Modern Organ Stops

MODERN ORGAN STOPS

A practical Guide to their Nomenclature, Construction, Voicing and Artistic use

WITH A

GLOSSARY OF TECHNICAL TERMS

relating to the Science of Tone-Production from Organ Pipes

BY THE REVEREND

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"*Omne tulit punctum qui miscuit utile dulci.*"—HORACE: "*Ars Poetica.*"

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Preface

THE issue of this book is due wholly to the desire to place before the student a guide, sufficiently concise, and withal adequately comprehensive, to the clearer understanding of the science of organ tone-production. To the casual observer the alphabetical arrangement of stop-names would seem doubtless to convey the impression that yet a third dictionary of organ stops has been offered to the public. A closer scrutiny, however, should convince the reader that these pages do not seek to cover the same ground occupied by the excellent treatises of Wedgwood and of Audsley, but will, it is hoped, reveal the true aim and scope of the author. A number of stop-names have been deliberately omitted from the list, only those which have survived the ordeal of time and historic evolution and are still to be found engraved on the tablets of the modern organ have been selected for description arid discursive treatment. A few exceptions to this rule may be seized upon by the carping critic: these are included for some definite reason which will clearly emerge after the perusal of the text, it may be in order that new light might be thrown on a matter of unusual interest, or that it was felt desirable to clear up some point in the evolution of tone. Apart from this, references to past endeavour and the question of origins are comparatively few, since this does not claim to be an historical treatise compiled for the benefit of the antiquarian.

The fascinating subject of *voicing* and all that appertains to that esoteric art has received more than usual attention. The practical student will find embodied in these pages much information (hitherto unpublished in any language) on the relative scaling of reed stops; indeed, the whole subject of scaling, absolute and relative, has been dealt with as exhaustively as could be expected in a book of this limited size. Under the headings of CLARABELLA, DIAPASON and VIOLA will be found the broad outlines of treatment relating to the three great categories of flue tone, and likewise the subject of chorus reed tone is discussed under the headings of TROMBONE, TRUMPET and TUBA. As these six articles in the aggregate form a kind of introduction to the study of all varieties of organ tone, the reader is recommended to assimilate their contents first of all.

A glossary of technical terms associated with the science of voicing (which is a branch of physics and should be studied as such) has been compiled for the benefit of those less advanced students to whom the reading of this work may from time to time present difficulties. The avoidance of technical expressions would be impossible in the exposition of any scientific subject, and experience has shown that it is better for the student to master the special terminology of the author than for the author to descend to the level of the student. Looseness of expression is unpardonable. It is hoped, also, that the illustrations will materially assist in elucidating the text, and that the reader will find them readily accessible for reference.

Lastly, the organ as a musical instrument can hardly claim to be excluded from the Aristotelian canon that "the nature of a thing is its finished development." We cannot rest contented with the present stage of progress in tone and *ensemble* for all the wonderful improvements that have been introduced since the Victorian era. There are many schools of tonal design, each claiming to be the greatest; but in the organ of the future will be blended the best qualities of each school, and only with the perfection of all types will the ideal become the real.

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Modern Organ Stops

Acoustic Bass.—The organ stop thus labelled represents the effort of the organ builder to produce the effect of a deep-pitched note such as is normally obtained from pipes of 16ft., 32ft., and 64ft. speaking length without resorting to such big and costly pipes. This acoustical illusion, as it may not inaptly be called, was first discovered two centuries ago by Tartini, and was introduced in a practical form by the Abt (Abbot) Vogler (1749-1814).

The phenomenon may be explained thus: sound the CC 8ft. note on the organ (for preference an open flue pipe) and sound along with it the fifth above, GG, $5\frac{1}{3}$ ft. (preferably a stopped pipe): the effect of this sustained interval (CC and GG) should be to add to the unison note (CC) a soft yet distinct trace of the octave below (i.e., CCC, 16ft.). This experiment will prove the more successful if the two notes forming the interval of a fifth be produced from two pipes speaking very close to each other, their mouths pointing in the opposite direction, and if the lower note (CC) is fairly rich in overtones while the upper note (GG) is proportionately weaker and less equipped in overtones. Roosevelt and Gern have both demonstrated this with striking success by attaching the quint pipe (called a "monkey quint") to the unison pipe in such a way that both pipes are fed simultaneously from one common foot.

By a similar process, it is possible to secure a resultant 32ft. tone from the combination of the two notes CCC (16ft.) and GGG ($10\frac{2}{3}$ ft.), and a 64ft. resultant by combining CCCC (32ft.) with GGGG ($21\frac{1}{3}$ ft.)

Actually, the resultant note is not a sustained one. It is a rhythmical pulsation. For instance, the column of air in a 32ft. pipe vibrates approximately at the rate of 16 per second; that of a 16ft. pipe vibrates at the rate of 32 per second; and that of a $10\frac{2}{3}$ ft. pipe at 48 per second. When both 16ft. and $10\frac{2}{3}$ ft. pipes are speaking together, there are therefore 16 coincident vibrations per second; these vibrations being reinforced or accentuated correspond to the vibration number of a 32ft.

pipe, and consequently produce a resultant pulsation at 32ft. pitch. This is also called a differential tone, because it is produced by difference of the vibration numbers of two combined notes. As the synchronisation of the vibrations occurs every $\frac{1}{16}$ of a second, the resultant 32ft. tone pulsates at the periodic rate of 16 per second, which is sufficiently rapid to account for the illusory effect.

Other intervals are employed by builders besides the fifth. The sub-quint or fourth below the unison, coupled to the unison, produces the faintest possible trace of the double octave below,—e.g., the $21\frac{1}{3}$ ft., GGGG, sounded with the 16ft., CCC, gives a resultant 64ft. Walcker, the celebrated builder of Ludwigsburg, has for many years used the octave, tierce and superoctave as well as the quint, thus reinforcing the upper harmonics of a 32ft. violone.

