FOREWORD

This publication, which for the first time presents the full score of George Antheil's *Ballet mécanique* as he originally conceived it, is the result of a remarkable collaboration that took place over a span of about five years. William Holab, then director of publications at G. Schirmer, assembled a team of editors, musicologists, engravers, and other musicians to accomplish this task.

The score itself was researched and edited by George A. McGuire, an engraver, music editor, and longtime Antheil enthusiast. McGuire studied manuscripts housed in the Music Division of the New York Public Library and the Sylvia Beach Papers at Princeton University, as well as scores and instrumental parts that came to Schirmer from the Antheil estate. In addition to his editorial work, McGuire designed the layout of the score using plate engraver's manual spacing. In this manner he dictated the position of each item in the score to emulate plate engraving of the past instead of allowing the computer program's justification routines to determine the spacing.

Rex Lawson, an expert on player pianos who has spent a number of years researching the history of *Ballet mécanique* and has participated in several performances, went to the Curtis Institute of Music and made a photocopy of the first set of piano rolls that Pleyel punched. Using a special ruler that "decodes" the punched holes into notes, Lawson painstakingly went through the set of rolls and proofread them against Antheil's manuscript, carefully marking the differences between what was punched and what was written in the manuscript. For the first time, it was possible to see what the staff at Pleyel did to make the piece playable — how they adapted Antheil's rigorous demands on the mechanical pianos to the limits of both the instruments and the paper. (If there were too many notes, the paper would have had too many holes and would rip apart when the piece was played.)

Finally, Paul D. Lehrman, a pioneer in the field of electronic music and MIDI technology, did the crucial work that, in a sense, makes it all worthwhile. He translated the digital score data into a format that enables any ensemble with the appropriate MIDI equipment to perform the piece in the way Antheil wanted it performed— an unwieldy combination of humans and machines playing together, with the machines synchronized under the control of one central machine, and all from a score of extreme rhythmic and metrical complexity. Owing to the enormous technical obstacles involved in getting 16 pianolas to play this music precisely in synchronization, let alone in combination with human players and a conductor, Antheil's conception was never realized in his lifetime. Now, however, music technology has finally caught up with the composer. To culminate the project, Lehrman organized the world premiere of the original *Ballet mécanique*, which took place in Lowell, Massachusetts on November 18, 1999.

In the following pages, McGuire, Lawson, and Lehrman each write about their approaches to Antheil and their contributions to this project. Others who participated, and whose efforts are deeply appreciated, include B. Allen Schultz, who engraved the score under the direction of McGuire and Holab; David Flachs, Diana Jaensch, David Fetherolf, Ed Matthew, Peter Cressy, and Richard Brundage, who assembled and edited the newly prepared performance materials and oversaw the final steps of editorial production of the score. We would also like to acknowledge the gracious assistance and cooperation of George Boziwick, curator of the American Music Collection at the New York Public Library; the staff of the Department of Rare Books and Special Collections at the Princeton University Library; Elizabeth Walker, librarian at the Curtis Institute of Music; Charles Amirkhanian, who for nearly two decades kept Antheil's music alive by distributing it under the name "Antheil Press" before the catalogue was sold to G. Schirmer; and, finally, our colleagues at Hal Leonard Corporation who have supported this project from the outset.

—Susan Feder
Vice President, G. Schirmer, Inc.

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A final note: Anyone planning to perform the *Ballet mécanique* should read carefully through the Appendix at the back of this score. It provides crucial information on equipment, digital files, copyright regulations, rehearsal procedures, and technical support.

GEORGE ANTHEIL ON THE *BALLET MÉCANIQUE*

I.

My *Ballet mécanique* is the new FOURTH DIMENSION of music.

My *Ballet mécanique* is the first piece of music that has been composed OUT OF and FOR machines, ON EARTH...

My *Ballet mécanique* is the first music ON EARTH that has its very germ of life in the new fourth-dimensional phenomena wherein TIME FUNCTIONING IN MUSIC DIFFERS FROM ORDINARY TIME and the series of deductive and also purely physical phenomena that follow it.

My *Ballet mécanique* is the first TIME-FORM on earth.

My *Ballet mécanique* is neither tonal, nor atonal. In fact it is of no kind of tonality at all. It has nothing to do with tonality. It is made of time and sound...the two materials, FUNDAMENTAL materials, that music is made of...

My *Ballet mécanique* comes out of the first and principle[sic] stuff of music...TIME-SPACE...

My *Ballet mécanique* has a closer connection to life than any of the tonal music that preceded it. But it is a musical and not a literary connection.

In my *Ballet mécanique*, I offer you, for the first time, music hard and beautiful as a diamond...

The *Ballet mécanique* is the first piece IN THE WORLD to be conceived in one piece without interruption, like a solid shaft of steel...

reprinted from "My Ballet mécanique," ***De Stijl,*** *vol. 6 no. 12 (1925)*

II.

If the public still thinks of me at all, it probably thinks of me as the composer of this damned *Ballet mécanique*...it is frankly my *nightmare*, this in spite of the fact that since 1925 I have never again touched the idea of "mechanism" in music, either aesthetically or practically...

...Don't get the idea, however, that just because I grouse and mumble here, I consider my *Ballet mécanique* a mad youthful prank! It is a completely sincere, although possibly youthful, work, but utterly representative of a very interesting period in the world's history. It *has* had a tremendous success in Paris, aroused the enthusiasm of an entire artistic generation, among them Jean Cocteau, Virgil Thomson, Erik Satie, even James Joyce....It has also been in bad repute in America *only* because it once endured a wrongly advertised and badly presented performance in Carnegie Hall. In short, it became something else than what it really is, a myth.

...Its title, for instance, seems to imply that it is a "mechanical dance," a ballet of mechanism, machinery, possibly to illustrate the interior of a factory...I called my musical piece *Ballet mécanique*, but I really do not remember why. Actually I called it *Ballet mécanique* against the better advice of Sylvia Beach, who was certain that the title would be misinterpreted by the French as "Mechanical Broom"; the words for "ballet" and "broom" sound exactly alike in French.

My original title for the work (given on the manuscript started in Germany) was *Message to Mars*. Considered from the purely euphonistic point of view, it is, of course, a much worse one than *Ballet mécanique*; moreover it implies all kinds of moralistic and mystic things which would certainly be allergic to the ice blocks of its music. The words "*Ballet mécanique*" were brutal, contemporary, hard-boiled, symbolic of the spiritual exhaustion, the superathletic, non-sentimental period commencing "The Long Armistice."

...The *Ballet mécanique* strictly followed "the dream"; it had nothing whatsoever to do with the actual description of factories, machinery - and if this has been misunderstood by others, Honegger, Mossolov included, it is not my fault; had they considered it purely as music (as, being musicians, they should have), they might have found it rather a "mechanistic" dance of life, or even a signal of these troubled and war-potential 1924 times placed in a rocket and shot to Mars.

But certainly not a mundane piece of machinery!

It is true that at the time I did consider machines very beautiful, and I had even advised aesthetes to have a good look at them; still, I repeat again and again, even frantically, I had no idea (as did Honegger and Mossolov, for example) of *copying* a machine directly down into music, so to speak. My idea, rather, was to warn the age in which I was living of the simultaneous beauty and danger of its own unconscious mechanistic philosophy, aesthetic.

As I saw it, my *Ballet mécanique* (*properly* played!) was streamlined, glistening, cold, often as "musically silent" as interplanetary space, and also often as hot as an electric furnace, but always *attempting* at least to operate on new principles of construction beyond the normal fixed (since Beethoven's Ninth and Bruckner) boundaries.

I was not successful *en toto*, but it *was* a"try" towards a new form, new musical conception, extending, I think, into the future.

reprinted from **Bad Boy of Music** *(1945)*
by kind permission of the Estate of George Antheil, Charles Amirkhanian, executor

THE ORIGINS OF THE BALLET MÉCANIQUE

George Antheil was born on July 8, 1900, the son of the proprietors of Antheil's Friendly Shoe Store in Trenton, New Jersey. He studied music and piano in Philadelphia with Constantin von Sternberg (a pupil of Liszt who also taught Robert Armbruster of Aeolian Company* and Duo-Art* fame). In 1919 Antheil was accepted for further study with Ernest Bloch in New York, although Bloch initially turned him down flat. Later he returned to Philadelphia as both teacher and student at the future Curtis Institute, with a regular monthly allowance from the school's patron, Mrs. Mary Louise Curtis Bok. There is still at the Institute a set of three original rolls of the *Ballet mécanique*.

In 1922 Antheil left the United States for a recital tour in Europe and settled for a year or so in Berlin, where he met Stravinsky, an encounter that was greatly to affect his life and music. Also while there he met his future wife, Boski Markus, and made the acquaintance of a young German music critic, Hans von Stuckenschmidt, one of the eventual proponents of the player piano as a vehicle for composition.

But in the early 1920s the magnetic hub of Europe was Paris. On June 13, 1923, Antheil and his bride-to-be arrived there from Germany, just in time to attend the premiere of Stravinsky's *Les noces* at the Théâtre de la Gaieté Lyrique that very evening. The young American had summarily failed to show up for a piano recital that Stravinsky had arranged for him the previous December, but if Antheil is to be believed, his Russian "friend" happily overlooked the slight, and invited both George and Boski to visit him the very next day at his studio chez Pleyel* in the rue Rochechouart.

Thus, on Wednesday, June 14, 1923, the following event occurred:

> The next day we went to see him at Pleyel's, the great piano warehouse rooms where Chopin had often practiced; and Stravinsky himself played *Les noces*, this time on an electric pianola. I liked the second version even better than the one which we had heard last night; it was more precise, colder, harder, more typical of that which I myself wanted out of music during this period of my life. "It is wonderful!" I cried. Boski thought so too, she said.

(One of the results of this audition was the acquisition by the Antheil household of a set of the rolls for *Les noces*.)

Pleyel's brand of player piano was, naturally enough, the Pleyela, and while the firm did not produce its own true reproducing piano, it had what is nowadays known in mechanical music circles as an "expression piano," with a rather more limited system of dynamic control than, say, the Duo-Art. Inasmuch as Antheil recalls Stravinsky's studio Pleyela as an electric model, it seems likely that it was such an "Autopleyela," though for a number of years there was also a pedal Pleyela at the composer's home in the south of France.

According to the writer Margaret Anderson in *My Thirty Years' War*, Antheil reckoned that Stravinsky had lifted the idea of the four pianos in *Les noces* from him in Berlin the previous year. This typically red-blooded assertion is impossible to substantiate, but it is clear that a number of mechanical music and multiple-piano compositions were in the Parisian air at that time. Stravinsky and Pleyel had been working on a version of *Les noces* for pianola, roll-operated cimbalom, harmonium, voices, and percussion, only defeated in their object by the imminent threat of legal action by Diaghilev, to whom Stravinsky had rather rashly sold a three-year period of exclusivity before finishing the music. It should be noted, though, that the French and British premieres of *Les noces* used not four pianos, but two of the patent Pleyel double grand pianos, with two sets of strings and two keyboards at opposing ends of one oblong piece of furniture.

Pleyel also had a patented system for synchronizing multiple roll-operated instruments, and as well as *Les noces* and the *Ballet mécanique*, Antheil's music-theater *Cyclops* and Darius Milhaud's ballet arrangements of Chopin sought to seduce the player piano into public liaisons with live performers. *Cyclops* appears to have been scored for 11 pianos, with an array of percussion instruments linked to a central Pleyela. Since Stravinsky had abandoned the intended instrumentation of *Les noces* with some haste, Pleyel was doubtless delighted to encourage other composers to make use of the synchronizing system, even though the practical attempts at multiple player-piano concerts seem to have failed.

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*Major manufacturers of pianolas (player pianos)—Ed.

