REPUBLIC OF AZERBAIJAN

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ABSTRACT

of the dissertation for the degree of Doctor of Philosophy

THE NECESSITY FOR THE RESTORATION, IMPROVEMENT AND CREATION OF NATIONAL MUSICAL INSTRUMENTS: PROBLEMS, PROSPECTS

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Field of science: Art Study

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GENERAL CHARACTERISTICS OF THE DISSERTATION

Relevance and the degree of scientific development of the topic. The improvement, restoration and creation of Azerbaijani national musical instruments, their popularization and use occupy one of the important places in the preservation of cultural heritage and its transmission to future generations. The Development Concept "Azerbaijan – 2020. Vision to the Future" approved by the President of the Republic of Azerbaijan Mr. Ilham Aliyev on December 29, 2012, sets out a conceptual approach to the preservation and effective management of cultural heritage. As a result, a number of our national musical instruments have been included in the UNESCO's Representative list in recent years.

The study and popularization of the cultural heritage of the people have become global in the era of new revival of our culture. The improvement, restoration of our musical instruments and creation of new musical instruments, which are one of the main elements of our national cultural values, make up an important part of our musical culture.

As you know, our national musical instruments have played an important role in the development of the art of mugham, ashug creativity and national music in general and the preservation of performing traditions. The continuous misappropriation of several of our national musical instruments, and the periodic presenting these instruments by some peoples as their own on a global scale continues to this day. One of the issues is to preserve our national musical instruments, to reveal their uniqueness as a result of their restoration and improvement, and to determine their place, significance and role in the development of our national musical culture. In order to prevent our national and spiritual musical instruments and intangible cultural heritage from being misappropriated by foreigners, our main aim in the dissertation is to introduce our national musical instruments to the world. The creation of new rich musical instruments, the development of organology, the restoration and revival of forgotten instruments is a decisive and firm response to those who are trying to misappropriate our national culture.

Azerbaijani national musical instruments are closely associated with the historical development of the people and their culture. These instruments carry great spiritual energy. A new stage begins in the improvement of our national musical instruments in the most diverse periods of our history, in periods when national self-awareness processes are reflected in the cultural sphere, especially in the 20th century. The restoration of musical instruments on scientific-theoretical and scientific-practical basis has gained ground since the 1990s. Ancient musical instruments have been studied and restored based on a number of written sources, archaeological and fine art works. The Scientific Laboratory "Restoration and Improvement of Ancient Musical Instruments", which began operating at the Baku Music Academy named after U.Hajibeyli in 1991-1992 led by Majnun Karimov (1945–2013), has been doing great work for 30 years to bring back ancient musical instruments to modern performing art. The Research Laboratory "Improvement of National Musical Instruments" of the Azerbaijan National Conservatory has also been functioning for more than twenty years. Doctor of Arts, Professor Abbasgulu Najafzadeh (2003-2011), who headed the laboratory for many years, and Mammadali Mammadov, who was a researcher during 2010-2011 and has been the head of the laboratory since 2011, have improved a number of our widespread national instruments over the years, restored some ancient instruments and at the same time, carried out a number of reforms on previously restored instruments, as well as created new musical instruments.

The improvement and restoration of our national musical instruments in accordance with the requirements of the modern era and with the use of new technology, the accurate derivation of their measurement system and coefficients, and the development of state standards are among the urgent issues requiring comprehensive scientific study today.

National musical instruments, their history of creation and development began to be studied scientifically by the newly emerging science of organology in Azerbaijan in the 1960s. For the first time, researcher Saadat Abdullayeva (1940–2017) began to collect information about forgotten ancient instruments and

investigate them from a scientific point of view at that time. Besides researching the development history of the national musical instruments, Saadat Abdullayeva also provided detailed information about their appearance, dimensions, etc., and continued her research in this field, getting the degree of Doctor of Arts.

Majnun Karimov, one of Saadat Abdullayeva's students, began his work with the restoration of ancient musical instruments and restored 10 musical instruments – komuz, barbat, chagane, tanbur, rubab, nuzhe, cheng, rud, choghur and Azerbaijani santur in the field of organology. Majnun Karimov, who began his work in the field of organology with practical work on national musical instruments, concentrated his research in this field in his scientific works a few years later.

The scientific works by Avaz Rahmatov (1938–2006) and Fuad Azimli (1952–2011), PhDs in Art History, should be mentioned among the researchers working in the field of organology. Fuad Azimli did important work in the field of researching the names of our musical instruments and also studied national percussion instruments.

One of the researchers working in the field of organology in Azerbaijan and distinguished by his productive work is Doctor of Arts, Professor Abbasgulu Najafzadeh. He created an explanatory dictionary of musical instruments and conducted organological and historical research on national wind instruments and idiophones.

The researches by Uzeyir Hajibeyli (1885−1948)[1], Afrasiyab Badalbeyli (1907–1976)[2], Saadat Abdullayeva (1940-2017)[3], Gulnaz Abdullazadeh[4], Avaz Rahmatov (1938-2006)[5], Elkhan Babayev

[1] Hacıbəyli, Ü.Ə. Azərbaycan xalq musiqisinin əsasları / Ü.Hacıbəyli. – Bakı: Apastrof, – 2010. – 173 s.

[2] Bədəlbəyli, Ə.B. İzahlı monoqrafik musiqi lüğəti / Ə.B.Bədəlbəyli. – Bakı: Şərq-Qərb, – 2017. – 472 s.

[3] Abdullayeva, S.A. Azərbaycan xalq çalğı alətləri. Musiqişünaslıq-orqanoloji tədqiqat. / S.A.Abdullayeva. – Bakı: Adiloğlu, – 2002, – 454 s.