Very often the quint and other ranks designed to accompany the unison are not independent sets of pipes, but are borrowed from existing pedal stops (or it may be from a 16ft. master stop on the manuals). Thus, a quint may take the form of a "quint coupler,"—that is, be derived from the pedal stopped 16ft. bass, or else the 16ft. open or stopped bass may be coupled in fifths. If the 32ft. open be carried down to FFFF, it is possible to couple this FFFF note to the 16ft. CCC when playing the CCCC pedal key, thus producing a 64ft. resultant. On the whole, modern expert opinion is adverse to the derivation of the quint from the same rank of pipes as the unison employed, unless it be the stopped bass, which allows of a more powerful unison bass, such as the open 16ft., being added. The question of the tempered interval is hardly worthy of consideration, since the unison in any case draws the subordinate note into accord with it. What is of importance is to see that the unison or prime note takes precedence in power and tone.

We may deduce from the above that the acoustic bass is employed by builders either from motives of economy or as a harmonic-corroborating device on the pedal (a species of grave mixture). Where money is not forthcoming or where height is inadequate for the accommodation of a real 32ft. stop, it is felt by a great number of architects that the acoustic illusion serves as a passable substitute, though the device should be restricted to the lowest octave of the 32ft. pedal stop. It is better still if the 32ft. pipes can be carried as far down the compass of the pedal board as FFFF, the bottom five notes being acoustic. As a matter of fact, the lowest five pipes of the real 32ft., whether open or stopped, are admittedly a doubtful investment when one realises that the effect of these notes is hardly commensurate with their great cost, and that there is a distinct fall-off in tone-value below FFFF, even with large scales. Hence the adoption of the resultant bass at this point has this much to commend it, especially for use in *forte* combinations. But if the complete compass 32ft. open can be afforded, there is still every advantage to be gained from the addition of a series of harmonic-corroborating ranks, such as the fifth, octave, tierce, septime and superoctave, while the sub-quint of $21\frac{1}{3}$ft. pitch will prove of inestimable value in the full pedal.

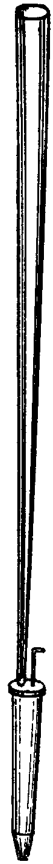
Æoline.—The prototype of this stop is the æolian harp, which is a delicate-toned stringed instrument designed to fit in a window frame for exposure to the wind, the effect of the wind blowing athwart the strings being to reproduce the sweet music of a distant string band. The name æoline, however, is also applied to a form of accordion introduced by Wheatstone before the concertina; this latter instrument would be the more correct prototype of the German reed stop bearing this name. In modern organs the æoline is invariably an echo string stop, and not infrequently forms one of the ranks of the céleste *(q.v.)*. In the organ at St. John Baptist's Church, Holland Road, Shepherd's Bush, there is a very beautiful example of the æoline by Gern on the choir, consisting of two ranks of slow-beating pipes on an open soundboard; the *timbre* of this specimen, however, is not in the category of string tone, but is really that of an echo dulciana céleste or unda mans. The æoline of the modern builder is an echo viol, the scale at CC (8ft.) being approximately $2\frac{1}{2}$in., and at tenor C (4ft.) $1\frac{1}{2}$in., and in some examples smaller still. The mouth varies from a fifth to two-ninths of the pipe's circumference in width, and the pipe may or may not be slotted. The roller-bridge is essential, of course, and the voicing the same as that required for stops of the viol class (see under VIOLA).

Baritone *or* **Baryton**.—See VOX HUMANA.

Basset Horn.—See CLARINET.

Bass Flute.—See STOPPED DIAPASON.

Bassoon.—The name given to a particular type of reed pipe employed for the lowest octave of the oboe and cor anglais *(q.v.)*: in other words, the distinctive tube of these stops is in the majority of cases not carried down below the 4ft. pipe. The scale of the bassoon tube at the top is usually $2\frac{1}{2}$in. at CC (8ft.), this narrow diameter making the tone somewhat nasal. The shallot is narrow, with a V-shaped opening. Familiarly speaking, the bassoon is a small scaled trumpet *(q.v.)* reduced in power, the tubes being the same length in proportion to the scale. Regulating caps are generally soldered on the top of the tubes, or else the caps are completely soldered all round and a slot cut immediately below with a regulating tongue of metal. Wooden tubes are occasionally used.



BASSOON

As a 16ft. stop, the bassoon is generally assigned to the swell and pedal divisions, and is labelled variously "bassoon," "double bassoon," "fagotto," and "contra fagotto." The last name is sometimes adopted for the 16ft. trumpet or oboe-horn, especially when the tubes of the bass portion are half-length and capped at the top. The scale at CCC (16ft.) varies from $3\frac{7}{8}$in. to 5in. Half-length reeds have an objectionable tendency to go out of tune with only slight changes of temperature, the "control" being obviously more difficult with the shorter resonator; but the margin for variation in consonance between tongue and tube is more defined if heavy wind pressure and relatively thick tongues are employed. The half-length tube, however, with the obvious exception of the 16ft. clarinet, which is necessarily so constructed, should be avoided unless no alternative is possible.

Bell Gamba.—See VIOLA.

Bombarde.—In the modern organ this stop represents a smoothly voiced 16ft. reed of trombone or even tuba power, the scale at CCC (16ft.) being from 7in. to 8in. The tubes may also be of wood, with or without a cap. The 32ft. pedal reed is very often called "contra bombarde" or "contra bombardon." In modern organ design the high pressure division comprising the tubas, 16ft., 8ft., 4ft., with a series of *ripieno* harmonic ranks is known as the "bombarde division" (French: *clavier des bombardes*). This forms the "artillery" of the organ, is generally enclosed in a swell box, and made available on more than one clavier. (See also under TROMBONE.)