According to Antheil, composition of the *Ballet mécanique* began in late 1923, continuing through the winter of 1924. What seems to be the first score is now housed at the New York Public Library, with a minute dedication to Boski ("pour Böske") and the year 1924 indicated on the cover. Only the music for the pianos is included, and it is clear from the subsequent full score that this was later copied across prior to the other instruments being added. At this early stage there is no indication in the music that player pianos were required; on the contrary there are devices such as glissandi on white or black keys (not therefore chromatic) that suggest Antheil was thinking in terms of live pianists. In any case, there are instructions to the Pleyel roll editors (dated 1925) included in the manuscript, which explain how some clusters are to be omitted on roll, since they remain valid only for the "8-hand-four-piano version." At the head of the music is another dedication "for my best of friends, Jack Bénoist-Méchin," and the American journalist Bravig Imbs reports that Antheil promised on the night of the full premiere to dedicate the Ballet to his American pianist colleague, Allen Tanner. Clearly, Antheil was liberal with his favors.

There is evidence that the composing of the work was done at one or two spaced intervals of time, for there are two distinct styles of handwriting. The tempo of the music in the third roll (of three) is ludicrously fast, and no piano action, let alone pianist, could even begin to play the notes as written. A large proportion of the third roll uses an exact double-speed retrograde version of an earlier section, perhaps implying a mind distracted by other newer compositional projects.

All this evidence suggests that Antheil had the germ of an idea for a four-piano work in his head while he was in Germany in 1922, and that he communicated this to Stravinsky. In Paris in 1923 he began in earnest to compose for a real piano quartet, but his visit to Pleyel introduced him in detail to the possibilities of the player piano. Being a lover of both publicity and forceful music, the possibilities of synchronized roll-operated instruments must have appealed to him greatly, so that the instrumentation for four-times-four Pleyelas took shape. The most believable chronicler of the time, Bravig Imbs, reports that 17 Pleyelas were required, and that other mechanical percussion instruments were to be controlled from the 17th, which would also synchronize the first 16. Despite all the excuses of player pianos not remaining together, it seems fairly likely that the one essential ingredient that was missing was someone to keep the master Pleyela in time with the conductor. Admittedly the latter (Vladimir Golschmann in the case of the ballet's premiere) might make an attempt to follow the pianola, but in music as challenging as the *Ballet mécanique* this is not a viable option. (The ballet was at one stage intended to accompany Fernand Léger's film of the same name, but once again synchronization proved too much of a problem, and the film was released separately.)

Although the instructions to the roll editors in the piano score speak only of two rolls, the actual number in the published set was three, since there was too much music to fit on any fewer. The tempo is clearly marked as ♩ = 152 throughout, although this writer recalls seeing a set of rolls reissued on the Compositeurs Associés label in the late 1920s on which the roll speed is marked as accelerating gradually (70, 71, 72, 73, etc.). One very interesting detail is that Antheil states the maximum number of notes in any chord to be 23, "as in Stravinsky's rolls." In point of fact he does not adhere to this rule with any consistency, and it is obviously intended more as a reassurance than a dictum, but it provides a valuable insight into the technical basis of Stravinsky's roll arrangements.

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Pleyel apparently had the first trial rolls ready for July 8, 1925, which happened to be George's 25th birthday. Evidently someone at Pleyel had a good sense of occasion, and the resulting aural birthday present caused the composer to shower his patron Mrs. Bok with four letters in four days, enthusiastically praising the Ballet as the "sincerest expression of America," with "the rhythm of machinery, presented beautifully."

The first private performance for an invited group of friends also took place at the rue Rochechouart, at about 4:00 pm on September 16, and since Bravig Imbs mentions that the rolls were only just ready, it would appear that they had been corrected from the first version perforated in July. Antheil himself was deliberately not present, since he had disappeared to Africa with a voluptuous Russian lady friend, partly as an amorous adventure and partly as a publicity stunt. The rest of the audience, according to Imbs, who had been given the task of inviting them by "pneumatique" (how appropriate!), consisted of James Joyce, Sylvia Beach and her friend Adrienne Monnier, Jacques Bénoist-Méchin, the American writer Elliott Paul, and a journalist colleague by the name of Darnton Fraser, plus another unnamed American journalist, who was probably Clarence Lucas of the *Musical Courier*.

Imbs was in charge of the proceedings, and he was forced to seek out the young lady who was to play the Pleyela, since the seance was some 15 minutes late in starting.

> I eventually found her. The rolls had been finished just that minute, she assured me, and they were the dickens to play, sometimes half the keys went down at once.
>
> When we returned to the room, we found the group scattered in expectant attitudes. I took my place near the pianola to be of assistance to the girl if any necessity should arise.
>
> All I remember of her is that she was very polite and had brightly rouged cheeks which became redder still as she pumped out that mastodon of music, the *Ballet mécanique*. The terrific thumping—it was a new idea then to employ the piano as a percussive instrument—and wild chords which seemed to be torn alive amid bleeding from the maws of machines, electrified the audience.
>
> I had sense enough to thank the girl for pumping so diligently and she rewarded me with a weary smile. I imagine playing those three rolls was like running three miles.

Nowhere is the young lady identified, but one possibility might be a certain Mlle. Köntzler, who appears as a staff pianist in the Pleyela roll catalogue from the mid-1920s, and who assisted Stravinsky with the arrangement of his works for the instrument. Since a number of Pleyel "rouleaux enregistrés," including Stravinsky's, are clearly not recorded but mechanically edited, it may also be that Mlle. Köntzler had herself marked up the master stencils for the *Ballet mécanique*; at any rate, Pleyel had charged 10,000 francs for their perforation, since the Duchesse de Clermont-Tonnerre had underwritten this cost.

Commissioning the rolls was only one of the many problems on the road to the first full performance of the *Ballet*. It took a while to persuade Mrs. Bok to underwrite the copying and performing costs connected with the work, but she finally sent $2,500, and Antheil reserved the Théâtre des Champs-Elysées for June 19, 1926. Vladimir Golschmann was retained as conductor, and the rehearsals went with predictable abandon. Bravig Imbs relates:

> One of the best conductors in town, Golschmann, was engaged. He had a matinee-idol face, lustrous black curls, a distinguished limp and considerable musical ability. I had tea with him at that little shop on the Place de la Madeleine where American layer cakes are sold. Böske was with us, very elegant in a misty blue tweed tailleur, and between bites of luscious coconut cake, Golschmann was already lamenting about the 17 pianolas.
>
> "We tried and tried, but it was impossible to have them play absolutely together," he said. "Only one was needed to put the other 16 off."
>
> "Couldn't they be operated electrically?" I suggested, thinking of the exertion of the pretty girl at Pleyel's. "Goodness, no," said Mr. Golschmann, "there isn't a hall in town with enough power for that!"
>
> I don't remember exactly how the matter was finally arranged, except that real pianists were used along with a few pianolas.

In fact Imbs later mentions that Antheil appeared on stage just before the *Ballet*, giving directions to movers who were pushing five pianos into place, so the clear implication is that four normal pianos took their place alongside one Pleyela. Antheil and Allen Tanner were two of the pianists, while Jacques Bénoist-Méchin appears to have operated the Pleyela and perhaps thereby controlled much of the percussion.

In his autobiography, Antheil dismisses this concert in a couple of paragraphs, and studiously avoids any mention of the *Ballet mécanique*. Financially it must have helped George and Boski (who had married in the autumn of 1925), since it sold out, with many fashionable Parisians being turned away. The lucky ones with reserved seats included Diaghilev, Brancusi, Koussevitzky, the Joyces, T. S. Eliot, Kiki (the model who appeared in Léger's film), the Duchesse de Clermont-Tonnerre, and Ezra Pound and friends in the pit.

The wild rhythms and thunderous dynamics of the *Ballet* caused the greatest musical riot in Paris since Stravinsky's *Rite of Spring* some 13 years before. The airplane propellers and amplified engine noises unleashed an imaginary gale of wind on the audience, so that a sheaf of umbrellas was soon opened, until "the theatre seemed decked with quite a sprinkling of black mushrooms." During a quieter passage, Ezra Pound yelled at the audience: "Vous êtes tous des imbéciles," and those in the gallery whistled and swore back at him.

The immediate effect of the concert was to ensure celebrity status for the young American, who was caught up in a whirl of receptions and parties. Sylvia Beach (Antheil's landlady and the original publisher of James Joyce's *Ulysses*) later cited the premiere as one of the biggest events of the 1920s. Along with a fellow composer, Virgil Thomson, Antheil persuaded the wife of the first secretary at the American embassy, Mrs. Virginia Gross, to host a series of salon concerts at her spacious apartment near the Eiffel Tower. Mrs. Gross combined considerable private means with a desire to establish herself amongst the glitterati of Paris, and so she sponsored performances of a wide range of both Antheil's and Thomson's music, including what Antheil himself refers to as "the first real full performance" of the *Ballet mécanique*.

On this subsequent occasion eight grand pianos were apparently used, with Vladimir Golschmann standing on top of one of them to conduct. The original full score rather roughly divides the pianola part into four strands of pianos, so with luck it is possible to perform the work entirely by hand, although the sheer quantity of notes cannot be achieved in this way. This rather unusual salon music caused guests to faint, to hang from chandeliers, and to consume unlimited cases of champagne, so the success of Mrs. Gross as a hostess was assured.

No such success attended the American premiere of the work in 1927, however, and the failure of the Carnegie Hall concert on April 10 may help to explain Antheil's ambivalent attitude in later years to his original scoring. Eight Baldwin pianos took the stage, along with one or two roll-operated instruments, and in view of Baldwin's trade connections, it appears that American Welte mechanisms were used. Aaron Copland and Carol Robinson, of Ampico and Duo-Art fame respectively, were among the pianists. Eugene Goossens, himself the composer of a work for pianola, conducted.

Unfortunately some of the complexities presented by the unusual percussion instruments defeated the performers' attempts to keep them in order. The siren failed to sound at the climax of the last roll, and instead appeared late, drowning out the less-than-enthusiastic applause. The wind machine, which provided not only sound but genuine gusts, embarrassed rather than angered those whose programs it blew away. A group of determined but amateur rioters failed to stir the audience, and the critics the next day took delight in panning the concert, no less than seven of them using the agreed pun that the performance had "tried to make a mountain out of an Antheil."

In 1952-53 Antheil revised and re-orchestrated the *Ballet* without pianola, but the original version retains its boyish vitality and fierceness of invention. It was revived at Carnegie Hall in 1989, under the baton of Maurice Peress and the feet of this writer, using nine grand pianos, to one of which a 1911 Pianola was attached. Two years later it received its premiere recording on the Music Masters label. But it was not until the production of the present score—along with a corresponding set of parts and an array of computer files—that Antheil's original desire to have 16 pianolas with an extra controlling instrument was finally fulfilled.

- Rex Lawson

This essay originally appeared in somewhat different form in **The Pianola Journal**, *No. 9, 1996.*
The **Journal** *is an annual publication of the Pianola Institute in London.*

THE *BALLET MÉCANIQUE* PROJECT: TECHNOLOGY CATCHES UP WITH ANTHEIL

The original score for George Antheil's *Ballet mécanique*, calling for 16 player pianos (or "pianolas") and ten or so human players, was never performed in his lifetime. Although the piano maker Pleyel had taken out a patent for synchronizing multiple player pianos, and this, presumably, was what Antheil had in mind for his piece, Pleyel was never able to build a working model of the system. When Antheil realized this, only weeks, if not days, before the scheduled premiere, he hastily re-wrote the piece for one player piano and multiple human-played pianos. This was the version that engendered riots in Paris and disdain in New York, and that Maurice Peress revived so successfully in 1989.

The 1924 version, however, was forgotten about for nearly three-quarters of a century. The story of its revival begins in 1992, when Charles Amirkhanian, executor of the Antheil estate and, as the sole operator of the Antheil Press, one of the few champions of Antheil's music, sold the publishing rights for all of the composer's unpublished catalogue to G. Schirmer. The original scores, which were still in the possession of Antheil's son Peter, were sold to the New York Public Library for the Performing Arts.

