# The Recent Revolution in Organ Building

George Laing Miller

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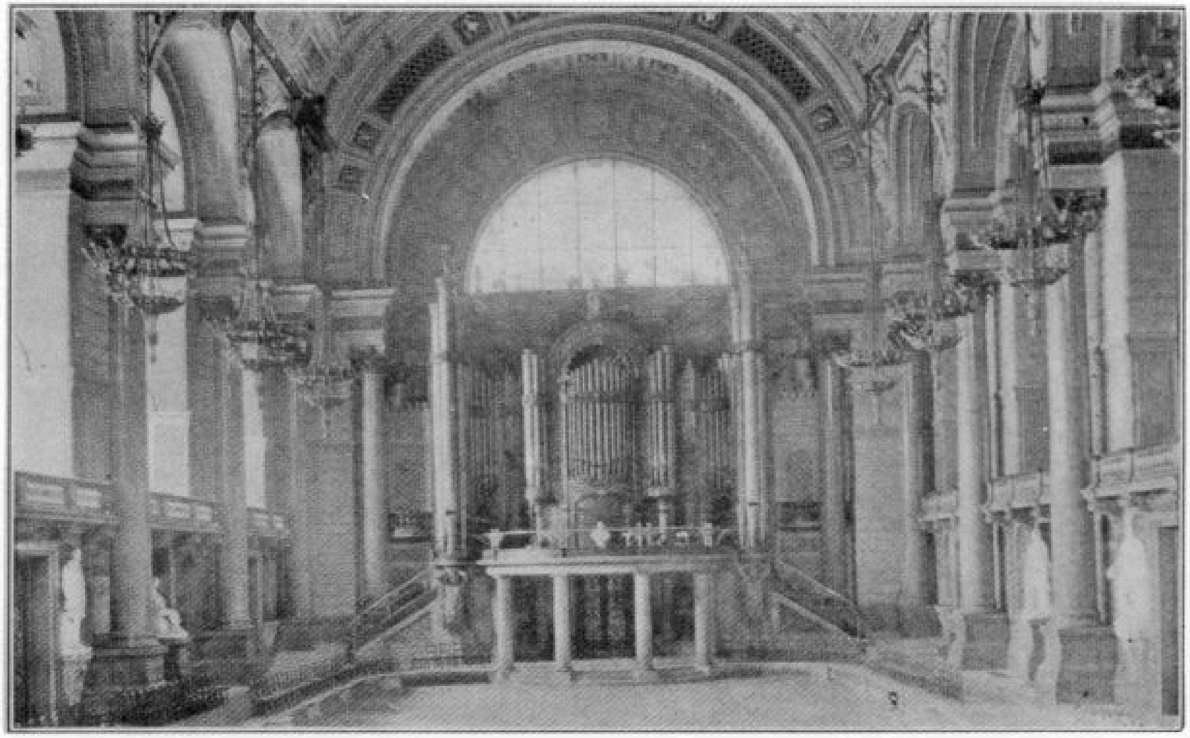

*The Organ in St. George's Hall, Liverpool, Eng. Built by Henry Willis in 1855. Rebuilt 1867 and 1898*
*The White Marble Bust Seen in Front is That of W. T. Best.*

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# The Recent Revolution in Organ Building

*Being an Account of Modern Developments*

**By**

# GEORGE LAING MILLER

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# FOREWORD

Some years ago the elders and deacons of a Scotch church were assembled in solemn conclave to discuss the prospective installation of a pipe organ. The table was piled high with plans and specifications and discussion ran rife as to whether they should have a two-manual or a three-manual instrument—a Great and Swell or a Great, Swell, and Choir organ. At last Deacon MacNab, the church treasurer and a personage of importance, got a chance to speak.

"Mr. Chairman," said he, "I don't see why we should have a Great, a Swell, and a Choir organ. I think that one organ is quite enough."

Now, Deacon MacNab was a master tailor, and a good one at that; so the musical man who was pushing the thing through appealed to his professional instincts in explaining the situation by saying:

"Surely, Mr. MacNab, you would not say that a man was properly dressed with only a coat on! You would expect him to have on a coat, waistcoat and trousers!" And the day was won for the three-manual organ.

Of course there had been no organ in this church before, or the worthy deacon might have known more about it. If he had read the second chapter of this book, he would have known all about it. The following pages have been written with the idea of helping those who may be placed in a similar position; who may be called upon to decide the serious question of the purchase of a new organ for their church, town hall, or an auditorium, or the rebuilding of the old one now in use; who are distracted by the conflicting plans and contending claims of rival organ builders; who are disinclined to rely upon so-called "expert" opinion, but wish to look into these things for themselves and intelligently purchase an instrument which is thoroughly up-to-date in every particular, which will not drive the organist to the verge of profanity every time he plays upon it, and will not prove a snug source of income to its builders—for repairs.

The organ-student, the amateur, and eke the professional organist, will also find much here that will interest them and lead to a better understanding of the instrument.

The revolution in organ-building herein described has for the most part taken place under the personal notice of the author, during the last fifty years. The organists of a younger generation are to be congratulated on the facilities now placed at their disposal, mainly by the genius and persevering efforts of four men—as hereinafter described.

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# THE RECENT REVOLUTION IN ORGAN BUILDING

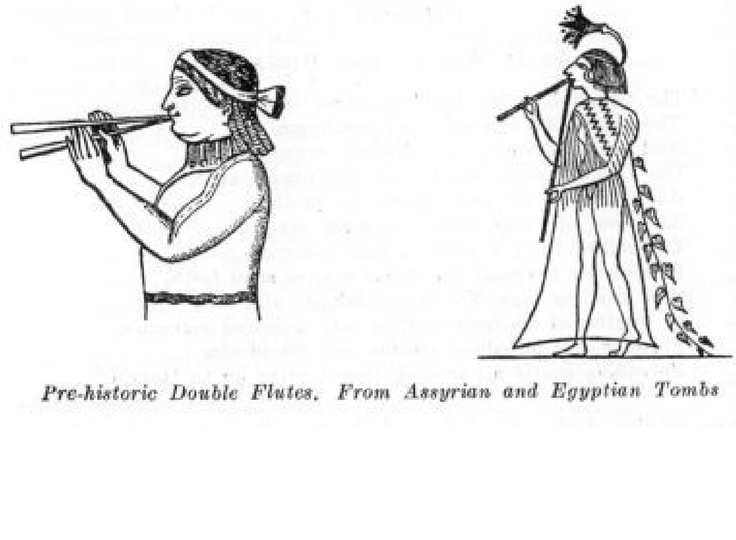
## CHAPTER I.

## AS IT WAS IN THE BEGINNING.

"The Organ breathes its deep-voiced solemn notes,
The people join and sing, in pious hymns
And psalms devout; harmoniously attun'd,
The Choral voices blend; the long-drawn aisles
At every close the ling'ring strains prolong:
And now, of varied tubes and reedy pipes,
The skilful hand a soften'd stop controuls:
In sweetest harmony the dulcet strains steal forth,
Now swelling high, and now subdued; afar they float
In lengthened whispers melting into cadenced murmurs,
Forming soft melodious strains, and placid airs,
Spreading gently all around, then soaring up to Heav'n!"
—*Dryden*.

The origin of the pipe organ is lost in the mists of antiquity. Tradition hath it that there was one in Solomon's Temple at Jerusalem, the sound of which could be heard at the Mount of Olives. It has the honor of being the first wind instrument mentioned in the Bible (Genesis iv, 21), where we are told that "Jubal is the father of all such as handle the harp and the organ." The Hebrew word here is *ugab*, which is sometimes translated in the Septuagint by cithara (the ancient lute), sometimes by *psalm*, sometimes by *organ*. Sir John Stainer ("Dictionary of Musical Terms," p. 444) says: "It is probable that in its earliest form the *ugab* was nothing more than a Pan's-pipes or syrinx, but that it gradually developed into a more important instrument." The passage, however, shows that the ugab was known in the time of Moses, who was "learned in all the learning of the Egyptians."

The flute, a component part of the organ, is one of the most ancient of musical instruments. We find it pictured on the walls of early Egyptian tombs, and specimens of it, still in playable condition, have been unearthed and can be seen in our museums. Some of them were double, as shown in the illustration. Side by side with these flutes we find the shepherd's pipe with a reed or strip of cane in the mouthpiece, which may be found in the Tyrol at the present day. The next step was probably the bagpipes. Here we find four of these pipes attached to a bag. The melody or tune is played on one of the pipes furnished with holes for the purpose, while the other three give a drone, bass. The bag, being blown up, forms a wind reservoir and the amount of tone can be regulated by the pressure of the arm. Here we have the precursor of the organ bellows. Next comes the Irish bagpipes, with a bellows worked by the arm furnishing the wind to the bag, the reservoir, and producing a much sweeter tone. This is one line of advance.



*Pre-historic Double Flutes. From Assyrian and Egyptian Tombs*

### Pre-historic Double Flutes. From Assyrian and Egyptian Tombs

On the other hand we have the syrinx or Pan's-pipes. Stainer says this was undoubtedly the precursor of the organ. "It was formed of seven, eight or nine short hollow reeds, fixed together by wax, and cut in graduated lengths so as to produce a musical scale. The lower ends of the reeds were closed and the upper open and on a level, so that the mouth could easily pass from one pipe to another." This is the instrument used at the present day by the Punch and Judy man. He wears it fastened around his throat, turning his head from side to side as he blows, while with his hands he beats a drum.

The next step would be to combine a set of flutes or shepherd's pipes with the wind reservoir of the bagpipes, placing a little slider under the mouthpiece of each pipe which could be opened or closed at will, so that they would not all speak at once. Then some genius steadied the wind pressure by pumping air into a reservoir partly filled with water. This was the so-called "hydraulic organ," which name has given rise to the impression that the pipes were played by the water passing through them—which is impossible.

And so we come down the ages to the Christian era. The Talmud mentions an organ (magrepha) having ten pipes played by a keyboard as being in existence in the Second Century. "Aldhelm (who died A. D. 709) mentions an organ which had gilt pipes. An organ having leaden pipes was placed in the Church of S. Corneille, at Compiegne, in the middle of the Eighth Century." St. Dunstan had an organ with pipes made of brass. Then we have the organ in Winchester Cathedral, England, described by Wulfstan of Winchester in his "Life of Saint Swithin." This was a double organ, requiring two organists to play it. It contained 400 pipes and had thirteen pairs of bellows. It was intended to be heard all over Winchester in honor of St. Peter, to whom the Cathedral was dedicated.

The year was now A. D. 951, and this is an important date to remember, as modern harmony took its rise about this time. Before this, as far as we know, there had been no harmony beyond a drone bass, and the vast companies of musicians described in Holy Writ and elsewhere must have played and sung in octaves and unison. I quote Stainer again:

"The large pipes of every key of the oldest organs stood in front; the whole instrument sounded and shrieked in a harsh and loud manner. The keyboard had eleven, twelve, even thirteen keys in diatonic succession without semitones. It was impossible to get anything else than a choral melody for one voice only on such an organ * * * the breadth of a keyboard containing nine keys extended to three-quarters the length of a yard, that of the single key amounted to three inches * * * even from five to six inches * * * The valves of the keys and the whole mechanism being clumsy, playing with the finger was not to be thought of, but the keys were obliged to be struck with the clenched fist, and the organist was often called '*pulsator organum*' (organ beater)."

Gradually the keys were reduced in size and the semitones were added. By 1499 they had almost reached the present normal proportions. In 1470 pedals were invented by Bernard, the German, a skilful musician of Venice, the pipe work was improved and so we come to the Sixteenth Century[1] after which the organ remained almost *in statu quo* for hundreds of years.

Since then there have been four great landmarks in organ construction, viz:

1. The invention of the swell box by Jordan in 1713;

2. The invention of the horizontal bellows, by Samuel Green, in 1789;

3. The invention of the pneumatic lever by Barker in 1832; and the electro-pneumatic action, by Péschard in 1866; and,

4. The marvelous improvements in mechanism and tone production and control in 1886 to 1913 by Robt. Hope-Jones.

[1] The organ compositions of Frescobaldi, a celebrated Italian organist who flourished 1591-1640, show that the organ must in his time have been playable by the fingers.

## CHAPTER II.

## THE ORGAN IN THE NINETEENTH CENTURY.

Before proceeding further we propose to give a brief description of the construction of the organ at the beginning of the last century and explain the technical terms we shall use later.

As everybody knows, the tone comes from the pipes, some of which are to be seen in the front of the instrument. The pipes are of various shapes and sizes and are arranged in ranks or rows upon the *wind-chest*. Each of these ranks is called a *stop* or *register*. It should be borne in mind that this word *stop* refers to the row of pipes, and *not* to the *stop-knobs* by the keyboard which operate the mechanism bringing the row of pipes into play. Much confusion of ideas prevails on this point, and cheap builders used to take advantage of it by providing two stop-knobs for each row of pipes, thereby making their instruments appear to contain more pipes than were actually there. This practice was at one time very prevalent in the United States.

The early organ-builders to obtain variety of tone divided the pipes into groups placed in various positions, each playable from a separate keyboard, and this practice prevails to this day. An average church organ will contain three or four wind-chests, each with its quota of pipes and designated as follows:

1. The Great organ, consisting of the front pipes and other loud-speaking stops. Back of this and usually elevated above the level of the Great organ pipes is

2. The Swell organ, all the pipes of which are contained in a wooden box with Venetian shutters in front, the opening or closing of which modifies the tone; below the Swell box is placed

3. The Choir organ, containing soft speaking pipes suitable for accompanying the human voice; and back of all or on the sides is

4. The Pedal organ, containing the large pipes played by the pedals.

Larger instruments have still another wind-chest called the Solo organ, the pipes of which are very loud and are usually placed high above the Great organ.

In some large English organs, notably that in the Town Hall of Leeds, a further division was effected, the pipes of the Great organ being placed on two wind-chests, one behind the other. They were known as Front Great and Back Great.

The original reason for dividing a church organ in this manner seems to have been the impossibility of supplying a large number of stops with wind from a single wind-chest.

It will thus be seen that our average church organ is really made up of three or four smaller organs combined.

The *wind-chest* is an oblong box supplied with air under pressure from the bellows and containing the valves (called *pallets*) controlling the access of the wind to the pipes. Between the pallet and the foot of the pipe comes another valve called the *slider*, which controls the access of the wind to the whole row of pipes or stop. The pallet is operated from the keyboard by the *key action*. Every key on the keyboard has a corresponding pallet in the wind-chest, and every stop-knob operates a slider under the pipes, so that both a slider must be drawn and a pallet depressed before any sound can be got from the pipes. The drawings will make this plain.

Fig. 1 is a front view and Fig. 2 a side view of the wind-chest. A is the wind-chest into which compressed atmospheric air has been introduced, either through the side or bottom, from the end of the wind-trunk B. The pallets, C C C, are held against the openings, D D D, leading from the wind-chest to the mouth of the pipes, by springs underneath them.

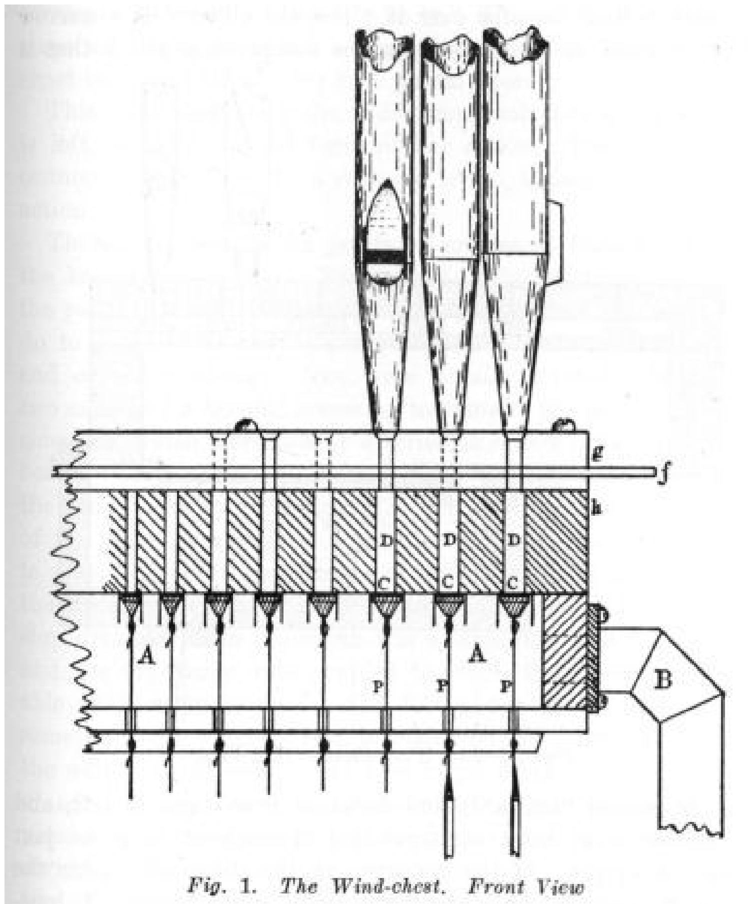



**Fig. 1. The Wind-chest. Front View**

The spring S (Fig. 2) keeps the pallet C against the opening into D. The wires called *pull-downs* (P, P, P), which pass through small holes in the bottom of the wind-chest and are in connection with the keyboard, are attached to a loop of wire called the *pallet-eye*, fastened to the movable end of the pallet. A piece of wire is placed on each side of every pallet to steady it and keep it in the perpendicular during its ascent and descent, and every pallet is covered at top with soft leather, to make it fit closely and work quietly. When P is pulled down (Fig. 1) the pallet C descends, and air from the wind-chest A rushes through D into the pipe over it. But the slider *f* is a narrow strip of wood, so placed between the woodwork *g* and *h* that it may be moved backwards and forwards from right to left, and is pierced with holes corresponding throughout to those just under the pipes. If the apertures in the slider are under the pipes, the opening of a pallet will make a pipe speak; if, however, the slider has been moved so that the apertures do not correspond, even if the pallet be opened and the chest full of air from the trunks, no sound will be produced.

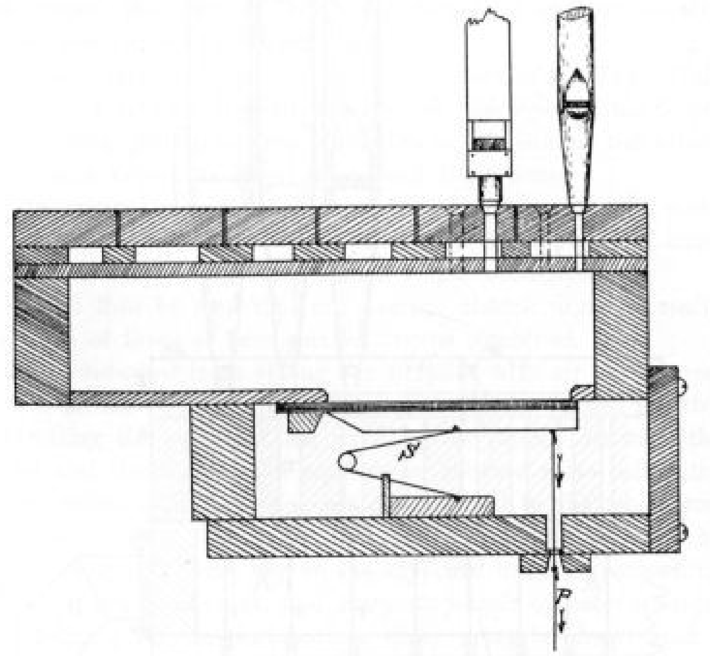


*Fig. 2. The Wind-chest. Side View*

**Fig. 2. The Wind-chest. Side View**

When the apertures in the slider are under those below the pipe, the "stop," the handle of which controls the position of the slider, is said to be *out*, or *drawn*. When the apertures do not correspond, the stop is said to be *in*. Thus it is that when no stops are drawn no sound is produced, even although the wind-chest be full of air and the keys played upon.

This wind-chest with the slider stop control is about all that is left to us of the old form of key action. The pallets were connected to the keys by a series of levers, known as the tracker action.

There were usually six joints or sources of friction, between the key and the pallet. To overcome this resistance and close the pallet required a strong spring. Inasmuch as it would never do to put all the large pipes (because of their weight) at one end of the wind-chest, they were usually divided between the two ends and it became necessary to transfer the pull of the keys sideways, which was done by a series of *rollers* called the *roller-board*. This, of course, increased the friction and necessitated the use of a still stronger spring. That with the increased area of the pallet is why the lower notes of the organ were so hard to play. And to the resistance of the spring must also be added the resistance of the wind-pressure, which increased with every stop drawn. When the organ was a large one with many stops, and the keyboards were coupled together, it required considerable exertion to bring out the full power of the instrument; sometimes the organist had to stand on the pedals and throw the weight of his body on the keys to get a big chord. All kinds of schemes were tried to lighten the "touch," as the required pressure on the keys is called, the most successful of which was dividing the pallet into two parts which admitted a small quantity of wind to enter the groove and release the pressure before the pallet was fully opened; but even on the best of organs the performance of music played with ease upon modern instruments was absolutely impossible.

## CHAPTER III.

## THE DAWN OF A NEW ERA—THE PNEUMATIC LEVER.

Just as we no longer see four men tugging at the steering wheel of an ocean steamer, the intervention of the steam steering gear rendering the use of so much physical force unnecessary, so it now occurred to an organ-builder in the city of Bath, England, named Charles Spachman Barker,[1] to enlist the force of the organ wind itself to overcome the resistance of the pallets in the wind-chest. This contrivance is known as the *pneumatic lever*, and consists of a toy bellows about nine inches long, inserted in the middle of the key action. The exertion of depressing the key is now reduced to the small amount of force required to open a valve, half an inch in width, which admits wind to the bellows. The bellows, being expanded by the wind, pulls down the pallet in the wind-chest; the bellows does all the hard work. The drawing on the next page, which shows the lever as improved by the eminent English organ-builder, Henry Willis, shows the cycle of operation.

When either the finger or foot is pressed upon a key connected with *k*, the outer end of the back-fall *gg* is pulled down, which opens the pallet *p*. The compressed air in *a* then rushes through the groove *bb* into the bellows *cc*, which rises and lifts with it all the action attached to it by *l*. As the top of the bellows *cc* rises, it lifts up the throttle-valve *d* (regulated by the wire *m*) which prevents the ingress of any more compressed air by *bb*. But the action of the key on *gg*, which opened the pallet *p*, also allowed the double-acting waste-valve *e* to close, and the tape *f* hangs loose. The compressed air, therefore, as it is admitted through *bb* cannot escape, but on the other hand when the key releases the outer end of *g*, and lets it rise up again, the tape *f* becomes tightened and opens the waste-valve, the bellows *cc* then drops into its closed position.

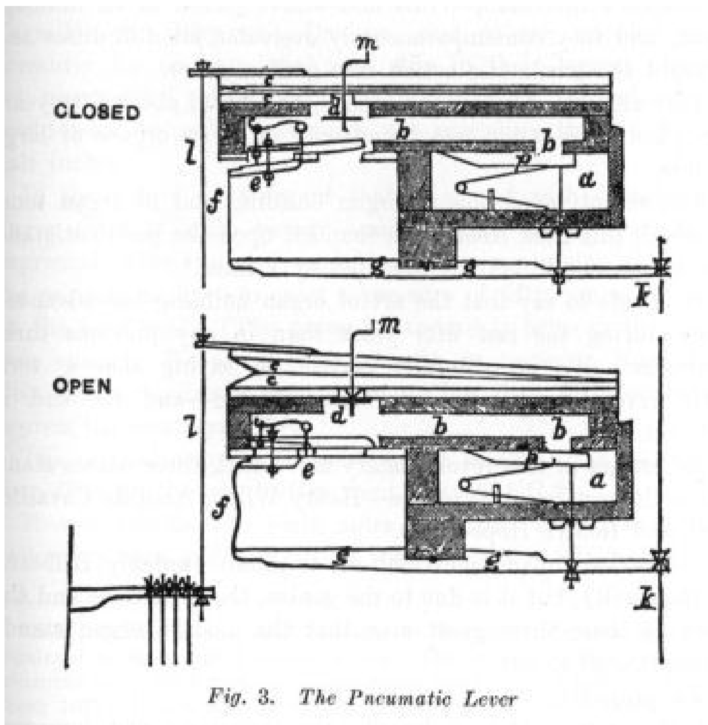



**Fig. 3. The Pneumatic Lever**

The organ touch could now be made as light as that of a pianoforte, much lighter than ever before.

This epoch-making invention, introduced in 1832, rendered possible extraordinary developments. It was at first strangely ignored and opposed. The English organ-builders refused to take it up. Barker was at length driven to France, where, in the person of Aristide Cavaillé-Coll, he found a more far-seeing man.

After Cavaillé-Coll had fully demonstrated the practical value of Barker's invention, Willis and others joined in its development, and they contemporaneously overcame all difficulties and brought the pneumatic action into general favor.

This process, of course, took time, and up to about fifty years ago pneumatic action was found only in a few organs of large calibre.

The recent revolution in organ building and in organ tone, of which this book treats, was founded upon the pneumatic and electro-pneumatic actions invented by Barker.[2]

It is safe to say that the art of organ building has advanced more during the last fifty years than in any previous three centuries. We are literally correct in saying that a veritable revolution has already been effected—and the end is not yet.

As leaders in this revolutionary movement, three names stand out with startling prominence—Henry Willis, Aristide Cavaillé-Coll and Robert Hope-Jones.

Others have made contributions to detail (notably Hilborne L. Roosevelt), but it is due to the genius, the inventions and the work of those three great men that the modern organ stands where it does to-day.

We propose:

1. To enumerate and describe the inventions and improvements that have so entirely transformed the instrument;

2. To trace the progress of the revolution in our own country; and,

3. To describe the chief actors in the drama.

In the middle of the last century all organs were voiced on light wind pressure,[3] mostly from an inch and a half to three inches. True, the celebrated builder, William Hill, placed in his organ at Birmingham Town Hall, England, so early as 1833, a Tuba voiced on about eleven inches wind pressure, and Willis, Cavaillé-Coll, Gray and Davison, and others, adopted high pressures for an occasional reed stop in their largest organs; yet ninety-nine per cent. of the organs built throughout the world were voiced on pressures not exceeding three and one-half inches.

In those days most organs that were met with demanded a finger force of some twenty ounces before the keys could be depressed, when coupled, and it was no uncommon thing for the organist to have to exert a pressure of fifty ounces or more on the bass keys. (The present standard is between three and four ounces. We are acquainted with an organ in New York City which requires a pressure of no less than forty ounces to depress the bass keys.)

The manual compass on these organs seldom extended higher than $f^2$ or $g^3$, though it often went down to GG.[4]

It was common to omit notes from the lower octave for economy's sake, and many stops were habitually left destitute of their bottom octaves altogether. Frequently the less important keyboards would not descend farther than tenor C.[5]

The compass of the pedal board (when there was a pedal board at all) varied anywhere from one octave to about two and a quarter octaves. The pedal keys were almost invariably straight and the pedal boards flat.

Fig. 4. Nomenclature of Organ Keyboard

**Fig. 4. Nomenclature of Organ Keyboard**

[1] The invention of the pneumatic lever has been claimed for Mr. Hamilton, of Edinburgh, Scotland. It is, however, generally credited to Barker and known as the "Barker pneumatic lever." (See also note about Joseph Booth, page 129.)

[2] Barker was also associated with Péschard, who in 1864 patented jointly with him the electro-pneumatic action. (See page 37.)

[3] The pressure of the wind supplied by the old horizontal bellows is regulated by the weights placed on top. The amount of this pressure is measured by a wind-gauge or anemometer invented by Christian Förmer about 1677. It is a bent glass tube, double U shaped, into which a little water is poured. On

placing one end of it fitted with a socket into one of the holes in the wind-chest (in place of a pipe) and admitting the wind from the bellows the water is forced up the tube, and the difference between the level of the surface of the water in the two legs of the tube is measured in inches. Thus, we always talk of the pressure of wind in an organ as being so many inches.

[4] The organ in Great Homer Street Wesleyan Chapel, Liverpool, England, had manuals extending down to CCC. It was built for a man who could not play the pedals and thus obtained 16 ft. tone from the keys. The old gallery organ in Trinity Church, New York, also has this compass.

[5] Tenor C is the lowest note of the tenor voice or the tenor violin (viola). It is one octave from the bottom note of a modern organ keyboard, which is called CC. The lowest note of the pedal-board is CCC. Counting from the bottom upwards on the manual we have, therefore, CC (double C), C (tenor C), c (middle C), $c^1$ (treble C), $c^2$ (C in alt) and $c^3$ (C in altissimo). This is the highest note on the keyboard of 61 keys. According to the modern nomenclature of the *pianoforte* keyboard this note is $c^4$, and is frequently so stated erroneously in organ specifications.

GG is four notes below CC, *the break in the scale coming between GG and FFF*. Tenor C is an important note to remember. Here is where the cheap builder came in again. He cut his stops short at tenor C, trusting to the pedal pipes to cover the deficiency.

PROSPER-ANTOINE MOITESSIER,

INVENTOR OF TUBULAR PNEUMATIC ACTION

## PROSPER-ANTOINE MOITESSIER, INVENTOR OF TUBULAR PNEUMATIC ACTION

In the year 1845, Prosper-Antoine Moitessier, an organ-builder of Montpellier, France, patented what he called "*abrégé pneumatique*," an organ action in which all back-falls and rollers were replaced by tubes operated by exhaust air. In 1850 he built with this action an organ of 42 speaking stops for the church of Notre Dame de la Dalbade at Toulouse. This organ lasted 33 years. In 1866 Fermis, schoolmaster and village organist of Hanterire, near Toulouse, improved on Moitessier's action by combining tubes conveying compressed air with the Barker lever. An organ was built on this system for the Paris Exhibition of 1867, which came under the notice of Henry Willis, by which he was so struck that he was stimulated to experiment and develop his action, which culminated in the St. Paul's organ in 1872. (From article by Dr. Gabriel Bédart in Musical Opinion, London, July, 1908.)

# CHAPTER IV.

## PNEUMATIC AND ELECTRO-PNEUMATIC ACTIONS.

Undoubtedly the first improvements to be named must be the pneumatic and electro-pneumatic actions.

Without the use of these actions most of the advances we are about to chronicle would not have been effected.

As before stated, Cavaillé-Coll and Willis worked as pioneers in perfecting and in introducing the pneumatic action.

The pneumatic action used by Willis, Cavaillé-Coll and a score of other builders leaves little to be desired. It is thoroughly reliable and, where the keys are located close by the organ, is fairly prompt both in attack and repetition. Many of the pneumatic actions made to-day, however, are disappointing in these particulars.

## TUBULAR PNEUMATICS.[1]

In the year 1872 Henry Willis built an organ for St. Paul's Cathedral, London, which was divided in two portions, one on each side of the junction of the Choir with the Dome at an elevation of about thirty feet from the floor. The keyboards were placed inside one portion of the instrument, and instead of carrying trackers down and under the floor and up to the other side, as had hitherto been the custom in such cases, he made the connection by means of tubes like gaspipes, and made a pulse of *wind* travel down and across and up and into the pneumatic levers controlling the pipes and stops. Sir John Stainer describes it as "a triumph of mechanical skill." He was organist of St. Paul's for many years and ought to know. This was all very well for a cathedral, where

> ". . . . the long-drawn aisles
> The melodious strains prolong"

but here is what the eminent English organist, W. T. Best, said about tubular pneumatic action as applied to another organ used for concert purposes: "It is a complete failure; you cannot play a triplet on the Trumpet, and I consider it the most d——nable invention ever placed inside an organ." Notwithstanding these drawbacks this action became very fashionable after its demonstration at St. Paul's, and was used even in small organs in preference to the Barker lever. One builder confessed to the writer that he had suffered severe financial loss through installing this action. After expending considerable time (and time is money) in getting it to work right, the whole thing would be upset when the sexton started up the heating apparatus. The writer is acquainted with organs in New York City where these same conditions prevail.

The writer, however, will admit having seen some tubular actions which were fairly satisfactory, one in particular in the factory of Alfred Monk, London, England, where for demonstration purposes the tubes were fifty feet long. Dr. Bédart informs us that Puget, the famous organ builder of Toulouse, France, sets fifty feet as the limit of usefulness of this action.

Henry Willis & Sons in their description of the organ in the Lady Chapel of Liverpool Cathedral state that their action has been tested to a repetition of 1,000 per minute, quicker than any human finger can move. This is a square organ in one case, but we note they have adopted the electric action for the great cathedral organ where the distance of the pipes from the keys is too great for satisfactory response.

In view of the wide use at present of this action we give a drawing and description of its operation as patented and made by Mr. J. J. Binns, of Bramley, Leeds, England. J. Matthews, in his "Handbook of the Organ," says that this action is very good and free from drawbacks.

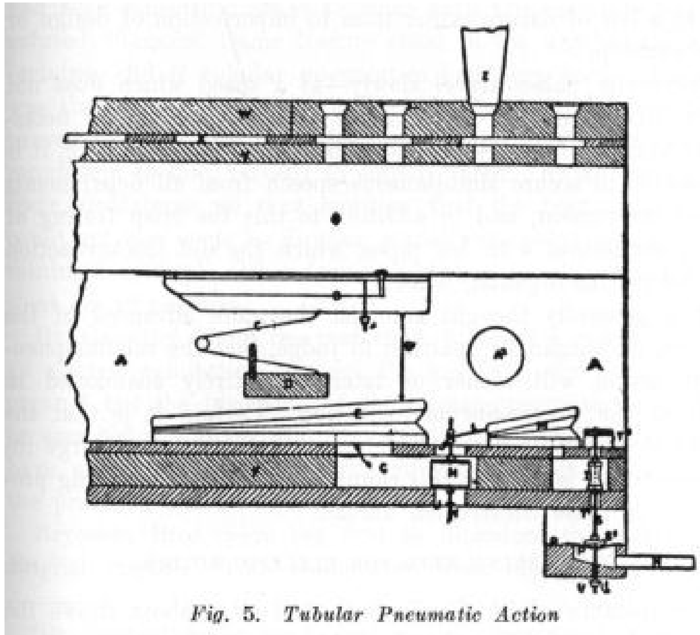


**Fig. 5. Tubular Pneumatic Action**

The tubes, N, from each key are fixed to the hole connected to the small puffs P in the puff-board E. Air under pressure is admitted by the key action and conveyed by the tubes N which raises the corresponding button valves $S^1$, lifting their spindles S and closing the apertures $T^2$ in the bottom of the wind-chest A, and opening a similar aperture T in the bottom of the cover-board F, causing the compressed air to escape from the exhaust bellows M, which closes, raising the solid valve H in the cover-board F and closing the aperture $J^1$ in the wind-chest A, shuts off the air from the bellows, which immediately closes, drawing down the pallet B, which admits air (or wind) to the pipes.

No tubular-pneumatic action is entirely satisfactory when the distance between the keys and the organ is great. This is often due to a law of nature rather than to imperfection of design or workmanship.

Pneumatic pulses travel slowly—at a speed which does not reach 1,100 feet per second. In large organs where necessarily some of the tubes are short and some have to be long, it is impossible to secure simultaneous speech from all departments of the instrument, and in addition to this the crisp feeling of direct connection with his pipes, which the old tracker action secured for the organist, is lost.

It is generally thought amongst the more advanced of the builders and organists qualified to judge, that the tubular-pneumatic action will sooner or later be entirely abandoned in favor of the electro-pneumatic action. Certain it is that the aid of electricity is now called in in practically every large instrument that is built in this country, and in an increasing proportion of those constructed abroad.

## THE CRYING NEED FOR ELECTRIC ACTION.

The instance of St. Paul's Cathedral cited above shows the demand that existed at that time for means whereby the organ could be played with the keyboards situated at some distance from the main body of the instrument. In the Cathedrals the organ was usually placed on a screen dividing the Choir from the Nave, completely obstructing the view down the church. There was a demand for its removal from this position (which was eventually done at St. Paul's, Chester, Durham, and other Cathedrals). Then in the large parish churches the quartet of singers in the west gallery where the organ was placed had been abolished. Boy choirs had been installed in the chancel, leaving the organ and organist in the west gallery, to keep time together as best they could. In the Cathedrals, too, the organist was a long way off from the choir. How glorious it would be if he could sit and play in their midst! Henry Willis & Sons stated in a letter to the London *Musical News*, in 1890, that they had been repeatedly asked to make such arrangements but had refused, "because Dame Nature stood in the way,"—which she certainly did if tubular pneumatics had been used. The fact was that up to this time all the electric actions invented had proved more or less unreliable, and Willis, who had an artistic reputation to lose, refused to employ them. As an instance of their clumsiness we may mention that the best contact they could get was made by dipping a platinum point in a cell containing mercury! Other forms of contact rapidly oxidized and went out of business.

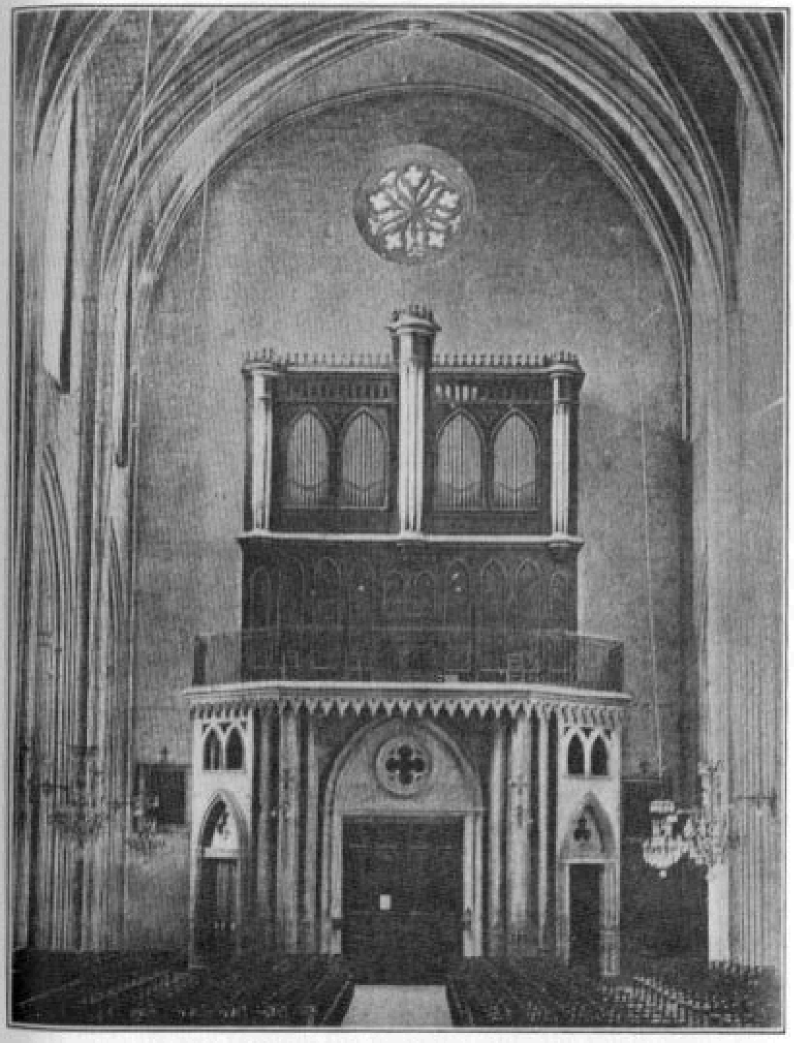
Dr. Gauntlet, about the year 1852, took out a patent covering an electric connection between the keys and the pallets of an organ,[2] but the invention of the electro-pneumatic lever must be ascribed to Barker and Dr. Péschard. The latter seems to have suggested the contrivance and the former to have done the practical work.

