



Waterdown, St James
Phelps–Casavant, 1961
Pipe Scales

By Blair Batty

Forward

I am a retired organbuilder. I learned to play the organ in the 1960's on the local romantic organs with their Melodias and Dulcianas. My favourite music was JS Bach, but it never sounded right. It was muddy and dull, even with the supers.

But as I got my older and got my own car, I explored further afield. I discovered a small 9-rank Gabriel Kney organ. It was my first experience of a neobaroque organ, and I fell in love for the first time. All of a sudden, I could hear the polyphony, and the glorious chiff. My favourite stop became the Larigot.

Then I found the big Phelps/Casavant 3 manual tracker organ at First St Andrews in London. I had found the finest organ in (my little) world, and it made Bach Glorious. I loved neobaroque organs. But - a decade later I took a study trip to Northern Germany to visit and study real Baroque organs. I was horrified to find that old Arp Schnitger got it all wrong; his organs sound nothing like a Phelps!

Shortly after that, I went to work for some modern tracker builders that further corrupted me. I learned that the neobaroque organ was a reaction against the Romantic organ. But like all reformers, the neoBaroquists went too far and got lots of things wrong. They were wonderful organs, that could play Bach beautifully, but the organs weren't quite historical.

By 1991, I had my own organbuilding company. We took a job cleaning and restoring the neobaroque 1961 Phelps/Casavant organ in Waterdown, On. To learn more about the Phelps type of organ, I used that opportunity to carefully examine the instrument and pipework. This booklet contains my notes.

If you are new to scaling, I recommend: <http://www.blairbatty.ca/tonal.html#scales>

Do contact me, if you have any comments, corrections, sources or questions. I won't be offended.

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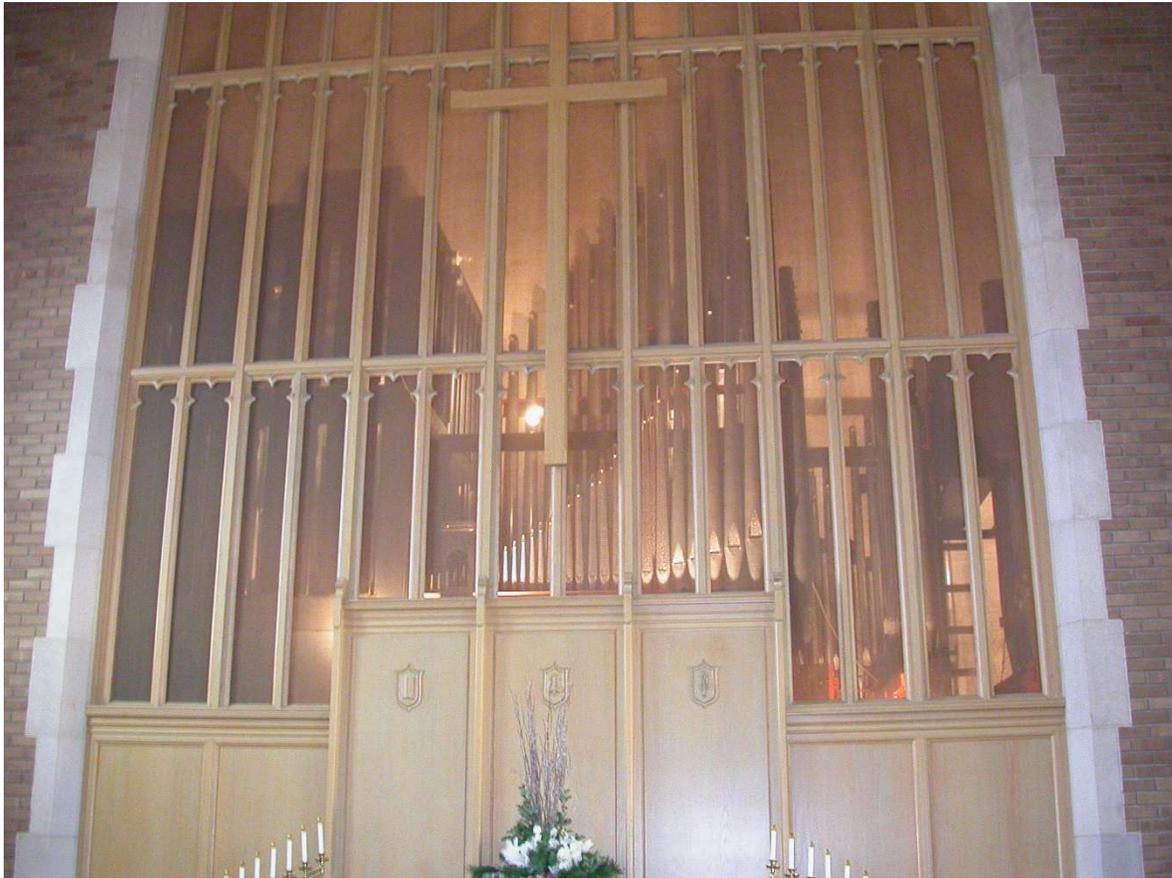
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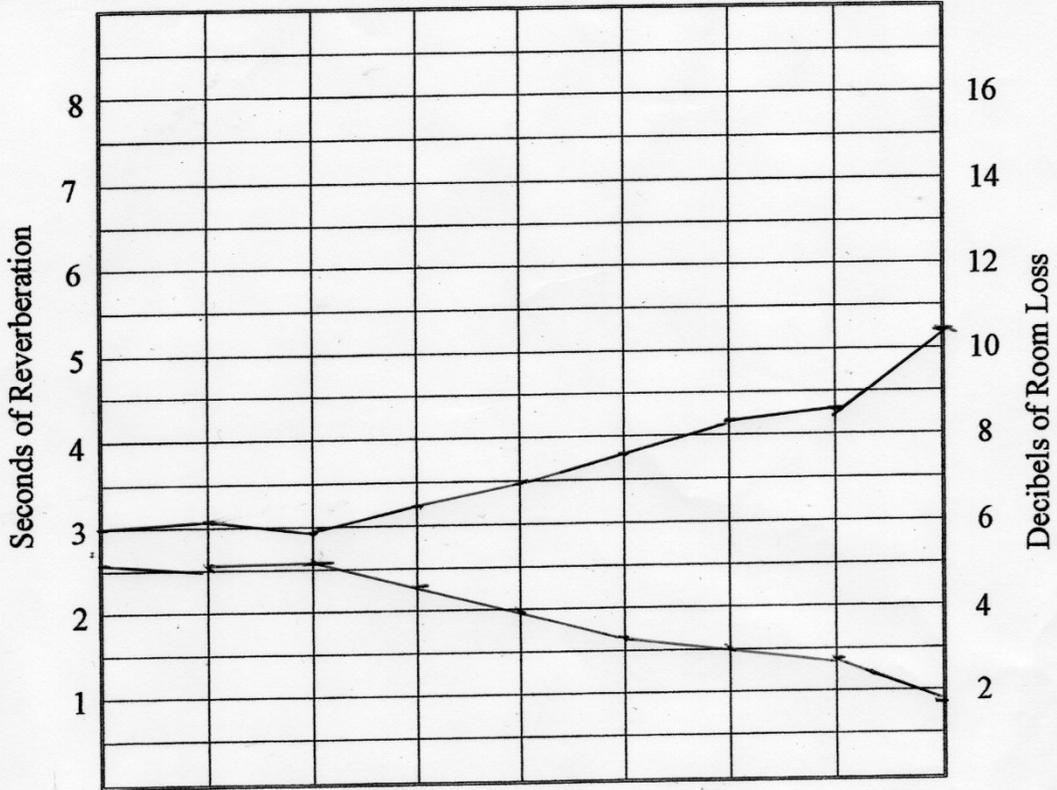
Waterdown St James United Church

Phelps – Casavant – 991, op2665

With the chamber lights on you can see the pipes thru the screen.

Pegal: 7.3dB
500 hz

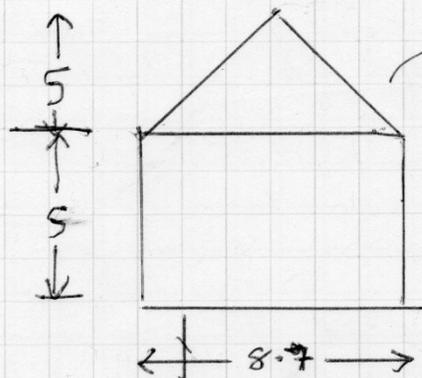
Room Acoustic Analysis



Hertz	31.5	63 (8')	125 (4')	250 (2')	500 (1')	1000	2000	4000	8000
Seconds	2.6	2.5	2.6	2.3	2	1.7	1.5	1.4	0.9
db	5.9	6.1	5.9	6.4	7	7.8	8.3	8.6	10.5
Sabians									

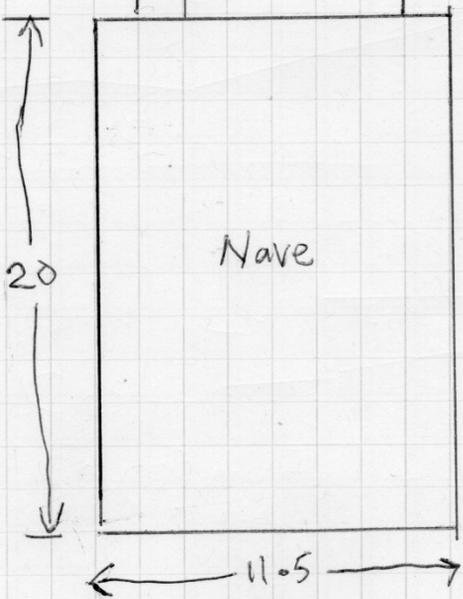
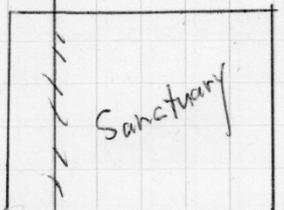
Church: St James United	Volume m ³ : 3125
City: Waterdown	Seating area m ² : 154
Date measured: 2011	Organ: $V/3/Seating^2 = 3125/167 = 18.7$

Volume of Church in Cubic Metres



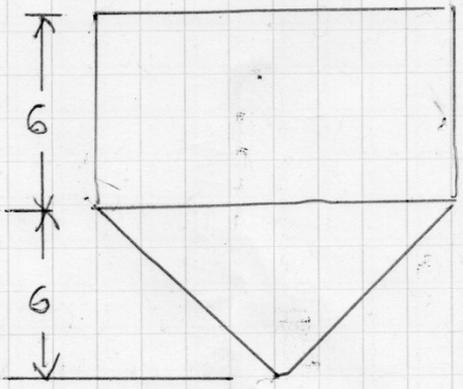
$$8.5 \times 8.7 \times \frac{5}{2} = 185$$

$$8.5 \times 8.7 \times 5 = \frac{370}{555}$$



$$20 \times 11.5 \times 6 = \frac{1380}{555}$$

$$20 \times 11.5 \times \frac{6}{2} = \frac{690}{3125 \text{ m}^3}$$



Stoplist

Great

16'	Nachthorn Gedackt	(pedal)
8'	Principal	M-11
8'	Spitzflote	M-11
4'	Octave	M-12
4'	Koppelflote	B-15
2'	Superoctave	
IV	Furniture	
	Swell to Great	

Swell

8'	Rohrflote	
8'	Salicional	M-11
8'	Voix Celeste	M-11
4'	Principal	M-12
2'	Waldflote	
1-1/3'	Klein Nasat	
II	Sesquialtera	
8'	Trompet	
4'	Hautbois	

Pedal

16'	Violone	M-11
16'	Nachthorn Gedackt	metal (Gt)
8'	Spitz Principal	M-11
8'	Gedackt	(from Nach Ged)
4'	Principal Italian	
16'	Posaune	

Couplers

Great to Pedal

Swell to Pedal 8 & 4

Accessories

Wind Pressures

There was some ambiguity in the wind pressures because these early schwimmers were not stable.

• Main bellows	74mm	3 ¼"	740pa
• Gt schwimmer	54mm	2 ¼"	560pa
• Sw schwimmers	63mm	2 ½"	640pa
• Bourdon #1-12	60mm	2 ½"	600pa
• Pedal schwimmer	65mm	2 ¾"	650pa

Description of Measurements

If you are not familiar with scaling measurements, I recommend you checkout my book of Scaling. It is available for free download from my website <http://www.blairbatty.ca/tonal.html#scales>. I typically measure every “c” and “f#” pipe, to understand how the dimensions of the pipes change, throughout the compass, from bass to treble.

Diameter: This is the inside diameter of the pipe, measured in millimeters.

