Decryption in Three Parts

2024

for percussion trio, sensors, and electronic sound

Commissioned by line upon line

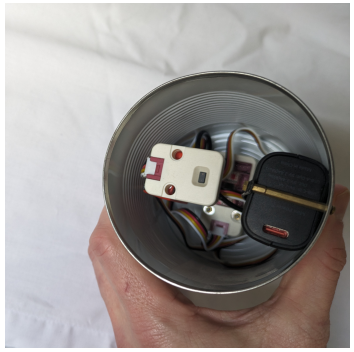
Benjamin Hackbarth

This piece uses wireless sensors installed inside of tin cans to create controllers for each of the three percussionists. At times, the controllers act as virtual microphones, processing and filtering sounds that the percussionists are making on other instruments. At other moments, the movements of the cans generate electronic sound. The form of the work charts a journey from mostly acoustic at the start to entirely electronic at the end — the sounds of the final minutes of the piece are created entirely out of the motions of the performers. The work is divided in to ten sections: Begin Transmission, Can(on), Radio Active, Live Broadcast, Shell Game, Docking Sequence, Air Lock, That Sinking Feeling, Ouverture, Piano Three Hands.

Tin Can Sensors

The sensors inside of the cans transmit low-latency information about distance of the can from the table, its xyz angle, and xyz acceleration. The cans are available to hire from the composer along with the Max/MSP patch which receives the sensor data and then drives sound synthesis and processing.

The cans are used in over a dozen different ways over the course of the piece. These are enumerated in the final section of this document along with inline links to video demonstrations of each usage. They are also all catalogued on this page: http://benhackbarth.com/d3p/vids.php



In addition, the following webpage contains videos describing how to setup and use the cans from a technical perspective:

http://benhackbarth.com/d3p/technical_videos.php

This page provides two different methods for connecting the tin cans to the computer, one method uses a router and the other does not: http://benhackbarth.com/d3p/establishing_a_network.php.

Stage Setup

The following gear is required:

- 3 wedge monitors
- subwoofer
- 3 microphones (I use KM184s) or 3 contact microphones
- 3 tin can sensor instruments (supplied from the composer)
- Laptop running Max/MSP patch
- Mixer

The following are notes on arranging equipment in the performance space:

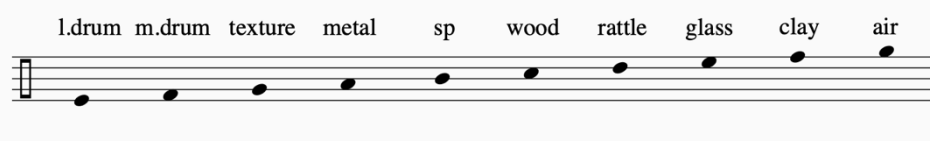
- The wedge speakers should be place underneath the table of each player. Use high quality stage monitors (they are the main sound outputs and should be angled towards to audience). Angle them to give wide coverage for the audience.
- A subwoofer is also suggested to capture low frequencies in the electronics, which are prevalent in the final minutes of the composition.
- The percussionists should be spaced apart by at least 2m.
- The contact microphones are to be attached to the sandpaper surface instruments of each player. Conventional mics are preferred as long as feedback isn't an issue.
- The audience must be able to see the tin cans; ensure that they are not obstructed by stands or other instruments.
- The tin can distance sensors work best on flat white surfaces, so a white cloth or sheet stretch over each of the three tables is ideal.

Lighting

Lighting for this work can be more or less conventional for acoustic instruments. If time and resources permit, it would be nice to have a lighting change of some sort at letter S. A lighting change here could be a difference in ambient lighting. But if could also consist of adding focused spots on each of the three players to highlight the movement of the wireless controllers. It would be ideal for the lighting change here to be fairly quick in terms of transition time; e.g. 2-4 seconds.

Required Instruments

Each percussion part requires the same list of instruments. Some are be selected by the player, and selections should contrast with the other players' choices. All instruments placed on a foam-covered table; all are thus deadened. The foam should be covered with a white sheet or towel to help optimize the tin can's distance sensors. In the score, instruments are arranged according to the following drum map. Protracted passages with a single instrument utilize a single-line staff.



l.drum - A clear resonant sounding drum-like instrument. Could be a tom, conga, kick drum, small bass drum, or inverted plastic bucket. Avoid anything pitched or anything with snares.

m.drum - A clear resonant sounding drum-like instrument, higher than l.drum. Could be a tom, conga, kick drum, or inverted plastic bucket. Avoid anything pitched or anything with snares.

texture - A textured object which sounds good scraped but can also be struck. Could be a guiro, a grooved tube, stiff drier hose, nails glued onto a thin cardboard box. Avoid non-resonant surfaces; e.g. flat materials.

box - A small cardboard box, taped shut, which is filled with interesting sounding objects and/or trash. For instance, an unopened amazon box full of broken glass.

sp - An A4/letter sized sheet of sandpaper taped to a slightly larger board or book. Played with a mallet with sandpaper wrapped around the head and taped on, see demo here.

wood - Clear-sounding crisp attack wooden object. For example, a medium- or high-pitched woodblock.

rattle - shaker-like object to be struck with mallet. Could be a single maraca, chicken shake, or jar full of beads.

glass - empty glass vessel. E.g. a whiskey bottle or glass bowl.

clay - high-pitched, punchy-sounding ceramic object. For example an inverted teacup, muffled flower pot, inverted bowl. Avoid anything resonant or anything that rings.

air - A can of compressed air for cleaning electronic equipment. Played by striking the can on it's side with a mallet or picked up and discharged.

Notations

X noteheads - Play with the shaft; if a drum, play with the shaft on the rim

Staccato (on traditional percussion instruments) - a deadstick.

Dashed slurs – This symbol always connects pairs of notes on the same instrument. The first note is a deadstick where the mallet remains in contact with the object for the duration of the slur. The second note is created by scraping the depressed mallet off of the surface.

"Txt stick" – Use a wooden stick with textured grooves.

Performance Notes

Demo videos and explanations for each of these techniques can be found at: http://benhackbarth.com/d3p/vids.php

1. **Sandpaper Surface** (m. 1): Perform with a sandpaper-covered mallet on the sandpaper surface. Each character indicated is to be drawn with a distinct shape and the same number of drawing actions each time it is encountered. There are 14 different characters you must learn — `C, i, P, H, E, R, …, S, T, O, rect, ., ?, !.` Note that, for most characters, the written duration doesn't matter; you should perform individual drawing actions as quickly and crisply as possible. However, for the characters `C, rect, !, O`, and `S` duration does matter as it scales the speed of the main drawing action. This section is amplified at the start. Ensure your tin can is right-side up until letter A. Dynamics are largely stable in this section. Given the same dynamic, the "butt" technique is expected to be softer than the mallet head.

2. **Can Amplifier** (m. 19): Your tin can acts as a virtual amplifier for the sounds you make on the sandpaper surface. If the can is upside down on the table, little amplification is given. However, if you flip the can right-side up, your sound will be amplified through the speaker under your table. Moreover, if you lift the can off of the table, more amplification is given the higher the can is from the table.

3. **Sideways Amplifier** (m. 52): Here you rotate your can sideways, pointing at another player indicated in the text (e.g. "right" indicates to point the can at the player furthest to your right). This amplifies the sound of this player's actions through your speaker, in effect panning their sound to you. The gesture you should make is a quarter circle turning motion. Note that the strength of the amplification depends on your angle — pointing straight at them (90º) gives full amplification; 45º is half, and can down on the table is no amplification.

4. **Vertical Amplifier** (m. 55): Here your can remains upside-down, however you move in vertically up and down to create a change in the processing of your amplified sound. When you raise it higher, the sound will get louder. A phasiness is also introduced to simulate moving the position of a virtual microphone akin to a doppler effect. This means that certain heights are linked to certain processing results, and therefore heights in cm are given throughout the score to give a precise sense of position relative to the table.

5. **Radio Can** (m. 102): Your can now functions as a simple radio. The can must always be upside down and should remain on the table. Tapping the hole on the top of the can turns on a radio station. Tapping again with the same gesture turns it off. Sometimes the center player's can functions as a tuning dial and, when turned, changes the station of your radio.

6. **Tuner Dial** (m. 121): Your can now functions as a radio tuner dial. Hold the can aloft at shoulder height. When you turn the can in clock-like circles you'll create a click sound every 40 degrees; there will be 9 clicks total in a full circle revolution. The notation shows a rhythm of clicks to try to create; don't worry about where you are in the circle, all that matters is the rhythmic timing of the clicks. You can turn the can in either direction or change directions. A tremolo indicates to turn the can quickly for a ratchet-like effect. If the can radio of the right or left player is turned on (see note 5), your dial will change the station of their radio.

7. **Compressed Air** (m. 161): Create sustains by discharging the can of compressed air without the tube affixed. Dynamics are created through changing the pressure on the button to let more or less air out. These gestures should be very quiet overall with punchy start and end points. The dynamics of both the compressed air sound and the sandpaper gesture should be roughly equal.

8. **Number Radio** (m. 161): In this section the radio signal becomes a Numbers Station. A voice announces a number at the start of each bar which is indicated in the bottom staff. You play the same number of notes per bar as specified by the radio.

9. **Radio Controls** (m. 220): Your can controls the volume and station of a

Numbers Station. The volume of the station is controlled with vertical movement and is notated from low to high on the staff - the bottom line is the can down on the table; the top line is 50cm above the table. The tuning is controlled by turning the can to the angle specified. Changing stations must always be done with a quick gesture. Note that the can sensors only register distance from the table when the can is not at an angle and thus an angle of 180º is always given whenever the can is moving up or down.

10. **Fine Tuner** (m. 224): Rotate the can to affect the fine tuning of percussionist 3's radio station. Hold the can in front of you at shoulder height and twist left or right in a clock-like motion. The middle line of the staff indicates that the can is pointing straight upwards (180º). Notes above the middle line indicate to twist the can clockwise; the top line indicates the can is upside-down at 0º. Notes below the middle line indicate to twist the can counter clockwise; the top line indicates the can is upside-down at 360º.

11. **Perri-Air** (m. 233): Your can now modifies the amplitude and processing of a noise stream depending on up/down vertical movement. Your can must always be upside down and never tilted sideways. The staff shows the vertical position of the can relative to the table in increments of 10cm — the bottom line is on the table; the middle line is 25cm above the table, and the top line is 50cm above the table. At letter N, a strobing effect is applied. Each time the center percussionist plays it changes the samples of the perri-air synthesis to match their timbre. At letter O, the strobing pulsations become attack sounds and changes in your vertical position change the samples used.

12. **Blow Vessels** (m. 295): Play the tin can like a can of compressed air – putting your finger over the hole in the top starts the sound, lifting it off stops it. Note that there is a crescendo effect when you release each sustained note which happens at the end - the peak of the crescendo will always occur 0.5 counts after you release the note. The rhythms in the score show when to release the note, not when the note stop sounding. The sampled sounds that you hear are created by blowing air into a resonant vessel – the vessel that is used is given in text above your staff. You periodically change this sound set by performing a rapid knocking gesture, shown in the score as a tilted can with arrows; this gesture will not make a sound, but will change the vessel blowing to a new set of samples.

13. **Low Instrument Sustains** (m. 332): Sempre can right-side up. Start a note by dramatically slapping your hand down on the can, covering the opening and the distance sensor eyelet. Stop the note by releasing your hand — like Blow Vessels, the sound will actually end 0.5 counts after you release it. When you vertically lift the can off the surface the note will be filtered; a larger distance will filter higher partials.

14. **Piano C4** (m. 340): Sempre can upside down. Tap the hole in the can to trigger a piano note; tap as if playing a piano key. Note that duration doesn't matter; the previously tapped note is turned off by the next note's onset.

15. **Piano C4 Harmonics** (m. 344): Sempre can upside down. You no longer play individual pitches by tapping; notes are now played automatically when the whooshing electronic sound is at its peak. Rather than creating piano onsets, the vertical position of your can controls the virtual position of a muting finger on the C4 piano string. When higher, the muted string produces higher harmonics; when on the table, the fundamental pitch is produced. Moving the can also affects the speed of the electronic whooshes; faster movement yields more dramatic changes.

At letter S you are asked to improvise vertical gestures. At one before S, m. 343, you shouldn't move and let the can remain down on the table. Then, at your discretion, pick up the can; this is the beginning of letter S. Improvise gestures to elucidate the harmonic string -> vertical movement coupling for the audience. At m. 347 cue the other percussionists. The music is now as written and your can should be 25cm high at the start of m. 347.

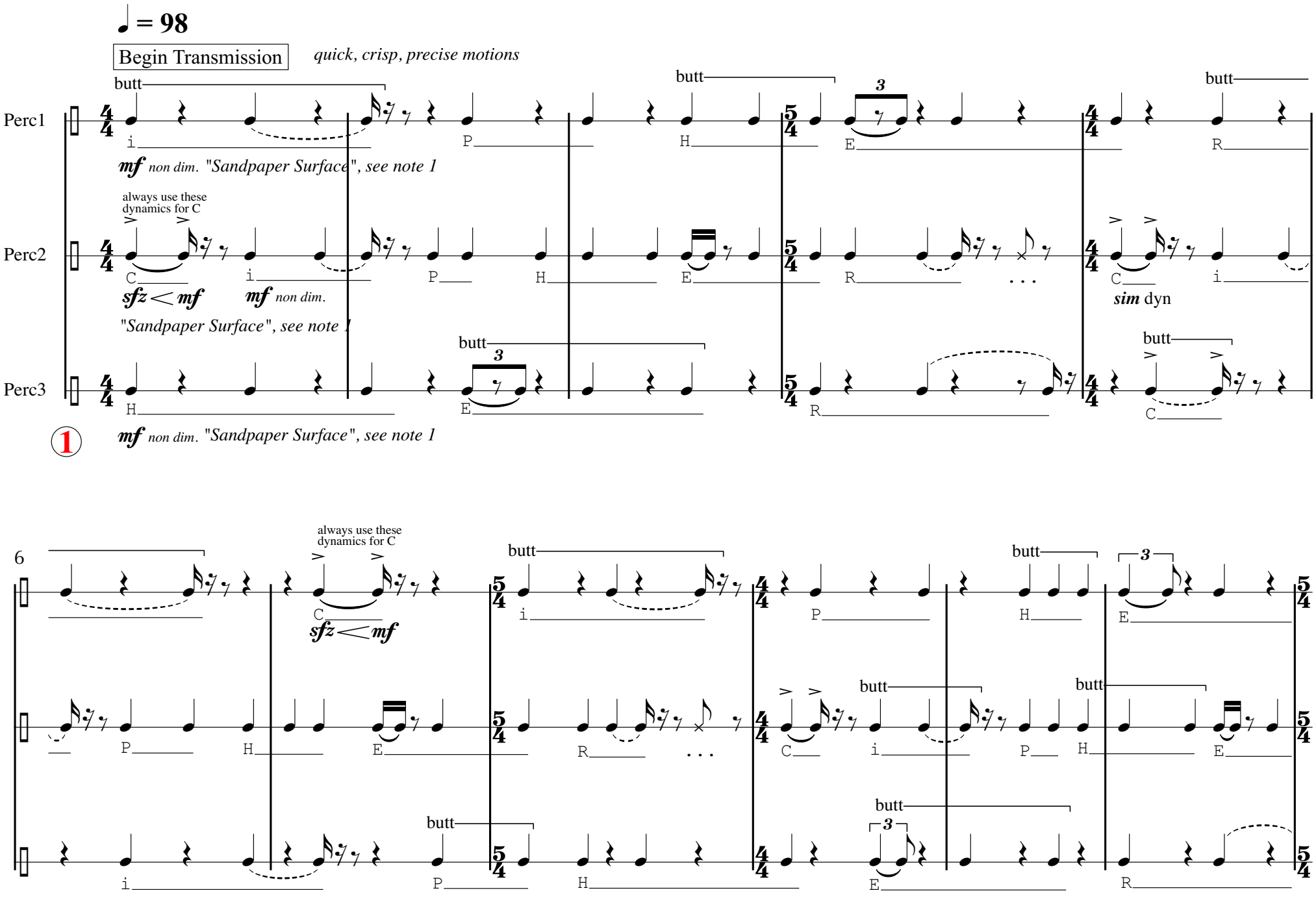
16**. Piano Interior** (m. 347): Sempre can right-side up. Visually dramatic actions create percussive samples taken from striking the interior of a piano with the pedal down. There are four different types of gestures: 1) a quick knocking gesture where you rapidly rotate the can 45º and then back to original position; 2) plunge the can down onto the table and let it remain there;

