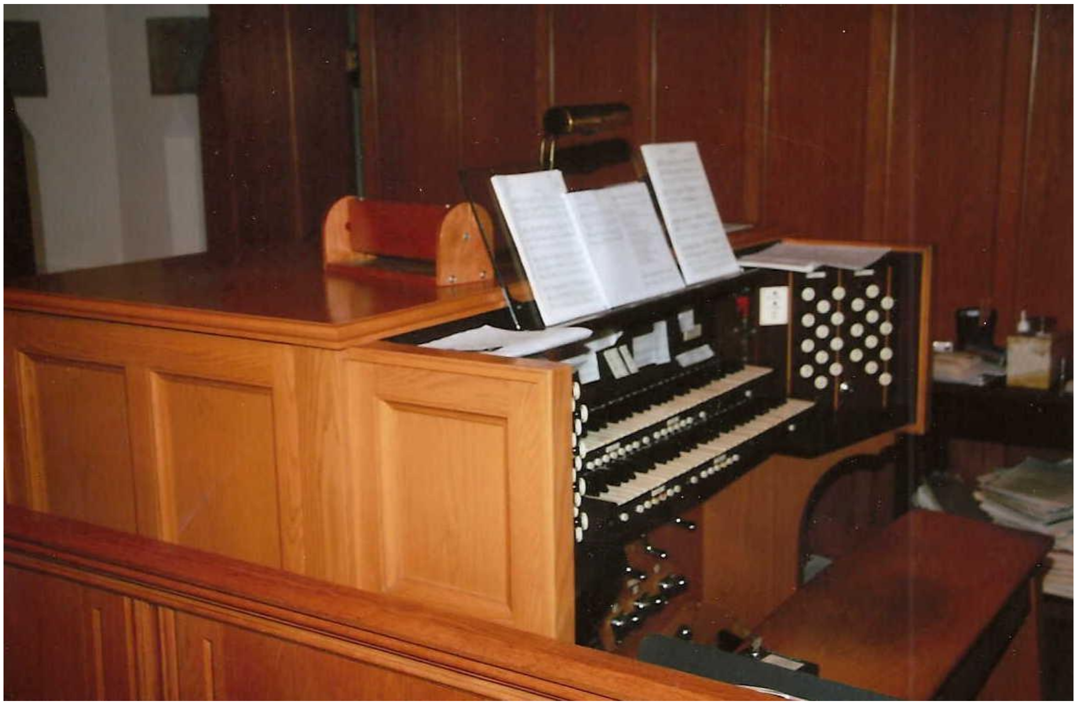


Holy Trinity
Lutheran Church

Pipe Organ
Owner's Manual

Several people have asked, "What prompted you to write this?"

Charlie Eaves, January 2015

Like a great many churches, Holy Trinity has several possessions which are unusual or possibly unique. Examples are the Alois Lang woodcarving over the altar, the Casavant organ, the kneelers and the stained glass windows. We have descriptive booklets for the latter two items and I thought it might be appropriate to have similar publications for the others.

As organ committee secretary for the Noack proposal and committee chairman for the Casavant project, I managed to learn a little about pipe organs. Richard and Terri Konzen were of inestimable help in expanding this knowledge, in checking the essay for technical accuracy and in suggesting many constructive changes to it.

Also, I would like to thank Pastor Roth for proofreading more than a dozen rough drafts and providing much guidance.

Finally, I must thank the members and friends of Holy Trinity - living and dead - who, financially or through considerable physical effort, made the organ a reality.

Charlie A. Eaves
June, 1996

". . . praise him with stringed instruments and organs. Let everything that hath breath praise the Lord."

— Psalm 150

Background

When a person decides to purchase some sort of mechanical device - a can opener, vacuum cleaner or an automobile, for example - he or she usually expects to receive some sort of "owner's manual." In all likelihood, he or she will feel cheated if this is not part of the purchase.

In 1969, the congregation of Holy Trinity voted to spend $64,000 for a pipe organ. This instrument, if purchased today, would cost approximately $400,000; but there is nothing - other than contract papers and engineering drawings - to describe what it is, how it works and how to operate it. This book is intended to help fill that void.

Some members I have talked to care little about the organ. ("It's here, it looks and sounds good, but it's far to complicated for me to understand, let alone play.") Others wouldn't dream of touching the console, but are fascinated by the pipes and casework and would like to know what they do. Still others would like to be able to play it. ("I can play the piano after a fashion, but this is too complicated and it belongs to Holy Trinity and I'd probably break it.")

Playing a tune on the organ is a lot like playing chess. You can learn the game in a few hours but not understand it after a lifetime. In one sense, the organ belongs to you - you and a number of other people are Holy Trinity. Collectively, you paid for the organ. If you don't habitually break pianos, you won't hurt the organ. If you sincerely want a demonstration - or lessons - ask the Director of Music.

History

The original meaning of the Greek work opyavov (organon) was "tool." Later, this name was applied specifically to tools of music - usually, to wind instruments. It then evolved to designate instruments composed of several pipes united in one instrument.

Invention of the organ, as opposed to a panpipe using a single row of pipes, is generally attributed to Ktesibios of Alexandria in the second century BC. Many of the early organs were painfully strident and thunderous to ears accustomed to the softer voices of lyres and harps. They might very well be considered ancestors of the steam calliope. As a result, the organ was quickly adopted for outdoor use where it had to carry over large areas with considerable background nose - in the Roman coliseum, for example. Under these circumstances it is quite understandable that the early Christian church wanted no part of an instrument associated with gladiatorial fights - and far worse.

For this reason, the organ was not accepted in churches until the fifth century AD in Spain and the eighth in England. Even so, the Reformation - committed to simplifying the service - did not take kindly to musical instruments. Calvin considered the organ superfluous and Zwingli banned it entirely. Martin Luther, a composer and musician as well as a theologian, was receptive to the instrument but still warned against too much organ playing in church. In view of this attitude, it is remarkable that in Protestant churches the organ was so quickly accepted; while in Catholic cathedrals it became the great showpiece of the church. In a throwback to the days of Christian persecution the Eastern Orthodox Church still excludes instruments from its service and the Sistine Chapel of the Vatican allows only vocal music.

During the ninth and tenth centuries, some organs grew to truly gigantic proportions. Organ pipes became larger, longer, and more difficult to open or close. By the year 1000 AD, a monastery in Winchester, England had acquired an organ so large and loud that parishioners could scarcely endure its roar. Operation of the monster required a small army. We learn from a contemporary description that two monks - "two brethren of concordant spirit" - operated the valves; while seventy additional men were required to pump its twenty-six bellows. "Everyone stops his gaping ears with his hands," we read, "being in no way able to draw near and bear the sound."

Instruments like this must have been especially difficult to manipulate because they had no keys as we understand them, but rather a row of wooden sliders called tongues (linguae). Pulling or pushing these sounded the pipes, and all pipes of the same pitch were controlled by one tongue.

Keys began to evolve in the eleventh century, but they were huge - four or five inches wide, about two weeks long, and had to be depressed at least a foot to admit air to the pipes. In Germany, the organist of that period was called Orgelschläger (literally, organ striker) who was chosen more for his size and strength than his musical ability. He would stride to and fro before the array of keys, striking with gloved fists what we must assume were the proper notes.

Even in the twelfth century St. Æthelred complained: "Why such organs . . . in the church? What with the sound of the bellows . . . and the united strains of the organ pipes, the common folk stand with wondering faces, trembling and amazed."

Instruments as described above must have driven musicians and organ builders to their senses, for over the next few centuries the keys became smaller and tonal quality replaced sheer volume. By the time Bach was born (1685) the church organ sounded almost as we know it today.

A number of things in nature are cyclic and human behavior is one of them. During the last half of the nineteenth and the early years of the twentieth centuries this trend toward softer, more expressive organs reversed. In general, the growth and increasing popularity of the symphony orchestra under Beethoven and the early romantics convinced many organ builders that the orchestra was an ideal to be copied. As a result, many instruments grew substantially in size and power at the expense of tonal beauty and clarity.

