom he had known in Paris, and one of whose workmen alone could aid him in the manufacture of the flute that he had invented. I am unable to tell you, Sir, at this moment, whether M. Boehm is indebted to my husband for the idea of the flute that he has sent you; whether he has only improved upon my husband's, or whether, as it may be, he has sent you my husband's instrument. I can write, if you so advise me, to the workman with whose assistance he made it, and I can send you the reply. But I know that after having passed some months in Munich, while constructing his flute, he went to London to endeavour to carry out his projects, but as he was of a very retiring disposition, and had neither letters of introduction nor knowledge of the world, he knew not how to proceed in order to gain success. Finding, at last, his pecuniary resources becoming exhausted before he had been able to make himself known, he returned here to his family, ill and disheartened.

619. "Then an accident occurred which put the finishing stroke to the trials that he had endured: the instrument that had cost him so many vigils and so much labour, was split in consequence of a further improvement that he attempted to make in it. Though much grieved, he again set about making another, for by his perseverance he had acquired an amount of skill far beyond that of the workmen around him. But the ardour with which he applied himself to the work, and the difficulty of executing it without assistance, combined with the opposition of all kinds that his projects have raised against him, have gradually impaired his intellectual faculties, and prevented the completion of his task. He has therefore been compelled to abandon it entirely, and to avoid every idea connected with it, in order to allow his mind to recover the tranquillity of which it stands so much in need. For this reason, Sir, I take up the pen in his place, without having been able to speak to him on the subject of my letter.

620. "Perhaps M. Boehm, who, during the winter, must have heard of my husband's condition from his workman, may have

considered that as my husband was struck down by mental disease, he could, without being wanting in delicacy, appropriate to his own use an invention which might otherwise have been lost to the public. My reason for this supposition is the coincidence of the invention of M. Boehm with my husband's illness.

"M. Drouet, of whom M. Gordon was once a pupil, and who has seen and admired his flute, will be able to tell you what he thinks of it, and when it was made. M. Tulou also must have seen it.

"I append to this letter the drawing of the instrument, with its tables of fingering, as completed by my husband, and since Providence has willed that you should interest yourself in this matter, and your sense of delicacy prompts you to seek the means to enable you to arrive at a just conclusion, kindly favour me, Sir, with your counsel, and inform me how to proceed in order to obtain for my husband those rights, which, should it please God to permit his recovery, might be some day useful to him. It is unnecessary for me to mention, Sir, all the claims you will acquire to my gratitude and esteem.

"M. GORDON."

621. (No. II). *Letter from Theobald Boehm to Victor J. B. Cöche.*

"Munich, June 2nd, 1838.

"SIR,

"I am much obliged to you for your letter of May 25th, and I am anxious that you should have an immediate reply. I know M. Gordon very well. He was formerly a Captain in the Swiss Guards of Paris. I first met him in London six years ago, and he had then a flute which differed from other flutes in construction, but which was false in its intonation and practically almost useless. He had learned that I was staying in London, and he came to consult me on the subject of flutes because he was aware that I was a manufacturer. I had already made in London the model of my new flute, and I showed him all that I had done. [See §§580-5].

"M. Gordon would not take up my flute because it was not of *his* invention, and he worked so hard to construct one on a

different system, that his efforts almost turned his brain. In 1834 [*sic*] he wrote to me from Lausanne saying that he much admired the workmanship of my flutes, and he asked me whether I would not make a flute for him after his own ideas. I consented, and he came to Munich, where I placed one of my workmen at his disposal. Following my advice, he adopted generally the positions of the holes of my flute; but he insisted on carrying out his own ideas with regard to the mechanism of the keys. After having worked nine months with my man, and after having designed and constructed several flutes, he at last finished one which partly resembled mine.

622. "I saw him, for the last time, in London in 1836, much embarrassed, when he told me that he intended to abandon his useless efforts and play on my flute. Some time afterwards he wrote to me at Munich asking me to send him one of my flutes for his own use. I sent him my conditions, after which I received no more letters from him, and a countryman of his afterwards informed me that he had entirely relinquished flute-playing; that he had thrown his instrument into the Lake of Geneva, and that he was ill. Last year he wrote again to my workman who had [made] his flute, suggesting a partnership for the purpose of establishing flute manufactories in Paris, London, Vienna, etc. At the same time a communication arrived from his family saying that he was in very bad health, and expressing a wish that no answer should be sent to his letter.

623. "I assure you, Sir, that I felt much compassion for M. Gordon, whom I esteemed on account of his disposition, and it is a pity that this man, who was highly esteemed as a brave officer, possessing great talents and much merit, should have lost his time and his money in indulging the folly of striving to become the inventor of a thing for which neither his knowledge of acoustics nor his mechanical skill was sufficient, and which caused him such trouble that both his mind and his circumstances became affected. If you desire to have certificates that my flute was already completed in 1832, and that M. Gordon was having his flutes made in my establishment at Munich in 1834, I

will send them to you at once. In 1834 there appeared an article concerning my new flute in the *Musical Gazette* of Leipsic, No. 5. [See §§596-7]. In 1833 MM. Farrenc, Camus and Laurent, manufacturers of flutes in the *Palais Royal*, who knew M. Gordon, were already acquainted with my new flute, and the cause of its not being more generally known at that time was that for three years I was too much occupied with iron manufacture in England, and that I played very little myself; but now I shall have a detailed history of my flute published in the musical gazettes and the political journals.

"Accept, Sir, my friendly salutations and my highest esteem.

"THEOBALD BOEHM.

*First Flute at the Chapel Royal, Munich,
and Instrument Manufacturer."*

624. (No. III). *Letter from Captain Gordon to M. Mercier.* No. 2 *Rue S. Nicaise.*

"Munich, July 15th, 1833.

"SIR,

"Having already experienced your kindness, I have no hesitation in asking you to do me a favour, namely, that you will undertake the delivery of some printed papers, which I send to you from Munich, to the herein named persons. I have just had made by a skilful workman here, an excellent instrument after my model. I am about to set out for London, where my address is 22 *New Castel Street, Strand*. Kindly send me a line there when you receive the papers, the carriage of which I have prepaid as far as I could. We will reckon the expenses later on. You might leave your address with some of the under-mentioned, in order that if any amateurs should make enquiries you would be able to give them mine in London.

"For M. Pleyel, Music Warehouse, *Boulevard des Italiens*, six copies; for Paccini, *idem* No. 11; M. Frey, No. 8 *Place des Victoires*; Schlesinger, No. 97 *Rue Richelieu*; M. Laurent, Flute-maker, 65 *Palais Royal*; M. Tulou, No. 27 *Rue des Martirs*; M. Drouet, No. 28 *Rue de l'Arcade*; M. Farrenc, No. 21 *Rue S. Marc*; M. Camus, *Rue Montmartre*, opposite the *Rue Montorgueil*; M. Lemoine, No. 9 *Rue de l'Echelle*; Jeannet and Cotelle, 123

Rue S. Honové; the office of M. Fétis, Editor of the *Journal des Beaux-Arts*, No. 31 *Rue S. Lazare*. Accept my thanks in advance, with my kindest regards to yourself and your family.

"Your faithful servant,

"GORDON."

625. *Letter from Captain Gordon to Theobald Boehm*. The letter to which Boehm alludes, in writing to Cöche, (See No. II. §621.) as having been sent to him by Gordon in 1834, is printed in his pamphlet (1847).

It will be observed, from the following translation, that it contains no mention of Gordon's admiration for Boehm's workmanship, as Boehm alleges in his letter.

"Lausanne, Feb. 15th, 1833.

"MY DEAR SIR,

"It is now a fortnight since I returned to Lausanne after a long stay in Paris, whither I went shortly after having met you in London before your return to Munich. I have not lost any time, and I have been working on perseveringly at a new flute that I have made myself, as well as I could, and that I have just finished.

"I have not forgotten you, and I have been expecting that you would send me a *flûte perfectionnée* that you proposed to make on your return to Germany. In accordance with your proposition in London, I am willing to send you my flute, begging you to make me a fine one on the same model. I possess the complete fingering for it, of which I will send you the scale.

"I did not like to send you my flute without having heard from you. Kindly, therefore, write to me at the following address: à M. Gordon, à Lausanne, Suisse; let me know what you consider will be the safest way for me to send it, so that it may reach you without accident, and whether you will be able to make me a similar one and to begin it as soon as possible. Hoping that this letter will find you at Munich, I send it to the address that you gave me.

"Accept my best regards,

"Your obedient servant,

"GORDON."

626. *Opinions of various Writers*. The evidence of Cornelius Ward on the subjects of this controversy is deserving of the highest consideration, because owing to the exceptional circumstances in which he was placed, he was better qualified than any one else to form an opinion on the merits of the case. On all occasions of conflict between his testimony and that of Boehm, I should unhesitatingly decide in favour of Ward, who was not only an absolutely disinterested witness, but Boehm's superior in every way excepting in the matter of musical attainments. Setting aside Ward's numerous conversations on the subject with myself, in which he allowed himself considerable latitude of expression, I need only refer, in this place, to his printed statements, which are studiously moderate in comparison.

One of these has been given in §598; the following extract from his pamphlet (1844), part of which I have already quoted, is of even greater importance.

"About the year 1831, we constructed a flute for Captain Gordon . . . who had been experimenting on this matter some time. In this flute the apertures were placed consistently with the proper length of tube required for each fundamental note in the chromatic gamut [scale] and the captain contrived a method of acting upon the additional apertures beyond the number of fingers. With this flute he returned to Paris. Mr. Boehm was at the same time trying to improve the flute, or to remodel it, and it is said, and with some reason, that he adopted a great part of the captain's contrivance. Upon this matter much has been said and written, and although some points were never clearly ascertained, we must give our decided opinion that Gordon is entitled to most credit in the affair. . . .

627. "Captain Gordon ardently persevered in the pursuit of his object, but did not obtain much favour from the professors; he was considered to be of unsound mind, and it was thought that he was thus affected on account of the defeat of his comrades and his own loss of fortune in the revolution of July. He was generally treated with consideration on that account, but very little attention was paid to his flute mania, such being the

light in which his views respecting the flute were regarded. His rival, Boehm, also failed in commanding any attention, on account of the old objection, the requisite change in the fingering. . . .

"We consider it due to Captain Gordon to state, from our own personal knowledge, that he was an ingenious, rational and kind-hearted gentleman, and we have reason to believe that he steadily persevered in his efforts to improve the flute with the view of amending his circumstances. . . ."

"The flute of Gordon is now in use by many professors of Paris, and several ingenious men of that capital have contributed to make it more perfect; the exertions of M. Dorus, in particular, being entitled to great credit. . . ."

628. Mr. Carte (1845) strongly espoused the cause of Boehm, and in allusion to the letter printed by Cöche (see §§621-3), he writes:

"This is M. Boehm's own statement, and he offers to give further proofs if necessary to establish what he has here advanced. Surely this should settle the matter beyond a doubt; for independently of M. Boehm's assertion, it cannot be supposed that, if he *had* made use of Gordon's invention, and laid claim to it as his own, the latter would afterwards have been on such friendly terms as to remain with him nine months, and avail himself of his services. The necessary conclusion is, that so far as the two Flutes may have corresponded previous to Gordon's acquaintance with Boehm, a similar thought must have suggested itself to both these individuals about the same period, but that the former, having superior knowledge and facilities, realised his conception and the latter did not."

629. This argument does credit to my excellent friend's talent for special pleading, but he seems to have forgotten that there is no reason whatever to believe that Gordon was aware of what Boehm was doing during the time that they were residing together, (see §608) and I cannot help thinking that Mr. Carte goes rather too far in suggesting that Boehm's *ex parte* statement

should be accepted as a proof sufficiently strong to decide the question.

