V

THE PERCUSSION: GENERAL CONSIDERATIONS

ACOUSTICS

The percussion are the most numerous and varied of all instruments, and almost every conceivable type of tone production is represented among them. Nonetheless, all except for a handful of miscellaneous instruments fall within two large organological groups, **membranophones** and **idiophones**. The term "membranophone" corresponds very closely to the ordinary word "drum": membranophones are instruments in which the sound is produced by the vibration of a taut membrane, the **drum head**, which may or may not be affixed to a resonator, or **shell**. In idiophones the vibrating object is a solid block which, unlike a string or membrane, does not need to be pulled taut in order to vibrate.

The acoustics of both membranophones and idiophones are quite complex. As an example, Figure 66 shows the four lowest vibratory modes of a drum head and of a rectangular bar. Note that, although the pattern shown for the drum head is essentially valid for membranophones of all sorts, the rectangular-bar pattern only holds good for those idiophones whose sounding elements are rectangular bars. Idiophones in other shapes behave entirely differently, and with even greater complexity; as a result, there is a tremendous variety of timbre to be found among them.

The partials produced by such complex vibratory patterns are inharmonic, a fact which accounts for several important aspects of percussion sound. The ear can derive only a weak sense of pitch from an inharmonically structured sound, since the upper partials seem to contradict the fundamental rather than reinforce it; many percussion instruments (e.g.,

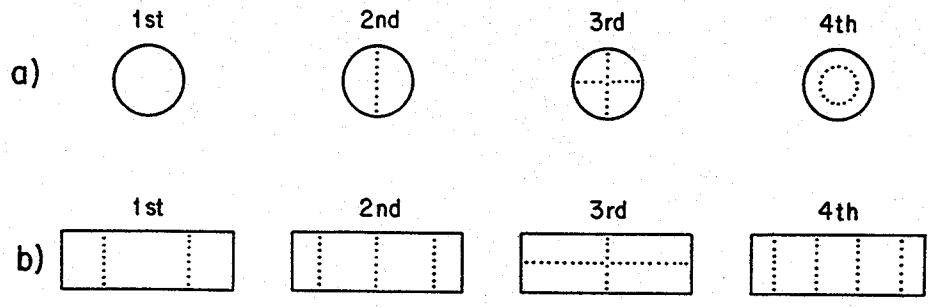


FIGURE 66. *The lower modes of vibration of (a) a drumhead and (b) a rectangular bar. The dotted lines indicate the positions of nodes.*

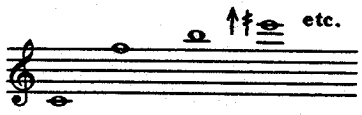


FIGURE 67. *Lower partials of a rectangular bar tuned to* c^1. *The frequencies of higher partials depend on the exact dimensions of the bar.*

cymbals, maracas, snare drums) have no definite pitch at all and can only be described as sounding relatively high or low. It has long been traditional to divide percussion instruments into those with and those without definite pitch, but the more one listens to percussion instruments, the clearer it becomes that such a division is untenable. The vast majority of percussion are neither clearly pitched nor clearly unpitched, and can be treated either way by composers. As a general rule, if two instruments, at least one of which is percussion, play at a dissonant interval, the ear interprets the percussion sound as an unpitched noise rather than as a dissonant pitch. The only important exceptions to this rule are the so-called **mallet instruments** (xylophone, vibraphone, and their relatives), the most strongly pitched of all percussion. Interestingly enough, it is these instruments that produce their sound from rectangular bars. Figure 67 shows why these instruments give such clear pitches: the upper partials are so widely separated from the fundamental that they do not conflict with it. Additionally, each bar rests on a pair of strings or felt-covered supports along the nodes of the first partial, so the upper partials are damped. Even with these instruments, however, the lack of reinforcement by harmonically generated partials leaves the pitch so weak that the ear frequently has difficulty in determining in which octave it lies. A great deal of focus can be given to any percussion pitch by doubling the note in some other non-sustaining instrument, such as piano, harpsichord, or plucked strings.

The characteristic shapes of gongs and bells were evolved to make their tonal spectra as harmonic as possible. Two or three partials spaced in approximately harmonic ratios persuade the ear to interpret the whole sound as harmonic, despite the presence of numerous other, clearly inharmonic partials. In fact, the perceived pitch of an instrument of this sort may not even be a part of its tonal spectrum, but a false fundamental supplied by the brain to what it interprets as an incomplete harmonic series.

The most strongly pitched membranophones are the timpani and the boobams. In boobams the long tubular resonator completely dominates the relatively small membrane, which thus acts as a kind of reed to set up truly harmonic vibrations within the tube. In

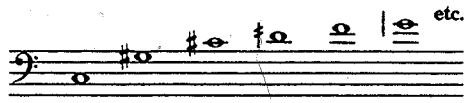


FIGURE 68. *Partials of a drum head tuned to* c^0.

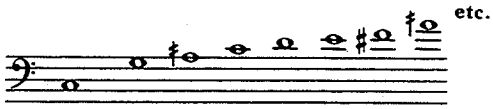


FIGURE 69. *Partials of a timpano tuned to* c^0. *The lowest pitch is really the second partial.*

timpani the membrane is stretched over a completely enclosed air space, and this displaces the normal drumhead partials (Fig. 68) into a vaguely harmonic pattern (Fig. 69). A small hole often present in the bottom of the shell completely suppresses the weak fundamental, which, if present, conflicts with the "harmonic" upper partials. A comparison of the tonal spectrum of the timpani with the true harmonic series (see Fig. 4) shows the closeness of the approximation and also makes it clear why the timpani give the impression of sounding an octave lower than they really are.

An important determinant of the timbre of an idiophone is the material of which it is made. The vast majority are made either of wood (or a plastic of equivalent resonance), a metal alloy of some sort, or a ceramic such as clay or glass. Each of these three basic materials has characteristic resonance features which lend a certain similarity to the timbres of all idiophones made with that material, regardless of shape or manner of tone production.

PERCUSSION ENVELOPES

With rare exceptions, the percussion are **non-sustaining instruments**, in which the sound, once produced, dies away completely of its own accord unless the sound is repeated. The decay time of a non-sustained sound can theoretically vary from less than a microsecond to half a minute or more; interestingly, the decay times of percussion instruments are not distributed evenly across this range but, rather, are clumped at the two extremes. The majority of percussion sounds decay completely in less than half a second, and most of the remaining instruments have long, smooth decay-times of ten to thirty seconds.