[4] Abdullazadə, G.A. Orqanologiya sahəsində milli musiqi alətlərinin bərpasında elmi nailiyyətlər // Azərbaycan milli musiqi alətlərinin patentlə mühafizəsi. – Bakı: Patent və Əmtəə Nişanları Mərkəzi, – 2017, – s. 41-46

[5] Rəhmətov, Ə.M. Azərbaycan xalq çalğı alətləri. – Bakı: İşıq, – 1975, – 64 s.

(1948–2003)[6], Fattah Khaligzadeh[7], Zakir Mirzayev, Ilham Najafov, Ahsan Rahmanli, Tarana Aliyeva, Aydin Aliyev, Seyran Gafarov (1969-2018) and other scientists reflected information on the science of organology, as well as the classification, development history, etymology, morphology of instruments, etc. of Azerbaijani folk musical instruments.

It should also be stated that a number of scientific problems have been raised and discussed in various scientific papers at symposiums, conferences and other events devoted to the study of musical instruments of Turkic-speaking peoples in Azerbaijan in recent decades. These materials were also included in the works related to the degree of development of the research.

The issues discussed at the scientific and practical conference "Azerbaijani National Musical Instruments: Our Past and Our Present" held in Baku in 2017, the research conducted in the field of organology, the detailed and complete coverage of valuable works, and the interesting papers and speeches provided us with great support in our research[8]. A number of speeches included in this collection reflect new ideas in the field of organology by Doctor of Science, Professor Kamila Dadashzadeh, Doctor of Science, Professor Abbasgulu Najafzadeh, Doctor of ScienceAlla Bayramova, PhD in Art Study, Professor Lala Huseynova, PhD in Art Study Maya Gafarova, People's Artist Siyavush Karimi.

The research work we have been conducting regularly for many years at the Scientific research laboratory "Improvement of National Musical Instruments" of the Azerbaijan National Conservatory on the improvement, restoration and invention of new instruments of national musical instruments has been reflected in the

[6]Babayev, E.Ə. Şifahi ənənəli Azərbaycan musiqisində intonasiya problemləri / E.Ə.Babayev. – Bakı: Elm, – 1998. – 146 s.

[7]Xalıqzadə, F.X. Ağalar Əliverdibəyovun musiqişünaslıq fəaliyyəti haqqında // – Bakı: Musiqi dünyası, – 2001. № 1-2, – s. 30-32.

[8]Azərbaycan milli musiqi alətlərinin patentlə mühafizəsi // "Azərbaycan milli musiqi alətləri: Keçmişimiz-bugünümüz" elmi-praktik konfransının materialları əsasında hazırlanıb. Tərtib edəni və layihə rəhbəri: Şərif Kərimli. – Bakı: Patent və Əmtəə Nişanları Mərkəzi, – 2017, – 172 s.

book “Improvement of Azerbaijani Folk Musical Instruments” published in 2018[9].

Research object and subject. The object of the research is several national musical instruments belonging to the idiophone, aerophone, membranophone and chordophone groups, which the applicant restored or improved, as well as invented.

The subject of the presented research is the restoration, improvement and creation of new musical instruments involved in the research, as well as the theoretical and experimental study of these instruments.

The improvement, restoration of Azerbaijani national musical instruments and creation of new instruments are also carried out in connection with a number of technical science fields – physics, mathematics, geometry, strength of materials and other fields. Therefore, for the first time, the main subject of the research is the determination of the ratio coefficient of the measurement systems of instruments, the determination and coefficientization of physical and geometric parameters, the development of schemes and projects, and the expansion of the sound range.

Research aim and objectives. The main aim of the presented research work is to elucidate each of the national musical instruments improved, restored and newly created by us as the head of the Scientific research laboratory “Improvement of National Musical Instruments” operating at the Azerbaijan National Conservatory and to investigate their structure and the size system of their parts on a scientific basis. These instruments were created on the basis of strict regularities. Undoubtedly, there are scientific bases that condition the creation of these instruments and create the basis for their existence. As we know, our existing national musical instruments have a certain sound range, which is mainly two and a half octaves. It is necessary to improve musical instruments with a small sound range and expand their sound range. The second issue is to create different types of these instruments. The new musical instruments are based on the achievements of modern technology.

[9] Məmmədov, M.M. Azərbaycan xalq çalğı alətlərinin təkmilləşdirilməsi. – Bakı: Red. N.Line, – 2018, – 236 s.

At the same time, the laws of physics, mathematics, geometry, strength of materials and other technical sciences are used to solve problems related to the improvement of national musical instruments.

Summarizing above, the main aim of our research is to restore forgotten musical instruments, to improve and to create new, modern instruments that meet the requirements of the time, and the solution of the problems arose during this process.

The objectives of the research are following:

- Highlighting the work carried out in the field of improvement and restoration of national musical instruments, creation of new instruments at the Azerbaijan National Conservatory;
- Research on the problems of improving musical instruments and ways to solve them;
- Applying the laws of technical sciences on a scientific basis in solving problems related to the improvement of national musical instruments;
- Investigating the physical processes occurring in the sound of stringed musical instruments and studying them scientifically;
- Determining the measurement systems of stringed musical instruments (tar, kamancheh, saz) scientifically, conducting research on the ratio coefficient and geometric parameters;
- Creating new family of instruments (tar, saz, kamancheh, yektay) and coefficientization of musical instruments in order to expand the sound range of these instruments;
- Eliminating the problem of low sound effect of instruments, rapid getting out of tune, expanding the range to 7 octaves;
- Creating a measuring table and scheme of improved, restored and newly created musical instruments;
- Carrying out constructive work to improve the sound effect of instruments;
- Creating a form that meets the performance requirements in the modern era by eliminating the shortcomings of previously restored musical instruments;
- Using new materials in the manufacture of instruments;
- Creating modern electronic versions of national musical instruments;

- Creating of bam (bass) and contrabass instruments;
- Creating new percussion instruments used in the national military orchestra;
- Investigating the distinguished peculiarities of new musical instruments created based on physical and mathematical laws from ancient instruments.

