THE PIANOLA JOURNAL

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The aims of the Institute
A small number of pianola owners and musicians have been concerned for some time at the unnatural break between the world of music rolls and the world of music. Few members of the musical public know much about player pianos, and the Institute aims to bring about a better understanding and appreciation of the instrument in a number of ways.

The Institute publishes a regular journal, puts on public concerts, and has plans for a lending library of rolls, a travelling exhibition, and in addition a roll and information archive, with a small collection of player pianos for listening and study purposes.

The Pianola Institute will endeavour to preserve, research and document the pianola's history, to improve the instrument's present standing, and by the commissioning of new compositions, to ensure that it remains an important musical force for the future.

The directors of the Institute are:
Louis Cyr, Keith Daniels, Mike Davies, Denis Hall, Eileen Law, Rex Lawson and Claire L'Enfant.

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Editorial

Louis Cyr, one of our founder directors, has decided it is time for him to step down. While we are delighted that, after a serious illness he is once again enjoying excellent health, we are sorry that we shall no longer have his valuable experience so readily at hand. It goes without saying, however, that we intend to stay in regular touch with him, and call on him when his particular talents can contribute to our activities. We have been most fortunate in having had the benefit of his wise counsel over the 25 years since our formation, and thank him for everything he has done for us.

It is with great sadness that I have to report the death of Yvonne Hinde Smith, a Member of the Institute, again, since its inception. Yvonne's lively contributions, sound advice and, most of all, her very special friendship will be greatly missed. An appreciation of her life appears later in this Journal.

We are very pleased to welcome another new contributor to the Journal - Mark Stikkelbroek. Mark has lived with a Philipps Duca piano for some twenty years, and must be as knowledgeable as anyone about this extremely rare type of reproducing piano. He has written a fascinating article outlining the history of the Duca and its variants, the Ducartist and the Ducanola, thereby making us aware that Welte, Ampico and Duo-Art were not the only important systems in production during the first 30 years of the twentieth century.

During the past few months, Rex Lawson has been researching important patents in connection with the recording of reproducing rolls and their manufacture. For some systems, the processes are relatively well known, but for others, it is only from obscure patents that we can now get any idea of how the rolls were made. The fact that some of the roll companies intentionally kept their processes secret has resulted in some preposterous theories being put forward; Rex Lawson shares his discoveries, and dispels some of the more outlandish ideas.

The accuracy, or otherwise, of reproducing pianos is a subject which has probably taxed musicians and academics ever since the first Welte-Mignon piano was shown at the Leipzig Fair in 1904. Of course all the systems which employed pneumatics have limitations of one sort or another, but one can surely not completely discount the fact that the majority of the greatest and subtlest pianists active during the first thirty years of the twentieth century recorded for at least one of the major systems. Had what they heard when their recordings were played back to them been greatly at odds from how they felt they played on the concert platform, the whole reproducing piano industry would never have taken off in the way it did. So how is it that reproducing pianos today get such bad press? Of course unless an instrument is of high quality and is in first class working order, a listener will not get a faithful experience of how the interpretation should sound, and unfortunately there are available recordings of instruments which just do not measure up to the very high standard necessary. But even allowing for that, there are two very extreme groups of listeners. The first who, having been lucky enough to listen to a good example, will find enough positive aspects of the reproduction to accept the validity of the medium. The second, sometimes without even having had any experience of the instruments, will describe their interpretation of the mechanics of the systems, and write off all reproducing pianos as worthless curiosities. After having met people of both persuasions over many years, we are tempted to think that many of the latter just do not know what they are listening to! Evidence of this, admittedly in another context, is sadly borne out by the fact that many a mediocre concert performance is received with rapturous applause by an indiscriminating audience.

Listening to an interpretation by means of a reproducing roll, preferably heard on an actual piano, but more likely on a recording, is different from what one experiences in a concert hall, or by means of a CD recording or similar. There are many younger music lovers who find the modest tape hiss of a pre-digital LP or tape distracting, never mind the more aggressive crackle of a 78 rpm disc. However, with the will to hear, these difficulties can be overcome, and the music roll performance well reproduced on a fine instrument can also speak, but on its own terms. A deal of education urgently needs to be undertaken. One of the Institute's aims is to encourage music lovers of all ages to enjoy and value performances from an earlier age by making available the best examples at its disposal.

Visit our website at www.pianola.org

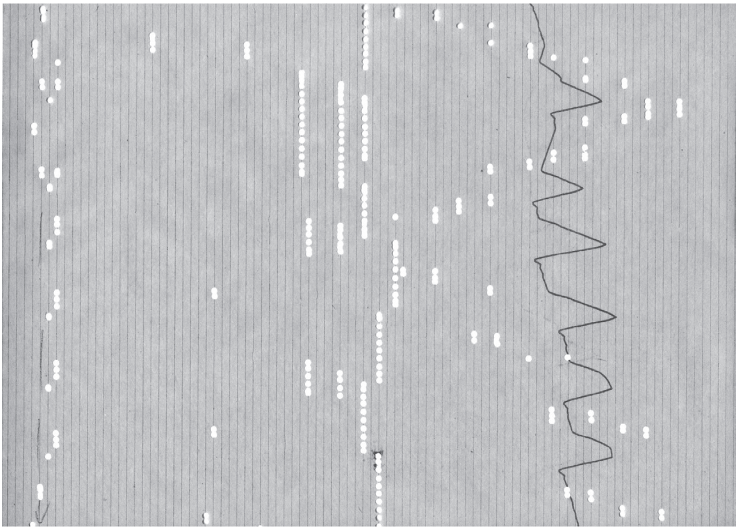
On The Right Track

The Recording of Dynamics for the Reproducing Piano (Part One)

Rex Lawson

Preface

The starting point for this article was a series of conversations held over the last four or five years with long-term friends and acquaintances in the player piano world. Along with a number of experienced restorers and musicians, I have been unhappy for a long time with the theories put forward for the system of dynamic recording used for the Welte-Mignon in Europe. During visits to Mark Reinhart, and to Thomas Jansen and his colleagues at the Musikwerkstatt Monschau, it became clear that they shared my unease, and I have been aware that Hans-W. Schmitz, generally regarded as the main Welte expert in Germany, has always avoided detailed explanations in the articles and recordings which he has produced.



Welte Mignon Second Master no 877, Liszt's "Mazeppa", played by Emil Sauer, showing automatically drawn playback dynamic traces.

Before Denis Hall acquired his Steinway grand Welte-Mignon, both he and I had always considered that the Mignon was the most basic of the main reproducing systems. Those which I had encountered from the 1970s onwards played rather unmusically, and I had assumed that later systems, such as the Duo-Art and Ampico, were quite simply more sophisticated. It was both a surprise and a delight that Denis managed slowly to draw a wholly undreamed of subtlety of reproduction from an instrument that we had both previously written off. Living only half an hour away from each other, it is an easy matter for us to listen to music together and discuss it, and I have always reckoned that part of my role in our friendship is to provide challenges and criticism, and I value his observations about my music-making in return.

Both of us slowly became aware of a very particular quality which we heard in Welte roll recordings. In the first place, we heard roughness, to be sure, as one does in every Mignon that has ever been put on to LP or CD, but we also perceived subtlety of a kind hardly ever heard on any of the other systems. What was particularly interesting was that the subtlety frequently occurred in places that were musically unimportant, places where no recording producer, under pressures of time, would have bothered to dally. It came at one out of the blue, when one was not really listening for it. This is a very difficult concept to analyse and report in detail, especially where one is seeking to explain it to non-musicians. It would be very easy for a technically-minded person to dismiss our experiences as imaginary, and the state of most reproducing pianos in the world is such that they will most likely be imperceptible elsewhere.

But these shared experiences made me think long and hard about the Mignon. We know very well that most of the reproducing systems needed the skill of roll editors to paint portraits of recording artists, and that the methods used for acquiring dynamic information were nearly always anything but automatic. In the case of the Welte I reckoned I could actually hear an automated process, with roughness as a side-effect of its very simplicity, but with subtleties that no roll editor would have bothered to include. Either Welte had an enormous team of genius roll-editors, who brilliantly transformed some very basic note-speed information into the system's proprietary dynamic coding, or they had an automatic system that could produce the actual coding directly from the pianists' playing. Since there is absolutely no evidence for a large Welte roll-editing department, I opted for the latter explanation, and I began to wonder just how they might have done it. How might one mark up the Welte dynamic coding completely automatically, leaving roll technicians the simple job of punching out the perforations?

Over a period of about three years, I reckon to have come up with a complete system for doing exactly that, and in the process to have identified a number of previously unnoticed or unexplained details of photographic evidence. This has been achieved, admittedly in theory only, using materials and components readily found in any player piano or organ factory of the early 1900s. Most of my friends will know that I do not make music or analyse mechanisms in order to add any cubits to my stature, so I do not labour under the illusion that I am somehow cleverer than the next man. In any case, people's abilities are wide and varied. But if the inventors at Welte did not come up with a system like the one I shall describe, then they must have been rather less ingenious than I am, and I simply don't believe that.

Richard Strauss Performs His Own Works in 1906
From the Welte Legacy of Piano Treasures,
Los Angeles, 1964

What I do believe is that Richard Simonton and his colleagues were not reliable purveyors of historical accuracy, and I shall hope to corroborate my belief with some concrete evidence. For those to whom the name means nothing, I should explain that Simonton corresponded with Edwin Welte in the late 1940s, eventually visiting him in Freiburg, exchanging Welte music rolls for food and other commodities desperately needed in postwar Germany, and finally helping to produce two sets of LP records of the Welte Mignon. The second set, the Welte Legacy of Piano Treasures, published in America during the early 1960s, carried a particularly detailed assertion of how the dynamic information for individual notes might have been recorded. There is no reason to suppose that Simonton was anything other than an engaging personality and a kindly man, but in contrast there is a good deal of evidence that he was not experienced at dealing with the history or technicalities of the player piano, besides which, most of the reports generally credited to him are written anonymously, with no satisfactory explanation for the reasons subsequent writers have chosen to give the credit to him personally.

In fact, the Welte Mignon was only one of a number of reproducing piano systems whose dynamic recording methods have frequently been reported with less than careful attention to detail, and so with these thoughts in mind, it seemed sensible to include the Welte process as one part of a larger article, allowing all the main reproducing piano recording techniques to be enumerated and compared. There are many similarities between different systems, particularly the Ampico and the Hupfeld Dea, and the Welte-Mignon and the Philipps Duca. As it happens, the Welte-Mignon was the first of the main reproducing pianos to be developed, and so it is necessary to court controversy at the very beginning of this article. In order to do this more effectively, we need to be aware of a few practical guidelines towards ferreting out the most likely versions of events.

The Truth, The Whole Truth and Nothing But The Truth

Most modern societies, when they attempt to establish the veracity of a disputed event, use the process of trial in a court of law. The law is not infallible, of course, but over the years a number of procedures have been established which have proved their worth in sifting the grain from the chaff. When considering historical events and developments, physical items of evidence stand first in line, since they are very hard to gainsay, unless there is some suspicion that they might have been falsified. Such original documents and artefacts are generally the most accurate pointers towards historical truth. Taking second place, photographic records are almost as reliable, although in recent years the advent of graphic computer programs, such as Adobe Photoshop, has meant that the processes of touching up and brushing out have been refined to a degree unthought of by our forebears.

Personal recollection comes next, and is best when written or recorded at the time of the events being described. The diaries of Clarence Hickman are very likely to be an accurate guide to the development of the Ampico *"B"*, but, as with any such testimony, one does have to take the character and motives of the witness into account. Charles Stoddard, in a lecture given to the American Guild of Piano Tuners in 1927, bends the truth to his own commercial ends. For example, consider the following excerpt from his talk:

> *"Simultaneously with the development of the Welte, there was a similar development made in this country which later was brought out by the American Piano Company and is now known as the Ampico. Sometime after the Ampico came the Duo-Art, which was also entirely automatic."*

Now, as far as we can tell, the Welte-Mignon was first shown to the public at the Leipzig Autumn Trade Fair of 1904, at the latest by the August of that year, since it is reported in the issue of *"Zeitschrift für Instrumentenbau"* dated September 1st. At this very early stage, the "Mignon" carried the alternative title of the *"Artist"*, and it was represented in Leipzig by the musical house of Popper. In passing, it might be useful to understand that such exhibitions and demonstrations were often located at the normal places of business of the respective firms, rather than in any special exhibition building, so that the atmosphere of the trade fair pervaded the whole city. The Mignon's initial step into the world of commerce occurred in the Popper salons at Reichsstrasse 31 - 35, Leipzig.

According to Carl Welte, an American cousin of Edwin Welte, one of the inventors of the Mignon, writing in a letter to Richard Simonton in 1950, and reported in the Encyclopedia of Automatic Musical Instruments, the first Mignon was also taken to the USA in 1904 and demonstrated on the Welte exhibit at the Louisiana Purchase Exposition in St Louis, Missouri, but the exact date of such a visit is unknown. The Exposition ran from April until October.

There must have been a period of research and development preceding these launch dates, lasting at least two or three years, so the beginning of the concept of the Welte Mignon must date back at the latest to 1900. Even if there were no other evidence of this, common sense would tell us it were the case, but in his same letter, Carl Welte remembered visiting Freiburg in 1901, and he confirms his memory of the fact that Edwin had been working on the development of the Mignon at that time. By contrast, Charles Stoddard's first application for a US patent connected with the system later known as the Ampico is dated April 30th, 1908. On the basis of his many other patents, Stoddard seems to have applied for such protection very promptly. For him to describe his research and development as simultaneous with the Welte, therefore, is disingenuous, especially when he further suggests that the Duo-Art came *"sometime after the Ampico,"* when in fact it was publicly launched in March 1914, only sixteen months or so after the Stoddard-Ampico was first introduced.

Taking the probable dates of either the research or the public appearances, there were at least eight years between the Welte Mignon and the Ampico, but only a year and a quarter between the Ampico and the Duo-Art. But Charles Stoddard was a wily bird, who caused consternation to his research colleague, Clarence Hickman, by installing a red light on one of his roll-mastering machines simply in order to impress visiting journalists. He doesn't actually tell any untruths, but he flavours the truth in a way that suits his own purposes, and he therefore stands as an excellent example of the way in which hidden motives can colour the record of history.

The fourth stratum of evidence in our reliability league table takes the form of recollections in later life, of those directly involved, perhaps as part of an autobiography or an interview. These are, of course, potentially less reliable than those written at the time; memory plays tricks on all of us, however impartial we think we may be, but nevertheless, any evidence from those directly involved in historical events inevitably carries a certain weight. Where some of the uncertainties arise are in the manner in which the recollections are passed on. Recorded interviews have the potential for inaccuracy, especially where leading questions are asked, perhaps by enthusiastic yet inexperienced interviewers.

At the bottom of the scale are the accounts reported by third parties, which need the greatest care in sifting, analysing and interpreting. The motives, the experience and the expertise of the reporters are all critical in influencing the versions of events which come down to us. Motives may simply be altruistic, which is ideal, but they may also be commercial, or inspired by a desire for self-aggrandisement (the Dutch have a phrase, *"He is building a statue for himself,"*) or even by desperation, where an enthusiast makes exaggerated claims, because he thinks the world will not otherwise pay much attention to his favourite subject. Experience and expertise ought to be a self-evident consideration, but the annals of the player piano are awash with those who have taken the word of self-appraised experts, without any examination whatsoever of their character and motives. Unfortunately, the wider world has fallen into the same trap, and in the same way that the internet now has the potential of providing a spurious authenticity for anyone who wishes to set up a website, past decades have seen poor scholarship decorated with attractive illustrations and expensive publishing.

As with any other historical process, the development of the reproducing piano needs to be treated in the light of all these considerations, and in addition it is generally wise to add two further ingredients, namely, common sense and scepticism. As an example of common sense, we may surmise that, if the development of an invention in a particular way would have necessitated the employment of dozens of extra skilled and articulate workers, then some trace of those people and their experiences would probably have survived to this day. Such a conclusion cannot necessarily be proven either way, but in the absence of any other evidence, then common sense needs to be our guide.

As far as scepticism is concerned, then my own feeling is that negative evidence ought to be taken just a little more seriously than positive. Ken Caswell in Austin, Texas, is now the only living member of the team which produced the Welte Legacy of Piano Treasures. It was Ken, not Richard Simonton, who was the technical player piano expert for the series, and who modified the Welte push-up, using an Ampico stack for what was at the time perceived as greater reliability. Ken has been a good friend to Denis Hall and myself for nearly twenty years now, and we have often talked about the Welte Mignon. He recalls asking Ben Hall, the LP production assistant, about the remarkable detail of the explanations and illustrations published along with the series, and receiving the answer, *"Well, we had to sell the recordings somehow."* This is certainly evidence that would be regarded as hearsay in the courts, and yet it has a ring of truth about it on account of the unguarded nature of the comment.

One should not allow oneself to be drawn into a perpetual state of cynicism, but on the other hand, simply to accept theories and assertions because they happen to be in published form, as Dr Ludwig Peetz has done with Richard Simonton and the Welte-Mignon, is more akin to religious belief than to scientific reasoning.

General Mechanical Principles

Let us agree on one or two very basic technical principles. Pneumatic reproducing pianos are capable of generating only two separate levels of dynamics at any one instant, and these levels must be split between the two sections of their playing mechanisms, known generally as treble and bass. The pitch of the division between these sections varies according to the make of instrument, but it is not possible for any of them to reproduce a separate dynamic for each note, unless the notes are displaced in time. Even then, the size of the dynamic contrast is closely related to the time interval of the note displacement. Pneumatics do not work at the same instantaneous speed as electronics.

In simple terms, a tester roll, which plays each note in succession, might be carefully edited to play at a great variety of loudnesses, but a roll of hymn tunes, in exactly synchronised four-part harmony, would manage a maximum of only two levels per chord.

The recording studios for most reproducing systems were inhabited by clever roll editors, who frequently displaced important notes in order to allow for greater dynamic interest. The subtlety with which such processes were carried out can only be fully perceived by a perforation-by-perforation analysis of original rolls. Copy rolls are no use in this respect, unless they can be guaranteed to be exact dot-for-dot reproductions. In some respects this editing is akin to the modern compression of audio files into proprietary computer formats, such as mp3; the ear can be easily deceived, and all the more so when the performance is on an actual, rather than a virtual, piano. But all the clever roll-editing in Christendom cannot alter the underlying physical facts.

This is not an implied criticism of the reproducing piano, and the apparent dynamic restrictions should not be taken as an indication that the relevant performances are intrinsically unmusical or historically unimportant. A properly functioning reproducing piano (though heaven knows, there are almost none in the world), can be quite stunning to listen to, but its cause is not enhanced by exaggerated claims.

To put this section into perspective, listen to the De Falla track on the Pianola Institute website, at the foot of the Welte-Mignon page. The atmosphere of bucolic tranquility is utterly magical, and yet it is all achieved by only two constantly varying levels of suction. As we grow older, it becomes all too apparent that our grandfathers were every bit as clever as we think we are!

Dynamic Registration

With the exception of the Welte-Mignon, and possibly the Philipps Duca, it is most unlikely that any full reproducing piano system had the capability of marking replay dynamic coding on a roll in any automatic way. Raw dynamic information is another matter, whether for each individual note or for the bass and treble sections in their entireties. For replay, all reproducing pianos use proprietary perforated coding at the edges of their rolls, which controls expression pneumatics and regulators in order to vary suction levels, and thereby dynamics, as effectively as possible.

In general, it took an army of extremely well-trained roll editors a great deal of time to produce these coding signals. Despite the impression given by the Ampico publicity department with regard to the spark chronograph (q.v.), and by present-day writers of CD sleeve notes, it is not much help to record a separate dynamic for each note individually. Reproducing pianos do not function like computers, suction levels can vary as more load is placed on the system by additional notes or a faster roll motor speed, and in the end rolls were edited to sound right on the pianos as they then existed. The major differences in coding between Duo-Art rolls recorded in New York and in London are a telling example of these practices.

All of this means, to use the terminology passed on to us by the late Gordon Iles, that recorded piano rolls are generally *"portraits"* of their respective artists, and not *"photographs"*. Gordon worked in the music roll industry for much of his life, with Aeolian in the 1930s, and later on establishing his own brand of rolls known as *"Artona"*, and his memories of the period were often enlightening. In comparisons between portraits and photographs, it is not always the photograph which comes off better; we have used the following illustrations of the pianist, Alfred Grünfeld, once before in the Pianola Journal, and it is clear that the hand-drawn sketch captures the magic of Grünfeld's performances far better than the photograph.

It is worth emphasizing that researchers who limit their approach to a consideration of methods for producing dynamic levels for each note individually, are in general missing the point. There were many ways of doing this, quite a few recorded in patents of the time, and the method invented by Charles Stoddard for the early Ampico was very clearly far easier to interpret than any notional Welte-Mignon system. And yet it was not long used, at least not according to the recollections of later Ampico musical staff. A dynamic reading for each note is of remarkably little value to the human roll editor, and I speak here as one who has edited reproducing piano rolls on and off since 1972, and indeed created literally hundreds of very complex new classical music rolls for the normal pianola. The Ampico staff abandoned Stoddard's early system in favour of marking wavy lines on musical scores as the pianist played, a technique that bears far more relation to an expression control system based on crescendos and descrescendos, as opposed to switching between hundreds of discrete dynamic levels.

Surviving Resources in 2009

In order to help document this aspect of player piano history in a detailed manner, we have a number of resources of physical evidence at our command. In the first place, we have many original rolls used for editing and perforating at the various reproducing piano studios and factories. For the Welte-Mignon, there are surviving second master rolls from the factory at Freiburg, Germany, and these are mainly located at the Augustiner Museum in Freiburg, and at the University of Southern California in Los Angeles. Welte used a system of first and second masters, whereby the original recorded rolls were punched and kept as fair copies, to be used only for manufacturing second masters, which were then in their turn corrected and used for the production of commercial rolls. Those now in Freiburg are reputed to have come from the personal collection of Edwin Welte, one of the inventors of the Mignon, and the USC archive was presented many years ago by Richard Simonton, who acquired them shortly after the Second War, possibly from Edwin Welte, though more probably from his brother-in-law and colleague, Karl Bockisch, who remained in charge of the Welte factory until the early 1950s.

Besides the two collections of second master rolls mentioned above, there is probably one surviving Mignon first master roll, of a small piece recorded by Vladimir Horowitz in 1926. Since it is likely that the rolls for the Welte Philharmonic Organ were recorded in a very similar way to those of the Mignon, it is also worth noting that several Welte organ master rolls, from the American Welte recording studios, are in existence in private hands in the USA. Welte was relatively unusual in using normal-sized master rolls for production purposes, and most other companies used larger *"stencils"* as masters, in order to ensure greater accuracy of copying, editing the initial recordings by means of *"trial"* rolls. Welte's New York organ recording machine still exists, but in two sections, one at the Museum für Musikautomaten at Seewen in Switzerland, and the other until recently owned by Durrell Armstrong of the Player Piano Company in Wichita, Kansas.

For the various Hupfeld reproducing piano systems, very little has survived. About a hundred edited trial rolls from the 1920s are in private hands in Germany, and their present owner, Hans-W. Schmitz, has described and illustrated a few in an article in *"Das Mechanische Musikinstrument"*, the journal of the Gesellschaft für Selbstspielende Musikinstrumente, no. 58, published in July 1993.

Several hundred Duo-Art trial rolls from the New York studios of the Aeolian Company have survived at the International Piano Archives at the University of Maryland. This remarkable resource came from the personal collection of W. Creary Woods, the main Duo-Art recording producer and editor at Aeolian Hall in New York City, from 1914 to the end of the 1920s. The rolls are mixed in with a larger collection of normal Duo-Art recordings, and all of these were not very accurately catalogued by undergraduate students during the 1980s, and their physical condition still gives cause for concern. A few British Duo-Art trial rolls are in the possession of the Pianola Institute, having come down from the late Gordon Iles of Artona Music Rolls, and others were at one time with Gerald Stonehilll in London, but have since been dispersed.

The main Ampico factory roll collection belongs nowadays to Richard Groman, of Keystone Music Rolls in Bethlehem, Pennsylvania, who still uses many of the stencils for the production of new copies of Ampico rolls. A few trial rolls exist in Bethlehem, and there are also a couple with the Pianola Institute, having been sent for correction and approval to artists who happened to be in Britain at the time. Richard Groman also has some original Duo-Art stencil paper, which is a very rare commodity indeed!

