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Author(s): Leland Smith

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## HENRY COWELL'S RHYTHMICANA

Leland Smith

Stanford University

Before 1930 Henry Cowell had already established a reputation in Europe and America as a musical *enfant terrible* who assaulted the piano in hitherto unthinkable ways. Much to the surprise of the audiences of the twenties, Cowell's penetrations into regions thought to be forbidden to all except pianoforte surgeons produced truly musical results. Like his close friend of the previous generation, Charles Ives, Cowell had the good fortune of growing up in a musical atmosphere that was virtually free of the smog of nineteenth-century Europe's musical industry.

From his teens, Cowell demonstrated an uninhibited curiosity about the fundamental nature of music and a desire to exploit elements of the world of sound which had either been ignored or relegated to a largely non-essential or decorative role. His book, *New Musical Resources*,<sup>1</sup> contains theories which were mostly worked out before 1920 but which had to wait over thirty years before gaining acceptance by other composers.

Cowell's interest in both complex cross rhythms and new acoustical formations received great impetus when, in 1929, the conductor Nicolas Slonimsky introduced him to an electrical engineer named Leon Theremin.<sup>2</sup> The *Aetherophone*, later simply called the *Theremin*, had just made its entrance upon the musical scene. Some time later the brain child of the collaboration of Cowell and Theremin was introduced to the New York public:

... a new musical wonder, provisionally christened 'rhythmicon,' was presented to the world for the first time on January 19, 1932, at the New School for Social Research, where Cowell is in charge of musical activities. The rhythmicon can play triplets against quintuplets, or any other combinations up to sixteen notes in a group. The metrical index associated, in accordance with Henry Cowell's scheme as expounded in *New Musical Resources*, with the corresponding frequency of vibrations. In other words, quintuplets are of necessity sounded on the fifth harmonic, nonuplets on the ninth harmonic, and so forth. A complete chord of sixteen notes presents sixteen rhythmical figures in sixteen harmonics within the range of four octaves. All sixteen notes coincide, with the beginning of each period, thus producing a synthetic harmonic series of tones.<sup>3</sup>

Not too long before this Cowell had included in the third movement, titled *Counter Rhythm*, of his *Concerto for Piano and Orchestra* (1929) a

passage which combined the rhythms of three, four, six, eight, twelve and sixteen.<sup>4</sup>

In 1932 Cowell wrote a letter to his stepmother, Olive Cowell, describing his contribution in the design of the rhythmicon:

My part in its invention was to invent the idea that such a rhythmic instrument was a necessity to further rhythmic development, which had more or less reached the limit of performance by hand, and needed the application of mechanical aid. That which the instrument was to accomplish, what rhythms it should do, and the pitch it should have, and the relation between the pitch and rhythm, are my ideas. I also conceived that the principle of broken-up light, playing on a photoelectric cell, would be the best means of making it practical. With this idea, I went to Therman, who did the rest. He invented the method by which the light could be cut, did the electrical calculations, and built the instrument.

The purpose of the instrument is twofold: to make possible the production of rhythm and related tone beyond the point where they could be produced before now by any known means; and to be used, first, for making rhythmical melody and harmony for use in musical composition, and, second, for the carrying on of numerous scientific physical and psychological experiments with rhythm.<sup>5</sup>

Although Cowell cites the compositional use of the rhythmicon as primary, there seemed to be some doubt on this score. Concern was expressed by Charles Ives in a letter to Nicolas Slonimsky which, however, tells us that the development of the rhythmicon was deemed important enough to warrant Ives' financial support.<sup>6</sup>

164 EAST 74 STREET  
NEW YORK  
JANUARY 1932

DEAR N.S.A.\*—This doesn't mean "no swearing allowed" nor "no silence aloud,"

I had a long talk with Henry the day after you left. I told him what I told you about the "Rhythmicon" situation as I had got to thinking about it after our meeting—and we went into it from all angles. It relieved my mind to know especially that the new one would be nearer to an instrument, than a machine. There will be a "lever" that can readily change the "tempo" with pedals and also the "tones" etc. It wasn't so much the question of having another made—as I think it ought to—it will be improved, transported, and studied on—but the