Bourdon.—A stopped pipe of 16ft. tone, nearly always made of wood, but occasionally to be found in metal or zinc. The 32ft. stop is called sub-bourdon. The pedal bourdon is frequently and advisedly labelled "sub-bass," the term bourdon being more properly restricted to the manual examples.

The manual bourdon is fast losing its popularity in this country in spite of the fact that Schulze was very partial to it on the great, and that at one time the swell was almost universally considered incomplete without it. To-day consensus of opinion seems to lie in favour of the *open diapason* as the most suitable double for the great diapason chorus, because the latter obviously extends the true diapason tone downwards just as the principal and fifteenth extend that tone upwards. It is therefore felt that if the bourdon or stopped double is to find a place in the great organ scheme at all, that place must be a secondary one, the relationship to the diapason chorus being similar to that of the 8ft. flute. The swell bourdon is still accorded the privilege of a place in the swell organ by some builders, although its inclusion is probably due to the desire to thicken up the softer flue stops of this department, and also to utilise the opportunity thus offered of deriving an expressive pedal bass from the same rank of pipes. The usefulness of the enclosed bourdon is exceedingly problematical. Confinement within a thick-walled chamber is the worst possible position for it, as even with the box fully open the bass octave is only just audible at the console (assuming the latter to be attached) while at a distance of (say) 30ft. from the organ it is very seldom audible at all. It is therefore more often than not waste of money to pack these pipes away in a box and to borrow them as an "echo bass" on the pedal. Nor is it possible to make expressive that which cannot be crescendoed, for it is but the multiplication of nought. Again, what is the artistic value of a rank of pipes that creates with the combinations of stops drawn with it a mere muddy precipitate? This is not organ tone, but a smudge of colours causing anything but pleasure to the analytical ear. Think, too, of the valuable space usurped by these bulky wooden pipes at the back of the swell box, space that could and should be far better occupied by other stops demanding precedence. If the bourdon is to be enclosed at all, let the enclosed portion be confined to the tenor C register, let it be constructed of metal or zinc, and the 16ft. octave planted on a separate chest outside the box, regulated to the required power. For the scaling and voicing of manual stopped pipes the reader is referred to the remarks under STOPPED DIAPASON.

As a pedal sub-bass, the bourdon is of distinct value, and is moreover the most economical form of 16ft. toned stop, its half-length pipes rendering it especially amenable to restrictions of height. The chief difficulty experienced with it is its uncertain carrying power. It is not an exaggeration of the truth to say that the number of examples audible in all parts of the building in which they are designed to be heard is a very small percentage indeed. This is due to the fact that the sound waves project in great loops and are missed through dissipation unless in some way they can be disciplined by reflection. There are only two methods to which organ builders can resort for the solution of this problem. One is to make the pipes of large scale, the other is to plant them close to a reflecting surface. The question of scales is always a moot one: each builder has his own predilection. To steer between the "tubs" of the worthy Dr. Hayne, who advocated a scale of 13in. by 11½in. at CCC (16ft.), and the absurdly small scaling of certain German builders only fit for the lieblich category would seem to be following the dictates of sanity and common sense. If the English type of block and cap (see under STOPPED DIAPASON) be adopted, the scaling must be relatively larger than that which is appropriate to the Schulze formation of pipe. The author prefers the latter variety as giving a richer tone without in the least sacrificing the intensity of the prime partial. The smallest scale that can be guaranteed to produce a reliable and effective note is 8½in. by 6in. at CCC (16ft.). Schulze's well-known Hindley scale of 8in. by 5¾in. is certainly effective at Hindley and at other places where copies of the same pipe have been introduced; but success has not *invariably* attended the employment of this scaling in positions less advantageous than that at Hindley, so that one must plead this excuse for advocating as a minimum scale something larger. On the principle embodied in the familiar Latin saw *In medio tutissimus ibis*, it would be safer still to adopt a yet larger scale than the 8½in. by 6in. in accordance with the range of difficulties involved (such as those created by space and position). Anything between l0in. by 9in. and 8½in. by 7in. may be confidently recommended, whether the English or Schulze formation be used. With regard to the position of the pipes, as has already been hinted, close proximity to a reflecting surface is essential to good results. The reflector should be some kind of wall lined with some non-absorbent material such as cement, or it may be a casing of hard wood lined with zinc or painted with hard-drying enamel. It is not necessary to plant the pipes with their mouths facing the reflector, though this is probably the ideal arrangement: often the available floor space will not permit of this, and then the backs of the pipes have perforce to touch the wall. The minimum speaking room for a bourdon mouth is 4in. It is a great gain if the stop can be planted on the main floor of the building, so that the sound waves may as far as possible be focussed along it and thus have a better chance of reaching the listener. This is not an easy matter when the organ is built *en bloc* on a gallery floor, but the advantage of the main floor position should not be lost sight of in the design of a new instrument, as it also applies with equal force to all pedal stops.