Besides the actual music rolls, there are many surviving photographs of reproducing piano recording sessions, often, but not always, retouched to hide some of the more detailed views of the mechanisms involved. Welte recording sessions in Leipzig and Freiburg were frequently photographed, and published in roll catalogues and instrument brochures, and several original photographs remain at the Augustiner Museum in Freiburg. There were also some Welte recording photographs made in Russia.

Many of the early Hupfeld recording sessions were photographed, in Leipzig, Paris and Vienna, and these survived unscathed through two World Wars, and are now owned by the Musical Instrument Museum of the University of Leipzig.

Reginald Reynolds, the British Duo-Art recording producer, kept a series of photographs of roll recording sessions at Aeolian Hall in London, and these were presented to the Player Piano Group by his daughter, Yvonne Hinde-Smith, a dear friend, who sadly died earlier this year, and whose obituary appears elsewhere in this issue of the Pianola Journal. Some photographs of New York Duo-Art sessions have survived, at the Library of Congress and elsewhere, but of the Ampico there is surprisingly little that has yet come to light. In the 1927 Ampico roll catalogue, the only artist seen sitting at the recording piano is a light music pianist, Vincent Lopez, who is widely considered not to have played very much part in the performance of the rolls attributed to him – perhaps an attempt at subliminal advertising, and a graphic illustration of the dangers of trusting entirely in photographic evidence!

By contrast, there are many patents for the recording devices used by Ampico, leaving us with very little doubt as to the systems intended for use, whether or not these were put into practice, and Hupfeld also seems to have patented its early dynamic recording system. Welte and Duo-Art, however, kept quiet about the ways in which their dynamics were captured, though both W. Creary Woods and Reginald Reynolds wrote articles on the Duo-Art system of recording, in *Music Trades Review* of 11 December 1920, and in the *Gramophone* Player-Piano Supplement of February 1924. The Reynolds article goes into a great deal more detail, but nevertheless remains coy where the question of dynamics is concerned.

Clarence Hickman described in exact detail the Ampico spark chronograph of the late 1920s, in an article in the *Journal of the Acoustical Society* *of America* in October 1929, and Charles Stoddard made passing reference to his early dynamic recording system in a lecture given to the National Association of Piano Tuners, published in the Tuners' Journal for August 1927.

In his book on the nature of piano tone, *"Das Wesen des Klavierklanges"*, published in Leipzig in 1911, Ludwig Riemann, a music educationalist from Essen, Germany, described the dynamic recording process at Hupfeld in the early years of the 20th century, albeit with a certain lack of exactitude caused by his unfamiliarity with the processes of piano roll manufacture.

There are many other articles in magazines of the time, explaining to the piano specialist and layman alike the methods of recording for this or that system of reproducing piano, but none goes into any detail of the capturing of dynamics.

Since the Second World War, many deliberate, though often not very expert, attempts have been made to document the practices of the reproducing piano. Inventors and musicians have been interviewed, sometimes with an almost verbatim account of the process, but sometimes with the results rather vaguely written up, and even not credited to particular writers. Subsequent musical historians have been prepared to take uncorroborated accounts as representing the exact truth, a situation exacerbated by the fact that musicologists have in general been remarkably ill-informed about the player piano.

Dynamic Recording Systems

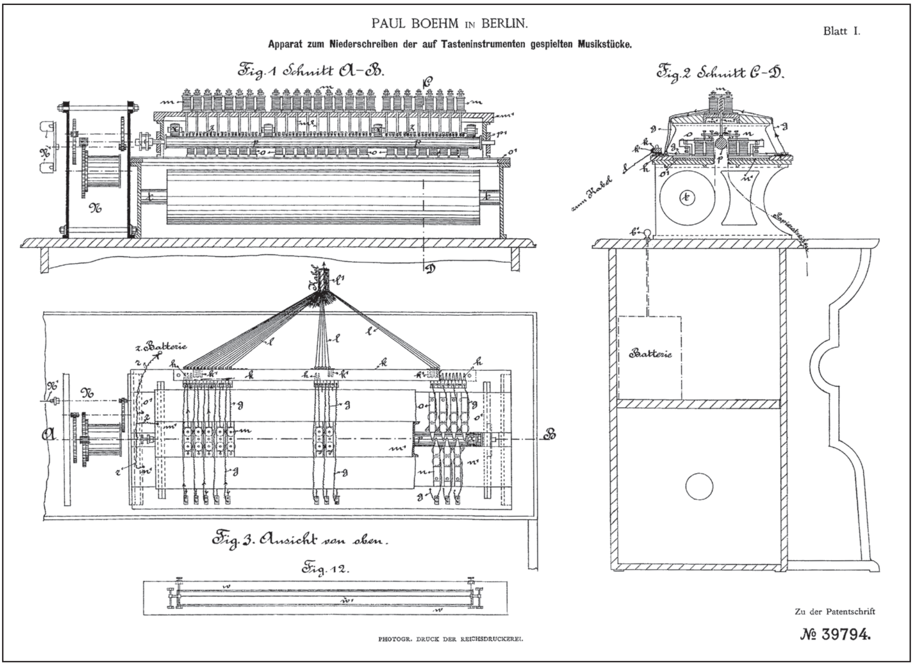
1 - The Welte-Mignon

Historical Background

The first main reproducing piano system came into the world from a relatively unexpected quarter. Michael Welte und Söhne of Freiburg-im-Breisgau was a manufacturer of organs and orchestrions, and not of pianos. In 1904 and 1905, it must therefore have caused the German piano world a great deal of surprise that such a significant forward step in the development of the player piano should not have come from within its own ranks, and it is clear that Ludwig Hupfeld in particular took steps to introduce his own reproducing system within a very short time.

Equally, the Americans were taken unawares, when the Mignon set foot in the USA, and Charles Stoddard of the American Piano Corporation unwittingly implied as much in his lecture to the American Guild of Piano Tuners in 1927, *"His (Edwin Welte's) achievement was by far the greatest step forward made up to that time in mechanically produced music."*

So why on earth would a firm of orchestrion specialists have been the first to conceive of reproducing the playing of actual pianists in a lifelike way?

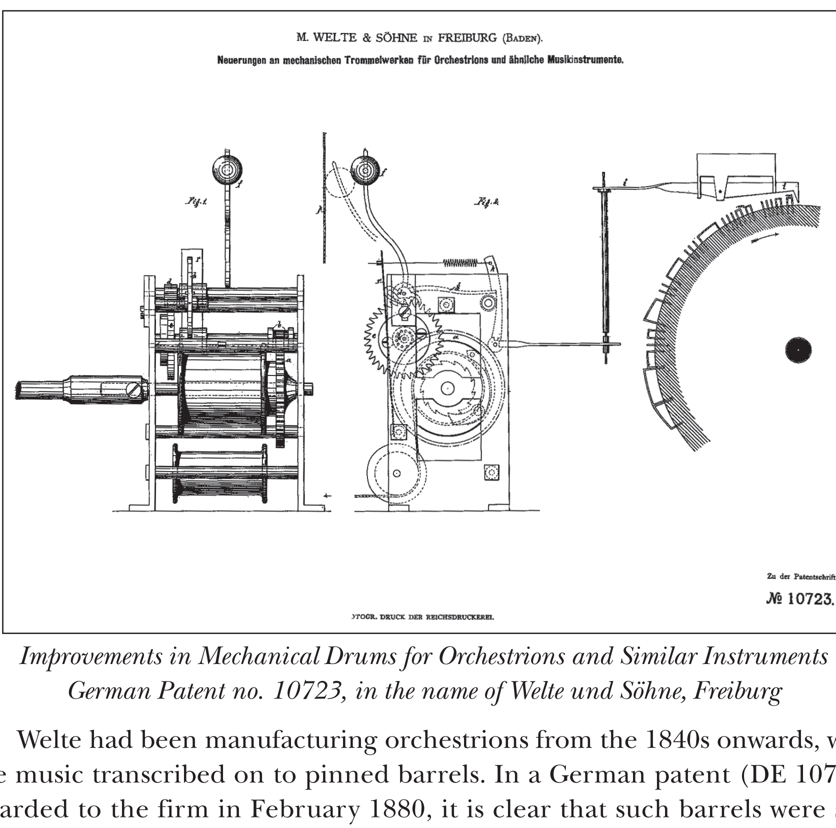


Apparatus for Registering Music played on Keyboard Instruments
German Patent no. 39794, in the name of Paul Boehm, Berlin

The answer is perhaps not so difficult to find, though almost impossible to prove conclusively. Some fifteen years beforehand, on 27 June 1886, Paul Boehm, a young engineer in Berlin, patented an ingenious and scrupulously detailed design for an *"Apparat zum Niederschreiben der auf Tasteninstrumenten gespielten Musikstücke."*

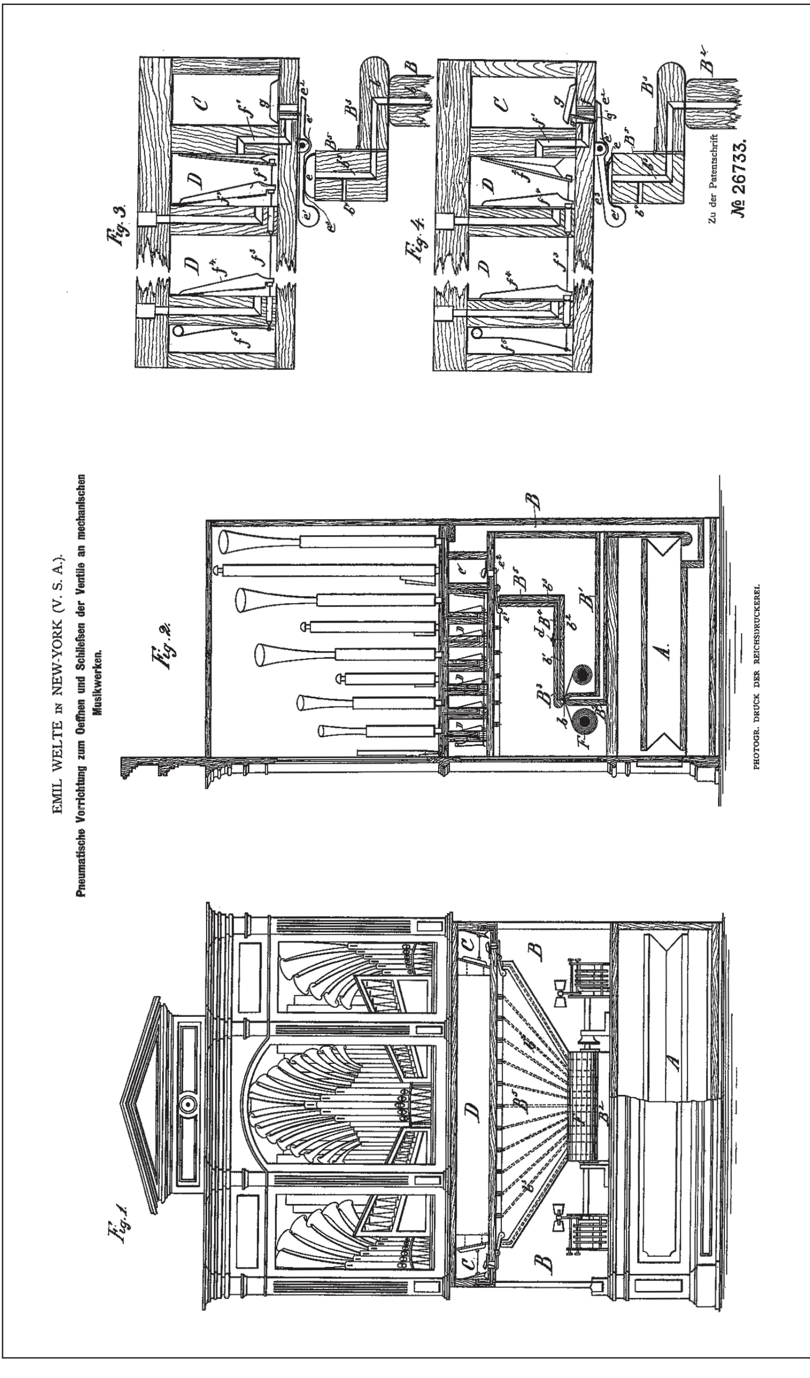
The machine uses solenoids and small metal roller wheels to mark carbon-paper traces on a constantly moving roll of paper, pre-marked with lines dividing it into strips for each note. Contacts under the keys of a piano or similar keyboard instrument control the operation of the solenoids, and the speed of the master roll paper is both regulated and controllable. A marked out guide is provided for the machine operator, so that the recorded notes can subsequently be deciphered. No indication is given in the patent as to the ways in which the machine is to be put to commercial use, but it is clear from the very detailed nature of the drawings that the patent is not merely an imaginary project. It must have cost a great deal to develop and manufacture, with all the implications of funding and commerce that are thereby brought to bear. In 1886, Paul Boehm was based in the Alexandrinenstrasse in central Berlin, an area to the east of the Potsdamer Platz with many small industrial enterprises, but no particular proximity to a manufacturer of mechanical music. However, common sense tells us that it was not simply made as a museum piece.

Since there is no indication within the patent itself of any specific commercial relationships, we need to look at the details of its mechanism and the date of its publication, to see with which existing firms or instruments it has the most in common. Counting the roller wheels on one of the patent illustrations, the compass of the marking machine is set at 74 notes, which is a remarkably large range for the mid-1880s. This may not have been the exact amount used for practical purposes, of course, but there would have been no particular reason for any gross exaggeration. In addition, one can sensibly surmise that such a machine was designed to fulfil a well defined need, rather than representing a merely speculative enterprise. One does not go to the trouble of such complex design without a practical purpose in mind, and without some previous experience of the manufacture of perforated music on the part of either the engineer or his client. The question is, very simply, which firms in Germany were manufacturing music sheet instruments with such a wide range of notes, and the only answer, equally simply, is Michael Welte und Söhne of Freiburg. All other orchestrion manufacturers of the time were using pinned barrels, and there were no roll-operated pianos with anything like such an extensive musical range.



Improvements in Mechanical Drums for Orchestrions and Similar Instruments
German Patent no. 10723, in the name of Welte und Söhne, Freiburg

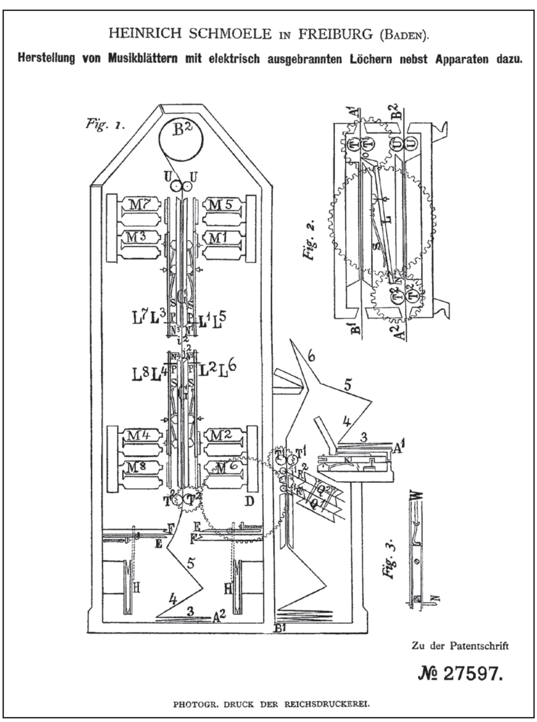
Welte had been manufacturing orchestrions from the 1840s onwards, with the music transcribed on to pinned barrels. In a German patent (DE 10723) awarded to the firm in February 1880, it is clear that such barrels were still



Pneumatic Mechanism for Opening and Closing Valves in Mechanical Musical Instruments
German Patent no. 26733, in the name of Emil Welte, New York

being used, but by 1883, Emil Welte had applied for a patent (DE 26733) for operating such orchestrions from a perforated paper music roll. Emil was Michael Welte's eldest son, who had emigrated to America in the mid-1860s and set up M. Welte & Sons in New York, as a means of representing and expanding the family business in the New World. The general layout of the orchestrion in his patent is exactly the same as for a barrel-operated instrument, and the roll compartment is as a result perhaps rather larger than it needed to be. What is particularly interesting about this early German roll patent is that it was taken out by the American branch of the Welte family, who would no doubt have been brought into contact with the tremendous developments of the music roll in the USA in the 1870s and early 1880s.

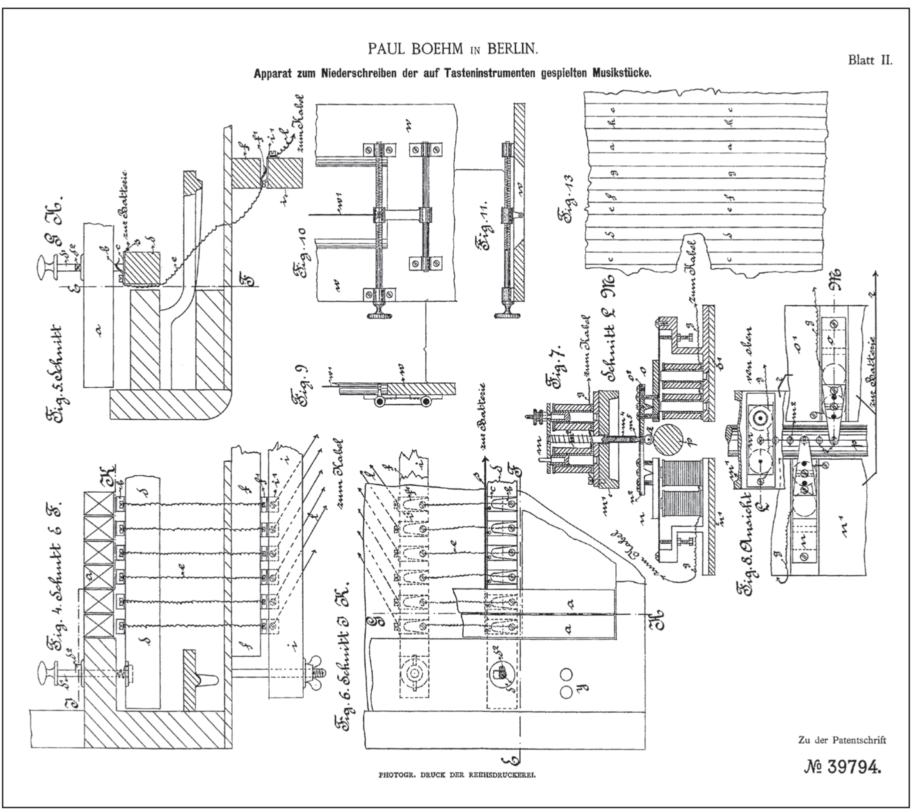
Having established the principle of operating an orchestrion, with its many organ-like pipes, from a perforated roll, the Welte company then set about developing the new technology at its factory in Freiburg. It appears to have secured the services of Henry (Heinrich) Schmoele, one of two brothers from Philadelphia, both of whom had been working on roll-operated technology since the early 1870s. Schmoele, with an address in Freiburg, applied for a patent for producing perforated music rolls in real time, by burning holes



The Production of Music Sheets with Holes Burnt Electrically and the Apparatus for Producing Them.
German Patent no. 27597, in the name of Heinrich Schmoele, Freiburg.

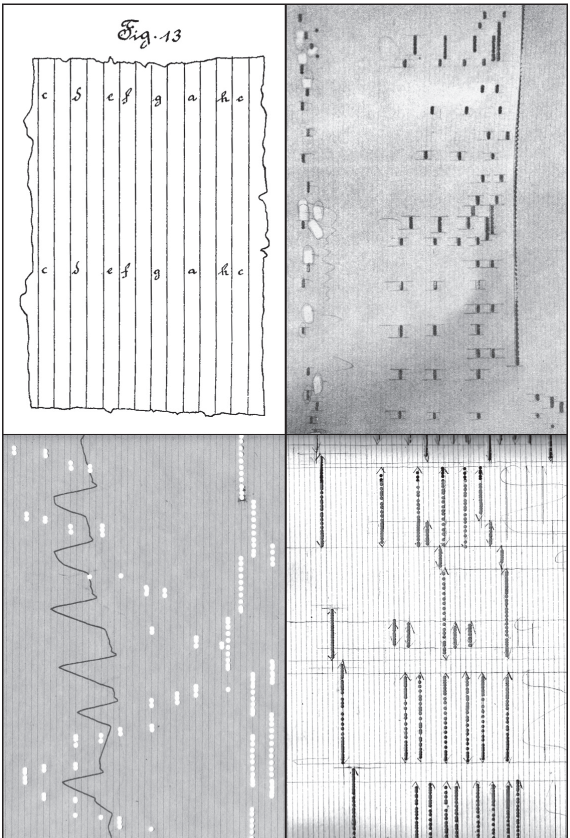
electrically, a clear sign that the Company was intending to use recording as an important means of its roll production. This technique, in the mid-1880s, was around twenty years ahead of any serious competition in the field, a quite remarkable state of affairs, whose unfamiliarity in recent years is in part accounted for by the fact that Welte did not seek to make any promotional capital out of it. Indeed, it may be that the firm regarded its means of roll production as a form of trade secret, not to be broadcast to the wider world in order to safeguard its commercial advantage, and this was certainly the case later on with the Welte-Mignon.

According to Gerhard Dangel, in his article in *Pianola Journal* no. 18, the burning of perforations was not apparently put into regular practice, and certainly the drawings in Schmoele's patent do not have the detail that would suggest a machine that had been constructed and put to the test over a period of time. By contrast, the Boehm patent mentioned earlier is drawn very exactly, and a number of its design features tally with subsequent Welte practice.



Apparatus for Registering Music played on Keyboard Instruments
German Patent no. 39794, in the name of Paul Boehm, Berlin

In the first place, it is worth noting that Boehm specifies the use of paper that has been printed in advance with lines delineating strips for each note. Many published Welte rolls, all the surviving Welte second masters, and the only Welte first master so far traced, contain lines of exactly the same sort, with the difference, in the case of the second masters and issued rolls, that the lines themselves indicate the centre of the note pitch, whereas the Boehm patent places the pitches in between the lines. However, on the rather grainy photograph of the only known Welte first master, it is just possible to see how the note traces occur in the spaces between the printed lines, whereas the subsequent hand-punched perforations occur directly on the lines. It was no doubt a wise course to mark a recording slightly to the side of the guide lines, in case any corrections needed subsequently to be made, and it would

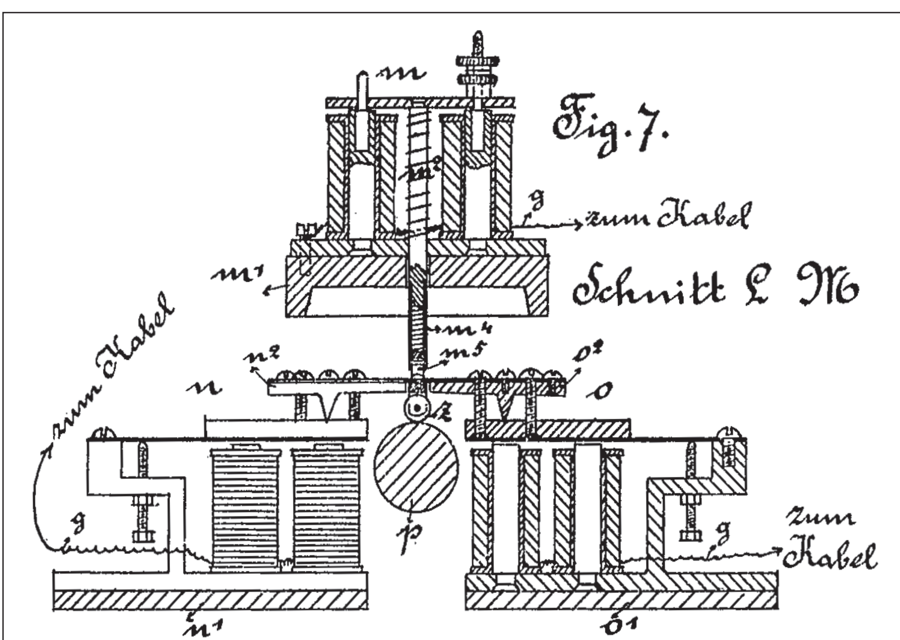


Lined Music Roll Paper (clockwise from top left)
1: Paul Boehm Patent, 1886 2: Welte-Mignon First Master, no. 4119, 1927
3: Welte-Mignon Second Master, with Playback Dynamic Line, no. 877, 1920s
4: Welte Philharmonic Organ First Master, USA, 1920s

also explain a phenomenon that is very noticeable on Welte rolls, namely, the frequency of wrong notes which are out by a semitone. Normally, where pianists make such minor errors, the wrong notes are displaced by a whole tone, by the very nature of the keyboard layout, but it is easy to perceive how a Welte roll puncher, having perhaps forgotten to include some note or other, might have returned to the master roll from the other side of the table, and inadvertently punched along the adjacent line. This is a phenomenon that no doubt needs more exact documentation, but it is one that several regular Mignon listeners have noticed and recognised.