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\* The initials stand for Nicolas Slonimsky Adlow (Dorothy Adlow-Slonimsky).

main question is whether it is yet time to present it at Paris—and if so how is the best way to do it. Henry feels as I do about that—and after the demonstration at the New School for Social Research next Tuesday we can know better how to do it. I sent the remitted check to Mr. Theremin yesterday—and he's started the building. It will be yours and Henry's—I just want to help—and sit under its "shadow" on a nice day.

I was glad to hear that you feel better about the 3 other pieces of mine at the Paris concert. Good, clear parts are made. It can be put like this: Three Pieces for (Large) Orchestra: I. *The Cage*, II. *The 4th of July*, III. *An Elegy*. Hoping to see you soon.

Sincerely,  
Chas. E. Ives

Cowell must have been intent on proving the compositional usefulness of the rhythmicon from the very start because by the end of 1931 he had completed *Rhythmicana*, a work in four movements for rhythmicon and full orchestra. Another work, for violin and rhythmicon, is mentioned in a review in the San Francisco *Argonaut* of 20 May 1932<sup>7</sup> but no other reference to this piece has been found and it is unknown to Mrs. Henry Cowell, the composer's widow.

My own interest in *Rhythmicana* came about as the result of a chance conversation with Oliver Daniel at a San Francisco cocktail party given by Broadcast Music Incorporated early in 1970. I had been describing the potential of computer generated sound in the performance of all types of music when Mr. Daniel, a long-time friend of Henry Cowell, mentioned that he had almost given up hope of ever hearing a performance of *Rhythmicana*. From Daniel's brief description of the rhythmicon it seemed that there should be no great problems encountered in making a computer realization of this music. Since *Rhythmicana* is one of the few Cowell works which has never been published a difficulty arose as to the location of the manuscript. Oliver Daniel suggested I first try the Americana Collection of the New York Public Library and, that failing, I might contact Mrs. Henry Cowell. Nothing was found in New York City but Mrs. Cowell informed me that I could get a duplicate of the *Rhythmicana* score from the Edwin Fleisher Collection of the Free Library of Philadelphia. Finally, late in June of 1970 I first saw the score of *Rhythmicana*.

While the orchestral parts of the work were written in the conventional manner, the part for the rhythmicon obviously employed a special type of notation. Thanks to Nicolas Slonimsky's description of the rhythmicon quoted above it was possible to make a good guess as to the principles behind Cowell's tablature. A letter to Slonimsky produced unhopd-for results. His answer included the following bits of information:<sup>8</sup>

I am very much interested in your attempt to realize Cowell's *Rhythmicana* for a modern electronic performance. Cowell wrote it for me in 1932 and Theremin constructed a portable Rhythmicon which I had intended to use on my European tour of concerts of American music. Unfortunately, the schedule went awry and the project fell through. I kept my Rhythmicon for some ten years and then sold it to Schillinger. Cowell's own Rhythmicon went to the New School for Social Research. Neither of the two existing instruments could be activated for a performance. I could never find out what happened to the one in Schillinger's possession.

\* \* \* \*

By an extraordinary bit of luck I dug up from my files Cowell's original sheet of instructions which he gave me at the time, indicating the *modus operandi* of the Rhythmicon.

\* \* \* \*

All sounds were staccato, of course, but Cowell experimented with sustained sounds, too, even in the upper overtones, presumably by closing some apertures, or prolonging the sound by cutting out a concentric ribbon.

The instruction sheet which Cowell wrote in 1932 is here quoted in full:

Directions of notating music for the Cowell-Theremin rhythmicon.