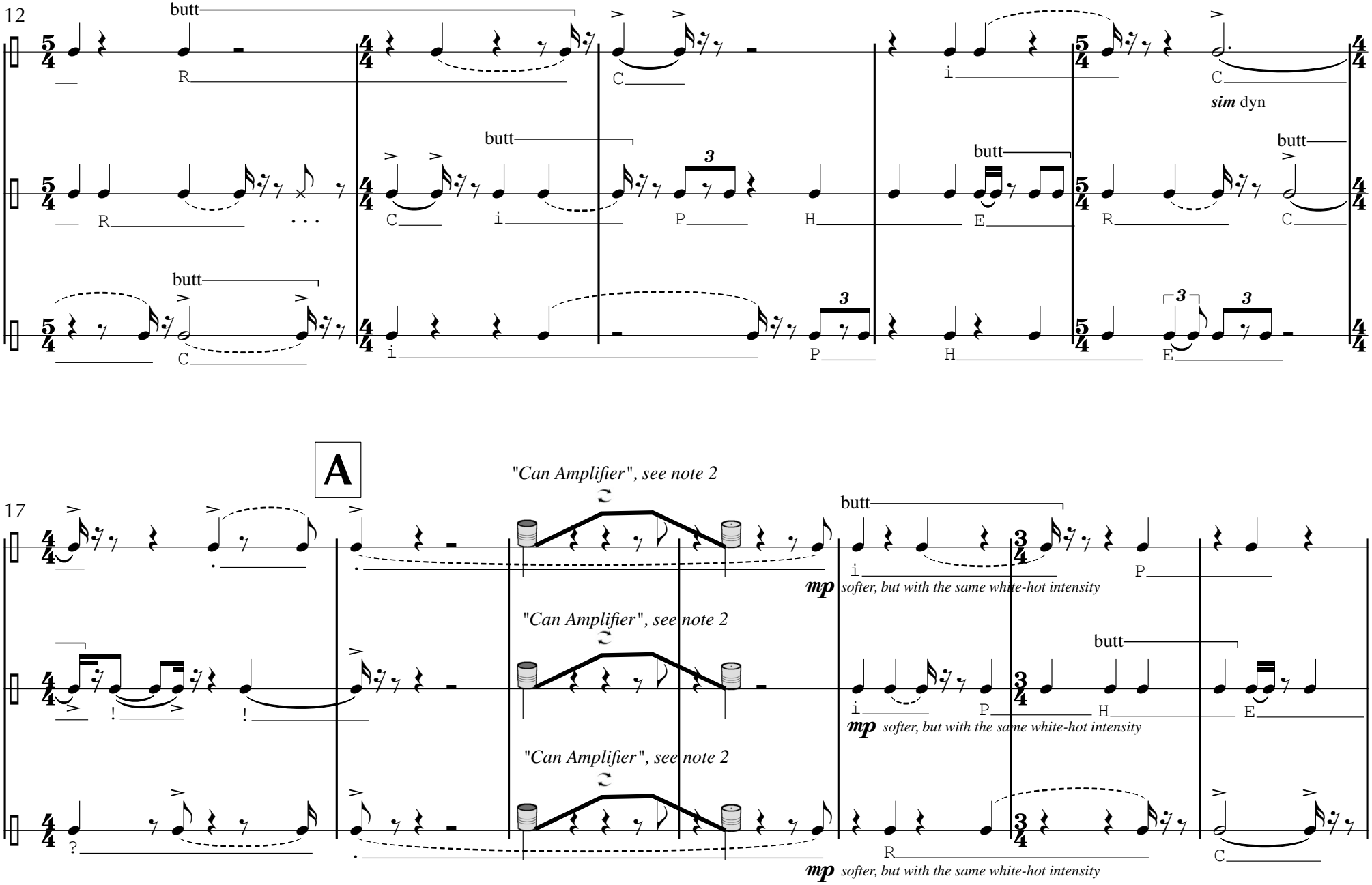
3) quickly lift the can back off of the table; and 4) when the can is down on the table, slap your hand over the top to cover the opening. Dynamics in quotation marks indicate the visual intensity of the action; e.g. a louder knock gesture should be more dramatic and have a larger motion than a softer one.

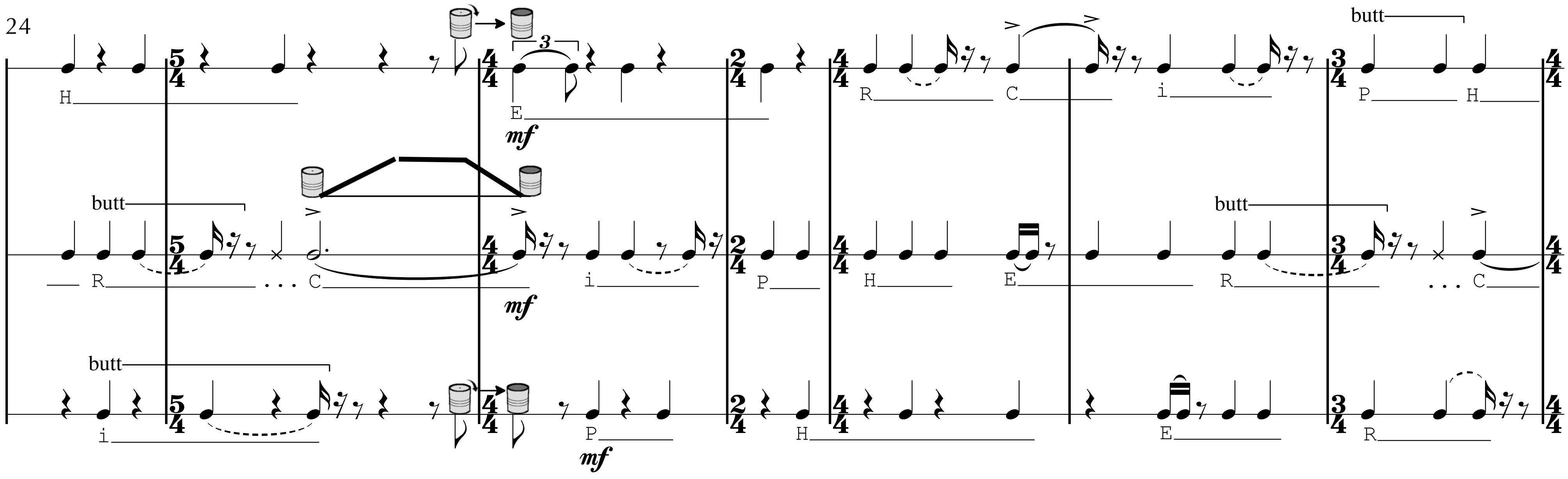
17. **Piano Cluster** (m. 355): Moving the can up and down vertically changes the timbre of sustained piano clusters. M. 356 asks you to improvise gestures like those show in the video – this type of gesture should only happen when the can is 50cm or more off the table. Only improvise this gesture periodically; try to listen for the decelerating repeated sustain piano tones and perform this gesture in response to them. In terms of the up and down movement, know that when the can approaches the table a clear piano pitch emerges – avoid this sound until the last few bars of the piece.

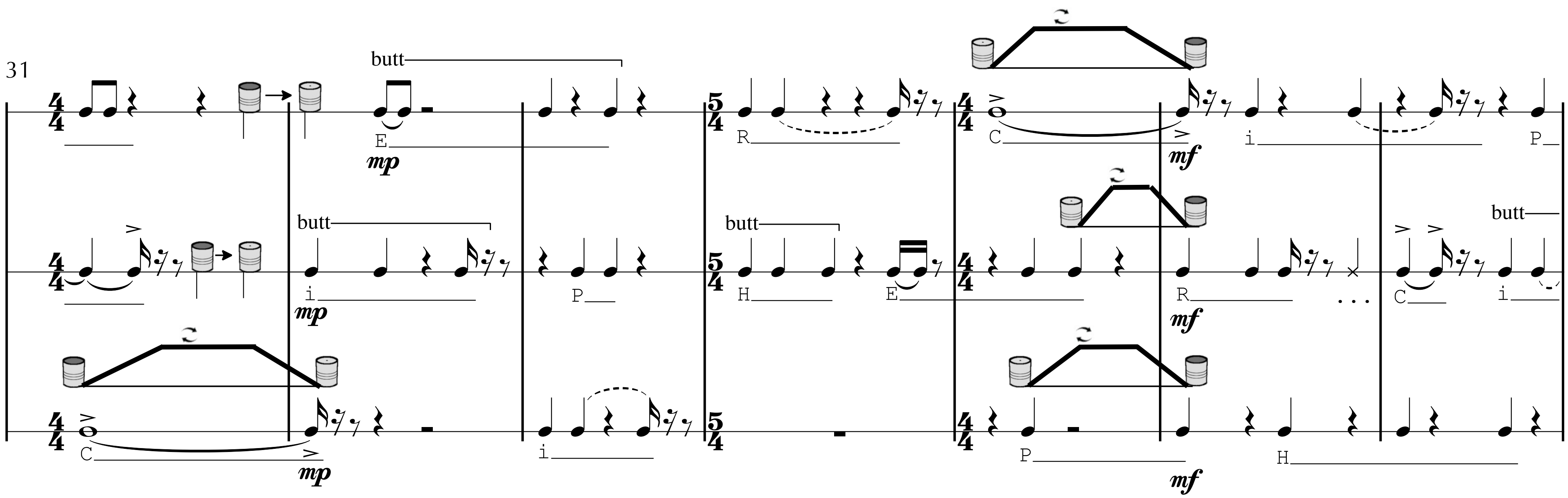
18. **Piano Bass** (m. 358): Up/down motions with the can right-side up change the amplitude of a low bass rumble. It would be good to have a subwoofer for this one.

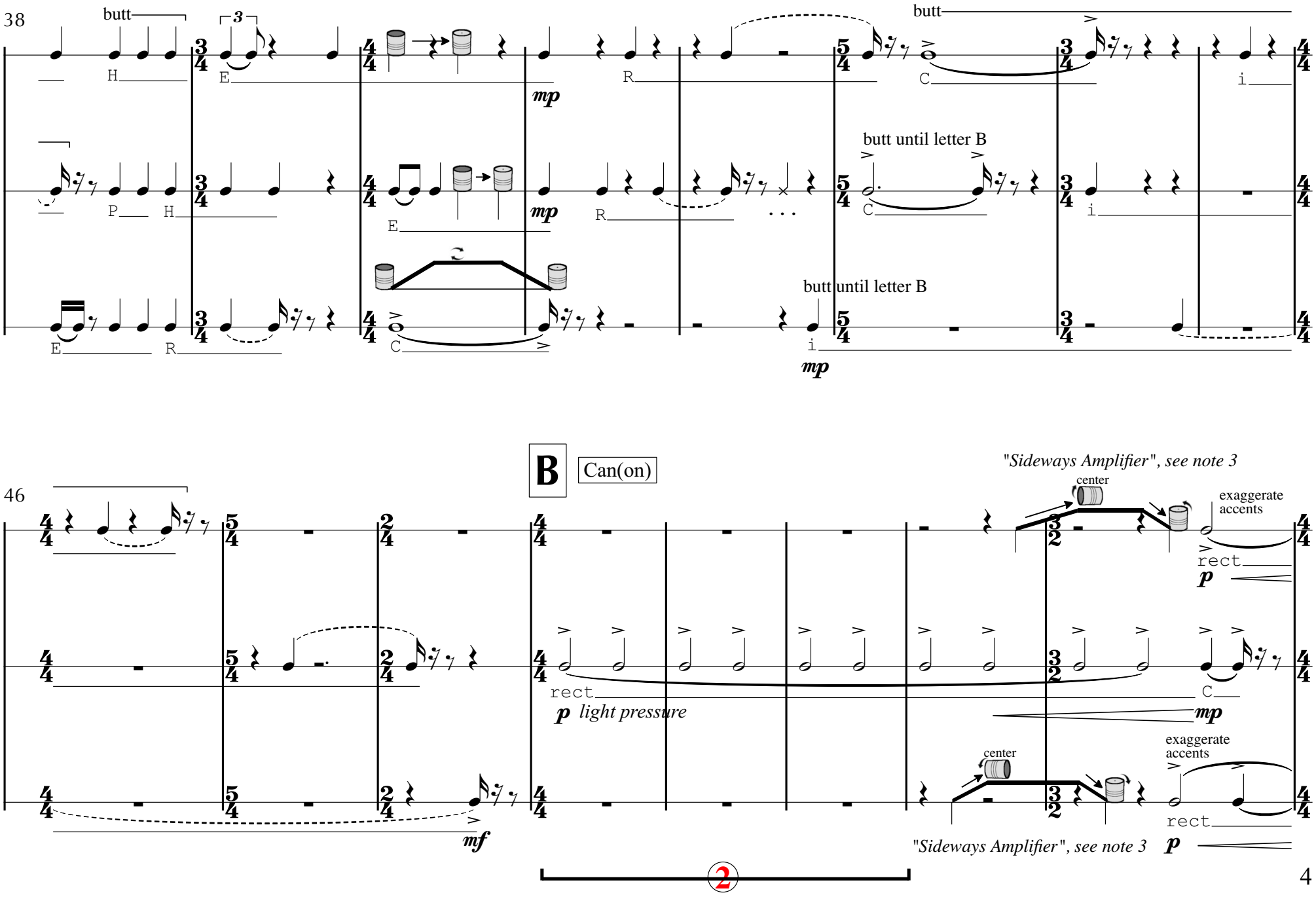
19. **Piano C4 Pluck** (m. 359): Sempre can upside down. Lifting the can off the table produces a plucked C4 string. The note is sustained as long as the can is held aloft. Turning the can left or right pans the sustained sound to other speakers. Always use sudden, jerky movements to change from one position to another.