630. The late Mr. Clinton was at one time a strong partisan of Boehm. His *Essay on the Boehm Flute* (1843), and his *School for the Boehm Flute* (1846) were both dedicated to him. In the latter work, Clinton gives, as I have stated, a representation of Gordon's later flute (*fig. 54, §577*), but he makes no mention of the earlier and better one (*fig. 53, §570*). He also prints a letter, written by Boehm in his usual style, dated Aug. 12th, 1845, but as this fails to throw any new light on the question I have not reproduced it. Eventually Clinton seems to have changed his opinion, for in a pamphlet published nine years later (1855) he remarks: "To take a general view of the subject, we find, practically, there are but two systems of fingering in existence; that of the old eight-keyed flute, and that of Gordon, known in this country as the Boehm flute."

631. Schafhäutl's latest contribution to this controversy appeared in the *Musical World* of Feb. 18th, 1882. It is written in the same strain as his article in the *Allgemeine Musikalische Zeitung* of Jan. 29th, 1834 (see §§596-7), and it consists, for the most part, of extravagant and baseless assertions that are really not worth the trouble of contradicting. It is, however, only fair to add that although the writer was evidently acquainted but imperfectly with his subject, and was, besides, certainly actuated by a spirit of blind partisanship, there is no reason to doubt his perfect good faith.

I am now glad to leave this discussion, in which hitherto I have taken no part. I have re-opened it with much regret, but to have passed over the subject in a work of this kind, without notice, would have been unjust to the memory of a good and clever, though unfortunate man.

The date of Gordon's death is unknown. At the beginning of 1839, according to Fétis, he was still alive but hopelessly deranged in intellect.

632. **Alterations in the New Flute, by Cöche and Buffet.** But a very short time elapsed before the mechanism of

the new flute was completely re-organised by Côme and Buffet, who also made certain important changes in the fingering, one of which was indubitably good. Côme, in his *Examen*, writes as follows: "The keys that on the old flute were the easiest became on the flute of Böhm the most difficult, *et vice versâ*. But after six months' study and observation I saw the necessity of making some modifications in the system. I remembered that in playing the violoncello I found the third and fourth fingers of my left hand extremely weak on account of their strained position. This observation applies so well to the flute that I decided to re-establish the closed $g\sharp$ key of the old flute . . . at the same time taking the necessary precautions for preserving the pure intonation and the equality of tone of the other notes."

What these precautions were is by no means clear, but Côme and Buffet eventually adopted the well-known "Dorus $g\sharp$ key," described in §635.

An extremely valuable invention by Côme was the now universally adopted key for the shakes $c''\sharp-d''\sharp$, $c'''\sharp-d'''\sharp$, etc. See *fig. 57*, §634.

The *a* hole of the flute shown in Côme's pamphlet is surrounded by a ring, intended to close the $b\sharp$ hole. However useful this ring might have been in affording facilities for fingering $b\sharp$ in rapid passages, it is hardly likely to have been actually applied to a flute, as it would have caused the necessity for opening two holes below the proper vent-hole in fingering $f'''\sharp$, thus spoiling that note. I am therefore inclined to think that this modification only existed on paper. The idea was evidently soon abandoned by its author, for in his *Méthode*, written about the same time (1838B), the ring for the third finger of the left hand is applied to a different purpose.

633. Côme appears to have been much impressed by certain advantages that he supposed to be due to an "excavation" in that part of the head-joint which rested against the lower lip, and he considered that the player was enabled, by its means, to avoid the hissing sound of the breath, then, as now, a common fault amongst flute-players. He laid no claim to the invention

of this contrivance, and at first attributed it to Boehm, but after the receipt of Madame Gordon's letter, and certain drawings by which it was accompanied, he altered his opinion and assigned the merit to Gordon. The excavation is still frequently employed, especially on flutes of metal; I am unable to perceive that any advantage is gained by its use. The idea was probably first conceived by Dr. Ribock.

The wood-cut on the next page (*fig. 57*) is a reduced copy of a portion of an engraving in Côme's *Méthode*. The mechanism of the flute represented will be seen, at a glance, to have been greatly superior to that of the flutes of either Gordon or Boehm. As a matter of fact, it was, both in efficiency and elegance, far in advance of any that had been previously adapted to musical instruments. Besides other valuable improvements, hereafter mentioned, the needle-spring was first applied to this flute. A representation and a description of this excellent contrivance is given in §390. The flute was patented in France by Buffet; Côme's name does not appear in the *brevet d'invention* (1839).

As regards their intonation, these flutes were almost as defective as those made by Boehm (see §§594 and 644), the finger-holes being, like his, far too wide apart. The tone of the *nouvelle flûte* was decidedly inferior to that of Boehm's model, although it was superior to that of the French *flûte ordinaire*.

I am able to speak positively on all these matters, as in my young days I frequently had opportunities of playing on the flutes of Côme and Buffet, and of comparing them with those of other makers.

Côme's engraving represents the three flutes, shown in *figures 53, 56 and 57* of this work, side by side and superscribed as follows: "*Invention*, Gordon. *Modification*, Boehm. *Perfectionnement*, V. Côme." Some of the items of "*perfectionnement*" were introduced subsequently to the publication of the *Examen critique*.

634. *The Flute of Cêche and Buffet, 1838.*

A. Closed d'' key. This, and its touch a , are fixed to two tubes, $a a$, which are connected by a crank placed under the stem of the d'' key.

B. Closed d'' key. This, and its touch b , are fixed to a steel rod which runs through the tubes $a a$ and works on two steel points screwed into the balls of the pillars $b b$.

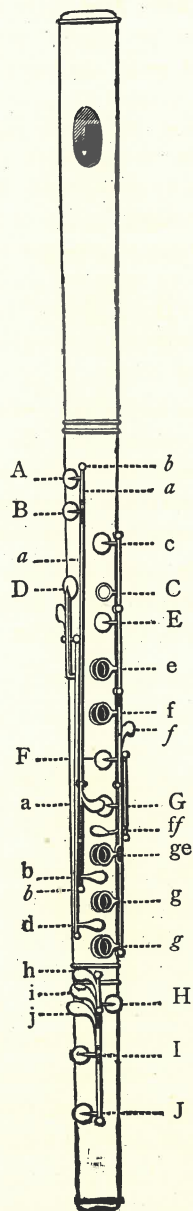
This mechanism, which Cêche and Buffet were the first to apply to the flute, is still in constant use, and no improvement has ever been made in it.

C. Open key of the c'' hole. Its touch c appears in the original engraving as a ring, but it was actually a plate, as here shown. The key and its touch are fixed on a tube which works on a steel axle. The axle passes through the pillar above C, and is screwed into the pillar below c . Its pointed end projects beyond the ball of the pillar, and forms a pivot on which works a rod reaching to the pillar above G. A steel point at this end forms the other pivot for the rod. The pillar between e and f must have been moveable.

D. Open key of the c'' hole, closed by thL , or by the additional lever at d .

E. Open key of the b'' hole, closed by the action of $2L$ on the ring e ; by the action of $1R$ on the ring $g e$, or by the action of $1L$ on c and E at the same time. The key E and the ring e , are fixed to a tube which is fastened to the above-mentioned rod. The ring $g e$ is fixed to a second rod which

FIG. 57.



extends from the pillar above G to g . Near the pillar, but out of sight, is a small lever, fixed to the first rod, which forms a stop for E. Another small lever, or "clutch" (also out of sight), fixed to the second rod and placed under the lever of the first rod, raises the latter when the ring $g e$ is pressed down, and thus closes the key E. The clutch also forms a stop, and finally regulates the rise of E. The hidden lever of the tube being above the clutch of the rod, the former works independently of the latter, so that although the ring $g e$ moves the key E and the ring e , neither of these moves the ring $g e$. The mechanism was sometimes so arranged that the clutch occupied a position between e and f . An improved form of the clutch is shown in *fig. 59, §638.*

F. The "Dorus g'' key," connected with the ring f and the lever f . A description of this key is given in §635. At ff is an additional lever for making the shakes, $f'' g''$ and $g-ab$, with $1R$.

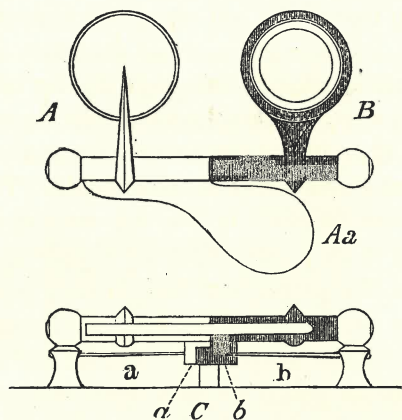
G. Open key of the g hole, closed by the action of $1R$, $2R$ or $3R$ on g , g or g , respectively. G , g and g are fixed to two tubes which move independently of the rod, but which are connected with each other by means of the crank under the shank of the ring $g e$. This shank presses on the crank, and thus closes G and E at the same time.

H, h. The closed d'' key and its touch. The tube on which these are placed moves on a steel rod that passes through the upper pillar and is screwed into the next one.

The mechanism of the open keys for the d'' and c'' holes is constructed on a similar principle to that of the closed keys A and B, the touches being, of course, reversed. The arrangement of the touches of the three foot-keys is ill-contrived, as it renders slurring from c' to $e'b$, or from $e'b$ to c' , impossible.

635. *The Dorus g'' Key.* This ingenious contrivance was invented by the distinguished professor, whose name it bears, in 1838. It constituted an entirely new feature in the mechanism of wind-instruments, and, being unprotected by patent, came at once into general use. It is still frequently and successfully employed, though it has of late been in a great measure superseded by an arrangement of duplicate holes. It was applied to the g'' and a holes of the flute in order to carry out effectively Gordon's idea of retaining the old fingering for these notes, and at the same time preserving the a from being veiled.

FIG. 58.



A. The $g\sharp$ key, with its shank and tube, the latter working on a steel rod supported by pointed screws which pass through the two pillars.

a. A weak spring, acting on the stop *a* and thus tending to close the key.

B. A ring surrounding the *a* hole, connected by the tube with the clutch *b*. This tube works likewise on the rod.

b. A strong spring, acting on the clutch *b* and overpowering the weaker spring *a*.

The key and the ring are kept in a raised position by the preponderance of the strength of *b* over that of *a*. When the ring *B* is pressed down by 3*L.*, *a*, being no longer overpowered by *b*, causes the closing of *A*.

A a. Touch of the $g\sharp$ key, by means of which the key is opened by 4*L.* when *B* is pressed down.

C. A projection, from the flute, which serves as a stop for the clutches. Various contrivances were employed for this purpose.

This arrangement is a great improvement on that of Gordon, but it is open to objection on account of the unavoidable strength of the spring *b*, when freed from the modifying influence of *a*, which renders the shake $g\sharp$ -*a* difficult to most persons.

636. Comparison of the Open and the Dorus $g\sharp$ Keys.

For players on the old flute, the Dorus $g\sharp$ key, sometimes rather unfairly termed the closed $g\sharp$ key, has certain advantages, inasmuch as it renders the fingering of the new flute similar in some respects to that of the old one, but although, as far as sound is concerned, it causes generally no departure from the open-keyed system, yet, as regards the fingering, its introduction must be considered a retrograde step, for in every combination of $g\sharp$ with $f\sharp$, $f\flat$, $e\flat$, $d\sharp$ or $d\flat$, in the lower and middle octaves, a cross-fingering or a veiled note is unavoidable. This key affords, in a few instances, facilities in the fingering of $d''\sharp$, but the $e''\flat$ is injured by it, as it necessitates the opening of the $g\sharp$ hole in addition to the proper vent-hole for this note, the *a* hole, which renders the production of the note somewhat uncertain.

The celebrated Camus began to play on the new flute in 1837, and he claims (1849) to have been the first who played and taught the instrument in France. For one year he used the open $g\sharp$ key, but he afterwards adopted the Dorus key.

Mr. Carte always used the open key. The late Mr. Clinton at first used the Dorus key, but soon afterwards adopted the open one.