These leviathans reached their peak with instruments such as the famous Wanamaker's organ in Philadelphia (232 stops and 18,146 pipes). An even larger one was built for the Atlantic City Convention Hall with 32,882 pipes on one pedal and seven manual keyboards. Wind pressure of up to 100 inches is provided by a blower of 200 horsepower. (The Holy Trinity organ, by comparison, has two blowers - 2 horsepower and ¾ horsepower, respectively. Wind pressure is 2 inches for the great and positiv division, 2¼ for the pedal.)

Anyhow, the day of the bellowing dinosaur is past. Tonality has once again replaced sheer power and many of the church organs built today are patterned after those of the seventeenth century.

Local History

The cornerstone of the original Holy Trinity Lutheran Church built in Greenville was laid on September 25, 1865. At first, progress was slow. Christmas 1866 was celebrated in a building which had planks laid across nail kegs for pews and a huge coal stove in one corner. By October 1867 the church boasted real pews, wainscoted walls, carpeting, chancel furniture and a reed organ - which was replaced three years later with a small pipe organ and in 1892 by a larger one.

Möller

I cannot find a description of any of these organs. We know the congregation continued to grow and this growth evidently was accompanied by a demand for a better instrument to support congregational singing. In 1904 a new Möller pipe organ was installed at a cost of $2,000. Half of this was a gift from Andrew Carnegie, who was the benefactor of a number of church organs.

During the summer of 1929, church council recommended and the congregation approved the purchase of still another organ to replace the Möller at a cost of $6,000. "We recommend this because our organ is obsolete . . . and the old mechanical action is continually growing more burdensome to operate, making it a question of only a short time when the organ must be replaced with a new and modern instrument."

However, in October of that year the stock market collapsed, triggering what some of us recall as "the Great Depression." Pastor H. N. Miller also resigned that month, stating he was, ". . . on the verge of nervous collapse." On January 8, 1932 council and the congregation acted to suspend any additions to the organ fund and hold the $1,238 already subscribed in escrow "until further action be deemed necessary." The depression, World War II, and inflation combined to keep the project dormant for over 30 years.

Why did the organ need replacement after only 25 years? Many tracker (mechanical) action instruments, given normal routine maintenance, are not only operable, but actually surpass their modern counterparts after two or three centuries of use. So do certain violins. To answer this, I think we need to look at the organ's environment.

The 1865 church ran parallel to Penn Avenue, with its front doors facing Central Park and the altar under the existing narthex. I believe it was originally built over a shallow crawl space with the basement added later. This basement was really a roughly excavated pit perhaps ten feet deep at the center and sloping upward on all sides so that its walls were only three or four feet high. A dozen unexcavated clay stalagmites, perhaps six feet high, were scattered about in this basement; and short, extremely heavy wooden posts extending from the tops of these earthen pillars supported the weight of the church. Evidently the cellar had never been flooded - if it had, the entire building would have collapsed.

This basement was quite damp and musty. It was anything but an ideal place to install an organ blower and air pressure regulator, but there they were. The remainder of the organ was above the floor of the chancel.

As a teenager, my attention (along with that of a number of my peers) was drawn to the organ. I suppose this was quite natural - many of us were fascinated by anything mechanical or electrical. One gloomy Saturday afternoon an associate and I were deep within the bowels of the organ experimentally removing pipes and blowing them to see what sounds could be generated. This sort of activity seemed appropriate, since it had been specifically prohibited by the property committee.

While we were thus employed, the custodian entered at the narthex, bringing his cleaning equipment. Now this gentleman normally maintained an ample supply of spirits in the boiler room. His progress up the main aisle seemed to indicate he had fortified himself adequately for the task at hand.

As he approached the chancel, my friends whispered, “When I tell you, blow two or three of these pipes.” He demonstrated and I followed suit. The sexton froze and stared, open mouthed, at the organ façade. At this point a sepulchral voice boomed out, “I see you! Oh, I see you and I’ve come for your soul!” The poor man dropped his dust rag and left at a rate of speed neither of us could possibly have attained.

The original church structure was demolished in 1950 to make room for the present one. At that time, church council decided the organ pipes were worth far more than they would bring if sold, so they were stored. A few years later, some of these were used by two Thiel students to build a small organ as a school project. Others were used by organ builders. A few found their way back to Holy Trinity and are there now. I had never really thought organ pipes should be labeled “recyclable material,” but it might be appropriate.

Baldwin

After the existing church had been constructed and was occupied (late 1953), attention naturally focused on rebuilding the old organ or obtaining a replacement for it. Indebtedness did not permit immediate consideration of an expensive instrument, so other avenues were explored. Pastor Brath had responded to a magazine advertisement for “A $25,000 Möller pipe organ for only $9,000” but nothing materialized.

Early in 1954, a Baldwin Model 10 electronic instrument (there was some hesitancy among music lovers within the congregation to refer to it as an “organ”) was purchased for $6,834. Evidently more attention was paid to the appearance of the console than to tonal qualities. A letter to Baldwin states:

“We are decided that we do not want the dark finished organ, but must have one finished to match the other wood work in our Church. I do not know what you mean by "bleached oak" but we want the organ finished natural oak. No May Mist, limed oak or Flemish Oak acceptable. We also do not want any course (sic) grained oak. I hope this is perfectly plain."

Noack

There is some question in my mind as to whether a pipe organ was ever <u>seriously</u> considered when the existing church was built. A spacious "organ chamber" above the Clinton Street stairwell was included and plans called for a similar mirror image room to be added above the corridor leading to Brath Hall, but these enclosures joined the chancel through very small openings covered with grillwork. Acoustically, similar effects might have been achieved by placing an organ in a house on the far side of Clinton Street and piping music into the church through a length of culvert.

Certainly, heated debate ensued on whether money should be spent on a pipe organ or whether some sort of electronic instrument would be adequate, and a few existing letters attest to that. Possibly the result was a "cop-out", build the chamber and let the next generation settle it.

At any rate, in 1963 the congregation directed council to appoint a committee to study and recommend a replacement for the Baldwin instrument. Very little was done for two years. In 1965, Mr. David Urness was hired as Director of Music. Dr. Fenner Douglas, Professor of Pipe Organ at Oberlin College, agreed to act as organ consultant and the project picked up steam.

The committee considered but excluded bids from six companies for various reasons. Fisk, Flentrop, Noack and von Beckerath were given favorable consideration.

Final recommendation was for a 25 rank Noack tracker action organ costing $61,000, to be installed in the gallery. (Noack was chosen primarily because of delivery time.) The proposal was debated at length during an April, 1967 congregational meeting and defeated. Primary reason for the rejection seemed to be removal of the choir from the view of the congregation, most parishioners were willing to go along with a gallery installation provided they could see the choir. The committee was directed to resume work and develop a proposal for a chancel installation.

Casavant

By 1968 Mr. Urness had resigned and Dr. Douglas indicated he could no longer act as consultant. Pastor Eugene Harmony accepted a call to Holy Trinity as associate Pastor and Director of Music. Dr. Frederick Jackisch, Director of Graduate Studies at Wittenberg University, had agreed to serve as consultant and we were back in business.

The first item now confronting the committee was choice of a builder. But hadn't it already chosen one? No. All the companies seriously considered for the gallery installation specialize in tracker action organs, which have a direct mechanical connection between the console and the pipes. We had for a short time thought about the possibility of the organ occupying part of the organ chamber and spilling over into the chancel, but it became obvious that there simply wasn't room for this. A split chancel arrangement with some form of electric action became mandatory.

Fifteen organ builders were asked to inspect the church and submit bids. Thirteen did so. Bids ranged from $44,000 to $80,000 with from 30 to 50 ranks of pipes.