Making the score

In 1995, the Frankfurt, Germany-based Ensemble Modern contacted William Holab, then director of publications at Schirmer, and requested copies of the score and parts for the live instruments of the 1924 version. George McGuire, working from two scores at the New York Public Library (one complete with the percussion and sound-effects parts, and one containing just the four pianola parts and sketches for the others) and from piano rolls provided by Rex Lawson, edited the score which Schirmer engraved on computer, using a program called *Score*. A copy of this computer-engraved score, in a somewhat raw form, and parts extracted from it, were sent to the Ensemble Modern, which premiered the piece at the Donaueschingen Festival in Baden-Baden in July, 1996, and played it a half-dozen more times in the months following. In place of the 16 player pianos Antheil wanted, the Ensemble Modern used only two: grand pianos with 1925-vintage Ampico player mechanisms, which had been custom-modified to respond to MIDI commands by Dr. Jürgen Hocker.

MIDI, the Musical Instrument Digital Interface, which since the mid-1980s has been the standard communications protocol for electronic musical instruments, was the missing link in Antheil's original idea for the *Ballet mécanique*: MIDI is capable of synchronizing a large number of instruments with a very high degree of precision. By using a computer program that is capable of recording and playing back MIDI data, known as a "sequencer," it is possible to solve the synchronization problem that Antheil and Pleyel were never able to overcome. Dr. Hocker used *Cakewalk*, a well-known sequencer program on the Windows platform.

The MIDI sequences that Dr. Hocker and the Ensemble used initially were created with a custom optical piano-roll reader built by a colleague of Dr. Hocker's, which converted the perforations on the original piano rolls into MIDI note events, which were then recorded by the computer into *Cakewalk*. In 1998, in an effort to improve the accuracy of the player-piano performances, another colleague re-did the MIDI sequences, entering the notes from the engraved score by hand into *Cakewalk*. The Ensemble Modern toured Europe with this new version in May 1999. Interestingly, although there were only two player pianos, the two "human" piano parts in these performances, in order to be heard, were performed by six pianists.

Making a publishable version

It was Holab's and Schirmer's idea to create and publish the score so that it could be played by any ensemble interested in doing so, using a wide range of easily obtainable instruments. The score and the conventional instrument parts would be on paper, while the player-piano parts would be distributed on computer disk, as a MIDI sequence file, readable by any number of software programs. But since the sequence files created for the Ensemble Modern performances were designed for two unique custom instruments, they could not played on commercially available MIDI player pianos, and were therefore not really usable in a published edition.

In July 1996, Holab met Michael Bates, director of academic and institutional relations for the piano division of Yamaha Corporation, the largest piano manufacturer in the world, and the two discussed Yamaha's extensive line of player pianos, both uprights and grands, known as "Disklaviers." These are acoustic pianos with on-board computers that electronically operate solenoids controlling the keys, hammers, and pedals, and are designed to reproduce human playing as accurately as possible. They are also capable of being controlled by an external computer, using MIDI. Bates indicated that Yamaha might be interested in loaning an appropriate number of Disklaviers to an ensemble which might want to make the first attempt at performing the piece.

Holab knew of my expertise in MIDI through the book *MIDI For the Professional*, a college-level textbook that I co-wrote with Tim Tully, which is published by Music Sales Corporation, Schirmer's parent company. In May 1998, Holab asked me if I would be interested in converting Antheil's player-piano parts to a publishable MIDI sequence. As it happened, I was familiar with the 1952-53 version of the *Ballet mécanique*, but I had no idea this earlier version existed. I recognized that I was being offered a unique opportunity: to use technology of the last part of the 20th century, with which I was expert, to realize the dreams of a young composer of the first part of the 20th century, and to bring to life a piece of music that, despite having been written nearly 75 years previously, had never been heard in its original form.

After I had a chance to examine the engraved score, I proposed to Schirmer that, in addition to creating the MIDI files from the player-piano parts, I would also obtain samples of the siren, bells, and propellers; create a "click" track to help the conductor through the complex time signatures and the long silences; and create a written document explaining to groups planning to perform the piece all of the technical issues with which they would have to deal. This proposal was accepted, and our work began.

We agreed on three primary goals for the project: First, we would make the piece as easy as possible for potential performing groups to rehearse and perform. Second, we would realize as closely as possible Antheil's original vision for his piece. And third, we would offer groups as much flexibility as possible, in terms of artistic choices and equipment availability.

Making the sequences and the sounds

Antheil's score is over 1200 measures long, and the four pianola parts (each to be played on four instruments) are incredibly dense, sometimes with several hundred notes in a measure. The piece incorporates more than 600 time-signature changes. *Ballet mécanique* also introduced a new element to musical composition: silence. The piece contains several sections, some as long as 20 seconds, in which absolutely nothing happens.

The task of sequencing the pianola parts took some three months, using Opcode's *Vision* sequencing software. In order to hear what I was doing, I monitored the pianola parts as I was sequencing them on four Kurzweil MicroPiano MIDI-controlled electronic piano modules, through a four-channel surround speaker system. Despite the incredible atonal cacophony of the piece, if anything was the least bit wrong with the texture at any point—for example, a wrong note—the problem stuck out *spatially* even more clearly than it did musically.

To ensure that my work was as historically accurate as possible, I consulted various literary sources such as Antheil's autobiography, other books and essays from the era, and collections of clippings and letters at Columbia University and the New York Public Library, as well as the two different versions of the manuscript score. Many hours were spent examining and resolving inconsistencies between the manuscripts in an effort to make the final product as close to the composer's intentions as possible.

Then it was time to test the sequences on real instruments. Modern player-piano mechanisms are very different form the pneumatic systems of the early 20th century, and I wasn't sure that today's pianos could handle Antheil's demands. In addition, modern pianos are designed to be used primarily with their own internal computers—they all have MIDI inputs, but they behave somewhat unpredictably when driven by external MIDI signals. With the assistance of George Litterst, a music educator and consultant for Yamaha, and The Piano Mill, a dealer in Newton, Massachusetts, I was able to test my files out on the three major brands of MIDI player pianos: Yamaha, QRS, and PianoDisc.

Among the problems that needed to be resolved was how to play the clusters of as many as 23 notes that the score calls for. Disklaviers and QRS pianos are capable of playing only 16 notes at a time. By "stealing" notes that were doubled in the different parts to bring the polyphony down to 16, I was able to solve that problem without any audible effects. Fast multi-note trills and ultra-fast repetitions of notes also created problems, which were solved by tweaking the durations and velocities of the notes, sometimes in unexpected ways. For example, on a Disklavier, fast repetitions work better not when the MIDI note durations are shortened relative to their nominal values, but when they are stretched to 120% of those values, so that in fact the notes overlap.

At the same time as I was working with the piano parts, I collected digital recordings of the sound effects on DAT, and brought them into my computer and made files out of them. The airplanes were recorded by Tim Tully at a private airfield in San Carlos, California; the siren was recorded at the central fire house in Arlington, Massachusetts; and the bells, obtained from a variety of hardware stores and Internet sources, were recorded in my own studio in Medford, Massachusetts. I edited and looped the samples, and assembled them as "banks" in two different formats: SampleCell, a digital sample-playback card made by Digidesign, and the Kurzweil K2000 family of instruments.

I assembled an array of electric bells from various sources, and wired them (with the help of engineer Coleman Rogers) to a power supply and a MIDI-controllable relay box made by MIDI Solutions. This allowed the bells to be turned on and off by a musician at a MIDI keyboard, or from the computer sequencer. This "MIDI Bell Box" was used in the first four US performances of the piece, and is available from this author to other groups performing the piece. I also made audio recordings of the player-piano parts, using the Kurzweil MicroPiano modules to play the finished sequence, at several different tempos. These I put onto a standard audio CD so they would be available for use as rehearsal tools.

Who's in charge?

Whenever one has mechanical devices and human beings working together to make music, the question arises, "Who's in charge?" In Antheil's day, the tempo of a player piano was controlled manually by a lever on the front of the instrument, and in expert hands could be adjusted very subtly. Today's MIDI sequencers can change tempo on the fly too, but the convoluted rhythms of the *Ballet mécanique*, with the quantity and complexity of its time-signature changes, would make it extremely difficult for the sequencer to follow a conductor. So it was decided, at least for the foreseeable future, that the pianolas and the computer driving them would be in charge, and the conductor would follow.

To make this possible, I created a "click track" that also contains vocal cues for rehearsal letters, which the conductor listens to through an earphone. This track enables the conductor not only to keep track of where he or she is during the most complex passages, but also to count out the long silences. Even with the machines leading, the live performers bring drama, shape, and musicality to the piece. And conceivably, the piece could be performed *without* a conductor if every member of the ensemble wore a personal monitor.

The newly revived 1924 *Ballet mécanique* had its world premiere in Lowell, Massachusetts, on November 18, 1999. It was performed in Durgin Hall by the students of the University of Massachusetts Lowell Percussion Ensemble, along with Professor Juanita Tsu and Tufts University Professor John MacDonald as the piano soloists. Yamaha, through their local dealer Boston Organ & Piano, supplied 16 Disklaviers for the performance. Two days later, the piece was recorded in the same hall, and in April, 2000 this recording was released on the Electronic Music Foundation's "CDeMusic" label.

Music for a film

And now a word about the film, *Ballet mécanique*. This stunning abstract film, by cubist painter Fernand Léger, photographer Man Ray, and cinematographer Dudley Murphy, was originally supposed to have a musical soundtrack by George Antheil: the score you have before you. For many reasons—including, apparently, that the filmmakers and the composer never made an effort to make the parts work together—the two *Ballets mécaniques* have existed almost entirely as separate works. The music, which is between 25 and 30 minutes long, had its premiere in Paris, while the film, which is just under 16 minutes, was premiered in Vienna. A few attempts have been made over the years to combine various versions of the music with the film, and while some have been fascinating, none have really been able to marry the two works successfully into a single entity.

Bruce Posner, a film curator, has put together a large collection of early avant-garde films called "Unseen Cinema," which in 2001 began a five-year tour of museums and theaters around the world. Among these films was a recently discovered print, in excellent condition, of *Ballet mécanique*. Posner knew of my work reviving this piece, and early in 2000 contacted me to see if the long-abandoned collaboration between Léger and Antheil could somehow be realized, through the technology that I had used to create this score.

As it happened, I did have the raw materials to make this work. When we made the recording of the music in Lowell, I also made a recording of the Disklaviers alone at a much faster tempo: ♩ =133. I copied this recording into Opcode's *StudioVision*, which besides being a MIDI sequencer, can also edit audio with great precision, in ways that were impossible just a few years ago and that Antheil and Léger never could have imagined.

Within *StudioVision*, I could play the recording back and at the same time watch the film on a videotape, synchronizing the audio to the video using SMPTE timecode. Adding the "live" instruments to this recording was simple: I used the MIDI part of *StudioVision* to play various synthesizers and samplers in my studio, which provided convincing pianos, xylophones, bass drums, and gong. The computer could play the parts effortlessly and with great precision, even at this speed. The result was a performance of the piece in which the "mechanical" instruments—the pianolas—were recorded "acoustically," while the "human" instruments were produced electronically. Even at this rapid tempo, the music was still too long for the film, and so I edited the recording in ten different places, removing some 400 measures.

I produced two recordings of this new soundtrack. One is on videotape, and can be shown in venues with high-quality video projection systems. Because the audio and video are on the same medium, the synchronization is perfect. The other recording is an audio CD, which is to be used in venues with film projectors. Posner and I decided that it made little sense to transfer the music to an optical track on the film itself, since the fidelity would be seriously degraded. Instead, when the film is shown, the audio CD is played on a separate system. If the projector is capable of precision speed control, then the music and visuals match astonishingly well, but even if the projector speed is a little off, the effect is still remarkable.

