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THE EFFECT OF LIP-SLUR PRACTICE ON INCREASING PITCH RANGE IN BRASSWIND INSTRUMENT STUDENTS

by

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TABLE OF CONTENTS

ABSTRACT

Lip-slur exercises comprise part of the practice routines of many professional and serious amateur brasswind players. There are several reasons why so many players practise lip-slurs. One of those reasons is the belief that lip-slurs contribute to the development of the brasswind high register. This study argues that while there is a vast amount of anecdotal evidence from many authors widely deemed to be influential in the form of method books or writings that lip-slurs can contribute to the development of the brasswind high register, there has been little research to support this widely held belief.

This study used a matched subjects control group pre-test/post-test design to test a researcher-designed lip-slur teaching program aimed at subjects in their second to fifth years of brasswind study. The subjects were in school years eight, nine and ten. The pre-test and post-test was a researcher-designed high register test utilising a chromatic scale.

In order to account for family variables which might influence the experiment, a questionnaire was developed and various statistical procedures used to calculate the effect of family background.

The results of this study indicated that lip-slurs play an important role in the acquisition of the high register by brasswind students. The degree of importance is dependent on various factors. From this study, it appears that a major factor is

the ceiling effect. Students who scored low to medium pre-test scores gained greater initial benefit from the inclusion of lip-slurs in the teaching program than those who had high pre-test scores. The students on whom the ceiling effect acted most were those who achieved high pre-test scores.

This study concluded that low achievers can gain rapid short term advantage from lip-slur practice, while for high achievers, the inclusion of lip-slurs in the daily routine could lead slowly to long term gain.

I certify that this thesis does not incorporate without acknowledgment any material previously submitted for a degree or diploma in any institution of higher education; and that to the best of my knowledge and belief it does not contain any material previously published or written by another person except where due reference is made in the text.

Signature 

Date 26/11/98

I wish to acknowledge the guidance and encouragement of my supervisor, Associate Professor John Williamson, friend and mentor for thirty-five years. I wish also to acknowledge the co-operation of the Principals, teachers and students who participated in this research, and the patience and encouragement of my wife Julie and my two children during the time of research and writing of this thesis.

LIST OF TABLES AND FIGURES

CHAPTER ONE

INTRODUCTION

This study is an investigation into a view held by some players of brasswind instruments in that practising lip slurs is one method of increasing the range of the high register. The major focus of this study relates to the physical aspects of brasswind playing that must be acquired in order to be able to play with musicality, style and taste. While musicality, style and taste are important goals, they are not the central objective of this research.

Background to the study

The desire to improve the playing skills of students has been helped by the use of sporting metaphors and analogies in this researcher's own teaching practice. Such analogies are used to explain various physical factors of brass playing including skills acquisition, strength and endurance. These analogies are also useful in explaining the need for many repetitions of a skill in order for it to become a reflex action. As students are aware of the need for repetition and practice in a sporting context, it is a simple step for them to accept that music performance has similar demands. This is a powerful motivational tool which also helps students understand concepts which are difficult to describe, taking them from a concept they already understand to a concept which is new.

From this, it was a short step to asking whether the ideas were not only analogous, but could also be adapted for better rehearsal techniques. The researcher's original intention was to adapt a Myological study from the human movement field to a

brasswind practice purpose, and then replicate the study as a brasswind practice routine. Further reading revealed however, that Myer Savits' unpublished thesis, *Muscle Training Techniques applicable to methods incorporating myological principles in elementary brass embouchure training curricula*, (1982), had already examined embouchure development using myological principles, establishing a link with the myological principles used in the study of human movement. Savits described commonly used embouchure building practice routines as either Isometric or Isotonic exercises. Isometric exercises included exercises such as long note playing, particularly in the high register, and "long-setting", playing a series of short, high notes. Lip slurring was described as an Isotonic exercise. While Savits mentioned Isotonic exercises, his study concentrated on Isometric exercises, and the results refer mainly to those types of exercises.

Brasswind performance background

Many trumpet and trombone parts, in both the orchestral and jazz idioms require players to play in the extreme high register above the eighth harmonic to as high as the sixteenth or twentieth harmonic, and in rare cases, higher. This requirement has its origins in the clarino trumpet, soprano trombone and alto trombone playing of the Baroque period and continues for all brass instruments to the present day. This researcher has observed that many professional and proficient amateur brass players use lip-slurs as one means of securing the high register.

There are other techniques for increasing range in the high register, such as long setting and playing increasingly higher scales and arpeggios. Many players use a mixture of all methods.

Savits, (1982, pp. 22-24), interviewed several hundred professional brass players and five hundred advanced college and high school students in the USA to investigate what methods they used to develop range and endurance. The most commonly used method books utilised the myological principles of isotonic and isometric exercises, and interval training.

Many professional brass players include muscle development techniques in their practice routines, using methods developed by Maggio, Shuebruk, Gordon, Caruso and others. In their definitive works on brass playing, both Edward Kleinhammer (*The Art of Trombone Playing,* 1964) and Philip Farkas (*The Art of Brass Playing* and *The Art of Horn Playing,* 1962) paid considerable attention to the physical aspects of brass playing and in particular, the facial musculature involved.

Purpose of the Study

The purpose of the study is to examine the effect that a graded series of lip slurs would have on the acquisition of the upper pitch range by brasswind students. The intention is to investigate the extent to which practising lip-slurs would enhance the acquisition of high notes on a brass instrument. From the data collected during the study it was inferred that under similar conditions, using a practice program of graded lip slurs as a supplement to their regular instruction program, other students would be able increase their high register and make their

high register more secure. The lip slur program was not intended to replace the normal teaching program, but to supplement that program. It anticipated that the results of this study would enhance brass teachers' confidence in designing that component of a course in brasswind study related to the acquisition of increased pitch range.

CHAPTER TWO

RESEARCH QUESTIONS

Major Questions

1. Will a series of graded lip slurs, when included in a normal brass teaching curriculum, enable students to more easily acquire a higher range compared to students who do not have a series of graded lip slurs in their curriculum?
2. Do lip slurs play an important role in the acquisition of the high register by brasswind players?

Subsidiary Questions

1. In what way/s can lip-slurs be employed in designing effective practice routines?
2. Using evidence collected from the Student Profile questionnaire, in what ways do Family Background factors influence practice routines and consequently, influence student achievement?

The Null Hypothesis

That for students who receive a series of graded lip-slurs as a supplement to a standard brasswind teaching curriculum, there will be no observable effect on the acquisition of higher range compared to students who do not have a graded series of lip-slurs as a supplement to the teaching curriculum.

LIMITATIONS TO THE STUDY

Many factors combine to create the ideal brass-wind performance. These include artistic factors such as interpretation and style and the physical factors which enable the performer to create the characteristic sound and technical capabilities of brass-wind instruments.

Skills involved in brass-wind performance include breathing, tonguing, fingering or slide technique and embouchure technique.

The skilful player's embouchure needs endurance, suppleness, flexibility and strength, which can be achieved with an appropriate balance of isometric and isotonic exercises. Isometric exercises, including long setting and long note exercises, enable the player to develop power. Isotonic exercises increase embouchure strength, flexibility and endurance. It is this author's contention that increased range is greatly enhanced by embouchure muscle strength and that isotonic exercises, specifically lip-slurring, are useful in increasing high register range.

Although both isometric and isotonic exercises increase muscle strength, this study will confine itself to investigating the effects of lip-slurs, an isotonic exercise, in improving the player's high register.

CHAPTER THREE

DEFINITION OF TERMS

For the purposes of this study the following terms are defined:

Ceiling effect: The ceiling effect is a source of error in the non-randomised control group pre-test/post-test design, whereby high scorers in the pre-test have less likelihood of gain than low pre-test scorers because they are already close to maximum performance. Low scorers, by contrast, are not close to the maximum and have a greater chance of exhibiting high gain scores. Burns (1994) gives a more detailed description of the ceiling effect.

Cultural capital: For the purposes of this dissertation, cultural capital is defined as the extent to which a family is prepared to, or is capable of, committing family income to items of a cultural nature. Such items may include reading matter such as books, magazines and journals, musical recordings on vinyl, compact disc or tape, sheet music and so on. In this study, a value distinction is made, in ascending order of preference, between "very little", "popular", "classical" and "a wide variety". No attempt is made to justify this order of preference. The amount of income spent by a family on cultural capital may be the result of any combination of attitude, priorities or financial circumstance.

Embouchure:

The way in which brass players set their lips to make the buzzing sound necessary to play brass instruments. This is formed when the Obicularis Oris muscle is contracted. The facial muscles surrounding Obicularis Oris act in opposition to O. Oris, thus having the effect of stabilising the complete group of muscles involved. This forms a hole in the lips known as the aperture, which, when viewed through an embouchure visualiser, looks like an oboe reed. By controlling the degree of contraction of the various muscles, the aperture can be made larger or smaller. A larger aperture gives a slower lip vibration hence a lower note and a smaller aperture gives faster lip vibration hence a higher note. Because a higher note requires a smaller aperture and balances a comparatively fast air stream, more strength is required to maintain the small shape. Farkas, (1962), and Kleinhammer, (1964), provide detailed information on this aspect of the topic.

Interval Training:

A training program that alternates high intensity work and rest intervals to induce a greater training effect than would occur in an uninterrupted work program. (Savits, 1982, p. 5)

Isometric:

(a) A system of exercising in which opposing muscles are so contracted which there is little shortening but great increase in tone of the muscle fibres involved. (Webster's Seventh New Collegiate Dictionary, 1971).

(b) Contraction in which tension is developed but there is no change in the length of the muscle. (Savits, 1982, p. 5)

Isotonic:

(a) Relating to or exhibiting equal tension. (Webster's Seventh New Collegiate Dictionary, 1971).

(b) Contraction in which muscle shortens with varying tension while lifting a constant load. However, owing to lever systems there is a change in resistance. (Savits, 1982 p. 6)

Lip-slur:

The practice of slurring between the naturally occurring harmonics of a brass instrument. The number of harmonics used may vary according to the experience of the player or the nature of specific exercises.

Long setting:

An extension of long tone studies where the mouthpiece remains in contact with the set embouchure for the duration of the exercise. (Savits, 1982, p.6)

Myological:

(a) From *myology*, the scientific study of muscles. (Webster's Seventh New Collegiate Dictionary, 1971)

(b) Generally accepted theories concerning muscle development such as overload, interval training and endurance and strength training regimes. (Savits, 1982, p. 7)

Overload principle:

Strength, endurance and muscle size increase, within limits, in response to repetitive exercise against progressively increased resistance. (Savits, 1982, p. 7)

Pitch convention for octaves: This dissertation follows the pitch convention for octaves described in the *Harvard dictionary of music* whereby the pitch "c" on the second space of the bass clef is described as c. The octave lower is described as C, while the octave higher, middle c is described as c^{i}. Successively higher octaves gain successively more superscripts, thus c in the third space treble clef becomes c^{ii}, the next octaves c^{iii}, c^{iiii} and so on. (Apel, 1970, p. 679).

CHAPTER FOUR

REVIEW OF THE LITERATURE

Extensive research into brass literature indicates that lip-slurring is a very old, possibly ancient practice that within the European cultural context has been passed down through successive generations of brass players and has been accepted by them as an effective practice. However, this reviewer has found little empirical evidence to support the view that lip-slurs are an effective method of increasing one's ability to play in the higher register. The evidence to date appears to be mainly anecdotal rather than research-based.

Historical Context

Brass instruments of various kinds such as the Greek salpinx, Roman buisine, buccina and lituus, and the Jewish shofar have existed since Biblical times. Similar instruments are still found in many Asian cultures. (Apel, 1970, p. 109). Like modern bugles and cavalry trumpets, they did not have valves, relying only on the naturally occurring harmonics of the instrument to produce notes of varying pitch. These instruments were used primarily for ceremonial and military signalling purposes in much the same way as bugles and cavalry trumpets are used today. The method of playing valveless instruments can reasonably be assumed to have stayed much the same throughout history.

Edward Tarr (1977/88, p. 95) described the apprenticeship and examination of prospective trumpet players during the Baroque era. Apprenticed trumpet players had to be able to play certain military signals and show some knowledge of clarino playing. "As today, he first learned to play in the low register, gradually ascending higher and higher."

John Hyde was the pre-eminent slide trumpet player of Britain in the 1700's. In 1798 he wrote a method book entitled *Complete Preceptor for the Trumpet and Bugle Horn.* On the subject of embouchure Hyde advised (cited in McCann, 1989, p. 38) "draw your lips tight over the teeth; then put your tongue between your lips and place the mouthpiece firm on the centre of your mouth, a little more on the upper lip than the lower one." With the exception of placing the tongue between the lips this is remarkably similar to the modern method of setting the embouchure. On the subject of playing higher notes Hyde advised "contract your ambesure [sic], press your instrument harder on your lips, and strike your tongue."

McCann (1989, pp. 38- 40) wrote that the method advised by Hyde was repeated by other authors such as J. Pashen (1825), T. Bull (1835), B.A. Burdett (1850), John Distin (1851), Alfred Sedgwick (1873 & 1876) and Winner (1877). These were in line with the practice favoured in the nineteenth and early twentieth century, and advocated by Arban (1859/1907), of increasing mouthpiece pressure to play high notes. Although mouthpiece pressure was advocated, Hyde still recommended contracting the embouchure as Arban later did in 1859, implying that the muscles of the embouchure should be involved.

Arban and others indicated that the range of the cornet or trumpet was two and a half octaves from written f sharp to written c^{iii}. But performance practice in both the Baroque era and the Twentieth Century requires trumpeters to play in extreme high registers, unlike during the late eighteenth and nineteenth centuries, when the art of clarino playing was apparently lost.

Edward Tarr (1977/1988) argued that Baroque trumpeters must have used techniques similar to modern trumpeters when he stated that:

> In the Baroque period, when trumpeters had to play melodies in the fourth octave of the harmonic series, they corrected the impure partials by a change in the lip tension. Modern-day trumpeters employ the same technique, called "lipping," in order to correct occasional deviations in pitch – deviations however, which are much smaller than those encountered by the Baroque trumpet. We can therefore say that the trumpeters of the Baroque era needed more lip strength in order to play their instrument in tune. (p.14)

In making that statement, Tarr was comparing the demands made by contemporary jazz and symphonic writing upon modern trumpet players with the demands clarino playing made upon Baroque players. In doing so, Tarr postulated that because the players from both eras faced similar problems, then the solutions to those problems must also be similar. Physical inspection of a Baroque trumpet mouthpiece reveals a very sharp, narrow rim, which if used with the pressure method, would cut painfully into the lips. The only reasonable technique would have to have been to use limited mouthpiece pressure, which is the desired practice today.

In a discussion on lipping out of tune partials into tune, Tarr (p.89) argues that lipping requires light mouthpiece pressure and that this is the method used by all professional players today. He goes on to say that modern trumpet methods emphasise light mouthpiece pressure and correct breathing. Tarr argues that modern and Baroque embouchures have much in common. In discussing lipping downwards, Tarr argues that the player needs a slightly puckered embouchure with as much upper lip as possible in the mouthpiece.

In his discussion of modern trumpet technique, Tarr (p.195) pointed out that orchestral trumpet playing has been influenced by jazz, and that modern players have learned to play in the register c^{iii} to c^{iiii} and sometimes higher. Tarr claims that this is accomplished not by the nineteenth century "smile" embouchure advocated by Arban, Hyde and others, but by "pushing the stiffened corners forward a bit, although allowing the lip muscles themselves to relax as far as possible." This is the "puckered" embouchure recommended by modern authors such as Farkas (1962/1965), Claude Gordon (1975/1977) and others (Savits, 1979, p. 88).

Arban and other authors in the nineteenth century advocated varying pitch by varying the mouthpiece pressure using the left arm as a regulator (Arban, 1859/1907, p.5). Those same authors also claimed that the range of the cornet (or any other brass instrument as indicated by the titles of the many "preceptors" cited by McCann) was only two and a half octaves. It is possible to argue that as extreme range was commonly used in both the Baroque era and in the twentieth century using the "puckered" embouchure and light mouthpiece pressure, then the

restricting factors in the nineteenth century were the "smile" embouchure and the use of excessive mouthpiece pressure.

The change in ideas from the nineteenth century methods to modern methods began during the late eighteen hundreds. By 1886 authors such as E. Bourke, in his *ABC Instructor* (cited in McCann, 1989, p. 40) had begun to advocate using breath pressure and lip tension in combination to produce differing pitches. McCann quotes Bourke as saying:

> By gentle compression of the lips and, blowing softly, the lower notes are produced; and by pressing with more firmness, contracting the lips more and blowing harder, the high notes will be produced. The aperture between the lips is larger for lower notes. (p. 40)

It is interesting to note that although variations in mouthpiece pressure were still recommended, the concepts of air pressure and lip control were advised, as well as possibly the first use of the term aperture and its relationship to pitch.

Authors Pietsch, Hofman and Koslek in the late eighteen hundreds and early nineteen hundreds emphasised stretching the lips, attention to breathing and lip-slurs and trills (McCann, 1989, p. 57). Their technique for slurs was to change the vowel shape of the mouth in a way that arched the tongue to ascend and lower it to descend. This is a very modern concept, widely accepted, and advocated by Schlossberg who was the teacher of many first chair American trumpeters (including Louis Davidson, author of Daily practice routines [1970], his most famous pupil) and is still a widely influential figure, even after his death, through

his book *Daily drills and technical studies for the trumpet* (1959). That Schlossberg was a pupil of Kosslek, a Russian Jew who migrated to USA in the late eighteen hundreds, and that Schlossberg's work is still influential, is an extant example of the passing down from one generation to the next the skills and techniques of brass playing. Those skills were passed down both within and across cultures. Lip-slurs and trills are part of that tradition indicating that lip slurring and trilling have probably been passed down through many generations of brass players. Given that modern brass players face some of the same performance problems as ancient players, then lip slurring may have been one of the techniques passed down from very old origins indeed.

In a personal sense this reviewer, an Australian, was a student of George Powers, an American who was at one time the principal trombone with the Cleveland Symphony Orchestra. Powers was a student of Arnold Jacob, principal tuba with the Chicago Symphony Orchestra, widely recognised by brass players as one of the most influential brass players of the twentieth century. For this reviewer, this is a personal example of how brass thought, technique and practice has been passed from one generation to the next, not just within a local cultural context, but between continents, just like Kosslek immigrating from Russia and teaching American students. It is this reviewer's personal connection with the oral history and traditions of his art, which like all teachers, he passes on to his students.

During the nineteen twenties various new methods began to appear, particularly in the USA, which advocated non-pressure methods, correct muscle control and buzzing of the lips. McCann (1989, p.57) cites H.A. Vander Cook in his *Modern*

Method of Cornet Playing (Chicago, 1922) as advocating the correct system of muscular contraction, controlled buzzing of the lips in all registers, particularly without a mouthpiece, and tongue arching techniques to aid in lip-slurring. McCann (p. 57) also cited O. A. Peterson (*The Cornet,* 1924) advocating playing without mouthpiece pressure: "Try to push the lips away from the teeth a little...This will produce the right effect...Long tones, lip-slurs, consistent practice and frequent rest are all recommended". Vander Cook and Peterson in the nineteen twenties advocated ideas which in the late twentieth century are virtually universally accepted. Specifically, the modern ideas were the use of non-pressure, achieved by muscle control and the use of lip-slurs and frequent rests to achieve that. Modern writers such as Philip Farkas (1962/1965), Claude Gordon (1965/1975), Louis Davidson (1970), Carmine Caruso (1979) and others have expressed those ideas in their various methods and treatises.

Anecdotal evidence versus research

This researcher has conducted an extensive search over a period of three years for both dissertations on brass players' embouchures and journal articles about brass players' embouchures. To date this researcher has found only one dissertation, by Myer F. Savits, (1982), which discussed the use of lip-slurs as a means of strengthening the brass player's embouchure, and one dissertation, by Roger Dane (1983), which investigated embouchure and breathing in relation to sound production on the trumpet. Savits' dissertation was an unpublished Doctoral thesis titled: *Muscle training techniques applicable to methods incorporating myological principles in elementary brass embouchure training curricula.* Dane's dissertation was an unpublished doctoral thesis titled *Theories on embouchure and*

breathing: an analytical investigation into the functions for sound production on the trumpet. By contrast there is a large number of journals containing articles written by a wide range of authors who mention using lip-slurs as a means to strengthen the embouchure. Many of the articles have been written by authors previously mentioned such as Claude Gordon, Carmine Caruso, Philip Farkas and others. Many other articles are interviews with the above authors or prominent players. A representative sample of such journals would include *The instrumentalist, Brass bulletin, International trombone association journal, International trumpet guild journal, Horn call* and *TUBA Journal.*

From a research viewpoint these articles, written by highly acclaimed contributors, can be considered as anecdotal evidence. Although the articles contain views that are widely accepted, such as the views already discussed under the heading *Historical Context,* they are not supported by the rigours of research; rather they represent the body of the oral tradition of brass playing. Significantly, as discussed in the section on historical context, the oral tradition (the currently accepted wisdom) is prone to shifts in what is accepted as best practice. The long running arguments on pressure playing versus non pressure playing and mouthpiece placement which occupied much of nineteenth and twentieth century discourse are such examples.

During the last thirty years or so, there has been a shift towards a more scientific approach to understanding the embouchure and how it works. Farkas (pp. 25-31, 1962) included photographic studies of virtuosic players to support his discussion on how to form a good embouchure. Edward Kleinhammer (p.24, 1963) included

a schematic diagram of the muscles of the lips and surrounding areas of the face that form the embouchure in his discussion of the correct embouchure and mouthpiece placement.

John Swallow (1987) argued:

> The embouchure is a highly sophisticated mechanism and our performing efforts and instruction should treat it as such...The complexity of the link between the music making parts of the anatomy and the brain deserves more serious attention. Sports medicine has contributed a great deal in the study of the attitudinal and physical aspects of building and accomplishing skills. I feel we should look there for support in our pursuit of new skills and concepts. (p.15)

Myer F. Savits (1982) based his dissertation on muscle training techniques and myological principles. Savits investigated the use of a variety of muscle strengthening exercises to develop the brass wind embouchure as a means of increasing range, endurance and improving tonal quality. He argued that performance on brass wind instruments is a muscular activity and that endurance, range and certain aspects of tonal quality are dependent upon the development and coordination of Obicularis Oris and its associated musculature. Savits concluded that embouchure strength could be increased by exercises utilising the overload principle. Those exercises may be "musical" such as long tones and lip-slurs, or "clinical", such as statics, lip-buzzing and pedal tones.

Like Swallow, Savits looked to sports medicine to explain how muscle training techniques work and how those techniques could be adapted to brass wind practice routines.

Roger Dane (1983, p. 25) investigated theories of sound production on the trumpet. He argued that two important considerations were proper breathing and an efficient embouchure. Dane (pp. 24–25) argued that the subject of the embouchure was very complicated because the details of anatomy and physiology were very complex. In doing so he quoted Weast (n.d.): "lip strength, embouchure strength and facial strength are all considered synonymous by brass men."

Dane concentrated his study on the use of air and mouthpiece placement, but in doing so acknowledged the role of embouchure strength and muscular considerations.

In his chapter on embouchure, Dane (pp. 34-44) described the function of the lips and facial muscles when forming an embouchure. He described smiling lips as fuller while stretched lips were thinner. He observed that most methods designed for power, extreme range and endurance favour the puckered embouchure in preference to the smile embouchure. Dane maintained that the smile embouchure had gone out of favour during the 1920's or thereabouts.

In his discussion on the limitations of his study, Dane (p. 6) stated that there were many elements involved in the production of sound and that his study would

confine itself to those concerning breathing. Dane described the muscles involved as numerous and complex, and that although much had been theorised about muscle involvement, there had been little in the way of controlled experiment.

It would appear that researchers, journal contributors and major performers are all interested in ways of developing embouchure strength as a means of improving range, endurance and tonal quality.

Facio-musclature considerations

Many commentators have described the importance of the facial muscles when forming an embouchure and playing a brass instrument, particularly those of the lips and chin, and those used when smiling.

Philip Farkas (1962) described four steps to creating a good embouchure:

1. Make sure the upper and lower teeth are separated. That is, keep the lower jaw down far enough that some influence is exerted towards arching the center of the lower lip downward.
2. Arch the chin muscles down with sufficient strength to make a wide "U" shaped indentation.
3. Avoid too wide a smile.
4. Make certain that the corners of the mouth are kept in so that the width of the mouth is shorter than when the mouth is smiling. (p. 39)

Dane (1983, pp.26-30) agreed with Farkas when describing the role of the cheeks, the corners of the mouth and the chin. Like Farkas he advocated the puckered embouchure, particularly for power, range and endurance. Stability of the jaw alignment was achieved by proper jaw position, made possible by the muscles of

the chin. Dane argued that a forward thrust jaw aligns the lips and the teeth, counteracting any overbite present, and that this contributed to a "big, rich and free tone".

When discussing the aperture, Dane (p.26) explained that the aperture should have the correct size, shape and texture for any given pitch and dynamic level. He based his description on that of Delbert Dale (1965) in which the lip and facial muscles radiate toward the centre like the hub of a wheel.

Kleinhammer (1963, p. 25) used a very similar description in his discussion of embouchure formation. He said that rather than use only those muscles involved in smiling, the finest brass instrument players use the muscles completely surrounding the aperture. He described the correctly formed aperture as oval shaped. To illustrate the point, Kleinhammer included a diagram of an oval shape with muscle forces pushing inwards to the centre of the aperture.

Claude Gordon (1965/1975, p.5) used a very similar diagram to Kleinhammer in his discussion of the use of the embouchure muscles. Gordon advocated contracting the lips toward the mouthpiece when ascending to the higher register and relaxing the lips for the lower notes. Gordon (p. 6) advised that the muscles of the face and lips should be trained to pull towards the mouthpiece. He described the routines for learning this as callisthenic routines. Gordon (p. 6) also advocated developing the feeling of gripping the mouthpiece and training the facial muscles to the point where correct use becomes a habit.

Major methods

The authors of many major methods such as Claude Gordon (1972), Carmine Caruso (1979) and others have confined themselves to the physical aspects of brass-wind playing. Invariably large proportions of their methods include lip-slur routines or arpeggiated routines which are very similar. Savits (1982) examined many of these methods and analysed them using myological principles. Other methods such as those of Arban (1859/1907) and Schlossberg (1959) address a wider range of performance considerations, but still include large sections on lip-slurring and similar exercises.

The modern method of playing brass instruments, particularly those with valves, has its origins in the early to middle eighteenth century, exemplified by the work of Jean Baptiste Arban in his *Cornet method* (1859/1907). Arban's book has several sections designed to exercise the muscles of the embouchure.

Most notable of the authors whose books confine themselves mainly to the multitude of permutations of the lip slur idea are Richard Shuebruk's *Graded lip and tongue trainers for brass instruments* (1925), Claude Gordon's *Systematic approach to daily practice* (1965), and *Daily trumpet routines* (1972), Charles Colin's *Advanced lip flexibilities* (1972), and Carmine Caruso's *Musical callisthenics for brass* (1979). Savits (1982) reviewed a greater number of lesser-

known methods such as that written by Deutsch (1975). Well known authors whose books include lip slurring as important sections of their methods include Richard Macdonald's *Daily exercises for trombone* (1926), Max Schlossberg's *Daily drills and technical studies* (1959), Paul Tanner's *Practice with the experts* (1962), Louis Maggio's *The original Louis Maggio system* (1968), Emory Remington's *Warm-up exercises (1980)*, and the various methods published by Rubank Inc, to name but a few.

Summary

The sheer number of authors who include lip-slurs to strengthen embouchure and increase range as a consequence is testament to the importance of lip-slurring. Carmine Caruso (1979) even went to the extent of describing them as callisthenics for the brass player. It would be difficult to argue that lip-slurs do not strengthen the embouchure and thus increase range in the high register as it is accepted by professional brass players and by major writers that they do, and yet it appears that no-one has yet demonstrated this in a controlled study. The knowledge of the value of lip-slurs seems to have been derived from experience with little supporting evidence from research.

CHAPTER FIVE

THEORETICAL FRAMEWORK

This study was influenced by the ideas George J. Posner presented in his book *Analysing the Curriculum* (1992). In that book Posner put forward the idea that to stay within one paradigm excludes all possibilities not included in that paradigm. A more useful approach is to make a considered decision to include ideas from many paradigms if it makes the development of a particular curriculum more relevant to the students' needs. In this study that idea was expanded to include applying the Reflective Eclecticism approach to research as well as to curriculum design. This study included, as part of its Reflective Eclecticism, ideas from the following sources: Structures of the Disciplines perspective, particularly Bruner's Spiral Curriculum model and his view of treating the student as an acolyte in the discipline; Behaviourism; and the three domains from Bloom's *Taxonomy of Educational Objectives* (1956), namely: Bloom's Cognitive Domain (1956), Krathwohl's Affective Domain (1964); and Harrow's Psychomotor Domain (1972).

Reflective Eclecticism

George J. Posner (1992) postulated:

> Reflective eclecticism is based on the assumption that, much as we would like to deny it, there is no panacea in education. People who are looking for 'the answer' to our educational problems are looking in vain. Different situations require different practices. The curriculum 'cultists' make a

> fundamental error in assuming that they have the answer to any problem, regardless of the particulars of the situation. What curriculum decision-makers need is an understanding of the myriad curriculum alternatives. But to avoid the trap of garbage-can eclecticism, they should understand the dilemmas that underlie each curriculum decision and be able to unpack the tacit assumptions behind each alternative. When they can do this, they will have gained the ability to assess critically the alternatives and the claims their proponents make. (p. 3 and pp.258-263)

The current researcher's experience suggested that for a given situation most practical teachers select the most useful ideas from any paradigm. Although Posner discusses curriculum development, this study extended the concept of reflective eclecticism to research generally.

Normally, experimental design will attempt to isolate the independent variable from all other variables to ensure that the measurement of the dependent variable is solely attributable to the independent variable. Subjects used in this experiment were drawn from Education Department of Western Australia classes, operating within all of the influences that impinge upon all secondary school students. It was neither practical nor desirable to isolate the subjects from contact with their surroundings. Therefore this study did not attempt to isolate the independent variable from all other variables. Instead an attempt was made to identify the variables, particularly family background factors, which may have influenced the subjects' performances during the experimental phase, and measure the effect they had. Within that context, where collection of data on a number of variables was part of the design of the study, the eclectic concept was deemed valid.

Structures of the Discipline

From the practical teaching aspect and the curriculum design implied by this study, the theoretical framework of this study owed much to the Structures of the Disciplines perspective. This study owed much to Bruner insofar as the use of lip slurs begins at an early stage of the brass student's playing life to be continually revisited, at varying levels of complexity and difficulty, and for various reasons, for the remainder of the performer's playing life. In this context lip-slurs are an element of a spiral curriculum.

By conceiving that from the very first lesson the student is embarking on a musical performance career at whatever level, be it amateur or professional, and considering the usual nature of instrumental teaching, the student is being treated by the teacher as an acolyte musician. As Bruner (Posner, 1992, p. 61) would have it, "---Socrates and the slave boy constantly being replayed."

Bruner (Posner, 1992) said:

> The prevailing notion was that if you understood the structure of knowledge, that understanding would then permit you to go ahead on your own; you did not need to encounter everything in nature to know everything, but by understanding some deep principles, you could extrapolate to the particulars as needed. Knowing was a canny strategy whereby you could know a great deal about a lot of things while keeping very little in mind. (p.60)

That notion is particularly useful in demonstrating the need for "non musical" skills in brass playing. By knowing these skills, one can know a great deal about playing one's instrument without having to memorise every piece of music one

needs to play. The skills learned allow one to play any piece of music commensurate with one's skill level. To paraphrase Bruner's words, the performer can extrapolate the skills required (that is, deep principles) to achieve any musical performance as needed. Of course lip slurring is but one of the many skills required, and artistic skills such as experience in style and interpretation also contribute to the performer's armoury, as no one skill or ability occurs in isolation.

The main question this study aimed to answer was whether lip slurring did what practical experience seemed to indicate, which is that lip-slurs help to increase one's high register. If it did, then it would be shown to be one of those skills that could be extrapolated to achieve a musical performance. It is also arguable that by teaching lip slurs, students were being inducted into the practice routines of professional brass players and were thus being treated as acolytes. To show that lip slurs work would legitimise that practice as it applied to lip slurs.

Behaviourism

Posner (1992, p. 61) asserted that the Behaviourist view concerns itself not with content, but with what students should be able to do. To this extent lip slurring is a behaviour that develops one of the skills necessary to perform musically. To do this, these skills must be known at the reflex level so that the brain is free to think about the artistic facets of music such as style, phrase shaping and interpretation.

Generally, behaviourists express goals in terms of "will be able to". By contrast, goal setting in this study was open-ended. Students progressed to the next

exercise when they had mastered the exercise they were currently studying and were thus progressing at their own rate. This study merely attempted to find out what gains students had made by the end of the study period. One of the current worldwide movements in educational philosophy and practice is to develop curricula, assessment and reporting systems from the perspective of student outcomes rather than teacher inputs. This approach measures and reports what the students are capable of achieving rather than the extent to which a student achieved an objective. In the current educational context, this study operated within the parameters of Student Outcomes.

Although there was no goal setting in the traditional behaviourist manner, the grading of the exercises was behavioural. Keller's (1968) Personalised Instruction System (Posner, 1992, p.64) devised courses that were broken down into a step-by-step series of behaviours, each of which had to be mastered before progressing to the next task.

In this study, the lip-slurs were graded by very small increments in difficulty, beginning with an example a novice was most easily able to execute. By stipulating that when the student had mastered one exercise he/she could then move on to the next exercise, this study embodied elements of Behaviourism.

Bloom's Taxonomy and Related Classifications

Elements of Bloom's *Taxonomy of Educational Objectives* (1956) were evident, particularly the psychomotor domain, but the affective domain was also in evidence. Additionally, there were elements of Robert Gagne's classifications,

particularly motor skills leading to attitudes, and of Gilbert Ryle's second type of knowledge; "knowing how" (Posner, 1992, pp. 82-84).

Affective Domain

David Krathwohl edited the second volume of the *Taxonomy of Educational Objectives*, (1964) dealing with the affective domain. The five levels of the affective domain are:

Level 1: listening to an idea,

Level 2: responding to it

Level 3: developing values and commitments to the idea,

Level 4: developing a value system based on the idea, and

Level 5: being characterised by a value or value complex.

Assuming that lip-slurs would work, and that the performer would benefit from the practice, then the values implicit in the exercise would be internalised, leading to a desire to do the exercises. Observations of the number of brass players who regularly, indeed enthusiastically, practised lip-slurs for the perceived benefits to be gained provided anecdotal evidence to support that concept. That the affective domain, being concerned with attitudes, appreciations, interests and desires, was being developed could be demonstrated by studying the effects of lip-slur practice on students' attitudes. The successful application of lip-slurs had the potential to overcome the inherent boredom of the exercise. The lip-slur program had the potential to stimulate positive attitudes through attentive listening, successful performance, knowledge of how to make the embouchure work successfully, interest in note production and articulation, and a desire to practise so as to

become a better performer. Those attributes represent levels 2 to 5 of Krathwohl's Taxonomy of the Affective Domain.

Psychomotor Domain

Most importantly, this study related closely to the psychomotor domain. Anita Harrow (*A Taxonomy of the Psychomotor Domain*, 1972) classified the psychomotor domain, in a lower-order to higher-order continuum, into six categories;

1. reflex movements,
2. basic-fundamental movements,
3. perceptual abilities,
4. physical abilities,
5. skilled movements and
6. nondiscursive communication (eg. expressive and interpretive movements),

The lip-slur exercises operate within the first five categories, enabling (in conjunction with many other skills) the performance of the sixth level, which is actual musical performance, requiring all of the interpretive and stylistic demands of an art form.

Reflex Movements are what John Swallow (1987, p. 13) referred to as "instinctive". The primary aim of lip-slurring is to develop appropriate embouchure muscle control at the reflex level so that there is never any need to think about that during performance. Thus, lip-slurring could be one of the first techniques a brass player learns, as it is a basic technique. In many ways, when a

player becomes competent at lip-slurring, he/she develops a mental picture of what is happening to the muscles involved, leaving the player with a much higher concept of what happens to facial muscles during embouchure manipulation. Undoubtably, lip-slurring is both a physical ability and a skill, the acquisition of which enables and enhances the acquisition of other abilities and skills.

Given that Robert Gagne's and Gilbert Ryle's classifications can be aligned, although not exactly, with Bloom's taxonomy, it can be argued that lip-slurring can be categorised by Gagne as motor skills and attitudes and by Ryle as "knowing how" (Posner, 1992, pp. 83- 84). From Ryle's point of view, knowing how requires practice, which is certainly true for any musical skill. Gagne argued the importance of acquiring prerequisite capabilities before proceeding to target skills. To some extent, the grading of the lip-slurs from very easy to more difficult could be categorised in that way but would be more akin to Bruner's spiral curriculum.

Mastery Model

The lip-slur exercises which form the experimental treatment followed the mastery model. This is argued by considering that the students were required to work at their own individual rate and that there were small graduations in skill levels required by the lip-slur experiment. The behaviourists, including Bloom, advocated mastery learning which required very small steps to operate effectively, and that the students progressed at their own rate.

Theoretical Intention

The intention of this study was to utilise a diverse range of theoretical positions incorporating a theoretical framework which focussed on reflective eclecticism, as postulated by Posner.

CHAPTER SIX

DESIGN OF THE STUDY AND METHODOLOGY

DESIGN OF THE STUDY

The study was designed with two components, the first an experiment using a Control Group and an Experimental Group, and the second, analyses of a questionnaire and student Practice Journals. The experimental component was used to examine the effect of the treatment, that is, the effect of a lip-slurring program in a brasswind instrumental curriculum. The questionnaire and Practice Journals were used to determine the effect, if any, which variables external to the treatment had on the results of the experiment. All of the collected data were expressed in the form of numbers in an interval scale, ordinal scale or nominal scale as appropriate and entered into a data matrix, which was then used to calculate statistics for the necessary comparisons. In order to avoid researcher bias, two highly qualified and competent teachers employed by the Education Department of Western Australia performed the teaching phase of the experiment.

The Experimental Component

The experimental phase used the Pre-test and Post-test Comparison design. Subjects were chosen for the Control Group and the Experimental Group using the Matched Subjects design to control variables caused by individual performance experience, instrument played, school attended and by which teacher they were taught.

The experimental phase of the study was conducted in three stages. The first stage was a pre-test to determine the students' abilities at the beginning of the experiment, the second stage was the teaching program and the third stage was the post-test to determine the students' abilities at the conclusion of the experiment. Progress was calculated by subtracting pre-test from post-test, resulting in a gain score for each student.

The pre-test and post-test were administered to students in both the Control Group and the Experimental Group, and gain scores were calculated for the students in both groups.

Each of the teachers taught their normal teaching curriculum to the students in each of their groups. The lip-slur program was added only to the curriculum of those students in each teacher's Experimental Group. Although the two teachers had their own personalised teaching methods, the teaching of the lip-slur program was the same for each teacher's Group. In this way, the effect of the lip-slurs was measured, not the effectiveness of the teacher's individual teaching styles.

Analysis of the Questionnaire and Student Practice Journals Component

The Student Profile Questionnaire was similar to an attitude survey in that it asked students to respond according to how they perceived the answers to questions about family attitudes, values and behaviours. Information about families would have been difficult to obtain, and may have aroused objections on privacy and ethical grounds. The questions asked probed the variables that researcher's

experience identified as more likely to influence the results of the experiment. As the students were capable of accurately indicating their perceptions of the described situations, these were used as a useful indicator of family influences on the students' performances.

Students were required to respond to questions using a four point Likert scale for questions requiring a descriptive answer, or a yes/no answer for questions with only two possible answers. A four-point scale was used to avoid receiving a large number of "unsure" or "don't know" answers, thus committing the respondents to relatively positive or negative answers. The questions were grouped into categories. Those results were then converted into scores on interval, ordinal or nominal scales as appropriate, for use in determining associations with the experiment results, practice times and between questionnaire categories.

Student Practice Journals

The amount of practice done by each student was identified as a variable that might have influenced the results of the experiment. Practice Journals were used to collect this information.

The normal procedure for all instrumental teachers employed by the Education Department of Western Australia is to monitor students' home practice using a Practice Journal. This is a publication designed by the School Of Instrumental Music, the body which administers the instrumental teaching program for EDWA, and is issued to every student in the EDWA instrumental music program. The practice records contained in the Practice Journal of each student in the study were

used to calculate the weekly average number of minutes of practice for each student. This number was entered into the data matrix and used to determine associations with questionnaire categories and with experiment data.

Ensuring that each student did exactly the same amount of practice per week would have been an impossible task. Moreover, it would have been undesirable to restrict the more motivated students to a minimum amount of practice. It was more desirable to monitor the amount of practice done by each student and then calculate mean and standard deviation for the Control Group and Experimental Group to determine whether or not practice was a significant variable, and then interpret the results of the experiment accordingly. Two-tailed t-test was used to test the significance of the comparison of the Practice times between the Experimental and Control groups. Further comparison was made by calculating an Analysis of Variance between the Experimental Group and the Control Group for practice times. To test if a ceiling effect was caused by differences in practice times, a two-way Analysis of Variance of practice minutes was calculated for Experimental and Control Groups against High/Low Gain scores. By using Practice as a link, the effect practice had on the experiment results would also prove useful in comparisons with questionnaire categories to determine the effect the variables identified in the questionnaire had on the experiment results.

Methodology

At the beginning of Second Semester, 1997, the Principals of the two schools involved were contacted to obtain permission to conduct the experiment. One Principal was very enthusiastic for the experiment to go ahead while the other had

some reservations concerning the intrusion of the experiment into the students' study time. As a result of this, the initial design of the experiment was modified.

Initially, the experiment was to include an Embouchure Rating Scale devised by Edward Paul Sandor, (1983) requiring videotaped evidence that would subsequently have been rated by a panel of experts. That result would then have been compared with the gain scores and used as a calibrating device for further analysis and possibly as a tool for assessing the validity of the experiment design. In meeting the wish of the Principal that the experiment make a minimal intrusion into the school routine, it was decided to omit this part of the experiment.

Parent permission agreements were then distributed to the parents of the intended subjects for signature and collection. There was a one hundred percent agreement.

The experiment began during week five of second semester. Week five was chosen because it was the week after a major band festival that required the students' and teachers' full attention during the preceding months. The experiment concluded during week eighteen, with two weeks semester break between weeks ten and eleven. Thus the experiment occupied a total of fourteen teaching weeks over a sixteen week period.

Pre-test

During week five, all students were given the Pre-test using the researcher designed *High Register Test.* (See Appendix A, pp. 76 – 79)

The Teaching Program

From week five to week eighteen, the students were taught the instructional program. The Control Group was taught the normal instructional program for that teacher, while the Experimental Group was taught the normal program, with the inclusion of the graded series of lip-slurs added to the warm-up phase of the lessons, and included as part of the home practice routine.

The Treatment

The Experimental Group had the lip-slur program added to the warm-up phase of their lessons and to their home practice routines. The lip-slurs were in a finely graded sequence from simple to more difficult and more complex. The exercises were grouped into lipbuilders titled *Lipbuilder 1* through to *Lipbuilder 6.*

Students progressed to the next exercise when they could competently play the previous exercise. In that way, the exercises were self-pacing, with the students progressing at their own rates.

The Post-test

During week eighteen, the students were given the Post-test, using the same *High Register Test* as the Pre-test. Because the *High Register Test* was open-ended, student progress was able to be determined, expressed as a Gain score.

The Student Profile Questionnaire

At the conclusion of the post-test, the students were given the *Student Profile Questionnaire* to complete. The conclusion of testing was chosen as the time for completing the questionnaire because the students had performed at concerts during the preceding week, requiring many weeks of preparation and rehearsal, and therefore this was the most convenient time for both the students and the teachers.

The Data

The data were collected as they became available. During week five the names of the students were entered into a data matrix by group (Control Group or Experimental Group) and each was assigned an identification code for confidentiality. The results of the Pre-test were entered into the data matrix.

During week eighteen the results of the Post-test were collected and entered into the data matrix. The results of the questionnaire were collected, analysed, grouped into categories and entered into the data matrix during the following weeks.

Analysis of the Data

The results of the experiment were entered into the data matrix under the headings Pre-test; Hi/Lo Pre-test; Post-test; Gain; Hi/lo Gain, Practice Times and Hi/Lo Practice Times. Mean and standard deviation for each of these were calculated for the total population, the Control Group and the Experimental Group. Graphs and charts were constructed to show mean and standard deviation for each.

Comparisons were made using correlation calculations, with significance levels of $P<0.05$ being accepted. To further test the correlations, a series of t-tests and Analyses of Variation were calculated with significance levels of $P<0.05$ being set. Variable SD's were pooled in tests of differences.

To test the ceiling effect, a crosstabulation using High Pre-test, Low Pre-test, High Gain and Low Gain was constructed and a Chi-Squared test calculated, setting a significance level of $P<0.05$.

Questionnaire data were entered into the data matrix under the categories Cultural Capital; Family Attitude to Music; Family Attitude to the Instrument; Family Attitude to Practice; Negative Reason 1; Negative Reason 2; Negative Reason 3; Family Members who play an Instrument; Learning an Instrument Out of School; Student Enjoyment of Listening to Music Rating and Ranking of Instrument Choice. Negative Reasons 1,2 and 3 refer to reasons why the family did not like home practice. A Bivariate Correlation was calculated giving a correlation for every item in the data matrix with every other item. Interval data were compared using Pearson's r. Bi-polar and Bi-modal data were compared using Spearman's rho and Kendall's tau. That information was used to determine what relationships existed within the data, and what if any variables influenced the results of the experiment. Correlations were deemed significant at a two-tailed t-test level $t< 0.05$.

All of the data were analysed.

Selection of the subjects

Two highly competent teachers were assigned the task of teaching the experimental phase of the study. One of the teachers specialised in high brass (trumpets) and the other specialised in low brass (trombone, euphonium and tuba). Students in the study group comprised the total of those teachers' brasswind student populations in years eight, nine and ten, a total of forty-four students. The two study groups, that is, the Control Group and the Experimental Group, were matched so that an equal number of students from each instrument family were in each of the two groups. An equal number of students from each of the year groups learning each of the instruments was in the Control Group and the Experimental Group. There were twenty-two students in each group giving a total population of forty-four students.

