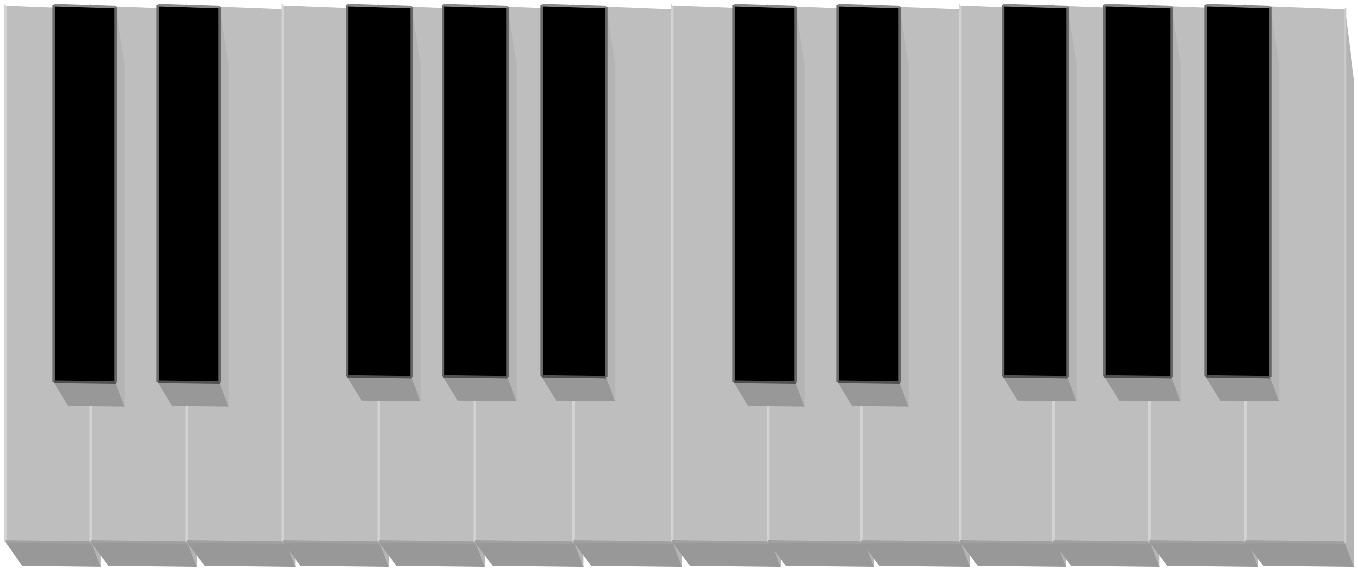

Curso MECÁNICA Y MANTENIMIENTO DEL PIANO CON REFERENCIA A LOS NUEVOS TIPOS DIGITALES

Piano

Historia, Mantenimiento y Afinación

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City and Guilds of London Institute
Newark and Sherwood College Diploma

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1. - THE CONDENSED HISTORY OF THE PIANOFORTE

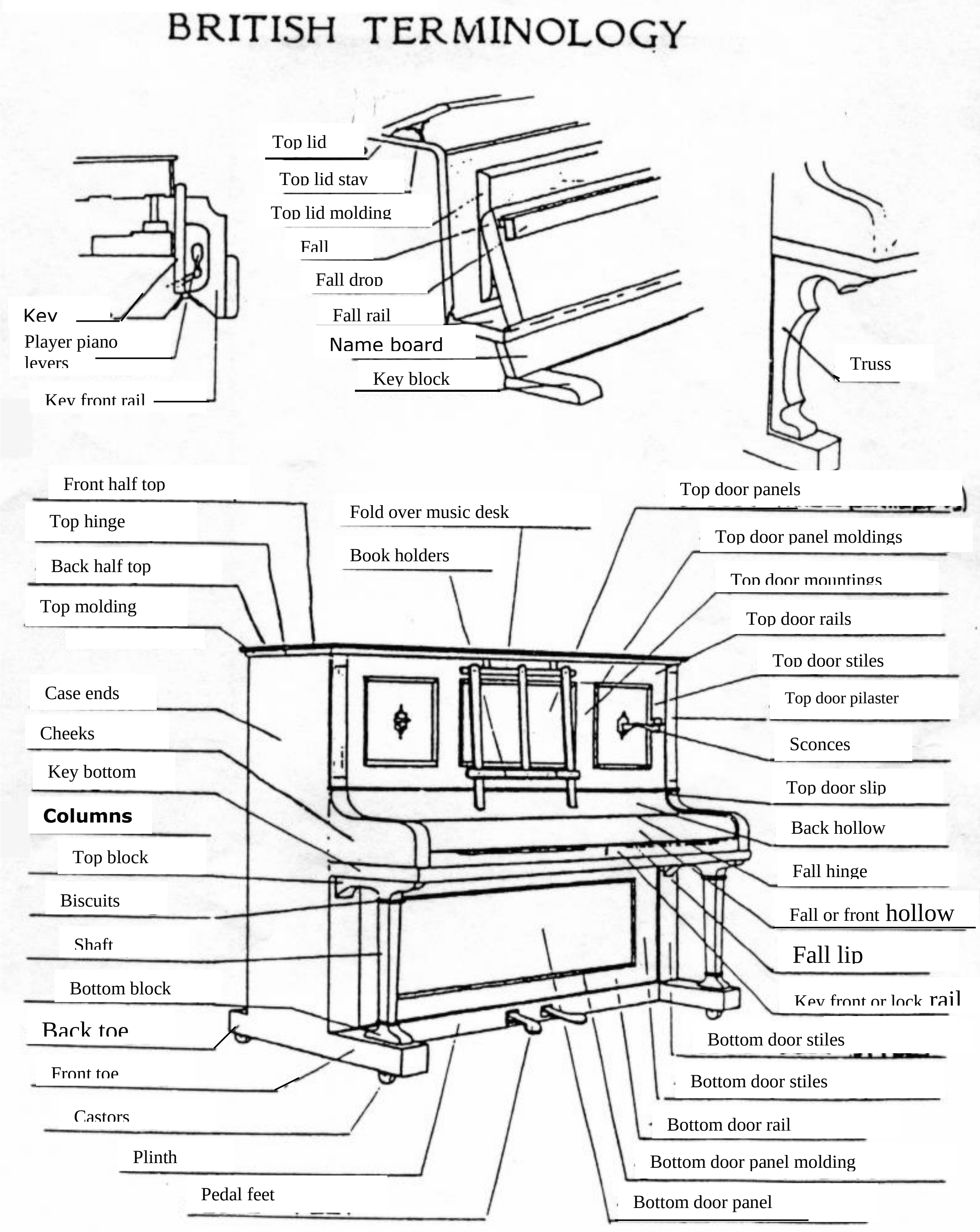
1705	**PANTALEON HEIBENSTREIT** – DEVELOPS A **9' DULCIMER** WITH 5 GUT STRINGS PER NOTE
1708	PANTALEON BECOMES ESTABLISHED IN THE COURT OF LOUIS XIV IN VERSAILLES
1709	**BARTOLOMEO CRISTOFORI – MAKES 3 PIANOS**
1711	MAFFEI – PUBLISES AN ARTICLE ON CRISTOFORIS INVENTIONS
1715	SCHOTER (DRESEN) – INVENTS AS ACTION THROUGH SEEING HEINBENSTREITS PLAY HIS DULCIMER
1716	MARIUS – ALSO DESIGN AN ACTION, THOUGH NEITHER BUILT ONE
1725	MAFFEI'S ARTICLE – INFLUENCES **SILBERMANN** INTO MAKING GRANDS BASED ON CRISTOFORI'S DESIGNS; THESE WERE EVENTUALLY APPROVED OF BY JS IN 1746
1726	CRISTOFORI – BUILDS HIS MOST FAMOUS PIANO (AS I STILL EXISTS). IT IS SO ADVANCED, IT TAKES NEARLY A CENTURY FOR OIT TO BE EFFECTIVELY 'RE-INVENTED
1740	**SILBERMANN** – GOES AWAY FROM THE CRISTOFORI DESIGN; DEVELOPS THE **PRELLMECHANIK (GERMAN ACTION)**. IMPROVED BY **FRIEDERICI AND STEIN** (FORMER PUPILS) AMONGST OTHERS – KNOWN AS THE **GERMAN ACTION**
	LATER ON (1733), STEIN INVENTS PRELLMECHANIC WITH INDIVIDUAL ESCAPEMENT (SPRUNG PRELLEISTE); COPIED BY VIENNA MAKERS- BECOMES KNOWN AS THE **VIENNESE ACTION**
1755-1762	SEVEN YEARS WAR DEVASTATES PIANO MAKING IN SAXONY. THE WORKMAN SCATTER: PARTY COME TO ENGLAND - BECOME **'THE TWELVE APOSTLES'**. INCLUDES **ZUMPE & BACKERS**
1760	**ZUMPE & POHLMANN** – PRODUCE LARGE QUANTITIES OF SQUARE **PIANOS** IN ENGLAND
1767	J.C. BACH – GIVES THE FIRST PUBLIC PERFORMANCE ON THE PIANO
1772	AMERICUS **BACKERS** – INVENTS THE **'ENGLISH ACTION'**; **SINGLE ESCAPEMENT** OR **DIRECT LEVER** GRAND ACTION