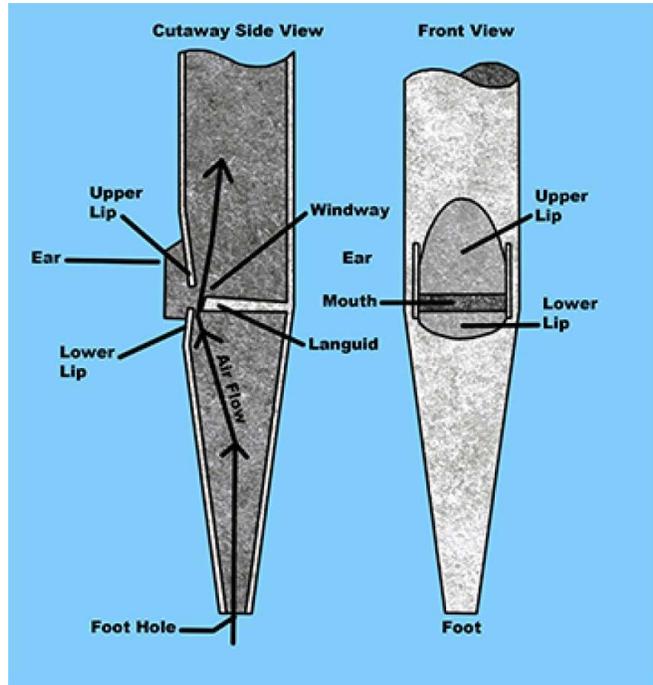
Mouthwidth: width of the mouth in millimeters.

Cutup: is distance between the upper and lower lips, in millimeters.

Windway: is the width of the slit of the windway, in millimeters.

Toehole: Is the diameter of the wind hole in the bottom of the foot, in millimeters.

Foot WP: Is the windpressure inside the foot of the pipe, measured in Pascal. Ten Pascal = ~1 millimeter watercolumn.



Calculations

Not everything was measured. Some of the numbers written down here were calculated from the measurements.

Topfer NM: The diameter, mouthwidth and cutup measurements were converted to Topfer Normmeasure and graphed.

Mouthwidth and cutups: are commonly described as fractions (e.g. $\frac{1}{4}$ mouthwidth, $\frac{1}{4}$ cutup). So, these fractions were also calculated.

Foot wp %: is $(\text{footpressure}/\text{chestpressure}) * 100$; another interesting reference.

Dr Hartmut Ising developed a formula to show how well the mouth matches the resonator. It provides an intonation number (I), a dimensionless value that represents a pipe's timbre and efficiency.

An Ising of 2 is an ideal match between the mouth and the resonator (*but not necessarily the best sound*). The pipe works most efficiently. For a given frequency, what Ising requires is the cutup, and the amount of energy input.

The Ising number provides a useful reference point. But you need some experience to make sense of the numbers. As Ising numbers get larger, the sound gets brighter;

- I=1.4 is typical for a Stopped Diapason.
- I=2 is a typical Diapason.
- I=3 makes a good string.

dB 3pf: Is the theoretical, nearfield, dB loudness of 3 adjacent pipes simultaneously played.

What do the Numbers Tell Us?

Some people, like I, enjoy measuring the various dimensions of the pipes in an organ, and generating various charts and graphs of that data. We do that to discover how the original designer and voicer scaled and manipulated the pipes, to arrive at the sound they wanted.

In very simplistic terms, scaling and voicing can be described in this way:

- Diameter determines the loudness of the fundamental of the pipe.
- Cutup fine-tunes the harmonic content.
- Toehole/mouthwidth/windway fine-tunes the loudness.

Of course, it's not that simple. For example, you can increase the scale of the pipe, which would increase the loudness of the fundamental (*and will also make the tone brighter*). Then by reducing the toehole size which reduces the wind and loudness, and by using a lower cutup to reduce the brightness you can approximate the original pipes sound. But it is not identical, change has consequence.

We are interested in this Phelps/Casavant because his voicing style was very different to previous Casavant organs. He liked low cutups, lower wind pressure, open toes and narrow windways. This had dramatic influence on how the organ sound. Low cutups gave a brighter sound. Lower chest wind pressures required larger toe openings, to keep equivalent wind flows. Narrower flues required higher windpressure in the foot to keep equivalent wind flows.

Loudness and Voicing

Loudness is determined by the energy of the wind. The greater the volume and pressure of the wind blowing the pipe, the louder the pipe is. The scale and mouth width of the pipe is fixed by the pipemaker. But the voicer can adjust the loudness by regulating the windchest wind pressure, the toe hole and the windway.

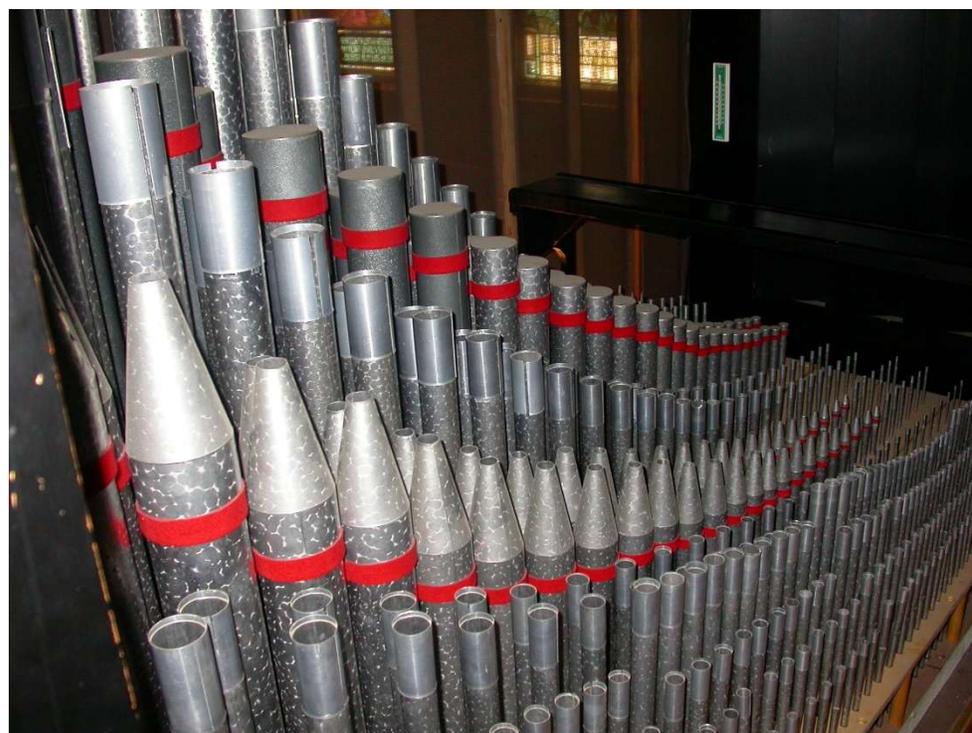
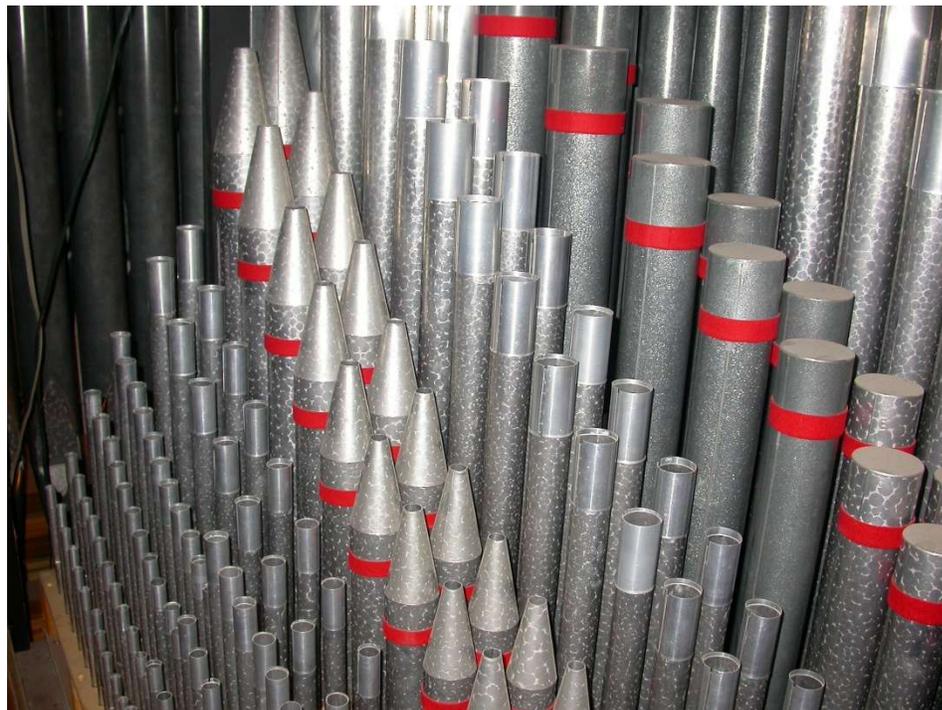
The foot of the pipe is essentially a tube that conducts wind from the chest to the mouth of the pipe. The foot has two constrictions that the voicer can use to regulate the flow of air through the foot. By opening and closing the tip of the for (the toehole) the voicer can control the airflow in the pipe. The foot wind pressure is the pressure in the foot, between the two constrictions.

The other constriction is the narrow, rectangular slit at the mouth, called the flue or windway. This slit blows a ribbon of air out of the foot towards the upper lip.

Narrow windways, higher foot pressures and no nixs, promoted attack transients, which the Victorians called speech defects, but neoBaroque called a delightful chiff.

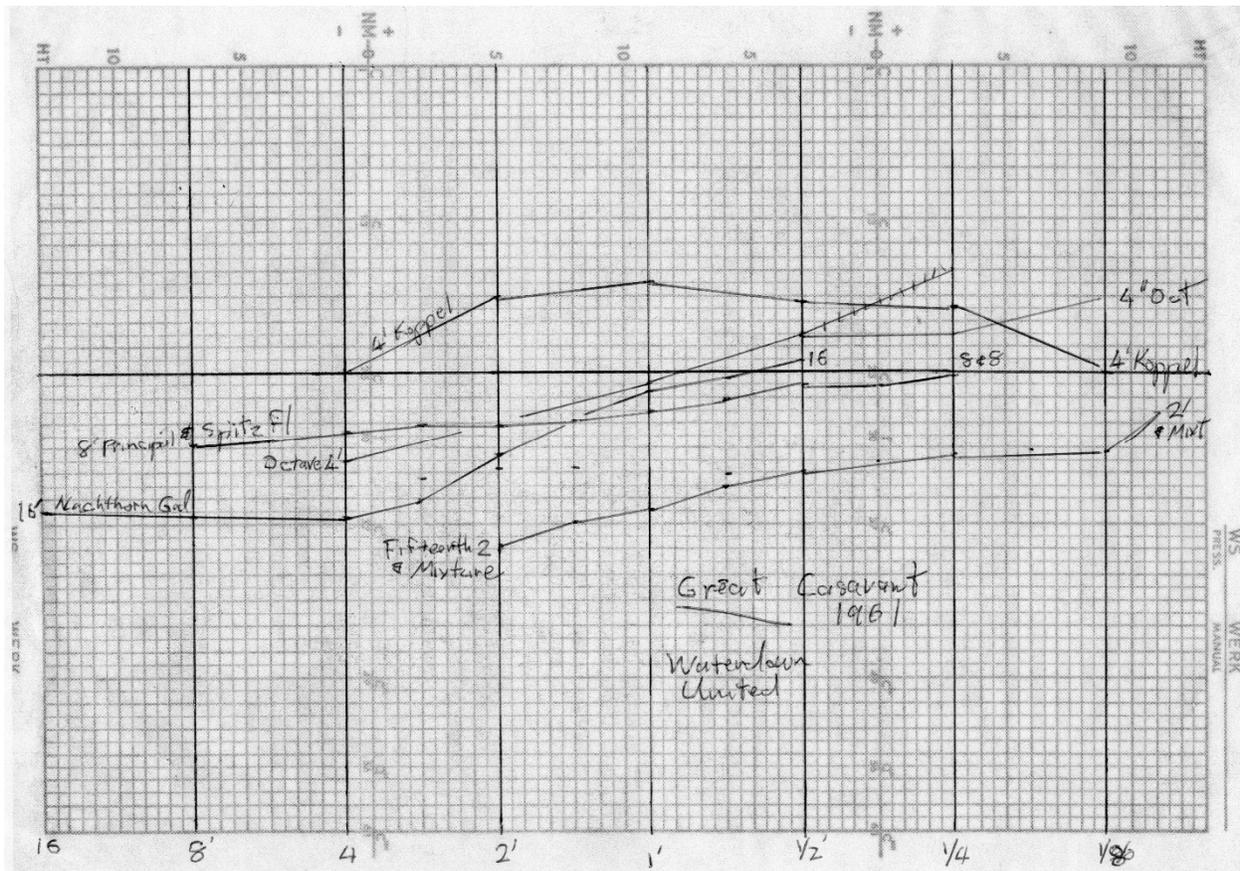
Phelps' organs have a bright, transparent, articulate sound. His pipe diameters (*scales*) are quite normal. His voicing style comes from his use of low cutups, open toes, narrow windways and his use of low chest pressures - high foot pressures.

The Great Organ



Generously laid out with easy access for tuning. Beautifully made spotted metal (from 4' C) pipework. All pipes got tuning sleeves; no slots or tuning scrolls except for the reeds. Notice the huge scaled stopped metal Nachthorn Gedackt 16', and how the Koppelflute 4' has open tops to bottom C.