Although the two teachers each taught at different number of students, their respective student populations were divided evenly between the Control Group and the Experimental Group. For each of the schools involved, an equal number of students were in the Control and Experiment Group. In this way the influences of teacher differences and school environment were taken into account. This enabled the Control Group and the Experimental Group to be as evenly matched as possible.

Measurement instruments

Two measurement instruments were used in the study. In addition, the students' Practice Journals were used to monitor and collect information on the average number of minutes of practice per week done by each student.

For both the Pre-test and the Post-test, the researcher designed *High Register Test* was used. (See Appendix A, pp. 76 – 79). This test measured the number of semitones above second line G for trumpet (or the equivalent harmonic for the other instruments) the student was capable of playing. For consistency and objectivity, any sound at the highest pitch was accepted, regardless of tonal quality. The number of semitones was recorded and then entered into a data matrix. These two scores were then used to calculate a gain score for each student. A number of statistical calculations were then possible.

The second measurement instrument used was the researcher designed *Student Questionnaire* (See Appendix A, pp. 80 – 82), which was used to assess family background information. Various statistical calculations were used to measure the effect that those variables might have had on the study, rather than try to isolate the experiment from those variables. The information collected included information on the family investment in cultural capital, attitude to music, attitude to home practice and attitude to the student's instrument. Student information collected included the student's enjoyment of listening to music, whether they learned another instrument outside of school hours, and whether the instrument learned at school was the student's first, second or third choice.

CHAPTER SEVEN

RESULTS AND DATA ANALYSES

DATA ANALYSES

Analysis of Pre-test

At the beginning of the study period the total sample of 44 students was given the High Register Test. To perform the test, each student played an open-ended chromatic scale beginning on second line G for trumpet, or the equivalent harmonic for the student's instrument, in semibreves, at crotchet = 80, until each individual student played the highest note of which s/he was capable. This was to determine the highest note that each student could play. In order to enhance objectivity, the test administrator made no judgement as to the quality of the highest note. The number of semitones played above second line G, or the equivalent for each instrument, was recorded by the observer. This was the pre-test score for each student. Each student's score was recorded by the observer and then entered in the data matrix.

Table 1
Results of the pre-test.

	Experimental group n = 22	Control group n = 22	Total sample n = 44
Range	12 - 22	10 - 29	10 –29
Mean	17.36	17.0	17.18
S.D.	3.33	4.68	4.02

To test for significant differences between the Experimental and Control groups, a two-sample t-test was calculated. The result was t = 0.30, P = 0.77 at df = 42.

Table 2
Two-sample t-test for pre-test.

	n	Mean	S.D.	S.E. Mean
Experimental Group	22	17.36	3.33	0.71
Control Group	22	17.0	4.68	1.0

T = 0.30 P = 0.77 df = 42

The two-sample t-test suggested that there was no significant difference in the results of the Pre-test between the Experimental Group and the Control Group. This indicated that Experimental Group and the Control Group were equivalent.

Analysis of Post-test

At the conclusion of the sixteen-week study period, each of the students completed the Post-test, their scores recorded and then entered into the data matrix. The High Register Test as used for both the Pre-test and the Post-test.

Table 3
Results of the post-test for experimental group, control group and total sample.

	Experimental Group n = 22	Control Group n = 22	Total Sample n = 44
Range	12 - 24	13 - 27	12 –27
Mean	18.18	18.36	18.27
S.D.	3.14	4.10	3.61

The results indicated that by the end of the study period the Control Group had higher Post-test scores than the Experimental Group, suggesting that they had performed better.

Analysis of Gain Scores

Gain scores were calculated to measure the progress of both groups by the end of the study period. Gain was calculated by subtracting Pre-test from Post-test. The resulting scores were expressed as either zero, negative or positive values and entered into the data matrix. From these results the range, mean and standard deviation of Gain was calculated for the Experimental Group, the Control Group and the Total Sample.

Table 4
Gain scores for the experimental group, control group and total sample.

	Experimental Group n = 22	Control Group n = 22	Total Sample n = 44
Range	-4 - +4	-3 - +8	-4 - +8
Mean	0.82	1.36	1.09
S.D.	1.82	2.57	2.22

Initial results indicated that the Control Group performed better than the Experimental Group in Pre-test, Post-test and Gain scores, suggesting that the lip-slur treatment had not made any significant difference to the results of the Experimental Group.

Two-tailed t-tests confirmed that that although both groups gained significantly, the Control Group gained more. (see Tables 5 and 6)

Table 5

Two-tailed t-test for correlated samples to test the significance of gain for the experimental group.

	n	Mean	S.D.	SE Mean	t	P value
Gain	22	0.818	1.816	0.387	2.11	0.05

Table 6

Two-tailed t-test for correlated samples to test the significance of gain for the control group.

	n	Mean	S.D.	SE Mean	t	P value
Gain	22	1.364	2.574	0.549	2.49	0.02

The Experimental Group's t score of 2.11 was significant at P = 0.05, indicating the group's gain was significant. However the Control Group's t score of 2.49 was significance at P = 0.02. The Experimental Group's Mean Gain was 0.818 while the Control Group's Mean Gain was greater at 1.364. These results indicated that both the Control Group and the Experimental Group made significant gains.

To further test the Gain score results, an Analysis of Variance on Experimental Gain vs Control Gain was calculated. The ANOVA indicated that a previously hidden factor might have affected the results.

Table 7
Analysis of variance between experimental group and control group for gain.

	df	Sum of Squares	Mean Squared	F	P
Gain	1	3.27	3.27	0.66	0.42
Error	42	208.36	4.96		
Total	43	211.64			

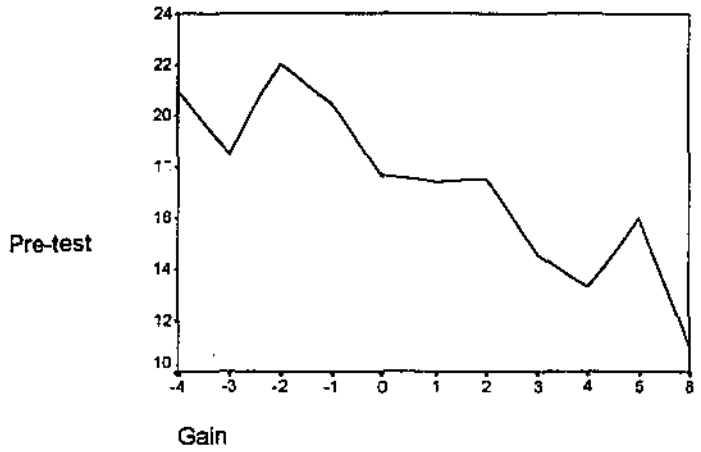
At 0.66, the F score indicates that the differences amongst scores within each of the groups are similar to the differences between the scores for each group. This indicates that both groups were similar. The significance level of P = 0.42 indicated that the difference in Gain score between the groups was not significant.

The Ceiling Effect

According to Burns (1994, p. 128), one of the possible effects that may result from the Pre-test and Post-test Comparison design, where gain is measured, is the ceiling effect. The ceiling effect operates on subjects who have high initial scores. It means that subjects with high pre-test scores were unlikely to exhibit much improvement during the study period. By contrast subjects with low pre-test scores were more likely to exhibit progress during the study period.

To detect if a ceiling effect was operating, the Correlation between Pre-test and Gain was calculated, accepting a two-tailed significance level of 0.05. The Pearson Correlation was r = -0.47 at a significance level of t = 0.001.

Figure 1
Graph of the correlation between Pre-test and Gain.



The negative correlation between Pre-test scores and Gain scores suggested that a ceiling effect was operating. Students who could already play high notes at the beginning of the study benefited less from the lip-slur program than students who could not play high notes the beginning of the study. Given the design of the study, and that the study was only sixteen weeks in duration, that was a predictable result.

To find out if there was a difference between the negative correlations for the control group and the experimental group, the correlation between Pre-test and Gain was calculated for each group. The correlation for the Experimental Group was $r = -0.443$ at a significance level of $t = 0.039$, while the correlation for the Control Group was $r = -0.486$ at a significance level of $t = 0.022$. However, the Control Group appeared to have a slightly more significant result than the Experimental Group. To test the results further, it was decided to calculate Crosstabulations and Chi-Squared tests for Total Sample, Experimental Group

and Control Group in order to discover what, if any, relationships existed within each group.

Crosstabulations and Chi-Squared Tests

Crosstabulations were used to determine any correlations between high pre-test scores, low pre-test scores, high gain scores and low gain scores. Scores for Pre-test and Gain were categorised as higher than or lower than their respective medians. The results for each of the groups were then compared.

The Chi-square test was used to determine the level of significance for the associations. First, Gain score categories (High/Low) were tested against Pre-test categories (High/Low) for each group.

The crosstabulation for the Total Sample (table 8) revealed a negative correlation with a strong association of low Pre-test with high Gain sores and high Pre-test with low Gain scores. Chi-Square was 9.031. This was statistically significant ($\chi 2 = 9.031$, df = 2, P = 0.003).

Table 8
Crosstabulation of high pre-test/low pre-test and high gain/low gain for the total sample.

	Low gain	High gain	Total
Low pre-test Count	7	14	21
Expected Count	11.9	9.1	
High Pre-test Count	18	5	23
Expected Count	13.1	9.9	
Total Count	25	19	44

Crosstabulation for the Control Group (Table 9) revealed no significant associations. However, taken alone, the Experimental Group (Table 10) revealed the same strong associations as the total sample. The association for the Experimental Group was significant. High Pre-test scores were associated with lower Gain scores. Students who scored low Pre-test scores made higher gains on the Post-test ($\chi 2 = 6.60$, df = 2, P = 0.01).

Table 9
Crosstabulation of high pre-test/low pre-test and high gain/low gain for the control group.

	Low gain	High gain	Total
Low pre-test Count	4	6	10
Expected Count	5.9	4.1	
High Pre-test Count	9	3	12
Expected Count	7.1	4.9	
Total Count	13	9	22

Table 10
Crosstabulation of high pre-test/low pre-test and high gain/low gain for the experimental group.

	Low gain	High gain	Total
Low pre-test Count	3	8	11
Expected Count	6.0	5.0	
High Pre-test Count	9	2	11
Expected Count	6.0	5.0	
Total Count	12	10	22

The results of the Crosstabulation and Chi-square calculations indicated that there was a strong ceiling effect. Compared to students who scored low in the Pre-test, students who were already able to play high notes made small gains during the sixteen-week study period. Further, the results implied that while the association between High/Low Pre-test and High/Low Gain for the control group was not significant, the association for the experimental group was significant and therefore probably caused by the lip-slur treatment.

Analysis of Practice Times

Of the variables that may have influenced the study, students individual practice times were considered the most likely. Students' individual practice times were collected in order to calculate the effect that variations in practice times may have had on the results of the experiment. Inspection of the student practice journals revealed a wide range in the number of average weekly practice minutes, with one student doing no practice during the experimental period, which was later verified by his teacher. Average weekly practice times for the Total Sample ranged from

zero to 250 minutes per week with a mean of 142.27 minutes and a SD of 55.90 minutes. Average weekly practice times for the Experimental Group ranged from 90 minutes to 220 minutes with a mean of 161.82 and a SD of 37.37, while the Control Group's practice ranged from zero to 250 minutes with a mean of 122.73 and a SD of 68.42.

Table 11
Descriptive statistics for average weekly practice times for the total sample, the experimental group and the control group.

	n	Minimum	Maximum	Mean	Std Deviation
Total Sample	44	0	250	142.27	55.90
Experimental Group	22	90	220	161.82	37.37
Control Group	22	0	250	122.73	64.82

The effect of the average number of minutes practice per week

The results showed that the experimental group did significantly more practice than the control group. For the control group there was a very even distribution about the mean for average weekly practice minutes. The resulting graph (See Appendix D, p.101) for control group practice times showed that the distribution was normal and was as one would have expected to find if there was no particular influence acting on that population.

Inspection of the graph of practice times for the experimental group (See Appendix D, p.101) revealed a different picture. The mean was thirty nine minutes higher than the mean for the control group, while the lowest experimental

group practice time was only 22 minutes lower than the control group mean. At 37.37, the standard deviation for the experimental group was almost half that for the control group at 64.82. This suggested that there was a much greater consistency of practice times within the experimental group, even though the control group had both the minimum and maximum times. The graphs showed that the experimental group consistently totalled much longer practice times than the control group. Looking at the distribution about the mean of practice times further reinforced that position. The graph was negatively skewed which meant that more students achieved practice times higher than the mean than those who achieved less than the mean. By contrast, inspection of the control group graph showed that the number of students who totalled a greater number of practice minutes than the mean was similar to those who totalled less. The results suggested that there was an influence acting on the experimental group that was not acting on the control group. Because of the design of the study, it was possible to infer that the influence was the lip-slur treatment.

There was a correlation between Practice Time and both pre-test and Post-test results. The correlation with Pre-test was a moderate 0.63 at a 0.000 significance level and a moderate correlation with Post-test of 0.58 at a 0.000 significance level. This suggested that students who practised more had higher Pre-test and Post-test scores than students who practised less, regardless of which group they belonged.

There were negligible negative correlations between practice times and Gain and scores. The correlation with Gain was $r = -0.14$ at a significance level of $p =$

0.36. This meant that the amount of practice done by the students was not a factor in the amount of gain achieved by them. When looked at in conjunction with the correlations between Practice and both Pre-test and Post-test, it suggested that students who practised the most not only had the highest test scores but also had the lowest gain scores. That result indicated that those were the students upon whom the ceiling effect acted most strongly. This helped reinforce the suggestion that it was the inclusion of lip-slurs in the practice routine, not a factor such as the amount of practice done by the students, that was responsible for the gain by low Pre-test scorers in the experimental group.

To test the correlations, further statistical analyses were undertaken. A Two-Sample t-test was performed to test the significance of the practice results.

Table 12
T-test comparing practice times for the experimental group and the control group.

	n	Mean	Std Deviation	S.E. Mean
Experimental Group	22	161.8	37.4	8.0
Control Group	22	122.7	64.8	14

t = 2.45 P = 0.0.012 df = 42
Pooled SD 52.9

The result confirmed that the Experimental Group practiced significantly more than the Control Group. Analysis of Variance was used to further test the significance of that result.

Table 13
Analysis of variance between experimental group and control group for practice minutes.

	df	Sum of Squares	Mean Squared	F	P
Practice	1	16809	16809	6.01	0.02
Error	42	117564	2799		
Total	43	134373			

The F score showed that the variance between the groups was 6.01 times greater than the variances within the groups which is a significant difference between the groups, at P = 0.019. That result suggested that the Ceiling effect might have been due to the Experimental Group doing more practice.

Even though the Experimental Group had significantly greater practice times, both groups had significant improvement in their high register scores. To test if Practice caused the significant Gain scores, a Two-way Analysis of Variance was calculated comparing variance between high and low Gain scores against practice minutes for both the Experimental and Control groups.

Table 14
Two-way analysis of variance of practice minutes for experimental and control groups against high/low gain scores.

	df	Sum of Squares	Mean Squared	F	P
Group	1	16809.091	16809.091	6.296	<0.05
Hi/Lo Gain	1	706.722	706.722	0.265	
Interaction	1	2054.991	2054.991	0.770	
Error(within sub groups)	43	114801.923	2669.812		
Total	44				

The F score of 6.296 for the variance between groups meant that the variance between the groups was 6.296 times greater than the variance within each group, confirming that there was a significant difference in practice times between the Experimental and Control groups. The F score of 0.265 for the variance between and within levels of Gain suggested that there was little difference in practice between levels of Gain. Students in the Experimental Group who had low Gain scores practised at the same levels as students in the Control Group who had low Gain scores. Conversely, students in the Experimental Group who had high Gain scores practised at the same levels as students in the Control Group who had high Gain scores.

The Interaction calculation tested whether there was an association between different amounts of practice and high or low gain. That is, was high gain associated with high practice levels and vice versa, or high g 'n with low practice and vice versa? The F score of 0.770 suggested that there was no significant interaction. These Analyses of Variance confirmed that there was no association

between high practice times and low or high Gain, or low practice times and low or high Gain. A chi-squared analysis revealed the same result. The ANOVAs confirmed that practice was not a variable that influenced the gain scores.

Because the foregoing Analyses of Variance confirmed that practice times were not a variable influencing Gain scores, and because both the Experimetal and Control groups had improved significantly in range of pitch, it appeared more likely that the lip-slur treatment caused increased practice by the Experimental Group and that for high achievers in the Experimental Group, the gains caused by the lip-slur treatment were modified by the ceiling effect far more intensively than for the Control Group.

SUBSIDIARY QUESTIONS

The Student Questionnaire

It was not possible to isolate the subjects from all other variables that may have influenced the results. Instead, as many variables as possible were identified and an attempt made to account for those. This was accomplished in the form of a Student Questionnaire designed to assess the families' cultural capital and attitudes to music. The subjects were asked to respond to thirty-two questions which were then grouped into eleven categories. Those categories were; Cultural Capital, Family Attitude to Music, Family Attitude to the Student's Instrument, Family Attitude to Home Practice, three reasons why the family does not like home practice, how many family members play a musical instrument, the student's self rating of how much they enjoy listening to music, and whether a

brass instrument was the student's first, second or third choice. The results of the questionnaires were entered into the data matrix for analysis.

Exploring Associations and Differences

Explorations of the data were made using Bivariate Correlations, where every variable in the Student Questionnaire was correlated with every variable in the data matrix. Correlations for interval data were made using Pearson's r. Kendall's tau and Spearman's rho were calculated for both bi-polar and bi-modal data.

The Effect of Cultural Capital

Cultural Capital explored the student's rating of how much family income was expended on acquiring books, magazines, sheet music and other music books, compact discs, records or tapes. This rating could be interpreted as either how prepared the family was to spend money on cultural items (a value judgement) or how much family money was available to spend on cultural items (a socio-economic factor). The correlations showed that there were no significant associations with any of the data from the experiment and no association with how much practice the students did. There was a moderate correlation with the Family Attitude to Music ($r = 0.42$ at $P = 0.007$) and a low correlation with the Student's Enjoyment (of listening to music) Rating. ($r = 0.31$, $P = 0.05$). (See Appendix D, p.105)

The Effect of Family Attitudes

The family attitudes measured included Family Attitude to Music, Family Attitude to (the student's) Instrument and Family Attitude to (home) Practice. If there was a negative attitude to home practice, the students were asked to respond with a yes or no answer to Negative Reason 1 (noise), Negative Reason 2 (disturbance to the family routine) or Negative Reason 3 (disturbance to the sleep of any family member).

Associations with the Experimental Data

The Family Attitude to Practice was found to have low correlations with Pre-test, Post-test and Practice. The correlation with Pre-test was $r = 0.4$, $P = 0.01$ and with Post-test; $r = 0.31$, $P = 0.05$. The correlation between Family Attitude to Practice and Practice was low at $r = 0.37$ with $P = 0.02$.

The Family Attitude to Instrument was found to have a low correlation with Practice: $r = 0.33$, $P = 0.04$, while the Family Attitude to Music had no associations with any of the experiment data.

The analyses showed that family attitudes caused no effect upon the experimental phase of the study. There were low correlations with Practice, but as practice was found to not influence the effect of the lip-slur treatment, then family attitudes also had no effect. Family Attitude to Practice had low correlations with Pre-test and Post-test, and with Practice. The analysis of Practice showed that students who practise more achieved higher results, but were also the students upon whom the ceiling effect acted most strongly. It was, then, possible to detect a trend that

the low correlations with family attitudes indicated that students from families who had a positive attitude practised more and achieved higher results. Also in this experiment, they were the students subject to the ceiling effect.

Associations within the Student Questionnaire

Family attitudes were found to have associations with cultural capital, and whether or not the student enjoyed listening to music. The Family Attitude to Practice had a strong negative correlation with Negative Reason 1 (noise); $r = -0.84$, $P = 0.00$. (Kendall and Spearman calculations gave the same result). From this it appeared that families do not object to the extra noise created by home practice. The Family Attitude to Practice had a low negative correlation with disturbance to the family routine; $r = -0.33$, $P = 0.04$. This indicated that families had very little objection to the disturbance to the family routine caused by home practice.

There was a low correlation between noise and disturbance to the sleep of any family member; $r = 0.33$, $P = 0.04$.

Other Factors

The Choice of Instrument rating was the only other category with associations with any other factor. Students were asked whether the instrument they learned at school was their first, second or third choice. Choice of Instrument had low correlations with Pre-test ($r = 0.36$, $P = 0.02$) and whether students learned another instrument outside of school hours (Spearman $r = -0.38$, $P = 0.02$)

The analysis of the Student Questionnaire indicated that family background factors had no discernible influence on the results of the experiment data.

CHAPTER EIGHT

CONCLUSIONS

Lip-slurs and the Ease of Acquiring Higher Range

The evidence collected by this study suggested that for some students, the inclusion of lip-slurs in the teaching curriculum and practice routine did help in increasing their high register range. The students for whom this was most useful were those who, at the beginning of the experimental period, had low to medium ranges.

Negative associations between pre-test and Gain suggested that a ceiling effect was present, that is, that it was difficult for high achievers to increase their range during the experimental period. Savits (1982, p. 18), when describing embouchure fitness, stated: "Generally the greatest gains in fitness occur in individuals with the lowest level of fitness".

The design of this study recognised the possibility that a ceiling effect may operate. It may be that if the experimental period had been longer, high achievers would have achieved a greater increase in the range of their gain scores.

Inspection of the correlation between Pre-test scores and Gain indicated that a ceiling effect operated on high achievers across the total sample. The negative

association between Pre-test scores and Gain confirmed the chi-squared test across the total sample. (Table 8, p.50)

However, chi-Square tests indicated that for the control group (Table 9, p. 50), the ceiling effect was negligible, while for the experimental group (Table 10, p. 51) there was a significant ceiling effect that suggested that there was a variable influencing the results of the Experimental Group.

Correlation and Analysis of Variance calculations for the category Practice indicated that high achievers, no matter to which group they belonged, practised more than low achievers. High achieving students also had the least Gain scores, especially in the Experimental Group. Therefore the amount of practice done by students was not the reason why low initial achievers had the greatest Gain scores. Because of this, and the design of the experiment, it would appear that the experimental treatment was the factor influencing the results for the experimental group. It is therefore possible to say that while the increase in pitch range for the control group was significant and normally distributed, the inclusion of lip-slurs into the brasswind curriculum for the experimental group helped, on the one hand, some students to increase pitch range significantly, notably those students who did not have secure high registers at the beginning of the experimental period, yet on the other hand, created an intense ceiling effect for high achievers, evidenced by the skewed distribution of gain scores.

Taking into account the concept of a ceiling effect, it may be concluded that the addition of lip-slurs to the curriculum may help increase pitch range, but that it

would take longer than the time frame of this experiment for improved results to be measured, particularly for high achievers.

The Role of Lip-slurs in the Acquisition of the Higher Register

This study leads to the conclusion that lip-slurs played an important role in the acquisition of the high register by high school brasswind students. The degree of importance is dependent on various factors. From this study, it appears that one major factor is the ceiling effect. This knowledge may be used in two ways.

First, it appears that low achieving students can gain rapid initial benefit from the inclusion of lip-slurs. Therefore it would be an effective way of solving a range problem for an inexperienced student, say, when there is a range difficulty in a band part. In this context, lip-slurs could be used as a "quick fix" in a band or performance context. The result would be entirely dependent on how close the students were to their individual ceiling at that time.

Secondly, if it were true that the ceiling effect includes the possibility that high achievers might benefit over a longer period of time, then lip-slurs might be used as part of a longer-term strategy for developing the high register.

Implications for the null hypothesis

The Null Hypothesis postulated that for students who received a series of graded lip-slurs as a supplement to a standard brasswind teaching curriculum, there would be no observable effect on the acquisition of higher range compared to

students who did not have a graded series of lip-slurs as a supplement to the teaching curriculum.

The conclusions of this study strongly infer that a ceiling effect influenced the rate of acquisition of high register gain for high achievers in both the control group and the experimental group. Furthermore, analysis of that ceiling effect suggested that initial low achievers gained greater improvement over a given time than high achievers. Because the results suggested that the control group performed in a normal fashion, and that for the experimental group, increased gain for low achievers was due to the inclusion of lip-slurs, there was an observable effect caused by the inclusion of lip-slurs in the teaching curriculum. Therefore the null hypothesis was disproved.

Possible uses of lip-slurs in developing effective practice routines

Studies such as those done by Savits (1982) indicate that lip-slurs are an isotonic exercise, and that isotonic exercises develop strength, flexibility and endurance. Various journal articles written by such authors as Toshio Nemoto (Brass Bulletin no. 91-111/1995) reinforce that opinion. Every brass teaching method and published practice routine found during an extensive literature search included lip-slurs or arpeggiated routines similar to lip-slurs, also reinforcing that opinion.

Why did the Experimental Group do more practice than the Control Group? One reason could have been that it was due to the Hawthorne Effect, whereby a group

which receives special attention, such as being part of an experiment, performs at a higher rate regardless of any change in working circumstances.

Because both groups had signed consent forms, and therefore knew that they were part of an experiment, then a second explanation may be more valid. One of the implications of Krathwohl's Five Levels of the Affective Domain is that when a person recognises a benefit from a practice, then that becomes internalised as a value, leading to a desire to do that practice. It could be that one of the effects of the lip-slur treatment was to motivate the Experimental Group to do more practice than they would otherwise have done. It was important to explore that idea further to determine if increased motivation to practice, for which ever reason, caused the ceiling effect rather than the lip-slur treatment.

The two teachers who conducted the experimental phase of the study reported that according to their observations, the better players did not increase range by much, but that their sound opened up and flexibility became much improved.

Keeping the above comments in mind, lip-slurs would be useful as part of a balanced practice routine. As part of a long-term strategy, they would help in developing the physical strength needed to play in the high register, as well as in developing the flexibility needed to execute arpeggiated passages or passages containing large intervals, and in developing the endurance needed by the brass player.

Savits (1982) titled his dissertation: *Muscle Training Techniques Applicable to Methods Incorporating Myological Principles in Elementary Brass Embouchure Training Curricula.* In his dissertation he described the need for both isometric and isotonic exercises in a balanced curriculum. Savits' elementary method (Teacher Workbook, p.88) however, was devised mainly using long setting, which is an isometric method. It is the view of this researcher that a combination of Savits' long setting, with the graded series of lip-slurs developed in this study, would provide for high school brasswind students an ideal balance of strength building exercises with endurance and flexibility exercises.

The influence of family background factors on practice routines and student achievement

This study found that the students who practised the most had the highest Pre-test score ($r = 0.626$, $p = 0.00$) and Post-test score ($r = 0.581$, $p = 0.00$) regardless of whether they were in the control group or the experimental group. From that result it would be reasonable to assert that the amount of practice a student does contributes to his/her achievement, and therefore that the factors that influence the amount of practice done by a student also influence that student's achievement. The data collected showed that family background factors did not play as big a part in home practice routines as might have been expected.

Factors such as the amount of cultural capital in the household or whether other members of the family were musicians did not show any significant correlations. Of more importance was the family's attitude to home practice and their attitude towards the instrument played. Those results tend to reinforce anecdotal evidence

observed by the researcher and gleaned by the researcher from conversations with colleagues.

The data collected suggested that cultural capital was not a factor in how much practice was done by a student, or on the student's achievement as measured by Pre-test, Post-test and Gain scores. The amount of cultural capital, that is, the amount of income the family is prepared to expend on items of a cultural nature such as books, magazines, compact discs, sheet music and musical instruments, may be an indication not only of family attitudes, but also of economic circumstance.

The cultural capital data suggest that the students comprising this study came from similar socio-economic backgrounds. If this is so, and if cultural capital is not a factor in students' success, then the data collected by the student questionnaire may help support the belief held by some music teachers that socio-economic background is not a determinant of musical success. Cultural capital, and possibly socio-economic circumstance, did not affect the results of this study.

Thirty-two out of forty four students in this study came from families where other members of the family played a musical instrument. This correlates with a study by Beverley Pascoe (1995, p.128) where she found that when parents or siblings played a musical instrument, then the student was more likely to elect to study music at high school. Pascoe's study did not comment on the relative success of the students. This study did not show any correlation between the amount of practice done by students and whether or not other members of the family played

musical instruments. It is likely that where other members of the family play a musical instrument there is a greater chance that a student will choose to play an instrument, but it does not necessarily follow that this is also a predictor of that student's achievement, at least not achievement as measured by this study. It would be interesting to compare student achievement with whether other family members play an instrument, using a much more comprehensive definition of achievement. This could form part of a study into factors that could be used as predictors of musical success.

It was found was that the family's attitude towards the student's instrument was of some significance. One of the problems perceived by teachers of brass instruments is that parents often discourage students from learning brass instruments, particularly those whose children are offered large brass instruments such as tubas and euphoniums. Often it also appears to teachers that parents discourage students from playing brass instruments because they are seen by some parents as loud and awkward to transport. Sometimes it seems that parents just don't like the instrument for some other reason.

This study found that the family's attitude to the instrument did not have a correlation with test scores or gain scores, but it did have a positive correlation with the amount of practice done by the students. Although the family's attitude to the instrument did not affect the gain scores of the students and thus did not affect the experiment, it did appear to have an effect on the amount of practice done by the students and therefore on the overall performance of the students. This is similar to conclusions reached by Pascoe (1995, p. 129) who found that

students were more likely to learn a musical instrument where there was a high degree of parental encouragement.

This current study found that if the student's family had a positive attitude to the instrument played, then the student was more likely to practice that instrument and was therefore more likely to achieve.

The family attitude to home practice correlated positively with Pre-test scores ($r = 0.40$, $p=0.011$) and mildly with Post-test scores ($r = 0.371$, $p = 0.51$)), and with the amount of practice done by the students. This shows a connection between family attitude to practice the amount of practice done by the student and the student's overall achievement. This is generally in line with Pascoe's conclusions about the importance of parental support. It shows that where there is family support for home practice, students are more likely to practice and therefore more likely to achieve.

The data collected in the student questionnaire were intended to discover whether any variables impinged upon the reliability and validity of the experiment. Because the family background data were similar for both the control group and the experimental group, we can be confident that the control group and the experimental group were evenly matched, thus increasing confidence in the reliability of the resulting data. Furthermore, the data collected by the questionnaire suggested that family background factors did not impinge upon the experiment in any way that would compromise reliability or validity. The data from the student questionnaire were intrinsically interesting and could form the

basis for further study into student motivation, predictors of student success, and into factors affecting student retention rates.

Suggestions for future research

The literature search revealed that although there is an abundance of writings on the subject of embouchure improvement in journals and magazines, there is little research. Further readings suggest that the fields of human movement and sports medicine may be useful in providing ideas for research into skills acquisition for musicians. Savits (1982) work could be used as a guide to books which contain isometric and isotonic exercises. It would then be possible to replicate studies in sports medicine, but replacing sports routines with musical routines. That may reveal further information on more effective and more efficient practice routines.

Using a combination of isometric routines similar to those developed by Savits and the lip-slur routines developed for this study, a student version of *Callisthenics for brass* could be developed and tested.

The student questionnaire developed for this study could be expanded and further developed to yield more information about students and their family environment. Using this information questionnaires could be developed to predict the student's likelihood of success or of dropping out. In the current economic climate of diminishing education budgets, such information could maximise the allocation and effectiveness of educational resources.

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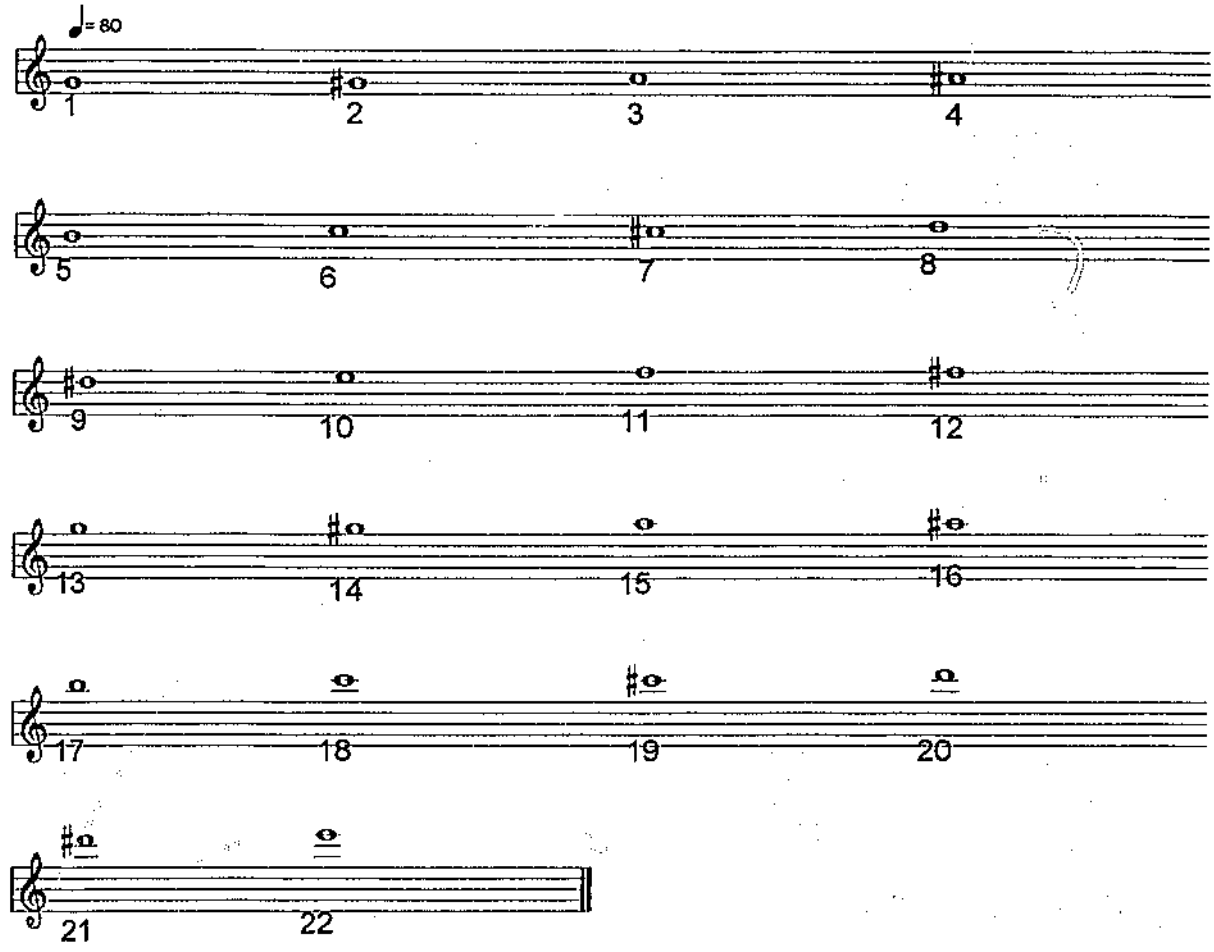
APPENDIX A

THE TEST INSTRUMENTS

HIGH REGISTER TEST

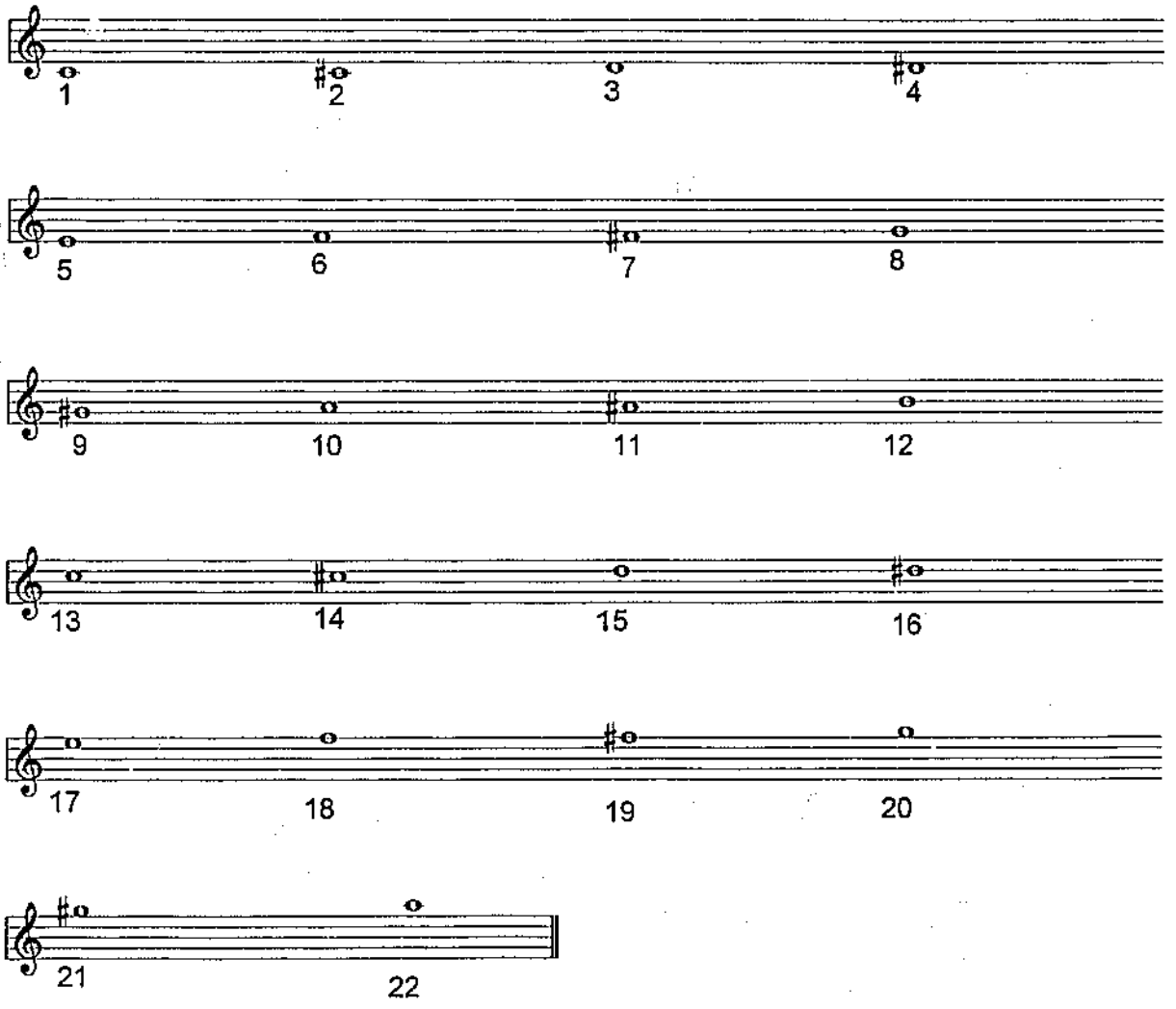
Play each note for four counts. Pause and breathe between each note. Play sucessively higher until the student can play no higher. Attempt the note of failure three times.
If the note can be played, no matter how insecurely, proceed to the next note until the last note cannot be played after three attempts. The number beneath the last note played is the student's score.



HIGH REGISTER TEST

HORN

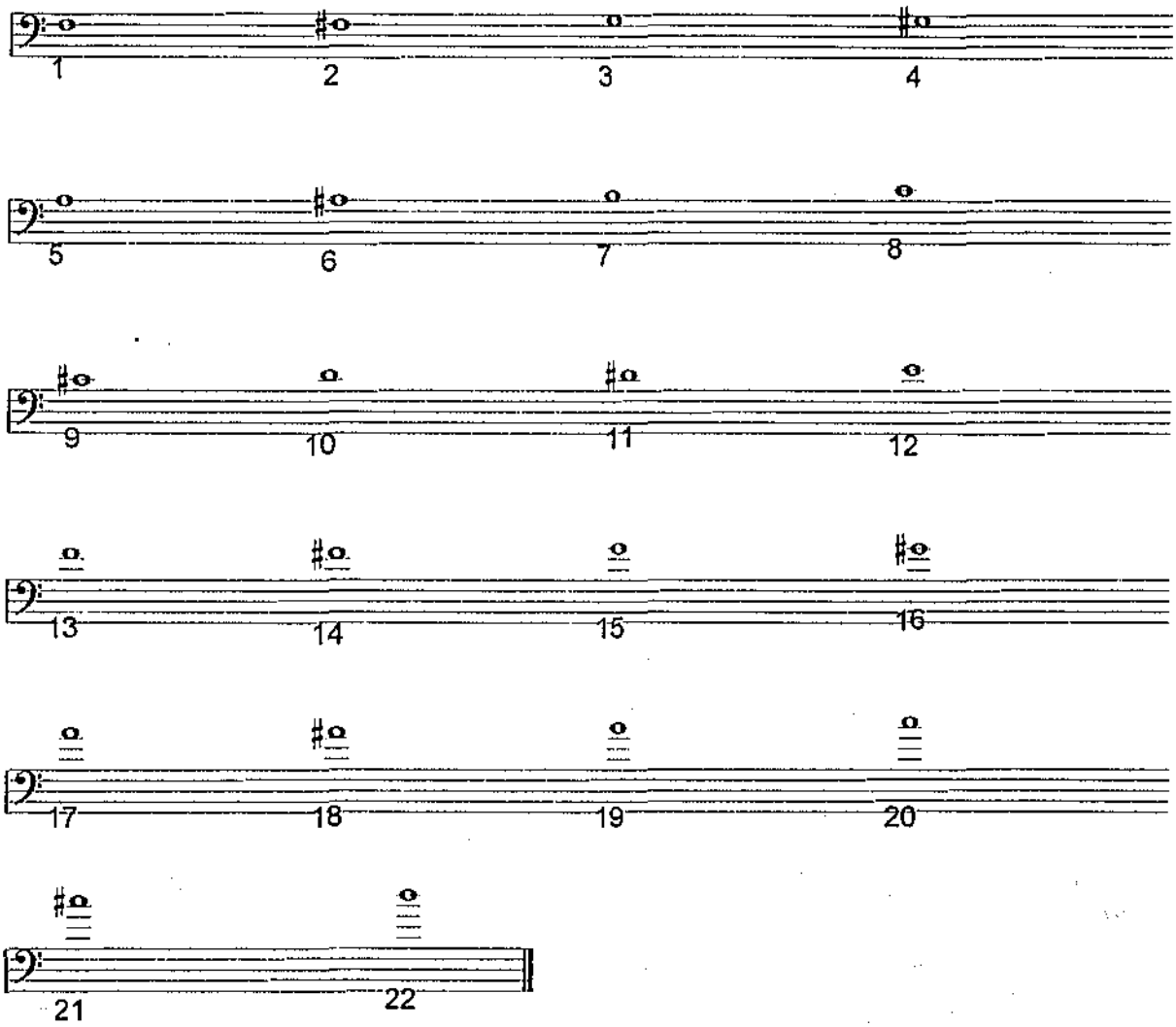
Play each note for four counts. Pause and breathe between each note. Play sucessively higher until the student can play no higher. Attempt the note of failure three times.
If the note can be played, no matter how insecurely, proceed to the next note until the last note cannot be played after three attempts. The number beneath the note of failure is the student's test score.



HIGH REGISTER TEST

TROMBONE/EUPHONIUM

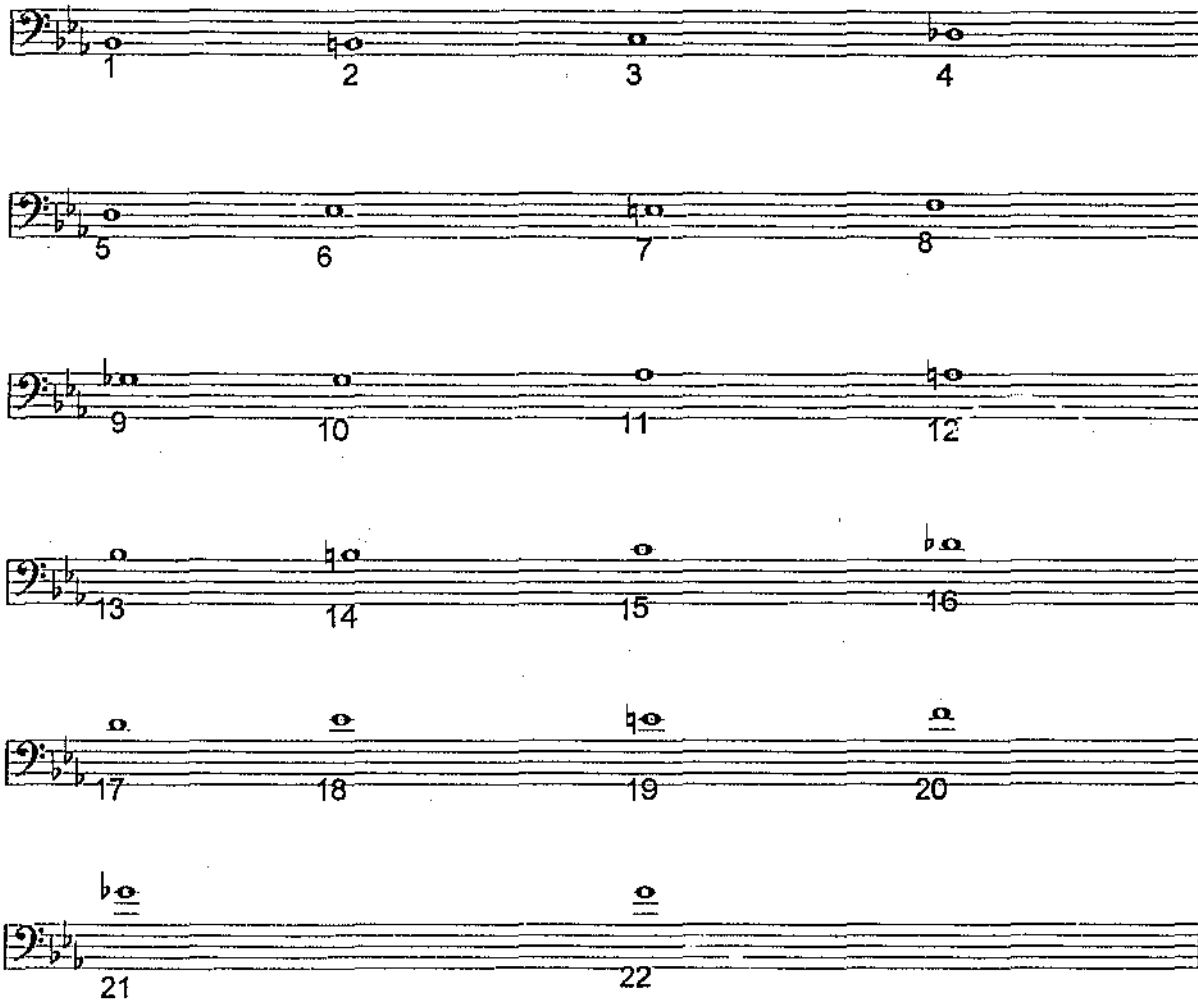
Play each note for four counts. Pause and breathe between each note. Play sucessively higher until the student can play no higher. Attempt the note of failure three times.
If the note can be played, no matter how insecurely, proceed to the next note until the last note cannot be played after three attempts. The number beneath the last note played is the student's test score.