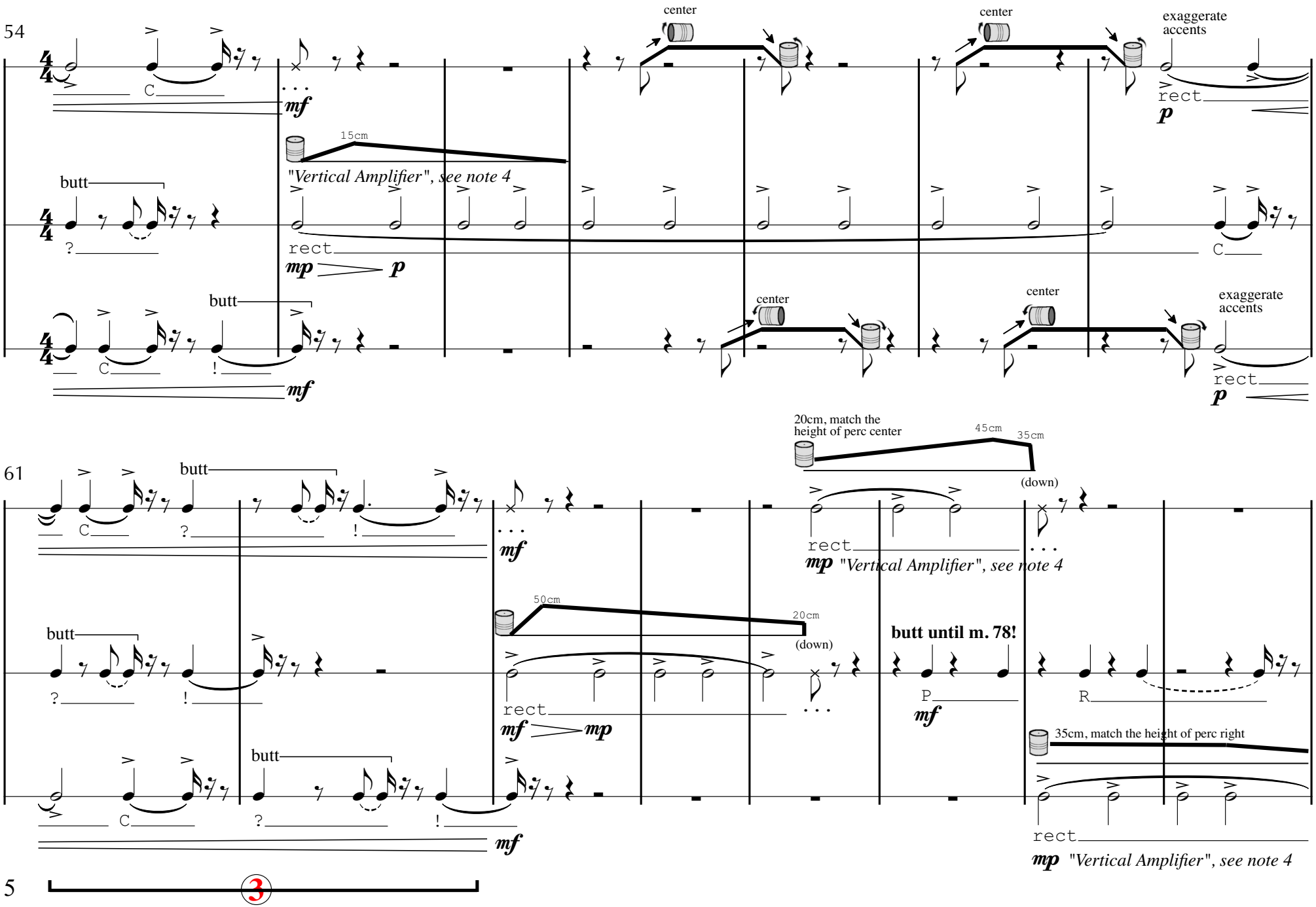

♩ = 98
Begin Transmission
quick, crisp, precise motions
Perc1
Perc2
Perc3
butt
always use these dynamics for C
mf non dim. "Sandpaper Surface", see note 1
sfz < mf
sim dyn
1
6

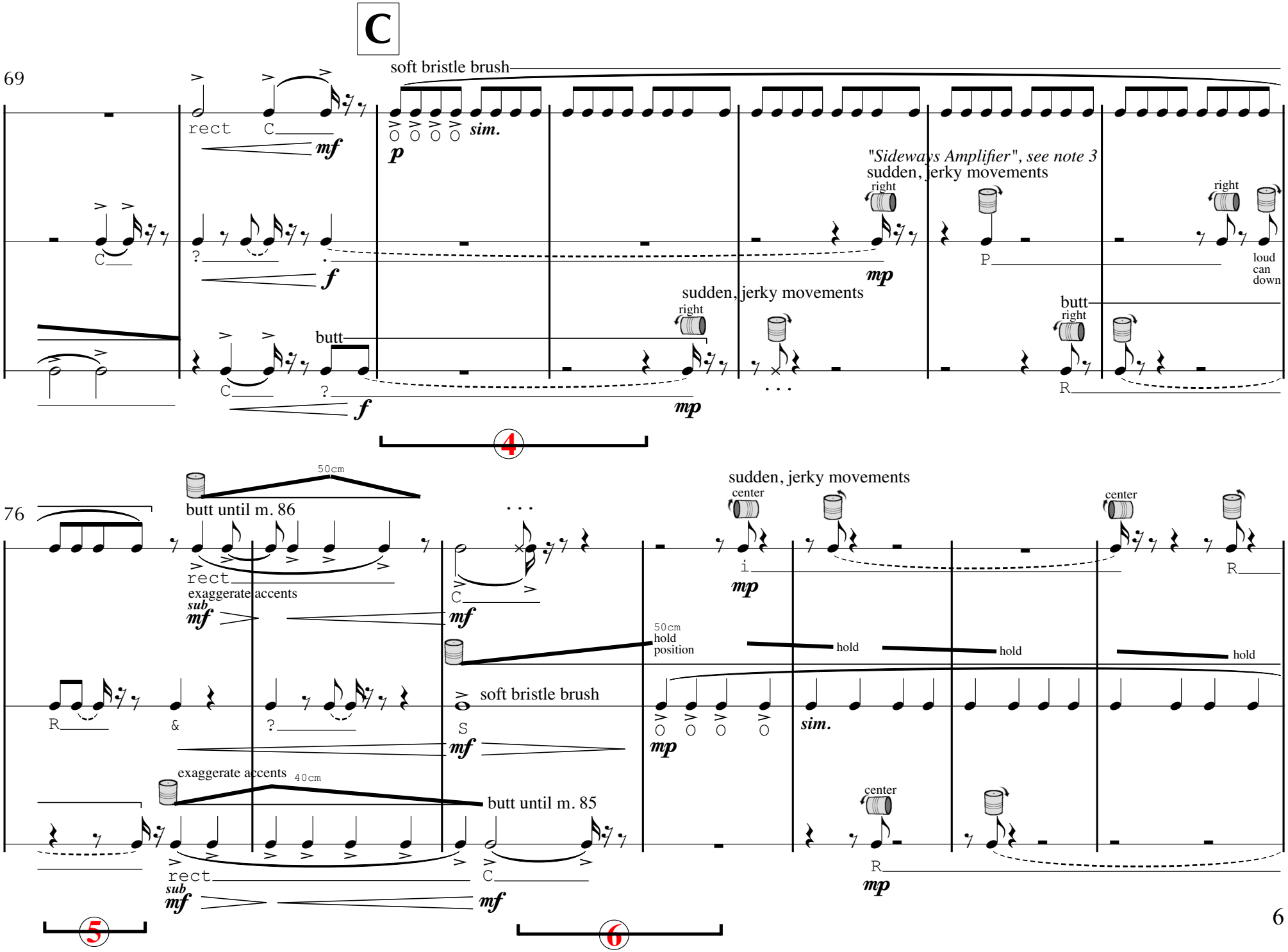

12
butt
R
C
i
C
sim dyn
butt
butt
butt
R
C
i
P
H
E
R
C
butt
C
i
P
H
E
A
17
"Can Amplifier", see note 2
butt
i
P
mp softer, but with the same white-hot intensity
"Can Amplifier", see note 2
butt
i
P
H
E
mp softer, but with the same white-hot intensity
"Can Amplifier", see note 2
R
C
mp softer, but with the same white-hot intensity

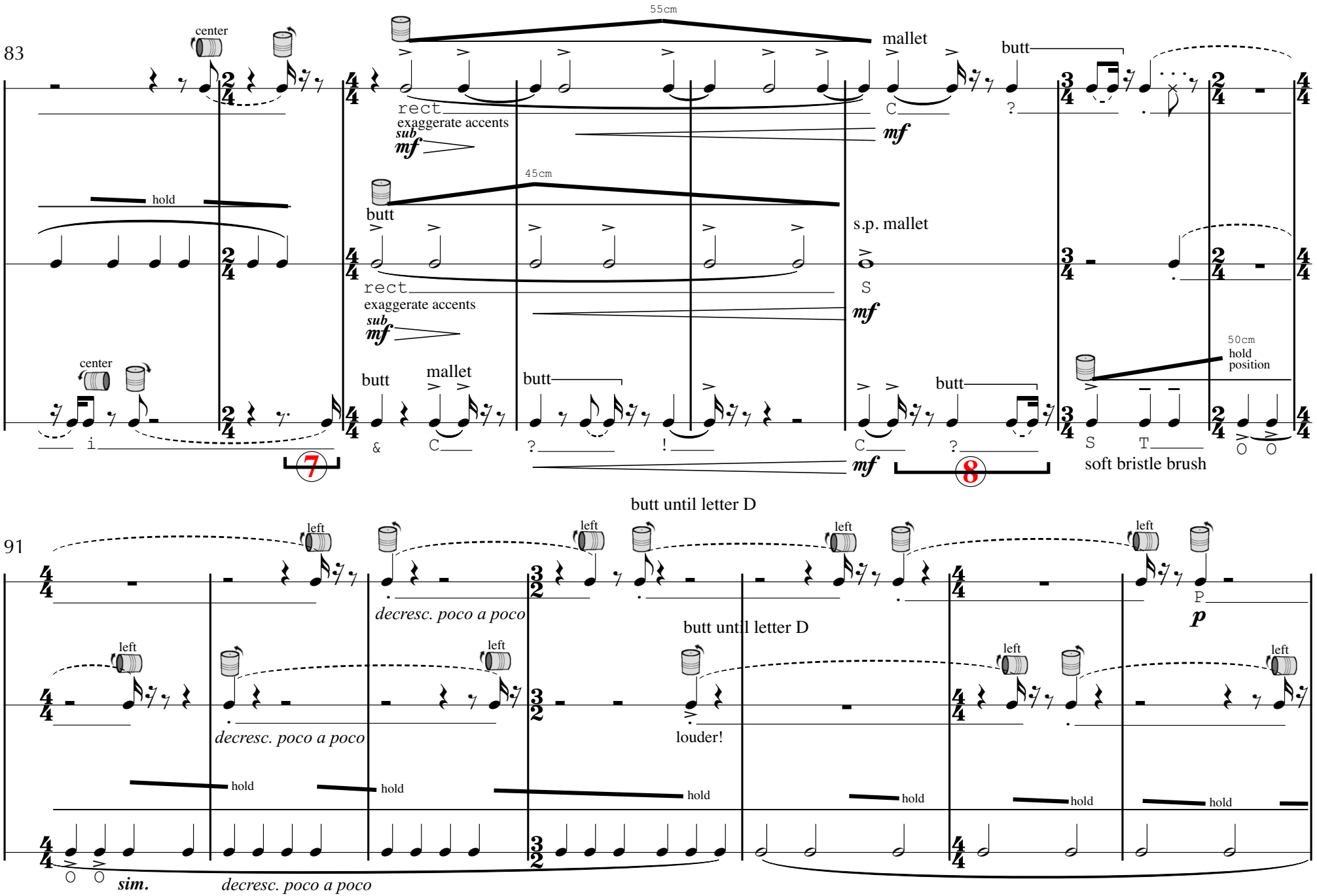

24
butt
H
E
mf
R
C
i
P
H
butt
R
. . . C
mf
i
P
H
E
R
butt
. . . C
butt
i
P
mf
H
E
R

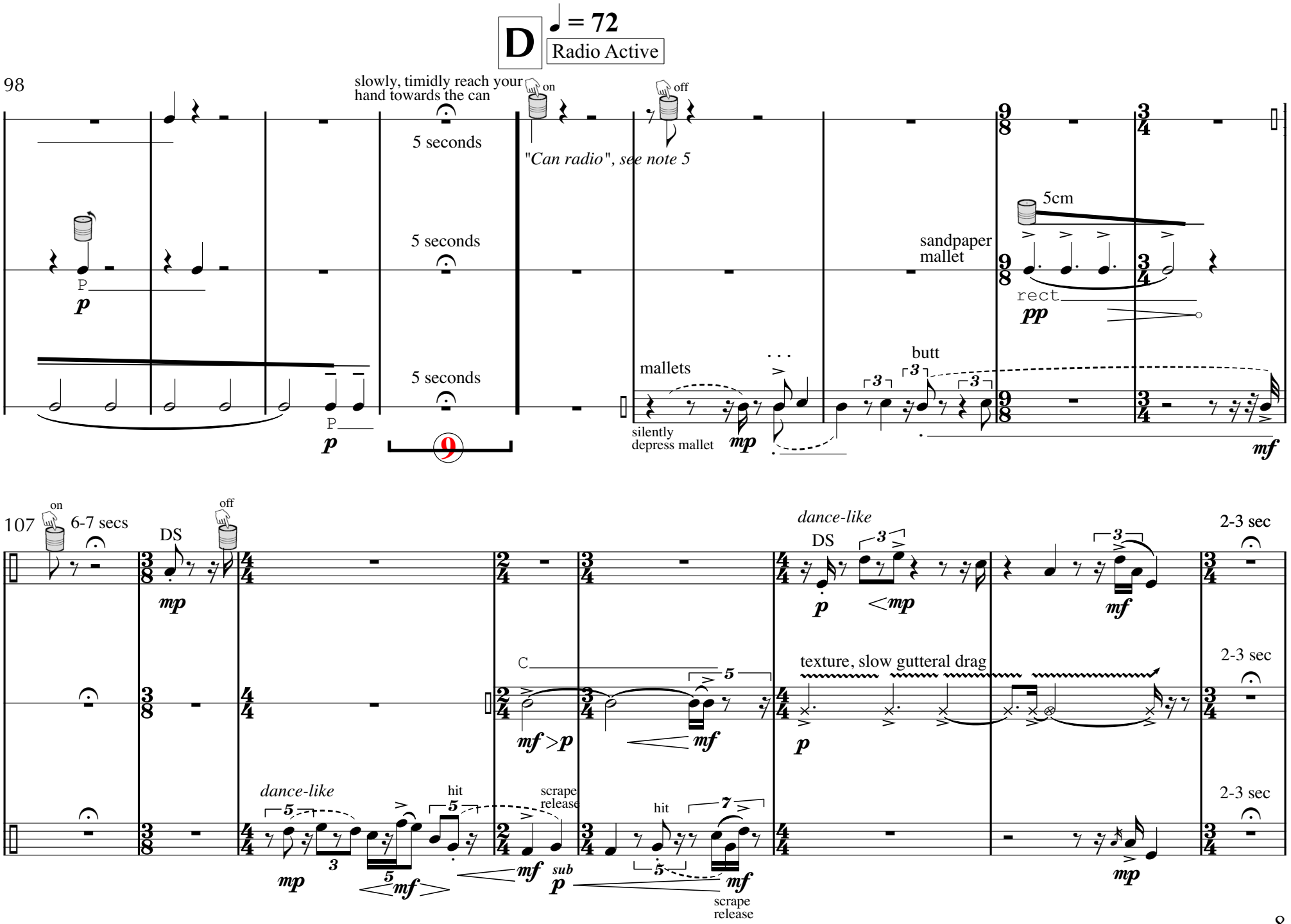

31
butt
E
mp
R
C
mf
i
P
butt
i
mp
P
butt
H
E
R
mf
. . .
C
i
butt
C
mp
i
P
mf
H

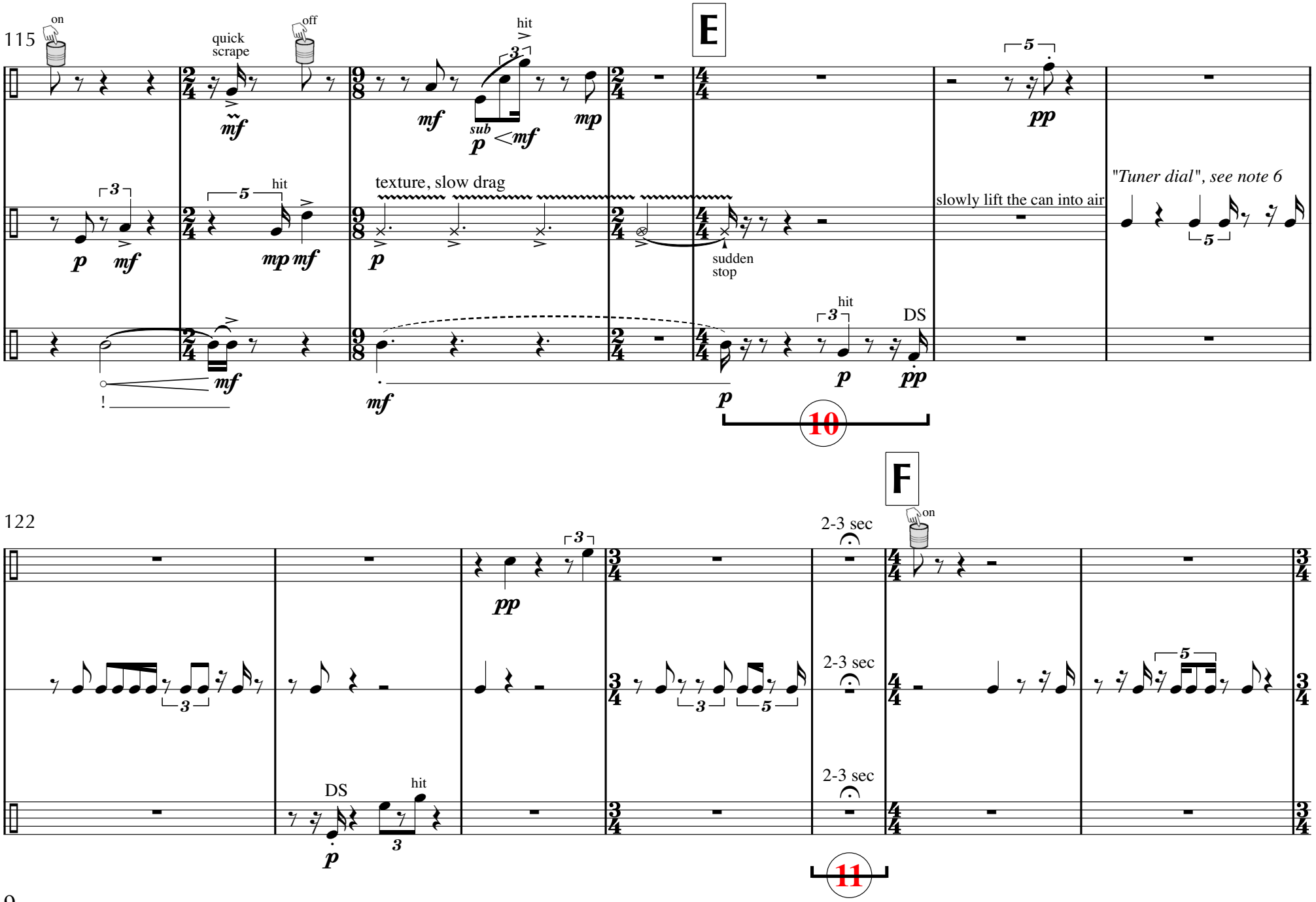

38
butt
butt
butt until letter B
butt until letter B
mp
mp
mp
B
Can(on)
46
"Sideways Amplifier", see note 3
center
exaggerate accents
rect
p
p light pressure
mp
center
exaggerate accents
rect
"Sideways Amplifier", see note 3
p
mf
2