Great Division



Great

16'	Nachthorn Gedackt	(pedal)
8'	Principal	M-11
8'	Spitzflote	M-11
4'	Octave	M-12
4'	Koppelflote	B-15
2'	Superoctave	
IV	Furniture	

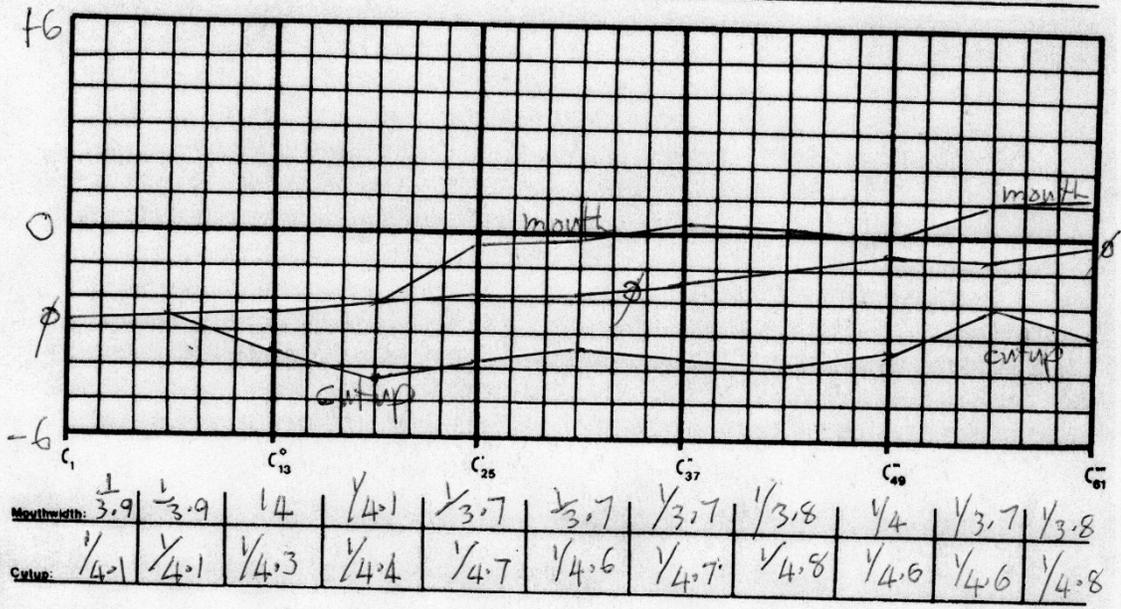
This is another reedless Great, typical of the period. The Nachthorn Gedackt 16' is an enormous scale, but moderated with 2/9th mouths. It doesn't overwhelm the Great, yet still provides adequate support, substituting for a Pedal Bourdon 16'. The Octave 4' becomes huge in the treble, copying what Harrison did at Skinners. The Koppel flute 4' spoke poorly in the bottom octave, where it should have been stopped. The two 8' stops shared the same scale. The fifteen and Mixture also had the same scale.

The scaling was generally good, despite a quirky stoplist. Though the pipework could benefit from raising some cutups. This is a very early Phelps at Casavant, where both were finding their way, working together. The Phelps style must have been quite a shock for Casavant traditionalists. Some ranks have very open toes and very narrow windways, prone to dust collection.

A. B. Batty

Stop: Principal 8 Div. 6t
 Wind pressure: 560 Pitch: _____
 Description of site & organ: _____

Builder: Casavant Date: 1961
 Church: Waterdown



	ACTUAL MEASURE										
	C'	F#	C	F#	C'	F#	C''	F#	C'''	F#'''	C''''
throat											
depth/dia	138	108	83.5	66	50.8	39	30.8	24.3	19.2	14.6	11.5
width											
mouthwidth	112	86	66	51	42.6	33	26	20	15.2	12.3	9.5
cutup	27	21	15.5	11.6	9.1	7.2	5.5	4.2	3.3	2.7	2
windway	1.7	.9	.6	.55	.35	.35	.3	.2	.25	.25	.25
toe d	14	9.5	8	8	8	6.8	6.5	6.7	6.7	4.2	3.2
toe X	1.2	.9	1	1	1.1	.95	1.02	1.04	1.01	1.01	1
Foot Pa	325	260	380	440	520	470	510	530	530	505	500
foot up %	58%	46%	68%	79%	93%	84%	91%	95%	95%	90%	89%
dB 3pt	82	80	79	79	78	78	76	76	77	78	78
I sing	2.4	1.9	2	2.3	2	2	1.7	1.8	2	1.9	2.1
metal thick	1.4	1.2	$\frac{.9}{1.3}$	$\frac{.85}{1.2}$	$\frac{.7}{1}$	$\frac{.6}{.9}$	$\frac{.5}{.8}$	$\frac{.5}{.8}$	$\frac{.5}{.8}$	$\frac{.4}{.6}$	$\frac{.4}{.6}$
body length											
Body/foot thickness											
Langwid											

Collector: _____ Material: ears #29
1.12 Zinc 13t Spot

A. B. Batty

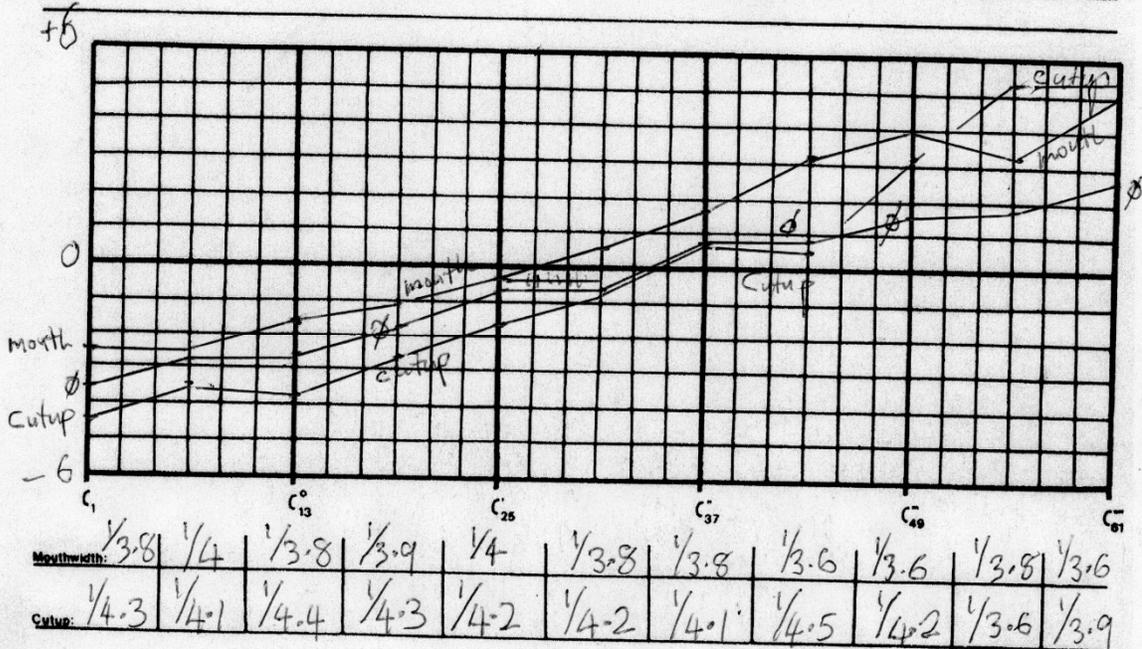
Stop: Octave 4' Div: 6t

Builder: Casavant Date: 1961

Wind pressure: 560 pa Pitch: _____

Church: Waterdown

Description of site & organ: _____



ACTUAL MEASURE

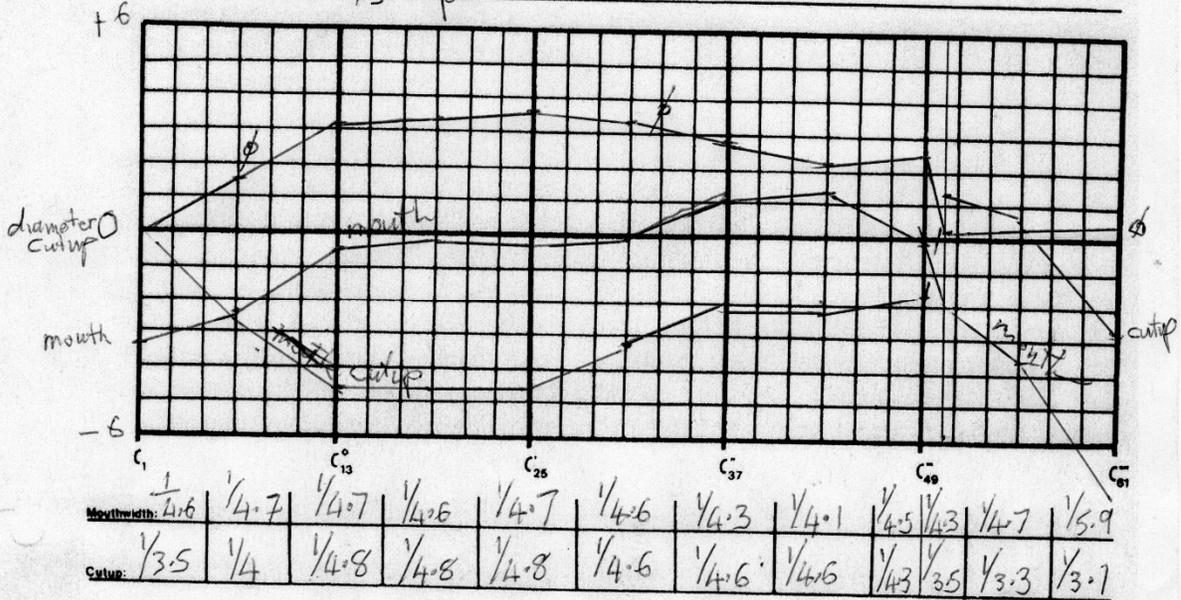
	C	F#	C	F#	C	F#	C	F#	C	F#	C
throat											
depth/dia	79	63	49	39	31.6	24.6	20	15.5	12.4	9.6	7.7
width											
mouthwidth	65	49.7	40	31.7	25	20.2	16.5	13.5	10.8	8	6.7
cutup	15	12	9.1	7.4	6	4.8	4	3	2.6	2.2	1.7
windway	.6	.6	.4	.3	.25	.25	.25	.2	.3	.2	.2
toe d	8.3	7.7	6.1	6.6	6.9	6.7	5.2	4.8	4	4.1	2.7
toe X	.95	1	.9	1.1	1.2	1.4	1.2	1.2	1.1	1.3	1
foot Pa	330	370	415	490	525	525	510	510	490	525	500
foot up %	59%	66%	74%	88%	94%	94%	91%	91%	88%	91%	89%
dB 3pt	78.4	78.8	77.6	77.4	77.3	78	79.1	78.6	81.4	80	81
I sing	2	2.1	2	1.8	1.6	1.6	1.5	1.4	1.5	1.1	1.2
metal thick											
body length											
Languit											

Collector: _____

Material: Spett ears to 37

A. B. Batty

Stop: Koppel flote 4' Div: 64 Builder: Casavant Date: 1961
 Windressure: 560 Pitch: _____ Church: Waterdown
 Description of site & organ: ears to 43, Koppel 1-49, Spitz 50-61, no mix
Bottom octave speaks poorly
1/3 taper



	C ^I	F#	C	F#	C ^I	F#	C ^I	F#	C ^{III}	F# ^{III}	C ^{IV}	
top	31	26.4	20.4	17.6	15.3	11.7	9	6.7	3.8	2.8	6.2	4.7
bottom	93	76	63	49	38.3	29	22	16.5	12.8	11	9	7
bottom taper	1:33	1:35	1:32	1:36	1:4	1:4	1:4	1:4	1:3	1:3	1:3	1:3
mouth width	63	50.5	42.5	33.2	25.5	19.7	16	12.5	7.9	6.8	6	4.7
cutup	18	12.5	8.8	6.9	5.3	4.3	3.5	2.7	2.1	2.3	1.8	1.2
windway	.2	.2	.2	.2	.2	.2	.2	.2	.2	.2	.2	.2
toe d	15.3	14.4	12.8	11	10	10	7.8	8	6.3	6.8	5.5	4.5
toe X												
foes		open	to much	for	chart							
foot Pa	530	540	540	530	540	540						
foot wp %	95%	96%	96%	95%	96%	96%						
dB 3pt	75.5	75.2	75.6	75.8	75.8	76.1						
T sim	1.1	1.4	1.7	1.7	1.8	1.7						
body	165	127	115	98	83	65	50	33	20.5			
body length	708	443	267	162	99	66.2	48	31	22			
cap	84	70	56	47	38.5	29	22	16	13.5			

