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A PROPOSED PLAN TO TEACH COLLEGE STUDENTS
HOW TO TUNE PIANOS

THESIS

Presented to the Graduate Council of the North
Texas State Teachers College in Partial
Fulfillment of the Requirements

For the Degree of

MASTER OF MUSIC

By

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Glenn A. Truax, B. S.

Canyon, Texas

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CHAPTER I

INTRODUCTION

Statement of the Problem

It is the belief of many tuners that the best education for the young tuner is to do apprentice work in a piano factory where he must learn all the construction of the piano from the frame work of the case to the final setting of the tuning pins. It appears that most tuners are men now in the late forties to late fifties and were either factory-trained or apprentice-trained by an experienced tuner. The situation has changed and the apprenticeship method of training professional men such as lawyers and physicians has long since been discarded as a method of education. It is now the generally accepted plan to go to a college or university where such specialized training is given or offered under the direction and tutelage of specialists, and where students learn other essential subjects, the knowledge of which is necessary to the success of any educated man or woman.

The United States government has, during the past three years, enlisted the facilities of the colleges and universities to prepare our fighting men for the business of war, which leads us to believe that the college-trained man

is the best-fitted for all types of work, whether it be the professional, the industrial, the skilled laborer, or the farmer-stockman and the fruit-grower. The government is also promoting the college and special school idea for every man in the service by passing the "GI Bill of Rights,"¹ thereby encouraging the discharged man to continue his education in his chosen field.

Historical Background

A survey of the institutions offering training in the tuning of piano reveals that there is a relatively small number. Inasmuch as there are so few schools² to teach piano repairing and tuning, it is the responsibility of the colleges and universities to add courses of tuning to the curriculums as soon as teachers for such courses are available.

There has been a great disadvantage in the organization for total benefits of music in America and that disadvantage is in the "necessary evil" of keeping the pianos tuned. This must be done by a specialist. The good tuner has been the unmentioned man in the press and in the thousands of books written on topics about the piano. Some of the best known authors of books on tone production in

¹Public Law No. 346, Seventy-Eighth Congressional Record.

²

See page 10 of this study.

the piano have failed to mention that a tuner has ever had anything to do with the tone concerning which they write so much. Here is an example of this attitude. "The pianist has at his direct control only two of the four factors in music, namely, intensity and time. Pitch and timbre are determined primarily by the composer and the instrument."³ The pitch is determined by the tuner, not by the instrument. Pitch and timbre both suffer when the tuner does not tune the heavily used piano at least once a month, and no amount of technical training in playing will ever produce a beautiful tone from the out-of-tune piano. It is scientifically true that the tuner should be recognized as an artist in his field of endeavor as is the man who plays. It is the opinion of the investigator that it takes as much education and practice to become a first class tuner as it does to become a first class pianist. How many piano players, even virtuosos, could explain the details involved in correctly tuning a piano? Tuners are not born, as some people think; and the ear, in itself, is not keen enough to tune without the aid of tone waves.

To become a good tuner it is not necessary to have a perfect sense of pitch; it is more important to be a good

³ Carl Seashore, Psychology of Music, 19.

mechanic and have a great capacity of patience. The tuner must be even tempered to tune the equal temperament.⁴

There are several reasons why the tuner is not recognized as an artist. The good tuner has all he can do without demanding attention and has not received recognition as an artist. The poor tuner is not of the caliber that deserves recognition. He is generally not even a factory-trained man. Many times the poor tuner is an uneducated man and sometimes he unethically fails to do that for which he is respectfully paid.

There is a great need for schools of music to offer instruction and eventually degrees in piano tuning, so the pianos in the United States may be kept in better condition musically.

At the American Society of Piano-Tuner Technicians meeting in 1941 it was revealed that there are in the United States fewer than three thousand men of all grades of competence who are now engaged in tuning pianos. At the same time it was estimated that there are at least six million pianos in the United States.⁵

Piano manufacturers estimate that to keep a piano in good condition and tune it should be tuned and serviced at least twice a year. If the piano is in constant use it

⁴R. E. Watrous, "It's an Art to Tune a Piano," Etude, LV (April, 1937), 232.

⁵Letter from William Braid White, Principal, Chicago Musical College, 64 East Van Buren Street, Chicago, 5, Illinois, June 20, 1945.

should be tuned once a month. For the average piano, tuning should be at least three times a year. That would necessitate eighteen million tunings a year. Each of the three thousand tuners at present would then be obliged to do six thousand tunings a year if all these pianos were to be properly cared for. A tuner might tune 1,000 a year if he did not have to repair the piano as well as tune it. If a tuner could tune 1,000 pianos a year, we would still need 15,000 tuners in the United States.

The investigator had an experience one time that reflected the attitude of many people who have pianos in their homes. He was asked to come and replace some ivory tips on the keys, and to check the piano to see if it needed tuning. During the work of replacing the keys, the lady of the house asked him to see if the piano needed tuning, saying that it had not been tuned for ten years and she just loved the "mellow" tone. She was serious. She said that the last man that tuned it had just ruined it. The writer told her it needed to be tuned and she told him to proceed. After spending a half day tuning, the writer charged her a modest four dollars and thought he had given her her money's worth. The next day he received a call saying that she was not satisfied with his work and complained that he had ruined the "mellow tone of the piano."

Such ignorance is due to the lack of tuners to keep all pianos in tune and the lack of tuners is the fault of the people who sell pianos, those who make them, those who teach tone production and playing technique, and those who play them. Forty years is long enough to go without an adequate number of capable tuners. Three thousand tuners of all grades cannot tune six million pianos.⁶

Through the natural and established channels of education there should be an educated class of tuners put into this neglected field of music. Through them and the National Association of Piano Tuners⁷, the piano owners of America should be educated on how their instruments, very often the most expensive piece of property in their homes, should be serviced.

The Purpose of the Study

The purpose of this study is to bring to light the existing conditions in regard to piano tuners and piano technological schools; and further to point out the great opportunities that lie ahead for the young tuner if colleges

⁶ William Braid White, "Profitable Calling for Women," Etude, XL (September, 1942), 585-586.

⁷ Letter from Roy Chipman, July 25, 1945.

and universities add tuning schools to their courses of study. Opportunities for women in this field are great. Neatness in appearance, a patient disposition, a careful attention to business details and good natural sense of pitch are essential. All these qualities are as feminine as they are masculine.⁸

The purpose of the piano technology school should be to train suitable men and women to go into the field of piano service as skilled piano-tuner technicians.

The demand for skilled piano service is constantly increasing, while the number of those actively engaged in the work is actually falling off.⁹ This has been due to causes connected with the slump into which, during the early days of radio, the piano temporarily fell, and, as a consequence of which, the opportunities offered by the piano service field came to be almost completely overlooked for a number of years. During the last ten years, however, the piano has come back permanently to a greater popularity than ever, while at the same time the race of skilled piano tuner-technicians has begun to die out, so that outside of a few of the largest cities, skilled experts are today almost unobtainable. The opportunities thus presented to men and women

⁸ Ibid.

⁹ By letter from William Braid White, July 20, 1945.

interested in the piano and possessing some liking for mechanico-artistic work, are remarkably favorable.¹⁰

The Source of Material

The material for this study has been gathered by bits over a period of twenty-five years. Much of it has been knowledge gained in the investigator's experience, some of it has been gained by interviewing the expert piano technician A. D. Schrimpf of Dallas, Texas.