Solution of a number of other objectives is also required to achieve the set aim:

- Investigating the physical processes occurring in the sound of stringed musical instruments and studying them scientifically;
- Determining the ratio coefficient of tar, kamancheh and saz musical instruments;
- Determining modern measurement units for restored musical instruments;
- Creating forms of national musical instruments that meet the performance requirements of modern times;
- Stage-by-stage examining instruments involved in improvement;
- Determining the practical directions of action of these instruments;
- Comparatively investigating some similar musical instruments;
- Determination or standardization of coefficients of musical instrument.

Research methods. The presented dissertation work is based on a complex research method. The methods of analysis, accepted in organology, as well as the method of comparative analysis of similar musical instruments were used in the research process. The dissertation is based on a complex method of research on historical and theoretical issues related to organology.

The scientific researches of Azerbaijani organologists – S.Abdullayeva, M.Karimov, A.Najafzadeh, V.Abdulgasimov and others have been referred in the research work. At the same time, some historical sources are taken as a basis.

Since the research is conducted from the point of view of organology, the main points of the classification and theoretical concept of the Hornbostel-Sachs system are given priority.

While working on the dissertation, we used the scientific works of medieval Azerbaijani scientists Abu-Nasr al-Farabi (870−950), Safi al-Din Urmawi (1216−1294), Abdulgadir Ibn al-Hafiz Qeybi Maraghali (1353−1435), and in later stages Mir Mohsen Navvab (1833−1918), Agalar bey Aliverdibayov [10] (1880−1953), Uzeyir bey Hajibeyli, Mammadsaleh Ismayilov[11] (1912−1994), Saadat Abdullayeva, Majnun Karimov, Fuad Azimli, Abbasgulu Najafzadeh and other musicologists, and benefited from their methods. At the same time, we paid attention to the works of musicologists-scholars working in other fields – Ulviyya Imanova, Imruz Efendiyeva, Lala Huseynova, Akif Guliyev, Sona Ibrahimova, Alla Bayramova, Aytaj Rahimova and others, and we use some of their methodological styles at certain points.

A number of works by fraternal Turkish scientists – Ayhan Sari[12], Murat Bardakchi[13], Bahaeddin Ogel[14], Temel Hakki Kara Hasan[15], Rauf Yektabey[16] and others have been the focus of our research.

At the same time, we have also used the works of other foreign authors, including T.S. Vizgo[17], P.Vostrikov[18],

[10] Əliverdibəyov, A.Ə. Rəsmli musiqi tarixi. Transliterasiyası, tədqiqi və lüğətin tərtibçisi: A.Xəlilova. – Bakı: Şuşa, – 2001, – 232 s.

[11] İsmayılov, M.C. Azərbaycan xalq musiqisinin janrları / M.C.İsmayılov. – Bakı: İşıq, – 1984. – 100 s.

[12] Sarı, A. Türk müziği çalgıları (ud, tanbur, kanun, kemençe, ney, kudum) / A.Sarı. – İstanbul: Berdan matbaası, – 2012. – 276 s.

[13] Bardakçı, M.G. Maragalı Abdülkadir / B.Ögel. – İstanbul: PanYayıncılık, – 1986, – 200 s.

[14] Ögel, B. Türk kültür tarihine giriş [10 ciltde] / B.Ögel, – Ankara: Başbakanlık Basımevi, – VIII c. – 1987. – 486 s. Ögel, B. Türk kültür tarihine giriş [10 ciltde] / B.Ögel, – Ankara: Başbakanlık Basımevi, – IX c. – 1987. – 393 s.

[15] Karahasan, T.H. Çalgıların dili – musiki sözlüğü / T.H.Karahasan. – İstanbul: Bestem Yayıncılık, Köksu Metbeecilik senaye ve ticaret, – 1999. – 174 s.

[16] Yektabey, R. Kafkasyada musiki. // "Şehbal" dergisi, №59. – İstanbul: – 1912, – s. 210.

[17] Вызго, Т.С. Музыкальные инструменты Средней Азии. Исторические очерки / Т.С.Вызго. – Москва: Музгиз, – 1980, – 190 с.

[18] Востриков, П.П. Музыка и песня у азербайджанских татар // Сборник материалов для описания местностей и племён Кавказа. – Тифлис: Вып. 42, –1912, – с. 1-34

S.Levin[19], O.Matyakubov[20], A.Panayotov[21], A.Modr[22], A.Oleari[23], A.Semyonov[24], S.Speranski[25], etc.

Since the research work is directly related to physics, mathematics, geometry, strength of materials and other fields of technical science, their methodology was also taken as a basis. The investigation of physical processes occurring in the sound of musical instruments was carried out on scientific basis. This methodology was most often used in string musical instruments. We are based on a number of laws of physics, methods of application of mathematical calculations.