As a contrast to so many of Boehm's assertions which it is to be regretted that he ever allowed himself to make, it is pleasant to be able to refer to an extract from a letter by him, quoted by Mr. Carte (1845), which, notwithstanding the unjust depreciation of the French artists and the characteristic grandiloquent boasting by which it is marred, contains much plain truth and sound argument on the question of the merits of the two $g\sharp$ keys.

637. "The Boehm Flute as I play it myself, with the $g\sharp$ key open, is perhaps the best among a dozen of other systems of fingering, all well considered, and some executed and tried by myself, playing for months upon that which I found adapted best to all possible combinations of notes, and consequently of passages of all descriptions. After what I have seen and known in mechanics, and done myself in my youth in that line, I may be believed if I say that I did not want to wait for the French artists to construct a key for $g\sharp$, but that I might have made half-a-

dozen plans very soon for that purpose, perhaps better than that made by M. Dorus. But I cannot see why my simple and most rational system should be sacrificed to prejudice and unwillingness to overcome an old habit, which by anyone is conquered in less than four weeks, and rewards sufficiently the small trouble in the beginning. Nobody found fault with all the other notes but the $g\sharp$, only because all others have such a different fingering that the idea of changing must be given over at once, only this little poor $g\sharp$ key found objection because it remains more on the old system, though every one, after the least consideration, must assert that it gives not in the least more trouble or action to the finger to shut my $g\sharp$ key than it gives to open one. If it was possible to make a key for this note without complication, I would not say a word against it, but as this cannot be, and as there is for a beginner not the least difference, and for an old player but a practice of a short time necessary, so I will never give way in a prudent and rational good cause. I should advise my system to be adopted without any change, and I feel persuaded in a short time you will be thanked for persevering in this, as I am sure the French players will never arrive at the same perfection in their way, as has long been attained by German players, particularly by M. Stettmayer at Hechingen, who shows off this Flute in a splendid way.

“THEOBALD BOEHM.

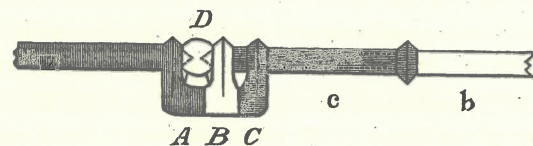
“Munich, March 7, 1843.”

See the remarks on the use of the little finger of the left hand in §378.

638. Further Improvements in the Mechanism of the new Flute. Soon after the year 1838, the action of the keys of the $c\sharp$, $b\flat$ and $g\flat$ holes, and of the rings of the $b\flat$, $f\sharp$, $f\flat$ and $e\flat$ holes, was much improved by the reversal of the position of their axles, these being placed on the *near* side of the flute. The clutch was also improved by being placed at a greater distance from the axle, and by the bearing surfaces being made larger; thus a better leverage was secured and the action was rendered more certain.

FIG. 59.

The improved Clutch.



A. S top of the key of the b hole.

B. Stop of the key of the g hole, fixed to a rod which, passing through the tube c , communicates with b . The rings of the f and e holes are fixed to b .

C. Clutch, soldered to the tube c , which is joined to the ring of the $f\sharp$ hole. The clutch passes beneath A and B , and therefore raises them when the ring is pressed down, thus closing the $b\flat$ and $g\flat$ holes. A and B work also independently of C and of each other.

D. Pillar.

Actual contact of the metal of the bearing surfaces is prevented by thin plates of cork.

The clutch is still constructed on the same principle as that above described, but it is now made on a larger scale.

639. Cornelius Ward, in his letter (1843), already quoted, writes:

“In 1839 I began to make what is termed the Boehm flute in London, as improved by Dorus, and Signor Folz performed upon one made by me at many concerts in England in the course of that year.” Ward invariably adopted the improved mechanism of Cöche and Buffet, with the modifications described in §638.

Godfroy of Paris, who made a large number of the new flutes, adopted the machinery of Boehm for closing the b and g holes, but he eventually employed Buffet’s needle-springs. The workmanship of his flutes was exquisite, and far in advance of that of any other maker for at least ten years.

640. Ward’s Patent Flutes, 1842. The patent for these

flutes is dated January 18th in the above-named year. It embraces seven flutes, each with a different system of fingering, only one of which is worth consideration. Those who wish to examine the details of the other six, which display some ingenuity of design, may easily obtain a copy of the specification (1842) for a few pence. One of them has Pottgiesser's closed $g\sharp$ key for the left hand thumb, see §544; another is built on the lines of the flute of Tromlitz described in §§483-5. The wood-cut, *fig. 60*, and the accompanying description, somewhat curtailed and otherwise modified, are taken from the inventor's interesting pamphlet so often quoted in these pages. This instrument was known as "Ward's patent flute." The object of the inventor was the construction of a flute on the open-keyed system which should afford greater mechanical facilities than had been obtained by Gordon, Boehm or Cöche. The flute will be seen to bear a strong resemblance, in some points, to the flutes of Pottgiesser, especially as regards the appropriation of the four open holes (for e , f , $f\sharp$ and g) to the four fingers of the right hand (see *fig. 47*, §496), and the $d\sharp$ and $g\sharp$ keys to the left hand thumb. See §544. It will be remembered that Ward was acquainted with Pottgiesser's flute of 1803, and he probably knew also of that of 1824, perhaps obtaining the information from Captain Gordon.

641. Ward's Flute. Fig. 60.

1. Closed key of the d'' hole, opened by the action of $1R$. on the lever X.
 2. Open key of the $c''\sharp$ hole, closed by $1L$. when closing the small hole within the ring. See §362.
 3. Open key of the c'' hole, closed by either of the fingers that act on the holes 4, 8 and 9. When the b hole is closed, by the ring at 4, the key can be raised by the lever Y.
- This key is provided with mechanism similar to that of the Dorus $g\sharp$ key.
4. The b hole, closed by $2L$.
 5. The $b\flat$ hole, closed by $3L$.
 6. Open key of the a hole, closed by $4L$.
 7. Key of the $g\sharp$ hole. This is connected with the key 6 by mechanism similar to that of the Dorus $g\sharp$ key. The key 7 is opened sepa-

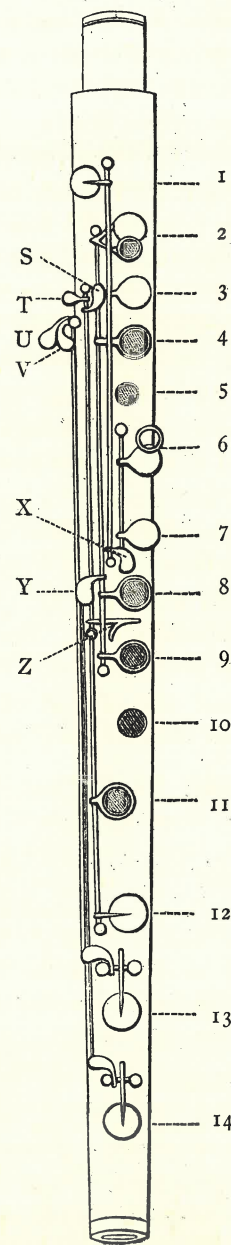
FIG. 60.

ately by the lever Z or by the action of thL on the lever S.

8. The g hole, closed by $1R$.
 9. The $f\sharp$ hole, closed by $2R$.
 10. The f hole, closed by $3R$.
 11. The e hole, closed by $4R$.
 12. Key of the $e\flat$ hole, connected with the ring 11 by mechanism similar to that of the Dorus $g\sharp$ key. The touch of the key 12 is the lever T.
 13. Open key of the d' hole, making $c''\sharp$ by the action of thL on the lever U.
 14. Open key of the $c''\sharp$ hole, making $c''\flat$ by the action of thL on the lever V.
- U and V are traction levers, communicating with their respective keys by means of silver wires, on the same principle as those of Gordon. See §571.

642. The stopper of this flute is of silver. It is moved by means of an eccentric disc, within the head, which is connected with a small index-lever outside. There is also a dial-plate with numbers corresponding to others on the tuning slide. This arrangement has not come into vogue.

All the keys are provided with the needle-springs, which Ward was the first in this country to make. The pads are flat and well-made, but are injudiciously covered with kid-leather. There is nothing specially noticeable in the conical bore. The holes are not correctly placed, being too far apart.



This flute, like most others, has its merits and its demerits. Its best point is the appropriation of the touches of the open foot-keys to the left hand thumb, a mastery is thus attained over these generally intractable keys such as has never otherwise been equalled. I played on a flute of this kind for about a year, 1844-5, but before I had practised on it for a month I was able to play, at a good rate, the second variation of Frisch's *Réminiscences à Herold*, which can only be played on any other flute by the aid of a second *c''* lever for the left hand little finger. Unfortunately this advantage cannot be obtained without sacrificing the control of the *c''* by the thumb, a loss that more than counterbalances the gain.

The ring of the *f''* hole was suggested by Mr. Alfred Chittenden, a good amateur flute-player, and one of the first to adopt Ward's flute. Amongst a few improvements which I, then a lad, contrived in the mechanism, and which Ward willingly carried out, was a small stud fixed to the key of the *c''* hole. This enabled the first finger of the left hand to finger *b*, and the troublesome use of the rings, 8 and 9, was in a great measure avoided in most of the keys with sharps. I still use a lever similar in its object to this. Another addition that I suggested was a *g''* lever for the fourth finger of the left hand.

As a proof of Ward's skill, and the rapidity with which he must have worked, it may be mentioned that the elaborate flute, *fig.* 60, beautifully finished, with silver keys and fittings, silver socket, and handsome morocco case, was sold by him to the public for sixteen guineas. Two good specimens of these flutes may be seen in the collection of my friend Mr. Henry Carte, at 23 Berners Street, London.

643. The Progress of the open-keyed System in this Country. The appearance of Ward's patent flute caused a violent commotion amongst the English flute-players and manufacturers. For a short time it was held in considerable estimation by a large circle of amateurs, but its inventor was not fortunate enough to obtain the support of any professor of

eminence, and it eventually fell completely into disuse. Previous to the date of Ward's patent, not only Boehm and Folz, but the distinguished professors Camus and Dorus played at several concerts in London on the flute which Boehm claimed to have invented, and with which his name was generally coupled, but although these performances were successful, and attracted considerable attention, the old flute held its ground, and the new one was generally regarded as a failure. The temporary success of Ward's flute was no doubt the immediate cause of the re-introduction of the so-called "Boehm-flute" into this country. In 1843, amidst a storm of opposition, Mr. Carte, and after him the late Mr. Clinton, adopted this instrument, and Messrs. Rudall and Rose began to make it. Unfortunately the model that was selected was that shown in *fig.* 56, §591, and not only was Boehm's mechanism copied exactly, but also his arrangement of the finger-holes. Even the fine conical bore, which had contributed so largely to the well-merited renown of this firm, was sacrificed in order to obtain a perfect reproduction of an inherently imperfect thing.

644. Though the new flute, as at first made in this country, was an improvement, in some respects, on the foreign flutes of the old type, it was lamentably inferior in tone to the best patterns of the English flute. Its intonation was in some respects better, in others worse, than that of the old flute. The upper notes of the first and second octaves were far too sharp, and the lower notes of both were outrageously flat, but the tones and the semitones were much more equal than those of the eight-keyed flute, and the scales could therefore be more correctly played on the new flute, provided great care was taken to ensure the agreement, in pitch, of the upper and lower notes of each octave with the middle notes. It was just possible to obtain this agreement but only by the sacrifice of tone.

The notes of the third octave were not nearly so well in tune as those of the eight-keyed flute, because of the extravagantly high position of the holes which it was necessary to employ as

vent-holes. When I adopted this flute I used a series of special fingerings for the third octave, above d''' , which gave flatter notes. The ordinary fingerings I reserved for playing *piano*.