HIGH REGISTER TEST

EEb Tuba

Play each note for four counts. Pause and breathe between each note. Play sucessively higher until the student can play no higher. Attempt the note of failure three times. If the note can be played, no matter how insecurely, proceed to the next note until the last note cannot be played after three attempts. The number beneath the last note played is the student's test score.



STUDENT QUESTIONNAIRE

Music at my Home

Please fill out this questionnaire. It will allow you to describe to the music teacher what type of musical environment you think exists at your home. Your answers to this questionnaire are strictly confidential.

1. Tick which best describes the number of CDs, tapes and records in your house.

0 -10 [ ] 11 -20 [ ] 21 -30 [ ] 31+ [ ]

2. Tick the word which best describes the variety of types of music on CDs, tapes and records at home:

none[ ] small [ ] wide [ ] extensive [ ]

3. Tick the word which best describes how often your parents/guardians listen to music of any description:

never [ ] seldom[ ] frequently[ ] very often[ ]

4. Tick the answer that best describes the type of music your parents/guardians listen to.

a) A wide variety of music [ ]
b) Mainly classical music [ ]
c) Mainly popular music [ ]
d) Very little [ ]

5. Tick the answer which best describes the type of music your sisters/brothers listen to.

a) A wide variety of music [ ]
b) Mainly classical music [ ]
c) Mainly popular music [ ]
d) Very little [ ]

6. Tick the word which best describes how many books or magazines are in your house.

none[ ] few[ ] many[ ] very many[ ]

7. Tick the word which best describes how many music books, including sheet music, are in your house.

none[ ] few[ ] many[ ] very many[ ]

8. Tick the answer that best describes your parent's/guardian's reaction to the following statements:

a) My parents like my instrument.

not at all[ ] a little[ ] a lot[ ] very much[ ]

b) My parents like the sound of my instrument.

not at all[ ] a little[ ] a lot[ ] very much[ ]

c) My parents like to hear music played in the house

not at all[ ] a little[ ] a lot[ ] very much[ ]

d) My parents are prepared to transport my instrument to school when necessary.

never[ ] sometimes[ ] often[ ] always[ ]

9. Tick the answer that best describes your brother's or sister's reaction to the following statements:

a) My brothers and/or sisters like my instrument.

not at all[ ] a little[ ] a lot[ ] very much[ ]

b) My brothers and/or sisters like the sound of my instrument.

not at all[ ] a little[ ] a lot[ ] very much[ ]

10. Does your family complain about your home practice?

yes[ ] no[ ]

11. If yes, tick the appropriate the reason/s:

a) [ ] Noise.
b) [ ] Disturbs the family routine.
c) [ ] Disturbs the sleep of one or more members of the family.

12. Tick which member/s of your family plays a musical instrument at home:

a) [ ] My father
b) [ ] My mother
c) [ ] My sister
d) [ ] My brother
e) [ ] Other. State:_____

13. Do you learn a musical instrument outside of school?

yes[ ] no[ ]

For questions 14 and 15, tick the best answer.

14. I enjoy listening to music.

never[ ] sometimes[ ] often[ ] always[ ]

15. To play a brass instrument is my:

1st choice[ ] 2nd choice[ ] 3rd choice[ ]

APPENDIX B

THE DATA MATRIX USED FOR STATISTICAL ANALYSIS

Table 6: *The data matrix used for statistical analyses.*

STD NO	PRE TEST	HI/LO PRE TEST	POST TEST	GAIN	HI/LO GAIN	PRAC MINS	CULTURAL CAPITAL	FAM ATT MUS	FAM ATT INSTR	FAM ATT PRAC	NEG REAS 1	NEG REAS 2	NEG REAS 3	FAM MEM PLAY INSTR	LEARN OUT OF SCH	ENJ MUS	INST CHOICE
E1	23	Hi	22	-1	Lo	190	13	8	18	1	0	1	0	0	1	4	2
E2	12	Lo	12	0	Lo	100	14	7	15	1	0	0	0	1	1	3	1
E3	15	Lo	15	0	Lo	190	15	9	20	1	0	0	0	1	0	4	3
E4	16	Lo	20	+4	Hi	200											
E6	17	Hi	15	+2	Lo	190	14	9	19	1	0	0	1	0	1	3	3
E7	18	Lo	21	+3	Hi	180	15	9	19	1	0	0	0	1	0	4	3
E8	21	Hi	21	0	Hi	150	14	9	19	1	0	0	0	1	1	4	3
E9	21	Hi	17	-4	Lo	210	15	8	15	1	0	0	0	3	1	2	2
E10	15	Hi	17	+3	Lo	180	15	8	19	0	1	0	0	1	1	3	3
E11	13	Lo	15	+3	Hi	180	11	8	12	0	1	0	0	3	1	3	3
E12	18	Lo	19	+1	Hi	140	11	7	13	1	0	0	0	1	0	2	3
E13	17	Lo	19	+2	Lo	150	14	7	19	1	0	0	0	3	1	4	2
E14	13	Lo	14	+1	Hi	100	14	10	14	1	0	0	0	1	1	2	3
E15	19	Hi	19	0	Lo	190	11	8	11	1	1	0	1	0	0	4	3
E16	19	Hi	20	+1	Lo	150	14	10	20	1	0	0	0	0	0	4	3
E17	22	Hi	24	+2	Lo	180											
E18	14	Lo	16	+2	Hi	150	16	12	12	1	0	0	0	1	0	4	3
E19	18	Hi	17	-1	Lo	120	12	7	20	1	0	0	0	1	0	3	3
E20	16	Lo	18	+2	Hi	120	15	10	20	0	1	0	0	1	0	4	3
E21	13	Lo	16	+3	Hi	90	10	8	14	1	0	0	0	1	0	3	2
E22	19	Hi	19	0	Lo	180	16	9	22	1	0	0	0	1	0	3	3
C1	13	Lo	14	+1	Lo	30	14	9	16	0	1	0	0	2	0	4	3
C2	10	Lo	14	+4	Hi	30	14	10	15	0	1	0	0	0	0	4	2
C3	15	lo	13	-2	Lo	90	16	12	12	1	0	0	0	2	0	4	2
C4	11	Hi	19	+8	Hi	60	15	5	6	0	1	1	1	1	1	2	1
C5	29	Hi	27	-2	Lo	230	16	12	14	1	0	0	0	4	0	4	3
C6	20	Hi	21	+1	Lo	130	13	6	16	1	0	0	0	4	1	3	3
C7	18	Hi	15	-3	Lo	0											
C8	19	Hi	16	-3	Lo	160	14	10	16	0	1	0	0	1	0	4	3
C9	25	Hi	27	+2	Hi	250	13	9	15	1	0	0	0	2	0	3	3
C10	18	Hi	19	+1	Lo	200	14	7	19	1	0	0	0	1	1	4	3
C11	19	Hi	20	+1	Lo	160	14	9	12	1	0	0	0	0	0	3	3
C12	13	Lo	14	+1	Lo	70	15	6	14	0	0	1	0	2	0	4	3
C13	14	Lo	17	+3	Hi	120	16	12	14	1	0	0	0	1	1	4	3
C14	14	Lo	18	+4	Hi	190	14	10	23	1	0	0	0	2	1	3	2
C15	13	Lo	14	+1	Lo	80	13	7	16	1	0	0	0	2	1	4	2
C16	13	Lo	15	+2	Hi	120	12	9	14	1	0	0	0	1	0	3	2
C17	13	Lo	15	+2	Hi	110	10	9	13	1	0	0	0	1	0	2	3
C18	16	Lo	21	+5	Hi	90	14	9	15	1	0	0	0	1	0	4	3
C19	19	Hi	20	+1	Lo	170	16	10	22	1	0	0	0	3	1	4	2
C20	21	Hi	22	+1	Lo	140	11	8	14	1	0	0	0	0	0	4	3
C21	21	Hi	23	+2	Hi	110	12	9	18	1	0	0	0	1	0	4	3
C22	20	Hi	20	0	Lo	160	16	10	18	1	0	0	0	3	0	4	3

APPENDIX C

BIVARIATE CORRELATIONS

The following tables were calculated using Pearson's r, which assumes interval scales. Where data was Bi-polar or Bi-modal Kendall's tau and Spearman's rho, which are accurate for ordinal and serial scales, were calculated. There were some changes in the values of the correlations, but associations of significance remained and no new associations of significance were revealed.

Correlations

		group	hi/lo pretest	pretest	post test
group	Pearson Correlation	1.000	.046	-.046	.025
	Sig. (2-tailed)	.	.769	.768	.870
	N	44	44	44	44
hi/lo pretest	Pearson Correlation	.046	1.000	.754**	.659**
	Sig. (2-tailed)	.769	.	.000	.000
	N	44	44	44	44
pretest	Pearson Correlation	-.046	.754**	1.000	.836**
	Sig. (2-tailed)	.768	.000	.	.000
	N	44	44	44	44
post test	Pearson Correlation	.025	.659**	.836**	1.000
	Sig. (2-tailed)	.870	.000	.000	.
	N	44	44	44	44
gain	Pearson Correlation	.063	-.361*	-.473**	.062
	Sig. (2-tailed)	.686	.016	.001	.688
	N	44	44	44	44
hi/lo gain	Pearson Correlation	-.046	-.453**	-.329*	.036
	Sig. (2-tailed)	.767	.002	.029	.815
	N	44	44	44	44
PRACTICE	Pearson Correlation	-.354*	.336*	.626**	.581**
	Sig. (2-tailed)	.019	.026	.000	.000
	N	44	44	44	44
CULTURAL CAPITAL	Pearson Correlation	.080	-.015	.071	.018
	Sig. (2-tailed)	.625	.929	.663	.913
	N	40	40	40	40
FAMILY ATTITUDE TO INSTRUMENT	Pearson Correlation	-.223	.079	.243	.140
	Sig. (2-tailed)	.167	.630	.131	.389
	N	40	40	40	40
FAMILY ATTITUDE TO MUSIC	Pearson Correlation	.114	-.168	.147	.054
	Sig. (2-tailed)	.484	.300	.364	.741
	N	40	40	40	40
FAMILY ATTITUDE TO PRACTICE	Pearson Correlation	-.100	.250	.399*	.311
	Sig. (2-tailed)	.539	.120	.011	.051
	N	40	40	40	40
NEGATIVE REASON 1	Pearson Correlation	-.025	-.125	-.305	-.220
	Sig. (2-tailed)	.878	.442	.056	.172
	N	40	40	40	40
NEGATIVE REASON 2	Pearson Correlation	.081	.095	-.090	.025
	Sig. (2-tailed)	.620	.560	.580	.877
	N	40	40	40	40
NEGATIVE REASON 3	Pearson Correlation	-.109	.095	-.090	-.029
	Sig. (2-tailed)	.502	.560	.580	.857
	N	40	40	40	40
NUMBER OF MUSICIANS IN FAMILY	Pearson Correlation	.241	.023	.225	.160
	Sig. (2-tailed)	.134	.886	.163	.323
	N	40	40	40	40
INSTRUMENT LEARNED OUT OF SCHOOL	Pearson Correlation	-.143	-.102	-.126	-.124
	Sig. (2-tailed)	.378	.531	.439	.446
	N	40	40	40	40

Correlations

		group	hi/lo pretest	pretest	post test
STUDENTS ENJOYMENT RATING	Pearson Correlation	.181	.000	.199	.170
	Sig. (2-tailed)	.264	1.000	.218	.296
	N	40	40	40	40
CHOICE OF INSTRUMENT RANKING	Pearson Correlation	-.057	.175	.362*	.282
	Sig. (2-tailed)	.727	.281	.022	.078
	N	40	40	40	40

Correlations

		DIFFERENCE	hi/lo difference	PRACTICE	CULTURAL CAPITAL
group	Pearson Correlation	.063	-.046	-.354*	.080
	Sig. (2-tailed)	.686	.767	.019	.625
	N	44	44	44	40
hi/lo pretest	Pearson Correlation	-.361*	-.453**	.336*	-.015
	Sig. (2-tailed)	.016	.002	.026	.929
	N	44	44	44	40
pretest	Pearson Correlation	-.473**	-.329*	.626**	.071
	Sig. (2-tailed)	.001	.029	.000	.663
	N	44	44	44	40
post test	Pearson Correlation	.062	.036	.581**	.018
	Sig. (2-tailed)	.688	.815	.000	.913
	N	44	44	44	40
gain	Pearson Correlation	1.000	.732**	-.141	-.108
	Sig. (2-tailed)	.	.000	.363	.507
	N	44	44	44	40
hi/lo gain	Pearson Correlation	.732**	1.000	-.003	-.123
	Sig. (2-tailed)	.000	.	.986	.448
	N	44	44	44	40
PRACTICE	Pearson Correlation	-.141	-.003	1.000	.110
	Sig. (2-tailed)	.363	.986	.	.498
	N	44	44	44	40
CULTURAL CAPITAL	Pearson Correlation	-.108	-.123	.110	1.000
	Sig. (2-tailed)	.507	.448	.498	.
	N	40	40	40	40
FAMILY ATTITUDE TO INSTRUMENT	Pearson Correlation	-.190	-.091	.331*	.245
	Sig. (2-tailed)	.240	.578	.037	.128
	N	40	40	40	40
FAMILY ATTITUDE TO MUSIC	Pearson Correlation	-.192	.118	.157	.420**
	Sig. (2-tailed)	.235	.467	.332	.007
	N	40	40	40	40
FAMILY ATTITUDE TO PRACTICE	Pearson Correlation	-.264	-.202	.371*	-.102
	Sig. (2-tailed)	.100	.211	.018	.530
	N	40	40	40	40
NEGATIVE REASON 1	Pearson Correlation	.235	.202	-.224	-.044
	Sig. (2-tailed)	.145	.211	.165	.788
	N	40	40	40	40
NEGATIVE REASON 2	Pearson Correlation	.189	-.053	-.195	.093
	Sig. (2-tailed)	.242	.746	.227	.568
	N	40	40	40	40
NEGATIVE REASON 3	Pearson Correlation	.278	.139	.029	-.074
	Sig. (2-tailed)	.082	.392	.859	.652
	N	40	40	40	40
NUMBER OF MUSICIANS IN FAMILY	Pearson Correlation	-.207	-.113	.165	.252
	Sig. (2-tailed)	.201	.488	.309	.116
	N	40	40	40	40
INSTRUMENT LEARNED OUT OF SCHOOL	Pearson Correlation	.120	.021	.137	.137
	Sig. (2-tailed)	.462	.899	.401	.398
	N	40	40	40	40

Correlations

		DIFFERENCE	hi/lo difference	PRACTICE	CULTURAL CAPITAL
STUDENTS ENJOYMENT RATING	Pearson Correlation	-.141	-.118	-.012	.312
	Sig. (2-tailed)	.384	.467	.942	.050
	N	40	40	40	40
CHOICE OF INSTRUMENT RANKING	Pearson Correlation	-.174	-.093	.293	-.055
	Sig. (2-tailed)	.282	.569	.066	.736
	N	40	40	40	40

Correlations

		FAMILY ATTITUDE TO INSTRUMENT	FAMILY ATTITUDE TO MUSIC	FAMILY ATTITUDE TO PRACTICE	NEGATIVE REASON 1
group	Pearson Correlation	-.223	.114	-.100	-.025
	Sig. (2-tailed)	.167	.484	.539	.878
	N	40	40	40	40
h/lo pretest	Pearson Correlation	.079	-.168	.250	-.125
	Sig. (2-tailed)	.630	.300	.120	.442
	N	40	40	40	40
pretest	Pearson Correlation	.243	.147	.399*	-.305
	Sig. (2-tailed)	.131	.364	.011	.056
	N	40	40	40	40
post test	Pearson Correlation	.140	.054	.311	-.220
	Sig. (2-tailed)	.389	.741	.051	.172
	N	40	40	40	40
gain	Pearson Correlation	-.190	-.192	-.264	.235
	Sig. (2-tailed)	.240	.235	.100	.145
	N	40	40	40	40
h/lo gain	Pearson Correlation	-.091	.118	-.202	.202
	Sig. (2-tailed)	.578	.467	.211	.211
	N	40	40	40	40
PRACTICE	Pearson Correlation	.331*	.157	.371*	-.224
	Sig. (2-tailed)	.037	.332	.018	.165
	N	40	40	40	40
CULTURAL CAPITAL	Pearson Correlation	.245	.420**	-.102	-.044
	Sig. (2-tailed)	.128	.007	.530	.788
	N	40	40	40	40
FAMILY ATTITUDE TO INSTRUMENT	Pearson Correlation	1.000	.121	.189	-.243
	Sig. (2-tailed)	.	.458	.242	.131
	N	40	40	40	40
FAMILY ATTITUDE TO MUSIC	Pearson Correlation	.121	1.000	.161	-.084
	Sig. (2-tailed)	.458	.	.322	.606
	N	40	40	40	40
FAMILY ATTITUDE TO PRACTICE	Pearson Correlation	.189	.161	1.000	-.844**
	Sig. (2-tailed)	.242	.322	.	.000
	N	40	40	40	40
NEGATIVE REASON 1	Pearson Correlation	-.243	-.084	-.844**	1.000
	Sig. (2-tailed)	.131	.606	.000	.
	N	40	40	40	40
NEGATIVE REASON 2	Pearson Correlation	-.277	-.425**	-.332*	.095
	Sig. (2-tailed)	.083	.006	.036	.560
	N	40	40	40	40
NEGATIVE REASON 3	Pearson Correlation	-.331*	-.251	-.095	.332*
	Sig. (2-tailed)	.037	.118	.560	.036
	N	40	40	40	40
NUMBER OF MUSICIANS IN FAMILY	Pearson Correlation	.053	-.009	.000	-.117
	Sig. (2-tailed)	.746	.956	1.000	.471
	N	40	40	40	40
INSTRUMENT LEARNED OUT OF SCHOOL	Pearson Correlation	.128	-.293	.026	-.026
	Sig. (2-tailed)	.430	.066	.876	.876
	N	40	40	40	40

Correlations

		FAMILY ATTITUDE TO INSTRUMENT	FAMILY ATTITUDE TO MUSIC	FAMILY ATTITUDE TO PRACTICE	NEGATIVE REASON 1
STUDENTS ENJOYMENT RATING	Pearson Correlation	.310	.348*	-.035	.035
	Sig. (2-tailed)	.051	.028	.828	.828
	N	40	40	40	40
CHOICE OF INSTRUMENT RANKING	Pearson Correlation	.188	.263	.022	-.022
	Sig. (2-tailed)	.246	.101	.894	.894
	N	40	40	40	40

Correlations

		NEGATIVE REASON 2	NEGATIVE REASON 3	NUMBER OF MUSICIANS IN FAMILY	INSTRUMENT LEARNED OUT OF SCHOOL
group	Pearson Correlation	.081	-.109	.241	-.143
	Sig. (2-tailed)	.620	.502	.134	.378
	N	40	40	40	40
hi/lo pretest	Pearson Correlation	.095	.095	.023	-.102
	Sig. (2-tailed)	.560	.560	.886	.531
	N	40	40	40	40
pretest	Pearson Correlation	-.090	-.090	.225	-.126
	Sig. (2-tailed)	.580	.580	.163	.439
	N	40	40	40	40
post test	Pearson Correlation	.025	-.029	.180	-.124
	Sig. (2-tailed)	.877	.857	.323	.446
	N	40	40	40	40
gain	Pearson Correlation	.189	.278	-.207	.120
	Sig. (2-tailed)	.242	.082	.201	.462
	N	40	40	40	40
hi/lo gain	Pearson Correlation	-.053	.139	-.113	.021
	Sig. (2-tailed)	.746	.392	.486	.899
	N	40	40	40	40
PRACTICE	Pearson Correlation	-.195	.029	.165	.137
	Sig. (2-tailed)	.227	.859	.309	.401
	N	40	40	40	40
CULTURAL CAPITAL	Pearson Correlation	.093	-.074	.252	.137
	Sig. (2-tailed)	.568	.652	.116	.398
	N	40	40	40	40
FAMILY ATTITUDE TO INSTRUMENT	Pearson Correlation	-.277	-.331*	.053	.128
	Sig. (2-tailed)	.083	.037	.746	.430
	N	40	40	40	40
FAMILY ATTITUDE TO MUSIC	Pearson Correlation	-.425**	-.251	-.009	-.293
	Sig. (2-tailed)	.006	.118	.956	.066
	N	40	40	40	40
FAMILY ATTITUDE TO PRACTICE	Pearson Correlation	-.332*	-.095	.000	.026
	Sig. (2-tailed)	.036	.560	1.000	.876
	N	40	40	40	40
NEGATIVE REASON 1	Pearson Correlation	.095	.332*	-.117	-.026
	Sig. (2-tailed)	.560	.036	.471	.876
	N	40	40	40	40
NEGATIVE REASON 2	Pearson Correlation	1.000	.279	-.100	.155
	Sig. (2-tailed)	.	.081	.538	.340
	N	40	40	40	40
NEGATIVE REASON 3	Pearson Correlation	.279	1.000	-.278	.155
	Sig. (2-tailed)	.081	.	.082	.340
	N	40	40	40	40
NUMBER OF MUSICIANS IN FAMILY	Pearson Correlation	-.100	-.278	1.000	.240
	Sig. (2-tailed)	.538	.082	.	.137
	N	40	40	40	40
INSTRUMENT LEARNED OUT OF SCHOOL	Pearson Correlation	.155	.155	.240	1.000
	Sig. (2-tailed)	.340	.340	.137	.
	N	40	40	40	40

Correlations

		NEGATIVE REASON 2	NEGATIVE REASON 3	NUMBER OF MUSICIANS IN FAMILY	INSTRUMENT LEARNED OUT OF SCHOOL
STUDENTS ENJOYMENT RATING	Pearson Correlation	-.047	-.182	-.025	-.232
	Sig. (2-tailed)	.773	.262	.878	.151
	N	40	40	40	40
CHOICE OF INSTRUMENT RANKING	Pearson Correlation	-.323*	-.158	-.072	-.392*
	Sig. (2-tailed)	.042	.332	.660	.012
	N	40	40	40	40

Correlations

		STUDENTS ENJOYMENT RATING	CHOICE OF INSTRUMENT RANKING
group	Pearson Correlation	.181	-.057
	Sig. (2-tailed)	.264	.727
	N	40	40
hi/lo pretest	Pearson Correlation	.000	.175
	Sig. (2-tailed)	1.000	.281
	N	40	40
pretest	Pearson Correlation	.199	.362*
	Sig. (2-tailed)	.218	.022
	N	40	40
post test	Pearson Correlation	.170	.282
	Sig. (2-tailed)	.296	.078
	N	40	40
gain	Pearson Correlation	-.141	-.174
	Sig. (2-tailed)	.384	.282
	N	40	40
hi/lo gain	Pearson Correlation	-.118	-.093
	Sig. (2-tailed)	.467	.569
	N	40	40
PRACTICE	Pearson Correlation	-.012	.293
	Sig. (2-tailed)	.942	.066
	N	40	40
CULTURAL CAPITAL	Pearson Correlation	.312	-.055
	Sig. (2-tailed)	.050	.736
	N	40	40
FAMILY ATTITUDE TO INSTRUMENT	Pearson Correlation	.310	.188
	Sig. (2-tailed)	.051	.246
	N	40	40
FAMILY ATTITUDE TO MUSIC	Pearson Correlation	.348*	.263
	Sig. (2-tailed)	.028	.101
	N	40	40
FAMILY ATTITUDE TO PRACTICE	Pearson Correlation	-.035	.022
	Sig. (2-tailed)	.828	.894
	N	40	40
NEGATIVE REASON 1	Pearson Correlation	.035	-.022
	Sig. (2-tailed)	.828	.894
	N	40	40
NEGATIVE REASON 2	Pearson Correlation	-.047	-.323*
	Sig. (2-tailed)	.773	.042
	N	40	40
NEGATIVE REASON 3	Pearson Correlation	-.182	-.158
	Sig. (2-tailed)	.262	.332
	N	40	40
NUMBER OF MUSICIANS IN FAMILY	Pearson Correlation	-.025	-.072
	Sig. (2-tailed)	.878	.660
	N	40	40
INSTRUMENT LEARNED OUT OF SCHOOL	Pearson Correlation	-.232	-.392*
	Sig. (2-tailed)	.151	.012
	N	40	40

Correlations

		STUDENTS ENJOYMENT RATING	CHOICE OF INSTRUMENT RANKING
STUDENTS ENJOYMENT RATING	Pearson Correlation	1.000	.204
	Sig. (2-tailed)	.	.206
	N	40	40
CHOICE OF INSTRUMENT RANKING	Pearson Correlation	.204	1.000
	Sig. (2-tailed)	.206	.
	N	40	40

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

APPENDIX D

CHARTS AND GRAPHS OF THE EXPERIMENTAL DATA

Figure 2a
Results of the pre-test; total population.

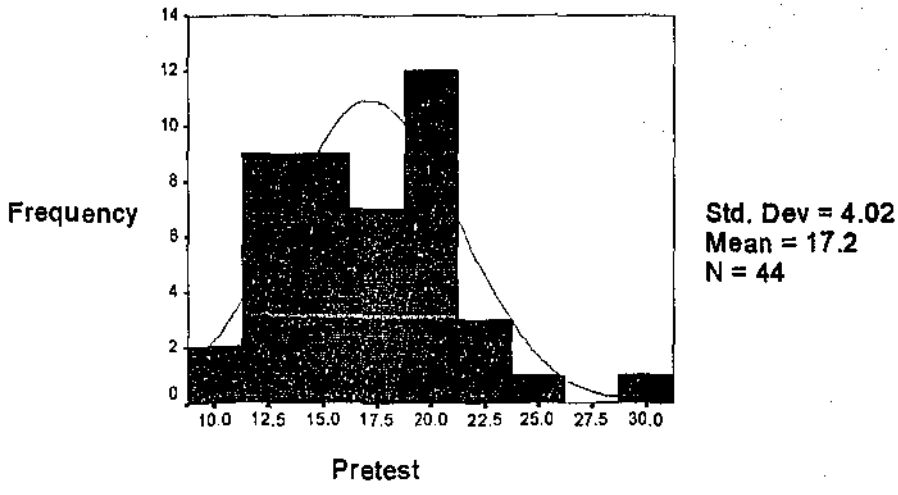


Figure 2b
Results of the pre-test; control group.

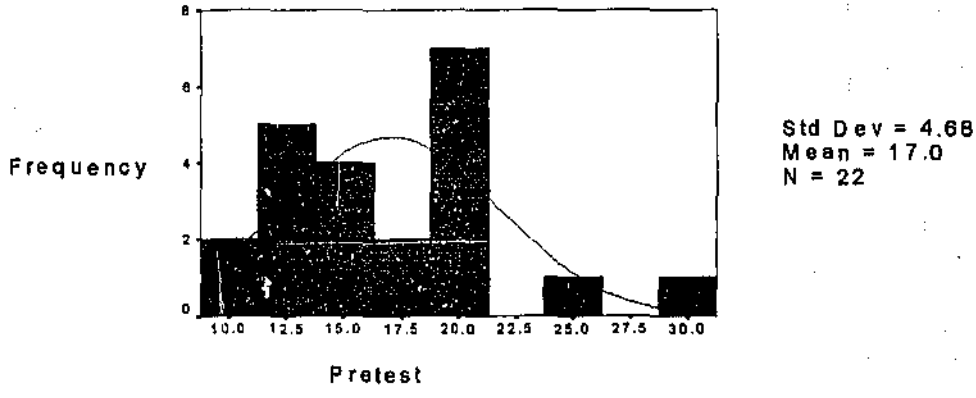


Figure 2c
Results of the pre-test; experiment group.

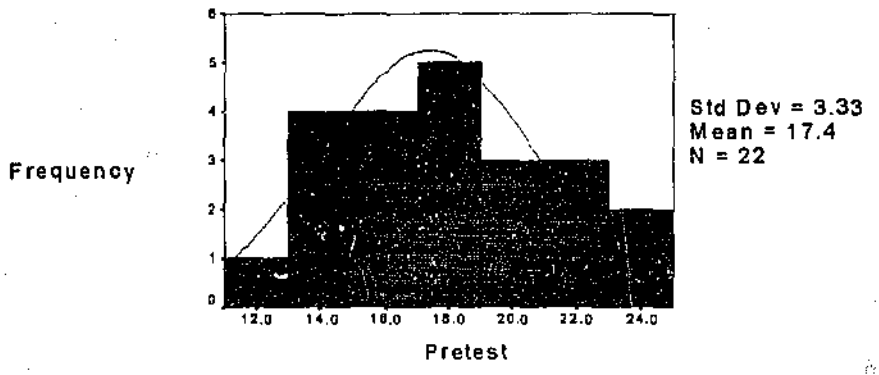


Figure 3a
Results of the post-test; total population.

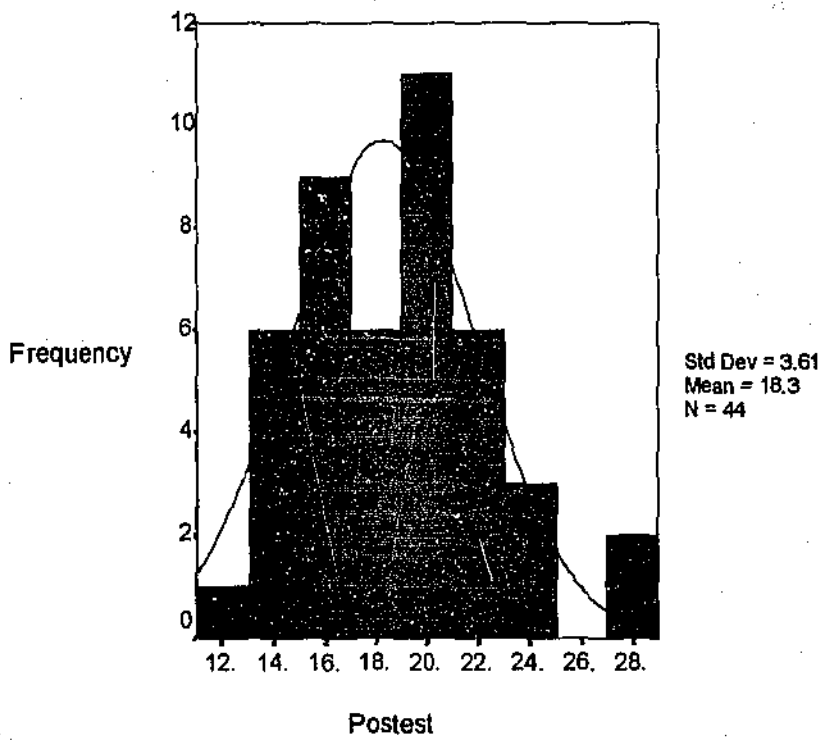


Figure 3b
Results of the post-test; control group.

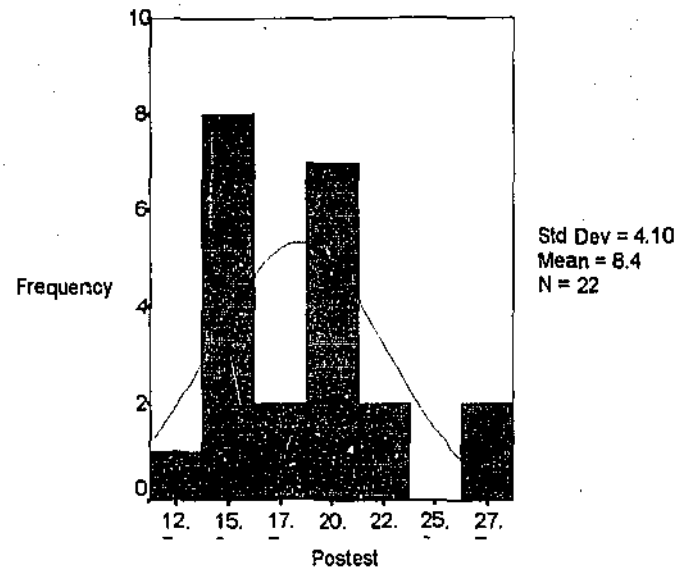


Figure 3c
Results of the post-test; experiment group.

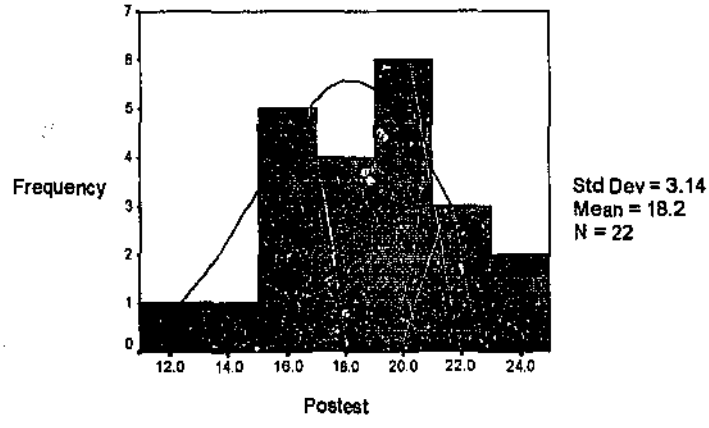


Figure 4a
Gain for total population, control group and experiment group.

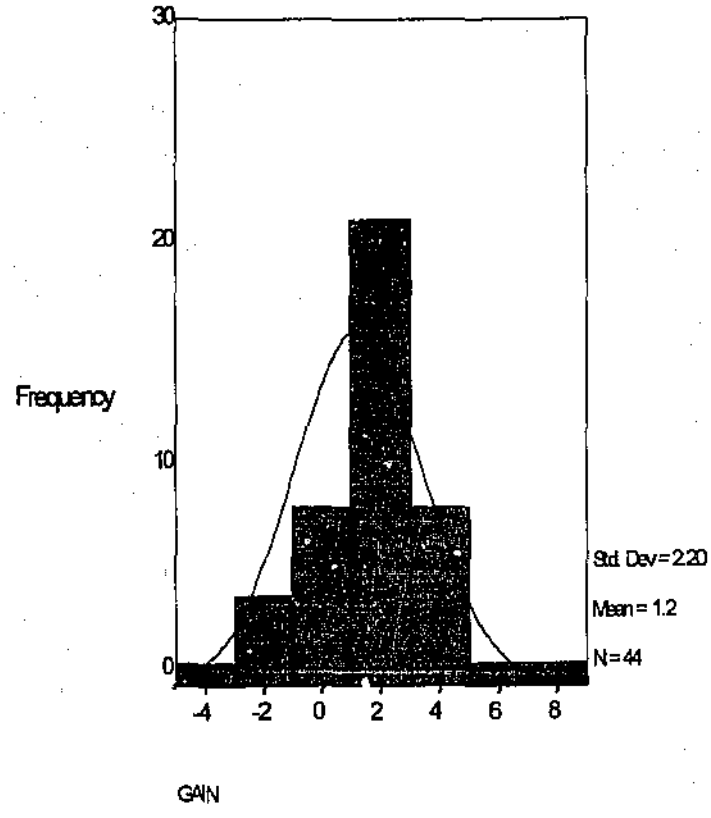


Figure 4b
Gain for control group.

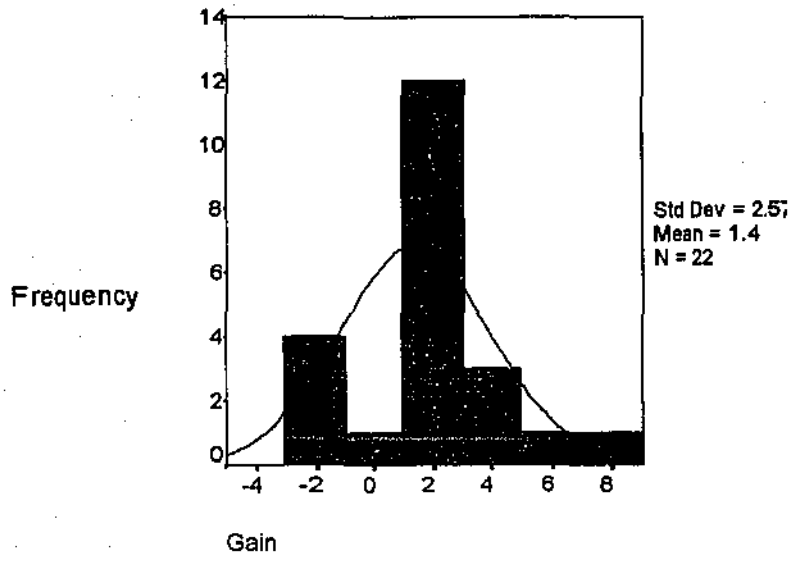


Figure 4c
Gain for experiment group.

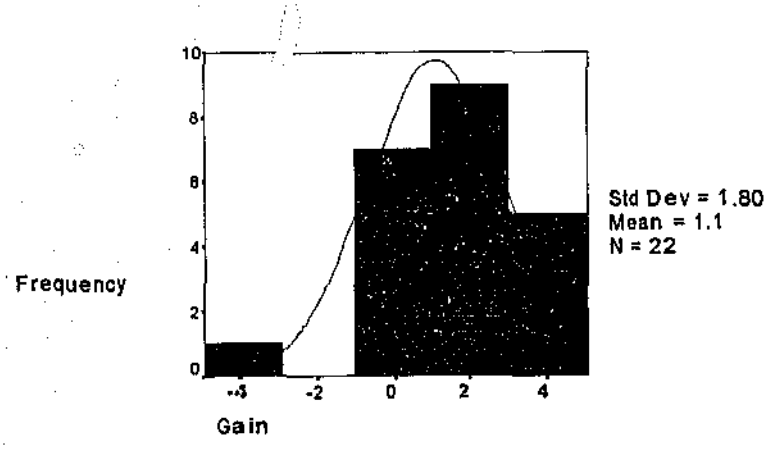


Figure 5a
Average weekly practice minutes for the experimental group.

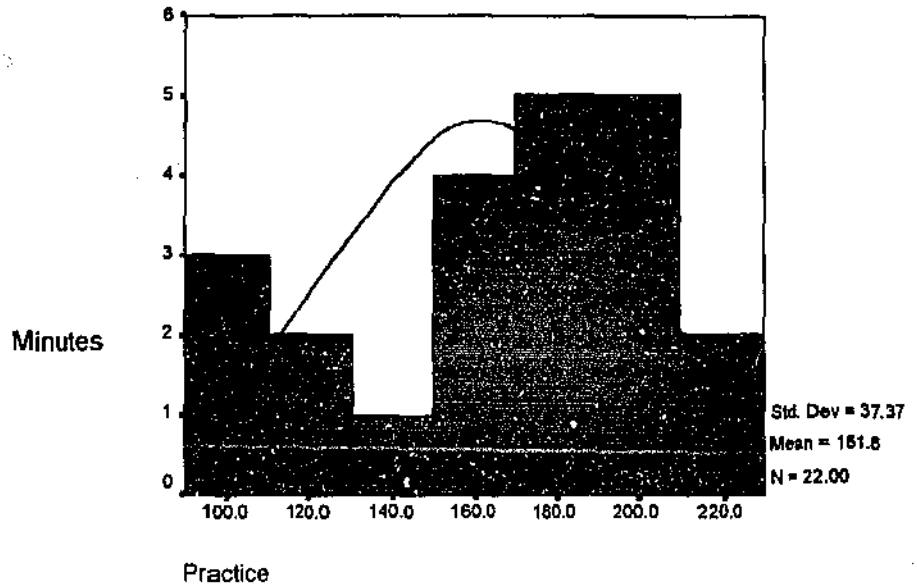


Figure 5b
Average weekly practice minutes for the control group.

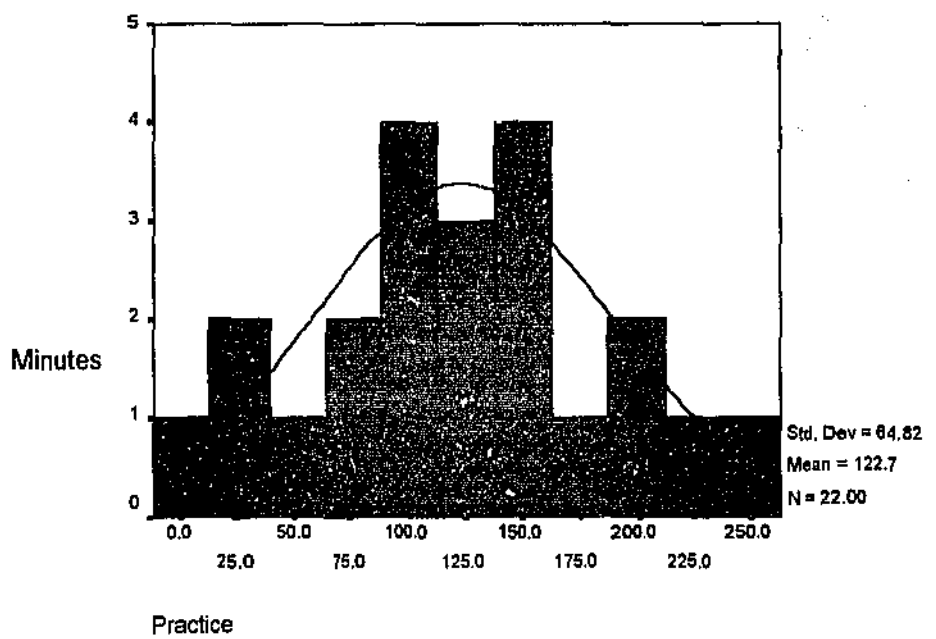


Figure 6
The correlation between pre-test and gain.

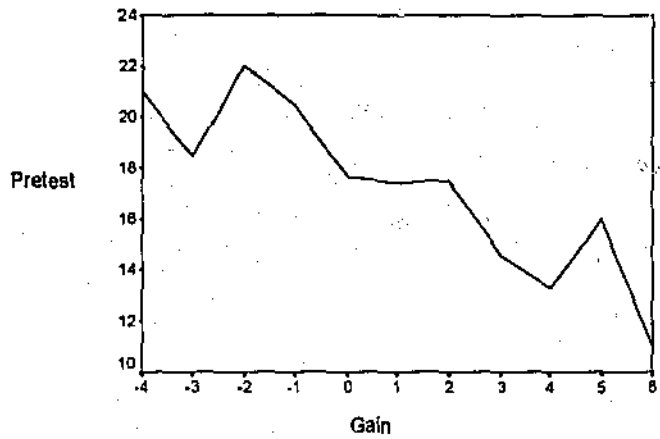


Figure 7
The correlation between high/low pre-test and high/low gain.

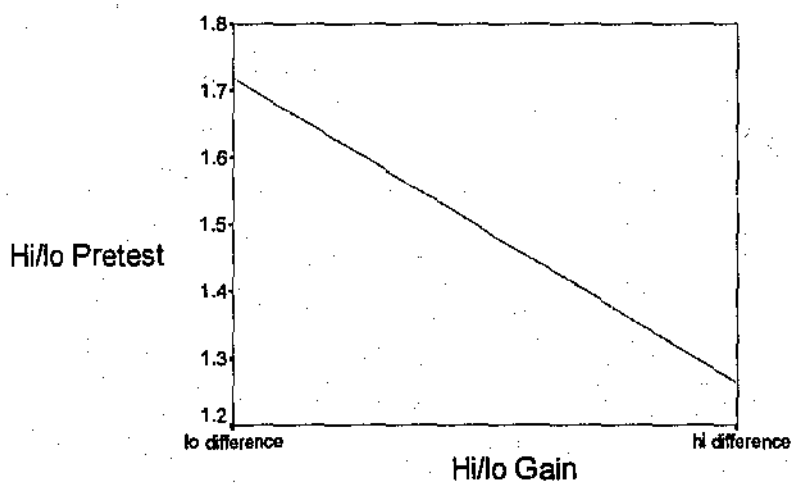


Figure 8
The correlation between group and practice.

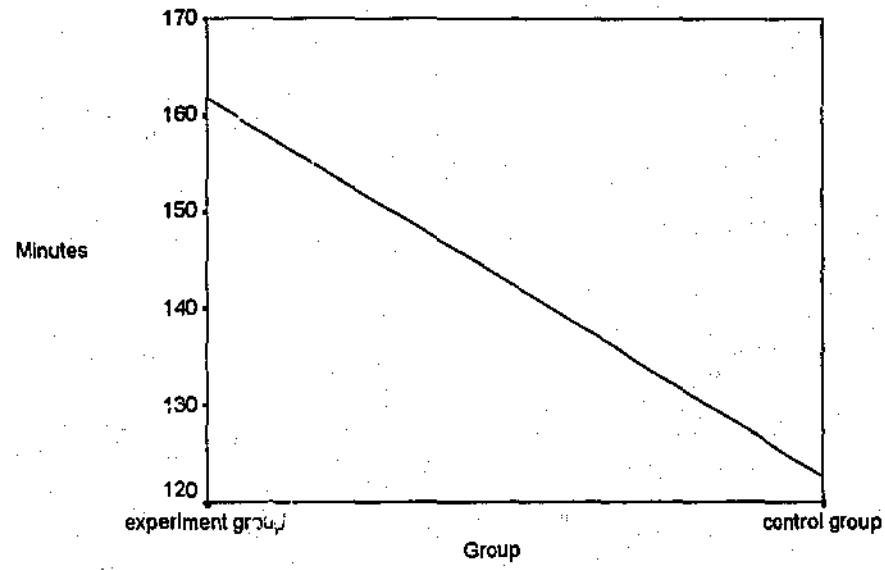


Figure 9
The correlation between hi/lo pre-test and practice.