1774	MERLIN – INTRODUCE LEATHER AND CLOTH TOP COVERING ON HAMMER HEADS
1783	BROADWOOD – INVENTS THE DAMPER LIFT RAIL
1788	BURY – COVERS THE HAMMER HEADS WITH FELT UNDER COVERING AND LEATHER TOP COVERING
1799	JOSEPH SMITH – STRENGTHENS THE PIANO WITH IRON BARS EARLIEST PATENT FOR METAL BRACING (NOT FRAME)
1800	MULLER – INVENTS UPRIGHT IN VIENNA
1800	JOHN ISAAC **HAWKINS** – INVENTS **UPRIGHT** IN USA; HALF SIZE OF A GRAND, HOLDS TUNING 5 TIMES AS LONG
1802	THOMAS LOUD – INVENTS AND PATENTS OBLIQUE STRINGING
1808	SEBASTIAN **ERARD** – INVENTS THE REPETITION ACTION (NOT DOUBLE YET) AND **AGGRAFES**
1808	**BROADWOOD – INTRODUCES METAL HITCH PIN PLATE**
1821	**ERARD – PATENTS THE DOUBLE- ESCAPEMENT GRAND ACTION**
1825	ALPHAEUS **BABCOCK** – INVENTS THE **CAST IRON FRAME** WITH HITCH PLATE IN A SQUARE PIANO
1826	HENRI **PAPE** – PATENTS **FELT** COVERED **HAMMERS IN LAYERS**
1827	**COTE** – PATENTS **SINGLE** THICK **LAYER OF FELT** FOR HAMMERS
1827	JAMES **STEWART** – INTRODUCE **RETURN STRINGING**
1827	**BROADWOOD** – USES A **COMPOSITE** IRON FRAME
1828	**PAPE** – INTRODUCES **OVERSTRINGING ON AN UPRIGHT**
1837	**WORNUM** – INVENTS **TAPE CHECK ACTION** (PATENTED 1842)
1839	PAPE – BUILDS A PIANO 2’9” HIGH WITH DROP ACTION AND OVERSTRINGING
1843	ANTOINE BORD – INVENTS THE CAPO D’ASTRO (PRESSURE BAR)

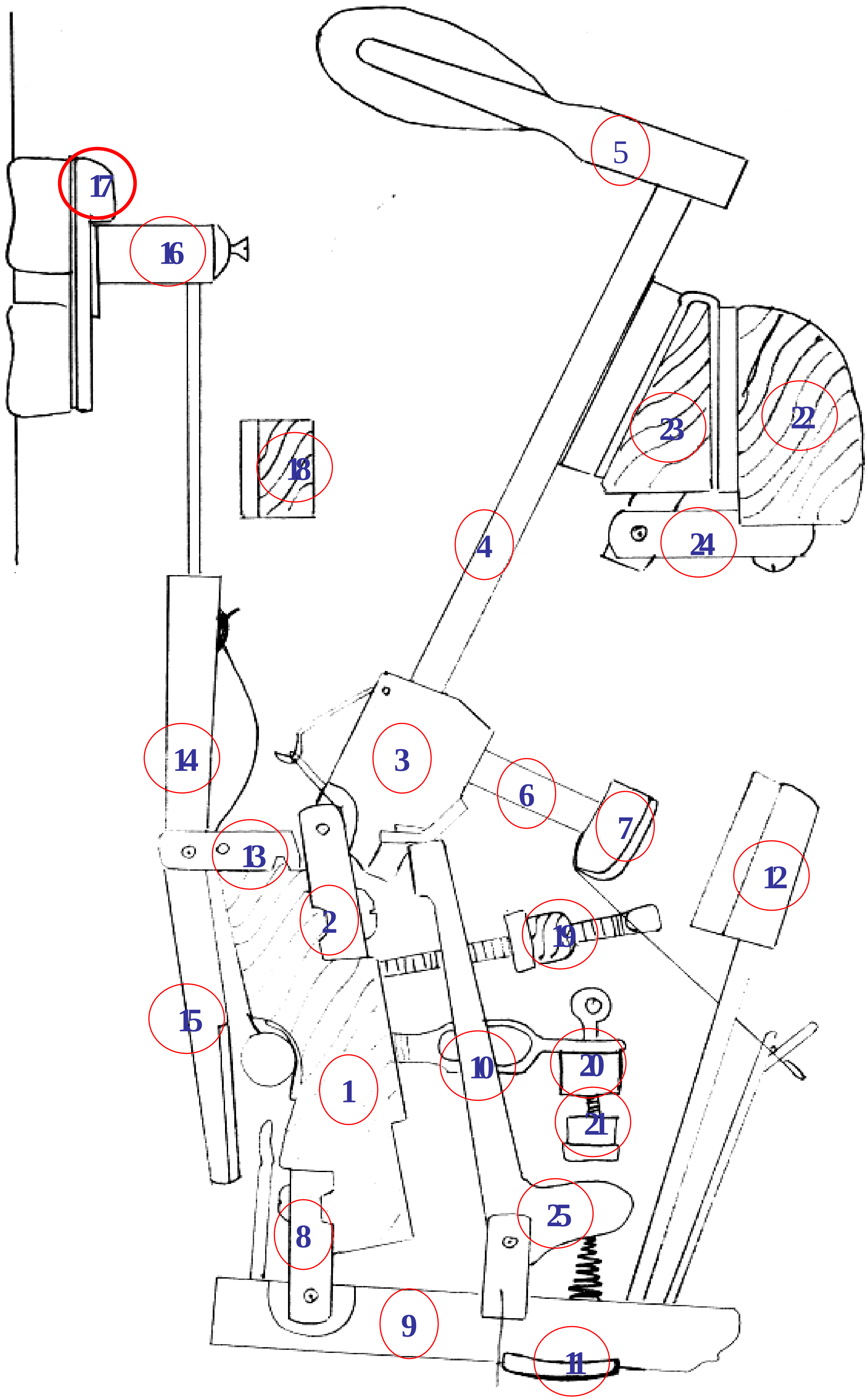
1847	BROADWOOD – INVENTS SPECIAL CONCERT GRAND IRON FRAME
1850	HENRI **STEINWAY – WENT TO NEW YO**RK
1857	STEINWAY – INTRODUCES A CAST IRON OVERSTRUNG FRAME AND MORE MODERN STEEL MUSIC WIRE TO THEIR GRAND
1874	**STEINWAY** – PATENTS THE **SOSTENUTO PEDAL**