1. The keyboard of the rhythmicon is represented on two staves. Only four lines are necessary for each of the staves, but for convenience in using ordinary score paper, five-line staves may be used; in which case the lower line of the lower staff is not used, nor the top line of the top staff. Corresponding with the white keys on the rhythmicon, the spaces are used. On the lower staff the lowest space is rhythm 1 (the first white key), the second space is rhythm 2 (the second white key), the third space is rhythm 4, the fourth space is rhythm 6 and the top space above the staff is rhythm 8. Corresponding to the black keys, the lines are used. The first line (the second if a five-line staff is used) is the off-beat key, which gives a beat in the middle of each measure. This is the first black key. The second line is rhythm 3, the third line is rhythm 5, the fourth line is rhythm 7. On the upper staff the same system is continued. The staff is divided only for the sake of clarity in reading. Thus the first line is rhythm 9, the second line is rhythm 11, the third line is rhythm 13, the fourth line is rhythm 15. The top line, if a five-line staff is used, is not employed. On the upper staff the first space is rhythm 10 (starting again with the sixth white key), the second space is rhythm 12, the third space is rhythm 14, the fourth space is rhythm 16. No clefs are necessary.

2. In notating the rhythm on the staves, there is a barline just preceding the beat of rhythm 1, or in other words, all the rhythms coincide just after the barline. No attempt is made to notate the number of times the various rhythms sound. The rhythm is notated (which goes by a standard of a whole note to a measure) indicating the way the keys are to be played, rather than the sounds which the keys will produce. The only time when the rhythm of the keys is notated, is when it is necessary to enter the rhythm or leave it in the middle, or during the duration of the rhythmical cycle, in which case the proportion of the rests and the note-beats are indicated by fractions. For example, if it is desired in the seven rhythm to play only the three final notes, then there is a rest with  $4/7$  over it, indicating that four of the seven beats are to be rested; and a note with  $3/7$  over it, indicating that the final three notes of the seven rhythm are to be sounded. When rhythms are to be sustained this is indicated in every case by whole notes at the beginning of each measure. Ties will be taken for granted, and will be left out as unnecessary.

3. The rheostats governing the tempo and pitch are notated on an additional staff under the other two. The top line on the staff is used for tempo. The basis of the notation is to indicate the length of a whole note (or duration of rhythm 1) in seconds. A whole note is written with a figure over it, and the figure indicates the number of seconds the whole note is to last. Thus — indicates that rhythm 1 will contain four seconds to complete its period; —\* indicates that rhythm 1 will have half a second between its beats, etc. The tempo is indicated in this way at the beginning of each section, and is assumed to last until there is another indication. If there is to be acceleration, the tempo at the beginning and the end is given, with a wavy line going upward between the two, showing the duration of the acceleration period. Inversely a wavy line going downward shows retardation. Pitch is indicated on the lowest line of this staff, and is shown by a letter indicating the pitch in conjunction with a fraction which shows what octave the fundamental note is in. Thus C $1/4$  indicates the C produced by moving the finder on the rheostat  $1/4$  of the way from the bottom, etc. There are five C's on the rheostat:  $1/8$ ,  $1/4$ ,  $1/2$ ,  $3/4$  and C 1, which is at the very top. Sliding up or down in pitch is indicated by a wavy line as in tempo. A sign for pitch is given at the beginning of each section, and lasts until altered.

Apparently only two rhythmicons were built in America.<sup>9</sup> Sometime before World War II Cowell's instrument found its way to the Department

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\* The two blanks are in the quotation provided to me by Slonimsky. From the context as well as from the previous sentence it is clear that the first blank should contain a whole note with the figure 4 above it, and the second blank should contain a whole note with the figure  $1/2$  above it.

Example 1. From Introduction to *Rhythmicana*.  
Notation for rhythmicon.