The committee inspected, played and listened to representative organs and narrowed the field to three. Dr. Jackisch suggested two of these be avoided. He felt they were well priced but marginal instruments which might be compared to the proverbial "broom peddler's special" automobile, four wheels, a motor, a heater and little else. Casavant was finally chosen as the builder.

A proposal to purchase a two-manual 42 rank organ for $64,000 was presented to the congregation at a special meeting in February, 1969 and approved by a two-to-one margin. That organ, if bought in 1953, would have cost about $20,000. The price today (1996) would be approximately $400,000.

Installation

The organ was delivered very early one cold (3º F.) Monday morning in January, 1970. We had half-a-dozen volunteers waiting for it and Casavant sent three men. Pipes were unloaded, brought in through the back door of Brath Hall and stacked. They filled the library, nursery, hall, cloister and most of the narthex. Plans were to install as much as possible that week and clear enough space to permit holding services the following Sunday. By lunchtime all the pipes were in.

This left the really heavy, bulky items, the console, wind chests and regulators. They had to come in through the front doors, so one of the volunteers and I looked over the situation on Penn Avenue, which at the time was lined with parking meters.

"If we could get one of those meters out they could back the trailer right up to the landing. I can't see carrying that stuff up two flights of stairs."

My friend produced a three foot pipe wrench from his truck and went to work on the meter post. All he did was flatten it a bit.

"Get in the truck." "Where are we going?" "Up to Crash's to get the burning torch. I'll cut that thing off right at the ground."

Before this plan could be put into effect, the Casavant truck came down Clinton Street and, in a unbelievable display of skill, the driver backed his trailer, in one pass with no juggling, between two parking meters and up to the landing. I couldn't believe it. There was about ½ inch of clearance on one side and very little more on the other. The Casavant foreman (Francois) beamed.

"How do you like that? This man is our best driver. He wins all kind of semi driving rodeos. He was champion of Canada for two years straight."

As soon as the trailer was empty, the driver left for his return to Montreal and the Holy Trinity volunteers went home. It was now about 4:00, a day of hard physical work for all concerned. I thought it was a good stopping point, but Francois informed me that he and Leo needed some food and that they planned to work late into the evening. He also suggested that a steady supply of beer would help greatly. If it could be tolerated within the church better progress would be made as he and Leo wouldn't need to take frequent breaks. I bought four cases as a start, delivered them to the organ chamber (it was barely above freezing in the church) and kept them replenished. Pastor Keck objected at first, but relented when he saw the twelve-hour-plus days the pair was putting in and realized the organ would be finished in three weeks, rather than the four originally scheduled. We had in inexhaustible supply of volunteers. Many parishioners came to watch and stayed to work. In many ways, the project reminded me of a traditional Amish barn raising.

Several episodes were unforgettable. In one of these, we needed a three inch hole through the chancel floor for an electrical conduit. (The floor is eight inch thick reinforced concrete.) A jack hammer was ruled out as too destructive, so I borrowed masonry bits and a large hammer drill from my employer.

A three-quarter inch pilot hole was drilled with no trouble, but the larger bit threw up such a cloud of dust that we stopped immediately.

"If we keep this up they'll be cleaning concrete dust out of the church for the next fifty years." "Pour some beer in the hole. That ought to kill the dust." "Might lubricate them a bit, too."

The beer worked to perfection.

The last week of installation was especially tense. Up to that point work had been scheduled so that Sunday services could be held as usual and visual changes to the chancel were minimal. Console, support hooks, blowers and ductwork were all in as were wiring, wind chests and pipes <u>within the chamber</u>. The chamber opening was covered with a tarpaulin. Plans were to complete the organ that week. Incredibly, things went according to plan.

Two days later the big moment arrived. The organ still needed a lot of work, but the remaining wind chests and pipes were all in place and most of the wiring had been completed. The blowers were started and wind pressure adjusted. How would it sound?

Leo leaped onto the organ bench like the Lone Ranger mounting Silver in hot pursuit of the cattle rustlers.

Now, professional organists will be happy to explain what the term "full organ" means. Their definition may be disputed. At that moment, it meant that all the stops and every key on the organ were opened simultaneously. The experience, especially to those of us who were unprepared and standing in the organ chamber, was memorable. For an instant I thought I had died and followed Orpheus straight into the bowels of the underworld. I turned to Francois.

"The man's gone completely mad!"

"No, no!" Francois screamed back. "He's just blowing the dust and dirt out of the ducts and pipes. This is the fastest way. We'll start voicing it as soon as he gets done."

Watching and listening to that voicing over the next few days, hearing the organ change from a raucous noisemaker into the instrument it is today, was unforgettable. There were some anxious moments. A number of the pedal pipes wouldn't speak at all and wind pressure to them was increased slightly. A good organist will tell you they are still a bit sluggish. Further adjustments can certainly be tried, but at that point we were running out of time.

We had deliberately left the Baldwin console adjacent to the new one and placed its speakers in the baptistry. Admittedly a bit dramatic, it offered us a chance to hear them both in rapid sequence, a direct "A/B" comparison. And at the conclusion of the next Sunday's worship, we did exactly that. Norman Owen, of the Thiel faculty, and Pastor Harmony played identical musical passages.

The demonstration was most effective. It would be nice to say that approval was unanimous; but I have never, in my 66 years as a member of Holy trinity, attended a congregational meeting where an initial vote on a critical issue, such as a pastoral call, was. One individual who had been especially adamant in his opposition throughout the project confronted me after the service, white with anger.

"You have desecrated my church. I'll never forgive you!"

Words failed me. Eventually his attitude mellowed and we became reasonably good friends once more, but we never again discussed the organ.

The other people who spoke to me after the service stated that while they might have harbored some doubts prior to the demonstration, they certainly had none at its conclusion.

Organ Construction

When reduced to its simplest possible form, an organ is made up of pipes, a source of wind and a means of distributing and controlling the wind flow. Let's look at these sections individually.

Wind Supply

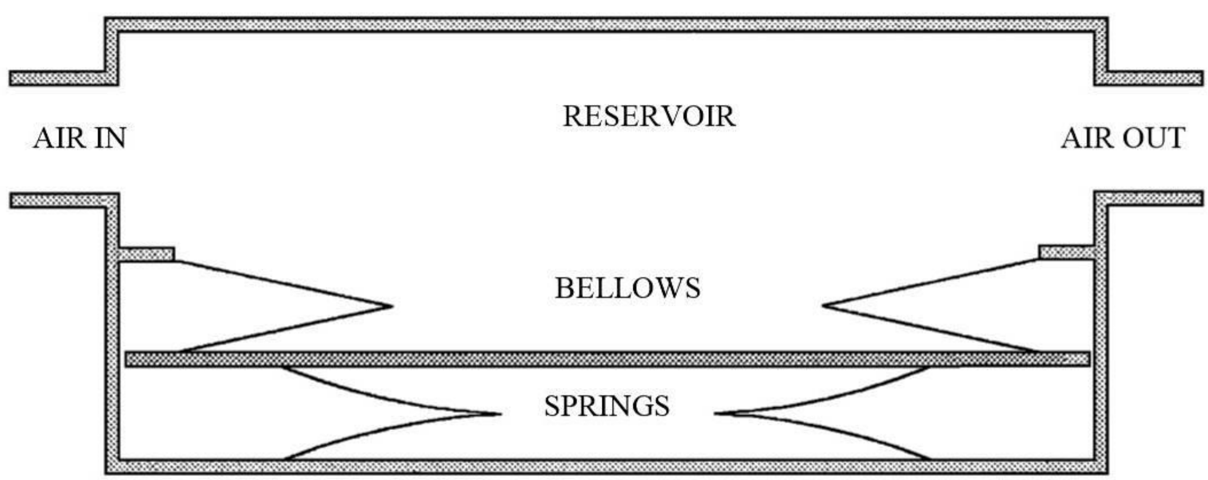
A pipe organ requires a large volume of air at a closely controlled pressure. If the pressure is allowed to vary, the pipes will fly well off key.