A second similarity between Boehm and Welte occurs in the method of marking traces on the roll, which, in the illustrations accompanying the patent, is done by means of small roller wheels. As will be seen later on in this article, the explanation of Welte recording reported by Richard Simonton in the sleeve note of a set of early Columbia LPs, published in 1950, states that,

> *"This machine had within it the conventional rolls of paper which were entirely blank and without perforations, but were ruled their entire length with over one hundred fine lines, each corresponding to the center line of its control mechanism. Above the point at which the impression actually took place on the paper was a series of small rubber rollers of a composition similar to the type used in a printing press, and these rollers were inked with an ink similar to that used by the printing industry."*



Detail from Paul Boehm Patent (DE 39794), showing Roller Wheels

Now in fact the Boehm patent, like the early Ampico recording machine, makes use of a carbon treated roller to mark traces as the paper is pressed against it, rather than the conventional ink of a printing press, but there is enough similarity to identify the Boehm patent as most likely to have been commissioned and used by Welte, and in any case, the explanations given by Richard Simonton or those using his name are demonstrably unreliable, as we shall see. One of the problems caused by Simonton is that his own evidence is that of an inexpert witness, rather than a deliberate liar, so that some sections may well have grains of truth hidden within them. What is unwise nowadays is to take Simonton's explanations without careful critical analysis, not of their feasibility, but of their historical probability, which is an entirely different matter.

Also in favour of the Boehm recording machine is the date of its patent, namely the summer of 1886. The first occasion on which Welte roll-playing organs were significantly demonstrated to the public was the Upper Rhine Industrial Exhibition, opened by the Grand Duke of Baden in July 1887. The firm exhibited two separate concert organs, joined by electrical cable, and playable by hand or by "coupirte Notenblätter", an interesting and somewhat archaic term for perforated music rolls, using a form of vocabulary nowadays reserved for the neutering of animals, perhaps testimony to the very novelty of the concept in Germany at the time.

In all, it seems very likely that Welte recorded its music rolls from the late 1880s onwards, for organs and orchestrions alike, from the playing of staff musicians. This would actually have been quite an inexpensive process, but with reliably musical results, and renders far more comprehensible the unexpected birthplace of the first reproducing piano. Quite simply, Welte had been doing it for years.

Musical Staff

What are now thoroughly lost in the mists of time are the personalities of any musicians responsible for the production of such rolls, though one or two clues have survived. Alfred Hollins, the British concert organist, in his autobiography, *"A Blind Musician Looks Back,"* recalls with some fondness his trip to Freiburg in late August 1913 to play on the Welte recording organ, and he describes in detail the nature of his recording sessions. In particular, he singles out a Herr Buchali as the *"head musician"*. Since his general recollection provides insights into the ways Welte carried out its recordings, it is worth quoting at length.

> *"In the same year I was engaged by Welte & Sons of Freiburg, in Breisgau, to make fifty records for their automatic organ-player. They were the inventors of the Welte-Mignon piano-player, success with which had led them to develop a player for the organ, and the reproduction was, if possible, still more accurate.*

"A nephew of mine went with me to Freiburg, and we stayed at the Hotel Europa, close to the railway station. There was a Welte-Mignon upright piano in the large dining-room, and there were records made by the great pianists. The manager put in a roll for us to hear while we were at supper. I had had a piano-player of my own for some years and I had to admit the superiority of the Welte-Mignon.

"Welte's premises were quite close to the hotel, but on the other side of the railway line, and we went through a subway to reach them. The studio was a large and beautiful room, plainly furnished. On the walls were photographs of the musicians who had made records. The room could be entered by a door from the main building, of by a French window opening into a garden. The head of the recording department, Herr Bokisch (sic) – whom I dubbed the recording angel – had not yet returned from a week-end motor tour in the Black Forest, and while waiting for him I got to work at the organ. When he arrived he introduced me to the head musician, Herr Buchali. Bokisch spoke English perfectly, but Buchali very little.

"Bokisch had asked me to bring a copy of every piece I intended to record, and this I had done. The first two days I spent playing over my intended records, and Buchali sat beside me marking in the copy whatever combination of stops I selected. When I began recording he still sat beside me and followed the music closely. Every morning Bokisch asked me to play a chromatic scale two or three times up and down each manual as fast as my fingers could go, so as to make sure that the markers were working freely after having stood idle all night. When I had played my scales like a good boy, Buchali used to take my hand in his big soft paw and say: "Ach! Well done! Those nice warm fingers!"

"We worked every day from ten till about one and from half-past two until half-past five, with a break at four, when tea and dainty little cakes were brought in. But although we were busy we found time to see most of the city …

"Bokisch wanted me to hear one of my rolls before I left, and it was arranged that I should take a day off while Buchali got one ready. The day was gloriously fine and warm and we went to the Black Forest …

"Herr Welte, the founder and head of the firm, a fine example of old age, often came into the studio while I was recording. He knew only a few words of English, but we managed to have many a good talk together. In the studio there was a charming little organ – without keyboard – on which rolls were played. One of the stops was an open wood flute known as a Vienna Flute, and when I told Herr Welte how much I liked it he opened out at once. Before developing the Welte-Mignon and the organ-player, the firm's main business had been – and to an extent was still – the building of orchestrians (sic) for use with roundabouts and shows at fairs. Bokisch let me hear one of these instruments. It was wonderfully realistic, but what a dreadful noise it made inside the building!

"I left all my music so that the records could be checked and corrected before the rolls were made. When war was declared it had not been returned, and this was not surprising seeing that to go over my fifty alone would take a long time, and Buchali had a large number made by other people to examine also. During the four years of war

I forgot all about the music – although not about my friends at Freiburg – and I was both surprised and pleased when, early in 1919, I received a note from Bokisch saying that my music had been sent off. Both my friends had come through a very hard time. The music arrived in perfect condition, and I am glad to have this opportunity of acknowledging the sincerity and straightforwardness Weltes showed in all their dealings with me."

Alfred Hollins Recording for the Welte Philharmonic Organ
Welte Studios, Freiburg-im-Breisgau, August 1913

Many interesting nuggets of information come out of this recollection, which has the appearance of being reliable, and can to some extent be checked, since the Freiburg street directories are now available online. Hollins is the only source to mention Herr Buchali as Welte's "head musician", but a Friedrich Buchali does indeed show up in the Freiburg directories, with an occupation described (in 1923) as a town musician, and later as chamber musician, retiring from work around 1938. Interestingly, Herr Buchali remained living in Freiburg until 1961, so he must have reached a good age, and it is rather sad that no-one took the opportunity to interview him.

Simply because Friedrich Buchali worked on Alfred Hollins' organ rolls does not necessarily mean that he worked on piano rolls as well, though common sense tells us that the recording machines for both instruments must have had many similarities, and Hollins' memories are sufficiently reliable that his description of Buchali as the "head musician" carries a certain weight. Karl Bockish's request that Hollins take copies of all the music he was intending to play implies that some form of musical control was likely to be exercised by people other than Hollins, either at the time of recording or afterwards. As Hollins reports, the firm held on to the scores until the rolls were finished, so that they must have been used during the process of perforating or correcting the master rolls, and his description of the way in which Buchali observed and noted down his changes of registration implies that the firm had no automatic means of carrying out this procedure.

There are two observations which give an insight into the length of time it took to prepare music rolls. In the first place, Hollins recalls very clearly that he was sent on a day trip around the Black Forest, while Herr Buchali prepared one roll as an audition trial. By his own account, Hollins recorded around fifty rolls in August 1913, and yet by the outbreak of war, September 1914, his music had not been returned, meaning that the rolls had most probably not been completed by that time. We seem to be dealing here with a process that initially takes about a day per roll, and given the number of other organists who had each played their two score and ten party pieces, it is not so surprising that more than a year might elapse before Hollins' complete set of rolls was ready for publication.

Josef Hofmann Recording for the Welte Mignon
Welte Studios, Freiburg-im-Breisgau, c. July 1913

In the official photograph taken of the recording session, one can see some of the music on the table at which Berthold Welte is seated, and this typical Freiburg practice of someone following the music at a table, as the artist played, can also be observed in some of the Welte piano recording sessions in Freiburg, such as Josef Hofmann's visit a few weeks before Hollins in the summer of 1913. Berthold Welte is indeed sitting at exactly the same table and chair in both photographs!

Finally, it is worth noting that Hollins makes a distinction between the "records" and the "rolls", the former being the master sheets with note traces on them, and the latter being the punched rolls, into which they were converted and then duplicated. The terminology which is generally used in the case of Welte factory rolls is that of first and second masters, the former being the rolls marked in the recording machine, which were subsequently punched by hand, and the latter the first generation copies that were made from these, and then corrected by eye and used in their turn for perforating normal commercial rolls. Over the period between 1905 and the late 1920s, commercial Welte rolls improved very considerably in accuracy, and it can be readily seen that at the outset they were not very exact. This whole question is in need of detailed and documented research, which can only be done with original rolls, and not with modern copies, particularly where these give no indication of the date of the source roll. But it is very noticeable that Welte did not place any great importance on the accuracy of its roll copying in the first five or six years of Mignon production, and that the situation only improved gradually after that time, presumably as a result of competition from other reproducing piano companies. This is another pointer, if one were needed, to the improbability of Welte's having employed a large roll-editing department.

One of Friedrich Buchali's predecessors or colleagues seems to have been Heinrich Burkard, born in 1884, a young light-music organist who recorded many piano rolls for Welte, and who moved to the USA in 1912, to take charge of roll-recording activities at the new Welte factory at Poughkeepsie. According to Gerhard Dangel and Hans-W. Schmitz, in their *"Complete Library of the European Recordings 1904-1932 for the Welte-Mignon Reproducing Piano"*, Burkard was a highly prized colleague, who not only recorded many rolls himself, but also composed arrangements, and operated the recording equipment for the Mignon as well as the Philharmonic Organ. The source of this information is not given, however.

Lydia Reinbolz was apparently another member of the Welte roll editing staff, interviewed in 1976 by Hans-W. Schmitz, who in turn reported some of his findings to Mark Reinhart, whose article on Welte Recording Techniques appeared in Pianola Journal 16. Miss Reinbolz apparently asserted that the Welte *"mother rolls"* ran at twice the speed of the playing copies, though it is not clear whether the *"mothers"* she referred to were the first or the second masters. Certainly the accuracy of Welte rolls published during the 1920s is much greater than those from earlier periods, so it is possible that longer first or second masters were used. However, all the surviving second master rolls, at Freiburg and at the University of Southern California in Los Angeles, are of normal length, as is the Horowitz first master roll whose photograph survives and appears earlier.

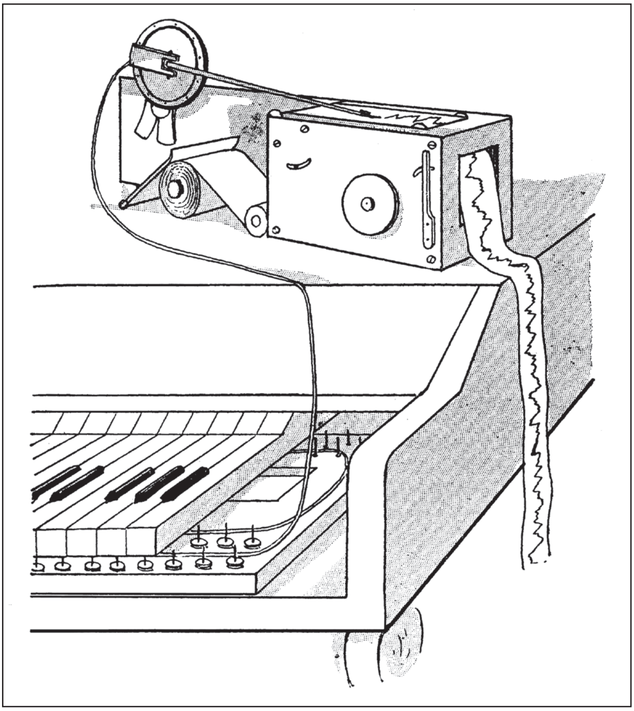
According to the Dangel and Schmitz catalogue mentioned earlier, Max Schreier, a trumpeter in the Freiburg Theatre Orchestra, worked at Welte from about 1910 until 1932, and dealt with the newly recorded rolls to prepare them as first masters. This source of this information is not given, but presumably comes from Hans-W, Schmitz's private researches.

The name of Kähle appears on some of the second master rolls at USC in Los Angeles, as having modified (*"corrigiert"*) second master rolls for use also with the later Welte 98-note green roll system. This work involved in part the modification of loud and soft pedal tracks, to avoid excessively long perforations, which might weaken the rolls. The earlier red rolls use a lock and cancel system which calls only for short signals.

Besides these relatively unknown individuals, there was during the 1920's the young pianist and composer, Hans Haass, who not only edited, but also recorded rolls for the Mignon, and of course the inventors themselves played a large part in the recording process. When Alfred Hollins travelled to Freiburg to record for the organ, Edwin Welte was on board the S.S. George Washington on the way between Cherbourg and New York, but Hollins makes it clear that Karl Bockisch attended his recording sessions and operated the marking machine personally, and there seems little doubt that by far the majority of Welte rolls were brought to life in this very individual way. Having invented such a clever recording system, one can hardly blame them!

Some early experiments in dynamic recording

In view of the importance of Edwin Welte and Karl Bockisch as the originators of the reproducing piano, their predecessors in the quest for recorded musical documents have frequently gone unnoticed. However Mark Reinhart, in his authoritative article in *Pianola Journal* no. 16, pays tribute to a number of these, but I don't want simply to cover the same ground. In particular, a distinction needs to be made between those inventions which sought to capture improvisation and to render it into printed music, and those which concentrated on the audible reproduction of ephemeral performance. What interests us here is the second of the two categories, and in particular those which concentrated on the measurement of dynamic force. As a starting point, we should again note the experiments carried out by Binet and Courtier in the 1890s, written up in the newly established French journal, *l'Année Psychologique*, in 1895, and subsequently reported in the USA in the *Scientific American Supplement* and in the journal, *Nature*.



Binet and Courtier's Graphical Piano Recorder, Paris c. 1895

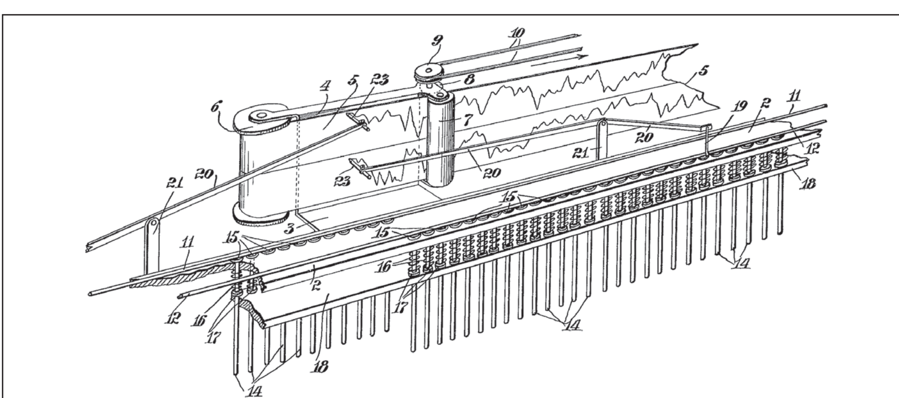
In the 1890s, Alfred Binet was the Assistant Director of the Laboratory of Physiological Psychology at the Sorbonne, and Jules Courtier was his assistant Head of Work, and together the two men designed, constructed and operated a machine for measuring performance at the piano graphically. The system used was based around a rubber tube placed uniformly under the keys of what appears to be a grand piano, with separate runs for the black and white notes, the whole forming one looped tube whose two ends terminated on one side of a rubber diaphragm, the other side of which was open to atmosphere. The diaphragm was in its turn attached to a marking device, consisting of an early fountain pen and a moving roll of paper.

In fact, it would not have been possible for the Binet and Courtier machine to record dynamics in any accurate way, and probably not at all, since the deformation of the rubber tube depended on the distance travelled by the key, and not on its speed of depression, which is the true manifestation of the force exerted by the fingers of the pianist. The only minor differences caused by force would have depended on inertia in the diaphragm and marking device, and both give every appearance of being rather light. One can also see, in the illustrations of recorded traces which accompany the article, that two notes gave twice the reading of one, and so on. However, Binet was not primarily seeking to analyse dynamic force, but rather the irregularities in the tempo of human music-making, caused either by deliberate musical sentiment, or by anatomical considerations, such as the passing of the thumb under various other fingers, during the playing of scales and arpeggios.

His own explanation of the artistic application of his experiment makes his intentions very clear:

> *"We know that, despite its complications, musical notation is incapable of indicating all the nuances of musical performance; it gives the tempo without any subtlety; there are potentially many different inflections of duration between white and black notes; the tempos of a musical piece can become marginally faster or slower without the printed music being able to indicate it properly. As a result we use and abuse a whole host of vague, mostly Italian expressions, to get round this serious difficulty. Let us also remember that the metronome is for the same reasons far too coarse an instrument for measuring the real tempo of music. Essentially, different people will play the same piece in very different ways, even though each of them remains faithful to the letter of the printed music. It would be intensely valuable to have the traced record of a composer playing his own work: he would surely accept wholeheartedly a means of expression which allowed him to indicate his thoughts in such an exact way. The graphical method can effectively set down the tempo of playing to an accuracy of a hundredth or even a thousandth of a second, and indicate the relative intensity of notes."*

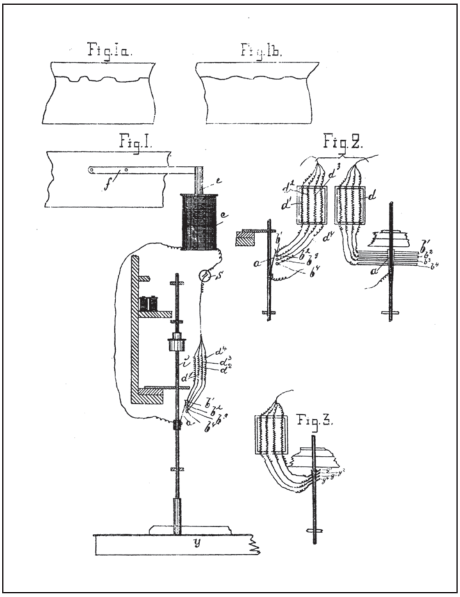
Although, strictly speaking, the Binet and Courtier apparatus was not a dynamic recorder, its design clearly influenced both Welte and others in the industry. Welte's own recording equipment can just about be seen to have used a similar trace recorder, and Philip Meahl in New Jersey patented a device with separate dynamic traces for treble and bass as late as 1913. It is important to note, however, that these seismographic lines can only be read by human editors, who then have to interpret them as best they can, if they are ultimately to be used for the preparation of music rolls: they are not in themselves an automatic means of reproducing dynamic information.



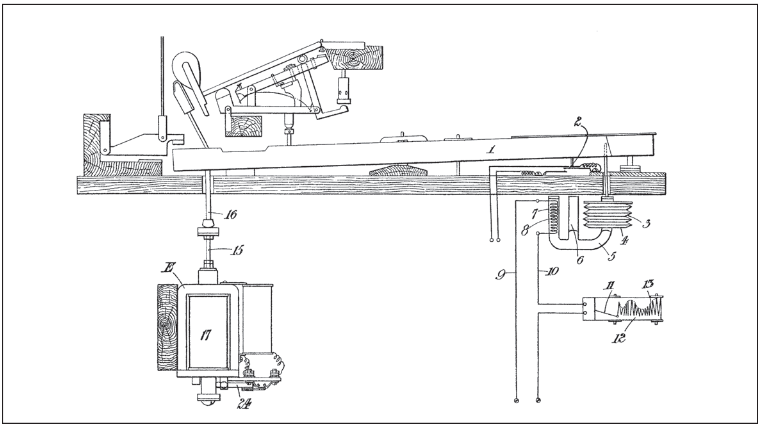
Philip Meahl's Seismographic Dynamic Recorder, New Jersey, 1913

Another pioneer in the quest for dynamic reproduction was the Swede, Carl Nystrøm, who in late 1898 patented a dynamic recorder and controller for use with electrically played pianos. Nystrøm's patent specified the use of the device with instruments in which a long rotating roller provided the necessary force to operate the keys, rather like the mechanism which used to be found in electric typewriters, or indeed in the foot-operated Pianotist player piano. The recording device, which was controlled by solenoids operated through switched resistances, contained a thick roll of wax-coated paper, and instead of marking an undulating line in ink, Nystrøm used a stylus to cut a groove into the wax surface, which could then be tracked by a reading head and used as a means of controlling the speed of the rotating roller for playback. Although this was apparently the first attempt at automatically reproducing dynamics of any kind on the piano, it is perhaps further away from the Welte system than the Binet and Courtier experiment, which was pneumatic rather than electric.

A rather more elegant and effective method of reproducing dynamics on electrically played pianos was designed by a Harvard-educated American, Clarence Wiener, and even though this was not patented until 1909, it is worth noting here on account of its similarities to the Welte system. Wiener was a larger than life character, the son of a wealthy Philadelphia businessman, who volunteered for the British Army in the Boer War, ran his own international news agency from the Strand in London, spent several years in Vienna, designing a quite remarkable reproducing piano system, and who subsequently twice attempted suicide, the second time successfully, in New York in 1932. He also had some musical connections; on the death of Wiener's father, his mother married again, to the composer Ludwig Amadeus von Gaertner, who had studied the violin with Joachim, and who is chiefly remembered in player piano circles as the originator of the delightful Viennese waltzes arranged and played by Ignaz Friedman on the Duo-Art. This Viennese connection may well explain the reason why the appropriately-named Wiener chose that city for the development of his reproducing piano, and perhaps his stepfather also had contacts in the Austrian musical world.

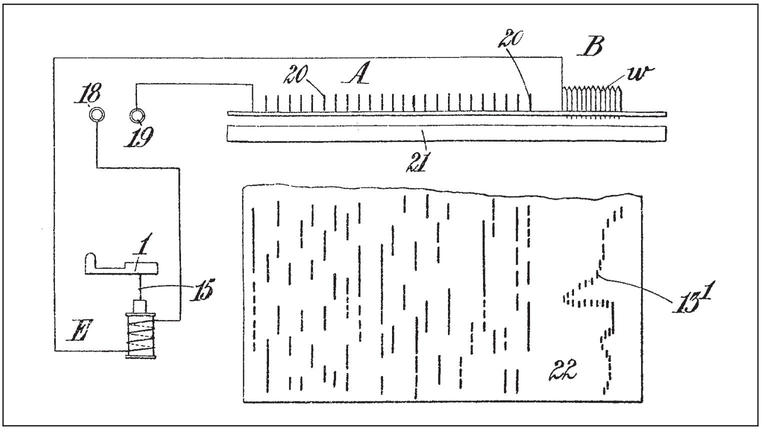


Carl Nystrøm's Solenoid-controlled Dynamic Recorder, Karlstad, 1898



Clarence Wiener's Dynamic Recording System, Vienna, 1909

As can be seen in the illustration above, each key of Wiener's piano pressed down a small pneumatic accordeon bellows when played, which in turn caused the displacement of a quantity of mercury in a small "U"-tube. The tube was actually more like a letter "W" than a simple "U", since it also had a central arm, through which it vented to atmosphere. At the left-hand side of the "W" in the illustration, a small uninsulated electrical resistance was located inside the mercury tube, and when the key played, the level of mercury was correspondingly raised, shorting the resistance, and playing its part in marking a seismographic line on a moving roll. In contrast to the central arm of the "W", which was completely open to atmosphere, the top of the left arm only vented through a small bleed, in such a way that, as the force of the keystroke increased, the mercury was increasingly displaced, shorting out more of the coiled resistance. This is a clever and elegant idea, but it is not clear whether it was ever put into practice in any commercial way.