2 - UPRIGHT PIANO PARTS

2.1. – CASE PARTS

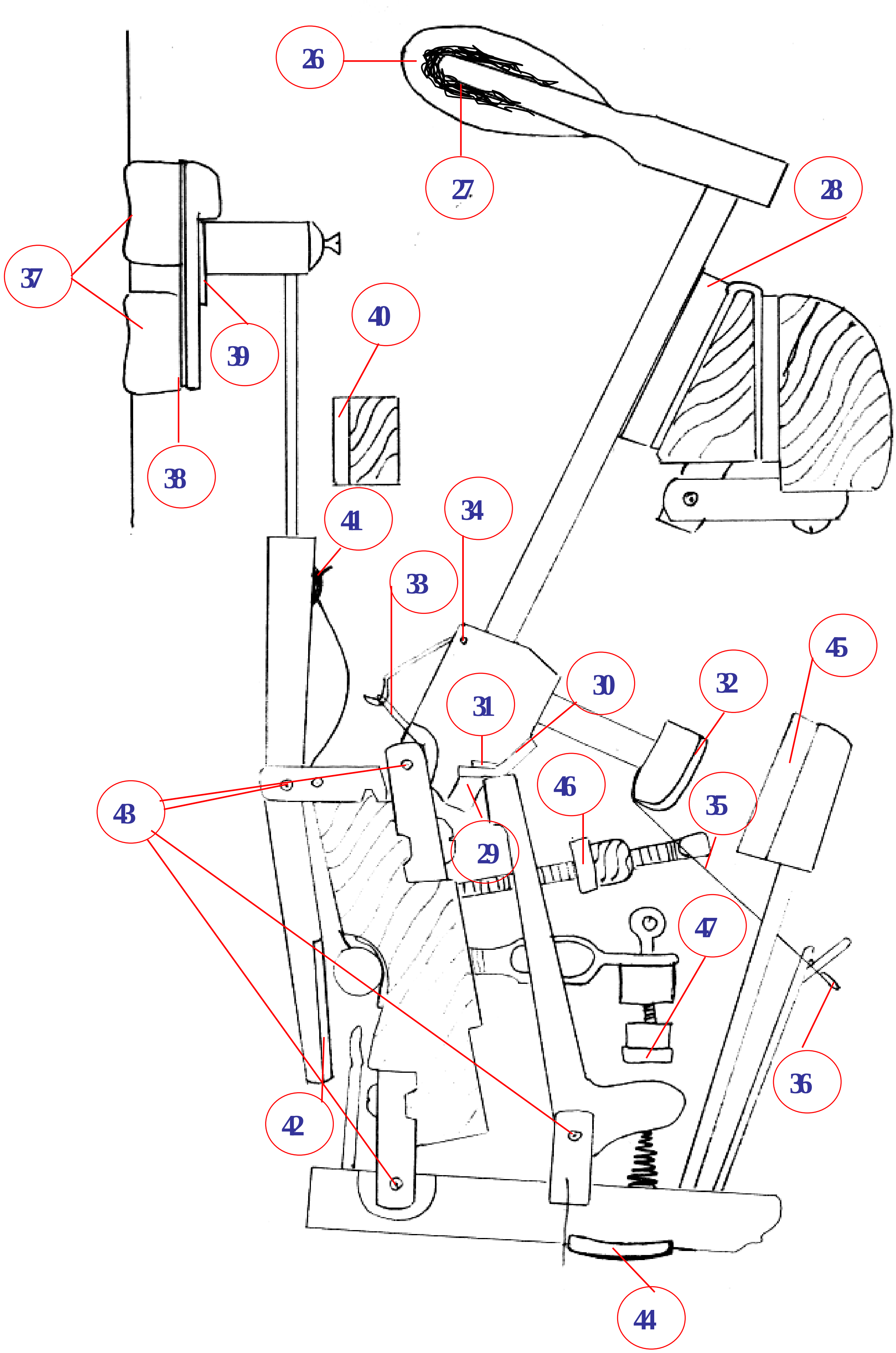


2.2. - ACTION WOODEN PARTS



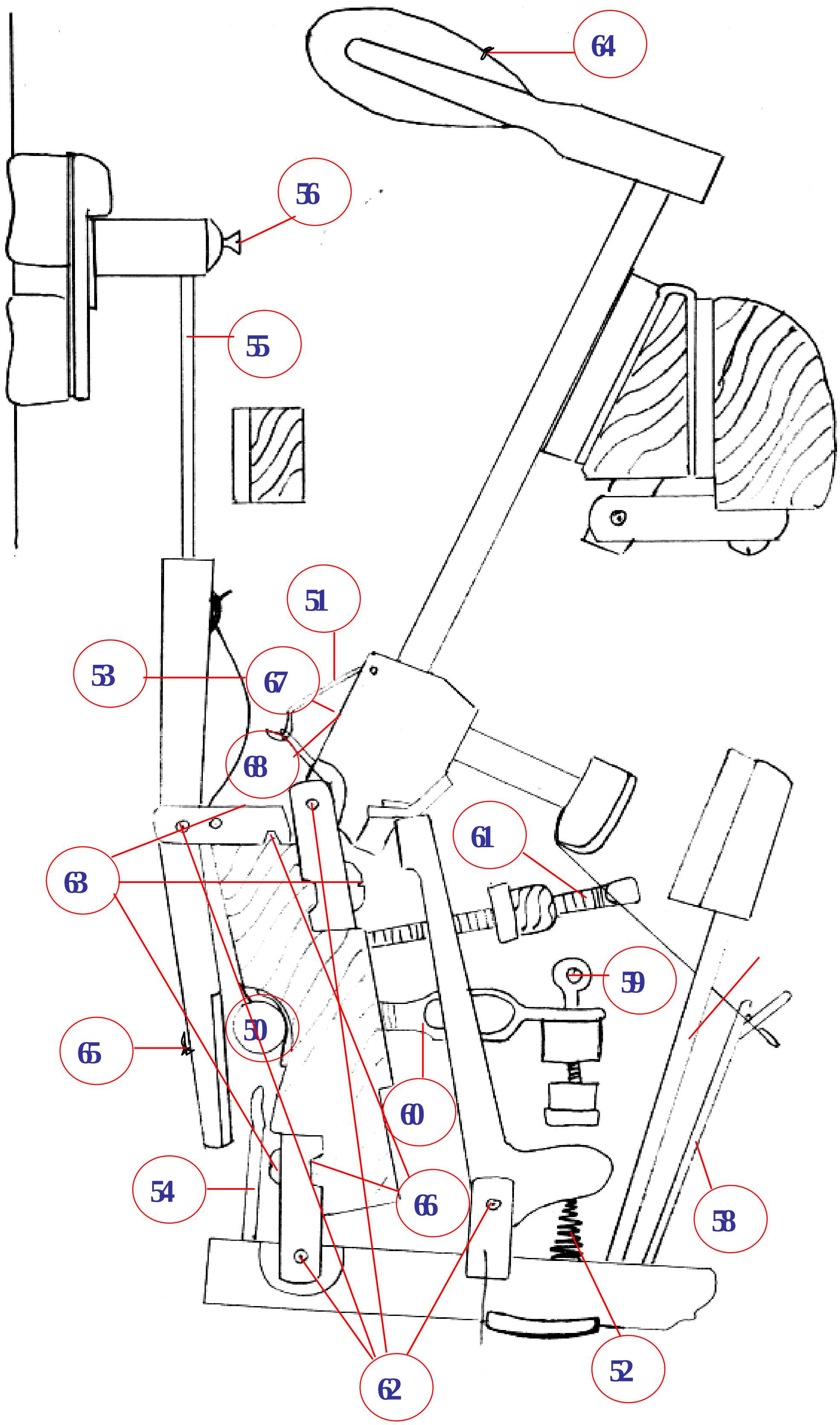
1.- BEAM
2.- HAMMER FLANGE
3.- HAMMER BUTT
4.- HAMMER SHANK
5.- HAMMER HEAD
6.- BALANCE HAMMER SHANK
7.- BALANCE HAMMER
8.- LEVER FLANGE
9.- LEVER BODY OR WHIPPEN
10.- JACK
11.- LEVER BLOCK OR HEEL
12.- CHECK
13.- DAMPER FLANGE
14.-DAMPER BOTTOM
15.- DAMPER TALE
16.- DAMPER BARREL OR DRUM
17.- DAMPER HEAD
18.- DAMPER SLAP RAIL
19.- JACK SLAP RAIL

2.3. - ACTION SOFT MATERIALS



26.- HAMMER FELT
27.- HAMMER FELT UNDERCOVERING
28.- HAMMER REST BAIZE
29.- NOTCH CUSHION, BUTT C. OR C. FELT
30.- NOTCH LEATHER
31.- BUTT PAD
32.- BALANCE LEATHER
33.- LOOP CORD
34.- SPRING CORD
35.- TAPE
36.- TAPE END
37.- DAMPER FELT
38.- DAMPER FELT BACKING
39.- DAMPER DRUM BUSHING
40.- DAMPER SLAP RAIL FELT
41.- DAMPER BODY PUNCHING
42.- DAMPER TALE BAIZE
43.- BUSHING CLOTH
44.- LEVER HEEL BOX CLOTH
45.- CHECK FELT