The main defended points represent the important results of the research and are listed as following:

- The improvement and restoration of national musical instruments, as weel as the creation of new instruments are among the priority fields at the Azerbaijan National Conservatory;
- The regularities of technical sciences are of great importance in solving problems related to the improvement of national musical instruments;
- The ratio coefficients and geometric parameters are based on the defined measurement systems of string musical instruments (tar, kamancheh, saz);

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[19] Левин, С.Я. Духовые инструменты в истории музыкальной культуры [в 2 частях] / С.Я.Левин. – Ленинград: Музыка, – ч.1. – 1973, – 264 с.; Левин, С.Я. Духовые инструменты в истории музыкальной культуры [в 2 частях] / С.Я.Левин. – Ленинград: Музыка, – ч.1. – 1983, – 190 с.

[20] Матякубов, О.Р. Фараби об основах музыки Востока (tərcümə: Fərabi Şərq musiqisinin əsasları haqqında) / О.Р.Матякубов. – Ташкент: ФАН, – 1986. – 88 с.

[21] Панайотов, А.Н. Ударные инструменты в современных оркестрах / А.Н.Панайотов. – Москва: Советский композитор, – 1973. – 182 с.

[22] Модр, А. Музыкальные инструменты / Модр, А. Пер. с чеш. Л.А.Александрова. – Москва: Музгиз, – 1959. – 322 с.

[23] Олеарий, А.М. Подробные описание путешествия Голштинского посольства в Московию и Персию в 1633, 1636 и 1639 годах / А.М.Олеарий. Пер. с нем. П.Барсова. – Москва: Моск. Ун-ская типография, – 1870. – 1038 с.

[24] Семёнов, А.А. Среднеазиатский трактат по музыке Дервиша Али (XVII век). Сокращенное изложение персидского (таджикского) текста / А.А.Семёнов. – Ташкент: – 1946. – 84 с.

[25] Сперанский, С.Л. Музыкальные товары / С.Л.Сперанский. – Москва: Экономика, – 1987. – 176 с.

- The creation of the family of instruments such as tar, saz, kamancheh and yektay is aimed at increasing the range of sound in orchestras and ensembles;

- The problem of low sound effect of instruments and rapid getting out of tune is the result of non-observance of physical and geometric laws in their structure;

- The use of improved, restored and newly created musical instruments in ensembles and orchestras gives rise to new and interesting ideas;

- Our elimination of the defects of restored musical instruments meets the requirements of modern performers.

Scientific novelty of the research. For the first time, the laws of technical sciences were used in the research work to solve the problems related to the improvement of national musical instruments. Our ancient musical instruments, which are considered the pearl of culture, reflect the customs, social lifestyle, everyday life, aesthetic taste and genetic memory of our people. The structure, range, materials from which our national musical instruments made have passed a very complex and long-stage development, and their acoustic capabilities have been comprehensively studied in the research works of many organologists. For the first time, the determination of the ratio coefficient of the sizes of our national musical instruments, as well as physical and geometric parameters are studied in our research work.

- Drawings and size tables of all instruments mentioned in the research work have been presented for the first time;

- For the first time, the creation, structure and development of instruments belonging to the tar, kamancheh, saz and yektay families have been clarified through mathematical calculations, and a measurement system has been defined in this research work;

- A number of renovation works have been carried out to solve the problems such as getting out of tune and improving the sound effect of the instruments;

- For the first time, new electronic versions of national musical instruments (electro kamancheh, electro musical instrument “Qoç”, bam electro cylinder kamancheh, etc.) have been created;

- The sizes of the parts are obviously indicated during restoring instruments, specific sizes of which were not given;

- The author created a number of new percussion instruments and gave explanations about their structure.

Theoretical and practical significance of the research. The musical instruments, which the applicant developed, restored, improved and created newly, have already used in performing practice and are performed in ensembles, and even a special ensemble ("Əsrlərin səsdası") consisting of these instruments has been created under the National Conservatory. Several composers have composed works for this ensemble. For example, composer Firudin Allahverdi composed "Uzaqlardakı vətən" ("Far Away Homeland"), Rufat Khalilov composed "Heydarnameh", associate professor Aliya Mammadova composed "Passakalya" ("Passacaglia"), Ayaz Gambarli composed "Naxışlar" ("Patterns"), Farid Fatullayev composed "Cəngi" ("Jangi") for the orchestra of folk musical instruments.

The main points and results of the dissertation are used as auxiliary supplies in the teaching of the subject "Organology" at the music faculties of higher music education institutions of the Republic. We would like to state that we teach the subject of "Development of Musical Instruments" and teach our research work to students at the Republican Art Gymnasium.

A number of the author's researches presented in the dissertation were collected in the book "Improvement of Azerbaijani Folk Musical Instruments" written in 2018. This book is intended for teachers, students of music education institutions, organologists, masters, performers and a wide readership.

Approbation and use. Most (about seventy) of the improved, restored and newly created musical instruments have been registered with the Copyright Agency and the Intellectual Property Agency and confirmed by certificates.

The main results and points of the research work were reflected in articles published in periodical scientific editions of Azerbaijan, as well as in countries such as Kazakhstan and Turkey, which are included in the international abstracting and indexing system. Papers on the topic have been presented at many scientific and theoretical

conferences. The author's researches in the field of our national musical instruments were published in the book "Mammadali Mammadov's Work in the Improvement of Our National Musical Instruments" by A.M.Rahmanli (Baku: Ed. N.Line, 2016, 158 p.).

The name of the institution where the dissertation work was performed. The dissertation was completed at the Department of "Ethnomusicology" of the Azerbaijan National Conservatory.