In the matter of envelope—obviously of supreme importance in percussion timbre—the percussion can be divided into three broad groups: those (the majority) in which the instrument is normally struck with some sort of mallet; those in which two approximately equal objects are struck together to produce the sound; and those in which the sound is produced by rattling or scraping. In the first two of these groups, the sound builds up to its attack peak while two objects are in contact with each other; the return of the first complete vibration bounces them apart, and the player's hand follows through on the bounce—that is why the hand and arm movements involved in playing percussion are so quick and precise. Some of the most massive or deep-pitched instruments start very slowly and may have build-up times as long as a quarter of a second; in these instruments the beater is rebounded by a relatively small group of quick-starting mid-range partials that receive most of the energy of

the initial stroke, later distributing it among the remaining partials until a stable vibratory pattern is achieved. In the rattling instruments of the third group (which contains rattles of all sorts, ratchets, rasps, and windchimes), the envelope is compounded of numerous individual small clicking or dinging sounds interpreted by the brain as a single complex sound. In ratchets and rasps a more or less continuous sound is produced, with a definite beginning and end; but the overall envelope of rattles and windchimes is a non-sustaining attack and decay pattern similar to that of other percussion; most of the individual small clicks occur almost at the same time, and the ear hears this as the attack peak. Clicks occurring before the peak form the attack pattern, and those occurring after it form the decay. This can be heard very clearly in windchimes, in which each click can easily be identified; the decay pattern of a windchime is simply an irregular series of clicks that gradually decrease in frequency. Note that the loudness of each click also decreases, since the entire system is gradually being drained of its energy.

PERFORMANCE

PLACEMENT OF THE INSTRUMENTS

In the next two chapters we will encounter nearly a hundred different percussion instruments. These instruments can be played singly, but for the most part they are used in mixed groups. The percussionist plays all the instruments in such a grouping simultaneously, as if they were a single complex instrument. The performance characteristics of this large "instrument" depend not only upon the individual percussion instruments of which it is comprised but upon the way they are positioned around the player. In all percussion writing except that which is very easy or heavily indeterminate it is essential that the composer have a definite array of instruments in mind for each percussionist, and if the set-up is particularly large or complex, a diagram of their placement must be provided. The student should attend as many percussion-ensemble concerts and solo percussion recitals as possible, since it is essential to be able to visualize clearly the way percussion instruments can be arranged on a stage and the ways a player must move to "cover" them all when performing.

If the instruments used are few and small, they are placed in a group directly in front of the player; larger arrays are spread out into a semicircle; in extreme cases, the instruments may be arranged in a circle, completely surrounding the player. Mallet instruments, drums, and other instruments with horizontal striking surfaces are wherever possible placed at a level a little below the player's waist. To this end they are attached to adjustable stands or laid on special racks or small towel-covered tables.* Also laid on towel-covered tables, and at this same level, are the "hand instruments"—such as claves or flexatone—which must be picked up and held in order to be played, and any mallets the player will need. Instruments such as gong, chimes, and triangle, which present vertically aligned playing surfaces and are typically suspended from above, are placed at about chest level and generally behind the horizontal instruments (i.e., further from the player). Chimes are suspended from a built-in rack, and special stands are made for gongs and tam-tams, but most of the "vertical" instruments must be suspended from music stands, microphone booms, or coat racks. It is perhaps un-

* A few large instruments (e.g., timpani, vibraphone) have built-in stands of the proper height.

derstandable, in the light of all this, why the percussion section is sometimes referred to as "the kitchen." Indeed, there is a strong analogy between a kitchen and a percussion array, not only in that so many fascinatingly sonorous objects are to be found in the kitchen, but that in a well-designed kitchen the cook is surrounded by stove, sink, and cutting surfaces at waist level, with vertical cabinets and racks ranged above and behind them: in both cases a wide variety of objects large and small have been placed to facilitate the most typical motions of the human arms, hands, and upper body.

In large arrays it may be desirable or necessary to place the "horizontal" instruments in two rows, one behind the other; in this case the instruments further from the player will usually be placed on a slightly higher plane than the nearer ones. It is generally but not invariably desirable in such cases that instruments requiring precise, detailed motions (e.g., mallet instruments) be placed in front of those, such as large drums, that require less precision. Drums in the second row will often have their heads tilted toward the player, making them easier to reach. As a drastic expedient even mallet instruments can be tilted in this way, by mounting them on blocks. A large array can be compacted somewhat by allowing instruments to overlap, so that, for instance, the back half of a timpano may actually be placed *under* a table full of hand instruments, a windchime may be suspended directly over an unused half-octave at the top or bottom of a mallet instrument's range, or the unused bars may even be covered with a towel and used as a table.

It is usual to place sets of identical instruments (e.g., a set of four timpani or of five temple blocks) in a row, with the highest instrument to the player's right—like the notes on a piano keyboard. Such an arrangement is not essential, but it is standard and should be used unless overriding musical considerations favor some other arrangement. It may be desirable to place the instruments in two staggered rows, thus, in order to save space:

Because the player must move about a great deal, percussion instruments are normally played standing. The major exception to this is the **traps**, or jazz drum set, a "prefab" percussion set designed to be played sitting down. The exact makeup of a set of traps is variable, but it will always contain a snare drum, a small double-headed drum, a large tomtom (which may be single- or double-headed), a small, pedal-operated bass drum, at least two suspended cymbals, and a hi-hat (Fig. 70). Note that the suspended cymbals and the smaller drums are all tilted toward the player and that the set-up consists essentially of a row of drums (the highest is on the left, reversing the usual pattern), behind which is a row of cymbals. The small double-headed drum is usually attached to the shell of the bass drum, and there is room there to attach another instrument as well—a cencerro, a woodblock, or another drum or cymbal. The whole system can be further expanded by the addition of, for instance, another bass drum to the left of the original bass drum; two more instruments may in turn be attached to the shell of this drum. In some rock groups the set of traps rivals the most complex "classical" arrays, with tam-tams above and behind the cymbals and a table for hand instruments to one side behind the player—all to be played sitting down!

MOVEMENT OF THE PLAYERS

The position of a traps player in an ensemble is fixed and straightforward, but the motions the music requires of standing players must constantly be kept in mind. The percussionist(s)