The image shows a musical score for a rhythmicon. It consists of two staves. The top staff has a treble clef and the bottom staff has a bass clef. The tempo is marked as (MM ♩ = 120). There are two measure numbers in boxes: 130 and 135. The notation includes various note values, rests, and dynamic markings. The notes are often beamed together in groups, suggesting a rhythmic pattern. The bottom staff has a 1/2 time signature at the beginning.

of Psychology at Stanford University but eventually became inoperative and was, with Cowell's approval, discarded. The heirs of Joseph Schillinger gave the Slonimsky instrument to the Smithsonian Institution in 1966. It is planned that this instrument will eventually be restored to working condition. A third rhythmicon apparently exists in the Soviet Union. In *The New York Times* of 26 April 1967 Harold Schonberg describes a visit to Leon Theremin's Moscow laboratory where a rhythmicon was seen. Efforts to contact Theremin by mail at this time have proved unsuccessful.

It is probable that the actual tone color of the rhythmicon was a secondary concern for Cowell. In the New York Public Library there exist two acetate disk recordings, from the Schillinger collection, of the rhythmicon's capabilities. These recordings were probably made before 1943. The sounds which are heard can only be described as rhythmicized grunts. The nearest equivalent sound among conventional instruments is that produced by short, heavy strokes of the bow on the string bass. Perhaps this rough tone was a principal reason for the lack of wider enthusiasm for the instrument.

Near the end of 1970, when the computer realization of the rhythmicon music was almost complete, it was learned that a complete set of orchestral parts for *Rhythmicana* was to be found in storage at the Library of Congress. It seemed that this material, which also included the original manuscripts of the first and fourth movements of the full score, though destined for Philadelphia, had been sent to the Library of Congress by mistake after the composer's death in 1965. Rubber stamps on the scores showed that the manuscripts had at one time been at the American Music Center in New York City and at the American Composers' Alliance library. All this material is now at the Fleisher Collection of the Philadelphia Free Library.

Study of the original of the fourth movement of *Rhythmicana* revealed several crucial errors in the copyist's score. In addition to misplaced tempo indications, Cowell's use of the signs < and > in the rhythmicon part were completely misunderstood. Cowell apparently intended these signs to mean *increase* and *decrease*, sometimes in regard to pitch (glissando up or down), sometimes in regard to tempo (accelerando or ritard-

ando). This was of course quite reasonable since these parameters of the sound were controlled by rheostats. Needless to say this movement had to be completely reprogrammed. It should be pointed out that at least as much flexibility must have been available in the dynamic realm, but there are no dynamics found anywhere in the rhythmicon part.

Causing the computer to reproduce the intricacies of the rhythmicon part presented no difficulties.<sup>10</sup> During the previous two years a generalized notation program for computer music called SCORE had been developed by this author which allows all the parameters of sound to be treated in musical terms.<sup>11</sup> A computer model of the rhythmicon as a single instrument, i.e. a single program block with the capability of playing all the required rhythms at once, could have been devised easily enough. However, since most of the time only a few of the rhythms are used at once, it was more economical, from the point of view of computer time, to set up an "orchestra" wherein each instrument played a single rhythm. The name given each instrument in the computer score was simply that of its rhythm; ONE, TWO, THREE, etc. The only rhythmic input necessary for each instrument was the number of beats to be heard in the time of a whole note: 1, 2, 3, . . . 16. The real time value of any rhythmic unit is determined by the TEMPO feature of the SCORE program and has complete flexibility. As indicated earlier, the pitches of the rhythmicon were in exactly the same relationships as the rhythms, that of the harmonic series. For reasons of economy, a separate instrument, with the capability of playing the glissandi found in the finale of *Rhythmicana*, was added to produce a fundamental pitch which could be multiplied for use by all the other instruments. This instrument was never to be heard and was activated only when the fundamental changed. In this way it was possible to restrict all pitch input for the sounding parts to the harmonic numbers associated with each of the rhythms. For example, in instrument SEVEN the rhythmic input was seven (seven beats per whole note) and the pitch input was seven (the fundamental frequency was multiplied by seven). Thus in the first movement, where the fundamental was set to C<sub>2</sub> (the low C of the cello), instrument SEVEN produces the seventh harmonic, a somewhat low B<sub>♭</sub> above middle C.