Collector _____

Material: spotted metal

A. B. Batty

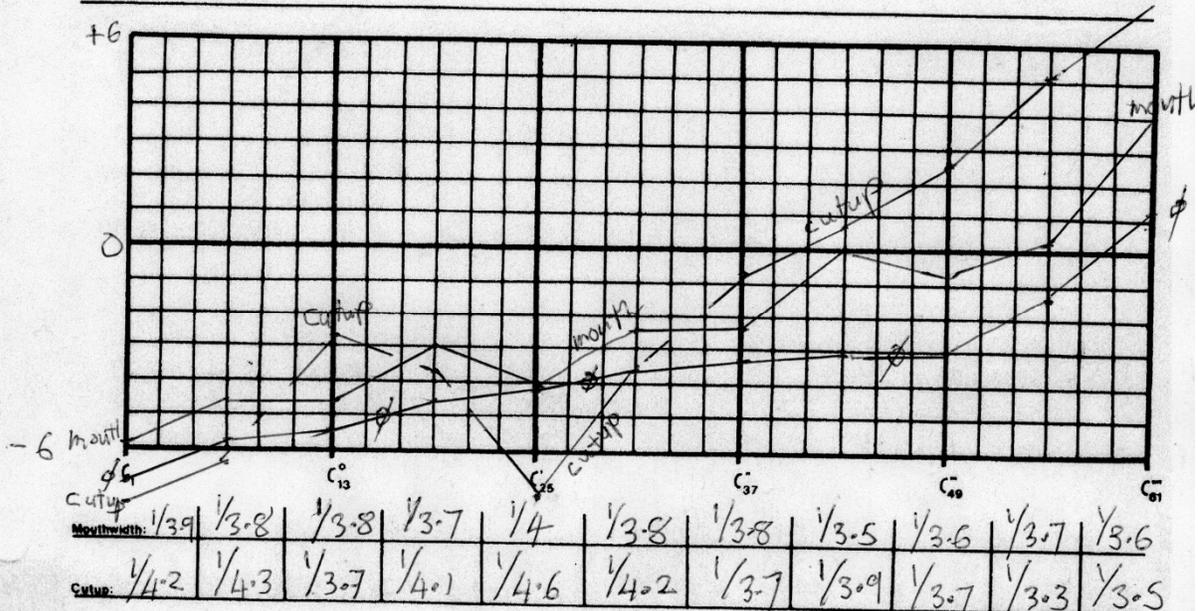
Site: Fifteenth 2' Div: GT

Builder: Casavant Date: 1961

Windmeasure: 560 Pitch: _____

Church: Waterdown

Description of site & organ: _____



ACTUAL MEASURE

	C	F#	C	F#	C	F#	C	F#	C	F#	C
throat	4.1	3.3	25.5	20.5	16.3	12.8	10	7.8	6	5	4.3
depth/dec											
width											
mouthwidth	33.4	27.2	20.9	17.4	12.8	10.6	8.2	7	5.2	4.2	3.8
cutup	7.9	6.3	5.7	4.2	2.8	2.5	2.2	1.8	1.5	1.3	1.1
windway	0.2	0.15	0.1	0.15	0.15	0.1	0.15	0.1	0.1	0.1	0.1
toe &	7	6.5	5.5	4.8	3.3	4.4	3	2.2	2.2	2	2.2
toe X	1.1	1.2	1.1	1.1	0.9	1.2	0.9	0.8			
foot Pa	490	520	520	520	440	500	480	450			
foot up %	88%	93%	93%	93%	79%	82%	86%	80%			
dB 3pt	72	71.8	71	73.3	71.5	71.7	74.3	73.9			
I sing	1.9	1.7	1.1	1.5	1	1.3	1.7	1			
metal thick											
body length											
Languid											

Collector: _____

Material: Spot 1-12 ears

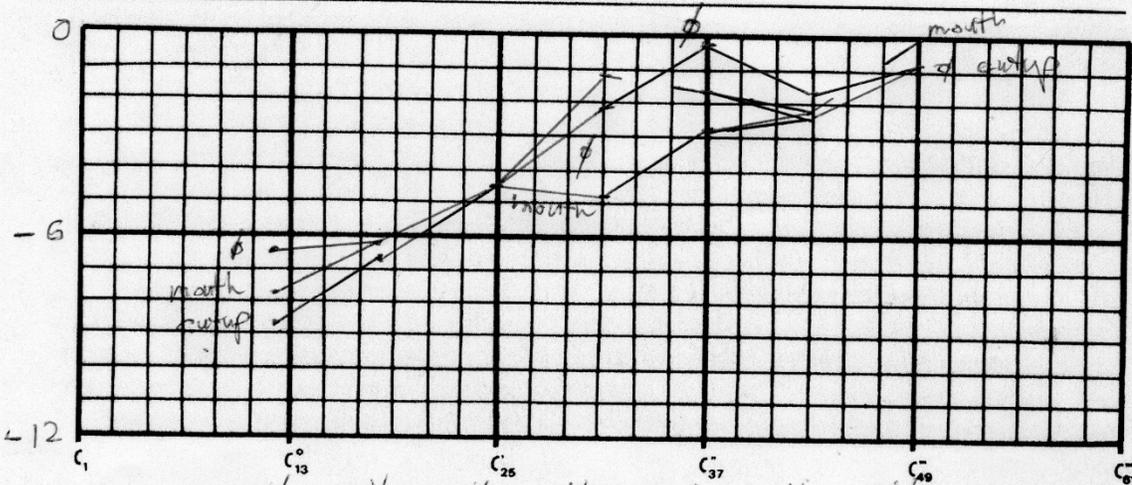
The Great Mixture

A. B. Batty

Stop: 2' of Mixture Div: 6" ft
 Wind pressure: 560 psf Pitch: 2 1/4"

Builder: Casavant Date: 1961
 Church: Waterdown

Description of site & organ:



Mouthwidth:	1/4.3	1/4	1/4	1/4.5	1/4.3	1/4.1	1/3.9	
Cutup:	1/4.1	1/4.1	1/3.9	1/3.4	1/4.3	1/3.9	1/4.1	

ACTUAL MEASURE

	C	F#	B	F°	C'	F#'	C''	F#''	C'''	F#'''	C''''
--	---	----	---	----	----	-----	-----	------	------	-------	-------

throat depth/dia			26	20.2	16	13.6	11.5	8.2	6.6	5	
width			19	16	12.6	9.5	8.5	6.3	5.4	5	
mouthwidth			19	16	12.6	9.5	8.5	6.3	5.4	5	
cutup			4.6	3.9	3.2	2.8	2	1.6	1.3	1.1	
windway			.35	.4	.3	.25	.2	.3	.3	.3	
toe of foot Pa			3.2	2.8	2.6	3	2.5	2.4	1.8	2.3	
toe X			0.65	0.65	0.6	0.8	0.7	0.8	0.75		
foot Pa			500	465	440	500	490	5			
foot up %			48%	43%	38%	75%	71%	70%	61%		
d/B 3 pf			71.8	73.7	73.9	74.9	74.9	76.4	77.6		
I sing			2.2	2	1.4	1.6	1.7	2	1.8		
metal thick											
body length											
Languid											

Collector:

Material:

T

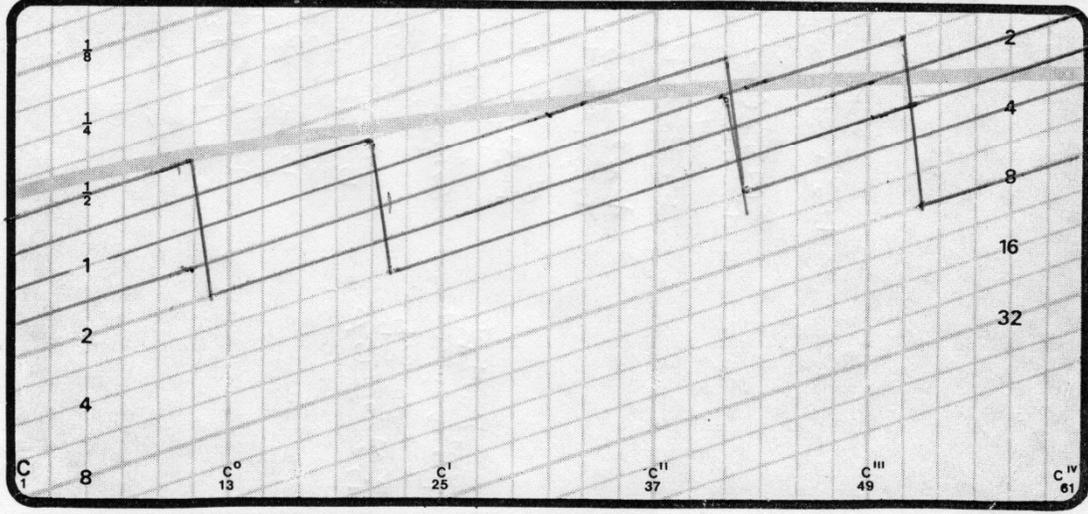
Mixture

Stop _____ Div 6+ Church Waterdown United

Builder _____ Opus _____ Year _____ Scale _____ Wind _____ Pa. Seating Area _____ m²

Vol. _____ m³ Rev. 500/1000 s -dB Room _____ Pitch _____ Hz. Seats _____ Vol./Seats _____

Misc. _____



Mixture Ranks

Note	C ₁	f#	C ₁₃	f ₀	C ₂₅	f ₀	C ₃₇	e:
Diameter	25	20.3	16.4	13	10.5	8.4	6.5	5.9
Mouthwidth	20	16	12.5	10	8.2	6.8	5.5	5
Cutup	4.7	3.8	3	2.4	2	1.9	1.3	1.2
Flue	.4	.3	.25	.3	.2	.2	.3	.2
Toe	3.7	3.2	2.6	2.4	2.2	2.3	2	1.6
Foot Pa.								
Foot % Chest Pa.								
Flue % Mouth								
dB.								
Ising								

Note	C ₁	f ₀	C ₁₃	g#
Diameter	19.5	15.6	12.5	9.2
Mouthwidth	13.5	10.8	8.7	7
Cutup	3.3	2.7	2.3	1.8
Flue	.3	.35	.3	.25
Toe	2.8	2.3	2.5	1.8
Foot Pa.				
Foot % Chest Pa.				
Flue % Mouth				
dB.				
Ising				

2005
XD

GT Mixt
Waterdown
United

C lost

C
F#
480
500

Note	B12	f019	c25	f031	c11	f0	c11	f0	as11
Diameter	26	20.2	16	13.6	11.5	8.2	6.6	5	4.7
Mouthwidth	19	16	12.6	9.5	8.5	6.3	5.4	4.2	3.6
Cutup	4.6	3.9	3.2	2.8	2	.16	1.3	1.1	.9
Flue	.35	.4	.3	.25	.2	.316	.3	.2	.3
Toe	3.2	2.8	2.6	3	2.5	2.4	1.8	2.3	2
Foot Pa.	270	240	200	420	400	390	340		
Foot % Chest Pa.	500	465	440	500	490	500			
Flue % Mouth									
dB.									
Ising									

2 2/3

Note	A22	C25	F#	C37	f0	C49	f0	C61	d0	f5	C61
Diameter	21.6	19.4	15.8	12.4	10.2	8	6.4	4.9	14.3	13	10.2
Mouthwidth	15.6	13.6	11	8.7	7.2	5.5	4.9	4	11.2	10	8
Cutup	3.9	3.4	2.8	2.3	1.9	1.3	1.2	1.1	3	2.3	2
Flue	.3	.3	.3	.25	.25	.25	.3	.3	.3	.3	.2
Toe	2.8	2.5	2.8	2.7	2.5	2.2	2.4	2	2.8	2.7	2.5
Foot Pa.											
Foot % Chest Pa.											
Flue % Mouth											
dB.											
Ising											

1/3

Note	C1	f0	C19	f5	C25	f5	C37	f0	d51
Diameter	30.5	24.4	13.2	15.7	12.5	10.2	8	6.1	4.26
Mouthwidth	20.3	16.5	13.2	10.4	9	7.5	6	5	4
Cutup	5.6	4.1	3.3	2.6	2.1	2	1.4	1.2	1
Flue	.3	.3	.3	.25	.2	.2	.2	.25	.2
Toe	3.2	3.3	2.8	2.3	2.3	2.5	2.2	2.1	1.7
Foot Pa.	280	300	220	280	375	450	420		
Foot % Chest Pa.									
Flue % Mouth									
dB.									
Ising									

2x1

Note	C1	f0	A#			F#	C49	f#	C61
Diameter	16.3	12.8	11.2			13.5	10.2	8.2	6.5
Mouthwidth	12.3	9.9	8.5			10.5	8.1	6.8	5
Cutup	3.2	2.4	2.2			2.7	2.2	1.6	1.3
Flue	.3	.3	.25			.3	.3	.25	.25
Toe	2.7	2.4	2.2			2.5	2.5	2.3	2
Foot Pa.									
Foot % Chest Pa.									
Flue % Mouth									
dB.									
Ising									

8'

4'

Mixture Ranks

Note	C1	f#	C13	fD	C25	f0	C37	e:
Diameter	25	20.3	16.4	13	10.5	8.4	6.5	5.9
Mouthwidth	20	16	12.5	10	8.2	6.8	5.5	5
Cutup	4.7	3.8	3	2.4	2	1.9	1.3	1.2
Flue	.4	.3	.25	.3	.2	.2	.3	.2
Toe	3.7	3.2	2.6	2.4	2.2	2.3	2	1.6
Foot Pa.								
Foot % Chest Pa.								
Flue % Mouth								
dB.								
Ising								

Note	C1	fD	C13	f#
Diameter	19.5	15.6	12.5	9.2
Mouthwidth	13.5	10.8	8.7	7
Cutup	3.3	2.7	2.3	1.8
Flue	.3	.35	.3	.25
Toe	2.8	2.3	2.5	1.8
Foot Pa.				
Foot % Chest Pa.				
Flue % Mouth				
dB.				
Ising				