By correspondence, the investigator has received valuable information from Roy Chipman, Secretary to the National Association of Piano Tuners, and from the Tuners Supply Company of Boston, Massachusetts.

Validity of Data

The validity of this data is qualified by the closeness with which these different men state the same thoughts and facts. It is as if they had all met and agreed in what was to be told.

Organization of Material

The material for this study has been organized into five chapters. Chapter 1 is introductory and Chapter 2 deals with piano tuning schools as they are found in the United States today. Chapter 3 discusses the status quo. Chapter 4 sets

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R. E. Watrous, "It's an Art to Tune a Piano," Etude LV (April, 1937), 232.

forth the proposed plan, dealing in particular with prerequisites of tests and course of study, together with the physical set-up which includes the laboratory, tools and equipment, textbooks and how the plan might be put into effect. Chapter 5 contains the conclusions reached by the investigator.

CHAPTER II

PIANO TUNING SCHOOLS AT PRESENT IN THE UNITED STATES

The School of Piano Technology under the auspices of the Chicago Musical College, 64 East Van Buren Street, Chicago, 5, Illinois, has as its principal Dr. William Braid White. It is the recognized technical school of the American piano industry and has been officially approved by the National Piano Manufacturers Association of America and the National Association of Music Merchants, Incorporated.

The New York Trade School, 304 or 312 East Sixty-Seventh Street, New York City, is a tuners' school sponsored by the government in the rehabilitation of discharge veterans.

Other piano tuning schools are: The Frank Wiggins Trade School, Los Angeles, California, and the Cincinnati Conservatory of Music, Cincinnati, Ohio. A non-professional course in principles of tuning is offered at Teachers College, Columbia University, with Alex Hart as the instructor.

Prof. Glenn A. Truax
Denton, Texas

220 West 107th. Street
New York, 26, New York

Dear sir:

Your letter received, and sorry I could not answer sooner.

1. I use no textbooks.
2. I do not teach piano tuning but what to do in an emergency.
3. I teach the students only what I have gained through my own experience, through the years as a tuner and repairer.
4. Teachers College is not a Tuning School.
5. There is a Faust School of Piano Tuning in Boston, and lately the New York Trade School.

I am sorry I cannot help you.

Are you a piano tuner? Have you had any practical experience? Write me again.

Sincerely,

Alex Hart

Tuning is taught in many of the state schools for the blind. There was a school of tuning in Boston, established about 1900 by Oliver C. Faust, but it evidently disappeared when Faust died. No mention of the school was made in recent correspondence received from the National Association of Piano Tuners in regard to schools of tuning. The above-mentioned schools of tuning are all that there are in the country, and they are filled to capacity.

CHAPTER III

STATUS QUO

The use of pianos is on the increase, due to the existing economic conditions. People have more money and it is natural that they want to spend it, some of these increased earnings have gone for piano instruction. Pianos must be serviced if they are to stand constant use. Many men tuners are getting past the age of their best work.¹ They cannot withstand the long hours of concentrated listening as it is a strain on the nervous system. Men who tuned eight to ten pianos daily in their more virile years are not capable of tuning four pianos a day now. Some of these older men have gone on the road as "itinerant tuners" where they may make more money per piano and where they feel like they have no reputation to keep up and where they have more time out in the open air and sunlight. They do poor tuning, because they know that they probably will not go back to the same locality very often, if at all. They realize the ignorance of most owners of pianos in regard to the tuning of pianos and often tune a piano to a pitch far below the

¹ Letter from William Braid White, June 20, 1945.

official pitch of A-440. They carry few supplies as a rule, and many times do patched-up work on the action which is neither well done nor lasting. They have been known to use rubber bands for springs - string for bridle straps, paper for front rail punchings and vaseline for graphite.

They are a detriment to the profession and definitely a hindrance to the best interests of music in general. Most of these men are lacking in general education. Apparently they are poor business men and do not know how to deal ethically with people.

Training

The factory-trained man.--The man, who as a boy out of high school went to a piano factory and stayed four years or more before beginning to tune for the public, is perhaps the best tuner of today. He learned the basic principles of tuning and repairing improved to the point of knowing all the fine points of the art of tuning and repairing. Practically every problem that arises in tuning is different from any previous problem. The training consists of several different phases of piano building. The first division of this work is case building. (a) Case work consists of building the frame, the top, the desk, the fall board, the legs and finishing them with the desired stains and lacquers. (b)

(b) The second phase of the work is the shaping of the sound board, the construction and placing of the pin block and securing it to the case. (c) The third phase is the placing of the metal plate, the boring of the pin holes, and the placing of the pins in the block. These three phases are classed as the work for the beginner because no knowledge of tuning and repairing is used in that work in that it is primarily wood shop work.

The second division of piano building consists of work by a more highly trained man who places the wires in the piano and does the "chipping" or the first rough tuning given to the strings before the action is fitted to them.² While the preceding work is in progress, a third man is building the delicate mechanism of the action.

Pianos, though constructed on the same pattern, are different. There may be different methods employed in the construction of the same pattern of piano. On a cheap piano the work of making a sound board might be done by machine and on the more expensive pianos the sound board might be hand-made. The wood in the pin block might not be as well seasoned as in the wood of another block. A piano might be of the same pattern but put together by

² White, op. cit., 250.

workers with varying degrees of workmanship. Only piano construction experience can teach a tuner how to handle each problem in repairing and adjustment. Reference is here made to Letter No. 1 in the Appendix as a specific example illustrating this point.

Many of the best tuners of today went from the factory to piano dealers and tuned the new pianos sold and made minor repairs. They had contact with the public and learned about the business of selling services and pianos. Experience of that sort should be very beneficial to the future success of the man.

The tutor-trained man.--Some tuners today take students and train them by the observation method. After some days of watching and listening, the instructor sets a temperament and allows the student to tune the octaves and unisons. After a few weeks of this experience the student is allowed to start independently by setting the temperament and tuning by himself. After some weeks with the instructor doing the final delicate adjustments in the process, the student buys a set of tools and starts out independently. His fee for this instruction costs from twenty-five to one hundred dollars for the total schooling in piano tuning. This man, if he has some good mechanical sense and uses care and good judgment in dealing with the

public, will become an average tuner after several years' experience.

The un-trained tuner.--This class of tuner is like a stray dog. No one wants him, yet he is engaged to do the usual tuning jobs in churches, schools, and private homes. He leaves town as soon as possible and cheats another group of people in another community, leaving each to suffer in silence. He is uneducated, sometimes practically illiterate. He has an attitude of suspicion towards everyone. He talks against people who have authority and influence. His training in piano tuning and repairing has been "picked up" here and there. He probably has a fairly good sense of pitch and some natural mechanical sense, but his lack of other qualities that make for successful work, do not make him a desirable man in the profession. Again, reference is made to Letter No. 1 in the Appendix.