2.4. - ACTION METAL PARTS



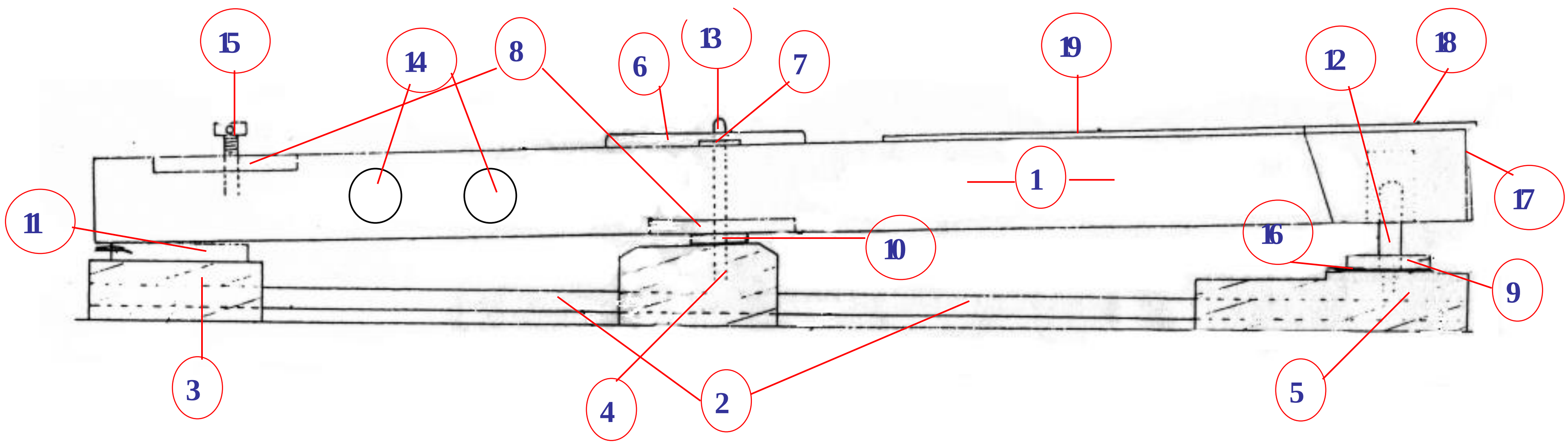
50.- DAMPER LIFT ROD
51.- BUTT SPRING
52.- JACK OR SPIRAL SPRING
53.- DAMPER SPRING
54.- DAMPER SPOON
55.- DAMPER WIRE
56.- DAMPER DRUM SCREW
57.- CHECK WIRE
58.- TIE OR BRIDLE
59.- SET OFF SCREW
60.- SET OFF RAIL BRACKETS
61.- LEFT AND RIGHT SCREW
62.- CENTER PINS
63.- ACTION SCREWS
64.- HAMMER FELT STAPLER
65.- DAMPER GRUB SCREW

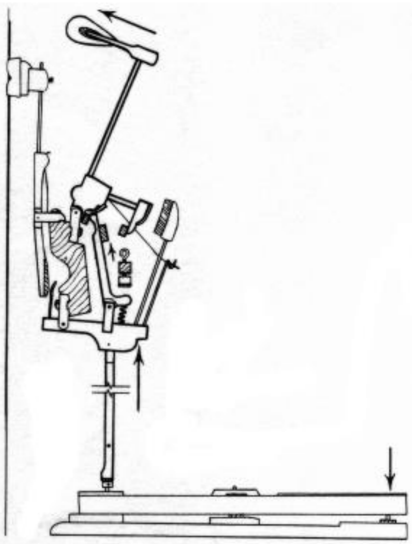
2.5. - UPRIGHT KEYBOARD PARTS:

1.- KEY
2.- KEY FRAME
3.- BACK TOUCH RAIL
4.- BALANCE RAIL
5.- FRONT TOUCH RAIL
6.- CHASE
7.- MORTISE
8.- HARDWOOD INSERTS
9.- FRONT TOUCH WASHER
10.- BALANCE WASHER

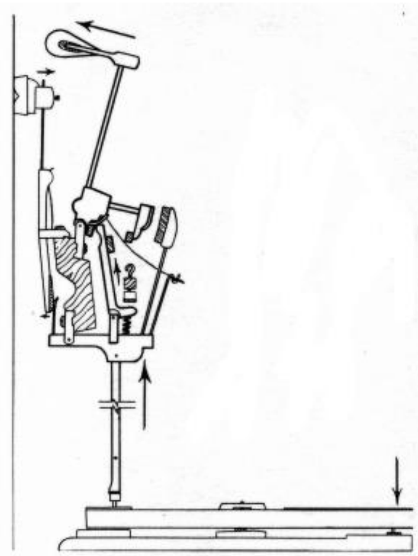
11.- BACK TOUCH BAIZE
12.- BAT PIN
13.- BALANCE PIN
14.- KEY LEADS
15.- CAPSTAIN, or PILOT or ROCKER or WOODSCREW
16.- PAPER WASHER

17.- KEY FRONT
18.- KEY TOP OR HEAD **KEY COVERING**
19.- KEY TAIL

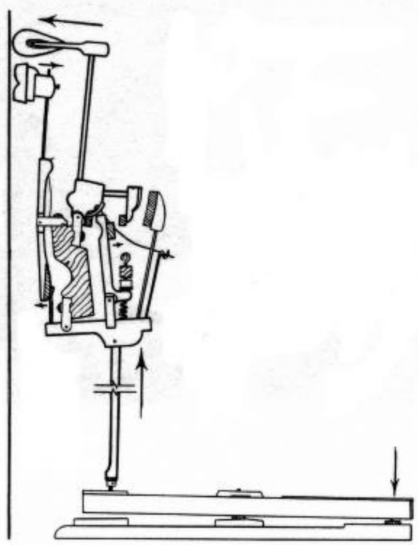




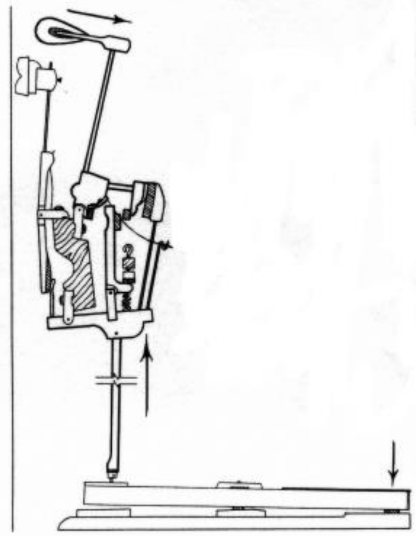
2-48 (above). Operation of the upright action: key begins moving down, raising sticker, wippen, jack and hammer butt.



2-49 (above). Damper spoon begins to move damper lever, lifting damper off strings.



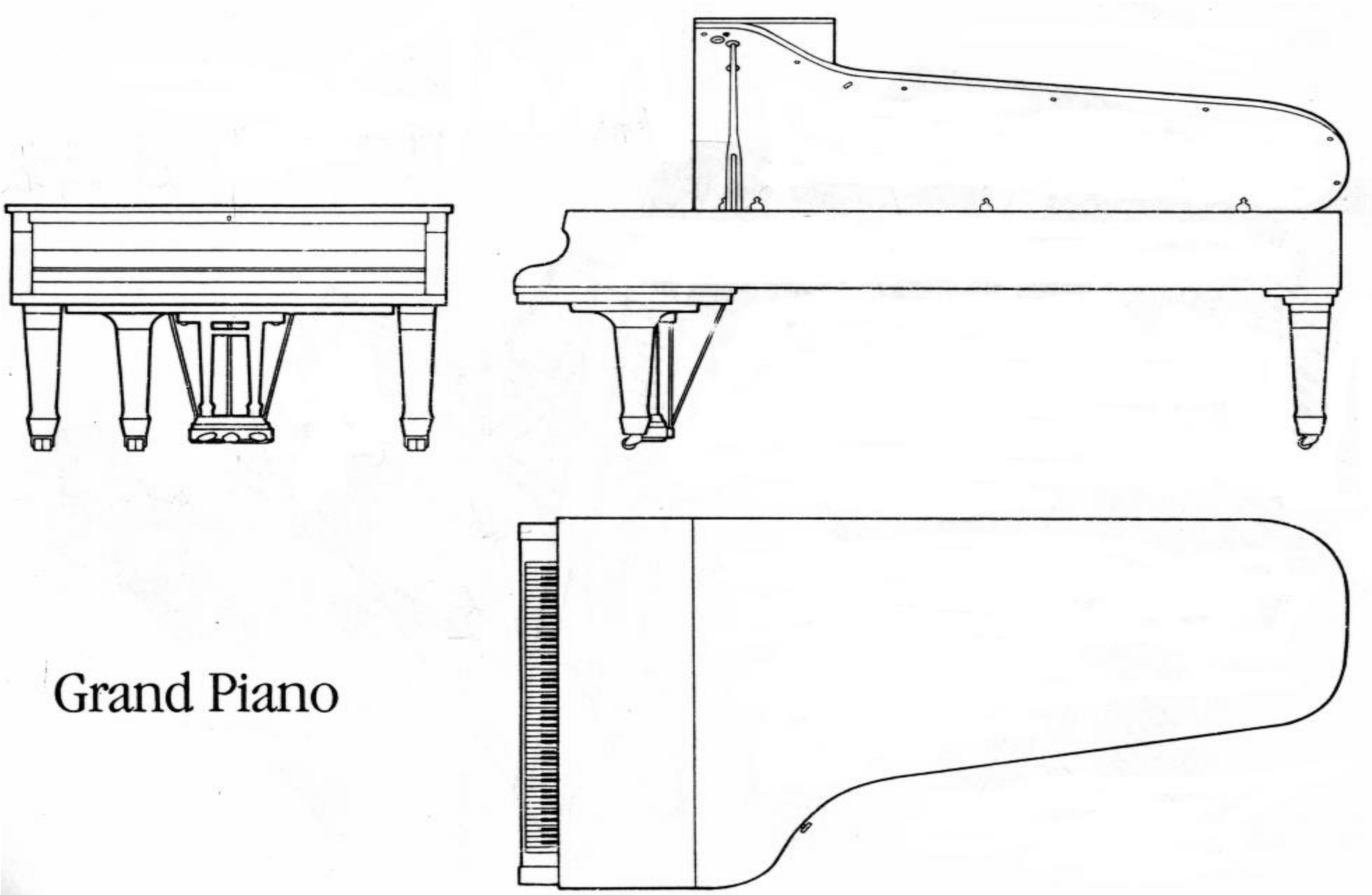
2-50. Jack disengages from hammer butt when jack toe engages letoff button.