Bryceson Bros. were the first to introduce this action into English organs. They commenced work along these lines in 1868, under the Barker patents, their first organ being built behind the scenes at Her Majesty's Opera House, Drury Lane, London, the keys being in the orchestra. This organ was used successfully for over a year, after which it was removed and shown as a curiosity in the London Polytechnic Institute, recitals being given twice daily.

Schmole and Molls, Conti, Trice and others took a leading part in the work on the European continent, and Roosevelt was perhaps its greatest pioneer in the United States.

Various builders in many countries have more recently made scores of improvements or variations in form and have taken out patents to cover the points of difference, but none of these has done any work of special importance.

Not one of the early electric actions proved either quick or reliable, and all were costly to install and maintain.[3]



*The First Electric Organ Ever Built*
*In the Collegiate Church at Salon, Near Marseilles, France* (1866).

**The First Electric Organ Ever Built. In the Collegiate Church at Salon, Near Marseilles, France (1866).**

This form of mechanism, therefore, earned a bad name and was making little advance, if not actually being abandoned, when a skilled electrician, Robert Hope-Jones, entered the field about 1886. Knowing little of organs and nothing of previous attempts to utilize electricity for this service, he made with his own hands and some unskilled assistance furnished by members of his voluntary choir, the first movable console,[4] stop-keys, double touch, suitable bass, etc., and an electric action that created a sensation throughout the organ world. In this action the "pneumatic blow" was for the first time attained and an attack and repetition secured in advance of anything thought possible at that time, in connection with the organ or the pianoforte.

Hope-Jones introduced the round wire contact which secures the ideally perfect "nibbing points," and he makes these wires of dissimilar non-corrosive metals (gold and platinum).

He replaced previous rule-of-thumb methods by scientific calculation, recognized the value of low voltage, good insulation and the avoidance of self-induction, with the result that the electro-pneumatic action has become (when properly made) as reliable as the tracker or pneumatic lever mechanism.

## DESCRIPTION OF THE ELECTRIC ACTION.

The electric action consists substantially of a small bellows like the pneumatic lever, but instead of the valve admitting the wind to operate it being moved by a tracker leading from the key, it is opened by an electro-magnet, energized by a contact in the keyboard and connected therewith by a wire which, of course, may be of any desired length. We illustrate one form of action invented and used by Hope-Jones.[5]

Within the organ, the wires from the other end of the cable are attached to small magnets specially wound so that no spark results when the electric contact at the key is broken. This magnet attracts a thin disc of iron about 1/4 inch in diameter, (held up by a high wind pressure from underneath) and draws it downward through a space of less than 1/100 of an inch.

The working is as follows: The box A is connected with the organ bellows and so (immediately the wind is put into the organ) is filled with air under pressure, which passes upwards between the poles of the magnet N. Lifting the small iron disc L it finds its way through the passage L into the small motor M, thus allowing the movable portion of the motor M to remain in its lower position, the pallet $C^1$ being closed and the pallet $C^2$ being open. Under these conditions, the large motor B collapses and the pull-down P (which is connected with the organ pallet) rises.

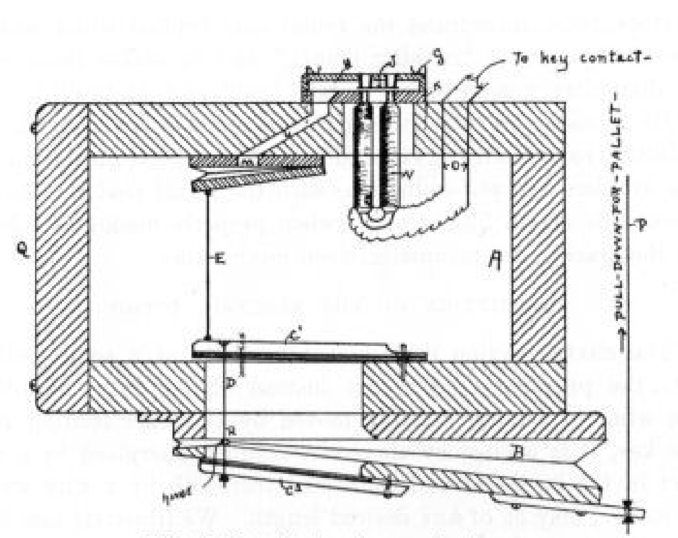



Fig. 6. The Electro-Pneumatic Lever

**Fig. 6. The Electro-Pneumatic Lever**

When a weak current of electricity is caused to circulate round the coils of the electro-magnet N, the small armature disc J is drawn off the valve-seat H on to the zinc plate K.

The compressed air from within the small motor M escapes by way of the passage L, through the openings in the valve seat H into the atmosphere. The compressed air in the box A then acts upon the movable portion of the small motor M in such a manner that it is forced upwards and caused (through the medium of the pull-wire E) to lift the supply pallet $C^1$ and close the exhaust pallet $C^2$, thus allowing compressed air to rush from the box A into the motor B and so cause this latter motor to open and (through the medium of the pull down P) to pull the soundboard pallet from its seat and allow wind to pass into the pipes.

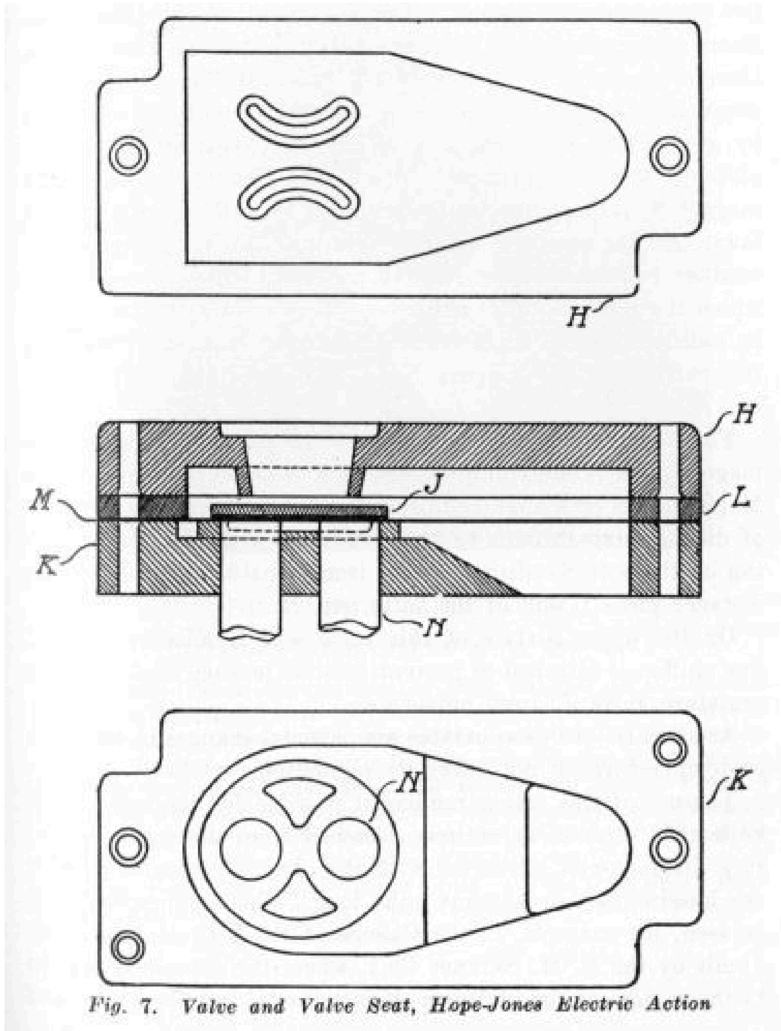



**Fig. 7. Valve and Valve Seat, Hope-Jones Electric Action**

The valve-seat H has formed on its lower surface two crescent shaped long and narrow slits. A very slight movement of the armature disc J, therefore, suffices to open to the full extent two long exhaust passages. The movement of this disc is reduced to something less than the 1/100 part of an inch. It is, therefore, always very close to the poles of the magnet, consequently a very faint impulse of electricity will suffice (aided by gravity) to draw the disc off the valve-seat H. The zinc plate K being in intimate contact with the iron poles of the magnet N, protects the latter from rust by well-known electrical laws. All the parts are made of metal, so that no change in the weather can affect their relative positions. R is the point at which the large motor B is hinged. G is a spring retaining cap in position; O the wires leading from the keys and conveying the current to the magnet N; Q the removable side of the box A.

Fig. 7 represents a larger view of the plate K in which the magnet poles N are rigidly fixed—of a piece of very fine chiffon M (indicated by a slightly thicker line) which prevents particles of dust passing through so as to interfere with the proper seating of the soft Swedish charcoal iron armature disc J—of the distance piece L and of the valve seat H.

On the upper surface of this valve seat H another piece of fine chiffon is attached to prevent possible passage of dust to the armature valve J, from outside.

As all parts of this apparatus are of metal changes in humidity or temperature do not affect its regulation.

The use of this action renders it possible for the console (or keyboards, etc.) to be entirely detached from the organ, moved to a distance and connected with the organ by a cable fifty or one hundred feet or as many miles long. This arrangement may be seen, for example, in the College of the City of New York (built by the E. M. Skinner Co.), where the console is carried to the middle of the platform when a recital is to be given, and removed out of the way when the platform is wanted for other purposes.

As all the old mechanism—the backfalls, roller-boards and trackers—is now swept away, it is possible by placing the bellows in the cellar to utilize the *inside of the organ* for a choir-vestry, as was indeed done with the pioneer Hope-Jones organ at St. John's Church, Birkenhead.

## DIVISION OF ORGANS.

Before the invention of pneumatic and electro-pneumatic action, organs were almost invariably constructed in a single mass. It was, it is true, possible to find instruments with tracker action that were divided and placed, say, half on either side of a chancel, but instances of the kind were rare and it was well nigh impossible for even a muscular organist to perform on such instruments.

The perfecting of tubular pneumatic and especially of electro-pneumatic action has lent wonderful flexibility to the organ and has allowed of instruments being introduced in buildings where it would otherwise have been impossible to locate an organ. Almost all leading builders have done work of this kind, but the Aeolian Company has been quickest to seize the advantage of division in adapting the pipe organ for use in private residences.

Sound reflectors have recently been introduced, and it seems likely that these will play an important part in organ construction in the future. So far they appear to be employed only by Hope-Jones and the firms with which he was associated. It has been discovered that sound waves may be collected, focussed or directed, much in the same way that light waves can. In the case of the Hope-Jones organ at Ocean Grove, N. J., the greatest part of the instrument has been placed in a basement constructed outside the original Auditorium. The sound waves are thrown upward and are directed into the Auditorium by means of parabolic reflectors constructed of cement lined with wood. The effect is entirely satisfactory. In Trinity Cathedral, Cleveland, Ohio,[6] Hope-Jones arranged for the Tuba to stand in the basement at the distant end of the nave. Its tone is directed to a cement reflector and from that reflector is projected through a metal grid set in the floor, till, striking the roof of the nave, it is spread and fills the entire building with tone. In St. Luke's Church, Montclair, N. J., he adopted a somewhat similar plan in connection with the open 38-foot pedal pipes which are laid horizontally in the basement. We believe that the first time this principle was employed was in the case of the organ rebuilt by Hope-Jones in 1892 at the residence of Mr. J. Martin White, Balruddery, Dundee, Scotland.

## OCTAVE COUPLERS.

In the days of mechanical action, couplers of any kind proved a source of trouble and added greatly to the weight of the touch. The natural result was that anything further than unison coupling was seldom attempted.

In some organs hardly any couplers at all were present.

In Schulze's great and celebrated organ in Doncaster, England, it was not possible to couple any of the manuals to the pedals, and (if we remember rightly) there were only two couplers in the whole instrument. Shortly after the introduction of pneumatic action, an organ with an occasional octave coupler, that is a coupler which depressed a key an octave higher or lower than the one originally struck, was sometimes met with.

In the pioneer organ built by Hope-Jones in Birkenhead, England (about 1887), a sudden advance was made. That organ contains no less than 19 couplers. Not only did he provide sub-octave and super-octave couplers freely, but he even added a Swell Sub-quint to Great coupler!

Octave couplers are now provided by almost all builders.

Though condemned by many theorists, there is no doubt that in practice they greatly add to the resources of the instruments to which they are attached. We know of small organs where the electric action has been introduced for no other reason than that of facilitating the use of octave couplers, which are now a mere matter of wiring and give no additional weight to the touch.

Hope-Jones appears to have led in adding extra pipes to the wind-chest, which were acted upon by the top octave of the octave couplers, thus giving the organist a complete scale to the full extent of the keyboards. He made the practice common in England, and the Austin Company adopted it on his joining them in this country. The plan has since become more or leas common. This is the device we see specified in organ builders' catalogues as the "extended wind-chest," and explains why the stops have 73 pipes to 61 notes on the keyboard. An octave coupler without such extension is incomplete and is no more honest than a stop which only goes down to Tenor C.

[1] The researches of Dr. Gabriel Bédart, Professeur agrégé Physiologie in the University of Lille, France, a learned and enthusiastic organ connoisseur, have brought to light the fact that the first tubular pneumatic action was constructed by Moitessier in France in 1835. It was designed upon the exhaust principle.

[2] Dr. Gauntlett's idea was to play *all* the organs shown in the Great Exhibition in London, in 1851, from one central keyboard. He proposed to place an electro-magnet inside the wind-chest under each pallet, which would have required an enormous amount of electric current. The idea was never carried out. This plan seems also to have occurred to William Wilkinson, the organ-builder of Kendal, as far back as 1862, but, after some experiments, was abandoned. An organ constructed on similar lines was actually built by Karl G. Weiglé, of Echterdingen, near Stuttgart, Germany, in 1870, and although not at all a success, he built another on the same principle which was exhibited at the Vienna Exhibition in

1873. Owing to the powerful current necessary to open the Pallets, the contacts fused and the organ was nearly destroyed by fire on several occasions.

[3] Sir John Stainer, in the 1889 edition of his "Dictionary of Musical Terms," dismisses the electric action in a paragraph of four lines as of no practical importance. In that same year the writer asked Mr. W. T. Best to come over and look at the organ in St. John's Church, Birkenhead, which was then beginning to be talked about, and he laughed at the idea that any good could come out of an electric action. He was a man of wide experience who gave recitals all over the country and was thoroughly acquainted with the attempts that had been made up to that time. He did not want to see any more electric organs.

[4] Console—the keyboards, pedals and stop action by which the organ is played; sometimes detached from the instrument.

[5] from Matthews' "Handbook of the Organ," p. 52 *et seq*.

[6] Organ built by the Ernest M. Skinner Co.

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DR. ALBERT PESCHARD

INVENTOR OF ELECTRO-PNEUMATIC ACTION.

**DR. ALBERT PESCHARD. Inventor of Electro-Pneumatic Action.**

Dr. Albert Péschard was born in 1836, qualified as an advocate (Docteur en droit), and from 1857 to 1875 was organist of the Church of St. Etienne, Caen, France. He commenced to experiment in electro-pneumatics in the year 1860, and early in 1861 communicated his discoveries to Mr. Barker. From that date until Barker left France, Péschard collaborated with him, reaping no pecuniary benefit therefrom. Péschard, however, was honored by being publicly awarded the Medal of Merit of the Netherlands; the Medal of Association Francaise pour l'Avancement de la Science; Gold Medal, Exhibition of Lyons; and the Gold Medal, Exhibition of Bordeaux. He died at Caen, December 23, 1903. (From Dr. Hinton's "Story of the Electric Organ.")

## CHAPTER V.

## STOP-KEYS.

On looking at the console of a modern organ the observer will be struck by the fact that the familiar draw-stop knobs have disappeared, or, if they are still there, he will most likely find in addition a row of ivory tablets, like dominoes, arranged over the upper manual. If the stop-knobs are all gone, he will find an extended row, perhaps two rows of these tablets. These are the *stop-keys* which, working on a centre, move either the sliders in the wind-chest, or bring the various couplers on manuals and pedals on or off.

*Fig. 8. Console, Showing the Inclined Keyboards First Introduced Into This Country by Robert Hope-Jones*

**Fig. 8. Console, Showing the Inclined Keyboards First Introduced Into This Country by Robert Hope-Jones**

We learn from Dr. Bédart that as early as 1804 an arrangement suggestive of the stop-key was in use in Avignon Cathedral. William Horatio Clarke, of Reading, Mass., applied for a patent covering a form of stop-key in 1877. Hope-Jones, however, is generally credited with introducing the first practical stop-keys. He invented the forms most largely used to-day, and led their adoption in England, in this country, and indeed throughout the world.

*Fig. 9. Console on the Bennett System, Showing Indicator Discs*

**Fig. 9. Console on the Bennett System,
Showing Indicator Discs**

Our illustration (Fig. 8) gives a good idea of the appearance of a modern Hope-Jones console. The stop-keys will be seen arranged in an inclined semi-circle overhanging and just above the keyboards. Fig. 9 shows a console on the Bennett system. Figs. 10 and 11, hybrids, the tilting tablet form of stop-keys being used for the couplers only.

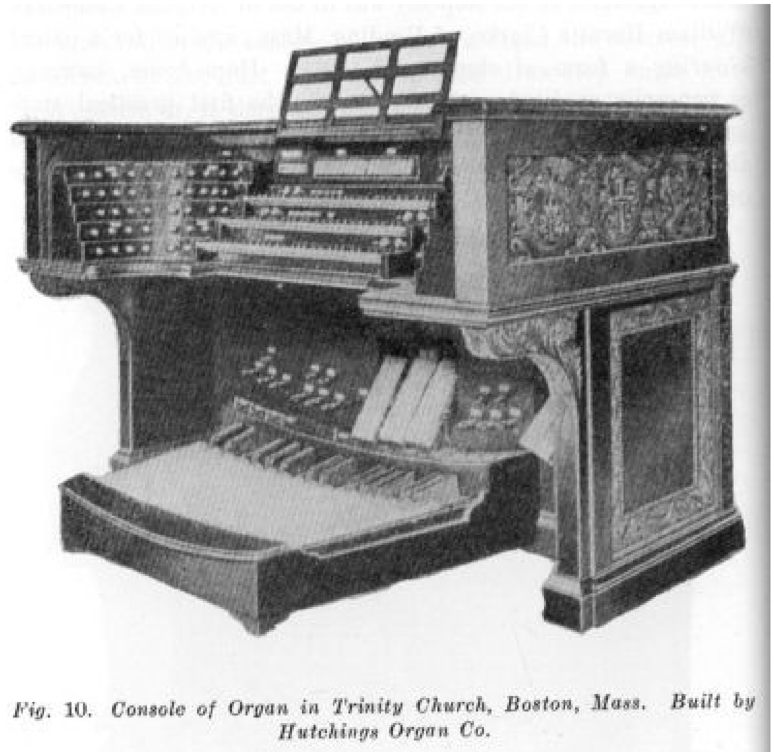


**Fig. 10. Console of Organ in Trinity Church, Boston, Mass. Built by Hutchings Organ Co.**

There is much controversy as to whether stop-keys will eventually displace the older fashioned draw-knobs.

**Fig. 11. Console of Organ in College of City of New York. Built by The E. M. Skinner Co.**

A few organists of eminence, notably Edwin H. Lemare, are strongly opposed to the new method of control, but the majority, especially the rising generation of organists, warmly welcome the change. It is significant that whereas Hope-Jones was for years the only advocate of the system, four or five of the builders in this country, and a dozen foreign organ-builders, are now supplying stop-keys either exclusively or for a considerable number of their organs. Austin, Skinner, Norman & Beard, Ingram and others use the Hope-Jones pattern, but Haskell, Bennett, Hele and others have patterns of their own. It is a matter of regret that some one pattern has not been agreed on by all the builders concerned.[1]

## CONTROL OF THE STOPS.

In older days all stop-keys were moved by hand, and as a natural consequence few changes in registration could be made during performance.

Pedals for throwing out various combinations of stops were introduced into organs about 1809; it is generally believed that J. C. Bishop was the inventor of this contrivance.

Willis introduced into his organs pneumatic thumb-pistons about the year 1851. These pistons were placed below the keyboard whose stops they affected.

T. C. Lewis, of England, later introduced short key-touches arranged above the rear end of the keys of the manual. Depression of these key-touches brought different combinations of stops into use on the keyboard above which they were placed. Somewhat similar key-touches were used by the Hope-Jones Organ Co. and by the Austin Organ Co.

Metal buttons or pistons located on the toe piece of the pedal-board were introduced by the ingenious Casavant of Canada. They are now fitted by various builders and appear likely to be generally adopted. These toe-pistons form an additional and most convenient means for bringing the stops into and out of action.

At first these various contrivances operated only such combinations as were arranged by the builder beforehand, but now it is the custom to provide means by which the organist can so alter and arrange matters that any combination piston or combination key shall bring out and take in any selection of stops that he may desire. Hilborne Roosevelt of New York, was the first to introduce these adjustable combination movements.

The introduction of the above means of rapidly shifting the stops in an organ has revolutionized organ-playing, and has rendered possible the performance of the orchestral transcriptions that we now so often hear at organ recitals.

In order to economize in cost of manufacture, certain of the organ-builders, chiefly in America and in Germany, have adopted the pernicious practice of making the combination pedals, pistons or keys bring the various ranks of pipes into or out of action without moving the stop-knobs.

This unfortunate plan either requires the organist to remember which combination of stops he last brought into operation on each keyboard, or else necessitates the introduction of some indicator displaying a record of the pistons that he last touched. In the organ in the Memorial Church of the 1st Emperor William in Berlin, the builder introduced a series of electric lights for this purpose. This device can be seen in use in this country.

When this plan is adopted the player is compelled to preserve a mental image of the combinations set on every piston or pedal in the organ and identify them instantly by the numbers shown on the indicator—an impossibility in the case of adjustable combinations often changed—impracticable in any case.

Almost all the greatest organists agree in condemning the system of non-moving stop-knobs, and we trust and believe that it will soon be finally abandoned.

[1] Organists find, after using them a short time, that a row of stop-keys over the manuals is wonderfully easy to control. It is possible to slide the finger along, and with one sweep either bring on or shut off the whole organ.

## CHAPTER VI.

## RADIATING AND CONCAVE PEDAL BOARDS.

Pedal boards had always been made flat with straight keys until Willis and the great organist, Dr. S. S. Wesley, devised the radiating and concave board whereby all the pedal keys were brought within equal distance of the player's feet. This was introduced in the organ in St. George's Hall, Liverpool, in 1855, and Willis has refused to supply any other type of board with his organs ever since. Curiously enough, the advantages of this board were not appreciated by many players who preferred the old type of board and at a conference called by the Royal College of Organists in 1890 it was decided to officially recommend a board which was concave, but had parallel keys. The following letter to the author shows that the R. C. O. has experienced a change of heart in this matter:

THE ROYAL COLLEGE OF ORGANISTS.
LONDON, S. W., 27th May, 1909.

Dear Sir: In answer to your inquiry the Resolutions and Recommendations to which you refer were withdrawn by my Council some years ago. No official recommendation is made by them now. It is stated in our Calendar that the Council wish it understood that the arrangements and measurements of the College organ are not intended to be accepted as authoritative or final suggestions. I am,

Yours faithfully,
THOMAS SHINDLER,
*Registrar*.

The radiating and concave board has been adopted by the American Guild of Organists and has long been considered the standard for the best organs built in the United States and Canada. It is self-evident that this board is more expensive to construct than the other. That is why we do not find it in low-priced organs.

In most American organs built twenty years ago, the compass of the pedal board was only two octaves and two notes, from CCC to D. Sometimes two octaves only. Later it was extended to F, 30 notes, which is the compass generally found in England. Following Hope-Jones' lead, all the best builders have now extended their boards to g, 32 notes, this range being called for by some of Bach's organ music and certain pieces of the French school where a melody is played by the right foot and the bass by the left. The chief reason is that g is the top note of the string bass, and is called for in orchestral transcriptions. Henry Willis & Sons have also extended the pedal compass to g in rebuilding the St. George's Hall organ in 1898.

## PEDAL STOP CONTROL.

For a long time no means whatever of controlling the Pedal stops and couplers was provided, but in course of time it became the fashion to cause the combination pedals or pistons on the Great organ (and subsequently on the other departments also) to move the Pedal stops and couplers so as to provide a bass suited to the particular combination of stops in use on the manual. This was a crude arrangement and often proved more of a hindrance than of a help to the player. Unfortunately, unprogressive builders are still adhering to this inartistic plan. It frequently leads to a player upsetting his Pedal combination when he has no desire to do so. It becomes impossible to use the combination pedals without disturbing the stops and couplers of the Pedal department.

The great English organist, W. T. Best, in speaking of this, instanced a well-known organ piece, Rinck's "Flute Concerto," which called for quick changes from the Swell to the Great organ and *vice versa*, and said that he knew of no instrument in existence on which it could be properly played. An attempt had been made on the Continent to overcome this difficulty by the use of two pedal-boards, placed at an angle to each other, but it did not meet with success.

The Hope-Jones plan (patented 1889) of providing the combination pedals or pistons with a double touch was a distinct step in advance for it enabled the organist by means of a light touch to move only the manual registers and by means of a very much heavier touch on the combination pedal or piston to operate also his Pedal stops and couplers. Most large organs now built are furnished with a pedal for reversing the position of the Great to Pedal coupler. Though to a certain extent useful when no better means of control is provided, this is but a makeshift.

Thomas Casson, of Denbigh, Wales, introduced an artistic, though somewhat cumbersome, arrangement. He duplicated the draw-knobs controlling the Pedal stops and couplers and located one set of these with the Great organ stops, another set with the Swell organ stops and a third with the Choir. He placed in the key slip below each manual what he called a "Pedal Help." When playing on the Great organ, he would, by touching the "Pedal Help," switch into action the group of Pedal stops and coupler knobs located in the Great department, switching out of action all the other groups of Pedal stops and couplers. Upon touching the "Pedal Help" under the Swell organ keys, the Great organ group of Pedal stops and couplers would be rendered inoperative and the Swell group would be brought into action. By this means it was easy to prepare in advance groups of Pedal stops and couplers suited to the combination of stops sounding upon each manual and by touching a Pedal Help, to call the right group of Pedal stops into action at any moment. The combination pedals affecting the Great stop-knobs moved also the Pedal stop-knobs belonging to the proper group. The Swell and Choir groups were similarly treated.

But the simplest and best means of helping the organist to control his Pedal department is the automatic "Suitable Bass" arrangement patented by Hope-Jones in 1891 and subsequently. According to his plan a "Suitable Bass" tablet is provided just above the rear end of the black keys on each manual.

Each of these tablets has a double touch. On pressing it with ordinary force it moves the Pedal stop keys and couplers, so as to provide an appropriate bass to the combination of stops in use on that manual at the moment. On pressing it with much greater force it becomes locked down and remains in that position until released by the depression of the suitable bass tablet belonging to another manual, or by touching any of the Pedal stop-knobs or stop-keys.

When the suitable bass tablet belonging to any manual is thus locked down, the stops and couplers of the Pedal department will automatically move so as to provide at all times a bass that is suitable to the combination of stops and couplers in use upon that particular manual.

On touching the suitable bass tablet belonging to any other manual with extra pressure, the tablet formerly touched will be released and the latter will become locked down. The Pedal stops and couplers will now group themselves so as to provide a suitable bass to the stops in use on the latter-named manual, and will continue so to do until this suitable bass tablet is in turn released.

This automatic suitable bass device does not interfere with the normal use of the stop-keys of the pedal department by hand. Directly any one of these be touched, the suitable bass mechanism is automatically thrown out of action.

The combination pedals and pistons are all provided with double touch. Upon using them in the ordinary way the manual stops alone are affected. If, however, considerable extra pressure be brought to bear upon them the appropriate suitable bass tablet is thereby momentarily depressed and liberated

—by this means providing a suitable bass. In large organs two or three adjustable toe pistons are also provided to give independent control of the Pedal organ. On touching any of these toe pistons all suitable bass tablets are released, and any selection of Pedal stops and couplers that the organist may have arranged on the toe piston operated is brought into use. The Hope-Jones plan seems to leave little room for improvement. It has been spoken of as "the greatest assistance to the organist since the invention of combination pedals."[1]

Compton, of Nottingham, England[2] (a progressive and artistic builder), already fits a suitable bass attachment to his organs and it would seem likely that before long this system must become universally adopted.

[1] Mark Andrews, Associate of the Royal College of Organists, England, President of the National Association of Organists and Sub-Warden of the American Guild of Organists.

[2] Mr. R. P. Elliott, organizer and late Vice-President of the Austin Co., said on his last return from England that Compton was at that time doing the most artistic work of any organ-builder in that country. He is working to a great extent on the lines laid down by Hope-Jones, and has the benefit of the advice and assistance of that well-known patron of the art, Mr. J. Martin White. His business has lately been reorganized under the title of John Compton, Ltd., in which company Mr. White is a large shareholder.

## CHAPTER VII.

## MEANS OF OBTAINING EXPRESSION.

## CRESCENDO PEDAL.

To most organs in this country, to many in Germany, and to a few in other countries, there is attached a balanced shoe pedal by movement of which the various stops and couplers in the organ are brought into action in due sequence. By this means an organist is enabled to build up the tone of his organ from the softest to the loudest without having to touch a single stop-knob, coupler or combination piston. The crescendo pedal, as it is called, is little used in England. It is the fashion there to regard it merely as a device to help an incompetent organist. It is contended that a crescendo pedal is most inartistic, as it is certain to be throwing on or taking off stops in the middle, instead of at the beginning or end of a musical phrase. In spite of this acknowledged defect, many of the best players in this country regard it as a legitimate and helpful device.

We believe the first balanced crescendo pedal in this country was put in the First Presbyterian Church organ at Syracuse, N. Y., by Steere, the builder of the instrument.

## SFORZANDO PEDAL—DOUBLE TOUCH.

Under the name of Sforzando Coupler, the mechanism of which is described and illustrated in Stainer's Dictionary, a device was formerly found in some organs by which the keys of the Swell were caused to act upon the keys of the Great. The coupler being brought on and off by a pedal, sforzando effects could be produced, or the first beat in cadi measure strongly accented in the style of the orchestration of the great masters. Hope-Jones in his pioneer organ at St. John's Church, Birkenhead, England, provided a pedal which brought the Tuba on the Great organ. The pedal was thrown back by a spring on being released from the pressure of the foot. Some fine effects could be produced by this, but of course the whole keyboard was affected and only chords could be played. Various complicated devices to bring out a melody have been invented from time to time by various builders, but all have been superseded by the invention of the "Double Touch." On a keyboard provided with this device, extra pressure of the fingers causes the keys struck to fall an additional eighth inch (through a spring giving way), bringing the stops drawn on another manual into play. If playing on the Swell organ, the Choir stops will sound as well when the keys are struck with extra firmness; if playing on the Choir the Swell stops sound; and if playing on the Great the Double Touch usually brings on the Tuba or Trumpet. It is thus possible to play a hymn tune in four parts on the Swell and bring out the melody on the Choir Clarinet; to play on the Choir and bring out the melody on the Swell Vox Humana or Cornopean; or to play a fugue with the full power of the Great organ (except the Trumpet) and bring out the subject of the fugue every time it enters, whether in the soprano voice, the alto, tenor, or bass.

In the latest Hope-Jones organs arrangements are made for drawing many of the individual stops on the second touch, independently of the couplers.

## BALANCED SWELL PEDAL

At the commencement of the period of which we are treating (some fifty years ago) the Swell shutters of almost all organs were made to fall shut of their own weight, or by means of a spring. The organist might leave his Swell-box shut or, by means of a catch on the pedal, hitch it full open.

When, however, he wanted the shutters in any intermediate position, he had to keep his foot on the pedal in order to prevent its closing.

The introduction of the balanced Swell pedal (Walcker, 1863) has greatly increased the tonal resources of the organ. It is used almost universally in this country, but strangely enough the country in which the Swell-box was invented (England, 1712) lags behind, and even to-day largely adheres to the old forms of spring pedal.

A further and great step in advance appears in recent organs built by the Hope-Jones Organ Company. The position of the swell shutters is brought under the control of the organist's fingers as well as his feet. Each balanced swell pedal is provided with an indicator key fixed on the under side of the ledge of the music desk, where it is most conspicuous to the eye of the performer. As the swell pedal is opened by the organist's foot, the indicator key travels in a downward direction to the extent of perhaps one inch and a quarter. As the organist closes his pedal, the indicator key again moves upward into its normal position. By means of this visible indicator key the organist is always aware of the position of the swell shutters. Through electric mechanism the indicator key is so connected with the swell pedal that the slightest urging of the key either upward or downward by the finger will shift the swell pedal and cause it to close or open as may be desired and to the desired extent. When an organ possesses four or five swell boxes, and when these swell boxes (as in the case of Hope-Jones' organs) modify the tone by many hundred per cent., it becomes highly important that the organist shall at all times have complete and instant control of the swell shutters and shall be conscious of their position without having to look below the keyboards. Hope-Jones also provides what he calls a general swell pedal. To this general swell pedal (and its corresponding indicator key) any or all of the other swell pedals may be coupled at will.

Hope-Jones has also recently invented a means of controlling the swell shutters from the manual keys to a sufficient extent to produce certain sforzando effects.

When this contrivance is brought into use upon any manual and when no keys upon that manual are being played, the swell shutters assume a position slightly more open than normal in relation to the position of the swell pedal. Directly any key upon the manual in question is depressed, the swell shutters again resume their normal position in relation to the swell pedal. This results in a certain emphasis or attack at the commencement of each phrase or note that is akin to the effect obtained from many of the instruments of the orchestra.

These contrivances are applicable only to such organs as have the balanced swell pedal.

## SWELL BOXES.

The invention of the Swell is generally attributed to Abraham Jordan. He exhibited what was known as the nag's head Swell in St. Magnus' Church, London, England, in the year 1731.

The "nag's head" Swell, with its great sliding shutter, rapidly gave place to the "Venetian" Swell shades, used almost universally to this day. At the beginning of the period under consideration Swell boxes were almost invariably made of thin boards and their effect upon the strength of the tone was small. Willis was one of the first to realize the artistic possibilities of the Swell organ and in almost all his organs we find thick wooden boxes and carefully fitted shutters, and often an inner swell box containing the delicate reeds, such as the Vox Humana and Oboe.

Many of the leading organ builders now employ this thicker construction, and it is no uncommon thing to find Swell boxes measuring three inches in thickness and "deadened" with sawdust or shavings between the layers of wood of which they are formed.

A few organs of Hutchings and other makers are provided with a double set of shutters, so that sound waves escaping through the first set are largely arrested by the second. The *crescendo* and *diminuendo* are thus somewhat improved.

By the adoption of scientific principles Hope-Jones has multiplied the efficiency of Swell boxes tenfold. He points out that wood, hitherto used in their construction, is one of the best known conductors of sound and should, therefore, not be employed. The effects produced by his brick, stone and cement boxes (Worcester Cathedral, England; McEwan Hall, Edinburgh, Scotland, Ocean Grove, New Jersey, etc.) mark the dawn of a new era in Swell-box construction and effect. It is now possible to produce by means of scientific Swell boxes an increase or diminution of tone amounting to many hundred per cent.

We have heard the great Tuba at Ocean Grove, on 50-inch wind pressure, so reduced in strength that it formed an effective accompaniment to the tones of a single voice.

The Hope-Jones method seems to be to construct the box and its shutters (in laminated form) of brick, cement or other inert and non-porous material, and to substitute for the felt usually employed at the joints his patented "sound trap." This latter is so interesting and of such import in the history of organ building that we append, on the next page, illustrations and descriptions of the device.

If a man should stand at one end of the closed passage (C) he will be able to converse with a friend at the other end of the passage (D). The passage will in fact act as a large speaking tube and a conversation can be carried on between the two individuals, even in whispers (Figure 12).

This passage is analogous to the opening or nick between Swell shutters of the ordinary type.

If a man should stand in room 1 at A, he will be able to see a friend standing in room 4 at B, but the two friends will not be able to converse. When A speaks, the sound waves that he produces will spread out and will fill room 1. A very small percentage of them will strike the doorway or opening into room 2. In their turn these sound waves will be diffused all through room 2, and again but a small percentage of them will find access into room 3. The sound waves will by this time be so much attenuated that the voice of the man standing in room 1 will be lost. Any little tone, however, that may remain will become dissipated in room 3, and it will not be possible for a person standing in room 4 to hear the voice.

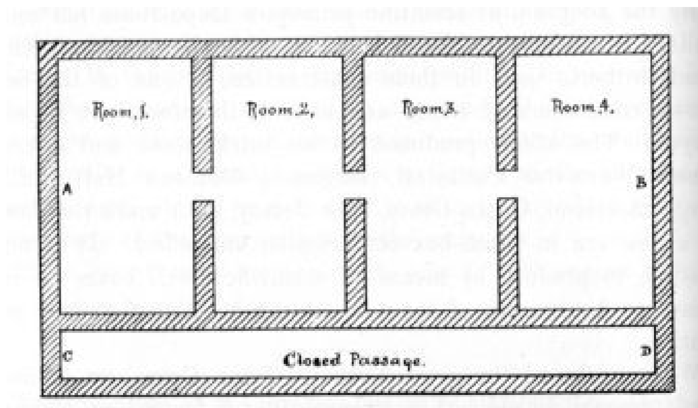


*Fig. 12. The Principle of the Sound Trap*

**Fig. 12. The Principle of the Sound Trap**

This plan illustrates the principle of the sound trap joint.

Figure 13 shows in section the joint between two Swell shutters. A small proportion of the sound waves from inside the Swell box striking the sound trap joint, as indicated by the arrow, will pass through the nick between the two shutters, but these sound waves will become greatly weakened in charging the groove A. Such of the sound waves is pass through the second nick will become attenuated in charging the chamber B. They will be further lost in the chamber C, and practically none will remain by the time the chamber D is reached.

It is Hope-Jones' habit to place the shutters immediately above the pipes themselves, so that when they are opened the Swell box is left practically without any top. It is in such cases not his custom to fit any shutters in the side or front of the Swell box.