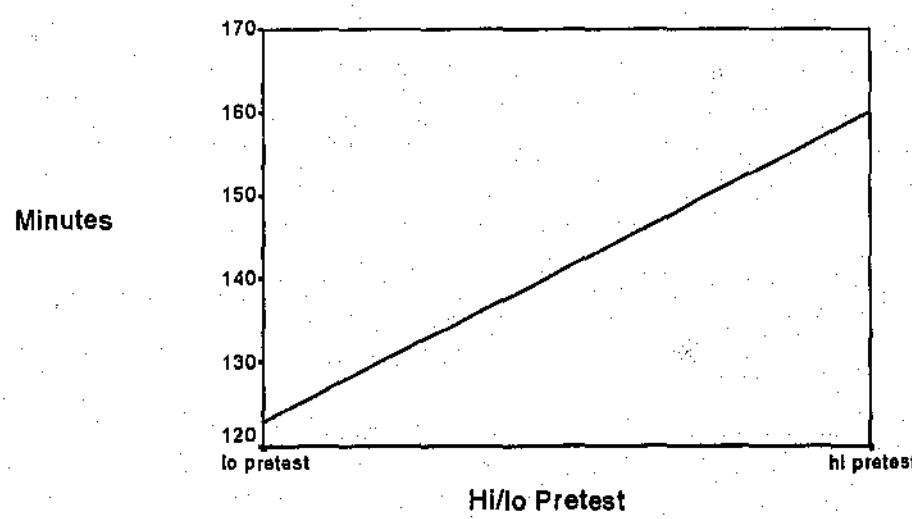


Figure 10
The correlation between pre-test and practice.

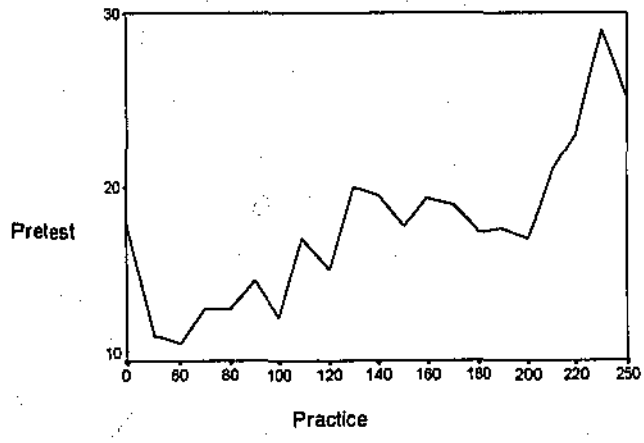


Figure 11
The correlation between cultural capital and family attitude to music.

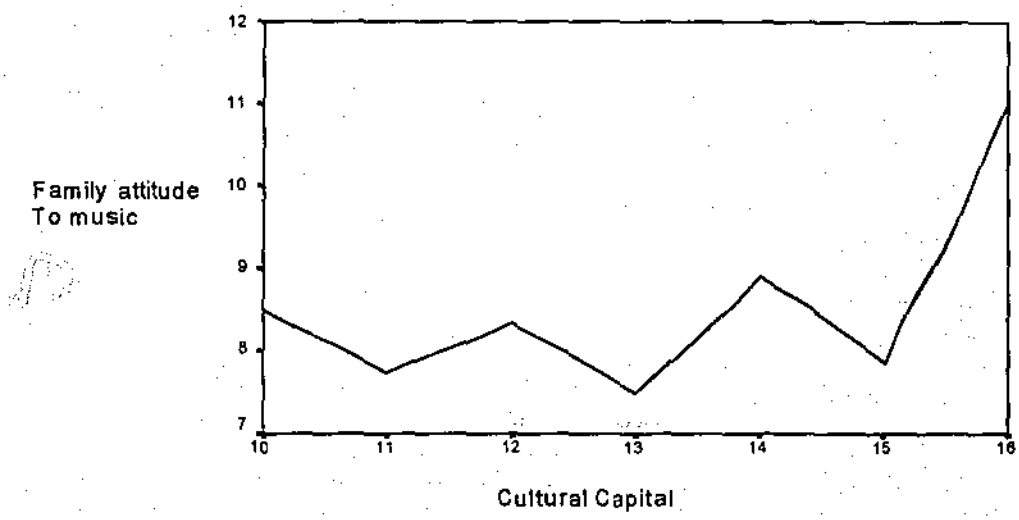
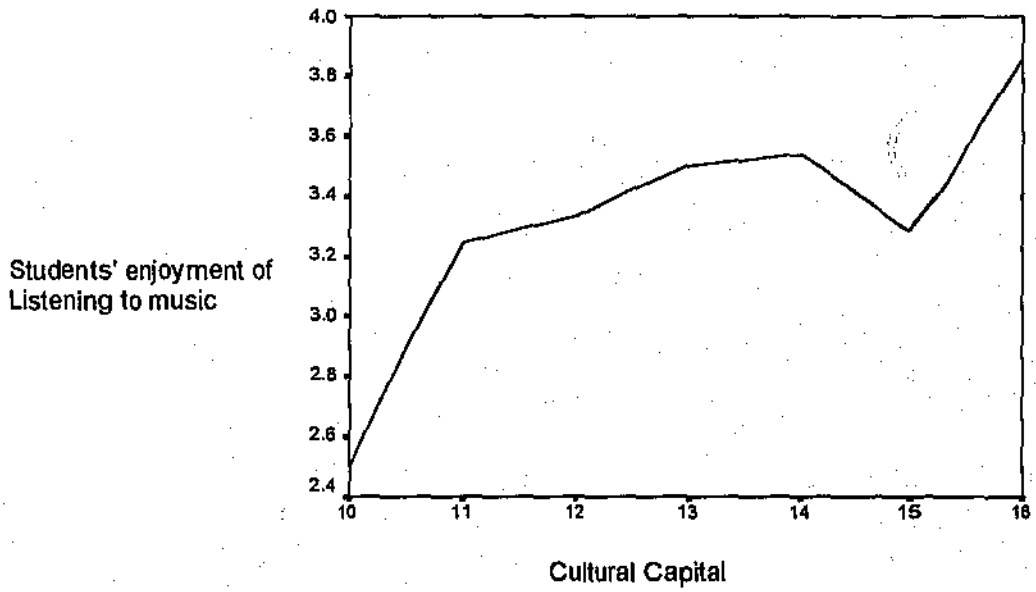


Figure 12
The correlation between cultural capital and students' enjoyment of listening to music.



APPENDIX E

THE TEACHING PROGRAM

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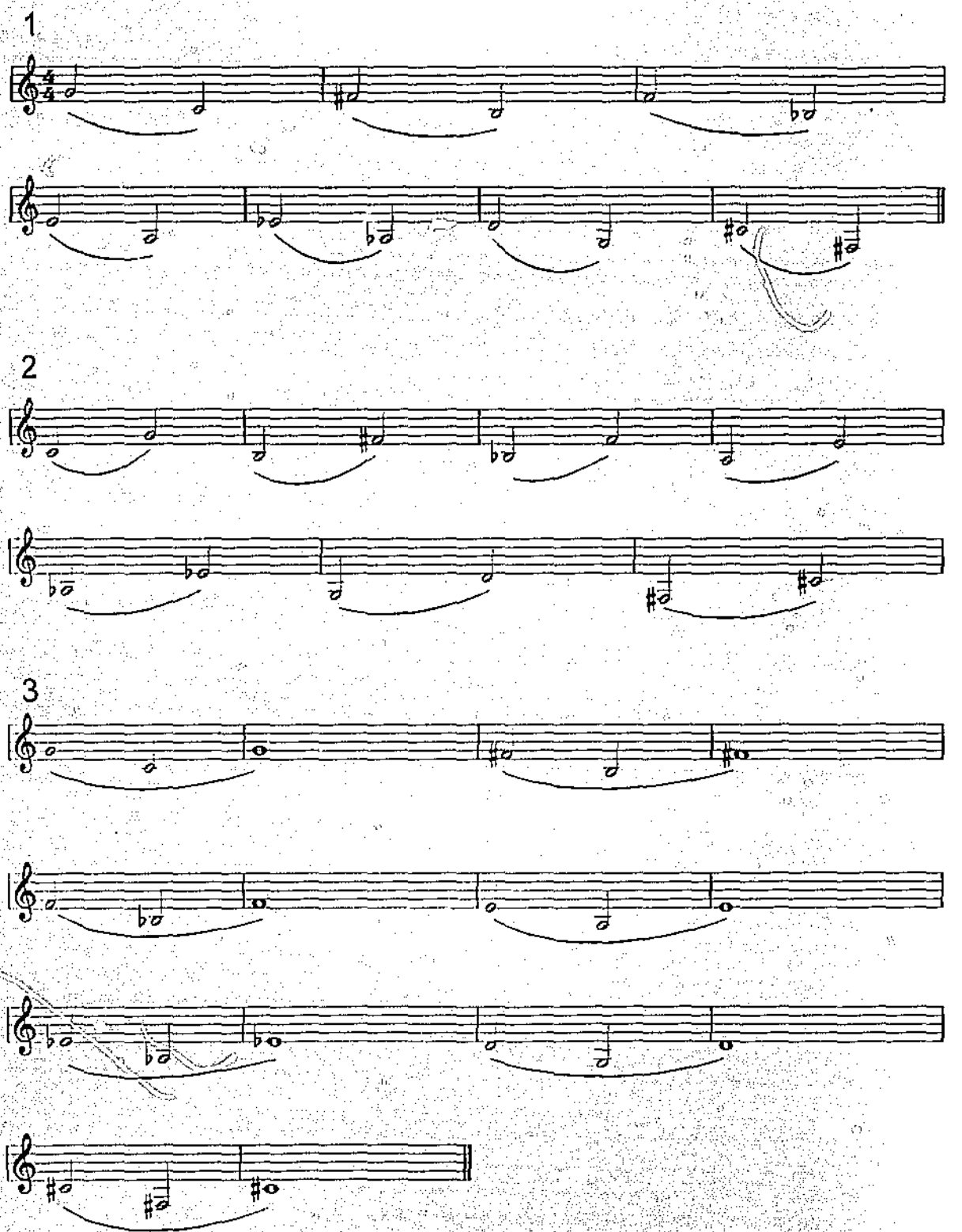

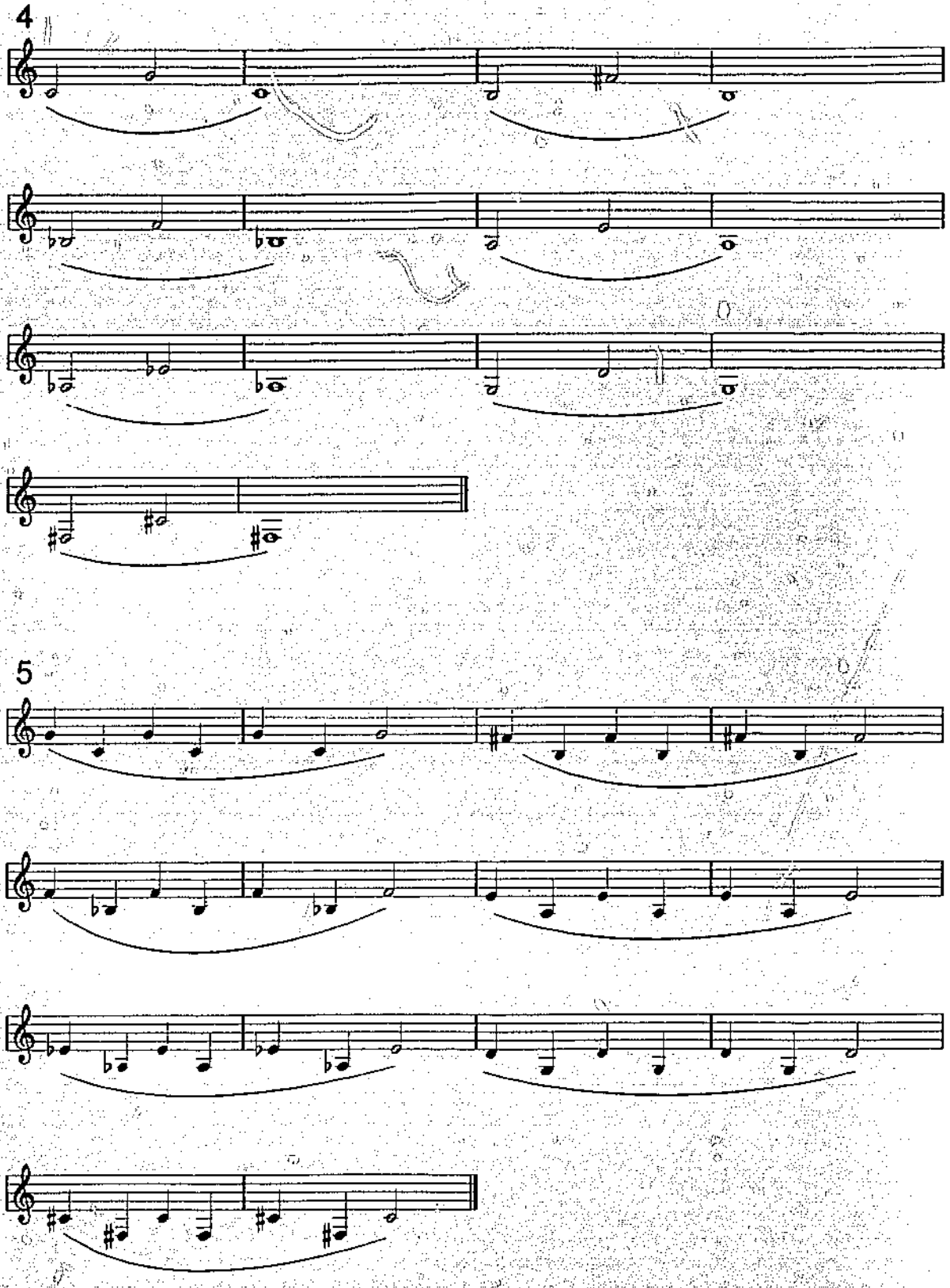
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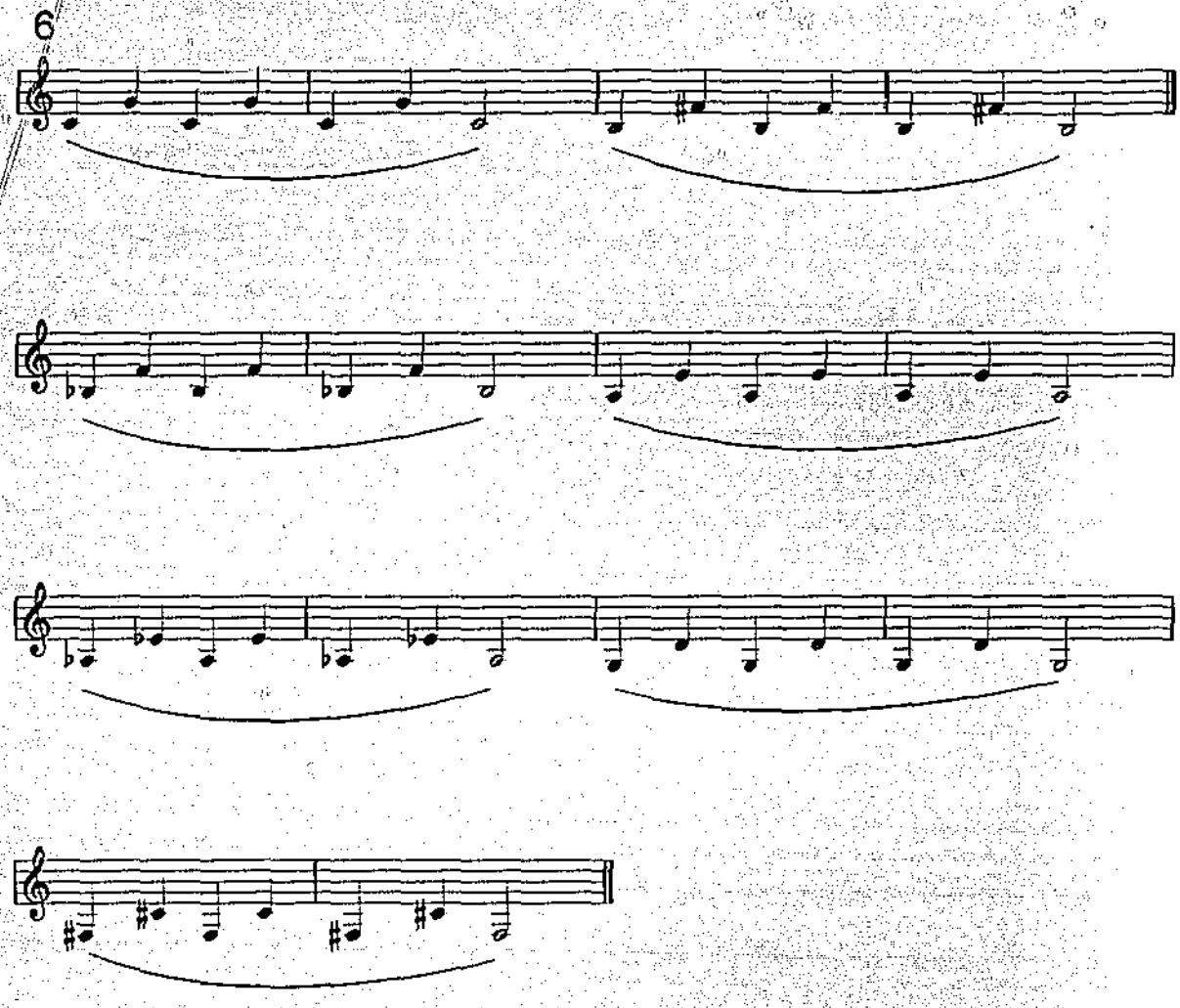
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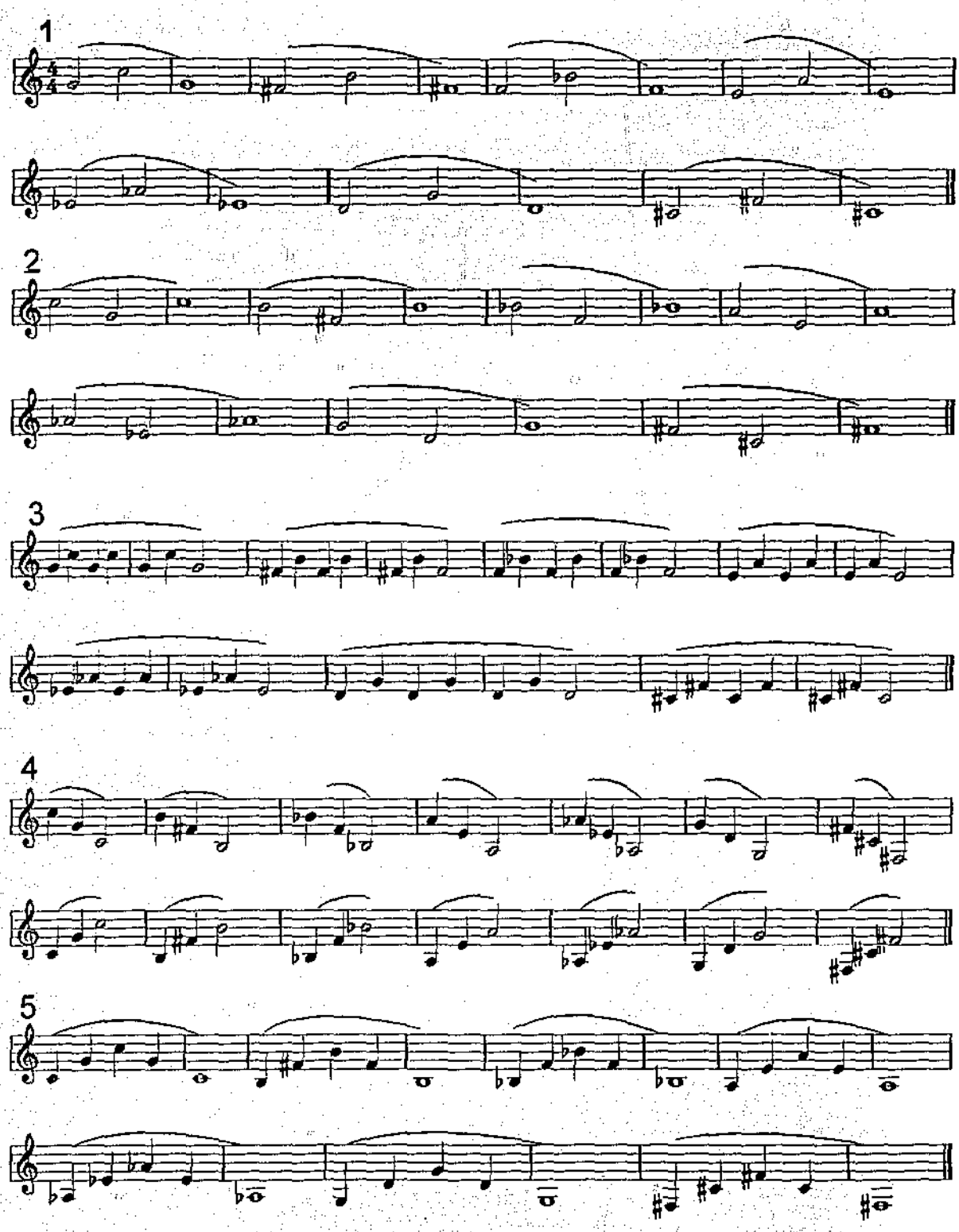

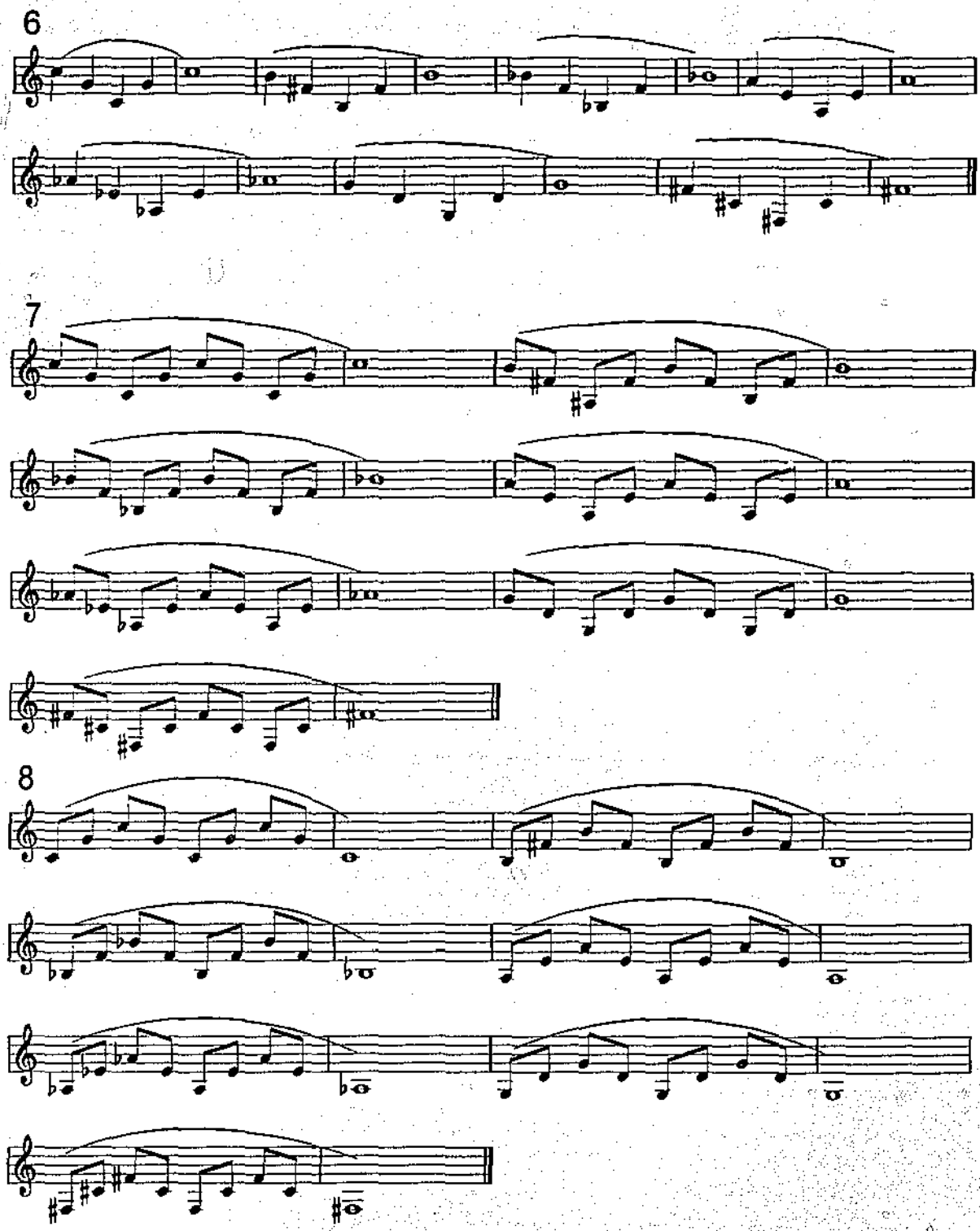
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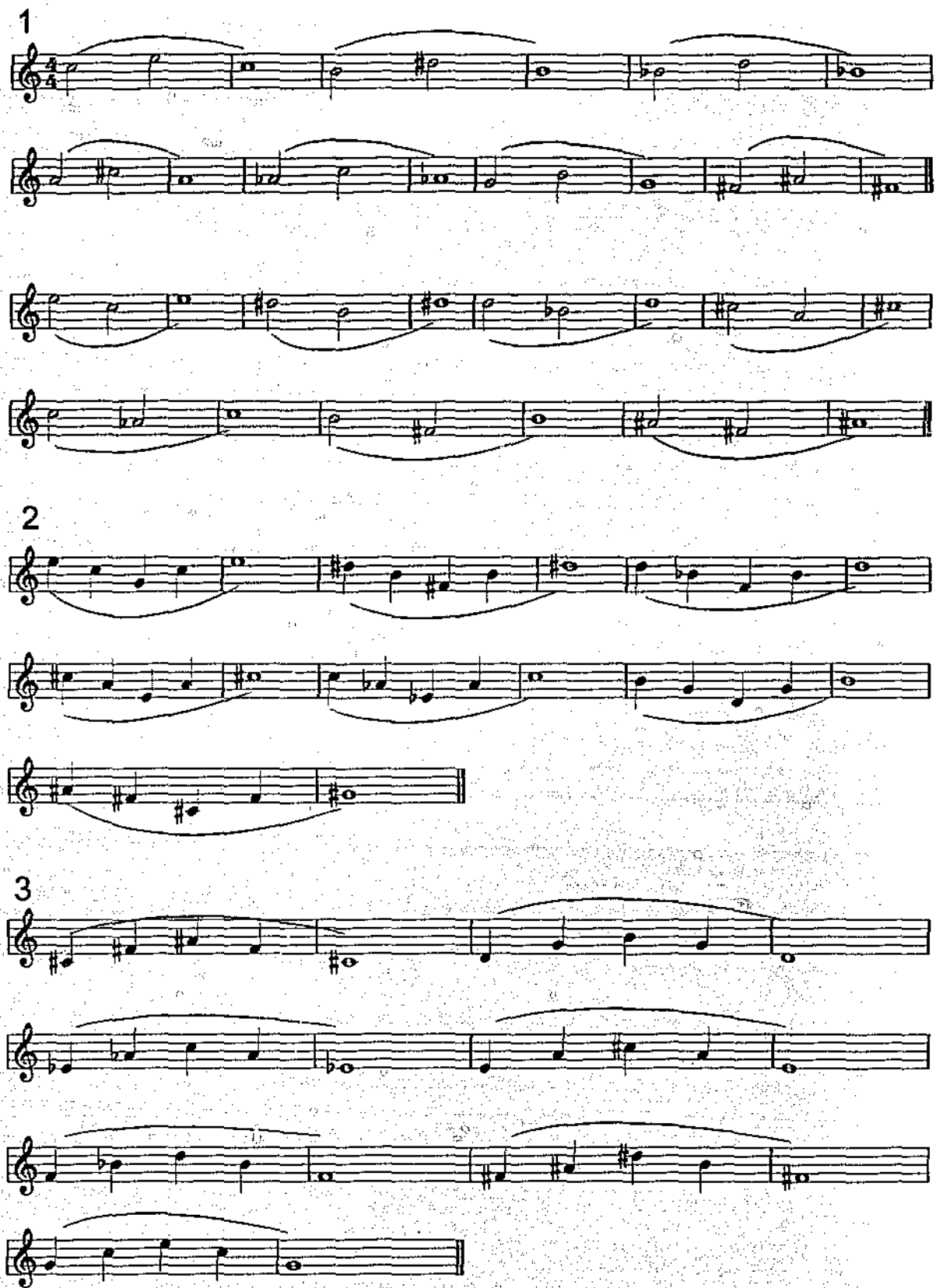

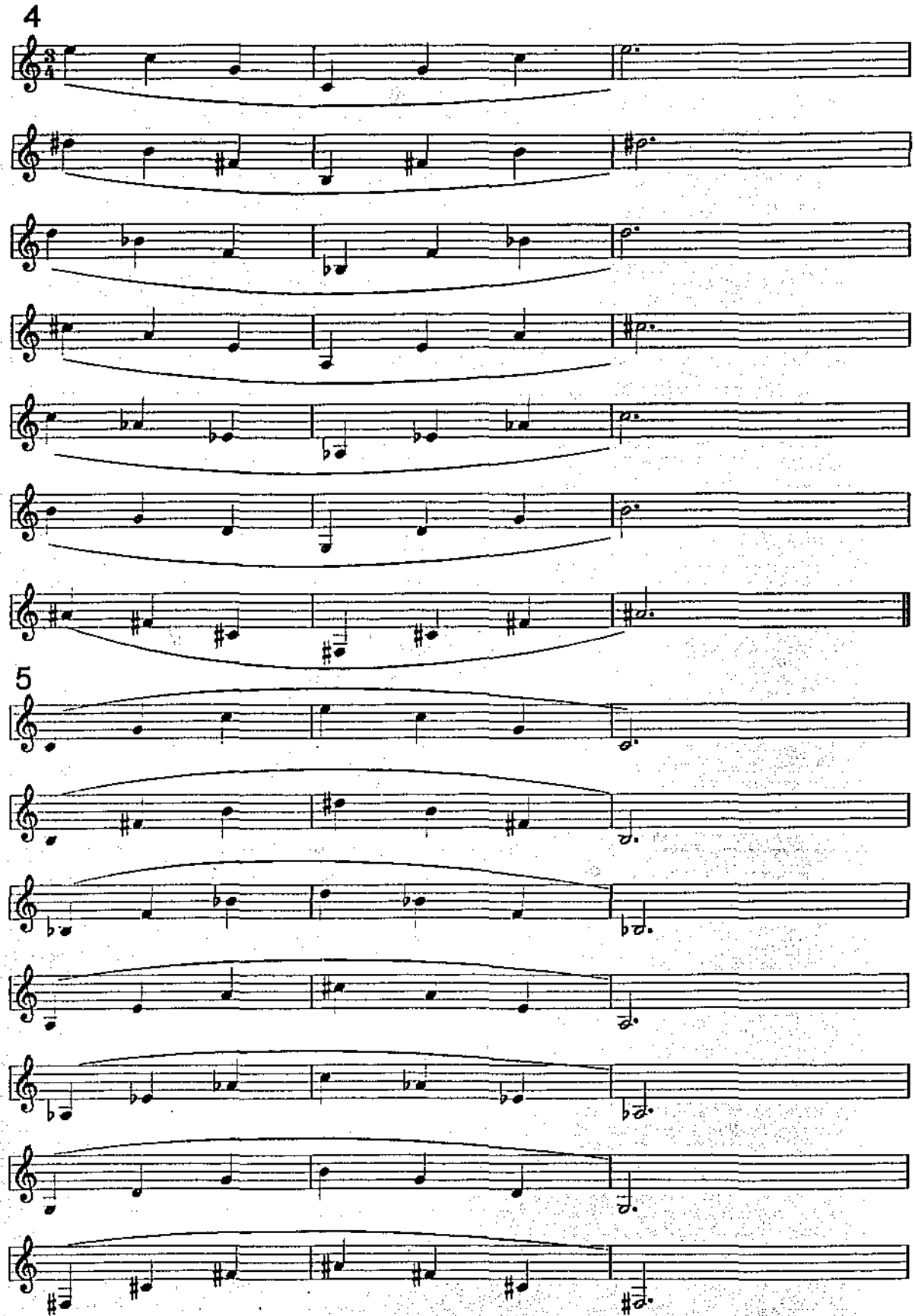
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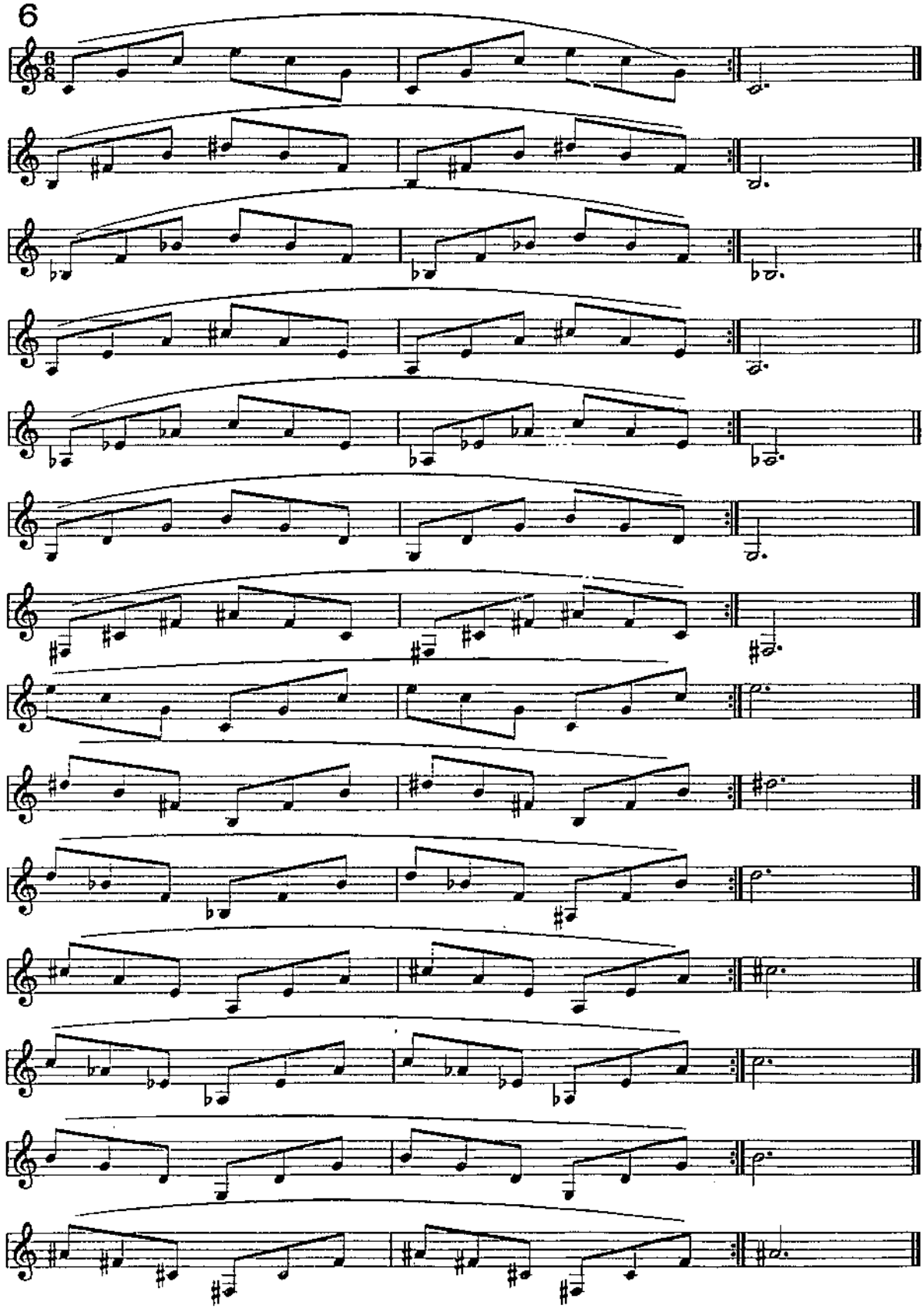
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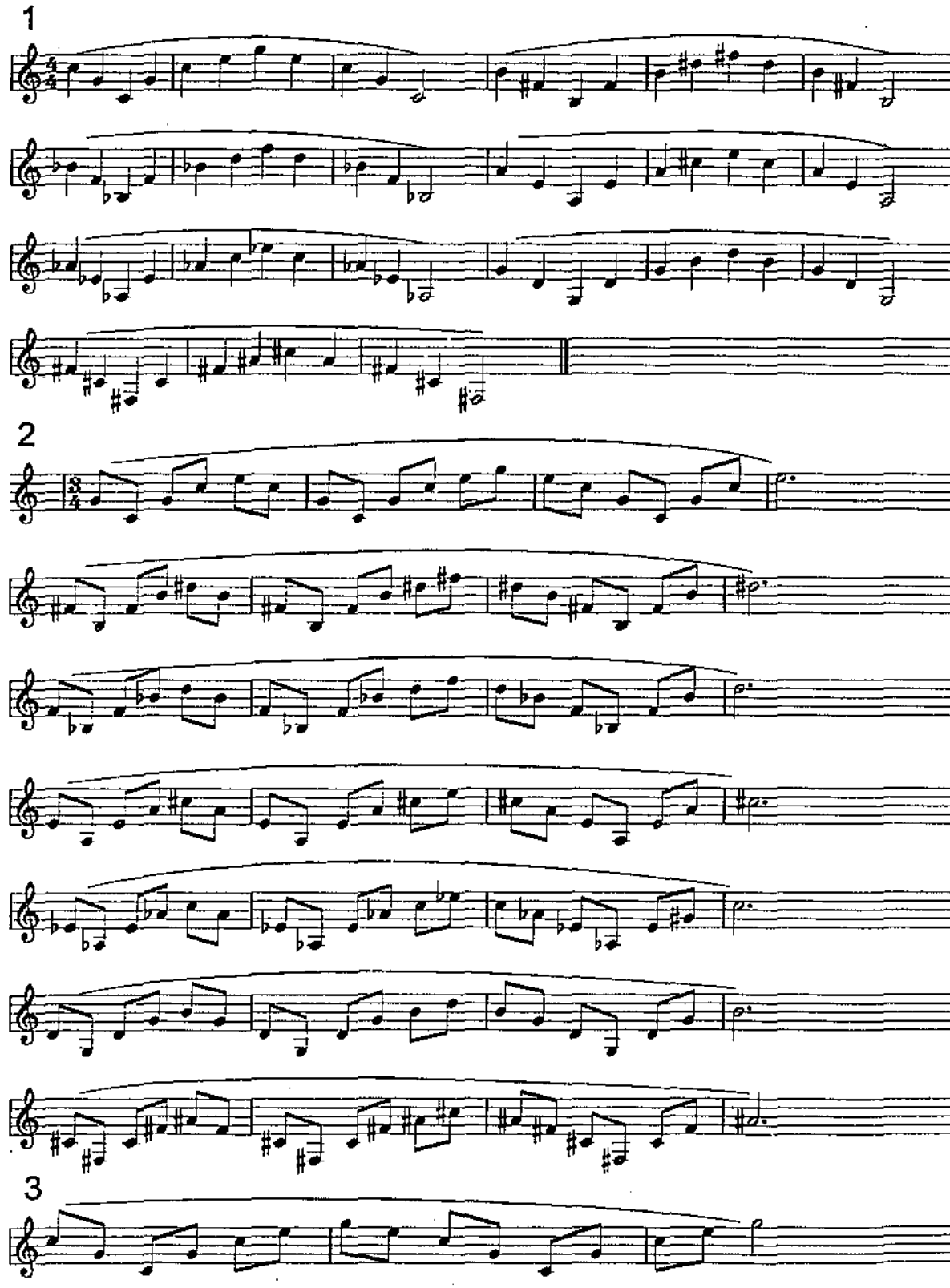

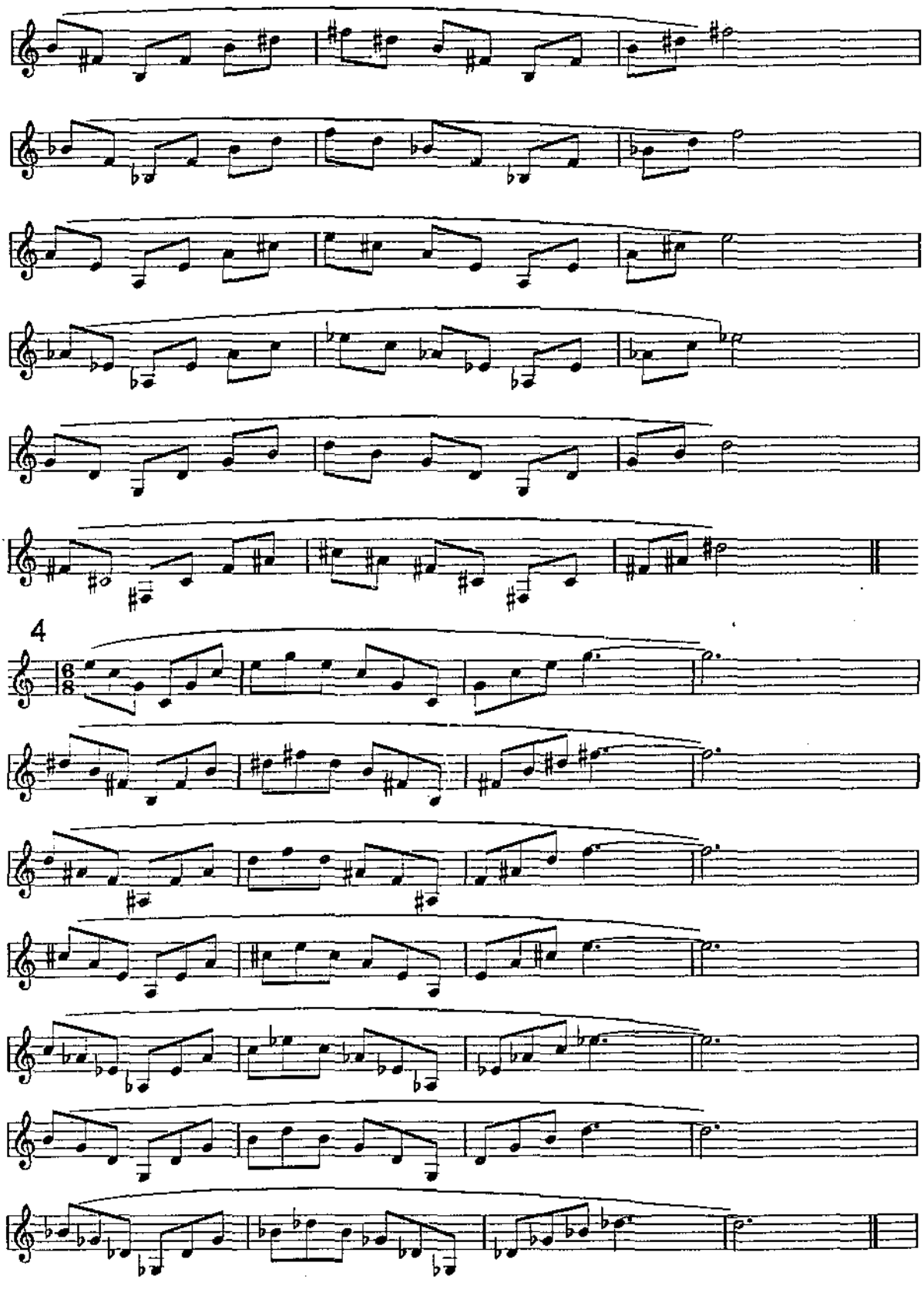
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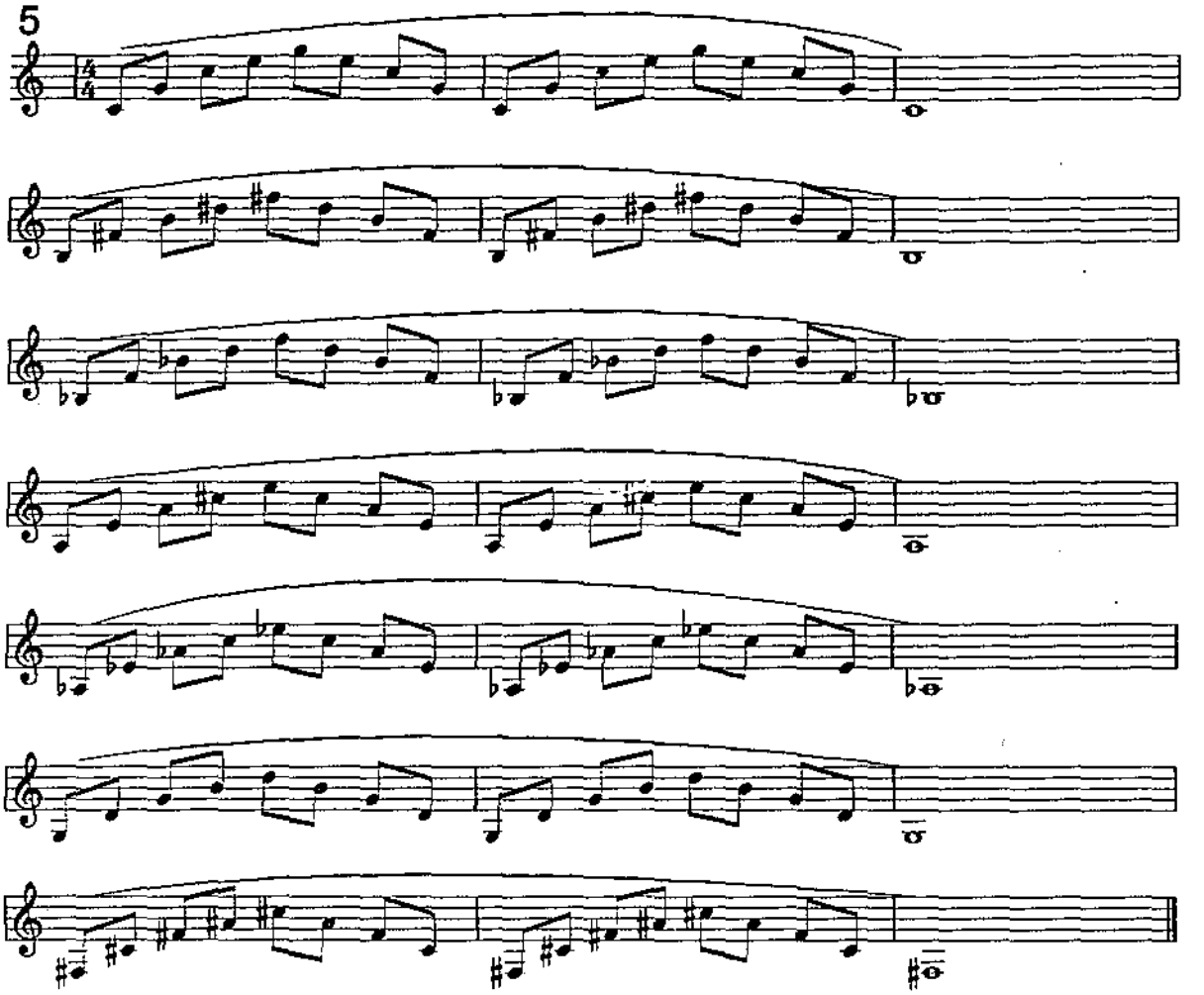
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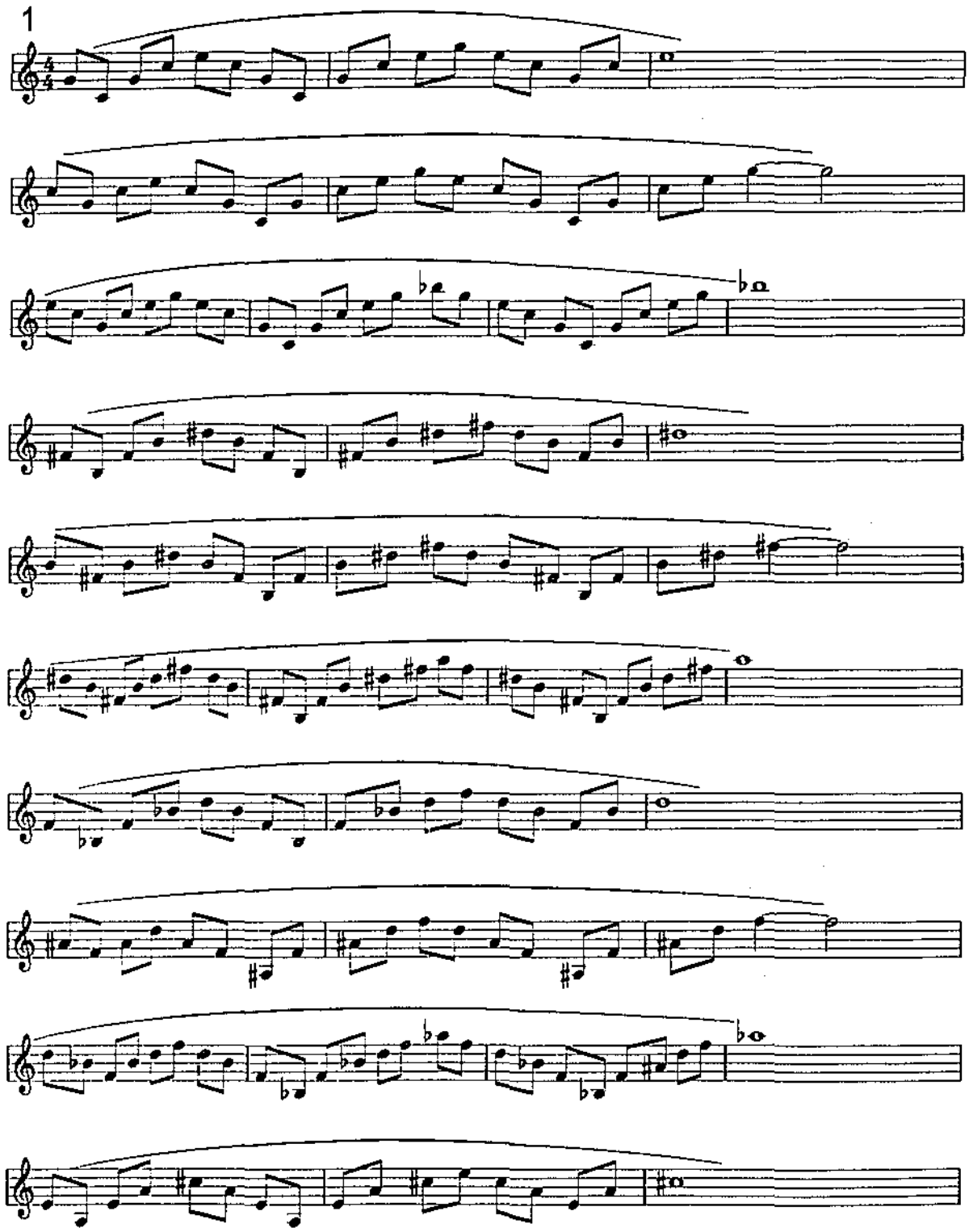