Until the beginning of the present century, most organs were supplied with air compressed by hand with good old-fashioned bellows. I can remember one such instrument at Thiel during the late forties and early fifties. Instruments built today use electric motors.

The Holy Trinity organ has two blowers. One with a 2 horsepower motor is located at the rear of the organ chamber. It supplies the great and pedal divisions. A second ¾ horsepower unit which handles the positiv is above the drop ceiling in the basement.

Organ pipes require air at a very low pressure - about ⅛th of a pound per square inch. This is a far cry from the pressure needed to inflate your tires, or your air mattress, for that matter.

Modern organ builders use devises called schwimmers (Figure 1), large spring loaded bellows, for pressure regulation. Usually, several of these devices are used in conjunction with the individual wind chests rather than one large schwimmer. This arrangement is to be found on our organ.



SCHWIMMER

FIGURE 1

Wind Chests and Actions

Next we will deal with the wind chests and actions. Literally dozens of different arrangements exist, so only those pertaining to Holy Trinity organs will be mentioned.

The existing instrument utilizes pitman action. Direct electric and electropneumatic actions are included as introductory to the pitman. Since tracker action coupled with slider chests was used in the Möller organ and planned for the Noack installation, a description of that is also included.

Think of the chests as manifolds which serve to distribute pressurized air while actions control its flow. *Stop* actions guide air to the various ranks while *key* actions admit or block the airflow to individual pipes on each rank. These functions are sometimes combined and in any event are closely intertwined, as we shall see.

<u>Direct Electric Action</u>. Operation is shown in Figure 2. Depressing a key closes a set of electrical contacts (not shown) which energizes electromagnet (A), pulling the iron armature (B) to the right. This opens valve (C) and admits air to the foot of the pipe.

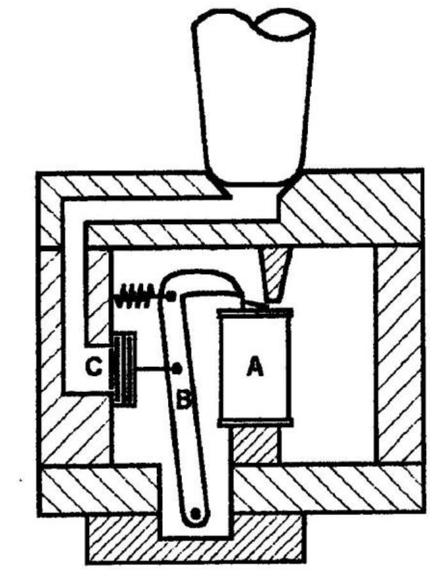
Despite the speed implied at all-electric operation, this system is not all that fast. Problems involve the relatively high inertia of the heavy armature and a tendency of the valve to bounce when reseating.

<u>Eletropneumatic Action</u>. Refer to figure 3. Again, depressing a key energizes an electromagnet (A), but this attracts an iron disc (B), exhausting channel (C) through hole (D). Air within the chest pushes leather diaphragm (E) against spring (F), opening valve (G) and admitting air to the pipe foot.

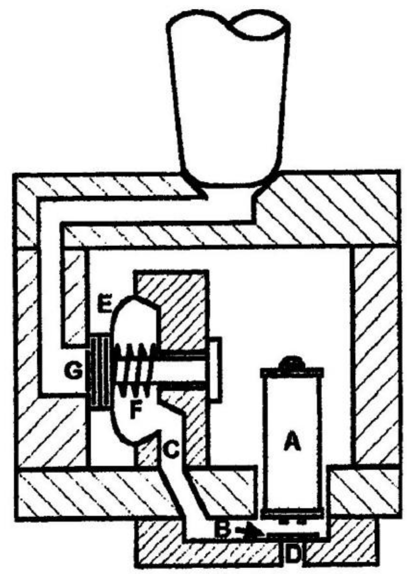
This action tends to become sluggish with larger pipes, as exhaust port area cannot keep up with the increase in diaphragm size.

<u>Pitman Action</u>. This variation of electropneumatic action depicted in Figure 4, is the one used in our organ. Here, the left hand chest responds to input from the keys, while the right hand one is controlled by the stops. (Static air pressure in the latter chest must be maintained at a higher value than in the other two.)

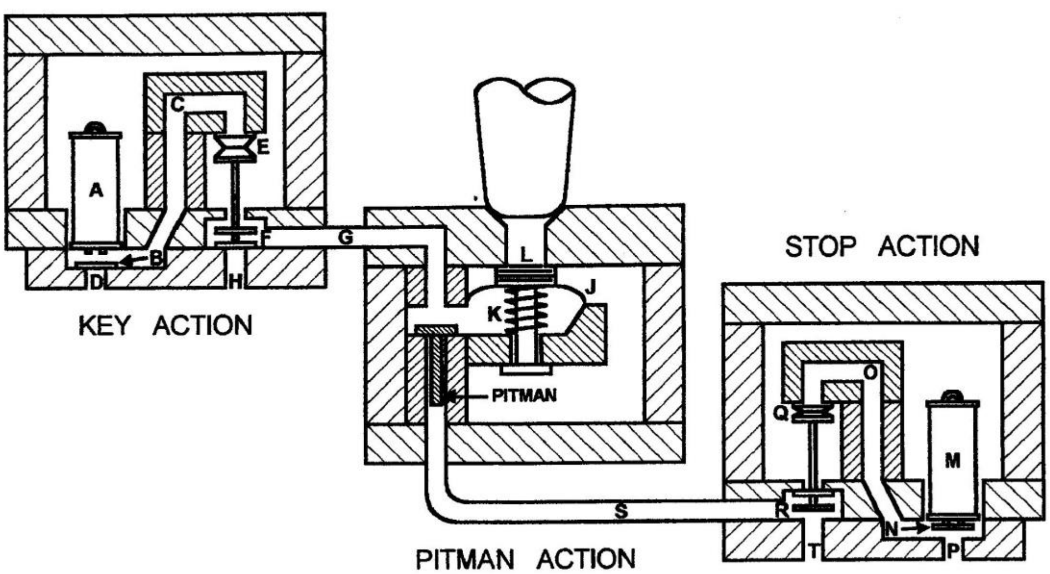
Depressing a key energizes electromagnet (A) attracting (B) exhausting (C) through (D). (So far, the sequence is identical to that in the electropneumatic action.) Air pressure within the key action chest now collapses pouch (E) raising valve (F) and exhausting passage (G) through hole (H). With the pitman in the position shown, air pressure within the central chamber now pushes diaphragm (J) down against spring (K) opening valve (L) to the pipe foot.



DIRECT ELECTRIC ACTION
FIGURE 2



ELECTROPNEUMATIC ACTION
FIGURE 3



PITMAN ACTION
FIGURE 4

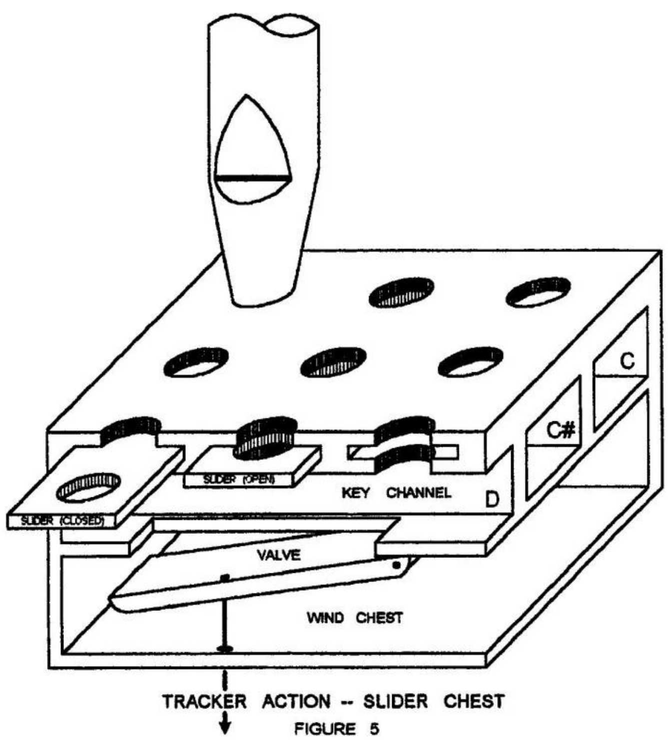
The right hand chest is shown with the stop drawn. If the stop is cancelled, electromagnet (M) is de-energized, disc (N) drops, sealing hole (P). Air flowing around the electromagnet and into passage (O) expands pouch (Q), closing (T) and pressurizing (S).