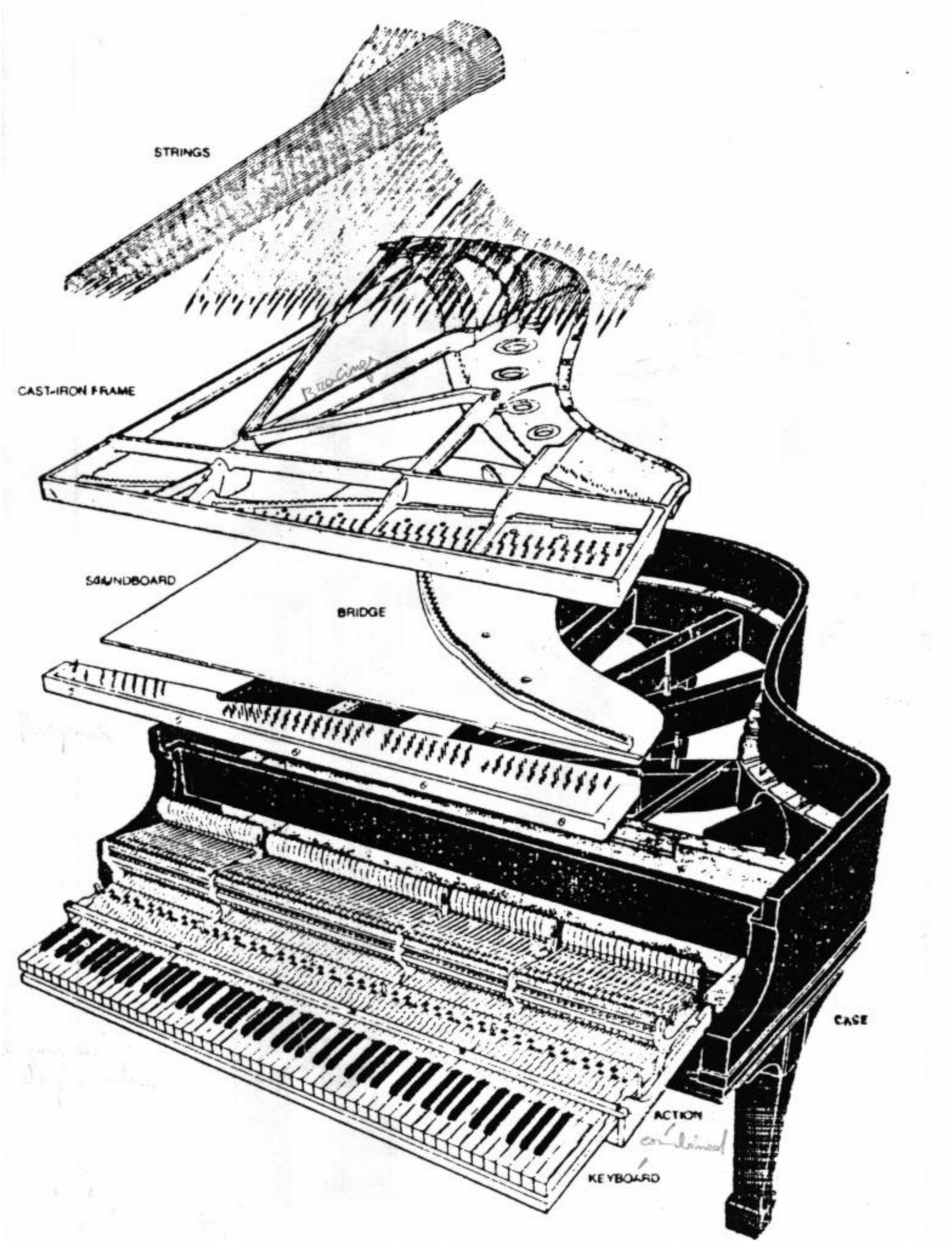
2-51. Hammer hits string and rebounds. Backcheck catches butt catcher. When key is released, all parts return to their positions in illus. 2-48.