The voicing of the bourdon is a matter of importance in connection with its effectiveness as a pedal bass. It may safely be predicated that the higher the cut up of mouth the less likelihood there is of the tone travelling through every part of the building. On the other hand, the distressing tendency of these pipes to cough their twelfth prior to settling down to the prime is notorious. Reducing the wind supply only suppresses the twelfth at the expense of the prime. Increasing the height of the mouth also has its attendant dangers, two of these being unsteadiness of speech and windiness, a third having already been alluded to. With the scaling recommended above, these difficulties are reduced to a minimum. The mouth does not require to be cut up more than three-eighths of its width, and is quite safe to cut up one-third only, increasing to three-eighths if necessary. Small scaled bourdons have to be cut up as much as three-quarters of the mouth width, or even more before the twelfth can be eliminated, or else the feet must be plugged up till what tone is left is unworthy of the pipe. Nobody knew better than the late Father Willis the value of a low mouthed bourdon as a tone traveller: unfortunately, he was too lenient with the twelfth, and thus spoilt the whole effect. The flue of the CCC (16ft.) pipe should not exceed $\frac{3}{32}$ in.; the foot of the pipe should not be plugged unless absolutely necessary for regulation purposes; the upper lip should be at least $\frac{3}{8}$ in. thick (the late T. C. Lewis was known to use a lip as much as $\frac{11}{16}$ in. in thickness), and the planks of which the longer pipes are made should not be less than 1 in. thick before being planed. The device sometimes adopted of leathering or felting the upper lip is entirely unnecessary if the pipe is properly constructed and finished; nor is there any special advantage to be gained from “clothing the flue,” though it has been claimed by some voicers that this process intensifies the prime. There is, however, some justification for resorting to it in the case of heavy pressures, which are known to be inimical to the bourdon. In the ordinary course of things the bourdon should not be placed on a wind pressure exceeding 4in.; but if higher pressures are used it will be necessary to reduce the supply of wind at the foot in proportion to the sound-board pressure until a point is reached when plugging should make way for the process of leathering the lips. But nothing is to be gained from the deliberate adoption of heavy wind pressure, so far as the successful production of tone is concerned.

The idea of obtaining two distinct powers of tone from the same set of bourdon pipes has much to commend it provided that the pipes so treated do not extend higher than the 16ft. octave. Above this point in the compass the deviation from true pitch is too apparent to justify the economy. But it is the lowest octave that costs the most, so that a considerable saving of expense and space is effected by the process. Two ventil or drawstop boxes are attached to the same soundboard, the one trunked to the heavy pressure reservoir, the other to the light. The pipes are voiced to the higher pressure, and when the lower pressure wind is admitted to the chest the tone is feebler though still distinct. Mr. John Compton, one of the most resourceful and artistic of English organ builders, many years ago introduced a clever yet simple compensating device by which the pitch of the stop on either pressure was maintained. This is not absolutely necessary if the two pressures are applied to the bottom octave of pipes only; and the upper portion of the stop can be derived from a manual stopped bass, or even a new set of pipes from CC added to complete the softer toned edition. In any case, such a device is more commendable than the more common one of duplicating the swell bourdon on the pedal as an echo bass.

The 32ft. bourdon (sub-bourdon) carries the 16ft. stop down a further octave to CCCC, but below FFFF the result is not by any means satisfactory when the cost of these big pipes is taken into consideration. A very safe scale for the FFFF pipe is 11in. by $9\frac{1}{2}$in., the mouth being cut up one-third of its width and fitted with a bridge or roller. A high mouth is fatal to success, and a low mouth encourages our old friend the twelfth: by applying the bridge the twelfth is brought under proper control and the prime is preserved as far as possible. The notes below FFFF are best obtained "acoustically" (see under ACOUSTIC BASS), the CCCC note, for instance, being produced by the coupling of the CCC and FFFF notes, or it may be better to derive the CCC note from an open 16ft. stop.

Mr. John W. Whiteley, the well known voicer, has adopted the ingenious device of obtaining two notes from one stopped pipe in the 32ft. and 16ft. octaves. The CCC pipe, for instance, is voiced to speak the 16ft. C note perfectly and to pitch: the CCC sharp key operates a circular disc valve which covers a circular hole bored in the back plank of the CCC pipe, immediately opposite the mouth, the diameter of this hole being equal to the height of the mouth. By pneumatically uncovering the hole, the exact semitone above is sounded.

Céleste.—See VOIX CÉLESTES.

'Cello.—See VIOLONCELLO and VIOLA.

Chimney Flute.—See ROHRFLÖTE.

Clarabella (also named Claribel or Claribel Flute).—The original stop, invented by J. C. Bishop, was simply the early English stopped diapason without its stopper, the scale being usually $1\frac{7}{8}$in. by $1\frac{5}{8}$in. at middle C (2ft.). The quality is that which can only be obtained from this formation of pipe, the large scale and low mouth combining to impart considerable foundation to the tone without the least approach to hardness. The beautiful Willis claribel flute on the great at Salisbury Cathedral is $1\frac{3}{4}$in. by $1\frac{7}{16}$in. at middle C; while the clarabella in the same division at All Saints, St. John's Wood, London, measures at this pipe 2in. by $1\frac{9}{16}$in.

As a solo stop, there can be no question as to its exceeding beauty, while it is not in the least upset (but rather assisted) by heavy pressure if properly adapted to it. But it is not a good mixer. With diapasons especially its companionship is undesirable, the old stopped pipe being far superior in this respect. We have here, however, to discuss what is the most suitable form of flute for use in combination with pure organ tone. Various kinds of flute tone have been put on their trial by organ builders; indeed, it is not an exaggeration to say that nearly every firm of repute has its own particular type of claribel designed to form an integral part of the great flue chorus. Thus, one may find one firm of builders introducing the Bishop clarabella, another the inverted lipped wald flöte, another the harmonic metal flute, another the fundamental-toned metal flute with a high cut mouth, another the double mouthed wooden open or stopped flute (doppelflöte), another the large scaled claribel with leathered lip (tibia), another the large scaled metal stopped flute with leathered lip (tibia clausa), another the same in wood, and yet another the triangular hohl flöte of Schulze, with or without inverted mouth; and this list is not exhaustive by any means. Now, the question may fairly be asked: Which of these numerous types of flute best serves the purpose in view? The answer is, None of them, if any competition with the diapasons is aimed at. Pure organ tone in its ideal presentment is entirely capable of preserving its independence of assistance from flute tone; and, unless the latter is definitely subservient, may only too readily be injured by it. Hence no greater mistake could have been made than to include in the specification of the great organ an assertively voiced unison flute stop designed to cope with the diapason chorus. The hohl flötes of Schulze are by no means assertive, nor are the harmonic flutes of the late T. C. Lewis; and these two men appreciated the full value of pure organ tone. Provided, therefore, that the unison flute, be it open or stopped, of wood or metal, harmonic or otherwise, is treated as a subordinate voice in the diapason structure, the actual formation is of secondary importance.