A further error committed by Rudall and Rose was the adaptation, to the new flute, of a head-joint for which they had a patent (1832). Their specification sets forth that the invention consists in the application of "two screws of different degrees of obliquity, that is to say, the one a quick and the other a slow screw." The slow screw was connected with the cork, and the quick one with the tube. Both were moved simultaneously by a silver button at the top of the head. This mechanism was of no real use; it added inordinately to the weight of the head-joint, and it was otherwise objectionable.

645. The disputes on the advantages and the disadvantages of the new flute waxed, at one time, very warm, and in 1843 a series of amusing letters on the subject appeared in the *Musical World*. Both the advantages and the disadvantages were grossly exaggerated. The chief exponent of the former was the late Mr. John Clinton, who shortly afterwards condemned Boehm's flute as bitterly as he had extravagantly praised it. The chief detractor was the late Mr. Thomas Prowse (a flute-maker of Hanway Street, and a son of the Thomas Prowse who had worked for Clementi and Co.), who soon found it necessary to move with the times, and to make the new instrument. One of the contributors to this correspondence, who signed himself "AULETES," stated, succinctly enough, what he considered the respective advantages of the flutes of the period (counting perfection 100), in the following terms:

"Ordinary English eight-keyed flute,	-	-	25
Imitation Boehm by Rudall and Rose,	-	-	50
Genuine Boehm (French),	-	-	70
Ward's Patent Flute,	-	-	95."

It was reserved for an amateur of Plymouth to perpetrate the crowning folly: "The Boehm flute," wrote this gentleman, "is as superior to the old eight-keyed instrument as is the latter to the one-keyed flute."

A well-known flute-player, the late William Card, adopted a system of mechanism for the *e*, *f*, $f\sharp$ and *g* holes, similar to that made by Boehm, while retaining the old fingering and the old arrangement of the holes for the left hand. It is hardly necessary to say that such a combination could not be a success.

In contrast with the narrow and obstructive spirit displayed by several other firms, it is gratifying to record the liberality of Messrs. Keith, Prowse and Co. of Cheapside, who have always been foremost in the adoption of improvements in musical instruments. Although manufacturers themselves, they have never allowed their own productions to stand in the way of the improvements introduced by others. This has been notably the case with regard to the flute, and when the new instrument was made in England, they were amongst the first to aid its progress. About that time they devoted a portion of their premises to the purposes of a musical academy; engaged a staff of professors, and offered to the public, especially those persons who were engaged in the City, such opportunities for the study of music at moderate cost as were not to be found elsewhere in England.

646. **Siccama's Patent Flutes.** Abel Siccama was a teacher of languages in London, and an amateur flute-player of very moderate capabilities. About the year 1842 he conceived the unfortunate idea that he was destined to be the inventor of a new flute that should eclipse everything that had been made or imagined. Having become imbued with this notion, he set to work with all the vigour of an energetic nature. He had little knowledge of the flute and less inventive genius, but he determined to bring out a flute associated with his name and he did so.

Concerning the origin of this flute Mr. Carte kindly writes to me as follows: "There is an entry in my diary on the twenty-fifth of May, 1842, saying that I went to Siccama to see the model of his new flute. Another entry, on the twenty-eighth, mentions Chittenden's [see §642] coming to me about it. It was he who went between us. A third entry, on the thirtieth of the same month, relates to what passed between Rudall, Rose and

myself on the subject. On the second of June I find that Siccama met Rudall and Rose at my house, and, after making the necessary promise of secrecy, they were shown the model, and talked over the matter, which ended in their not thinking it worth further consideration. I was pleased with the idea, but saw plainly that the thing would not do as it was. Siccama urged me to consider it well, and I took the flute with me to Newcastle, but shortly afterwards returned it to him at his desire. So much for the date of Siccama's first abortion."

647. On March 13th, 1845, Siccama obtained a patent embracing four flutes, three of which were absolutely worthless, and I believe these never passed beyond the stage of models. In the following year he published a pamphlet (1846) containing a scale of fingering for one of these three, which he styled the "Chromatic Flute."

Another flute described in the pamphlet, termed the "Diatonic Flute" closely resembles the one shown first in the specification. This is the instrument still known by the name of the "Siccama flute." The following opinions of its designer are extracted from his larger and later work (1847):

648. "Although the flute has always been a popular instrument, scientific musicians have ever regarded it as an imperfect one, on account of its being in almost every key out of tune. Many have tried at various times to remedy this defect, and much was hoped for in France from the introduction of the Boehm flute, which, as far as equality of tone is concerned is an improvement on the old plan; but, when examined with respect to correctness of tune, it is very defective, particularly in the higher notes, without taking into consideration the difficulties arising from the complexity of its mechanism. All other attempts in a like manner have only partially succeeded, until it has become the general opinion that this defect of the flute could only be modified, and that it is incapable of being played as perfectly in tune as the violin. This imperfection has hitherto formed the great obstacle in studying the flute, for only consummate skill, united with great perseverance and a scientific ear,

could enable the performer to arrive at any degree of excellence in the art of flute-playing.

"This subject has occupied the attention of the inventor for some years; and after a very careful investigation of the theory of sounds, and repeated experiments, he has succeeded in producing a flute equal in correctness of tune to the violin. In order to prove this assertion it will be necessary to enter briefly into the subject of Tune."

In the above remarks, and in the treatise on intonation that follows them, which the reader may well be spared, Siccama shows that he has fallen into the popular error of supposing that stringed instrument players use the "just" scale. See chapter VIII.

649. In addition to the ordinary eight keys, the diatonic flute has an open key over the $a\sharp$ hole, like that shown in *fig. 55*, §585, and a similar key over the $e\sharp$ hole. Some years afterwards, Siccama applied a contrivance for improving the fork $c''\sharp$ which, however, was of little use.

The following measurements are taken from an early flute of Siccama's, No. 247, kindly lent to me by a young lady pupil. It is a good specimen of its kind and in good preservation. The flute is of cocus-wood with silver keys mounted on pillars. Eight of the keys have flat cups, screwed to the shanks. The $c'\sharp$ and $c''\sharp$ keys have metal plugs. The tone of the first and second octaves is generally good and powerful, though, on account of the veiled notes and the varying size of the holes, unequal. When the slide is pushed in closely, the flute gives an a with 452 vibrations. The cork is placed at a distance of .74 inch from the centre of the oval mouth-hole.

650. *The Bore of Siccama's Diatonic Flute.*

Diameter of bore.		Distance from cork.
Inch.		Inches
.74	Head-joint, cylindrical, - - -	
.74	Upper end of middle, - - -	06.18
.54	Lower end of middle, - - -	18.80
.55	Upper end of foot, - - -	18.80
.48	Smallest part, - - -	22.45
.50	Open end, - - -	23.35

651. *The Finger-holes of Siccama's Diatonic Flute.*

Finger-holes.	Exterior diameters.	Distance of centre of hole	from centre of
c'' \sharp	- .32 open	8.65	- Mouth-hole.
c''	- .39 covered	0.76	- c'' \sharp hole.
b	- .39 open	0.68	- c'' "
b \flat	- .41 covered	0.96	- b "
a	- .45 covered	0.84	- b \flat "
g \sharp	- .41 covered	1.02	- a "
g	- .41 open	0.96	- g \sharp "
f \sharp	- .41 open	1.00	- g "
f	- .44 covered	1.04	- f \sharp "
e	- .43 covered	1.18	- f "
e \sharp	- .52 covered	1.49	- e "
d	- .46 covered	1.03	- d \sharp "
d \sharp	- .44 covered	1.31	- d "
c'	- .50 open end	1.69	- c \sharp "

652. Although the errors and irregularities of the diatonic flute were numerous and glaring, Siccama avoided the mistake of placing the holes generally too far apart, consequently the upper and lower notes of the first and second octaves were fairly well in tune with each other, but the third octave was almost irredeemably bad.

To Abel Siccama must be attributed the blame for having been the first to take the retrograde step of attempting to apply the new distribution of the holes to a flute of the old fingering; an unphilosophical and unnatural combination of two incompatible things which necessarily resulted in the loss of the best points of both. The old flute, with eight keys and upwards, possesses certain facilities in the fingering of the third octave which are not afforded by any flutes on the open-keyed system, but the facilities offered by the latter in the first and second octaves far outweigh the slight disadvantages in the third. Siccama's diatonic flute has all the original difficulties of the two lower octaves, while in the third octave it presents greater difficulties and imperfections than either the old or the open-keyed flutes. As on all other flutes in which the old fingering is

attempted to be combined with the new system of holes, there is but one note above d'' \sharp which can be fingered, with even a tolerable result, in the same manner as on the eight-keyed flute.

Siccama possessed considerable commercial talent, and having found a friend to supply him with money, he obtained some popularity for his flutes by presenting them to any professional flute-players willing to adopt them, and he otherwise advertised them largely. He was particularly fortunate in securing the patronage of two highly distinguished performers, namely Joseph Richardson, who used Siccama's flute until the close of his career in 1862, and my valued and lamented friend, Robert Sidney Pratten, who relinquished its use about ten years earlier.

653. *The "Cylindrical Flute with Parabolic Head-joint."*

In the year 1847 Boehm restored the original cylindrical form of the bore to the body of the flute, and reduced the diameter of the upper part of the head-joint. (See §§341, 342 and 467.) There is a curve in the lines of the bore of this head-joint which is stated to be parabolic, and as I am often asked the question, "where is the parabola?" it may not be out of place to explain that a parabola is a figure formed when a cone is intersected by a plane, in a direction parallel to one of its sides. A solid figure, generated by the revolution of a parabola on its axis, is a paraboloid. The upper part of Boehm's head-joint resembles the frustrum of a paraboloid.

Boehm at first made these flutes of metal, and he sold the invention to Messrs. Rudall and Rose, who obtained a patent for it on September 6th, 1847, in the name of John Mitchell Rose. The specification declares that the invention "consists in constructing flutes of all descriptions, clarionets, and other similar wind-instruments, of metal instead of wood. . . . The invention consists, secondly, in making the body of the flute perfectly cylindrical, instead of a long cone, as has heretofore been done; but the head or mouth-piece of the instrument, instead of being cylindrical, as heretofore, I make conical, or, rather, in the form of a parabola."

The patent right for France was sold to M. Godfroy and his

son-in-law, M. Louis Lot, Mr. Carte and the late Mr. Rudall arranging the terms of purchase in Boehm's interest.

The advantages and the disadvantages of the new head-joint have been already mentioned. As it was at first made, the disadvantages greatly predominated, but it was much improved by Messrs. Rudall, Rose and Carte (Mr. Carte joined the firm in 1850) and in course of time it became, and still remains, deservedly popular.

For the cylindrical portion of the bore Boehm adopted a diameter of 19 mm, or .748 inch. The bore of his head-joint measured .669" at the centre of the mouth-hole. The cork was placed nearly in its correct position.

654. Boehm soon discovered that this head-joint was not suitable for a flute with finger-holes of the ordinary size, he therefore enlarged them to such an extent that the fingers were unable to cover them, consequently every hole had to be provided with a key. He states (1847) that the best results would be obtained with holes having a diameter of one fourth less than that of the bore, which would amount to .56 inch, but the diameters of the holes of a German silver flute that he made about the year 1851 (*fig. 61*.) vary, very irregularly, from .46 inch, for the $c''\sharp$ hole, to .539 inch, for the $d''\sharp$ hole. The diameter of the $c'\sharp$ hole is only .535 inch. The distances between the holes are also extremely irregular, so much so that I have not thought it worth while to give an account of them.

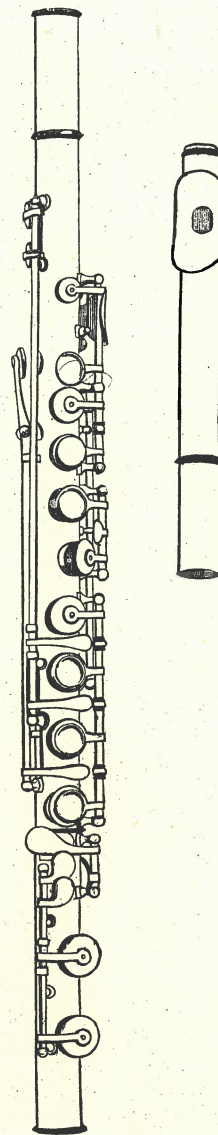
The tone of this flute is very poor and thin, not nearly equal to that of an eight-keyed flute of average excellence.