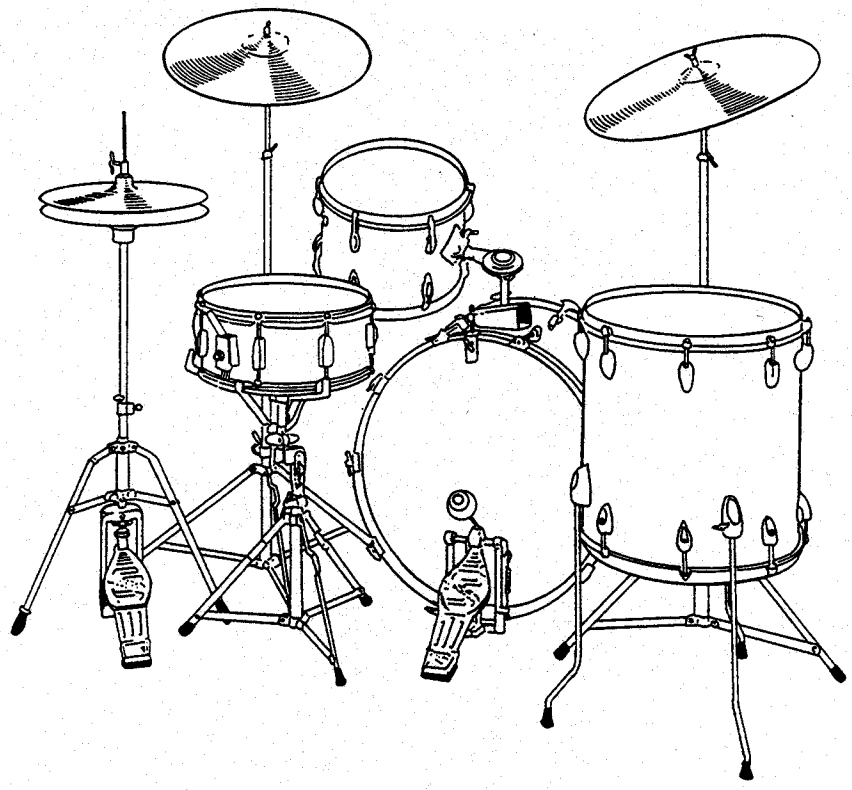
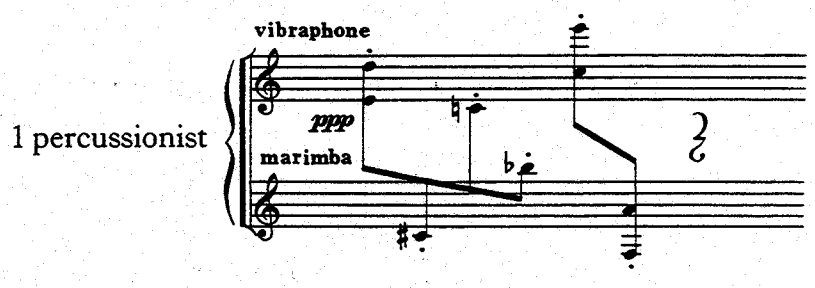


FIGURE 70. *A set of traps.*

must be able to make eye contact with the other players or conductor, if any, whenever necessary. Also, it is difficult to play delicately if violent motions of the body are required. An already difficult passage such as



becomes almost impossible if the vibraphone and marimba have been placed at opposite sides of the array. For these reasons the composer must consider very carefully the layout of each percussion array and the positioning of each of these arrays on stage relative to other performers.

There is a strong theatrical component to percussion playing which the composer can ignore only at peril. Any percussion part requiring extensive motion of the player's upper body will take on a dance-like aspect; a player surrounded by a dense, tall array may give the impression of being caged by the instruments or of having erected a protective wall around him/herself; players whose adjoining arrays share an instrument are associated psychologically as strongly as though they were holding hands or tied together with a rope, and if they

play that instrument simultaneously, facing each other across its surface, an intense sense of cooperative or competitive endeavor is generated. Most theatrical of all are situations in which a player is required to walk from one array to another or in which instruments must be moved about—pieces calling for a great deal of such movement can become veritable percussion ballets. The dramatic force of all these gestures and situations will be equal to or even greater than that of the musical ideas that necessitate them. If the composer has not calculated the effect of all such procedures theatrically as well as musically, the theater will seem unmotivated, distracting from the music and impeding its flow. This applies even to motions that take place between movements: if a change from one set-up to another is required, the time necessary for the change (up to ten minutes, in extreme cases) must be taken into account, and if the change with all its hectic activity can be woven into the fabric of the piece, so much the better.

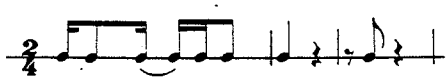
Although it is as hard to play percussion well as it is to play any other instrument, the basic technique of striking or shaking is relatively simple, so non-percussionists may be asked to play one or two percussion instruments as well as their own. Parts for such "amateurs" should not include mallet instruments or chimes, nor call for rolls, rapid passagework, or fast changes of mallets. Again, the use of percussion in non-percussion parts is unavoidably theatrical.

NOTATION

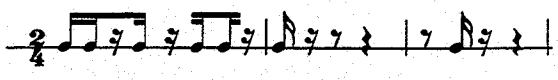
The notation of percussion parts has for some time been in a state of flux. In this period of great notational freedom one can of course use any system so long as it makes sense, but it is best to regard the system given here as standard and to depart from it only where necessary for musical or other esthetic reasons. This system constitutes the best and most common modern practice, designed to be easily readable, readily understood, internally consistent, and adaptable to almost any musical context.

UNPITCHED NOTATION

Let us consider first the simple case of a single percussion instrument to which no specific pitch has been assigned. The part for such an instrument is normally written as a rhythm on a single line, thus:

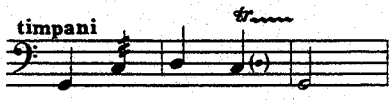


If the instrument is one with a quick decay (e.g., maraca or bongo) no note value greater than the quarter-note should be written—slow rhythms should be notated with alternating notes and rests, as with the last two notes of the above example. On the other hand, note values below the quarter-note should be written so as to be easily read even if they exceed the actual length of the sound. If the example given here were to be played on the claves, for instance, the actual sound would be something like

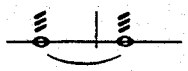


but the less exact notation is much easier to read. Instruments with longer decays (e.g., cymbals) should be given exactly the desired note values, as with sustaining instruments. If it is desired that a note die away naturally during a rest or while other notes are being played, an open tie (♩‿) should be appended to it, with the indication "l.v." (for "let vibrate") below the first of any group of such notes. It may occasionally be necessary to put a cautionary "non l.v." in places where this effect might be expected but is not desired.

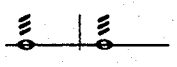
Virtually all percussion instruments make use of unmeasured rapid repetition of a note to create the illusion of a continuous, sustained sound. This *roll* or *tremolo* effect is notated with three strokes through the note stem (𝅗𝅥), just like the fluttertongue of winds or the tremolo of strings. The notation "𝆖" formerly used for this effect should be reserved for true trills, as in the following example:



The articulation of rolls must be clearly marked, and distinctions drawn between

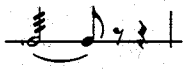
 (a single long roll)

and

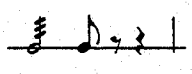
 (two separate rolls),

as well as among

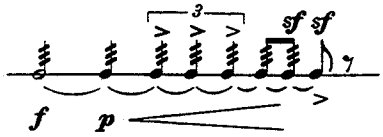
 (roll simply stops at end of note),

 (roll ends on the following beat with a definite stroke),

and

 (roll and single note clearly separated from each other).

Dynamics and accents can be used to articulate *within* a tied roll, thus:

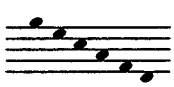


PITCHED NOTATION

So far we have been speaking of a single, unpitched percussion instrument, but suppose a definite pitch is wanted? In this case instead of a single line a regular five-line staff with appropriate clef should be used. The one exception to this is the very simple case of an instrument that plays only one pitch throughout a piece; in this case the pitch may be indicated in the prefatory remarks (or on a tiny staff at the beginning of each line of score), the part itself notated on a single line as if it were unpitched. When more than one pitch is required, a staff must be used. A single staff is used not only for those few percussion instruments that can individually play a wide range of pitches, but for those, such as timpani or bells, that are used in sets; in the timpani example given above, for instance, a single staff is used even though three drums are needed to play the passage. This is the usual way of writing for such instruments, but if the three timpani were located at widely separated locations within the array and served differing musical purposes, then three staves would be necessary. On the other hand, any set of pitched percussion instruments grouped together to provide one note each of a scale from which a single melodic line is to be fashioned may be notated on a single staff,* no matter how heterogeneous the combination. Several of Harry Partch's unique percussion instruments (otherwise outside the scope of this book) display such heterogeneity in their construction.