Clarence Wiener's Dynamic Reproducing Mechanism, Vienna, 1909

Further contacts under the keys connected with a roll-marking device for the pitch and duration of the notes played. Once the roll had been completed, it was removed from the recorder, edited and perforated in the usual manner, except that the seismographic dynamic trace was subjected to a process which we would now call digitisation, in that it was reduced to a fixed, though liberal number of steps, represented by individual perforated tracks. The result can be seen in Illustration 16. The playback system used electrical *"feeler"* contacts, which effectively read the perforations of the music roll, and these were formed into a metal comb, with a particularly high density of contacts at the right-hand end, used for reading the dynamic trace. Each one of the dynamic contacts shorted out more or less of an electrical resistance, controlling the power with which solenoids operated the keys of the reproducing piano. If this ingenious system had been commercially developed to the same extent as the Welte-Mignon was, it should have changed the course of musical history, but nothing seems to have been done with it after the development stage. Clarence Wiener, for all his derring-do, was a very effective inventor.

There are other dynamic recording patents to be examined, but they will follow naturally during consideration of the various types of reproducing piano.

Previous theories of the Welte system

No other reproducing piano recording system has been so poorly represented in academic and commercial historical literature as that of the Welte-Mignon. It is worth examining why this strange state of affairs should have come about, and in which ways the misrepresentations have affected the reputation of the Mignon in general, and the attitudes towards its recorded performances in particular. Over the years great credence has been placed in what we have been repeatedly told are the explanations provided by the late Richard Simonton, even though very few of these can be conclusively attributed to him. Recently, Dr Ludwig Peetz, currently the Dean of the Faculty of Applied Sciences at the Kaiserslautern Technical College at Pirmasens in Germany, has applied his considerable scientific experience to the matter. Dr Peetz has quite brilliantly shown how the unusual theories propounded in the name of Richard Simonton might today be put into practice. However, not once has he examined whether these theories might be historically true, nor the reliabilities and in most cases the identities of the witnesses from whom they might have come down to us, and he has also not considered the practical use, if any, of the methods broadcast under Richard Simonton's name, particularly with regard to the preparation, by a very limited number of early twentieth-century musical staff, of literally thousands of recorded music rolls in the space of about fifteen to twenty years, allowing for a mostly quiet period during the First World War.

It is particularly sad that the evidence of the methods actually used is there for us to observe and analyse, if we will only look. For example, as far as I am aware, no-one, apart from Denis Hall and myself, has bothered to examine the Welte second master rolls at the University of Southern California with this analysis in mind. It is of no particular credit to us that we have done so, albeit in a period of time limited by financial constraints, because in all truth anyone claiming to investigate the Welte recording process should have made a similar effort: it is simply common sense.

As an example of the dangers of not bothering to check on the reliability of evidence, we might consider how Dr Peetz has come to report, as an undisputed fact, the remarkable notion that Philipps of Stuttgart used a large wax cylinder to record the dynamics for its Duca reproducing piano. Luckily for us, Dr Peetz is well trained in the writing of academic articles, and he is, albeit selectively, quite punctilious in crediting the sources of his information.

He writes as follows:

> *"The dynamic recording for the Philipps Duca system was carried out, as former employees have testified, by means of a wax cylinder, which was located above the strings, spanning the whole width of the recording grand piano. A sprung stylus was attached to each hammer, and as the string was struck, the stylus continued to move in proportion to the speed of striking, thereby cutting a more or less deep incision in the layer of wax. The wax cylinder rotated on a helical basis, so that each note could be marked on the spiral, up to a total playing time of 11 minutes. This information was posted to the American internet archive, "Mechanical Music Digest", by Dan Wilson, where it is available for anyone who is interested."*

There is no suggestion in Dr Peetz's article, not even a hint, that this report is anything other than the exact historical truth. He has clearly not investigated Dan Wilson's sources, nor Dan's character. Perhaps we can help him in this regard. The late Dan Wilson was a dear friend of many of us in the Pianola Institute, and if I choose to remember him personally, there will be many others who will share the general perspective of my recollections. It is perhaps necessary here to depart from the relatively impersonal nature of most academic journals, but that is an indulgence which we can grant ourselves from time to time.

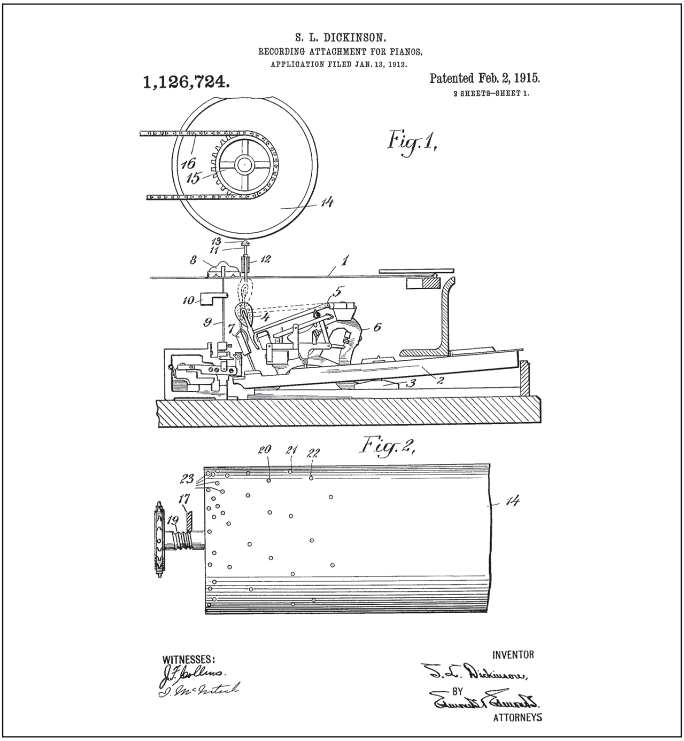
I knew Dan for about 25 years, and he was one of my closest friends; he died in late 2005, and I miss him very much. He was the best jazz Pianola player I could ever wish to have heard, and he even played at Rona's and my wedding. Dan stayed at our house on several occasions, and, more unusually, I stayed at his. Dan's house was the most untidy I have ever come across, but that was a facet of his eminently lovable character. I even ate dinner cooked by Dan, making myself the only person in the player-piano fraternity who had done so, as far as I am aware, and causing other friends to question my wisdom and my instincts for self-preservation!

Part of Dan's charm was his perceived ability both to divine the location of water, and to diagnose and cure the illnesses of people and industrial buildings by the laying on of hands. This talent could also be applied to the solution of various, otherwise impenetrable mysteries. On one occasion in the early 1980s, a group of us were spending Easter together, and we took a walk through the woods near Denis Hall's house. Dan had brought his water-divining twig with him, just to keep his hand in, and he occasionally lagged behind the rest of us, as he sensed some underground rivulet. There was a large tree that we passed, and a huge flock of birds making a tremendous noise, which caused us to stop and stare. What was it that was causing the rumpus, we wondered, before carrying on through the depths of Hayes Common. We hardly noticed that Dan had once again fallen behind, but after about a quarter of an hour, he returned, and told us that he asked his twig the reasons for the birds' excitable chatter.

The twig only twitched for "Yes" or "No", but he had managed to frame his questions appropriately, and he told us that the reason for all the noise was that the young female birds were wanting to carry on having a good time with the lads, whereas the parents were shouting at them that they must settle down with a single partner and set about breeding, for the good of the flock. In a similar way, he once laid his hands on Denis Hall's Steck Pianola grand, and declared that it had spent much of its life in South Africa.

Now, who am I to question Dan's hands or his twig? Maybe his explanation for what was going on with the chattering birds was the closest we should ever get to the truth. But I have to say that I was not convinced, and I should not be happy to base my researches into the recording practices of the Welte-Mignon on the answers of a forked twig. In any case, Dr Peetz's wax cylinder is well documented, were he to look for it, and common sense makes it abundantly clear that, if it was ever used in the player piano industry, then it would most likely have been in connection with the Aeolian Company, or just possibly with another New Jersey manufacturer.

Dan made his posting about the wax cylinder in January 2000, about a month after the death of Rein Groos, another dear friend, to whom he attributes the information. Well, at that time I had been doing some research in the Patents division of the British Library, and I had come across a number of real-time roll perforating machines, and one or two dynamic recording systems for good measure. I still have the photocopies of the wax cylinder patent which I obtained at the time, and which I don't doubt I shared with Dan at one of our regular Friends of the Pianola Institute committee meetings. Both Dan and I were unreformed bachelors at the time, and Denis Hall would kindly provide supper for us before the rest of the committee arrived. We always spoke a great deal about player piano history, which was a constant part of our friendship.



Samuel Dickinson's Wax Dynamic Recording Cylinder, New Jersey, 1915

The patents in question are more easily available nowadays, since the US Patent Office archives are all on line, albeit only by means of a numerical search. The inventor was Samuel L. Dickinson, of Cranford, New Jersey, and his patents are nos. 1,126,724 and 1,126,725, dated February 2nd, 1915, and applied for in January and April 1912. As it happens, I have visited Cranford several times, since its township border is on the corner of the main factory of the Aeolian, Weber Piano and Pianola Company in Garwood. The Cranford street directories are also available on line, and in 1912, Samuel Dickinson was living at 232, North Avenue West, about ten houses to the east of the junction where the former Aeolian site begins, also on North Avenue. At this point, common sense surely tells us that Dickinson's invention might just have had something to do with the Aeolian Company's efforts to develop the Duo-Art.

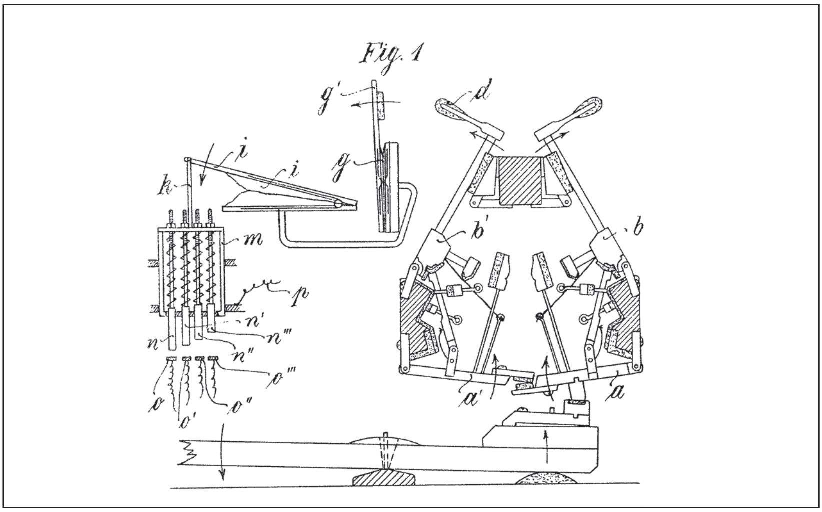
One of the patents is witnessed by J.W. Dickinson, who lived down the road in the same house as J.H. Dickinson, who had no less than 27 official Aeolian patents to his name, and who worked for the Aeolian Company at Garwood. We do not have a complete record of Aeolian Garwood employees, but the likelihood of someone, living ten houses away from Aeolian, assigning his patent to a competitor company in a country that was at war with his own must be so negligible as to be out of the question.

It is regrettable that such trivial mistakes should need such lengthy space and such expenditure of time and effort to point them out, but such is the almost Biblical intensity with which commentators adhere to Richard Simonton's supposed writings, that it is an inevitability, if we are to come anywhere near to the truth. Dr Peetz also misrepresents the Hupfeld dynamic recording system, and suggests that it recorded every note with up to five separate lines, misquoting Ludwig Riemann in his support. It is necessary to quote the original German here, in order to make the distinction clear:

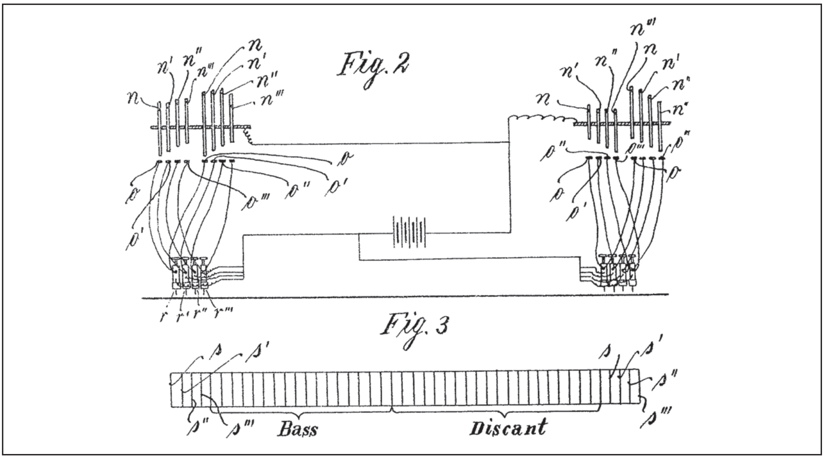
> Peetz: *"Jede Taste war über 5 Schläuche, die den Stärkegraden pp, p, mf, f und ff entsprechen, mit einem Aufnahmegerät verbunden. Stiftschreiber markierten 1-5 Linien beim Tastenanschlag auf eine laufende Papierrolle, wodurch die Agogik- und Dynamik-Informationen festgehalten wurden."*
>
> Riemann: *"Jede Taste war mit fünf Schläuchen des Apparats verbunden, die den hauptsächlichsten Stärkegraden entsprachen: pp, p, mf, f, ff. Je nach Stärke des Fingerdrucks trieb die dadurch entstehende pneumatische Kraft einen oder mehrere Stifte auf das Papier, sodaß z. B. ein Strich = pp, fünf Striche = ff anzeigten."*

In English, the two versions are as follows:

> Peetz: *"Each key was connected to a recording device by means of 5 tubes, which correspond to the dynamic levels pp, p, mf, f and ff. As the note played, marking pens drew 1 to 5 lines on a moving roll of paper, by means of which the tempo and dynamic information were set down and recorded."*
>
> Riemann: *"Each key was connected to five tubes of the mechanism, which corresponded to the main dynamic levels: pp, p, mf, f, ff. According to the force exerted by the finger playing the key, the pneumatic power which resulted pushed one or more pens against the paper, so that, for example, one line represented - pp, or five lines - ff.*



Walter Bernhard's Dynamic Line Recorder - Hammer Mechanism, Leipzig, 1908

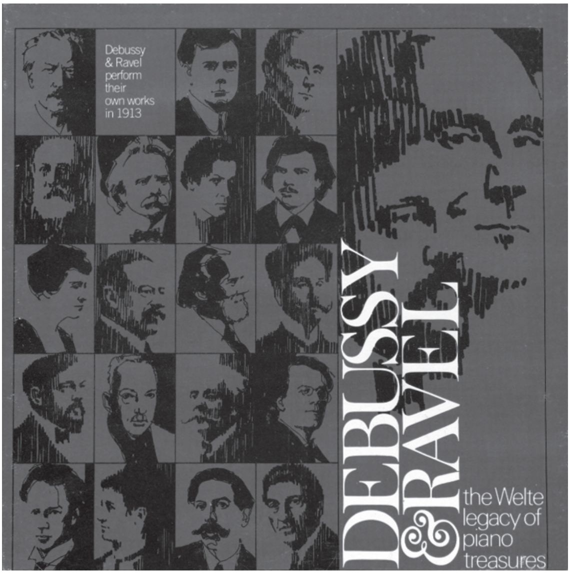


Walter Bernhard's Dynamic Line Recorder - Marking Contacts, Leipzig, 1908

"The main point of distinction between these two versions is that Ludwig Riemann simply describes how each note was connected to five tubes of the mechanism, without suggesting that each note had its own five tubes. Dr Peetz, on the other hand, states that each note was connected to the recording device via its own five tubes, and goes on to speculate on the timing differences between the multiple lines for each note. Riemann describes a parallel system, Peetz an individual one. Something of the truth may be seen in the dynamic recording patent awarded to Walter Bernhard of Leipzig in January 1908, the month after the Dea was introduced to the public, which very clearly depicts a machine recording up to four dynamic lines at the treble and bass edges of the music roll. The Dea will be discussed more fully in the next instalment of this article, but for the moment it may be noted that Bernhard makes the sensible point that four marginal lines equate to five dynamic levels, since the absence of a line represents the lowest dynamic. In that connection it may be that Riemann was in fact correct to remember five lines, since the Dea has six basic levels of dynamics on each side of its pneumatic stack.

The more general point in both of these examples is that of common sense, as alluded to earlier in this article. It is simply not conceivable that an inventor living on the edge of Garwood, New Jersey, should make over his invention to an enemy firm that had in any case developed its reproducing piano some seven years before the patent was issued. One really cannot take a posting to Mechanical Music Digest, whatever the source, and simply equate it with historical fact. Equally, a recording piano with 88 notes and two pedals, and with five tubes for every note, would necessitate 442 tubes being connected to the recording machine. The tubes would extend all the way round the edge of the piano, which is ludicrous, and in any case it can be seen in the Hupfeld recording photographs that this is not the case.

We now need to turn to Richard Simonton, and to examine both his character and his writings. The latter are relatively rare, since there is no evidence that most of what is nowadays attributed to Simonton actually came from his pen at all. The main source to which most writers have referred is the set of sleeve notes accompanying the 1960s LPs, issued under the general title of *"The Welte Legacy of Piano Treasures."* These recordings, as far as one can tell, used rolls which Richard Simonton had brought back from Germany after the War, and had obtained from either Edwin Welte or Karl Bockisch, or more likely a mixture of the two. Simonton gave many of his rolls to the University of Southern California in Los Angeles, and a good proportion of them are what we now call "second masters", meaning fair copies of the rolls, that were duplicated and corrected by hand from the original recordings, and used in their turn for producing commercial copies.

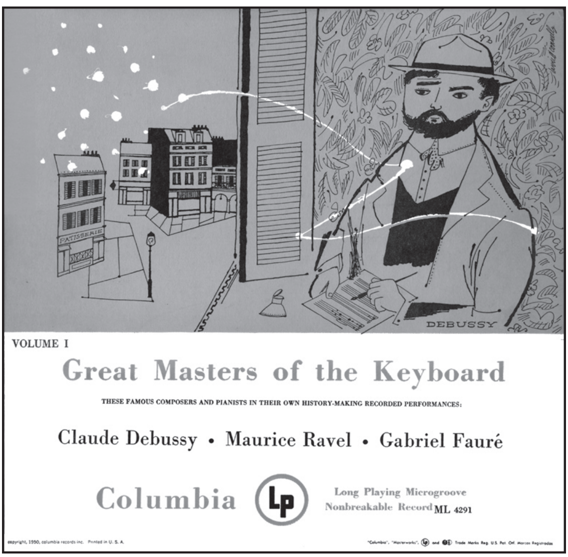


Debussy and Ravel Perform in 1913
From the Welte Legacy of Piano Treasures,
Los Angeles, 1964

The majority of the team involved in the recordings have now passed away, including Simonton himself, the producer, Walter Heebner, and the production assistant, Ben Hall. The main survivors are Kenneth K. Caswell, of Austin in Texas, who owned and was responsible for the musical functioning of the Welte push-up that was used, and Mary Heebner, the producer's daughter, who created the conceptual drawings of the various pianists and composers for the record sleeves. One important musical point to note in passing is that Ken Caswell recalls he used an Ampico stack in place of the original Welte mechanism.

The description of the Welte recording process contained in the recording sleeve notes is remarkably detailed, but it is not credited to any particular author, and subsequent writers have therefore only speculated in attributing it to Richard Simonton. When he asked about the reliability of these detailed descriptions, Ken Caswell recalls that Ben Hall's answer was, *"Well, we had to sell the recordings somehow!"*

I have so far come across three accounts of the Welte process which are either credited in writing to Simonton, or written or spoken by him directly, and it may be as well to examine these before proceeding further. During this process, I should emphasize that I am not in any way seeking to assassinate anyone's character. As far as I know, both Richard Simonton and Ludwig Peetz, and the progenitors of the Welte Legacy are or were amiable and responsible men, but I am not looking towards their sociability or their friendliness, but rather to their accuracy at relating a very specific and a very tiny part of European musical history. It would be a great pity if the commercial interests of the 1960s and 1970s were allowed to cloud or undervalue the genius of Edwin Welte and Karl Bockisch.



LP Cover from Great Masters of the Keyboard, 1964

The first detailed account of the Welte-Mignon recording process comes in the descriptive sleeve note attached to the first set of Long Playing records of Welte-Mignon rolls, published in 1950 by Columbia Masterworks in the United States. It reads as follows:

(The operation of this mechanism has been described as follows by Richard C. Simonton, who was largely responsible for securing these recordings for Columbia Masterworks Records.)

"There was a standard Steinway grand piano, equipped with a trough running the length of the keyboard and immediately under it," writes Mr. Simonton. "In this trough, there was a pool of mercury, and when the key was depressed, a carbon rod attached to the bottom of the key engaged this mercury and caused an electrical contact to be made. The resistance of this contact varied with the pressure exerted on the carbon rod so that actually, depending upon the blow with which the key was struck, there was a corresponding change in the electrical resistance of the contact made. All of the keys were connected by wires to the recording machine, which was usually some feet away from the controlling piano. This machine had within it the conventional rolls of paper which were entirely blank and without perforations, but were ruled their entire length with over one hundred fine lines, each corresponding to the center line of its control mechanism. Above the point at which the impression actually took place on the paper was a series of small rubber rollers of a composition

similar to the type used in a printing press, and these rollers were inked with an ink similar to that used by the printing industry. The result was that as the keys of the piano were depressed, these rollers engaged the piano and transferred their inking to the paper in such a way that, depending upon the blow or touch exerted upon the keys of the piano, there was a corresponding difference in the inking of the paper on the master roll. Other functions of playing were also transferred, such as pedaling. After the recording was completed, it was sent to the laboratory and very carefully prepared for being used in the reproducing machine, or used in reverse in order to give a performance and re-create once again the actual playing of the artist as the roll had recorded it. For this purpose, the Weltes had constructed a machine which was the exact opposite of the recording piano. This device had felt-covered levers - one for every key. It was a cumbersome thing that was placed in front of the keyboard of a piano and when a roll master was put inside, it actuated the mechanism within this monster in such a way that these levers came down and depressed the keys with the same dynamics in the same order as in the original performance. Every precaution was taken to get conditions as nearly equal as possible to the original performance so these wooden levers were made the same length as a man's fingers from the pivot of his wrist to the tips, so that the same power of touch would produce the same dynamic strength on the piano as the artist when he struck the keys during the making of the recording."

There are two main elements to note in this account; in the first place it is a great deal simpler than the description published fourteen years later in the Welte Legacy series, and in the second it is clear that Richard Simonton has not understood the mechanics of piano touch, in that it is the speed with which the keys are moved, and not the pressure upon them, which creates the loudness of the notes. It would be impossible for carbon rods to alter their characteristics in response to variations of pressure. Leaving aside for the moment the likelihood or otherwise of carbon rods being used for the measurement of changes in resistance, it is immediately clear that Richard Simonton either did not at that stage fully understand how the dynamics were recorded, or else that for some reason he chose not to share the information. The wording which he uses is:

> *"… as the keys of the piano were depressed, these rollers engaged the piano and transferred their inking to the paper in such a way that, depending upon the blow or touch exerted upon the keys of the piano, there was a corresponding difference in the inking of the paper on the master roll."*

The sentence, which is correctly reproduced here, actually makes no sense, because the rollers clearly did not engage the piano, whatever that might mean. Perhaps some editor incorrectly substituted *"piano"* for *"roll,"* which might make more sense, but either way, the description of a *"corresponding difference in the inking"* could mean just about anything.