One of the problems concerning the rhythmicon notation was never fully resolved. Cowell's instructions state that the first line above the fundamental, labeled 1/2 on the score, is for "the off-beat key, which gives a beat in the middle of each measure." Although it is unknown what pitch the rhythmicon produced when this key was pressed, it seemed musically most satisfactory to shift this "off-beat" to one octave below the fundamental (i.e., half the frequency).

Several experiments were made in regard to timbre. There seemed to be little purpose in reproducing the rough quality heard on the rhythmicon recordings. In the San Francisco *Chronicle* of 16 May 1932 the tone



was described as a “cross between a grunt and a snort in the low ‘tones’ and like an Indian war whoop in the high tones. Frequently there is a combination of both.” Actually this type of timbre tended to obscure the differentiation of the rhythms. Since it surely was Cowell’s desire that the rhythmic intricacies be projected, a set of unobtrusively contrasting timbres was devised. Taken into account was the fact that rather low pitches must include stronger overtones if they are to balance properly with notes in the middle and upper ranges.

In all musical performance including a combination of a mechanical source and live players a major problem of coordination exists. It is fortuitous that the emergence of precoded tape as an ensemble instrument since the nineteenth fifties has paralleled a marked decrease in composers’ desire for the continual precise coordination of all the voices in a musical work.

Had *Rhythmicana* been performed in 1932 as originally planned, it can be imagined what kind of difficulties would have ensued. It is not infrequent that the soloist in a Mozart piano concerto will exhibit an independent idea of tempo when entering after an orchestral tutti. The rhythmicon’s basic tempo being set by a rheostat, to this day a none too accurate device, it would likely have been next to impossible to make an entrance at a tempo close enough to be within the conventions of the times. Once running, the rhythmicon’s flexibility in tempo was limited. There could be very little “give and take” between conductor and soloist. The problems are even greater when dealing with a prerecorded tape. In this case there is *no* flexibility.

The solution used in preparing *Rhythmicana* for performance was to devote one track of the tape to coordination beats which were transmitted to a single earphone worn by the conductor. Given the natural and necessary inclination of conductors to avoid mechanically precise tempi this called for considerable psychological readjustment. After a couple of rehearsals, however, the conductor came to accept the situation and succeeded in creating musical phrases, even under the tyranny of the machine. The simultaneous computer generation of the coordination track was extremely simple since the Stanford computer can produce up to four channels of sound at once. The original rhythmicon was “monophonic” so only one tape track was needed for its part.

Forty years after its composition, *Rhythmicana* was given its première on December 3, 1971 by the Stanford Symphony Orchestra conducted by Sandor Salgo. The work was greeted with considerable enthusiasm by the audience.

The music of *Rhythmicana* is representative of its time. The four movements take on the aspect of a suite, although considering the prominent solo part in all movements it is reasonable to call it a concerto. The

first movement, based on the note C, is an Introduction and Chorale using only the brass and piccolo in orchestra; the second, based on E, is a Scherzo for woodwinds; the third, based on G, is a “passacalia” [sic] for strings; the finale, again based on C, uses the full orchestra and is without subtitle. It is interesting to note that another work of the same year, Bartók’s Piano Concerto No. 2, shows a similar interest in creating maximum instrumental contrast between movements.<sup>12</sup>

The individual movements of *Rhythmicana* are further contrasted by their uses of specific modes of musical organization as well as the exploitation of particular facets of the rhythmicon. The Introduction of the first movement utilizes only the rhythmicon, and indeed Cowell writes on the score that this section may be extracted for solo performance. The Introduction is very strictly organized and presents a résumé of rhythms over the fundamental of one beat per measure on low C (C2). After four bars of the fundamental, the second harmonic (i.e., two beats per measure and one octave higher) is added. After four more bars the fourth harmonic is added and so on until we hear all the octave relations (1, 2, 4, 8, 16) and then the process is reversed. This is followed by a similar procedure involving the octaves above the third harmonic and rhythm (1, 3, 6, 12), the fifth harmonic and its octave (1, 5, 10), and the seventh harmonic and its octave (1, 7, 14). A curious aspect of this opening section is that, as a result of the exclusive use of two as a multiplier, one begins to experience something like the octave effect applied in the realm of rhythm.