GROUPED INSTRUMENTS

Homogeneous groups of indefinitely pitched instruments are also notated on staff-like sets of lines, one line for each instrument, arranged from highest (top line) to lowest (bottom line). By way of illustration, if in the timpani example cited above no specific pitches were to be assigned, the passage would be notated thus:

For groups of five or fewer instruments, each instrument should be notated on a separate line, the spaces between the lines not being used. A group of six should be notated on the spaces (not the lines) of a five-line staff,  , and groups of more than six need both the

* Two staves (treble and bass) may be necessary if an extraordinarily wide pitch range is to be covered.

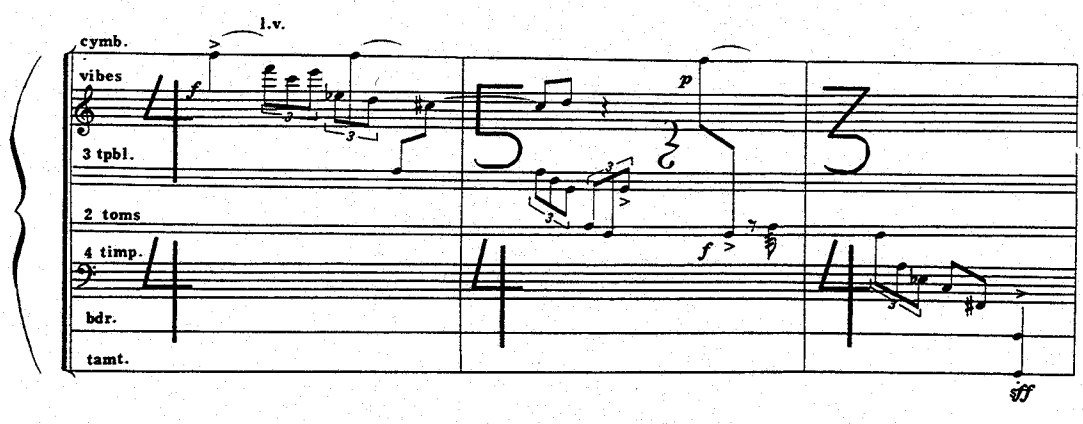


FIGURE 71. *Example of percussion notation.*

lines and spaces of the staff. Ledger-lines should not be used, nor, usually, should staves of more than five lines; in the rare event that a continuum of more than eleven (!) like instruments is required, two five-line staves will be needed, braced together like a piano part. Staves and staff-like configurations of this sort should be used only for unmixed sets of identical instruments graded in pitch.

COMPLETE ARRAYS

Figure 71 shows a sample of notation for a complete percussion array (one player). Note that though the various single lines, staves, and grouped lines are all distinctly separated, the line of music written across them is clearly a single line for a single player. There are no rests on the cymbal line, for instance, because all the cymbal notes are clearly assigned to an overall rhythmic pattern distributed among all the instruments. The meter signatures sprawl across the whole system so that the player will be sure to notice them; dynamic marks are placed directly under the first note they affect; the large quarter-rest in the $\frac{5}{4}$ bar is designed to lead the eye unambiguously from the temple blocks up to the cymbal. The vibraphone has its own notes and rest in this bar for as long as it remains contrapuntally independent of the main line of music, but at the earliest convenient point (third beat) it is notationally reintegrated into the overall rhythmic pattern. The names of all the instruments should be given at the left of each line of percussion score, as here, and the whole part should be braced together at the left.

The positions of the instruments in the score should in general correspond to their positions in the array, with instruments on the player's right appearing at the top of the score and those on the left on the bottom. In the example in Figure 71, for instance, the smallest timpano would probably be directly in front of the player; the other timpani would curve off to the left, with the bass drum at the end. To the player's right would be the tomtoms, and to the right of the tomtoms would be the vibraphone. The tam-tam would be placed behind the timpani, the temple blocks behind the tomtoms, and the cymbal behind the vibraphone. Of course, whatever page order is chosen for the instruments must be adhered to throughout the piece.

There are ways to streamline the rather bulky systems needed for large percussion arrays. First of all, when an instrument is to be silent for several pages of score, its line(s) may

be omitted from those pages. Ideally, a blank space should be left to indicate the omission, but this is not absolutely necessary. Suppose in Figure 71 the temple blocks were to fall silent, with their lines omitted and the gap between tomtoms and vibraphone closed: it would be desirable, to avoid confusion, to put a cautionary "(toms)" immediately before the next tomtom note, making it clear that it was not they but the temple blocks that had been omitted. When the temple blocks reenter, an abbreviation such as "tpbl." should be put before their first note.

It is possible to write for two or more different instruments on a single line, if the instruments are used only a few times in the course of a piece and never play simultaneously. Hand instruments in particular can often be notated in this fashion, since many of them must be played with both hands and cannot be played simultaneously with any other instrument; parts for (say) vibraslap, ratchet, and tambourine could all be written together on a single line because of the near-impossibility of more than one of these instruments being played at a time.* If this type of notation is used, the name of the instrument to be played must be given at the beginning of each musical passage on the line.

MULTIPLE PARTS

In pieces with more than one percussion part, the systems for the different players are placed one above another in the score and labeled "perc. I," "perc. II," etc., the brace at the left of each part serving to identify which instruments belong to which player. Note that the positioning of the instruments on the page is entirely a function of who is playing them: if there are four players, each with (among other things) one cymbal, the four cymbals will not be grouped together on the page but will be more or less widely separated, depending on their positions within the players' arrays. If two players share an instrument, that instrument must appear twice in the score.

MALLETS

Percussion instruments are played with a great variety of *mallets* or *sticks* (the two terms are virtually interchangeable). The various types were originally developed for use with certain specific instruments, but the association of mallet-to-instrument is now in most cases tenuous at best, and each instrument can be played with any of a number of different mallets.

The tone quality elicited by a given mallet is almost entirely determined by the size, weight, and hardness of its *head* (the end that strikes the instrument), though one normally speaks of "hard sticks," "light sticks," etc. Generally speaking, small sticks elicit higher frequencies than large ones, as do hard sticks compared to soft ones; hard sticks also produce more attack noise than do soft sticks. Heavy sticks produce louder sounds than light sticks. For ordinary purposes the composer will only need to designate three types of stick: hard, medium, and soft, or heavy, medium, and light. The sticks chosen by the percussionist to fit these categories will depend upon the instrument(s) used and the musical context.

* Under certain circumstances these and other hand instruments *can* be played simultaneously (see discussion in chapters VI and VII).