In the enclosed and orchestral divisions of the organ extreme latitude is admissible in the treatment of flutes, and each type may be found dealt with under their respective names. (See CORNO FLUTE, DOLCE, DOPPEL FLÖTE, FLAUTO AMABILE, FLÛTE OUVERTE, HARMONIC FLUTE, HOHL FLÖTE, LIEBLICH GEDACKT, ROHR FLÖTE, STOPPED DIAPASON, TIBIA, WALD FLÖTE.)

The clarabella is seldom used in octave pitch, though occasionally it may appear on the unenclosed choir division as a 4ft. stop under the name of “suabe flöte.” The scale is two or three pipes smaller than the 8ft. stop.

The 16ft. clarabella frequently occurs on the pedal, but is never so labelled, the name of open diapason 16ft. being commonly (and incorrectly) assigned to it. The “tibia profunda” (quite a good name) of Hope-Jones is a large-scaled sub-clarabella with leathered lips (see TIBIA).

Either the claribel or the diapason formation may be employed for the 32ft. open pipe: both are conspicuously successful down to FFFF, and from the actual note produced it would be almost impossible to discriminate between the two types in this particular octave.

Very frequently the open portion of the manual 8ft. claribel flute does not extend below 2ft. C; and in any case no advantage is to be gained from using open pipes below the 4ft. C, as the break between open and stopped pipes can be completely covered by a skilful voicer and finisher.

Clarinet (sometimes labelled Orchestral Clarinet, Cremona, Corno di Bassetto, Basset Horn).—The spelling "clarionet" is incorrect. This is a reed stop, voiced in imitation of its prototype. The tube is cylindrical in shape, and half the length of a trumpet tube, this formation suppressing the even harmonics in the same way as a stopped flue pipe does. The shallot has a V-shaped opening, the apex being cut about a distance of one-quarter from the head or base. The tongue is only slightly curved, the tuning length being kept as short as possible. There are three types of clarinet tone, each of them legitimate productions as variants.
They are (1) the normal, round, woody *timbre* of moderate power, produced from a maximum scale of 1in. to $1\frac{1}{8}$in. at middle C with open tube; (2) the broad-toned, loud, basset horn or krummhorn type, produced from a large-scaled tube open at the top and sometimes surmounted by a conical bell; and (3) the thin piquant *timbre* produced from a small-scaled tube, often capped at the top with a slot for regulation. The latter type, with a sufficiently reduced scale of tube, becomes a musette *(q.v.)*


CLARINET

The first type is the most generally useful, and should be prescribed where only one clarinet stop is permissible in the scheme of an organ. All types are the better for enclosure; and although it is quite possible to voice good examples on low pressure increase of pressure enables the voicer to preserve the requisite smoothness when greater power is desired in an enclosed position.

The relative scaling of this stop is quite differently arranged from the normal ratio of progression for reeds, which halves on the thirty-second note. (See TRUMPET.) From CCC (16ft.) to BB (one note below tenor C) the usual reed scale ratio is employed; but from tenor C to C^3 the diameters very gradually diminish in what is known as "sevens and fives." Thus, supposing the scale of the tenor C (4ft.) pipe to be $1\frac{1}{4}$in., the next six pipes (T. C sharp to F sharp) are made to the same scale, namely $1\frac{1}{4}$in., and at G the diameter becomes $1\frac{3}{16}$in., and the next four (to B) are scaled the same, then middle C starts a fresh series of $1\frac{1}{8}$in. diameters, and so on to C in alt., after which the scale remains fixed to the top note. Some voicers prefer to stop the "seven and five" ratio at treble C and continue for the remainder of the compass with equal diameters; so that if the scale of treble C is $\frac{15}{16}$in., the rest of the pipes from this note are also $\frac{15}{16}$in. Flue pipes are often used for notes above top D, owing to the difficulty of keeping the small half length reeds in tune. The conical tip is scaled by the same method at middle C it is 2in. long, and the diameter at the tip is three-eighths to one-third of that at the top.

The following table of measurements shows the diameters and lengths of the tubes at the various C's:—

NOTE	DIAMETER	LENGTH (C=517$\frac{1}{2}$)
CCC (16ft.)	$2\frac{1}{4}$ in.	9ft. 4in.
CC (8ft.)	$1\frac{3}{4}$ in.	4ft. 7in.
T.C (4ft.)	$1\frac{1}{4}$ in.	2ft. 3in.
Mid. C (2ft.)	$1\frac{1}{8}$ in. (often 1 in.)	1ft. $1\frac{1}{2}$ in.
Treb. C (1ft.)	$\frac{15}{16}$ in.	$6\frac{3}{4}$ in.
C in alt (6in.)	$\frac{13}{16}$ in.	$3\frac{5}{8}$ in.

The 16ft. octave is difficult to voice (as are all lower octaves of reed stops) and requires a very experienced artist. The tone of a well voiced bass is round and smooth, every note being regular and even. The tongues must be weighted at the end (the weights being regulated in accordance with the pressure of wind used and the general dimensions of each pipe and its various parts) from CCC to BB. The lengths of the tubes when open may be nicely adjusted by tin slides, which can be tapped up or down as required.

Some of the French examples, labelled cor de basset, clarinette, have inverted conical tubes capped at the top: the tone is, however, less smooth and imitative than that which is imparted by a cylindrical tube.