The pitman now rises and blocks any input from the key action chamber, via passage (G).

The pitman system provides a comparatively prompt touch response. Despite its complexity and the apparent paradox of two cascaded stages being faster than one, a properly designed power assisted control system will do exactly that.

Tracker Action. Earlier, I had spoken of a "tracker" or direct mechanical action in connection with the Noack proposal. This method of key action, coupled with a stop action arrangement known as the "slider" or "tone channel" or "key channel" chest, is one of the oldest. In many respects it is still considered the best.

Air under constant pressure is fed into the wind chest. Depressing a key (either manual or pedal) opens an appropriate valve (see Figure 5) by means of a heavy wire (shown) and other mechanical linkage (not shown). This allows air to flow into the adjoining key channel. Above the key channels are foot holes for the various organ pipes. These holes may be opened or closed by perforated wooden slats, called "sliders." The slider on the left is shown in its closed position, while the one in the center is open. The right hand slider has been omitted for clarity of illustration.



TRACKER ACTION -- SLIDER CHEST
FIGURE 5

Pipes running from front to back in the illustration are similar in appearance and construction, but differ steadily in size, and therefore, in pitch. Those arranged from left to right are identical in pitch but differ substantially in appearance and in tonal quality.

Each slider, then, controls a “rank” of pipes (61 for the manual keyboards; 32 for the pedal) similar in appearance and in tonal voicing but progressive in size and pitch. Each key handles pipes with widely divergent tonal properties but common in pitch.

The slider chest offers enormous valves with a very small air pressure drop. Automotive engineers love this sort of thing when designing an engine and refer to it as good “volumetric efficiency.” As soon as a pipe is keyed, air pressure at its foot rises almost instantaneously to a final or steady state value. The pipe will speak promptly, with almost percussive attack, and it sounds bright and clear. (Oscillographic studies of various stringed instruments have shown that Stradivarius violins exhibit the same rapid attack.) Small valves generally result in a protracted rise time, with a pipe taking as much as a full second to reach normal volume. (Pitch also changes during this period.) Such a pipe sounds dull or “muddy.”

Slider chests have common wind channels which tend to synchronize the pitches of pipes mounted on them. (An arrangement called the “stop channel chest” has each rank on a common channel. At its worst, with a slightly mistuned organ, for example, it can produce some rather disquieting sounds.)

Disadvantages are inflexibility of arrangement, tracker action would have been totally impractical in a split chancel arrangement, and initial cost. Maintenance used to be a sore spot; but the adoption of modern materials, as an example, Teflon® coated slides have been used successfully, has resulted in reliability which equals or surpasses that of the electropneumatic actions.

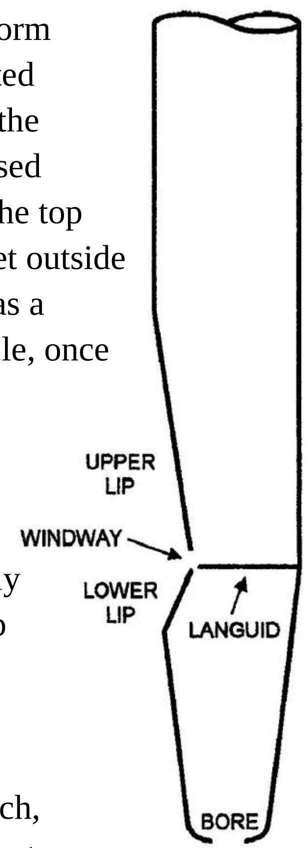
Pipes

Now we come to the very heart of the organ, the pipes.

With a set of pipes, some scrap lumber, a few hand tools and a vacuum cleaner one can build a crude, playable organ. Without the pipes (or the means of making them, which takes far more than the usual basement workshop expertise and equipment) he or she is lost.

At the time Holy Trinity bought its instrument, organ builders made their own pipes. Some still do, but much of this work is now subcontracted. Two of my good friends, a husband and wife team in Erie, have a very nice little business making and selling pipes to several of the "name" builders.

Pipes are divided into two classes, flue and reed. In both types sound is produced by a vibrating air column, but the oscillation is induced by different means. Let us look first at flue (or "labial" pipes), which comprise about 85% of the pipes in a typical organ. See Figure 6.



FLUE PIPE
FIGURE 6

<u>Flue Pipes</u>. Wind passes through the bore and the windway in the form of a flat sheet or invisible reed or tongue. This wind sheet is deflected either toward the interior of the pipe or the external atmosphere. If the sheet is deflected inward, the air column within the pipe is compressed and a pressure wave or crest starts up the pipe. This is reflected at the top of the pipe. When it returns to the upper lip, it pushes the wind sheet outside the pipe and gives rise to a partial vacuum which starts up the pipe as a trough, is reflected, returns and pulls the sheet back inside. The cycle, once established, repeats until air flows to the pipe is interrupted.

If the pipe is long it will take more time for the wave to traverse its length and the pitch will be lower. If for a given length the top of the pipe is open rather than closed, the pipe will speak approximately one octave higher. Conical pipes which taper inward toward the top are lower in pitch than cylindrical ones of the same length; and the converse is true of pipes which flare as they ascend.

Since the length of the flue pipe is the primary factor controlling pitch, open pipes are frequently fitted with sliding metal cylinders for tuning. Some older ones are tuned by coning the ends in or belling them out, but repeated tuning will eventually destroy such a pipe. The stoppers on covered pipes are made so they will slide in and out.

Proportions of the pipe are quite important. Ratio of "cut up" (distance between the upper and lower lips) to mouth width to pipe diameter to pipe length are all critical, as well as wind pressure and numerous other parameters. A dissertation on voicing is far beyond the scope of this book, dozens of books on the subject exist, if the reader is interested.

No musical instrument can generate a "pure" tone, one consisting of a single frequency. They all produce a fundamental pitch plus a series of multiples of this pitch called overtones or harmonics.

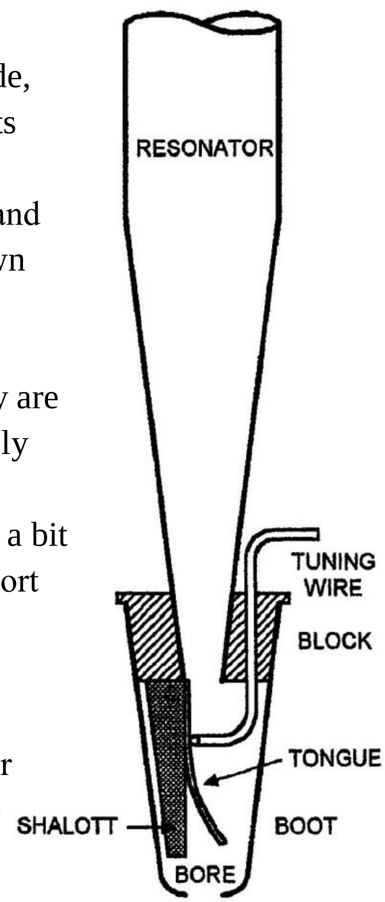
Flue pipes are divided into families called "flutes," "principals" and "strings." These differ primarily in the diameter to length ratio of the pipe. Flutes are relatively fat. They emphasize the fundamental and have little harmonic development. Strings are slender with a softer, thinner sound and relatively strong overtones. Principals have a sound instantly identifiable as "pipe organ."