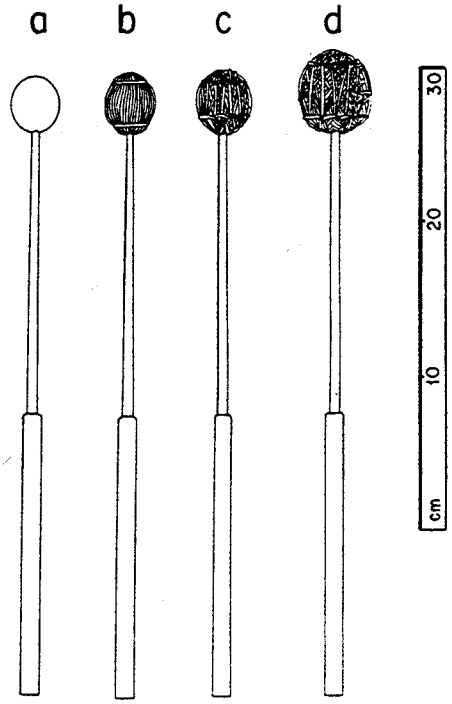


FIGURE 72. *"Rubber series" mallets: (a) unwound rubber mallet; (b) hard wound mallet; (c) medium wound mallet; (d) soft wound mallet.*

RUBBER SERIES MALLETS

It is somewhat annoying that there is no generally accepted term for the most widely used of all percussion mallets, the rubber-headed sticks generally used to play virtually all high and medium-pitched percussion, particularly idiophones. I will use the term "rubber series" to denote these mallets as a group. The heads of these mallets are small rubber balls, ranging from extremely hard to so soft they can be squeezed with the fingers (Fig. 72a). An almost unbroken continuum of these sticks exists between the hardest and softest varieties (one maker, for instance, offers twelve different hardnesses), and there is a parallel series of mallets the heads of which are tightly wrapped in yarn. The yarn of these **wound mallets** (Fig. 72b, c, d) is of a thicker gauge on soft mallets than on hard ones, so the wrapping and the core vary together in hardness. Wound mallets give a gentler attack than the unwound ones and are slightly larger and effectively softer than unwound mallets of equivalent hardness. For an instrument that makes everyday use of these sticks (see the vital-statistics charts in the next two chapters), the indications "soft sticks," "medium sticks," and "hard sticks" are sufficient to denote mallets within the range of winding and hardness normally used with that instrument. To call for an unusually hard or soft mallet or to demand the use of any of these mallets on an instrument with which they are not normally associated it is necessary to fall back on a rather vague terminology derived from the mallet instruments with which the rubber-series mallets were originally exclusively associated. Figure 73 shows how various degrees of hardness can be designated in wound or unwound mallets. The "bell mallet," by the way, is not a mallet for bells but for the "orchestra bells"—i.e., the glockenspiel.

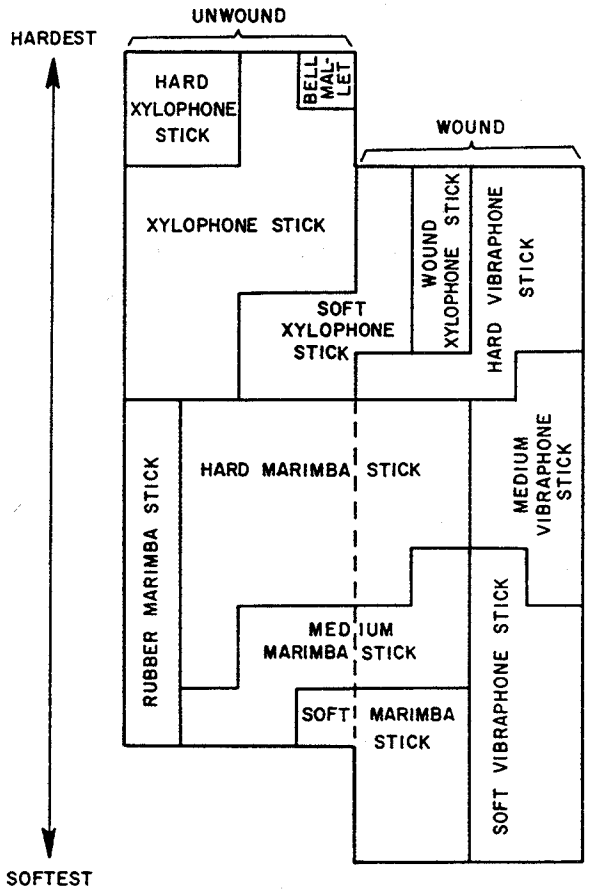


FIGURE 73. *"Objective" names of rubber-series mallets. Each block covers the range of sticks, wound and/or unwound, denoted by the term written inside it.*

Harder than any of these are **plastic sticks**, which are identical to hard xylophone sticks in weight and appearance but have heads made of phenolic or acrylic plastic rather than hard rubber. Their normal use is in production of harsh, clangorous sounds of almost unbelievable loudness from small or medium-sized metal idiophones, though they can of course elicit soft sounds as well.

FELT STICKS

The sticks used most frequently for large, low-pitched percussion have heads made of felt that are larger, heavier, and softer than the rubber-series mallets; the hardest of these **felt sticks** are a little harder than the softest marimba sticks. Most important among the felt sticks are the **timpani sticks**, available in a continuum of hardnesses out of which the composer need only distinguish hard, medium, and soft (Fig. 74a–c). Softer, larger, and heavier than any timpani stick is the **bass drum beater**, which comes in "heavy" and "light" varieties; many, as in our illustration, have a heavy and a light head at the two ends of a single stick. Most ponderous of all is the **gong beater**, normally used only for large gongs, tam-

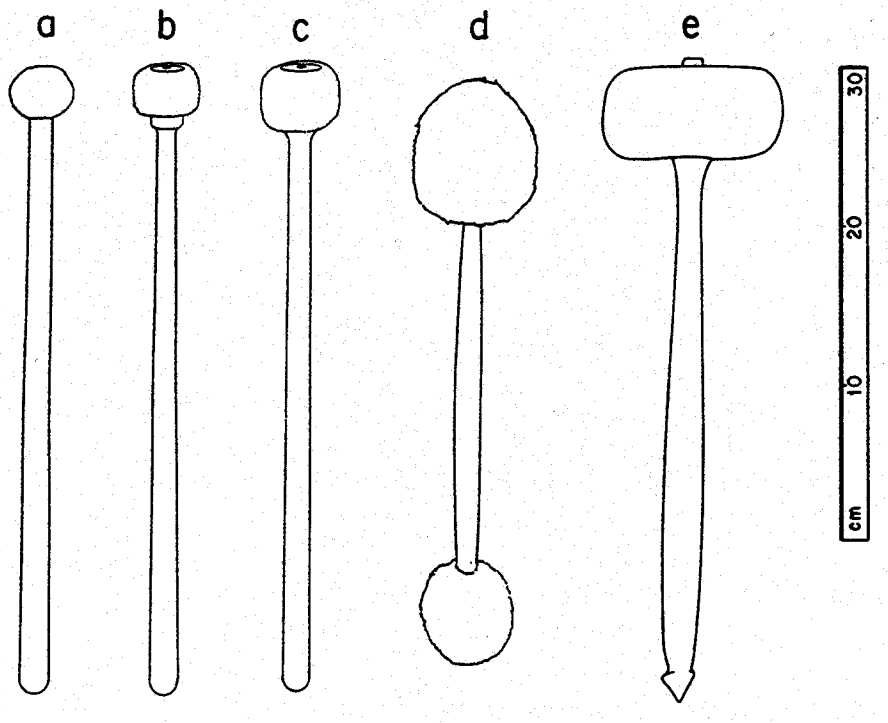


FIGURE 74. *Felt sticks: (a) hard timpani stick; (b) medium timpani stick; (c) soft timpani stick; (d) bass drum beater; (e) gong beater.*

tams, and thundersheets. The important thing about a gong beater is not its softness (some are as hard as a medium timpani stick) but its size and weight.