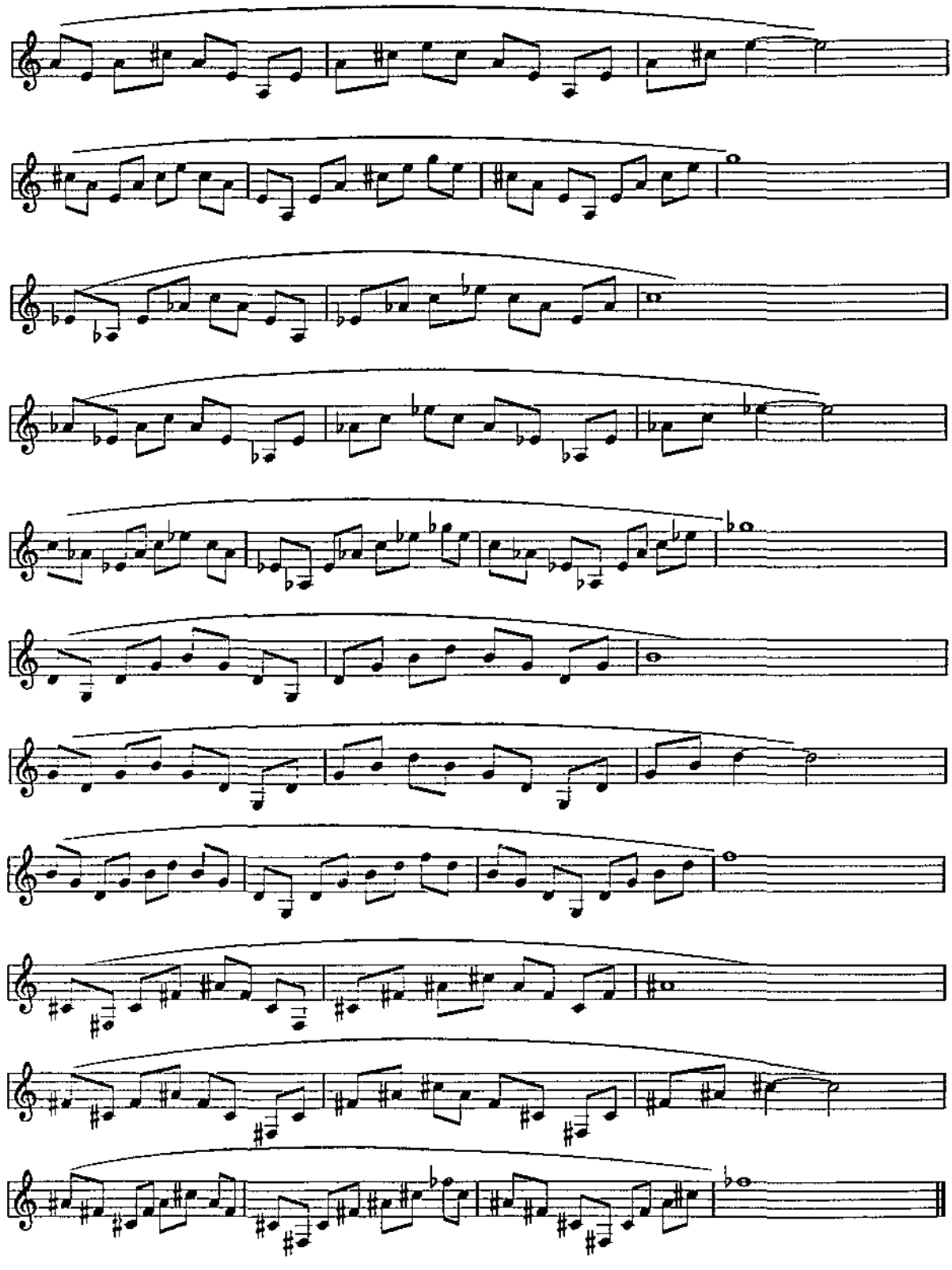

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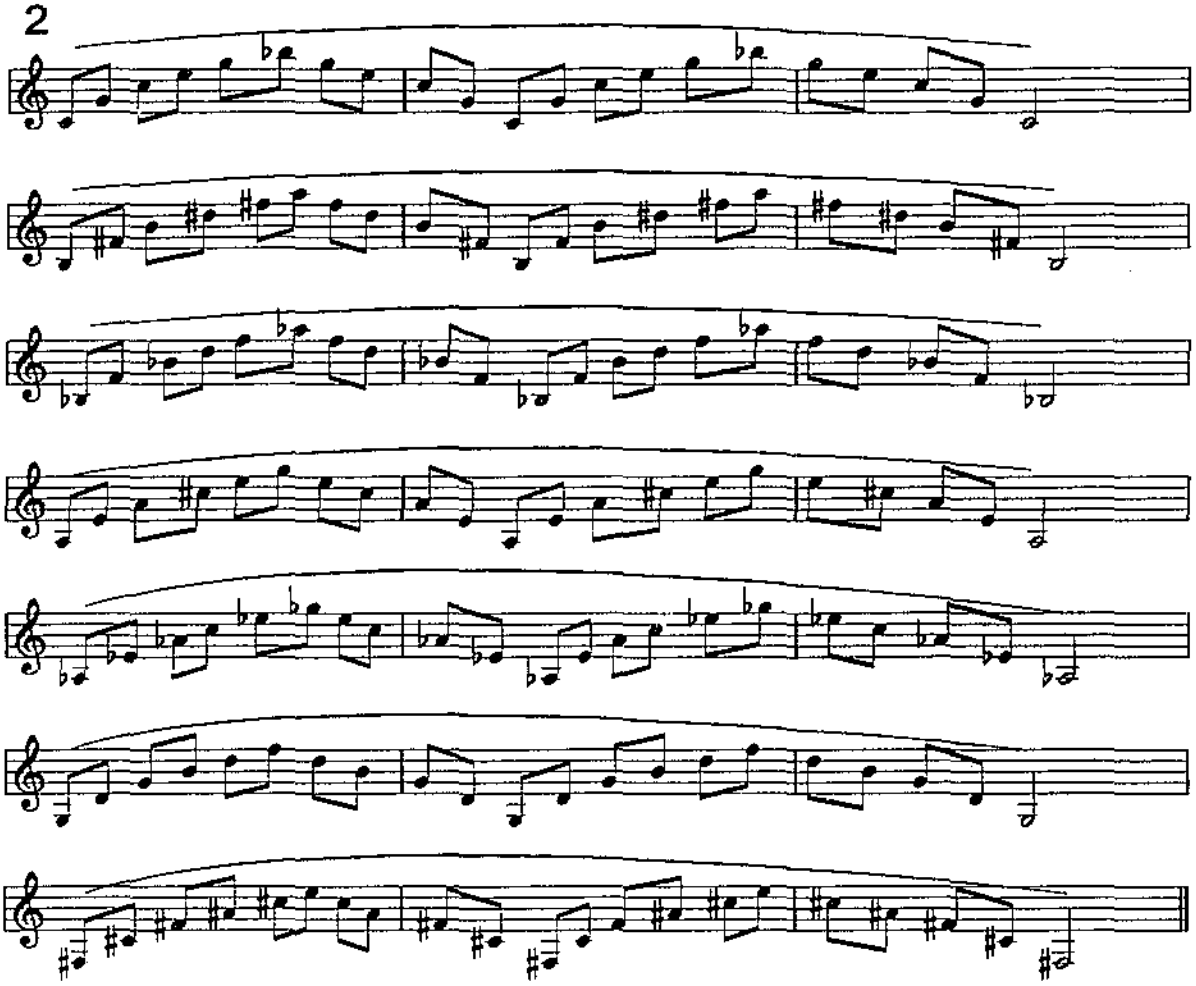

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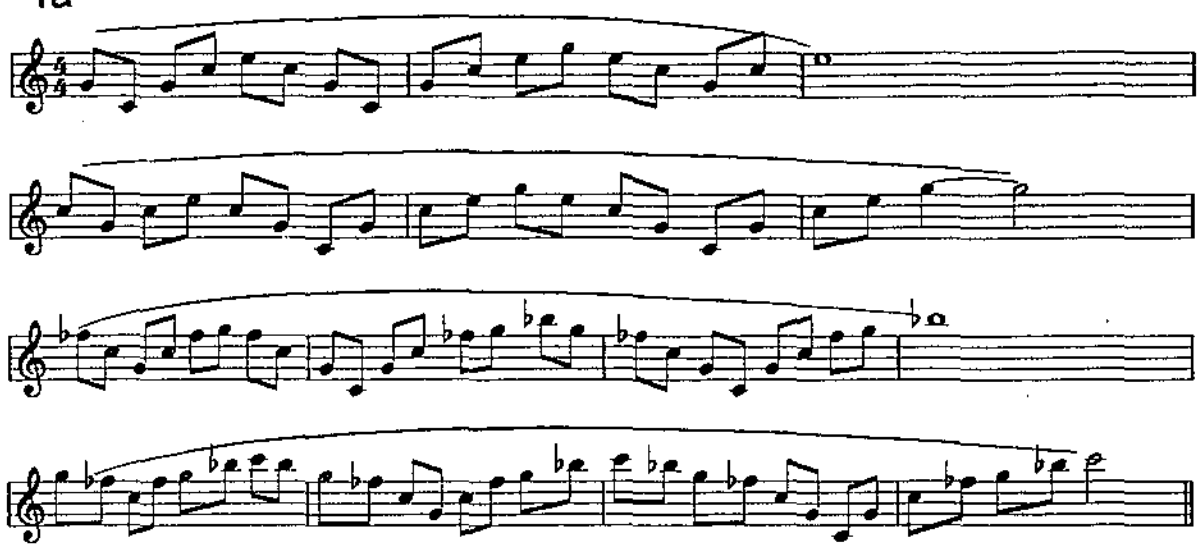

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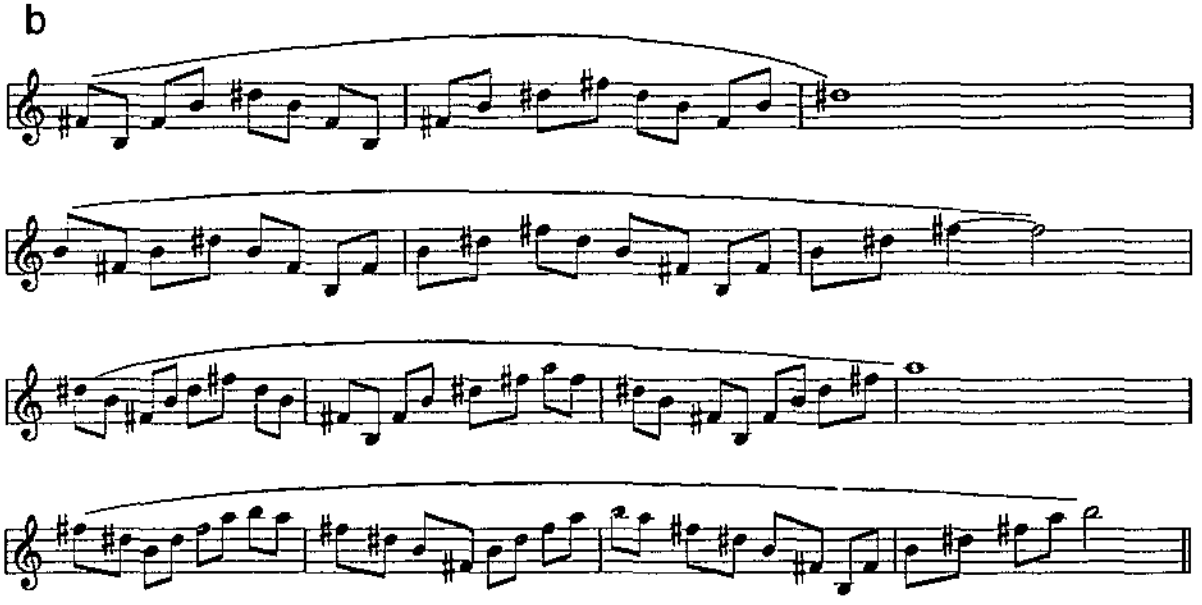

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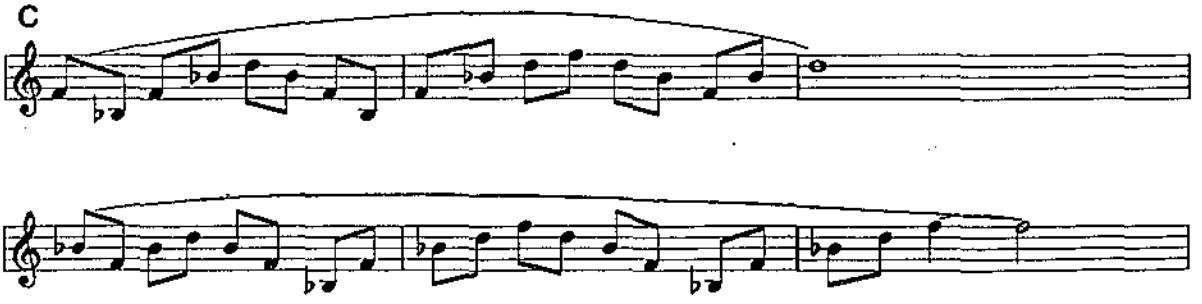

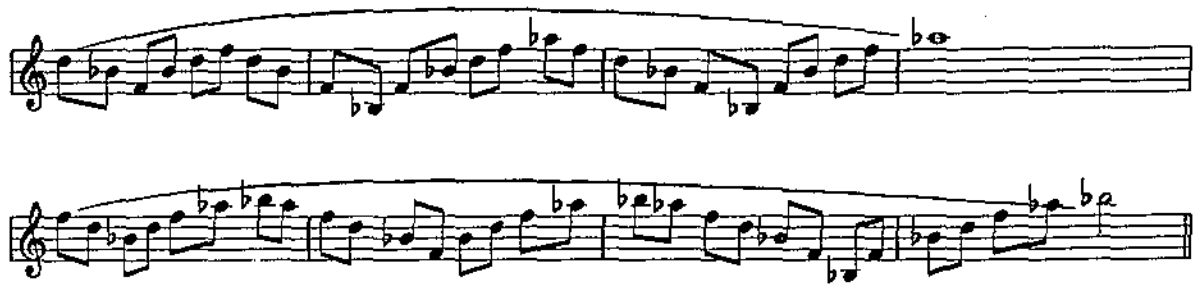

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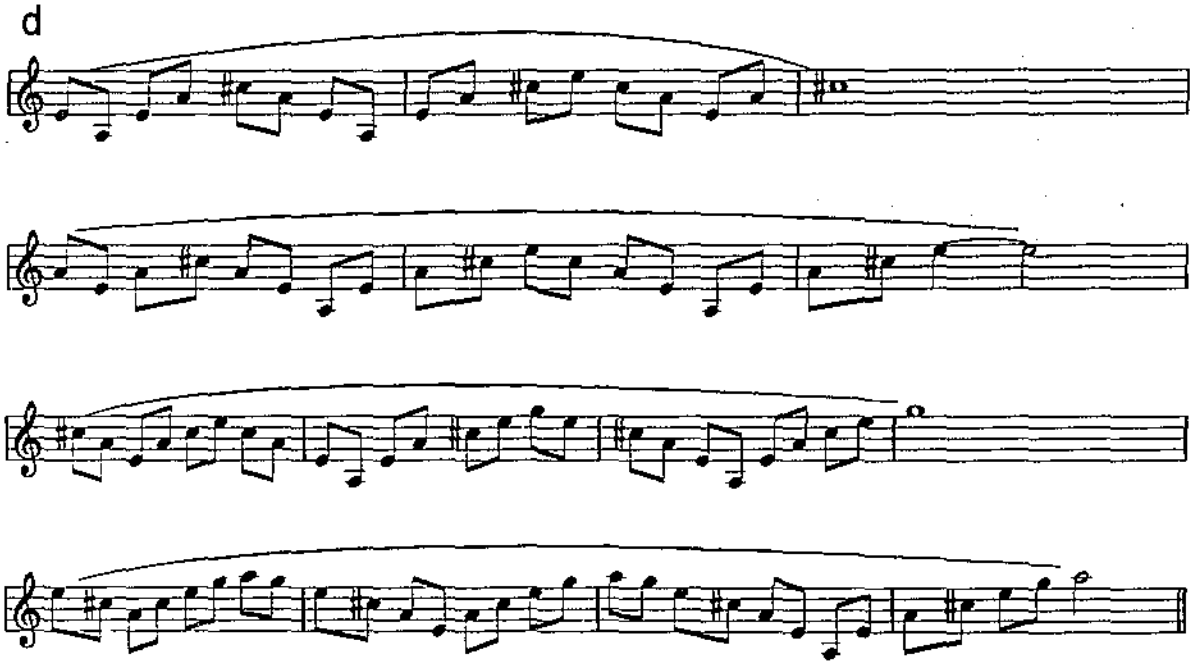

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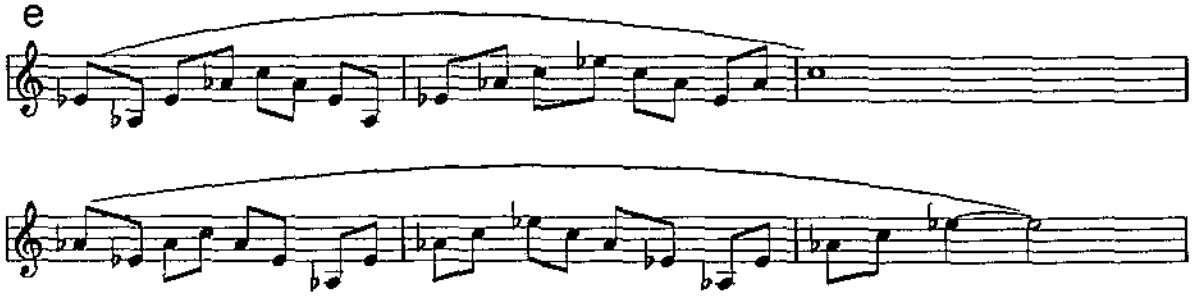

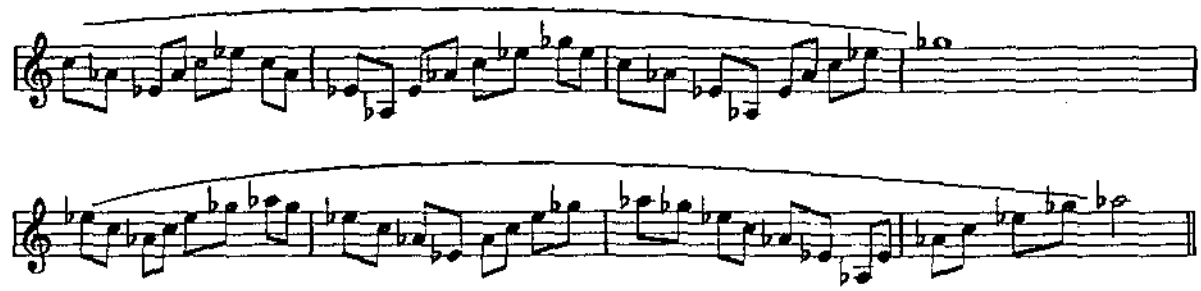

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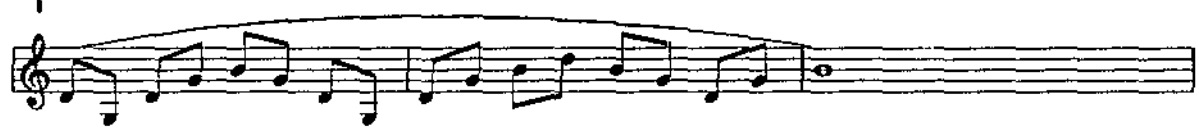

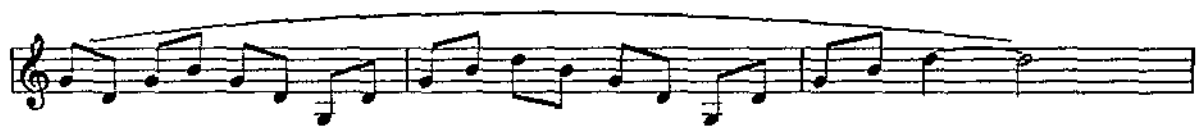

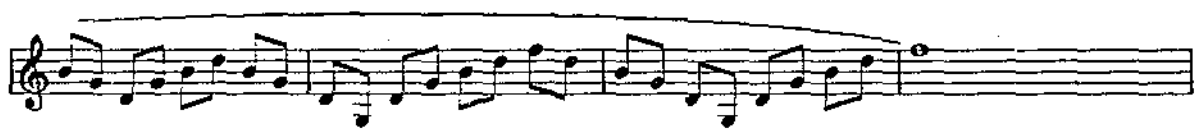

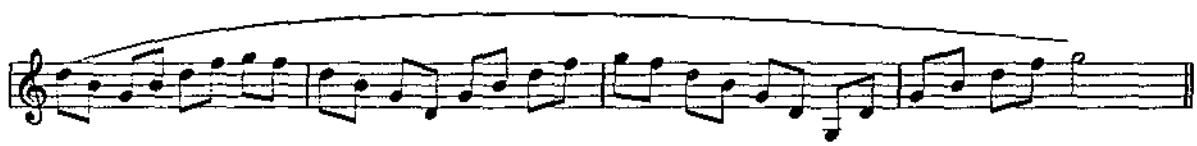

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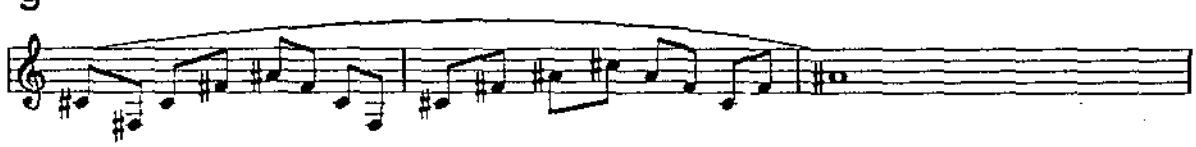

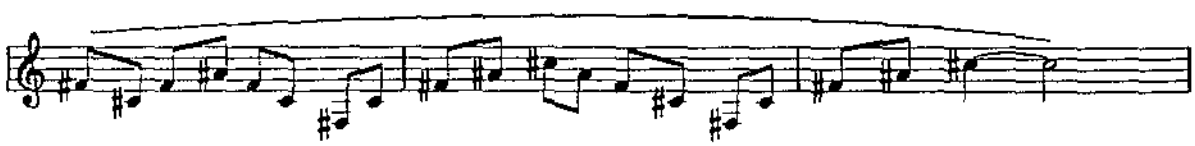

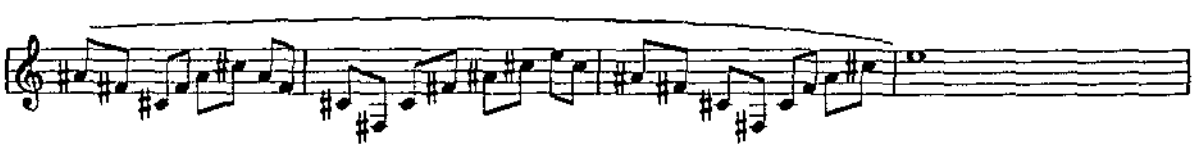

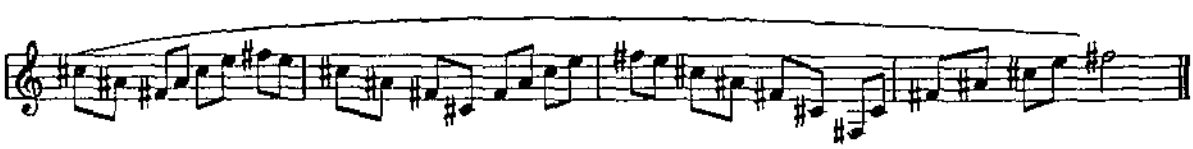

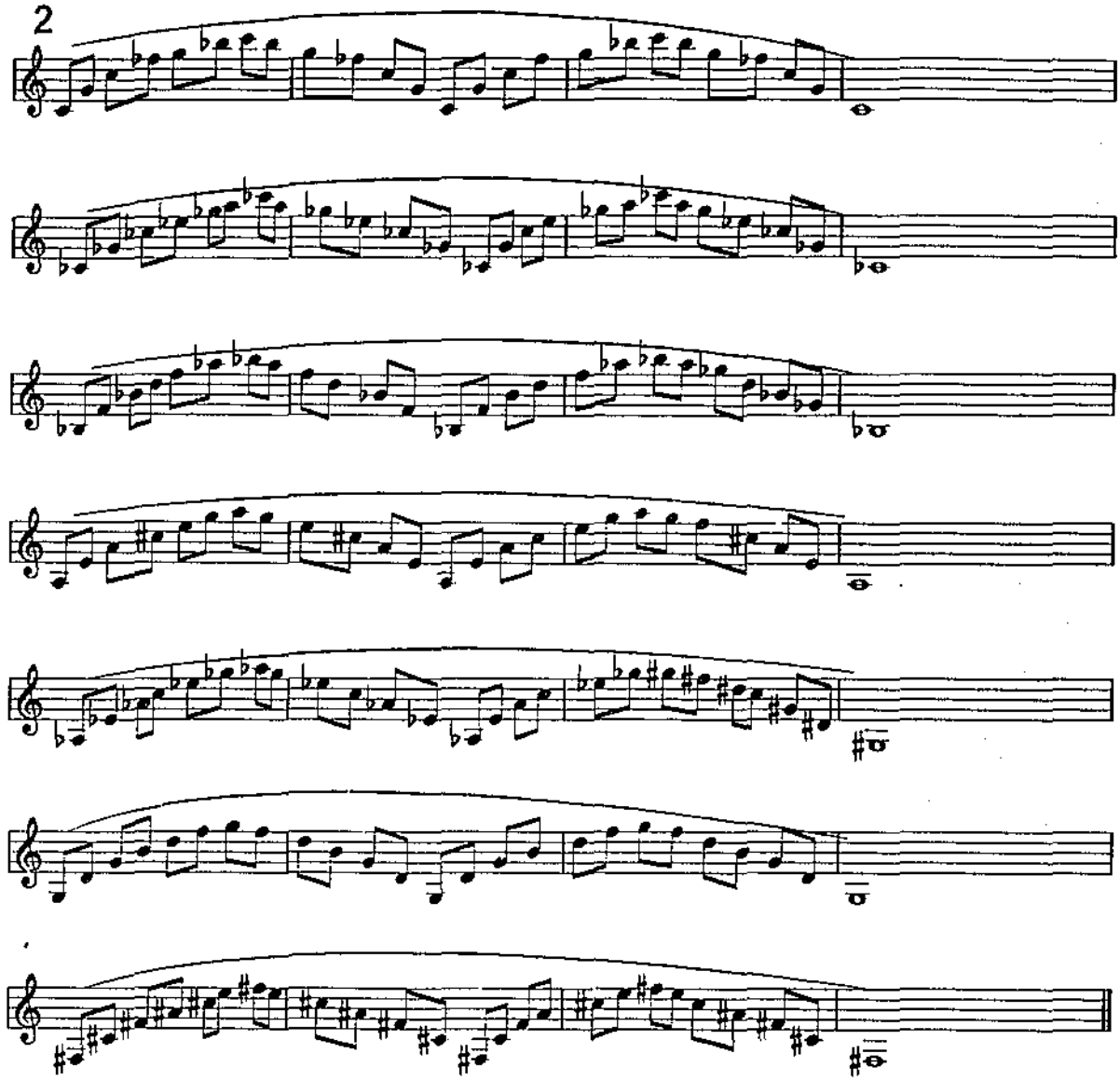
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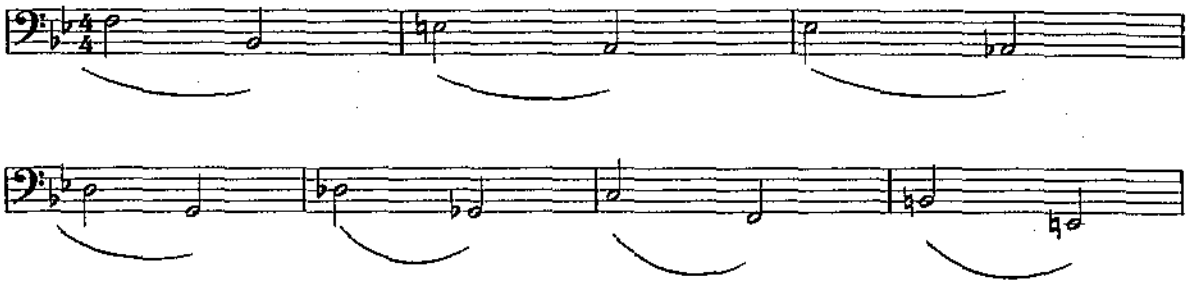

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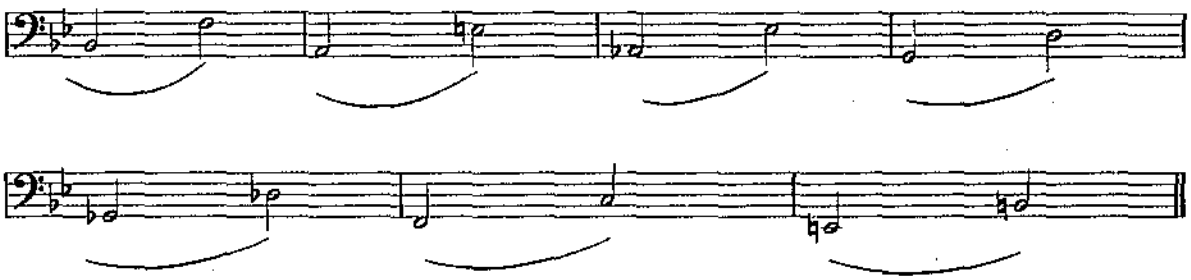

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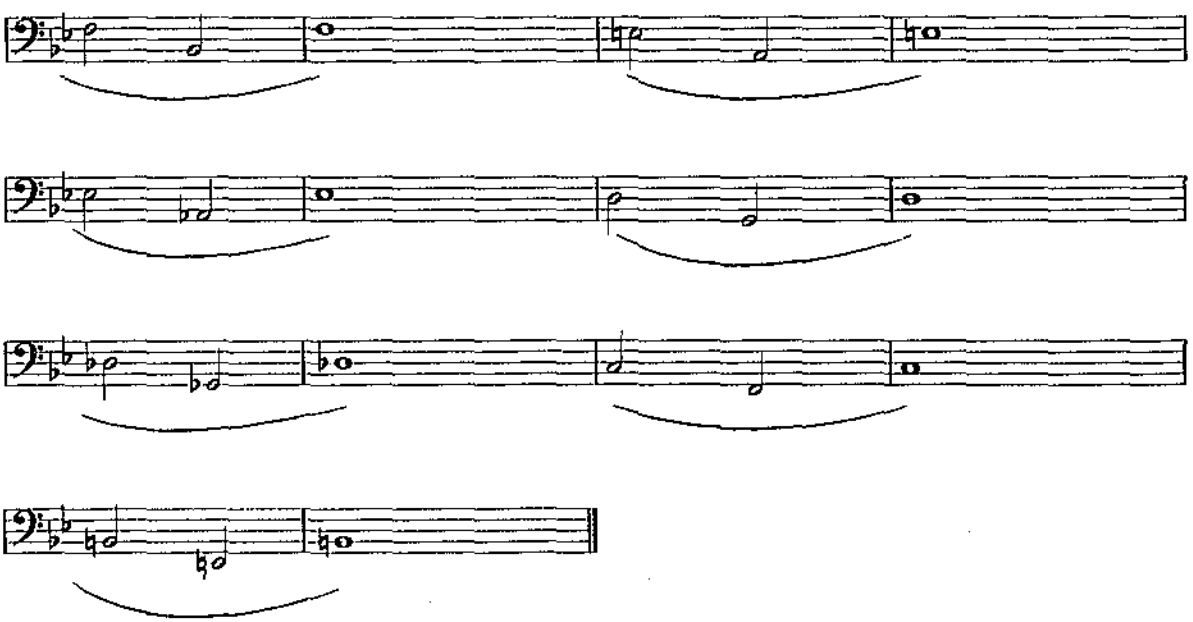

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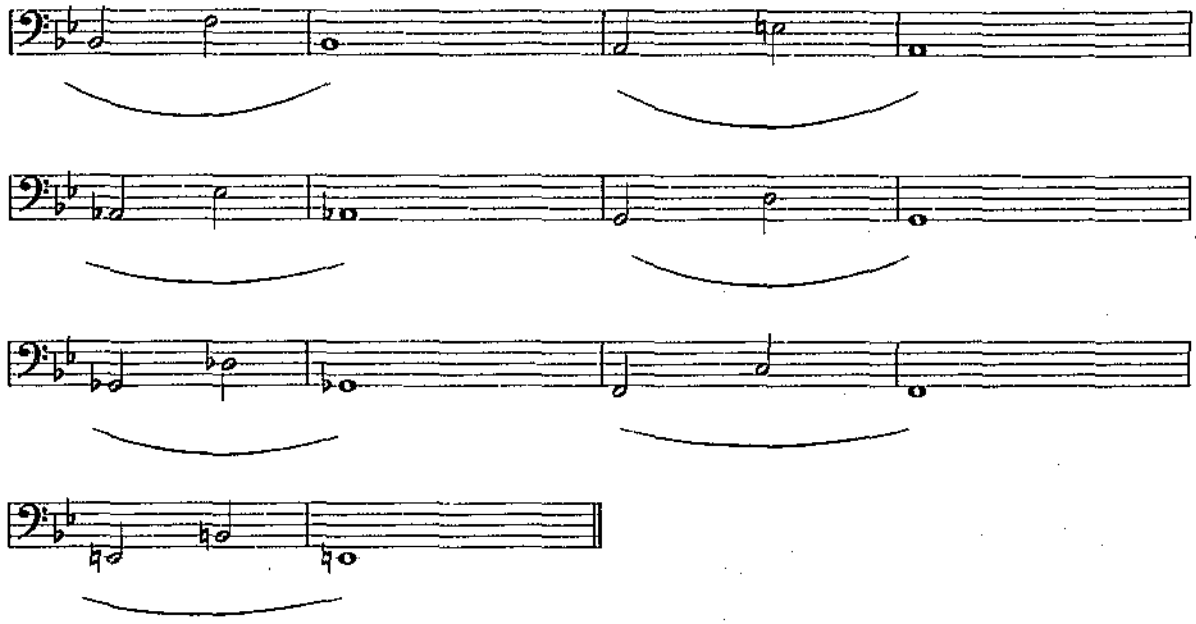

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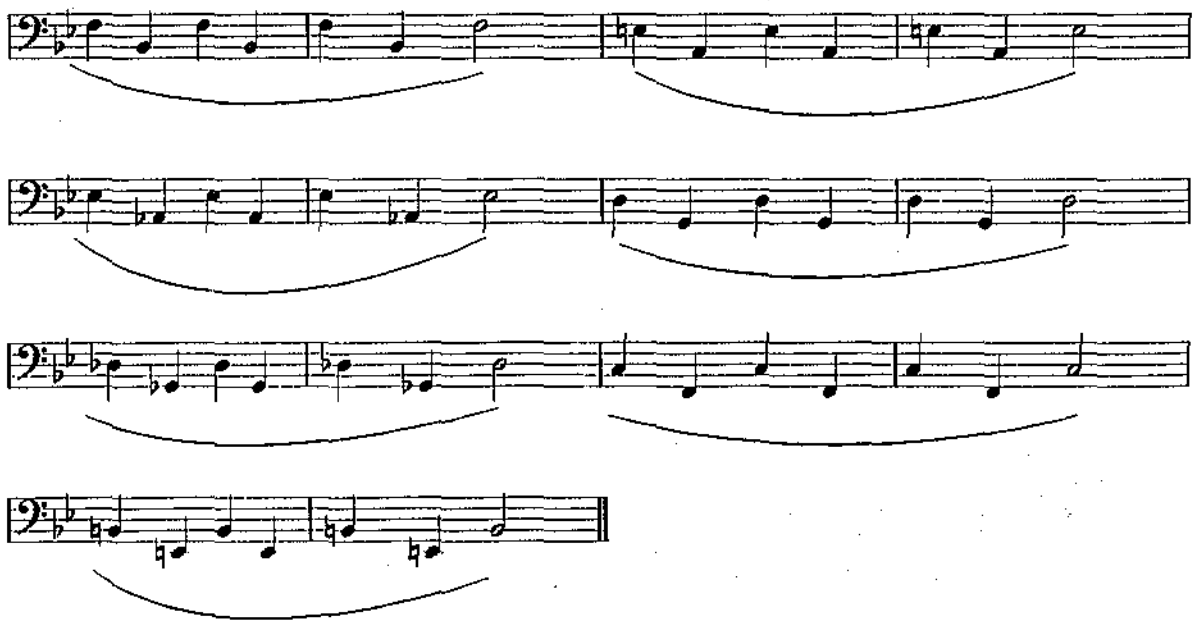

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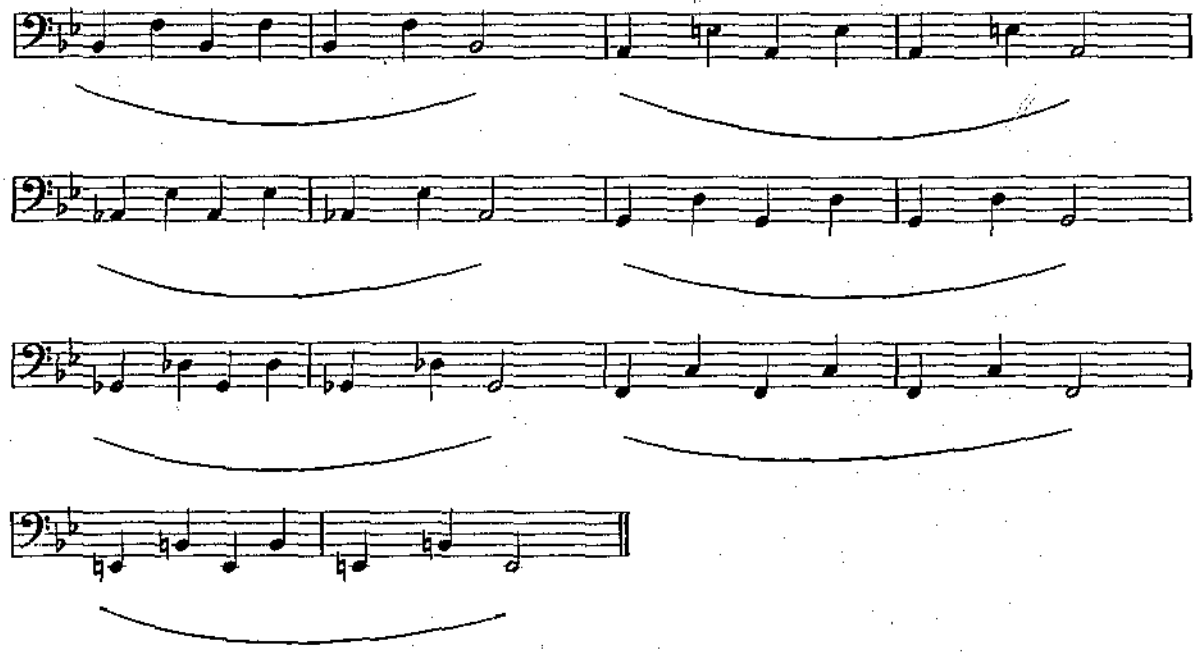

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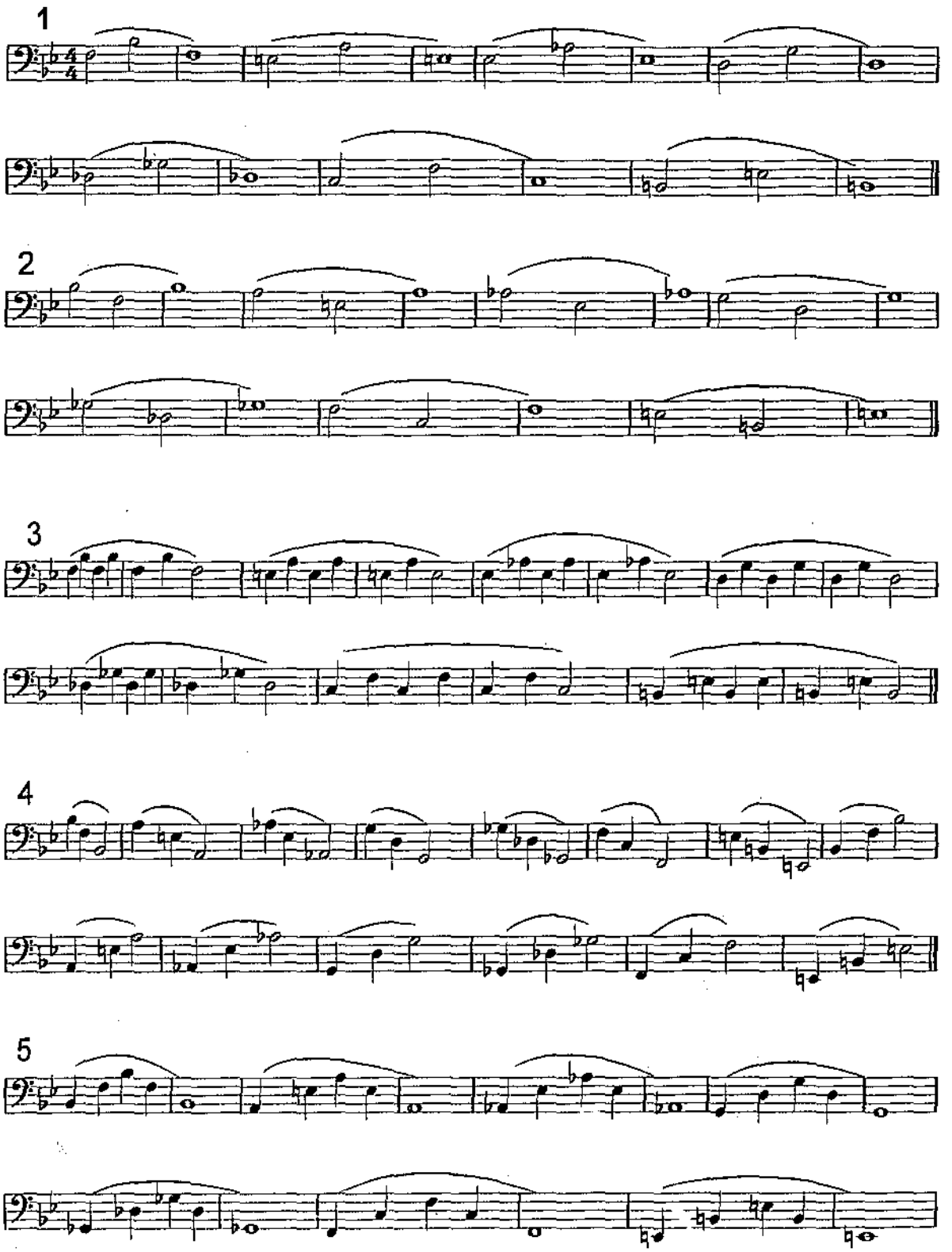