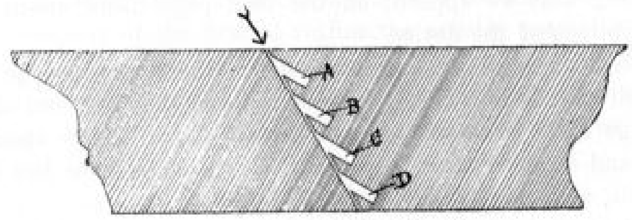


Fig. 13. Sound Trap Joint

**Fig. 13. Sound Trap Joint**

To relieve the compression of the air caused by playing for any length of time with the shutters closed, he provides escape valves, opening outside the auditorium. He also provides fans for driving all the cold air out of the box before using the organ, thus equalizing the temperature with the air outside—or he accomplishes this result through the medium of gas, electric or steam heaters, governed by thermostats.

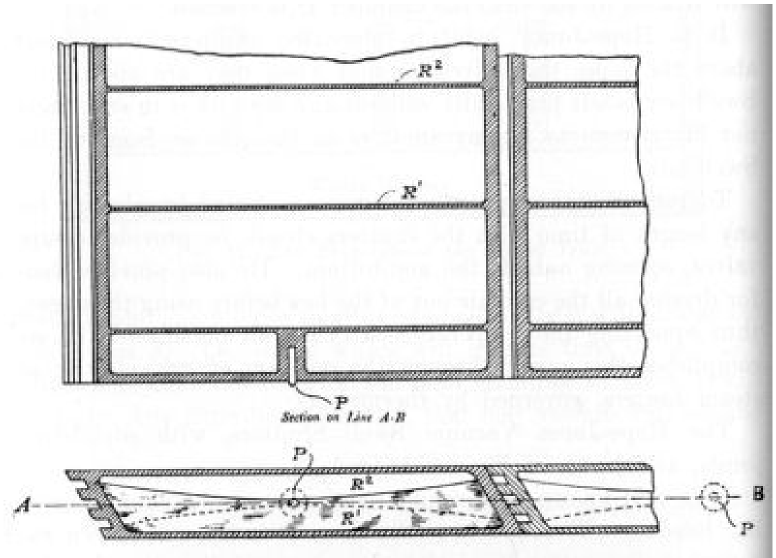
The Hope-Jones Vacuum Swell Shutters, with sound-trap joints, are shown in Figures 14 and 15.

It is well known that sound requires some medium to carry it. Readers will doubtless be familiar with the well-known experiment illustrating this point. An electric bell is placed under a glass dome. So long as the dome is filled with air the sound of the bell can be heard, but directly the air is pumped out silence results, even though it can be seen that the bell is continuously ringing. As there is no air surrounding the bell there is nothing to convey its vibrations to the ear.

That is why the hollow swell shutter, from the interior of which the air has been pumped out, is such a wonderful non-conductor of sound.

The shutters shown in Figures 14 and 15 are aluminum castings.

Ribs $R^1$ and $R^2$ are provided to support the flat sides against the pressure of the atmosphere, but each of these ribs is so arranged that it supports only one flat side and does not form a means of communication between one flat side and the other. Thus $R^1$ supports one flat side whilst $R^2$ supports the other. The aluminum shutters are supported by means of pivot P.




*Figs. 14-15. The Vacuum Shutter*

**Figs. 14-15. The Vacuum Shutter**

They are very light and can therefore be opened and closed with great rapidity.

A very thin vacuum shutter forms a better interrupter of sound waves than a brick wall two or three feet in thickness.

When partially exhausted the aluminum shutters are dipped into a bath of shellac. This effectually closes any microscopic blow-hole that may exist in the metal.

The use of Swell boxes of this vastly increased efficiency permits the employment of larger scales and heavier pressures for the pipes than could otherwise be used, and enormously increases the tonal flexibility of the organ.

It also does away with the need for soft stops in an organ, thus securing considerable economy. Where all the stops are inclosed in cement chambers (as in the case of recent Hope-Jones organs) and where the sound-trap shutters are employed, *every* stop is potentially a soft stop.

# CHAPTER VIII.

## A REVOLUTION IN WIND SUPPLY.

Prior to the construction of the above-named organ at Birkenhead, England, it had been the custom to obtain or regulate the pressure of wind supplied to the pipes by means of loading the bellows with weights. Owing to its inertia, no heavy bellows weight can be set into motion rapidly. When, therefore, a staccato chord was struck on one of these earlier organs, with all its stops drawn, little or no response was obtained from the pipes, because the wind-chest was instantly exhausted and no time was allowed for the inert bellows weights to fall and so force a fresh supply of air into the wind-chests.

## BELLOWS SPRINGS VERSUS WEIGHTS.

In one of Hope-Jones' earliest patents the weights indeed remain, but they merely serve to compress springs, which in turn, act upon the top of the bellows.

Before this patent was granted he had, however, given up the use of weights altogether and relied entirely upon springs.

This one detail—the substitution of springs for weights—has had a far-reaching effect upon organ music. It rendered possible the entire removal of the old unsteadiness of wind from which all organs of the time suffered in greater or less degree. It quickened the attack of the action and the speech of the pipes to an amazing extent and opened a new and wider field to the King of Instruments.

In the year 1894 John Turnell Austin, now of Hartford, Conn., took out a patent for an arrangement known as the "Universal air-chest." In this, the spring as opposed to the weight is adopted. The Universal air-chest forms a perfect solution of the problem of supplying prompt and steady wind-pressure, but as practically the same effect is obtained by the use of a little spring reservoir not one hundredth part of its size, it is questionable whether this Universal air-chest, carrying, as it does, certain disadvantages, will survive.

## INDIVIDUAL PALLETS.

Fifty years ago the pallet and slider sound-board was well nigh universally used, but several of the builders in Germany, and Roosevelt in this country, strongly advocated, and introduced, chests having an independent valve, pallet or membrane, to control the admission of wind to each pipe in the organ.[1]

In almost all of these instances small round valves were used for this purpose.

A good pallet and slider chest is difficult to make, and those constructed by indifferent workmen out of indifferent lumber will cause trouble through "running"—that is, leakage of wind from one pipe to another. In poor chests of this description the slides are apt to stick when the atmosphere is excessively damp, and to become too loose on days when little or no humidity is present.

Individual pallet chests are cheaper to make and they have none of the defects named above. Most of these chests, however, are subject to troubles of their own, and not one of those in which round valves are employed permits the pipes to speak to advantage.

Willis, Hope-Jones, Carlton C. Michell and other artists, after lengthy tests, independently arrived at the conclusion that the best tonal results cannot by any possibility be obtained from these cheap forms of chest. Long pallets and a large and steady body of air below each pipe are deemed essential.[2]

## HEAVY WIND PRESSURES.

As previously stated, the vast majority of organs built fifty years ago used no higher wind pressure than 3 inches. Hill, in 1833, placed a Tuba stop voiced on about 11 inches in an organ he built for Birmingham Town Hall (England), but the tone was so coarse and blatant that such stops were for years employed only in the case of very large buildings.[3] Cavaillé-Coll subsequently utilized slightly increased pressures for the trebles of his flue stops as well as for his larger reeds. As a pioneer he did excellent work in this direction.

To Willis, however, must be attributed greater advance in the utilization of heavy pressures for reed work. He was the first to recognize that the advantage of heavy wind pressure for the reeds lay not merely in the increase of power, but also in the improvement of the quality of tone. Willis founded a new school of reed voicing and exerted an influence that will never die.

In organs of any pretensions it became his custom to employ pressures of 8 to 10 inches for the Great and Swell chorus reeds and the Solo Tubas in his larger organs were voiced on 20 or 25 inches.

He introduced the "closed eschallot" (the tube against which the tongue beats in a reed pipe) and created a revolution in reed voicing. He has had many imitators, but the superb examples of his skill, left in English Cathedral and town hall organs, will be difficult to surpass.

Prior to the advent of Hope-Jones (about the year 1887) no higher pressure than 25 inches had, we believe, been employed in any organ, and the vast majority of instruments were voiced on pressures not exceeding 3 inches. Heavy pressure flue voicing was practically unknown, and in reeds even Willis used very moderate pressures, save for a Tuba in the case of really large buildings.

Hope-Jones showed that by increasing the weight of metal, bellying all flue pipes in the centre, leathering their lips, clothing their flues, and reversing their languids, he could obtain from heavy pressures practically unlimited power and at the same time actually add to the sweetness of tone produced by the old, lightly blown pipes. He used narrow mouths, did away with regulation at the foot of the pipe, and utilized the "pneumatic blow" obtained from his electric action.

He also inaugurated "an entirely new departure in the science of reed voicing." [4]

He employs pressures as high as fifty inches and never uses less than six. His work in this direction has exercised a profound influence on organ building throughout the world, and leading builders in all countries are adopting his pressures or are experimenting in that direction.

Like most revolutionary improvements, the use of heavy pressures was at first vigorously opposed, but organists and acousticians are now filled with wonder that the old low-pressure idea should have held sway so long, in view of the fact that very heavy wind is employed for the production of the best tone from the human voice and from the various wind instruments of the orchestra.

Karl Gottlieb Weiglé, of Stuttgart, was a little in advance of many of his confrères in using moderately heavy pressures, but he departed from the leather lip and narrow mouth used by Hope-Jones and has obtained power without refinement.

In employing these heavy pressures of wind, increased purity and beauty of tone should alone be aimed at. Power will take care of itself.

## MECHANICAL BLOWERS.

The "organ beater" of bygone days was invariably accompanied by the "organ pumper," often by several of them. There is a well-known story of how the man refused to blow any longer unless the organist said that "*we* had done very well to-day." The organ pumper's vocation is now almost entirely gone, especially in this country, although we know of organs in England which require four men "to blow the same" unto this day.

When Willis built the great organ in St. George's Hall, Liverpool, in 1855, he installed an eight-horsepower steam engine to provide the wind supply. There is a six-horse steam engine in use in Chester Cathedral (installed 1876).

Gas and petrol (gasoline) engines have been used extensively in England, providing a cheaper, but, with feeders, a less controllable, prime mover. By far the commonest source of power has been the water motor, as it was economical and readily governed, and as water pressure was generally available, but the decline of the old-time bellows, with the fact that many cities to-day refuse to permit motors to be operated from the water mains, have given the field practically to the electric motor, now generally used in connection with some form of rotary fans. The principle of fans in series, first introduced by Cousans, of Lincoln, England, under the name of the Kinetic Blower, is now accepted as standard. This consists of a number of cleverly designed fans mounted in series on one shaft, the first delivering air to the second at, say, 3-inch pressure, to be raised another step and delivered to the next in series, etc., etc. This plan permits tapping off desired amounts of air at intermediate pressures with marked economy, and as it is slow speed, and generally direct connected with its motor on the same shaft, it is both quiet and mechanically efficient.

[1] One object of this was to prevent what was called "robbing." While the pressure of the wind might be ample and steady enough with only a few stops drawn, it was found that when all the stops were drawn the large pipes "robbed" their smaller neighbors of their due supply of wind, causing them to sound flat. By giving each pipe a pallet or valve to itself, the waste of wind in the large grooves was prevented. Another object was to get rid of the long wooden slides, which in dry weather were apt to shrink and cause leakage, and in damp weather to swell and stick.

[2] A striking instance of the difference between the two kinds of pallet can be seen in All Angels' Church, New York. The organ was built originally by Roosevelt, with two manuals and his patent wind-chest. In 1890 the church was enlarged and Jardine removed the organ to a chamber some thirty feet above the floor and fitted his electric action to the Roosevelt wind-chest. At the same time he erected an entirely new Choir organ, in the clerestory, with his electric action fitted to long pallets. The superiority of attack and promptness of speech, especially of the lower notes, of the Choir over the Great and Swell organs is marvelous. The same thing can be seen at St. James' Church, New York, where the Roosevelt organ was rebuilt with additions by the Hope-Jones Organ Co. in 1908.

[3] Some congregations could not stand them and had them taken out.

[4] Wedgwood: "Dictionary of Organ Stops," p. 167.

## CHAPTER IX.

## TRANSFERENCE OF STOPS.

At the commencement of the period of which we are treating, the stops belonging to the Swell organ could be drawn on that keyboard only; similarly the stops on the Great, Choir and Pedal organs could be drawn only on their respective keyboards. It is now becoming more and more common to arrange for the transference of stops from one keyboard to another.

If this plan be resorted to as an effort to make an insufficient number of stops suffice for a large building, it is bound to end in disappointment and cannot be too strongly condemned. On the other hand, if an organ-builder first provides a number stops that furnish sufficient variety of tonal quality and volume that is ample for the building in which the instrument is situated, and then arranges for the transference of a number of the stops to other manuals than their own, he will be adding to the tonal resources of the instrument in a way that is worthy of commendation. Many organs now constructed have their tonal effects more than doubled through adoption of this principle.

It is difficult to say who first conceived the idea of transference of stops, but authentic instances occurring in the sixteenth century can be pointed out. During the last fifty years many builders have done work in this direction, but without question the leadership in the movement must be attributed to Hope-Jones. While others may have suggested the same thing, he has worked the system out practically in a hundred instances, and has forced upon the attention of the organ world the artistic advantages of the plan.

His scheme of treating the organ as a single unit and rendering it possible to draw any of the stops on any of the keyboards at any (reasonable) pitch, was unfolded before the members of the Royal College of Organists in London at a lecture he delivered on May 5, 1891.

When adopting this system in part, he would speak of "unifying" this, that or the other stop, and this somewhat inapt phrase has now been adopted by other builders and threatens to become general.

Extraordinary claims of expressiveness, flexibility and artistic balance are made by those who preside at "unit (Hope-Jones) organs," but this style of instrument is revolutionary and has many opponents. Few, however, can now be found who do not advocate utilization of the principle to a greater or less degree in every organ. For instance, who has not longed at times that the Swell

Bourdon could be played by the pedals? Or that the Choir Clarinet were also in the Swell?

Compton, of Nottingham, England, employs this plan of stop extension and transference, or unifying of stops, in all the organs he builds.

As additional methods facilitating in some cases the transfer of stops must be named the "double touch" and the "pizzicato touch." The former, though practically introduced by Hope-Jones and found in most of his organs built during the last fifteen years, was, we believe, invented by a Frenchman and applied to reed organs. The pizzicato touch is a Hope-Jones invention which, though publicly introduced nearly twenty years since, did not meet with the recognition it deserved until recently. The earliest example of this touch in the United States is found in the organ at Hanson Place Baptist Church, Brooklyn, N. Y., 1909.

In the French Mustel reed organ the first touch is operated by depressing the keys about a sixteenth part of an inch. This produces a soft sound. A louder and different tone is elicited upon pushing the key further down. In the pipe organ the double touch is differently arranged. The first touch is the ordinary touch. Upon exerting a much heavier pressure upon the key it will suddenly fall into the second touch (about one-eighth of an inch deep) and will then cause an augmentation of the tone by making other pipes speak. The device is generally employed in connection with the couplers and can be brought into or out of action at the will of the organist. For instance, if the performer be playing upon his Choir Organ Flute and draws the Oboe stop on the Swell organ, he can (provided the double-touch action be drawn), by pressing any key or keys more firmly, cause those particular notes to speak on the Oboe, while the keys that he is pressing in the ordinary way will sound only the Flute.

The pizzicato touch is also used mostly in connection with the couplers. When playing upon a soft combination on the Great, the organist may draw the Swell to Great "pizzicato" coupler. Whenever now he depresses a Great key the Swell key will (in effect) descend with it, but will be instantly liberated again, even though the organist continue to hold his Great key. By means of this pizzicato touch (now being fitted to all Hope-Jones organs built in this country) a great variety of charming musical effects can be produced.

## THE UNIT ORGAN.

The Unit organ in its entirety consists of a single instrument divided into five tonal families, each family being placed in its own independent Swell box. The families are as follows: "Foundation"—this contains the Diapasons, Diaphones, Tibias, etc.; "woodwind"—this contains Flutes, Oboes, Clarinets, etc.; "strings"—this contains the Gambas, Viols d' Orchestre, Dulcianas, etc.; "brass"—this contains the Trumpets, Cornopeans and Tubas; "percussion"—this contains the Tympani, Gongs, Chimes, Glockenspiel, etc.

On each of the keyboards any of the stops, from the "foundation" group, the "woodwind" group, the "string" group, the "brass" group and the "percussion" group, may be drawn, and they may be drawn at 16 feet, at 8 feet, and, in some instances, at 4 feet, at 2 feet, at twelfth and at tierce pitches.

Arranged in this way an organ becomes an entirely different instrument. It is very flexible, for not only can the tones be altered by drawing the various stops at different pitches, but the various groups may be altered in power of tone independently of each other. At one moment the foundation tone may entirely dominate, by moving the swell pedals the strings may be made to come to the front while the foundation tone disappears; then again the woodwind asserts itself whilst the string tone is moderated, till the opening of the box containing the brass allows that element to dominate. The variety of the tonal combinations is practically endless.

The adoption of this principle also saves needless duplication of stops. In the organ at St. George's Hall, England, there are on the manuals 5 Open Diapasons, 4 Principals, 5 Fifteenths, 3 Clarinets, 2 Orchestral Oboes, 3 Trumpets, 3 Ophicleides, 3 Trombas, 6 Clarions, 4 Flutes, etc., etc. In the Hope-Jones Unit organ at Ocean Grove effects equal to the above are obtained from only 6 stops. The organist of Touro Synagogue, New Orleans, has expressed the opinion that his ten-stop Unit organ is equal to an ordinary instrument with sixty stops.

## SYMPATHY.

A strong reason against the duplication of pipes of similar tone in an organ is that curious acoustical phenomenon, the *bête noir* of the organ-builder, known as *sympathy*, or interference of sound waves. When two pipes of exactly the same pitch and scale are so placed that the pulsations of air from the one pass into the other, if blown separately the tone of each is clear; blown together there is practically no sound heard, the waves of the one streaming into the other, and a listener hears only the rushing of the air. That the conditions which produce sound are all present may be demonstrated by conveying a tube from the mouth of either of the pipes to a listener's ear, when its tone will be distinctly heard. In other words, one sound destroys the other. Helmholtz explains this phenomenon by saying that "when two equal sound waves are in opposition the one nullifies the effect of the other and the result is a straight line," that is, no wave, no sound. "If a wave crest of a particular size and form coincides with another exactly like it, the result will be a crest double the height of each one" (that is, the sound will be augmented). * * * "If a crest coincides with a trough the result will be that the one will unify the other," and the sound will be destroyed.[1] That is why in the old-style organs the builder, when he used more than one Diapason, tried to avoid this sympathy by using pipes of different scale, but even then the results were seldom satisfactory; the big pipes seemed to swallow the little ones. In the big organ in Leeds Town Hall, England, there was one pipe in the Principal which nobody could tune. The tuner turned it every possible way in its socket without avail, and at last succeeded by removing it from the socket and mounting it on a block at a considerable distance from its proper place, the wind being conveyed to it by a tube. This is only one instance of what frequently occurred.

In the Hope-Jones organ the usual plan of putting all the C pipes on one side of the organ and all the C# pipes on the other, is departed from. The pipes are alternated and in this ingenious way sympathy is largely avoided.

[1] Broadhouse: "Musical Acoustics," p. 261.

## CHAPTER X.

## THE PRODUCTION OF ORGAN TONE.

We now come to the department of the organ which will be of more interest to the listener, viz., the various organ tones. The general shape and construction of the pipes now in use, judging from the earliest drawings obtainable, have not changed for hundreds of years. The ancients were not wanting in ingenuity and we have pictures of many funny-looking pipes which were intended to imitate the growling of a bear (this stop was sometimes labeled Vox Humana!), the crowing of a cock, the call of the cuckoo, the song of the nightingale, and the twitter of the canary, the ends of these pipes being bent over and inserted in water, just as the player blows into a glass of water through a quill in a toy symphony. Then there was the Hummel, a device which caused two of the largest pipes in the organ to sound at once *and awake those who snored during the sermon*! Finally there was the Fuchsschwanz. A stop-knob bearing the inscription, "Noli me tangere" (touch me not), was attached to the console. As a reward for their curiosity, persons who were induced to touch the knob thereby set free the catch of a spring, causing a huge foxtail to fly into their faces—to the great joy and mirth of the bystanders.

In order to understand what follows we must make a short excursion into the realm of acoustics. We have already remarked upon the extreme antiquity of the Flute. The tone of the Flute is produced by blowing across a hole pierced in its side; in other words, *like a stream of wind striking upon a cutting edge*. It is possible to produce a tone in this way by blowing across the end of any tube made of any material, of glass, or iron, or rubber, or cane, or even the barrel of an old-fashioned door key. The primitive Flutes found in the Egyptian tombs and also depicted on the ancient hieroglyphics are made of reed or cane, about 14 inches long, possessing the usual six finger-holes. The top end is not stopped with a cork, as in the ordinary Flute, but is thinned off to a feather edge, leaving a sharp circular ring at right angles to the axis of the bore. By blowing across this ring a fair but somewhat feeble Flute tone is produced.

The six holes being closed by the fingers, the ground tone of the tube is produced. On lifting the fingers in successive order from the bottom end, we get the seven notes of the major scale. Closing the holes again and blowing harder, we get the scale *an octave higher*. By blowing still harder we get an octave higher still. In other words, we are now producing *harmonics*.

It is possible to produce from a plain tube without finger-holes or valves, such as the French Horn, by tightening the lips and increasing the pressure of the player's breath, the following series of harmonics:

**Series of harmonics**

The harmonics of a pianoforte string can be easily demonstrated by the following experiment: Depress the "loud" pedal and strike any note in the bass a sharp blow. On listening intently, the 3d, 5th, and 8th (the common chord) of the note struck will be heard sounding all the way up for several octaves. In this case the other strings of the piano act as *resonators*, enabling the harmonics to be heard.

Coming back to our Flute again and applying the knowledge we have gained to an organ pipe, we observe:

1. That the *pitch* of the sound depends on the length of the tube.

2. That the pitch of the sound *also* depends on the amount of wind pressure.

From this last will be seen how important it is that the pressure of the wind in an organ should be steady and uniform. Otherwise the pipes will speak a harmonic instead of the sound intended—as, indeed, frequently happens.

When a stop is labeled "8 ft.," that means that the bottom pipe, CC is 8 feet long and the pitch will be that of the key struck. A "16-ft." stop will sound an octave lower; a "4-ft." stop an octave higher. These measurements refer to pipes which are open at the top and are only correct in the case of very narrow pipes, such as the stop called Dulciana. Wider pipes do not require to be so long in order to produce 8-ft. tone.

"If a tube * * * open at both ends be blown across at one end, the fundamental tone of the tube will be sounded; but if the hand be placed at one end of the tube, so as to effectually close it, and the open end be blown across as before, a sound will be heard exactly one octave below that which was heard when both ends of the tube were open. One of these pipes was an open pipe, the other a stopped pipe; and the difference between the two is that which constitutes the two great classes into which the flue pipes of organs are divided." [1]

Thus by stopping up the end of an organ pipe we get 8-ft. tone from a pipe only 4 ft. long, 16-ft. tone from a pipe 8 ft. long, and so on, but with loss of power and volume. The harmonics produced from stopped pipes are entirely different from those of the open ones; their harmonic scale is produced by vibrations which are as 1, 2, 3, 4, etc., those of a stopped pipe by vibrations which are as 1, 3, 5, 7. All these harmonics are also called upper partials.

The Estey Organ Company claim to have discovered a new principle in acoustics in their Open Bass pipes, of which we show a drawing opposite. This invention (by William E. Haskell) enables the builders to supply open bass tone in organ chambers and swell boxes where there is not room for full-length pipes.

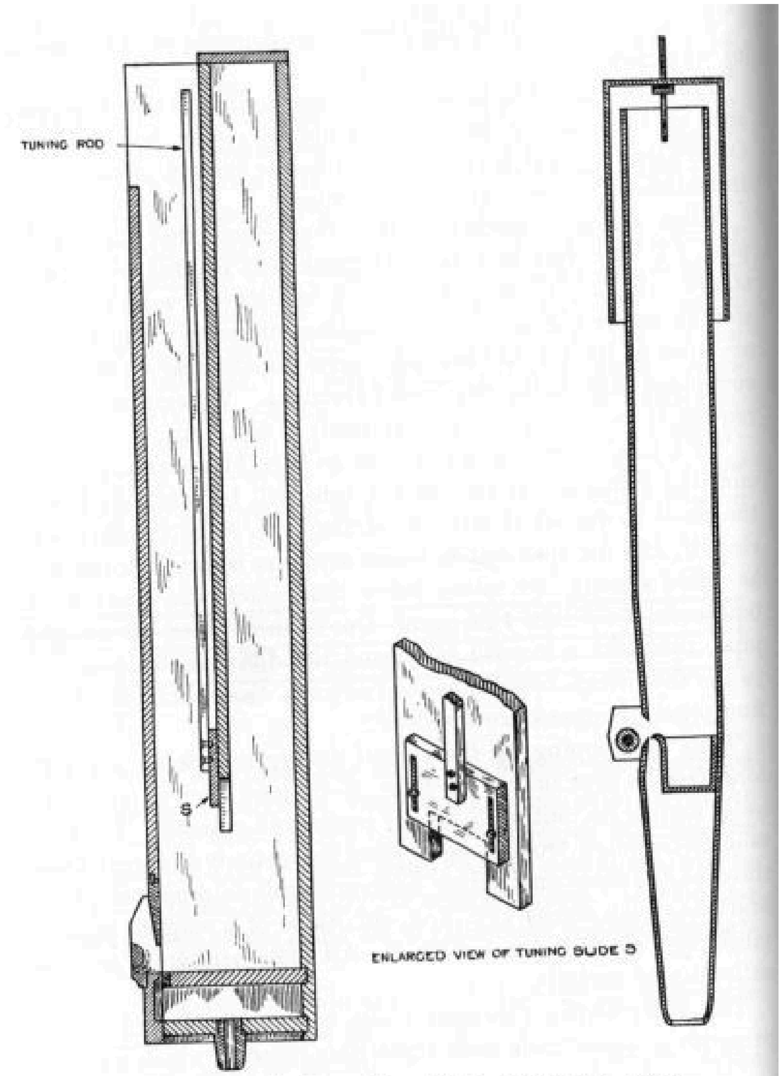



*Fig. 16. Estey's Open Bass Pipes—Wood and Metal*

**Fig. 16. Estey's Open Bass Pipes—Wood and Metal**

Referring to the illustration, it will be seen that the pipes are partly open and partly stopped, with a tuning slide in the centre. The builders write as follows:

"The inserted tube, or complementing chamber, in the pipe is such in length as to complete the full length of the pipe. It is, as will be noted, smaller in scale than the outside pipe. The effect is to produce the vibration that would be obtained with a full-length pipe, and in no way does it interfere with the quality of tone. In fact, it assists the pipe materially in its speech. This is most noticeable in a pipe such as the 32-foot Open Diapason, which when made full length is quite likely to be slow in speech. With this arrangement the pipe takes its speech very readily and is no slower in taking its full speech than an ordinary 16-foot Open Diapason.

"We have worked this out for all classes of tone—string, flute and diapason—and the law holds good in every instance."

Helmholtz was the first to demonstrate that the *quality* of all musical tones depends entirely upon the presence or absence of their upper partials. In the hollow tone of the Flute they are almost entirely absent; in the clanging tone of the Trumpet many of the higher ones are present; and if we take an instrument like the Cymbals we get the whole of the upper lot altogether.

The different qualities of tone of the organ pipes are therefore determined: (1) By the material of which the pipes are made; (2) by the shape of the pipe; (3) by the amount of wind pressure; (4) by the shape and size of the mouth, the relation of the lip to the stream of wind impinging on it from a narrow slit, and the shape and thickness of the lip itself. The manipulation of the mouth and lip to produce the tone desired is called voicing and calls for considerable artistic skill. The writer recollects an instance of a clever voicer (Gustav Schlette) taking a new organ in hand, which was not quite satisfactory, and on the following Sunday he hardly knew it again.

Another kind of harmonics must now be described, called combinational or Tartini tones (from Tartini, a celebrated Italian violinist of the XVII century, who first described them). "These tones," says Helmholtz, "are heard whenever two musical tones of different pitches are sounded together loudly and continuously." There is no necessity for giving a table of all of their tones here; we select the two most useful. If two notes at an interval of a fifth are held down, a note one octave below the lower one will be heard. So organ builders take two pipes—one 16 feet long (CCC) and one 10 2/3 feet long (GG)—which make the interval of the fifth, and, by sounding them together, produce the tone of a pipe 33 feet long (CCCC). This is the stop which will be found labeled "32-ft. Resultant." Hope-Jones makes a stop which he calls Gravissima, 64-ft. Resultant, in his large organs. Many contend that this system produces better results than if pipes of the actual lengths of 32 or 64 feet were employed. Indeed, a pipe 64 feet long would be inaudible; the human ear has its limitations and refuses to recognize tone lower than 32 feet (just as we cannot lift water by a suction pump over 32 feet)—*but*, these great pipes *produce harmonics* which wonderfully reinforce the tone of the organ. Therefore their use is worth while.

The other combinational tone to which we refer is that produced by the interval of a major third. It sounds two octaves below the lower note. The writer is not aware that this has ever been used as an organ stop, but it is found written in the organ compositions of Guilmant and other first-rate composers. It will be seen that a skilful organist, with a knowledge of these tones, can produce effects from small organs not available to the ordinary player.

Reverting once more to our Flute, whose tube is shortened by lifting the fingers from the holes, it is not generally known that this can be done with an organ pipe; the writer has met with instances of it in England. The two lowest pipes of the Pedal Open Diapason were each made to give two notes by affixing a pneumatic valve near the top of the pipe. When the valve was closed the pipe gave CCC. When the organist played CCC sharp, wind was admitted to the valve, which opened, and this shortened the pipe. The device worked perfectly, only that it was not possible to hold down both CCC and CCC sharp and make "thunder"! The organist of Chester Cathedral had been playing his instrument twice daily for ten years before he found this out, and then he only discovered it when the pipes were taken down to be cleaned. It is an admirable makeshift where a builder is cramped for room.

Organ pipes are divided into three families—Flues, Reeds and Diaphones. The flues are subdivided into Diapasons, Flutes, and Strings, and we now proceed to consider each of these groups separately.

## DIAPASONS.

The pipes usually seen in the front of an organ belong to the Great organ Open Diapason, long regarded as the foundation tone of the instrument. The Open Diapason may vary in size (or scale) from 9 inches diameter at CC to 3 inches. The average size is about 6 inches.

The Diapasons of the celebrated old organ-builders, Father Schmidt, Renatus Harris, Green, Snetzler and others, though small in power, were most musical in tone quality. Though sounding soft near the organ, the tone from these musical stops seems to suffer little loss when traveling to the end of quite a large building. About the year 1862 Schulze, in his celebrated organ at Doncaster, England, brought into prominence a new and much more brilliant and powerful Diapason. The mouths of the pipes were made very wide and they were more freely blown. Schulze's work was imitated by T. C. Lewis, of England, and by Willis. It has also exercised very great influence on the work done by almost all organ-builders in this country, in Germany, and elsewhere. Schulze's method of treatment added largely to the assertiveness and power of the tone, but gave the impression of the pipes being overblown and led to the loss of the beautiful, musical, and singing quality of tone furnished by the older Diapasons. Hard-toned Diapasons became almost the accepted standard. Willis even went so far as to slot all of his Diapason pipes, and Cavaillé-Coll sometimes adopted a similar practice. Walker, in England, and Henry Erben, in this country, continued to produce Diapasons having a larger percentage of foundation tone and they and a few other builders thus helped to keep alive the old traditions.

In the year 1887 Hope-Jones introduced his discovery that by leathering the lips of the Diapason pipes, narrowing their mouths, inverting their languids and increasing the thickness of the metal, the pipes could be voiced on 10, 20, or even 30-inch wind, without hardness of tone, forcing, or windiness being introduced. He ceased to restrict the toe of the pipe and did all his regulation at the flue.

His invention has proved of profound significance to the organ world. The old musical quality, rich in foundation tone, is returning, but with added power. Its use, in place of the hard and empty-toned Diapasons to which we had perforce become accustomed, is rapidly growing. The organs in almost all parts of the world show the Hope-Jones influence. Few builders have failed now to adopt the leathered lip.

Wedgwood, in his "Dictionary of Organ Stops," pp. 44, 45, says:

"Mr. Ernest Skinner, an eminent American organ-builder,[2] likens the discovery of the leathered lip to the invention by Barker of the pneumatic lever, predicting that it will revolutionize organ tone as surely and completely as did the latter organ mechanism, an estimate which is by no means so exaggerated as might be supposed. The leathered Diapason, indeed, is now attaining a zenith of popularity both in England and America.[3] A prominent German builder also, who, on the author's recommendation, made trial of it, was so struck with the refined quality of tone that he forthwith signified his intention of adopting the process. A few isolated and unsuccessful experimental attempts at improving the tone of the pipes by coating their lips with paper, parchment, felt, and kindred substances, have been recorded, but undoubtedly the credit of having been the first to perceive the value and inner significance of the process must be accorded to Mr. Robert Hope-Jones. It was only at the cost of considerable thought and labour that he was able to develop his crude and embryonic scientific theory into a process which bids fair to transform modern organ building. The names of Cavaillé-Coll and George Willis, and of Hope-Jones, will be handed down to posterity as the authors of the most valuable improvements in the domains of reed-voicing and flue-voicing, respectively, which have been witnessed in the present era of organ building."

The desire for power in Diapason tone first found expression in this country by the introduction into our larger organs of what was called a Stentorphone. This was a large metal Diapason of ordinary construction, voiced on heavy wind pressure. It was most harsh, unmusical and inartistic. It produced comparatively little foundation tone and a powerful chord of harmonics, many of them dissonant. In Germany, Weiglé, of Stuttgart, introduced a similar stop, but actually exaggerated its want of refinement by making the mouth above the normal width. As knowledge of the Hope-Jones methods spreads, these coarse and unmusical stops disappear. He is without question right in urging that the chief aim in using heavy pressure should be to increase refinement, not power of tone. Sweet foundation tone produced from heavy wind pressure always possesses satisfactory power. He is also unquestionably right in his contention that when great nobility of foundation tone is required, Diapasons should not be unduly multiplied, but Tibias or large Flutes should be used behind them.

Every epoch-making innovation raises adversaries.

We learn from these that pure foundation tone does not blend. True, there are examples of organs where the true foundation tone exists but does not blend with the rest of the instrument, but it is misleading to say that "pure foundation tone does not blend." Hope-Jones has proved conclusively that by exercise of the requisite skill it does and so have others who follow in his steps. A view of the mouth of a Hope-Jones heavy pressure Diapason, with inverted languid, leather lip and clothed flue, is given in Figure 17.

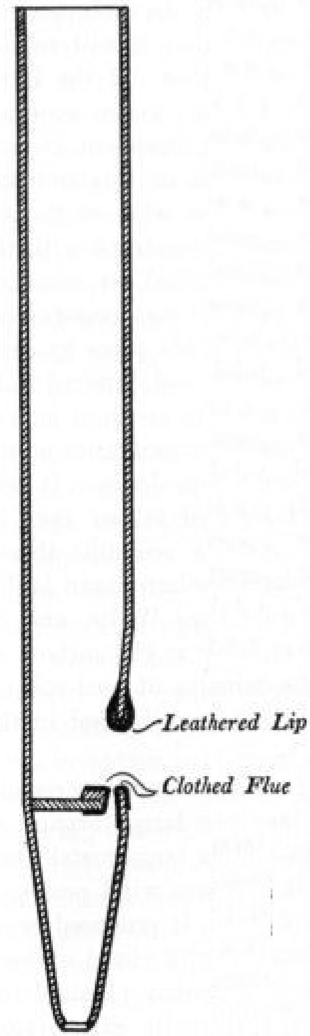



Fig. 17. Diapason Pipe with Leathered Lip

**Fig. 17. Diapason Pipe with Leathered Lip**

The dull tone of the old Diapasons was due to the absence of the upper harmonics or partials. With the introduction of the Lutheran chorale and congregational singing it was found that the existing organs could not make themselves heard above the voices. But it was discovered empirically that by adding their harmonics artificially the organs could be brightened up and even made to overpower large bodies of singers. Hence the introduction of the Mixture stops (also called compound stops), which were *compounded* of several ranks of pipes. The simplest form was the Doublette sounding the 15th and 22nd (the double and treble octave) of the note struck. Other ranks added sounded the 12th, 19th, and so on, until it was possible to obtain not only the full common chord, but also some of the higher harmonics dissonant to this chord, from a single key.

## THE DECLINE OF MIXTURES.

Fifty years ago it was common to find the number of ranks of mixtures in an organ largely exceed the total number of foundation stops. Mixtures were inserted in the pedal departments of all large organs. Organists of the time do not seem to have objected and many of the leading players strongly opposed Hope-Jones when he came out as the champion of their abolition. These stops greatly excited the ire of Berlioz, who declaims against them in his celebrated work on orchestration.

The tone of these old organs, when all the Mixture work is drawn, is well nigh ludicrous to modern ears, and it is hard to suppress a smile when reading the statements and arguments advanced in favor of the retention of Mixtures by well-known organists of the last generation. These mutation stops still have their place in large instruments, but it is no longer thought that they are necessary to support the singing of a congregation and that they should be voiced loudly. The decline of Mixture work has in itself entirely altered and very greatly improved the effect of organs when considered from a musical point of view. The tone is now bright and clear. Mr. James Wedgwood says:

"The tendency to exaggerate the 'upper work' of the organ reached a climax in the instrument built by Gabler, in 1750, for the Monastic Church at Weingarten, near Ravensburg. This organ comprised no less than ninety-five ranks of Mixture, including two stops of twenty-one and twenty ranks, respectively. Toward the close of the Eighteenth Century, the Abt Vögler (1749-1814) came forward with his 'Simplification System,' one feature of which consisted in the abolition of excessive Mixture work. The worthy Abbe, who was a capable theorist and a gifted player, and possessed of an eccentric and, therefore, attractive personality, secured many followers, who preached a crusade against Mixture work. The success of the movement can well be measured by the amount of apologetic literature it called forth, and by the fact that it stirred the theorists to ponder for themselves what really was the function of the Mixture. * * * The announcement by Mr. Hope-Jones at the beginning of the last decade of the past century of his complete discardment of all Mixture and mutation work may fairly be stated to have marked a distinct epoch in the history of the controversy."

It is indeed strange to find that this man, who did much to discourage the use of mixtures, has never quite abandoned their employment and is to-day the sole champion of double sets of mixture pipes, which he puts in his organs under the name of Mixture Celestes! However, these are very soft and are of course quite different in object and scope from the old-fashioned mixture—now happily extinct.

## FLUTES.

The chief developments in Flutes that have taken place during the period under consideration are the popularization of the double length, or "Harmonic," principle,[4] by Cavaillé-Coll, by William Thynne and others, and the introduction of large scale leather-lipped "Tibias" by Hope-Jones.