Richard Simonton (1915 – 1979)
photo courtesy Puget Sound Theatre Organ Society

The second account given over Simonton's signature comes in a letter, dated August 15, 1963, to Larry Givens, the writer of the Ampico history, "Re-enacting the Artist", and an important American player piano expert and roll producer in the 1960s and 1970s. Givens had clearly asked directly how the recording machine worked, and yet Simonton avoids giving any clear answers:

> *"To my knowledge there are no printed technical descriptions of the method used by the Weltes for recording the dynamics. This was a closely guarded secret, and outsiders were never permitted to examine the machine, and it was kept under lock and key at all times, and all recordings were supervised by Karl Bockisch.*
>
> *"The only information that I have about it was a complete description from Bockisch as to how it worked, and he did not refuse to tell me anything about it, however I never saw one of the machines, as they were all destroyed when the factory was bombed in 1943, and never having seen one, I could only grasp an impression of it from his description. There were several of them in existence at one time, but he personally built all of them, and was an excellent draftsman, and the parts were machined without the machinist knowing how they were to be used.*
>
> *"The machine used in New York by the licensee was in no way similar to the German machine, and Bockisch always felt that rolls produced here were inferior to those he made, and produced by the method he used. There are pictures of his machine in some of the old literature.*

"If you are really interested in what he told me about it and how it functioned, I will sit down with a tape recorder and give it to you from memory, and I am sure I can give you the highlights. I do know that they took a large amount of DC to actuate all the mechanism, and they had motor generators and even storage batteries for some of the set-ups. In essence, the German Welte system recorded the velocity with which the piano key was depressed, and this was translated electrically by carbon rods entering a pool of mercury, all very complicated, but it did work."

This is undoubtedly the most honest description of Simonton's knowledge, for he freely admits that he had only been able to grasp an impression of how the Welte recording machine worked.

By contrast, the third occasion on which an explanation can be directly attributed to Simonton was the musical presentation of the Welte Legacy series given at the University of Southern California on 5 January 1964, hosted by the University Music Department and Professor John Crown. Luckily for us, a recording of this event was preserved, and it is available for purchase online at www.cambriamus.com/cds/cd_archival.htm. As far as the recording process is concerned, we are at a disadvantage, since Welte and Bockisch chose, presumably for sound commercial reasons, to keep the process secret, and so there are no contemporary accounts which we can lay against those credited to Mr Simonton. However, the general history of the Welte Company is far better known, and it is therefore instructive to read Richard Simonton's version of events, which are here transcribed verbatim:

SIMONTON: *"The Welte empire, the Welte developments were sort of legends in their own time, and when I was a youngster in Seattle, some of the tales of the musical world up there were of this firm, and what they had done. I think that Seattle, perhaps more than other sections of the country, because they at one time had had dealers there, who had imported the instruments prior to World War One, so that there were fairly numerous examples of them in that area. Los Angeles was not so fortunate, and I don't believe other sections of the United States had them to the same percentage that we did up there.*

"But these people became famous because of their foresight and their vision in their recording technique, not only from the standpoint of creating an instrument capable of capturing this, but in their vision in employing artists to record, who were to become so famous, largely not only as performers, but as composers as well, and the appeal which the Weltes extended to the artists, or the appeal which they used to convince them to record for them, was that they were preserving their work for posterity, and no other form was as permanent. Therefore, if the composer wished to be heard by future generations, then this was the only means available. Therefore, take advantage of it, or else you will be only remembered by the printed page.

"So as a result, they were able to convince a number of the famous artists, composers, to record for them, and for a number of years were embarked on quite a campaign of this, traversing the length and breadth of Europe, even going in to

Russia, where they set up temporary recording facilities in St Petersburg, and they recorded there the works of Glazounov and Scriabin, and the famous Russians of the day, as well as in Paris, where they did Ravel and Debussy, Saint-Saëns, Fauré, others equally famous, and then their own main plant in Freiburg, the sort of centre of their activity, where they ran a regular recording schedule - at least one artist a week, that was brought there for the prime purpose of recording.

"This has been a known fact, that they had done all this, but somehow or other it disappeared from view during the days of the Hitler Government, and subsequently through World War Two, but after the end of the hostilities, it seemed like an intriguing project to try to find out what became of this - where had it gone, had it been destroyed, or did it still exist? So I set out on a campaign of writing letters, until I eventually found someone who could give me some answers, and it turned out to be Edwin Welte himself. And it was fortunate that they realised that the factory would probably be bombed, as it was in a prime location, so they had removed these devices, and these master recordings, to a place of hiding in the Black Forest, and after prolonged negotiations, and a great deal of red tape, not only with our government, but with the French occupying forces, because it was in the French zone of occupied Germany, we finally, my wife and I were finally able to go over there and bring them back, but only in the form of doing a recording on the spot, with the best that was available at that time, and it certainly wouldn't compare with what's available today. However, it did whet our appetite for more, and even though we were not able to do it under the controlled conditions that it was later done, we did realise the musical worth of what was there.

"So then in 1952 we went back, and this time the gentlemen had reached an age where their survival would not be many more years - they have all now passed away - and we were able then to bring back to this country the examples of the machines and the rolls themselves, so that we now have them preserved, and literally everything that exists today, we have here. There's virtually nothing left."

CROWN: *"Well, by "here", you mean you have."*

SIMONTON: *"Well, yes, in the United States.*

"The firm has ceased to exist, largely due to the ravages of war. The firm was founded in 1832, and it existed virtually until the Hitler Government put them out of business. It was non-essential to the German dreams of conquest, so consequently it could be dispensed with, and was, and so they simply - in fact, they had been dispossessed of their building in Freiburg, and it had been converted to war industries and was therefore a prime target. So literally the only things that could be salvaged were those which they could take out in their hands and put in some place of safe keeping. I wish that we had been able to, or they had been able to preserve a great deal more, but we're grateful for what they did save."

Clearly, the reason for including this long excerpt is to allow readers to make their own judgments about Richard Simonton's reliability as a witness, but it might be as well to single out one or two salient points. There is no mention whatsoever of the Welte Company's organisation in the United States, and he even suggests that the main activity was that individual dealers in Seattle had imported instruments directly from Germany. Any American visiting a large city public library in the 1960s for just a few hours could easily have traced Welte advertisements in the national press, so the omission of this history is disappointing, to say the least. There is not a word about orchestrions, no mention of Poughkeepsie, of the showrooms in New York, of Welte Licensee, or of the literally thousands and thousands of instruments and rolls which existed all over the world.

This omission cannot be attributed to ignorance, since in correspondence with Simonton around 1950, Edwin Welte and his cousin, Carl, had described the Company's American activities in some detail. Perhaps it was caused by a nervous reaction to speaking in public to a university audience. But Mr Simonton is in no doubt when he makes the following statement:

> *"… we were able then to bring back to this country the examples of the machines and the rolls themselves, so that we now have them preserved, and literally everything that exists today, we have here. There's virtually nothing left."*
>
> CROWN: *"Well, by "here", you mean you have."*
>
> SIMONTON: *"Well, yes, in the United States."*

It beggars belief that Richard Simonton should have thought that he had brought all surviving Welte rolls back to the USA. Perhaps he imagined that in a war-ravaged country, such items as paper music rolls might have been universally burnt, by the Hitler government in pursuit of their dreams of conquest, as he might himself have put it. But Edwin Welte retained an enormous collection of rolls, which are nowadays in the Augustiner Museum in Freiburg, and it is simply not credible that Simonton knew nothing of these. If he had really been ignorant of them, then Edwin Welte would have been hiding things from him, and that would hardly lead to any confidence that the secrets of recording were passed on in any comprehensive or honest way.

But it is perhaps more likely that Simonton knew very well that the rolls he had brought back were not unique. The collection given to the University of Southern California contains a disproportionate amount of rolls recorded by the "famous composers", and gives every impression of having been selected by someone who was concerned with what might best sell on record. The Welte catalogue was not uniquely directed towards recordings by composers; it was Paderewski and his colleagues who sold the most rolls, as can be seen in contemporary Welte advertisements, and the Welte Company was far more concerned in selling rolls to the music lovers of the time, rather than preserving music for audiences at some sixty or seventy years' distance. Simonton's emphasis on the rolls made by composers, taken together with the nature of the collection at USC, are at the very least an indication that he knew his claim that virtually nothing else existed was not true.

There is also a technical explanation which he gave during the same presentation:

> *"They were very candid in their approach to it, and they realised that the dynamic intensity, or the force with which the key was depressed, the velocity of the key, if that could be captured, it was the key to the dynamic, the musical nuance. So therefore they evolved a rather elaborate means, and it was electrical, even at a very early day, for recording not only the sequence of notes, which was not unique in itself, but the dynamic force or velocity with which the key was depressed. Therefore, by having an accurate record, and a means of re-creating this same velocity, you would therefore get the same nuances of expression if you could reverse this procedure, and allow it to actuate the piano in exactly the same degrees of force with which the mechanism that recorded it had been actuated, and this is in effect what they did.*
>
> *"The piano was a standard grand piano, not unique in itself, but beneath the keyboard was a trough of mercury, and attached to each piano key was a carbon rod, and when the artist pressed the keys, these rods engaged, or dipped into the mercury, and mercury provides a very excellent electrical contact, and so therefore they established not [only] the sequence of the notes, but also the harder the key was depressed, the further it went into the mercury. It lowered the resistance of the electrical contact. Therefore there was a larger current flow in those which were hit hard, over those which were hit very softly, and they had a means of recording this with colloidally deposited ink, which was electrically conductive, through a series of little rubber rollers into a recording machine, and this then captured, on this paper roll, by virtue of the width of the line which it made, whether it was lightly hit, or very heavily hit.*
>
> *"And then they had a reversing process, where they were able to play it back in that form, and the philosophy of the vorsetzer was that by creating the wooden levers which are actuated by the mechanism, they were actually re-creating the length of a man's finger, from the pivot of his wrist to the average length of his finger, so therefore, by having something which would create the same amount of force, they could produce, with the same leverage, the same degree, the same relative intensities as the performance which they had captured.*
>
> *"From the original machine, which was entirely electrically operated, operating from the colloidally deposited ink on the roll, they transferred it then, through a translation device, to an all-pneumatic system, because the colloidal ink was not a permanent form; it was only a reference, from which they evolved the pneumatic system that is used in anything but the initial recording. The colloidal ink was used only for the initial recording, after which it became a pneumatic record.*
>
> *"They were correct, I think, in their assumption, that by creating this mechanism, and having it completely reversible, so that it would re-create in exactly the same way with which it was actuated, they would indeed have a reflection, an accurate reflection of the performance that they were capturing."*

This is certainly muddled thinking, and it is difficult to understand why subsequent writers have tried so hard to explain or excuse it. "… *the harder the key was depressed, the further it went into the mercury*" is not only a statement completely at odds with reality, it is the theory of someone who does not understand the mechanics of the piano at all. Why then, should we try so hard to excise just a few elements from this ramshackle set of explanations, and to turn them into an overall theory of the ways in which Welte recorded their dynamics? We invent springs, so that the carbon rods can bobble up and down in the mercury, magic 1905 solenoids that can operate on electronic levels of current in order to avoid burning the colloidally deposited ink, tiny variations in the leading edge slope of the colloidally deposited ink traces, which allow sharp-sighted roll editors to evaluate the dynamic level of each note played, without affecting the response of the magic 1905 electronically driven solenoids. It makes no sense whatsoever, unless it be that competing experts are determined to fight each other with theories, in an effort to win some obscure contest and prove themselves cleverer than the next person.

Any musician with experience of editing dynamics on reproducing piano rolls can instantly confirm that a dynamic level for each individual note is the last think they need in trying to create dynamic coding. It may be that it is useful to have a rough idea of individual accents which stand out more than a certain amount, but by far the most important element is to have a constantly varying overall level for treble and bass separately. That is what was created for the Duo-Art by the recording producers' two dials, it is what Hupfeld recorded for the Dea with its two sets of dynamic lines, and it is what the Ampico "A" roll editors drew on their musical scores, rather than using Charles Stoddard's early patent for recording individual note dynamics. We shall come to Stoddard's inventions when we consider the Ampico in a later instalment, but it should be noted that his 1914 patent, applied for in 1908, provides a far clearer method of recording individual dynamics than any notional system using the slope caused by the gradual engagement of soft rubber printing wheels. And yet it was clearly not used in practice.

This section has been difficult to write, since it has involved pointing out errors and confusion on the part of others, and we are all human, so we all make mistakes. It will take a very long time, if it ever happens at all, for the theories advanced in the name of Richard Simonton to subside. He himself would perhaps be rather surprised at all the fuss, for in his written and spoken words he gives every impression of a man for whom the technical details were not that important, especially when contrasted with the warm friendships that he clearly made with the elderly Edwin Welte and Karl Bockisch. But, as in religion, the traditions of earlier times are frequently lost, and those that have evolved more recently take over, each generation believing that it alone has preserved the path towards the truth.

The Welte dynamic recording system: a probable solution

As we have discussed earlier in this article, it is very likely that from the late 1880s onwards, Welte und Soehne were producing rolls for their orchestrions by means of recordings made at a keyboard, with a real-time marking machine using small metal rollers to create traces on wide, pre-lined paper. This not only explains why an orchestrion company in a relatively small town in the Duchy of Baden should have led the world in developing a piano-based recording instrument, but it also renders the invention of a dynamic recorder more feasible, and the desire to do so more understandable. Further than that, if the orchestrion recording process was a commercial confidence within the Welte Company, giving it a musical edge over its competitors, and helping it to maximise its profits, it might well explain the otherwise incomprehensible prejudice against the Mignon on the part of Emil Welte in New York, who was so unwilling to help with promoting the new instrument that a separate company and separate American premises had to be established.

The most useful form of dynamic recording mechanism would have been one that somehow made use of each individual note dynamic, automatically converted it into the coding needed for operating the bass and treble sections of the replay mechanism, and marked it on the master roll at the time of recording. Such a process would ideally have used materials and methods already common at the Welte factory: pneumatic motors, electro-pneumatic valves and contacts, wooden and metal frameworks, and a marking machine and paper of the same nature as those already in use for the Welte orchestrion rolls. This puzzle has obsessed me for several years now, as my long-suffering friends will testify. If such a chimaera of a machine were to have existed, it would have to fit with all the evidence gleaned from photographs, master rolls and occasional written sources from the historical era, it would have to allow for the fact that only a small number of musical staff were available to edit the rolls, it would need at least some correlation with Richard Simonton's tenuous memories, and above all, it would need to work.

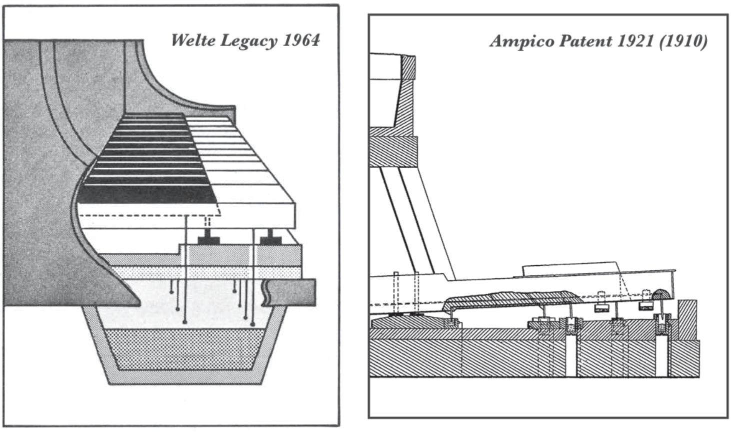
I have now invented such a machine, or, more exactly, I reckon to have deduced how Welte and Bockisch did so. There will no doubt be details that we shall never know, because too much time has passed, and no-one thought to ask the right questions at the right time. However, the machine I shall now describe fulfils all the conditions set out above, and, if built, should be capable of recording Welte Mignon rolls in real time, with the dynamics automatically registered. If Welte and Bockisch did not invent such a machine, or one very like it, then I am cleverer than they were, and of course I do not for one moment believe that.

There is no shortage of photographs of the Welte-Mignon recording machine. It appears in roll catalogues, in the large album entitled, "Autogramme berühmter Meister der Tonkunst," published by Welte in

Freiburg around the beginning of the First War, in various instrument brochures, in newspaper advertisements, and in articles in trade publications, such as "Zeitschrift für Instrumentenbau." There are two aspects of the machine photographs that immediately stand out, one being the extension that was constructed at the top of the cabinet between mid-March and late May 1907, about a year after the equipment had returned from Leipzig, and the other being the disposition of the operators. In the early Welte recording sessions at the Popper studios in Leipzig in 1905 and 1906, there is without exception someone sitting at the operating position of the cabinet, in front of the opening where the master roll moves. This is usually Edwin Welte or Karl Bockisch, though in at least one case, at the recording session for Frederic Lamond in September 1905, Edwin's father, Berthold, is given the chair, as the elder statesman of the firm, three days after his birthday – one knows exactly how his 62-year-old legs might have felt!

On the return to Freiburg, and more particularly after the cabinet extension was constructed, the machine operator is usually standing, and there is often evidence of someone sitting at a table, and following a musical score. There are other features of the cabinet that stand out, and these will be more fully discussed and illustrated as we proceed.

To begin with, let us agree that carbon rods and mercury are a wonderful idea for making an electrical contact without affecting the touch of a piano action more than is necessary, as long as individual mercury cups are used, and not some enormous bath, subject to ripples as fistfuls of chords are played in purple moments. Charles Stoddard used more or less the same procedure in his first two dynamic recording patents for the Ampico, and the similarity between one of the drawings for the second of these, and the illustration of the keyboard on the sleeve of the Welte Legacy of Piano Treasures is certainly remarkable. Had some discreet patent research taken place, one wonders?



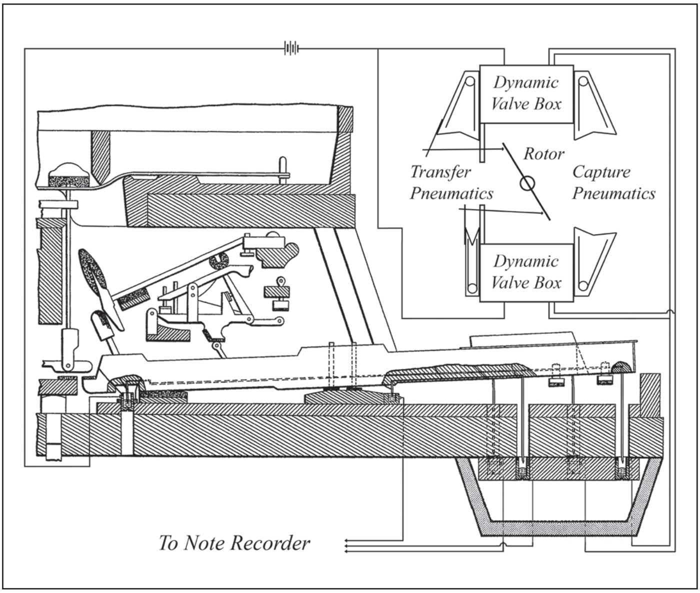
Recording Pianos using Mercury – Welte Legacy, 1964, and Ampico, 1910

What is important for recording dynamics from a piano keyboard is not force but speed. A quiet note takes longer to play than a loud one, and the minute differences in durations between the attack times of different notes must somehow be analysed and recorded. This information is far too detailed to be of much use to a roll editor, but rather it needs to be captured and converted in real time to the coding perforations utilised by the reproducing piano. In my view, only Welte ever managed to do this with real success, though, as we shall see in the next instalment, they almost certainly came to an agreement with Philipps of Stuttgart, to license both their playback and recording systems for use with the Duca.

The easiest way of recording the duration of a note attack is to have not one, but two contacts hidden away somewhere in the recording piano action, and to devise some means of storing the information temporarily, until it can be combined with the dynamics of other more or less simultaneous notes into a unified dynamic level for treble or bass. Peter Hagmann, in his comprehensive thesis on the Welte-Mignon, "Das Welte-Mignon-Klavier, die Welte-Philharmonie-Orgel und die Anfänge der Reproduktion von Musik," reports that the Basel piano technician, Franz Scheerer, was asked to undertake some mechanical repairs on the Welte recording piano. With the action out of the piano, he noticed five light copper contact wires at the rear of each key, but received evasive answers to his subsequent questions. If the recording piano were not only to register the duration of the notes, but also their dynamics, then a number of contacts might well have been necessary.

If we go back to the Binet and Courtier diaphragm, we noted earlier that this must have been incapable of recording dynamics in any sensible way, since it was by all accounts airtight, so that the movement of a note produced a given displacement of the diaphragm, regardless of the time taken to play it. There was no doubt a dynamic component to the diaphragm's motion, but represented by the speed of its movement to each step of the recording trace, which would have been quite impossible to read as soon as multiple notes were played and released.

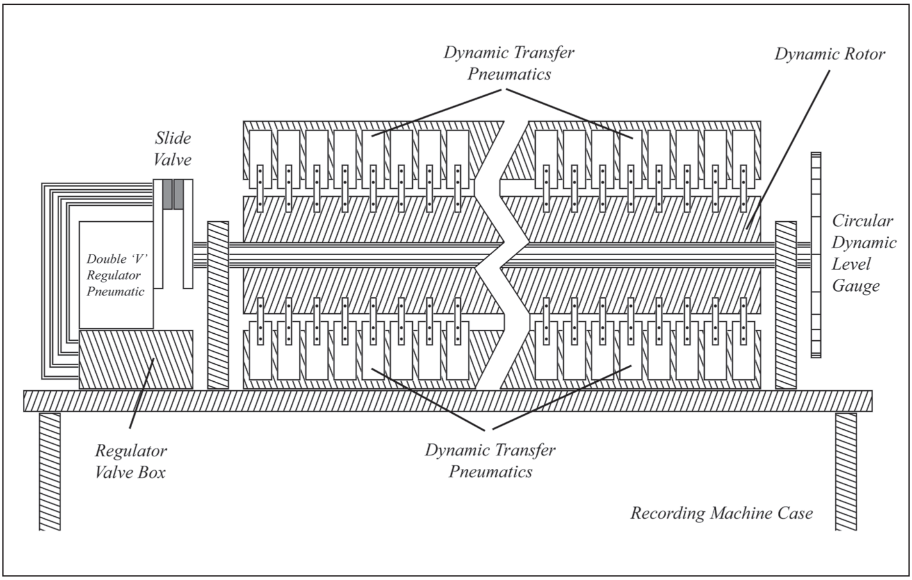
However, the equivalent of Binet's diaphragm, in terms of a player piano, might be a pair of pneumatic motors, one normally evacuated against a spring, and one normally open, with a similar spring coming into effect as a when it closed. As soon as the first note contact, the carbon rod and mercury, came into play, electro-pneumatic valves of the type commonly used in Welte organs could begin to alter the state of the two pneumatics, as well as beginning the trace for the note duration on the master roll. As the key moved downwards, the two dynamic capture pneumatics could begin to reverse their positions: atmosphere could pass to the evacuated one through a controlled bleed hole, and suction could draw the air out of the open one through another bleed of matching dimensions. As the hammer struck the string, another contact could cause the electro-pneumatic valves for the capture pneumatics to close, instantaneously freezing the pneumatics in the position they had reached. Such a pair of pneumatics would hardly move at all, if the relevant note were played at fortissimo level, but they would completely reverse their state if the note were the quietest pianissimo. My thanks to Brian Rees for his help with this and other illustrations.



Dynamic Capture Mechanism for a Possible Welte Recording System

The position of this pneumatic pair at the end of the keystroke would therefore be proportional to the dynamic of the related note, but it would not be much use, unless some means could be found to combine it with the dynamics of the other notes being played. In a sense, this means that the note dynamics need to be recorded in parallel, for each section of the keyboard, though the analogy cannot be taken too far. But it is not easy to combine suction levels in parallel; taking the output of many small pneumatics to a larger group reservoir simply evens out any precise dynamic variations. A mechanical means of combining the individual dynamic readings is necessary.

Those readers who have worked on American organs, and there will certainly be some who are familiar with their workings, will probably have encountered the mechanism for the Vox Humana, consisting of a long rotor blade made up of a wooden axle and fibre vanes, rotating at high speed in order to oscillate the surrounding air and thereby to mimic the vibrato of the human voice. Imagine if you will a pair of these rotors, constructed not of fibre, but of light and very strong metal or wood, a little narrower and longer than the average Vox Humana. Such mechanisms could be made to rotate with very little friction, and only over a restricted arc of their overall circumference. If a means could be found to transfer the individual positions of the dynamic capture pneumatics to these rotors, one for treble and one for bass, then the position of each rotor would represent the overall dynamic for its related section of the piano.