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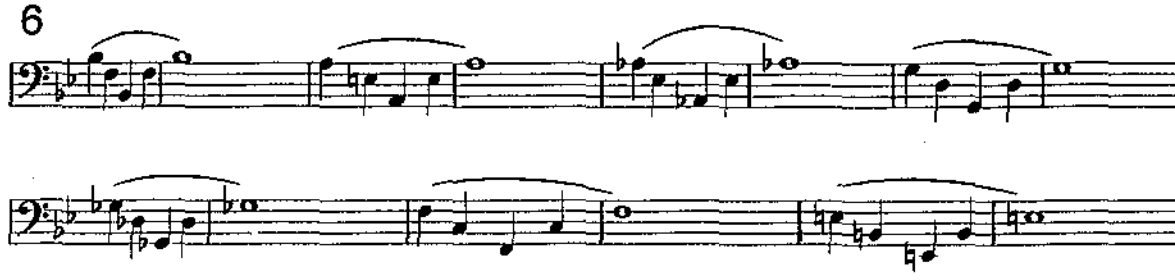

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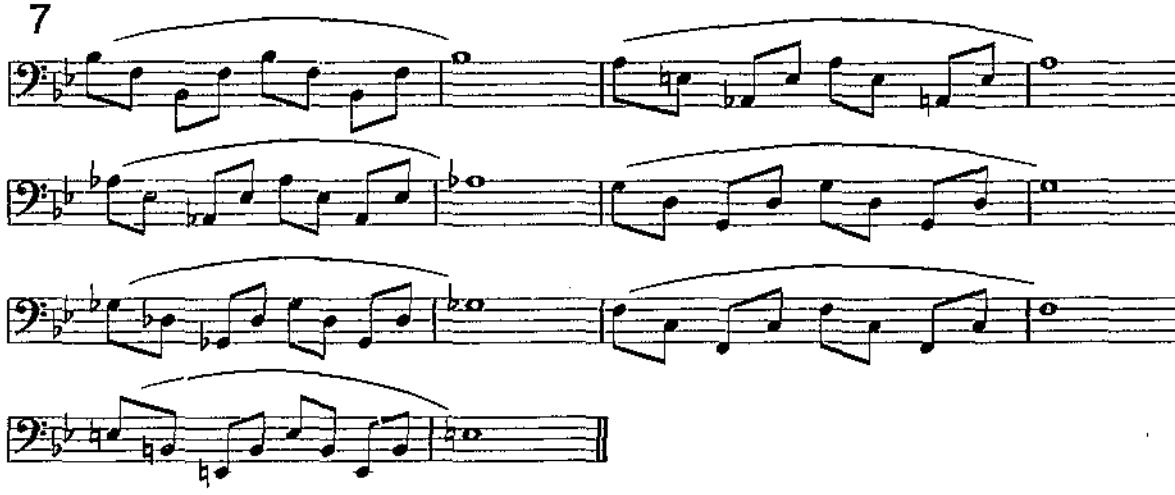

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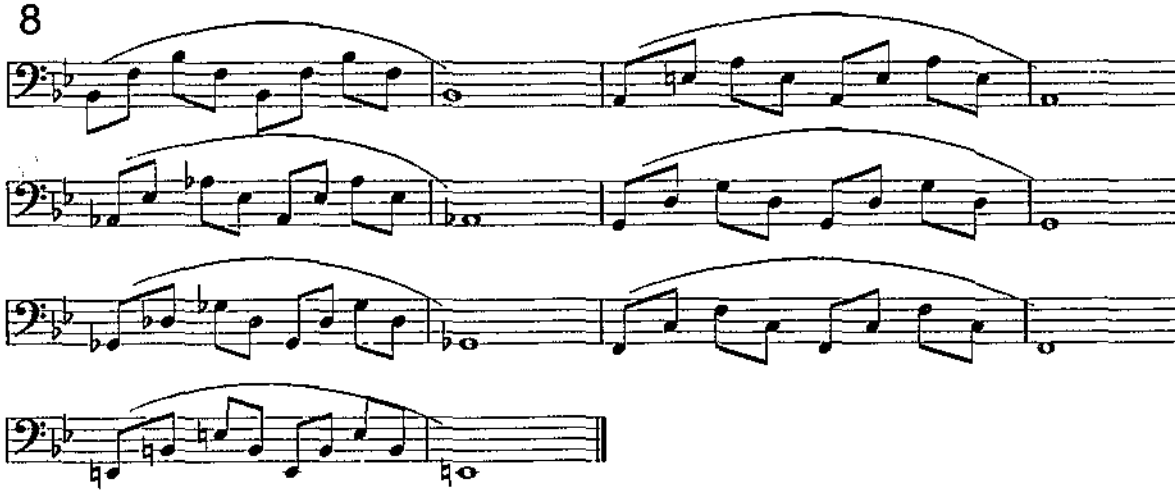

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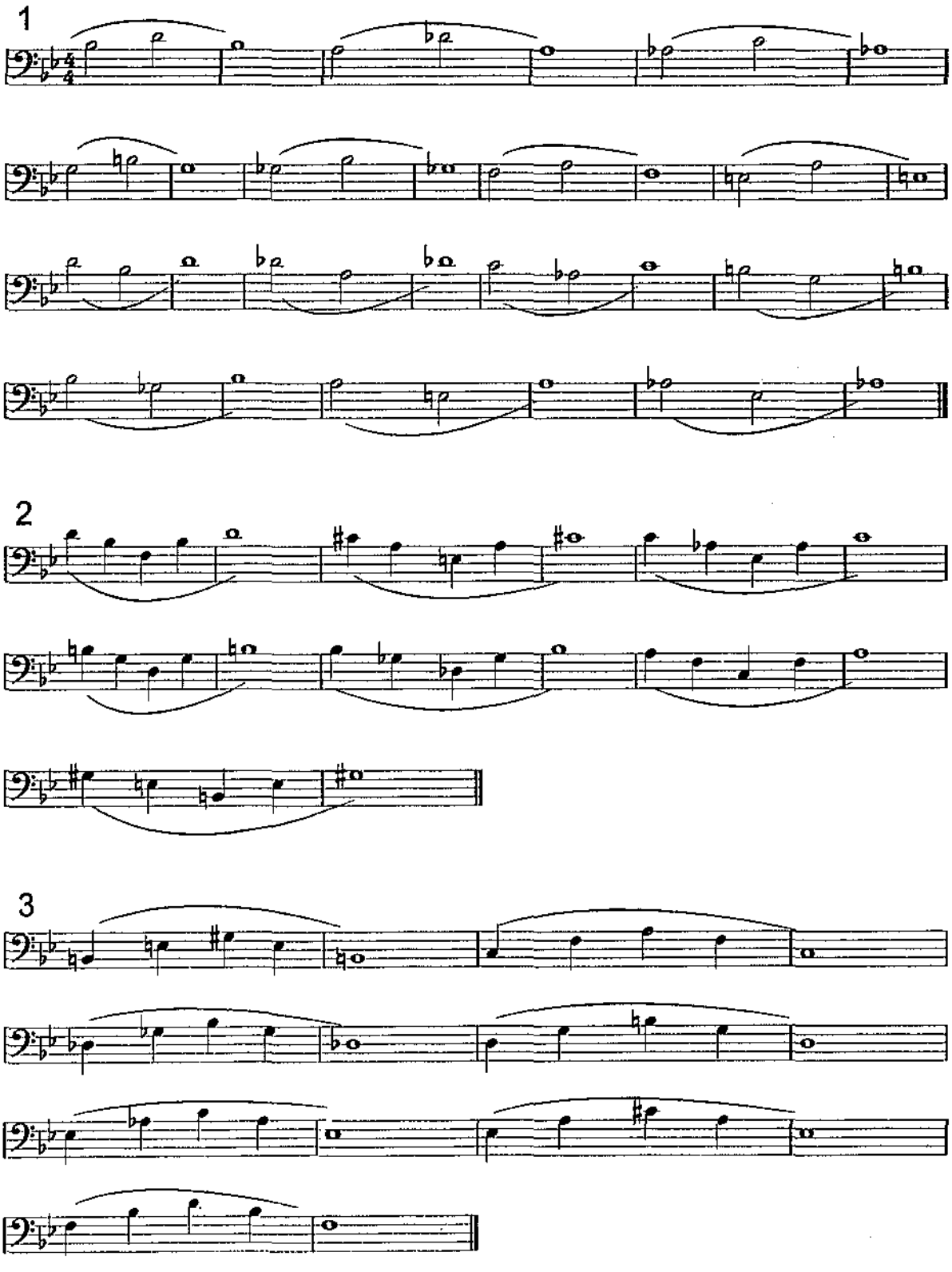

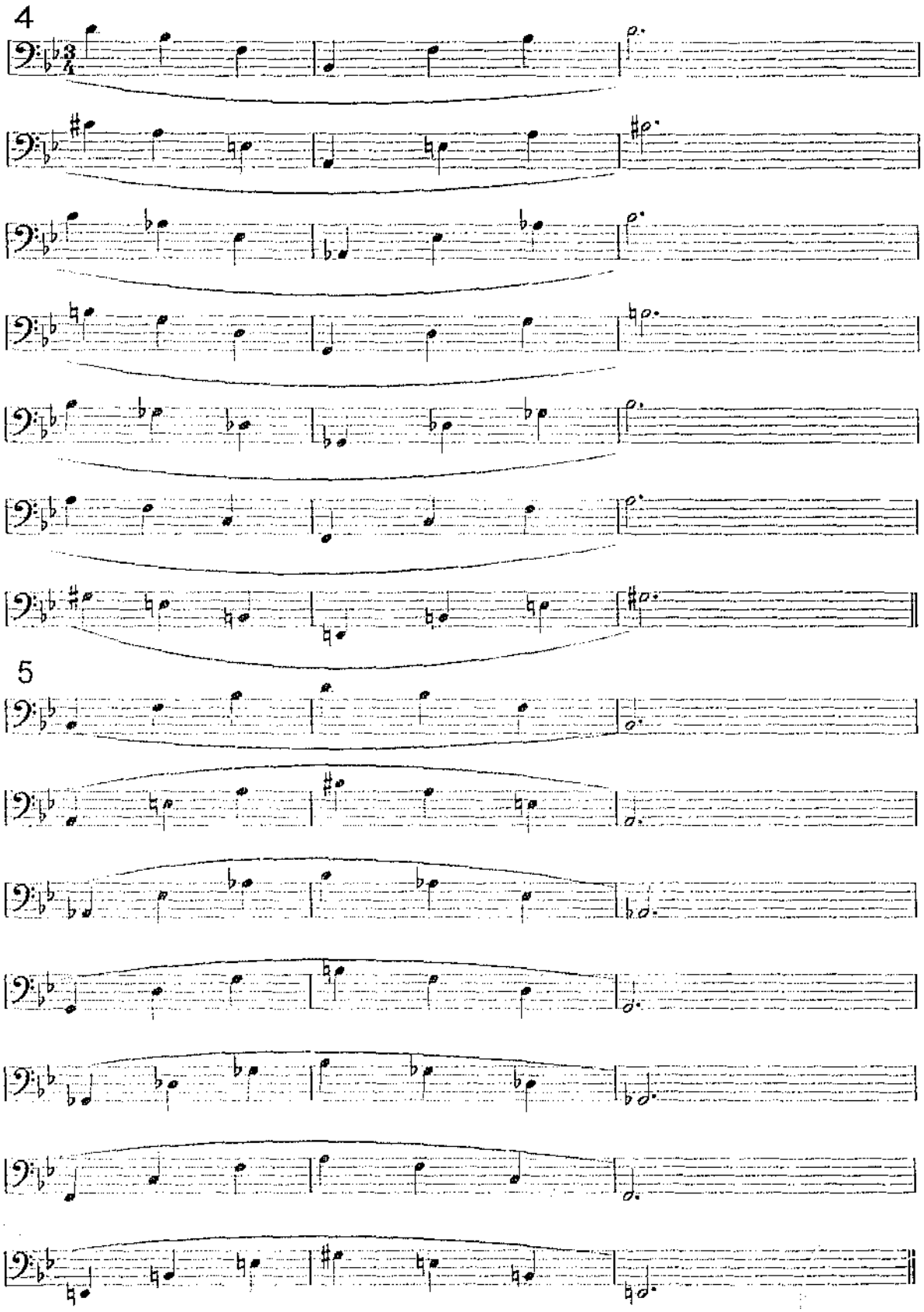
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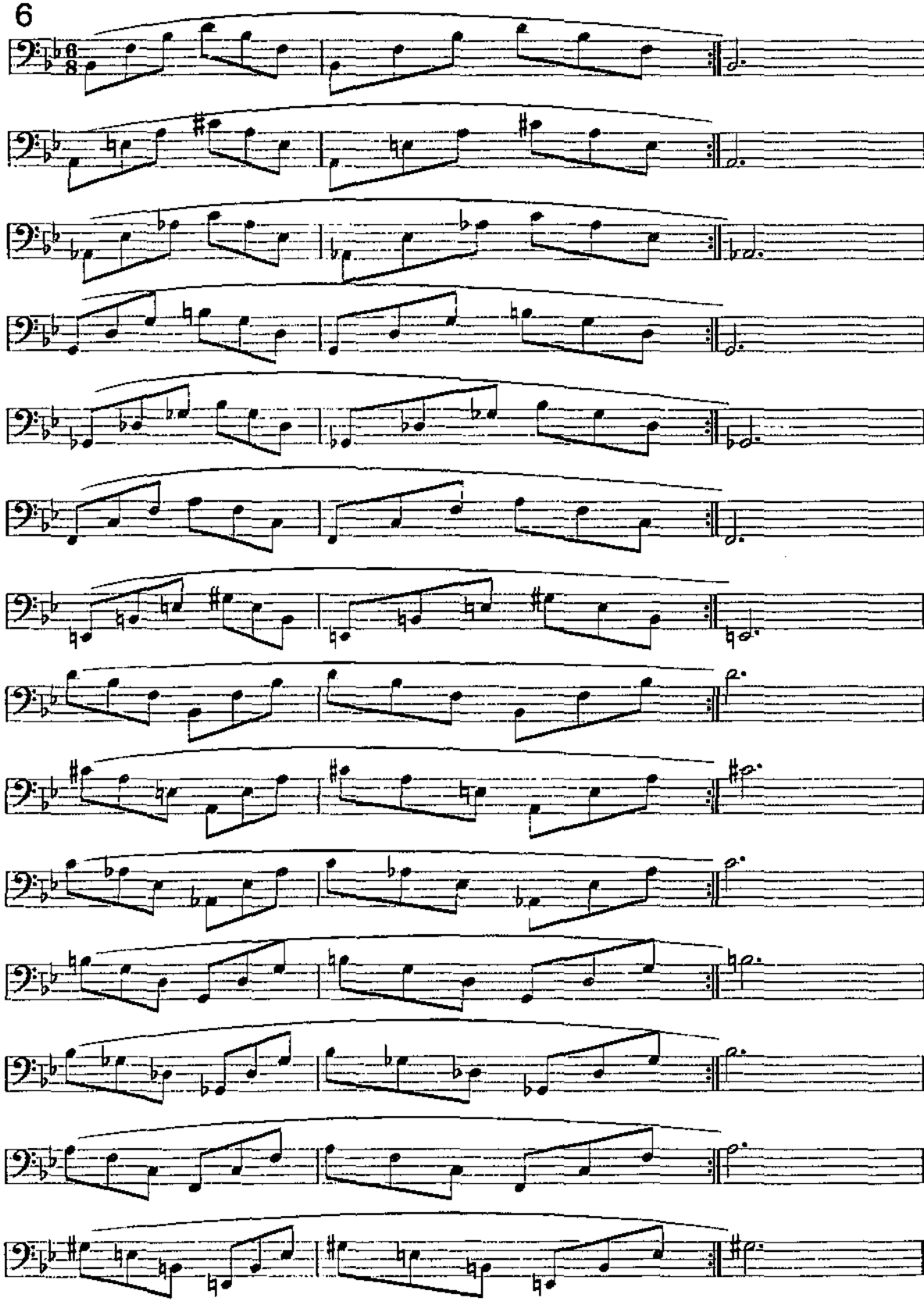

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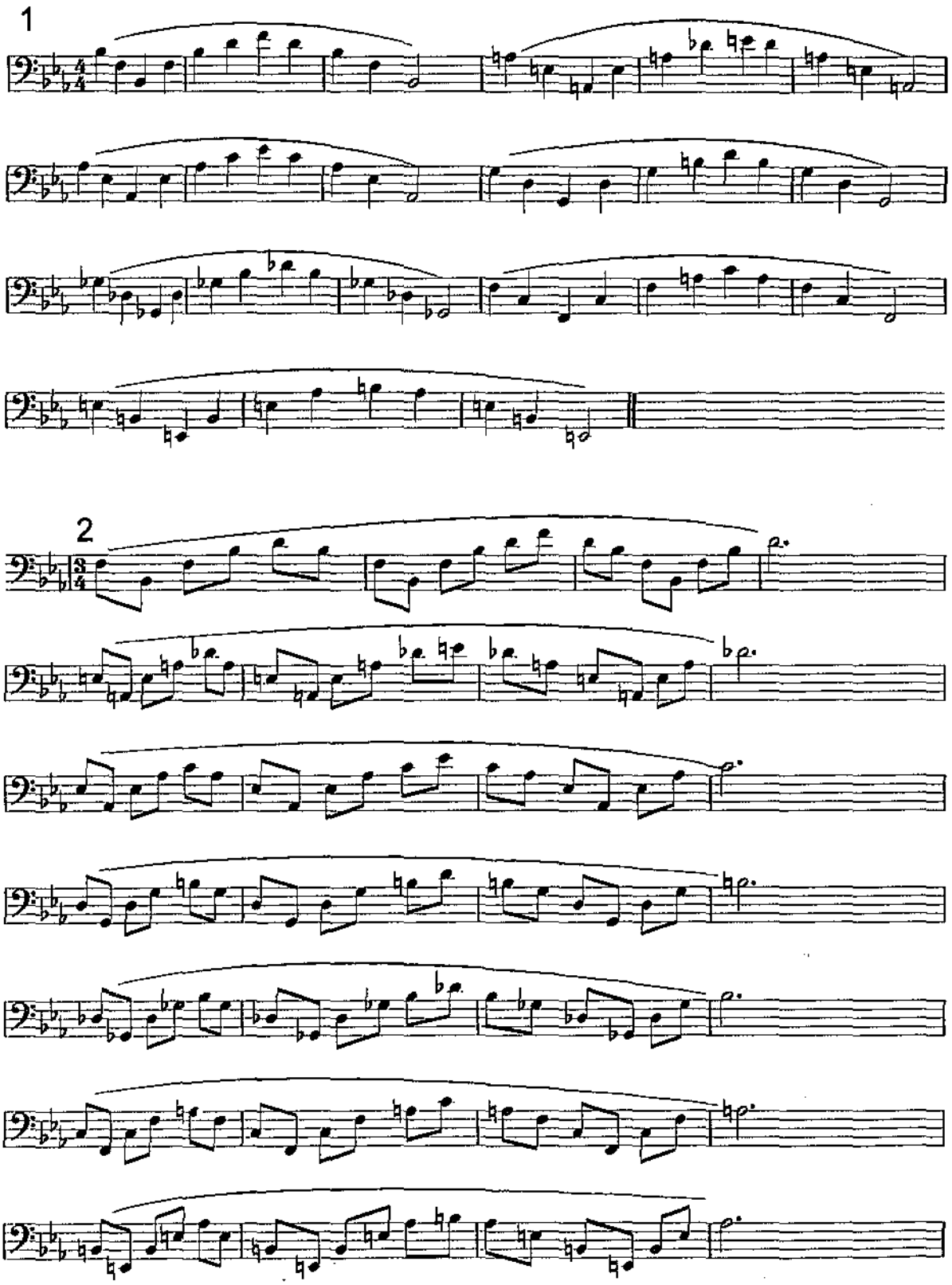

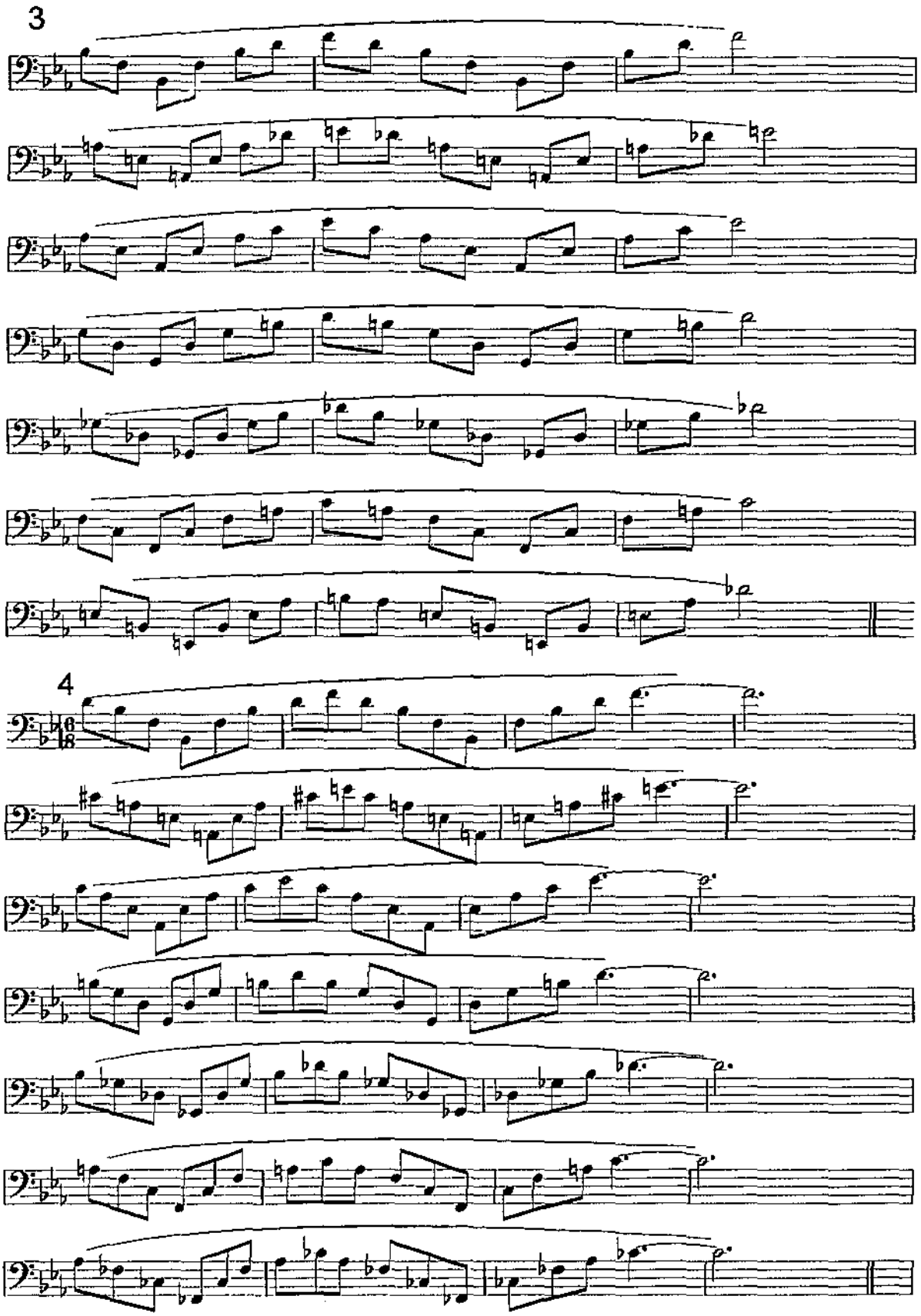
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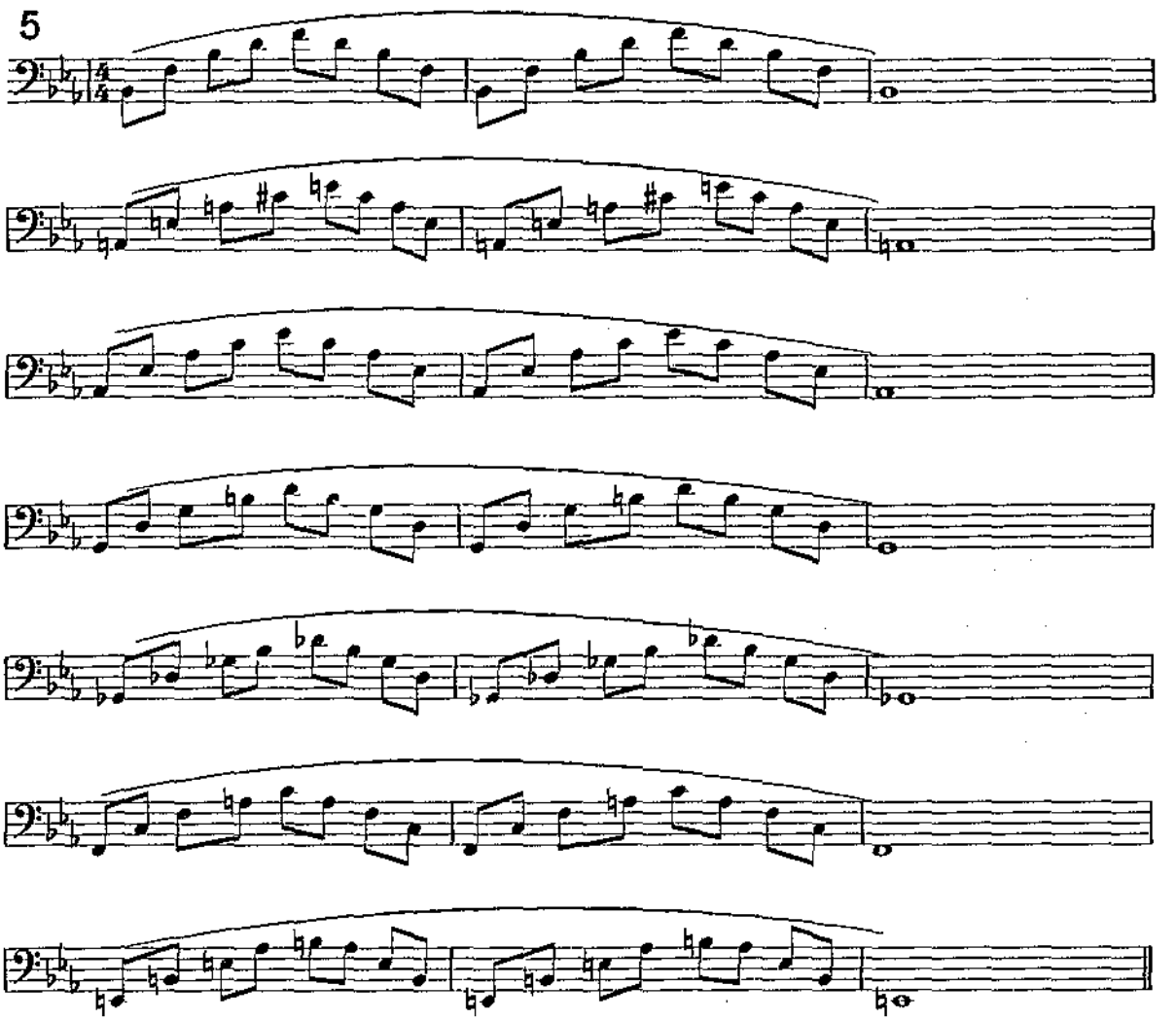
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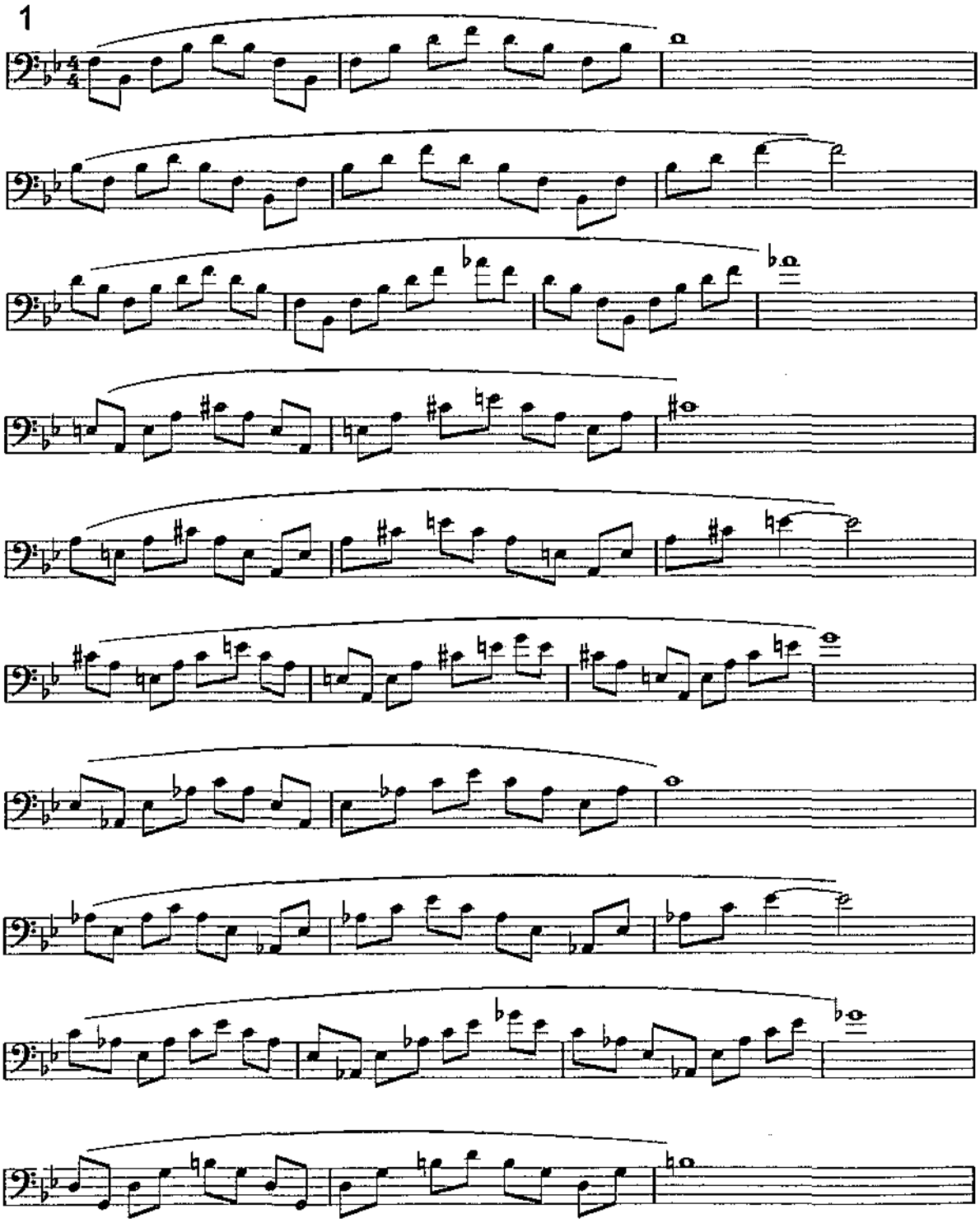

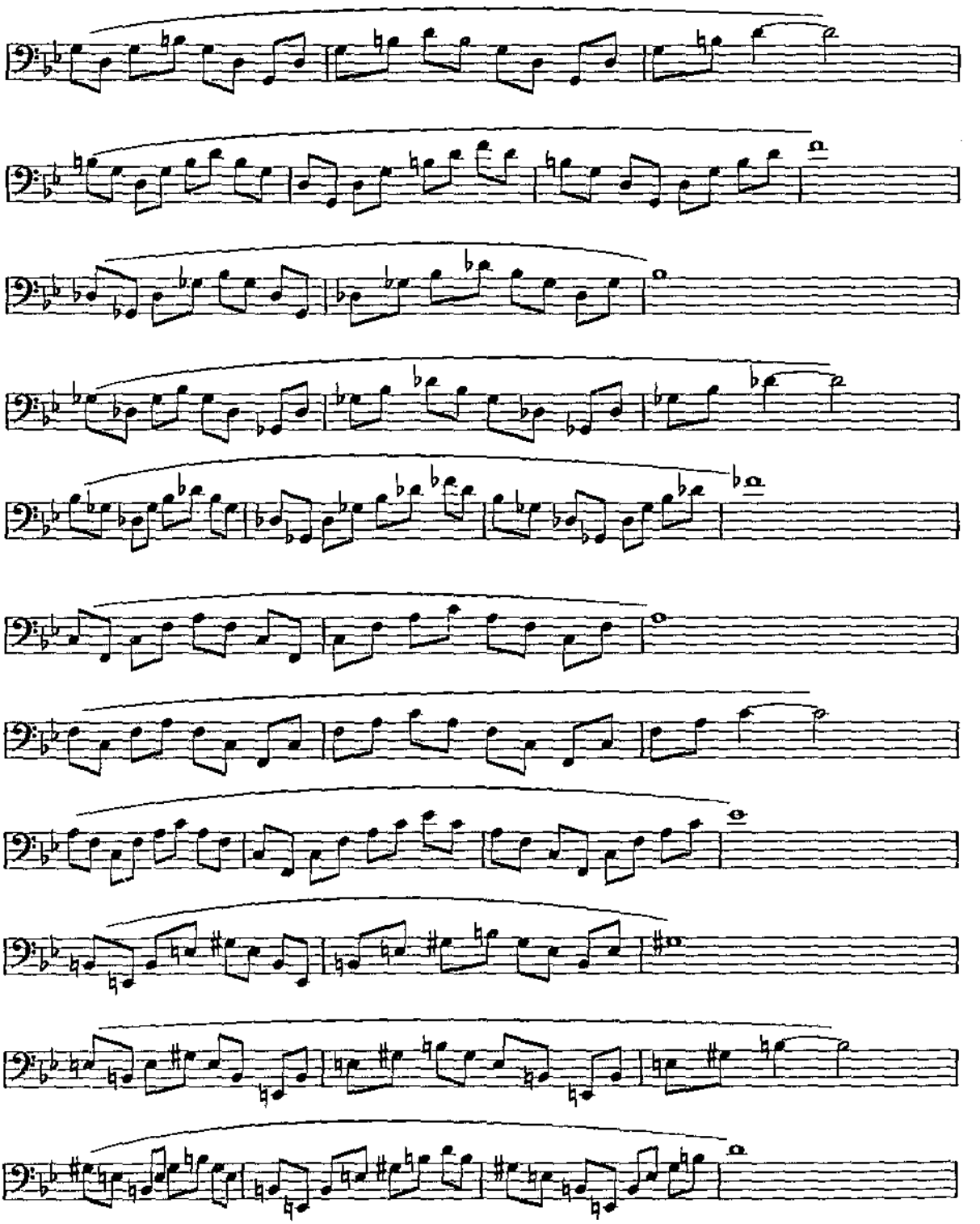

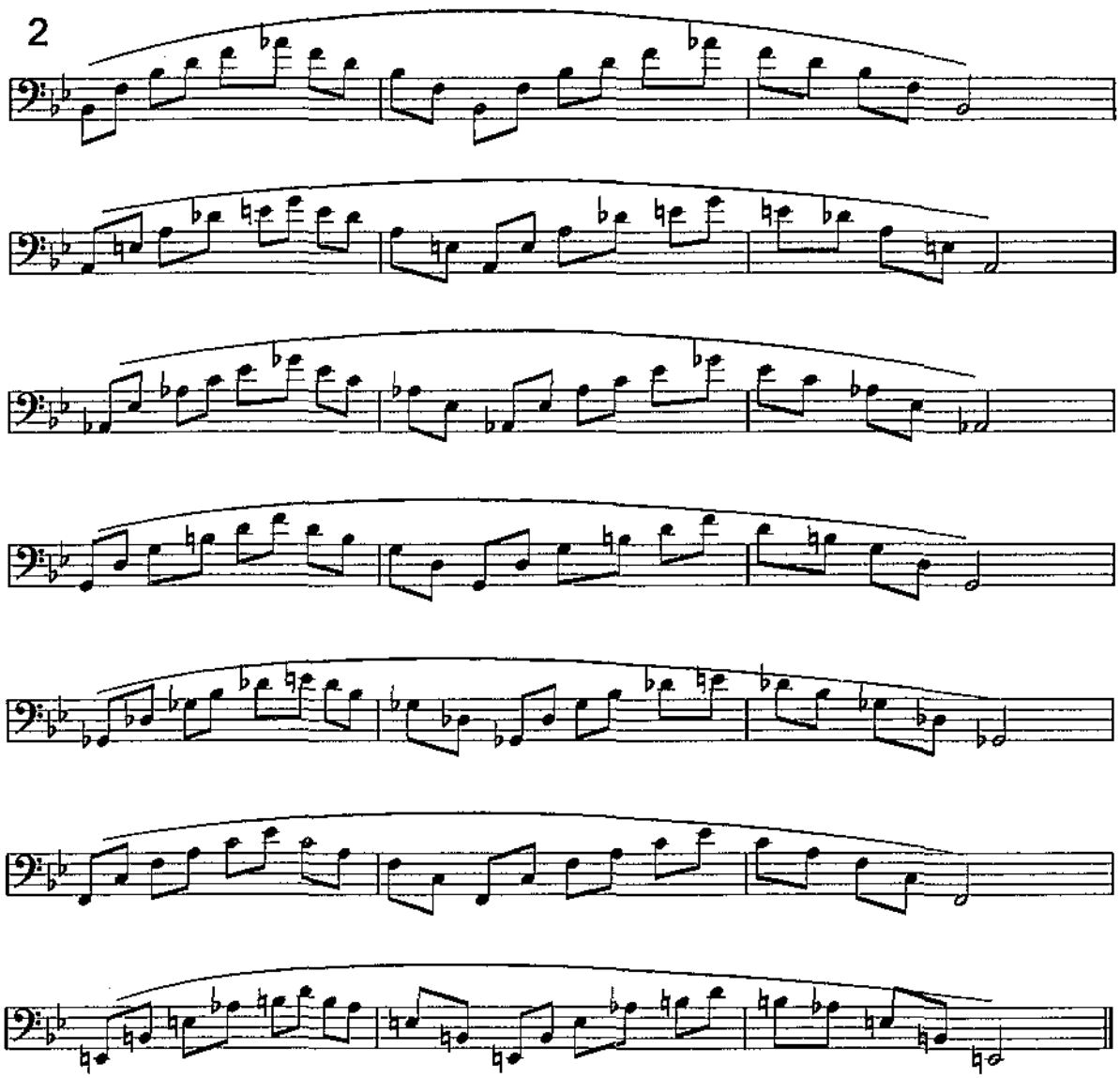
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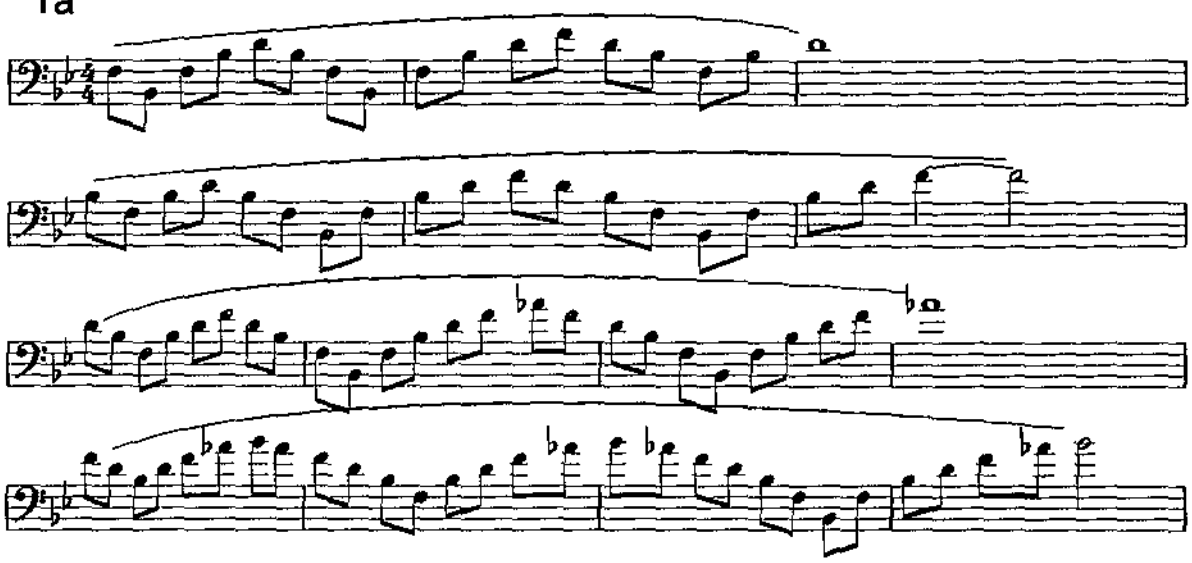

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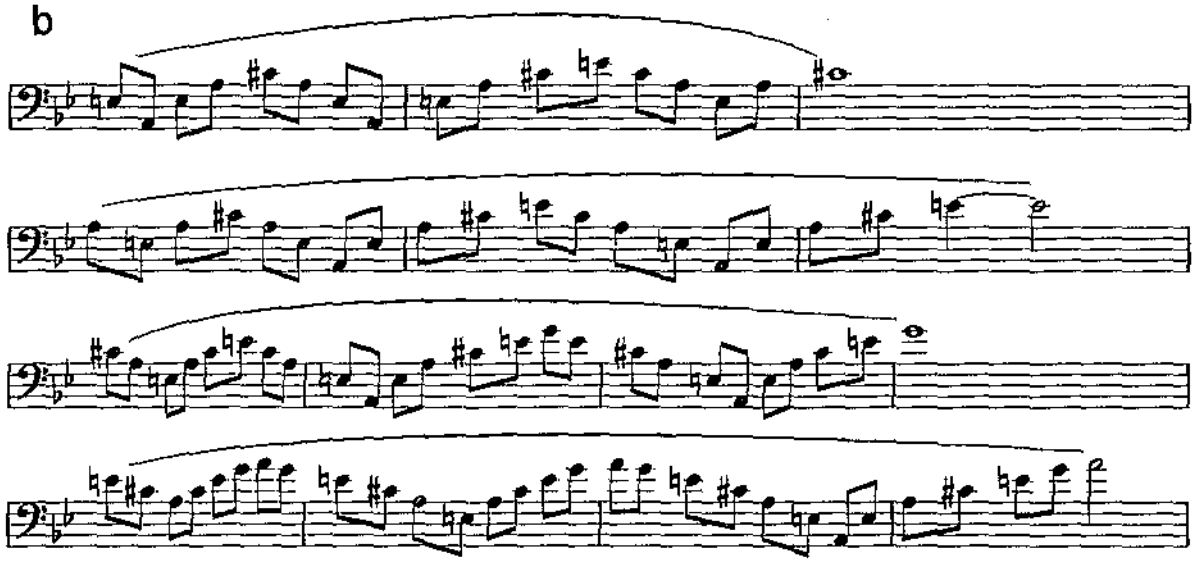

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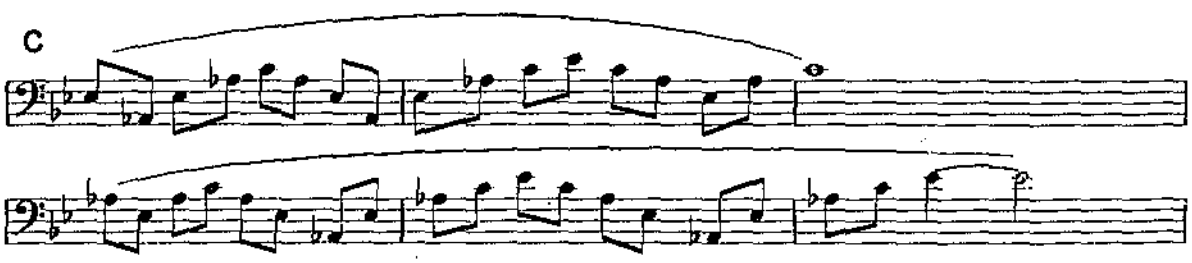

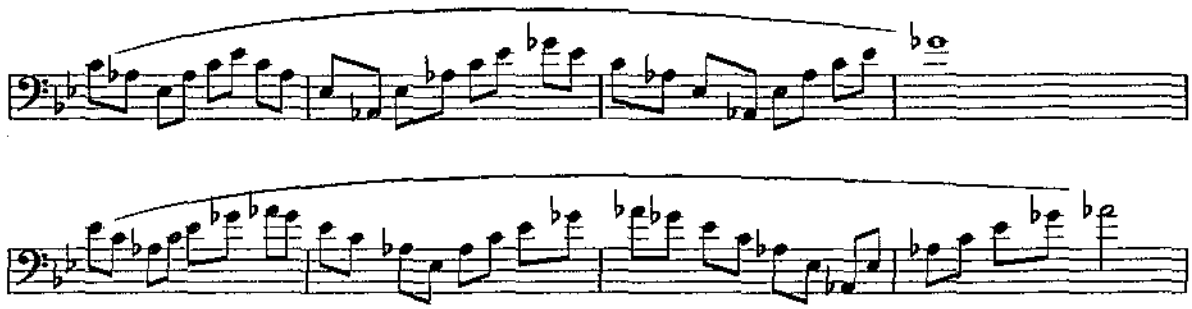

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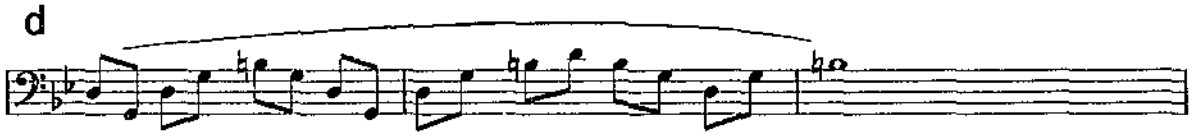