3. – GRAND PIANO

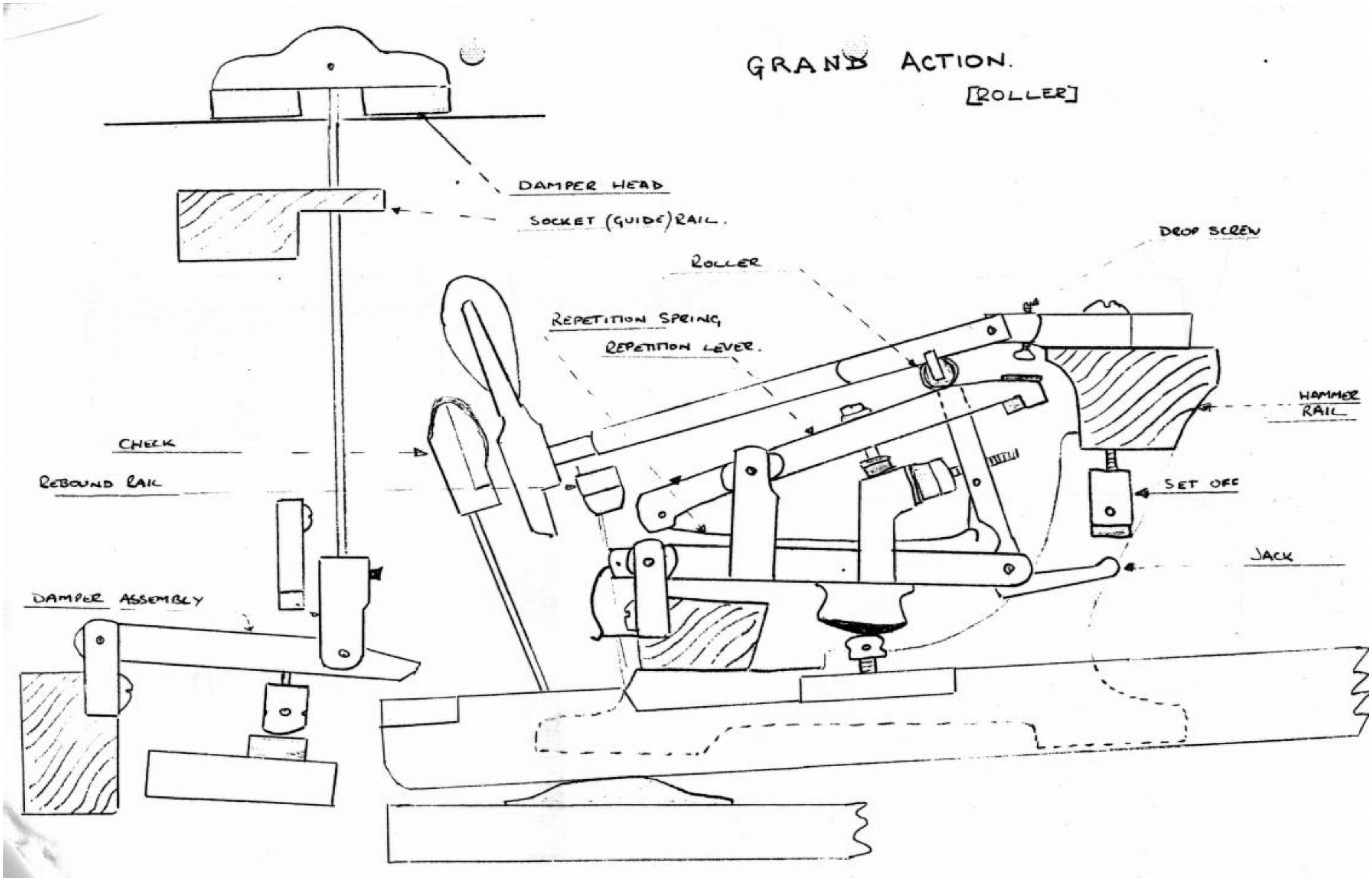
3.1. - GRAND CASE



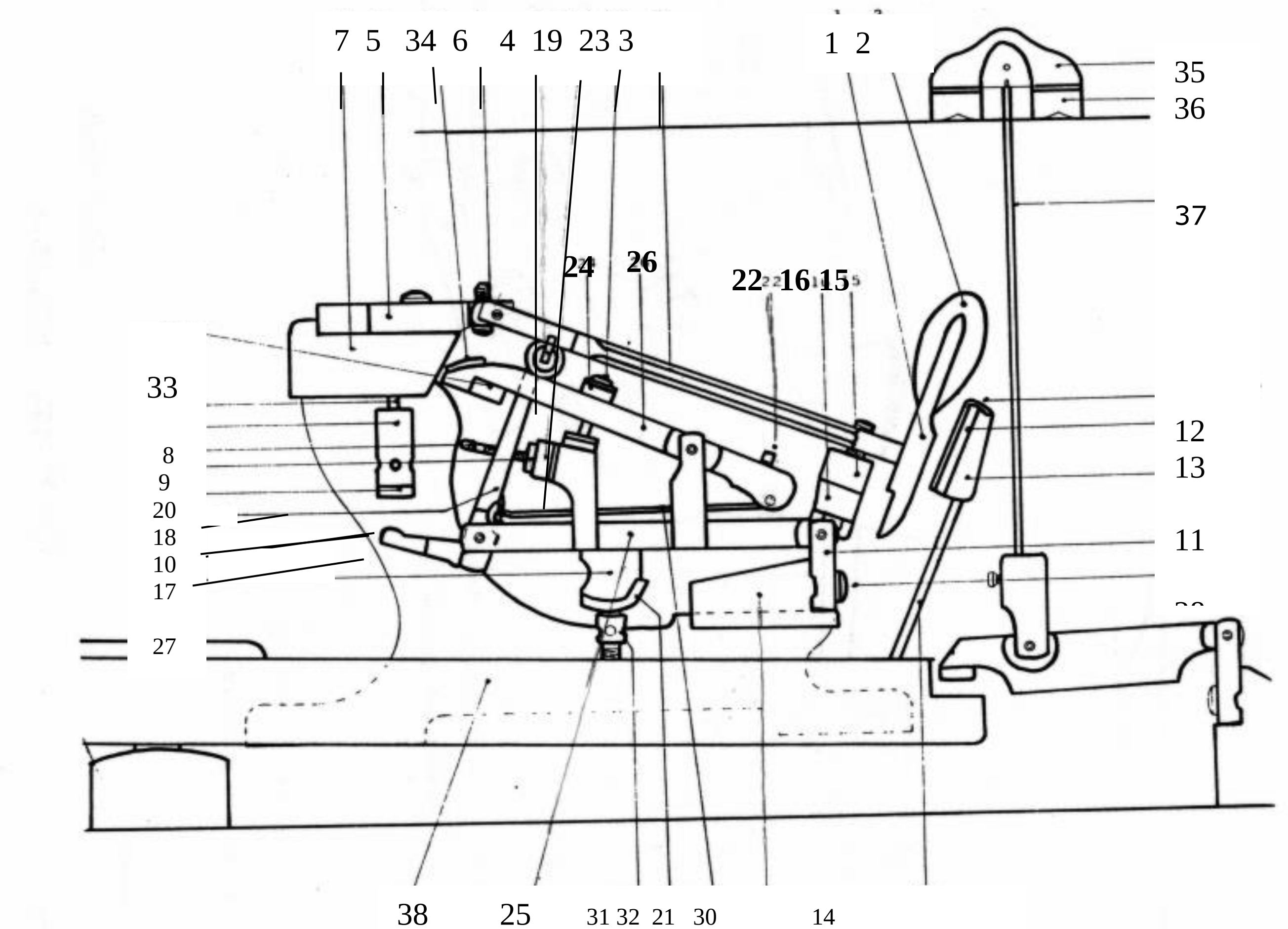
3.2. – GRAND STRUCTURE



3.3. - GRAND ACTION MECHANISM

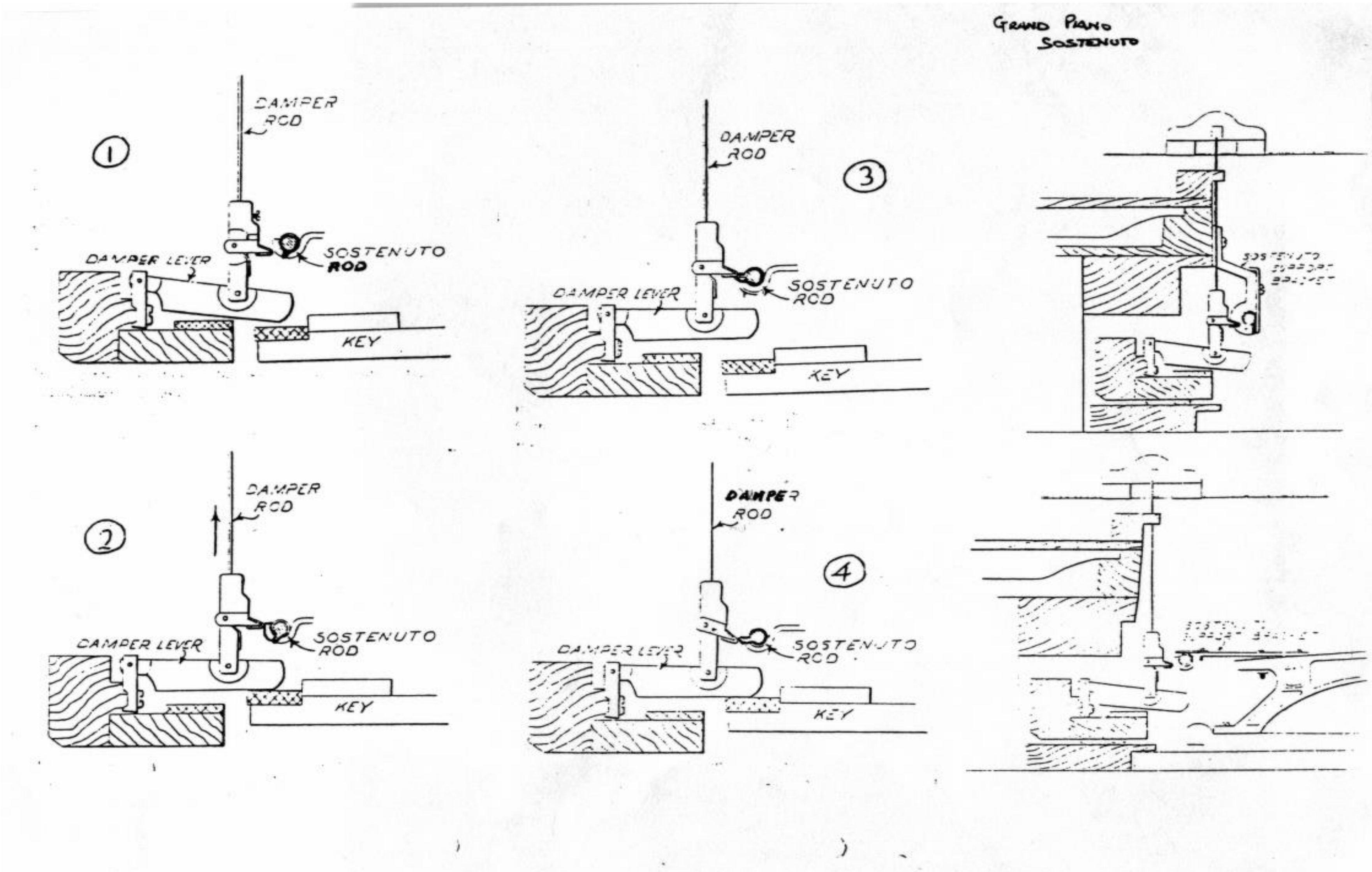


3.4. - GRAND ACTION PARTS



1.- HAMMER HEAD
2.- HAMMER FELT
3.- HAMMER SHANK
4.- ROLLER
5.- FLANGE
6.- GRAND SET OFF SCREW
7.- HAMMER RAIL
8.- ESCAPEMENT DOLLY WIRE
9.- ESCAPEMENT DOLLY
10.- ESCAPEMENT FELT
14.- CHECK WIRE
15.- HAMMER REST BAIZE
16.- HAMMER REST RAIL
17.- JACK
18.- JACK REGULATING BUTTON
19.- JACK REGULATING FELT
20.- JACK REGULATING SCREW
21.- LEVER SPRING
22.- GRUB SCREW
23.- ROCKER REGULATING
27.- LEVER HEEL
28.- LEVER FLANGE
29.- FLANGE SCREW
30.- LEVER RAIL
31.- CAPSTAIN SCREW
32.- LEVER HEEL BOXCLOTH
33.- JACK PAD
34.- ROCKER STOP PAD
35.- DAMPER HEAD
36.- DAMPER FELT
37.- DAMPER WIRE
38.- KEY

3.5. - GRAND PIANO SOSTENUTO PEDAL SYSTEM



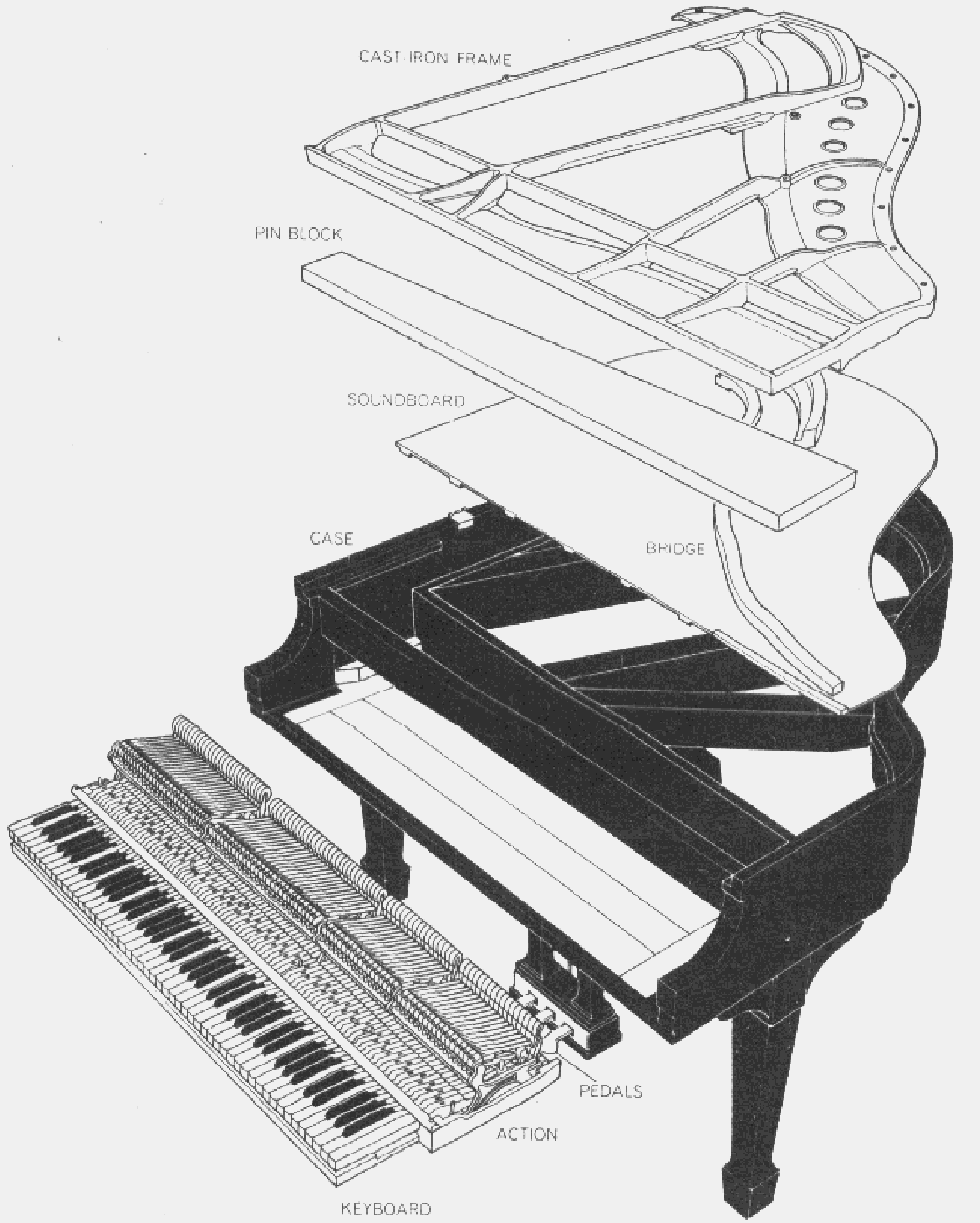


Illustration courtesy of Steinway & Sons.

4.- TUNING THEORY AND TERMINOLOGY

A piano sounds **in tune** when its strings vibrate at certain frequencies determined by musical and acoustical rules. Here it is explained enough about musical and acoustical theory for you to understand how and why tuning works. The music theory presented in this chapter will seems elementary to a trained musician, as will the acoustic theory to anyone trained in physics. You'll need to know exactly how the music and science fit together.

Musical Tone & Noise