The Introduction continues with other equally methodical combinations. A climax is reached when two-bar groups are alternated which exploit all the even-numbered and then all the odd-numbered harmonics. The result is rather unlike any progression produced by conventional means. The effect is that of *relative* harmonic and rhythmic simplicity followed by *relative* complexity. Yet, since all the sounds are from the same harmonic series, the contrast is that of changing illumination of always the same color. The Introduction is brought to a conclusion with the bar by bar addition of voices, beginning 1, 2, 3/ 1, 2, 3, 4/ etc., until all sixteen parts, plus the “off-beat,” are heard together. This ushers in a great C major chord in the brass section, which continues “in style of a choral.”

The effect of this Introduction as a separate piece is strangely hypnotic. With its persistent sounding of the fundamental low C and the different-but-same quality produced by the strict harmonic relationship of all the other notes, this work emerges as a prominent member of the musical “drone” family which stretches from long before Purcell’s *Fantazia upon One Note* up to and beyond Terry Riley’s *In C*. Cowell’s work, however, is closely related to a special aspect of the contemporary aesthetic of the “object.” Here we have a musical “object,” in this case “hard-edge,” which never really progresses, but is rather simply “exposed” to the ear.

The primary procedure utilized in the brass chorale is that of having one or two planes of major triads moving in exact parallelism. The second half of the rhythmicon Introduction returns, now superimposed on the brass music.

The second movement is a scherzo with trio, but, instead of returning *da capo*, the music moves directly to a coda. The scherzo has something of the flavor of the brittle, chromatic German jazz of the late twenties while the trio is a polytonal, triadic waltz which, by its intentional naiveté, produces a very "American" sound. Throughout the scherzo section the rhythmicon presents an ostinato, based on a fundamental E, of all available rhythms at a relatively slow pace. One complete cycle of the rhythmicon covers four 2/4 bars of the woodwind music. The solo part remains silent during the trio but reenters in the coda, where the score asks that the rhythmicon "tune as fast as possible and as high as possible." Nevertheless metronome marking of half note equals sixty (the tempo of the scherzo) and the layout of the score seem to indicate that Cowell wanted the rhythmicon to move at exactly four times its original speed. Since pitch and tempo on the instrument were controlled separately it is impossible to know what pitch was intended. (Was this an aleatoric element?) No help is given by the woodwind parts which here produce a kind of non-harmonic parody of the rhythmicon. A tuning one octave above the opening E was used for the computer realization of the solo part at this point.

The third movement, "passacalia," divides the string orchestra into nine parts. An eight-bar phrase is presented eleven times with subtle modification of the tone-cluster texture. The clusters are played at times ponticello, tremolo, as harmonics, as trills, and in the ordinary manner. The rhythmicon part, now based on a fundamental G, takes on a quasi-melodic role in this movement. For the first time we hear the upper harmonics of the rhythmicon as single entities. The first phrase presents one harmonic per measure. Cowell's notation of the beginning of this phrase and a conventional transcription of it appear in Example 2.

Example 2. "Passacalia," entrance of rhythmicon.

(CONVENTIONAL NOTATION)

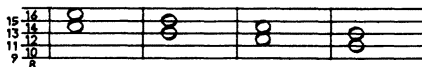
The next several phrases present a problem that has not been fully solved. The score instructs to “play keys in time as written.” A typical measure of the rhythmicon notation appears in Example 3.

Example 3. “Passacalia,” rhythmicon part, measure 30.