655. The annexed figure was photographed on wood, from the above-mentioned instrument, which was kindly lent to me by Mr. Alfred Hays.

It will be observed that Boehm had at length adopted the rods and tubes of Cöche and Buffet. The key for the $c''\sharp$ - $d''\sharp$ shake he had previously placed, with a separate solid stem, on his wooden flute. On the metal flutes he used a modified form of the needle-spring. See §390.

All the holes of this flute being governed by keys, it became

FIG. 61.



necessary that means should be provided for closing certain keys separately, and also in the necessary combinations. For this purpose Boehm employed clutches with no larger bearing surfaces than were afforded by the thickness of small collars placed on the tubes between the shanks of the keys: see *fig.* The collars being only about .05 inch in thickness, the action of the keys was, of course, extremely uncertain.

The enlargement of the holes was an improvement that would have more than counterbalanced the inconvenience caused by the increase in the number of the keys, had these been fitted with practicable mechanism.

656. Rudall and Rose, as well as Godfroy, used the improved clutch of Cöche and Buffet (*fig. 59*, §638) for the connection of the key of the $f\sharp$ hole with the keys of the $g\flat$ and $b\flat$ holes. The clutches of the keys of the $e\flat$, $f\sharp$ and $b\flat$ holes were contrived in the shanks of the keys. They acted on small projections of metal fixed to the rods of the keys of the g and b holes respectively. Mechanism of this kind is still in use, but the bearing surfaces are too small and too near the axles of the keys to admit of their affording sufficient leverage; consequently their action is uncertain, and the keys soon get out of order.

The sacrifice of the uncovered holes tended to reduce the resources of the flute with regard to delicacy of intonation, but

very soon after the purchase of the patent, Godfroy conferred a great benefit on flute-players of refinement by the re-introduction of perforations in five of the keys: see §§391, 509 and 544. The patentees made their keys of the pattern shown in *fig. 31, c and d*, §387, and *fig. 33*, §389. For a few years both firms made "cylinder flutes" with ring-keys and with necessarily small holes. These flutes were not successful, and their construction was soon discontinued. The best flutes of the "cylinder" pattern were made with holes of the uniform diameter of .52 inch until the year 1864. Godfroy was the first to make these flutes of wood, in 1848.

657. A Flute patented by John Clinton, (1848). The two useless contrivances described in the specification of this patent may be dismissed with few words. The first consisted in the substitution of a single bar for the three rings then in vogue for closing the *g* hole. The second was a piece of mechanism for fingering *c''* after the old method. The *b♭* and *g♯* holes were covered by the usual closed keys of the old flute.

658. The Inventions of Giulio Briccialdi, 1849. The most noteworthy mechanical addition that has ever been made to the flute of Gordon is the now well-known *b♭* lever invented by this justly celebrated flute-player, and the value of the invention is proved by the fact that no flute on the open-keyed system is now made without it, either in its original form, or with some undesirable modification. The first suggestion for this lever was made in 1845 by a well-known amateur, an intimate friend of mine, Dr. Burghley of Camden Town, but there is no reason for supposing that Briccialdi was aware of the suggestion, and at any rate he was the first to bring the idea to a practical issue, in May or June, 1849. The original mechanism is simple in construction and certain in action. It has been many times altered but it has never been improved.

FIG. 62.

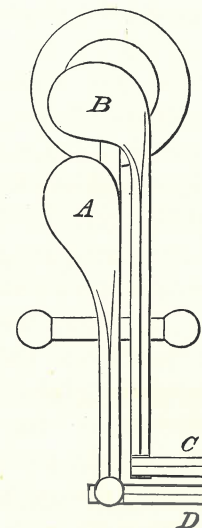
Briccialdi's b♭ lever.

A. Key of the *c''* hole.

B. Briccialdi's lever, governed by the left hand thumb.

C. Lever at the back of the key of the *b* hole, which forms the stop of the key. It is raised by the lever *B* when this is pressed by the thumb, and the key *A* is closed at the same time. When the *c''* hole is closed, *b♭* is fingered by the thumb alone. The fingering for *b* and *c* remains as before, and when *b* and *b♭* occur in immediate succession, *b♭* is fingered, in the original manner, by the first finger of the right hand.

D. Part of the lever for closing the key *A* by the first finger of the right hand.



This *b♭* lever was first added by Rudall and Rose, under Briccialdi's direction, to a cocus-wood flute by Godfroy. I purchased this flute in 1849 or 1850, but I did not keep it, as I found it generally inferior to a flute with tapered bore, by Rudall and Rose, to which I had become accustomed and which I had somewhat improved in intonation by enlarging the lower holes.

659. It is to be regretted that the inventor of the useful appliance described above, ever attempted to make any other change in the fingering of the flute, or at least that he did not continue to direct his energies towards the improvement of the open-keyed system. I am informed by Mr. Carte that in the year 1849 Briccialdi began to contrive schemes for adapting the old fingering to the new flute. The first of these was carried out for him by Rudall and Rose. It was an admitted failure,

but he persevered in his efforts, and eventually he had a flute, with the old bore and the small holes of the foreign flutes, made by Pask of London. He soon afterwards returned to Italy, and finally adopted a silver flute, of the new bore, with the old fingering for the lower octaves. Such instruments are still made in Italy.

Amongst the numerous designs in connection with the proposed revival of the old fingering, the only one that has borne permanent fruit is a contrivance for closing the *f* hole by means of one of two rings, or keys, surrounding, or covering, the *f* and *e* holes. This is, in fact, simply a shifting, one degree lower, of the ordinary mechanism for closing the *g* hole, with the inevitable drawback of the loss of the third ring, or the key in lieu of it. It has been thought that Briccialdi was the author of this contrivance, but the matter is involved in some doubt, and Mr. Carte thinks that the responsibility may rest in some degree on himself, but that William Forde, he of the famous *Forty-eight trios*, may have been the first to propose the scheme. At any rate it was adopted by Briccialdi and by Clinton; Mr. Carte also placed this mechanism on his first new flute (see §661-3), and it has figured in more or less modified form, on several of the modern flutes with the "old system of fingering."

660. Further Attempts to revive the old Fingering. Since the year 1849 there have appeared, from time to time, many different kinds of flutes retaining the old closed keys, for which their inventors have claimed a combination of all the advantages of the old and the new flutes, but which, in reality, have generally possessed all the worst qualities of both, and none of the special merits of either. Space will not admit of a description of these numerous efforts, which would indeed be out of place in a history of the development of the flute, inasmuch as none of them ever led, directly or indirectly, to any real improvement of the instrument. The most that can be said, even for the best of them, is that they were ingenious attempts:

"Downward to climb and backward to advance."

In justice to the consistency of our Continental neighbours it should be mentioned that while we have been too prone to vacillation between the old, the new, and the pseudo-old systems, the French have been generally loyal to the system of Gordon, excepting, of course, in the fingering of the lowest four notes, and the Germans have, with equal pertinacity, adhered to the old flute, pure and simple.

661. Mr. Carte's first Patent Flute (1850), 1851. The inventor's reasons for bringing forward this flute will be best set forth in his own words (1851 p. 25): "Having myself taken up the Boehm flute warmly, upon its first introduction into this country, and having been the first native professor to perform upon it in public, I watched with interest the experiments of the many talented individuals occupied in endeavouring to carry out its principles in the new direction, intending, if one should be produced with the same perfection of tone and tune, but with greater facility of execution, to adopt it. It was not until all these efforts had failed, that, for the first time, I gave my attention fully to the subject, with the view of ascertaining whether I could not design a mechanism which should retain the open keys and equidistant holes of Boehm's flute, and yet secure a greater facility of fingering. I was the more readily emboldened to make this attempt, as I had full knowledge of the means taken by all those who had preceded me, and of the nature and cause of the failure of their endeavours. In a short time I succeeded beyond what I could possibly have anticipated. The great cause of difficulty in fingering the Boehm flute arises from the necessity of constantly keeping the little finger and thumb of the left hand upon their keys to shut them. . . . This, especially in the upper octave, cramps the action of the other fingers. The cause of the superior facility of the ordinary flute is the freedom of these fingers, the keys worked by them being kept closed by their springs. As the open keys were the cause of the superior *tone* of Boehm's flute, and the closed keys the cause of the superior *facility of execution* of the old flute, the object was to free the little finger and thumb, and yet retain the

open keys, so that facility of execution and beauty of tone might be at once secured. This I have been enabled to effect. By means of the mechanism adopted, every perfect note of Boehm's is retained, and some additional fine ones are gained; and at the same time a facility of execution is secured never dreamed of even by players on the old flute. . . ."

662. (p. 29). "By the introduction of an additional hole for the note D of the second and third octaves, [the "open *d*" mentioned in §365] some further most objectionable cross-fingerings of both the Boehm and the Ordinary flutes are also removed, and the necessity of boring the C sharp hole, so as to adapt it, though imperfectly, for several different purposes is no longer necessary, and this note is rendered as perfect for its legitimate use (C sharp) as any other note, which is not the case upon either of the other flutes." Mr. Carte gained a prize medal for this instrument at the Exhibition of 1851.

Before the close of that year important modifications were introduced by the inventor in the arrangement of the upper keys and the ordinary *d*" (the harmonic of *d*", vented by a *c*"# hole of small size), which had been sacrificed on the earlier instrument, was restored. The flute, in its later form, became known as the 1851 patent. Mr. Carte claims for it that "the fingering is easier than that of the Boehm or of the old system. It is, at the same time, a smaller departure from the latter."

663. *Mr. Carte's "1851 Patent" Flute, fig. 63.*

- A. The open *d*" hole, closed by the action of 1*L* on *ba*, *thL*. on C, 3*L* on F, or 1*R* on *hgca*.
- B. The *c*"# hole, closed by 1*L* on *ba*.
- C. The *c*" hole, closed by *thL*, or by 1*R* on *hgca*.
- Cc. Duplicate *c*" hole, closed by 1*L*, 2*L* or 3*L* on *ba*, E or F, respectively.
- D. The *b* hole, closed by *thL* on D, by 2*L* on E, or by 3*R* on Jd.
- E. The *b*_♭ hole, closed by 2*L*.
- F. The *a* hole, closed by 3*L*.
- G. The *g*"# hole, closed by 4*L* on *g*, or by 1*R* on *hgca*.
- H. The *g* hole, closed by 1*R* on *hgca*.

Fig. 63.

I. Lever to close the key of the *f*"# hole by the action of 4*L*. Neither the hole nor its key could be shown. The key is also closed by 2*R* on Jj or by 3*R* on K; the note *f* may therefore be fingered by 1*R* and 3*R* acting together as in the old "fork-fingering" of the one-keyed flute, but this fingering gives a badly veiled note.

i, i, i. Three arms, either of which closes the key of the *f*"# hole. The upper arm is connected with I, the second with Jj, and the third with K.

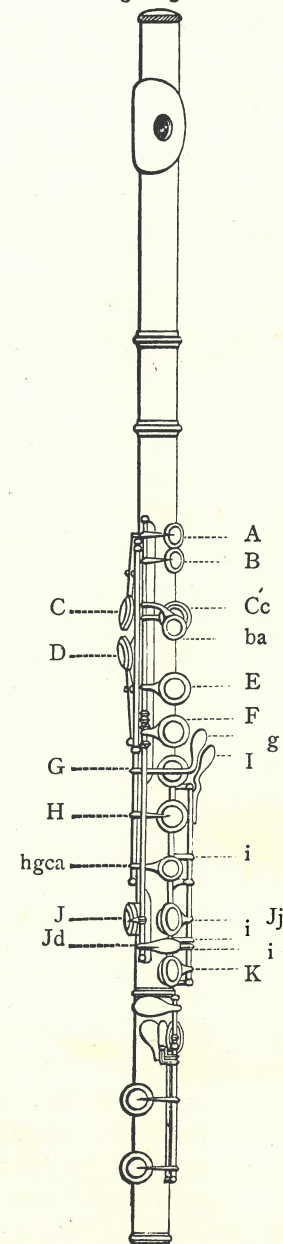
J. The old closed "cross *f* key" opened by 3*R* on Jd.