The total length of the dissertation with a character indicating the length of the structural sections of the dissertation separately. The dissertation consists of the structural sections – Introduction, four Chapters (each chapter has several paragraphs), Conclusion, List of References and Appendices. "Introduction" consists of 11 pages, 17121 characters, Chapter I consists of 37 pages, 65405 characters, Chapter II – 27 pages, 41277 characters, Chapter III – 30 pages, 45916 characters, Chapter IV – 20 pages, 31253 characters, and "Conclusion" – 16 pages, 25254 characters. The total length of the research work, excluding the "List of references" and "Appendices", consists of 139 pages and 229550 characters.

THE MAIN CONTENT OF THE DISSERTATION

The relevance and degree of development of the topic are substantiated, and the main defended points are determined in the **Introduction** of the dissertation. A number of new principles that form the basis of the main methodology of the research, and according to this, the scientific novelty of the research are explained, and the theoretical and practical significance of the research is determined.

The Chapter I of the dissertation is called **"Musical instruments – as carriers and transmitters of national sound stereotypes"**. This chapter consists of three paragraphs.

The first paragraph is called **"Musical instruments as an object of scientific research"**. The important research conducted in the field of organology, which is an important branch of musicology in Azerbaijan, is discussed in detail this paragraph. As an introduction to the interpretation of this topic, a brief reference is

given to the classification system (E.Hornbostel, K.Sachs, Hans-Heinz, Dreger, Igor Matsievsky system) of instruments, which is one of the main fields of organology.

This paragraph provides some information on interesting thoughts and opinions about our national musical instruments by great composer, scientist, musicologist Uzeyir Hajibeyli, who made important contributions to the establishment of the science of organology in Azerbaijan, as well as his accurate statements about his scientific articles. Besides the research of scientists working in the field of organology, which has a history of 60 years, brief information is given about musical instruments of Safi al-Din Urmawi, who created the scientific theory of Eastern music in the Middle Ages, Abd al-Qadir al-Maraghi, as well as Mir Mohsen Navvab, who was an encyclopedist scientist of the 19th century. These issues are raised for a reason. As you know, today, research conducted in several directions in the field of organology, i.e. the study of source materials, observing musical instruments from the context of terminology and etymology, restoration of instruments, improvement and creation of new instruments and finally, the study of the size and acoustics of musical instruments refers mainly to the treatises of medieval scientists.

The second paragraph of Chapter I of the dissertation is called **"On the fields of organology in Azerbaijan"**. This paragraph considers several stages in the development of the science of organology. The first stage covers the 60-70s of the 20th century. This initial stage is mainly associated with the names of the prominent scientist, composer Afrasiyab Badalbeyli, the first scientific specialist in the field of organology of modern national musicology Saadat Abdullayeva, and Avaz Rahmatov. The development history of our national musical instruments, their structure and musical-acoustic characteristics are investigated in these historical and theoretical studies, based on medieval musicologists, scientific articles by U. Hajibeyli and reconstruction work conducted by a number of performers. Saadat Abdullayeva's scientific researches based on various sources provide detailed information about 60 string, wind, percussion and idiophonic musical

instruments that were widespread in Azerbaijan in ancient and medieval times.

The fundamental research work "Explanatory Monographic Dictionary of Music" by the encyclopedist-scientist Afrasiyab Badalbeyli, who made great contributions to the first stage of the development of organology, also provides some interesting information about our ancient musical instruments.

Candidate of Art History Avaz Rahmatov classified various instruments into four groups (with pick, bow, wind, percussion) in his researches on folk musical instruments.

We have also mentioned the valuable services of some performers – tar player Ahmad Bakikhanov, Kamil Ahmadov in the field of organology in this paragraph.

The second stage in the development of organology is the last two decades of the 20th century – the 80s-90s. At this stage, organologist Saadat Abdullayeva's scientific work expanded and became more profound. The researcher worked on the issues of the historiography of folk musical instruments in the 90s.

As you know, a Scientific research laboratory for the restoration of ancient musical instruments was opened at the BMA named after U.Hajibeyli in 1991, and Majnun Karimov was appointed its head. The research conducted in this laboratory, which is engaged in the restoration of forgotten instruments, the expansion of the technical and performance capabilities of a number of instruments, the collection of information about ancient musical instruments and many other studies, has contributed to the emergence of new branches of organology. The research of Professor Saadat Abdullayeva, Fattah Khaligzadeh, Majnun Karimov, as well as the candidate of physical and mathematical sciences Shamil Hajiyev, who worked in the laboratory, a number of researchers who were attracted here later, as well as a number of ancient musical instruments restored and improved in the laboratory have provided important support for the development of organology. M.Karimov's researches conducted in the field of organology in the 90s of the last century, his restored musical instruments and especially his classification of folk instruments into three groups are of particular

interest. M.Karimov divided instruments into three groups: stringed, wind, idiophonic and percussion instruments. Four groups are shown within string instruments – with pick, bow, fingering (plucked) and percussion instruments. Wind instruments are classified according to their playing style as − with mouthpiece, without mouthpiece, and bellows (with skin). Finally, the classification of percussion instruments is given as following – membranophone, idiophone, and ideo- membranophone.

The researches by Fuad Azimli, PhD in Art History, in the field of organology in the 80s and 90s of the last century are also of particular interest. The research work "The names of our musical instruments" conducted by Fuad Azimli, who conducted research by referring to the treatises of some of medieval scientists, the researches by U. Hajibeyli, A. Badalbeyli, historical sources of Turkic-speaking peoples and written literature, with the suggestion and support of Honored Journalist Osman Mirzayev is the first attempt in the field of chrematonymy.