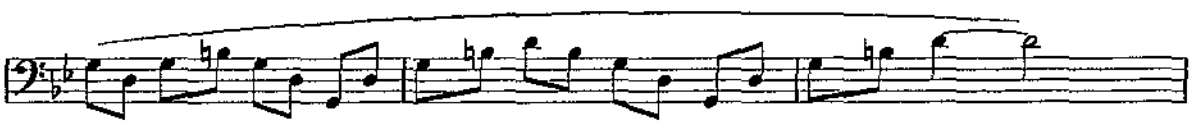

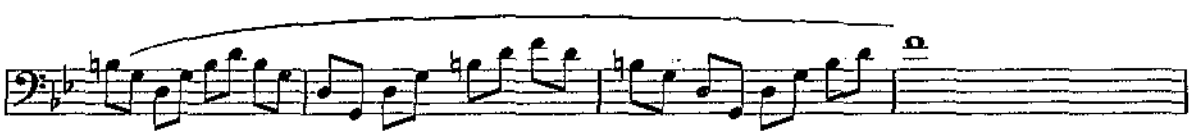

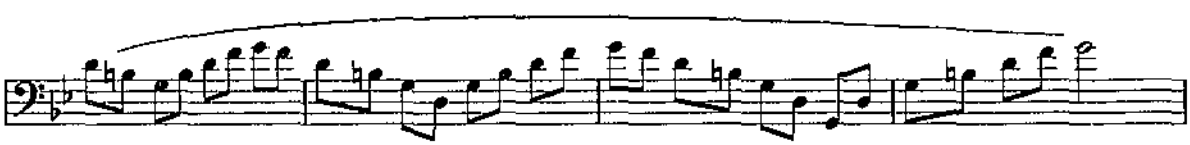

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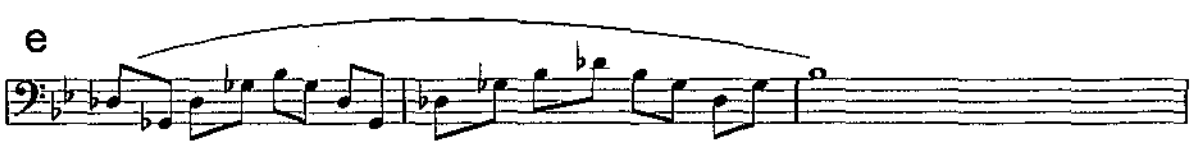

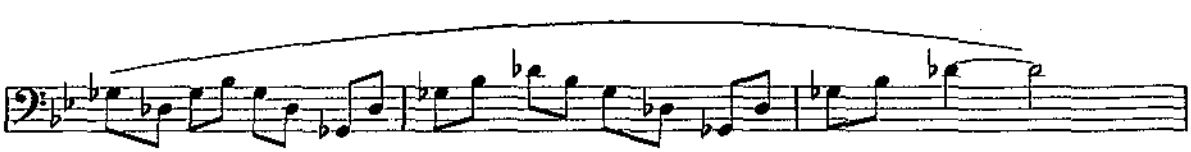

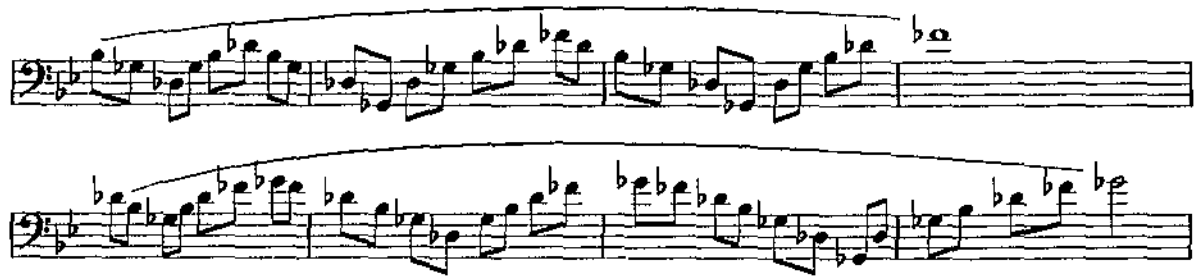

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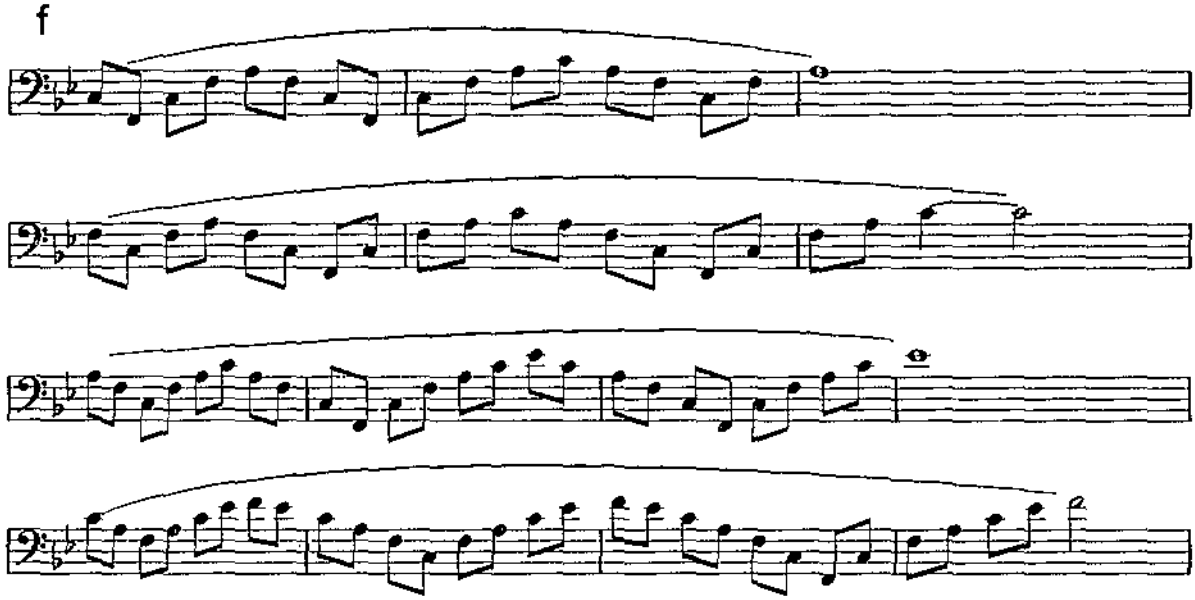

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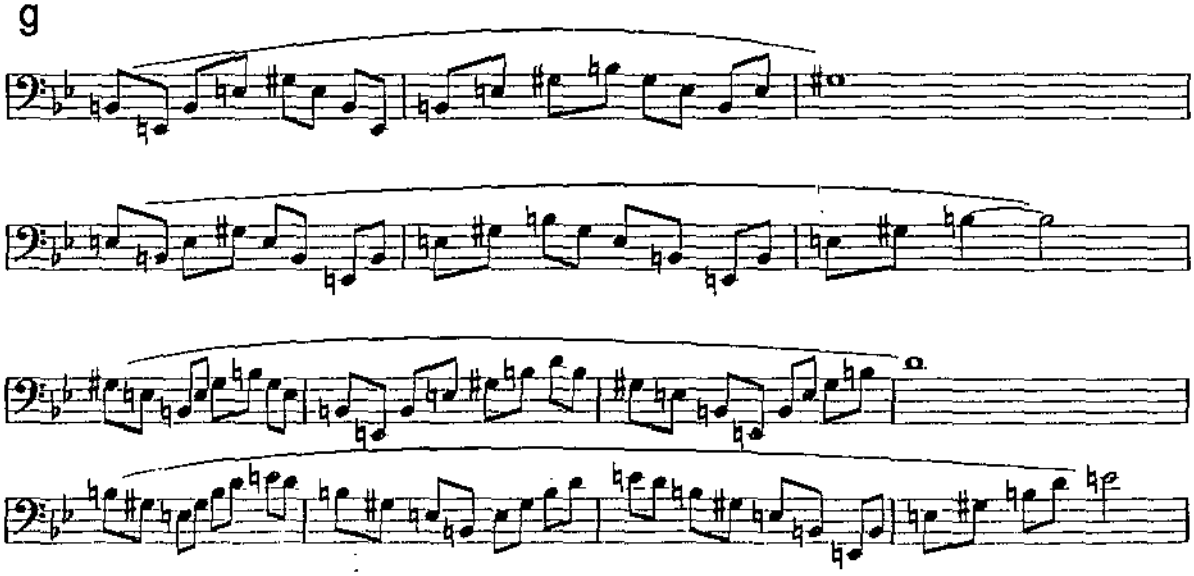

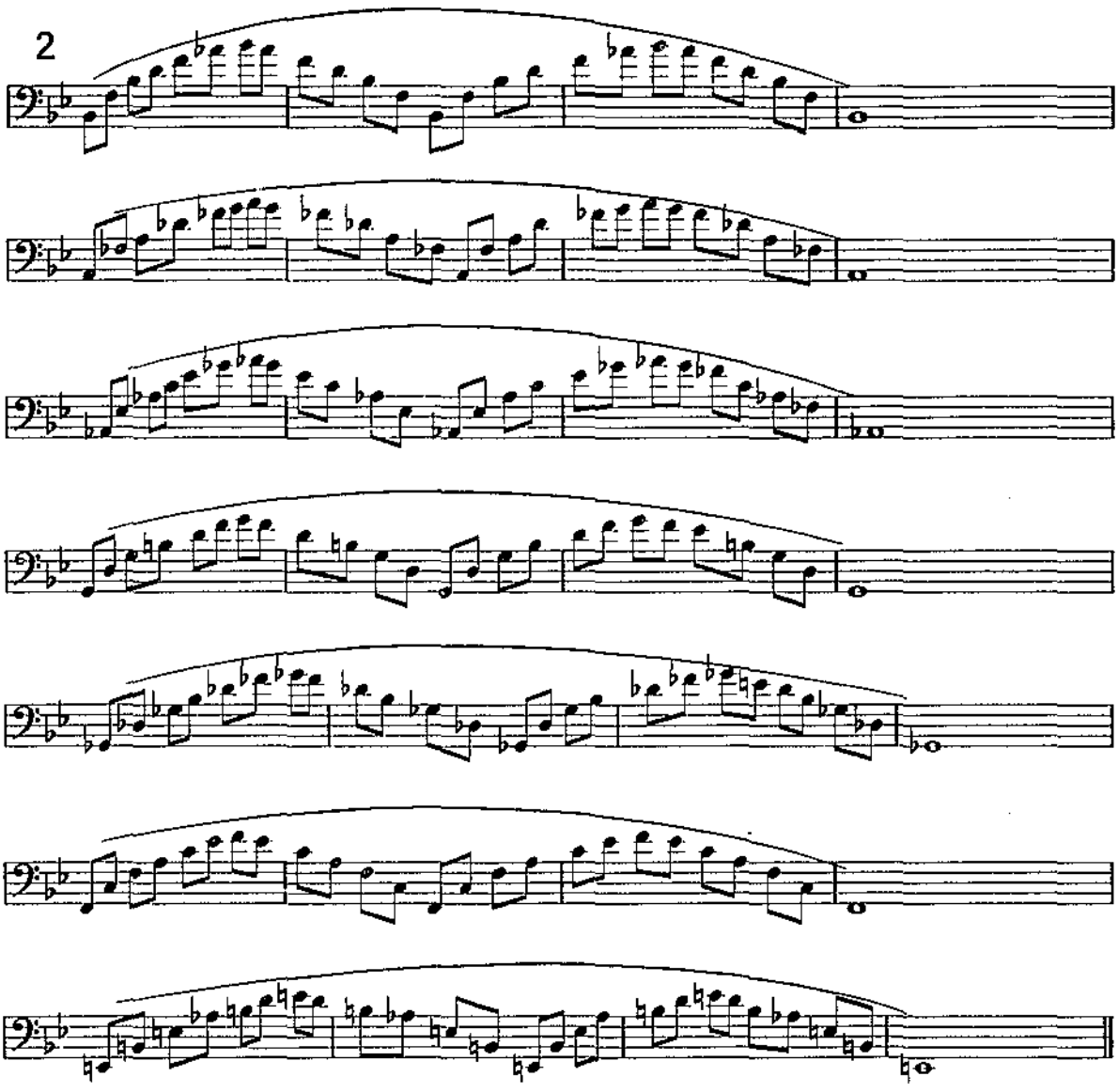
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LIP BUILDER No 1

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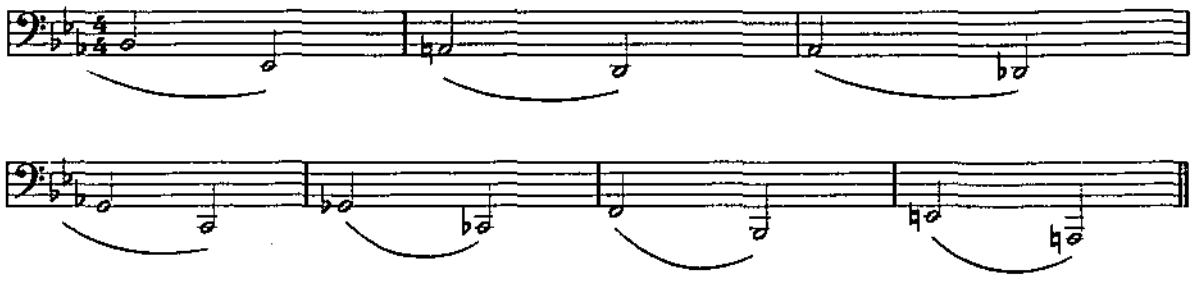

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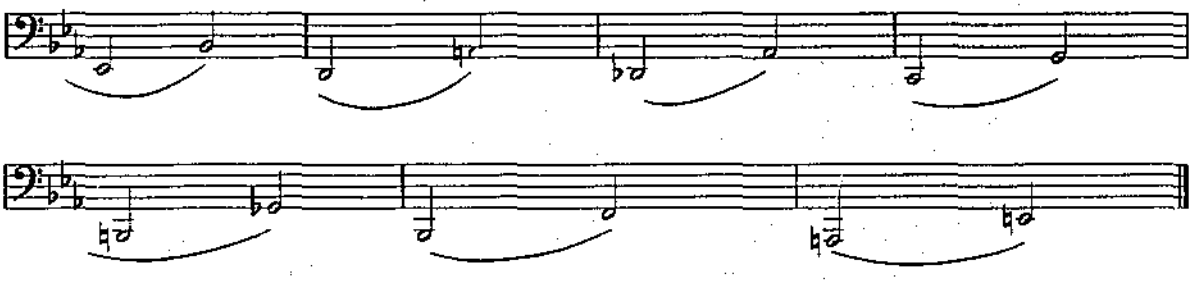

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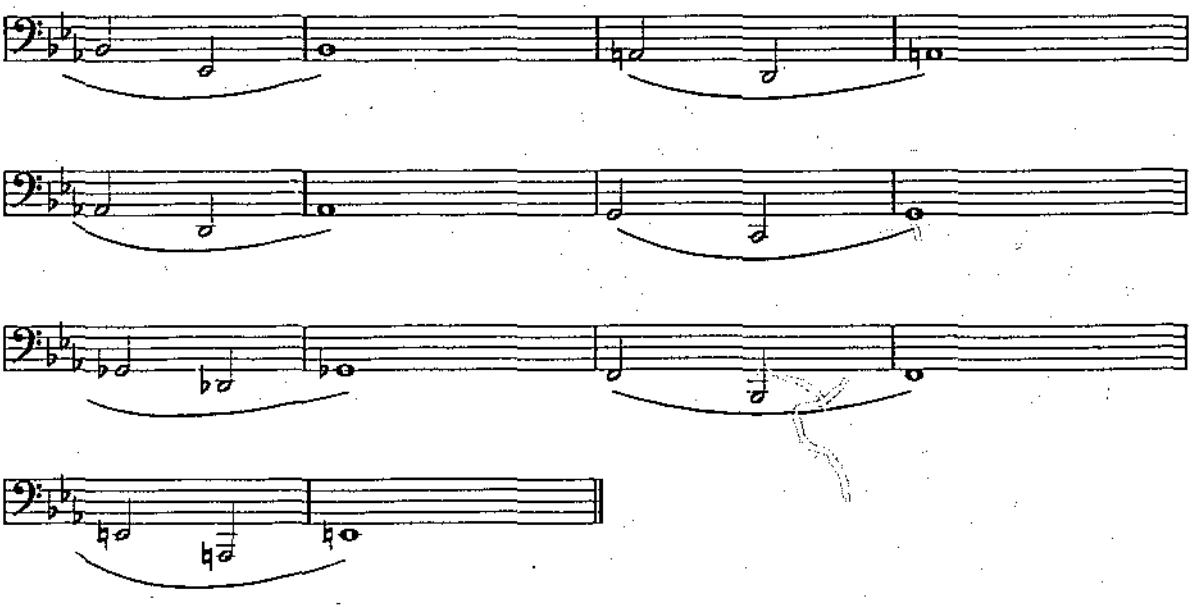

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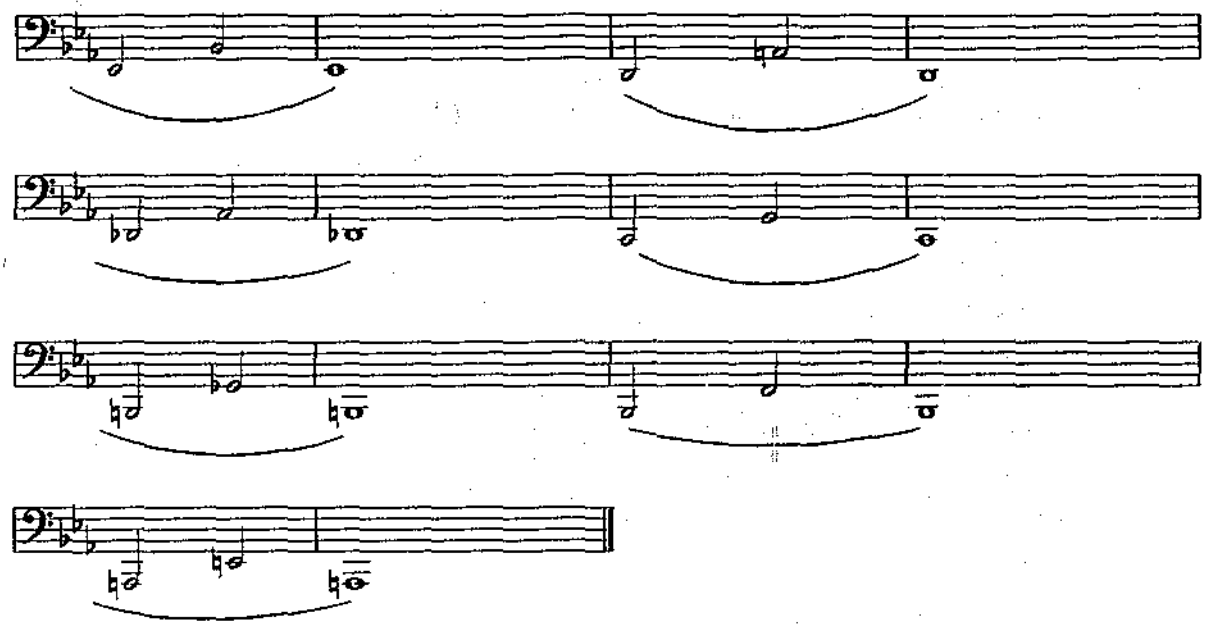

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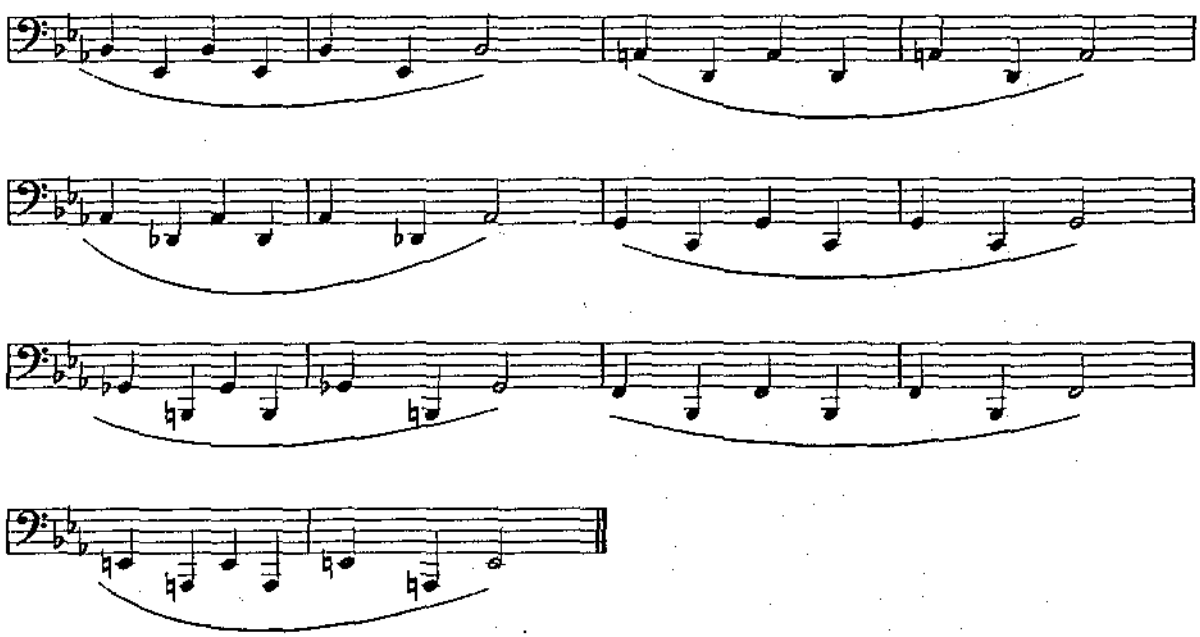

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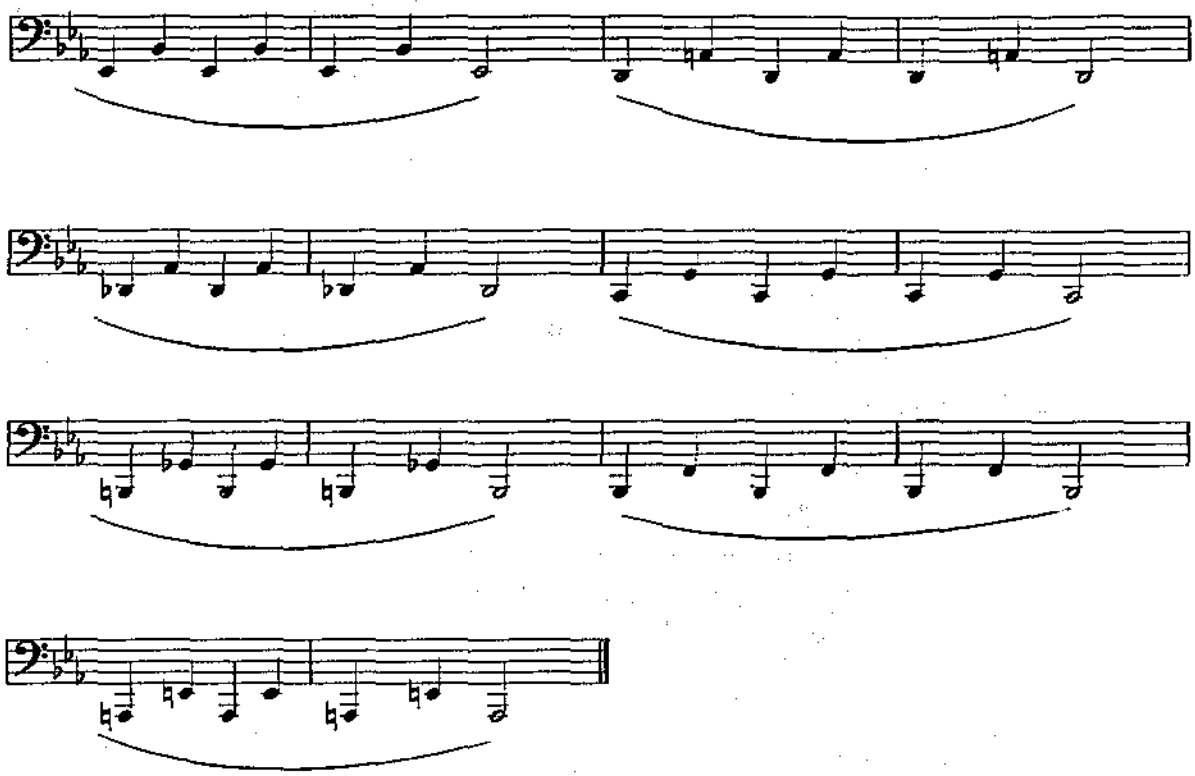

LIP BUILDER No 2

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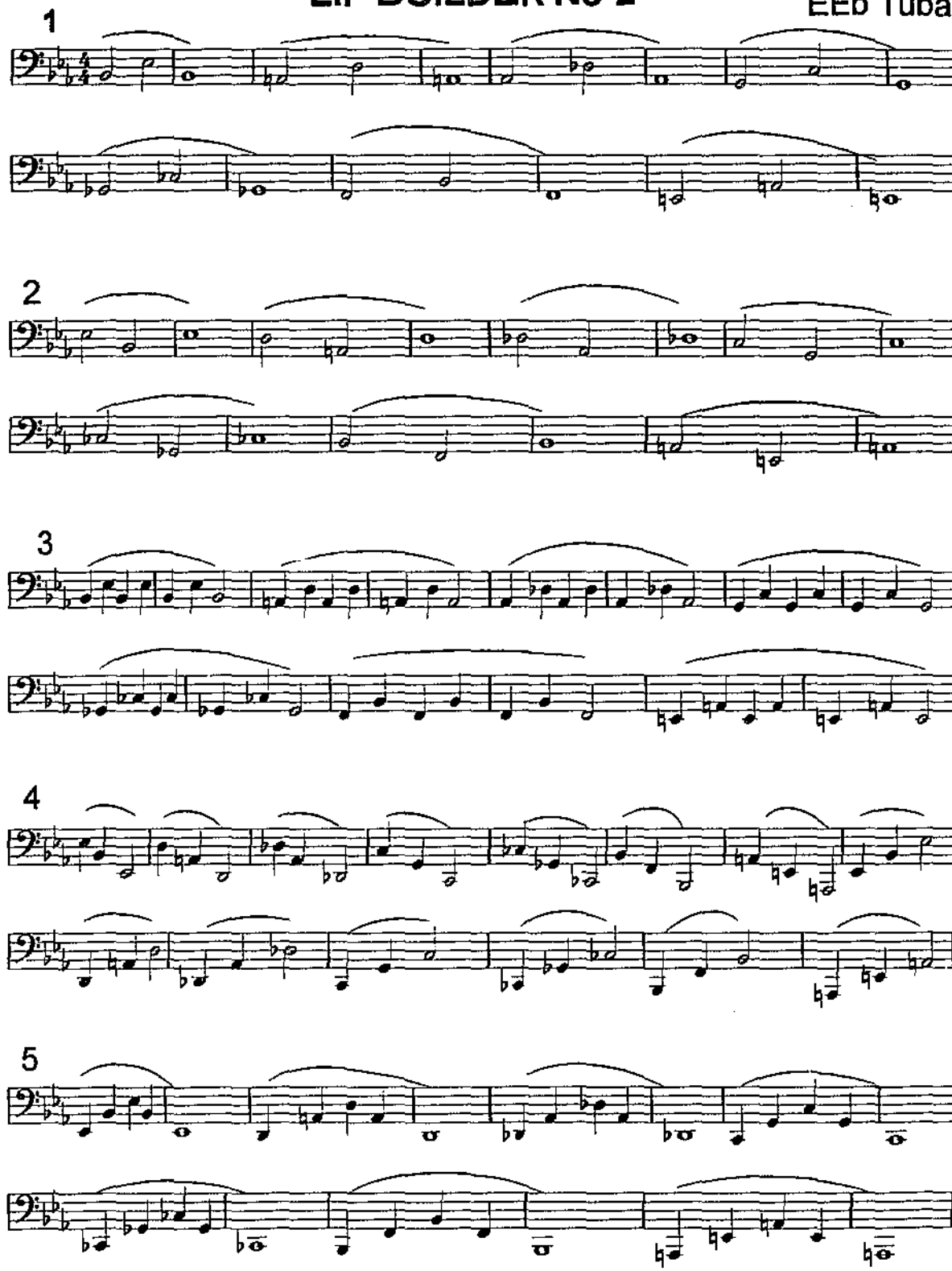

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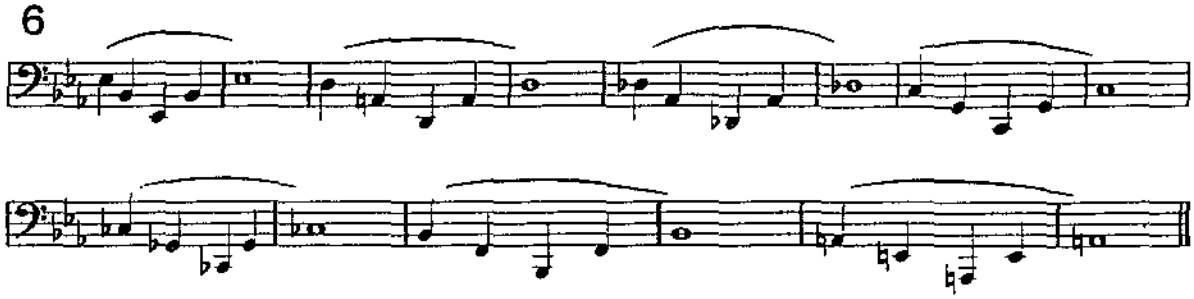

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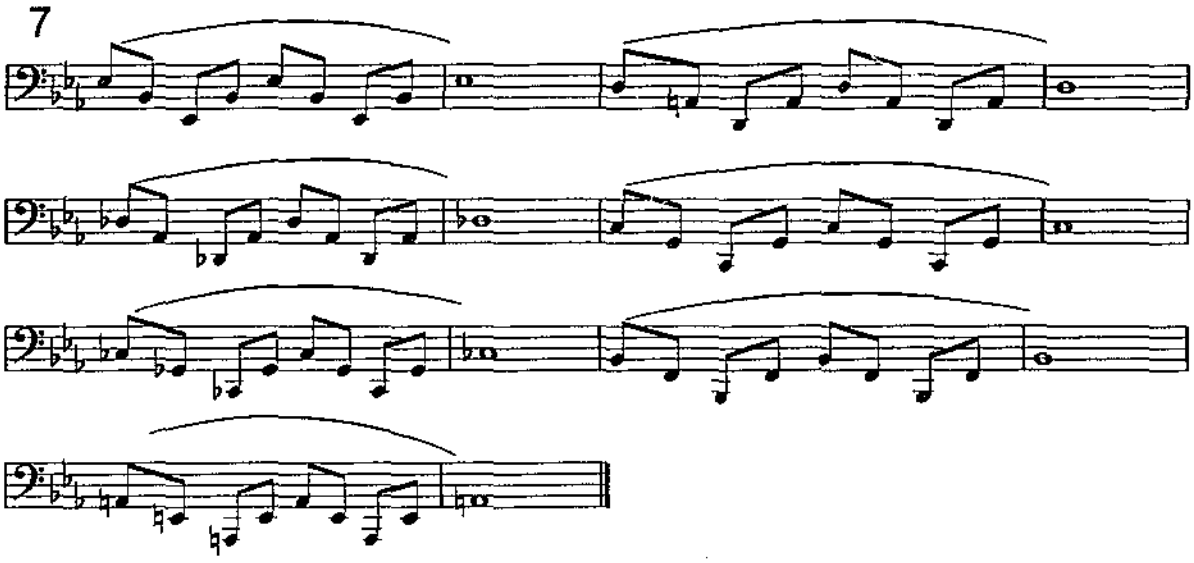

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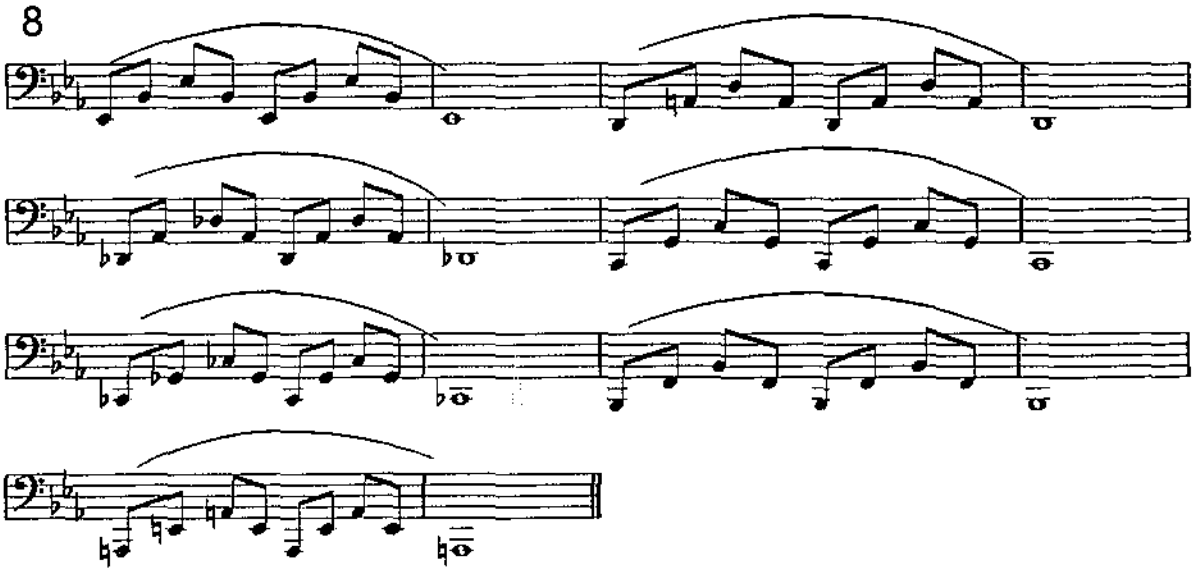

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EEb Tuba

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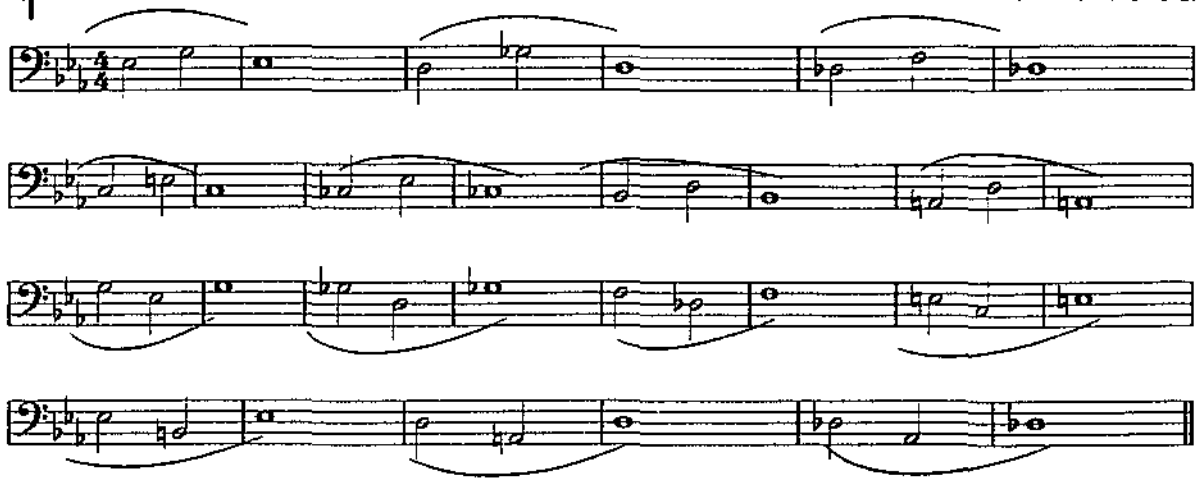

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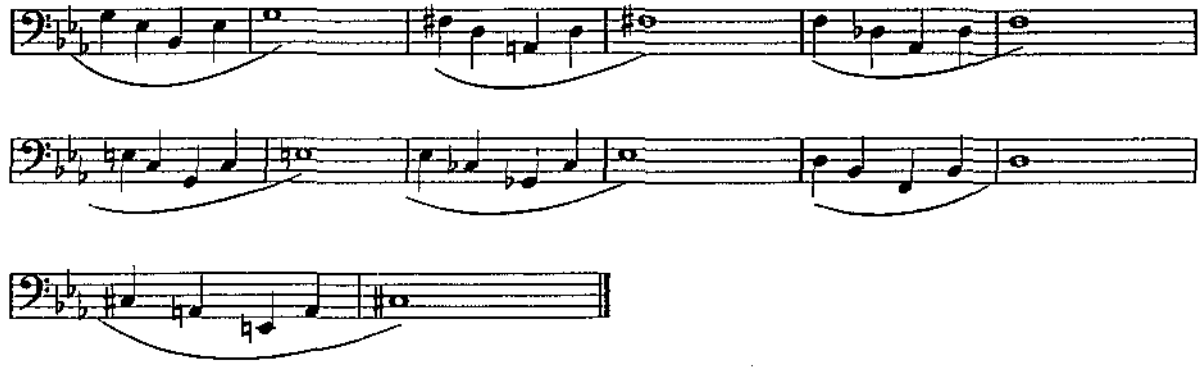

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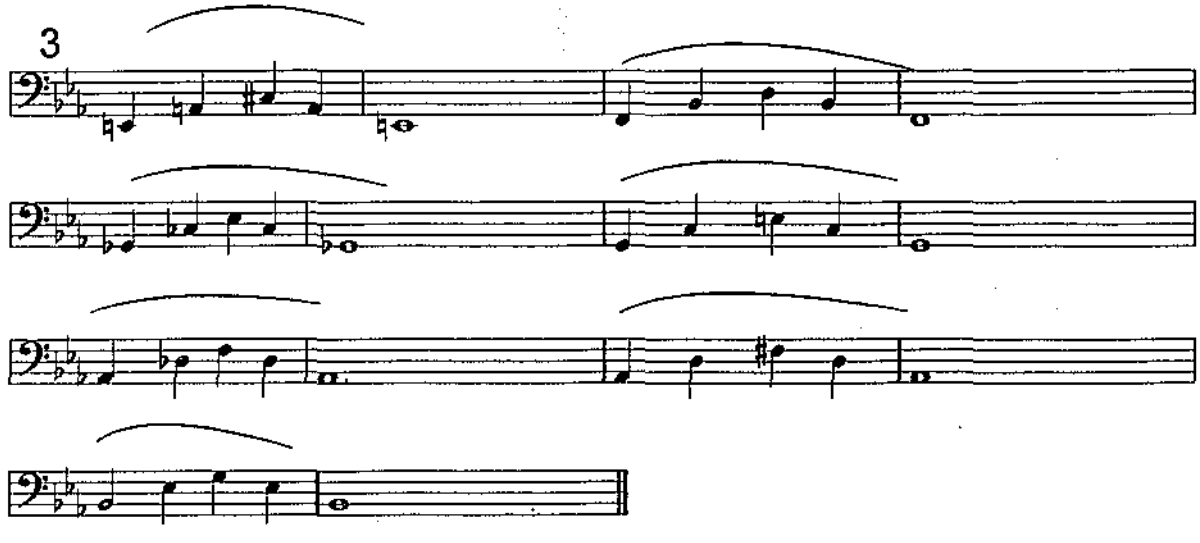

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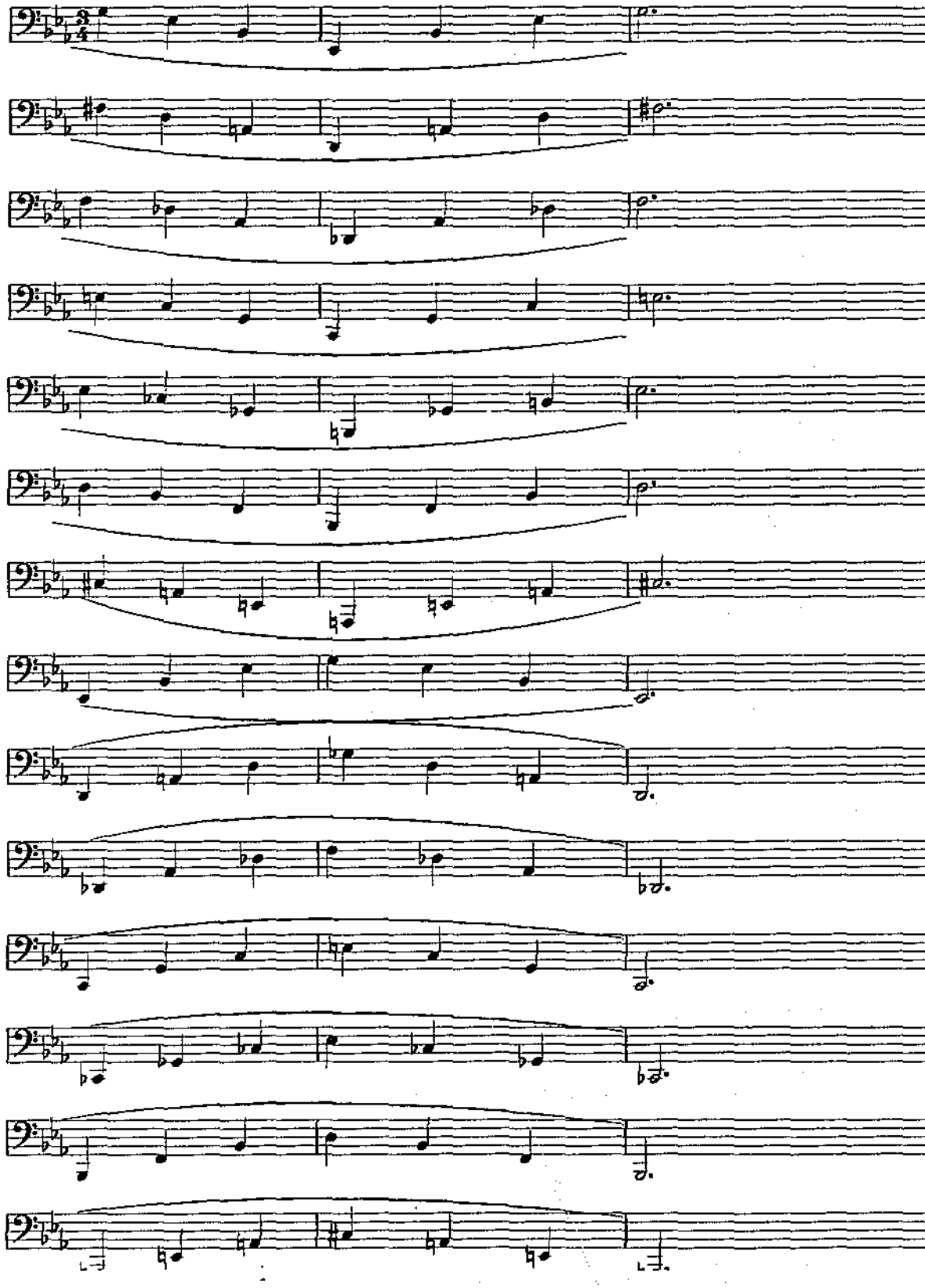

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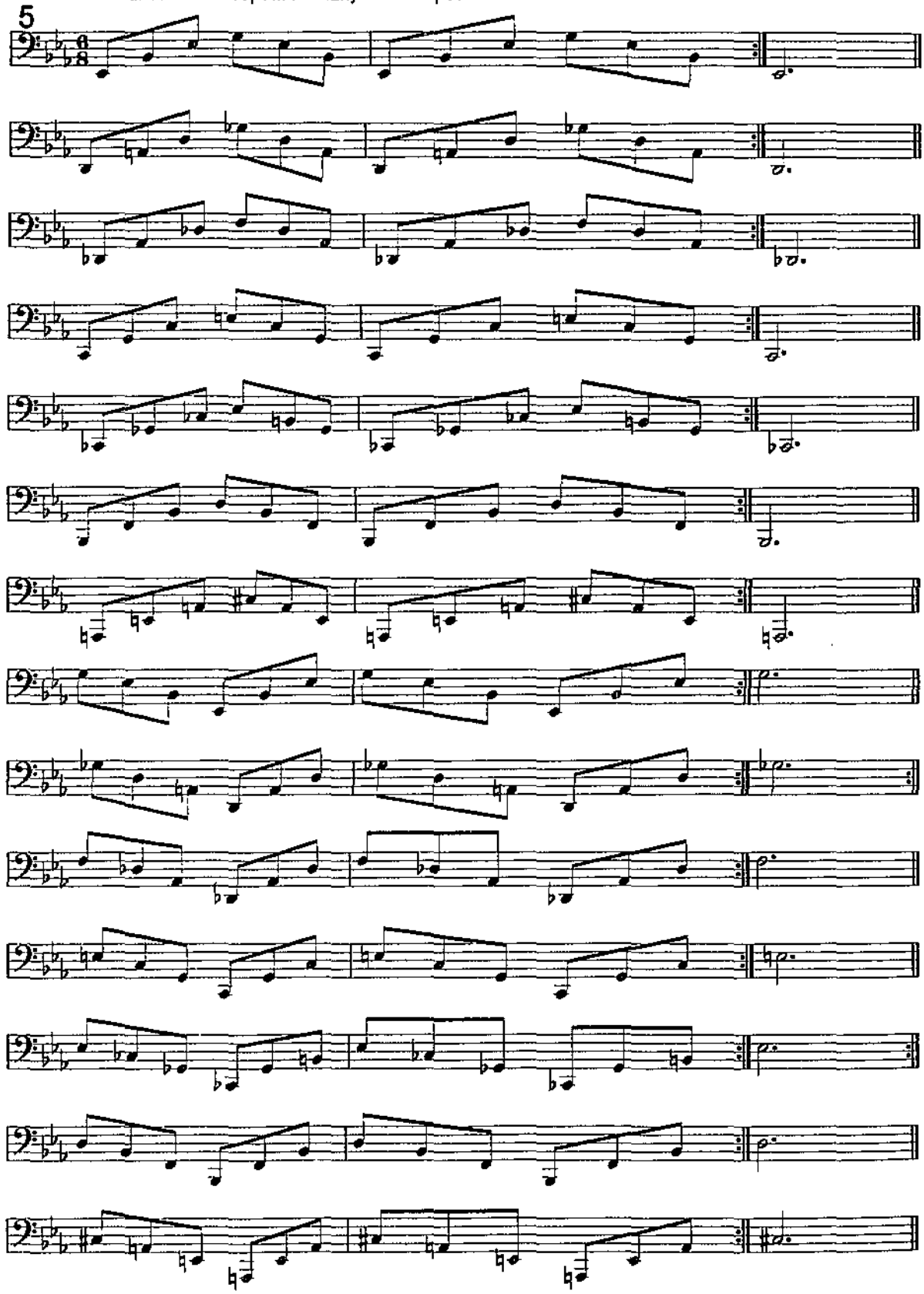