Jj. Duplicate *f* hole, closed by 2*R*.

K. The *e* hole, closed by 3*R*.

The general fingering of this flute will be easily understood from the descriptions of that of the earlier open-keyed flutes, and from the diagram with its explanation. The reader will scarcely fail to perceive that the greatest defects of the flute of 1851 are due to the retention of the old closed *f* key.

644. Mr. Carte informs me that, soon after the invention of this flute, he made for an old customer of the firm, Captain Harry Lee Carter, an instrument similar to it, excepting that the *g*"# key was "closed," and that the open *d*" key was omitted, the ordinary closed shake-key being added in its place. Thus



altered, the flute of 1851 is still made, though it is now sold under a different title, and is classed amongst the flutes with the "old system" of fingering.

The flute of 1851 may be considered to have been entirely superseded by a far superior invention of Mr. Carte's, namely, the "1867 patent," which is described and figured in §684.

665. Improved Conoidal Bore by Rudall, Rose and Carte.

In the year 1851, or perhaps rather earlier, Messrs. Rudall, Rose and Carte wisely ceased to make conoidal flutes after Boehm's model, and they brought out a new bore which greatly improved the tone, though its proportions only differed slightly, in actual measurement, from the fine one that had so materially assisted the fortunes of the firm. The lines of the new bore were straight, there being no longer any necessity for resorting to "chambering:" see §340. The following interesting remarks on the bore of the flute are extracted from the pamphlet of Mr. Carte (1851, p. 21).

666. "It appears that Boehm's investigations, which led to his discovery of the parabolic head and cylindrical tube, arose from the circumstance that he could not obtain a tone so fine in the lowest notes of the old conical body, used in his first flute, as in the rest of the notes. . . . Now, it is to be observed that Boehm's having failed to obtain the notes in question so perfectly with the conical bore as he afterwards did with the parabola and cylinder, is no proof that these notes were not to be obtained with the old shape. On the contrary, there are reasons to be given why he might be expected to fail in this respect. One reason is this: the Germans, although the original inventors of the ordinary flute, have ever been slow in experimenting with the bore. Experiments in this direction have been chiefly made in England. In France very little was done in this way before the introduction of Boehm's flute. The eminent performers also, both German and French, have always aimed rather at mere sweetness of tone than power. Very different has been the case in England. No performers have ever approached the English in the union of a rich and large volume with sweetness of tone,

and it has, doubtless, been from the desire to obtain this, that so many experiments have been made by the English performers and manufacturers with different-sized holes and variations of the general bore.

667. "Tacet . . . in the last century, experimented with large holes, as did also the late Mr. Nicholson's father; but the most important improvements as to the tone of the ordinary flute, especially those gained by variations in the bore, have been effected by Messrs. Rudall and Rose. Now it may easily be conceived that Boehm, who is a German, coming necessarily, as he did, to the subject without much previous experience with regard to the bore, and falling upon, or turning his attention to, the more scientific mode of shaping the tube before he had exhausted the resources of the conical tube, did not ascertain to the fullest extent the capabilities of the old shape. I am also convinced that this was the case by experiments which have lately been made. As it was thought that flutes of wood, of the parabolic and cylindrical shape, if made sufficiently thin to be held comfortably in the hands, would be liable to crack, and as some preferred the tone of the wooden flute, while others could manage the embouchure of it better than that of the same flute in metal, strenuous efforts have been made by Mr. Rose so to vary the proportions of the cone as to correct the defective notes mentioned as having existed in the first of Boehm's flutes; and so successful have been his efforts, that not only are these notes rendered equal to the others, but so much is the general tone of the instrument improved, that it becomes a matter of opinion whether the wooden flute with parabola and cylinder, or that with this improved conical bore, is now the better."

668. The Writer's first Scheme for the Improvement of the Flute, 1852. Having again and again tried the cylindrical flute with parabolic head-joint, always relinquishing it in disgust on account of its absolute unfitness, as at first made, for orchestral playing, and being much impressed with the advantages of Mr. Rose's new tapering bore, so highly and justly commended by Mr. Carte, I determined to give this a

fair trial. With the view to having the best flute that, according to my judgment, could be made, I set to work seriously to try and so arrange the positions of the holes as to overcome those defects of intonation which had proved the main obstacle to the general adoption of the open-keyed system. I had no intention of posing as a regenerator of the instrument, my chief wish was to have a flute for my own use that should be correctly tuned according to equal temperament.

It has already been explained that the intonation of the open-keyed flutes was as false as that of the eight-keyed flute, but that instead of erring in an irregular manner, like that of the old flute, it became steadily and persistently more and more false as the finger-holes approached the mouth-hole.

I began the work by finding the length of tube corresponding to a vibration, in various parts of an ill-tuned flute with Rose's new bore. This I effected by comparing the notes of the flute with those of a well-tuned harmonium, and counting the beats. Eventually I proceeded according to the method indicated in §§343 to 361. The scale for the positions of the holes was completed on April 10th, 1852, and was given, set out on a slip of box-wood, to Rose on the same day. On May 11th I received a flute made precisely in accordance with my design.

669. The finger-holes of this flute were not so large as might have been wished, on account of my desire to retain the five uncovered holes and their rings, the machinery for covering all the holes by keys being at that time very uncertain in its action, and liable to continual derangement. The five uncovered holes were equal in size, and about .43 inch in diameter; the covered g , $g\sharp$, b and c' holes were also equal to each other, but were made slightly larger than the uncovered holes, in order to compensate for the flattening influence of the overshadowing keys. The holes of the foot-joint were larger still, and therefore below their true positions, an error that I have since rectified.

This I believe to have been the first attempt to arrange the positions of the holes of a wind-instrument on any rational system; an attempt founded, it is true, on actual experiment,

but nevertheless carried out on intelligible and definite principles, and as far as the first and second octaves were concerned the result was entirely successful.

The notes of the third octave were still too sharp to be played strongly with the ordinary fingering, and this defect could not have been removed without making the upper holes larger and placing them lower down. The first and second octaves would then have been ruined, as the lower holes could not effectively have been made larger than the bore, and therefore the lower notes would have been comparatively weak; moreover, the holes could not have been stopped with certainty.

When this flute was finished, and I tried it, my good friend Rose remarked: "I have been trying experiments all my life and this is the first time that I ever knew one to answer completely." Rose was less critical than I, with regard to the third octave, but the success of the flute being indisputable, though qualified, he adopted, with my willing consent, the new positions of the holes, and the firm never afterwards made a conoidal flute with Boehm's positions of the holes.

The instrument described above had the open $g\sharp$ key, and the $d'\sharp$ key of Cöche; the lowest four notes were fingered as on the eight-keyed flute; in other respects the fingering was the same as that of Gordon's flute (*fig.* 53, §570). The material was cocus-wood. The metal-lined head-joint was provided with the ordinary tuning slide and screw-stopper. I sold the flute in 1858 and I have now lost sight of it; I have also lost the scale. It would not be worth while to recalculate the distances of the holes, as the pattern is now obsolete.

670. *The Writer's Extra $f\sharp$ Lever, etc.*, 1852. The last-mentioned flute was furnished with the mechanism described in §638, but I had been accustomed to make free use of the ring of the $e\flat$ hole without closing the hole, so that the third finger might remain on the edge of the ring while $e\flat f\sharp$, or $e\sharp f\sharp$, were played, cross-fingering or veiled notes being thus avoided, and I foresaw that the reversal of the position of the ring would cause some inconvenience on account of the loss of leverage; I therefore

altered the position of the *b-c* shake-lever, so that it might be used by the first finger instead of by the third, and in its place I put a simple lever to close the *g* hole. The touch of the *d'* key was left in its original place. The extra *f* lever removes all possible objection to Gordon's fingering for the right hand.

It has been inaccurately asserted that Boehm had used this lever on his hautboy some years before I placed it on the flute. The contrivance which Boehm used, and which he showed to me in 1851, was, I believe, suggested by the late M. Lavigne. It was a closed key covering a duplicate *f* hole. On the key being opened by the third finger while the other *f* hole and the *g* hole were closed by the first finger, the note *f* was given. The only advantage attendant upon the use of this key was that an *f* was obtainable with the same fingering as on the old hautboy. The Dorus *g* was placed on this instrument for a similar reason, which I hope the reader will consider a very bad one, as the old hautboy is fingered nearly in the same way as the old flute.

The lever to close the *g* hole was placed on the hautboy some years afterwards.

The now common crescentic shape of the touch of the *d'* key (represented in *fig.* 64, §683, and described in §681, VIII), I designed for the flute of 1852. The object was to facilitate the slurring of *c'* and *d'*.

671. Pratten's "Perfected Flute." It is stated, in §652, that the distinguished Robert Sidney Pratten adopted Siccama's flute for a time. In the year 1852 he began to make improvements in the flute with the old fingering; he associated himself with a clever man who had once been Siccama's constructor, and the musician and the mechanic worked together with some success.

Pratten highly approved of the tuning of my flute of 1852, and he asked me to allow him to copy the sizes and positions of its finger-holes, a request which was most gratifying, and with which I was glad to comply. He also adopted the crescent-shaped lever of the *d'* key of that flute. Amongst other improvements, he re-introduced the closed *c''* key for the left

hand thumb: see §455. Subsequently he had all the finger-holes covered by keys, some of which were perforated for the improvement of the third octave. Having considerably widened the lower part of the bore he was able to employ larger holes for the lower notes than had previously been possible on a conoidal flute.

672. In 1856 Pratten's able coadjutor became foreman to Messrs. Boosey and Co., who then undertook the manufacture of the "perfected flute." Mr. D. J. Blaikley has kindly furnished me with the following particulars: "About the year 1857, as soon as the flute work was fairly started by Messrs. Boosey, Mr. Pratten turned his attention to the further improvement of the cone-flute, on the one hand, and to the adaptation of the cone-fingering to the cylinder flute on the other. Recognising the merits of Boehm's work, and yet not seeing his own way to taking up a new fingering, he increased the sizes of the holes of the cone-flute and added various keys, leaving the original eight-keyed flute as a seventeen-keyed instrument with holes practically as large as those of Boehm.

"With the cylinder flute his work was to bring it to the same fingering as his seventeen-keyed cone-flute. He worked at this, not as introducing a modification of the Boehm-fingering, but with the aim of boldly transplanting the cone-fingering to the cylinder flute."

673. The Writer's Scheme for the Improvement of the "Cylinder Flute," 1858. Messrs. Rudall, Rose and Carte eventually improved the head-joint of the flute of 1847 as much as they had improved the proportions of the conoidal body of the older instrument, and in 1858 I determined to adopt their latest improvement, but the tuning of the flute with the new bore being as defective as at first, it became necessary to repeat my experiments of 1852. The mechanism had been so much improved that I made but two alterations in it. One was the addition of the lever for closing the *g* hole, now well known as "the extra *f* lever." (See §670.) It was obvious that the substitution of the covered for the open holes would render

this lever more than ever useful. Of course it was necessary that both it and the key of the *g* hole should be fixed to the rod alone, and that the three open keys for the fingers of the right hand should be placed on tubes provided with clutches. The other alteration was the placing of the open *g*♯ key and the key of the *a* hole on a single rod at the *near* side of the flute. This was a very different arrangement to that in vogue at the time, and it facilitated the action of the third and fourth fingers. Briccialdi's *b*♭ lever, in its original form (see §658), was added to this flute. In other respects the fingering was precisely the same as that of the flute of 1852. There were perforations in the keys of the *f*♯ and *b*♭ holes only; the former for the sake of the shake *f*'''*♯*-*g*'''*♯*; the latter for the sequence *f*'''*♯*, *e*'''*♯*, *f*'''*♯*. In those days, I regret to say, I was not sufficiently enlightened to be able to appreciate the advantages of the other three perforations that were then commonly used in France. The tuning I arranged on the same principles as I had before adopted, but those principles were more rigidly carried out, and the holes for all the notes from *c*♯ to *c*''*♯*, inclusive, were of almost uniform size, the only exceptions being the *f*♯ and *b*♭ holes, which were made slightly smaller than the others in order to compensate for the sharpening effect of the perforations in the keys. The distance between the *c*♯ and *c*''*♯* holes was .375 inch less than it had previously been.