The mechanism of the rhythmicon, which apparently began all the rhythmic cycles at the beginning of each measure, must have caused the three last notes in the example to begin on partial rhythms since none of the rhythmic divisions are multiples of four. Faithful computer realization of such passages was achieved but, because of the semi-staccato envelope employed, a much more musical result was obtained by shifting the partial beat to the end of each short segment in the cycles. Thus each cycle was treated as if beginning at quarter note intervals. The melodic writing in the rhythmicon part, being restricted to harmonics seven through sixteen, recalls the unadjusted pitches of the top range of the baroque trumpet. A particularly successful effect is produced by a passage of “written” parallel thirds (Example 4).

Example 4. “Passacalia,” rhythmicon part, measures 33–36.



Of course the true interval between the pitches is always changing while the difference between the harmonic numbers remains the same.

The finale begins with an orchestral tutti. A passing gesture to the rhythmicon writing found in the previous movement appears in several of the wind parts where an even-tempered version of the ten upper harmonics is used (Example 5).

Example 5. Finale, measure 3.



A new technique to appear in the solo part is that of varying the pitch and tempo rheostats while notes are being played. The rhythmicon entrance is shown in Example 6.

Example 6. Finale, rhythmicon part, measures 11–18.

PITCH - HIGHEST C TEMPO ○=6 SECONDS		SLIDE PITCH TO LOW C TEMPO TO ○=3				REMAIN REMAIN	
15	14	15	14	15	14	15	14
13	12						
11	10						
9							
7	6						
5	4						
3	2						
1							

The orchestral music in the middle of the finale presents contrapuntal planes of parallel triads interspersed with tempo and pitch changes in the rhythmicon. The last solo statement of the rhythmicon is a sixteen-bar *ritardando* and *accelerando* using the upper eight harmonics. This leads into the coda which uses again the opening tutti material while the rhythmicon reverses a procedure heard in the first movement. Now the rhythms are added on from the top downward (Example 7).

Example 7. Finale, rhythmicon part, measures 176–179.

ONE MEASURE OF R. EQUALS ♩ IN ORCHESTRA.

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
13	12	11	10	9	8	7	6	5	4	3	2	1		
11	10	9	8	7	6	5	4	3	2	1				
9	8	7	6	5	4	3	2	1						
7	6	5	4	3	2	1								
5	4	3	2	1										
3	2	1												
1														

MM ABOUT ♩=70  
(FOR ORCHESTRA)

The work ends with a blaze of fanfares arriving on an extended C-based chord plus all the notes of the rhythmicon (Example 8).

There remains to be written a thorough history of American music at the beginning of the nineteen thirties. From our present perspective it is clear that a talented and inventive group of composers were embarking upon their careers at that time and that a more than adequate father-figure was emerging in the person of the retired Charles Ives. It is also evident that the fourteen years of depression and war greatly undermined the support that was due these musicians, putting off until the nineteen fifties the first large-scale flowering of American music.

Henry Cowell lived long enough to see his position as one of the few true pioneers of American music become well recognized. Cowell's *Rhythmicana* was perhaps the first work of quality that exploited in a fun-

Example 8. Finale, last chord in orchestra.



damental way the new electronic technology. It took another twenty years for electronic music of various sorts to reach the point where composers of only ordinary vision could advantageously make use of its capabilities. *Rhythmicana* will surely remain a curiosity, but one whose essence was an early harbinger of a most important aspect of twentieth-century music.

## NOTES

<sup>1</sup> Henry Cowell, *New Musical Resources* (New York: Knopf, 1930 [written in 1919]; 2nd ed., New York: Something Else Press, 1969).

<sup>2</sup> Leon Theremin was born in Russia in 1896 and resided in the United States from 1927 until 1938. During this time he developed many electrical musical instruments and collaborated with several composers, of whom the best known were Cowell, Percy Grainger, and Joseph Schillinger. Theremin's last reported location (1967) was in the U.S.S.R., where he was Professor of Acoustics at the Moscow Conservatory.

<sup>3</sup> From chapter on Henry Cowell by Nicolas Slonimsky, in *American Composers on American Music*, ed. Cowell (Stanford University Press, 1933; 2nd ed., New York: Frederick Unger, 1962).