The Swell Organ

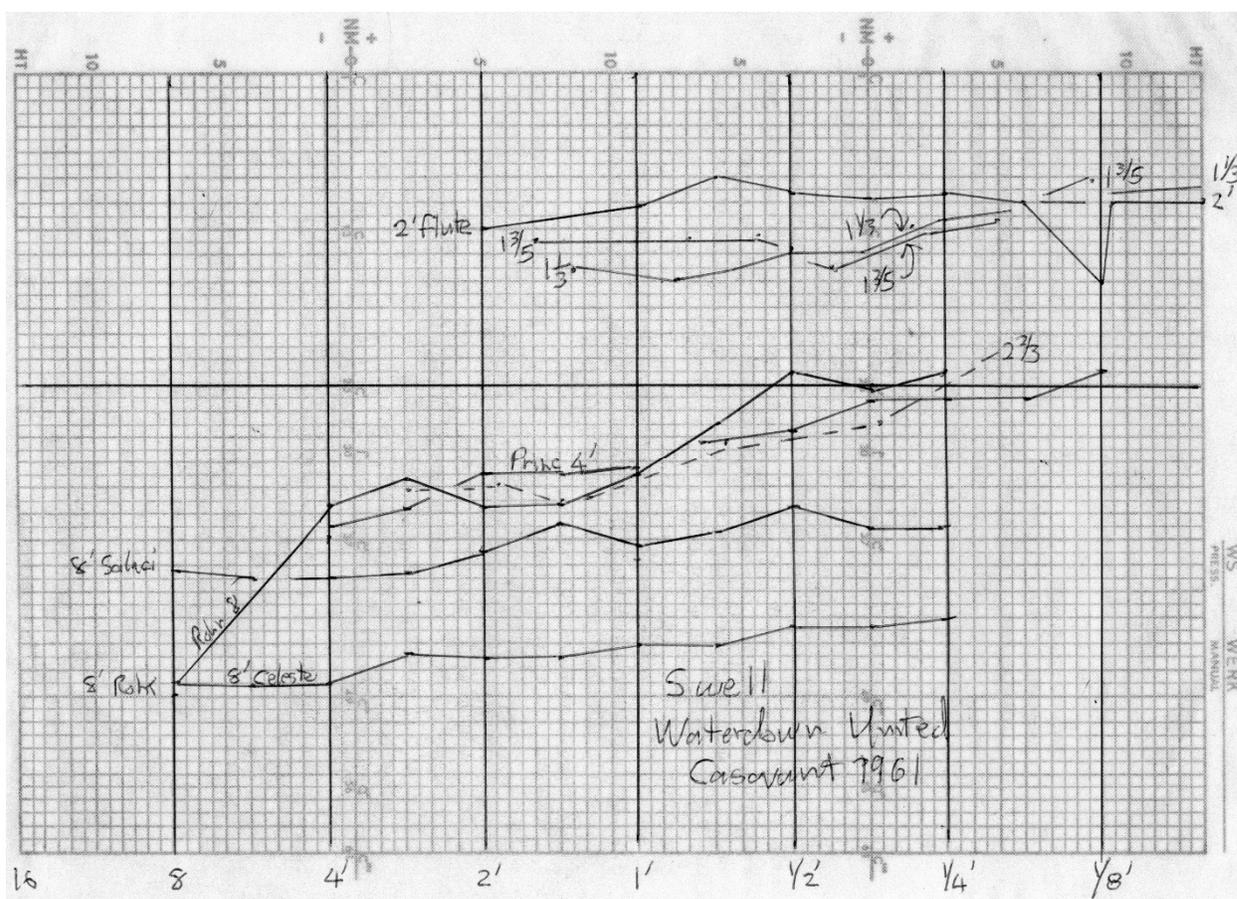


Above, you can see the Salicional 8', unslotted and rollers only in the bass. Going right, you see the Principal 4', a hidden Waldflöte 2' and the skinny Trumpette 8'.



The photo to the right shows the Oboe 4', Klein Nasat 1-1/3', II Sesquialtera, Rohrflöte 8' and the Celeste 8'

Swell Division



Swell

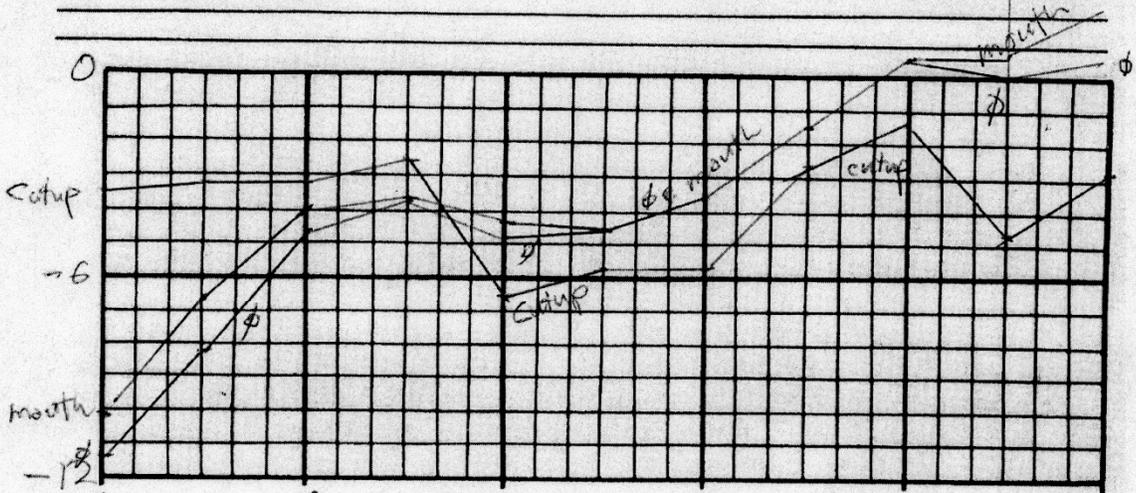
8'	Rohrflote	
8'	Salicional	M-11
8'	Voix Celeste	M-11
4'	Principal	M-12
2'	Waldflote	
1-1/3'	Klein Nasat	
II	Sesquialtera	
8'	Trompet	
4'	Hautbois	

Phelps didn't like strings, so the Salicional is actually a skinny Diapason, without slots or rollers. The 2-2/3' of the Sesquialtera is in the form of a Rohrflote. The Trumpet is very skinny, with narrow shallots and thin tongues, and resonators that are too short; very unstable.

Swell

A. B. Batty

Stop: Rohr #1 Div: SW Builder: Casavant Date: 1961
 Wind: 630 p.p.h. Pitch: Church: Waterdown
 Description of site & crane:



Mouth:	1/3.8	1/3.8	1/3.9	1/4	1/3.9	1/4	1/3.9	1/4	1/4.1	1/3.9	1/3.8
Cutup:	1/3	1/3.4	1/3.9	1/3.8	1/4.3	1/4.2	1/4.5	1/4.2	1/4.3	1/5	1/5

ACTUAL MEASURE

	C ¹	F ¹	C ¹⁰	F ¹⁰	C ²⁵	F ²⁵	C ³⁷	F ³⁷	C ⁴⁸	F ⁴⁸	C ⁵¹
throat depth/ dia	95	84	76	61	44.5	35	28	23.5	20	15	12
width											
mouth width	79	70	61	47.5	35.5	27.5	22.4	18.5	15.5	12	10
cutup	26.3	20.5	15.8	12.5	8.2	6.5	5	4.4	3.6	2.4	2
windway	.4	.35	.3	.3	.2	.2	.2	.2	.2	.2	.2
toe d	15	15	12.8	10.3	9.5	9.2	8.8	8.3	7.4	7	6
toe X	1.06x	1.06x	1.05x	1.03x	1.04x	1.06x	1.07x	1.07x	1.07	1.09x	1.07x
foot Pa	580	620	620	620	630	630	630	630	630	630	630
foot up %	97%	98%	98%	98%	100%	100%	100%	100%	100%	100%	100%
d/B 3 pf	74.6	75.7	76.4	76.6	73.5	73.8	74.3	75.9	77.2	76.3	77.7
I sing	1.9	1.9	1.8	1.8	2	2	2.1	1.8	1.7	2.2	2
metal thick											
body length											
chime d			19	14.5	11.5	8.2	6.6	5.6	4.5	3.5	2.5
length			153	118	90	68	50	38	24.5	15.5	9

Collector

1-12 zinc spott

A. B. Batty

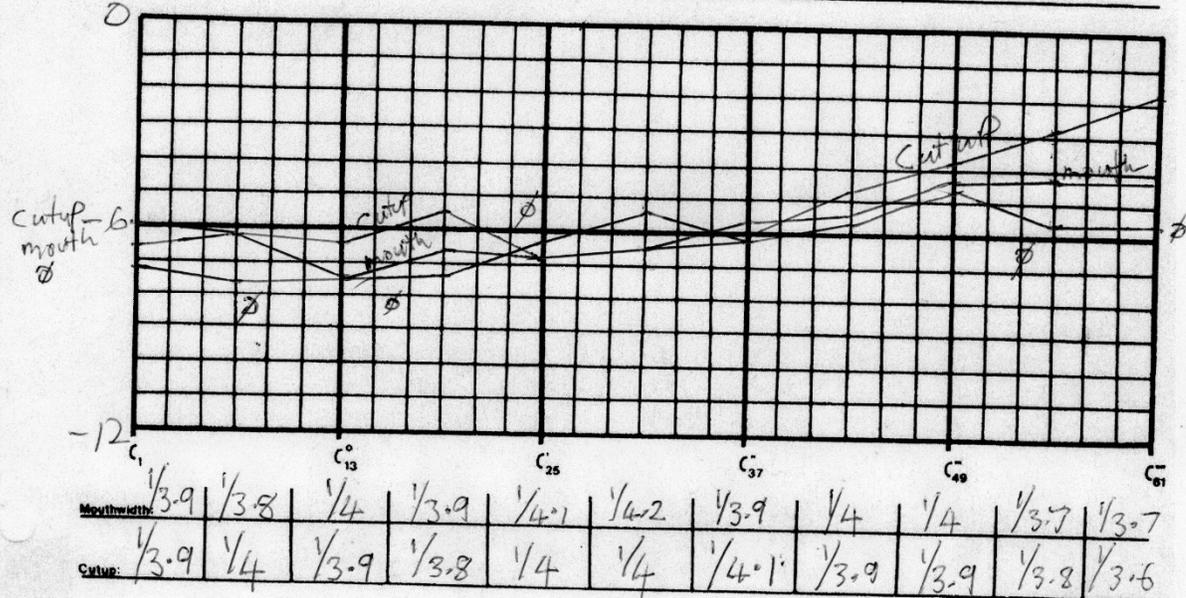
Stop: Salucional 8' Div: Sw

Builder: Casavant Date: 1961

Windpressure: 630 Pitch: _____

Church: Waterdown

Description of site & organ: _____
ears to 4th, 1-12 slotted, rollers to fix



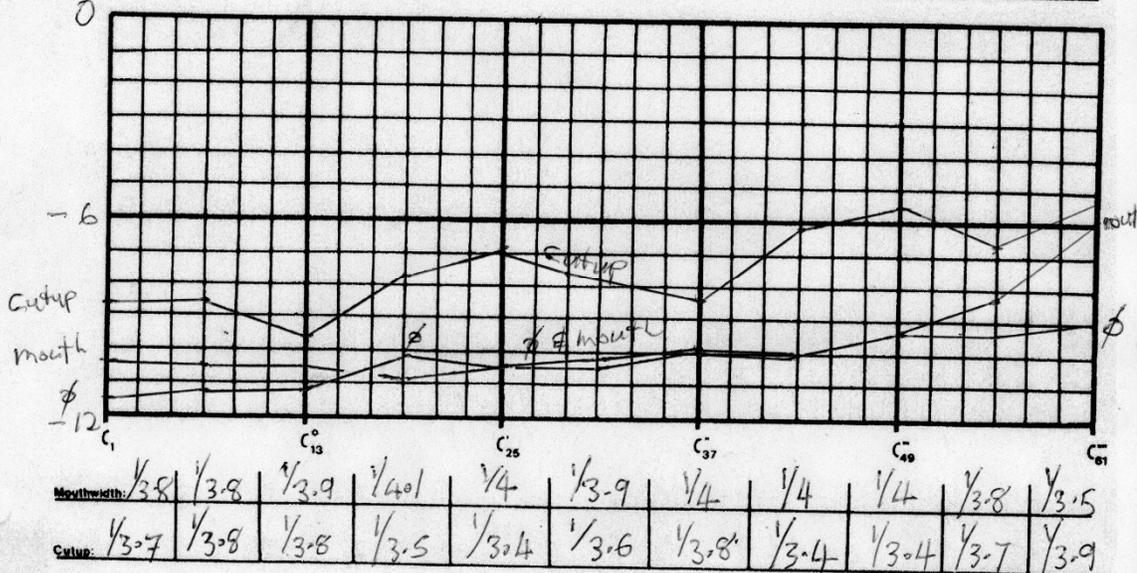
	ACTUAL MEASURE											
	C ⁱ	F [#]	C	F [#]	C ⁱ	F [#]	C ⁱⁱ	F [#]	C ⁱⁱⁱ	F [#]	C ^{iv}	
throat												
depth/dia	114	86	66.7	52	42	33.5	25	19.6	15.4	11.6	9	
width												
mouthwidth	91.5	72	53	42	32	25	20	15.5	12	9.8	7.6	
cutup	23.5	18	13.7	11	8	6.3	4.9	4	3.1	2.6	2.1	
windway	.8	.9	.4	.3	.3	.25	.25	.25	.2	.25	.25	
toe d	10	7.7	6.8	5.7	3.7	4	3.2	3.2	3	1.7	2.1	
toe X	.95	.8	.8	.8	.6	.7	.7	.75	.7	.5	.7	
foot Pa	280	180	450	490	400	500	465	510	570	340	400	
footwp %	44%	29%	71%	78%	63%	79%	74%	81%	90%	54%	63%	
d/B 3pt	76.9	76.6	74.5	74	73	73	73.3	73.9	73.3	74.3	75	
I sing	2.2	2	2.2	2	2	2.1	2	2.1	2	1.6	1.7	
metal thick												
body length												
Languid												
rollers	16	12	7									