Harmonic Flutes, of double length open pipes,[5] are now utilized by almost all organ builders. Speaking generally, the tone is pure and possesses considerable carrying power. Thynne, in his Zauber Flöte, introduced stopped pipes blown so as to produce their first harmonic (an interval of a twelfth from the ground tone). The tone is of quiet silvery beauty, but the stop does not seem to have been largely adopted by other builders. Perhaps the most beautiful stop of this kind produced by Thynne is the one in the remarkable organ in the home of Mr. J. Martin White, Balruddery, Dundee, Scotland.

The Hope-Jones leathered Tibias have already effected a revolution in the tonal structure of large organs. They produce a much greater percentage of foundation tone than the best Diapasons and are finding their way into most modern organs of size. They appear under various names, such as Tibia Plena, Tibia Clausa, Gross Flöte, Flute Fundamentale and Philomela.

"The word Tibia has consistently been adapted to the nomenclature of organ stops on the Continent (of Europe) for some centuries. The word Tibia is now used in this country to denote a quality of tone of an intensely massive, full and clear character, first realized by Mr. Hope-Jones, though faintly foreshadowed by Bishop in his Clarabella. It is produced from pipes of a very large scale, yielding a volume of foundation tone, accompanied by the minimum of harmonic development. Even from a purely superficial point of view, the tone of the Tibia family is most attractive; but, further, its value in welding together the constituent tones of the organ and coping with modern reed-work is inestimable." [6]

"The Tibia Plena was invented by Mr. Hope-Jones, and first introduced by him into the organ at St. John's, Birkenhead, England, about 1887. It is a wood Flute of very large scale, with the mouth on the narrow side of the pipe. The block is sunk, and the lip, which is of considerable thickness, is usually coated with a thin strip of leather to impart to the tone the requisite smoothness and finish. It is voiced on any wind pressure from 4-inch upwards. The Tibia Plena is the most powerful and weighty of all the Tibia tribe of stops. It is, therefore, invaluable in large instruments. * * * The Tibia Profunda and Tibia Profundissima are 16-ft. and 33-ft. Pedal extensions of the Tibia Plena." [7]

"The Tibia Clausa is a wood Gedackt of very large scale (in other words, a stopped pipe), furnished with leather lips. It was invented by Mr. Hope-Jones. The tone is powerful and beautifully pure and liquid. The prevailing fault of the modern Swell organ is, perhaps, the inadequacy of the Flute work. * * * It was the recognition of this shortcoming which led to the invention of the Tibia Clausa." [8]

The Tibia Dura is another of Mr. Hope-Jones' inventions. It is an open wood pipe of peculiar shape, wider at the top than the bottom, and described by Wedgwood as of "bright, hard, and searching" tone.

The Tibia Minor was invented by Mr. John H. Compton, of Nottingham, England, one of the most artistic builders in that country. "The Tibia Minor bears some resemblance to Mr. Hope-Jones' Tibia Clausa, but being destined more for use on an open wind-chest, differs in some important respects. The stop is now generally made of wood, though several specimens have been made of metal. In all cases the upper lip is leathered. The tone of the Tibia Minor is extraordinarily effective. In the bass it is round and velvety * * * in the treble the tone becomes very clear and full * * * it forms a solo stop of remarkably fine effect, and in combination serves to add much clearness and fulness of tone to the treble, and, in general, exercises to the fullest extent the beneficial characteristics of the Tibia class of stop already detailed. If only by reason of the faculty so largely exercised, of thus mollifying and enriching the upper notes of other stops—which too often prove hard and strident in tone—the Tibia Minor deserves recognition as one of the most valuable of modern tonal inventions." [9]

The Tibia Mollis, invented by Mr. Hope-Jones, is a Flute of soft tone, composed of rectangular wooden pipes. The name Tibia Mollis is also employed by Mr. John H. Compton to denote a more subdued variety of his Tibia Minor.

Other Flutes found in organs are the Stopped Diapason, Clarabella, Clarinet Flute, Rohrflöte ("Reed-flute"), Wald Flöte, Flauto Traverso, Suabe Flute, Clear Flute, Doppel Flöte (with two mouths), Melodia, Orchestral Flute, etc., each of a different quality of tone and varying in intensity. The Philomela as made by Jardine is a melodia with two mouths.

## STRINGS.

Under this head are grouped the stops which imitate the tones of such stringed instruments as the Viola, the Violoncello, the Double Bass, and more especially the old form of Violoncello, called the Viol di Gamba, which had six strings and was more nasal in tone.

At the commencement of the period herein spoken of string-toned stops as we know them to-day scarcely existed. This family was practically represented by the Dulciana and by the old slow-speaking German Gamba. These Gambas were more like Diapasons than strings.

Edmund Schulze made an advance and produced some Gambas and Violones which, though of robust and full-bodied type, were pleasant and musical in tone. They were at the time deemed capable of string-like effects.

To William Thynne belongs the credit of a great step in advance. The string tones heard in the Michell and Thynne organ at the Liverpool, England, exhibition in 1886 were a revelation of the possibilities in this direction, and many organs subsequently introduced contained beautiful stops from his hands—notably the orchestral-toned instrument in the residence of J. Martin White, Dundee, Scotland—an ardent advocate of string tone. Years later Thynne's partner, Carlton C. Mitchell, produced much beautiful work in this direction. Hope-Jones founded his work on the Thynne model and by introducing smaller scales, bellied pipes and sundry improvements in detail, produced the keen and refined string stops now finding their way into all organs of importance. His delicate Viols are of exceedingly small scale (some examples measuring only 1 1/8 inches in diameter at the 8-foot note). They are met with under the names of Viol d' Orchestre, Viol Celeste and Dulcet.[10] These stops have contributed more than anything else towards the organ suitable for the performance of orchestral music.

Haskell has introduced several beautiful varieties of wood and metal stops of keen tone, perhaps the best known being the labial Oboe and Saxophone, commonly found in Estey organs. His work is destined to exert considerable influence upon the art.

Other string-toned stops found nowadays in organs are the Keraulophon, Aeoline, Gemshorn, Spitzflöte, Clariana, Fugara, Salicet, Salicional, and Erzähler.[11]

## REEDS.

As remarked in our opening chapter, pipes with strips of cane or reeds in the mouthpiece are of great antiquity, being found side by side with the flutes in the Egyptian tombs. These reeds, as those used at the present day, were formed of the outer siliceous layer of a tall grass, *Arundo donax*, or *sativa*, which grows in Egypt and the south of Europe. They were frequently double, but the prototype of the reed organ-pipe is to be seen in the clarinet, where the reed is single and beats against the mouthpiece. Of course, an artificial mouthpiece has to be provided for our organ-pipe, but this is called the *boot*. See Figure 19, which shows the construction of a reed organ-pipe. A is the boot containing a tube called the eschallot B, partly cut away and the opening closed by a brass *tongue* C, which vibrates under pressure of the wind. D is the wire by which the tongue is tuned; E the body of the pipe which acts as a resonator.

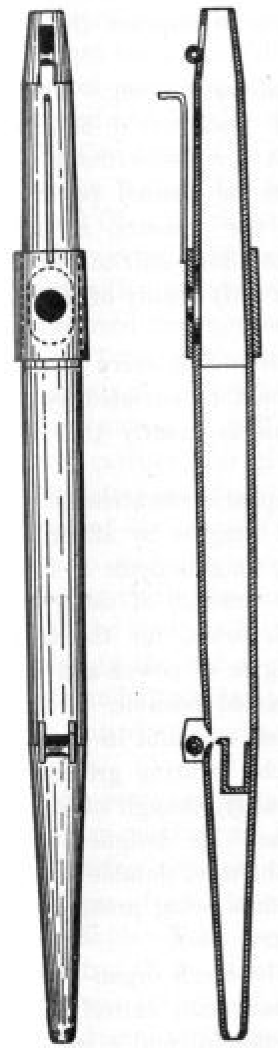


*Fig.* 18. *Haskell's Clarinet Without Reed*

**Fig. 18. Haskell's Clarinet Without Reed**

In the last half-century the art of reed voicing has been entirely revolutionized. Prior to the advent of Willis, organ reeds were poor, thin, buzzy things, with little or no grandeur of effect, and were most unmusical in quality. Testimony to the truth of this fact is to be found in old instruction books for organ students. It is there stated that reeds should never be used alone, but that a Stopped Diapason or other rank of flue pipes must always be drawn with them to improve the tone quality.

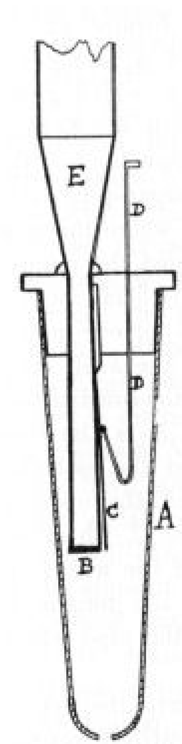



*Fig.* 19.
*Diagram of*
*Reed Pipe*

**Fig. 19. Diagram of Reed Pipe**

Willis created an entirely new school of reed voicing. He was the first to show that reeds could be made really beautiful and fit for use without help from flue stops. When he wanted power he obtained it by raising the pressure, in order that he might be able to afford still to restrain the tone and to consider only beauty of musical quality.

He was the first to show that every trace of roughness and rattle could be obviated by imparting to the reed tongue exactly the right curve.

He restrained too emphatic vibrations in the case of the larger reed tongues by affixing to them with small screws, weights made of brass. He quickly adopted the practice of using harmonic, or double-length tubes, for the treble notes, and secured a degree of power and brilliance never before dreamed possible.

Willis gave up the open eschallot in favor of the closed variety, thereby securing greater refinement of musical quality, though of course sacrificing power of tone. He designed many varieties of reed tubes, the most notable departure from existing standards being probably his Cor Anglais and Orchestral Oboe.

Under the guiding genius of Willis, the Swell organ—which had hitherto been a poor and weak department, entirely over-shadowed by the Great—became rich, powerful and alive with angry reeds, which were nevertheless truly musical in effect. Hope-Jones took up the work where Willis left it, and has not only pushed the Willis work to its logical conclusion, but has introduced a new school of his own.

He has taken the Willis chorus reeds and by doubling the wind pressures and increasing the loading and thickness of tongues, has produced results of surpassing magnificence. From the Willis Cor Anglais he has developed his Double English Horn, from the Willis Oboe his Oboe Horn, and from the Willis Orchestral Oboe the thin-toned stops of that class now being introduced by Austin, Skinner and by his own firm. His chief claim to distinction in this field, however, lies in the production of the smooth reed tone now so rapidly coming into general use; in his 85-note Tuba; in the use of diminutive eschallots with mere saw-cut openings; in providing means for making reed pipes stand in tune almost as well as flue pipes; and in the utilization of "vowel cavities" for giving character to orchestral-toned reeds.

The latter are of particular interest, as their possibilities are in process of development. The results already achieved have done much to make the most advanced organ rival the orchestra.

To exemplify the principle of the vowel cavities Hope-Jones was in the habit, in his factory in Birkenhead, England, in 1890, of placing the end of one of his slim Kinura reed pipes in his mouth and by making the shape of the latter favor the oo, ah, eh, or ee, entirely altered and modified the quality of tone emitted by the pipe.

Some years ago in an organ built for the Presbyterian Church, Irvington-on-Hudson, N. Y., Hope-Jones introduced a beating reed having no pipes or resonators of any kind. He is using this form of reed in most of his organs now building.

In England this vowel cavity principle has been applied to Orchestral Oboes, Kinuras and Vox Humanas, but in this country it was introduced but seven years ago and has so far been adapted only to Orchestral Oboes. At the time of writing it is being introduced in connection with Hope-Jones' Vox Humanas and Kinuras. Examples are to be seen in the Wanamaker (New York) organ; in Park Church, Elmira; Buffalo Cathedral; Columbia College, St. James' Church, New York; College of the City of New York; Ocean Grove Auditorium, and elsewhere. There undoubtedly lies a great future before this plan for increasing the variety of orchestral tone colors. Figure 20 shows a vowel cavity applied to a Vox Humana (Norwich Cathedral, England), Figure 21 to an Orchestral Oboe (Worcester Cathedral, England), and Figure 22 to a Kinura (Kinoul, Scotland).

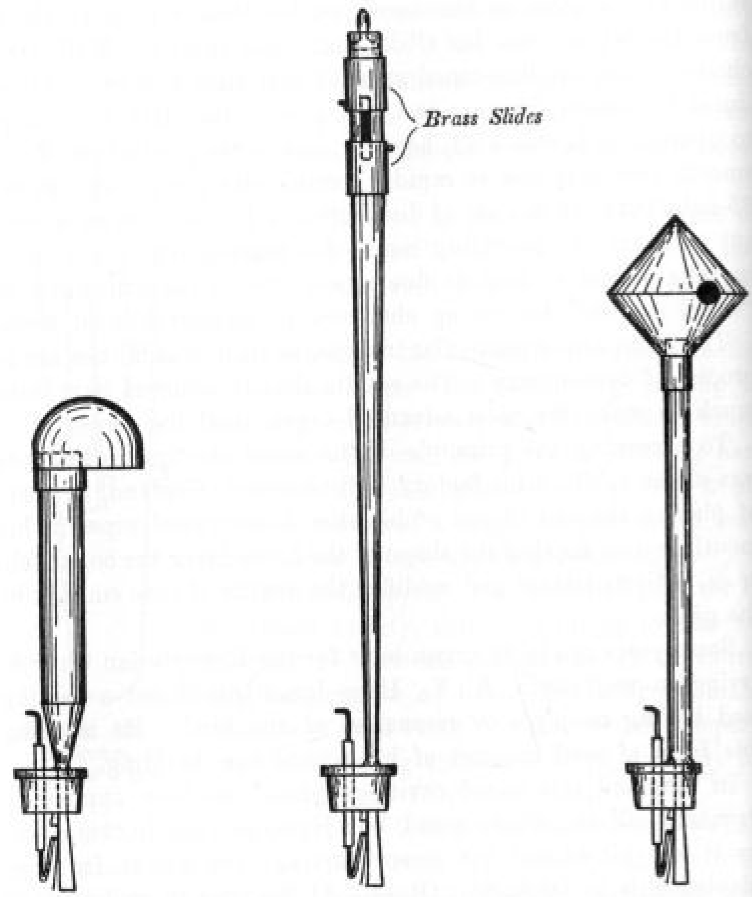



*Fig.* 20. *Vox Humana with Vowel Cavity Attached.*
*Fig.* 21. *Orchestral Oboe with Vowel Cavity Attached*
*Fig.* 22. *Kinura with Vowel Cavity Attached*

**Fig. 20. Vox Humana with Vowel Cavity Attached. Fig. 21. Orchestral Oboe with Vowel Cavity Attached Fig. 22. Kinura with Vowel Cavity Attached**

Builders who have not mastered the art of so curving their reed tongues that buzz and rattle are impossible have endeavored to obtain smoothness of tone by leathering the face of the eschallot. This pernicious practice has unfortunately obtained much headway in the United States and in Germany. It cannot be too strongly condemned, for its introduction robs the reeds of their characteristic virility of tone. Reeds that are leathered cannot be depended upon; atmospheric changes affect them and put them out of tune.

The French school of reed voicing, led by Cavaillé-Coll, has produced several varieties that have become celebrated. Many French Orchestral reeds are refined and beautiful in quality and the larger Trumpets and Tubas, though assertive and blatant, are not unmusical. The French school, however, does not appear to be destined to exercise any great influence upon the art in this country. (For further information regarding reeds see chapter on tuning.)

## UNDULATING STOPS—CELESTES.

The writer is not aware who first introduced into the organ a rank of soft-toned pipes purposely tuned a trifle sharp or flat to the normal pitch of the organ, so as to cause a beat or wave in the tone. Fifty years ago such stops were sparingly used and many organists condemned their employment altogether. Stops of the kind were hardly ever found in small organs and the largest instruments seldom contained more than one.

A great development in this direction has taken place and further advance seems to be immediate. Already most builders introduce a Celeste into their small organs and two or three into their larger instruments—whilst Hope-Jones' organs are planned with Vox Humana Celestes, Physharmonica Celestes, Kinura Celestes and even Mixture Celestes!

Most modern Celestes are tuned sharp, the effect being more animated than if it were tuned flat; but the aggregate effect and general utility of the stop are greatly enhanced by the use of two ranks of pipes, one being tuned sharp and the other flat to the organ pitch. A three-rank Celeste (sharp, flat, and unison) formed one of the novel features of the organ in Worcester Cathedral, England, built by Hope-Jones in 1896. Wedgwood credits its invention to Mr. Thomas Casson. The three-rank Celeste is also to be found in the organs of the Bennett Organ Company.

Apart from the inherent beauty of the tones there is much to be said in favor of the presence of these stops—if the organ is to be used as an adjunct to, or a substitute for, the orchestra. The whole orchestra is one huge and ever-varying "Celeste." Were it not so its music would sound dead and cold. Few of the instrumentalists ever succeed in playing a single bar absolutely in tune with the other components of the band.

## PERCUSSION STOPS.

This class of stop is also now finding its way into organs more generally than heretofore. Resonating gongs giving, when skillfully used, effects closely resembling a harp have been introduced freely by the Aeolian Company in its house organs, and there seems no possible objection to such introduction. The tone is thoroughly musical and blends perfectly with the other registers. Under the name of "Chimes" these resonant gongs are now finding place in many Church and Concert organs. Tubular bells are also used in a similar capacity by all the leading organ-builders,

The greatest development in this direction is found in the Hope-Jones Unit Orchestra. In these instruments fully one-third of the speaking stops rely on percussion for production of their tones. Even small instruments of this type have all got the following percussion stops: Chimes, Chrysoglott, Glockenspiel, Electric Bells (with resonators), Xylophone, and carefully-tuned Sleigh Bells—in addition to single percussive instruments, such as Snare-drum, Bass-drum, Kettle-drum, Tambourine, Castanets, Triangle, Cymbals, and Chinese Gong.

As all these tone producers are enclosed in a thick Swell box, an artist is able to employ them with as much refinement of effect as is heard when they are heard in a Symphony Orchestra.

Mr. Hope-Jones informs the writer that he has just invented an electric action which strikes a blow accurately proportioned to the force employed in depressing the key, thus obtaining expression from the fingers as in the pianoforte. He will apply this to the percussion stops in organs he may build in the future.

When skilfully employed many of these percussion stops blend so perfectly with the flue and reed pipes that they become an important integral part of the instrument—not merely a collection of fancy stops for occasional use.

## THE DIAPHONE.

The invention of the Diaphone by Hope-Jones in 1894 will some day be regarded as the most important step in advance hitherto achieved in the art of organ building. The existence of patents at present prevents general adoption of the invention and limits it to the instruments made by one particular builder. In addition to this the Diaphone takes so many forms and covers so large a field that time must necessarily pass before its full possibilities are realized.

Enough was, however, done by Hope-Jones in connection with the organs he built in England a dozen or eighteen years ago to leave the experimental stage and prove the invention to be of the greatest practical importance to the future of organ building. The author's opinion that before long every new large organ will be built upon the Diaphone as a foundation, is shared by all who have had opportunity to judge. By no other means known to-day can anything approaching such grand and dignified Diapason tone be produced. Were twenty large Diapasons added to the instrument in Ocean Grove, N. J., or to that in the Baptist Temple, Philadelphia, and were the Diaphone removed, the instrument would suffer most seriously. In the Pedal department no reed or flue pipe can begin to compare with a Diaphone, either in attack or in volume of tone.

In Figure 23 we give a sectional view of the first large Diaphone made, namely that constructed for the Hope-Jones organ in Worcester Cathedral, Eng., 1896.

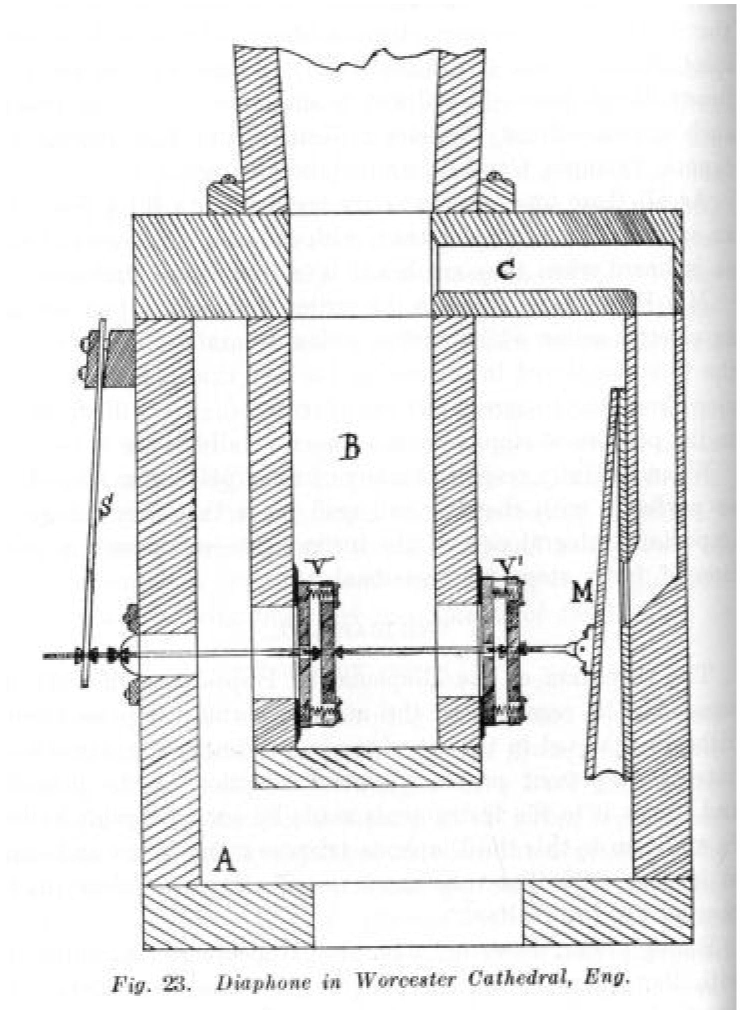



**Fig. 23. Diaphone in Worcester Cathedral, Eng.**

M is a pneumatic motor or bellows to which is attached a rod bearing the compound and spring valve V, $V^1$, working against the spring S. On the admission of wind (under pressure) to the box A, the motor M is caused to collapse, and thereby to open the valves V, $V^1$. Wind then rushes into the chamber B, and entering the interior of motor M through the passage C, equalizes the pressure in the motor. The action of the springs now serves to close the valves V, $V^1$, and to open out the motor M, whereupon the process is repeated.

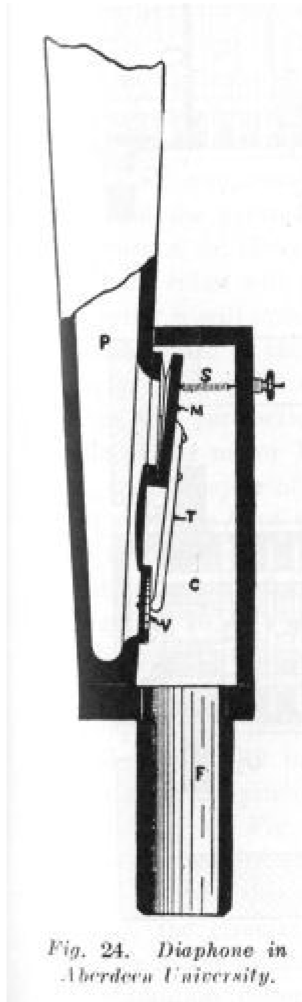
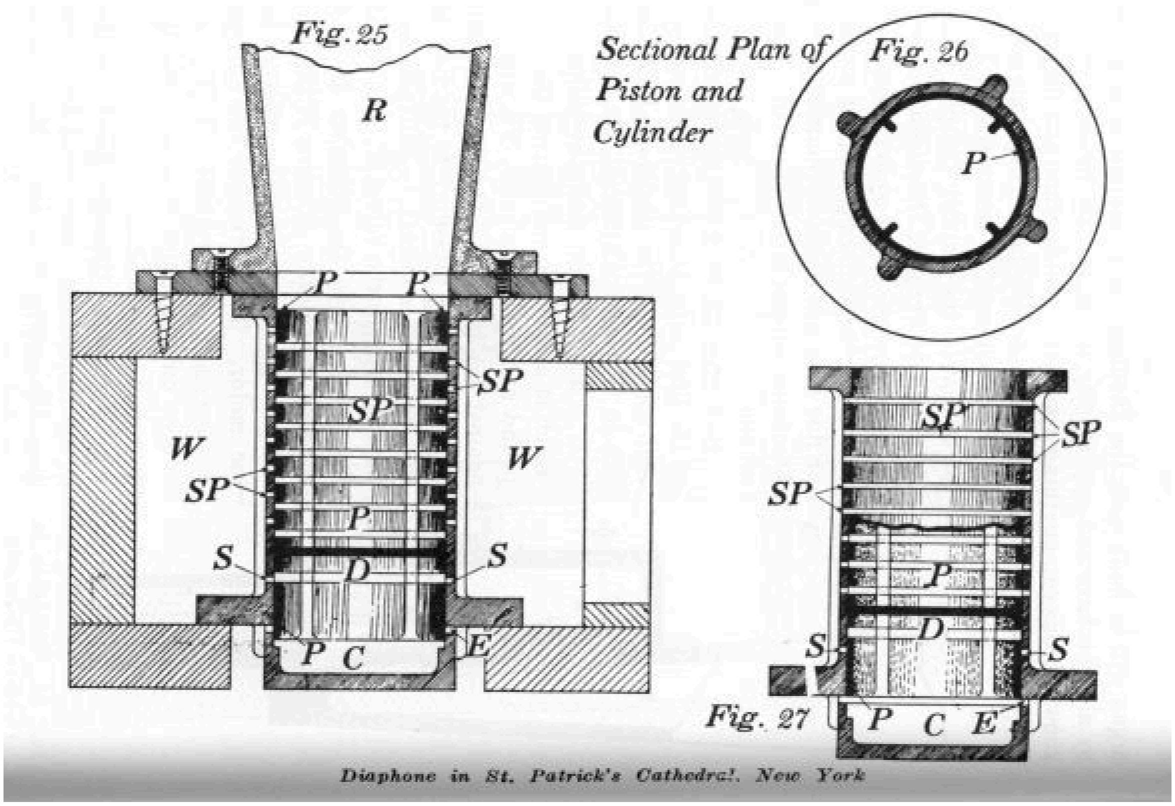



**Fig. 24.**
**Diaphone in**
**Aberdeen**
**University.**

In Fig. 24 we illustrate the Diaphone in the Hope-Jones organ built for Aberdeen University, Scotland. The action is as follows:

Wind from the organ bellows enters the pipe foot F, and raises the pressure in the chamber C. The air in the chamber will press upon the back of the valve V, tending to keep it closed. It will press also upon the bellows or motor M, and as this bellows has a much larger area than that of the valve, it will instantly collapse, and, through the medium of the tail piece T, will pull the valve V off its seat and allow the compressed air in the chamber C to rush into the resonator or pipe P. Owing to the inertia of the column of air contained in the pipe P, a momentary compression will take place at the lower end of the pipe, and the pressure of the air inside the motor M will, in consequence, be raised. The motor having now increased pressure both sides, will no longer keep the valve off its seat, and the spring S will open the motor and close the valve. The compression caused by the admission of the puff of air into the lower parts of the pipe P will be followed by the usual rarefaction, and as this rarefaction will exhaust or suck the air from the inside of the motor M, the valve will again be lifted from its seat, and the cycle of operations will be repeated as long as the wind supply is kept up. A series of regular puffs of wind will thus be delivered into the lower part of the resonator or pipe, resulting in a musical note.

Figs. 25, 26, 27 represent the first Diaphone heard in a public building in this country, namely that of a model sounded in St. Patrick's Cathedral, New York City, in 1905. In this form of Diaphone the pressure of air operating the Diaphone has been varied between 10 inches and 500 inches, without perceptible variation in the pitch of the note emitted.




**Figs. 25, 26, 27. Diaphone in St. Patrick's Cathedral, New York**

Referring to Fig. 25, the chamber WW is supplied with air under pressure whenever the organist presses a key or pedal calling into use this particular note. The pressure of air enters through the circular engine supply port S, thus raising the pressure in the chamber C and forcing in an upward direction the aluminum piston P through the medium of the division D (colored black), which forms a portion of the aluminum piston.

When the lower edge of the piston has risen a certain distance it will uncover the circular engine exhaust port E, and will allow the compressed air to escape into the atmosphere. At this moment the rise of the piston will have closed the engine supply port S.

The momentum acquired by the piston (see Fig. 27) will cause it to travel upward a little further, and this upward travel of the division D will cause a compression of air to take place at the foot of the resonator or pipe

R. This compression will be vastly increased through the simultaneous opening of the eight circular speaking ports SP.

The pressure of the compressed air at the foot of the resonator E will now by acting on the upper surface of the division D depress the aluminum piston until the engine supply port S is again opened.

By this time the compression at the foot of resonator R will have traveled up the pipe in the form of a sound wave, and will have been followed by the complementary rarefaction. This rarefaction on the upper side will render more effective the pressure of the compressed air again admitted through the engine supply port S on the underside of division D.

It will be seen that this cycle of operations will be repeated as long as the organist holds down his pedal or key admitting compressed air to the chamber W.

As the aluminum piston P is very light and is in no way impeded in its movement or swing, the speed of its vibration, and consequently the pitch of the note emitted, will be governed by the length of the resonator or pipe R.

The tone given by this particular form of Diaphone possesses a peculiar sweetness in quality, while the power is limited only by the pressure of air used to operate it.

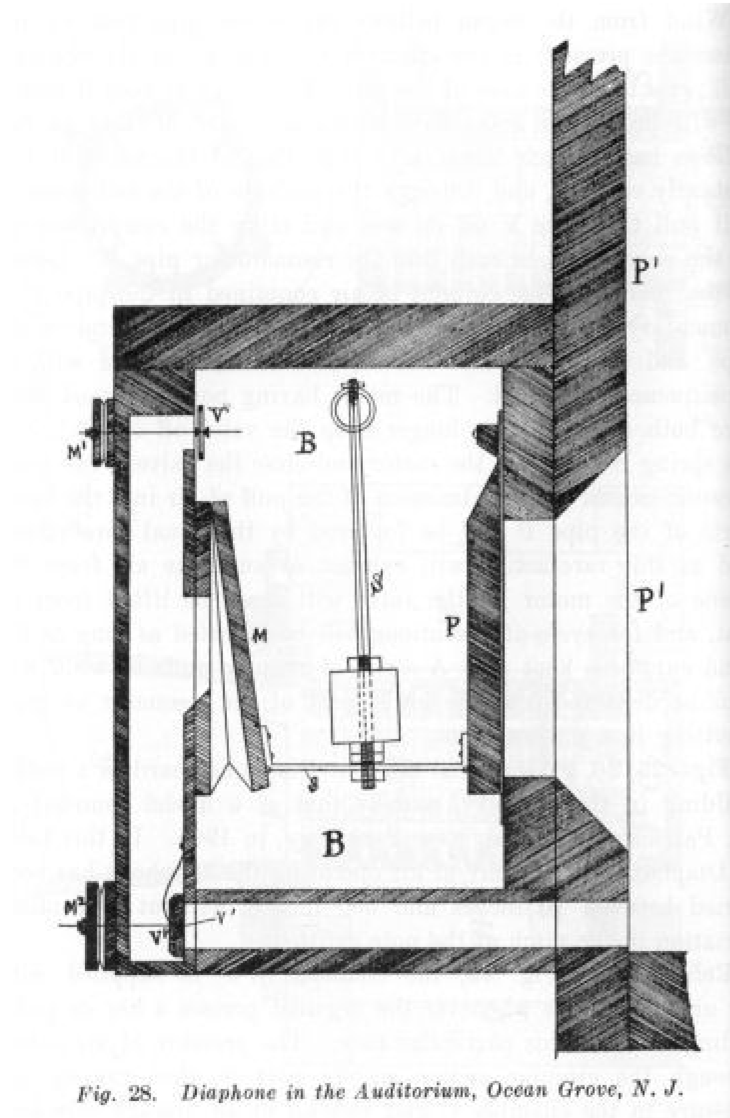



**Fig. 28. Diaphone in the Auditorium, Ocean Grove, N. J.**

In Fig. 28 we give an illustration of the form of Diaphone used in the Hope-Jones Unit organ at the Auditorium, Ocean Grove, N. J.

P is a pallet controlling the admission of air into the body of the pipe $P^1$. M is a motor adapted for plucking open the pallet P through the medium of strap *s*. The box B is permanently supplied with air under pressure from the bellows. When the valves V and $V^1$ are in the position shown in the drawing, the Diaphone is out of action, for the wind from the box B will find its way through the valve V (which is open) into the interior of the motor M.

When it is desired to make the note speak, the small exterior motors $M^1$ and $M^2$ are simultaneously inflated by the electro-pneumatic action operated by depressing the pedal key. The valve V will thereupon be closed and the valve $V^1$ be opened. As the pressure of air inside the motor M will now escape into the pipe or resonator $P^1$, the motor will collapse and the pallet P will be opened in spite of the action of the spring S which tends to keep it closed.

The wind in the box B will now suddenly rush into the lower end of the pipe $P^1$, and by causing a compression of the air at that point will again raise the pressure of the air inside the motor M. The pallet will thereupon close and the cycle of operations will be repeated—thus admitting a series of puffs of wind into the foot of the pipe $P^1$ and thereby producing a musical tone of great power.

As the valve $V^1$ is open, the sound waves formed in the pipe $P^1$ will govern the speed of vibration of the motor M. It will thus be obvious that the Diaphone will always be in perfect tune with the resonator or pipe $P^1$, and that the pitch of the note may be altered by varying the length of the pipe.

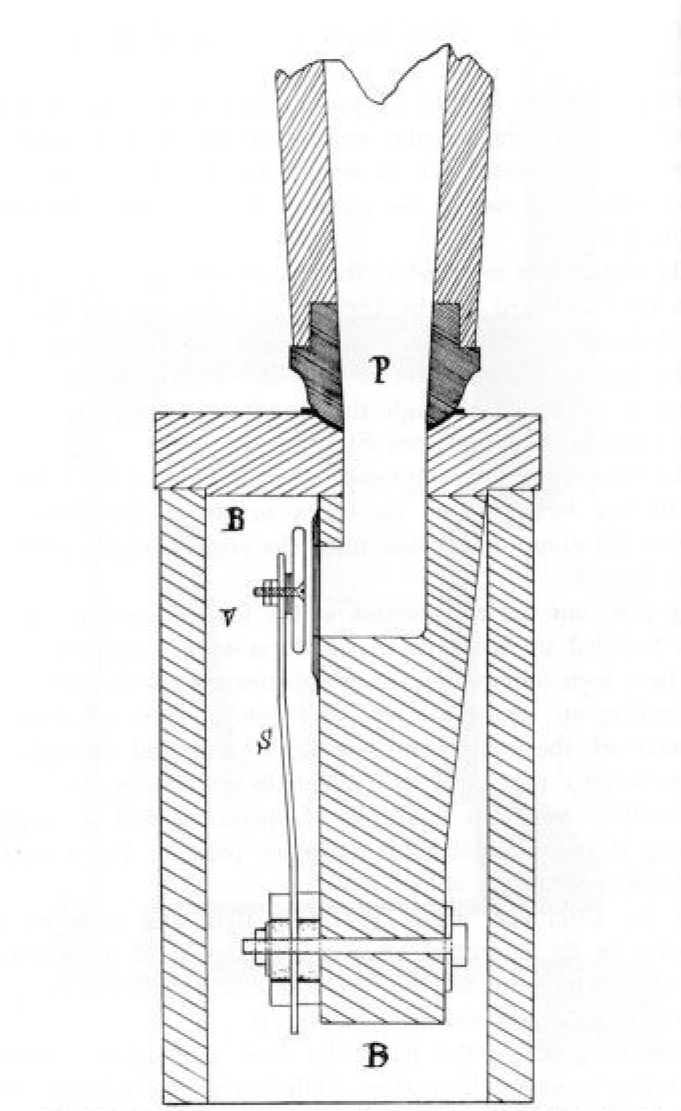



*Fig. 29. Diaphone in St. Paul's Cathedral, Buffalo, N. Y.*

**Fig. 29. Diaphone in St. Paul's Cathedral, Buffalo, N. Y.**

In Fig. 29 will be found an illustration of the Diaphone (or valvular reed) used in the Hope-Jones organ at St. Paul's Cathedral, Buffalo, N. Y.

Upon depressing a key, wind is admitted into the box B. Pressing upon the valve V it causes it to close against its seat in spite of the action of the spring S. This, however, does not take place until a pulse of air has passed into the foot of the pipe P, thereby originating a sound wave which in due time liberates the valve V and allows the spring S to move it off its seat and allow another puff of air to enter the pipe P. By this means the valve V is kept in rapid vibration and a powerful tone is produced from the pipe P. At Middlesborough, Yorkshire, England, Hope-Jones fitted a somewhat similar Diaphone of 16 feet pitch about 1899, but in this case the resonator or pipe was cylindrical in form and measured only 8 feet in length.

In Fig. 30 will be found another type of Diaphone in which the tone is produced through the medium of a number of metal balls, covering a series of holes or openings into the bottom of a resonator or pipe, and admitting intermittent puffs of air.

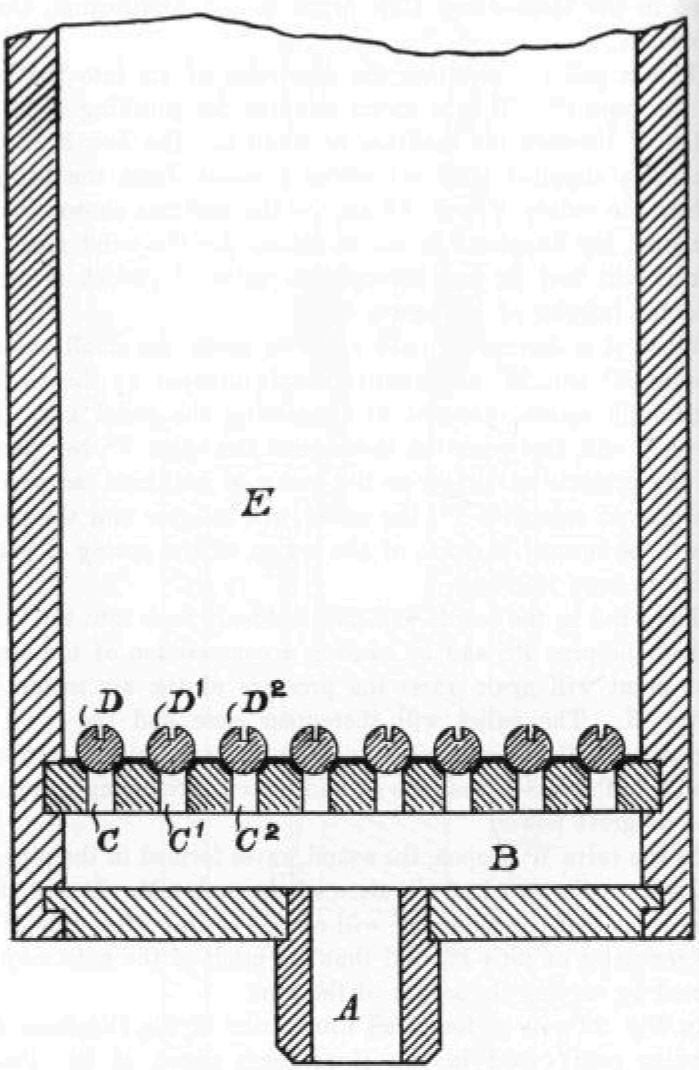



*Fig. 30. Diaphone Producing Foundation Tone*

**Fig. 30. Diaphone Producing Foundation Tone**

The action is as follows. Air under pressure enters the chamber B through the pipe foot A, and passing up the ports C, $C^1$, $C^2$, etc., forces the metal balls D, $D^1$, $D^2$, etc., upwards into the chamber E; the bottom end of the resonator or pipe. The pressure of air above the balls in the resonator E, then rises until it equals or nearly equals the pressure of air in chamber B. This is owing to the fact that the column of air in the pipe or resonator E possesses weight and inertia, and being elastic, is momentarily compressed at its lower end. This increased pressure above the balls allows them to return to their original position, under the influence of gravity. By the time they have returned to their original position, the pulse of air compression has traveled up the pipe in the form of a sound wave, and the complementary rarefaction follows.