674. This flute was of cocus-wood, with silver head-lining. The tuning slide was of the pattern shown in *fig.* 19, §327. The success of the instrument was unequivocal, as far as the first and second octaves were concerned, but the third octave being still inclined to sharpness, though better in tune than that of any open-keyed flute previously made, it was necessary to exercise great care in *forte* playing. The tone was of a sweeter quality than that of the flute of 1852, though scarcely so powerful. The necessary expenditure of breath was certainly greater.

I was at that time taking the principal flute part in several first-rate London orchestras, and for that work, as well as for

solo-playing, the flute nearly realised my expectations. For six years I used no other.

After 1858 Messrs. Rudall, Rose and Carte never reverted to the distribution of the holes as arranged by Boehm, though Mr. Carte, who had not occupied himself with that particular branch of flute construction, was much surprised when he learned that my system of tuning had been adopted by his partner. This method of placing the holes was also in great part adopted by the continental makers for flutes of the English pitch, but Boehm always placed the *f*♯ hole too high, with the object of improving the note when fingered with the second finger, and regardless of the fact that by so doing he caused it to be too sharp when fingered in the usual manner. Even M. Louis Lot, the best Continental flute-maker of his time but who long ago retired from business, followed Boehm's evil example.

675. **The Duplicate *g*♯ Hole and Key.** The opening of the large *g*♯ hole of the new flute below the true vent-hole for *e*''', which the key of Dorus rendered unavoidable, caused some difficulty in the production of this note; a further inconvenience arose from the increased strength in the springs which was necessary for keeping the large key properly closed. The latter inconvenience was partly removed by rendering the keys of the *g*♯ and *a* holes inseparable, and providing a duplicate hole, covered by a closed key, for *g*♯. At a later period the former inconvenience was remedied by arranging the keys of the *g*♯ and *a* holes in such a manner that the key of the *a* hole closed that of the *g*♯ hole, but the key of the *g*♯ hole did not close that of the *a* hole. The *g*♯ hole was closed by an arm extending from the key of the *g* hole. This plan perfected the *e*''' but caused the loss of a number of convenient fingerings. I then suggested, for the benefit of those who were accustomed to the closed *g*♯ key and were unwilling to change their fingering, that the key of the *g*♯ hole should be closed by that of the *f*♯ hole, but not by that of the *g* hole. The closing was effected by a clutch at the back of the *f*♯ hole. This arrangement is generally more convenient than any other, for the closed *g*♯ key, but of course

all this complicated mechanism would be rendered unnecessary by following Boehm's advice and adopting the simple open $g\sharp$ key.

676. Clinton's "Equisonant Flute" and his "Graduated Holes." In the year 1855 Clinton published a second pamphlet containing a description of a new flute of his, in which he strove to retain as much as possible of the old fingering, and which he called the "equisonant flute." "What is the meaning of 'equisonant,' Mr. Clinton," asked an ardent partisan of Boehm's, "does it mean equally bad all over?" Unfortunately the flute had not even that negative merit, for it was unequally bad.

On the expiration of the patent for the "cylinder flute," Clinton, although he had been the chief assailant of this instrument, immediately began to make it, but he never succeeded in getting a good head-joint. On March 31st, 1862, he obtained a patent "for graduating the holes of flutes known as cylinder flutes, thus: the lowest, or C sharp hole, is made very nearly as large as the diameter of the cylinder, and the holes are gradually diminished in size, subject to such slight deviation as may be necessary, to obtain equal temperament in the tuning." The amount of the reduction in size is not specified, but the c'' hole, as actually made, was only half the size of the $c\sharp$ hole. It would be unnecessary to explain, even to the most cursory reader, that the principle adopted was utterly false, but, ridiculous as was Clinton's idea, Boehm seems to have thought it worth while to dispute its originality, and, as a matter of fact, the only original point in the scheme was the extravagance with which it was carried out.

Mr. Carte has kindly furnished me with the copy of a letter, which he received from M. Louis Lot of Paris, on the subject of graduated holes, and of which the following is a literal transcription.

677.

*Th. Boehm à Louis Lot.**"Munich, 12 Juin 1862.**"Monsieur,*

"J'ai appris que Mr. Clinton en imitant les flûtes de ma fabrication s'est porté devant le Jury comme l'inovateur [sic] des trous gradués. Le monde flûtiste sait que pendant six années j'ai fabriqué toutes mes flûtes d'argent avec trous gradués, J'en ai fourni de ce genre à des Mess. Anglais, à Mr. Greville, à Mr. Cherry et à d'autres. Moi-même en 1851 lors de mon séjour à Londres je me servais d'une flûte à trous gradués. Le plus petit ut avait 12 millimètres et le plus grand ut en bas était à 15 millimètres, toujours un quart de millimètre de graduation.


"Les trous gradués sont à mon avis, les meilleurs, [sic] mais la différence n'est pas bien appréciable. J'ai cessé de les faire à cause [sic] de la plus grande difficulté dans la fabrication.

*"J'ai l'honneur d'être Monsieur**"Votre bien dévoué**"TH. BOEHM."**Translation.**"Munich, June 12th, 1862.**"Sir,*

"I understand that Mr. Clinton, imitating the flutes of my manufacture, has represented himself to the Jury [at the London Exhibition of 1862] as the inventor of graduated holes. The flute-playing world knows that for six years I made all my silver flutes with graduated holes. I have supplied flutes of this kind to some English gentlemen, Mr. Greville, Mr. Cherry and others. During my stay in London in 1851, I, myself, used a flute with graduated holes. The smallest, that for $c''\sharp$, was 12 mm. [.47 inch] in diameter, and the largest, that for $c\sharp$, 15 mm. [.59 inch], a constant graduation of a quarter of a millimeter. [very nearly .01 inch.]

"The graduated holes are in my opinion the best, but the difference is scarcely appreciable. I have discontinued making them on account of the greater difficulty in the manufacture."

It will be seen that there is considerable discrepancy between the measurements given above and those of the flute described in §654.

678. Clinton's last Patent, (1863). The only noteworthy feature in the specification of this patent is the application of a contrivance which is thus described by the patentee: "My invention applies to flutes having either a cylindrical or conical bore, and consists. . . . in having a lever level with and contiguous to the key which is acted upon by the first finger of the right hand, by which I can obtain an easy fingering for $F\sharp$ without altering the ordinary fingering of the note $F\sharp$ when taken thus : ." The fingering for $f\sharp$ is the same as that on the flutes shown in *figures* 53, 54, 55 etc., so that either $f\sharp$ or $f\sharp$ can be made by the first finger of the right hand. The patentee states that he does not confine himself to the particular arrangement of mechanism specified, but that he claims any plan by which the notes $f\sharp$ and $f\sharp$ may be fingered as above described. The general fingering of the flute is in great part similar to that of the old flute, the closed $f\sharp$, $g\sharp$ and $b\flat$ keys being retained, but the machinery is complicated excessively by each of these keys being provided with an open counterpart.

679. The Flute known as "Rockstro's Model" 1864-1877. The above title was given to this instrument by my worthy friend J. M. Rose at the time when the firm, in which he was the manufacturing partner, undertook to make it. Unfortunately in his generous desire to publish my name as widely as possible, he caused it to be placed on all flutes with the large holes of 1864, (see §345) although some of these instruments were constructed on principles of which I by no means approved, and some of them were, in fact, mere experiments. The error was soon afterwards rectified, but many of these experimental flutes, for which I am in no degree responsible, are still in existence, and the unwary purchaser of a second-hand flute, engraved or branded with my name, may be deceived.

In recent years a new difficulty has arisen: the various improvements, first applied to this model, have been placed on

so many different kinds of flutes, and have been appropriated by so many makers, that scarcely an open-keyed flute is now made on which some of them do not appear, and people have begun to ask wherein this model differs from others? It is therefore incumbent on me to explain the original points of difference, and I shall endeavour to do so as succinctly as possible.

680. There is no need for a recapitulation of the faults of the models of 1852 and 1858: it will suffice to say that in 1864 I made a successful attempt to improve the intonation of the third octave, and, by the same means, the tone of the instrument throughout its compass. Both these objects were effected by a uniform increase in the diameter of all the finger-holes below that for $c''\sharp$. A diameter of .64 inch had been occasionally adopted for the three holes of the foot-joint only, but though the tone of the $c'\sharp$, $d'\sharp$ and $d''\sharp$ was certainly improved by the change, the discrepancy in the size of the holes gave rise to a most objectionable break in the sound, as might have been expected. The diameter of .64 inch I decided to adopt for the equal-sized holes of my new flute. All further necessary information on this subject will be found in §§343 to 361.

681. The improvements that properly belong to, and form distinctive features of, the model under discussion may be briefly enumerated as follows:

I. The uniform diameter of .64 inch, or thereabouts, for all the finger-holes of the notes from $c'\sharp$ to c'' , inclusive.

II. The placing of the finger-holes in such positions that, whether used as note-holes or as vent-holes, they should render the intonation practically perfect, according to the system of equal temperament.

III. "The extra $f\sharp$ lever" modified as on the flute of 1858: see §673.

IV. The placing of the open $g\sharp$ key and the key of the $a\sharp$ hole as described in §673. Boehm soon afterwards adopted this arrangement.

V. A separate lever for closing the $g\sharp$ key. The ordinary lever formed part of the key, and, on account of its necessarily

unprotected position, it was frequently the cause of the key being bent on one side. The accidental bending of the lever, now detached from the key, does not affect the "stopping."

Boehm used, at one time, a separate lever working in an opposite direction to the present one (see *fig. 61*, §655), but his arrangement was very inconvenient and it was soon abandoned; he eventually copied that described above.

VI. The enlargement of all the bearing surfaces of the stops and clutches of the keys, and the removal of the parts of contact to a greater distance from the axles, thereby securing a safe leverage and permitting the application of cork at five places, instead of two, for the sake of silence in working.

VII. The increase in the length of the shanks of all the keys but that of the $c''\sharp$ hole, which allows the keys to open more widely than before, without rising higher in front.

VIII. The crescentic touch of the $d'\sharp$ key of 1852, and an alteration in the shape of the touches of the keys of the $c'\sharp$ and $d'\natural$ holes. These modifications render the slurring of $c'\natural e'b$, $e'b d'b$, etc., comparatively easy.

IX. The $b\natural$ lever, for making b by the pressure of the first finger of the left hand alone. The $a'\sharp$ being fingered by placing the thumb on the Briccialdi $b\natural$ lever, and the $b\natural$ and $f'''\sharp$ with the left hand first finger on the $b\natural$ lever, without using the thumb, the keys with five or six sharps are rendered as easy as any others: see §642, fourth paragraph. The $b\natural$ lever was first applied to my model in 1873. In my hastily written pamphlet (1884) the date of this application is erroneously given as 1866 or 1867.

The next three additions were made in 1877. On the first page of the above-mentioned pamphlet the date is misprinted "1857."