Clarion.—An octave trumpet or tromba, 4ft. on the manuals and 8ft. on the pedal (See.) TRUMPET, TROMBA, TUBA.)

Concert Flute.—See HARMONIC FLUTE.

Contra.—A prefix indicating the stop as of suboctave pitch. Other prefixes bearing the same meaning are double, sub, gross.

Contra Bass.—Also named contra basso, double bass, violone (See VIOLONE.)

Contra Fagotto.—See BASSOON.

Contra Gamba.—See VIOLA, VIOLONE.

Contra Hautboy.—See OBOE.

Contra Posaune.—See TRUMPET.

Contra Trombone.—See TROMBONE.

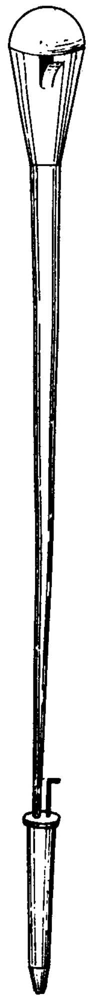
Contra Tuba.—See TUBA.

Contra Violone.—See VIOLONE.

Cor Anglais.—A reed stop imitating the tone of the orchestral instrument. In *timbre* it is allied to the oboe, but has a more hollow quality. Some idea of the tone may be gained by combining an 8ft. violoncello with a 4ft. stopped flute. The reed tube is that of a small-scaled oboe with the exception that the bell at the top is of dual formation, being inverted conical like the oboe bell *plus* a conical portion soldered on the top of that; in other words, the bell first widens and then narrows. It is not capped: the regulating slot should be cut below the bell, or else a half-cap soldered on the top. The tongue and shallot are the same as those of the oboe, though some voicers employ the orchestral oboe shallot. (See ORCHESTRAL OBOE.) The scale, though always small, varies considerably. The tenor C (4ft.) tube may be an inch in diameter at the top at the point at which the bell is soldered on, while the bell may be $1\frac{3}{4}$in. at the widest point (centre) and $1\frac{1}{4}$in. at the top.

COR ANGLAIS

This represents the minimum scaling. Some builders use the single bell, thus making their cor anglais pipe the same as other builders' orchestral oboe. At Bristol Cathedral, Walker used a half-length bassoon pipe completely capped at the top with a slot at a distance of two diameters below: the CC pipe is $1\frac{7}{16}$in. scale, the length of the tube being 3ft. $7\frac{1}{2}$in. Perhaps the best form of all would be a small-scaled oboe tube and bell fitted with a domed cap and slotted immediately below the cap. A good scale at tenor C (4ft.) would be 2in. at the top of the bell, 1in. at the bottom, the tube being full length. The lowest octave (CC to BB) is often made of bassoon pipes, but whatever formation is adopted the stop should be carried down to CC. From top F up viol pipes may be used.



COR ANGLAIS
(with domed cap)

Cor de Nuit.—See QUINTATÖN.

Cornet.—An obsolete mixture stop formed of large-scaled fluty-toned pipes, with the tierce rank topping the series, and intended for solo use. The inclusion of this stop in this work is really inconsistent with its aim, which is to deal with the stops of the modern organ only. It is mentioned, however, in view of the value that may be attached to the style of pipe employed in its composition, namely a full scale diapason pipe of the Father Smith type lightly blown,—an excellent recipe for fifth-sounding mutations. (See HARMONICS.)

Corno di Bassetto.—A large-scaled clarinet *(q.v.)*.

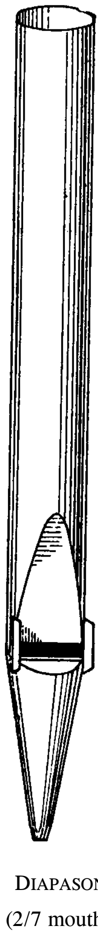
Corno Flute.—A flue stop invented by Mr. Herbert Norman, designed by him for use as a soft great organ accompanimental voice in place of the usual dulciana or dolce. It possesses an inverted languid (not nicked, of course), the top surface of which lies level with the lower lip-edge. The upper lip is arched and unflatted. The scale at middle C (2ft.) is $1\frac{1}{2}$in., the mouth being a fifth wide. The inverted languid is also used by Messrs. Hill, Norman & Beard for the bass and tenor octaves of some of their diapasons. The *convergent* flue thus formed helps to increase the quantity of wind discharged without retarding the speech.

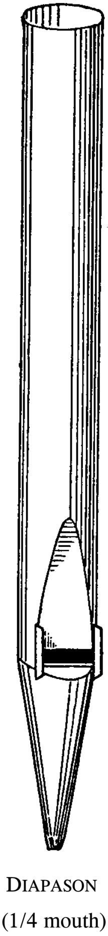
Cornopean.—This is the cornet-à-piston of the orchestra, the tone of which is intermediate between the horn and the trumpet. The organ stop named cornopean was introduced by William Hill as the chorus reed of the swell division, and was simply a trumpet of slightly increased scale. The name cornopean was retained by Henry Willis for his own swell chorus 8ft. reed; but the tone of his reeds was more fiery and the scaling frequently that of the trumpet, the wind pressure being almost invariably 7in., as at St. Paul's Cathedral, London. The cornopean on the choir division of the fine organ at St. Saviour's, Ealing, London, by Willis is the freest-toned reed in that instrument; so that it can readily be inferred that the trumpet and cornopean were to that master practically interchangeable terms in connection with *timbre*. If, however, we are to be guided by the tone of the cornet-à-piston, the stop under consideration belongs of necessity to the category of modern smooth toned reeds introduced by Robert Hope-Jones (or, more truthfully speaking by Franklin Lloyd, a Willis-trained reed voicer who migrated to Hope-Jones's factory). At the same time, there would be some distinction between the cornopean and the horn, the latter representing in the domain of reed voicing the minimum of harmonic development. The true cornopean would presumably not contain a more prominent chord of harmonics than that which characterises the tuba or tromba of Willis, while it might conceivably contain less harmonics provided that some of the "clang tint" be retained. In the fine organ by Harrison & Harrison in St. Mary Redcliffe, Bristol, there may be found in the swell division an 8ft. trumpet and an 8ft. horn, both on 12in. wind, presenting a complete harmonic contrast,—the contrast that in the domain of flue work would be obtained from the juxtaposition of a clarabella and a geigen or 'cello. Somewhere between these two tonal extremes falls the cornopean and the tromba.