Collector: _____ Material: 1-12 zinc, 13+ spotted

A. B. Batty

Stop: Celeste S' Div: Sw Builder: Casavant Date: 1961
 Windmeasure: 630 pa Pitch: _____ Church: _____
 Description of site & organ: ears to #49, Rollers to #35 1-12 zinc

 _____ Starts bottom C 1/2 _____



	ACTUAL MEASURE										
	C	F#	C	F#	C	F#	C	F#	C	F#	C
throat	95	73.5	57	46	35	27	21.5	16.4	13	10	7.8
depth/da											
width											
mouth width	78	60	46	35	27.5	21.5	17	13	10.2	8.2	7
cutup	21	16	12	10	8	6	4.5	3.8	3	2.2	1.9
windway	.8	.5	.3	.3	.2	.25	.2	.2	.3	.3	.3
toe φ	7	6	5	4	3.5	3	2.7	2.1	1.9	1.7	1.8
toe X	.8x	.7x	.7x	.6x	.7x	.6x	.6x	.5x	.5x	.5x	.6
foot Pa	150	220	370	315	360	275	400	340	310		
foot up %	24%	35%	59%	50%	57%	44%	63%	54%	70	49%	
d/B 3 pf	73	71.7	70.4	70.4	69.4	69.7	70	70			
I sing	1.9	1.9	2.1	1.8	1.6	1.7	2	1.7			
metal thick											
body length											
Langwid											
mouth roller	15.7	11.5	10	8	5.5	4					

Collector _____

Material: _____

A. B. Batty

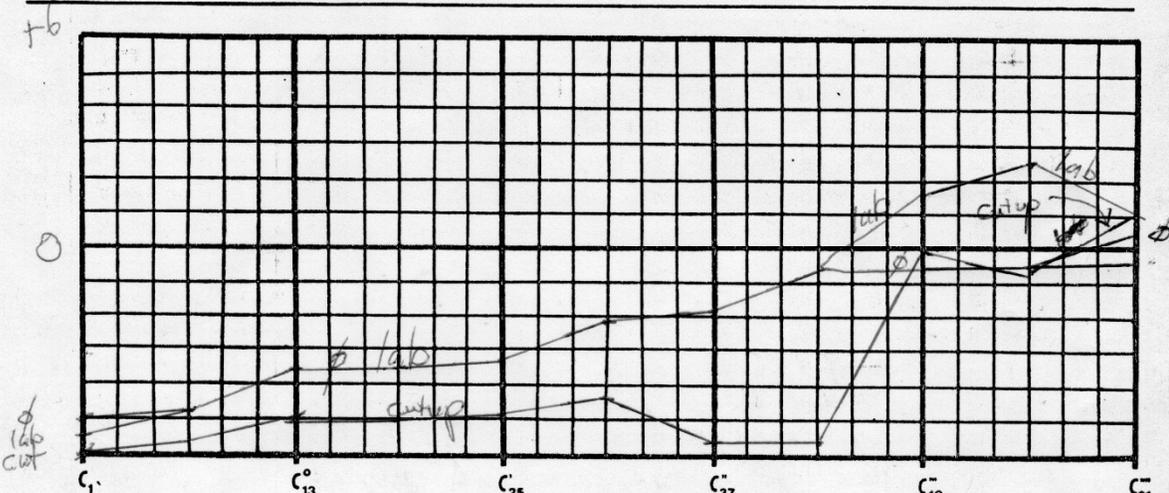
Stop: Principal 1' Div: SW

Builder: Casavant Date: 1961

Windpressure: 630 Pitch: _____

Church: Waterdown

Description of site & organ: _____



Mouthwidth:	1/4	1/4	1/4	1/4	1/4	1/4	1/4	1/3.9	1/3.6	1/3.5	1/3.9
Cutup:	1/4.1	1/4.3	1/4.2	1/4.3	1/4.4	1/4.7	1/4.09	1/4.03	1/4.6	1/4	

Pressure 45%

ACTUAL MEASURE	C1	C13	C25	C37	C49	C61
Top Diameter:	0.75x	0.8x	0.8x	0.9x	0.9x	0.7x
Diameter at Mouth:	58	47	36.2	28.3	23	18
Mouthwidth:	57	45.5	36.7	28.4	22.3	18
Cutup:	14	11	8.6	6.7	5.2	4.1
Metal Thickness:	0.8	0.8	0.6	0.5	0.4	0.4
Windway:	0.55	0.35	0.35	0.3	0.35	0.4
Lead:	70° x 3	70° x 2.3	70° x 2.3	70° x 2.1	70° x 1.8	70° x 1.7
Body Length:	1178	815	574	394	274	191
Toe Hole:	6.5	6.5	5.5	5	4.7	3.2
db 3rd:	75.9	75.4	76.1	76.3	76	76.8
F1:	2	2.1	2.2	2.3	2.3	2.2
Start Pa 300	470	500	510	560	430	400

Source of Data: _____ Material: _____

NOTES (ears, bears, slots, tuners, voicing, etc.) light feather mix

A. B. Batty

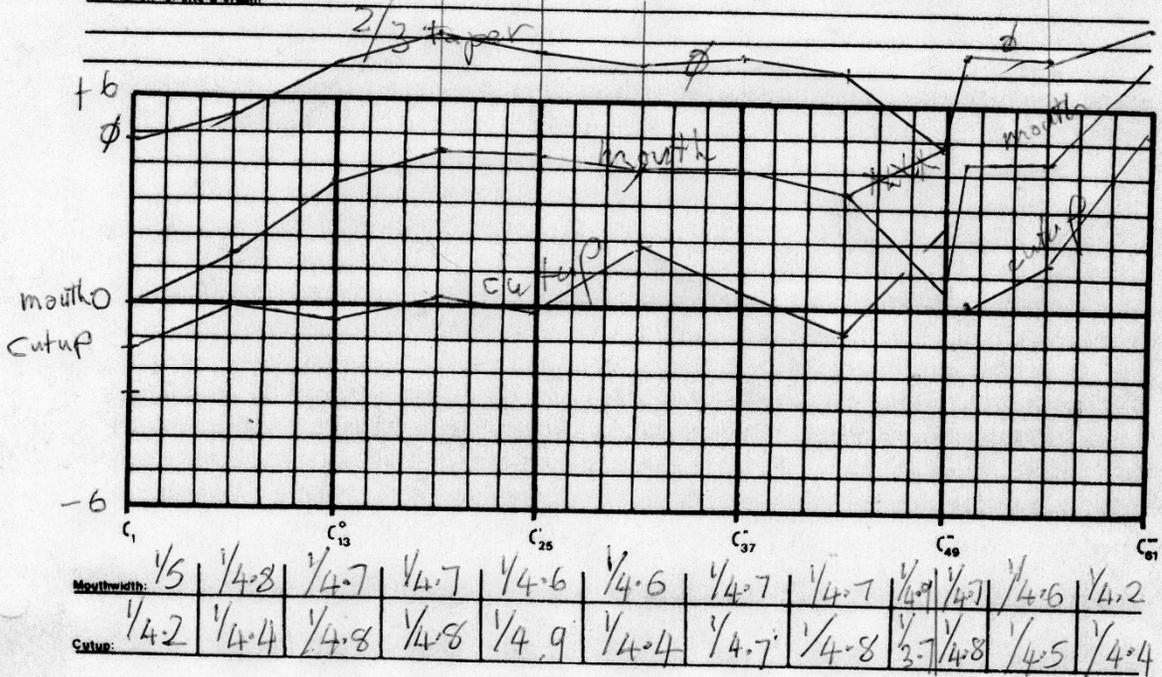
Step: 2' flute Div: SW

Builder: Casavant Date: 1961

Wind measure: 640 Pitch: _____

Church: Waterdown

Description of site & organ: _____



ACTUAL MEASURE

	C ₁	C ₁₃	C ₂₅	C ₃₇	C ₄₉	C ₆₁
throat	4.9	3.9	3.2	24.3	18.6	14.2
depth/dia	6.8	5.4	44.5	3.6	2.7	20.5
mouth width	15.12	15.73	15.68	15.67	15.69	15.69
cutup	10.2	8.3	6.3	5	3.8	3.2
windway	0.5	0.5	0.5	0.1	0.1	0.5
toe	11.8	11.4	9.6	9	9.2	7.2
toe X	1.4	1.6	1.4	1.5	1.8	1.6
foot Pa	640	640	640	640	640	620
foot up %	100%	100%	100%	100%	100%	97%
dB 3 pf	77	76.8	77.8	76.6	76.5	76.8
I sing	1.3	1.2	1.3	1	1.1	1
back taper	15.72					
metal thick						
back length						
Languid						

Collector: _____

Material: _____

A. B. Batty

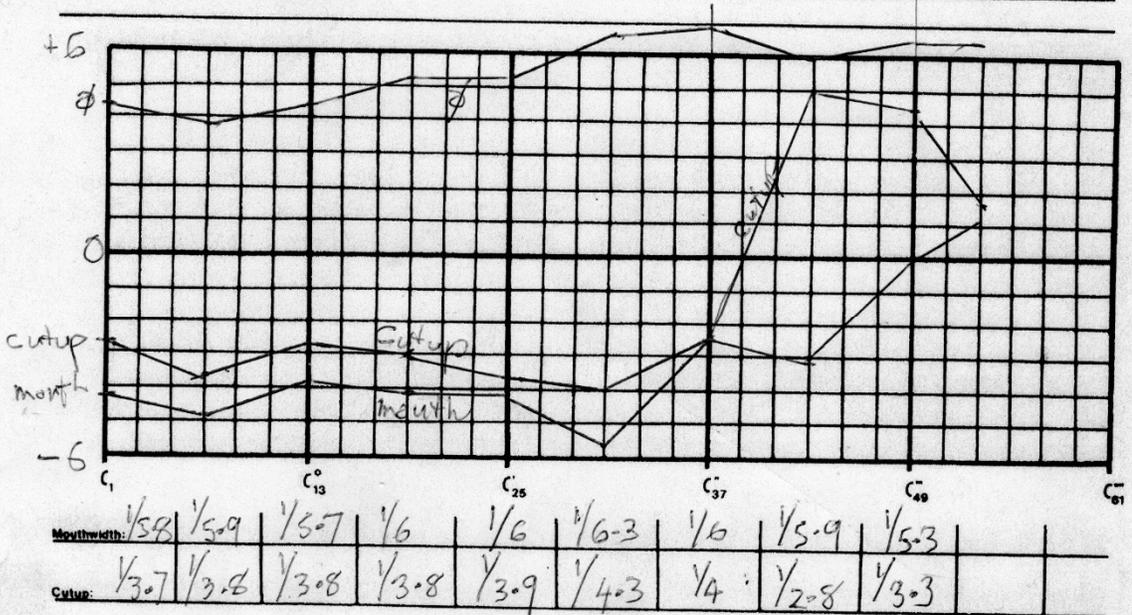
Site: Nazat 1/3 Div: Sw

Windressure: 630 Pitch: _____

Description of site & cross: _____

Builder: Consarant Date: 1961

Church: Waterdown



	ACTUAL MEASURE									
	C'	F#	C	F'	C'	F#'	C''	F#''	C'''	Notes
throat										
depth/dia	29	37	29	23.3	18	12.7	11.5	8.5	6.7	5.6
width										
mouthwidth	26.5	19.8	16	12.2	9.4	7.3	6	4.5	4	3.5
cutup	7.1	5.2	4.2	3.2	2.4	1.7	1.5	1.6	1.2	.9
windway	.1	.1	.1	.1	.13	.1	.1	.1	.1	.1
toe d	11.2	11.2	10	9.4	8.5	7.5	6.5	5.4	4.8	4.2
toe X	1.6x	1.8x	1.9x	2x	2x	1.9x	1.9x	1.9x	1.9x	1.8x
Foot Pa										
foot up %										
dB 3pt										
I sing										
metal thick										
body length										
Langui										