The cycle of movement will then be repeated numerous times per second, with the result that a very pure foundation tone musical note will be produced.

The Diaphone is tuned like ordinary flue pipes and will keep in tune with them; the pressure of wind (and consequently the power of the tone) may be varied without affecting the pitch. The form of the pipe or resonator affects the quality of the tone; it may be flue-like or reedy in character, or even imitate a Pedal Violone, a Hard and Smooth Tuba, an Oboe, or a Clarinet.

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In closing this chapter, the writer desires to express indebtedness for much of the material therein to the comprehensive "Dictionary of Organ Stops," by James Ingall Wedgwood, Fellow of the Society of Antiquaries, Scotland, and Fellow of the Royal Historical Society (published by the Vincent Music Co., London, England). Although the title is somewhat forbidding, it is a most interesting book and reveals an amount of original research and personal acquaintance with organs in England and the

Continent that is simply marvelous. It ought to be in the library of every organist.

[1] Broadhouse, J., "Musical Acoustics," p. 27.

[2] Mr. Skinner has built some of the finest organs in this country.

[3] Much of Roosevelt's finest work is now being improved by various builders by leathering the lips.

[4] The "Harmonic" principle is described in Dom Bedos' book, published in 1780, as applied to reeds, and Dr. Bédart states that this principle was applied to flutes as early as 1804.

[5] That is to say, the pipes are made double the length actually required, but are made to sound an octave higher by means of a hole pierced half-way up the pipe.

[6] Wedgwood; "Dictionary of Organ Stops," p. 150.

[7] Wedgwood: *Ibid*., p. 153.

[8] Wedgwood: *Ibid*., p. 151.

[9] Wedgwood: *Ibid*. p. 153.

[10] "The Hope-Jones pattern of Muted Viol is one of the most beautiful tones conceivable."—Wedgwood: "Dictionary of Organ Stops," p. 173.

[11] The Erzähler, a modified Gemshorn, is found only in organs built by Ernest M. Skinner.

## CHAPTER XI.

## TUNING.

Having described the improvements in pipes, we now consider how they are tuned, and the first thing we must notice is the introduction of equal temperament.

About fifty years ago most organs were so tuned that the player had to limit himself to certain key signatures if his music was to sound at all pleasant. Using excessive modulation or wandering into forbidden keys resulted in his striking some discordant interval, known as the "wolf." The writer remembers being present at a rehearsal of Handel's "Messiah" in St. George's Hall, Liverpool, Eng., in 1866, when the organ was tuned on the unequal temperament system, and there was a spirited discussion between the conductor and Mr. W. T. Best, who wanted the orchestra to play "Every Valley" in the key of E flat so as to be in better tune with the organ.

The modern keyboard is imperfect. One black key is made to serve, for instance, for D sharp and for E flat, whereas the two notes are in reality not identical.[1] To secure correct tuning and tone intervals throughout, forty-eight keys per octave are required, instead of the twelve now made to suffice.

In what is called the *equal temperament* system the attempt is made to divide the octave into twelve equal parts or semi-tones, thus rendering all keys alike. To do this it is necessary to slightly flatten all the fifths and sharpen the major thirds. The difference from just intonation is about one-fiftieth of a semi-tone. Although recommended and used by J. S. Bach, equal temperament was not introduced into English organs until 1852.

Much has been lost by adopting equal temperament, but more has been gained. To a sensitive ear, the sharp thirds and fourths, the flat fifths and other discordant intervals of our modern keyed instrument, are a constant source of pain; but the average organist has become so accustomed to the defect that he actually fails to notice it!

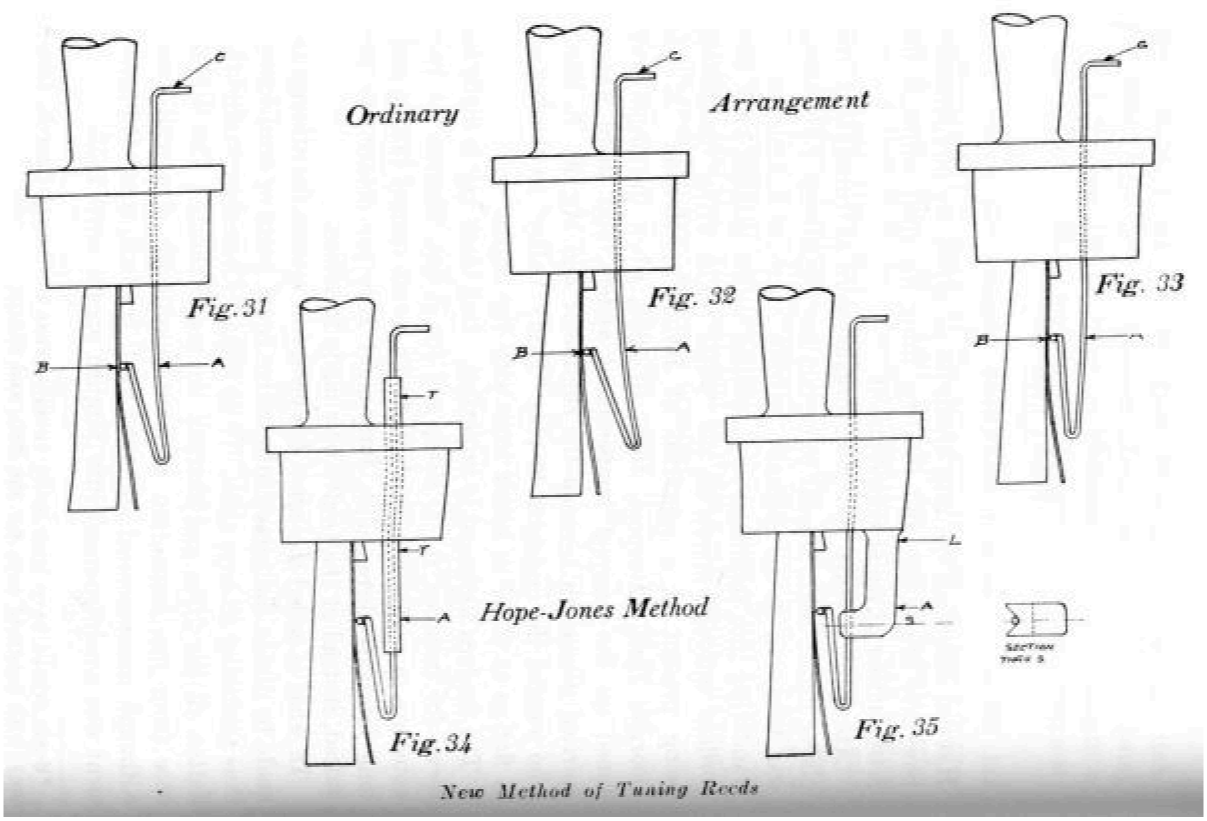
The change to equal temperament has on the other hand greatly increased the scope of the organ and has rendered possible the performance of all compositions and transcriptions regardless of key or modulation.

The tuning of an organ is seriously affected by the temperature of the surrounding air. Increased heat causes the air in the open pipes to expand and sound sharp contrasted with the stopped pipes through which the air cannot so freely circulate. The reeds are affected differently, the expansion of their tongues by heat causing them to flatten sufficiently to counteract the sharpening named above. Hence the importance of an equable temperature and the free circulation of air through swell-boxes, as described on page 59, *ante*.

## NEW METHOD OF REED TUNING.

Organ reed pipes, especially those of more delicate tone, fail to stand well in tune, especially when the tuner is in a hurry or when he does not know enough of his business to take the spring out of the reed wire after the note has been brought into tune.

Few persons fully understand the reason why reeds fail to stand in tune as they ought to.




**Figs. 31-35. New Method of Tuning Reeds**

Figures 31, 32, and 33 will serve to make clear the chief cause for reeds going out of tune. Figure 31 may be taken to represent a reed block, eschallot, tongue and tuning wire at rest.

In this case the tuning wire will be pressing firmly against the tongue at the point B, but said tuning wire will not be subjected to any abnormal strain.

Turning to Figure 32, if we use the reed knife and slightly lift the tuning wire at the point C, friction against the tongue at the point B will prevent said point B from moving upward. (In this connection it must be borne in mind that the co-efficient of friction in repose is much greater than the co-efficient of friction in motion.)

In consequence of the drawing up of the tuning wire at point C, and the frictional resistance at point B holding the latter steady, the lower part of the tuning wire will assume the shape shown in Figure 32, and point A will in consequence move farther away from the tongue.

Now, if the reeds be left in this state and the organ be used for any length of time, it will be found that point B of the tuning wire will have risen upward until the abnormal strain upon the tuning-wire spring has been satisfied. In consequence of this, this particular note will be sounding flatter in pitch than it ought to do.

Conversely, if the portion of the tuning wire lettered C be slightly driven down, as in Figure 33, the retarding effect of the friction of repose at point B will cause the lower portion of the tuning wire to approach nearer the tongue than it should do.

If now this reed be left in this state, after the pipe has been used for some time and the tongue has been vibrating, it will be found that point B on this tuning wire will have traveled nearer to the tip of the tongue, in order to relieve the abnormal strain upon the lower portion of the tuning wire. Point A will then have resumed its normal position.

In Figures 32 and 33, the defective action of the lower portion of the tuning spring has been purposely exaggerated in order to make the point clear. This bending of the tuning wires, however, takes place to a much larger extent than most organ builders imagine. It is the chief reason why reeds fail to stand in tune.

When point A on the reed tuning wires is rigidly supported and held by force in its normal position, reeds can be made to stand in tune almost as well as flue pipes.

Figure 34 represents the Hope-Jones method of supporting the tuning wire at point A. It consists of having a brass tube T inserted in the block moulds before the block is cast. This tube T therefore becoming an integral part of the block itself. The inside bore of tube T is of such diameter that the tuning wire fits snugly therein.

In Figure 35 another method used by him for accomplishing the same purpose is shown. In this case a lug L is cast upon the block, forming, indeed, a portion of said block. The lower end of lug L is formed into a V, which partly embraces a tuning wire and supports it in such manner as to prevent improper movement of said tuning wire at point A.

When this method of construction is employed, the reeds are very much easier to tune, and, when once tuned, will stand infinitely better than reeds made in the ordinary way.

[1] Some organs have been made (notably that in Temple Church, London) with separate keys for the flats and sharps.

## CHAPTER XII.

## PROGRESS OF THE REVOLUTION IN OUR OWN COUNTRY.

In the study of the art of organ-building one cannot fail to be struck by the fact that almost all the great steps in advance have been due to Englishmen: the compound horizontal bellows, the concussion bellows, the swell box, the pneumatic lever, the tubular-pneumatic action, the electro-pneumatic action, the Universal air chest, the leathered lip, the clothed flue, the diaphone, smooth reed tone, imitative string tone, the vowel cavity, tone reflectors, cement swell boxes, the sound trap joint, suitable bass, the unit organ, movable console, radiating and concave pedal board, combination pedals, combination pistons and keys, the rotary blower—and many other items—were the inventions and work of Englishmen.

Speaking in general terms, this country lagged very far behind not only England, but also behind France, and even Germany, in the art of organ-building until comparatively a few years ago.

It has recently advanced with extraordinary rapidity, and if it be not yet in the position of leader, it is certainly now well abreast of other nations.

Hilborne Roosevelt constructed a number of beautiful organs in this country, beginning his work about the year 1874. While his organs altogether lacked the impressive dignity of the best European instruments of the period, they were marked by beauty of finish and artistic care in construction. He invented the adjustable combination action, and this forms about all his original contribution destined to live and influence the organ of the future. Nevertheless, his marks on organ-building in this country were great and wholly beneficial. He studied the art in Europe (especially France) and introduced into this country many features at that time practically unknown here. Several of the organs constructed by his firm are in use to-day and are in a good state of repair. They contain Flutes that it would be hard to surpass, Diapasons that are bold and firm, and far above the average, though thought by some to lack weight and dignity of effect. The action is excellent and the materials employed and the care and workmanship shown throughout cannot be too highly praised.

Roosevelt must be set down as the leader of the revolution which, by the introduction of foreign methods, has in the last twenty years so completely transformed organ-building in the United States.

Roosevelt was also the pioneer in using electro-pneumatic action here. Accounts had reached England of his wonderful organ in Garden City Cathedral, part of which was in the gallery, part in the chancel, part in the roof, and part in the choir vestry in the basement. The author, on arriving in Philadelphia in 1893, as organist of St. Clement's Church there, was anxious to see a Roosevelt electric organ and was invited to see one in the concert hall of Stetson's hat factory. He was shown one of the magnets, which was about six inches long! Here is an account of the organ in Grace Church, New York City, which appeared in the American Correspondence of the London *Musical News*, February 15, 1896:

There are three organs in this church by Roosevelt—in the chancel, in the west gallery, and an echo in the roof, electrically connected and playable from either of the keyboards, one in the chancel and one in the gallery. The electric action is of an old and clumsy pattern, operated from storage batteries filled from the electric-light main, and requiring constant attention. The "full organs" and "full swells" go off slowly, with a disagreeable effect, familiar to players on faulty pneumatic instruments.

This organ has lately been entirely rebuilt with new action and vastly improved by Mr. E. M. Skinner.

In 1894 the writer made the acquaintance of the late Mr. Edmund Jardine, who was then building a new organ for Scotch Presbyterian Church in Central Park West, with an entirely new electric action that had been invented by his nephew. Of course by this time Mr. Hope-Jones' inventions were well known over here, and Mr. Jardine told the writer that some of the other organ-builders had been using actions which were as close imitations of the Hope-Jones as it was possible to get without infringement of patents. The Jardine action seemed to the writer a very close imitation also, and he can testify to its being a good one, as he later on had nearly three years experience of it at All Angels' Church.

But the pioneers had troubles of their own, no doubt, caused by using too large and heavy magnets, which exhausted the batteries faster than the current could be produced. The writer had this experience with the batteries at two different churches and had some difficulty in getting the organ-builders to see what was the matter. The steady use of the organ for an hour-and-a-half's choir rehearsal would exhaust the batteries. The organ-builder would be notified, and, on coming next day, *would not find anything the matter*, the batteries having recovered themselves in the interim. Finally, two sets of batteries were installed with a switch by the keyboard, so that the fresh set could be brought into use on observing signs of exhaustion. Many churches have installed small dynamos to furnish current for the key action. Even in these cases signs of weakness are often apparent—the organist in playing full does not get all the notes he puts down. Same cause of trouble—too heavy magnets. Here is where the Hope-Jones action has the whip-hand over all others, all the current it requires being supplied by a single cell! At the writer's churches there were six and eight cells. Most of the electric organs erected in this country, 1894-1904, have had to be entirely rebuilt.

About the year 1894 Ernest M. Skinner (at that time Superintendent of the Hutchings Organ Co., of Boston, Mass.), went over to England to study the art in that country. He was well received by Hope-Jones, by Willis and others. He introduced many of the English inventions into this country—the movable console (St. Bartholomew's, New York; Symphony Hall, Boston, etc.), increased wind pressure and the leathered lip (Grace Church, Plymouth Church, Columbia College, College of the City of New York, Cleveland Cathedral, etc.), smooth heavy pressure reeds, Tibias (Philomela) small scale strings, etc. In this work Skinner eventually had the advantage of Hope-Jones' services as Vice-President of his own company and of the assistance of a number of his men from England.

About the year 1895 Carlton C. Michell, an English organ-builder, who had been associated with Thynne and with Hope-Jones, and who had as the latter's representative set up new-type organs in Baltimore, Md., and Taunton, Mass., joined the Austin Organ Co., Hartford, Conn. He rapidly introduced modern string tone and other improvements there.

In 1903 Hope-Jones came to this country and also joined the Austin Organ Co. as its Vice-President, whereupon that company adopted his stop-keys, wind pressures, scales, leathered lip, smooth reeds, orchestral stops, etc. (Albany Cathedral, Wanamaker's organ, New York, the organs now standing in the Brooklyn Academy of Music, and others.)

In 1907 the Hope-Jones Organ Co., Elmira, N. Y., commenced the construction of organs containing all these and other English improvements (Ocean Grove, N. J.; Buffalo Cathedral, N. Y.; New Orleans, La., etc.).

The influence of the work already done by the aforenamed pioneers in this country is being manifested in a general improvement in organ tone and mechanism throughout the United States.

Musical men, hearing the new tones and musical effects now produced, realize for the first time the grandeur and refinement and amazing variety of musical effects that the organ is capable of yielding; on returning to their own churches they are filled with "divine discontent," and they do not rest until a movement for obtaining a new organ, or at least modernizing the old one, is set on foot. The abandonment of old ideas as to the limitations of the organ is begun, new ideals are being set up, and a revolution which will sweep the whole country has now obtained firm foothold.

Until recently England unquestionably led in the development of the organ, and Hope-Jones led England. Now that his genius is at work in this country, who shall set limit to our progress? Even when expressing himself through other firms, his influence entirely altered the standard practice of the leading builders, and now, since direct expression has been obtained, improvements have appeared with even greater rapidity.

It is the author's opinion (based on a wide knowledge of the instruments in both countries) that in the course of the last ten years this country has made such great strides in the art that it may now claim ability to produce organs that are quite equal to the best of these built in England. And he ventures to prophesy that in less than another ten years, American-built organs will be accepted as the world's highest standard.

At a banquet given in his honor in New York in 1906, the late Alexandre Guilmant complained that no organ that he had played in this country possessed majesty of effect. The advent of Hope-Jones has entirely changed the situation. Tertius Noble, late of York Minster, England, who has just come to this country, asserts that organs can be found here equal to or superior to any built in England, and the celebrated English organist, Edwin Lemare, pronounced the reeds at Ocean Grove, N. J., the finest he had ever heard.


ARISTIDE CAVAILLE-COLL.

**ARISTIDE CAVAILLE-COLL.**

## CHAPTER XIII.

## THE CHIEF ACTORS IN THE DRAMA.

We now purpose to give a brief account of the leaders in revolutionizing the King of Instruments, the men whose genius and indomitable perseverance in the face of prejudice, discouragement and seemingly insurmountable obstacles, financial and otherwise, have made the modern organ possible. First of all these comes

## CHARLES SPACHMAN BARKER,

who was born at Bath, England, on Oct. 10, 1806. Left an orphan when five years old, he was brought up by his godfather, who gave him such an education as would fit him for the medical profession, and he was in due time apprenticed to an apothecary and druggist in Bath. This apothecary used to draw teeth, and it was Barker's duty to hold the heads of the patients, whose howls and screams unnerved him so that he refused to learn the business and left before his term of apprenticeship expired.

Dr. Hinton does not credit the story that Barker, accidentally witnessing the operations of an eminent organ-builder (Bishop, of London) who was erecting an organ in his neighborhood, determined on following that occupation, and placed himself under that builder for instruction in the art. It seems to be admitted, however, that after spending most of the intervening time in London, he returned to Bath two years afterwards and established himself as an organ-builder there.

About 1832 the newly built large organ in York Minster attracted general attention, and Barker, impressed by the immense labor occasioned to the player by the extreme hardness of touch of the keys, turned his thoughts toward devising some means of overcoming the resistance offered by the keys to the fingers. The result was the invention of the pneumatic lever by which ingenious contrivance the pressure of the wind which occasioned the resistance to the touch was skilfully applied to lessen it. He wrote to Dr. Camidge, then the organist of the Cathedral, begging to be allowed to attach one of his levers in a temporary way to one of the heaviest notes of his organ. Dr. Camidge admitted that the touch of his instrument was "sufficient to paralyze the efforts of most men," but financial difficulties stood in the way of the remedy being applied. Barker offered his invention to several English organ-builders, but finding them indisposed to adopt it, he went to Paris, in 1837, where he arrived about the time that Cavaillé-Coll was building a large organ for the Church of St. Denis. M. Cavaillé-Coll had adopted the practice of making his flue and reed pipes produce harmonic tones by means of wind of heavy pressure; but he encountered difficulty as the touch became too heavy for practical use. Mr. Barker's apparatus, which simply overpowered the resistance that could not be removed, was therefore an opportune presentation; he took out a *brevet d' invention* for it in 1839, and M. Cavaillé-Coll immediately introduced it, together with several harmonic stops, into the St. Denis organ. Besides the organ of St. Denis, Barker's pneumatic lever was applied to those of St. Roch, La Madeleine, and other churches in Paris.

"Barker's connection with Cavaillé was not of long duration, and we next find him in the Daublaine & Callinet organ-building company. At this time the company was rebuilding the magnificent organ at St. Sulpice, the acknowledged masterpiece of Cliquot, the French 'Father Schmidt.' * * *

"During the time this restoration of the organ was in hand, Louis Callinet experienced acute financial difficulties, and, failing to induce Daublaine, his partner, to advance him a relatively small sum, * * * Callinet became so bitterly incensed that one day, going to the organ on some trifling pretext, he entirely wrecked it with axe and handsaw.

"This act of vengeance or criminal folly involved Daublaine in the same financial ruin as himself, and through this tragic occurrence the firm in which Barker was beginning to be securely established came to an end. Callinet, being absolutely penniless, was not prosecuted, but ended his days in the employ of Cavaillé as voicer and tuner.

"Nor was this the only disaster which occurred during the time Barker was with Daublaine & Callinet. In 1844 (December 16th), it was Barker's ill-fortune to kick over a lighted candle while trying to remove a cipher in the organ his firm had recently erected in St. Eustache, which occasioned the total destruction of the organ. * * *

"The outlook seemed unpromising for Barker when the firm of Daublaine & Callinet came to an end. The good will of that concern was, however, purchased by M. Ducroquet (a capitalist), who entrusted him with its management.

"J. B. Stoltz, Daublaine & Callinet's foreman, a very able man and a splendid workman, feeling aggrieved at Barker's promotion, seceded and set up for himself, his place in the new firm being filled by M. Verschneider, in whom Barker found efficient support in matters of technical knowledge and skill.

"During the time Barker was with M. Ducroquet the present organ at St. Eustache was built, to replace that so unfortunately destroyed by fire; also an organ which was exhibited at the great exhibition of London in 1851. * * *

"In the Paris exhibition of 1855 Barker was admitted as an exhibitor, independently of M. Ducroquet (who was in bad health and on the eve of retiring from business), obtaining a first-class medal and nomination as Chevalier of the Legion of Honor.

"At the death of M. Ducroquet, which occurred shortly afterwards, Merklin took over the business carried on by Ducroquet, and Barker remained with him until 1860, when he set up on his own account in partnership with M. Verschneider, before named, and it was during the decade 1860-70 that the electric organ came into being."

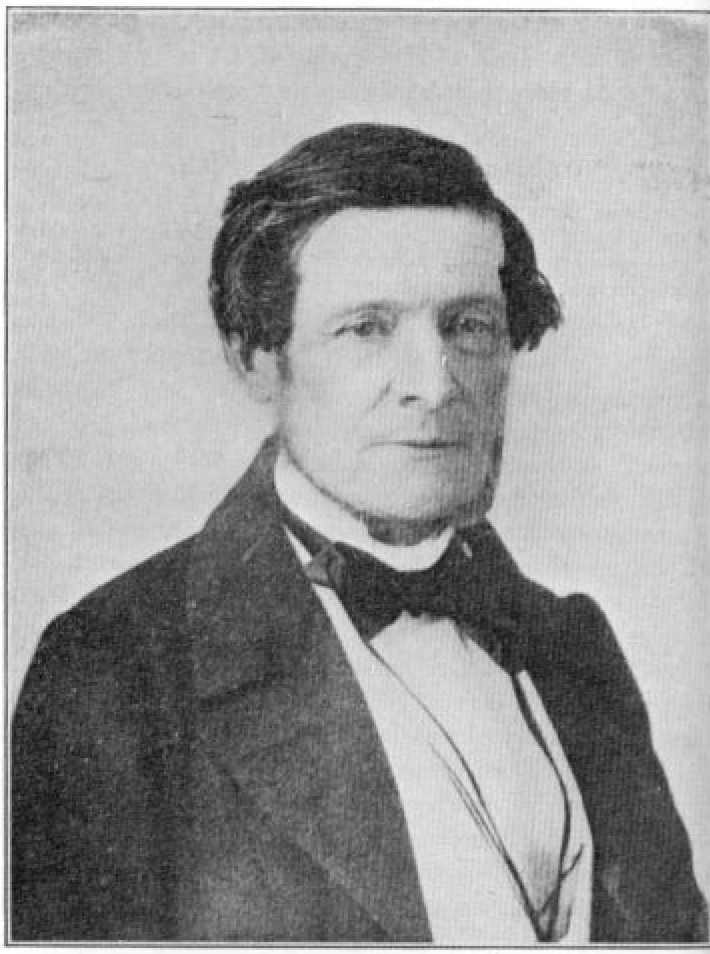
The story of Dr. Péschard's invention has been already set forth in this book (see page 37). Barker seems to have been somewhat jealous of him and always described the action as "Pneumato-electrique," objecting to the term "Electro-pneumatic," although this was putting the cart before the horse. Dr. Hinton says: "Though I was much in touch with Barker during part of his brief period of activity in electric work, Péschard's name was rarely mentioned and carried little meaning to me. I did not know if Péschard were a living or a dead scientist, and if I (a mere youth at the time) ever thought of him, it was as being some kind of bogie Barker had to conciliate."

Bryceson Brothers, of London, exhibited an organ at the Paris Exposition Universelle in the Champ de Mars in 1867, on which daily recitals were given by Mons. A. L. Tamplin, who induced Mr. Henry Bryceson to visit the electric organ then being erected in the Church of St. Augustin. Mr. Bryceson, being convinced that this was the action of the future, lost no time in investigating the system thoroughly, and arranged with Barker for the concession of the sole rights of his invention as soon as he should obtain his English patent, which he got in the following year. Barker, however, repented him of his bargain, and the exclusive rights were eventually waived by the Brycesons, although they retained the right to use the patent themselves. They made considerable improvements on Barker's action, the chief defects of which seem to have been the resistance of the pallets (which had to be plucked from their seats; he did not even use the split pallet) and the cost of maintenance of the batteries, which rapidly deteriorated from the action of the powerful acids employed. A full description and drawing of Péschard's and Barker's action will be found in Dr. Hinton's "Story of the Electric Organ."

This same Paris Exposition of 1867 is also responsible for the introduction of tubular-pneumatic action into England by Henry Willis. He there saw the organ by Fermis which induced him to take up that mechanism and develop it to its present perfection.

The Franco-Prussian War of 1870 drove Barker from Paris, his factory was destroyed in the bombardment, and thus at the age of 64 he was again cast adrift. He came to England and found, on attempting to take out a patent for his pneumatic lever, that all the organ-builders were using what they had formerly despised!

He succeeded, however, in obtaining the contract for a new organ for the Roman Catholic Cathedral in Dublin, Ireland, and it was arranged that he should receive a certain sum in advance, and a monthly allowance up to the amount of the estimated cost of the instrument. He seems to have had trouble in obtaining expert workmen and only succeeded in getting a motley crowd of Frenchmen, Germans, Dutch and Americans. They spoke so many different languages that a Babel-like confusion resulted. Hilborne Roosevelt, the great American organ-builder, was at that time in Europe, and in response to Barker's earnest entreaty, came to Dublin *incognito*, so as not to detract from Barker's reputation as the builder. Roosevelt's direction and advice were most invaluable, being moreover given in the most chivalrous and generous spirit; but, notwithstanding this and the excellent material of which the organ was constructed, the result was anything but an artistic or financial success.



CHARLES SPACHMAN BARKER.

## CHARLES SPACHMAN BARKER.

Barker built an organ for the Roman Catholic Cathedral at Cork, which was no better, and this was his last work. These misfortunes culminated in an appeal to his countrymen for subscriptions on his behalf in the musical papers. In his old age he had married the eighteen-year-old daughter of M. Ougby, his late foreman. He died at Maidstone, Eng., November 26, 1879.

This sketch of Barker's career is taken partly from Grove's Dictionary of Music, from Hopkins and Rimbault's History, and from Dr. Hinton's "Story of the Electric Organ." The paragraphs within quotation marks are verbatim from this book by kind permission of Dr. Hinton, whom we have to thank also for the portrait of Barker which appears on another page.

## ARISTIDE CAVAILLE-COLL.

The following sketch of the life of this eminent artist is taken from Dr. Bédart's forthcoming book on "Cavaillé-Coll and His Times," and from Le Monde Musical, of Paris, October 30, 1899, translated by Mr. Robert F. Miller, of Boston. The portrait is from the same magazine.

Aristide Cavaillé-Coll was born at Montpellier, France, on the 4th day of February, 1811. He was the son of Dominique Cavaillé-Coll, who was well known as an organ-builder in Languedoc, and grandson of Jean Pierre Cavaillé, the builder of the organs of Saint Catherine and Merci of Barcelona. The name of Coll was that of his grandmother. If we should go back further we find at the commencement of the Eighteenth Century at Gaillac three brothers—Cavaillé-Gabriel, the father of Jean Pierre; Pierre, and Joseph, who also was an organ-builder. Aristide Cavaillé, therefore, came honestly by his profession and at the age of 18 years was entrusted by his father to direct the construction of the organ at Lerida, in which he introduced for the first time the manual to pedal coupler and the system of counter-balances in the large wind reservoirs.

In 1834 Aristide, realizing the necessity of cultivating his knowledge of physics and mechanics, went to Paris, where he became the pupil of Savart and of Cagnard-Latour. The same year a competition was opened for the construction of a large organ in the royal church of St. Denis; Aristide submitted his plan and succeeded in obtaining the contract. This success decided the Messrs. Cavaillé to remove their organ factory to Paris, where they established themselves in the Rue Neuve St. George. On account of repairs being made to the church building, the organ of St. Denis was not finished until 1841, but it showed improvements of great importance, first and foremost of which was the Barker pneumatic lever (see *ante*, page 120). The wind pressure was on a new system, whereby increased pressure was applied to the upper notes, giving more regularity of tone to each stop. The wind reservoirs were provided with double valves, insuring a more steady supply, whether all the stops were played together or separately. The introduction of Harmonic stops was practically an innovation, as their use hitherto had been almost prohibited by the difficulty of playing on a high wind pressure (see *ante*, page 21). This enriched the organ with a new group of stops of a superior quality on account of the roundness and volume of sound.

In 1840 Cavaillé-Coll submitted to the Académie des Sciences the result of his experimental studies of organ pipes; on the normal tone of the organ and its architecture; the length of pipes in regard to intonation and precision in blowing. He made many experiments and improvements in wind supply. He was also the inventor of "Poikilorgue," an expressive organ, which was the origin of the harmonium.

Between 1834 and 1898 he built upward of 700 organs, including Saint Sulpice, Notre Dame, Saint Clotilde, la Madeleine, le Trocadero, Saint Augustin, Saint Vincent de Paul, la Trinite (all in Paris); Saint Ouen at Rouen, Saint Sernin at Toulouse; the Cathedrals at Nancy, Amsterdam, and Moscow; the Town Halls of Sheffield and Manchester, England. The most celebrated of these is Saint Sulpice, which contains 118 stops and was opened in April 29, 1862.[1]

The fine period of Cavaillé-Coll was during the Empire, about 1850. The Emperor Napoleon III, to flatter the clergy and the bishops, ordered the Cathedral organs to be rebuilt, and gave the order to Cavaillé-Coll. He in many instances preserved the old soundboards, dividing them on two ventils for reeds and for flues, increased the wind pressures, introduced pneumatic levers, and transformed the small Tenor C Swells into large 15 to 20 stop Swells, *with 16-foot reeds* included, and so crowned the fine flue work and mixture work of these Cathedral organs.

We all know the fine effect of a large Swell. The French Cathedral organs were deprived of this tonal resonance in 1850, and Cavaillé-Coll, by judicious overhauling, use of good materials, and by the addition of large Swells, *transformed the sonority of these large instruments located in splendid positions* above the grand west entrance doors of these fine Gothic buildings.

Cavaillé-Coll, during his long career, received from the Universal Expositions the highest honors. He was appointed a Chevalier of the Legion of Honor in 1849, and officer of the same order in 1878. He was also Honorary President of the Chamber of Syndicates of Musical Instruments.

Much enfeebled by age, he in 1898 relinquished the direction of his factories to one of his best pupils, M. Charles Mutin, who has never ceased to maintain the high integrity of the house.

Aristide Cavaillé-Coll died peacefully and without suffering on October 13, 1899, in his 89th year. He was interred with military honors. A simple service was held at Saint Sulpice and M. Charles Widor played once more, for the last time to the illustrious constructor, the grand organ which was the most beautiful conception of his life.

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We have in the course of our review mentioned some of Cavaillé-Coll's principal contributions to the progress of organ-building, his development of harmonic stops and use of increased wind pressures. Mr. W. T. Best, in 1888, in a report to the Liverpool Philharmonic Society as to the purchase of a new organ for their Hall, recommended Cavaillé-Coll as "the best producer of pure organ tone" at that time. Next to him he placed T. C. Lewis & Sons, then W. Hill & Son.

But the organists of the world have to thank Cavaillé-Coll chiefly for the assistance he gave Barker in developing the pneumatic lever, without which the present tonal system with its heavy wind pressures would have been impossible of attainment.

"Blest be the man," said Sancho Panza, "who first invented sleep! And what a mercy he did not keep the discovery to himself!" Joseph Booth, of Wakefield, England, put what he called a "puff bellows" to assist the Pedal action in the organ of a church at Attercliffe, near Sheffield, in 1827. But he kept the invention to himself, and it only came to light 24 years after his death! Note on the other hand the perseverance of Barker. For five weary years he kept on trying one builder after another to take up his idea without avail, and then took it beyond the seas. Which reminds us of the Rev. William Lee, the inventor of the stocking-knitting frame in the time of Queen Elizabeth, whose countrymen "despised him and discouraged his invention. * * * Being soon after invited over to France, with promises of reward, privileges and honor by Henry IV * * * he went, with nine workmen and as many frames, to Rouen, in Normandy, where he wrought with great applause." Thus does history repeat itself.

## HENRY WILLIS.

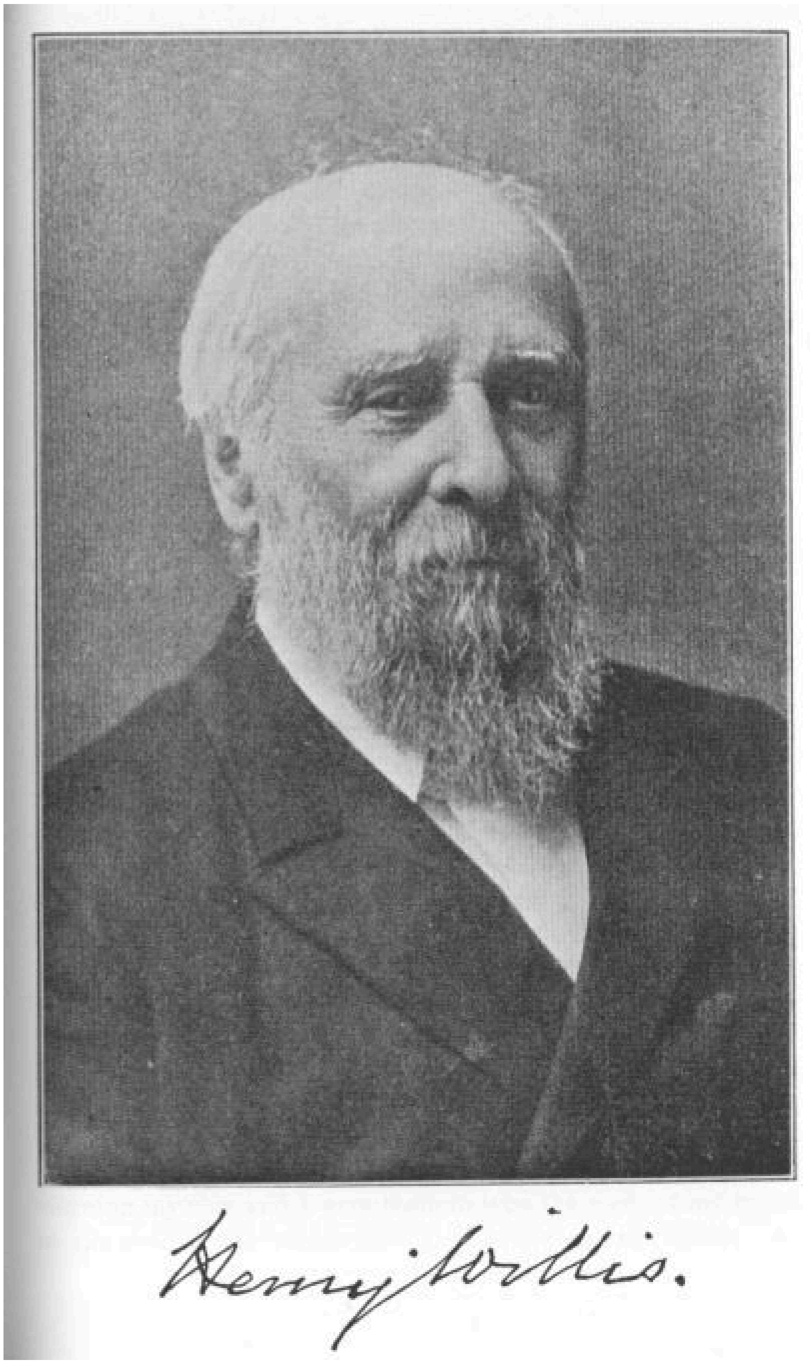
The following sketch of the greatest organ-builder of the Victorian Era has been condensed from an interview with him as set forth in the London *Musical Times* for May, 1898.