When something vibrates, it cause the surrounding air to imitate its movement. For example, when the surf pounds of the shore, the movement of the water transmits its scrambled collection of vibrations to the surrounding air. In turn, the air makes your eardrums vibrate and creates the sensation of **noise**. You hear any unorganized collection of vibration as noise. On the other hand, when an object vibrates at a certain speed and causes your eardrums to vibrate at the same speed, you hear **musical tone**, if the vibration is too slow, you hear each cycle individually like the click of a ratchet or the pounding of a jackhammer. If the rate is too fast, you can't hear it at all. The speed at which the object vibrates is its **frequency**, measured in **cycles per second**, or **hertz** (**hz**). As the object vibrates faster, it frequency is higher, and you hear a higher tone. The frequency of vibration in hz also called **pitch**. The faster the vibration, the higher the pitch.

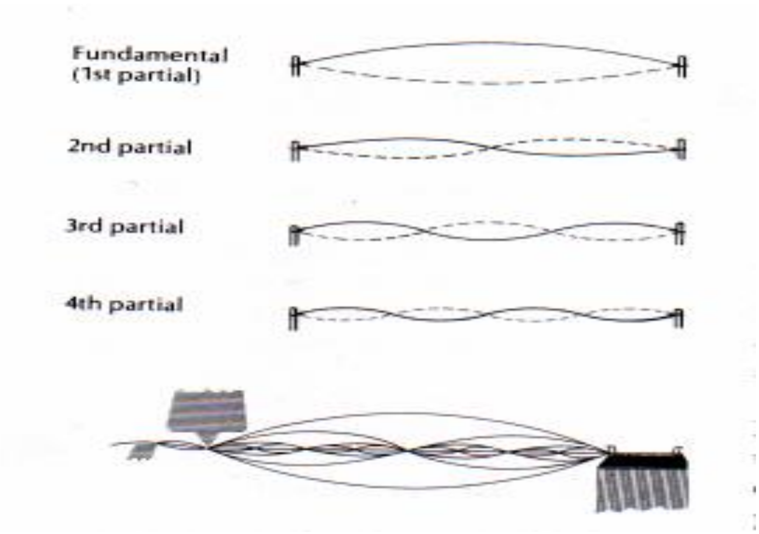
The Vibration of Wire

Three factors influence the pitch of a vibrating wire

1. The length: Other factors being the same, the shorter the wire, the higher its pitch.
2. The thickness: Other factors being the same, the thinner the wire, the higher its pitch.
3. The tension: Other factors being the same, the tighter the wire, the higher its pitch.

Another factor, the wire's **stiffness**, is a result of a combination of the other factors. If two wires of different lengths –made of the same material- have the same thickness, the shorter wire is shorter in proportion to its thickness than the longer wire, so the shorter wire is stiffer.