X. A large hole with a closed key, connected inseparably with the ordinary key of the $d''\natural$ hole. This renders easy and good all alternations of d'' , $d'\sharp$, d''' or $d'''\sharp$ with the $a'\sharp$, b , c or $c'\sharp$ below them; several shakes are also improved by this hole, particularly $c''-d''$ and $g''-a''$. See §§365-6.

XI. A lever by means of which the c'' hole is partly closed by the second finger of the left hand: see §§393, 792, 793 and 795.

XII. A small vent-hole connected with the key of the $c''\sharp$ hole: see §362.

682. When I submitted the scale for the holes of this flute to Rose he professed perfect confidence in my calculations, but the result was not at first entirely successful, for though the flute was in tune, the effect of the necessarily increased thickness of the wood had exceeded my anticipations, and the general pitch was slightly too low. By the adoption of the method described in §653, I was able to rectify the error, and the next flute that was made was practically perfect. Its scale is invariably used by Messrs. Rudall, Carte and Co. for the holes from e to c'' , inclusive, and from $c'\sharp$ to $d'\sharp$, inclusive. Only for the sake of the undesirable variation in the size of the holes, described in §686, has it been necessary to alter the distance between the $e\natural$ and $e\natural$ holes.

The five perforations in the keys (*fig. 64*) form no special feature of this model; I have already stated that they were re-introduced by Godfroy of Paris soon after the year 1847.

Flutes of this model can be made with the "closed $g'\sharp$ key" of any desired pattern, and in that case all the fingering of Gordon's flute (*fig. 53*, §570) is retained, excepting, of course, that depending on the keys of the foot-joint. It is scarcely necessary to repeat that I prefer the simple open $g'\sharp$ key.

In the preservation of this fingering, with the above-named exceptions, I have always taken especial pride, and I still hope that the time will come when closed $f\natural$, $g'\sharp$, $b\natural$ or $c''\natural$ keys, with or without their specious concomitants, duplicate holes, will become things of the past, and when flute-players will agree that Gordon's system of fingering, in its general features, is the only one entitled to consideration. It is an incontrovertible fact that no system has ever been devised at once so simple, so easy, and so free from the reproach of giving rise to the necessity for the employment of extra fingerings in the execution of ordinary passages. The natural yearnings and prejudices of those who

have been accustomed to the "old flute" from their childhood may be pardoned but they should be disregarded.

683. *The "Rockstro-Model" Flute as completed in 1877 with the improvements mentioned in §§681-2. Fig. 64.*

The advantages of the additional keys are set forth in §§791-6, and an explanation of the diagram is given in §792.

As a proof of the efficiency of the mechanical arrangements of this model, and the skill with which it is manufactured by Messrs. Rudall, Carte and Co., it may be mentioned that a cocus-wood flute of mine, which has been in constant use since 1874, has only once been repaired, and that an ebonite flute, which I have also used continually since it was made in 1877, has never required any repair but a new pad to the $d'\sharp$ key.

684. *The "Carte and Boehm Systems combined," (1866). Fig. 65.* The following description of the instrument known as the "1867 patent" flute, is transcribed from Mr. Carte's specification, dated 5th December, 1866.

"The object of my invention is to give increased facility to the fingering of the flute where the notes $B\flat$, $F\sharp$ and $F\natural$ are used in combination with other notes. These improvements are effected by a combination of fingerings which are commonly used on the flute with the Boehm fingering, as ordinarily known under that designation, and the flute for which I obtained a patent in the year 1850, (subsequently improved by me, and

FIG. 64.

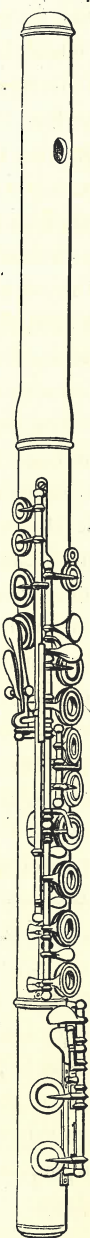
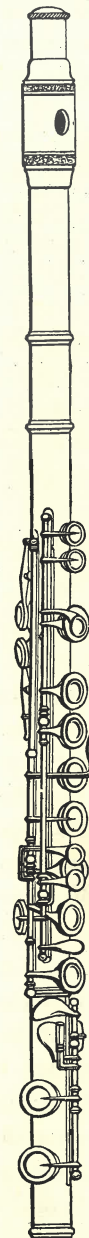


FIG. 65.

known as and hereafter called "my flute,") but which have never been before combined on one instrument. On the flute with the Boehm fingering the $F\sharp$ is produced by pressing down the third finger of the right hand, the fingers and thumb of the left hand being pressed on their respective holes and keys; I am enabled to adopt the same fingering, at the same time being able to produce $F\sharp$ with the first finger of the right hand, as heretofore on my flute. By this arrangement for producing $F\sharp$ I am enabled to dispense with the long side key on my flute, at the same time I produce the note $F\natural$ with the first finger of the right hand, as in the flute with Boehm's fingering, and with the same finger I can close the $B\sharp$ hole to produce the $B\flat$ as on the flute with Boehm's fingering in a similar manner as the same $B\flat$ is operated on by the third finger of the right hand on my flute. I obtain these combinations as follows:—In order to obtain $F\sharp$ I press the first finger of the right hand on a lever which will close the $G\sharp$ hole, in the same manner as on my flute; this $G\sharp$ hole is also closed by pressing the third finger of the right hand on the key covering the E hole, by means of a clutch, this being the Boehm fingering for $F\sharp$. The $F\natural$ is produced by pressing the first finger of the right hand on a lever, which is also made to close the G hole by a clutch and the $F\sharp$ hole by immediate pressure on the key covering that hole, and this lever communicates with the $B\flat$ key by means of a clutch which shuts the $B\sharp$ hole and produces the $B\flat$, in the same manner as



on the flute with the Boehm fingering, and in the same manner as is effected by pressing the lever of the $F\sharp$ key with the third finger of the right hand on my flute. At the same time I retain the method of producing $F\sharp$ by means of the key operated upon by the third finger of the right hand, as on my flute."

The addition of Gordon's $f\sharp$ to the flute of 1851, the first step towards the improvements which culminated in the flute of 1867, was suggested by my esteemed friend, Mr. George Spencer of London, a well-known and most enthusiastic amateur.

In fingering $f\sharp$, by means of the first finger of the right hand, the $g\sharp$ hole is closed as on the flute of 1851. The $f\sharp$ lever also closes the d'' and c'' holes: see the four uses of the lever $hgca$ in the explanation of *fig.* 63, §663. The flute of 1867 cannot be considered complete without the two shake-keys for $c''d''$, $c'''d'''$, $c''\sharp-d''\sharp$ and $c'''\sharp-d'''\sharp$. Precise details of the fingering of this flute will be found in §§789 and 790.

685. Mr. Barrett's Modification of the "1867 Patent" Flute. My friend, Mr. William Lewis Barrett, the clever and deservedly popular flute-player, has made what appears to me to be an exceedingly useful improvement in Mr. Carte's flute of 1867. By means of this he has simplified the fingering of many of the scales and passages in which the notes $c''\sharp$ and $c'''\sharp$ occur. Almost all passages with $c''\sharp$ and $c''\natural$, or $c'''\sharp$ and $c'''\natural$, in juxtaposition, on the flutes of 1851 and 1867, require a cross-fingering between the first and third fingers of the left hand; the unavoidable penalty that has to be paid for the sake of the ingenious and undoubtedly useful "open d'' ." This matter will be clearly understood on reference to §789. By an application of the principle of the "Dorus $g\sharp$ key" to the $c''\sharp$ and d'' holes, Mr. Barrett has retained most of the advantages of the open d'' , while at the same time he has restored the ordinary fingering for $c''\sharp$, consequently the notes $c''\sharp-c''\sharp$ and $c''\sharp-c''\natural$, can always be played in succession without any cross-fingering. The machinery for the open d' is put into gear by

simply pressing the usual $c''-d''$ shake-lever. By releasing this lever, the open d'' is thrown out of gear, and the open $c''\sharp$ is brought into play. With the exception of the modification above described, the flute used and recommended by Mr. Barrett is the same as Mr. Carte's flute of 1867.

686. The "Medium Holes." About the end of the year 1868, or the beginning of 1869, Mr. George Spencer suggested that the finger-holes should be made of the mean diameter between that of the large holes (.64 inch) and that generally adopted before 1864 (.52 inch). These were to be called the "medium holes." The diameter actually chosen was about .56 inch, though the designer of course intended it to be .58 inch.

As far as the first and second octaves are concerned, the difference caused by the reduction would not be very serious, were it not that the holes of the foot-joint are as large as before. This causes a sudden comparative weakness in the $e\sharp$ and the $e''\sharp$, which is decidedly objectionable, and at the same time quite unnecessary, as holes of the medium size do not afford, to the player, a single advantage over those of .64 inch. In the third octave the former are attended by two further disadvantages, one of which is very important. For the reasons set forth in §§357-9, the high positions of the holes, which their reduction in diameter renders necessary, causes all the notes above d''' to be too sharp. That this is not a mere matter of opinion may be easily demonstrated by anyone who will take the trouble to try the experiment described in §359. The correction of the above-mentioned defect by the player, though possible, is difficult and rarely achieved. The third disadvantage, though of much less consequence than the second, is still too important to be ignored. This is the useless sacrifice of the surpassing brilliancy and clearness of the high notes which is afforded only by the large holes.

The allegation that finger-holes of .64 inch in diameter are the cause of "wildness" in the tone is refuted in §345.

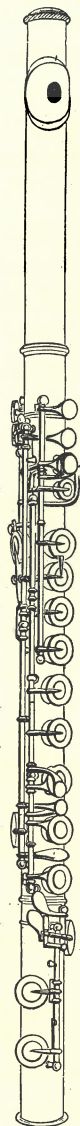
Mr. Spencer soon saw the futility of his scheme and abandoned it, readily admitting that the "medium" were far inferior

to the large holes that they were intended to supersede, but unfortunately many flutes are still made with finger-holes of varying size, to the manifest detriment of correct intonation, as well as of equality, purity and volume of tone. Flutes with small or medium-sized holes are generally approved by manufacturers and workmen, as they are more cheaply and easily made than those with large holes.

687. The Alto (or "Bass") Flute. Not long after the invention of the new head-joint, Boehm constructed a so-called bass flute, giving sounds a *fourth* lower than those of the ordinary flute. The bore of this instrument was much too large, and, as a consequence, the tone, though powerful, was of an exceedingly hollow character in the lowest register; most objectionably nasal in the second and third octaves, and generally heavy and inflexible. The holes were irregularly graduated in size; the tuning was grievously defective, and the instrument was altogether valueless. A few years before his death, Boehm much improved the tone of this flute by reducing the diameter of the bore, but the tuning of the later flute was as false as that of the earlier one. Mr. Henry Carte has lately further improved this instrument by an entire re-arrangement, and a considerable increase in the diameter, of the finger-holes; he has also, by an ingenious system of mechanism, adapted to it the fingering of his father's flute of 1867. The latest form of the alto flute is shown in *fig. 66*.

The length of this instrument, from the face of the stopper to

FIG. 66.



the open end, is 31.625 inches. The diameter of the cylindrical part of the bore is 1.035 inch; that of the narrowest part of the bore (at the stopper) is .906 inch. The diameter of the finger-holes, which are of uniform size with the exception of the *c''* and *d''* holes, is .744 inch.

The place of the left hand is at the upper part, and that of the right hand at the lower part, of the middle joint.

688. The latest Improvement in the Flute, the tubular extension of the *c''* hole, is fully described in §363, and its practical applications are explained in §796. It does not appear in the wood-cut, *fig. 64*, because I desired to show the flute as it has hitherto been made, and because the contrivance is so simple that a representation of it would be unnecessary. At the time of my writing, only one of these tubes has been made, but its success is so complete that in future no flute of my model will be made without the improvement. This addition to the *c''* hole is unattended by a single disadvantage that I have been able to discover.