Henry Willis was born in London on April 27, 1821. His father was a builder, a member of the choir of Old Surrey Chapel, and played the drums in the Cecilian Amateur Orchestral Society. The subject of this sketch began to play the organ at very early age; he was entirely self-taught and never had a lesson in his life.

In 1835, when he was fourteen years of age, he was articled for seven years to John Gray (afterwards Gray & Davidson), the organ-builder. During his apprenticeship he invented the special manual and pedal couplers which he used in all his instruments for over sixty years. He had to tune the organ in St. George's Chapel, Windsor, where he made the acquaintance of Sir George Elvey, who took a great fancy to the boy tuner.

While still "serving his time" and before he was out of his teens, Henry Willis was appointed organist of Christ Church, Hoxton. In the early fifties he was organist of Hampstead Parish Church, where he had built a new organ, and for nearly thirty years he was organist at Islington, Chapel-of-Ease, which post he only resigned after he had passed the Psalmist's "three score years and ten." In spite of the engrossing claims of his business, Mr. Willis discharged his duties as organist with commendable faithfulness; he would often travel 150 miles on a Saturday in order to be present at the Sunday services. In his younger days he also played the double-bass and played at the provincial Musical Festivals of 1871 and 1874.

After his apprenticeship expired he lived in Cheltenham for three years, where he assisted an organ-builder named Evans, who afterwards became known as a manufacturer of free reed instruments. They produced a model of a two-manual free reed instrument with two octaves and a half of pedals which was exhibited at Novello's, in London. Here Willis met the celebrated organist, Samuel Sebastian Wesley.




**Henry Willis**

About the year 1847 Henry Willis started in business for himself as an organ-builder, and his first great success was in rebuilding the organ in Gloucester Cathedral. "It was my stepping-stone to fame," he says. "The Swell, down to double C, had twelve stops and a double Venetian front. The *pianissimo* was simply astounding. I received 400 pounds for the job, and I was presumptuous enough to marry."

For the Great Exhibition of 1851 in the Crystal Palace (then in Hyde Park), Mr. Willis erected a magnificent organ which attracted extraordinary attention and was visited by the Queen and Prince Consort. It had three manuals and pedals, seventy sounding stops and seven couplers. There were twenty-two stops on the Swell, and the Swell bellows was placed inside the Swell box. The manual compass extended to G in *altissimo* and the pedals from CCC to G—32 notes. There were other important features in this remarkable instrument which went a long way towards revolutionizing the art of organ-building. First, the introduction of pistons, inserted between the key-slips, which replaced the clumsy composition pedals then in vogue. Again, to use Mr. Willis' own words, "that Exhibition organ was the great pioneer of the improved pneumatic movement. A child could play the keys with all the stops drawn. It never went wrong."

This organ was afterwards re-erected in Winchester Cathedral in 1852, and was in constant use for forty years before being renovated. It was also the means of procuring Willis the order for the organ in St. George's Hall, Liverpool. "The Town Clerk of Liverpool wrote to me," said Mr. Willis, "to the effect that a committee of the Corporation would visit the Exhibition on a certain day at 6 A. M., their object being to test the various organs with a view to selecting a builder for the proposed new instrument in St. George's Hall. He asked me if I could be there. I was there—all there! The other two competing builders, X and Z, in anticipation of the visit, tuned their organs in the afternoon of the previous day, with the result that, owing to the abnormal heat of the sun through the glass roof, the reeds were not fit to be heard! I said nothing. At five o'clock on the following morning my men and I were there to tune the reeds of my organ in the cool of the morning of that lovely summer's day. At six o'clock the Liverpool committee, which included the Mayor and the Town Clerk in addition to S. S. Wesley and T. A. Walmisley, their musical advisers, duly appeared. Messrs. X and Z had specially engaged two eminent organists to play for them. I retained nobody. But I had previously said to Best, who had given several recitals on my organ at the Exhibition, 'It would not be half a bad plan if you would attend to-morrow morning at six o'clock, as you usually do for practice.'

Best was there. After the two other organs had been tried, the Town Clerk came up and said: 'We have come to hear your organ, Mr. Willis. Are you going to play it yourself?' I said, 'There's one of your own townsmen standing there (that was Best); ask him.' He did ask him. 'Mr. Best has no objection to play,' said the Town Clerk, 'but he wants *five* guineas!' 'Well, give it to him; the Corporation can well afford it.' The matter was arranged. Best played the overture to 'Jessonda' by Spohr, and it was a splendid performance." The organ was quite a revelation to the Liverpudlians, and after talking it over in private for twenty minutes the committee decided to recommend Willis to the Council to build the organ in St. George's Hall. He had, however, serious differences with Dr. S. S. Wesley, who wanted both the manuals and pedals to begin at GG. "I gave in to him in regard to the manuals," said Mr. Willis, "but I said, 'unless you have the pedal compass to C, I shall absolutely decline to build your organ.'" And so the matter was compromised. But Willis lived to see the manual compass of his magnificent Liverpool organ changed to CC (in 1898). When the organ was finished he recommended that Best should be appointed organist, although Dr. Wesley officiated at the opening ceremony in 1855. Not only did Willis practically get Best appointed to Liverpool, but he had previously coached him up in his playing of overtures and other arrangements for the organ. "I egged him on," said the veteran organ-builder, and we all know with what results. Notwithstanding all that Best owed to Willis, he quarreled with him violently towards the close of his career over the care of the St. George's Hall organ. As Best told the writer, "not because Willis *could* not, but because he *would* not" do certain things in the way of repairs, that he claimed did not come under his contract. This led to the care of the organ being transferred to T. C. Lewis & Sons, but it was given back to Willis after Best's death.

Mr. Willis gained a wide and deservedly high reputation as the builder of many Cathedral organs—upwards of sixteen. His largest instrument is that in the Royal Albert Hall, London. He designed it entirely himself; he had not to compete for the building of it, but had *carte blanche* in regard to every detail.

There was an amusing incident in connection with deciding upon the pitch of the instrument. The authorities arranged that Sir Michael Costa, Mr.

R. K. Bowley, then general manager of the Crystal Palace, and some of the leading wind-instrument players of the day, including Lazarus (a famous clarinetist), should attend at the factory to settle the question of the pitch of the organ. "They also brought a violinist," said Mr. Willis; "but I couldn't see what a fiddler, who is a very useful man in his way, had to do with settling the pitch. (I should tell you," added Mr. Willis, *sotto voce*, "that *I* had formulated some idea of the proper pitch before these gentlemen arrived.) However, we duly proceeded, Costa presiding over the conclave. When they began to blow into their different instruments each man had a different pitch! It was a regular pandemonium! By and by we settled upon something which was considered satisfactory, and we bade each other good morning." The sequel need not be told. We leave it to our readers to draw their own conclusions as to whether the Royal Albert Hall organ was actually tuned to the pitch of Messrs. Costa, Bowley, Lazarus & Co., or to that previously decided upon by Mr. Willis.

He erected two large organs for the Alexandra Palace, and one in Windsor Castle with two keyboards, one in St. George's Hall, and one in His Majesty's Private Chapel, whereby the instrument is available for use in both places.

It was entirely owing to Willis' dominating personality that the organ in St. Paul's Cathedral was rebuilt in its present form. He had the old screen taken down and the old organ case, which happened to be alike on both sides, he cut in two and re-erected on each side of the choir. The change also involved the removal of the statues of Lord Nelson and Lord Cornwallis. When one of the committee asked him if he proposed to have two organists for his divided organ, he replied, "You leave that to me." And proceeded to invent[2] his tubular pneumatic action (see page 25). When this organ was used for the first time at the Thanksgiving service for the recovery of the Prince of Wales from typhoid fever in 1873, the pneumatic action for the pedals was not finished. Willis rigged up a temporary pedal board inside the organ near the pedal pipes and played the pedal part of the service music himself while George Cooper was at the keys in the regions above. After the service Goss said to Ousley, who was present, "What do you think of the pedal organ?" "Magnificent!" replied the Oxford Professor. "You know that the pipes are a long way off; did the pedals seem to go exactly together with the manuals?" Goss asked. "Perfectly," replied Ousley, "but why do you ask me in that way?" Then Goss let out the secret—for it was really a great secret at the time.

Willis' great hobby was yachting. He owned a 54-ton yacht named the *Opal*, and attributed the wonderful health he enjoyed to his numerous sea voyages. "I have circumnavigated the whole of England and Scotland," he said, "and I am my own captain. Those two men over there" (pointing to two of his employees working in the factory) "are my steward and shipwright. The steward is a fisherman—a fisherman being very useful as a weather prophet. * * * I do all the repairs to the yacht myself and have re-coppered her bottom two or three times. I also put entirely new spars into her, and there stands her old mast. Some years ago I injured the third and fourth fingers of both my hands with the ropes passing through them. These four fingers became bent under, and for a long time I had to play my services with only the thumb and two fingers of each hand. But Dr. Macready, a very clever surgeon, begged me to allow him to operate on my disabled fingers, with the result that I can use them as of old, or nearly so."

Henry Willis died in London on February 11, 1900, in his 80th year, deeply mourned by all who knew him, and was interred in Highgate cemetery. In the course of this work we have referred to the many improvements he effected in organ construction and reed voicing. As Sir George Grove said, his organs are celebrated for "their excellent engineering qualities." Clever, ingenious, dauntless and resourceful—qualities blended together with a plentiful supply of sound judgment and good common sense—were some of the striking characteristics of this remarkable man. He gave his personal attention to every department of his factory; nothing was too insignificant to claim his notice; his thoroughness was extraordinary—every pipe went through his hands. An organist himself, he was always thinking of the player in laying out his instruments. He had a remarkably inventive genius, which he turned to good account in the mechanical portions of his organs. He took infinite pains with everything and his enthusiasm knew no bounds. But, above all, he possessed in a striking degree that attribute which a similar successful worker once aptly described as "*obstinate* perseverance." He had a strong aversion to newspaper men and sent them away without ceremony. While free from conceit, he was not always amenable to dictation, especially when he had disputes with architects—in which the architects were generally worsted.

He regarded his organ in St. Paul's Cathedral (rebuilt in 1899), as his *magnum opus*. "There is nothing like it in the world," he remarked, with pardonable pride, one Saturday when Sir George Martin was playing that kingly king of instruments. To paraphrase the inscription on Purcell's monument in Westminster Abbey:—

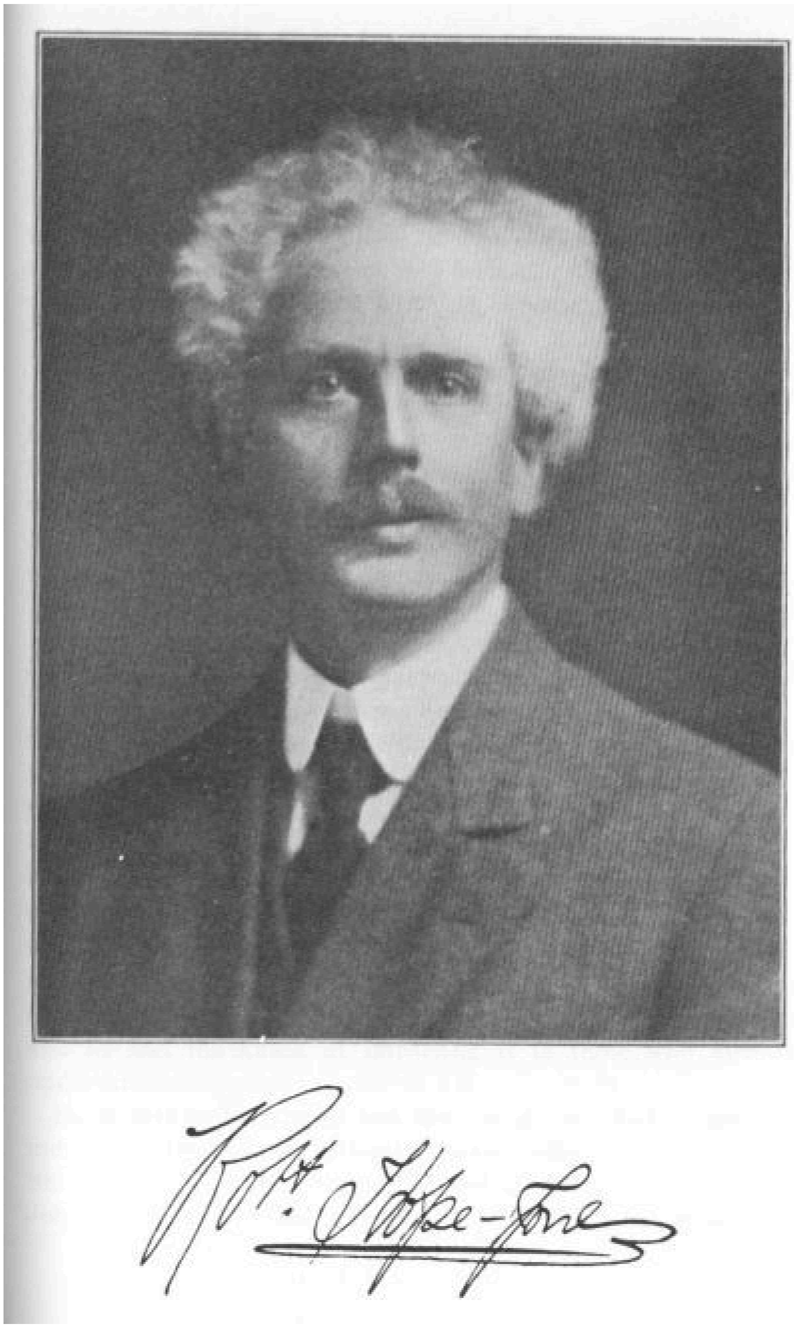
"He has gone where only his own Harmony can be excelled,"

leaving behind him many noble specimens of his remarkable achievements.

## ROBERT HOPE-JONES.

Robert is the third son of the late William Hope-Jones, Hooton Grange, Cheshire, England.

His father, a man of means, was prominent as one of the pioneers in organizing the volunteer army of Great Britain. He was musical, playing the cornet and having an unusual tenor voice. His mother (Agnes Handforth)—also musical and a gifted singer—was a daughter of the Rector of Ashton-under-Lyne, Lancashire,—a highly nervous woman.



**Robert Hope-Jones**

There were nine children of the marriage—two girls and seven boys. Robert appeared on the ninth of February, 1859. He inherited in exaggerated degree his mother's highly strung nervous nature. Melancholy, weak and sickly as a child, he was not expected to live. To avoid the damp and cold of English winters he was periodically taken to the south of France. Deemed too delicate for school, a private tutor was provided.

Joining in sports or games was out of the question for so sensitive and delicate a youth,—what more natural, therefore, than that he should become a dreamer—a thinker? Too ill for any real study, his musical instincts drove him to the organ, and we find him playing for occasional services at Eastham Parish Church at the age of nine. After his father's death, when he was about fourteen, he spent a couple of years in irregular attendance at school, and at the time of his confirmation was persuaded that by superhuman effort of will his physical disabilities might be disregarded and a life of some value be worked out. Then began the desperate struggle that gradually overcame every obstruction and resulted in the establishment of an iron will and determination to succeed that no misfortunes have been able to quell. His want of health greatly interfered with his career till he was nearly thirty years of age.

When fifteen he became voluntary organist and choir-master to the Birkenhead School Chapel. Two or three years later he simultaneously held a similar office at St. Luke's Church, Tranmere, where he trained a boy choir that became widely celebrated. For this Church he bought and set up a fine organ. He subsequently served as Churchwarden and was active in many other Church offices. He erected an organ in the Claughton Music Hall and organized and conducted oratorio performances in aid of various Church funds; training a large voluntary chorus and orchestra for the purpose. For Psalms whose verses are arranged in groups of three, he wrote what he called "triple chants"—a form of composition since adopted by other Church writers; he also composed Canticles, Kyries and other music for the services of the Church.

Though St. Luke's Church was situated in a poor neighborhood, the men and boys forming his choir not only gave their services but also gratuitously rang the Church bell, pumped the organ bellows, bought all the music used at the services, paid for the washing of the surplices and helped raise money for the general Church fund. Hope-Jones' enthusiasm knew no bounds and he had the knack of imparting it to those who worked under him.

So earnest and energetic was this young man that in spite of indifferent health and without at once resigning his work at St. Luke's, he became choirmaster and honorary organist of St. John's Church, Birkenhead, doing similar work in connection with that institution. He trained both the latter-named choir together, and the writer (whose son was in St. John's choir) frequently assisted him by playing the organ at the services on Sunday. It was at this Church and in connection with this organ that Hope-Jones did his first great work in connection with organ-building. The improved electric action, movable console and many other matters destined to startle the organ world, were devised and made by him there, after the day's business and the evening's choir rehearsals. He had voluntary help from enthusiastic choirmen and boys, who worked far into the night—on some occasions all night. Certain of these men and boys are to-day occupying responsible positions with the Hope-Jones Organ Company.

All this merely formed occupation for his spare time. About the age of seventeen he began his business career. He was bound apprentice to the large firm of Laird Bros., engineers and shipbuilders, Birkenhead, England. After donning workman's clothes and going through practical training in the various workshops and the drawing office, he secured appointment as chief electrician of the Lancashire and Cheshire (afterwards the National) Telephone Company. In connection with telephony he invented a multitude of improvements, some of which are still in universal use. About this time he devised a method for increasing the power of the human voice, through the application of a "relay" furnished with compressed air. The principle is now utilized in the best phonographs and other voice-producing machines. He also invented the "Diaphone," now being used by the Canadian Government for its fog signal stations and declared to be the most powerful producer of musical sound known (in a modified form also adapted to the church organ).

About 1889 he resigned his connection with the telephone company in order that he might devote a greater part of his attention to the improvement of the church organ, a subject which, as we have seen, was beginning to occupy much of his spare time. He had private practice as a consulting engineer, but gradually his "hobby"—organ building—crowded out all other employment—much to his financial disadvantage and to the gain of the musical world.

His organ at St. John's Church, Birkenhead, became famous. It was visited by thousands of music lovers from all parts of the world. Organs built on the St. John's model were ordered for this country (Taunton, Mass., and Baltimore, Md.), for India, Australia, New Zealand, Newfoundland, France, Germany, Malta, and for numbers of English cathedrals, churches, town halls, etc. Nothing whatever was spent on advertisement. The English musical press for years devoted columns to somewhat heated discussion of Hope-Jones' epoch-making inventions, and echoes appeared in the musical periodicals of this and other countries.

In spite of every form of opposition, and in spite of serious financial difficulties, Hope-Jones built organs that have influenced the art in all parts of the globe. He proved himself a prolific inventor and can justly claim as his work nine-tenths of the improvements made in the organ during the last twenty years. Truly have these words been used concerning him—"the greatest mind engaged in the art of organ-building in this or in any other age."

Every organist fully acquainted with his work endorses it, and upwards of thirty organ-builders have honored themselves by writing similar testimony. The Austin Organ Company, of Hartford, Conn., says: "We have taken considerable pains to study his system and to satisfy ourselves as to the results he has achieved. There is, we find, no doubt whatever that he has effected a complete revolution in the development of tone."

Sir George Grove, in his "Dictionary of Music and Musicians" (p. 551), says: "No reference to this description of action [electric] as set up in recent years would be complete without mentioning the name of Mr. Robert Hope-Jones. * * * The researches in the realm of organ tone by Mr. Hope-Jones and others who are continually striving for excellence and the use of an increased and more varied wind-pressure (ranging from 3 to 25 inches) all combine to produce greater variety and superiority in the quality of organ tone than has ever existed before."

Elliston in his book on Organ Construction devotes considerable space to a description of the organs built by Hope-Jones in England and Scotland, and says: "The Hope-Jones system embraces many novelties in tone and mechanism."

Matthews, in his "Handbook of the Organ," referring to the Hope-Jones instruments, says:

"In his electric action Mr. Hope-Jones sought not only to obtain a repetition of the utmost quickness, but also to throw the reeds and other pipes into vibration by a 'percussive blow,' so to speak; being in this way enabled to produce certain qualities of tone unobtainable from ordinary actions. Soundness and smoothness of tone from the more powerful reeds, and great body and fullness of tone as well as depth from the pedal stops, are also noticeable features in these organs."

Ernest M. Skinner, of Boston, used the following words: "Your patience, research and experiment have done more than any other one agency to make the modern organ tone what it is. I think your invention of the leathered lip will mean as much to organ tone as the Barker pneumatic lever did to organ action, and will be as far-reaching in its effect.

"I believe you were the first to recognize the importance of a low voltage of electric action, and that the world owes you its thanks for the round wire contact and inverted magnet.

"Since I first became familiar with your work and writing I have found them full of helpful suggestions."

At first Hope-Jones licensed a score of organ-builders to carry out his inventions, but as this proved unsatisfactory, he entered the field as an organ-builder himself, being liberally supported by Mr. Thomas Threlfall, chairman of the Royal Academy of Music; J. Martin White, Member of the British Parliament, and other friends.

It was, perhaps, too much to expect that those who had so far profited from Hope-Jones' contracts and work should remain favorably disposed when he became a rival and a competitor.

For nearly twenty years he has met concerted opposition that would have crushed any ordinary man—attacks in turn against his electrical knowledge, musical taste, voicing ability, financial standing, and personal character. His greatest admirers remain those who, like the author, have known him for thirty years; his greatest supporters are the men of the town in which he lives; his warmest friends, the associates who have followed him to this country after long service under him in England.

Long before Hope-Jones reached his present eminence, and dealing with but one of his inventions, Wedgwood, a Fellow of the Royal Historical Society and a learned student of organ matters, classed him with Cavaillé-Coll and Willis, as one whose name "will be handed down to posterity"—the author of most valuable improvements.[3]

Early in his organ-building career, Hope-Jones had the good fortune to meet J. Martin White, of Balruddery, Dundee, Scotland. Mr. White, a man of large influence and wealth, not only time and again saved him from financial shipwreck and kept him in the organ-building business, but rendered a far more important service in directing Hope-Jones' efforts toward the production of orchestral effects from the organ.

Mr. White, in spite of his duties as a member of the British Parliament, and in spite of the calls of his business in Scotland and in this country, has managed to devote much time and thought to the art of organ playing and organ improvement.

Thynne, who did pioneer work in the production of string tone from organ pipes, owes not a little to Martin White; while Hope-Jones asserts that he derived all his inspiration in this field from listening to the large and fine organ in Mr. White's home.

Mr. White argued that the Swell Organ should be full of violin tone and be, as the strings in the orchestra, the foundation of accompaniment as well as complete in themselves. He lent to Hope-Jones some of his "string" pipes to copy in Worcester Cathedral, whence practically all the development of string tone in organs has come. Mr. White further urged that the whole organ should be in swell boxes.

It is extraordinary that an outsider like Mr. White, a man busy in so many other lines of endeavor, should exert such marked influence on the art of organ building, but it remains a fact that but for his artistic discernment and for the encouragement so freely given, the organ would not to-day be supplanting the orchestra in theatres and hotels, nor be what it is in the churches and halls.

Mr. White has for nearly thirty years helped, enthused and encouraged, not only artistic organ-builders like Casson, Thynne, Hope-Jones and Compton, but also the more progressive of the prominent organists.

All honor to Martin White!

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In the spring of 1903 Hope-Jones visited this country. At the instigation of Mr. R. P. Elliot, the organizer, Vice-President and Secretary of the Austin Organ Company, of Hartford, Conn., he decided to remain here and join that corporation, taking the office of Vice-president. Subsequently a new firm—Hope-Jones & Harrison—was tentatively formed at Bloomfield, N. J., in July, 1904, but as sufficient capital could not be obtained, Hope-Jones and his corps of skilled employees joined the Ernest M. Skinner Company, of Boston, Hope-Jones taking the office of Vice-president, in 1905. Working in connection with the Skinner Company, Hope-Jones constructed and placed a fine organ in Park Church, Elmira, N. Y., erected in memory of the late Thomas K. Beecher. He there met, as chairman of the committee, Mr. Jervis Langdon (Treasurer of the Chamber of Commerce, Elmira). That gentleman secured the industry for his city by organizing a corporation to build exclusively Hope-Jones organs.

This "Hope-Jones Organ Company" was established in February, 1907, the year of the financial panic. It failed to secure the capital it sought and was seriously embarrassed throughout its three years' existence. It built about forty organs, the best known being the one erected in the great auditorium at Ocean Grove, N. J.

The patents and plant of the Elmira concern were acquired by the Rudolph Wurlitzer Co. in April, 1910, and Mr. Hope-Jones entered its employ, with headquarters at its mammoth factory at North Tonawanda, N. Y., continuing to carry on the business under his own name.

Robert Hope-Jones is a member of the British Institute of Electrical Engineers; of the Royal College of Organists, London, England; of the American Guild of Organists; and of other bodies.

In 1893 he married Cecil Laurence, a musical member of one of the leading families of Maid stone, England. This lady mastered the intricacies of her husband's inventions, and to her help and encouragement in times of difficulty he attributes his success.

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We suppose that the reason "history repeats itself" is to be found in the fact that human nature does not vary, but is much the same from generation to generation. From the Bible we learn that one Demetrius, a silversmith of Ephesus, became alarmed at the falling off in demand for silver shrines to Diana, caused by the preaching of the Apostle Paul, and called his fellow craftsmen together with the cry of "Our craft is in danger," and set the whole city in an uproar. (Acts xix-24.)

In the year 1682 a new organ was wanted for the Temple Church in London, England, and "Father" Smith and Renatus Harris, the organ-builders of that day, each brought such powerful influence to bear upon the Benchers that they authorized *both* builders to erect organs in the church, one at each end. They were alternately played upon certain days, Smith's organ by Purcell and Dr. Blow, and Harris' organ by Baptist Draghi, organist to Queen Catherine. An attempt by the Benchers of the Middle Temple to decide in favor of Smith stirred up violent opposition on the part of the Benchers of the Inner Temple, who favored Harris, and the controversy raged bitterly for nearly five years, when Smith's organ was paid for and Harris' taken away. This is known in history as "The Battle of the Organs." In the thick of the fight one of Harris' partisans, who had more zeal than discretion, made his way inside Smith's organ and cut the bellows to pieces.

In 1875-76 the organ in Chester Cathedral, England, was being rebuilt by the local firm of J. & C. H. Whiteley. The London silversmiths took alarm at the Cathedral job going to a little country builder and got together, with the result that, one by one, Whiteleys' men left their employ, tempted by the offer of work at better wages in London, and had there not been four brothers in the firm, all practical men, they would have been unable to fulfil their contract. The worry was partly responsible for the death of the head of the firm soon after.

All this sounds like a chapter from the dark ages, of long, long ago, and we do not deem such things possible now.

But listen! In the year 1895 what was practically the first Hope-Jones electric organ sold was set up in St. George's Church, Hanover Square, London, England.

The furor it created was cut short by a fire, which destroyed the organ and damaged the tower of the church. With curious promptitude attention was directed to the danger of allowing amateurs to make crude efforts at organ-building in valuable and historic churches, and to the great risk of electric actions. Incendiarism being more than suspected, the authorities of the church ordered from Hope-Jones a similar organ to take the place of the one destroyed.

About the same time a gimlet was forced through the electric cable of a Hope-Jones organ at Hendon Parish Church, London, England. Shortly afterwards the cable connecting the console with the Hope-Jones organ at Ormskirk Parish Church, Lancashire, England, was cut through. At Burton-on-Trent Parish Church, sample pipes from each of his special stops were stolen.

At the Auditorium, Ocean Grove, N. J., an effort to cripple the new Hope-Jones organ shortly before one of the opening recitals in 1908 was made. And in the same year, on the Sunday previous to Edwin Lemare's recital on the Hope-Jones organ in the First Universalist Church, Rochester, N. Y., serious damage was done to some of the pipes in almost each stop in the organ.

Robert Hope-Jones died at Rochester, N. Y., on September 13, 1914, aged 55 years, and was interred at Elm Lawn Cemetery, No. Tonawanda, near Niagara Falls, N. Y.

Since his association with the Rudolph Wurlitzer Company in April, 1910, they have built under his personal supervision the organs in the Baptist Temple, Philadelphia; the rooms of the Ethical Culture Society, New York; and amongst others the unit orchestras in the Vitagraph Theatre, New York; the Crescent Theatre, Brooklyn; the Paris Theatre, Denver, Colo.; the Imperial Theatre, Montreal; and the Pitt Theatre, Pittsburgh, Pa., which last Hope-Jones considered his chef d'oeuvre.

[1] Dr. W. C. Carl, of New York, who is well acquainted with these instruments, considers the one in Notre Dame to be better than St. Sulpice and more representative of Cavaillé-Coll's work, even if a little smaller. We therefore give that specification, page 157.

[2] Exhaust tubular pneumatic had been practically applied in France as early as 1849 and pressure tubular pneumatic in 1867. See page 23.

[3] "Dictionary of Organ Stops," p. 44 and elsewhere.

NOTE.—This book has been translated into French, and published with annotations by Dr. G. Bédart, Professor Agrégé à la Université de Lille, France, under the title of "Révolution Récente dans la Facture d'Orgue." Lille: Librairie Générale Tallandier, 5, Rue Faidherbe. Prix net 4 Fr.

## CHAPTER XIV.

## HOW WE STAND TO-DAY.

Looking backward over the field we have traversed we find that the modern organ is an entirely different instrument from that of the Nineteenth Century.

Tracker action, bellows weights, the multitude of weak, drab-toned stops, have disappeared, and in their place we have stops of more musical character, greater volume, under perfect and wide control; new families of string and orchestral tones; great flexibility, through transference of stops; an instrument of smaller bulk than the old one, but yet of infinitely greater resources.

In his "Handbook of the Organ" (page 24), J. Matthews says: "There can be no *finality* in organ building. Whilst the violin fascinates by its perfection, the organ does so no less by its almost infinite possibilities, and modern science is fast transforming it into a highly sensitive instrument. The orchestral effects and overwhelming *crescendos* possible from such organs as those described in this work, 'double touch,' new methods of tone production, such as the Diaphone, the ease with which all the resources of a powerful instrument can now be placed instantaneously at the performer's command are developments of which Bach and Handel never dreamed."

And the modern tendency of the best builders is to make the organ still more orchestral in character, by the addition of carillons and other percussion stops.

The late W. T. Best, one of the finest executants who ever lived, stated to a friend of the writer who asked him why he never played the Overture to Tannhauser, that he considered its adequate rendition upon the organ impossible, "after having had the subject under review for a long time." Nowadays many organists find it possible to play the Overture to Tannhauser; the writer pleads guilty himself. Dr. Peace played it at the opening of Mr. White's organ at Balruddery and stated that he found the fine string tones it contained of peculiar value for Wagnerian orchestral effects. Dr. Gabriel Bédart says that music ought to be specially written for these new instruments.

While we associate the organ chiefly with its use in Church services, a new field is opening up for it in Concert Halls, Theatres, Auditoriums, College and School Buildings, Ballrooms of Hotels, Public Parks and Seaside Resorts, not as a mere adjunct to an orchestra but to take the place of the orchestra itself. The Sunday afternoon recitals in the College of the City of New York are attended by upwards of 2,500 people, many hundreds being unable to gain admittance; and the daily recitals at Ocean Grove during July and August, 1909, reaped a harvest of upwards of $4,000 in admission fees. Organs have been installed in some of the palatial hotels in New York and other cities, and one is planned for an ocean pier, where the pipes will actually stand under sea level, the sound being reflected where wanted and an equable temperature maintained by thermostats.

Organists have found it necessary to make special study of these new instruments, and the University of the State of New York has thought the matter of sufficient importance to justify it in chartering the "Hope-Jones Unit Orchestra School" as an educational institution.

Our review would be incomplete without some mention of

## AUTOMATIC PLAYERS.

When one listens to the Welte-Mignon Piano Player, it seems difficult to believe that a skilled artist is not at the keyboard performing the music.

The exact instant of striking each note and the duration during which the key is held are faithfuly recorded and reproduced with absolute accuracy, and a pretty close approximation to the power of blow with which each key is struck is obtained.

The first of these, that is, the time and duration of the note, is directly recorded from the artist who plays the piece to be reproduced. The second of these, that is, the power of tone, is subsequently added to the record either by the artist himself or by musicians who have carefully studied his manner of playing.

The result of this is a very faithful reproduction of the original performance.

In the case of the organ, the pressure with which the keys are struck does not need to be recorded or reproduced, but instead of this, we have to operate the various stops or registers and the various swell shades if we would obtain a faithful reproduction mechanically of the piece of music played by an artist on the organ.

Automatic Players are attached to many pipe organs. They, for the most part, consist of ordinary piano players so arranged that they operate the keys, or the mechanism attached to the keys, of an organ.

This is a very poor plan, and the resulting effect is thoroughly mechanical and unsatisfactory. Only one keyboard is played upon at a time as a rule, and neither the stops nor the pedals, nor the expression levers are operated at all.

The Aeolian Company, of New York, effected an improvement some years ago when they introduced what they term the double tracker bar. In this case, the holes in the tracker bar are made smaller than usual and they are staggered--or arranged in two rows. Every evenly numbered hole is kept on the lower row, and the oddly numbered holes are raised up to form a second row.

Provided the paper be tracked very accurately, and be given careful attention, this plan adopted by the Aeolian Company allows of two manuals of an organ being played automatically; but still the stops and expression levers are left to be operated by hand.

More recently a plan has been brought out by Hope-Jones that provides for the simultaneous performance of music upon two manuals and upon the pedals--each quite independent of the other. It also provides for the operation of all the stops individually in a large organ, and for the operation of the expression levers.

A switch is furnished so that when desired the stops and expression levers may be cut off and left to be operated by hand. The Hope-Jones

Tracker Bar has no less than ten lines of holes--it is, of course, correspondingly wide.

We look for a great development in the direction of organs played by mechanical means.

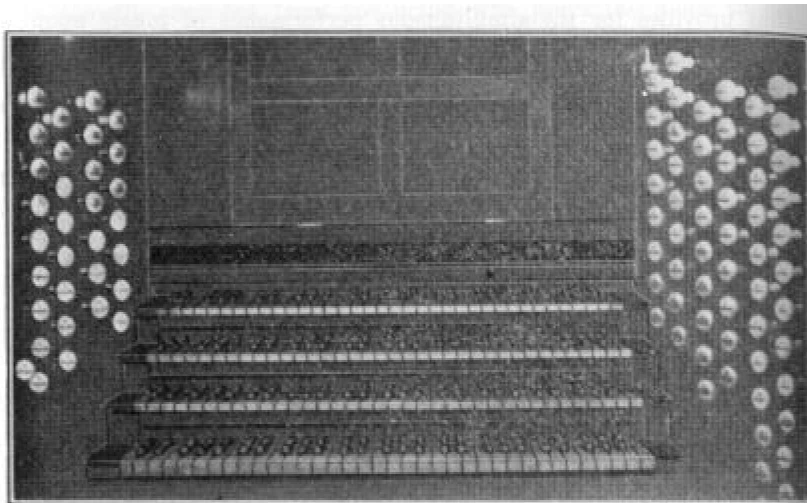
The piano player has done a very great deal to popularize the pianoforte and in the same way it is believed that the automatic player will do a very great deal to popularize the organ.

Many people who cannot play the organ will be induced to have them in their homes if they knew that they can operate them at any time desired, even in the absence of a skilled performer.

We now give specifications of some of the most notable organs of the world, all of which have been built or rebuilt since the year 1888, and embody modern ideas in mechanism, wind pressures, and tonal resources. First in the writer's estimation comes the

## ORGAN IN ST. GEORGE'S HALL, LIVERPOOL, ENG.

This noble instrument was built by Henry Willis to the specification of Dr. S. S. Wesley, by whom it was opened on the 29th and 30th of May, 1855. The writer made its acquaintance in 1866, when it was tuned on the unequal temperament system. In 1867 Mr. Best succeeded in getting it re-tuned in equal-temperament, several improvements were made, and the wind pressure on four of the reed stops on the Solo organ increased from 9 1/2 inches to 22 inches. In 1898 the organ was thoroughly rebuilt with tubular pneumatic action in place of the Barker levers. The compass of the manuals was changed from GG--$a^3$ to CC--$c^4$,[1] five octaves, and the pedals were carried up to g--33 notes. A Swell to Choir coupler was added (!) and various changes made in the stops, the Vox Humana transferred from the Swell to the Solo organ, and two of the Solo wind-chests were enclosed in a Swell-box. We note that the Tubas are still left outside. The cast-iron pipes of the lowest octave of the 32-ft. Double Open Diapason on the Pedal organ were replaced by pipes of stout zinc, and four composition pedals added to control the Swell stops.



*Keyboards of Organ in St. George's Hall, Liverpool. Two Rows of Stops at Left Omitted*

**Keyboards of Organ in St. George's Hall, Liverpool.**

**Two Rows of Stops at Left Omitted**

The following is the specification of the organ as it now stands, in its revised form:

FIRST MANUAL (CHOIR), 18 STOPS.

| | FEET. | | FEET. |
|---|---|---|---|
| Double Diapason | 16 | Gamba | 4 |
| Open Diapason | 8 | Twelfth | 2 2/3 |
| Clarabella | 8 | Fifteenth | 2 |
| Stopped Diapason | 8 | Flageolet | 2 |
| Dulciana | 8 | Sesquialtera, 3 ranks | |
| Viol da Gamba | 8 | Trumpet | 8 |
| Vox Angelica | 8 | Cremona | 8 |
| Principal | 4 | Orchestral Oboe | 8 |
| Harmonic Flute | 4 | Clarion | 4 |

SECOND MANUAL (GREAT), 25 STOPS.

| | FEET. | | FEET. |
|---|---|---|---|
| Dble. Open Diap. (metal) | 16 | Twelfth | 2 2/3 |
| Open Diapason, No. 1 | 8 | Fifteenth | 2 |
| Open Diapason, No. 2 | 8 | Harmonic Piccolo | 2 |
| Open Diapason, wood | 8 | Doublette, 2 ranks | |

| | | | |
|---|---|---|---|
| Open Diapason, No. 3 | 8 | Sesquialtera, 5 ranks | |
| Stopped Diapason | 8 | Mixture, 4 ranks | |
| Violoncello | 8 | Trombone | 16 |
| Quint | 5 1/2 | Trombone | 8 |
| Viola | 4 | Ophicleide | 8 |
| Principal, No. 1 | 4 | Trumpet | 8 |
| Principal, No. 2 | 4 | Clarion, No. 1 | 4 |
| Flute | 4 | Clarion, No. 2 | 4 |
| Tenth | 3 1/2 | | |

THIRD MANUAL (SWELL), 25 STOPS.

| | FEET. | | FEET. |
|---|---|---|---|
| Double Diapason (metal) | 16 | Piccolo | 2 |
| Open Diapason, No. 1 | 8 | Doublette, 2 ranks | |
| Open Diapason, No. 2 | 8 | Fourniture, 5 ranks | |
| Dulciana | 8 | Trombone | 16 |
| Viol da Gamba | 8 | Contra Hautboy | 16 |
| Stopped Diapason | 8 | Ophicleide | 8 |
| Voix Celeste | 8 | Trumpet | 8 |
| Principal | 4 | Horn | 8 |
| Octave Viola | 4 | Oboe | 8 |
| Flute | 4 | Clarionet | 8 |
| Twelfth | 2 2/3 | Clarion, No. 1 | 4 |
| Fifteenth, No. 1 | 2 | Clarion, No. 2 | 4 |
| Fifteenth, No. 2 | 2 | | |

FOURTH MANUAL (SOLO), 15 STOPS.

| | FEET. | | FEET. |
|---|---|---|---|
| Viol da Gamba | 8 | Vox Humana | 8 |
| Open Diapason, wood | 8 | Orchestral Oboe | 8 |
| Stopped Diapason | 8 | Corno di Bassetto | 8 |
| Flute (Orchestral) | 4 | *Ophicleide | 8 |
| Flute Piccolo | 2 | *Trumpet | 8 |
| Contra Fagotto | 16 | *Clarion, No. 1 | 4 |
| Trombone | 8 | *Clarion, No. 2 | 4 |
| Bassoon | 8 | | |

These stops are all placed in a new swell-box, except those marked*, which are on the heavy wind pressure.