The *Ballet mécanique* is an extraordinary piece of music, even to modern ears. It is loud, but it is also highly textured, and the textures are constantly shifting. It is repetitious, but often in an angular, asymmetrical way that constantly challenges the ear. It is joyous and angry, uplifting and grindingly heavy, funny and parodistic and deadly serious, plodding and completely frantic, lyrical and brutally noisy. And it also has those silences: what Antheil, in various provocative essays he wrote at the time, referred to as "time-space." Decades before John Cage, George Antheil incorporated several passages into the *Ballet mécanique* in which everything stops dead, for lengths of time that are almost uncomfortable. And then, out of the silence, the music slowly winds up again, and comes to a crashing finale. Today, after a century that gave rise to Varèse, Stockhausen, The Beatles, and Nine Inch Nails, the *Ballet mécanique* still sounds outrageous.

Tempo Issues in the *Ballet mécanique*

George McGuire's fascinating essay on the tempo of the *Ballet mécanique*, which follows, is unfortunately not much help to modern performers of the piece. The tempo that Antheil specifies in the score, ♩ = 152 (which, by the way is the tempo he used in the 1952-53 version), is far too fast for humans, or even MIDI-controlled player pianos, to play. On the other hand, at ♩ = 76 the piece seems much too slow and lugubrious.

The MIDI sequences on the CD-R that is provided with the performing materials were designed to play at ♩ = 100, which was the tempo for the premiere performance. Subsequent performances have been in the range 90-115. A performing group is welcome to select any tempo it likes, but adjusting the MIDI sequences for other tempos is not entirely straightforward, and should only be done by someone who has read and understood the technical documentation that accompanies the rental materials. The fastest tempo possible is ♩ = 135: any faster than that and the player pianos will encounter serious problems.

One interesting idea, which was actually given to me by Dr. Hocker, and was successfully tried at the May 2001 performance at Symphony Hall in Boston, is to slow down the tempo for the fast and complex section in mm. 1008–1133. If this section is slowed to, for example, ♩ = 90, then the rest of the piece could be played faster. The MIDI sequence files permit this but, again, they should be altered only by a qualified person.

—Paul D. Lehrman

THE SOURCES AND THE TEMPO PROBLEM

The first source consulted for this edition was the 85-page holographic ink manuscript housed in the Music Division of the New York Public Library for the Performing Arts. Antheil himself refers to this as the version for four pianos, eight hands. The first page of music lacks both a title and a tempo indication. The cover, designed and executed by Antheil who was quite a good graphic designer and typographer, bears the title *BALLET MÉCANIQUE* and is dated 1924.

Also included are two pages of front matter dated 1925. Here a tempo is indicated, and very clearly:

> The *BALLET MÉCANIQUE* has but one Tempo:
> M.M. ♩= 152
> For practical purposes it may be cut a trifle slower.

These two pages of front matter contain the information needed for the punching of the pianola rolls; thus the word "cut" instead of "played."

The manuscript itself really contains three separate versions of the piece. The first, as noted above, is the four-piano eight-hands version. On top of this, in red ink, parts for xylophones and other percussion instruments have been added, indicating a version for four pianos plus percussion. In addition to the percussion parts, instructions for the production of the pianola parts, separating the pianolas from the pianos, are given in purple and green ink. This is clearly the manuscript from which the piano rolls were actually "cut" or punched. This manuscript was also used as the basis for the holograph full score of 359 pages, which is also in the New York Public Library collection. The pianola and piano parts, now separated, were simply copied, and the other instruments added. This full-score manuscript is the principal source for the present edition.

A set of the pianola rolls from the library of the Curtis Institute in Philadelphia were also used as a source for the present edition, both holograph manuscripts being read against the rolls and vice versa.

The only tempo indication on the full-score manuscript is "Pianola = 85" in Antheil's hand. This somewhat enigmatic indication most probably refers to the speed of the roll across the playing mechanism. A speed of 8.5 feet per minute would give a tempo very close to the "♩= 152" mentioned above.

So far, all would seem clear enough. But there is a problem: neither man nor machine can reproduce the notes of the score at this speed. The repeated 32nd-note chords on the first two rolls are very close to the limit of what a piano mechanism can tolerate. And, as Rex Lawson points out in his essay, a good portion of the third roll consists of material from the first two rolls, in retrograde and twice as fast! The rolls cannot be played on mechanical devices (pianos or pianolas made of wood and metal) at this speed. Probably in desperation, the technicians responsible for the punching of the rolls, realizing that the tempo was impossible, simplified the score and rather haphazardly left many notes out.

There is one possible—and indeed probable—explanation. Antheil, like many composers of his time and earlier, often used the formula "♩= X" to indicate the beat, whether the beat was a quarter note or not. And while both manuscripts start with meters of 3/4, 5/8, 3/4, 4/4, etc., upon examination one can see that underneath these tempo indications is another set, partially scraped off but clearly visible: 6/8, 5/8, 6/8, 8/8, etc. Indeed, the basic rhythmic unit for the whole of the *Ballet mécanique* is the eighth note, not the quarter. How else can we explain, for example, the long pauses notated completely in eighth-note rests with each rest numbered? One measure has 64 rests notated this way, and nothing else! If the tempo really is "♩= 152," it follows that "♪= 304." Just try to count at this speed.

In Antheil's "Composer's Notes" accompanying the 1952-53 "re-editing" of the *Ballet mécanique*, the composer writes, "Repetitious measures . . . have been cut out abundantly, reducing the playing time from the original of more than half an hour to less than 18 minutes." Now we can do some basic arithmetic. The earlier version of the score, i.e., the present edition, consists of 1,240 measures containing exactly (if I have counted right) 3,058.375 quarter notes. If these

3,058.375 quarter notes are played at a tempo of "♩ = 152," then, without cuts—and cuts there were—the *Ballet mécanique* would last exactly 20.12 minutes. But at a tempo of "♪ = 152," the duration would be double that, or 40.24 minutes.

So what happened? It might have been clear to Antheil that "♩ = 152" really meant "♪ = 152," but most likely this wasn't clear to the technicians at Pleyel, who did exactly what they were told. They must have noticed that something was very wrong by the time they got to the third roll, but by then it was a little late. The production of the rolls was enormously expensive, on the order of $500 a piece. This was a lot of money in 1925. Antheil was stuck with them.

On the other hand, Antheil could not but have been fascinated by the inhumanly fast tempo. Even a single pianola could not have been pushed up to the 8.5-feet-per-minute speed; but one pianola on its own, unencumbered by normal pianos, percussion and human hands, could play a good bit faster than "♪ = 152." In his October 1925 review in *La Revue European* of the Pleyel concert described above by Rex Lawson, Jacques Bénoist-Méchin (to whom the *Ballet mécanique* was at one time dedicated) wrote, "La rythme est constamment tenu a une moyenne de 110, 120." This indicates that perhaps Antheil was toying with a faster tempo; a tempo of "♩ = 110–120" makes perfectly good sense for a single Pleyela.

But if the piece was to be played faster than this, it would have to be completely re-written—which is just what Antheil eventually did. The opening (and principal) tempo of the 1952-53 version is "*Allegro (feroce)*, ♩ = 144:160," exactly bracketing 152. And this is a very different piece. The smallest rhythmic values are 32nd notes. The fastest repeated chords are 16th notes. There are no 64th, 128th or 256th notes as in the earlier versions.

This leads to one further question: were the difficulties encountered in the synchronization of multiple pianolas the result of real technical limitations, or were they the result of the rolls for the *Ballet mécanique* getting punched at the wrong speed?

In 1925, Antheil certainly hadn't yet given up on the idea of synchronized music machines. In the same issue of *La Revue European* mentioned above, there is also an "Extract (first pages)" of *Mr Bloom and the Cyclops*, an "opera upon 'Cyclops' episode in James Joyce's *Ulysses*." The instrumentation is given as follows:

Voice, Chorus (from electric amplifier), 16 mechanical pianos operated from master roll and controlled from switchboard, 8 Xylophones controlled from switchboard, Amplified Gramophone, containing all of the ordinary orchestral instrument[s] registered upon gramophone record—amplified and controlled from switchboard, Auto Siren, 4 Bass Drums, 4 Electric Buzzers (and Bells), 4 Pieces of Steel, Electric Motor (wood attachment), Electric Motor (steel attachment).

The vocal part to this barely begun work opens with the words, "I was just passing the time of day . . ." The music is the same, transposed, that begins at measure 530 of the *Ballet mécanique*. Curiously, this theme, which is repeated several times in the original version, has been completely deleted from the 1952-53 version. There is—perhaps mercifully—no tempo indication.

—George A. McGuire

INSTRUMENTATION

3 Xylophones
Electric Bells
3 Propellers
Tamtam
4 Drums
Siren
2 Pianos
16 Pianolas (minimum 4, written in 4 parts)

Note: While this score does not specify a Drum type, a source indicates them to be Bass Drums.

duration ca. 30'

Rental materials, including instrumental parts, technical manual, and digital files, are available from the Publisher.

G. Schirmer Rental Department
P.O. Box 572
445 Bellvale Road
Chester, NY 10918
(845) 469-4699
(845) 469-7544 (fax)
http://www.schirmer.com

Please note that the technical manual is also accessible online at the following URL:

http://www.schirmer.com/balletmec

BALLET MECANIQUE

George Antheil
(1924–1925)

Pianola = 85 *

Xylophone 1

Xylophone 2

Xylophone 3

Electric Bells

Propellers

Small Wood

Large Wood

Metal

Tamtam

Drums

1

2

3

4

Siren

Piano 1

Piano 2

Pianolas

I

II

III

IV

8ba

8ba

* See the introduction for a discussion of the tempo indication.

6

Xyl. 1

Xyl. 2

E. B.

Propellers

S. W.

L. W.

M.

Drums

1–4

5/8 2/4 3/4 2/4 3/8 2/4

Pianolas

I
II

III
IV

8va

8ba

11

Xyl. 1

Xyl. 2

E. B.

Propellers

S. W.

L. W.

M.

Drums

1–4

2/4 5/8 4/8 5/8

Pianolas

I
II

III
IV

8va

8ba

15

Xyl. 1

Xyl. 2

E. B.

Propellers

S. W.

L. W.

M.

8

Pianolas

I
II

III
IV

8ba

18

Xyl. 1

Xyl. 2

3/8 2/4 3/4 2/4

E. B.

Propellers

S. W.

L. W.

M.

Tam.

Drums

1–4

3/8 2/4 3/4 2/4

8

Pianolas

I
II

III
IV

8ba

23

Xyl. 1

Xyl. 2

E. B.

Tam.

Drums

1–4

Pianolas

I
II

III
IV

8va

8ba

29

Xyl. 1

Xyl. 2

E. B.

Pianolas

I
II

III
IV

8ba

34

Xyl. 1

Xyl. 2

E. B.

Propellers

S. W.

L. W.

M.

4/4 3/4 4/4 2/4 3/4

I II

III IV

Pianolas

8ba

A

38

Tam.

1–4

Drums

AX Siren

Siren

Pno. 1

Pno. 2

3/4 2/4 3/8 2/4

I II

III IV

Pianolas

8ba 8ba 8ba

43

Drums
Tam.
1–4
Siren
Pno. 1
8va
Pno. 2
8va
Pianolas
I II
8ba
III IV
8ba
48
Propellers
S. W.
L. W.
M.
Tam.
Drums
1–4
Siren
8va
Pno. 1
8va
Pno. 2
Pianolas
I II
8ba
III IV
8ba

54

E. B.

Propellers

S. W.

L. W.

M.

Drums

1–4

Siren

8/16 7/16

Pianolas

I II

III IV

8va 8va

gliss. gliss. gliss. gliss. gliss.

8ba 8ba 8ba 8ba 8ba 8ba

57

E. B.

Propellers

S. W.

L. W.

M.

Drums

1–4

Siren

7/16 5/16 3/4 5/8

Pianolas

I II

III IV

8va

gliss.

8ba 8ba 8ba 8ba

B

61

Xyl. 1

Xyl. 2

E. B.

Drums

1

2

3

4

Pianolas

III
IV

8ba

67

Xyl. 1

Xyl. 2

E. B.

Propellers

S. W.

L. W.

M.

Drums

1

2

3

4

Pno. 1

Pianolas

I
II

III
IV

8va

8ba

gliss.