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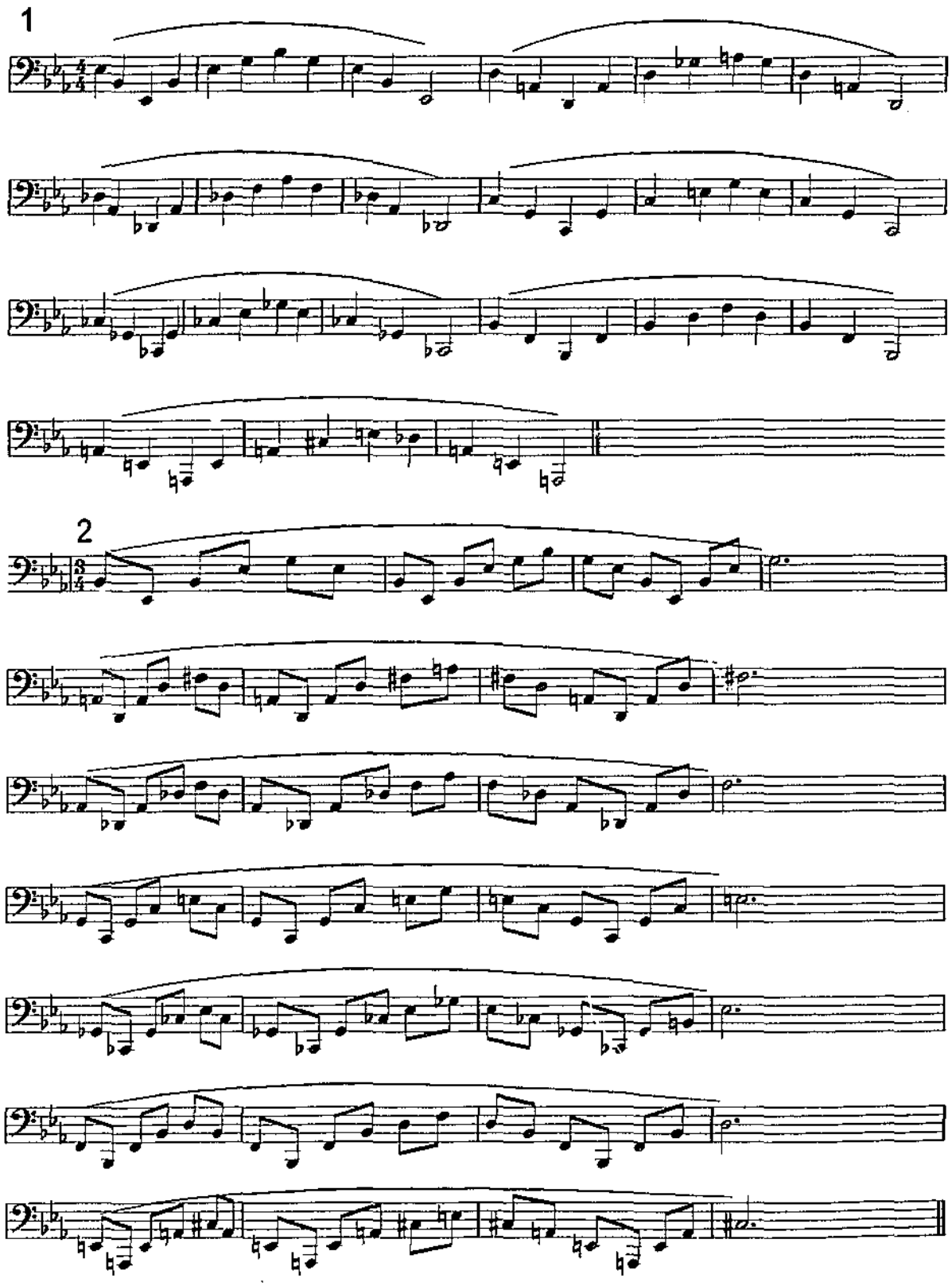

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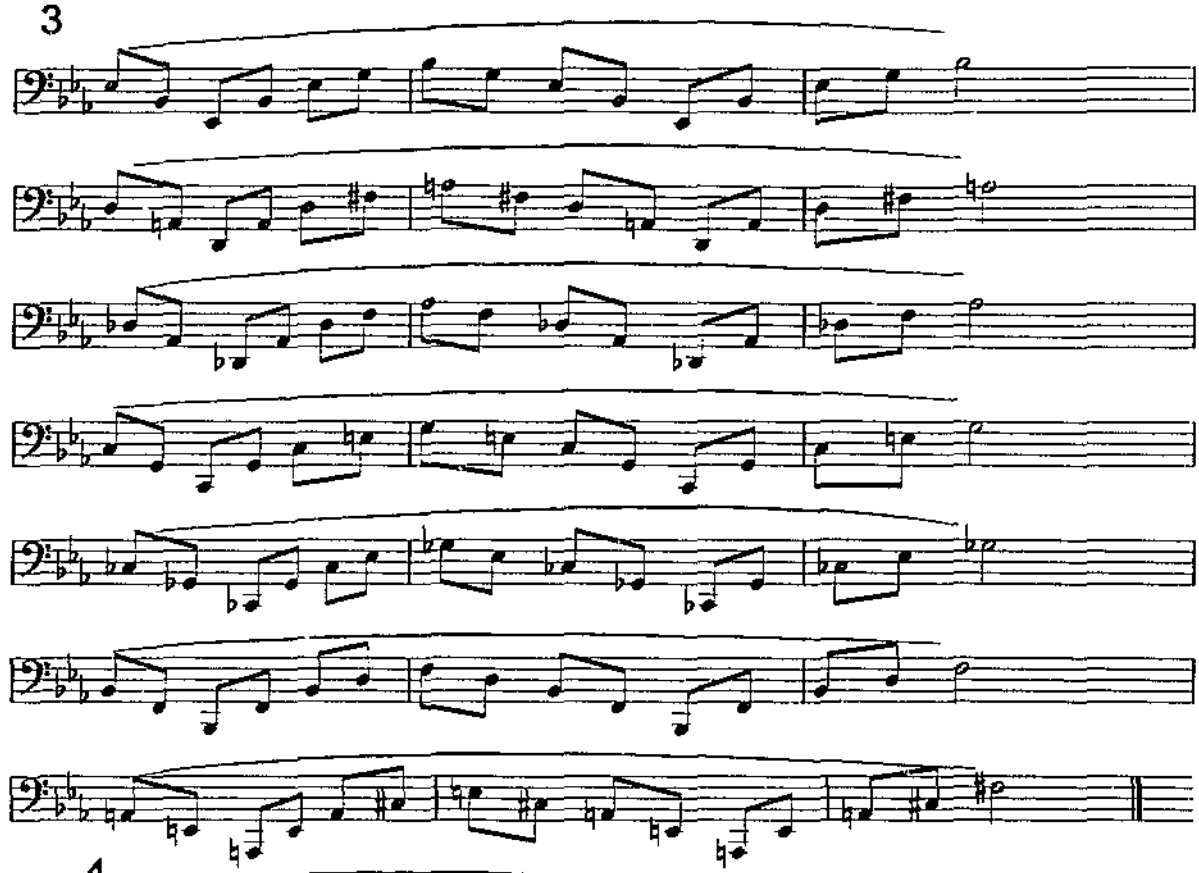

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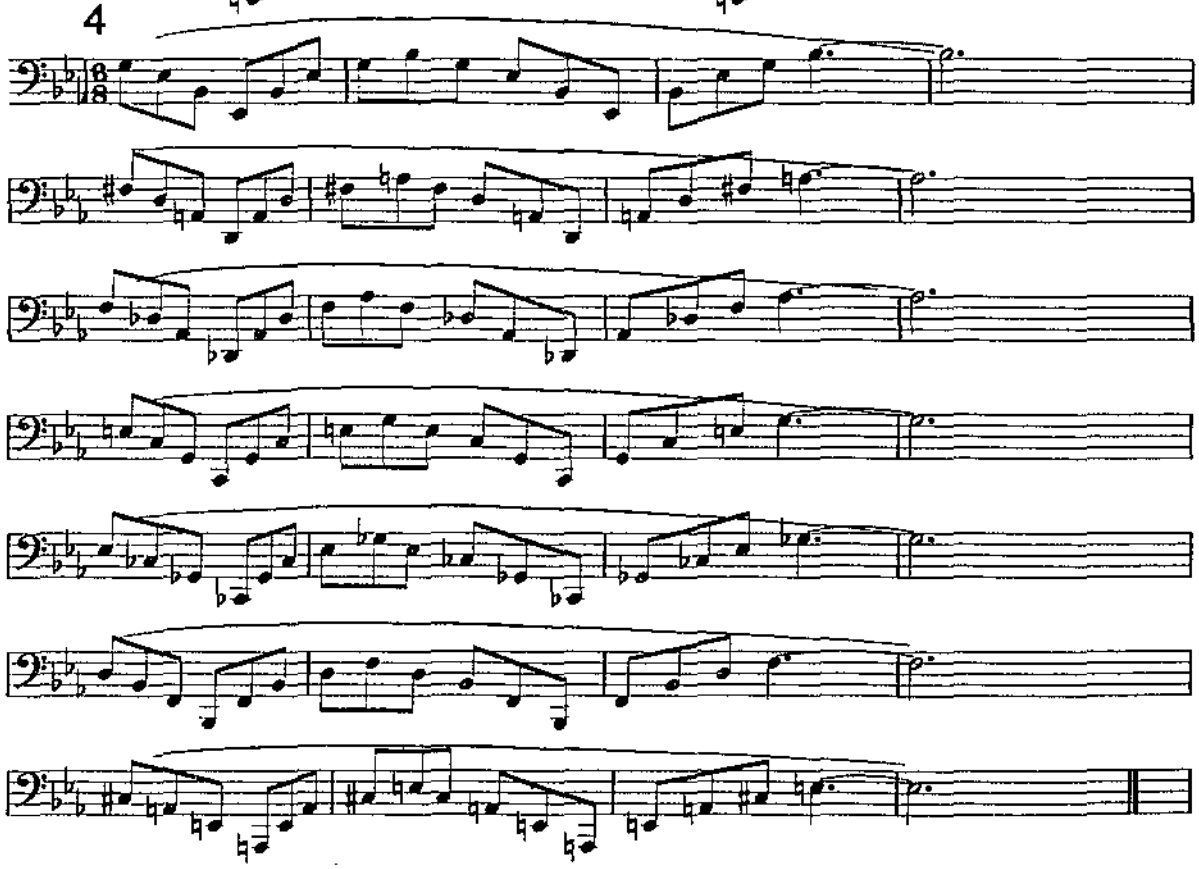

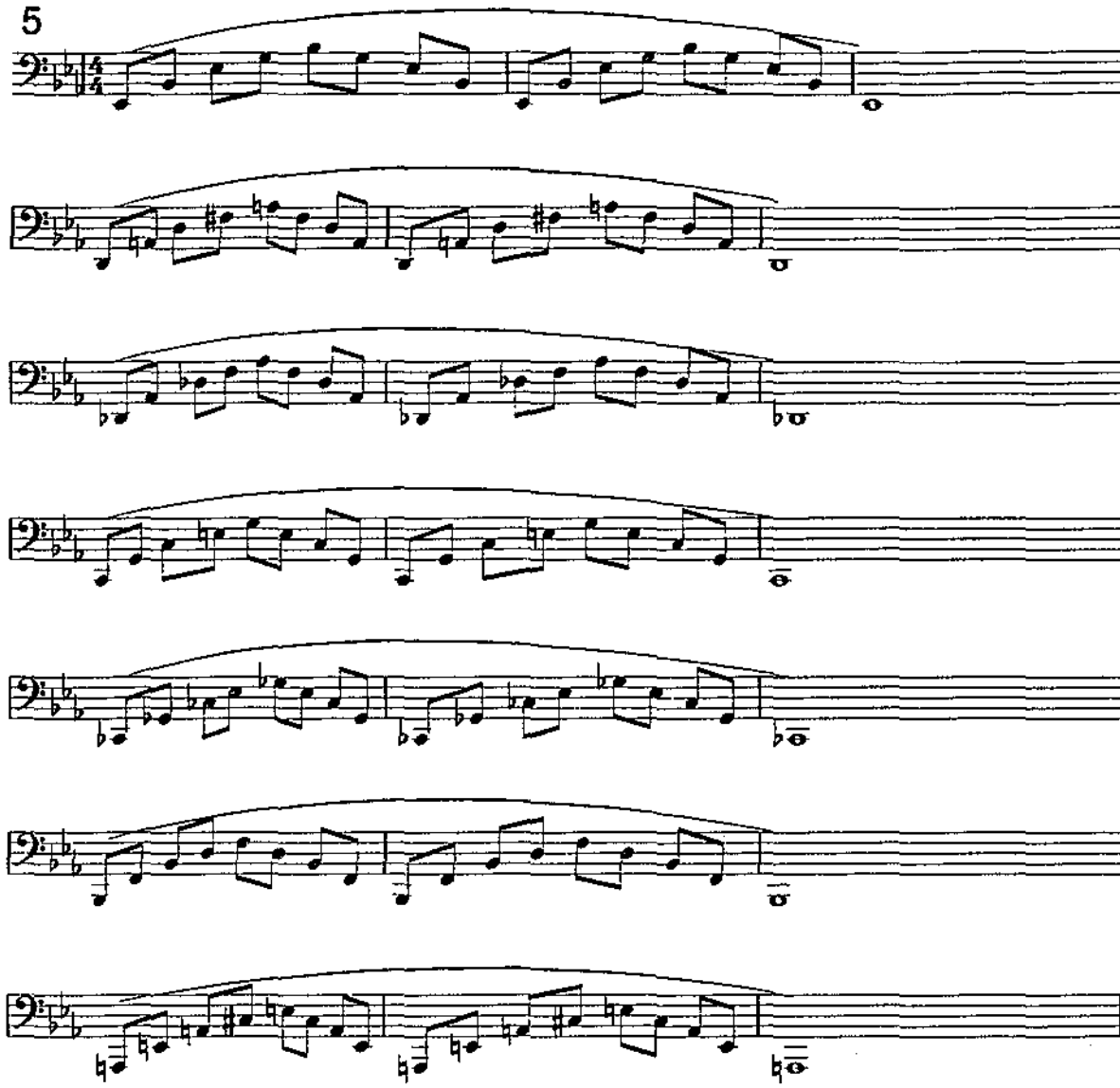
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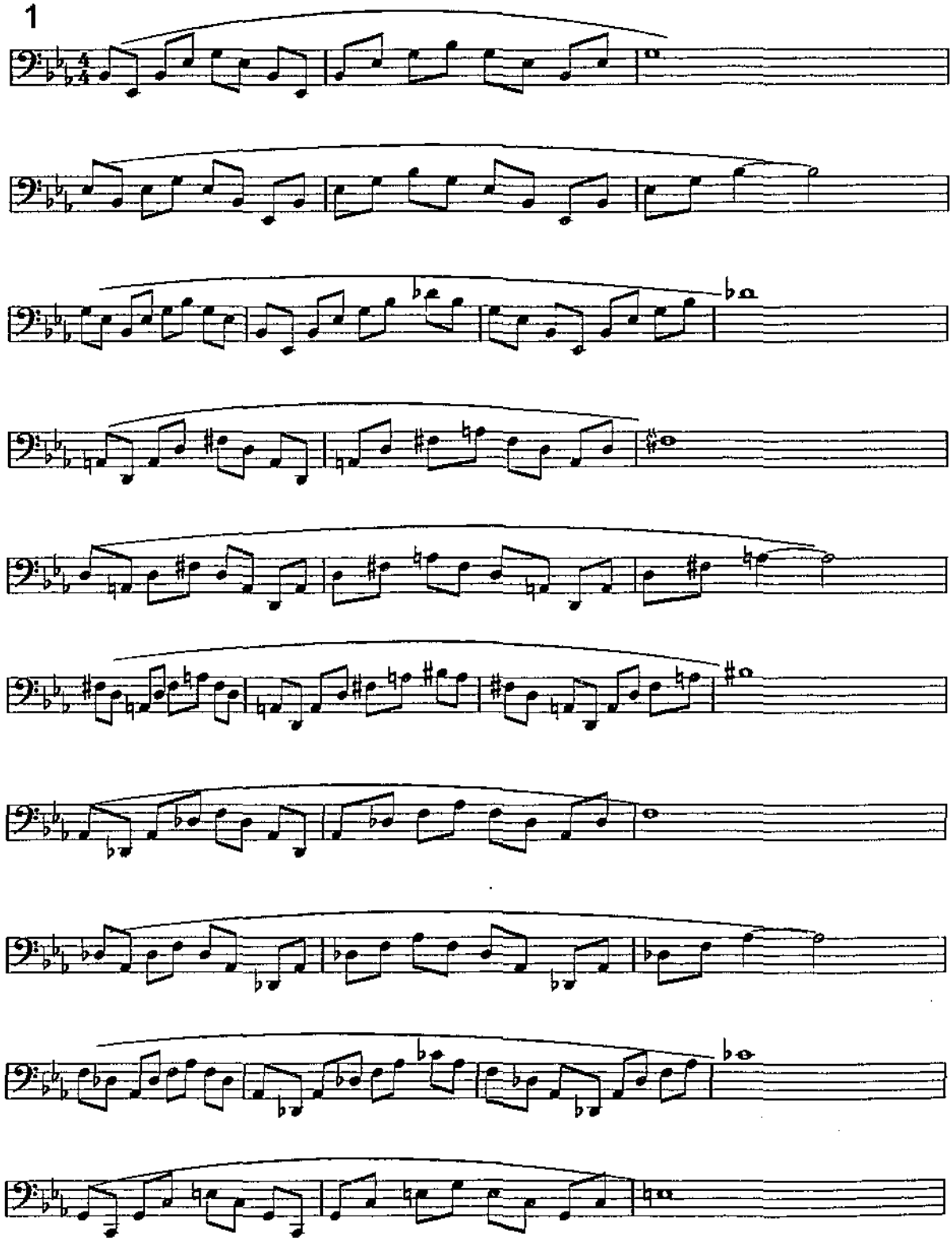

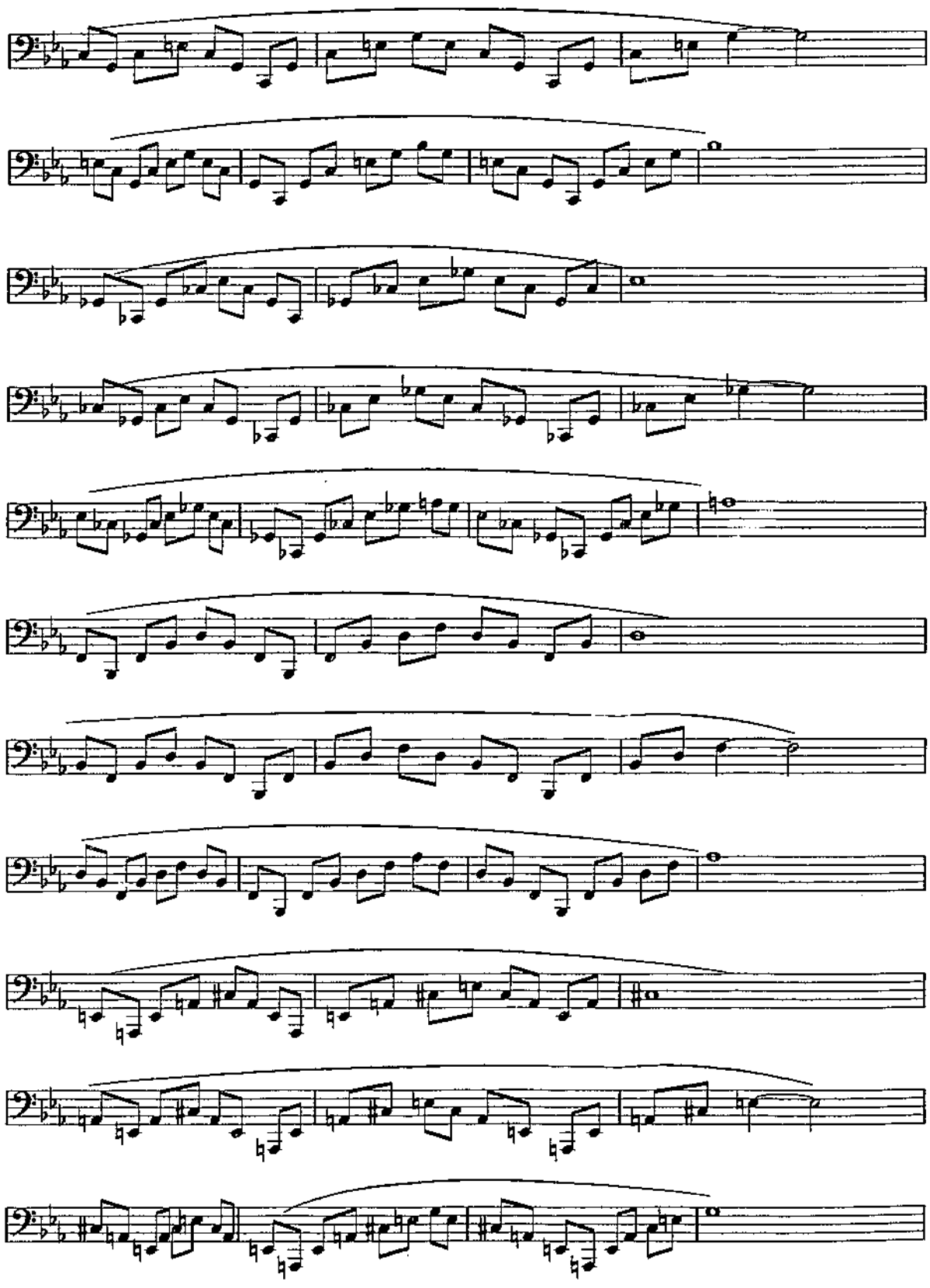

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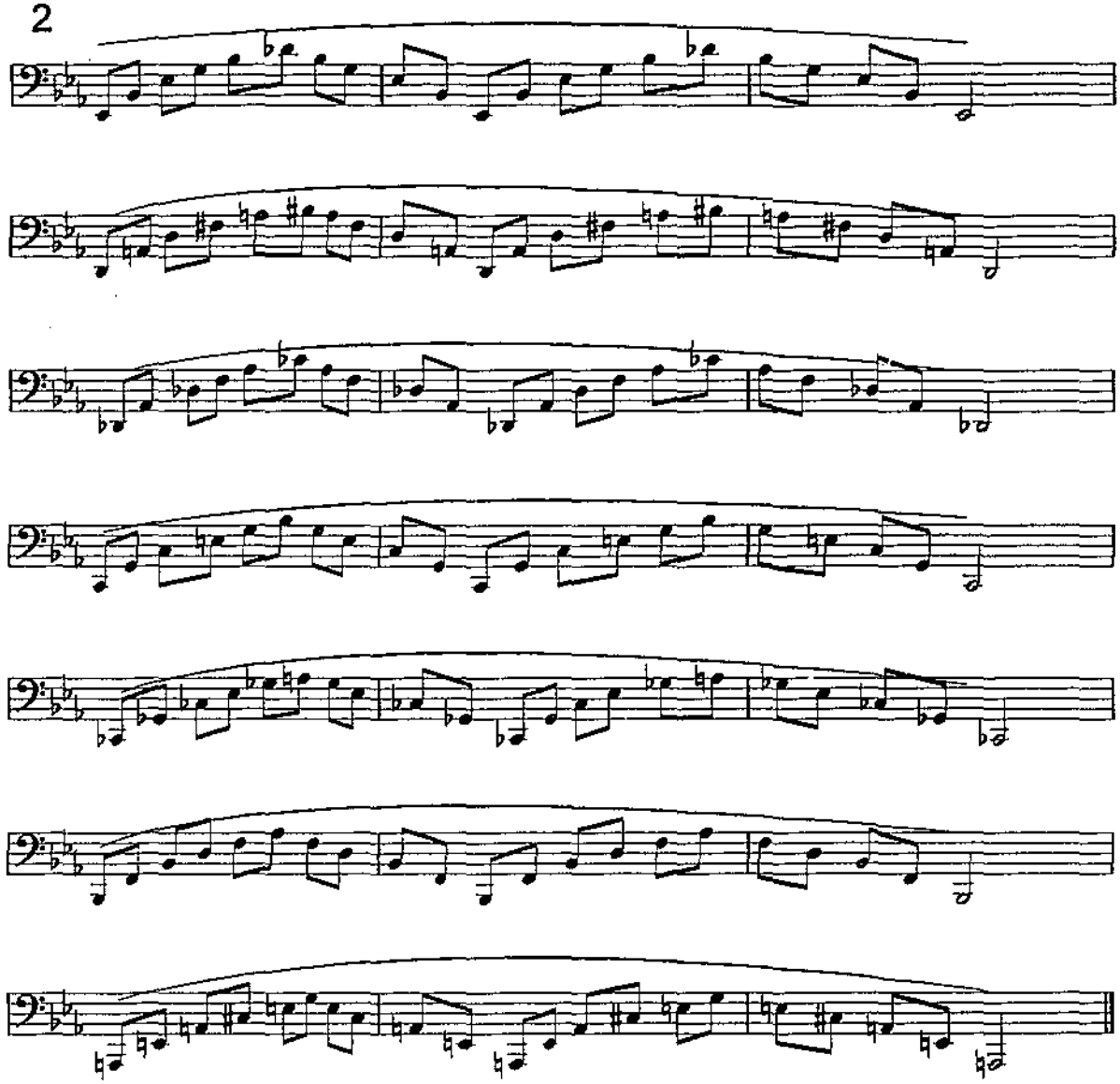

LIPBUILDER No 6

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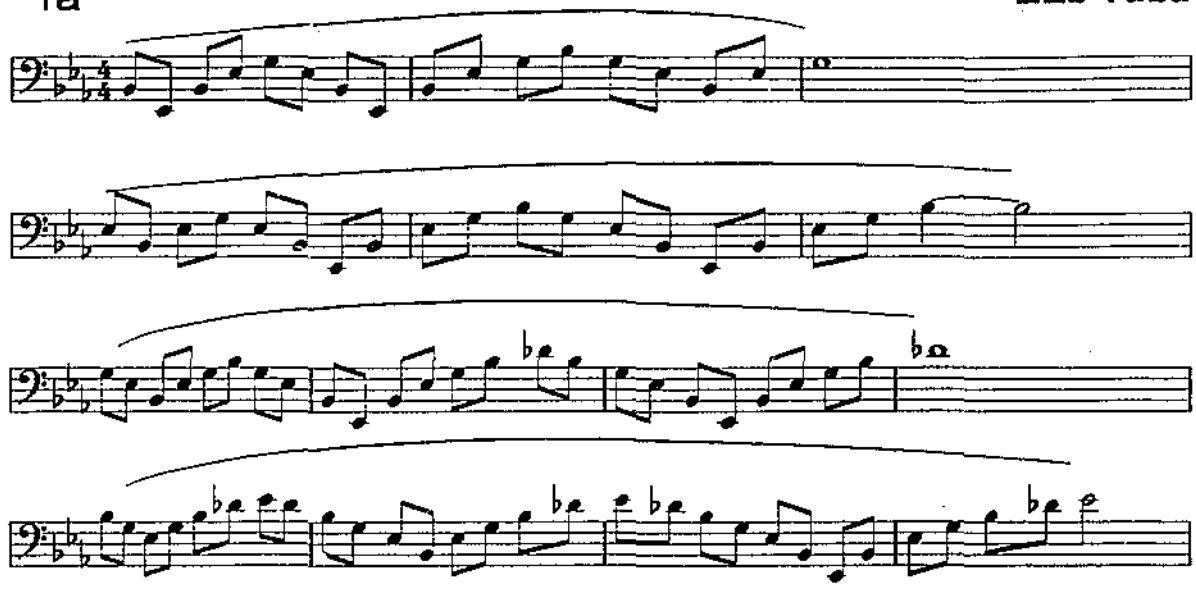

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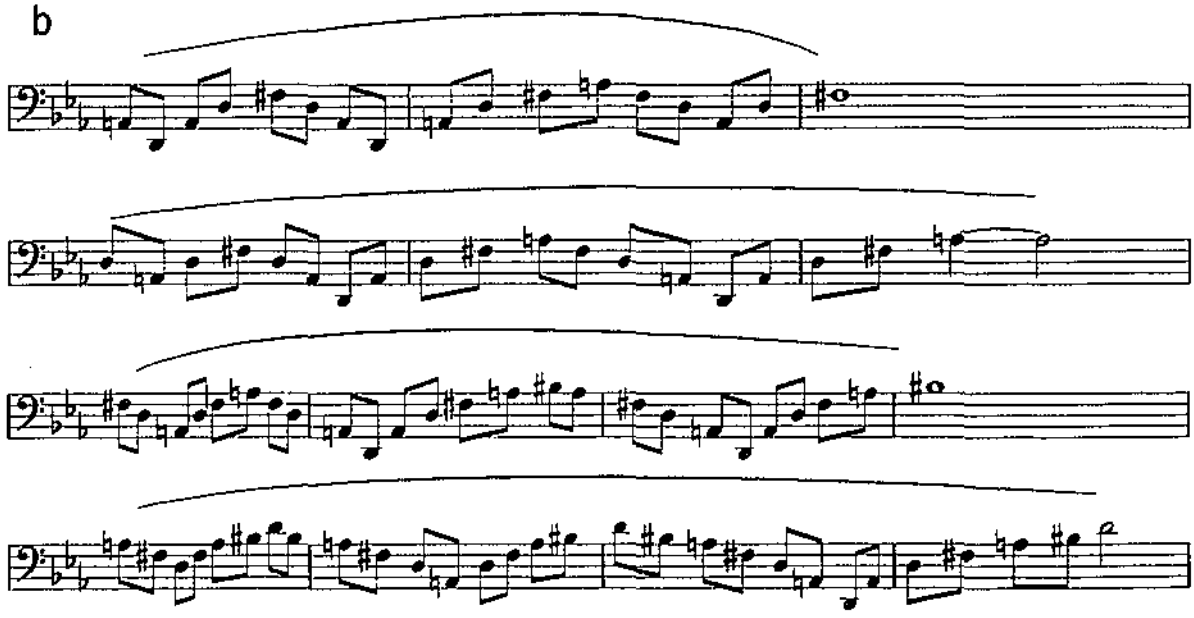

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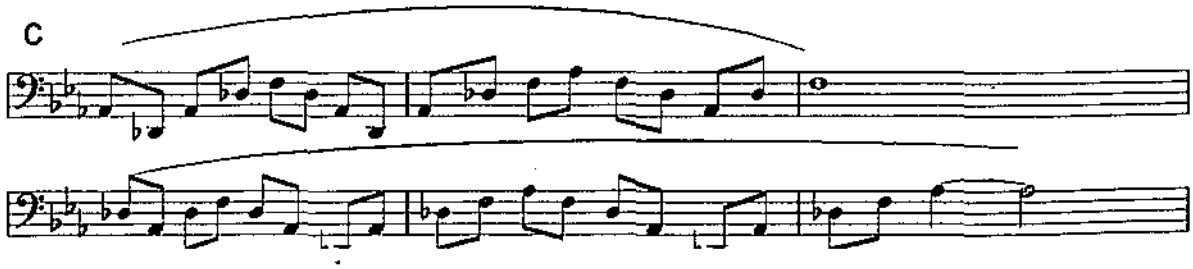

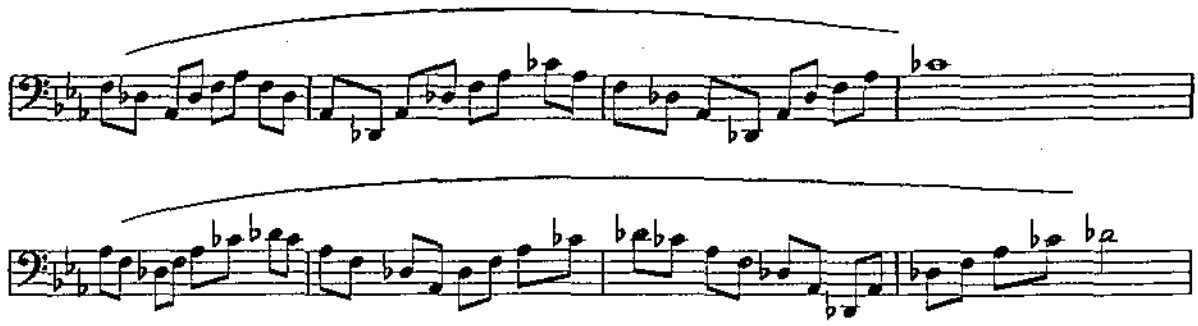

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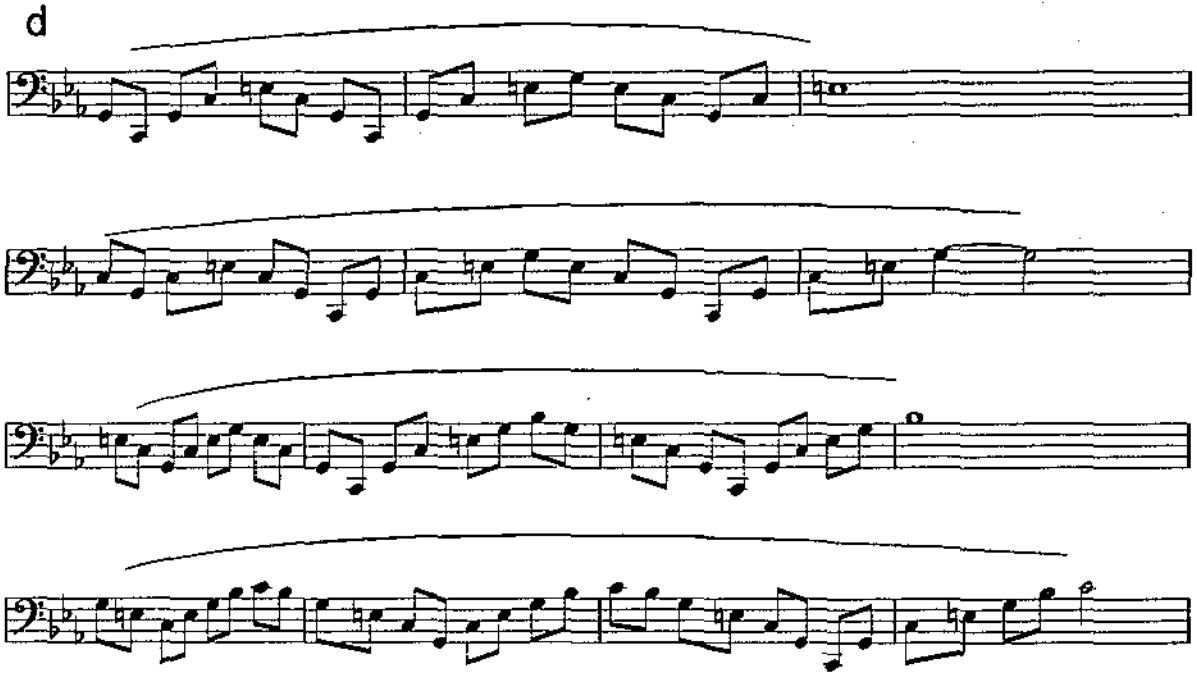

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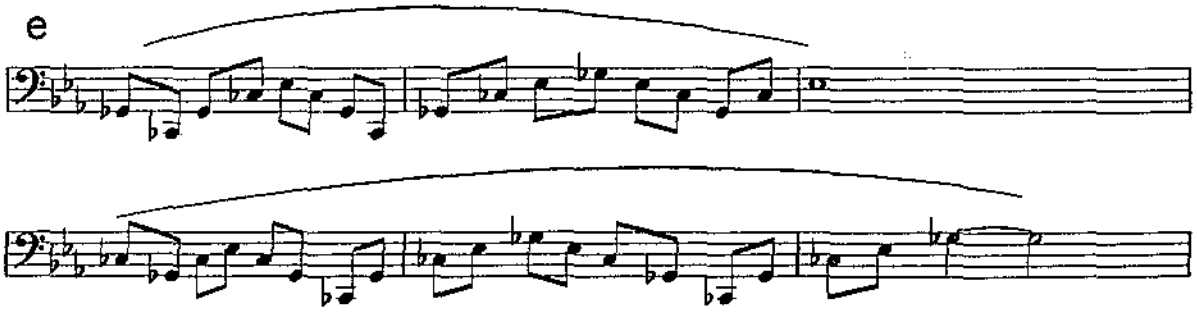

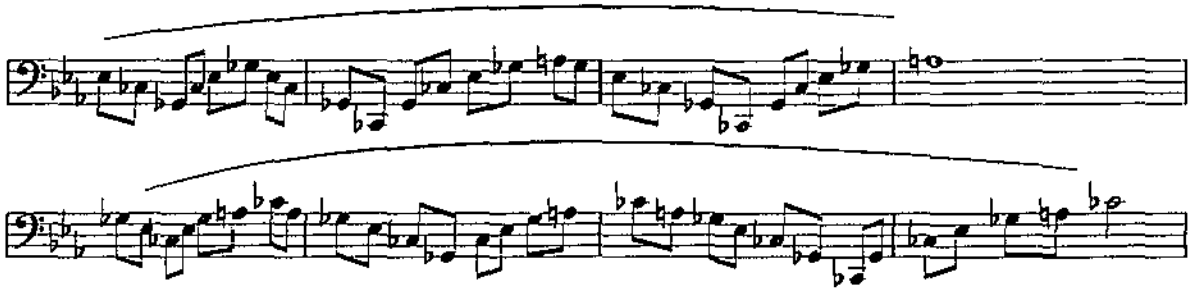

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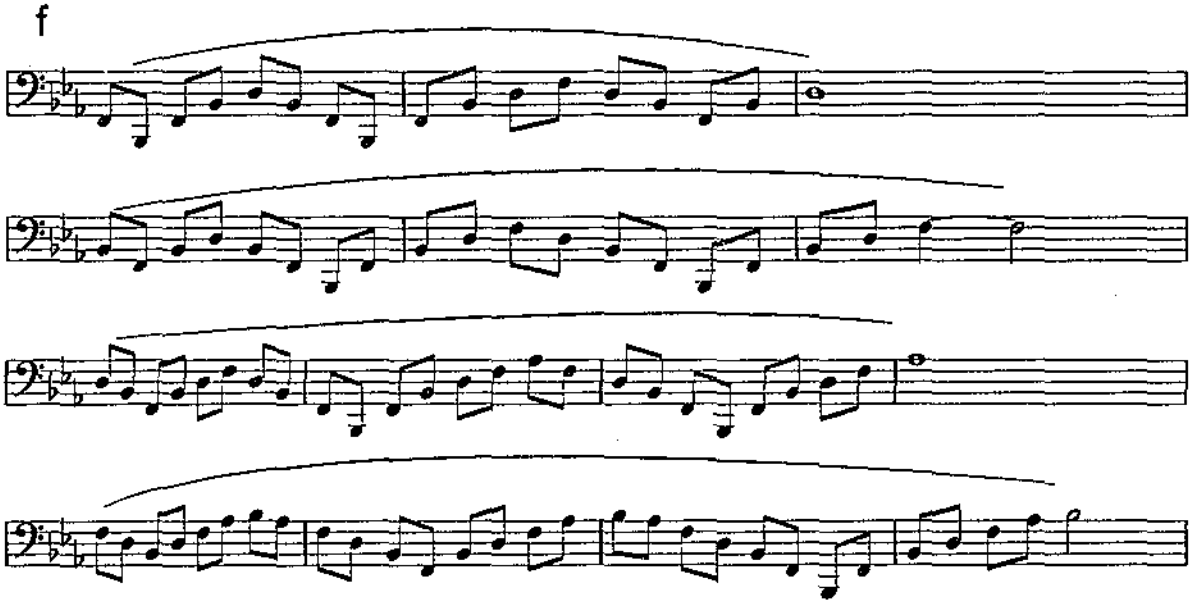

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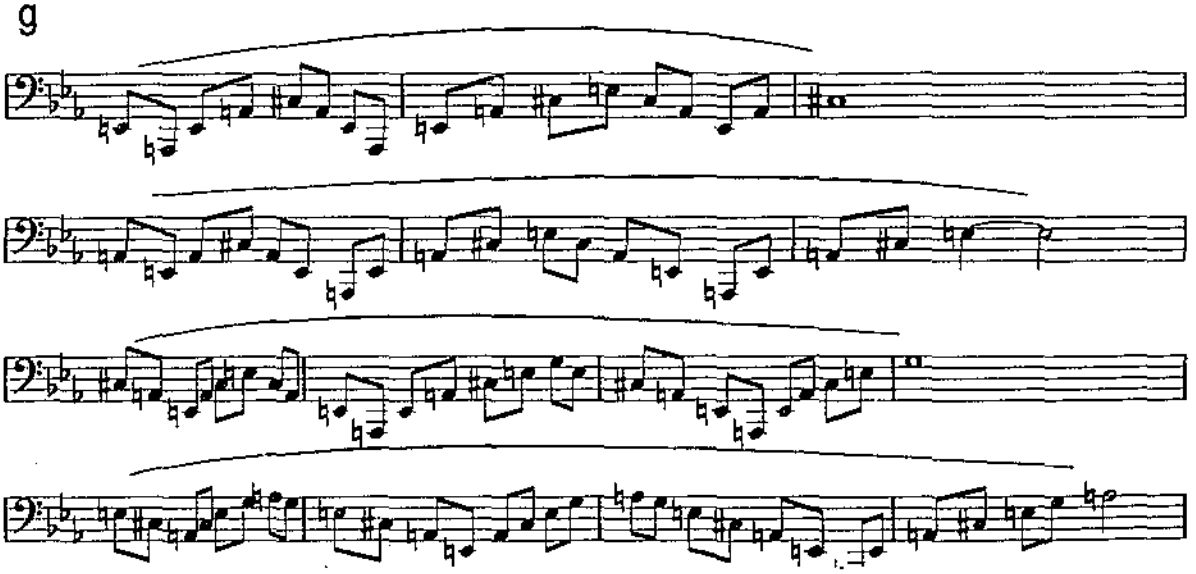

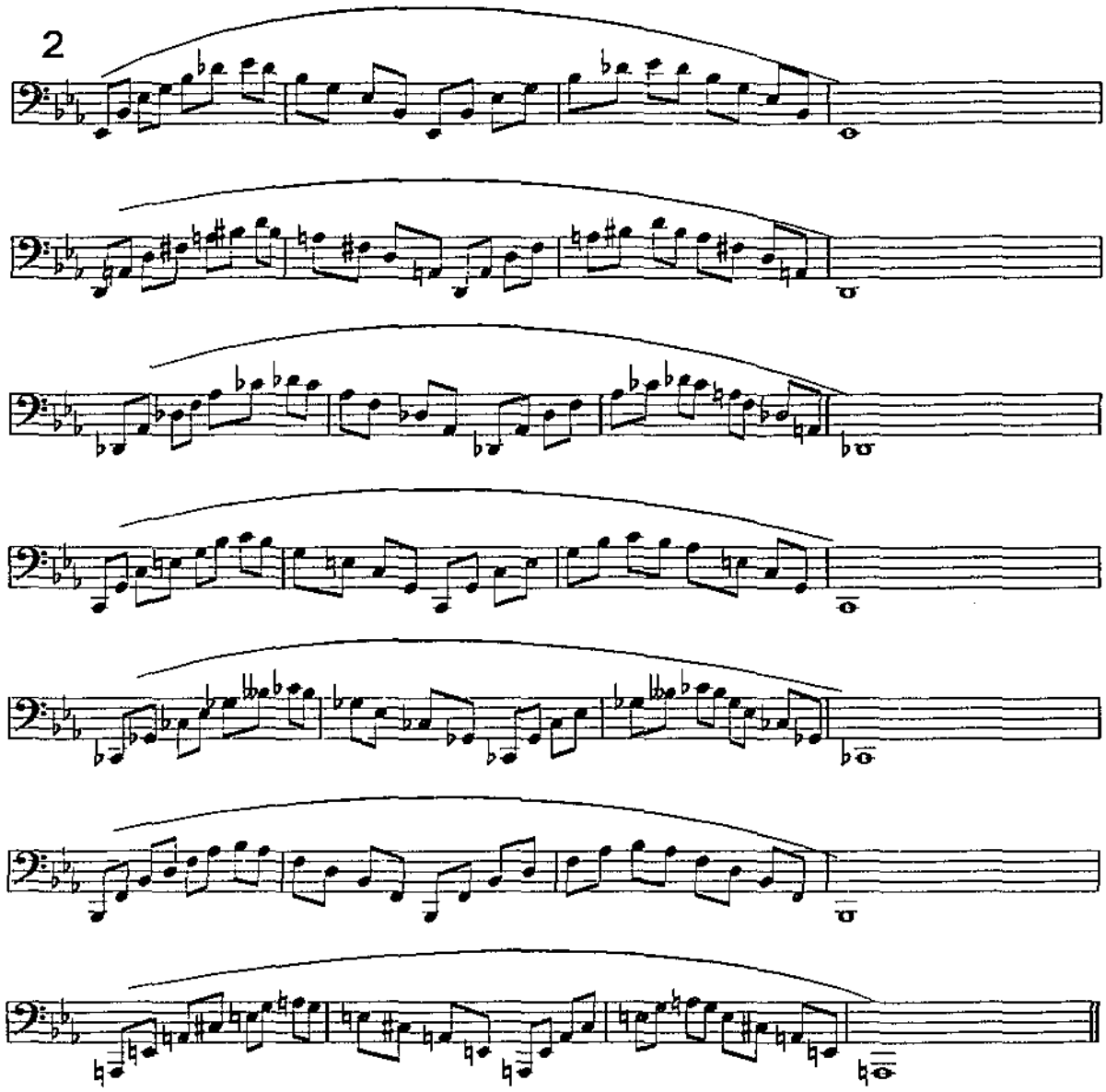
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