PEDAL ORGAN (17 STOPS).

| | FEET. | | FEET. |
|---|---|---|---|
| Double Open Diapason (wood) | 32 | Quint (metal) | 5 1/2 |
| | | Fifteenth | 4 |
| Double Open Diapason (metal) | 32 | Fourniture, 5 ranks | |
| | | Mixture, 3 ranks | |
| Open Diapason (wood) | 16 | Posaune | 32 |
| Open Diapason (metal) | 16 | Contra Fagotto | 16 |
| Salicional (metal) | 16 | Ophicleide | 16 |
| Bourdon (wood) | 16 | Trumpet | 8 |
| Bass Flute (wood) | 8 | Clarion | 4 |
| Principal (wood) | 8 | | |

COUPLERS.

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Solo Super-Octave.                  Choir to Great.
Solo Sub-Octave.                    Choir Super-Octave.
Solo to Great.                      Choir Sub-Octave.
Swell to Great Super-Octave.        Solo to Pedals.
Swell to Great Unison.              Swell to Pedals.
Swell to Great Sub-Octave.          Great to Pedals.
Swell to Choir.                     Choir to Pedals.
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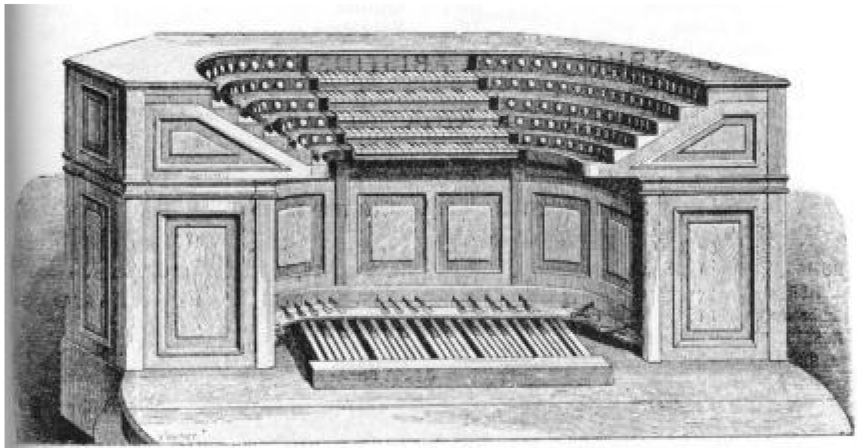
In addition to these coupling movements there are other accessories, consisting of 36 pneumatic pistons, 6 to each manual, and 12 acting upon the Pedal stops. There are also 6 composition pedals acting upon the "Great" and "Pedal" stops simultaneously, and 4 pedals acting upon the Swell organ pistons. The Swell and Solo organs are each provided with tremulants.

Two large bellows in the basement of the Hall, and blown by two steam engines of 8 h.p. and 1/2 h.p. respectively, supply the wind, which passes from the bellows to 14 reservoirs in various positions in the instrument, the pressure varying from 3 1/2 to 22 inches.

## ORGAN IN THE CATHEDRAL OF NOTRE-DAME, PARIS, FRANCE.

The ancient organ in the Cathedral of Notre-Dame de Paris was built in the reign of Louis XV by Thierry Leselope and the best workmen of his time. In the Eighteenth Century repairs and additions were made by the celebrated Cliquot. Further repairs were made by Dalsey from 1832 to 1838, and in 1863 the French Government confided the complete reconstruction of the instrument to Aristide Cavaillé-Coll. He spent five years over the work, and the new organ was solemnly inaugurated on the 6th of March, 1868.



*Keyboards, Cathedral Notre Dame, Paris*

**Keyboards, Cathedral Notre Dame, Paris**

It will be noticed that this illustration is not a photograph, but a wood engraving, drawn by hand, and the artist was evidently not a musician--he only shows 38 keys on each manual; there should be 56.

It stands in a gallery over the west door of the Cathedral. It has five manuals of 56 notes each, CC to $g^3$, pedal of 30 notes, CCC to F; 86 sounding stops "controlled by 110 registers"; 32 combination pedals, and 6,000 pipes, the longest being 32 feet. The action is Cavaillé-Coll's latest improvement on the Barker pneumatic lever. The wind reservoirs contain 35,000 litres of compressed air, fed by 6 pairs of *pompes* furnishing 600 litres of air per second. Here is the specification:

PEDAL ORGAN (16 STOPS).

| | FEET. | | FEET. |
|---|---|---|---|
| Principal-Basse | 32 | Quinte | 5 2/3 |
| Contre-Basse | 16 | Septième | 4 4/7 |
| Grosse Quinte | 10 2/3 | Centre Bombarde | 32 |
| Sous-Basse | 16 | Bombarde | 16 |
| Flute | 8 | Trompette | 8 |
| Grosse Tierce | 6 2/5 | Basson | 16 |
| Violoncelle | 8 | Basson | 8 |
| Octave | 4 | Clairon | 4 |

FIRST CLAVIER (GRAND CHOEUR), 12 STOPS.

| | FEET. | | FEET. |
|---|---|---|---|
| Principal | 8 | Larigot | 1 1/3 |
| Prestant | 4 | Septième | 1 1/7 |
| Bourdon | 8 | Piccolo | 1 |
| Quinte | 2 2/3 | Tuba Magna | 16 |
| Doublette | 2 | Trompette | 8 |

| | | | |
|---|---|---|---|
| Tierce | 1 3/5 | Clairon | 4 |

SECOND CLAVIER (GBAND ORGUE), 14 STOPS.

| | FEET. | | FEET. |
|---|---|---|---|
| Violon-Basse | 16 | Octave | 4 |
| Montre | 8 | Doublette | 2 |
| Bourdon | 16 | Fourniture, 2 to 5 ranks | |
| Flute Harmonique | 8 | Cymbale, 2 to 5 ranks | |
| Viola de Gambe | 8 | Basson | 16 |
| Prestant | 4 | Basson-Hautbois | 8 |
| Bourdon | 8 | Clairon | 4 |

THIRD CLAVIER (BOMBARDES), 14 STOPS.

| | FEET. | | FEET. |
|---|---|---|---|
| Principal-Basse | 16 | Quinte | 2 2/3 |
| Principal | 8 | Septième | 2 1/7 |
| Sous-Basse | 16 | Doublette | 2 |
| Flute Harmonique | 8 | Cornet, 2 to 5 ranks | |
| Grosse Quinte | 5 1/3 | Bombarde | 16 |
| Octave | 4 | Trompette | 8 |
| Grosse Tierce | 3 1/5 | Clairon | 4 |

FOURTH CLAVIER (POSITIF), 14 STOPS.

| | FEET. | | FEET. |
|---|---|---|---|
| Montre | 16 | Flute Douce | 4 |
| Flute Harmonique | 8 | Doublette | 2 |
| Bourdon | 16 | Piccolo | 1 |
| Salcional | 8 | Plein Jeu, 3 to 6 ranks | |
| Prestant | 4 | Clarinette-Basse | 16 |
| Unda Maris | 8 | Cromorne | 8 |
| Bourdon | 8 | Clarinette Aigue | 4 |

FIFTH CLAVIER (RECIT EXPRESSIF), 16 STOPS.

| | FEET. | | FEET. |
|---|---|---|---|
| Voix Humaine | 8 | *Prestant | 4 |
| *Basson-Hautbois | 8 | *Plein Jeu, 4 to 7 ranks | |
| *Diapason | 8 | Quinte | 2 2/3 |
| *Flute Harmonique | 4 | Octavin | 2 |
| Voix Celeste | 8 | Cornet, 3 to 5 ranks | |
| *Flute Octav | 4 | Bombarde | 16 |
| Voile de Gambe | 8 | Trompette | 8 |
| Quintaton | 16 | Clairon | 4 |

The printed specification kindly furnished to us by Dr. William C. Carl, of New York, who obtained it specially from Mr. Charles Mutin, of Paris, Cavaillé-Coll's successor in business, is not clear on the matter of couplers. Apparently all the manuals can be coupled to the Grand Choeur; the Grand Orgne and the Grand Choeur to the Pedals; and each manual has a suboctave coupler on itself. One of the combinations to the Pedal organ is designated, "Effets d'orage"--a thunder stop.

The organ was completely overhauled and renovated by Cavaillé-Coll shortly before his death (in 1899) and the stops marked * were inserted in the Swell (Recit Expressif) in place of others. The inauguration announcement states that it is one of the largest and most complete in Europe, and that independently of the perfection of the mechanism it possesses a power and variety of tone hitherto unknown in organ building, and now only realized for the first time. It is undoubtedly Cavaillé-Coll's finest work, and a lasting monument to his genius.

## ST. PAUL'S CATHEDRAL ORGAN, LONDON, ENG.

The old organ in St. Paul's Cathedral, London, on which Sir John Goss played, and which had felt the magic touch of Mendelssohn, had 13 stops on the Great, 7 on the Swell, 8 on the Choir and only one on the Pedal. It stood in a case on the screen between the choir and the nave of the Cathedral. We have noted elsewhere in this book how Willis had this screen removed, and rebuilt the organ on each side in 1872. In 1891 it was rebuilt in its present form as noted below. The writer first saw and heard this organ in 1873, and never failed, on his frequent visits to London in later years, to attend a service in St. Paul's Cathedral, where there are two choral services daily all the year round. No summer vacations here. The effect of the Tuba ringing up into the dome is magnificent. Willis looked upon this organ as his *chef d' oeuvre*, saying "There is nothing like it in the whole world!"

The Great organ is situated on the north side of the chancel. The Swell and Choir organs are on the south side. The Solo organ and one-third of the Pedal organ are under the first arch on the north side of the chancel. The Altar organ, which can be played through the Solo organ keys, is under the second arch on the north side of the chancel. The remaining two-thirds of the Pedal organ and three Tuba stops occupy the northeast quarter gallery in the dome. The keyboards are on the north side of the chancel, inside the organ case, and can be seen from the "whispering gallery." There are five manuals, CC to $c^3$, 61 notes; pedals CCC to g, 32 notes.

PEDAL ORGAN (NORTHEAST GALLERY OF DOME), 10 STOPS

| | FEET. | | FEET. |
|---|---|---|---|
| Double Diapason | 32 | Octave | 8 |
| Open Diapason, No. 1 | 16 | Mixture, 3 ranks | |
| Open Diapason, No. 2 | 16 | Contra Posaune | 32 |
| Violone Open Diapason | 16 | Bombardon | 16 |
| Violoncello | 8 | Clarion | 4 |

PEDAL ORGAN (UNDER ARCH, NORTH SIDE OF CHANCEL), 8 STOPS

| | FEET. | | FEET. |
|---|---|---|---|
| Violone | 16 | Octave | 8 |
| Bourdon | 16 | Ophicleide | 16 |
| Open Diapason | 16 | | |

CHOIR ORGAN, 11 STOPS

| | FEET. | | FEET. |
|---|---|---|---|
| Contra Gamba | 16 | Flute Harmonique | 4 |
| Open Diapason | 8 | Principal | 4 |
| Dulciana | 8 | Flageolet | 2 |
| Violoncello | 8 | Corno di Bassetto | 8 |
| Claribel Flute | 8 | Cor Anglais | 8 |
| Lieblich Gedackt | 8 | | |

GREAT ORGAN, 16 STOPS

| | FEET. | | FEET. |
|---|---|---|---|
| Double Diapason | 16 | Principal | 4 |
| Open Diapason, No. 1 | 8 | Octave Quint | 3 |
| Open Diapason, No. 2 | 8 | Super Octave | 2 |
| Open Diapason, No. 3 | 8 | Fourniture, 3 ranks | |
| Open Diapason, No. 4 | 8 | Mixture, 3 ranks | |
| Open Diapason | 8 | Trombone | 16 |
| Quint, metal | 6 | Tromba | 8 |
| Flûte Harmonique | 4 | Clarion | 4 |

SWELL ORGAN, 13 STOPS

| | FEET. | | FEET. |
|---|---|---|---|
| Contra Gamba | 16 | Fifteenth | 2 |
| Open Diapason | 8 | Echo Cornet, 3 ranks | |
| Lieblich Gedackt | 8 | Contra Posaune | 16 |
| Salicional | 8 | Cornopean | 8 |
| Vox Angelica | 8 | Hautbois | 8 |
| Principal | 4 | Clarion | 4 |

SOLO ORGAN (NOT IN SWELL BOX), 3 STOPS

| | FEET. | | FEET. |
|---|---|---|---|
| Flûte Harmonique | 8 | Piccolo | 2 |
| Concert Flûte Harmonique | 4 | | |

SOLO ORGAN (IN SWELL BOX), 10 STOPS

| | FEET. | | FEET. |
|---|---|---|---|
| Open Diapason | 8 | Tuba | 8 |
| Gamba | 8 | Orchestral Oboe | 8 |
| Contra Fagotto | 16 | Corno di Bassetto | 8 |
| Contra Posaune | 16 | Cornopean | 8 |
| Cor Anglais | 8 | Flute | 8 |

ALTAR ORGAN (PLAYED THROUGH SOLO ORGAN KEYS), 5 STOPS

| | FEET. | | FEET. |
|---|---|---|---|
| Contra Gamba | 16 | Vox Humana | 8 |
| Gamba | 8 | Tremulant | |
| Vox Angelica, 3 ranks | 8 | | |

TUBA ORGAN, 6 STOPS

| | FEET. | | FEET. |
|---|---|---|---|
| Double Tuba (in quarter gallery) | 16 | Tuba (in quarter gallery) | 4 |
| Tuba, (in quarter gallery) | 8 | Tuba Major (over Great organ) | 8 |
| | | Clarion (over Great organ) | 4 |

COUPLERS AND ACCESSORIES--PNEUMATIC

Swell to Great Sub-octave.
Swell to Great Unison.
Swell to Great Super-octave.
Solo to Swell.
Dome Tubas to Great.
Chancel Tubas to Great.
Chancel Tubas to Great.

COUPLERS--MECHANICAL

Tuba Organ to Pedal.
Solo Organ to Pedal.
Swell Organ to Pedal.
Great Organ to Pedal.
Choir Organ to Pedal.

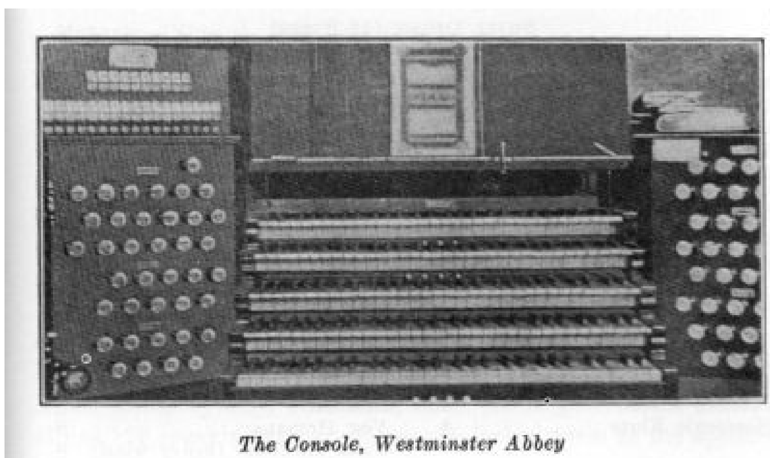
Six Pistons operate on the whole Organ.

About forty Adjustable Pistons and Composition Pedals.

The mechanism is entirely new. The quarter dome portion of the organ is playable by electric agency; the rest being entirely pneumatic. There are one hundred draw-stops. The most novel features are the new Altar and Tuba organs. The former, containing Vox Humana, Vox Angelica (3 ranks), and two Gambas (16 and 8 feet) serves for distant and mysterious effects and to support the priest while intoning at the altar; while the Tuba organ produces effects of striking brilliancy; three of the Tubas being located in the northeast quarter-gallery and speaking well into the body of the building. Among the accessories, also, may be noted the large supply of adjustable combination pistons, which bring the various sections of the instrument well under the player's control. Various wind pressures are employed, from 3 1/2 to 25 inches.

## WESTMINSTER ABBEY ORGAN, LONDON, ENG.

All good Americans when they visit London go to Westminster Abbey, and will be interested in the organ there; in fact we believe it was largely built with American money. The house of William Hill & Son, who built this organ, is the oldest firm of organ-builders in England, being descended from the celebrated artist, John Snetzler, whose business, founded in 1755, passed into the possession of Thomas Elliot, and to his son-in-law, William Hill (inventor of the Tuba), in the earlier part of the Nineteenth Century. The business has been in the Hill family nearly a hundred years and is now directed by William Hill's grandson. The firm has built many notable instruments in Great Britain and her colonies (Sydney) celebrated for the refinement and purity of their tone.



**The Console, Westminster Abbey**

The organ in Westminster Abbey is placed at each side of the choir screen, except the Celestial organ, which is placed in the triforium of the south transept (Poets' Corner) and connected with the console by an electric cable 200 feet long. The form of action used is Messrs. Hill's own, and the "stop-keys" therefor (made to a pattern suggested by Sir Frederick Bridge) will be seen in the picture to the left of the music desk. Note that this organ can be played from two keyboards. The main organ has pneumatic action throughout. It was commenced in 1884, added to as funds were available, and finished in 1895. The specification (containing the additions made in 1908-9) follows:

GREAT ORGAN (14 STOPS)

| | FEET. | | FEET. |
|---|---|---|---|
| Double Open Diapason | 16 | Harmonic Flute | 4 |
| Open Diapason, large scale | 8 | Twelfth | 2 2/3 |
| Open Diapason, No. 1 | 8 | Fifteenth | 2 |
| Open Diapason, No. 2 | 8 | Mixture, 4 ranks | |
| Open Diapason, No. 3 | 8 | Double Trumpet | 16 |
| Hohl Flöte | 8 | Posaune | 8 |
| Principal | 4 | Clarion | 4 |

CHOIR ORGAN (11 STOPS)

| | FEET. | | FEET. |
|---|---|---|---|
| Gedackt | 16 | Nason Flute | 4 |
| Open Diapason | 8 | Suabe Flute | 4 |
| Keraulophon | 8 | Harmonic Gemshorn | 4 |
| Dulciana | 8 | Contra Fagotto | 16 |
| Lieblich Gedackt | 8 | Cor Anglais | 8 |
| Principal | 4 | | |

SWELL ORGAN (18 STOPS)

| | FEET. | | FEET. |
|---|---|---|---|
| Double Diapason, Bass | 16 | Dulcet | 4 |
| Double Diapason, Treble | 16 | Principal | 4 |
| Open Diapason, No. 1 | 8 | Lieblich Flöte | 4 |
| Open Diapason, No. 2 | 8 | Fifteenth | 2 |
| Rohr Flöte | 8 | Mixture, 3 ranks | |
| Salicional | 8 | Oboe | 8 |
| Voix Celestes | 8 | Double Trumpet | 16 |
| Dulciana | 8 | Cornopean | 8 |
| Hohl Flöte | 8 | Clarion | 4 |

SOLO ORGAN (8 STOPS)

| | FEET. | | FEET. |
|---|---|---|---|
| Gamba | 8 | *In a Swell Box* | |
| Rohr Flöte | 8 | Orchestral Oboe | 8 |
| Lieblich Flöte | 4 | Clarinet | 8 |
| Harmonic Flute | 4 | Vox Humana | 8 |
| | | Tuba Mirabilis (heavy wind) | 8 |

CELESTIAL ORGAN (17 STOPS)

First Division--

| | FEET. | | FEET. |
|---|---|---|---|
| Double Dulciana, Bass | 16 | Voix Celestes | 8 |
| Double Dulciana, Treble | 16 | Hohl Flöte | 8 |
| Flauto Traverso | 8 | Dulciana Cornet, 6 ranks | |
| Viola di Gamba | 8 | | |

The following Stops are available, when desired, on the Solo keyboard, thus furnishing an independent Instrument of two Manuals; whilst in combination with Coupler Keys, Nos. 1 and 2, Coupler Keys Nos. 3 and 4 can be interchanged, thus reversing the Claviers.

Second Division--

| | FEET. | | FEET. |
|---|---|---|---|
| Cor de Nuit | 8 | Vox Humana | 8 |
| Suabe Flute | 4 | Spare Slide | |

| | | | |
|---|---|---|---|
| Flageolet | 2 | Glockenspiel, 3 ranks | |
| Harmonic Trumpet | 8 | Gongs (three octaves of brass gongs, struck by electro-pneumatic hammers). | |
| Musette | 8 | | |
| Harmonic Oboe | 8 | | |

ORGAN (10 STOPS)

| | FEET. | | FEET. |
|---|---|---|---|
| Double Open Diapason | 32 | Bass Flute | 8 |
| Open Diapason | 16 | Violoncello | 8 |
| Open Diapason | 16 | Contra Posaune | 32 |
| Bourdon | 16 | Posaune | 16 |
| Principal | 8 | Trumpet | 8 |

Manuals--CC to a|3|. Pedal--CCC to F.

The entire instrument is blown by a gas engine, actuating a rotary blower and high pressure feeders.

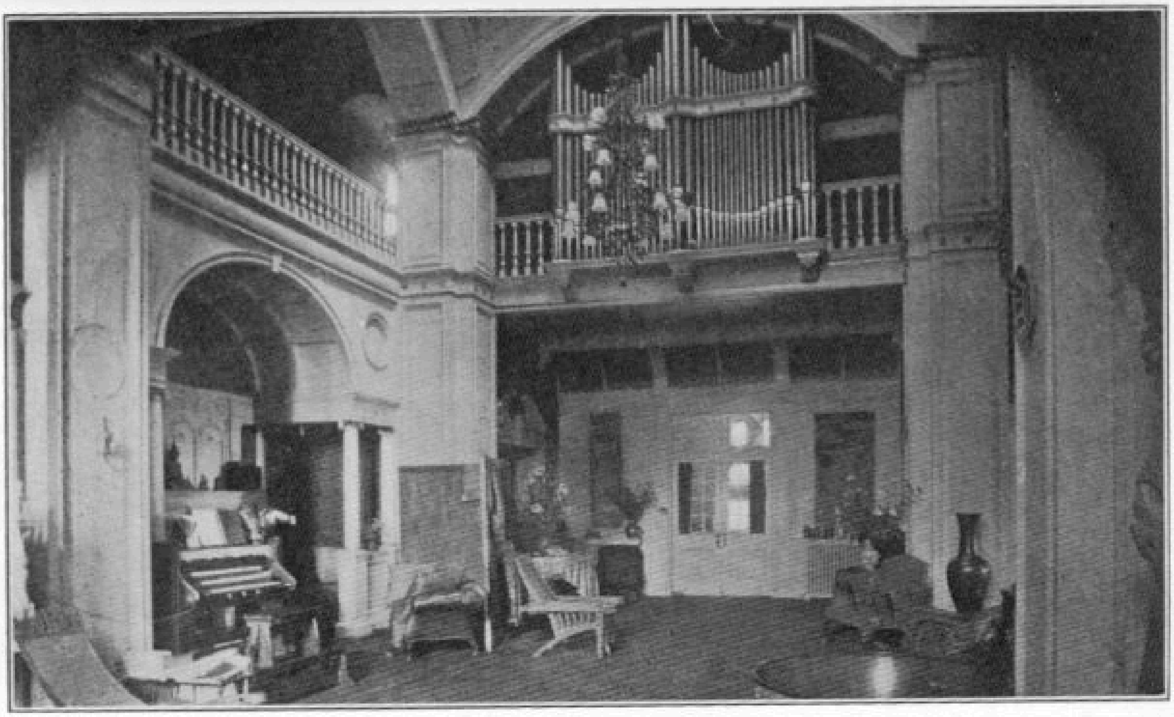
There are 24 Couplers; 10 Combination Pedals affecting Great, Swell, and Pedal stops; 24 Combination Pistons, and 3 Crescendo Pedals.

In 1908-1909 the organ was refitted throughout with William Hill & Sons' latest type of tubular pneumatic action (excepting the Celestial organ, for which the electric action was retained), an entirely new console was provided, a large-scale Open Diapason added to the reed soundboard of the Great organ, and several additions made to the couplers and combination pistons.

William Hill & Sons are also the builders of the organ in the Town Hall, Sydney, Australia, once the largest in the world; it has 126 speaking stops. It may be looked upon as the apotheosis of the old style of organ-building, with low pressures, duplication, and mixtures. The highest pressure used is 12 inches and there are no less than 45 ranks of mixtures which were characterized by Sir J. F. Bridge as being "like streaks of silver." The writer saw this organ in the builder's factory in London before it was shipped to Sydney. A unique novelty was the Contra Trombone on the Pedal of 64 feet actual length. The bottom pipes were doubled up into three sections and the tongue of the reed of the CCCCC pipe was two feet long. Although almost inaudible when played alone this stop generated harmonics which powerfully reinforced the tone of the full organ. The organ is inclosed in a case designed by Mr. Arthur Hill after old renaissance examples.

## ORGAN IN THE MANSION OF J. MARTIN WHITE, ESQ., BALRUDDERY, SCOTLAND

The organs heretofore described have been somewhat on the old lines, but we come now, in 1894, to "the dawn of a new era," and the star of Hope-Jones appears on the horizon. With the exception of an instrument rebuilt by Hope-Jones in Dundee Parish Church, this is the first organ with electric action in Scotland.


Organ in Hall of Balruddery Mansion, Dundee, Scotland

## Organ in Hall of Balruddery Mansion, Dundee, Scotland

Balruddery mansion, the rural residence of Mr. J. Martin White, stands in a fair country seven miles to the west of Dundee. The grounds of the mansion are a dream of sylvan beauty, with the broad bosom of the River Tay within the vision and beyond that the blue line of the Fife shore.

The organ is the work of three hands. It was originally built by Casson; the most notable characters in the voicing are due to Thynne; and it remained for Mr. Hope-Jones to entirely reconstruct it with his electric action, stop-keys, double touch, pizzicato touch and some of his new stops. The console is movable, connected with the organ by a cable about one inch thick, containing about 1,000 wires, enabling the player to hear the organ as the audience hears it.

Referring to the view of the hall on page 167, the Great organ is in the chamber behind the pipes seen in the upper gallery. The Swell and Solo organs are in the attic above, and the sound of these can be made distant by shutting the Swell shutters, or brought near by opening them. The pedal pipes are put upside down so that their open ends may be toward the music room.

SPECIFICATION.

Three manuals, CC to a|3|, 58 notes.  Pedal CCC to F, 30 notes.

PEDAL ORGAN (G STOPS).

| | FEET. | | FEET. |
|---|---|---|---|
| Open Diapason | 16 | Principal | 8 |
| "Great" Bourdon | 16 | (Partly from 16 feet open.) | |
| "Swell" Violone | 16 | Couplers: | |
| Ophicleide | 16 | Great to Pedal. | |
| (First and second touch, partly from Tuba.) | | Swell to Pedal. | |
| "Swell" Viola | 8 | Solo to Pedal. | |

GREAT ORGAN (9 STOPS).

In swell box No. 2, except the Open Diapason, Clarabel and Sourdine.

| | FEET. | | FEET. |
|---|---|---|---|
| Bourdon | 16 | Principal | 4 |
| Open Diapason | 8 | Zauber Flöte | 4 |
| Clarabel | 8 | Piccolo | 2 |
| Sourdine | 8 | Mixture, 5 ranks | |
| Gedackt | 8 | | |

Couplers: Swell to Great (first and second touch).
" Swell to Great Sub-Octave.
" Swell to Great Super-Octave.
" Solo Unison to Great (first, second, and pizzicato touch).
" Solo to Super-Octave to Great.
5 Composition Pedals.

SWELL ORGAN (10 STOPS).

In Swell Box No. 1.

| | FEET. | | FEET. |
|---|---|---|---|
| Violone | 16 | Geigen Principal | 4 |
| Geigen Open | 8 | Horn | 8 |
| Violes d' Orchestre | 8 | Oboe | 8 |
| Harmonic Flute | 8 | Violes Celestes (Tenor C) | 8 |
| Echo Salcional | 8 | Vox Angelica (Tenor C) | 8 |

Couplers: Sub-Octave and Super-Octave.
" Solo to Swell (second touch).
" Great to Swell (second touch).
5 Composition Pedals.

SOLO ORGAN (5 STOPS).

In Swell Box No. 2.

| | FEET. | | FEET. |
|---|---|---|---|
| Harmonic Flute | | Tuba Mirabilis | |

```
   (8 inches wind)           8        (8 inches wind)        8
  Violoncello                8      Cor Anglais              8
  Clarionet                  8
  Couplers: Sub-Octave; Super-Octave.
```

GENERAL ACCESSORIES.

Three Pedal Studs *p, f, ff*.
Sforzando Pedal *f, ff*.
Stop Switch (Key and Pedal).
Tremulant (Swell and Solo).

## ORGAN IN WORCESTER CATHEDRAL, ENGLAND.

Next in chronological order comes the epoch-making organ in Worcester Cathedral, England, built by Hope-Jones in 1896. Here he gave to the world the result of his researches into the production of organ tone, and we make bold to say that no other instrument has so revolutionized and exerted such an influence on the art of organ-building both in England and the United States. Here for the first time we find that wonderful invention, the Diaphone, and even the nomenclature of the various stops is new, however familiar they may be now, seventeen years later. Hope-Jones is reported to have spent several days in the Cathedral studying its acoustic properties before planning this organ, and the result was a marvelous ensemble of tone. The fame thereof spread abroad and eminent musicians made pilgrimages from all parts of the earth to see and hear it, as mentioned in our account of Yale University Organ later.

Charles Heinroth, Organist and Director of Music, Carnegie Institute, Pittsburgh, Pa., says:

"I don't believe I could forget my first impression on hearing the Worcester Cathedral organ, to me a perfect masterpiece. At once a sense of something out of the ordinary took hold of me at hearing the tone quality of the various stops and combinations--it seemed altogether uncommon."

Similar opinions were expressed by many others.

There were two organs in Worcester Cathedral. The older of the two, standing on the north side of the choir, though it had been rebuilt by Hill & Son, contained pipes over 200 years old from the original instrument by

Renatus Harris. The second organ, built by Hill & Son in 1875, stood in the south transept. It was a gift to the Cathedral from the late Earl of Dudley.

In 1895-1896 Hope-Jones constructed a new organ retaining the Renatus Harris and some of the Hill pipes. It stands in three portions, part against the south wall of the transept and part on either side of the choir, all controlled from the console originally placed inside the screen just west of the choir stalls, but since moved into the north choir aisle. It was planned to have the Solo Tuba on a wind pressure of 100 inches, but we regret to say the funds for this have not been forthcoming. The specification follows; the compass of the manuals is from CC to $c^4$, 61 notes; of the pedals, CCC to F, 30 notes.

GREAT ORGAN (11 STOPS).

| | FEET. | | FEET. |
|---|---|---|---|
| Diapason Phonon | 16 | Octave Diapason | 4 |
| Tibia Plena | 8 | Quintadena | 4 |
| Diapason Phonon | 8 | Harmonic Piccolo | 2 |
| Open Diapason | 8 | Tuba Profunda | 16 |
| Hohl Flute | 8 | Tuba | 8 |
| Viol d'Amour | 8 | | |

SWELL ORGAN (15 STOPS).

| | FEET. | | FEET. |
|---|---|---|---|
| Contra Viola | 16 | String Gamba | 8 |
| Violes Celestes | 8 | Quintaton | 8 |
| Tibia Clausa | 8 | Gambette | 4 |
| Horn Diapason | 8 | Harmonic flute | 4 |
| Harmonic Piccolo | 2 | Cor Anglais (free) | 8 |
| Double English Horn | 16 | Vox Humana | 8 |
| Cornopean | 8 | Clarinet | 8 |
| Oboe | 8 | | |

CHOIR ORGAN (10 STOPS).

| | FEET. | | FEET. |
|---|---|---|---|
| Double Open Diapason | 16 | Dulciana | 8 |
| Open Diapason | 8 | Flute | 4 |
| Cone Leiblich Gedackt | 8 | Flautina | 2 |
| Viol d'Orchestre | 8 | Cor Anglais (beating) | 8 |
| Tiercina | 8 | Clarionet | 8 |

SOLO ORGAN (5 STOPS).

| | FEET. | | FEET. |
|---|---|---|---|
| Rohr Flute | 4 | Tuba Sonora | 8 |
| Bombarde | 16 | Orchestral Oboe | 8 |
| Tuba Mirabilis | 8 | | |

PEDAL ORGAN (13 STOPS).

| | FEET. | | FEET. |
|---|---|---|---|
| Gravissima | 64 | Octave Violone | 8 |
| Double Open Diapason | 32 | Flute | 8 |
| Contra Violone | 32 | Diaphone | 32 |
| Tibia Profunda | 16 | Diaphone | 16 |

| | | | |
|---|---|---|---|
| Open Diapason | 16 | Tuba Profunda | 16 |
| Violone | 16 | Tuba | 8 |
| Bourdon | 16 | | |

Couplers: Choir, Great, Swell, Solo to Pedal; light wind Great Sub Oct (on itself); Great reeds Super Oct (on themselves); Solo to Great, Sub, Super and Unison; Swell to Great, Sub, Super and Unison; Choir to Great, Sub and Unison. Swell Sub and Super Octave (on itself); Solos to Swell; Choir to Swell.

Choir Sub and Super Octave (on itself); Swell to Choir, Sub, Super and Unison.

Solo Organ Sub and Super Octave (on itself).

Solo Tuba to Great 2d touch.

Swell to Great 2d touch.

Swell to Choir 2d touch.

Choir to Swell 2d touch.

Solo and Pedal Tubas have double tongues and are voiced on 20 inches of wind.

Accessories: 5 compound composition keys for Great and Pedal, Swell and Pedal, Solo; 3 for Choir and Pedal, and 2 to each manual for couplers; 2 combination keys; Tremulant to Swell; 5 composition pedals; Stop Switch, Key and Pedal.

The composition keys between the manuals if touched in the centre give automatically an appropriate Pedal bass in addition to the particular stops acted upon; but if touched on one side do not disturb the Pedal department. All combination movements affect the stop keys themselves. The "stop switch" enables the player to prepare in advance any special combination of stops and couplers, bringing them into play at the moment desired. The organ is blown by a six-horse gas engine.

## ORGAN IN WOOLSEY HALL, YALE UNIVERSITY, NEW HAVEN, CONN.

This magnificent instrument, built by the Hutchings-Votey Organ Company in 1902, possesses increased foundation tone and higher wind pressures. The late Professor Samuel S. Sanford, devoted much time and interest in its design. He visited Worcester Cathedral, England, and was profoundly impressed with the new epoch in tone production heralded by that organ. He made an effort to have Mr. Hope-Jones voice one of his Tibias and Smooth Tubas for the Yale organ; and though his effort was not successful, leading features of the Worcester instrument were frankly imitated and generously acknowledged. It was largely due to the liberality of Mr. George S. Hutchings in interpreting the terms of the contract that such a complete instrument was secured for the

University. In recognition of this and in view of Mr. Hutchings' artistic contributions to the art of organ-building, the University conferred upon him the honorary degree of Master of Arts. The Diapasons are voiced on pressures ranging from 3 1/2 to 22 inches; the reeds in the Great and Swell on 10 inches, and the Tuba on 22 inches. The builders state that the mixtures have been inserted at the request of many noted organists. There are now 78 sounding stops.

Compass of Manuals from CC to c|4|, 61 notes. Compass of Pedals from CCC to g, 32 notes.

GREAT ORGAN (19 STOPS).

| | FEET. | | FEET. |
|---|---|---|---|
| Diapason | 16 | Octave | 4 |
| Quintaton | 16 | Wald Flute | 4 |
| Diapason | 8 | Gambette | 4 |
| Diapason | 8 | Twelfth | 2 2/3 |
| Diapason | 8 | Fifteenth | 2 |
| Doppel Floete | 8 | Mixture, 5 ranks | |
| Principal Flute | 8 | Trumpet | 16 |
| Gross Gamba | 8 | Trumpet | 8 |
| Viol d'Amour | 8 | Clarion | 4 |
| Gemshorn | 8 | | |

SWELL ORGAN (21 STOPS).

| | FEET. | | FEET. |
|---|---|---|---|
| Contra Gamba | 16 | Vox Celestis | 8 |
| Bourdon | 16 | Harmonic Flute | 4 |
| Stentorphone | 8 | Principal | 4 |
| Diapason | 8 | Violina | 4 |
| Gamba | 8 | Flautino | 2 |
| Bourdon | 8 | Dolce Cornet, 6 ranks | |
| Flauto Traverso | 8 | Posaune | 16 |
| Salicional | 8 | Cornopean | 8 |
| Quintadena | 8 | Oboe | 8 |
| Unda Maris | 8 | Vox Humana | 8 |
| Aeoline | 8 | Tremolo | |

CHOIR ORGAN (13 STOPS).

(Inclosed in a Swell Box)

| | FEET. | | FEET. |
|---|---|---|---|
| Contra Dulciana | 16 | Violoncello | 8 |
| Diapason | 8 | Viola | 4 |
| Melodia | 8 | Flauto Traverse | 4 |
| Viol d'Orchestre | 8 | Piccolo Harmonique | 2 |
| Lieblich Gedacht | 8 | Clarinet | 8 |
| Dulciana | 8 | Contra Fagotto | 16 |
| Viol Celeste, 2 ranks | 8 | Tremolo | |

SOLO ORGAN (6 STOPS).

(In a Swell Box)

| | FEET. | | FEET. |
|---|---|---|---|

| | | | |
|---|---|---|---|
| Tibia Plena | 8 | Hohlpfeife | 4 |
| Tuba Sonora | 8 | Dolce | 8 |
| Gross Flute | 8 | Orchestral Oboe | 8 |

PEDAL ORGAN (19 STOPS).

| | FEET. | | FEET. |
|---|---|---|---|
| Gravissima (Resultant) | 64 | Contra Bass (Resultant) | 32 |
| Diapason | 32 | Diapason | 16 |
| Contra Bourdon | 32 | Diapason | 16 |

There are 20 Couplers; 29 Combination Pistons; 11 Composition Pedals; 3 Balanced Swell Pedals and Balanced Crescendo Pedal.