73

C

Xyl. 1

Xyl. 2

2/4

E. B.

Propellers

S. W.

L. W.

M.

Drums

1

2

3

4

Pno. 1 2

2/4

8va

8ba

Pianolas

I II

III IV

gliss.

80

E. B.

Propellers

S. W.

L. W.

M.

Pno. 1 2

8

Pianolas

I II

III IV

87

Propellers

E. B.

S. W.

L. W.

M.

Pno. 1 2

8

Pianolas

I II

III IV

93

Siren

Pianolas

I II

99

Siren

Pianolas

I II

D

105

Drums

1

2

3

4

Pianolas

I II

8ba

III IV

8ba

112

Drums

Pno. 1

Pno. 2

Pianolas

I II

III IV

8ba

116

Drums

Pno. 1

Pno. 2

Pianolas

I II

III IV

8ba

120

Drums

1
2
3
4

Pno. 1

Pno. 2

8ba

3/4 5/8 3/4 5/8 3/4

Pianolas

I
II

III
IV

8ba

124

Drums

1
2
3
4

Pno. 1/2

3/4 2/4 3/8

Pianolas

I
II

III

IV

8ba

128

Drums

Pno. 1 2

Pianolas

8ba

132

Drums

Pno. 1 2

Pianolas

8ba

8va

137

Pno. 1 2

Pianolas I II

Pianolas III IV

8ba

E

142

E. B.

Drums 1 2 3 4

too hooked in the [illegible]

Pno. 1

Pno. 2

Stravinsky

Pianolas III IV

147

E. B.

Drums

1

2

3

4

Pno. 1

Pno. 2

Pianolas

III
IV

152

E. B.

Drums

1

2

3

4

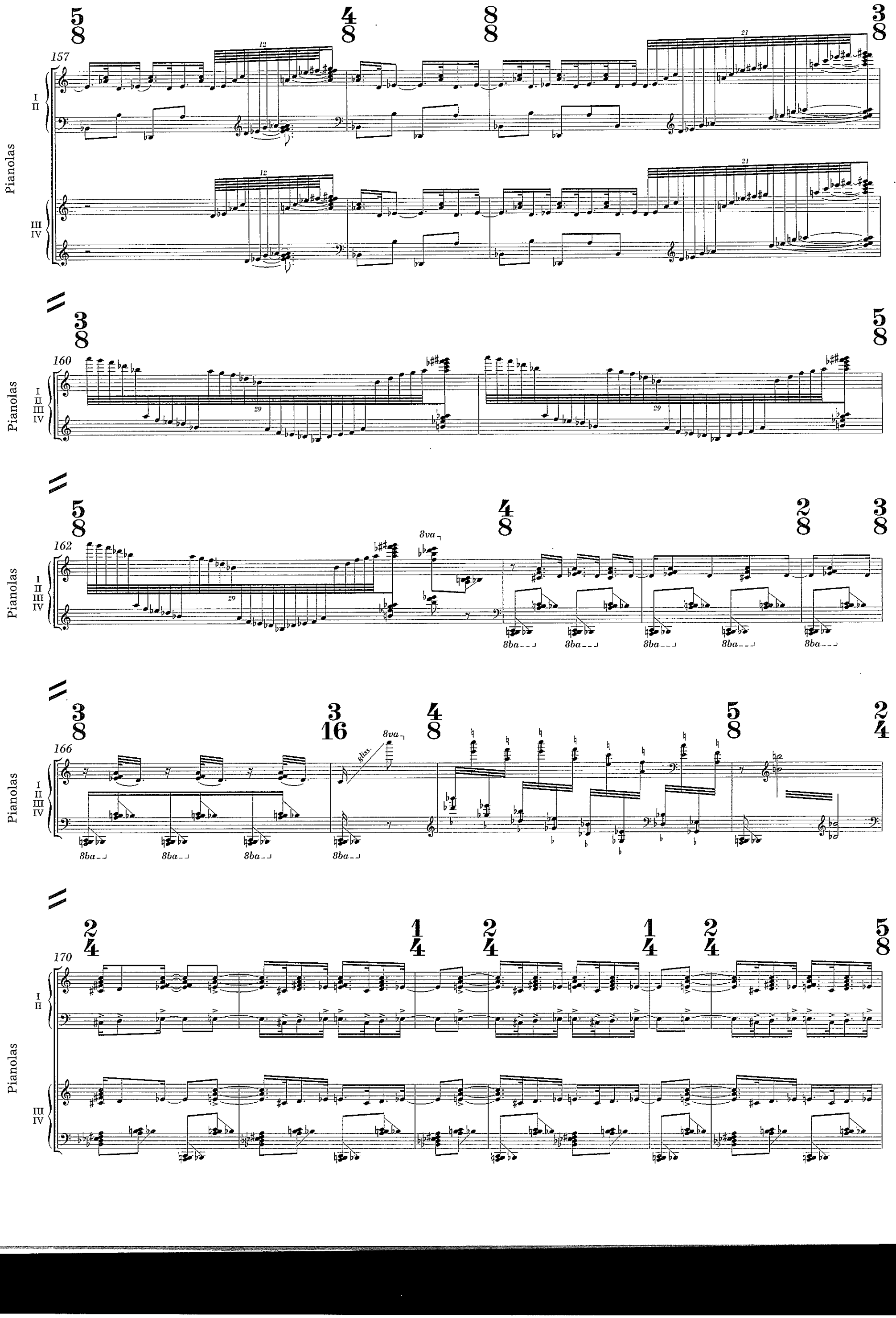
Pno. 1

Pno. 2

Pianolas

I
II

III
IV


157
160
162
166
170
Pianolas
I
II
III
IV
8va
8ba
gliss.

176

Siren

Pianolas

I
II

III
IV

5/8 4/8 2/8 3/8 4/8 2/8

8va

black key gliss.

white key gliss.

8ba

F

183

Xyl. 1

Xyl. 2

3/8 2/8 3/8 4/4

E. B.

Propellers

S. W.

L. W.

M.

Drums

1

2

3

4

Siren

3/8 2/8 3/8 4/4

Pianolas

I
II
III
IV

8va

8ba

189

Xyl. 1

Xyl. 2

Xyl. 3

E. B.

Propellers

S. W.

L. W.

M.

Tam.

Drums

1

2

3

4

Siren

Pno. 1

Pno. 2

Pianolas

I

II

III

IV

8va

8va

8ba

8ba

191

Xyl. 1

Xyl. 2

Xyl. 3

E. B.

Propellers

S. W.

L. W.

M.

Tam.

Drums

1

2

3

4

Siren

Pno. 1

Pno. 2

Pianolas

I
II
III
IV

8va

8ba

8va

8ba

193

Xyl. 1

Xyl. 2

Xyl. 3

E. B.

Propellers

S. W.

L. W.

M.

Tam.

Drums

1

2

3

4

Siren

8va

Pno. 1

Pno. 2

Pianolas

I

II

III

IV

8va

8ba

194

Xyl. 1

Xyl. 2

Xyl. 3

E. B.

Propellers

S. W.

L. W.

M.

Tam.

Drums

1

2

3

4

Siren

8

Pno. 1

Pno. 2

8va

Pianolas

I

II

III

IV

8ba

195

Xyl. 1

Xyl. 2

Xyl. 3

7/8

E. B.

Propellers

S. W.

L. W.

M.

Tam.

Drums

1

2

3

4

Siren

8

Pno. 1

Pno. 2

gliss.

7/8

8va

Pianolas

I

II

III

IV

8ba

196

Xyl. 1

Xyl. 2

Xyl. 3

E. B.

Propellers

S. W.

L. W.

M.

Tam.

Drums

1

2

3

4

Siren

Pno. 1

Pno. 2

8va

8va

Pianolas

I

II

III

IV

8ba

8ba

198

Xyl. 1

Xyl. 2

Xyl. 3

E. B.

Propellers

S. W.

L. W.

M.

Tam.

Drums

1

2

3

4

Siren

Pno. 1

Pno. 2

Pianolas

I

II

III

IV

8va

8ba

201

Xyl. 1

Xyl. 2

Xyl. 3

4/4

7/8

E. B.

Propellers

S. W.

L. W.

M.

Tam.

Drums

1

2

3

4

Siren

Pno. 1

Pno. 2

4/4

7/8

Pianolas

I

II

III

IV

8va

8ba

204

Xyl. 1–3

E. B.

Drums Propellers

S. W.

L. W.

M.

1–4

Pno. 1

Pno. 2

8va

Pianolas

I
II
III
IV

8ba

206

Xyl. 1–3

E. B.

Drums Propellers

S. W.

L. W.

M.

1–4

Pno. 1

Pno. 2

8va

Pianolas

I
II
III
IV

8ba

208

Xyl. 1

Xyl. 2

Xyl. 3

E. B.

Propellers

S. W.

L. W.

M.

Tam.

Drums

1

2

3

4

Siren

Pno. 1

Pno. 2

Pianolas

I

II

III

IV

8va

8ba

210

Xyl. 1

Xyl. 2

Xyl. 3

7/8

E. B.

Propellers

S. W.

L. W.

M.

Tam.

Drums

1

2

3

4

Siren

Pno. 1

Pno. 2

7/8

Pianolas

I

II

III

IV

8va

8ba

8va

8ba

212

Xyl. 1

Xyl. 2

Xyl. 3

E. B.

Propellers

S. W.

L. W.

M.

Tam.

Drums

1

2

3

4

Siren

Pno. 1

Pno. 2

Pianolas

I
II
III
IV

8va

8ba

215

Xyl. 1

Xyl. 2

Xyl. 3

E. B.

Propellers

S. W.

L. W.

M.

Tam.

Drums

1

2

3

4

Siren

Pno. 1

Pno. 2

Pianolas

I

II

III

IV

8va

8ba

219

Xyl. 1–3

Tam.

Pno. 1

Pno. 2

Pianolas
I
II
III
IV

8va

8ba

222

Xyl. 1–3

Tam.

Pno. 1

Pno. 2

Pianolas
I
II
III
IV

8va

225

Xyl. 1–3

Propellers
S. W.
L. W.
M.

Tam.

Pno. 1

Pno. 2

Pianolas
I
II
III
IV

8va

8ba

229

Propellers
S. W.
L. W.
M.

Pno. 1

Pno. 2

Pianolas
I
II
III
IV

1 pno
2 sirens !

235

S. W.
L. W.
M.
Siren
no. 1
no. 2
I
II
III
IV

242

S. W.
L. W.
M.
Siren
no. 1
no. 2
I
II
III
IV

247

S. W.
L. W.
M.
Siren
I
II
III
IV

250

Propellers
S. W.
L. W.
M.
Siren

Pianolas
I
II
III
IV

8ba 8ba 8ba 8ba 8ba 8ba

253

E. B.

Propellers
S. W.
L. W.
M.
Siren

8va 8:5

Pno. 2

Pianolas
I
II
III
IV

8ba 8ba 8ba 8ba 8ba

256

E. B.

Propellers
S. W.
L. W.
M.
Siren

8va 8:5 8va 8:5

Pno. 1

8va 8:5 8va 5:3

Pno. 2

Pianolas
I
II
III
IV

8ba 8ba 8ba

G

260

Xyl. 1

Xyl. 2

Xyl. 3

E. B.

Propellers

S. W.

L. W.

M.

Tam.

Drums

1

2

3

4

Siren

Pno. 1

8va

Pno. 2

Pianolas

I

II

III

IV

8ba

263

Xyl. 1

Xyl. 2

Xyl. 3

2/4 4/4 3/8

E. B.

Propellers

S. W.

L. W.

M.

Tam.

Drums

1

2

3

4

Siren

8va

Pno. 1

8va

Pno. 2

2/4 4/4 3/8

Pianolas

I

II

III

IV

8ba 8ba 8ba 8ba 8ba 8ba

267

Xyl. 1

Xyl. 2

Xyl. 3

3/8 2/4 3/4

E. B.

Propellers

S. W.

L. W.

M.

Tam.