The researches conducted by some performers in the second stage of the development of organology are also of particular significance. Formerly a tar player, a well-known teacher, PhD in Art History, Professor Vagif Abdulgasimov referred to the scientific propositions of some European and Eastern scientists – Harvard University professor Ella Zonis, French musicologist, Professor Jean During, Yevgeny Bertels, Ruhulla Khalegi in his research work "Azerbaijani Tar".

The third stage in the development of organology began in the 2000s. Professor Saadat Abdullayeva's scientific work expanded greatly at this stage, and her achievements, which were the result of her forty-year research in this field, were collected in the work "Azerbaijani Folk Musical Instruments (musicology-organological research)", published in 2002. The author stated the existence of 88 folk musical instruments (32 string, 23 wind, 16 percussion, 17 idiophonic) in the territory of Azerbaijan at different times.

Many of the researches conducted in the third stage of the development of organology in Azerbaijan are associated with the name of the famous scientist Abbasgulu Najafzadeh. The scientist's

work in the field of ethnoorganology should be specially emphasized. A. Najafzadeh studied folk musical instruments in terms of ethnoorganology and prepared a textbook for teaching the subject of "Ethnoorganology" in higher schools for the first time in Azerbaijan. The field of ethnoornalogy, which was first substantiated as a new term in the 80s of the last century by I.V.Matsiyevski, studies the history of the creation of folk musical instruments, their etymology, morphology, archeology, linguistic sources and ancient miniatures.

A.Najafzadeh headed the Laboratory of national musical instrument under the AMC during 2005-2010 and was directly involved in the restoration and improvement of several instruments. He represented our culture at folklore festivals held abroad as a skilled performer of a number of instruments.

A number of conferences, round tables and symposiums have been held in the field of studying, researching and restoring national instruments, and creating new instruments in Azerbaijan since the beginning of the 21st century. Interesting papers were presented around new directions in the study of our national musical instruments at these large-scale events. The second paragraph of the research provides some information about this.

The third paragraph of the first chapter of the research work deals with the work carried out on the improvement and restoration of national musical instruments at the AMC. This paragraph also deals with the work of the Laboratory of "Improvement of national musical instruments", which was established under the AMC in 2003 and headed by Abbasgulu Najafzadeh till 2010 and has been headed by us since that year. Besides the restoration of some instruments, the laws of physics, geometry and other technical sciences are applied to solve problems related to their improvement in this laboratory. The main aim of improving instruments in the laboratory is to eliminate some of the defects that hinder performance due to their performance characteristics, expanding the sound range of instruments, increasing their resistance to moisture, eliminating difficulties in tuning and achieving a more effective sound.

The Chapter II of the research work is called **"Problems of improving widespread string musical instruments and ways to solve them"**. The introduction to Chapter II of the dissertation deals expanding the range of the instruments (especially tar and kamancheh) to four octaves by altering the sound intensity (with decibels) and its frequency (with hertz) in the improvement of string musical instruments, and their ability to give the timbre of some European instruments. The main aim of these improvement works is to bring national musical instruments to the same level as symphony orchestra instruments. The introduction to Chapter II also deals with the contributions by Mirza Sadig Asad oglu and Barham Mansurov, who made important improvements to the tar, as well as the innovations they brought to the instrument.

The first paragraph of Chapter II is devoted to the basic principles of the improvement process on widespread string musical instruments. For the first time, information is provided on defining the ratio coefficient of the sizes of these instruments, as well as on researching in the direction of their physical and geometric parameters. The research deals with the problems of preventing strings from getting out of the tune in tar, saz and kamancheh, and adjusting strings mechanically based on the laws and provisions of physics, mathematics, geometry, strength of materials and other technical sciences. The vibration of strings, sound waves and sound frequency are clarified. The changes in the octaves of the vibration frequencies and the diameters of the strings are looked through in the tables. As a result of experiments conducted in the laboratory, the accuracy of the arrangement of sounds on the plane is determined by applying coefficients.

The second paragraph is called **"Improvement of various types of tar according to their sizes"**. The measurement system of secular, mensurate and string sizes applied in the scientifically creation of each instrument belonging to the tar musical instrument family (professional tar, student tar, small tar, bass tar, contra tar) is used, here. The size of 100 tars was recorded in the laboratory for the study. Some of them are owned by prominent tar players Haji Mammadov, Agasalim Abdullayev, Mohlat Muslimov, Ramiz

Guliyev, Rafig Musazadeh, as well as a number of well-known tar players. Improved types of tar were registered with the Copyright Agency in 2017. The improvement process also led to several other changes. For example, the new method of winding the wounds in the arrangement of the tar membranes, increasing the resistance of the ashikhs (pegs) to moisture, eliminating the difficulties in tuning the strings, etc.

The third paragraph of Chapter II deals with the improvement work carried out on the kamancheh musical instrument and the creation of the kamancheh family (orchestral kamancheh, improved bam kamancheh, contra kamancheh, student kamancheh, zil (high-pitched) bam kamancheh). As in the first paragraph, the new reforms are also based on precise mathematical calculations here. The problems such as two-sided pinching of the resonance box, getting out of tune, etc. in the instrument are solved in this paragraph.

The fourth paragraph of Chapter II is called **"Defining the measurement systems of the musical instrument and improvement work"**. A brief introduction to the history of the creation of the saz is given here. Then the purpose of the improvement work on the saz is clarified. In other words, since each master has his own template for making a musical instrument, which creates a different measurement system, it became necessary to define the measurement systems of all members of the saz family. Therefore, the sizes and coefficients of the parts of each instrument (1/4 saz, middle saz, main saz) included in the family have been defined.