WOOD AND METAL STICKS

There are rather sketchy wood and metal series of sticks, as well as a few specialized mallets that defy classification. The most common wood stick is the **snare stick** used, as its name implies, mostly with the snare drum. This stick tapers to a very small, light tip which may be carved out of the wood of the shaft or jacketed with plastic. One can distinguish light and heavy snare sticks, but the best way to get a distinctly heavier sound is by using the back end of the shaft, which is considerably thicker and heavier than the tip. The reverse of a timpani stick is of similar weight and in many instances is designed specifically for use as a wooden stick of medium weight. The instruction for reversing these or any other sticks is simply "back of snare [or whatever] sticks." Heavier even than reversed snare or timpani sticks is the **wooden timpani stick**, used on the timpani and other large drums to get a particularly brilliant "drummy" quality. The heaviest "wood" stick is the **chime mallet**, still associated almost exclusively with the chimes; it is actually a small hammer with a cylindrical head made of a rolled-up strip of rawhide, which is more durable than wood and has virtually the same weight and hardness. For "wood" sticks even lighter than snare sticks one may turn to the rattan or plastic backs of any of the rubber-series mallets, which are very light and thin. These produce a sound that is mostly attack noise.

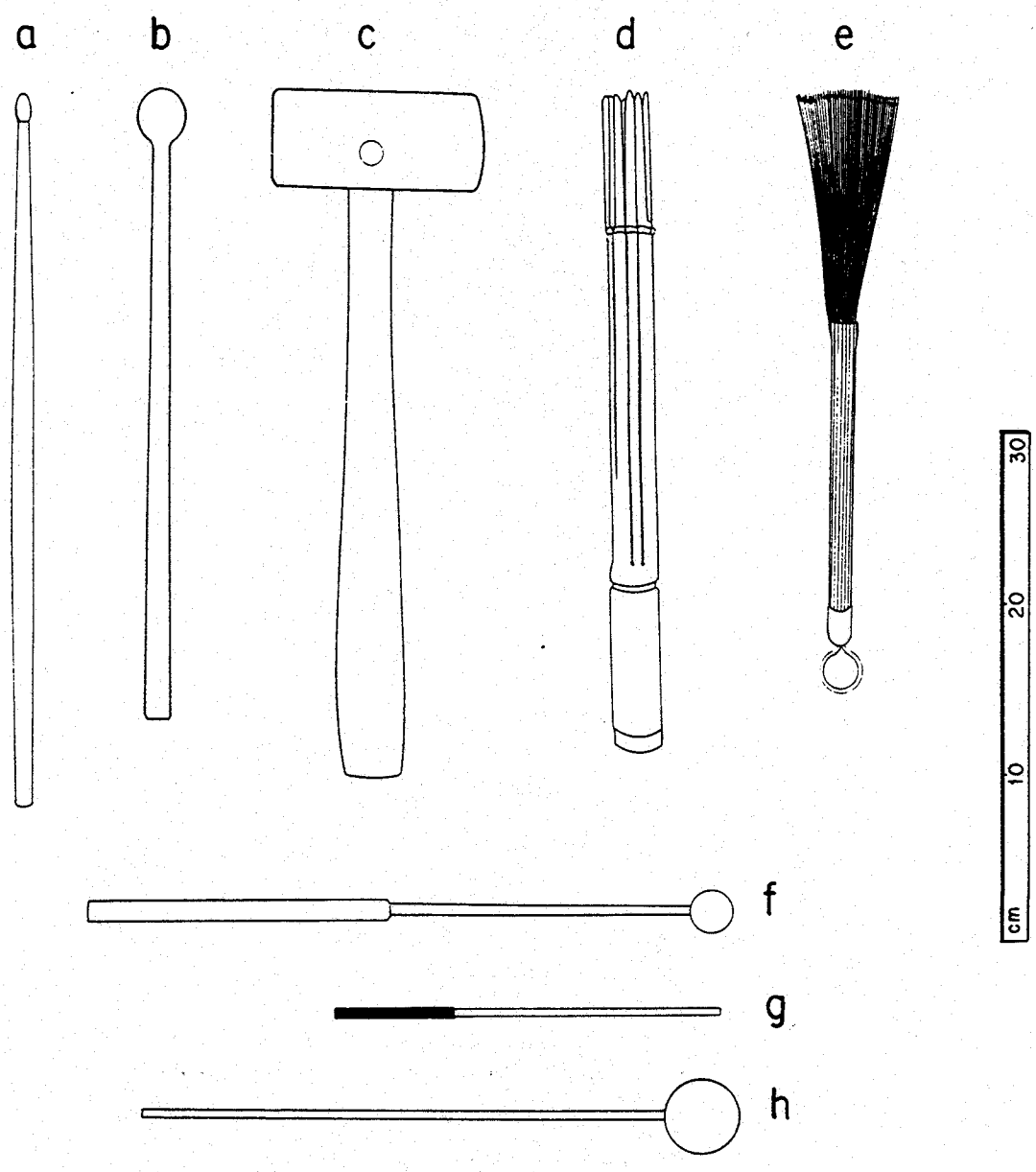


FIGURE 75. *Miscellaneous sticks and mallets: (a) snare stick; (b) wooden timpani stick; (c) chime mallet; (d) switch; (e) wire brush; (f) metal glockenspiel stick; (g) triangle beater; (h) superball stick.*

The hardest sticks of all are those with metal heads. Chief among these are **metal glockenspiel sticks**, the heads of which are tiny balls of spun brass weighing about as much as a rubber-series mallet. These metal sticks give a very light, precise, pinging sound to glass or metal idiophones; they are destructive to drums and wooden instruments unless used very gently. For a very light metal stick actual **knitting needles** made of hollow aluminum have occasionally been used. These produce a sound that is almost all attack noise but somewhat louder and more metallic than that of the reversed rubber-series mallets.

The use of anything heavier than metal glockenspiel sticks is primarily a theatrical gesture. There are the ordinary **nail hammer** and the somewhat smaller **geologist's hammer**,

neither of which can be safely used with full force on any but the most simple and rugged of homemade idiophones, and finally the **sledge hammer** (as in, e.g., Berg's *Three Pieces for Orchestra*) which can only be withstood by a massive, flat block of wood or metal and which always makes the percussionist look a bit like a berserker. Since percussion instruments are as a rule both delicate and expensive, none of these hammers should be employed indiscriminately. A specialized metal stick of light weight is the **triangle beater** (Fig. 75g), a simple, headless* metal rod designed to strike from the side rather than the tip. One end of the beater is frequently rubber-jacketed, giving a very weak, muffled sound.