Piano Tuning and Tuners

In the early days of the twentieth century the same problem in tuning confronted the musical world as today; there were not enough tuners. There was an acknowledged dearth of first class tuners even in New York, Boston, Chicago, and other centers, and throughout the country at large there was a scarcity of men of even a second or third

grade.³ The majority of the latter had never seen the inside of a piano factory. What they knew had been acquired through itinerant or warehouse practice, assisted by incidental "pointers", or, perhaps, instruction from a regular graduate of a factory. A large proportion was, however, self-taught. Much of this inefficiency is due to the peculiar circumstances under which a knowledge of tuning and repairing is acquired outside of the factory. The young man who desired to learn the business was unable to get systematic instruction, except in rare instances when he paid a competent tuner for information regarding the inner mysteries of the art. He is compelled to get into the business of the "picking-up" principles, without a knowledge of theory or the laws underlying the various processes of tuning, tone regulations, or the repairing of serious defects.⁴

Piano tuning is difficult mainly because the piano is an imperfect musical instrument. It does not possess enough keys to play all the notation called for in music. (One key must do, for example, F[#] and G_b .) The compromise by which

³
Daniel Spillane, The Piano, 9.

⁴
Ibid., p.11.

piano strings are tuned to represent musical tones that are close in pitch, but not identical, involves a mathematical theory of Pythagorean complexity. Practically, the problem is to put the piano systematically and artistically out of tune, by equalizing the tonal distances between half steps. In getting each note of the piano just enough out of tune, the piano tuner cannot trust to any such simple measuring device as his own sense of pitch. Once he has tuned middle C with the aid of a tuning fork, according to a standard pitch, he sounds fourths and fifths. He listens not to pitch but to the frequency of minute oscillations known as "beats," produced by the conflict of vibrations when two notes are struck simultaneously. The struggle to bring these "beats" to the proper frequency is very nerve-wracking. No two master tuners will tune a piano exactly alike, nor will any master tune a piano the same way for different occasions.⁵

A piano that is perfectly tuned and regulated for a broadcasting studio will sound all wrong in Carnegie Hall. A piano that is to accompany a violin is adjusted differently from one that is to accompany a cello. A tuner with a sensitive personal touch will tune pianos differently for

⁵ Herman L. F. Hemholtz, Sensation of Tone, Chapter XVI.

different pianists. Virtuosos such as Josef Hofmann and the late Sergei Rachmaninoff hire a favorite tuner's full-time services. The most famous piano tuner who ever lived was the late Eldon Honbert of Boston, who for thirty years was Paderewski's constant companion. Thus piano tuning is both an act and a science.

Tuners require about nine months to learn the basic principles of their craft, at least three more years to become proficient. Curiously, a few of them can play the piano.⁶

Information from Reliable Sources

A list of thirteen questions was sent out to the Secretary of the National Association of Piano Tuners and to Yale of the well-known Tuners Supply House. The questions and the replies received follow.

1. Is there definitely a shortage of tuners?

Both Chipman, secretary of the National Association of Piano Tuners, and Yale of the Tuners Supply Company, answered "yes" to this question. They should know because of their national over-all view and close association with the men who tune America's pianos.

2. Are there enough young men being trained at the

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"Tuners and Tuning," Time, XLIV (July 10, 1944), 55.

present time to do the tuning in America?

When the above-mentioned men both answer "No" to this question it would be reasonable to suppose it to be a fact.

3. Should there be additional schools of tuning set up in the East? Yes. In the Middle West? Yes. In the Southwest? Yes. In the North? Yes. In the West? Yes.

4. Are there sufficient factory men available for tuning and repair at the present time? No.

5. Will there be sufficient men in the piano industry after the war? No.

Yale replied as follows:

The Veterans Rehabilitation Administration is recommending and approving schools and colleges to teach piano tuning to veterans of this war, particularly to those with affected eyesight. The only tools we are making now are going to these schools under priority ratings, although we expect to resume production for general use within three or four months.

6. Do you think tuners should have a college education? Yes.

Yale added this:

The art of piano tuning does not require a college education in itself. A grammar school graduate with a keen ear will make as good a tuner as a college man, but education is a great advantage in meeting people and building up a successful business. The higher education, however, tends to place a man above the trade or profession of piano tuning and renders him less apt to be able to give his undivided interest to the work. Until such time as piano tuning can be advanced in the public mind beyond trades such as carpenter, painter, or plumber, the average college man will not long remain a tuner, but will advance to the piano sales field and hire this work done.

7. Do you think schools of music should add courses in tuning at the non-professional level? Yes. At the professional level? Yes.

8. Do you favor the use of "hearing aids?"

Hearing aids are very desirable for experienced tuners who are losing their hearing through age, but are definitely not desirable for a student.

"Hearing aids" are scientific instruments which are made to register "beats" on a dial. They are used by some who do not know the pitch by ear or can detect the "beats" between two frequencies.

9. As far as I know, the best tuners use the same methods of tuning now as they did twenty-five years ago. Have tuning methods advanced in a scientific way during the last twenty-five years?

"I do not think so."

There are two methods of tuning, one by fourths and fifths and the other by thirds. The result is the same since the purpose is simply to divide an octave into equal parts and this can be done by either of the two systems. This can be done by ear or by a scientific device with electronic equipment combined with rotating discs designed to throw an image on a screen. Such a device is expensive due to small demand but it is of course far simpler than the present development of radar.

10. Will there ever be a piano that will hold a pitch permanently?

"I do not think so."

No. The Mason and Hamlin Company produced pianos over fifty years ago with a screw device designed to replace a tuning pin in a wood block, on the theory that it was the slipping of the pin that caused a piano to go out of tune. In the course of time it was found that this was not the cause and a well-prepared pin block, if maintained at proper degrees of temperature and humidity was a better construction and it is now universally used except for a few experimenters who are ignorant of the results of past research. Steel strings start to deteriorate after four years of tension and through natural fatigue will lose fifty per cent of their efficiency in fifty years, by which time they usually become so brittle they can be broken in the fingers, although steels vary a great deal in this respect and after the war improvements in analysis can be expected.

No. Wood sounding boards expand and shrink with changes in humidity.

11. Are tools available for schools of tuning at the present time?

No. It is very doubtful.

12. In training college students for professional tuning, how many hours per week should they take in shop work?

Ninety-five per cent.

It is the belief of tuners in general that shop work or piano laboratory should take the major portion of the student's time since it takes actual experience with the tools to learn tuning and regulating.⁷

How many hours per week should college students take

⁷
A. D. Schrimpf, by interview, July, 1945.

in text-book study connected with tuning?

Five per cent.

13. What courses of study would be required other than English?

One did not answer this question. Yale included his answer in his reply to question number 6 in the list.

It is obvious that the point of view of the present tuner is not in sympathy with the college point of view of putting theory before practice.

CHAPTER IV

THE PROPOSED PLAN

Pre-requisites

The prospective tuner need not be an accomplished musician - however, being a performing musician would not hinder his progress, but neither would it be of particular help. He or she does, however, need to have a keen interest in music as a whole and realize that the art of tuning is a very necessary profession within the field of music.

It is a worthy profession though not in the least glamorous. The work shop or where the tuner does his work, is generally the finest room in people's homes. The instrument is the most expensive piece of furniture in the house. Around it evolves, many times, the whole spirit and morale of a home and community.

The prospective tuner must have an unusual amount of patience. There is so much concentrated listening connected with the tuning that it becomes nerve-wracking if carried on for too many hours daily. There are so many little adjustments to be made and it takes so much valuable time to hunt out a measly little squeak that it takes an even temper and a calm disposition to make a success.

A tuner must be able to move smoothly from a "honky-tonk" where the proprietor is trying to cheat him out of his pay to the studio of a professional musician who hovers around trying to tell him how to perform his highly technical job. He must preserve his equanimity while clocks tick, automobiles honk and children play with his tools. Working with intense concentration, he can rarely tune more than three or four pianos a day. Despite their apparent calm dispositions, it is not surprising that piano tuners sometime have nervous break-downs.