<sup>4</sup> Among Cowell's early works are others that show his great interest in complex rhythmic relationships. In some prefatory notes for his two quartets, "Romantic" and "Euphometric" (1915–1917), which are on handwritten sheets dating from 1964, found in the Americana Collection of the Library and Museum of the Performing Arts of the New York Public Library, Cowell wrote: ". . . I used the ideas more freely in several musical compositions, employing these concepts in rhythm and flowing polyphony, but not always with the precise exactitude—Hence the name 'Romantic' quartet for 2 fl., vla. and vlc. and 'Euphometric' quartet for 2 v., vla. and vlc. They were totally impractical works at that time, and therefore thought of as entirely fanciful. However, I hoped that an instrument could be devised that would control even more complex rhythms by means of simple performance on a keyboard. . . . At present the 1st movement of the Romantic qt could only be performed, with its rhythmic complications, by electronic means. If this is done the quality of sound should be varied, but warm and rich, and slightly rubato rather than icy in tone and rigid in rhythmic durations."

The piano piece titled *Fabric* (1917) demonstrates in various combinations the interactions of rhythmic units of one through nine. In a preface Cowell sets forth a "shapenote" system for all divisions of the whole note through sixteen parts.

<sup>5</sup> Gertrude Norman and Miriam Lubell Shrifts (eds.), *Letters of Composers: An Anthology, 1603–1945* (New York: Knopf, 1946).

<sup>6</sup> This letter is quoted from Nicolas Slonimsky, *Music Since 1900*, 4th ed. (New York: Scribner's, 1971).

<sup>7</sup> The last two paragraphs of the *Argonaut* review read as follows: "Mr. Cowell used his Rhythmicon to accompany a set of violin movements which he had written for the occasion and which were interpreted by Carol Weston. The accompaniment was a strange complexity of rhythmical interweavings and crosscurrents of a cunning and precision as never before fell on the ear of man, and the sound-pattern was as uncanny as the motion. The sound and rhythm are both produced by a new principle of television, and are caused by the influence of light on a photo-electric cell.

The writer believes that the pure genius of Henry Cowell has here put forward a principle which will strongly influence the face of all future music."

<sup>8</sup> Letter from Nicolas Slonimsky to the author, November 7, 1970.

<sup>9</sup> Payment for the first rhythmicon is recorded on a receipt that Theremin received \$200 from Cowell on March 7, 1931, "for a 'rhythm' instrument to be constructed by me." (Item in the Americana Collection, New York Public Library at Lincoln Center.)

In a letter to the author, Mrs. Henry Cowell described the fate of this instrument: "The first rhythmicon made a round trip or two between NYC and California in Henry's car, and was left at the Department of Psychology at Stanford University, because some psychological tests using it were proposed. This never came about, and when the Department of Psychology moved into new quarters about 1938, the instrument, which was unusable and whose case had cracked and come unglued, so that the whole thing was a wreck—at the time of the move, with HC's permission the instrument was thrown away. It never worked very well from the first, and it got worse and worse."

<sup>10</sup> A full explanation of the principles of computer music may be found in Max V. Mathews, *The Technology of Computer Music* (Cambridge, Mass.: M.I.T. Press, 1969). One of the earliest articles on the subject to appear in a music journal was by James Tenney, "Sound Generation by Means of a Digital Computer," in *Journal of Music Theory* 7 (1963).

<sup>11</sup> Leland Smith, "SCORE—A Musician's Approach to Computer Music," *Journal of the Audio Engineering Society* 20/1 (1972). All computer work described was done on a Digital Equipment Corporation PDP10 computer at the Stanford Artificial Intelligence Project.

<sup>12</sup> In Bartók's second piano concerto the instrumentation of the movements is as follows:

- I. Woodwinds, brass and percussion
- II. Adagio—Strings and timpani  
Presto—tutti  
Adagio—Strings and timpani
- III. Tutti

In his first piano concerto (1926) Bartók uses only percussion and winds in the second movement.