In the modern swell organ the chorus reed foundation is based on more or less free trumpet tone, the scale and treatment being modelled on that of Willis, whose swells have always owed their magnificence and fame to the gorgeous quality of the 16ft., 8ft. and 4ft. chorus trumpets. Hence the name cornopean should be abandoned in favour of trumpet for the foundation reed of the swell; and it is even questionable whether the title is needed at all in the modern organ when it is borne in mind that every type and shade of chorus reed tone can be comprehended in the names trumpet, tuba, tromba and horn.

Cremona.—A false and corrupt name given to the clarinet.

Diapason (also called Principal).—The name given to the principal flue stop of the organ, representing pure organ tone in all its pitches, especially from the 16ft. pipe up to the 6in. pipe. Diapason tone is peculiar to the organ as a musical instrument in that it finds no counterpart in the orchestra. All other tones in the organ are more or less imitative of or inspired by the tone of their orchestral prototypes: the diapason alone claims absolute independence of the orchestra. Hence the cinematic organ—designed to serve as an effective substitute for the cinematic orchestra, and often nick-named the "one man band"—has little or no scope for diapason tone, and indeed, in the opinion of many critics of repute, is better without it. The organ of classical and ecclesiastical tradition and development is, however, as little able to dispense with its diapasons as a violin to dispense with its strings. Pure organ tone is *par excellence* the "music of the vaulted shrine," possessing that mysterious quality of otherworldliness that "brings all heaven before one's eyes."


DIAPASON (2/7 mouth)


DIAPASON (1/4 mouth)

The tone of the diapason stands midway between the two extremes of flute and string: it may sometimes incline towards the one, sometimes towards the other, but never can it cross the boundary line without losing its distinctive character. It partakes of some of the body and foundation of the flute category, while possessing a modicum of harmonic development known as the "natural string;" but the *timbre* is such that neither flute nor string tone is unduly favoured. Thus, the name diapason is the very best that could be given to it, the word signifying a standard or normal tone, all deviations from which are classed as variants. At the same time it has to be remembered that, strictly speaking, the diapason belongs to the order of flue or mouth pipes, and represents the basic tone of that *genus*, so that its relation to the combinational reeds of the organ is not determined without some difficulty. To say that the diapason holds the balance between flute, string and reed tone is to propound a theory of tonal architecture which in the modern organ is seldom if ever carried into practice. Such a theory, pushed to its logical terminus, would result in the relegation of chorus reed tone to a position of complete subordination in the tonal scheme; for the most powerful of diapasons must yield to the overpowering personality of the modern heavy pressure trumpet or tuba. In the days when low pressures were in vogue and reeds and diapasons shared the same soundboard, the supremacy of the diapason was a natural and realisable conception. Nothing has proved more disastrous to the interests of true diapason tone than modern attempts to produce something that will successfully cope with the heavy pressure chorus reed. So far these heroic attempts have been thoroughly retrograde, pure organ tone having been sacrificed on the altar of foundationalism; and all in vain, for the reed work still holds its own in the *ensemble*. The true solution of the problem is not to be found in these inartistic methods of bolstering up the flue foundation, but in the arrangement of a special reed chorus designed to balance the diapason chorus. We already have for this purpose the Willis swell organ, which is actually a secondary reed chorus under the control of the swell shutters. It is thus possible to create a perfect homogeneity by the combination of the unenclosed diapason organ and the enclosed reed organ; for the diapasons can be made sufficiently powerful and the reeds sufficiently restrained, with artificial harmonics to balance both, without injury to either of these contrasting tone colours. The primary reed chorus, however, must be treated independently of the flue foundation: it then occupies the same position in organ tonal design as the brass occupies in the orchestra, its purpose being to supply climax effects. Thus it can be seen that the question of determining the relationship of the diapason to other tonal categories is bound up with the whole question of tonal architecture; and the only reasonable conclusions at which it is possible to arrive are (1) that at all costs pure organ tone (that is, true diapason tone) must be produced within the limits of natural voicing, and a selection of all the other tones must be subordinated to it in such a way that it may hold the balance between them; (2) that after this primary condition has been fulfilled, there can be no objection on artistic grounds to the provision of a specially powerful bombarde division designed for use in *fortissimo* combinations.

We must now speak of the unison diapason and its voicing. (The treatment and voicing of the octave ranks will be discussed under HARMONICS and DOUBLE DIAPASON.) There are four classes of diapason: (1) the early English, (2) the Schulze, (3) the geigen and (4) the modern English.