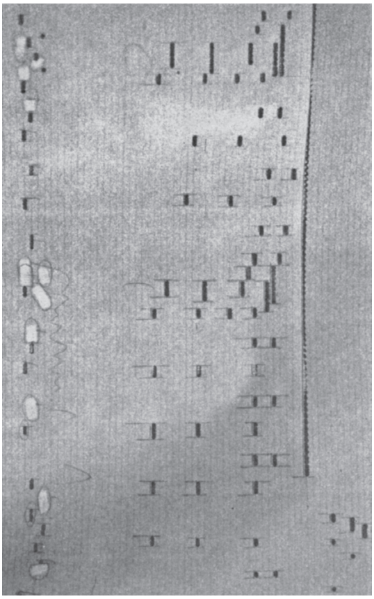


Dynamic Transfer Pneumatics and Rotor for a Possible Welte Recording System

The size of the rotors might be just the length of the Welte recording cabinet, and their diameter might be just a little smaller than each of the two holes in the 1907 extension. Positioned about the rotor vanes might be a second pair of pneumatics for each note, the dynamic transfer pneumatics. As the hammer hit the string, electro-pneumatic valves could not only prevent any further change to the dynamic capture pair, but could also channel whatever suction was to be found in this first pair, to the transfer pneumatic pair, both normally sprung open, and operating like a wide-open jaw about the two rotor vanes. One side of the rotor would be surrounded with these double pneumatic pairs, distributed evenly along both its blades.

The effect of all this would be to move the rotor in exact accordance with the dynamics of the music, and it would be an easy matter to attach some form of linkage which would mark up a dynamic trace on the edge of the master roll. There would be a tendency to record the average dynamic, rather than the peak, but in extreme situations this could be counteracted by post-production editing, and in any case, Welte dynamics are actually rather simple, although very natural.

We now come to one or two relevant illustrations from the depths of Welte history. In the first place, as we observed earlier, the only Welte first master known to have survived at least until the 1980s was a short piece, composed and played by Vladimir Horowitz, entitled *"Moment Exotique"*, published in 1927 on roll 4119. In the 1980s, the roll was in the possession of Kenneth Caswell of Texas, where it was photographed by Kent Holliday, for use as an illustration in his book, *"The Reproducing Piano, Past and Present."* The quality of the photograph is regrettably rather grainy, but Kent Holliday has kindly provided a new scan, which is the best we can hope for.

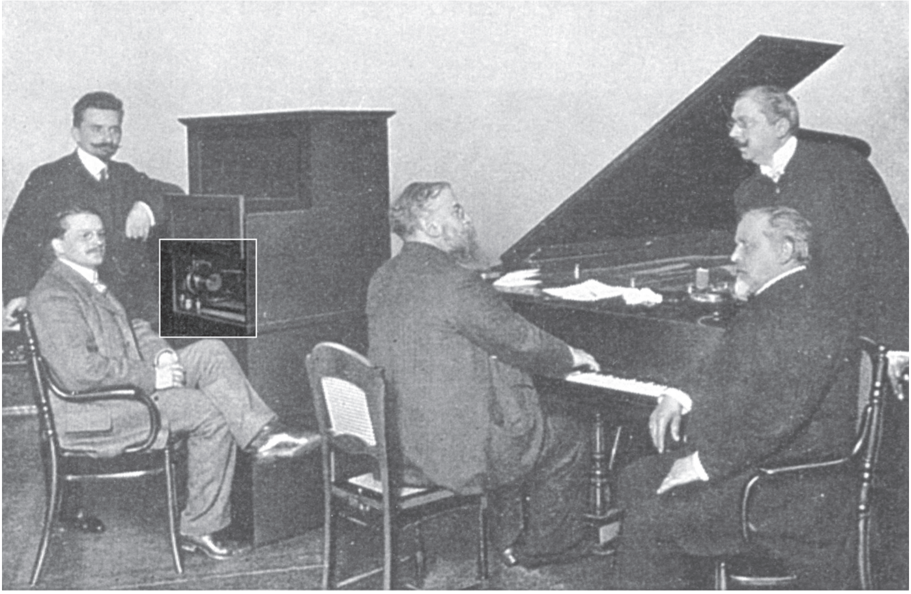


Welte Roll 4119, Moment Exotique by Vladimir Horowitz

The roll shows clear signs of a recorded dynamic trace at the left-hand edge. As we saw earlier, Welte used other styles of dynamic traces for different stages in the recording and reproduction of its rolls: as a check during the editing process, and as a guide for owners of pedal-electric Welte pianos, in order that they might seek to follow the recorded dynamics of the original pianist.

Such dynamic information would be recorded in arrears of the note, and so on the master roll it would need to be advanced, in order to regain and indeed overtake the corresponding note durations. The note traces were most likely marked at the front of the recording machine, as was done in the Welte Philharmonic Organ recorder, allowing the operator a clear view of the notes as they passed back into the cabinet and towards the take-up spool. One would need to look for two marking devices, a little deeper into the cabinet, and at the edges of the roll. Unfortunately, the photographs of the Mignon recorder are always taken from one side, so that even in the best cases, where the roll opening is not covered by the operator, only the bass side is visible.

Thanks to the kindness of Henk Strengers and Mark Stikkelbroek of the Nederlandse Pianola Vereniging, I am able to reproduce a particularly clear view of the inside of the Mignon recorder, a detail from a photograph of a recording session in Leipzig with Raoul Pugno in September 1905, reproduced in an American Welte brochure from 1910, from Henk Strengers' collection. In the normal Welte roll catalogues, a later photograph of Pugno, taken in Freiburg in March 1907, is substituted. Perhaps the earlier version somehow avoided the Company's censorship!

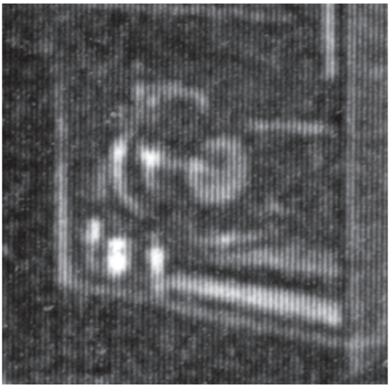


Mignon Recording Session with Raoul Pugno, Leipzig, 26 September 1905

A similar photograph, but with the recording roll in place, can be found in an article in the issue of "Zeitschrift für Instrumentenbau," dated 11 March 1905, and I am very grateful to Martin Elste for his help in sourcing as clear a view as possible. This is a very early recording photograph, which may account for the unguarded view.

Mignon Recording Session with Alfred Grünfeld, Leipzig, 20 January 1905

Placing the selected detail of the two photographs together gives us as clear an idea of the interior of the recorder in 1905 as we are likely to get. One might have expected a roll-wide spool to help guide the master roll on its way, but instead what we see in the left-hand detail is a stub of a spool, with what appears to be an angled lever above it, as well as a few control levers at the front and at the left-hand side.



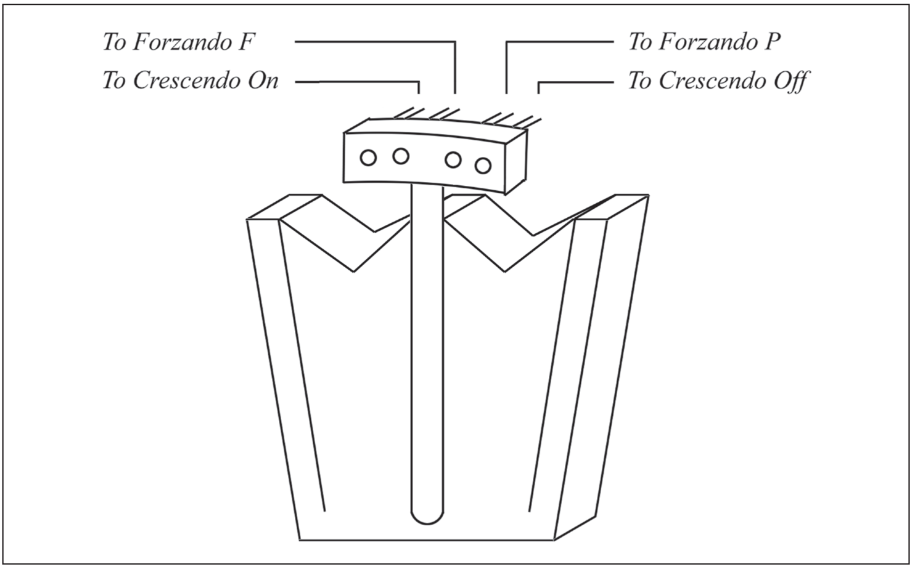
Details from the two Recording Sessions, showing Interior of Recording Cabinet

In the right-hand detail we can still just about see what might be an angled marking lever, but at least the position of the roll is clearer. If a dynamic trace were to be marked on the roll, this is more or less exactly how it might be done, at a position a little in advance of the note pens, and with some form of truncated roller to support the roll at the point of marking. There might need to be another roller at the treble end, though this is out of the camera shot, but it is not an inevitability that Welte's dynamic recording system remained the same from 1905 to the end of the 1920s. Particularly in the early years it would have been very natural for improvements to have been made, one of which might well have been the development of two dynamic recording tracks, instead of just one. A close examination of early Welte rolls reveals a quite remarkable lack of exactitude in punching, in the placement of both notes and dynamic coding alike, so the simplicity of only one dynamic recording channel would not have been out of the question.

Continuing on our way towards a wholly automatic form of dynamic recording, we next need to convert the positions of our dynamic rotors into markings for the coding used by the Welte Mignon itself. Such a process would allow the roll editors to select and punch out the dynamic information in exactly the same way as the notes. This can be achieved without too much complication, but there is one important proviso: part of the Mignon mechanism involves the use of what are known in English as the *"Mezzoforte Hooks"*, which can engage with the treble or bass dynamic regulators and prevent them from moving either below or above the mezzoforte level.

In practice, these devices are far more frequently used to restrict the dynamics in an upward direction, so that loud accents may be more effectively created by means of the forzando (fast crescendo) mechanisms. If we are to create the dynamic coding automatically, then we need an operator to choose the moments when the mezzoforte hooks are to be engaged, because if the dynamic rotors are in the wrong part of the loudness spectrum, then the effect of the hooks will be the reverse of what is intended.

Of course, we have just such human operators in the shape of Edwin Welte and Karl Bockisch, both of whom would be well experienced in their own recording system, and in Leipzig, whichever one of them chose to control the machine would sit immediately in front of it, with a clear view of the dynamic trace markings. All that would be needed would be two pneumatic buttons or levers. But we are running ahead of ourselves a little, and we should first consider how the dynamic rotors might convert their positional information into coding for the *"crescendo on,"* the *"crescendo off,"* the *"forzando f"* and the *"forzando p,"* to use the Mignon terminology.



Double "V" Control Pneumatic and Slide Valve for a Possible Welte Recording System

Imagine another double pneumatic, this time rather like a letter "W" in cross-section, or at least a double "V" with a common central board. Such pneumatics, though perhaps smaller, are to be found on Aeolian wind motors in push-up Pianolas. Mounted on the side of the pneumatic, and attached to the edge of its central board, is a slide valve, with four small, round openings in a gentle arc. On the far end of our dynamic rotor is the other side of the well-graphited valve, sprung to keep it in good, airtight contact with its counterpart. We'll assume all of the openings on the slide valve are covered.

As a note or chord plays, the dynamic capture pneumatics move accordingly, and they transfer their potential energy to the dynamic transfer pairs, which in turn pass it to the dynamic rotor, which rotates a little. Let's say that it passes towards the louder end of the spectrum, but just by a small amount. As soon as it moves more than the merest fraction, it uncovers one of the outer holes on the corresponding slide valve, which triggers a pneumatic valve and thereby causes two actions to happen. In the first place, it marks a small length of the *"crescendo on"* control on the master roll, and secondly, it causes suction and atmosphere to pass via controlled bleeds to the two pneumatics of the double "V." As a result, the central board of the pneumatic moves slowly across, and the open port in the slide valve closes. However, even when the port has closed, the double "V" pneumatic continues to move, and if the rotor now remains stationary, the opposing outer port of the slide valve will open to atmosphere, again causing two things to happen. Firstly, a small length of the *"crescendo off"* is marked on the roll, and secondly, the double "V" pneumatic reverses its direction. If the rotor resolutely remains static, then the double "V" will slowly float, and every so often there will be *"crescendo on"* and *"crescendo off"* controls marked on the master roll. Such patterns can frequently be seen on Welte-Mignon rolls, though there are exceptions, since the automatic nature of such recording does not preclude the subsequent editing of dynamics if desired.

To return to our dynamic marking process, let us now assume that a sudden accent has been played. The effect on the capture and transfer pneumatics is more marked, and as a result, the dynamic rotor moves round rather more than just a fraction. It uncovers not just one, but two ports in the slide valve, and so not only is the *"crescendo on"* triggered, but also the *"forzando f"*, marking the appropriate trace on the roll, for as long as the slide valve port remains open, and causing the double "V" pneumatic to move at a considerably faster rate, to catch up. In a similar way, the *"forzando p"* port is triggered by sudden quiet notes, always with the default floating between *"crescendo on"* and *"crescendo off"* in the background.

In such a system, the mezzoforte hook must be triggered by a human operator, who knows in advance that certain sections of the music are likely to need it, and who can see that the dynamics are in the correct part of the spectrum, before engaging the appropriate lever. Such a person would have to read a musical score and correlate it with the displayed dynamic information. The recording mechanism would simply mark a length of the *"mezzoforte on"* trace on the master roll, and physically restrict the dynamic rotor to one or the other half of its travel. The necessary alterations to the subsequent dynamic coding would happen quite automatically thereafter. The switching off of the hook would have the reverse effect, by marking *"mezzoforte off"* on the roll and removing the physical restriction.

Essentially, that is all there is to it, though there are several other items of evidence to quote in favour of the theory. About a year after the recording cabinet came back to Freiburg, an extension was built at the top, with two round apertures facing the piano, and a double series of much smaller holes down what might be regarded as the treble end of the case. A good photograph, with the smaller holes covered, comes from the recording session undertaken by Eugen d'Albert on 2 June 1913, on which single day the emigré Scot produced no less than forty rolls, if the Welte box labels are to be believed. He must have had the constitution of an ox! At any rate, Karl Bockisch is standing at the recording machine, Edwin Welte is at the foot of the piano, following musical scores, of which there are very many, and the two apertures in the cabinet extension, as well as the shallow cover on the side of the cabinet, can all be clearly seen.

Mignon Recording Session with Eugen d'Albert, Freiburg, 2 June 1913

On 20 July 1909, the Hungarian pianist, Yolanda Merö, recorded eight rolls, and the double series of nine small holes was in evidence.

Mignon Recording Session with Yolanda Merö, Freiburg, 20 July 1909

What might the significance of these various orifices have been? The answer, though we shall never know it for sure, is probably rather simple. In his autobiography, *"A Blind Musician Looks Back,"* the organist Alfred Hollins remarks on the fact that Karl Bockisch asked him to bring to Freiburg a complete set of all the music he was going to play, so that the roll editors could follow it as he recorded and mark it up with his choices of registrations. Admittedly Hollins was recording for the organ, and not the piano, but in the photograph of d'Albert seen above, the presence of musical scores is greatly in evidence, as it is in Josef's Hofmann's session, seen earlier in this article, where Berthold Welte gives every impression of being a modern-style recording producer.

The most likely answer concerns the mezzoforte hook, the one element of the dynamics that could not be recorded automatically. In Leipzig, either Welte or Bockisch sat at the front of the recording machine, and could follow the dynamic traces on the roll as it was marked up, although there may well have been many opportunities for error. Back in Freiburg, on the other hand, there was much more space available, and it would have made sense to operate the mezzoforte control at a distance, if some method could be found to signal the state of the two dynamic recording mechanisms. In that way, it would have been possible to follow the musical score at a table, and there is often a table in the photographs from 1907 onwards. If rotors were used, it would have been extremely easy to have attached two indicators, like early railway signals, and to locate them in the apertures at the top of the cabinet. That would even be the reason why the extension was at the top in the first place, since it would have made sense to have it clearly visible.

The two series of smaller holes very likely had a similar function, of indicating the two dynamic levels by means of lights or colours. If one considers the two most popular present-day methods of displaying dynamic levels in audio recording equipment, they take the form of either meters or LED arrays, the former being roughly rotational, and the latter a series of small lights, mounted one on top of the other, forming a vertical series. There is something very natural about displaying dynamic levels in these ways, though the Welte displays in the larger apertures may have had more in common with early railway shunting signals than with delicate electromagnetic sensors.

All that is missing is some sign of a remote control device, but luckily we do not have to look too far. In the photograph of Fanny Bloomfield-Zeisler's recording session on 6 August 1908, a trailing cable can be seen at the front of the recording cabinet, together with some form of junction box at waist level. It is not a very clear picture, but beggars cannot be choosers, and, given that both Welte and Bockisch were determined that no-one should find out how they did it, we are lucky to have anything at all.

Mignon Recording Session with Fanny Bloomfield-Zeisler, Freiburg, 6 August 1908
(Detail enlarged at right-hand corner)

This instalment is far longer than any other section of this article will be, a situation caused in part by the necessity of examining previous theories of Welte-Mignon recording. When one contemplates some of the remarkably complicated research that has held sway in the matter of the Welte-Mignon for far too long, it is worth reminding ourselves of Karl Bockisch's comment, made to Walter Donath of Zittau, who on occasion worked for the Welte Company, and who shared his memory with Werner König. Werner quotes him as follows in Pianola Journal no. 18:

> *"I was at Welte's on a number of occasions, each time for a number of weeks, and towards the end of my time there I asked Mr. Bockisch if I might attend a recording session and have a look at the recording device. Mr. Bockisch replied with a charming smile, "You've made the acquaintance of our reproducing device and have seen that the way it works, even as regards the finer modulations, is basically extremely simple. The way the recording-device works is even simpler, but that is our most closely guarded secret. Apart from myself and my brother-in-law Edwin Welte, our technical director is the only person who knows about it."*

"Simplex sigillum veri – simplicity is the sign of truth."

The Philipps Duca Reproducing Piano

Mark Stikkelbroek

Introduction by Denis Hall

Many of us have been brought up to think that there are only three types of reproducing piano - the Welte-Mignon, the Ampico and the Duo-Art - and perhaps one or two others. It is only with a bit more experience that it becomes obvious that there were other very significant players in the field, but which, for whatever reason, have barely survived into the twenty-first century. An important one of these "others" is the Duca, invented by J.D. Philipps & Soehne of Frankfurt.

The Duca seems to have been sold mainly in Germany, although one of the adverts mention Brussels and Vienna. But judging from the very few instruments and rolls which have survived, it may never have been a great commercial success. For all that, Philipps must have had big plans for it, and the roll catalogue boasts some of the greatest pianists of the day, and the repertoire includes major works, some not recorded elsewhere. As Mark Stikkelbroek notes, the earliest rolls date from 1908, and not surprisingly, these are in the main played by pianists who did not enjoy an international reputation. Eugen d'Albert was the first world-famous artist to appear, and playing some substantial items, such as the first movement of the 'Waldstein' sonata, Chopin's Polonaise Op 53, and the Liszt 'Tarantella, Venice and Naples'; this last work he did not record elsewhere. As he was a major Liszt pupil, this is obviously an important roll. Two pianists, Fridtjof Backer-Grøndahl and Julius Roentgen, who both knew Grieg, played for the Duca, and recorded pieces by him. One may assume that Philipps were anxious to produce a comprehensive catalogue as quickly as possible, and the names which stand out in the early roll numbers include Carl Friedberg, who studied briefly with Clara Schumann, and was associated with the music of Schumann and Brahms, Frederic Lamond, the Scottish Liszt pupil, and James Kwast and his wife, Frieda Kwast-Hodapp, a pupil of Clara Schumann and an advocate of the works of Reger.

We should be grateful to the roll companies for their initiative in capturing so many of the great artists at a time when the gramophone companies were not so adventurous as far as pianists were concerned; indeed they were reluctant to essay anything longer than the four-minute duration of a single disc side until well into the 1920s. The Duca catalogue includes many large scale works in unique interpretations. It is worth noting that during the early years of the twentieth century, the roll companies did not sign up their artists under exclusive contracts, as became the norm later on, and so many of the Duca pianists also recorded for Welte and Hupfeld.

One could continue to list names of artists, but of more interest today are some of what must have been the glories of the Duca catalogue. The Liszt pupil Conrad Ansorge played the Beethoven sonatas Op 31/2 and 111. What would we not give to have heard Busoni play Bach's Chromatic Fantasy and Fugue, which he recorded only for Duca? The tempestuous Teresa Carreño recorded Beethoven's sonatas Op 31/3 and 57.

Arthur Friedheim, yet another important Liszt pupil, and whose disc recordings are so disappointing, recorded the six Paganini Etudes and what must have been the first recording of the Beethoven 'Diabelli' Variations, a big undertaking by any standards. One name which, surprisingly, appears early on is that of Ignaz Friedman, playing Schumann's 'Carnival', a work which must have suited him down to the ground! Ossip Gabrilowitsch, 'Poet of the piano', who generally eschewed recording substantial works, nevertheless played Glazounov's Sonata op 74 and Schubert's sonatas Op 120 and 42. The composer, Hans Pfitzner, recorded twenty rolls of his own compositions in 1912. Raoul Pugno romps through Bach's 'Italian' Concerto and a Beethoven sonata Op 31/2; they would be fascinating to hear! The great French pianist, Edouard Risler, whose only disc recordings are a group of Pathés in very dim sound, played 22 rolls for Duca, including a sonata by Paul Dukas. Quite early, Arthur Schnabel, whose fame these days rests on his gramophone recordings of the 32 Beethoven sonatas, made an important group of rolls for Duca including the complete Brahms 'Handel' Variations. The erratic Liszt pupil, Josef Weiss, recorded his master's Sonata and his Fantasia quasi Sonata (après une lecture du Dante). To hear these would indeed be a valuable addition to our knowledge of how Liszt himself must have played.

A most attractive feature of the Duca catalogue is a large group of rolls of light music by such composers as Johann and Josef Strauss, Robert Stolz, Emil Waldteufel and Emmerich Kalman. Waltzes and selections from Viennese operettas well played must have been very popular during the 1920s, and they still retain their magic today. Robert Armbruster's rolls for Duo-Art cover some of the same ground - but with a decidedly American twang!

The Duca catalogue also embraced the latest American dance crazes, with a good number of Two-Steps, Foxtrots, Shimmies and Waltzes for dancing - far more than, for example, the German Welte catalogue.

This introduction will, I hope, have demonstrated that the Duca was far more than an 'also ran'. It is strange, and sad, that the surviving pianos are so uncommon. Perhaps it was that the Welte-Mignon and the Hupfeld Dea just got in first, and coming in a year or two later and with yet another non-standard roll size, it was never quite able to take its rightful place in the reproducing piano field.

The Philipps Duca Reproducing Piano

Several different brands of reproducing pianos existed during the twentieth century, but only three were really successful: the Welte Mignon, Aeolian's Duo-Art and the American Piano Company's Ampico. There were several more, such as the Hupfeld Dea and the later Triphonola, the Artrio-Angelus by Wilcox and White, the Duca by Philipps, and many others. This article is an attempt to bring the Duca system out of obscurity. The Duca never really came out of the shadow of the Welte-Mignon, which was the first true reproducing system, but nevertheless it remained moderately successful. It is a forgotten system, and a collector once observed, "It is as though the Philipps Company never existed," so hard it is to find anything about the instrument. Bringing the few surviving pieces of the puzzle together makes a fascinating story.

A brief history of the Philipps company

The Duca grand reproducing piano –
J.D. Philipps und Söhne, Frankfurt

In 1869, the 23 year old Johann Daniel Philipps settled in Frankfurt am Main, in Germany, and became the proprietor of a café with adjoining premises for dancing. When some of his musicians threatened to go on strike, the determined Johann acquired an orchestrion in order to provide alternative music for the dancers. Ultimately he decided to build an orchestrion himself, but to make it an even better one, of course. In 1877 he founded the manufacturing partnership of Philipps and Ketterer, but later reverted to business on his own, under the name of the "Frankfurter Orchestrion und Instrumental-Pianofabrik J.D. Philipps". The rest of the company's history can be easily imagined: the business prospered. When both of Johann's sons, August and Oswald, had finished their education, they too became managers of the company.