Drums

1

2

3

4

Siren

8va

Pno. 1

8va

Pno. 2

3/8 2/4 3/4

Pianolas

I
II

III
IV

8ba

271

Xyl. 1–4

E. B.

Propellers

S. W.

L. W.

M.

Tam.

Drums

1–4

Pno. 1

Pno. 2

8va

(glissando)

16:12

16:12

Pianolas

I

II

III

IV

8ba

H

275

Drums

1

2

3

4

Pno. 1–2

8va

Pianolas

I

II

III

IV

8ba

280

Xyl. 1

Xyl. 2

Xyl. 3

(glissando)

5/8 3/4 4/4

Drums

1

2

3

4

Pno. 1

Pno. 2

8va

Pianolas

I
II

III
IV

8ba

283

Xyl. 1

8

Pno. 1

8va

Pianolas

I
II
III
IV

8ba

1

286

Xyl. 1

Xyl. 2

Xyl. 3

7/8

Drums

1
2
3
4

8

Pno. 1

Pno. 2

7/8

8va

Pianolas

I
II
III
IV

8ba

289

Xyl. 1

Xyl. 2

Xyl. 3

Drums

1

2

3

4

Pno. 1

8

Pno. 2

Pianolas

I
II

III
IV

8va

8ba

291

Xyl. 1

Xyl. 2

Xyl. 3

Drums

Pno. 1

Pno. 2

Pianolas

294

Xyl. 1

Xyl. 2

Xyl. 3

Drums

Pno. 1

Pno. 2

Pianolas

I
II

III
IV

297

Xyl. 1

Xyl. 2

Xyl. 3

Drums

1

2

3

4

8

Pno. 1

Pno. 2

Pianolas

I
II

III
IV

8va

8ba

300

Xyl. 1

Xyl. 2

Xyl. 3

4/4

7/8

Drums

1

2

3

4

Pno. 1

8

Pno. 2

4/4

7/8

Pianolas

I
II

III
IV

8va

8ba

302

Xyl. 1

Xyl. 2

Xyl. 3

7/8

Drums

1

2

3

4

8

Pno. 1

Pno. 2

7/8

8va

8ba

Pianolas

I
II

III
IV

304

Xyl. 1

Xyl. 2

Xyl. 3

Pno. 1

Pno. 2

Pianolas
I
II
III
IV

8va

8ba

307

Xyl. 1

Xyl. 2

Xyl. 3

Pno. 1

Pno. 2

Pianolas
I
II
III
IV

8va

8ba

310

Xyl. 1

Xyl. 2

Xyl. 3

Pno. 1

Pno. 2

Pianolas

I
II
III
IV

8va

8ba

313

Xyl. 1

Xyl. 2

Xyl. 3

Pno. 1

Pno. 2

Pianolas

I
II
III
IV

8va

8ba

316

J

Xyl. 1

Xyl. 2

Xyl. 3

Pno. 1

Pno. 2

Pianolas

I
II
III
IV

8va

8ba

320

8

Pno. 1

Pno. 2

Pianolas

I
II
III
IV

8ba

325

8va

Pno. 1

Pno. 2

Pianolas

I
II
III
IV

7/8

8ba

7/8

2/4

328

Pianolas

I
II
III
IV

332

Drums

1
2
3
4

Pno. 2

2/4

3/8

3/4

4/4

3

3

3

3

8ba

8ba

336

Drums 1 2 3 4

Pno. 2

Pianolas I II III IV

8ba

340

Pianolas I II III IV

8ba

345

E. B.

Pianolas I II III IV

353

E. B.

Pianolas I II III IV

8ba

360

Xyl. 1

Xyl. 2

Xyl. 3

4/4 2/4

E. B.

Propellers

S. W.

L. W.

M.

Tam.

Pno. 1

Pno. 2

4/4 2/4

8va

I

II

8ba

8va

III

IV

8ba

Pianolas

361

Xyl. 1

Xyl. 2

Xyl. 3

2/4

Drums

1

2

3

4

8va

Pno. 1

8va

Pno. 2

2/4

8va

Pianolas

I
II

III
IV

8ba

3/8

2/4

367

8

I
II

III
IV

8ba

8ba

8ba

371

Pianolas
I
II
III
IV

8ba

8ba

8ba

374

Pianolas
I
II
III
IV

8va

8ba

8ba

8ba

377

Pianolas
I
II
III
IV

8ba

8ba

8va

8ba

7/16

9/16

7/16

380

Pianolas
I
II
III
IV

8va

8ba

8ba

8ba

8ba

8ba

9

10

11

383

Pno. 1

Pno. 2

8va

10

11

10

11

7/16

5/16

Pianolas
I
II
III
IV

8ba

10

11

8ba

8va

8ba

8va

386

Pno. 1

Pno. 2

I
II

III
IV

8ba

8va

391

3/8

2/4

5/8

Pianolas

397

4/8

7/8

3/4

gliss.

403

Xyl. 1

Pno. 2

Pianolas

I
II

III
IV

8va

8ba

408

Xyl. 1

Pno. 2

Pianolas

I
II

III
IV

8va

8ba

414

Xyl. 1

Pno. 2

Pianolas

I
II

III
IV

8ba

420

Xyl. 1

Pno. 1

Pno. 2

Pianolas

I II

III IV

8va

8ba

425

Xyl. 1

Pno. 1

Pno. 2

Pianolas

I II

III IV

8va

430

Xyl. 1

Pno. 1

Pno. 2

Pianolas

I
II

III
IV

435

Xyl. 1

Pno. 1

Pno. 2

8va

Pianolas

I
II

III
IV

439

Pno. 1

Pno. 2

5/8 2/4

I II

III IV

Pianolas

445

Xyl. 1

Xyl. 2

Xyl. 3

3/4 2/4

Pno. 1

Pno. 2

3/4 2/4

I II

III IV

Pianolas

451

Xyl. 1

Xyl. 2

Xyl. 3

Siren

Pno. 1

Pno. 2

Pianolas

I
II

III

IV

8va

8ba

K

456

Xyl. 1

Xyl. 2

Xyl. 3

Propellers

S. W.

L. W.

M.

Tam.

Siren

Pno. 1

Pno. 2

8ba

Pianolas

I

II

III

IV

8va

8ba

459

Xyl. 1

Xyl. 2

Xyl. 3

Propellers

S. W.

L. W.

M.

Tam.

Siren

Pno. 1

Pno. 2

8ba

8va

8ba

8va

8ba

8va

8ba

Pianolas

I

II

III

IV

8ba

L

462

Xyl. 1–3

Propellers

S. W.

L. W.

M.

Siren

Pno. 1

Pno. 2

8ba

Pianolas

8va

I
II

III
IV

467

E. B.

Tam.

8

471

E. B.

Propellers

S. W.

L. W.

M.

Tam.

Drums

1

2

3

4

Siren

Pno. 2

8ba

8

8va

I

8ba

8ba

Pianolas

II

8

III

8

IV

476

E. B.

Propellers

S. W.

L. W.

M.

Tam.

Drums

1

2

3

4

Siren

Pno. 2

8ba

I

8va

8ba

8va

8ba

Pianolas

II

8

III

8

IV

480

E. B.

Propellers

S. W.

L. W.

M.

Tam.

Drums

1

2

3

4

Siren

Pno. 1

Pno. 2

8ba

8va

8ba

8va

8ba

I

Pianolas

II

8

III

8

IV

M

484

E. B.

Propellers

S. W.

L. W.

M.

Tam.

Drums

1

2

3

4

Siren

Pno. 1

8ba

Pno. 2

8ba

I

8va

8ba

II

III

IV

Pianolas

491

E. B.

Propellers

S. W.

L. W.

M.

Tam.

Siren

Pno. 1

8ba

Pno. 2

8ba

I

8va

8ba

8va

8ba

8va

Pianolas

II

III

IV

496

3/4

Propellers

E. B.

S. W.

L. W.

M.

Tam.

Siren

Pno. 1 2

8ba

3/4

Pianolas

I II

III IV

8ba

4/4 2/4

500

E. B.

Propellers

S. W.

L. W.

M.

Tam.

Drums

1-4

Siren

Pno. 1 2

8ba

4/4 2/4

8va

Pianolas

I II

III IV

8ba

504

Xyl. 1

Xyl. 2

Pno. 1

Pno. 2

8ba

Pianolas

I
II
III
IV

510

Xyl. 1

Xyl. 2

Pno. 1

Pno. 2

8ba

Pianolas

I
II
III
IV

514

Xyl. 1

Xyl. 2

Pno. 1

Pno. 2

8ba

Pianolas
I
II
III
IV

518

Xyl. 1

Xyl. 2

Pno. 1

Pno. 2

8ba

Pianolas
I
II
III
IV

522

Xyl. 1

Xyl. 2

Pno. 1

Pno. 2

8ba

Pianolas

I
II
III
IV

526

Xyl. 1

Xyl. 2

Xyl. 3

Pno. 1

Pno. 2

8ba

Pianolas

I
II
III
IV

N

530

Xyl. 1

Xyl. 2

Pno. 1

Pno. 2

8ba

Pianolas

I
II

III
IV

535

Xyl. 1

Xyl. 2

Pno. 1

Pno. 2

8ba

Pianolas

I
II

III
IV

539

Xyl. 1

Xyl. 2

Pno. 1

Pno. 2

8ba

Pianolas

I
II

III
IV

544

Xyl. 1

Xyl. 2

Pno. 1

Pno. 2

8ba

Pianolas

I
II

III
IV

549

Xyl. 1

Xyl. 2

Pno. 1

Pno. 2

8ba

Pianolas

I
II

III
IV

3/4 2/4

554

Xyl. 1

Xyl. 2

Pno. 1

Pno. 2

8ba

Pianolas

I
II

III
IV

2/4 3/4 2/4 3/4

559

Pianolas

I II

III IV

564

Pianolas

I II

III IV

569

Propellers

S. W.

L. W.

M.

Tam.

Pno. 1

Pno. 2

Pianolas

I II

III IV

576

Propellers

S. W.

L. W.

M.

Tam.

Pno. 1

Pno. 2

3/4 2/4

Pianolas

I II

III IV

583

Propellers

S. W.

L. W.

M.

Tam.

Pno. 1

Pno. 2

3/4

Pianolas

I II

III IV

590

Propellers
S. W.
L. W.
M.
Tam.
Pno. 1
Pno. 2

3/4

Pianolas
I
II
III
IV

595

Propellers
S. W.
L. W.
M.
Tam.
Pno. 1
Pno. 2

2/4

Pianolas
I
II
III
IV

P

600

Propellers
S. W.
L. W.
M.

Pno. 1 2

Pianolas
I
II
III
IV

2/4 5/8

608

Propellers
S. W.
L. W.
M.

Pno. 1 2

Pianolas
I
II
III
IV

5/8 2/4 5/8 2/4 3/4 2/4 3/4 2/4 3/4

616

Propellers
S. W.
L. W.
M.

Pno. 1 2

Pianolas
I
II
III
IV

3/4 2/4 3/4 2/4 3/4 2/4 3/4 2/4

623

Xyl. 1

Pianolas
I
II
III
IV

629

Xyl. 1

Pianolas
I
II
III
IV

635

Xyl. 1

Pno. 1
2

Pianolas
I
II
III
IV

642

Xyl. 1

Siren

Pno. 1 2

3/4 6/8 5/8 8/8

Pianolas

I

II

III

IV

8ba

*

646

Siren

Pno. 1 2

8/8 5/8 2/4

8va

5

I

II

III

IV

8ba

* Notated in 2/4 in ms.

649

Xyl. 1

Siren

I

II

III

IV

8ba

Pianolas

655

Xyl. 1

Siren

2/8 4/8

II

III

8ba

Pianolas

660

Tam.

Siren

8va

Pianolas

I
II
III
IV

663

Tam.