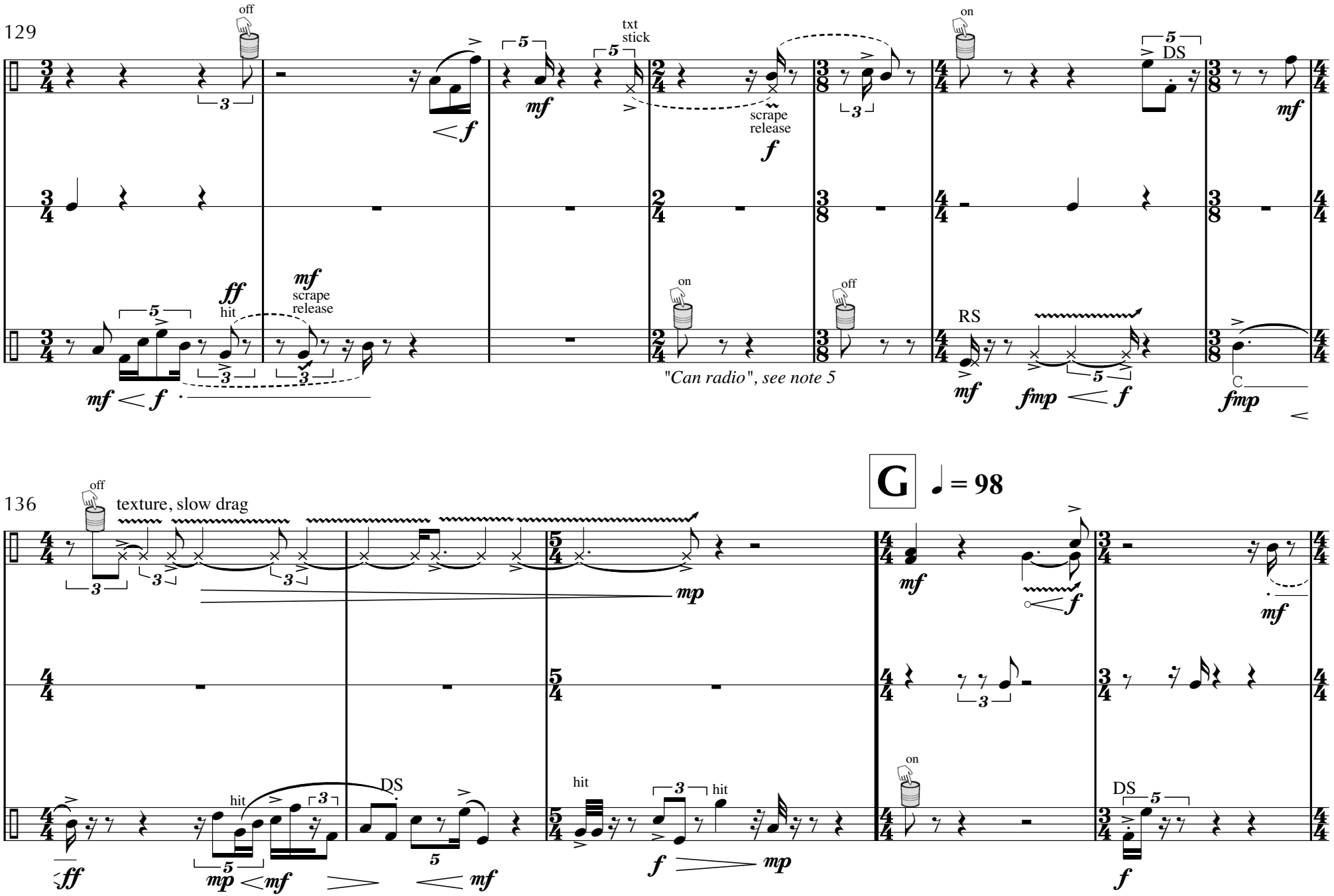

54
center
center
exaggerate accents
15cm
"Vertical Amplifier", see note 4
butt
rect
mp
p
mf
61
20cm, match the height of perc center
45cm
35cm
(down)
50cm
20cm
butt until m. 78!
35cm, match the height of perc right
"Vertical Amplifier", see note 4
5
3

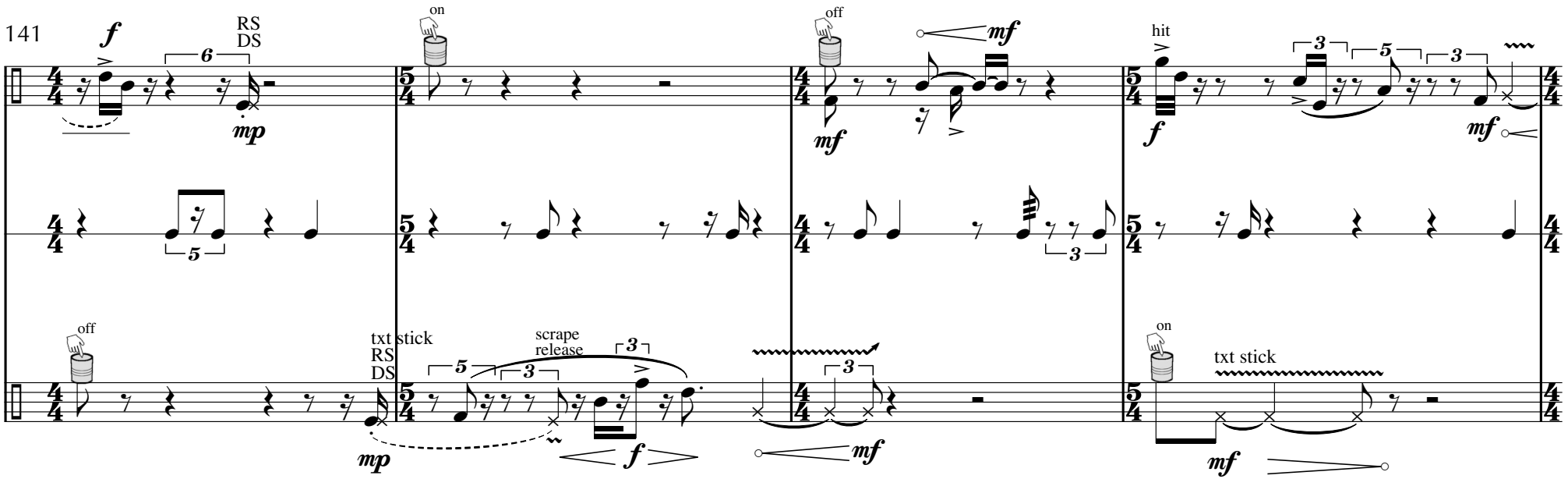

C
69
soft bristle brush
rect
C
mf
p
sim.
"Sideways Amplifier", see note 3
sudden, jerky movements
right
mp
P
loud
can
down
butt
f
4
76
50cm
butt until m. 86
exaggerate accents
sub
mf
hold
position
hold
soft bristle brush
S
exaggerate accents
40cm
butt until m. 85
center
i
R
5
6

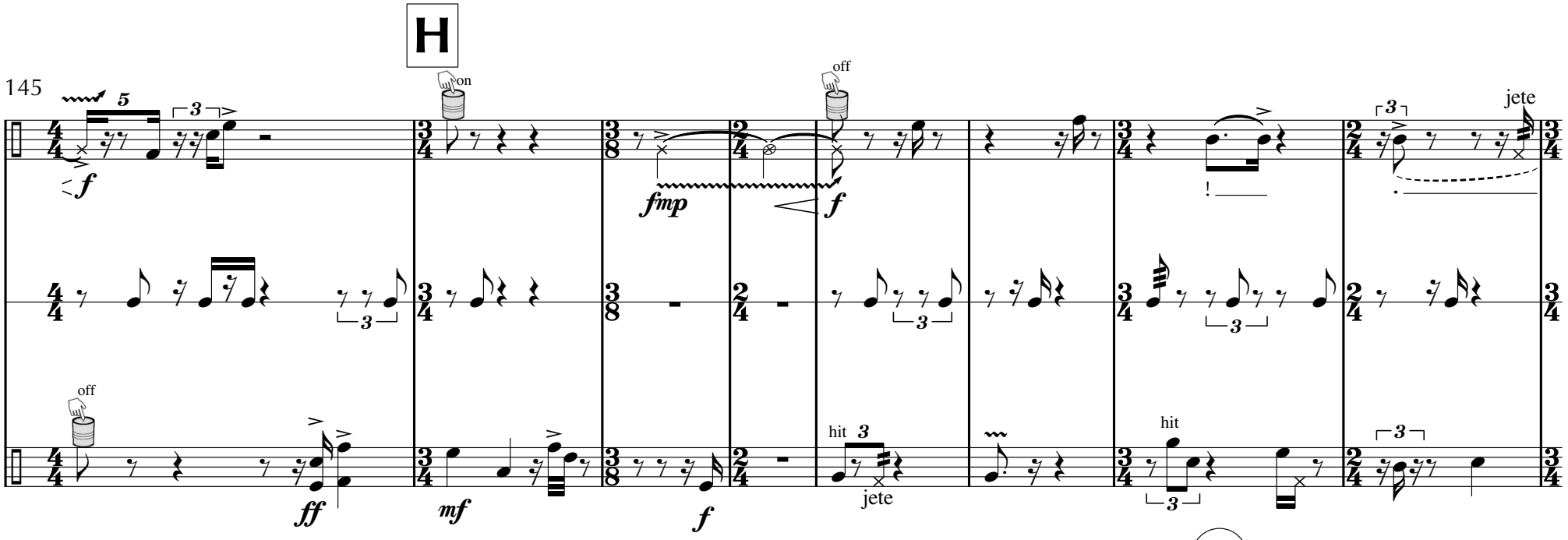

83
center
55cm
mallet
butt
rect
exaggerate accents
sub
mf
mf
hold
45cm
butt
s.p. mallet
rect
exaggerate accents
sub
mf
S
mf
50cm
hold
position
center
butt
mallet
butt
butt
i
&
C
?
!
C
?
S
T
mf
7
8
soft bristle brush
butt until letter D
91
left
decresc. poco a poco
butt until letter D
P
p
louder!
hold
O
O
sim.
decresc. poco a poco
7

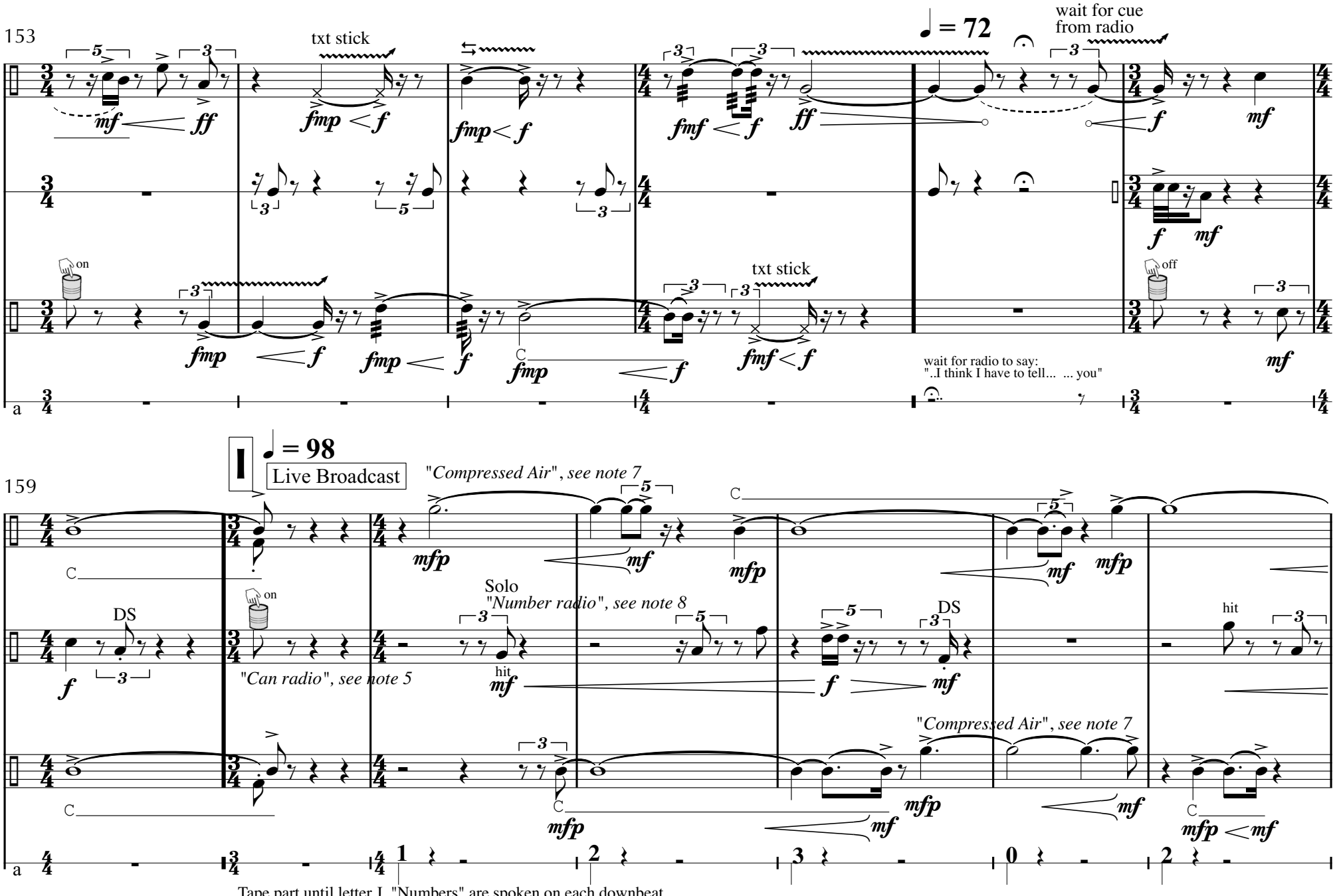

D
= 72
Radio Active
98
slowly, timidly reach your hand towards the can
on
off
5 seconds
5 seconds
5 seconds
"Can radio", see note 5
5cm
sandpaper mallet
rect
pp
mallets
butt
silently depress mallet
mp
mf
9
107
on
6-7 secs
DS
off
mp
dance-like
DS
p
<mp
mf
2-3 sec
C
mf >p
mf
texture, slow gutteral drag
p
2-3 sec
dance-like
hit
scrape release
mp
mf
sub p
hit
mf
scrape release
mp
2-3 sec