In 1903, Philipps introduced the Pianella line of automatic pianos and orchestrions. In 1908, the Duca reproducing piano came on to the market, and in 1911, Philipps introduced the foot-pedalled Ducanola player piano, as well as the Paganini, a series of medium and large sized orchestrions that were much more sophisticated than the Pianella. In 1921, the Ducartist, a combination of an 88-note player piano and a Duca reproducing piano, was ready for sale. Apart from player pianos and reproducing pianos, Philipps also built a considerable number of regular pianos, both uprights and grands. As with all producers of mechanically playing pianos and orchestrions on the continent of Europe, the early years after the First World War were reasonably prosperous, but the golden years of the time before the War did not return. After about 1925, Philipps' sales went down, and around 1931, the production of mechanically playing instruments came to a complete halt, although regular pianos continued to be manufactured, as well as limited numbers of pipe organs for theatres and churches.

The Duca upright reproducing piano –
J.D. Philipps und Söhne, Frankfurt

The Duca

By 1905, Welte & Söhne of Freiburg-im-Breisgau had invented and introduced the first reproducing piano in the world, the Welte-Mignon. For the first time, a mechanical piano was able to reproduce the playing of a pianist by means of specially recorded hand-played rolls. The Welte recording machine was able to capture not only the pitch and duration of the notes, but also their dynamic intensity.

Hupfeld of Leipzig, which was at that time the leading Continental producer of player pianos, electric pianos and orchestrions, came out with a prompt reply in the form of an instrument called the Phonoliszt. The Phonoliszt, however, was rather simpler, and was not capable of competing from a musical point of view with the Welte-Mignon. Hupfeld was aware of this, and no cost or effort was spared in the development of a reproducing piano that could compete with the Welte-Mignon. A year later Hupfeld introduced the Dea reproducing piano, which was much more advanced than the Phonoliszt. Philipps of Frankfurt also saw an opportunity of increasing their turnover, by starting on the production of reproducing pianos.

In all probability the Duca appeared for the first time in public at the Leipzig Michaelismesse (the autumn trade fair) of 1908.

The introduction of the Duca

The earliest Duca rolls that can be dated with any certainty (nos. 42 to 74, played by Anatol van Roessel), were recorded in November 1908, and so 1908 can be taken as the probable year of the instrument's introduction. In the "Zeitschrift für Instrumentenbau", the first article mentioning the Duca reproducing piano is the description of new instruments at the "Michaelismesse" at Leipzig which started on Sunday 30th of August 1908. The description in the article from the "Zeitschrift" of 11th September is in typically elegant language of the time:

> Als Neuheit hatten die Herren Philipps (es waren diesmal beide Inhaber anwesend) ein neues Kunstklavier „Duca“ mitgebracht, sozusagen ein etwas verspätetes Konkurrenzinstrument zu „Dea“ und „Mignon“. Wie bei diesen, so ist auch hier das Spiel des vortragenden Künstlers (wir hörten etwas von Prof. Rehberg) durch Aufnahme-Apparat festgehalten worden, und es kann hier konstatiert werden, daß das schöne von Lipp & Sohn gebaute Instrument sich mit seinen 85 Tönen Umfang und seinem reichen Nuancierungsmechanismus vollwertig seinen beiden Vorgängern anschließt. „Artista“ ist ein wesentlich billigeres Kunstklavier; in der Wiedergabe kommt es dem Phonoliszt gleich und ist in der Hauptsache für feinere Cafés berechnet.

As an example of their latest creation, the gentlemen from Philipps (on this occasion both of the proprietors were in attendance) had brought with them a new self playing piano, *the "Duca", which one might characterize as a somewhat tardy competitor for the Dea and the Mignon. As with these two, so also in this case is the playing of the performing artist (we heard a selection by Prof. Rehberg) preserved by a recording machine, and we may here observe that the beautiful instrument built by Lipp & Son, with its compass of 85 notes and its rich expression mechanism is in every way the equal of its two predecessors. The "Artista" is a much less expensive self playing instrument; in its performance it is comparable to the Phonoliszt and is mainly intended for use in high class cafés.*

After the introduction there was a remarkable silence in the press. The "Zeitschrift" again mentions the Duca as Philipps displayed it at the Leipziger Messe in the spring of 1909:

Inzwischen ist auch für das prächtige Kunstklavier „Duca" ein vornehmes Repertoire geschaffen worden, wobei man den Namen von tonangebenden Künstlern, ja man kann wohl sagen von Koryphäen des Klavierspiels begegnet. Die tadellose Wiedergabe auch der leisesten Gefühls-Erregungen und Anschlags-Schattierungen stellt dem herrlichen Instrumente das Zeugnis eines wahrhaften Kunstproduktes aus.

In the meantime the magnificent Duca reproducing piano has also had a distinguished repertoire bestowed upon it, in which one may encounter the names of pre-eminent artists, indeed one might say, the very élite of the piano-playing world. The flawless reproduction of even the most subtle turns of phrase and shading of dynamics has established this wonderful instrument as a true work of art.

A testimonial for the Duca reproducing piano
(Zeitschrift für Instrumentenbau, Leipzig, 11th July 1910)

The Duca was again presented at the Leipzig Fairs in both the autumn of 1909 and the spring of 1910 and, although Philipps advertised its orchestrions in every issue of the "Zeitschrift für Instrumentenbau", we find the first actual illustration of a Duca in an advertisement from July 1910, after a silence of nearly two years. The reason for what appears to have been some kind of hesitation in the introduction may perhaps have been problems with the processes of recording or delays in the editing of rolls. The 1910 advertisements mention only the pianist Eugen d'Albert, but in the 1911 advertisements the names of Raoul Pugno, Carl Friedberg, James and Frieda Kwast, Frederic Lamond and Maria Carreras also appear, with an indication that "many more are in preparation".

A testimonial from the Vienna State Opera conductor, Karl Krüger (Zeitschrift für Instrumentenbau, Leipzig, 11th February 1913)

An advertisement for the Duca grand reproducing piano

Duca Instrument Models

The Philipps Duca first appeared, in its earliest incarnation, in 1908, in the form of an upright piano. Decorated casework later became available; at the Brussels World Fair of 1910, Philipps exhibited two Duca models, the first "a beautiful Feurich piano in sapele mahogany, with bronze and black columns and marquetry, and the second a Lipp piano, in dark mahogany and bronze". In early 1911 a push-up model was introduced, and an advertisement from 1st March 1911 first mentions the Duca "Vorsetzapparat". A keyless cabinet player ("ohne Handspiel") was developed in the same year, and first advertised in the autumn. Then, at the Leipzig Michaelismesse in 1912, the Duca grand reproducing piano made its first appearance. The reviews of the Fair in "Zeitschrift für Instrumentenbau" bear witness to an experienced writer, who was evidently impressed by the Duca grand piano's performance:

Das Glanzstück der Ausstellung der **Frankfurter Musikwerke-Fabrik J. D. Philipps & Söhne** in Frankfurt a. M. war ein Kunstspiel-Instrument „Duca", eingebaut in einem wunderbaren Feurich-Flügel. Der Apparat hat einen kaum noch zu überbietenden Grad der Vollendung erreicht und vermittelt virtuose Darbietungen mit einer Exaktheit der Wiedergabe, mit Anschlagsfinessen und Nuancen, mit einem seelischen Gefühl, die einfach bewunderswert sind. Wir hörten die Klavier-Titanen Ansorge, Busoni, Schnabel u. a., und wie sie einen guten Teil ihres Virtuosentums und ihre Künstlerseele auf „Duca" gewissermaßen übertragen haben. Das Spiel ist weich und doch niemals weichlich, virtuos bis zum äußersten und doch niemals hart, und dabei entwickelt „Duca" eine nie versagende, perlende Repetition.

"The highlight of the display presented by the Frankfurter Musikwerke-Fabrik J.D. Philipps & Söhne of Frankfurt am Main was a reproducing player system, the "Duca", built into a wonderful Feurich grand piano. The machine has reached a level of perfection that can hardly be surpassed, and it offers virtuoso performances with an exactness of reproduction, with refinements of touch and rubato, and with a spiritual dimension that is quite simply miraculous. We heard those keyboard giants Ansorge, Busoni, Schnabel and others, and we heard the ways in which they had engraved their virtuosity and their artistic souls on the Duca. The playing can be gentle but never weak, virtuosic in the extreme and yet never too hard, and through it all the Duca displays an unfailing and sparkling repetition."

Two advertisements for the Duca push-up (Zeitschrift für Instrumentenbau, Leipzig, October and November 1916)

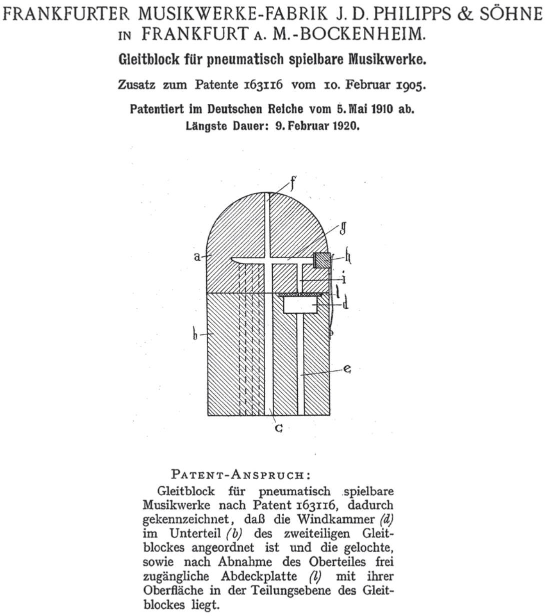
It seems likely that the Duca push-up and cabinet players were not very successful from a commercial point of view. In a Philipps price list published in 1921, both types are still mentioned, but in a 1923 price list they do not appear any more.

The Duca Vorsetzer, or push-up model (Duca catalogue, Frankfurt, 1912)

Technical design of the Duca

In 1903 Philipps introduced a new series of electric pianos and orchestrions under the title of “Pianella”. The Pianella line of instruments played a 23 cm wide roll, with 4 perforations per centimetre. Philipps called this combination of small perforations and narrow rolls “Enge Teilung”, or “narrow spacing” in English. Compared to the later standardized 88-note rolls this was not inordinately small, but in comparison to the 65 and 72 note piano rolls of the time, and to the many different orchestrion rolls of the period, it represented

An advertisment for the
Duca upright model



FRANKFURTER MUSIKWERKE-FABRIK J. D. PHILIPPS & SÖHNE
IN FRANKFURT A. M.-BOCKENHEIM.

Gleitblock für pneumatisch spielbare Musikwerke.

Zusatz zum Patente 163116 vom 10. Februar 1905.

Patentiert im Deutschen Reiche vom 5. Mai 1910 ab.
Längste Dauer: 9. Februar 1920.

PATENT-ANSPRUCH:

Gleitblock für pneumatisch spielbare Musikwerke nach Patent 163116, dadurch gekennzeichnet, daß die Windkammer *(d)* im Unterteil *(b)* des zweiteiligen Gleitblockes angeordnet ist und die gelochte, sowie nach Abnahme des Oberteiles frei zugängliche Abdeckplatte *(l)* mit ihrer Oberfläche in der Teilungsebene des Gleitblockes liegt.

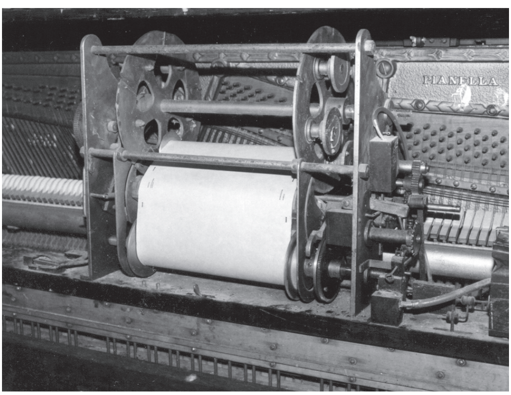
Improvement on the wooden trackerbar.
Philipps patent 229939, May 1910

a significant difference. According to Philipps themselves, the advantage of the narrower scale was that it caused fewer problems with the expansion or contraction of the paper on account of changes in humidity.

The Duca was of very similar construction to the Pianella. In both cases one can see the same nickel plated, cast iron spoolframes, the same kinds of pneumatic stack with three tiers and a double valve system, and the same general arrangement as the smaller (piano) models of the Pianella line. The new and different feature was of course the expression system, which was mounted under the keybed of the uprights, and enclosed in a purpose-built casing under the soundboard of the grands.

In most Duca upright pianos, the stack is mounted above the keys, but in some cases it is located beneath. The latter construction is an advantage for the piano tuner, but can cause problems when the stack needs attention. The wooden tracker bar on all earlier models, as seen above, was of the same clever design as that of the Pianella, and it could be removed in a second to reveal the bleed holes for cleaning. Duca grand pianos were fitted with a motor and exhauster pump in a separate cabinet that was connected to the piano via a hose.

The Duca was offered in a variety of makes of piano. The least expensive was the “Spezial”, which was probably made by the Arnold piano factory, later taken over by Philipps. Other pianos in which the Duca was installed were Brinkmann & Goebel, Feurich, Fiedler, Lipp, Niendorf and Scheel. Most of the upright piano cases, quite possibly all of them, were made by Philipps themselves. The piano manufacturer, most frequently Feurich, simply provided the back of the piano, including the soundboard, pin block and metal frame, and most probably the piano action as well. This is why we find Philipps/Feurich instruments with exactly the same case design as, for example, Philipps/Lipp. It is not known whether the cases of grands were made by Philipps or by the piano manufacturers themselves. The Duca was offered with oak veneer or polished ebony finish as standard. The prices of more expensive finishes, such as polished mahogany or walnut were between 5 and 10 per cent more expensive.

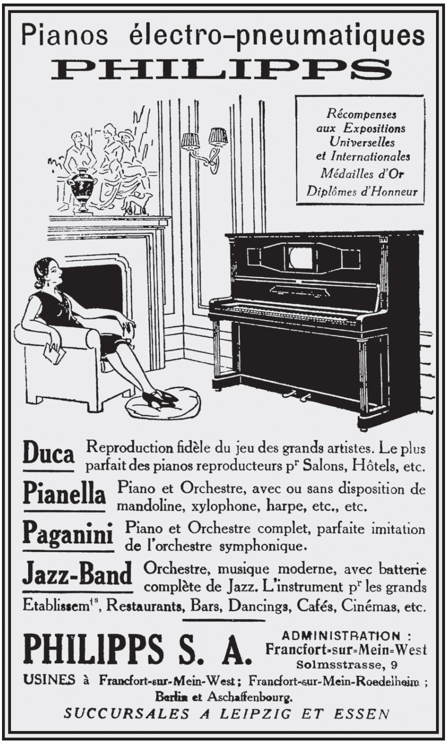


A Duca upright piano with automatic roll changer

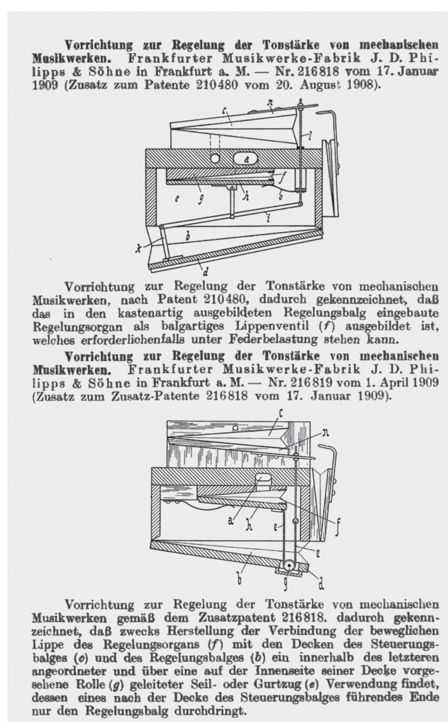
Duca pianos manufactured for commercial use

Like the Welte-Mignon and the Hupfeld Dea, the Duca was originally intended for the salons of the wealthy. Welte did everything it could to preserve that status, and declared that the Mignon would not be sold for use in public places. Philipps were more flexible in the matter, and they soon put on sale Duca instruments that were specially made for commercial use, initially sold under the name of the “Pianella Conzert Piano”. These upright instruments had cases with all the features of the normal electric pianos supplied for public performance, with ornamental casework and electric lamps. Many different case designs were offered.

Later on this type of upright was sold under the Duca name as well, and as an extra feature, an automatic roll changer was available. Special commercial rolls were introduced into the catalogue, with 3 to 4 tunes, usually with the music arranged by hand, instead of being recorded at the piano. Such rolls were known as “Serien Rollen”, with catalogue numbers beginning at 5200 onwards. After each selection there was a perforation to cut off the motor, and at the end of the music, the roll would rewind and come to rest at the starting point. This enabled the use of coin box operation.



Advertisement for the Duca in France (Musique-Adresses Universel, Paris, 1928)



Vorrichtung zur Regelung der Tonstärke von mechanischen Musikwerken. Frankfurter Musikwerke-Fabrik J. D. Philipps & Söhne in Frankfurt a. M. — Nr. 216818 vom 17. Januar 1909 (Zusatz zum Patente 210480 vom 20. August 1908).

Vorrichtung zur Regelung der Tonstärke von mechanischen Musikwerken, nach Patent 210480, dadurch gekennzeichnet, daß das in den kastenartig ausgebildeten Regelungsbalg eingebaute Regelungsorgan als balgartiges Lippenventil (*f*) ausgebildet ist, welches erforderlichenfalls unter Federbelastung stehen kann.

Vorrichtung zur Regelung der Tonstärke von mechanischen Musikwerken. Frankfurter Musikwerke-Fabrik J. D. Philipps & Söhne in Frankfurt a. M. — Nr. 216819 vom 1. April 1909 (Zusatz zum Zusatz-Patente 216818 vom 17. Januar 1909).

Vorrichtung zur Regelung der Tonstärke von mechanischen Musikwerken gemäß dem Zusatzpatent 216818. dadurch gekennzeichnet, daß zwecks Herstellung der Verbindung der beweglichen Lippe des Regelungsorgans (*f*) mit den Decken des Steuerungsbalges (*c*) und des Regelungsbalges (*b*) ein innerhalb des letzteren angeordneter und über eine auf der Innenseite seiner Decke vorgesehene Rolle (*g*) geleiteter Seil- oder Gurtzug (*e*) Verwendung findet, dessen eines nach der Decke des Steuerungsbalges führendes Ende nur den Regelungsbalg durchdringt.

Philipps patents of the Duca expression system, with mezzoforte hook (German Patent Office, nos. 216818/9, Berlin, 1908 and 1909)

The Duca Expression system

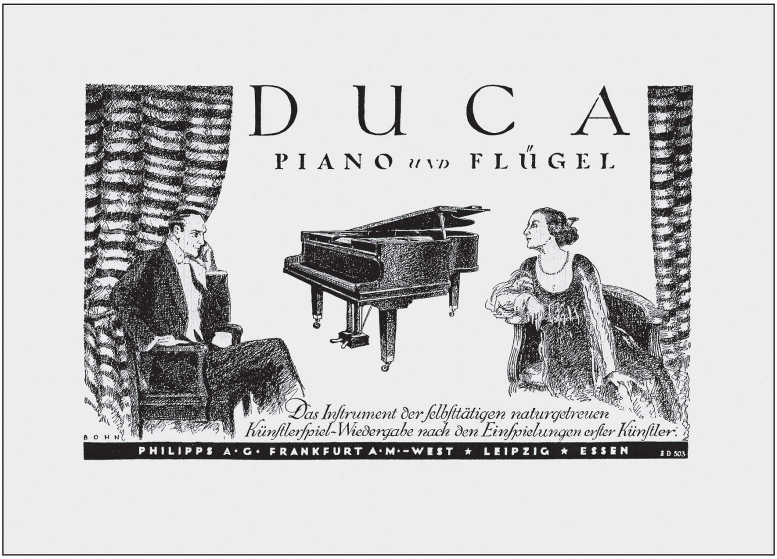
The expression system for the Philipps Duca has many similarities to that of the Welte-Mignon, and indeed it is almost certain that Philipps made use of some of Welte's patents under licence. The pneumatic stack and expression mechanism are divided into bass and treble sections, with the division between notes 46 and 47 (F# and G). The flow of suction to control the loudness of playing is controlled by a double pneumatic, one part of which increases the flow, while the other reduces it. By contrast, Welte used only a single pneumatic for each half of the stack. The movement of each control pneumatic and its respective knife-valve can be restricted by means of a mezzo-forte pneumatic and hook, exactly as on the Welte-Mignon. The suction regulating pneumatics are normally able to move freely between piano and forte, but when the mezzo-forte function is in operation, the movement is restricted to run between either piano and mezzo-forte, or between mezzo-forte and forte.

The regulating pneumatics can move slowly or quickly, also as on the Welte-Mignon, but accenting mechanisms for treble and bass are quite different. These operate in a similar fashion to the Aeolian Company's Themodist, but the longer the signal perforation in the roll, the more powerful the accent that results. Another difference from the Welte-Mignon is that the hammer rail has three steps, at rest, half lifted and fully lifted, operated by a double pneumatic, which also takes up any lost motion on the note pneumatics. This is a most effective way of ensuring that the piano plays reliably at the quieter levels. As would be expected, the Duca is also fitted with an automatic sustaining pedal, controlled by a perforation on the roll.

At 4 perforations per centimetre across the paper width, Duca rolls have the same spacing as standard Pianella rolls, but the number of perforations is increased to a total of 102. The paper is 264 mm wide, and rolls for both types of instruments are fitted with rather expensive spools, with adjustable steel flanges at each end.

The layout of the Duca trackerbar is as follows:

1	Bass accent
2	Bass mezzoforte off
3	Bass mezzoforte on
4	Bass decrescendo (slow)
5	Bass crescendo (slow)
6	Bass decrescendo (fast)
7	Bass crescendo (fast)
8	Soft pedal (hammer rail) off
9	Soft pedal (hammer rail) half forward
10	Motor off
11	First playing note – key 4 (C)
91	Last playing note – key 84 (Ab)
92	Soft pedal (hammer rail) fully forward
93	Re-roll
94	Sustaining pedal on
95	Sustaining pedal off
96	Treble crescendo (fast)
97	Treble decrescendo (fast)
98	Treble crescendo (slow)
99	Treble decrescendo (slow)
100	Treble mezzoforte on
101	Treble mezzoforte off
102	Treble accent



A 1920s advertisement for the Duca

Frederic Lamond at the Duca recording piano, Frankfurt, 21 July 1909

The Duca recordings

Philipps followed the trend set by Welte and Hupfeld of inviting famous pianists to record the rolls for its reproducing piano. With this in mind, they ordered a grand piano from Richard Lipp in Stuttgart in December, and this was specially adapted and connected to a machine that could record the pitch and duration of the notes played by the pianist. The recording piano still exists, and was discovered several years ago by Hans-W. Schmitz of Stuttgart, Germany, who recognised its significance as a result of the many pianists' signatures that had been inscribed on the piano frame. Unfortunately, all the mechanisms that had been added for recording purposes had long since been removed and are now lost. Apart from the signatures, the only evidence of the piano's use for recording purposes was a long slot that had been cut in the keybed, and a number of screw holes on the underside.

Whether, and by what means the force of the keystroke might have been recorded is no longer known. The only information we have about the recording process comes from a series of the heavily retouched photographs from the testimonial booklets that were issued for publicity purposes. These depict several of the Duca pianists seated at the recording piano, which is connected to a machine on which a paper roll and an electric motor are visible. According to Leopold King, one of the former technicians of the Philipps Company, several recording pianos, from different piano makers, were used at the Philipps studios.