Siren

8va

8ba

Pianolas

667

I

II

III
IV

8ba

Pianolas

671

I

II

III
IV

8ba

Q

677

Drums

1
2
3
4

Pianolas

I
II

5/8 2/4

686

Drums

1
2
3
4

2/4 5/8 2/4 5/8 2/4

Pianolas

I
II

III
IV

694

Xyl. 1

3/4 2/4 3/4

Drums

1
2
3
4

3/4 2/4 3/4

Pianolas

I
II

III
IV

701

Xyl. 1

Drums

1
2
3
4

Pianolas

I
II

III
IV

706

Xyl. 1

Drums

1
2
3
4

Pno. 1

Pno. 2

Pianolas

I
II

III
IV

712

Xyl. 1

Drums

1

2

3

4

Pno. 1

Pno. 2

Pianolas

I
II

III
IV

718

Xyl. 1

Drums

1–4

Pno. 1
2

Pianolas

I
II

III
IV

724

Drums

Xyl. 1

1–4

Pno. 1 2

Pianolas

I II

III IV

3/4 2/4

730

Drums

Xyl. 1

1–4

Pno. 1 2

Pianolas

I II

III IV

2/4 3/4 2/4 3/4

735

Drums

1–4

Pianolas

I II

III IV

3/4 2/4 3/4

740

Drums
1–4

Pianolas
I
II
III
IV

745

Xyl. 1

Drums
1–4

Pianolas
I
II
III
IV

751

Xyl. 1

Pno. 1

8va

Pno. 2

Pianolas
I
II
III
IV

758

Xyl. 1

Pno. 1

Pno. 2

8va

Pianolas

I II

III IV

765

770

775

6/8 R — 2/4 — 3/8

Pianolas

I

II

III

IV

8ba

8ba

8ba

781

Drums

1

2

3

4

3/4 — 2/4 — 3/8

Pianolas

I

II

III

IV

8ba

785

Drums

1
2
3
4

Pianolas

I
II
III
IV

790

Tam.

Drums

1
2
3
4

Pianolas

I
II
III
IV

795

Tam.

Drums

1

2

3

4

Pianolas

I

II

III

IV

8ba

801

Tam.

Drums

1

2

3

4

Pianolas

I

II

III

IV

8ba

806

Tam.

Drums

1

2

3

4

Pianolas

I

II

III

IV

8ba

812

Tam.

Drums

1

2

3

4

Pianolas

I

II

III

IV

8ba

817

Tam.

Drums

1

2

3

4

I

II

III

IV

Pianolas

8ba

823

Tam.

Drums

1

2

3

4

I

II

III

IV

Pianolas

8ba

828

Tam.

Drums

1

2

3

4

Pianolas

I

II

III

IV

8ba

834

Tam.

Drums

1

2

3

4

Pianolas

I

II

III

IV

8ba

839

Tam.

Drums

1

2

3

4

Pianolas

I

II

III

IV

8ba

845

Tam.

Drums

1

2

3

4

Pianolas

I

II

III

IV

8ba

850

Tam.

Drums

1

2

3

4

Pianolas

I

II

III

IV

8ba

856

Tam.

Drums

1

2

3

4

Pianolas

I

II

III

IV

8ba

861

Tam.

Drums

1

2

3

4

Pianolas

I

II

III

IV

8ba

866

Tam.

Drums

1

2

3

4

Pianolas

I

II

III

IV

8ba

872

Tam.

Drums

1

2

3

4

Pianolas

I

II

III

IV

8ba

877

Tam.

Drums

1

2

3

4

Pianolas

I

II

III

IV

8ba

882

Tam.

Drums

1

2

3

4

I

II

III

IV

Pianolas

8ba

888

Tam.

Drums

1

2

3

4

I

II

III

IV

Pianolas

8ba

893

Tam.

Drums

1

2

3

4

I

II

III

IV

Pianolas

8ba

898

Tam.

Drums

1

2

3

4

I

II

III

IV

Pianolas

8ba

904

Tam.

Drums

1

2

3

4

Pianolas

I

II

III

IV

910

Tam.

Drums

1

2

3

4

Pianolas

I

II

III

IV

916

Tam.

Drums

1

2

3

4

Pianolas

I

II

III

IV

2/4

3/8

921

Tam.

Drums

1

2

3

4

Pianolas

I

II

III

IV

2/4

3/8

926

Tam.

Drums

1

2

3

4

Pianolas

I

II

III

IV

2/4

3/8

931

Tam.

Drums

1

2

3

4

Pianolas

I

II

III

IV

2/4

3/8

3/4

Pianolas

936

941

946

I

II

III

IV

8ba

8va

951

Pianolas

I

II

III

IV

8va

956

961

T

966

Drums 1 2 3 4

Pianolas I II III IV

2/4 5/8

975

Drums 1–4

2/4 5/8 2/4 6/8 2/4 6/8 2/4

Pianolas I II III IV

982

Drums 1–4

6/8 2/4 6/8 2/4 6/8 2/4 6/8

Pianolas I II III IV

989

Drums

1
2
3
4

Pianolas

I
II
III
IV

2/4 6/8 2/4 3/4 2/4

994

Drums

1
2
3
4

Pianolas

I
II
III
IV

2/4 3/4 2/4 3/4

1001

Drums

1
2
3
4

Pianolas

I
II
III
IV

U

1007

Tam.

Drums

1
2
3
4

Pianolas

I
II
III
IV

8va

8ba

1010

V

Tam.

Drums

1

2

3

4

Pianolas

I
II
III
IV

6/8 7/8 4/8 5/16 7/16

8ba

1014

Tam.

Drums

1

2

3

4

Pianolas

I
II
III
IV

7/16 11/16 4/8

8ba 8ba 8ba 8ba 8ba 8ba 8ba 8ba

1018

E. B.

Drums

1

2

3

4

Pianolas

I
II
III
IV

4/8 3/16

8va 8va 8va 8va 8va

8ba 8ba 8ba 8ba 8ba

Pianolas

1023

8va

8ba

gliss.

1027

8va

8ba

gliss.

1031

8va

8ba

29

1035

Propellers

S. W.

L. W.

M.

Drums

Tam.

1–4

8va

8ba

1039

Propellers
S. W.
L. W.
M.
Tam.
Drums
1–4

6/16 15/16 7/16

Pianolas
I
II
III
IV
8ba

1041

Propellers
S. W.
L. W.
M.
Tam.
Drums
1–4

7/16 8/16 6/16 11/16

Pianolas
I
II
III
IV
8ba

X

1044

Drums

1 2 3 4

11/16

I

II

III

IV

Pianolas

8ba

1046

Drums

1 2 3 4

10/16

I

II

III IV

Pianolas

8ba

1048

Drums

1
2
3
4

10/16

2/8

Pianolas

I
II
III
IV

8ba

1050

E. B.

Drums

1
2
3
4

2/8

7/16

Pianolas

I
II
III
IV

8ba

1057

Pianolas

I II III IV

7/16 9/16 7/16 15/16

1060

Pianolas

I II III IV

15/16 7/16 9/16

1062

Propellers

S. W.
L. W.
M.

9/16 7/16 2/16

Pianolas

I II III IV

1068

Propellers

S. W.
L. W.
M.

Pianolas

I II III IV

1074

Propellers

S. W.
L. W.
M.

5/32

Pianolas

I II III IV

5/32

1080

Propellers: E. B., S. W., L. W., M., Tam.

Drums: 1, 2, 3, 4

5/32

Pianolas: I, II — 8ba; 8va gliss.; III, IV — gliss.

9/16

1085

Propellers: E. B., S. W., L. W., M., Tam.

Drums: 1, 2, 3, 4

9/16

Pianolas: I, II — 8ba; 8 gliss.; III, IV — gliss.

1089

E. B.

Propellers

S. W.

L. W.

M.

Tam.

Drums

1

2

3

4

Pianolas

I
II

III
IV

8ba

3/8 5/32 7/32

8va

1094

Tam.

Drums

1

2

3

4

7/32 8/32

Pianolas

I
II

III
IV

gliss.

8ba

8va

1096

Tam.

Drums

1

2

3

4

7/32

Pianolas

I
II

8

14

15

8va

8ba

III
IV

gliss.

10

1098

Tam.

Drums

1

2

3

4

7/32

7/16

Pianolas

I
II

III
IV

8ba

Y

1102

Drums

Pianolas

E. B.

Propellers

S. W.

L. W.

M.

Tam.

vib. et tremolo

1106

8ba

1111

Propellers
E. B.
S. W.
L. W.
M.
Tam.

Pianolas
I
II
III
IV

3/8 4/8 6/8 5/8

8ba

1114

Propellers
E. B.
S. W.
L. W.
M.
Tam.

Pianolas
I
II
III
IV

5/8 4/8

8va

8ba

1117

Propellers
E. B.
S. W.
L. W.
M.
Tam.

Pianolas
I
II
III
IV

3/8 4/8 3/16

8va

Z

1120

E. B.

Propellers

S. W.

L. W.

M.

Tam.

Siren

3/16

10/16

8va

2:3

4:5

4:5

Pianolas

I
II

III
IV

1122

E. B.

Propellers

S. W.

L. W.

M.

Tam.

Siren

5/32

8

4:5

4:5

4:5

4:5

Pianolas

I
II

III
IV

8ba

1124

Propellers

E. B.

S. W.

L. W.

M.

Tam.

Siren

5/32 4/32 7/32 6/32 4/32 5/32

Pianolas

8va

I II

III IV

8ba

1129

Propellers

E. B.

S. W.

L. W.

M.

Tam.

Siren

5/32 8/32 6/32 5/32 6/32 10/8

Pianolas

8va

I II

III IV

8ba

1134

E. B.

Pianola

I

8va

8ba

1138

1142

1146

1150

1154

solo

E. B.

10/8 4/8 9/8 4/4 3/8 4/8

8va 8ba 8va 8ba

I

1159

E. B.

Propellers S. W. L. W. M.

4/8 5/8 4/4 25/8

8va 8ba 8va 8ba

Pianola I

AA

1164

Propellers S. W. L. W. M.

25/8 3/16 10/8 3/16

8va 8ba

Pianolas I II

gliss. 8va 22

III IV

1167

E. B.

Propellers

S. W.

L. W.

M.

Tam.

3/16 9/8 3/16 3/8 6/8 4/8 12/8

8va 8va

I II

8ba 8va

Pianolas

III

22 8va

IV

22 8va

8ba

1173

E. B.

Propellers

S. W.

L. W.

M.

Tam.

12/8 3/16 10/8

8va

I II

8ba 8va

gliss.

Pianolas

III

22 8va

gliss.

IV

22 8va

1176

Propellers

E. B.

S. W.

L. W.

M.

Tam.

3/16 10/8 17/8 3/16

Pianolas

I

II

8va

8ba

1180

Tam.