Ranks which form octaves of the 8' reference are known as "foundation stops." However, there are others (2⅔', 1 3/5' and 1⅓') which are called "mutations" and they make it possible to create tone colors which are unique to the organ and cannot be duplicated by any other single instrument.

Reed Pipes. Reed (or "lingual") pipes have a springy metal blade, called a tongue, which vibrates at a frequency set primarily by its length. As shown in Figure 7, a heavy tuning wire presses the upper portion of this reed against a firm support (the "shallot") and alters the unsupported or effective length. Pushing the wire down raises the pitch while pulling it up has the opposite effect.

Many reed pipes have resonators, but these do not set pitch, they are used to influence tone color. Pipes with resonators approximately the same length as flue pipes of equivalent pitch will have the fundamental tone reinforced. Usually such resonators are tuned a bit sharp, and the reed "pulls" the air column into synchronism. Short resonators normally reinforce the harmonics.

Reed pipes are also grouped into families. We speak of "chorus reeds" which are used collectively with principals and with other reed stops. Then there are "solo reeds" which have a distinctive tone quality and are designed to be used alone, in single line melodies.



REED PIPE

FIGURE 7

Pipe organs are quite sensitive to temperature. Usually the reeds hold pitch fairly well, but the flue pipes follow the thermometer up and down. It is absolutely essential to set the building thermometer and leave it alone. Otherwise, organ tuning bills alone would be far greater than any savings realized by reduced heating costs, to say nothing of major expense resulting from added wear and tear on the instrument.

Console

An individual examining an organ console for the first time would be baffled by the names engraved on certain of the stop drawknobs. Some of these provide an exercise in semantics.

Pipes may be named for their shape, spitzflöte (pointed flute), rohrflöte (tube or chimney flute), gedackt (covered); by pitch, subbass and oktav; by comparison with another musical instrument, trompete and salizional (Latin salix, "willow", thus willow flute); by tonal characteristics, scharf (sharp) and nasat (nasal); and others.

One may also be curious about the custom of referring to pitch in terms of distance, specifically, in feet. Originally, the length of the longest in a rank of open pipes was used as its pitch designation. For a rank of "normal" pitch extending down to low C (two octaves below middle C), this was approximately 8 feet. A sixteen-foot rank speaks an octave lower; a four-foot one, an octave higher.

Covered or stopped pipes are approximately half as long as open ones for a given pitch. Formerly, they were labeled "X-foot pitch". This custom has fallen into disuse. A rank starting at tenor C (one octave below middle C) is now referred to as a four-foot rank, regardless of pipe length.

In organ playing, it is often necessary to change registration (stop selection) very rapidly; and provision for this is made. Immediately in front of the pedal clavier (keyboard) is an array of chromium plated knobs, somewhat resembling outmoded automobile headlight dimmer footswitches. These are called "combinations" or "studs". The organist draws the particular arrangement of stops desired and, while holding down a "setter button", depresses a stud. This programs the organ for the particular combination of stops drawn, while erasing any combination previously set for that particular stud. Depressing the stud again will automatically draw the particular stop arrangement.

Other combinations are preset in the same fashion. The organist may then proceed through a passage of music involving various tonal shades and levels of intensity without pausing to reset a dozen or more stops. The studs are duplicated by numbered pushbuttons below the manual keyboards so that either hands or feet may be used to effect the changes.

Casework

Organ pipes exhibit dozens of shapes (hundreds, if we wish to include those considered obsolete). Like any other musical instrument they owe their appearance to the sound each can produce.

Here is an alphabetic list of the pipes included in our organ and a brief description of the function of each. The letter in parentheses refers to the pipe's physical appearance (see Figures 8 through 11). Location of the various pipes is shown in Figures 12 and 13 should the reader wish to identify a particular rank.