On the roll labels for the Duca, and also in the various catalogues and supplements, we find the following names of recording artists:

Ugo Afferni
Eugen d'Albert
Conrad Ansorge
Pitt Bittong
Fritz von Bose
Marte Braun
James Braun
Ferruccio Busoni
Teresa Carreño
Maria Carreras
Maria Theresia Conzen
Alfred Cortot
Augusta Cottlow
Léandro Criscuolo
François de la Croix
Norah Drewett
Kurt Drucker
Paul Eggert
J. Elber
Alfred Emch
Lonny Epstein
Leo Eysoldt
Ida Feinmann
Alban Förster
Anton Förster
Hans Förster
Fr. Franz
Carl Friedberg
Arthur Friedheim
Ignaz Friedman
Ossip Gabrilowitsch
Ferry Gebhardt
Rio Gebhardt
Mme. Denis- van Gelder
Berthe Marx-Goldschmidt
Paul Goldschmidt
Alfred Grünfeld
Heinz Hanitsch
Irene Hendorf
Willy M. Jinkerz
Else Kallmeyer
Marie Kaufmann
Friedrich W. Keitel
A. Knoof
Erich Wolfgang Korngold
James Kwast
Frieda Kwast-Hodapp
Fréderic Lamond
R. Laterre
Louise Löhr
Fritz Malata
Moritz Mayer-Mahr
Marc Meytschik
Hélène Moillet-Gobat
José Vianna da Motta
Theodor Müller-Reuter
Otto Neitzel
Rudolph Nelson
Marie Oppenheimer
Ellen Pairan
Peter Palla
Edmund Parlow
Max von Pauer
August Philipps
Oswald Philipps
Hans Pfitzner
Alexander Pohl
Raoul Pugno
Wynne Pyle

Ella Rafelson
Willy Rehberg
Walter Rehberg
Bruno Hinze-Reinhold
Alice Ripper
Eduard Risler
Julius Röntgen
Anatol van Roessel
Woldemar Sacks
Camille Saint-Saëns
Wera Schapira
Xaver Scharwenka
August Schmid-Lindner
Adolf Schmitt
Arthur Schnabel
Germaine Schnitzer
B. Schröder
Richard Singer
Max Sinzheimer
Paula Stebel
Johann Strauß
Adolf Tandler
Frieda Thury
Ernst Toch
Josef Treis
Gaspard de Vienne
Elfriede Vogel
Josef Weiss
S. Wilberg
Lucien Wurmser
Johan Wijsman
Michael von Zadora

Philipps certainly had an impressive catalogue, with many well known pianists. Most of these recorded between ten and twenty selections, although Hans Förster played hundreds of mainly popular titles, and the Swiss, Willy Rehberg (1863-1937), who at the time was Director of the Frankfurt Conservatory, recorded a large number of classical selections. Rehberg and the Austrian pianist, Fritz Malata (1882-1949), not only made recordings, but were also involved in the selection of the music to be published on roll. The pianists who recorded for Philipps were usually asked to leave testimonials for publicity purposes, and so, for example, Ferruccio Busoni wrote in May 1912:

"Mit großer Genugtuung hörte ich die Pianisten-Porträts durch Duca zu Gehör gebracht, welche durch ihre Ähnlichkeit und sehr künstlerische Ausführung verblüffen. Meine besten Wünsche begleiten den Apparat auf seiner Reise um die Erde."

"It was with very great satisfaction that I heard the pianistic portraits brought to audible life through the Duca, which confounds us by its faithfulness and highly artistic reproduction. My best wishes go with this instrument as it makes its journey around the world."

The label for Duca roll no. 1148, played by Ferruccio Busoni

Most of the important recordings for the Duca took place in relatively quick succession just before the Great War. During the War, production slowed down as the demand for pianos dropped, and many of the employees had to fight in the trenches. Even the directors, August and Oswald Philipps, joined the German forces.

On the 11th December 1915, a concert was organised by Philipps for the benefit of the war casualties in the Frankfurt hospitals:

> Bei vorwiegend instrumentalen Darbietungen rief, wie zu erwarten war, das hinlänglich bekannte Künstler-Reproduktions-Klavier „Duca“ lebhafte Bewunderung hervor. Als ob Prof. Max v. Pauer selbst konzertierte, so klang es aus dem Flügel heraus, als Liszt's von ihm eingespielte „Abendstimmung“ wiedergegeben wurde. Und auch Willy Rehberg's eigenes Spiel mit aller persönlichen Ausdrucksweise erkannten die Frankfurter Konzertbesucher sofort in der Wiedergabe von Weber-Tausig's „Aufforderung zum Tanz“. Die Leistungen des „Duca“-Flügels waren lebenswahre Wiederholungen von Originalvorträgen dieser Pianisten und forderten wegen ihrer Identität mit den Originalvorträgen zu einem Vergleich mit der Präzisionsarbeit der photographischen Technik auf. Aber auch charaktervolle, exakte Begleitung stand ihm gut, was ein gefühlvoller Cello-Vortrag (W. Mehne) mit „Duca“-Begleitung zeigte.
>
> Ein weitaus größerer Teil des Programmes ließ jedoch den von Herrn Direktor A. Philipps bedienten „Ducanola“-Kunstspielapparat im Flügel hervortreten, der bekanntlich jeden rasch zu künstlerischem Klavierspiel befähigt. Zunächst hörte man ihn als Solo-Instrument, wie auch als Begleit-Flügel zu den lebhaft applaudierten Gesangsvorträgen (Frau Grete Rieckeheer).

“The long-established and well-known Duca reproducing piano aroused much admiration, as one might have expected, with a programme of mainly instrumental music. It was as though Professor Max von Pauer was playing there in person, such were the sounds that came from the grand piano when Liszt’s “Abendstimmung” was reproduced. And the Frankfurt audience was not slow to recognise Willy Rehberg’s own style of playing, with all its personal expression, in a performance of the Weber-Tausig “Invitation to the Dance”. The performances given on the Duca grand were utterly lifelike reproductions of the playing of these pianists, so identical with the original performances that one was prompted to equate then with the techniques of photography. But the instrument also showed how well it could provide a precise and characterful accompaniment, as an expressive cello performance (W. Mehne) demonstrated.

“However, the greater part of the programme however, allowed one of the firm’s directors, A. Philipps, to play upon the grand piano by means of the Ducanola player mechanism, which is well-known as a means of rapidly allowing anyone to achieve an artistic standard of piano playing. At first we heard it as a solo instrument, and then also as an accompaniment for the enthusiastically applauded vocal performances, given by Frau Grete Rieckeheer.”

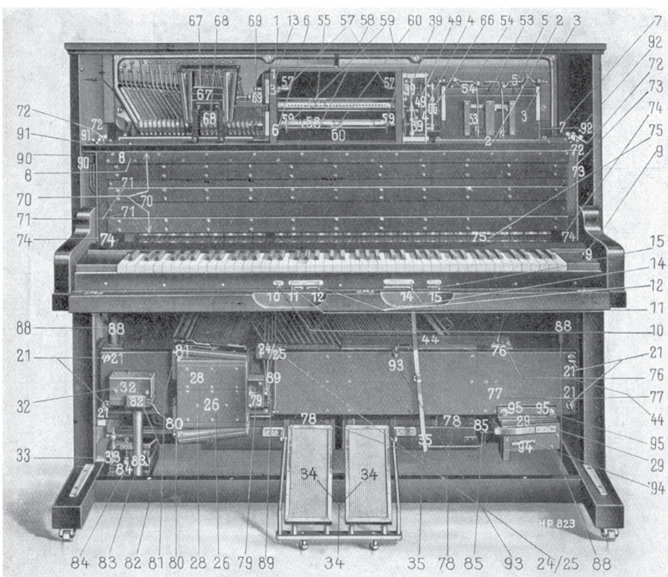
The label for Duca roll no. 349, described above, played by Willy Rehberg

Duca advertisement in Zeitschrift für Instrumentenbau, Leipzig, October 1913.

"Earning several fortunes won't be difficult any more if you would become a retailer of the new, inexpensive Duca reproducing piano! This instrument has been designed put all other makes in the shade, because of its excellent quality and its unequalled low price."

After 1918, the main focus of the Duca catalogue turned more towards popular music, which is a progression that we see with other companies as well. However, even when the company's sales were declining, many fine classical selections were still recorded. It is not known when the last recording session took place, but the last known serial number of a regular hand played roll is number 2315, listed in one of the last catalogue supplements, from Spring 1930. The title of the roll is; "Baby Gaby und die Spieluhr" ("Baby Gaby and the Musical Clock"), Foxtrot on the Black Keys, played by the Dutch pianist, Pierre Palla. There is only one later catalogue supplement known, from June 1930, but that does not contain any new recordings. Roll production may have continued for a while, however.

Apart from the normal recorded rolls, there were also the so-called "Tanz-Rollen", rolls for dancing, which were arranged rather than recorded. These rolls had a different numbering system, from no. 5000 onwards. Rolls for the Duca were of course made by Philipps, but also by the roll manufacturers Concordia of Leipzig, Eugène de Roi of Antwerp, and Euterpe of Amsterdam.



The Ducanola foot-pedalled player piano

The Ducanola

In the 1927 Philipps Jubilee brochure, mentioned earlier, we read that the Ducanola was introduced in 1911, after several years of preparation. It was Philipps 88-note foot-pedalled player piano, and was first exhibited in an upright piano, at the Leipzig Fair in the autumn of 1911. Later on it became available in the form of a grand piano, and as a push-up instrument. Most of the world's reproducing pianos were a development from normal player pianos, which is not surprising, since they are simply player pianos with a number of extra mechanisms. The Ducanola, however, was developed from the Duca, and this may be one of the reasons why it became such a high-quality instrument. From a construction point of view, it is one of the finest built player pianos, and also one of the most complicated. Development went on for many years, and the Ducanola was manufactured in many variants, though the most important was the position of the stack being above or below the keybed. Ducanolas could be obtained in some 20 different makes of piano, ranging from the least expensive, called the "Spezial", to the most important, the Blüthner. Since Ducanolas were made in considerable quantities, they are therefore not particularly rare.

Ducanola or Ducaliszt! – an advertisement for the new Ducanola

Philipps 88-note rolls

For these new 88-note instruments, the steadily growing archive of Duca recordings was used. New masters were most likely made, without the perforations for the expression system, apart from the sustaining pedal and accents. The new 88-note rolls were published under the "Philag" brand, no doubt because Philipps was proud that in 1911, the year in which the Ducanola was introduced, the Company added the suffix "A.G." to its name. "A.G." means "Aktiengesellschaft" in German, the equivalent of a British limited company.

The serial numbers of the 88-note rolls were the same as those for the Duca, and the labels on the rolls and boxes were almost the same, except for the omission of the words, "Reproduktions Klavier". Pianists who had recorded for the Duca were now asked to write testimonials for the Ducanola as well. In 1912, Ferruccio Busoni wrote:

"Ducanola, dem trefflichen Kinde der Duca erkläre ich mit Vergnügen meine Bewunderung: es ist in seiner Art vollendet".

"Ducanola, to the worthy child of the Duca I declare my pleasure and my admiration: it is perfection in itself."

The Ducartist

The Ducartist was the result of the Company's wish to develop an instrument that could play reproducing rolls as well as the regular 88-note rolls, so it was fitted with an electric motor and foot-pedals. At least one Duca was made that could play 88-note rolls without recourse to pedals, but whether this was made to special order is not known. The Ducartist, however, was a fully developed, new instrument.

Since the Duo-Art, Ampico and Welte Licensee were developed after the introduction of standard 88-note rolls, it was logical that these newer reproducing pianos were designed with the 88-note roll standard in mind. The reproducing systems needed specially prepared rolls, but still with the standard dimensions of paper and spools. As a result, it was quite simple to make them play 88-note rolls as well. After the Great War, both Welte and Hupfeld decided to follow these developments, and they must have invested considerably in adapting their existing systems to the new standard. Welte refashioned their Welte Mignon into what is now known as the "green" Welte, and Hupfeld went even further by developing the Triphonola.

Philipps, with 102 positions on the trackerbar of the Duca, had a major problem in converting it to standard sized rolls. On rolls based on the 88-note scale, there is no space for 102 perforations. To avoid redesigning the expression system and – probably more important – to avoid having to make new masters, Philipps decided to leave their Duca roll unchanged, except for the width of the paper. Because of the narrow spacing, it was possible to include the narrower scale within the wider roll width. This resulted in the Ducartist roll, which looks like a regular 88-note roll, with the same spools, but which does not play on a 88-note player piano, because the spacing is narrower than on an 88-note roll. By means of a double trackerbar the Ducartist could play the both the new rolls designed for it, as well as the standard 88-note rolls.

Philipps used the same roll numbers for the Ducartist, as for the Duca and the Ducanola. The only difference was the colour of the label, which was green. The new instrument was introduced at the Leipzig Fair in the spring of 1921. At the beginning the instrument was christened the "Ducaliszt", but that name was soon abandoned, and the name was changed to "Kombinationsinstrument". In June of the same year the name had been changed once more, to Ducartist. It is possible that Hupfeld raised problems with the name Ducaliszt, on account of its similarity to their trade name, Phonoliszt.

The Ducartist was installed in a number of piano makes. Some existing uprights had their motors and pump in a separate cabinet, while others had both foot pedals and electric pumps built into the piano case.

Ducas today

Today the Duca has become very rare. Most commonly one finds pianos from which the player mechanism has been removed. Those instruments that are still complete are not generally in playing condition. The majority are uprights, though a few grands are known to exist, and most instruments are found in Feurich pianos. Of the Duca Vorsetzers, not one is known to exist any more, while of the cabinet version only one, in the Musik Museum Monschau, seems to have survived. A couple of commercial-style Ducas still exist. The Pianola Museum in Amsterdam has two, of which one is equipped with a five-roll changer. Ducartists are very rare, with only a few existing, and probably only one with the early name Ducaliszt has survived, installed in a Grotrian-Steinweg. But do not despair - Ducanolas are not too hard to find!

Sources and further reading

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Review:
Player Pianos in the News (and not)

Paul Usher

A pianola concert is a rare thing. Not surprisingly, so too is any mention of the pianola and the player piano in the media. So it was something of a surprise, shortly before the concert under discussion here took place, to happen by chance on two mentions in the space of a few days.

Two well known and prominent musicians cited the influence of these instruments in their formative years. The first was on BBC 4 in a profile of Brian Eno - world famous producer and pioneer of 'ambient music'. He reminisced about his grandfather's player piano; the young Eno recalled how he would play hymn tunes over and over, enjoying the disjunction between the musical content and the 'mechanical' delivery. He draws no conclusions about the nature of the instrument - simply observes the way in which he enjoyed using it in a particular way - a way that fed into his later music.

The second mention was from jazz guitarist Pat Metheny. Metheny has recently released an album called 'Orchestrion' in which he controls a huge array of specially commissioned solenoid-based instruments controlled from his midi guitar via the Disklavier system.

In an article in the April 2010 edition of 'Sound on Sound' magazine, Metheny, in a similar reminiscence, describes his first encounters with these instruments during visits to his grandparents' house in Wisconsin. It is interesting to hear about the influence of these instruments - presumably more widespread than one might think - on a wide variety of musicians, but there are some things to take issue with. Metheny states, "… my grandfather's piano, you had to pump it to get the paper to go through the thing … it was very flabby, rhythmically. It didn't have the kind of precision that I would need." This may well have been true of his grandfather's instrument, but he draws a universal conclusion from it. He later adds, "The other thing - and this is maybe the most important thing - it didn't have dynamics. … in terms of playing a really expressive line where there are many shades of dynamics, you couldn't really do that …"

It is a bit disappointing that these comments go unchallenged in a specialist sound recording magazine that regularly discusses the historical aspects of recording technology. The recording is receiving a lot of attention in the music press and Metheny is presumably repeating these statements to a lot of people.

Anyway, moving on from the 'headline' news to someone who continues to explore the possibilities, both old and new, of the pianola, March 19th 2010 saw Rex Lawson's second Cardiff concert of the year – this time with the

Cardiff University Symphony Orchestra conducted by Mark Eager and another outing for Rachmaninoff's Piano Concerto No. 3 in D minor Op. 30 – only the second ever performance of this work on the pianola. Denis Hall gave the background to the first performance in the Pianola Journal No. 18, 2007.

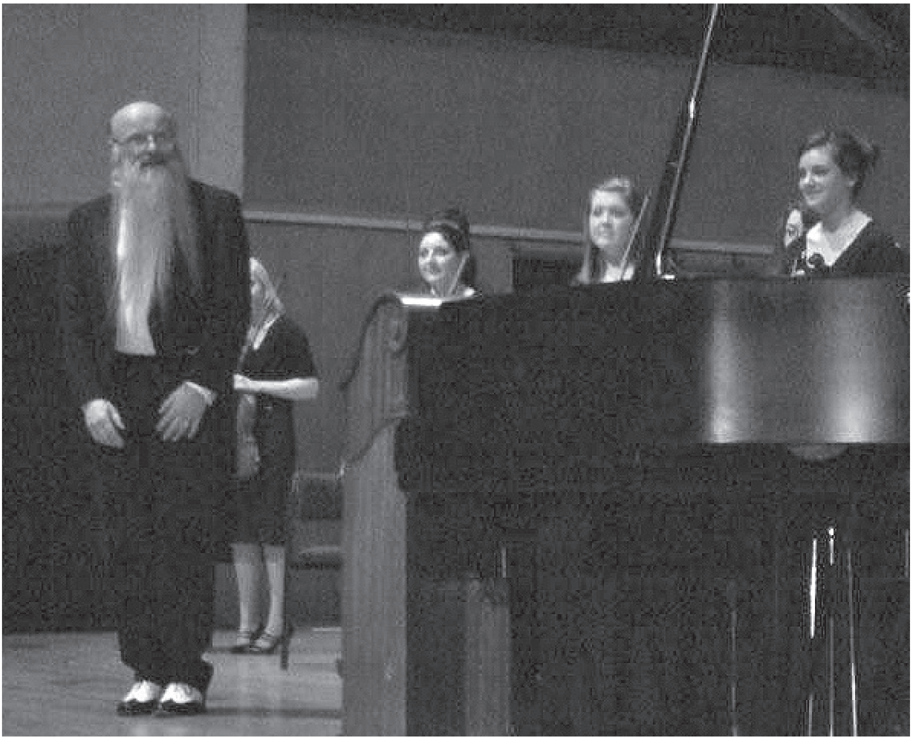
So, why play this on the pianola? And how does a performance on a pianola differ from one played in the conventional way. Can one tell the difference? These are difficult questions. It's a transcription of sorts – the presentation of a work written for one medium rethought for another — and when presented with a transcription, particularly of so familiar a work, you might question what can be done in the new medium that can't be done in another. However, this not a transcription in the usual sense – close your eyes and what's to tell you this is not a conventional pianist? All the notes are there in the same order on the same instrument. You can hear the sound of the paper roll in the quieter moments; also a few other noises - but while a lot of trouble is taken to remove as much of this extraneous noise as possible I for one would not want to lose it completely - just as one might enjoy the sound of the needle while listening to a vinyl LP - it puts the sound into a subtly different context. It is perhaps, an interpretation at one remove; Rex Lawson has made interpretive decisions in preparing the rolls - guided by his own deeply felt views on the performance of music that he loves - and a close listening to Rachmaninoff's own recordings in particular (and of course the whole history of the performance practice of the early twentieth century as evidenced through the recordings of many great pianists). There are things that can be done with real fingers that can't be done with felt ones but the reverse is also true - a rare clarity is obtainable, particularly in those passages that test a player to the limit. Yes, certain articulations cannot be changed during the performance, you cannot decide to roll a chord in a different order, you can't add a few more notes to a trill, but then how many decisions does a pianist make during a performance, how many are made beforehand, how many are dictated by necessity or not considered at all, left to habit. There is still the ebb and flow of the tempo, careful use of accents, and I might add that 'a really expressive line' was definitely present as were 'many shades of dynamics'.

So, can one tell the difference? - if this were any other pianola player the answer would probably be 'yes', but Rex Lawson is not an ordinary player or an ordinary musician. And finally the answer to the first question; why play this on a pianola? - it is simply this; here is an interpretation that can hold its own alongside others and enjoyed on its own merits.

The young players of the orchestra played to an exceptionally high standard drawing spontaneous applause after the first movement. There was the usual excitement at the end - the audience irresistibly drawn to the stage

- on this occasion the pianola having to be quickly removed so that the stage could be prepared for the second half.

Mention should also be made of the other pieces - before the Concerto we heard a lively performance of Dvorak's Slavonic Dance No. 8, Op. 46, and after the interval the orchestra was joined by the Cardiff University Choir, this time under the direction of David Ponsford, for a performance of excerpts from Boris Godunov. After a tentative start this developed into a very impressive performance.



Obituary: Yvonne Hinde Smith

Denis Hall

Yvonne Hinde Smith passed away quietly at her home in Joch, France, on 13th March 2010 at the grand age of 90 years. Up to a couple of weeks before her death, she was able to enjoy life in a full way, even though she was not as physically active as she would have liked.

Yvonne was born in 1919 while her father, Reginald Reynolds, Aeolian's principal Pianola player and recording producer for those Duo-Art rolls emanating from England, was on board ship, returning from a visit to the States. The exciting news of Yvonne's birth was telegraphed to the ship in mid-Atlantic! It was her great love for her father which was the reason for her interest in the player piano during the last 40 years of her life, for she would have been the first to admit that music and the Pianola had not previously played a large part in it. However, when she became aware of the Player Piano Group, and got to know its founder, Frank Holland, she was keen to take an active role at its social functions. It was through the Player Piano Group, around 1970, that I met her and her husband, John, who became its secretary, an appointment which he carried out most conscientiously and with great diplomacy. As I was committee chairman at that time, I visited them in their home at Leatherhead on a regular basis, and we became firm friends.

Yvonne and John met during the war, when they were both working for the Inland Revenue in Llandudno. In time, they were married, and came south to Surrey, and after several moves, settle in Leatherhead with their son, Robert. It was there that social gatherings took place, with the guests congregating either in the front room, playing rolls, or, in the case of those less 'musically' inclined, retiring to the magnificent garden with its unrivalled view over the North Downs.

When Rex and I formed the Pianola Institute in 1985, Yvonne and John were among its founding Members, and always showed a keen interest in everything we did, readily appreciating that the Group and the Institute complemented each other, rather than wanting to compete. Yvonne, for quite a number of years, was the Player Piano Group's Vice-President, an office which she greatly appreciated holding, but that did not come in the way of our friendship, and I continued to visit Yvonne at Leatherhead until her move to France in January 2009, to live with Robert and his wife, Carolynn.

Yvonne had a wide range of interests, including the National Trust, photography, scientific matters, and in her younger days cycling. In the loft at Leatherhead were a collection of lantern slides and a phonograph, interests which she must have shared with her father. She had strong Socialist leanings, which contrasted with John's firm Conservative sympathies, resulting in some lively discussions from time to time!

Until her increasing deafness and frailty made socialising difficult, she was a regular presence at Institute and Friends' functions, and her warm personality and welcoming manner were greatly appreciated.

We shall all miss Yvonne and John. Those of use who knew them were indeed fortunate to have enjoyed the friendship of such a wonderful couple.

Contributors

Denis Hall has been interested in recordings of pianists since his schooldays when he could buy new 78 rpm records of his keyboard heroes. He first became aware of reproducing pianos in the early 1960s, and bought his first Duo-Art in 1965. These days he spends much of his time in retirement maintaining his own reproducing pianos in a condition which he hopes does justice to the virtuosi of 100 years ago who entrusted their art to the piano roll medium.

Rex Lawson is a concert pianolist who has been involved in research and music-making with these instruments since 1974. He has travelled with his pianola to the USA, Canada and many European countries, transporting it by plane, shop, car and even, in 1988, by gondola in Venice. He has made a special study of music written for the pianola, by the hundred or so composers who have been interested in its possibilities during the course of the twentieth century. In 2004 he gave the world premiere of *Nancarrow Concerto* for pianola by Paul Usher.

Paul Usher was born in London and studied music at the Royal Academy of Music, Kings College (University of London) and the University of York. His music has been performed at events such as the Bath International Music Festival, the Huddersfield Contemporary Music Festival, Wien Modern and the Donaueschinger Musiktage. Performers include the Arditti Quartet, the Südwestfunk Symphony Orchestra and Ensemble Modern.

Mark Stikkelbroek was born in 1960 in Venlo, in the south-east area of the Netherlands, where he still lives and works. He is a printer by profession, and runs his own small printing company. When he was a child, his younger sister took up the piano, but her musical results did not impress him, and discouraged him from practising himself. At the age of 18, he and a friend found a bullet-ridden upright pianola in the basement of a former Gestapo villa. They removed the bullets and restored the instrument, and so began his passion for the player piano. Mark is married, with two sons, and is the editor and printer of the Dutch Pianola Society Bulletin.