It is well to remember that there is a lot of mechanical work connected with adjusting and regulating the action of a piano. A prospective tuner should have a high degree of mechanical sense. There are so many little things that can go wrong that it often requires a natural mechanical aptitude to discover the fault. Experience must be the teacher in that field because not many of the problems which arise out in the field occur in a piano shop or in a factory. The investigator had only one experience of this kind in twenty years. A country church piano would not play. Some of the strings would not sound and some of the keys would not depress. A look behind the music rack did not reveal the trouble. When the fall board was removed, and the action taken out, it was discovered that there were about three dozen "mud daubers" wasps nests

built in around the strings and under the key board.

There are certain aptitudes that a prospective tuner should possess before starting out to learn the profession. These may be determined at entrance to the tuner's course by a series of aptitude tests. One of these tests should measure musical ability or pitch and tone sensitivity. Another should measure mechanical talent. Tuners ought to be skilled mechanics and good judges of the mechanical principles of the action of a piano. A test of this type would be of necessity one designed to measure the natural mechanical aptitudes.

Since piano tuning has to do with selling the self to the public, the prospective tuner should take a test to show his ability to adapt himself to meeting people, working for people, being tolerant of people without losing patience or doing below-standard work.

Such a test would show what personality traits might be favorable to the best interests of the students and what personal desires might indicate that they could not be successful tuners.

Tests.--The first and the most important test for the prospective tuner is the Seashore Measurement of Musical Talent. It tests the degree of native talent in pitch, loudness, time, timbre, rhythm, tonal memory.

Obviously, a tuner must recognize pitch differences and

have a sensitive ear for hearing, recognizing and counting "beats," but he must also have a high degree of sense for distinguishing quality of tone which is employed in the voicing of the piano. Closely associated with tonal sense should also be a keen sense of differences in intensity. In voicing a piano, the notes should, when struck with equal force by the hammer, have equal degree of intensity.

The second test recommended is the Kuder Preference Record, which tests the natural inclinations toward various fields of endeavor, namely, social service, mechanics, science, and music. If a prospective student's preference record should lack high scores in music and mechanics, he should not be so likely to have success as a tuner. On the other hand, if he showed a high score on those fields of endeavor, other things being favorable, he should be allowed to follow his preference. The third test should be added for those who wish to repair band instruments, tune and repair pianos, or tune organs. It is the Minnesota Paper Board Test, by Likert and Quasha. This test consists of a series of forms which have to be selected and fitted into a compact form as is shown in each section. Sometimes the forms must be imagined inverted before they will fit, sometimes turned around. The ability of the eye to judge shapes and angles must be high to get a good grade in this test. It is primarily a mechanical test. There is no writing and no mathematical problems, but demands

a natural ability to fit patterns together which would enable him to have ability to fit the parts back and make them work when a piano has been broken in the action and the parts are mixed. Old pianos for which there are no repair parts necessitate the making of action parts by hand. The above test would measure native ability to do such work.

A fourth test which the investigator thinks should be added for the piano tuner is the Personal Audit by Adams and Lepley. It is designed to measure various areas of personality. These areas indicated by high score are:

- "1. Sociability - extroversion
2. Suggestibility - a tendency to agree with authority
3. Tendency to rationalize- to make alibies and excuses
4. Tendency to anxiety - a tendency to excess emotion-ality
5. Tendency to personal intolerance
6. Flexibility or docility of attitudes."¹

A prospective tuner should possess to a high degree the six facts of this personal audit because the requirements for success in this field are pretty well defined by those tuners who are successful and those who are not. A poor tuner is probably an introvert - he disagrees with authority - he makes alibies for failures - he is excitable and not well adjusted to society.

¹
C. R. Adams and W. M. Lepley, Manual of Directions for the Personal Audit, p. 1.

Proposed course of study.--Majors in music who wish to know the principles of pianoforte construction, the fundamentals of tuning, action regulating and tone regulating should take the first semester courses in piano construction, piano shop laboratory and acoustics. These courses alone would not prepare a student for doing professional tuning, but would be of inestimable value to the musician-performer and the musician-teacher.

In considering this proposed course of study as a course leading to a bachelor of science degree in piano technology, there appear certain objectives which must be included in the college training.

Wilfred Bain, Edward Kurtz, and Price Doyle, the committee on revision of the basic curriculum for the preparation of school music teachers of the National Association of Schools of Music, in cooperation with the American Association of Teachers Colleges, made recommendations for the basic curriculum. This curriculum was adopted by the National Association of Schools of Music and by the American Association of Teachers Colleges. It recognized four areas of knowledge which a college student should acquire as a preparation for the teaching of music. These areas are:

- 1) broad general culture consisting of forty semester hours, the preparation for which should assist the individual to

take his place in our democracy and be able to recognize human values and relationships; 2) preparation in musicianship would include thirty-two semester hours of studies leading to the reading, writing, understanding and reproducing orally the language of music. Subjects covering this field would include those dealing with ear-training, history of music, composing and performing music. A comparative course for the tuner-technician would include six hours in piano construction, four hours in piano, six hours in ear-training and sight-singing, six hours in music history, and three hours in harmony.

The preparation for the courses in the technical training would consist of the piano tuning courses totaling forty-two hours of laboratory work, tuning, repairing and regulating. The other courses would prepare these students to understand the teaching processes - an essential knowledge, whether they teach or not. 3) Thirty semester hours should be devoted to the acquiring of technical skill in performance for his own benefit and for service in the community in which he lives. 4) Electives to the total of eight semester hours give the student an opportunity of taking related subjects not required in his chosen field.

With these requirements in mind, a suggested course of study leading to the bachelor of science degree in piano technology might consist of the subjects and credits listed below:

The twelve hours of English; twelve hours of science; six hours of social studies and eight hours of electives would come under the heading of broad general culture.

According to criteria validated by a jury of superior educators of school music teachers, they made the following recommendations in the field of applied music.

School music majors should be required to concentrate in one field of applied music to the extent of developing solo^{1a} ability. This ability in the concentrated field in this course would be the practice of studying and tuning under supervision until the student could "solo" on his instrument or in other words, be able to tune, regulate and voice a piano.

Table 1 gives a suggested course of study.

TABLE 1
A SUGGESTED COURSE OF STUDY LEADING TO THE
BACHELOR OF SCIENCE DEGREE IN PIANO TECH-
NOLOGY

Year	Subject	Hours
Freshman 1st. Semester	English	3
	Library	1
	Piano	2
	Oral Harmony	3
	Piano Construction	3
	Piano shop laboratory	3
2nd Semester	English	3
	Oral Harmony	3
	Piano Construction	3

1 a

Edna McEachern, Education of School Music Teachers.