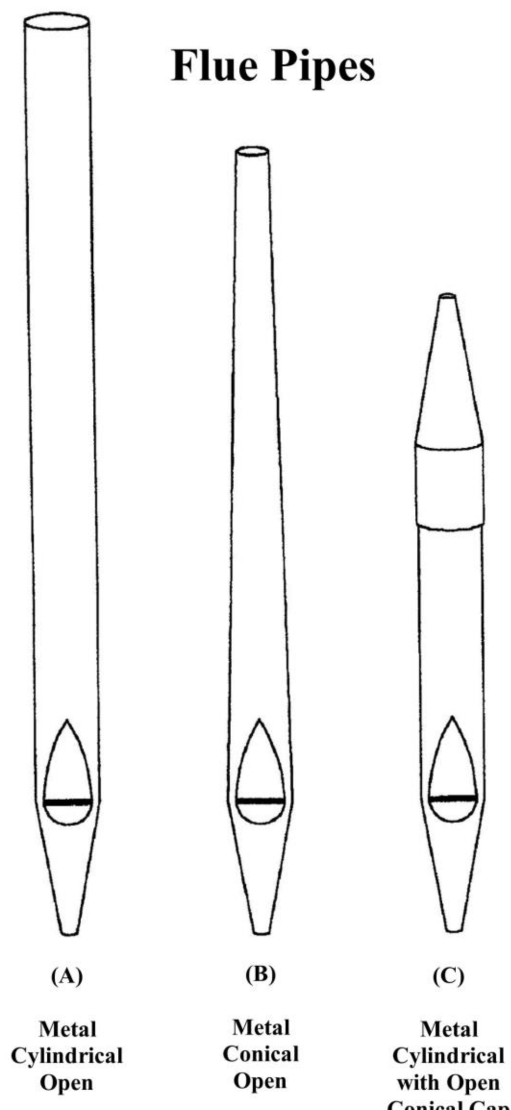


Figure 8

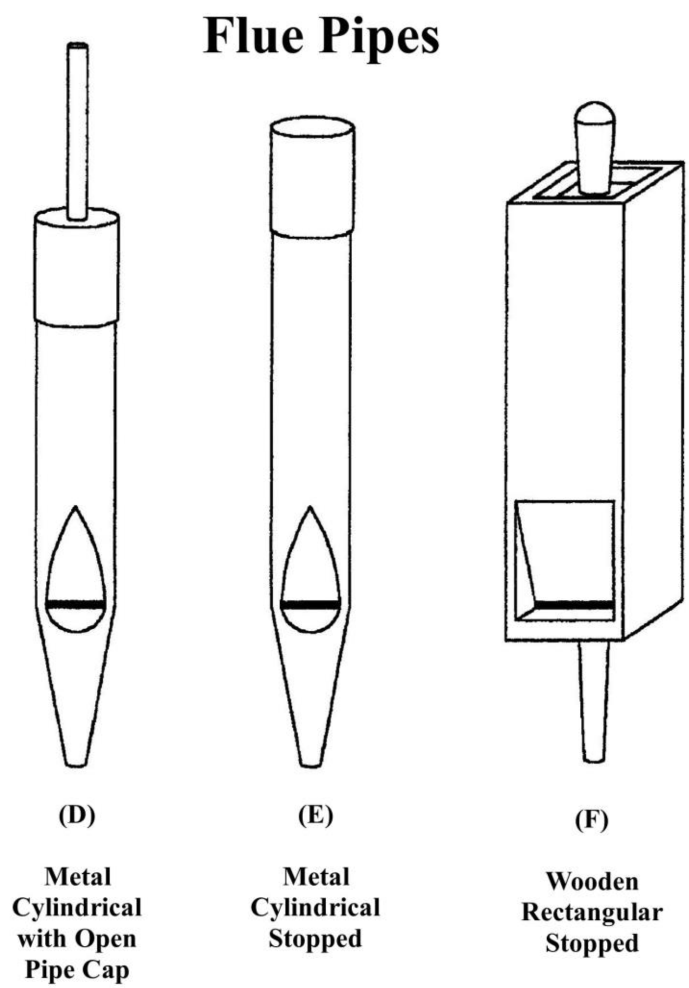


Figure 9

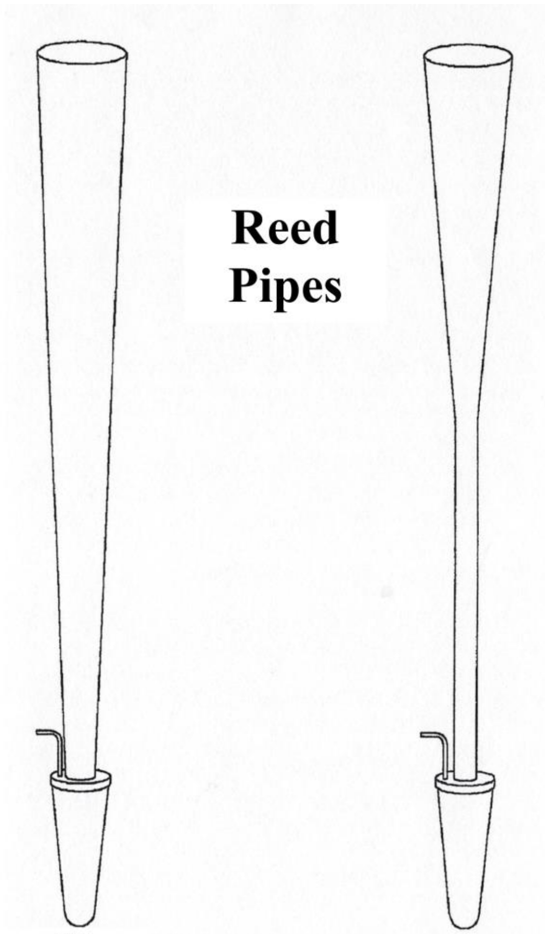


Figure 10

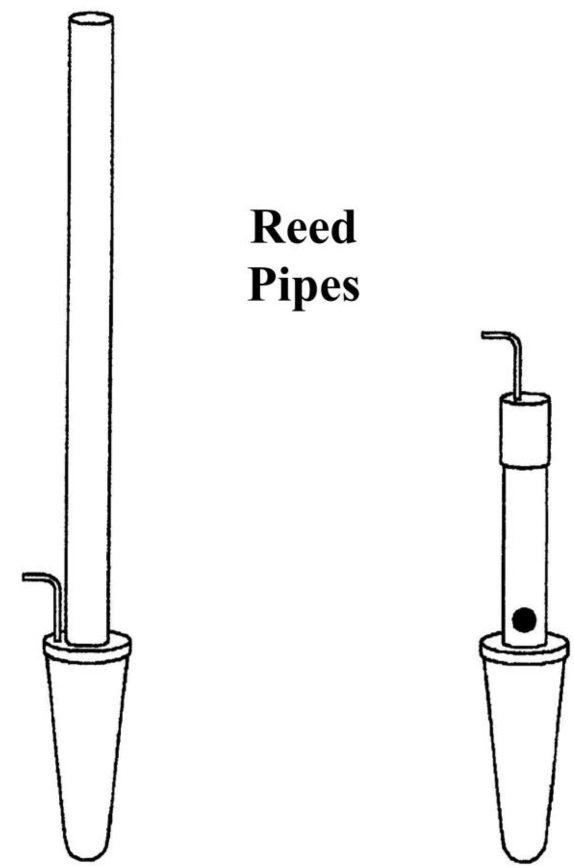
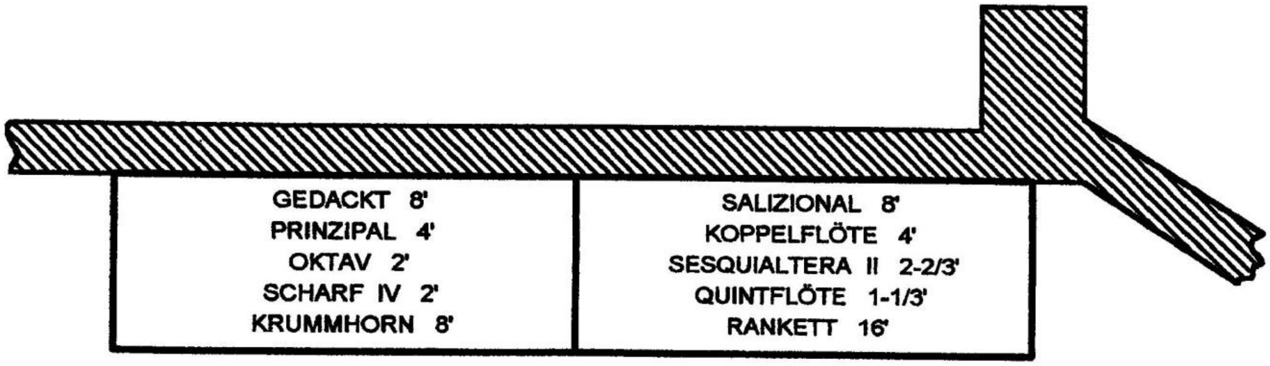


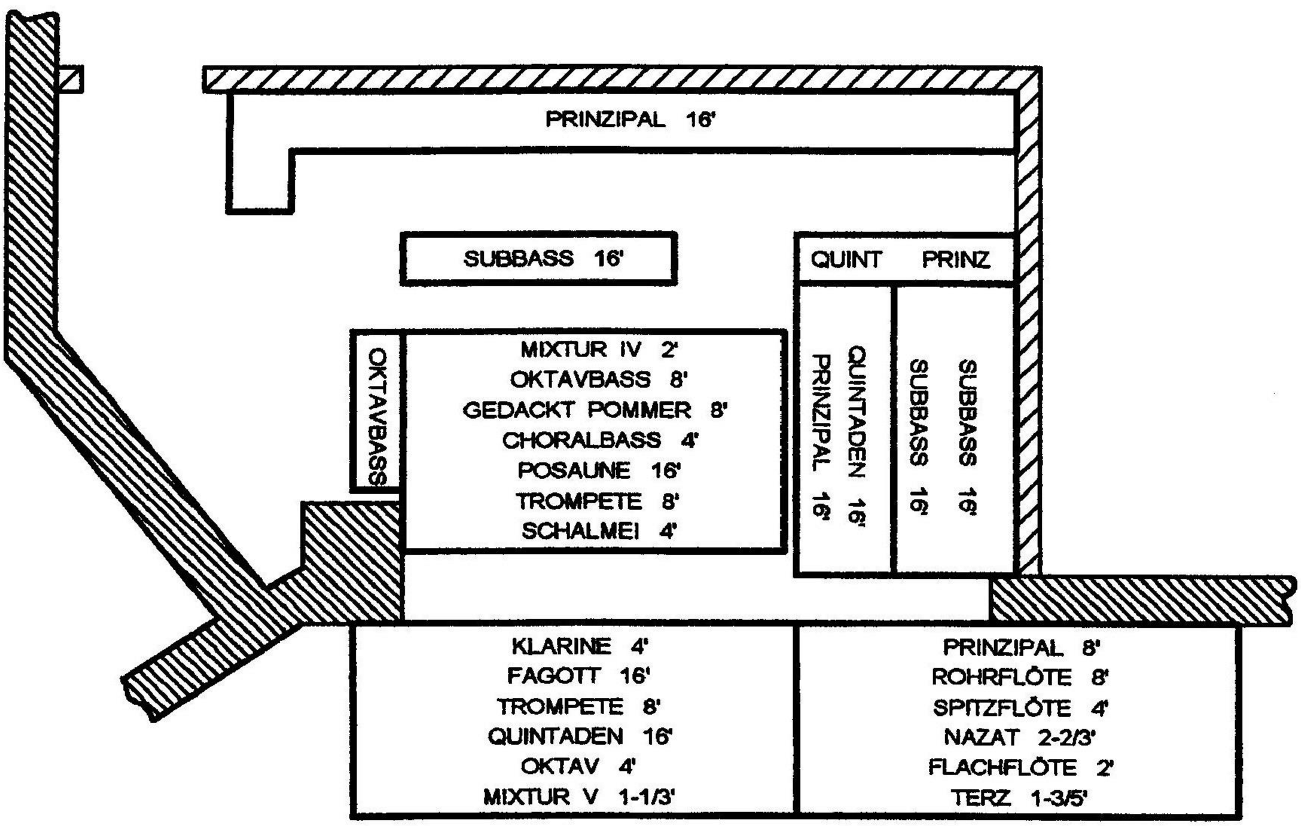
Figure 11



POSITIV

(PULPIT SIDE OF CHANCEL)