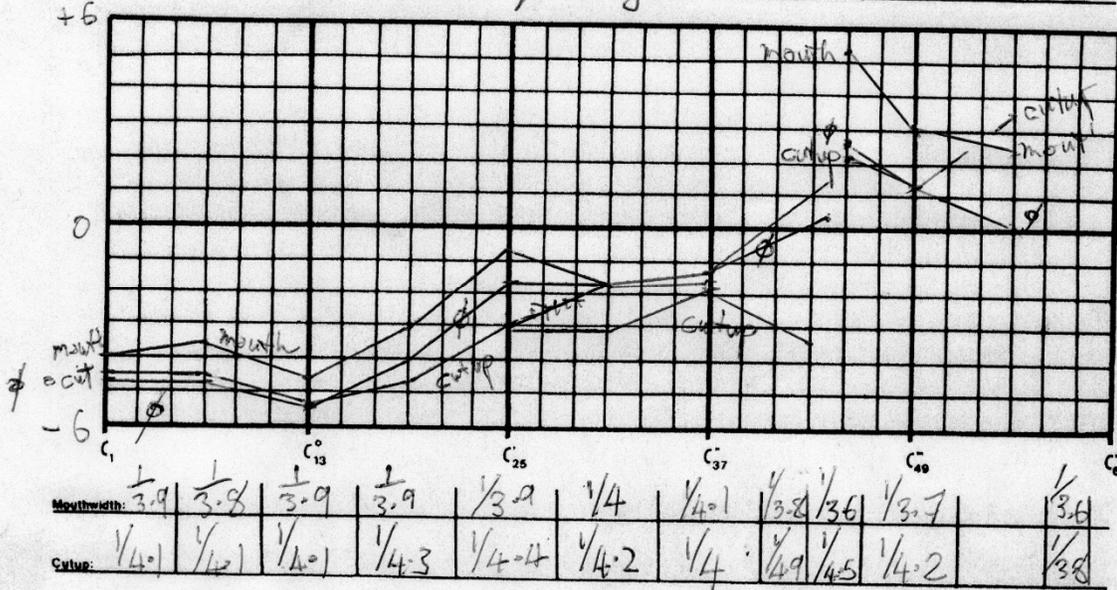
Collector: _____

Material: _____

A. B. Batty

Stop: Sesqui II 2 2/3 Div: SW Builder: Casavant Date: 1961
 Windpressure: 6.30 Pitch: _____ Church: Waterdown
 Description of site & crane: Casrohrflute

ear & chimneys to g''



ACTUAL MEASURE	C ^I	F [#]	C	F [#]	C ^I	F [#]	C ^{II}	F [#]	C ^{III}	F [#]	C ^{IV}	F [#]	C
throat dia	55.5	42.7	32	26.3	22.5	17.2	13.6	10.7	10.5	9	8.6	6.6	4.8
depth/dia	4.5	3.5	2.6	2.04	1.8.3	1.3.5	1.0.5	8.8	10	7.6	7.5	5.7	4.1
width	.11	8.5	6.3	5	4.2	3.2	2.6	1.8	2.7	1.8	1.7	1.5	1.1
mouth width													
cutup													
windway	.1	.1	.1	.1	.1	.1	.1	.1	.1	.1	.1	.1	.1
toe &	11.2	9	9	8.3	8.2	7.1	6.5	5.1	5.9	5	5	4	3.3
toe X	1.5x	1.4x	1.6x	1.6x	1.7x	1.7x	1.8x	1.6x	1.7x	1.7x	1.7x	1.6x	1.5x
foot Pa													
foot up %													
dB 3 pf													
I sing													
metal thick													
body length													
Labgwid													
keyway &	15.6	13.6	11.6	9.6	7.5.6	6.7	6.6	4.8.6					
length	110	97	87	73	81	49	38	10.7					

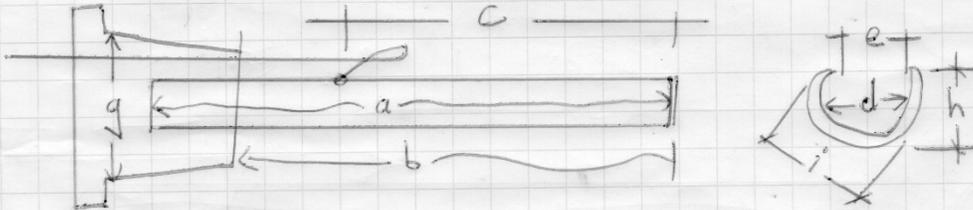
Collector: _____

Material: _____

8' Swell Trumpet

Curarant Waldowdown 1961
 Harmonic

Shallot	C	F ₀	C	F ₀	C	F ₀	C	G	F	C	G	F	C
total length	123	99	83	70	58	48.5	39	32	31.5	27	g	174	12.2
projects length	93	79	65	54	43	35	27	23	21	18	13	11.8	10
tuned length	74	65	52	41	32	24	18	10.5	7.7			8.1	3
inside ϕ	8.1	6.8	5.9	5.1	5.2	4.8	4.4	4.4	4.3	4	4	4.1	3.8
slot width	5.5	3.6	3	2.4	2.2	2.2	2.1	2.1	2.4	2	2.2	4.4	4.8
wall thick	1.1	1	1	1	.9	.8	.7	.7	.7	.7	.7		
block ϕ	46	46	44	36	36	31	26	26	26	23	23		
h/i	83/102	7.6/8.7	7/8	6/7	6/7	5.6/6.3	4.8/5.6	5/5.6	5/5.8	4.6/5.3	4.5/5.3		
toe hole	7.5	7.7	6.5	5.5	5.8	5.8	5	4.5	5.7	4.6	5.6		
lift	1.35	1	1	.6	.6	.55	.35	.3	.4				

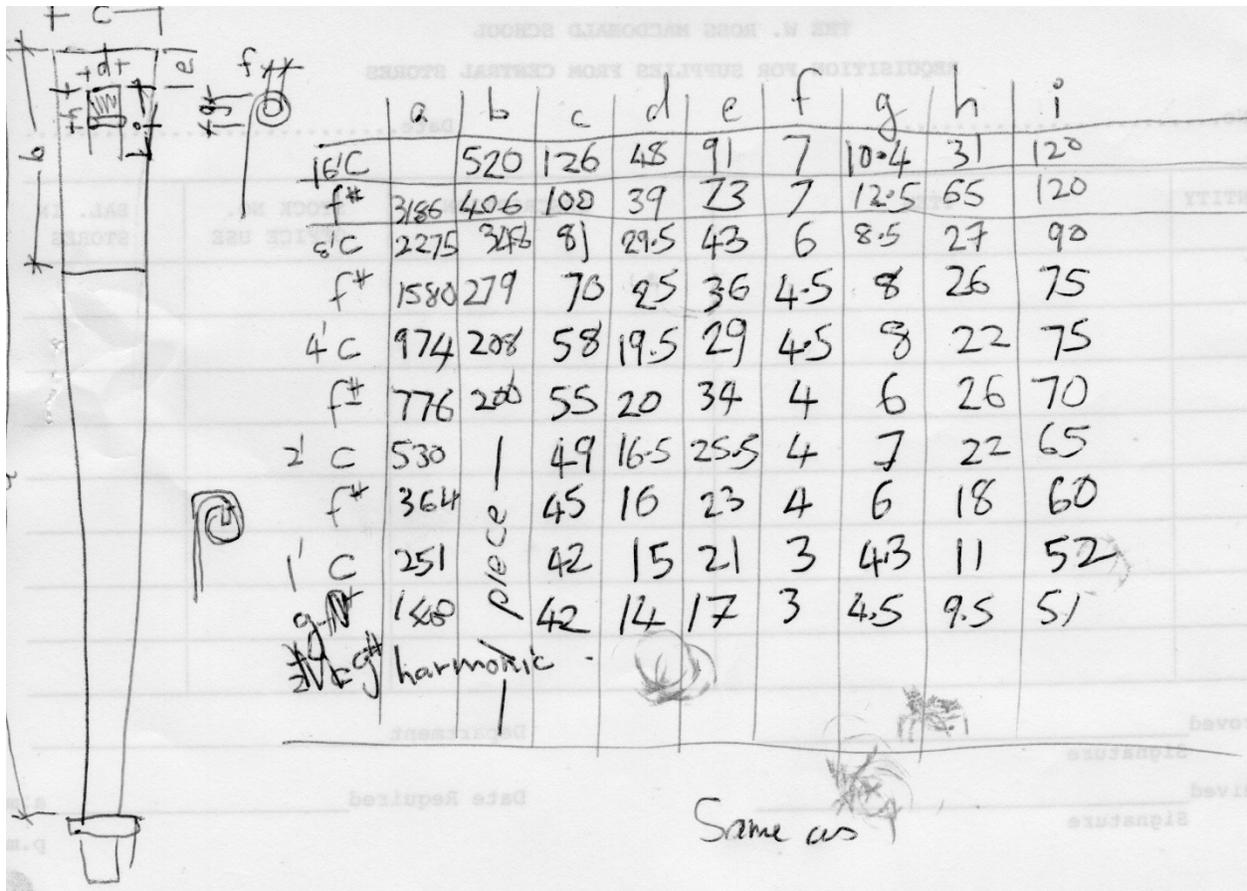


tongue	C	C	C	C	C	C	C	C	C	C	C
length	119	100	83	67	57.4	46.5	39	32	31	29	22
width	9/8	7.3/6	6.7/5.8	6/5	5.6/5	5.4	4.8/3.3	3.7/3.2	3.4/3.6	3	3.2
thick	.67	.63	.53	.4	.35	.26	.18	.15	.13	.06	.06
weight	8.5x2 felt 6x2 lead	6x3 felt 6x1 lead	6x3 felt	—	—	—	—	—	—	—	—

Resonator	C	C	C	C	C	C	C	C	C	C	
a	80			54	49	44	42	44	44	43	43
b	17	11	10	8.5	9	7.5	7	7	7	7	7
c	2270			780	533	364	252	155	334	255	150
d	136	119	102	86	74	62	48	44	44	38	34
e	102			70	49	40	42	43	58	28	38
f bell thick	1.1			.9	.9	.9	.8	.7	.7	.9	.9



Spotted metal



This Trumpet 16' is of the same era and scale, but includes much more detail. It is from the Brantford School of the Blind auditorium organ. It was 16' on the pedal, 8' on the Swell.

Pedal

A. B. Batty

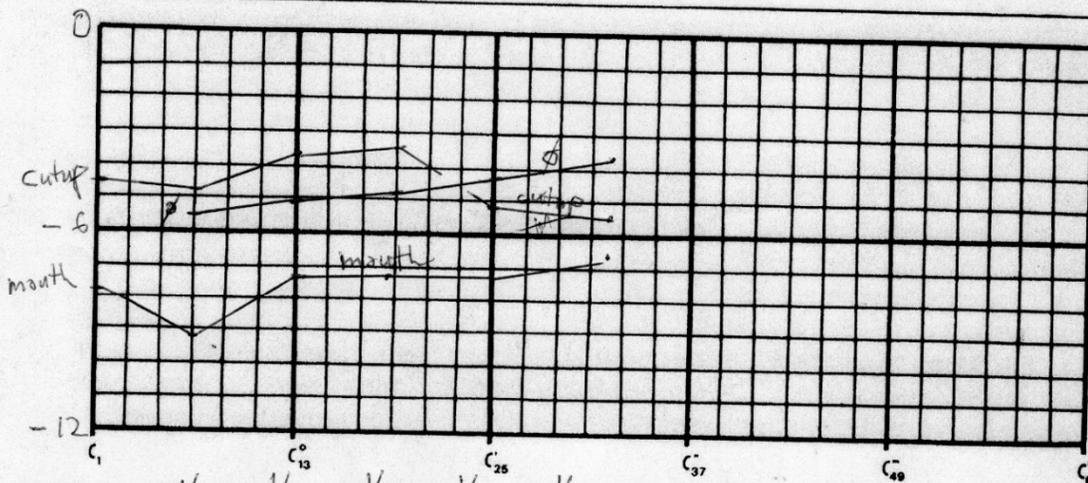
Stop: Violone 16' Div: Pedal

Windmassure: 600 pa Pitch:

Builder: Casseyon A Date: 1961

Church: Waterdown

Description of site & organ: 1/2 taper



Mouthwidth:	1/4.5	1/4.11	1/4.4	1/4.6	1/4.6				
Cutup:	1/3.5	1/3.5	1/3.5	1/3.4	1/3.7	1/3.8			

	C	F#	C	F#	C	F#	C	F#	C	F#	C
top throat	-	84.5	64	50	40	30.5					
depth/dia	-	1.59	1.25	1.2	1.1	1.05					
width	146.5	111	89.5	69	53	40					
mouth width											
cutup	42.2	32	26	20.3	14.5	10.6					
windway	1.5	1.2	1.1	1.2	.7	.45					
toe d	2.5	1.8	1.4.6	1.3	1.1	1.0					
Soth/Toep		1:0.63	1:0.51	1:0.52	1:0.52	1:0.53					
toe X		1.4x	1.25x	1.1x	1.2x	1.0x					
Foot Pa	500	450	480	280	540	540					
foot up %	83%	75%	80%	47%	92%	90%					
dB 3pf	80.7	79.2	80	79	78	76					
I sing	3.3	3	2.9	2.4	3	2.5					
metal thick	-	-	1.2	1	1"	.8					
body length	-	3610	2545	1800	1150	773	body only (sleeves pushed down)				
roller	35	25	17.7	11	8.5	tape 1.5-5/6					