TABLE 1--Continued

Year	Subject	Hours	
Sophomore	Piano shop laboratory	3	
	Acoustics	3	
	1st. Semester	English	3
		Oral harmony	3
		Biology	3
		Elementary tuning	3
		Piano shop laboratory	3
	2nd. Semester	English	3
		Oral harmony	3
		Biology	3
Elementary tuning		3	
Piano shop laboratory		3	
Junior	1st. Semester	Science	3
		Music history	3
		Intermediate tuning	3
		Piano repairing	3
		Piano shop laboratory	3
	2nd. Semester	Science	3
		Music history	3
		Intermediate tuning	3
		Piano repairing	3
		Piano shop laboratory	3
Senior	1st. Semester	Advanced repairing	3
		Advanced tuning	3
		Piano shop laboratory	3
		Electives	3
	2nd. Semester	Advanced repairing	3
		Advanced tuning	3
		Piano shop laboratory	3
		Electives	3
Total		120	

As has been well stated, "A little knowledge of tuning is

a dangerous thing."² A student with a tuning hammer and a small amount of knowledge should not attempt to tune a piano, and he should not expect to undertake the difficult task of setting a temperament or voicing a piano, without first getting some practical experience in a professional course.

It is the opinion of first-class tuners³ that every musician should know the basic principles of the equal temperament as different from the "just intonation" as is strived for in the symphony orchestra. He should learn the use of the hammer well enough to keep his own unisons in tune. He should understand how the piano should be tuned. He should also know why F[#] and G^b have to be the same on the piano and why they are of different pitch in the symphony. The young pianist should know why the piano gets out of tune and how to prevent it from being ruined by carelessness or ignorance.

The first semester of the technical course should include the study of the construction of the piano throughout. Lists of materials used for piano construction are found in the Appendix of this study. The student should understand the function of all the parts and tools used in

² A. D. Schrimpf, by interview, July, 1945.

³ Ibid.

the construction and tuning of the piano. The names of all the parts should be learned and classified as to the location on the piano. A list of tools and accessories used in repairing, tuning, and regulating pianos is found in the Appendix of this study. The student should study the scientific principles of the tone construction, and the physics of the frequencies used in the "equal temperament."

The second semester should include the training of the ear. This could be done by watching and listening to the tuner as he actually tunes a few pianos. The student should take notes on the actual procedure and should follow the tuner from the opening of the lid to the placing of the muting felt and follow closely a system of forty-nine steps in "laying the bearings" (setting equal temperament).

Table 2 shows the forty-nine steps as given by William Braid White.³

In order to avoid confusion as to the note referred to, the following subscript numbers after the note letter will guide the reader to the exact position. Thus the lowest bass note A on the full keyboard is designated A₁. The C's are C₄, C₁₆, C₂₈, C₄₀ (Middle C), C₅₂, C₆₄, C₈₈ (the last key on the right of the keyboard). The keys in order are numbered one to eighty-eight.

³W. B. White, Piano Tuning and Allied Arts, 88-89.

The laying of the bearings is made between F_{33} and F_{45} using the thirteen semitones inclusively, thus obtaining an octave of accurately tempered semitones from which the remainder of the scale may be tuned. Table 2 shows the procedure step by step. The intervals tuned are successive fourths and fifths. The intervals tested are minor thirds, major thirds and major sixths. The Table gives the rate of "beats" that must be left from the true or "just intonation" frequency. By taking all the fifths upwards and all the fourths downward, the process of diminishing the fifth and augmenting the fourth is performed by leaving each tuned note the required frequency flat, with one exception and that is from C_{40} to F_{33} since the fifth must be diminished, the F_{33} must be pulled until it is the required beats above the "true" pitch.

After a careful examination of Table 2, a few facts will be noted.

1. Fifths must be contracted or diminished.
2. Fourth's must be expanded or augmented.
3. Intervals contrasted are the fifths, minor thirds and minor sixths.
4. Intervals to be expanded are the fourths, the major thirds and the major sixths.

TABLE 2
SCHEME OF "LAYING THE BEARINGS" IN EQUAL TEMPERAMENT BETWEEN F33
AND F45 BY FOURTHS AND FIFTHS, WITH TESTS

Step	Process	Names of tones	Intervals	Beats per sec. to nearest 0.5	Beats in 5 secs. 4th.s & 5ths. to nearest 0.5	Step
1	Tune	C52-C40 from tuning fork or bar	Octave	0.0	0.0	1
2	Tune	C40-F33	V(Fifth)down	0.6	3.0	2
3	Tune	C40-G35	IV(Fourth)down	0.9	4.5	3
4	Tune	G35-D42	V up	0.7	3.5	4
5	Test	F33-D42	VI	8.0		5
6	Tune	D42-A37	IV down	1.0		6
7	Test	F33-A37	III	7.0		7
8	Test	F33-A37-C40	Major triad			8
9	Tune	A37-E44	V up	0.8	4.0	9
10	Test	G35-E44	VI	9.0		10
11	Test	C40-E44	III	10.5		11
12	Tune	E44-B39	IV down	1.1	5.5	12
13	Test	G35-B39	III	8.0		13
14	Test	B39-D42	III(Minor)	13.0		14
15	Test	G35-B39-D42	Major Triad			15
16	Tune	B39-F#34	IV down	0.8	4.0	16
17	Tune	F#34-A37	III (Minor)	10.0		17
18	Test	F#34-A37-D42	Inverted major triad			18
19	Tune	F#34-C#41	major triad	0.6	3.0	19
20	Test	A37-C#41	V up	9.0		20
21	Test	F#34-A37-C#41	III			21
22	Test	A37-C#41-E44	Minor triad			22
23	Test	C#41-E44	Major triad	15.0		23
24	Tune	C#41-G#36	III (Minor) IV down	1.0	5.0	24

TABLE 2--Continued

Step	Process	Names of tones	Intervals	Beats per sec. to nearest 0.5	Beats in 5 secs. 4ths. & 5ths. to nearest 0.5	Step
25	Test	G#36-C40	III (Minor)	8.5		25
26	Test	F33-G#36	Inverted Major Triad	9.5		26
27	Test	G#36-B39-E44	V up			27
28	Tune	G#36-D#43	VI	0.7	3.5	28
29	Test	F#34-D#43	III (Minor)	8.5		29
30	Test	B39-D#43	III (Minor)	10.0		30
31	Test	C40-D#43	Inverted Major Triad	14.0		31
32	Test	F#34-B39-D#43	IV down		5.0	32
33	Tune	D#43-A#38	III	1.0		33
34	Test	F#34-A#38	III	7.5		34
35	Test	A#38-D42	III (Minor)	9.5		35
36	Test	G36-A#38	III (Minor)	10.5		36
37	Test	A#38-C#31	VI-IV Chord	12.5		37
38	Test	F34-A#38-D42	V up			38
39	Tune	A#38-F45	IV	0.8		39
40	Test	F33-A#38	III	0.8	4.0	40
41	Test	C#41-F45	III (Minor)	11.0		41
42	Test	D43-F45	VI	16.0		42
43	Test	G#36-F45	Octave	9.5		43
44	Test	F33-F45		0.0		44

45 Compare ascending Fifths in succession from F33, beating 0.59, 0.62, 0.70, 0.74, 0.79, respectively (correct to 2 places of decimals).

46 Compare ascending Fourths in succession from F33 beating 0.79, 0.83, 0.88, 0.94, 0.99 1.05, 1.11, 1.16, 1.18, respectively (correct to 2 places of decimals).

47 Compare ascending Major Thirds in succession from F33, beating 6.93, 7.34, 7.77, 8.26, 8.73, 9.25, 9.79, 10.38, 10.99, respectively (correct to 2 places of decimals).

48 Compare ascending Major Sixths in succession from F33, beating 7.92, 8.38, 8.89, 9.42, respectively (correct to 2 places of decimals).