115
on
quick scrape
off
hit
E
texture, slow drag
hit
slowly lift the can into air
"Tuner dial", see note 6
sudden stop
hit
DS
10
122
F
2-3 sec
on
DS
hit
2-3 sec
2-3 sec
11


129
off
txt
stick
scrape
release
on
DS
mf
ff
hit
mf
scrape
release
on
off
"Can radio", see note 5
RS
fmp
136
off
texture, slow drag
G
= 98
mp
hit
DS
hit
hit
on
DS

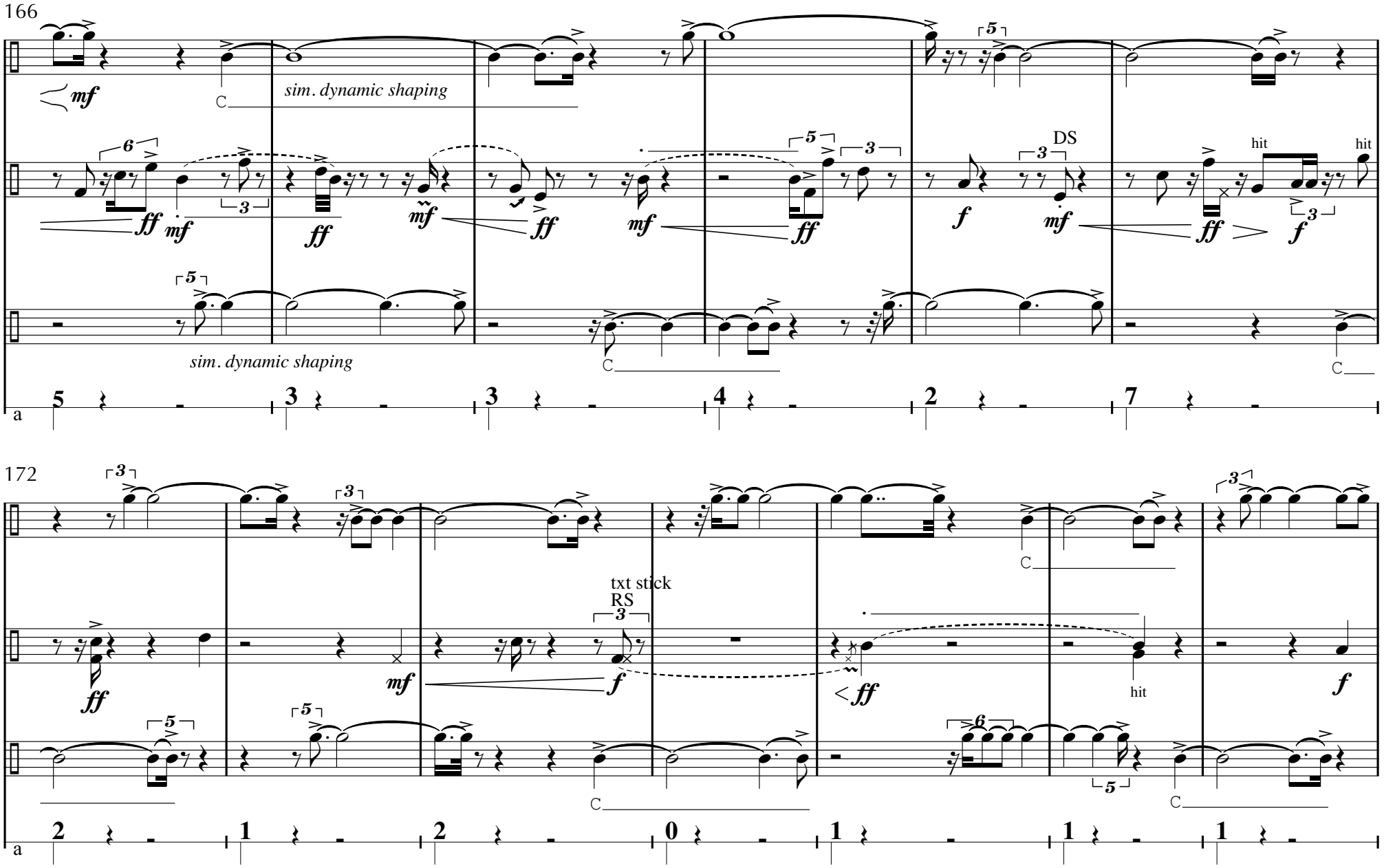

141
RS
DS
on
off
hit
off
txt stick
RS
DS
scrape
release
on
txt stick

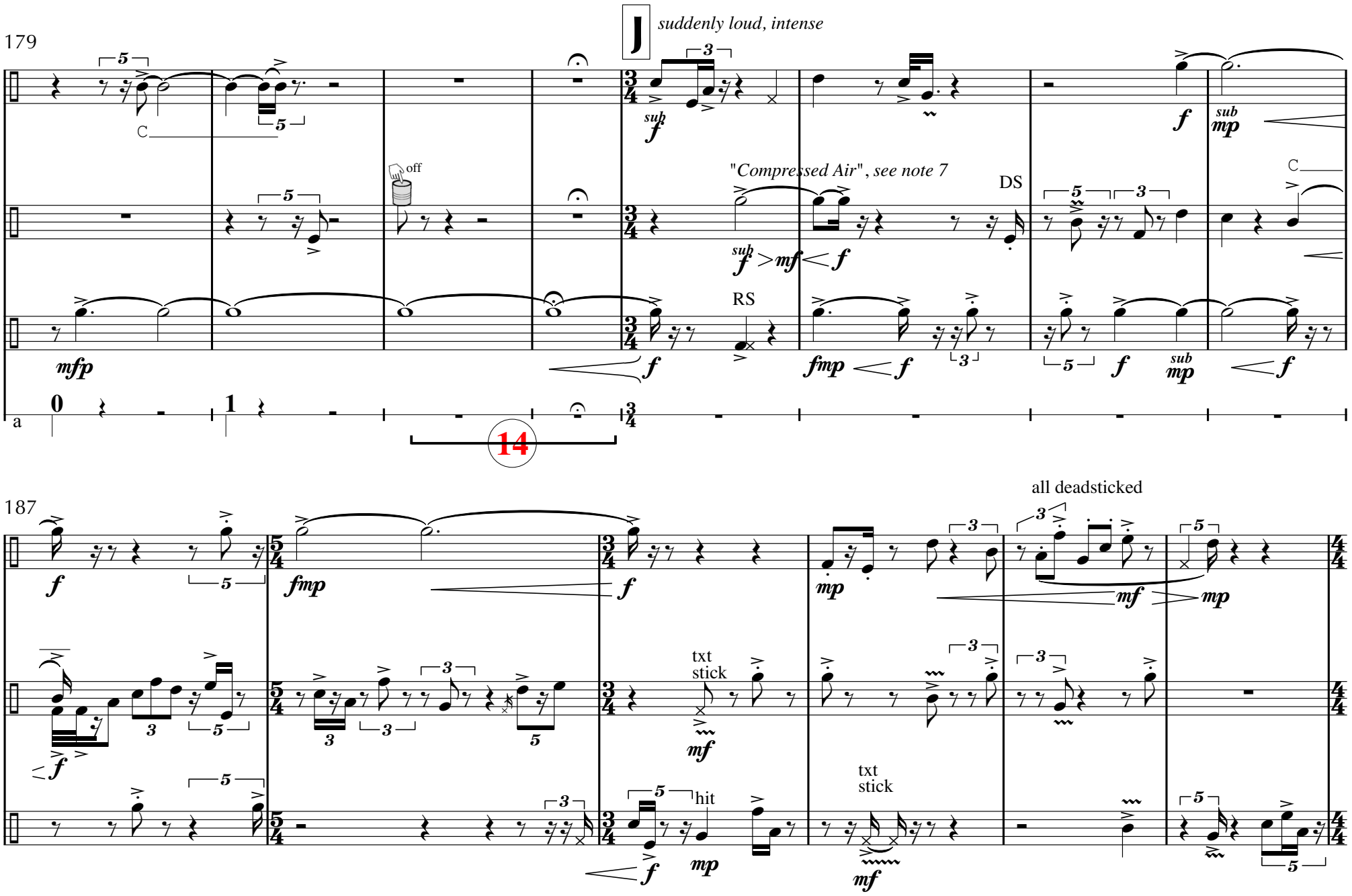

H
145
on
off
jete
off
hit
hit
jete

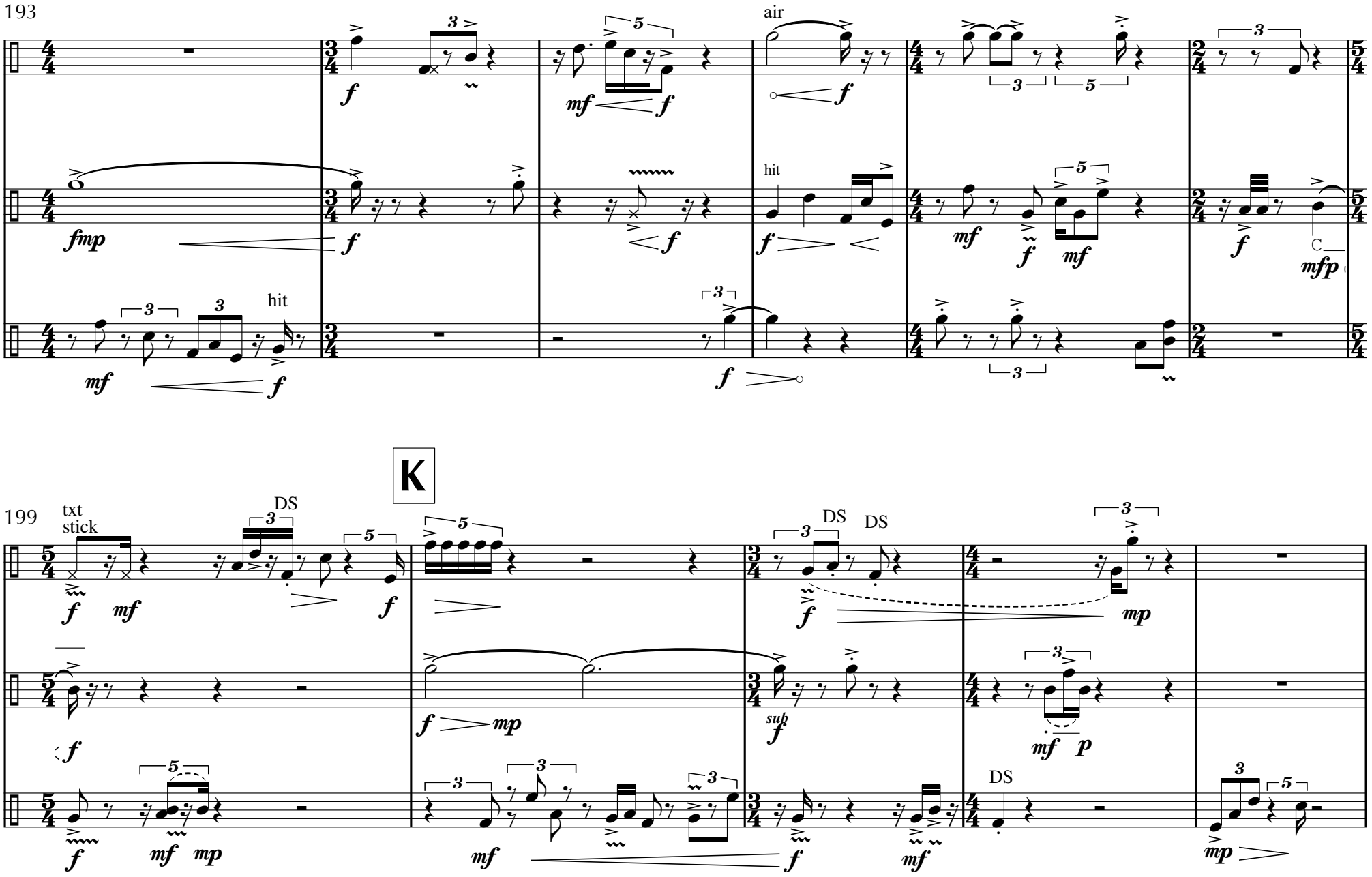


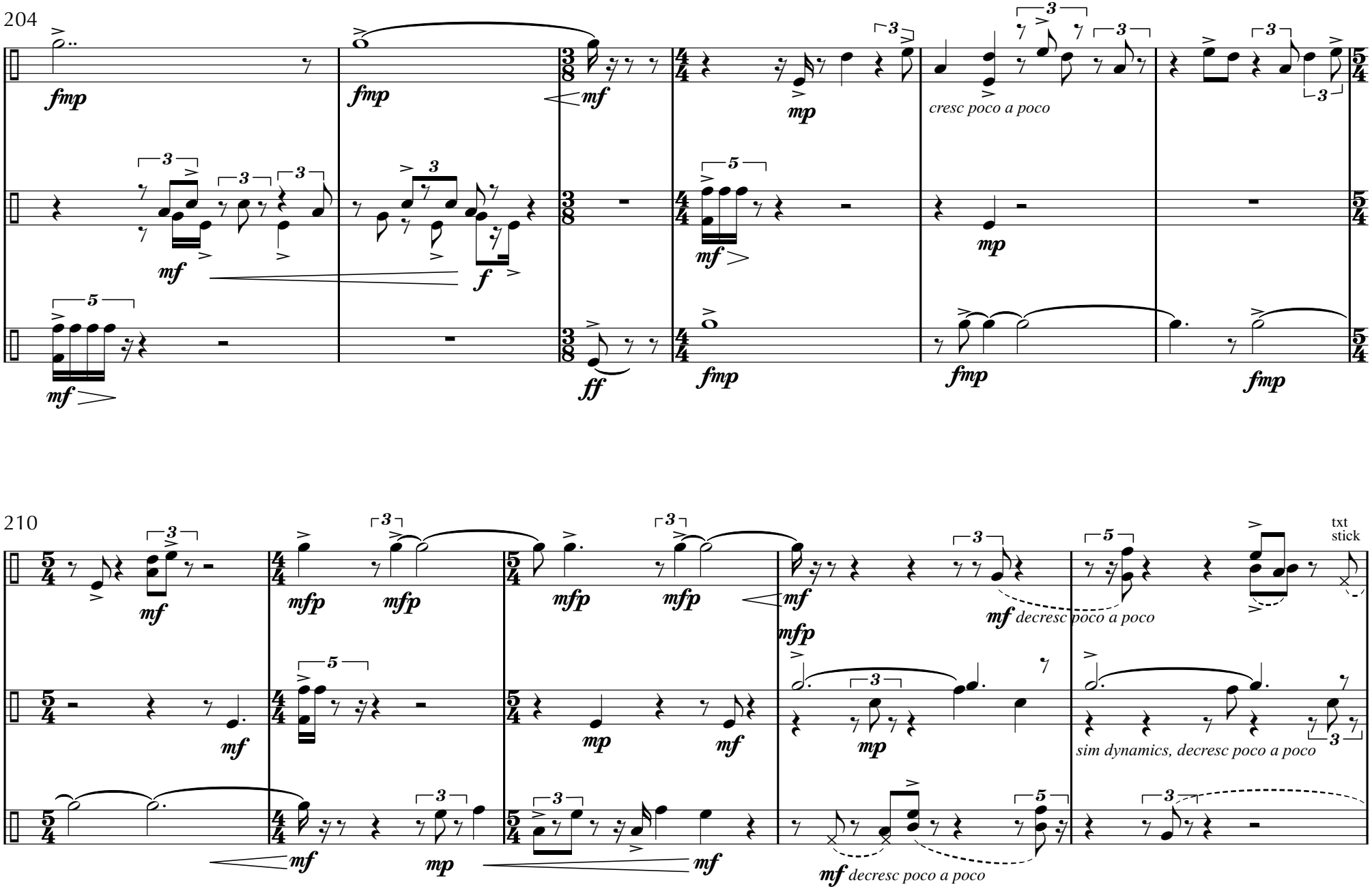
Tape part until letter J. "Numbers" are spoken on each downbeat.