The fifth paragraph is called **"Improvement of the qanun musical instrument"**. The work carried out to eliminate the tinkling sounds in the instrument is discussed here.

The sixth paragraph of Chapter II deals with improved wind instruments – zurna, ney, balaban set and pipe set. As a result of the improvement of the zurna, its range has been expanded, and conditions have been created for the easy achievement of some sounds that are difficult to play.

Finally, the last seventh paragraph of this chapter summarizes the results obtained in the improvement of folk musical instruments. It is stated that the family of the tar (small tar, student tar, orchestral

tar, bam tar, bass tar and contra tar), our national musical instrument, was created; the coefficients of the orchestral tar were defined and its standard was developed; the sizes and standards of the parts of the entire tar family were defined using the coefficients we obtained in the orchestral tar; the bowed tar was developed using the resonance box (sound box) of the student tar, and the bam bowed tar was developed using the resonance box of the orchestral tar. At the same time, the coefficients and the measurement system of the orchestra (professional) kamancheh were defined and the standards of the instrument were developed; the kamancheh family (student kamancheh, orchestral kamancheh, bam kamancheh, kamancheh with double resonance box, contra kamancheh with double resonance box) was created based on the coefficients we obtained for the orchestral kamancheh and the measurement system of each family member was defined; many musical instruments of kamancheh origin were first developed and then improved, including the Karabakh kamancheh, zil-bam kamancheh, double-cylinder kamancheh, etc. Each of these instruments has its own unique sound timbres. According to the results of the saz instrument, the sizes and standards of its parts were defined by determining the coefficients of the orchestral saz (medium saz); the measurement system of the entire saz family was defined using the coefficients of the orchestral saz (4/1 saz; 4/2 saz; 4/3 saz; 4/4 orchestral saz and main saz); the bam bowed saz was created using the resonance box of saz; the bowed saz musical instruments were created using the 4/2 resonance box of saz; the project for the contra saz musical instrument was developed using the coefficients of the saz musical instrument. The contra saz is currently used in the student orchestra of the AMC and the Philharmonic Orchestra of folk musical instruments. The results of work on qanun and wind instruments are also reflected in this paragraph. By making a constructive change in the resonance box of the qanun musical instrument, the sound effect, i.e. the mechanical waves are extinguished for a longer period of time. The sound range of the zurna musical instrument has been increased. Using the capabilities of the naghara (drum) musical instrument, the drum form for square was developed for playing in military national ensembles and orchestras.

The Chapter III of the dissertation is called **"Restoration and improvement of ancient musical instruments"**. This chapter consists of six paragraphs. The third chapter first deals with the sources on which ancient musical instruments are restored, and the first paragraph is called **"Historical basis of restoration work"**. The great contribution of the information provided in classical literature and the works of medieval musicologists to the restoration work is emphasised. The 2nd paragraph deals with the restoration of the yektay instrument and the development of its family. This ancient string musical instrument, played with a bow (kaman), was restored at the Scientific research laboratory of the AMC in 2019 and its new different types were created. Reference was made to Abd al-Qadir al-Maraghi's treatises and the medieval Tabriz artist Nizameddin Sultan Muhammad's miniature paintings during the restoration of this instrument. The etymology of the name of the instrument is scientifically investigated in detail in this paragraph and various sources, in particular, "Kitabi-Dede Korkud" are referred to.

When the yektay instrument was made, its resonance box was approached differently. We have created new types of yektay: 1. String yektay, 2. Tenor yektay, 3. Bass yektay, 4. Countra yektay, 5. Yektay with pick.

When the string yektay is played standing, a long endpin is used, and when played sitting, a small endpin on the knee (i.e. endpin of kamancheh) is used. The endpin of the bam yektay is adjusted depending on the height of the performer, and the size of the instrument is different. Since the pulling force of the strings of the bass-bowed yektay and the contra-bowed yektay is large, mechanical pegs are used. The bass bowed yektay is a musical instrument played with a pick on the knee. As a result of the restoration work carried out on the yektay, the instrument's range has exceeded three octaves.

The third paragraph explains the issues of restoring ancient string musical instruments with pick, bowed and idiophone musical instruments, including shahrud, dongar, ruhafza, shidirgi, Rum trentay, arghanun and pantur musical instruments. Information is provided about the tuning and size of the strings of each instrument. It is stated that the shahrud, restored based on the information

obtained from the works by A. Farabi (9th century) and A.Maraghi (14th century), as well as the research work by Abbasgulu Najafzadeh, was produced from a combination of oud and rud and assembled in a laboratory with a special construction. The sound range of the instrument is 3.5 octaves. The arghanun musical instrument was restored based on the research by Saadat Abdullayeva. The pegs of this instrument, which has a sound range of 2.5 octaves, are made of ebonite. The bam bowed arghanun instrument was also produced at the laboratory, the resonance box of which is made not of mulberry wood, but of walnut wood. The resonance box of the ruhafza and Rum trentay is also made of this material. The neck and pegbox of the pantur instrument are made of beech wood. The kaman (bow) instrument, which was widely used in Azerbaijan in the 12th-16th centuries, is mentioned among the idiophone instruments, and its restored sample is presented. The instrument consists of four parts - a bow, a peg for tying a rope, a jingle and a rope. This instrument was usually used by the lead dancer – yallibashi in the performance of the yalli dance.