(1) The *early English* examples are familiar to most of us. They may be recognised by their peaceful character, singing light-heartedly on wind pressures of $2\frac{1}{2}$in. to 3in.; thin languids obtusely bevelled and lightly nicked, low-cut mouths readily overblowing to the octave on an increased pressure, straight-flatted lips, small foot-holes, scales ranging from $2\frac{1}{2}$in. to $3\frac{1}{2}$in. at the 4ft. pipe,—these are the chief characteristics of the *genus*. The proper place for such a diapason seems to be on the unenclosed "chayre" division of a church organ, though it makes a beautiful third or fourth open on the great where such exists. The author has reproduced the type in a number of organs, as for instance at St. Peter's Mission, Uxbridge, St. Barnabas, Southfields, St. Elizabeth's (R.C.) Church, Richmond. Messrs. Hele & Co. have recently introduced a specimen in their organ at the Abbey Church of Buckfast (Devon). The title "early English diapason" was first adopted by the author in his earlier work, *Studies in Organ Tone*, where the construction of the pipe is described in detail. The secret, if there is one, lies in the obtuse bevel of the languid, the flat underlip, and the gentle supply of wind. Despite assertions to the contrary, Father Time adds his contribution in the finish-voicing of these diapasons.

(2) *Schulze diapasons* are to be found in the fine instruments voiced by that master at Armley, Hindley, Charterhouse, Tyne Dock, Doncaster, &c. Nearly every builder in this country has copied them with varying success. Their character is very striking; the tone is bold, singing and mellow. The upper partials are developed as far as the third (15th), never more, often less (as at Hindley), and there is never a sus-

picion of flutiness. At the root of Schulze's system lay the attempt to produce the maximum effect from low pressures. He made the foot-holes of the pipes very much larger than his contemporary English builders would have dreamed of doing: on the older type of pipe such a process would have utterly upset the speech. But the newer form of languid with its more acute bevel, introduced by Schulze into this country, made it possible to cut up the mouth to a greater extent without causing windiness and at the same time preventing the pipe overblowing to its octave or twelfth. Schulze, however, was averse from the practice of cutting up for pure organ tone, and in order to keep the note of his generously blown pipe on its prime harmonic and thoroughly sound in speech, he pulled the mouth outward, so to speak, instead of raising it: thus, by increasing the width rather than the height, the necessary mouth-area was provided. The standard width of mouth for diapasons is one-fourth of the pipe's circumference, and this was the width adopted by nearly all the old builders, the two-ninths width having been occasionally used. Schulze employed a width of two-sevenths almost invariably; for the large diapason he voiced for Leeds Parish Church he used four-fifteenths (very slightly narrower than two-sevenths), and a fourth mouth for the small diapason of that instrument. The two-sevenths mouth was cut up only a fourth of its width, and Schulze did not vary the cut up for varying wind pressures but altered the size of the foot-hole accordingly. On $2\frac{1}{2}$in. wind the foot-bore was enormous: the author well remembers the shock he experienced on seeing the bores of the upper octave pipes of the diapason and the mixtures belonging to the celebrated exhibition organ of 1851, voiced by Schulze on a wind pressure of $2\frac{1}{2}$in., the diameters of which were almost as large as the top of the pipe-body! The foot-hole diminishes with every increase of pressure, but not in the same ratio, since on the higher pressures (up to $3\frac{3}{4}$in.) the scaling of the pipe is enlarged with a view to adjusting the balance of parts. Up to $3\frac{3}{4}$in. of wind the two-sevenths mouth with the fourth cut up is capable of producing a pure diapason note of the finest quality, but beyond this limit (certainly on pressures of 4in. and upwards) the reduction of the area of discharge at the pipe-foot reaches a point at which it is no longer possible to retain the tonal characteristic. Even on $3\frac{3}{4}$in. it is questionable whether this mouth-area does not rather contribute a tendency to coarseness which would be noticeable in a non-resonant building, so that in any case we would seem to have reached the parting of the ways at this point. Schulze himself appears to have detected this tendency, as in his famous Leeds example, which was voiced on this pressure, he reduced the mouth-width to four-fifteenths (as we have already seen), in order that he might make a slight increase in the cut up (to two-sevenths of the width). By this adjustment of the area he still retained the majesty of tone for which his diapasons are celebrated without any sacrifice of refinement. The two-sevenths mouth, however, is not an absolutely indispensable factor in the production of the Schulze characteristic: it is possible to obtain a magnificent tone from the standard fourth mouth appropriately cut up by treating the foot-bores in the same way and thus admitting the requisite quantity of wind to the pipes at a suitable pressure. A phenomenal instance of this may be seen and heard at Bredon Church (near Tewkesbury), where the great organ contains a large diapason with a fourth by two-sevenths mouth, the scale being the same as at Tyne Dock and Leeds, and voiced on a pressure of 3in. only. In this example the characteristic Schulze tone is faithfully reproduced.

Other details connected with Schulze's diapason voicing may be briefly mentioned. The scaling varies from $2\frac{5}{8}$in. to $3\frac{3}{4}$in. at the 4ft. pipe. At Hindley (St. Peter's Church), the No. 1 diapason on the great is $3\frac{1}{4}$in.; at St. Bartholomew's, Armley, the major principal is $3\frac{1}{2}$in.; at St. Mary's, Tyne Dock, and at Leeds Parish Church the scale is $3\frac{3}{4}$in. The No. 2 diapason at Hindley is $2\frac{7}{8}$in. The CC to BB octave was frequently constructed in wood, Tyne Dock and Leeds being exceptions. The details of these pipes are given under DOUBLE DIAPASON.

The flatting of the lower lip was a departure from the more or less vertical form adopted by the early pipe makers. There is a distinct inward curve or convergence in the Schulze flatting, and this still represents the moderate curvature for general use to-day. The Willis "dubbed" lip yet further exaggerates the curve, and is chiefly of value in the domain of high pressure flue voicing. For the production of *cantabile* tone, the Schulze flatting cannot be improved upon.

The languid (as has already been pointed out) is acute-bevelled, this particular feature really forming the line of demarcation between ancient and modern flue voicing. A great characteristic of Schulze's voicing of diapasons is what is technically known as "slow speech." This does not mean that the pipe dragged its note or spoke with hesitation: it is but another expression for *cantabile* or singing tone, natural intonation, a something between slowness and quickness of speech yet