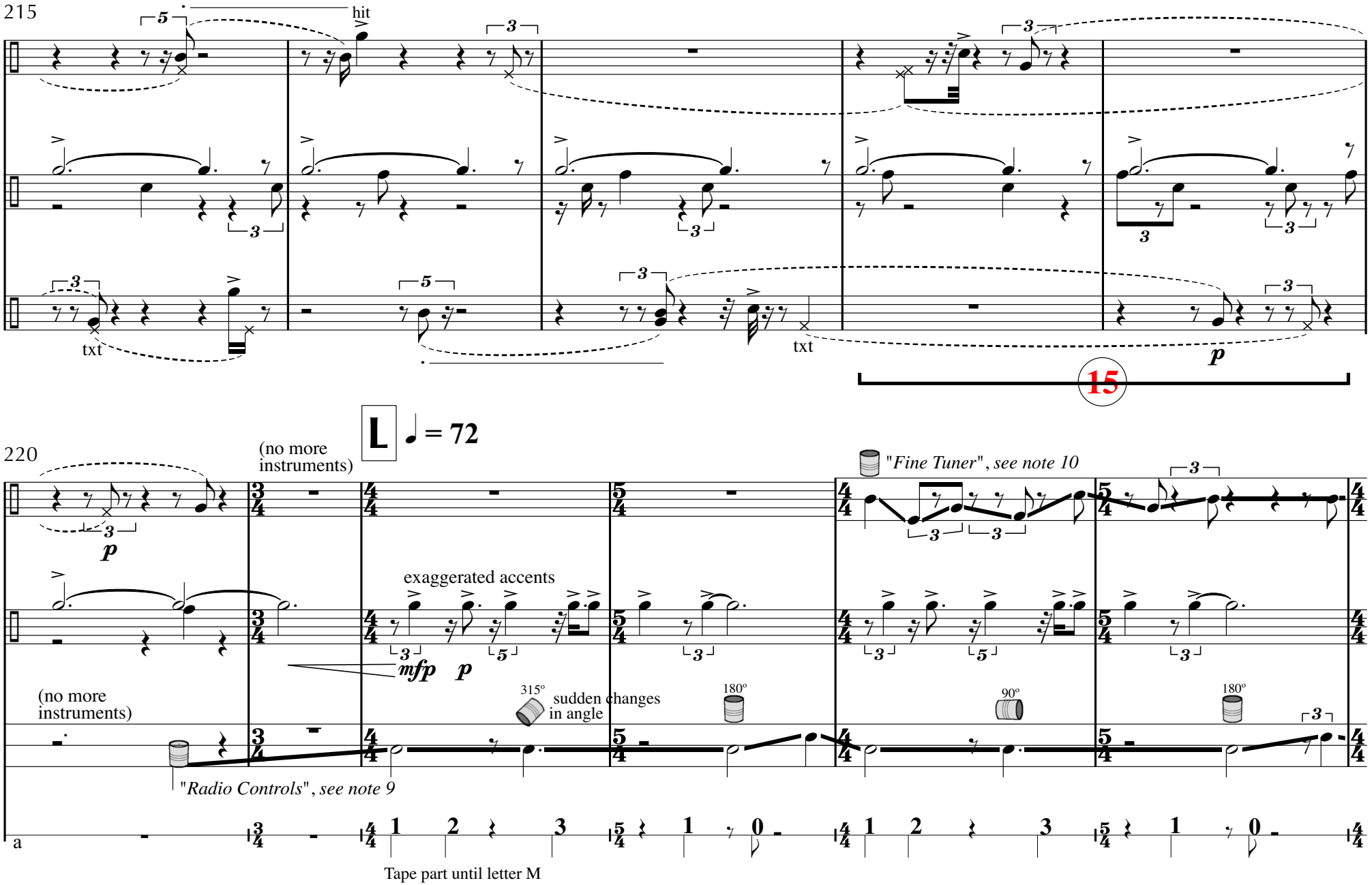
13


166
mf
C
sim. dynamic shaping
ff
mf
ff
mf
ff
mf
ff
f
DS
mf
hit
hit
ff
f
sim. dynamic shaping
C
C
a
5
3
3
4
2
7
172
txt stick
RS
mf
f
ff
hit
f
C
C
a
2
1
2
0
1
1
1

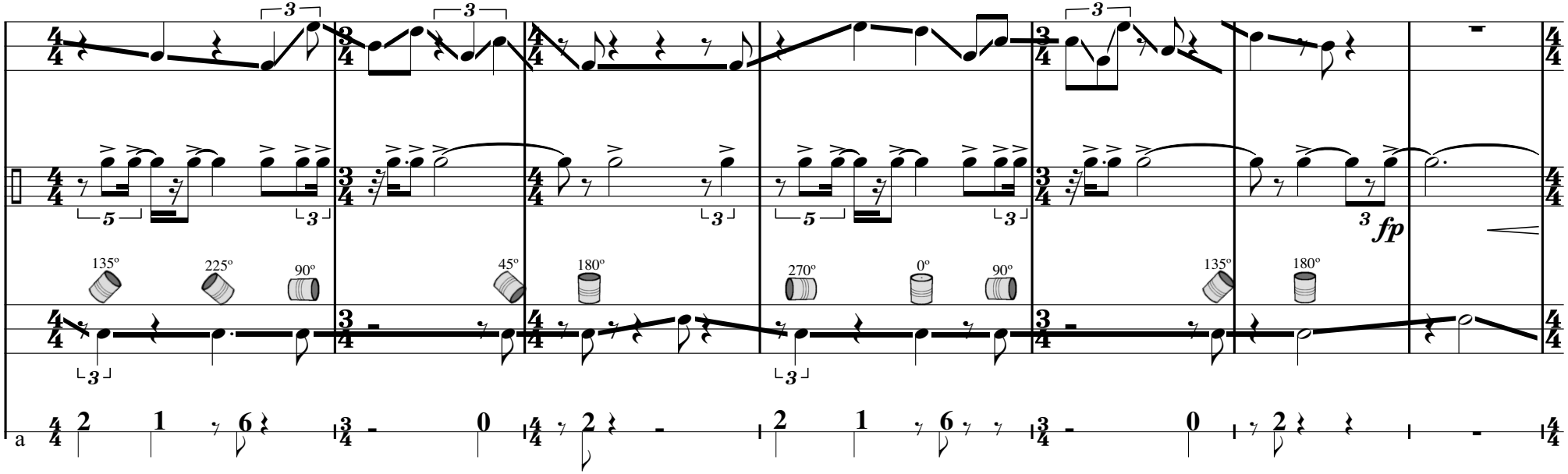

179
J
suddenly loud, intense
C
off
"Compressed Air", see note 7
DS
RS
sub
mfp
f
fmp
mf
mp
a
0
1
14
187
all deadsticked
txt
stick
hit


193
air
hit
hit
C
K
199
txt
stick
DS
DS
DS
DS
sub


204
fmp
fmp
mf
mp
cresc poco a poco
mf
f
mf
mp
mf
ff
fmp
fmp
fmp
210
mf
mfp
mfp
mfp
mfp
mf
mf decresc poco a poco
txt
stick
mf
mp
mf
mp
sim dynamics, decresc poco a poco
mf
mp
mf
mf decresc poco a poco

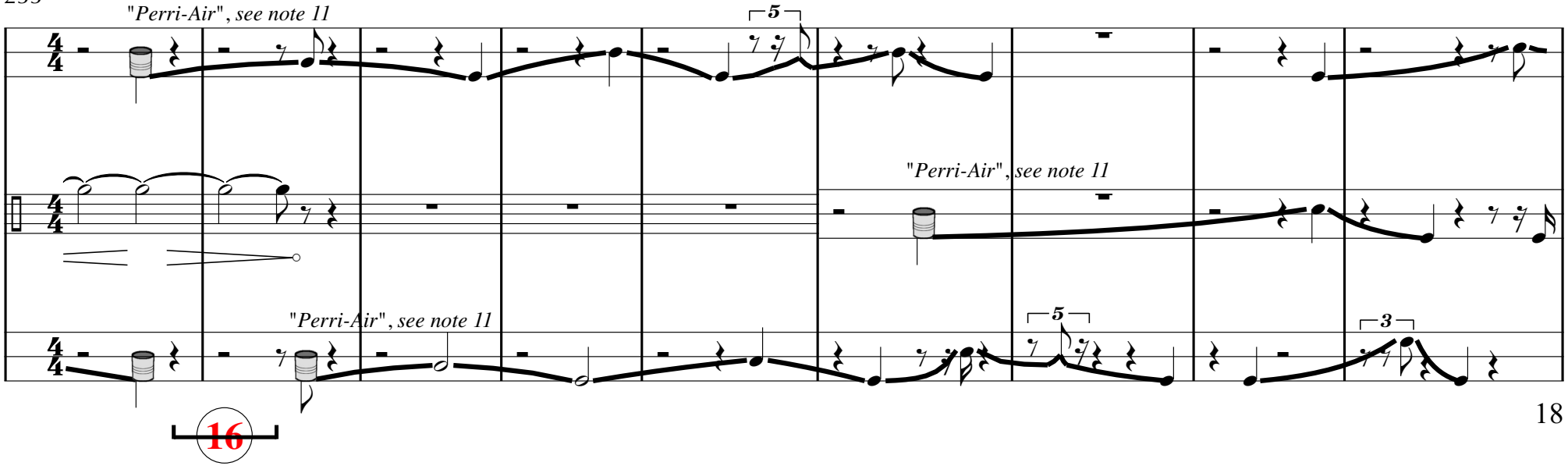

215
hit
txt
txt
15
220
(no more instruments)
L
= 72
"Fine Tuner", see note 10
exaggerated accents
mfp
p
(no more instruments)
315°
sudden changes in angle
180°
90°
180°
"Radio Controls", see note 9
a
Tape part until letter M