## ORGAN IN ST. PAUL'S CATHEDRAL, BUFFALO, N. Y.

This instrument, built by the Hope-Jones Organ Company and opened Christmas, 1908, in one of the finest churches in America, takes position among the great and important organs of the New World. It is built on the "Unit" principle, and is divided between the extreme ends of the lofty structure.

The chancel organ, consisting of four extended stops, occupies the old organ chamber, which opens into the chancel and the transept of the church. This portion of the instrument stands in a cement swell box, its tone being thrown through the arch and into the chancel by means of reflectors. It contains a Diaphone, the full organ being very powerful, although its various tones can be reduced to whispers by closing the laminated lead shutters, which are electrically controlled through the general swell pedal at the console.

The other division of the instrument, the organ proper, is located in the gallery at the distant end of the nave of the church, and in an adjacent room. This gallery division, complete in itself, represents the latest type of Unit organ. Speaking generally, all the stops are common to all four manuals, and to the pedals, and can be drawn at various pitches. Following more or less the analogy of the orchestra, the organ is divided into four distinct portions, each enclosed in its own cement swell box with its laminated lead shutters, controlled electrically from the console swell pedals. These divisions represent, respectively: "Foundation," "wood wind," "string" and "brass."

The entire instrument is played from one console, located in the nave, connected with the chancel organ by an electric cable sixty feet in length, and with the gallery organ by one of one hundred and sixty feet. This key desk is of the well-known Hope-Jones type, which appeals so strongly to most organists. It contains all the latest conveniences: Stop-keys, in semi-circular position above the manuals; combination keys, which move the stop-keys (with switch-board within easy reach for changing the selection of stops); suitable bass tablets, saving time and worry to the player; double touch, offering its wealth of tonal effects, etc. Through the operation of a small tablet the organs can be played separately or together.

COMPASS: MANUALS, 61 NOTES; PEDALS, 32 NOTES.

PEDAL ORGAN (16 STOPS).

| | FEET. | | FEET. |
|---|---|---|---|
| _Foundation._ | | Cello | 8 |
| Tibia Profundissima | 32 | Cello Celeste | 8 |
| Resultant Bass | 32 | _Brass._ | |
| Tibia Profunda | 16 | Ophicleide | 16 |
| Contra Tibia Clausa | 16 | Trombone | 16 |
| Open Diapason | 16 | Tuba | 8 |
| Tibia Plena | 8 | Clarion | 4 |
| Tibia Clausa | 8 | Great to Pedal. | |
| _Wood Wind._ | | Swell to Pedal. | |
| Clarinet | 16 | Swell Octave to Pedal. | |
| _String._ | | Choir to Pedal. | |
| Contra Viola | 16 | One Stud to release all | |
| Dulciana | 16 | Suitable Basses. | |

GREAT ORGAN (14 STOPS).

| | FEET. | | FEET. |
|---|---|---|---|
| _Foundation._ | | _Wood Wind._ | |
| Tibia Profunda | 16 | Concert Flute | 8 |
| Contra Tibia Clausa | 16 | Flute | 4 |
| Tibia Plena | 8 | _String._ | |
| Tibia Clausa | 8 | Dulciana | 8 |
| Open Diapason | 8 | _Brass._ | |
| Horn Diapason | 8 | Ophicleide | 16 |
| Octave | 4 | Tuba | 8 |
| | | Swell Octave to Great. | |
| Tromba | 8 | Swell Sub to Great. | |
| Clarion | 4 | Choir Unison to Great. | |
| Swell Sub to Great. | | Choir Octave to Great. | |
| Swell Unison to Great. | | Tuba to Great Second Touch. | |

One Double Touch Tablet to cause the Pedal Stops and Couplers to move so as at all times to furnish automatically a Suitable Bass.

Ten Double Touch Adjustable Combination Keys for Great Stops and Suitable Bass.

CHOIR ORGAN (22 STOPS).

| | FEET. | | FEET. |
|---|---|---|---|
| _Foundation._ | | Quintadena | 8 |
| Contra Tibia Clausa | 16 | Quint Celeste (Ten C) | 8 |
| Tibia Clausa | 8 | Dulciana | 8 |
| Horn Diapason | 8 | Unda Maris (Ten C) | 8 |

| | | | |
|---|---|---|---|
| | | Gambette | 4 |
| _Wood Wind._ | | Octave Celeste | 4 |
| Orchestral Oboe (Ten C) | 16 | Quintadena | 4 |
| Concert Flute | 8 | Quint Celeste | 4 |
| Clarinet | 8 | _Brass._ | |
| Oboe Horn | 8 | Trombone | 16 |
| Orchestral Oboe | 8 | Tuba | 8 |
| Vox Humana | 8 | Tromba | 8 |
| Flute | 4 | _Percussion._ | |
| _String._ | | Harmonic Gongs | 8 |
| Contra Viola | 16 | Harmonic Gongs | 4 |
| Viole d' Orchestre | 8 | Unison Off. Sub-Octave. Octave | |
| Viole Celeste | 8 | Choir to Swell Second Touch. | |

One Double Touch Tablet to cause the Pedal Stops and Couplers to move so as at all times to furnish automatically a Suitable Bass.

Ten Double Touch Adjustable Combination Keys for Swell Stops and Suitable Bass.

CHOIR ORGAN (22 STOPS).

| | FEET. | | FEET. |
|---|---|---|---|
| _Foundation._ | | Flute | 4 |
| Contra Tibia Clausa | 16 | Piccolo | 2 |
| Tibia Clausa | 8 | _String._ | |
| Horn Diapason | 8 | Dulciana | 16 |
| _Wood Wind._ | | Viole d' Orchestre | 8 |
| Clarinet | 16 | Viole Celeste | 8 |
| Vox Humana (Ten C) | 16 | Quintadena | 8 |
| Concert Flute | 8 | Quint Celeste | 8 |
| Clarinet | 8 | Dulciana | 8 |
| Oboe Horn | 8 | Unda Maris (Ten C) | 8 |
| Orchestral Oboe | 8 | Dulcet | 4 |
| Vox Humana | 8 | Unda Maris | 4 |
| | FEET. | Swell Sub to Choir | |
| _Percussion._ | | Swell Unison to Choir | |
| Harmonic Gongs | 8 | Swell Octave to Choir | |
| Unison Off. Sub-Octave. Octave. | | Swell to Choir second touch | |

One Double Touch Tablet to cause the Pedal Stops and Couplers to move so as at all times to furnish automatically a Suitable Bass.

Ten Double Touch Adjustable Combination Keys for Choir Stops and Suitable Bass.

SOLO ORGAN (8 STOPS).

| | FEET. | | FEET. |
|---|---|---|---|
| _Foundation._ | | Clarion | 4 |
| Tibia Profunda | 16 | _Percussion._ | |
| Tibia Plena | 8 | Harmonic Gongs | 8 |
| Open Diapason | 8 | Great to Solo. | |
| _Brass._ | | Swell Sub to Solo. | |
| Ophicleide | 16 | Swell Unison to Solo. | |
| Tuba | 8 | Swell Octave to Solo. | |
| Tromba | 8 | | |

Four Adjustable Combination Keys.

CHANCEL PEDAL ORGAN (2 STOPS).

| | FEET. | | FEET. |
|---|---|---|---|
| Diaphonic Diapason | 16 | Bourdon | 16 |

CHANCEL GREAT ORGAN (7 STOPS).

| | FEET. | | FEET. |
|---|---|---|---|
| Bourdon | 16 | Flote | 4 |
| Open Diapason | 8 | Octave Gamba | 4 |
| Doppel Flote | 8 | Horn | 8 |
| Gamba | 8 | | |

CHANCEL CHOIR ORGAN (4 STOPS).

| | FEET. | | FEET. |
|---|---|---|---|
| Doppel Flote | 8 | Flote | 4 |
| Gamba | 8 | Horn | 8 |

GENERAL.

Sforzando Pedal, Balanced Swell Pedal for Foundation, Balanced Swell Pedal for Wood Wind, Balanced Swell Pedal for String, Balanced Swell Pedal for Brass.

General Balanced Swell Pedal for all or any of the above.

Five Keys for indicating and controlling the position of the various Swell Pedals.

Tremulant for Wood Wind.

Tremulant for String.

## ORGAN KNOWN AS THE HOPE-JONES UNIT ORCHESTRA, IN THE PARIS THEATRE, DENVER, COLORADO.

This fine instrument was installed in May, 1913, and hailed by the people of Denver with great enthusiasm. The president of the Paris Theatre Company, writing under date of June 9, says:

"The wonderful instrument * * * is proving a source of interest to the whole city and has materially added to the fame of 'The Paris' as the leading picture theatre of Denver. No thirty-piece orchestra could accompany the pictures so well as the Hope-Jones Unit Orchestra does. Neither would it so completely carry away with enthusiasm the crowd that flock to hear it."

*The Author Playing a Hope-Jones Unit Orchestra.*

**The Author Playing a Hope-Jones Unit Orchestra.**

Only the keyboards are visible from the auditorium; the instrument is placed on each side of the proscenium, occupying the place of the usual stage boxes, the tone being reflected into the theatre through ornamental case work. The 32-foot open diaphone is located behind the picture screen. The specification:

PEDAL ORGAN (32 NOTES).

| | FEET. | | FEET. |
|---|---|---|---|
| Diaphone | 32 | Octave | 8 |
| Ophicleide | 16 | Clarinet | 8 |
| Diaphone | 16 | Cello | 8 |
| Bass | 16 | Flute | 8 |
| Tuba Horn | 8 | Flute | 4 |

Bass Drum, Kettle Drum, Crash Cymbals--Second Touches.
Great to Pedal; Solo Octave to Pedal.
Diaphone 32 ft. Second Touch; Ophicleide 16 ft. Pizzicato Touch.
Six Adjustable Toe Pistons.

ACCOMPANIMENT ORGAN (61 NOTES).

| | FEET. | | FEET. |
|---|---|---|---|
| Vox Humana (Ten C) | 16 | Octave Celeste | 4 |
| Tuba Horn | 8 | Flute | 4 |

| | | | |
|---|---|---|---|
| Diaphonic Diapason | 8 | Twelfth | 2 2/3 |
| Clarinet | 8 | Piccolo | 2 |
| Viole d'Orchestre | 8 | Chrysoglott | 4 |
| Viole Celeste | 8 | Snare Drum | |
| Flute | 8 | Tambourine | |
| Vox Humana | 8 | Castanets | |
| Viol | 4 | | |

Triangle, Cathedral Chimes, Sleigh Bells, Xylophone, Tuba Horn, Solo to Accompaniment--Second Touches.

Flute, Solo to Accompaniment--Pizzicato Touch.

Ten Adjustable Combination Pistons.

One Double Touch Tablet to cause the Pedal Stops and Couplers to move so as at all times to furnish automatically a Suitable Bass.

GREAT ORGAN (61 NOTES).

| | FEET. | | FEET. |
|---|---|---|---|
| Ophicleide | 16 | Clarinet (Ten C) | 16 |
| Diaphone | 16 | Contre Viole (Ten C) | 16 |
| Bass | 16 | Tuba Horn | 8 |
| Diaphonic Diapason | 8 | Flute | 4 |
| Clarinet | 8 | Twelfth | 2 2/3 |
| Viole d'Orchestre | 8 | Viol | 2 |
| Viole Celeste | 8 | Piccolo | 2 |
| Flute | 8 | Tierce | 1 3/5 |
| Vox Humana | 8 | Chrysoglott | 4 |
| Clarion | 4 | Bells | 4 |
| Viol | 4 | Sleigh Bells | 4 |
| Octave Celeste | 4 | Xylophone | 2 |

Octave, Solo to Great.
Ophicleide, Solo to Great--Second Touches.
Solo to Great Pizzicato Touch.
Ten Adjustable Combination Pistons.

One Double Touch Tablet to cause the Pedal Stops and Couplers to move so as at all times to furnish automatically a Suitable Bass.

SOLO ORGAN (37 NOTES).

| | FEET. | | FEET. |
|---|---|---|---|
| Tibia Clausa | 8 | Quintadena | 8 |
| Trumpet | 8 | Cathedral Chimes | 8 |
| Orchestral Oboe | 8 | Bells | 4 |
| Kinura | 8 | Sleigh Bells | 4 |
| Oboe Horn | 8 | Xylophone | 2 |

Six Adjustable Combination Pistons.

GENERAL.

Two Expression Levers, two Indicating and Controlling Keys, Thunder Pedal (Diaphone), Thunder Pedal (Reed), Two Tremulants, Re-Iterator for Strings, Re-Iterator for Solo.

One Double Touch Sforzando Pedal, First Touch, Full Stops, Second Touch, Percussion.

One Double Touch Sforzando Pedal, First Touch Snare Drum, Second Touch Bass Drum, and Crash Cymbals.

## CATHEDRAL OF ST. JOHN THE DIVINE, NEW YORK CITY.

This organ was built by the Ernest M. Skinner Company, Boston, Mass., in 1911. It is the gift of Mr. and Mrs. Levi P. Morton, and is said to have cost $50,000. It is contained in two cases on each side of the triforium of the chancel and blown by an electric installation of 85 h.p.

GREAT ORGAN (21 STOPS).

| | FEET. | | FEET. |
|---|---|---|---|
| Diapason | 16 | Harmonic Flute | 8 |
| Bourdon | 16 | Octave | 4 |
| 1st Diapason | 8 | Gambette | 4 |
| 2d Diapason | 8 | Flute | 4 |
| 3d Diapason | 8 | Fifteenth | 2 |
| Philomela | 8 | Mixture | |
| Grosse Floete | 8 | Trombone | 8 |
| Hohl Flute | 8 | Ophicleide | 16 |
| Gedackt | 8 | Harmonic Tuba | 8 |
| Gamba | 8 | Harmonic Clarion | 4 |
| Erzähler | | | |

SWELL ORGAN (26 STOPS).

| | FEET. | | FEET. |
|---|---|---|---|
| Dulciana | 16 | 1st Flute | 4 |
| Bourdon | 16 | 2d Flute | 4 |
| 1st Diapason | 8 | Violin | 4 |
| 2d Diapason | 8 | Flautino | 2 |
| 3d Diapason | 8 | Mixture | |
| Spitz Floete | 8 | Trumpet | 16 |
| Salicional | 8 | English Horn | 16 |
| Viola | 8 | Cornopean | 8 |
| Claribel Flute | 8 | French Trumpet | 8 |
| Aeoline | 8 | Oboe | 8 |
| Voix Celestes | 8 | Vox Humana | 8 |
| Unda Maris | 8 | Clarion | 4 |
| Gedackt | 8 | Tremolo | |
| Octave | 4 | | |

CHOIR ORGAN (IN BOX) (18 STOPS).

| | FEET. | | FEET. |
|---|---|---|---|
| Gedackt | 16 | Piccolo | 2 |
| Gamba | 16 | Fagotto | 16 |
| Diapason | 8 | Saxaphone | 8 |
| Geigen Principal | 8 | Clarinet | 8 |
| Dulciana | 8 | English Horn | 8 |
| Dulcet | 8 | Orchestral Oboe | 8 |
| Concert Flute | 8 | Vox Humana | 8 |
| Quintadena | 8 | Carillons | |
| Flute | 4 | Tremolo | |
| Fugara | 4 | | |

SOLO ORGAN (17 STOPS).

| | FEET. | | FEET. |
|---|---|---|---|
| Stentorphone | 8 | Gamba | 8 |
| Philomela | 8 | Hohl Pfeife | 4 |
| Claribel Flute | 8 | Flute | 4 |
| Harmonic Flute | 8 | Octave | 4 |
| Voix Celestes | 8 | Cymbal | |
| Ophicleide | 16 | Choir Clarinet | 8 |
| Tuba | 8 | Choir Orchestral Oboe | 8 |
| Tuba Mirabilis | 8 | Clarion | 4 |
| Flugel Horn | 8 | Tremolo | |

PEDAL ORGAN (24 STOPS).

| | FEET. | | FEET. |
|---|---|---|---|
| Diapason | 32 | 1st Octave | 8 |
| Contra Violone | 32 | 2d Octave | 8 |
| Violone | 16 | Super Octave | 4 |
| 1st Diapason | 16 | Bombarde | 32 |
| 2d Diapason | 16 | Euphonium | 16 |
| Gamba | 16 | Ophicleide | 16 |
| 1st Bourdon | 16 | English Horn | 16 |
| 2d Bourdon | 16 | Tuba Mirabilis | 8 |
| Dulciana | 16 | Tuba | 8 |
| Gedackt | 8 | 1st Clarion | 4 |
| Quinte | 10 2/3 | 2d Clarion | 4 |
| 'Cello | 8 | Pizzicato | 8 |

There are 32 Couplers. Stop Knobs are used, with Stop Keys for the Couplers. (See illustration of the College of City of New York, page 45.)

Suitable combination action adjustable at Console, and visibly affecting the registers.

The organ is provided with the following Expression Pedals and appliances:

Sforzando Pedal, Great to Pedal Reversible, Swell to Pedal Reversible, Balanced Swell Pedal, Balanced Choir Pedal, Balanced Solo Pedal, Crescendo Pedal.

## ORGAN IN UNIVERSITY OF TORONTO, CANADA.

Many fine organs have been erected in Canada and the northern part of the United States by Casavant Frères, of St. Hyacinthe, Province of Quebec, among which we may mention the Church of Notre-Dame in Montreal, the Cathedrals of Montreal and Ottawa, the Northwestern University, Chicago, and the Grand Opera House, Boston. The organ in the Convocation Hall of the University of Toronto has 4 manuals of 61 notes, CC to $c^4$; pedals of 32 notes, CCC to g; electro-pneumatic action; 76 speaking stops; 32 couplers, and 4,800 pipes.

The organ was inaugurated June 6, 1912.

The specification follows:

GREAT ORGAN (10 STOPS).

| | FEET. | | FEET. |
|---|---|---|---|
| *Double Open Diapason | 16 | **Octave | 4 |
| *Bourdon | 16 | **Harmonic Flute | 4 |
| *Open Diapason (large) | 8 | *Principal | 4 |
| *Open Diapason (medium) | 8 | **Twelfth | 2 2/3 |
| **Violin Diapason | 8 | **Fifteenth | 2 |
| *Doppel Flöte | 8 | **Harmonics (15-17-10-b21-22) | |
| *Flûte Harmonique | 8 | **Double trumpet | 16 |
| **Gemshorn | 8 | **Tromba | 8 |

* Stops marked * can be played by Coupler in Super Octave.
** Stops marked ** can be played by Coupler in Sub Octave.
[Transcriber's note: in "Harmonics", the "b21" above, the "b" represents the music "flat" symbol.]

SWELL ORGAN (17 STOPS).

| | FEET. | | FEET. |
|---|---|---|---|
| Gedeckt | 16 | Piccolo | 2 |
| Open Diapason | 8 | Mixture | 3 rks. |
| Clarabella | 8 | Cornet | 4 rks. |
| Stopped Diapason | 8 | Bassoon | 16 |
| Dolcissimo | 8 | Cornopean | 8 |
| Viola di Gamba | 8 | Oboe | 8 |
| Voix Celeste | 8 | Vox Humana | 8 |
| Fugara | 4 | Clarion | 4 |
| Flauto Traverso | 4 | | |

Wind pressure 5 inches; Cornopean and Clarion 6 inches.
Wind pressure 4 inches; Large Open Diapason and Reeds 6 inches.

CHOIR ORGAN (ENCLOSED) (12 STOPS).

| | FEET. | | FEET. |
|---|---|---|---|
| Salicional | 16 | Suabe Flute | 4 |
| Open Diapason | 8 | Violina | 4 |
| Melodia | 8 | Quint | 2 2/3 |
| Gamba | 8 | Flageolet | 2 |
| Dulciana | 8 | Contra Fagotto | 16 |
| Lieblich Gedeckt | 8 | Clarinet | 8 |

Wind pressure, 3 1/2 inches.

SOLO ORGAN (DIVISION I, ENCLOSED) (8 STOPS).

| | FEET. | | FEET. |
|---|---|---|---|
| Rohr Flöte | 8 | Concert Flute | 4 |
| Quintadena | 8 | Orchestral Oboe | 8 |
| Viole d'Orchestre | 8 | Cor Anglais | 8 |
| Violes Célestes (2 rks.) | 8 | Célesta | |

SOLO ORGAN (DIVISION II, ENCLOSED) (8 STOPS).

| | FEET. | | FEET. |
|---|---|---|---|
| Stentorphone | 8 | Harmonic Piccolo | 2 |
| Tibia Plena | 8 | Tuba Magna | 16 |
| Violoncello | 8 | Tuba Mirabilis | 8 |

| | | | |
|---|---|---|---|
| Octave | 4 | Tubular Chimes | |

Wind pressure, 12 inches.

PEDAL ORGAN (15 STOPS).

| | FEET. | | FEET. |
|---|---|---|---|
| Double Open | 32 | Violoncello | 8 |
| Open Diapason (wood) | 16 | Octave | 8 |
| Open Diapason (metal) | 16 | Bourdon | 8 |
| Violone | 16 | Super Octave | 4 |
| Dulciana | 16 | Trombone | 16 |
| Bourdon | 16 | Trumpet | 8 |
| Gedeckt | 16 | Clarion | 4 |
| Flute | 8 | | |

Wind pressure, 5 inches; Reeds, 12 inches.

There are 32 Couplers operated by Draw-stops, also by Pistons and reversible Pedals.

Combination Pistons, 6 to each Manual, and 4 (Pistons) to the Pedals. Four Foot Pistons on all Stops and Couplers; one Foot Piston for Great to Pedal reversible; one Foot Piston for Full Organ.

Balanced Swell Pedal to Swell, Choir, and Solo; Balanced Crescendo Pedal.

Tremulants to Choir, Swell, and Solo.

## CITY HALL, PORTLAND, MAINE.

This organ was built by the Austin Organ Company, of Hartford, Conn., in 1912. It was presented to the city of Portland by Mr. Cyrus K. Curtis, of the Saturday Evening Post, in memory of the late Hermann Kotschmar, whose "Te Deum" is well known in the United States. The organ is in a handsome case on the platform at one end of the hall and is entitled to take its place among the world's great instruments. It is certainly a coincidence that those who have been associated with Mr. Hope-Jones in business now rank as the foremost organ builders in America, as witness this fine organ and that in the Cathedral of St. John the Divine in New York.

The Portland organ has four manuals of 61 notes, CC to $c^3$, and pedal of 32 notes, CCC to g. There are 88 sounding stops and 33 couplers.

GREAT ORGAN (18 STOPS).

| | FEET. | | FEET. |
|---|---|---|---|
| Sub Bourdon | 32 | 2d Open Diapason | 8 |
| Bourdon | 16 | 3d Open Diapason | 8 |
| Violone Dolce | 16 | Violoncello | 8 |

| | | | |
|---|---|---|---|
| 1st Open Diapason | 8 | Gemshorn | 8 |
| Doppel Flute | 8 | Double Trumpet | 16 |
| Clarabella | 8 | Trumpet | 8 |
| Octave | 4 | Clarion | 4 |
| Hohl Flute | 4 | Cathedral Chimes (enclosed in Solo Box). | |
| Octave Quint | 3 | | |
| Super Octave | 2 | | |

SWELL ORGAN (16 STOPS).

| | FEET. | | FEET. |
|---|---|---|---|
| Quintaton | 16 | Harmonic Flute | 4 |
| Diapason Phonon | 8 | Flautino | 2 |
| Horn Diapason | 8 | Mixture, 3 and 4 ranks | |
| Viole d'Gamba | 8 | Contra Fagotto | 16 |
| Rohr Flute | 8 | Cornopean | 8 |
| Flauto Dolce | 8 | Oboe | 8 |
| Unda Maris | 8 | Vox Humana | 8 |
| Muted Viole | 8 | Tremulant | |
| Principal | 4 | | |

ORCHESTRAL ORGAN (13 STOPS).

| | FEET. | | FEET. |
|---|---|---|---|
| Contra Viole | 16 | Quintadena | 8 |
| Geigen Principal | 8 | Flute d'Amour | 4 |
| Concert Flute | 8 | Flageolet | 2 |
| Dulciana | 8 | French Horn | 8 |
| Viole d'Orchestra | 8 | Clarinet | 8 |
| Viole Celeste | 8 | Cor Anglais | 8 |
| Vox Seraphique | 8 | Tremulant | |

SOLO ORGAN (12 STOPS)

| | FEET. | | FEET. |
|---|---|---|---|
| Violone | 16 | Concert Piccolo | 2 |
| Flaute Major, Open Chests | 8 | Tuba Profunda | 16 |
| Grand Diapason | 8 | Harmonic Tuba | 8 |
| Gross Gamba | 8 | Tuba Clarion | 4 |
| Gamba Celeste | 8 | Orchestral Oboe (enclosed) | 8 |
| Flute Overte | 4 | Tuba Magna | 8 |

ECHO ORGAN (IN ROOF) (7 STOPS).

| | FEET. | | FEET. |
|---|---|---|---|
| Cor de Nuit | 8 | Echo Cornet, 3 ranks | |
| Gedackt | 8 | Vox Humana | 8 |
| Vox Angelica | 8 | Harp | |
| Viole Aetheria | 8 | Tremulant | |
| Fern Flute | 4 | | |

PEDAL ORGAN (AUGMENTED) (21 STOPS).

| | FEET. | | FEET. |
|---|---|---|---|
| Contra Magnaton | 32 | Gross Flute | 8 |
| Contra Bourdon | 32 | Violoncello | 8 |
| Magnaton | 16 | Octave Flute | 4 |
| Open Diapason | 16 | Contra Bombarde | 32 |
| Violone | 16 | Bombarde (25-inch wind) | 16 |
| Dulciana (from Great) | 16 | Tuba Profunda | 16 |
| First Bourdon | 16 | Harmonic Tuba | 8 |
| Contra Viole | 16 | Tuba Clarion | 4 |
| Second Bourdon | 16 | (From Solo Enclosed) | |
| Lieblich Gedackt (Echo) | 16 | Contra Fagotto | 16 |

| | | |
|---|---|---|
| Gross Quint | 10 1/2 | (From Swell) |
| Flauto Dolce | 8 | |

There are 6 Composition Pedals to the Pedal Organ and 8 Adjustable Pistons to each Manual controlling the Stops and Couplers. Stop-keys are used.

Accessory: Balanced Crescendo Pedal, adjustable, not moving registers; Balanced Swell Pedal; Balanced Orchestral Pedal; Balanced Solo and Echo Pedal; Great to Pedal, reversible; Solo and Echo to Great, reversible; Sforzando Pedal.

## LIVERPOOL CATHEDRAL, ENGLAND.

The firm of Henry Willis & Sons was established in 1845 by the late "Father" Willis, who took his two sons, Vincent Willis and Henry Willis, into partnership with him in 1878. The majority of the patents and improvements produced by the firm were solely the work of "Father" Willis, although his son Vincent was associated with him in certain of the later patents. Vincent Willis left the firm in 1894, six years previous to the death of "Father" Willis, which occurred in February, 1900, and the business has since been carried on by his son, Mr. Henry Willis, with whom is associated Mr. Henry Willis, Jr., the grandson of the founder.

The famous traditions of the firm in the field of reed-voicing and flue tone have been maintained by the present partners, who are both experienced voicers; and in general up-to-date mechanical details the firm is in the forefront of the English organ-building industry; as is evidenced by their recently obtaining the contract for the magnificent divided organ which they have now under construction (1913) for the enormous New Cathedral of Liverpool, the specification of which is here appended.

There are five manuals, of 61 notes, CC to $c^3$, and a radiating and concave pedal board of 32 notes, CCC to g. There are no extensions or duplications. With the exception of the Celestes, which go down to FF only, every stop is complete, of full compass. There are 167 speaking stops and 48 couplers, making a total of 215 draw stop knobs.

PEDAL ORGAN (33 STOPS).

| | FEET. | | FEET. |
|---|---|---|---|
| Dble. Open Diapason, wood | 32 | *Violoncello, metal | 8 |
| Dble. Open Diapason, metal | 32 | Flute, metal | 8 |
| Contra Violone, metal | 32 | *Quintadena, metal | 8 |

| | | | |
|---|---|---|---|
| Double Quint, wood | 21 1/3 | Twelfth, metal | 5 1/3 |
| Open Diapason No. 1, wood | 16 | Fifteenth, metal | 4 |
| Open Diapason No. 2, wood | 16 | Mixture, 17th, 19th, 22d | |
| Open Diapason No. 3, wood | 16 | Fourniture, 19, b21, 22, 26, 29 | |
| Open Diapason, metal | 16 | Contra Trombone | 32 |
| Contra Basso, metal | 16 | *Contra Ophicleide | 32 |
| *Geigen, metal | 16 | Trombone | 16 |
| Dolce, metal | 16 | Bombardon | 16 |
| *Violone, metal | 16 | *Ophicleide | 16 |
| Bourdon, wood | 16 | *Fagotto | 16 |
| *Quintaton, metal | 16 | Octave Trombone | 8 |
| Quint, wood | 10 2/3 | *Octave Bassoon | 8 |
| Octave, wood | 8 | Clarion | 4 |
| Principal, metal | 8 | | |

* Stops marked * are in separate Swell Box.
Wind pressures: 6, 7, 10, 15, and 25 inches.

CHOIR ORGAN (23 STOPS).

| | FEET. | | FEET. |
|---|---|---|---|
| Contra Dulciana | 16 | *Gambette | 4 |
| *Contra Gamba | 16 | Dulciana | 2 |
| Open Diapason | 8 | *Flageolet | 2 |
| *Violin Diapason | 8 | *Dulciana Mixture, 10, 12, 17, | |
| Rohr Flute | 8 | 19, 22 | |
| *Claribel Flute | 8 | *Bass Clarinet | 16 |
| Dulciana | 8 | *Baryton, dble. vox humana | 16 |
| *Gamba | 8 | *Corno di Bassetto | 8 |
| *Unda Maris (FF) | 8 | *Cor Anglais | 8 |
| Flute Ouverte | 4 | *Vox Humana | 8 |
| *Suabe Flute | 4 | *Trumpet (orchestral) | 8 |
| Dulcet | 4 | *Clarion | 4 |

* Stops marked * in separate Swell Box.

Wind pressures: 4 inches; Trumpet and Clarion, 7 inches.

GREAT ORGAN (28 STOPS, 1 COUPLER).

| | FEET. | | FEET. |
|---|---|---|---|
| Double Open Diapason | 16 | Octave Diapason | 4 |
| Contra Tibia | 16 | Principal | 4 |
| Bourdon | 16 | Flute Couverte | 4 |
| Double Quint | 10 2/3 | Flute Harmonique | 4 |
| Open Diapason, No. 1 | 8 | Twelfth | 2 2/3 |
| Open, No. 2 | 8 | Fifteenth | 2 |
| Open, No. 3 | 8 | Piccolo Harmonique | 2 |
| Open, No. 4 | 8 | Mixture, 10, 12, 17, 19, 22 | |
| Open, No. 5 | 8 | Sesquialtera, 19, b21, 22, 26, 29 | |
| Open, No. 6 | 8 | Double Trumpet | 16 |
| Tibia Major | 8 | Trumpet | 8 |
| Tibia Minor | 8 | Trompette Harmonique | 8 |
| Stopped Diapason | 8 | Clarion | 4 |
| Doppel Flöte | 8 | Solo Trombas on Great | |
| Quint | 5 1/3 | (By Coupler) | |

Wind pressures: 5, 10, and 15 inches.
[Transcriber's note: in "Sesquialtera", the "b21" above, the "b" represents the music "flat" symbol.]

SWELL ORGAN (31 STOPS).

| | FEET. | | FEET. |
|---|---|---|---|
| Contra Geigen | 16 | Lieblich Flöte | 4 |
| Contra Saliciona | 16 | Doublette | 2 |
| Lieblich Bordun | 16 | Lieblich Piccolo | 2 |

| | | | |
|---|---|---|---|
| Open Diapason, No. 1 | 8 | Lieblich Mixture, 17, 19, 22 | |
| Open Diapason, No. 2 | 8 | Full Mixture, 12, 17, 19, b21, 22 | |
| Geigen | 8 | Double Trumpet | 16 |
| Tibia | 8 | Wald Horn | 16 |
| Flauto Traverso | 8 | Contra Hautboy | 16 |
| Wald Flöte | 8 | Trumpet | 8 |
| Lieblich Gedackt | 8 | Trompette Harmonique | 8 |
| Echo Gamba | 8 | Cornopean | 8 |
| Salicional | 8 | Hautboy | 8 |
| Vox Angelica (FF) | 8 | Krummhorn | 8 |
| Octave | 4 | Clarion, No. 1 | 4 |
| Geigen Principal | 4 | Clarion, No. 2 | 4 |
| Salicet | 4 | | |

Wind pressures: 5, 7, 10, and 15 inches.

[Transcriber's note: in "Full Mixture", the "b21" above, the "b" represents the music "flat" symbol.]

SOLO ORGAN (23 STOPS).

| | FEET. | | FEET. |
|---|---|---|---|
| *Contra Hohl Flöte | 16 | Concert Flute | 4 |
| Contra Viole | 16 | Octave Viole | 4 |
| *Hohl Flöte | 8 | Piccolo Harmonique | 2 |
| Flute Harmonique | 8 | Violette | 2 |
| Viol de Gambe | 8 | Cornet de Violes, 10, 12, 15 | |
| Viol d'Orchestre | 8 | Cor Anglais | 16 |
| Viole Celeste (FF) | 8 | Clarinet (orchestral) | 8 |
| *Octave Hohl Flöte | 4 | Bassoon (orchestral) | 8 |
| French Horn (orchestral) | 8 | Tromba Real | 8 |
| Oboe (orchestral) | 8 | Tromba Clarion | 4 |
| Contra Tromba | 16 | *Diapason Stentor | 8 |
| Tromba | 8 | | |

All Stops in a Swell Box except Stops marked *.

Wind pressures: 7, and 20 inches.

CLAVIER DES BOMBARDES (TUBA ORGAN) (6 STOPS).

| | FEET. | | FEET. |
|---|---|---|---|
| Contra. Tuba | 16 | Octave Bombardon | 4 |
| Bombardon | 8 | Tuba Clarion | 4 |
| Tuba Mirabilis | 8 | Tuba Magna | 8 |

Wind pressures: 30 inches; Tuba Magna, 50 inches.

The Stops of this department will be played from the fifth Keyboard, the action being controlled by Draw-stop Knob marked "Tuba On."

ECHO ORGAN (19 MANUAL AND 4 PEDAL STOPS).

ECHO PEDAL.

| | FEET. | | FEET. |
|---|---|---|---|
| Salicional | 16 | Fugara | 8 |
| Echo Bass | 16 | Dulzian (reed) | 16 |

ECHO MANUAL.

| | FEET. | | FEET. |
|---|---|---|---|
| Quintaton | 16 | Flautina | 2 |
| Echo Diapason | 8 | Harmonica Aetheria (flute mixture), 10, 12, 15 | |
| Cor de Nuit | 8 | | |
| Carillon (gongs) | 8 | Chalumeau | 16 |
| Flauto Amabile | 8 | Cor Harmonique | 8 |
| Muted Viole | 8 | Trompette | 8 |

| | | | |
|---|---|---|---|
| Aeoline Celeste (FF) | 8 | Musette | 8 |
| Celestina | 4 | Voix Humaine | 8 |
| Fernflöte | 4 | Hautbois d'Amour | 8 |
| Rohr Nasat | 2 2/3 | Hautbois Octaviante | 4 |

Wind pressures: 3 1/2 and 7 inches.

Both Pedal and Manual Stops in Swell Box. The Echo Manual Stops played from the fifth Keyboard, the action being controlled by Draw-stop Knob marked "Echo On."

Arranged in two double columns on the left-hand or bass jamb are 48 draw-stop knobs for the Couplers and Tremulants. The principal Couplers may also be operated by reversible pistons and the Tremulants (3) by reversible pedals. There are also 5 reversible pedal pistons for the Manual to Pedal Couplers. In addition to the usual Inter-manual Couplers there are on the Choir, Swell, Solo, and Echo organs Sub and Super and Unison (off) Couplers, each on its own Manual.

A novelty is a coupler labeled Solo Tenor to Pedal. By its use the upper 20 notes of the pedal-board are available for a tenor solo by the right foot, at the same time the Pedal tones are cut off from these notes and the remainder of the pedal-board is available for use by the left foot as a bass.

The stop control is effected in the first place by 9 Adjustable Combination Pedals to the Pedal Organ. Then there are 9 Adjustable Combination Pistons to the Choir, Great, Swell, Solo and Echo organs and 5 to the Tuba organ. It is possible to couple each set of these Manual Pistons to the Pedal organ Combination Pedals, either by draw-stops or by piston, thus moving pedal and manual stops synchronously.

All these Combination Pedals and Pistons move the draw-stop knobs, showing a valuable index of their position to the organist.

There are 5 Adjustable Pistons on the treble key frame (and 5 duplicates on the bass key frame) for special combinations, on Manuals, Pedal, and Couplers.

There are 5 pedals to operate the various swell boxes of the lever locking type--a locking movement allowing the performer to leave pedal in any position. The swell pedal for the Pedal stops can be coupled to any of the others.

The Tremulants have attachments allowing the performer to increase or decrease the rapidity of the *vibrato* at will.

The action throughout is electro-pneumatic and tubular-pneumatic (according to distance of pipes from keyboard), excepting the Manual to Pedal Couplers, which are mechanical to pull down the manual keys.

There are seven separate blowing installations of electric motors.

The instrument occupied two special chambers on each side of the chancel, and a portion of the south chancel triforium. There are four fronts, two facing the chancel and two (32 feet) facing the transepts. The console is placed on the north side above the choir stalls. The organ is the gift of Mrs. James Barrow and cost (without cases) about $90,000. The specification was drawn up by Mr. W. J. Ridley, nephew of Mrs. Barrow, with the full approval of her committee, Mr. Charles Collins, Mr. E. Townsend Driffield, the Cathedral organist, Mr. F. H. Burstall, F. R. C. O., and Henry Willis & Sons.

It is claimed that this organ is now "the largest in the world." We give the dimensions of some notable instruments for the sake of comparison:

Paris, St. Sulpice, 118 stops; London, Albert Hall, 124; Sydney Town Hall, 144; St. Louis Exposition, 167; Hamburg, St. Michael's, 163, and Liverpool Cathedral, 215.

[1] This is really only $c^3$ (see footnote, page 22), but we have decided to adopt the usual nomenclature.

James Ingall Wedgwood, in writing his excellent "Dictionary of Organ Stops," felt it incumbent upon him to offer an apology, or rather, justification for introducing the name of Hope-Jones so frequently.

The author of this present volume feels the same embarrassment. He, however, does not see how it would be possible for him, or for any future writer, who values truth, to avoid reiteration of this man's name and work when writing about the modern organ.

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