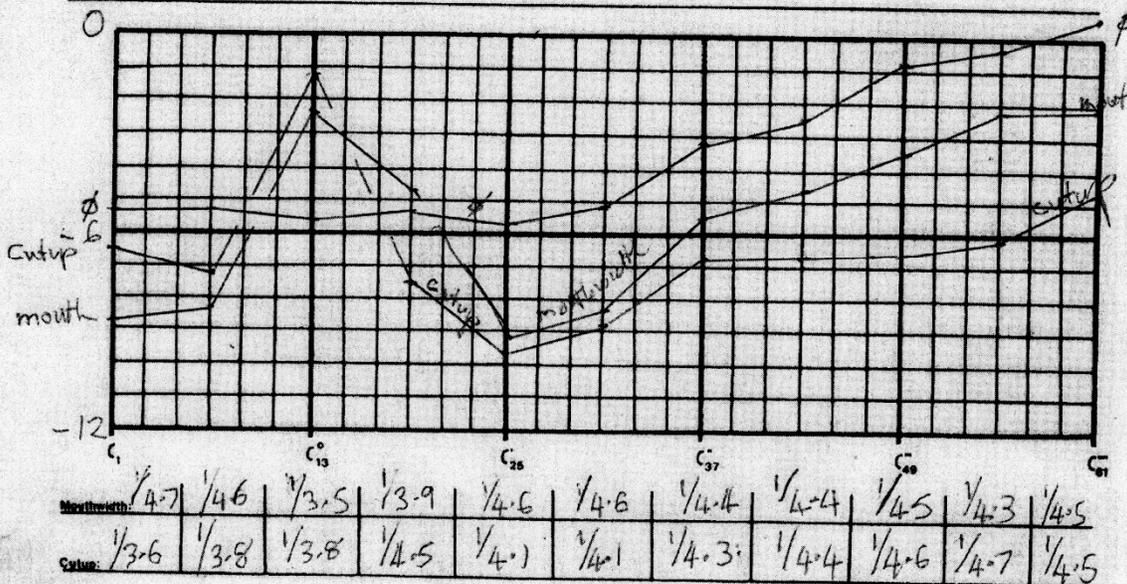
Collector: _____ Material: _____

Pedal Scales

Pedal Scales

A. B. Batty

Site: Nachtorn Gedackt 16' Gt - Ped Builder: Casavont Date: 1961
 Windressure: 540 Pitch: Ped 600 Church: Waterdown ON
 Description of site & organ:



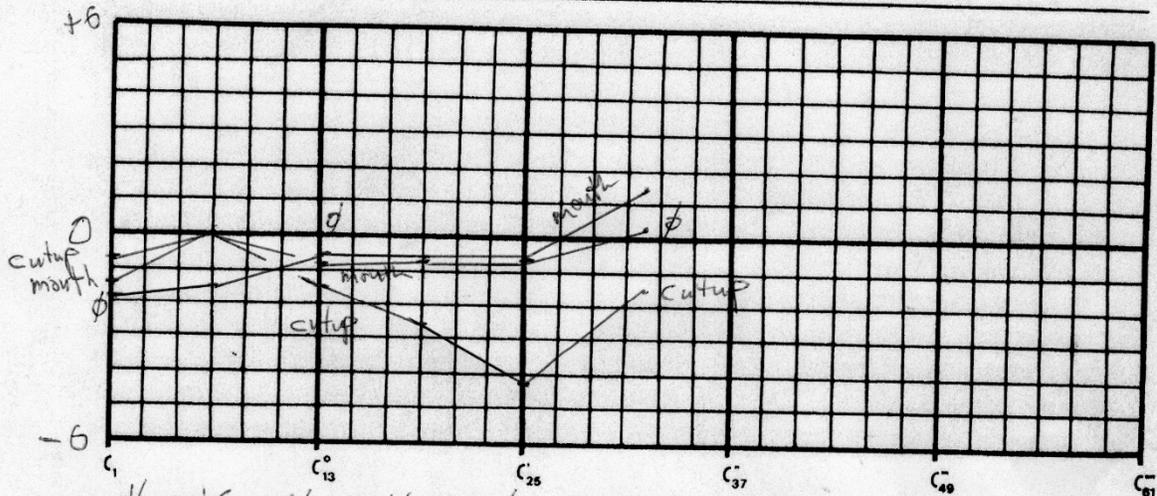
ACTUAL MEASURE	C ¹		F [#]		C		F [#]		C ¹		F [#]		C ¹¹		F ^{#¹¹}		C ¹²		
	C ¹	F [#]	C	F [#]	C ¹	F [#]	C ¹¹	F ^{#¹¹}	C ¹²	F ^{#¹²}	C ¹³	F ^{#¹³}	C ¹⁴	F ^{#¹⁴}	C ¹⁵	F ^{#¹⁵}	C ¹⁶	F ^{#¹⁶}	
throat																			
depth/dia	208	160	123	95	72	57.2	48	38	31.5	24.5	20								
width	140	110	85	76	49	39	34	27	22	18	14								
mouth width	140	110	85	76	49	39	34	27	22	18	14								
cutup	39	29	27	17	12	9.6	8	6.2	4.8	3.8	3.1								
windway	1.1	.5	.4	.3	.3	.3	.25	.25	.2	.2	.2								
toe ϕ	30	24	20	17	12.5	11	10	9	8.5	7.5	6.7								
toe X	2X	2.1X	1.8X	2.5	1.5	1.5	1.4X	1.4X	1.5X	1.5X	1.5X								
foot Pa	555	560	585	530	535	575	540	530	540										
foot up %	92.5%	93.3%	97.5%	98.1%	99%	99%	100%	98.1%	100%										
dB 3 pf	78.6	75.2	78.8	74.4	72	72.5	73.5	73.8	73.8										
I sing	3.4	2.5	1.6	2.1	2.6	2.5	2.2	2.2	2										
metal thick	1.5	1.2	1.1	1.1	.75	.7	.5	.6	.4	.4	.3								
body length	2230	1555	1098	770	522	350	238	158	100	66	40								
Langwid	6x70°	5x70°	4.2x70°	3.2x70°	2.5x70°	2.5x70°	2x70°	2x70°	1.8x70°	1.4x70°	1.3x70°								

Collector Blair

Material: Zinc 1-24
25 + Spott

A. B. Batty

Stop: Spitzer Principal Red Div: Red
 Windressure: 650 ps Pitch: _____ Builder: Casavant Date: 1961
 Description of site & crane: ears all, scrolled tops Church: Waterdown



Mouthwidth:	1/3.9	1/3.7	1/4.1	1/4.1	1/4.1	1/3.8				
Cutup:	1/3.9	1/4	1/4.1	1/4.3	1/4.6	1/4.5				

143	ACTUAL MEASURE	F#	C	f#	cI	f#	C	f#	cIII	f#	cIV
throat	19.6	74	58.5	44.5	36.5	27					
depth/dia	14.3	113	91	70	54	41					
width	115	95	70	54	41.5	34					
mouthwidth				64:100							
cutup	29.8	23.5	17	12.5	9	7.5					
windway	1	1	.6	.6	.4	.35					
toe d	17	13	8.3	7.2	7	6.8					
Top: Bottom	67:100		64:100	64:100	68:100	66:100					
toe X	1.4	1.25	0.9	0.85	1.0	1					
foot Pa	5.60	4.30	4.30	4.90	5.60	6.00					
foot up %	86%	66%	66%	75%	86%	92%					
d/B 3 pf	83.4	83.7	80.6	75.5	78.6	80.1					
I sing	2.4	2.2	1.9	2.3	2.3	2					
metal thick	1.2	1.1	1.2	.8	.6	.7					
body length	2478	1780	1158	802	561	372	← sleeves pinched down				
Languid											

Collector: _____ Material: 1-12 zinc, Spotted

A. B. Batty

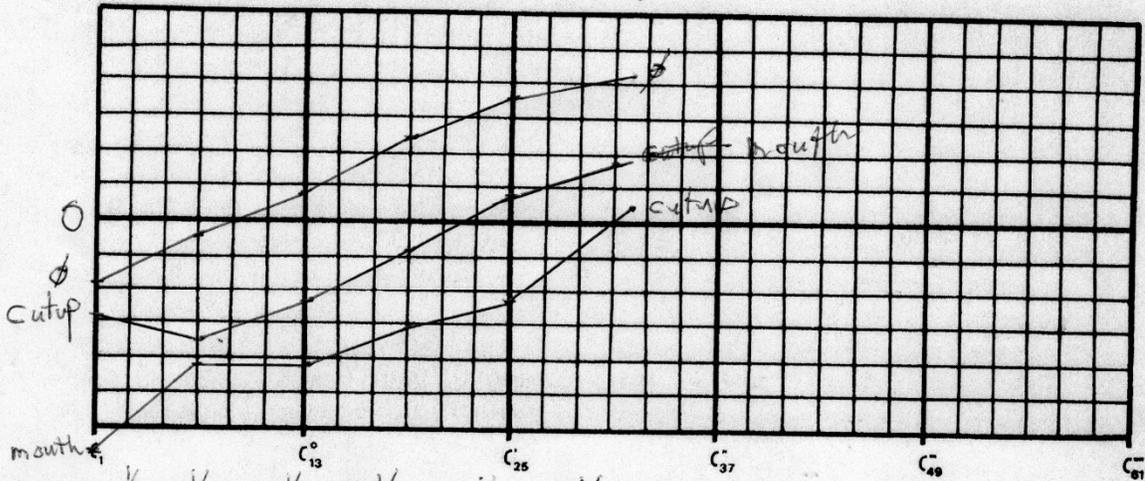
Stop: Principal Italian 4' Bed Div: Bed

Builder: Casavant Date: 1961

Windmass: 650 Pitch: _____

Church: Waterdown

Description of site & organ: _____



Mouthwidth:	1/4.9	1/4.7	1/4.6	1/4.6	1/4.5	1/4.4				
Cutup:	1/3.4	1/3.9	1/4.3	1/4.4	1/4.6	1/4.3				

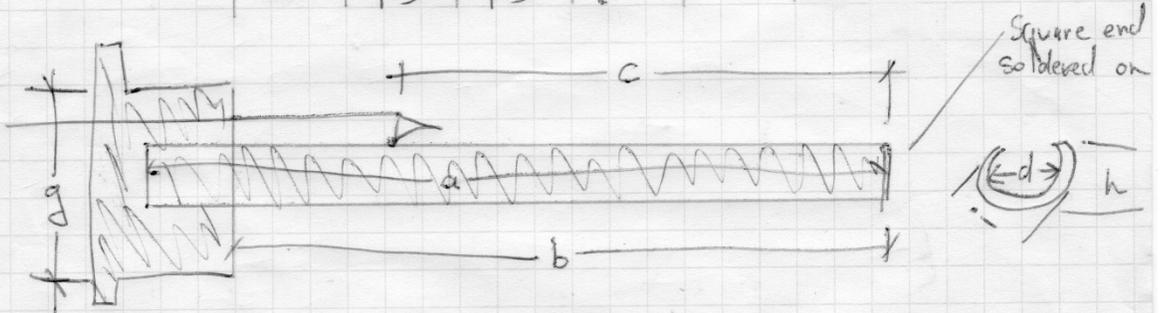
	C'	F#	C	F#	C'	F#	C''	F#''	C'''	F#'''	C''''
throat dia	86	70	57	47	38	29					
depth/dia											
width											
mouth width	55	46.7	39	32	26.5	20.5					
cutup	16	12	9	7.3	5.8	4.8					
windmass	.4	.3	.35	.3	.25	.25					
toe d	11.8	10.5	11	9	9.8	8.5					
metal thick	1.0	.9	.7	.5	.5	.6					
toe X	1.3	1.25	1.25	1.3		1.6					
foot Pa	610	635	645	635	645	645					
foot up %	94%	98%	99%	96%	99%	99%					
1/3 3pt	76.5	76.2	77.6	77.9	78.1	79.4					
I sing	2	2	2.3	2	1.9	1.7					
metal thick											
body length											
Language											

Collector: blax ears all - tight Knife feather mix
Material: Spotted

16' Posawane $\frac{7}{8}$ length, Pedal

Casavant Waterdown
1961

Shallot	c	F#	c°	fo	c'	g'
a) total length	186	146	114	92	74.6	62.2
b) projects length	148	112	87	68	53	42
c) tuned length	130 134	98 105	75 77	53 54	43 43	37
d) inside ϕ	12.6	10.3	8	6.8	6	5.2
e) slot width	6.5	4.6	4.2	3.3	2.5	1.9
f) wall thick	1.3	1.2	1.3	1.1	1.1	1
g) block ϕ	63	58	46	46	41	36
W	13.4/15.2	11.1/12.5	8.8/10.2	7.9/8.9	6.9/8.1	6.3/6.9
Toe hole	11.2	10.2	9	8	7.5	6.3
'sweamed "Lift"	10.6 10.6	10.1 10.5	9 10.3	8 9	7.5 9	6.3 7



Tongue length width thickness weight	184	143	112	94	74	61	
	11.5 x 10	9.7 x 9	8.3 x 6.7	5.7 x 7.4	6.1 x 5.5	5.9 x 4.5	very soft brass. ∇
	.8	.68	.57	.48	.43	.36	
	7 x 1.6 lead + 10 x 2 felt	7 x 1.6 lead 10 x 2 felt	6 x 1.6 lead 7.7 x 2 felt	3.3 x .5 lead 7.5 x 2 felt	2.5 x .5 lead 6.5 x 2 felt	6 x 3 felt	

Resonator			c°			g
d) Top ϕ	104	87	77.5	68	64	56
b) bottom ϕ	13	12	11.5	11	9	9
c) total length	2380	1630	1170	810	568	370
d)	200	163	126	113	94	78
e)	120	90	85	63	61	43
f) wall thick	1.4	1.2	1.1	1	1.1	1