226

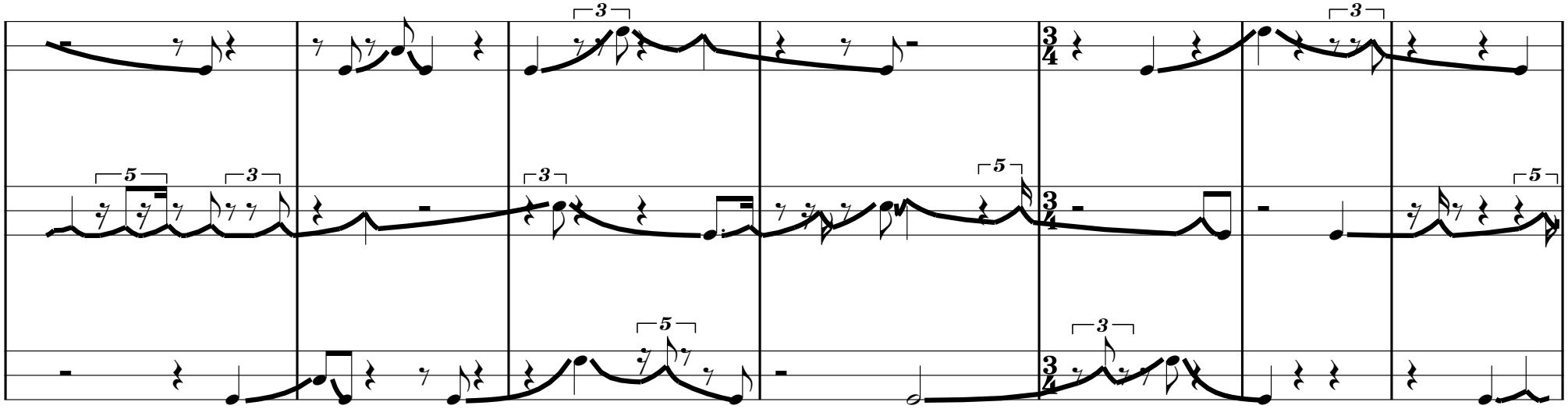


M Shell Game

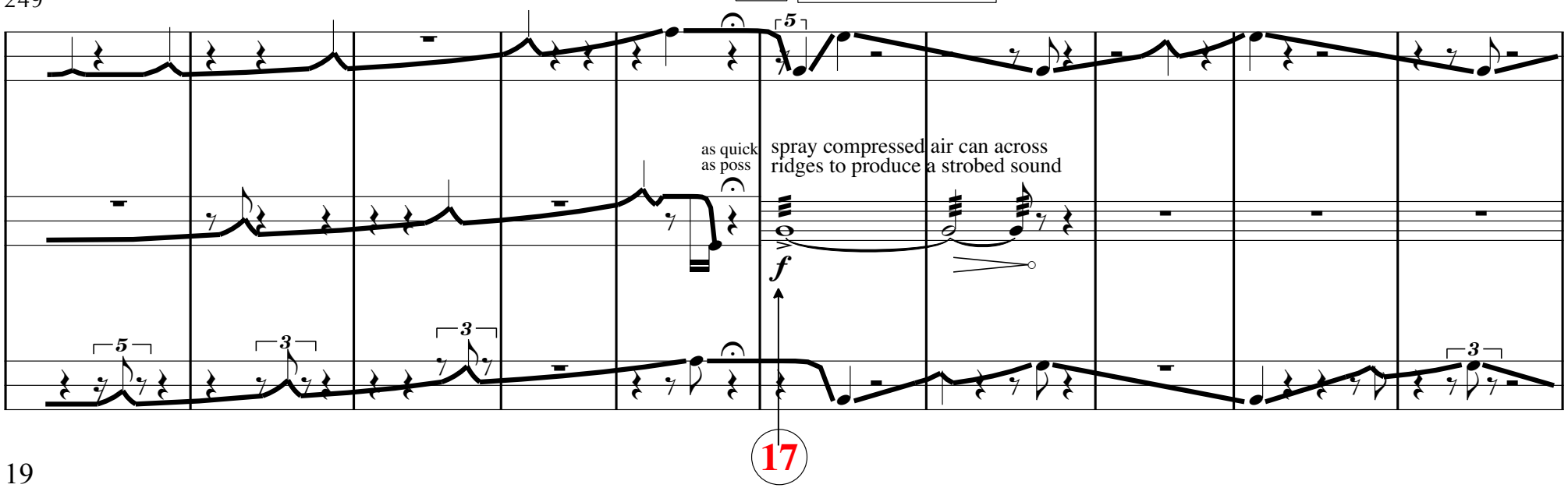
233



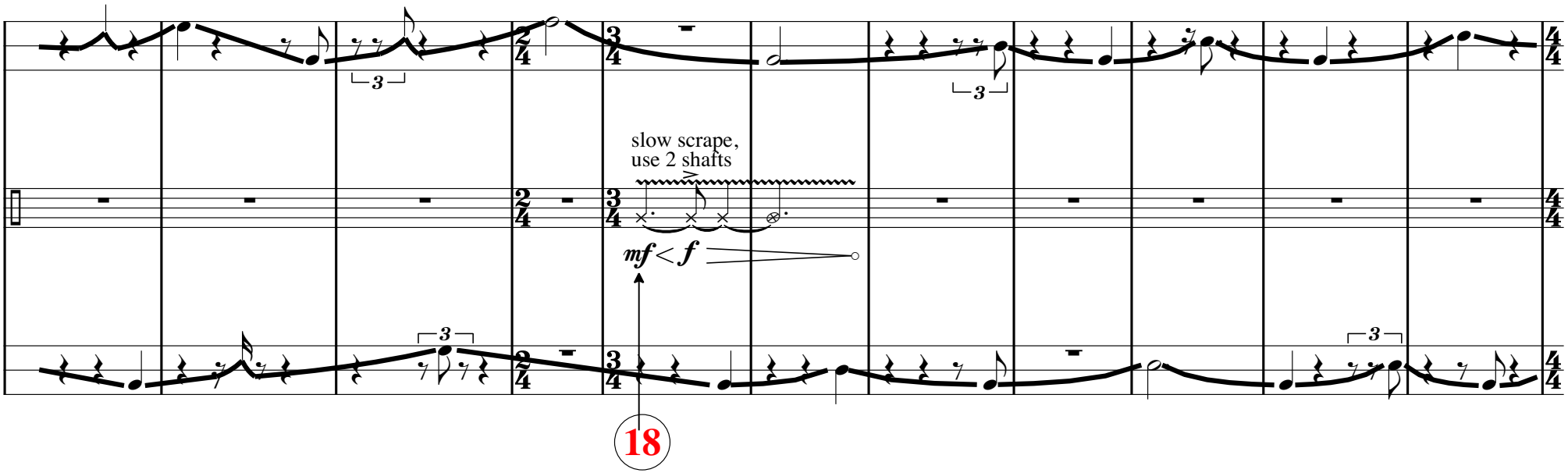
242



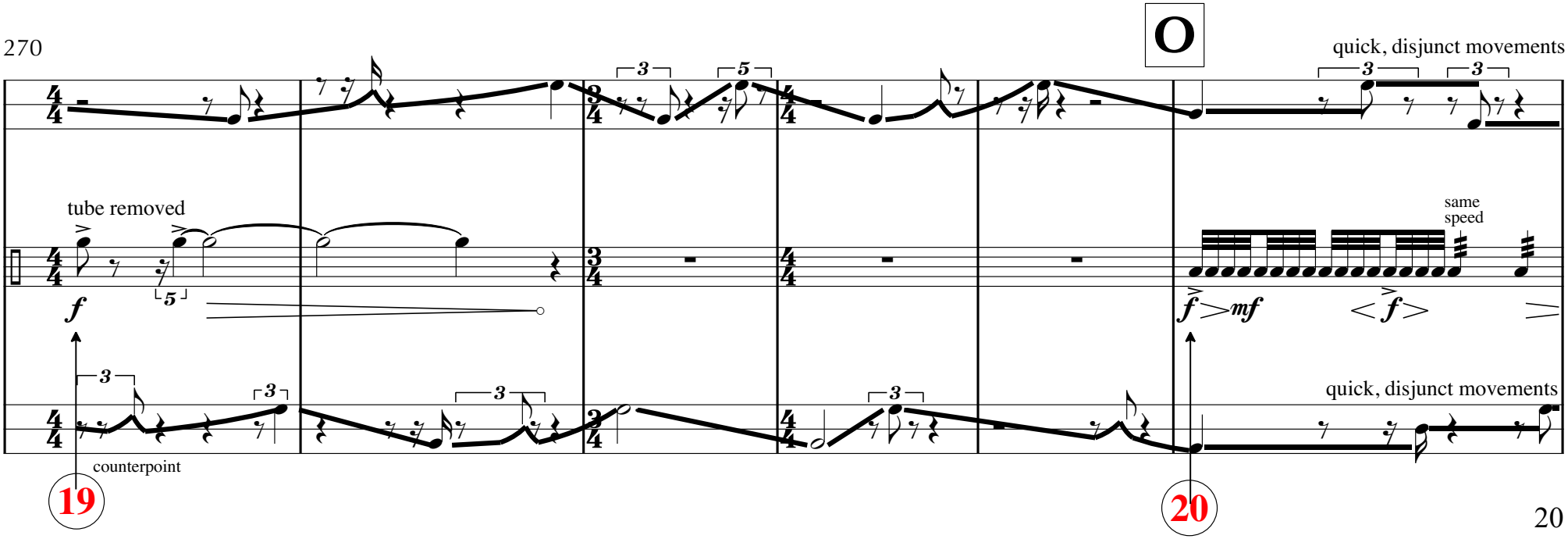
249


N
= 98
Docking Sequence
as quick as poss
spray compressed air can across ridges to produce a strobed sound
f
17

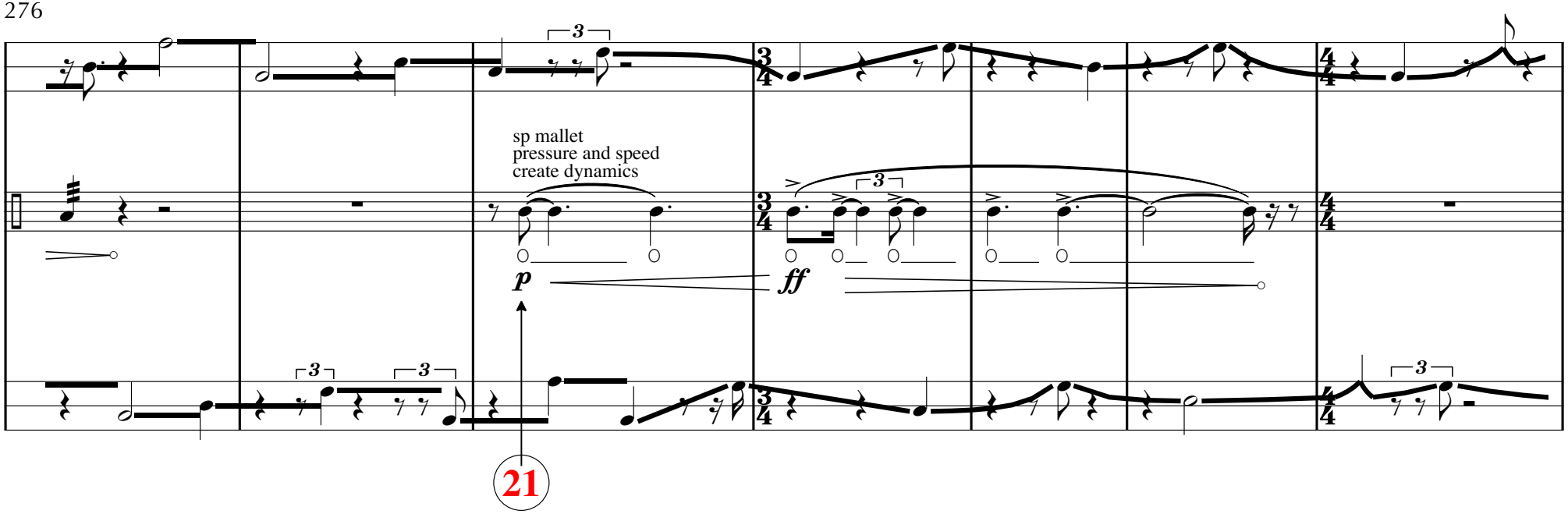
259


slow scrape,
use 2 shafts
mf < f
18

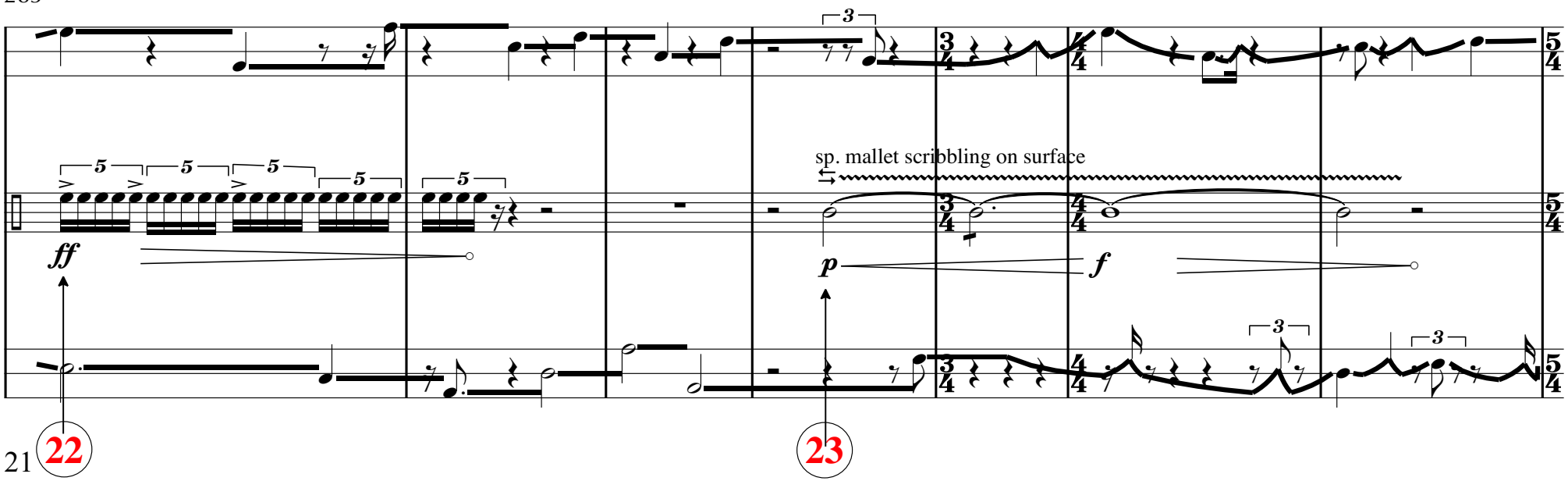
270


O
quick, disjunct movements
tube removed
f
same
speed
f > mf
< f >
quick, disjunct movements
counterpoint
19
20