49 Compare ascending Minor Thirds in succession from F33, beating 9.42, 9.98, 10.57, 11.20, 11.87, 12.57, 13.32, 14.12, 14.95, 15.85, respectively (correct to 2 places of decimals).

Although there are but thirteen notes tuned in the temperament, there are thirty-six steps which must be taken to test the number of beats which must be left in the intervals in order to have it accurately tuned.

5. The number of beats per second for each interval should be memorized. In order to get to the accurate number of beats as listed in the table, the metronome may be employed and set at sixty or 120. If the number of beats are three per second, the metronome set at sixty would make the rhythm of a triplet of beats per second. If the number of beats per second is eight, set the metronome at 120 and allow one group of four sixteenth notes per stroke of the metronome.

In preparing the string to sound the beats, the interval should be tuned "dead" (beatless) first, then by use of the hammer, the number of beats "out of tune" may be set.⁴ In this manner the ear keeps the true (beatless) pitch in mind and is more apt to hear the variation of frequency without being subjected to an auditory illusion causing the tuner to lose his "bearings."

The student should memorize this procedure and listen in concentrated attention to the "beats" per second which must be left in the various intervals of the octave between

⁴ Ibid., p. 93.

F₃₃ and F₄₅. This is the most important part of tuning and it is all important inasmuch as the piano cannot be tuned if the bearings are not laid to perfection.

As the teacher proceeds upward in the scale, all movements of the tuning hammer should be closely watched as every little arm and wrist movement has a definite meaning. Not only must the unisons be pulled till there are no beats, the pin must be set so it will not slip or pull the string sharp or let it sink flat. This is also an all-important part of the art of tuning.

The student should watch the tuner as he tunes the high register, and check his pitch sense of the octave tuning, with the pitch on which the tuner leaves it. It is natural for the ear to hear sharp on the high notes. The tuner therefore tunes the high notes just enough sharp to please the ear of the performer and listener. Care must be taken that the student not listen too high. At the opposite end of the keyboard it is natural for the ear to hear flat on the low bass notes so as the student listens to the bass as it is being tuned, he will notice that the bass notes are left a little flat since that is the way it sounds best to the artist. This raising of the treble and lowering of the bass is called "stretching" the octaves and requires much practice to get it to suit the ear of the tuner and the performer.

The tuning hammer is the most important tool in the possession of the piano-technician. There are many interesting points about the manipulation of the hammer which the student should know. The mechanical part of turning the tuning-pin looks simple but to do it properly requires a certain technique of manipulation.⁵

To the novice it would seem that it is merely a wrench and should be used as one in the manner of turning the nut on a bolt. Although it turns in the same direction as a nut being tightened, the tuning-pin has a downward pull on it of 150 to 160 pounds and when the hammer is placed on the tuning-pin in such a manner that the pull downward on the hammer is in line with the pull downward of the tension of the string the pin may bend, break or the wood in the block may be weakened so that it will not hold the tuning pin after a few tunings. In order to overcome these faults, the student will have to work his own method of manipulation, bearing in mind always that his object is to turn the tuning-pin and not to bend it.

If he merely bends it, he may alter the string tension enough to change the frequency as desired; but a smart blow on the piano key will soon knock it back again where it was before. The novice does not tune "solidly." He does not turn the tuning-pins, he merely bends them.

⁵Ibid., p. 100.

Most tuners use a hammer about twelve to fourteen inches long and use it in as vertical a position as possible on the upright piano. Thus the pull on the tuning-pin is not in the same direction as the pull of the string.

In attempting to turn the pin, the student should not jerk the hammer back and forth, nor use it like a wrench but rather try to turn it gently so that it will not slip and pull the string too far past the desired frequency. Some young tuners twist as they pull on the hammer downward. The muscles must be trained to move gently and firmly because such a small turn, a turn that could hardly be seen at the pin, moves the pin enough to change the frequency several degrees. The higher the pitch, the less turning there is to be done. "The tuning hammer is an instrument, not a club."⁶

To make the tuning "solid" it is best to tune slightly above the required frequency and let the string slack back by the help of a stroke of the key. Pulling the string up to the required frequency and stopping will usually result in the slacking off as soon as the piano is played.

Muting the string is done by using a long piece of

⁶Ibid., p. 102.

strip felt to stop off the two outside strings of the triple unions so that the middle string may be tuned throughout the range of the triple unisons.

The temperament octave is tuned first of course, then the octaves up to the top chromatically are tuned. Then the bass is tuned downward by octaves from the temperament octave. Some well-known tuners believe that the bass should be tuned first because the tension in the upper octave, if tuned first, may strain the frame. On good pianos there is not too much danger of over-straining.

After the unmuted strings are tuned to the satisfaction of the tuner, the strip felt may be removed, one string at a time until the strings have all been tuned.

The worst enemy of the tuner is the false beat in the single string. There are several technical causes why a string may be faulty. The only sure way to get rid of the false beats is to put on a new string or just leave them in and put up with them. They cannot be tuned to accurate frequency.

Voicing.--Voicing is the process of restoring the original tone quality which was built into the piano by the maker.⁷ The voicer has only the pitch of the unisons and the felt on the hammer with which to work when

⁷ Ibid., p. 195.

restoring the tone quality. When the unisons are out of correct frequency the voice of the piano on that individual pitch is to a degree "twangy", sounding as if the hammers were made of hardwood or steel. After the tuning is done, the voicer inspects the felt of the hammers. If the surface is cut in by the strings, it will be necessary for the tuner to smooth up the hammer by means of sand paper files. The sand paper file is a one-eighth inch strip of hardwood about seven inches long over which is stretched the desired roughness of sandpaper. To smooth the surface of the hammer, the file is stroked toward the crown of the hammer, rolling up a small roll of felt from either side. The other side of the hammer is treated in like manner. When the felt has been rolled from both top side and bottom side it is removed by a light stroke across the hitting surface. Careful practice is necessary to learn this process of filing and it requires much patience. Care must be taken that the striking surface be kept at the proper curve and kept in the middle of the hammer so as not to change the striking point on the string. The first rough work in filing is usually done with No. 1 rough sandpaper.

The next step in voicing is the process of conditioning the felt by needling until a uniform tone is yielded by all the hammers. The voicing instrument is a needle holder

containing three No. 6 needles about one-half inch long. These needles are used to stab the felt. Strokes are made by firmly pressing the needles straight down into the felt on each side of the point of the hammer as far as they will go, avoiding the point and gradually working down on each side to the bottom of the top felt. The needle should be pressed into the felt vertically in a series of strokes working outward from the molding and parallel to the line of the latter.⁸

It is necessary for the voicer to test by his sense of intensity and color the tone the hammers make as he goes along. A piano that is used principally by the beginner and intermediate students will have harder tone quality on the white keys than on the black keys. By testing the tone quality as he goes along he may make the tone of the best that the piano can produce.

If the tone is dead and needs "livening" up there is another tool with which this may be done, namely the hammer iron. It is so constructed that it fits the striking surface of the hammer. The iron is heated until a drop of water placed on the iron evaporates quickly. It should not be hot enough to make steam from the drop of water. The hot iron is then pressed over the side of the hammer while

⁸ Ibid., p. 195.

the hand presses from the other side, the felt being pressed upwards toward the crown. This is done on both sides of each hammer until the felt is well scorched and blackened. The file is then applied again and the scorched felt cleaned off. If the work is well done the tone will then be "livened" up.⁹

A voicer should have special qualifications of a good ear for tone quality. The mechanical process is not difficult to acquire when the feeling for the right tone is present. A sensitive ear for tone quality may be acquired by patient study of the physics of piano construction and by constant practice in the art of voicing.¹⁰ The aim and end of voicing is to make the piano sing beautifully and only by constant work on the piano can a voicer come to realize this "cantabile" idea in his own mind.