SPECIALIZED STICKS

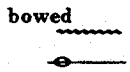
For very light, swooshing sounds two kinds of **brushes** are available. The older, and now less common, variety is the **switch**, originally—and often still—a bundle of ordinary twigs tied together at one end; for heavy-duty work, switches are made in the form of a wooden cylinder cut lengthwise into strips. Much more common than the switch, and derived from it historically, is the **wire brush**, a fan of thin metal wires. It is incapable of producing sounds louder than *forte*, but can create nuances of great subtlety and delicacy. The switch is a much coarser device than the wire brush, eliciting louder (up to *ff*) and deeper pitches from objects it strikes and containing so much attack noise that it can be used by itself as a hand instrument, producing a soft, dry clatter like a clutched windchime. Both switch and wire brush can be used to produce a continuous, whispery sound from an instrument by rubbing rather than striking. The notation for this is not quite standardized, but  is fairly unambiguous. The notation  with brushes indicates, as with other sticks, a rapidly repeated striking motion, and  should be used *only* for true trills. It is occasionally required that mallets of other sorts (especially metal ones) be rubbed across an instrument in this fashion; the notation is the same.

One stick, the **superball stick**, is specifically designed for rubbing rather than striking. Superballs are highly conservative of kinetic energy: when one of them strikes an object, it bounces back with some 90 percent of the speed and power with which it hit. If a hole is drilled into a superball and an ordinary rattan mallet-shaft is stuck into the hole, a mallet is created that will hum when rubbed against various objects. The friction involved in rubbing causes the head of the stick (the superball) to move in minute jerks rather than smoothly; the elasticity of the ball converts this jerking into a regular vibration—i.e., a very rapid bouncing motion. The reader may be familiar with such similar phenomena as the thumb roll of the tambourine or the sound produced by rubbing a wet finger around the rim of a wine glass, but because of its astonishing bounciness a superball stick will hum when rubbed against *anything*—not only drum heads and tam-tams but walls, floors, windowpanes, the bars, sides, and resonators of mallet instruments, any conceivable part of a piano or contrabass, the sole of a shoe. All that is required is that the surface offer some resistance to the ball, for the stick must be pressed down rather firmly to elicit the hum. The ball is so massive and so

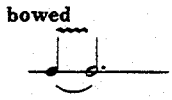
* The heaviest triangle beaters are curved into a loop at one end, forming a head of sorts.

elastic that the pitch of the hum (actually a groaning sound very similar to a string drum in timbre) has nothing at all to do with the pitch of the object being rubbed but is simply a function of the pressure and speed with which the ball is rubbed and of the smoothness of the surface against which it is rubbed. The loudness of the sound is also dependent on these factors, ranging between *pp* and *ff*. Of course, if a superball stick is rubbed against an instrument or other naturally vibratory object, the object will be set into vibration by the stick, *at its own frequency and timbre*. Superball sticks cannot be used (except as a theatrical gesture) to strike an instrument; the weight (as heavy as a bass drum beater) and elasticity of the head would cause the stick to bounce repeatedly on every stroke or to fly out of the player's hand.

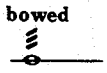
Another "rubbing" sound is that produced by **bowing**. The contrabass bow employed for this purpose can be used on any idiophone that presents a distinct edge to be bowed—most notably cymbals, gongs, and tam-tams. The sounds produced, which vary considerably, are discussed in Chapter VII, under the headings of the individual instruments. It is recommended that the notation  be used for bowing so that it is possible to differentiate among such effects as:



(note bowed for its entire length),



(note bowed for the first beat only, and the instrument allowed to resonate for three more beats), and



(bowed tremolo, as for the violin).

These notations must be accompanied, as above, by the word "bowed" placed immediately before the bowed passage. It may on occasion be desired to indicate downbow ⊓ and upbow ∨ (see Chapter IX).

SPECIAL EFFECTS

Some of the hand instruments can be used as mallets to strike other instruments; maracas and claves are the most useful in this respect. Intriguing and somewhat indeterminate sounds can be produced by dropping or throwing small objects (coins, marbles, dried beans, dice, gravel, BB shot) onto an instrument from above. If they are dropped from high up, or are poured in quantity from a container, they will of course remain underfoot until the end of the piece—unless the clean-up process is made part of the music!

Many subtle and delicate effects can be drawn from most percussion instruments by playing them directly with the hands and fingers. This **finger-style playing** is most useful on rimless, small-headed drums (congas, bongos, dumbegs, etc.), but is of occasional value elsewhere. Most idiophones can be played this way only *mezzo-piano* or softer. The different

strokes possible in finger-style playing are produced by (1) the tips of the fingers; (2) the flat of the fingers and side of the thumb; (3) the flat of the hand; (4) the heel of the hand; and (5) the fist. The fist is useful only for getting the loudest possible "hand" sound out of large drums and tam-tams; the various other strokes are covered in the next chapter as part of the discussion of bongos. A special technique is the **thumb roll**, executed by pushing the tip of the thumb across the surface of the instrument. The thumb will vibrate at a very low frequency (the vibration is produced by friction, as with the superball stick) which is not itself heard but which creates a very rapid, steady "roll" sound on the instrument. This effect can be continued indefinitely on loose-tensioned drums—most notably the tambourine, on which the thumb roll is a basic performance technique—but on other instruments it is a very transient phenomenon, more a special kind of attack than anything else. Thumb rolls should be notated like other "rubbing" effects (), with the indication "thumb," "thumb roll," or " 𝄾 " to be added when necessary as a reminder.

THE INSTRUMENTS

The expansion of the percussion section to its present size and diversity took place so recently that many of the instruments are not yet even approximately standardized. Also, a surprising number of the instruments are not manufactured as such but must be obtained from a variety of unlikely sources or even built from scratch by the percussionist. These uncertainties are reflected in the vital-statistics charts given in the next two chapters.

Most percussion instruments give out only a single pitch; for such instruments the pitch range given is the composite range covered by *all* available instruments of that type. Obviously the upper and lower limits of that range will be quite vague, as will the distinction between "normal" and "extension" tones: it is a matter of the statistical likelihood of finding an instrument of a given type built at a given pitch. Many idiophones are built with no thought of pitch in mind at all, so the distribution is truly random.

Synonyms are listed where necessary, and the more important minor variant instruments are discussed in the text. The nature and origin of each instrument are given in its chart as its **status**, which may fall into one or more of six categories: (1) **standard** instruments built by instrument manufacturers (example: vibraphone); (2) **exotic** instruments, which must be imported from a folk or non-Western music culture (example: tabla); (3) **novelty** instruments built and sold for educational or amusement purposes or as sonorous *objets d'art* (example: shell windchime); (4) **homemade** instruments the percussionist or composer must build from scratch (example: thundersheet); (5) **noisemakers** designed as signaling or warning devices (example: referee's whistle); and (6) **found objects** from kitchen or junkyard (example: brake drums). The "availability" of instruments in the last three of these categories is given only as an indication of how many percussionists *already have these instruments on hand*. For instance, if an instrument is listed as "homemade" and "very rare," this indicates that it will almost certainly be necessary to have one specially built to play any part written for it.