3/16 6/8 8/8 9/8 12/8

Pianolas

I

II

III

IV

8va

22

8ba

12/8 13/8 10/8 4/8 5/8 4/8

1185

Pianolas

I

II

III

IV

8va

8ba

Pianolas

1191

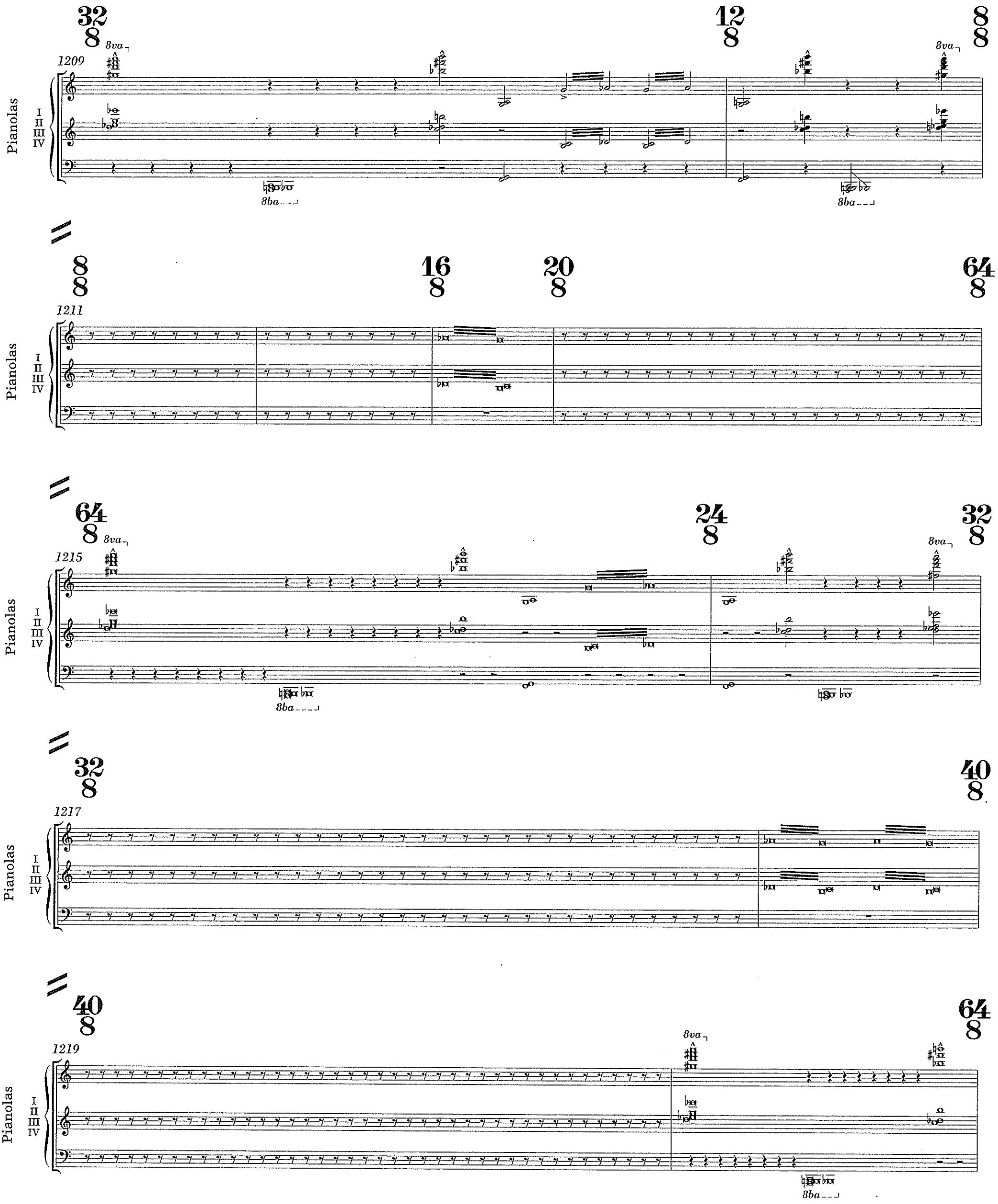
I
II
III
IV

8ba

1198

8va

1203


32/8
12/8
8/8
8va
1209
Pianolas
I
II
III
IV
8ba
8/8
16/8
20/8
64/8
1211
64/8
24/8
32/8
1215
32/8
40/8
1217
40/8
64/8
1219

1221

Xyl. 1

Xyl. 2

Xyl. 3

64
8

E. B.

Propellers

S. W.

L. W.

M.

Tam.

Drums

1

2

3

4

Siren

Pno. 1

Pno. 2

64
8

Pianolas

I

II
III
IV

1222

Siren

Pianolas

I
II
III
IV

8va

8ba

11/16

10/16

11/16

1223

8va

8ba

11/16

8/16

17/16

1226

8

8ba

17/16 | 8/16 | 12/16

1229

Pianolas

I II III IV

8 8ba

32/16 BB

1232

Pianolas

I II III IV

8 8ba

11/8

1237

Drums

1 2 3 4

11/8

Pianolas

I II III IV

8 8ba 5

APPENDIX
TECHNICAL REQUIREMENTS

There are a number of complex technical issues that must be addressed in order to perform this new edition of the *Ballet mécanique*. Anyone planning a performance should read through the information below and be sure to review thoroughly the technical manual that is provided with the Schirmer rental materials. We strongly recommend that a copy of the manual be obtained ahead of time so that the conductor and sound engineer can study it in order to determine what equipment is required and which of the optional rental materials will best suit the specific needs of the performance at hand.

Please note that the technical manual is also accessible online at the following URL:
http://www.schirmer.com/balletmec

Here is a summary of what is necessary and the options available.

COMPUTER

Macintosh Power Macintosh using System 7.6 or later, equipped with MIDI sequencing software: Mark of the Unicorn Performer 6.0 or later; Opcode Vision DSP or Studio Vision 4.0 or later; or similar.
—OR—
PC with Pentium processor using Windows 95 or 98, equipped with MIDI sequencing software and sound card (for voice cue and/or click track). Software: Cakewalk 8.0 or later; or similar.

PLAYER PIANOS (PIANOLAS)

4, 8, 12 or 16 MIDI-compatible acoustic player pianos.
—OR—
4, 8, 12 or 16 MIDI-compatible digital pianos, synthesizers, or piano modules with amplification.

For performance, the instruments must be in four identical groups. For rehearsal, two digital pianos or modules, with appropriate amplification, may be sufficient.

GRAND PIANOS

In order to be heard over the pianolas, it may be necessary to amplify the two grand pianos, in which case appropriate microphones, amplifiers, and speakers will be required. A simpler (although less authentic) solution might be to have the two pianists play on digital pianos, or MIDI keyboards connected to piano modules or synthesizers, which can then be amplified directly without the need of any microphones and the extra adjustments they require.

SOUND EFFECTS AND CLICK/VOCAL CUES

The sound effects can be produced either mechanically or electronically. If produced electronically, they must be produced with a digital sampler (either hardware or software) capable of playing looped samples, to accommodate the different lengths of cues and different tempos.

If a digital sampler is being used for any or all of the sound effects, it must have at least 16 megabytes of RAM, and have sufficient discrete audio outputs so that each sound produced can be controlled separately. A compatible CD-ROM drive to load the samples is also required. With a hardware sampler, a dedicated hard drive (either internal or external) is advisable, as it will make loading of the samples faster, and allow editing of the samples and programs.

propellers

Mechanical propeller machine (electric fan with an object stuck in the blades to make noise).

—OR—

Digidesign SampleCell card and SampleCell Editor software (Macintosh only).

—OR—

Kurzweil 2000 or 2500 series MIDI-controlled digital sampler. The propellers require three separate audio outputs (for three mono samples).

—OR—

Sample-playback software that supports looped samples, and sound card with at least three audio outputs.

siren

Hand-cranked siren with fast (< 1 second) rise time. Ideally, two sirens should be used, a small one for fast cues and a larger one for the longer cues.

—OR—

SampleCell or Kurzweil sampler, as above (stereo sample, requires two outputs).

—OR—

Sample-playback software that supports looped samples, and sound card with at least two audio outputs.

bells

Array of seven different-sized electric bells with power supplies and individual push-buttons.

—OR—

Array of seven bells with MIDI-to-contact-closure converter for control from sequencer or separate MIDI keyboard. This device is available from Paul Lehrman.

—OR—

SampleCell or Kurzweil sampler, as above (stereo sample, requires two outputs).

—OR—

Sample-playback software that supports looped samples.

for click track and vocal cues

SampleCell or Kurzweil sampler, as above (requires one output, but two outputs preferred).

—OR—

Sound card (Windows) or internal sound generator (Macintosh).

—OR—

Drum synthesizer or General MIDI synthesizer.

The propellers, siren and bells can be triggered automatically from the sequencer, or they can be played manually. If manual play is desired, one or more MIDI keyboards (depending on the number of musicians playing the parts) are required. These can be any MIDI-compatible keyboards, and the keyboards themselves do not require any audio amplification.

SOUND SYSTEM

A sound system will be required if digital samplers are used for any of the sounds. A mixing console is necessary that is large enough to accommodate all of the sources being used: two channels for the stereo siren, two channels for the bells arrayed in stereo, and three channels for the three propellers. Ideally, each mixer channel should feed its own amplifier and speaker.

Amplifiers should be good-quality professional sound-reinforcement types with at least 150 watts of power, and speakers should be full-range sound reinforcement speakers capable of delivering at least 96 dB SPL at one meter.

If fewer amplifier/speaker channels are available, it's permissible to combine sounds; however, it is not advisable to use fewer than three amplifiers and speakers if the propeller samples are being used, as the sound may get extremely muddy if one tries to combine the signals.

Note that a simpler sound system can be used for rehearsal, although the relative sound levels need to be monitored carefully to prevent distortion.

If amplified piano modules or synthesizers are being used, either for the pianola or the grand piano parts, these systems need their own mixing channels, amplifiers, and speakers. It will be easiest to set up a separate stand-alone system for each instrument requiring amplification. The amplifier and speaker requirements are the same as for the digital samplers.

MONITORING SYSTEM

The system for monitoring the click track and vocal cues requires its own separate mixing system to combine and balance the sounds. (If the mixing console being used for the samples has extra assignable outputs, one of them can be used for the monitor if it is convenient.) The output of the monitor mixer is fed to an earphone for the conductor to wear.

The conductor will probably want to have the click and cue tracks only in one ear, so they should be combined into a single mono output.

A conventional headphone (preferably an "open-air" type so as not to block the sound of the ensemble) is acceptable for rehearsal. For performance, however, it might be preferable if the conductor wears a wireless in-ear system, such as a Shure PSM-600 "personal monitor." This allows maximum freedom of movement, it is nearly invisible, and the "in-ear" aspect prevents the audience from hearing the click during the silent passages starting at measure 1134. (The conductor may want to turn down the click at that point, or the velocity of the clicks can be adjusted in the sequence itself.)

If some players or even the entire ensemble want to hear the click track, multiple receivers for any wireless system are easily obtained and require no special installation other than making sure they are all set to the same frequency. Each receiver has a volume control so players can set their individual volumes to taste.

MIDI INTERFACE

This must be compatible with the selected computer and capable of running in "fast" (MIDI x 2 or greater) mode. It *must* provide at least four discrete addressable MIDI outputs for the four groups of pianolas—preferably five if any other outboard MIDI devices (samplers, synthesizers) are used. *Combining multiple pianola parts on a single MIDI cable will cause audible timing errors.*

Recommended models include Mark of the Unicorn MIDI Time Piece or MIDI Express; Opcode Studio 64X or Studio 128X; Emagic Unitor 8; Roland MPU64; and MIDIMan BiPort 2x4s or Winman 4x4/s.

REHEARSALS

Since a stage full of player pianos may not be available over an extended rehearsal period, some ensembles may choose to use electronic MIDI-compatible piano modules to cover the pianola parts while the percussionists and live pianists rehearse with the conductor. To make this process as simple as possible, the rental materials include sequencer tracks that combine the four pianola parts into two, suitable for playing by a MIDI piano module. Do not attempt to play these tracks on a player piano—they will not work properly.

While it is possible to conduct the instrumentalists without using the click track, it is strongly advised that whenever the pianola parts are being played, whether from electronic or acoustic pianolas, the conductor listen to the click track. Besides helping to negotiate the long stretches of silence after measure 1134, the click track will also help the conductor sort out many of the more difficult rhythms and time signatures in the score, which may not be readily audible by listening to the pianolas alone.

Should the ensemble want to perform the piece without a conductor, it is crucial that every member be listening to the click track at all times.

RENTAL MATERIALS AND TECHNICAL SUPPORT

Rental materials, including instrumental parts, technical manual, and digital files, are available from the Publisher. All rental materials are copyrighted by G. Schirmer, Inc., and are the sole property of the publisher. Copying of any of this material, including digital files, is strictly forbidden by law except as noted in the technical manual.

It is strongly recommended that any ensemble attempting to perform the *Ballet mécanique* with these material s employ the services of a trained MIDI musician/technician familiar with computer sequencers, multiport MIDI interfaces and sampler programming.

Paul Lehrman, creator of the digital files and technical manual, is available to answer specific simple technical questions from performing groups on an informal basis. He can be reached by e-mail at lehrman@pan.com. More detailed help is available by arrangement with Mr. Lehrman.

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