Physical Set-Up

Laboratory.-- The piano shop should be large enough to hold enough pianos so that each student could be working on a piano. There should be a few long tables upon which might be placed the actions of the pianos.

Since about seventy-five per cent of the hours of study

⁹ Ibid., p. 197.

¹⁰ Ibid., p. 198.

in this course should consist of shop work, it should be a place in which both men and women could work under pleasant surroundings. Also, in the same room or adjoining room, there should be a classroom with the right kind of arm chairs so that the students could take examinations on the textbooks or take notes on lectures.

Tools and equipment.--Piano tools and supplies should be furnished by the college as in manual arts, a list of these tools is found in the Appendix of this study. The equipment should include models of grand actions, models of upright actions, and scientific apparatus on which to discover the wave frequency, accuracy in tuning.

Textbooks and publications.--The following is a selected list of books and publications that will be helpful to a piano tuner. The Tuners Journal, the official publication of the National Association of Piano Tuners, is devoted to the practical, scientific, and educational advancement of the tuner. Roy Chipman, Grand Rapids, 2, Michigan, is the secretary-treasurer.

The Musical Trade Review, suite 510, RKO Building, 1270 Sixth Avenue, New York, 20, New York.

Scientific Piano Tuning and Servicing, Alfred E. Howe, 116 Pinehurst, New York, New York.

William Braid White, Piano Tuning and the Allied Arts,

¹¹
Piano Tools and Supplies, Catalog No. 32 (1938).

Tuners Supply Company, Winter Hill Station, Boston, Massachusetts.

Oliver C. Faust, Tuners Pocket Companion, Tuners Supply Company, Winter Hill Station, Boston, Massachusetts.

Pianoforte, Daniel Spillane, copyright 1892.

How the plan might be put into effect.--Adding new courses to the curriculum that necessitate the hiring of an additional instructor and the purchase of expensive equipment is a difficult undertaking. A course of piano tuning would not draw many students and the cost per pupil might be deemed prohibitive by a practical-minded board of control. Considering a few of the possibilities, here it may be shown that the per pupil cost is not greater in proportion than any other technical subject and that it might even be self-supporting.

The instructor's salary could be a nominal sum with a guaranteed minimum and he would be required to keep the pianos owned by the college in good condition. Thus the cost to the college for that work done by an outsider might be saved by hiring a teacher who could do the work as part of his salary.

He could have several hours of free time in which he could do tuning and repair work in the community and receive the money thus made to increase his earnings.

The cost of setting up a piano shop could be cut by taking old pianos from the community and re-building them for the cost price of materials. It would save buying the pianos for laboratory equipment and would give a more practical benefit to the students enrolled in the piano technician course. The cost of putting in the course of study at the professional level, and incidentally the non-professional level would be something like this:

First year

Debit	Credit
Salary \$3600.	Laboratory fees for 20 students at \$25.00 per semester. \$1,000.00
Conn Stroboscope. 400.	
Mixed sets of tools 200.	State of Texas appor- tionment for college freshmen for 20 students at \$175, half of which might be credited to this teacher's salary. 1,750.00
Action parts 100.	
Repair supplies. 100.	
Band saw 75.	
Lathe 75.	For tuning college pianos, a saving included in the salary. 1,000.00
Model of grand action 100.	
Model of upright action 100.	
Set of Chromatic tuning bars 150.	
Miscellaneous 100.	
<u>5,000.00</u>	<u>3,750.00</u>

The cost the first year would be approximately \$1250.00.

Second Year

Debit	Credit
Salary \$3600.	Same as the first year, \$3,750.00
Supplies <u>200.</u>	
	<u>3800.</u>
	<u>3,750.00</u>

The second year would cost less and there probably would be more students which would bring in more fees. If the cost was too great, the laboratory fee could be raised and the students could, after two years of training, begin to earn a substantial sum assisting the teacher in tuning pianos in the community. The possibilities of this course are great. It is the opinion of the investigator that it would pay its way if the plan gets started right at first.

CHAPTER V

CONCLUSION

The profession of piano tuner-technician has a future if the schools of music see clearly to add this technical course to the curriculum. The tuning of a piano is an art and should be raised from its present position to one of a higher level. The present tuner is considered on the same level with plumbers, carpenters and paper-hangers.¹ The investigator is not saying that these occupations are not worthy of dignity - they are very necessary to the welfare of all of us, but they are not listed as arts or professions. Tuners should be listed with the architects, the artists, and other technical arts. Since most tuners are not educated men, it would seem advisable that a new and better tuner should come from our colleges and universities. There will then be enough piano technicians to do the job. The public would have its pianos tuned if there were dependable, educated men and women to be hired for the job. Prices for tuning can be advanced,

¹William Braid White, by letter, June 20, 1945.

better work will be done and thus the music will better be able to fill the need for which it is intended.

As a closing bit of advice to owners of pianos, the investigator presents this quotation:

There should be a society for the prevention of cruelty to piano tuners.

Don't ask your tuner to bring your old piano up to pitch so you can play with the boy friend's saxophone without first considering that perhaps the piano never was tuned to our present standard of pitch, and also remembering that strings, like bones, grow brittle with the years.

Don't neglect your piano for ten years, and then when it is tuned, complain that it 'sounds funny.' Folks do that very thing, forgetting that the ear becomes accustomed to terrible things through habitual association.

Don't sing the pitch of the string on which your tuner is working, and tell him you have 'perfect pitch.'

Don't let little Willie overhaul the tool kit, or bang out a little tune on the other end of the keyboard, or perhaps toot his toy horn while the job is being done. And if he does these things, don't tell him that you know he is a mechanical genius - lead him away and earn the gratitude of the tuner.²