FIGURE 12



GREAT & PEDAL

(LECTERN SIDE OF CHANCEL)

FIGURE 13

Choralbrass: An open cylindrical metal stop of principal quality, generally placed in the pedal division. (A)

Fagott: This is a reed stop, moderately soft and sounding much like a bassoon. (G)

Flachflöte: A cylindrical open metal flute with rich lower harmonics and dampened higher ones. (A)

Gedackt: A stopped flute with a smooth, soft, round tone. It blends well and is used chiefly as a combining stop. (E)

Gedackt Pommer: Another stopped flute, but with a prominent third harmonic which can be as laud as the fundaments. Similar in function to the quintaden and quintflore. (E)

Klarine: A reed stop similar to the trompete, but softer and without the latter's brilliance. (G)

Koppelflöte: A partially stopped flute sounding midway between a bright and dull quality. Unique in tone, it is designed to enhance the blend between other stops. (C)

Krummhorn: This is a reed pipe with a half-length resonator. Tone quality is dark, mournful and sedate, not pungent, but highly distinctive. (J)

Mixtur: A compound stop contains two or more ranks drawn by a single stop knob. A mixtur is a compound stop whose ranks are designed to break back in pitch one or more times, in a sawtooth or terrraced pattern, if you will, as the scale ascends. Many conventional organ voices sound a bit thick or muddy at the low pitched end and harsh or shrill at the high. Addition of the mixturs to a stop combination gives clarity to the bass and tenor and reinforces the treble. The effect is difficult to describe but unforgettable once heard. (A)

Nasat: The nasat, sometimes called the "twelfth", is designed to speak at the third harmonic of the note actually struck on the keyboard (an octave and a fifth higher). An open 2⅔' metal pipe, it brings out a whole series of harmonics not duplicated by any other pitch. (A)

Oktav: Open cylindrical metal pipes speaking one octave higher than and designed to mesh tonally with the great and positiv prinzipals. (A)

Oktavbass: Pipes similar to those of the two oktav ranks but proportionately larger in order to complement the pedal prinzipal. (A)

Posaune: A chorus reed with a loud and freely vibrating tone, somewhat similar to a trombone in timbre. (G)

Prinzipal: Pipes are the heart of the organ; and the stop known as the prinzipal (or principal) is their foundation. It provides the tone quality and dynamic value from which all other stops are classified, which we interpret as the characteristic sound of the church organ. The single factor which attracts the listener to this peculiar timbre is the unbelievable balance between overtones. Other stops do not have this and they, without exception, emphasize some harmonics at the expense of others. Without the prinzipal, other stops would have no reason to exist. Its importance is evident when we consider that of the 42 ranks of pipes in our organ, 26 are principals or a close variation. (A)

Quintaden: A stopped metal flute designed to emphasize the third harmonic, which may be as strong as the fundamental. Accordingly, the 16' quintaden produces a prominent $5\frac{1}{3}$' component. (E)

Quintflöte: A flute stop sounding an octave higher than the nasat. (A)

Rankett: Soft in dynamic range, but with a pronounced set of overtone pitches. Rankett pipes are short, cylindrical, capped and with a set of holes near the base, looking for all the world like a vital internal part of a toilet tank. (J)

Rohrflöte: The chimney extension on this stop allows reinforcement of a selected harmonic. Overall sound is liquid, light and transparent but not especially bright. Some versions are constructed with the rohr reentering the main cylinder, rather than extending above it. (D)

Salizional: A mild string stop. (A)

Schalmei: A reed stop speaking from a narrow cylindrical, than flared resonator with a bright, nasal, somewhat acidic and biting tone that is very rich in harmonics. Used for solo passages and in the ensemble. (H)

Scharf: This is a mixture of very high pitch with the pipes shaped like miniature prinzipals. At these frequencies timbre is of little consequence and the listener is mostly aware of pitch. (A)

Sesquialtera: A two-rank compound stop of principal quality (2⅔' and 1 3/5') but, unlike the mixtures, with no sawtoothed pitch pattern as the musical scale ascends. (A)

Spitzflöte: The conical form of this pipe removes some of the higher pitched harmonics and reinforces the lower ones. Its tone is that of a soft flute with some added color. (B)

Subbass: A heavy, rectangular wooden pedal stop. It makes a deep, penetrating, well-diffused sound that reaches down to and beyond the lower limits of human audibility. The subbass requires a generous supply of wind, as it takes a lot of energy at these low frequencies to move the 4½ tons of air in our building. (F)

Terz: This stop is a mutation speaking at the fifth partial (two octaves and a major third above the fundamental). In our organ, the 1 3/5' terz would normally be used in combination with the 8' prinzipal. (A)

Trompete: An unusually brilliant and loud chorus reed with a very high overtone development, as much as six octaves above the fundamental. It is well named and is capable of a broad and majestic brass tone equaled by few other stops. (G)

Outlook

So much for the history of our organs and a look at their operation. How long will it be before we need a new one?

Any machine, lacking preventative maintenance, will wear out and generally will do so quickly.

Leather valve components are usually the most vulnerable items in an organ. In days when little or no concern was expressed for the environment, organs in areas of heavy smog required replacement of leather valve components at 5 to 10 year intervals while those in a smoke-fee environment could last a century or more. The service technician who examined ours last year pronounced them “like new”. Schwimmer bellows are subject to constant flexing and usually wear out in 20 to 30 years. Ours have just been replaced.

Electric motors and blower bearings in intermittent service may last a century if properly lubricated. Key contact and other electrical maintenance costs are minor, although continuous, somewhat like the nuisance of changing light bulbs.

Tuning should be done at least twice a year.

These factors mandate the continued existence of an organ maintenance plan - which should be quite reasonable in cost. If this is followed, the organ will be here a long, long time. To answer the question, it should outlast the present church building.

About the Builder

In 1837 a Canadian blacksmith named Joseph Casavant decided to continue his education and enrolled in the College of Ste. Thérèse, near Montreal. While a student there, he was asked by l’abbé Ducharme to see if he could restore an old organ to working condition.

This project must have been satisfactory, for a few years later he was asked to build a completely new organ for the church of St. Martin de Laval, also near Montreal. Then in 1850 the Bishop of Bytown (now Ottawa) commissioned him to build a three-manual instrument for the Cathedral there. All in all, Joseph produced seventeen organs before his retirement in 1866.

Joseph’s two sons, Claver and Samuel, inherited their father’s love of organ building. After an apprenticeship under Eusèbe Brodeur of Montreal and several of the European builders they established themselves in St. Hyacinthe, Quebec as Casavant Frères (1879).

By the turn of the century their firm had turned out over a hundred organs. Today, Casavant has built nearly four thousand.

In the process of selecting an organ builder, we considered 19 firms and rejected most of them quickly. Organs built by those remaining were excellent tonally, but in the committee's opinion Casavant was clearly outstanding in workmanship and in material quality. While concealed portions of some of the instruments we inspected resembled those found in a roughly framed house, the Casavant products looked like fine furniture, inside and out.

One generally gets what one pays for.

> *"Many congregations . . . Have purchased inferior instruments to their later regret.   The selection and purchase of the church organ is no place to economize when one considers the significant role of the organ in worship."*

LCA Commission on Worship (1964)