The fourth, fifth and sixth paragraphs reveal the issues of improving the restored ancient musical instruments. First, the improvement work carried out on the golcha qopuz and ozan, as well as the chang instrument, was emphasized. Although the golcha qopuz (actually this is an ozan instrument) instrument was first restored by Majnun Karimov, since its parameters (physical, geometric measurement systems) were not set correctly by our masters, so further improvements were made to it. In order to get a profound sound in the instrument, a resonating hole was placed on it. At the same time, the number of strings in the chang instrument, restored by Majnun Karimov, was increased from 29 to 44, and compared to the previous instrument, condition for easy tuning was created as a result of the use of the laws of physics to keep it in tune. So, the range of the instrument was also expanded. It can be tuned chromatically and diatonically. In order not to get out of tune, the “Law of correlation of forces” was applied to the pegs.

Finally, the last sixth paragraph of this chapter is devoted to the improvement of restored string and bowed musical instruments -

barbat, rud, rubab, chaghanag. Although the yektay instrument was brought from China, it is shown that it belongs to the Turkic-speaking Uyghurs living in this country. Although the instrument has a small range, covering one octave, it has a chromatic scale.

The Chapter IV of the dissertation is called **"Results of experimental work on the creation of new instruments"**. This chapter consists of 2 paragraphs, each of which is dedicated to several newly created musical instruments. New stringed musical instrument with pick, bowed and wind instruments were presented in the first paragraph, and newly created percussion and idiophone instruments were presented in the second paragraph. As a result of numerous experiments conducted in the Laboratory of the "Restoration and improvement of national musical instruments" of the Azerbaijan National Conservatory, newly created musical instruments were registered with the Copyright Agency and approved with certificates. Each of these instruments has a unique structure and timbre and is intended not only as part of an orchestra, ensemble, but also as a solo instrument. The musical instruments created by us are followings: "Udmen", "Ay-Ulduz", a musical instrument called "Azerbaijan", "Sevgililer", "Urek", "Mohteshem", "Karabakh kamani", "Electro-kamancheh", "Taj shantur" percussion-string instrument, "Meydan-naghara", "Dordkunj davul" (drum), "Ikiuzlı zingirovlu qaval" (tambourine), "Shimshek", "Ilbiz". Detailed information is provided separately about these instruments, their structure, sizes and timbre of performance. Brief references are given about several new musical instruments created by us – Salyani (double-chambered bam sound musical instrument), hasa, "Koch" electric musical instrument, irs, esa (later renamed bowed electro-chelik with pick at the suggestion by Abbasgulu Najafzade) instruments.

Unlike the classic oud, the udman instrument has membrane and mugham membrane is also placed on it. This instrument has the third, fourth, fifth and sixth strings of the guitar, achieving acoustic and electronic sound. It is possible to place the note membrane by moving them on the beam (made of walnut wood, 43 cm long, 0.5 cm thick, and 4.3 cm wide). Mugham membrane is also placed on the Ay-ulduz string instrument. The first string of the four-stringed

musical instrument called “Azerbaijan” is taken from the tar, and the other three strings are taken from the I, II and III strings of the guitar. The mugham membrane is also inserted to the “Sevgililer” stringed musical instrument for a more perfect performance of mughams. The “Urek” musical instrument is designed on a resonance box that symbolizes the large resonance box of the tar, and this resonance box is shaped like a heart. The sound range of the instrument is 3 octaves. The “Mohteshem” musical instrument, which symbolizes the letter “M”, has 29 strings and 29 pegs, and besides the parts and sizes of the instrument, the history of its creation is also highlighted. Then, information is given about the Yayli ozan, the Karabakh kaman and the electro-kaman (ay kaman) instruments.

The second paragraph of Chapter IV deals with newly created percussion and idiophone instruments. These include a double-sided percussion instrument made of iron-bodied ceramic davul (drum), a double-sided bell qaval (tambourine), a triangle and a triangle with a high-pitched tone, a chovgan intended for the national military orchestra, a light-weight, 15-20-second-tuned square davul used in military orchestras with ability to change the timbre of the sound, a double-sided bell qaval, a musical instrument called idiophonic “Shimsek” and “Ilbiz”.

The **“Conclusion”** of the dissertation summarizes the research conducted in the previous chapters, it is stated that national musical instruments areinvestigated in various aspects, and the work on their improvement and restoration carried out in the Scientific research laboratory at the ANC was conducted in detail in 4 chapters.

First of all, the improving problems of widespread national string musical instruments and their solutionsare studied.The issues of improving the tar, kamancheh, saz, qanun and other types of wind instruments and their sizes are solved.The issues of restoration and improvement of ancient national musical instruments are also solved.The restoration of the yektay instrument and the creation of its family, the improvement of ancient musical instruments: the golcha qopuz and ozan qopuz, the improvement of the chang, the barbat, rud, rubab and chaganag musical instruments are solved.Experimental work was carried out on the creation of new musical instruments for the

Azerbaijani Folk Instrument Ensemble.As a result, the "Əsrlərin səsdası" ensemble, consisting of restored, improved and newly created musical instruments, was created.The voice range of this ensemble is 7 octaves.The ensemble was established on August 3, 2006.The ensemble consists mainly of students of the Azerbaijan National Conservatory. Concerts of the ensemble were successfully performed at a number of events, international seminars, the I and II "Nasimi poetry, art and spirituality" festivals.It should be stated that the instruments we restored and improved are preserved as works of art in the museum of the Heydar Aliyev Center, the museum of the International Mugham Center, the Tovuz Ethnography Museum and the Shamakhi Ethnography Museum.At the same time, the musical instruments we restored and improved were exhibited at various state events.It is worth to emphasize that the Ministry of Culture and the Institute of Standards are working on the development of state standards for national musical instruments of Azerbaijan.63 of our research works have been registered in the intellectual property agency.

The following works of the author have been published on the content of the dissertation:

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