2
C. F. Thompson, Jr., "Be Kind to the Tuner," Etude, LIV (February, 1936), 78.

APPENDIX

List of tools and parts

*

<p>Action cloth Agraffe Alcohol, denatured Alcohol lamp Awl, combination</p> <p>Backchecks Backcheck felt Backcheck regulator Backcheck wires Bags Bass strings Billings Flanges Bit, tuning pin Block plane Blue, royal Books Boring tool Braid, stringing Bridge remover Bridle straps Bridle strap inserter Bridle tacks Bridle tips Bridle wires Broaches Broach holder Bronze bushings Brush, dust Brushes Buckskin Bushings Butt felt Butts, hammer Butt felt inserter Butt felt squares Butt plate inserter Butt plates Buttons, rubber</p> <p>Capstan screws Capstan screw wrench Carrier wire Cases, tools</p>	<p>Casters Caster cups Celluloid Cement Center pins Center pin gauge Center pin holder Center pin lubricant Center pin nippers Center pin punch Chain, ladder Clips, repair Clamps, ivory Clamps, ivorine Cloth, bushing Cloth, rubber Cones, organ Conical spring Cork blocks Cork straps Covers, paper Crank, tuning pin Cut nippers</p> <p>Damper blocks Damper felt Damper flanges Damper heads Damper levers Damper regulator Damper springs Damper wedges Dollies, grand piano Dowels drill Duco cement</p> <p>Ebony sharps Elbows, lead Extractor, hammer Extractor, tuning pin</p> <p>Faces, celluloid</p>
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Felt in strips	Hinges
Felt knife	Hinge pins
Felt picker	Holder, broach
Felt punchings	Holder, center pin
Felt, rubbing	Holder, punching
Felt scissors	Holder, screw
Felt wedge	Hook, spring
File, ivory	
File, reed	Inserter, bridle strap
File sandpaper	Inserter, butt felt
Flanges	Inserter, butt plate
Forks, tuning	Ivory
French varnish	Ivory clamp
	Ivory
Gauge, center pin	Ivory cement
Gauge, music wire	Ivory cement wagers
Garnet paper	Ivory clamps
Glue	Ivory polishing outfit
Grand backchecks	Ivory springs
Grand Action springs	Ivory stain.
Grand desk support	
Grand hammer shanks	Jack flanges
Grand hammer spacer	Jack screw
Grand jacks	Jack springs
Grand leg plates	
Grand leveling leads	Key black
Grand lid support	Key bushing cloth
Grand lid support cut	Key buttons
Grand shank press	Key cement
Grand top catch	Key dip block
Graphite	Key leads
Graphite plate	Key pins
Graphitoleo	Key pliers
	Key rail cloth
Hacksaw	Key repairing
Hammer butts	Key spacer
Hammer extractor	Key wedges
Hammer, spacer	Key white
Hammer heads	Kimball flanges
Hammer head borer	Knife hinges
Hammer iron	Knobs, wood
Hammer rail cloth	Knuckles
Hammer shanks	
Hammer shank drill	Lead, elbows
Hammer shank roller	Leads, key
Hammer shank sleeves	Leather
Hammer springs	Leather nuts
Handle, combination	Levers, damper
	Lifter, punching
	Lifter, string

Long spout	Reamer flange bushing
Lyre braces	Reed file
	Reed scraper
Mandolin attachment	Regulating punchings
Mandolin wire	Regulating screws
Mats, rubber	Regulating tools
Moth exterminator	Repair clips
Muffler felt	Rogers glue
Music wire	Royal blue
Mute, gang	Rottenstone
Mutes, felt	Rubber buttons
Mutes, rubber	Rubber tubing
Nameboard felt	Sandpaper file
Nipples	Saw, hack
Nuts, action	Scraper
	Scratch remover
Oil can	Screw-driver
	Screw holder
Paper covers	Screw, Jack
Paper garnet	Shellac, stick
Pedal dowels	Shields, flange
Pedal hinges	Showwhite
Pedal mountings	Silk cord
Pedal pins	Sockets
Pedal props	Sounding board buttons
Pedal rods	Sounding Board Shims
Pedal slippers	Sounding board steel
Pedals	Spoon bender
Piano casters	Spoons
Piano polish	Springs
Pin setter	Springs, wire
Pins, bridge	Squeakdouse
Pins, center	Stain for ivory
Pins, hinge	Stain for wood
Pins, key	Steel rings
Pins, pedal	Steinway wrench
Pins, plate	Stickers
Pins, trap	Stop knobs
Plane, block	Stringing braid
Plastic wood	Strings, bass
Pliers	
Polisher, tuning pin	T Hammer
Polishing felt	Tacks
Pumice stone	Test roll
Punch, center pin	Tips, bridle
Punchings	Tirro mending tape
	Toggles, sounding board

Tool cases
 Tool outfits
 Tracker bar
 Transfer letters
 Trap Pins
 Trap springs
 Tubing Rubber
 Tuning forks
 Tuning Hammer
 Tuning pin bit
 Tuning pin bushings
 Tuning pin crank
 Tuning pin extractor
 Tuning pin gauge
 Tuning pin polisher
 Tuning pin punch
 Tuning pin setter
 Tuning pin socket

Tuning pin tightener
 Tuning pins
 Tweezers

 Varnish
 Varnish check eradicator
 Voicing pliers

 Webbing, pedal
 Wedge stripping
 Wedges, key
 Wippens
 Wire carrier
 Wire gauge
 Wire, music
 Wires, backcheck
 Wires, bridle

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Catalog, Tuners Supply Co., pp. 106-108.

List of Materials

Casework

The case of the vertical piano consists of the following parts:

Sides: glued on to the sides of the back.

Arms: extending from sides to support key-bed.

Key-bed: upon which the key-frame is laid.

Toes: extending from bottom of sides to support trusses.

Trusses: resting on toes and holding up key-bed. Sometimes called the "legs."

Fall-board. The folding lid over the keys.

Shelf: laid over fall-board to support music

Name-board: resting over keys to support single type fall-board.

Key-slip: strip in front of keys.

Key-blocks: heavy blocks at each extremity of keyboard.

Top-frame: folding or fixed frame, which supports music and conceals piano action and hammers.

Bottom-frame: similar frame to the above, covering trap-work and parts of piano under key-bed.

Pilasters: Decorative pillars sometimes placed on either side of top-frame to support it.

Top: The folding lid which covers top frame and finishes off the casework of the piano.

Bottom-Rail: rail running across the bottom of the casework, in which the pedals are housed.

Bottom-Board: board on which trap-work is mounted, behind the bottom-frame.

Materials Used in Piano Construction

Woods:

Mahogany
Walnut
Oak
Circassian walnut
Bird's eye maple

Maple

White wood
White pine
Spruce

Pear
Holly
Sycamore
Cedar
Mahogany

Used in:

Veneers for cases
Veneers for cases
Veneers for cases
Veneers for cases
Veneers for cases

Veneers for cases
Wrest-planks
Backs
Hammer moldings and shanks
Hammer rails, dowels, etc.

Body of case work
Key-frames and keys
Sounding-boards, posts, ribs

Various small
action parts

Leathers:

Doeskin
Elkskin
Buckskin

For action parts

Felt and cloth:

Green and white baize
Tone felt
Damper felt, hard
Damper felt, soft
Flannel

Key-rail cloth, punchings
Hammers
Bass dampers
Treble dampers
Casework, punchings, fall-board,
strips, name-board strips,
stringing

Ivory	Tops of white keys
Iron	Iron plate, action brackets, bolts and general hardware
Steel	Action angle rails, plates, trap-work, springs, steel wire for strings, etc.
Copper	Covering wire for bass strings
Brass	Action-springs, pedal feet, rods
Graphite	Lubrication of action, etc.

**

William Braid White, Piano Tuning and Allied Arts,
pp. 125-126, 128-129.

Letter Number 1

. . . I can no longer serve you with work on your piano, because I do no credit work and besides that, I can not wait on you until 3 p.m. to do the balance of the work on your piano, because that would make me two nights to be over on expense, so I would not make anything on the job, no more, not even as much as it takes for me to live on.

You may find someone that will do as you dictate, but I don't see how I can pay my way the way you want me to work.

I am now leaving for Wichita Falls where I do a lot of work.

Very sincerely,

O.B. S.

The investigator was called to put this piano, referred to in the above letter, back together. It had been left open, with the middle section of the hammers out. He also had to re-tune the piano which had been left badly out of tune by this man. The owner of the piano had paid O. B.S. to replace a broken flange, a job he could not do- but he had charged her \$5.00 to take the center section of the hammers out so she could send the broken part off for repairs. He had attempted to tune the piano for which she had paid him \$4.50.

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