276

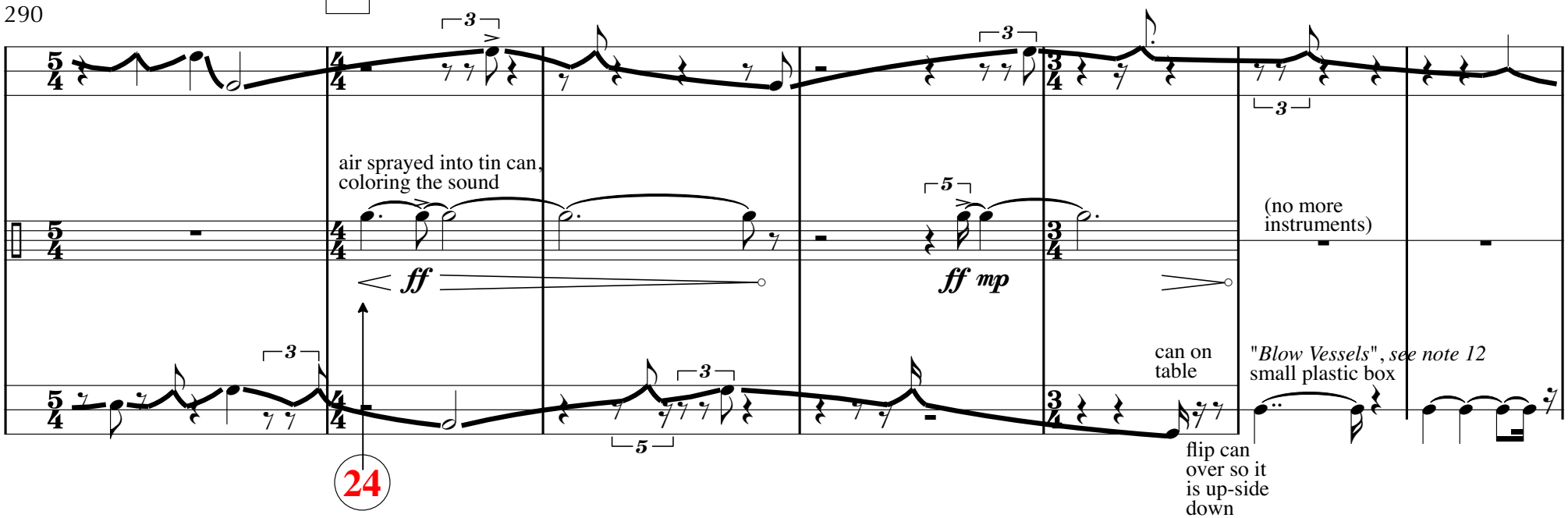

sp mallet
pressure and speed
create dynamics
p
ff
21

283

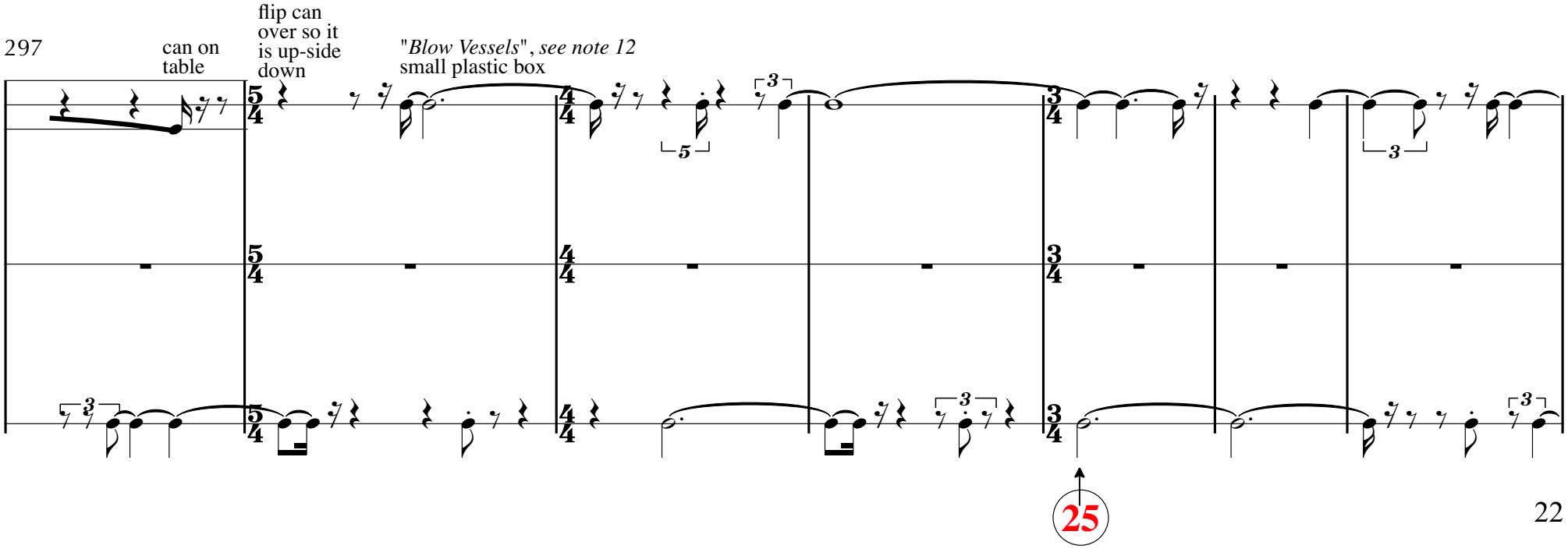

sp. mallet scribbling on surface
ff
p
f
22
23

P Air Lock

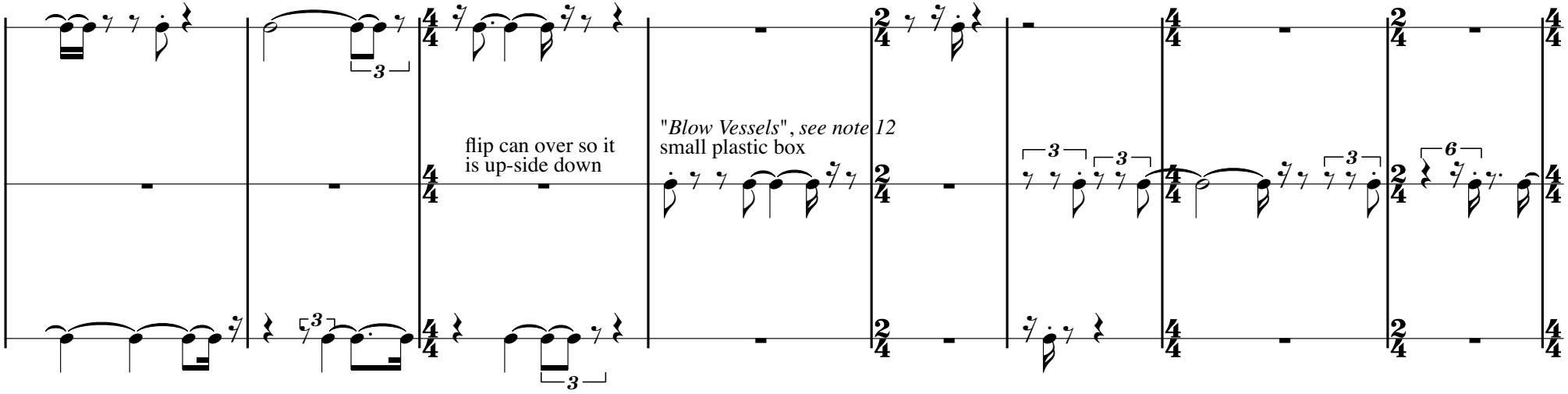
290



297

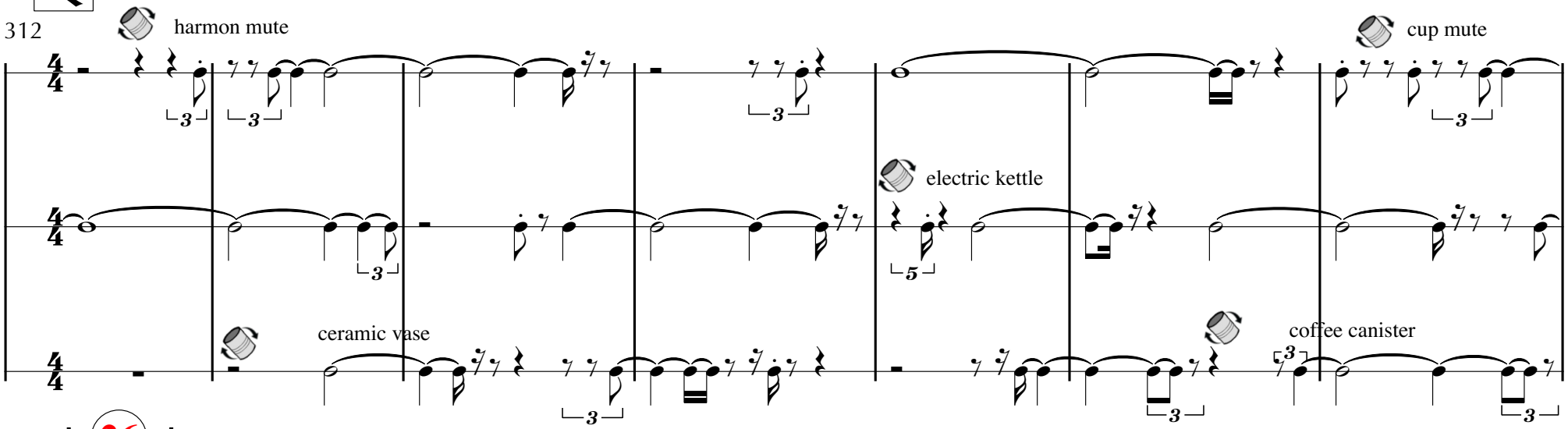


304

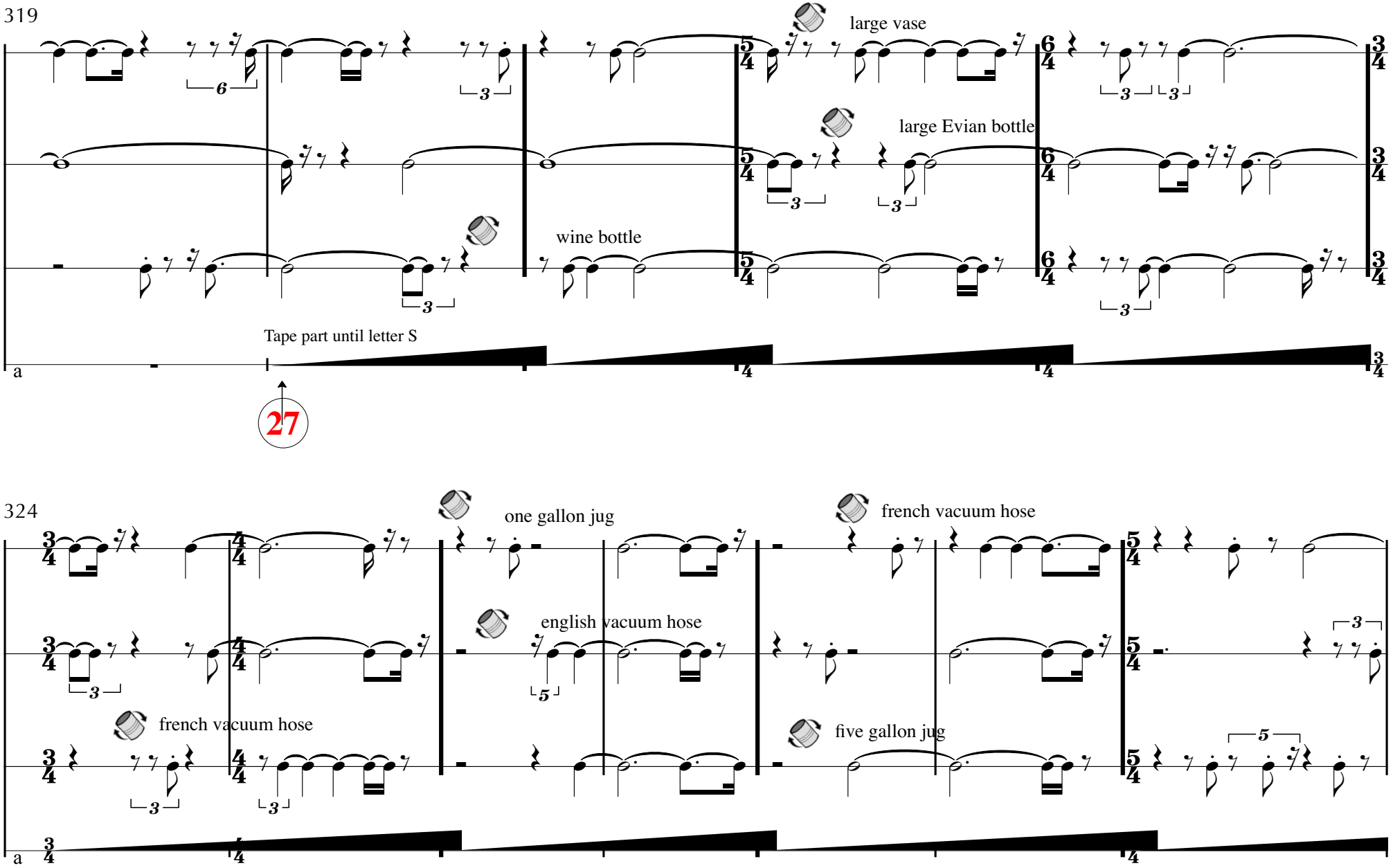


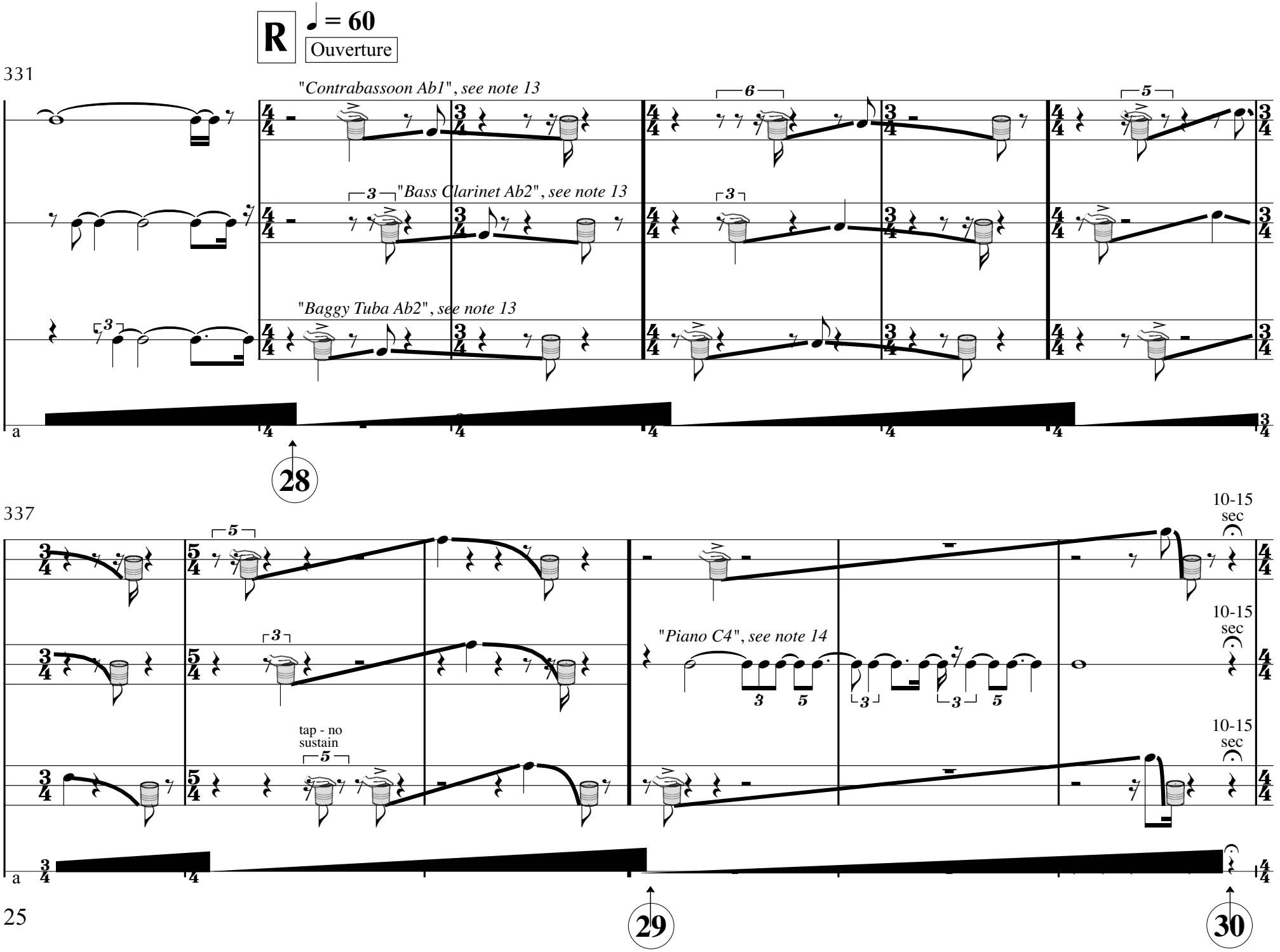
Q That Sinking Feeling

312



26


319
large vase
large Evian bottle
wine bottle
Tape part until letter S
a
27
324
one gallon jug
french vacuum hose
english vacuum hose
french vacuum hose
five gallon jug
a


R
♩ = 60
Ouverture
331
"Contrabassoon Ab1", see note 13
"Bass Clarinet Ab2", see note 13
"Baggy Tuba Ab2", see note 13
a
28
337
10-15 sec
"Piano C4", see note 14
tap - no sustain
29
30

S Piano Three Hands

Electronics are realtime

343 flip can over so it is upright

"*Piano Interior*", *see note 16*

piano C4 harmonics, *see note 15*

as written

improvise gestures

flip can over so it is upright

"*mf*" "*Piano Interior*", *see note 16*

31

"*f*" "*mf*" "*f*"

352

T

"*Piano Bass*", *see note 18*

"*f*" "*mf*" "*f*" "*ff*" "*mf*"

slowly put can back down on the table

on table

12-15 sec

note on

"*Piano C4 Pluck*", *see note 19*

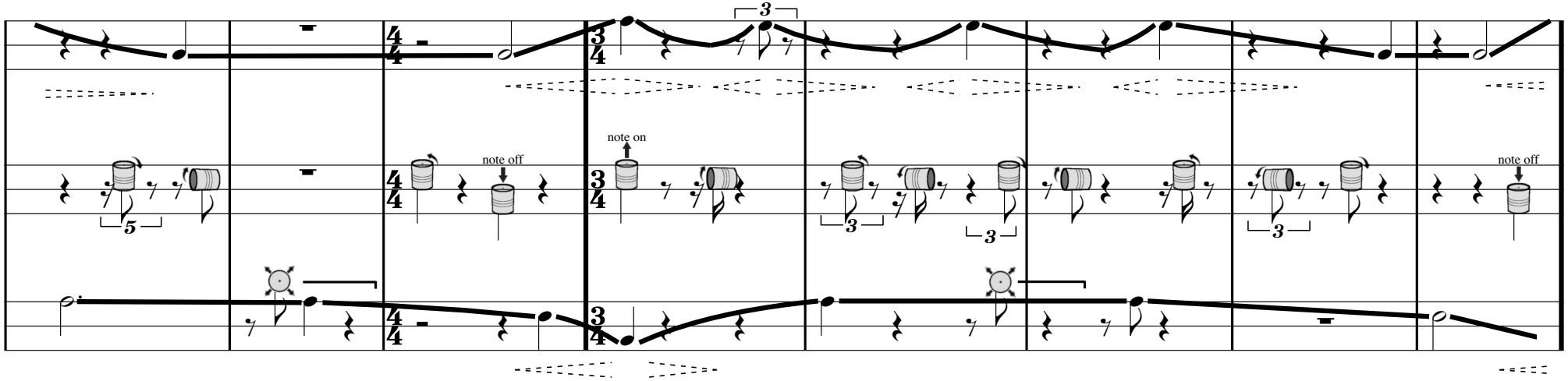
"*ff*" "*mf*" "*f*" "*ff*" "*Piano Cluster*", *see note 17*

improvise gestures

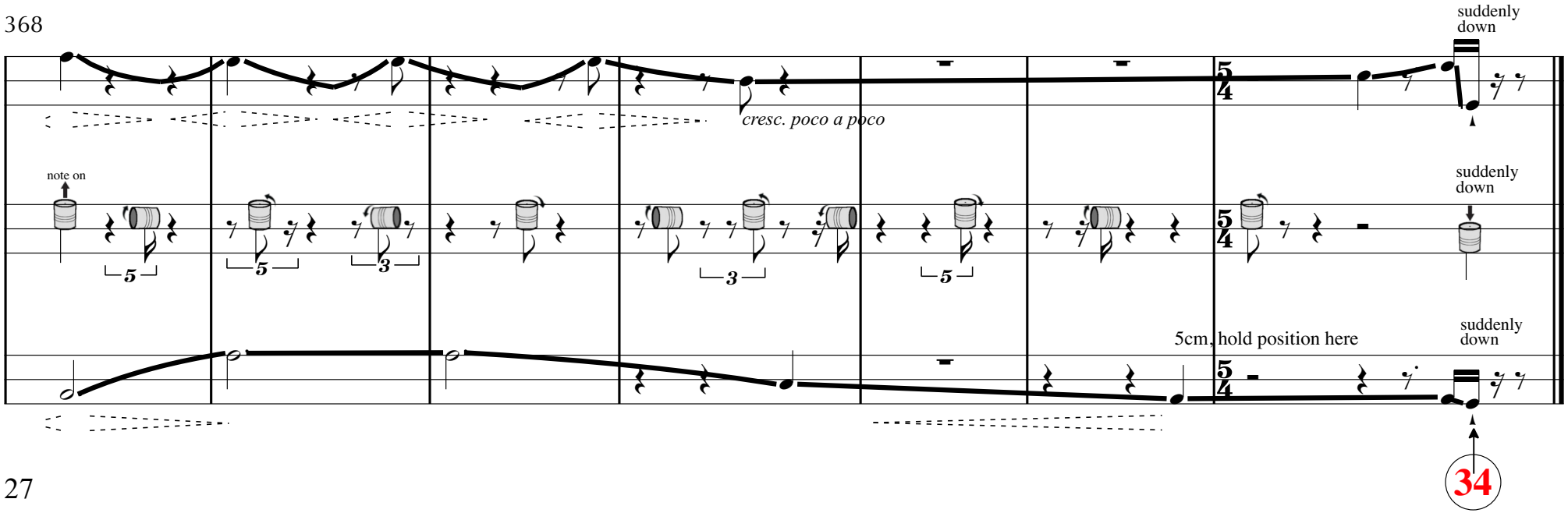
32

33

360



368



4 March 2024
London UK