Musical Examples

The pieces listed below are meant to serve as musical examples for chapters V through VII of this book. For each piece the number of percussionists involved is given, followed by a list of all the percussion instruments used, including those played by non-percussionists, in the order in which they are discussed here. Infrequently occurring instruments are cited in **boldface type** so that examples of their use may easily be tracked down. The names of all instruments are given exactly as they appear in the score (translated into English where necessary); when a different name is used in this book, the synonymy is indicated with an equals sign (=). Minor variants of instruments discussed here are designated with the sign of equivalence (≈), and the few instruments not covered here at all are analogized to instruments of similar timbre with the approximation sign (~).*

Milhaud, *L'Homme et son désir* (19 players)

- snare drum
- tambourin provençal≈**long drum**
- small double-headed drum
- tenor drum
- bass drums
- tambourine
- sleighbells
- **wood castanets**
- **metal castanets**
- slapstick
- triangle
- hammer, with board = **wood slab**
- suspended cymbal
- crash cymbals
- tam-tam
- **mouth siren**
- **wind machine**
- **whistle**

Varèse, *Ionisation* (13 players)

- tarole≈high snare drum
- snare drums
- tambour militaire≈field drum
- side drum = tenor drum
- bass drums
- tambourine
- bongos
- **string drum**
- maracas
- sleighbells
- güiros
- castanets
- slapsticks
- triangles
- claves
- **anvils**
- Chinese blocks = woodblocks
- muted cencerros
- suspended cymbal
- crash cymbal = **large Chinese cymbal**
- crash cymbals
- tam-tams
- gong
- chimes
- **sirens**

Chavez, *Sinfonia India* (5 players)

- timpani
- snare drum
- tenor drum = field drum, or **water gourd**
- bass drum, or tlapanhuehuetl≈very large Indian drum
- Indian drum
- maraca, or clay rattle
- **metal rattle**

* Such instruments are of limited musical usefulness and are introduced by composers largely as a theatrical gesture.

soft rattle, or tenabari = string rattle made of butterfly cocoons
rattling string = **wooden string rattle**, or grijutian = string rattle made of deer hooves
güiro
rasping stick = wooden rasp
claves
suspended cymbal
xylophone, or teponaxtles≈slit drums

Roldán, *Ritmicas V, VI* (11 players)

timbales de orquesta = timpani
timbales cubanos = **timbales**
bombo = bass drum
bongos
maracas
quijada
güiro
claves
cencerros
marimbula

Harrison, *Canticle No. 1* (5 players)

drums = tomtoms or double-headed drums
tambourine
sistrum
gourd rattle≈maraca
wood rattle
windbell≈glass windchime
morache≈wooden rasp
triangle
woodblocks
dragon's mouths = temple blocks or mokugyos
high bells
bell
large glass bells
clay bells
cowbells = cencerros or almglocken
thundersheet
suspended cymbal
tam-tam
gongs
brake drum

Cage, *Amores* (3 players)

tomtoms = **Indian drums**
pod rattle = **Mexican bean**
wood blocks (not Chinese) = **softwood planks**

Cage and Harrison, *Double Music* (4 players)

sistra
water buffalo bells≈small bells
sleigh bells≈small bells
Japanese temple gongs
cowbells = cencerros or almglocken
thundersheet
large tam-tams
muted gongs
water gong
brake drums

Messiaen, *Chronochromie* (5 players)

suspended cymbal
Chinese cymbal
tam-tam
gongs
chimes
xylophone
marimba

Boulez, *Le Marteau sans maître* (3 players)

frame drum
bongos
cymbalettes≈**jingles**
maracas
claves
cloche double = **agogo bells**
very large suspended cymbal
tam-tams
gong
xylorimba≈xylophone
vibraphone

Berio, *Circles* (2 players)

timpani
tablas≈**small kettle drums**
tomtoms

snare drum
bass drum
tamburo basco = tambourine
bongos
congas
Mexican bean
maracas
wood windchime
glass windchime
sandblocks
güiro
triangles
claves
clapped hands
woodblocks
log drum = slit drum
temple blocks
cencerros
lujon
suspended cymbals
sizzle cymbal
clap cymbals = crash cymbals
finger cymbals
hi-hat
tam-tams
gongs
suspended chimes = chimes
xylophone
marimbaphone = marimba
glockenspiel
vibraphone

Henze, *El Cimarrón* (1 player)

tomtoms
small drum = snare drum
gran cassa = bass drum
bongos
conga
bamboo drums = **boobams**
maracas
chain
bundle of hanging bamboo sticks≈wood windchime
glass chimes = glass windchime
shell chimes = **shell windchime**
matraca≈ratchet
güiro
claves
body percussion
wooden plank = **wooden slab**
metal sheet = **metal slab**
Trinidad gong drum = **steel drum** (ping pong pan)
log drums = slit drums
temple bells = Japanese temple gongs
cowbells = almglocken
marimbula
thundersheets
suspended cymbals
tam-tams
crotales
marimba
vibraphone
bird whistle≈crow

Xenakis, *Persephassa* (6 players)

timpani or timbales
tomtoms
snare drums
bass drums
bongos
congas
maracas
wooden simantras≈**wood rods**
metal simantras≈**metal rods**
stones
woodblocks
affolants = small aluminum-foil thundersheets
suspended cymbals
tam-tams
gongs
mouth sirens

Crumb, *Music for a Summer Evening* (2 players)

tomtoms
bongos
sistrum
maracas
sleighbells
bamboo windchime

glass windchime
quijada
güiro
bell tree
triangles
claves
Tibetan prayer stones≈**stones**
woodblocks
African log drum≈slit drum
temple blocks
Japanese temple bells≈bells
African thumb piano = **kalimba**
thundersheet
suspended cymbal
sizzle cymbal
tam-tams
crotales
tubular bells = chimes
xylophone
glockenspiel
vibraphone
slide whistles

Maxwell Davies, *Eight Songs for a Mad King* (1 player)

tomtom
side drum = snare drum
bass drums
rototoms
tambourine
jingles (= individual sleigh-type pellet-bells) and other small bells
chains
windchimes
football rattle = ratchet
washboard
steel bars = **anvils**
woodblocks
temple blocks
suspended cymbals
foot cymbals = hi-hat
tam-tam
crotales
xylophone
glockenspiel
railway whistle = referee's whistle
bird calls (various)
crow
squeak

Kagel, *Match für drei Spieler* (1 player)

snare drum
bass drum
Chinese paper drum~small Indian drum
Waldteufel≈very small string drum
sistrum
leather and metal dice cups, with dice (~rattles)
sleighbells
ratchets
metal castanets
handbells≈bells
wind-up bell≈electric bell
flexatone
suspended cymbals
sizzle cymbal
crash cymbals
marimba
referee's whistles