Wire vibrates in a complex way. Not only does an entire string vibrate, producing the **fundamental pitch**, it also divides it self into two vibrating halves, three thirds, four quarters, and so on, all simultaneously. Each portion produces its own pitch called a **partial**. Whenever a string vibrates, it produces a whole series of partials (or **partial serie**s) together with the fundamental pitch.



The partials are usually much softer than the fundamental, but it is possible to force a partial to predominate by touching the string lightly at a half, third, or other fraction of its length, and then playing it. The partial produced by the isolate segment will then sound louder than the fundamental.

Musicians have used the words **partial**, **harmonic**, and **overtone** interchangeably to describe vibrating string segments, but each term has its own specific meaning. A **partial** is a pitch produced by the whole vibrating string, or any vibrating string segment. The fundamental is the **first partial**, the two halves each produce the **second partial**, the three thirds the **third partial**, and so on.

SIXTH PARTIAL	1320	2640
FIFTH PARTIAL	1100	2200
FOURTH PARTIAL	880	1760
THIRD PARTIAL	660	1320
SECOND PARTIAL	440	880
FUNDAMENTAL (1st Partial)	220	440

The partial series of two theoretically perfect strings, one tuned to 220 and the other to 440, luce no audible beats because all partials either coincideor are too far apart.

A **harmonic** is a theoretical frequency that is an exact multiple of the fundamental. The second and higher partials of piano string don't necessarily vibrate at frequency that are exact mathematical multiples of the fundamental or first partial. Thus, not every partial is a true harmonic. Here partial refers to any vibrating string segment, while harmonic refers only to a partial that is multiple of the fundamental or pitch. Wire stiffness causes the vibrating segments to produce partials that are not true harmonics. The deviation of partials from the harmonic series is called **inharmonicity.**

An **overtone** is like a partial, but overtones are numbered differently. The first partial is the fundamental, but the first overtone is second partial. To avoid confusion, the term 'overtone' is not used in this book.

Simultaneously Vibrating Wires

If you strike two wires that have their tension adjusted, or **tuned**, to the same pitch, the sound produced by one reinforces the other, and the two produce a louder combined tone by **constructive interference**. If one wire vibrates out of synchronization with the other, they subtract from each other and produce a softer tone, by **destructive interference**.

If you tune one string to 440 hz and the other 442 hz, the vibration of the faster string will catch up to and overtake the slower string twice per second. Likewise, the other tone will grow louder and then softer twice per second. Each time the tone gets louder and softer is called one **beat**. Two strings vibrating at 440 produce no beats; and two strings vibrating at 442 produce no beats. Strings tuned to 440 and 441 beat once per second; strings tuned to 440 and 445 beat five times per second. If strings beat much faster than fifteen times per second, the beats are too fast to be heard. Instead of sounding like one tone with beats, the tone sounds like two pitches played at once.

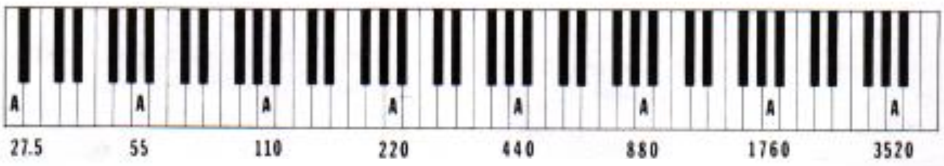
Partials and fundamental pitches can each cause beats. Thus, if one vibrating string has fundamental or partial in its series vibrating at 100 hz, and another has a fundamental or partial vibrating at 102 hz, two beats per second will be heard.

What Pitches Form the Musical Scale?

The musical scale, or tuning scale, of a piano is the assortment of pitches to which the strings are tuned, which can be played by playing the keys in order, one after the other. The word **scale** has several meaning. Don't confuse the musical scale discussed in this chapter with the stringing scale discussed elsewhere in this book. The latter refers to the physical dimensions of the plate, bridges, and strings.

Of the infinite number of possible pitches, only certain ones sound good when played simultaneously, and these pitches are the ones that make up our musical scale. They are related to each other according to certain rules of music theory, including the following:

1. One pitch, or a **unison,** sounds more pure than anything else. This is logical, since a single vibrating string theoretically produces no beats.
2. The most pure sounding combination of two pitches is produced when one is twice the frequency of the other. If you compare the partial series of two theoretically perfect strings, one tuned to 220 and the other to 440, none of them are close enough together. These two pitches sound more pure than any other combination. In fact, two pitches, one of which is twice the frequency of the other, sound so much alike that they have the same letter name in the scale.



6-5. A piano keyboard with the theoretical hz of all A's identified.

Every so often on illustration another "A" comes along, and each A is twice the frequency of the previous one. If the scale consisted of only one basic pitch and those pitches obtained by doubling its frequency repeatedly, these pitches sound so much alike that there wouldn’t be enough variety to play melodies. This leads to the next rule:

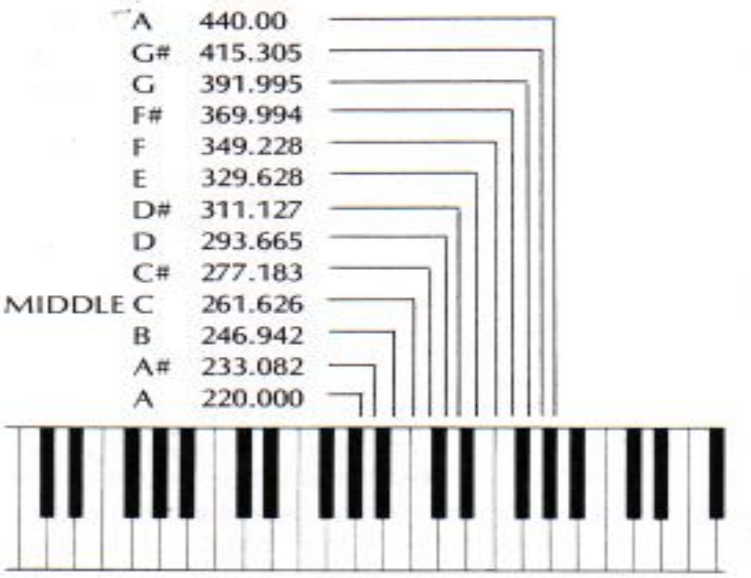
3. Going up the scale, there are twelve pitches between any two notes of the same name, or between a pitch of a given frequency. Look at the keyboard again, and count the keys between one A and the next. Every time the frequency doubles, twelve steps have gone by.

To review, random vibrations produce **noise** while organized vibrations produce **musical tone**. A vibrating wire produces a whole series of **partials** by subdividing itself into many vibrating parts, besides its **fundamental tone.** Pitches of nearly **coincident** frequencies produce **beats**, or pulsations in the loudness of the tone. The mathematical difference between the two pitches determines the speed of the beats. From these principles, some logical conclusions may be drawn, to arrive at the basis for the western tuning scale.

A vibrating string has a fundamental and a series of partials. This theoretical string produces no beats. A single vibrating string is the most pure sound in a piano. Therefore, a beatless tone is the most pure, and the more beats that a combination of pitches produces, the less pure the sound. The most pure combination of two pitches occurs when one has double the hz of the other, because theoretically these two pitches produce no beats. Since the musicians who developed our scale decided on twelve steps every time the frequency doubles, then the twelve basic pitches should be those that produce the fewest beats when played together in any combination. This, indeed, is the basis of the tuning system.

Mathematics of the Theoretical Scale

The octave interval consists of two notes of the same name. One pitch is double the frequency of the other, and there are twelve pitches between.



Given the pitch of the middle A on the keyboard (A440, or key number 49), you can find the theoretical pitches off all the higher A's by doubling 440 repeatedly, and the theoretical pitches of all the lower A's by halving 440 repeatedly. Given theoretical pitches in hz of all A's, how do you find the frequencies of the remaining pitches? The frequencies of all twelve pitches are related according to a mathematical law. This law states that starting with any pitch (say A37, or A220, for example), and multiplying it by a *constant number* twelve times in a row, the result is double the frequency of the starting pitch (or A440). The constant number is 1.0594631, which is the twelfth root of two. In 1925, musicians decided that the **international pitch standard**, or **tuning standard**, would be A440. Starting with A in octave lower (A220) and multiplying it by 1.0594631 twelve times in a row gives the theoretical frequencies for the twelve pitches near the middle of the keyboard, ending on A440. Given these twelve pitches, it is a simple matter to find the theoretical frequencies of the remaining keys on the piano, by halving each basic pitch repeatedly for the lower octaves, and doubling each repeatedly for the higher octaves. Illustration contains the results.

PITCH	1	2	3	4	5	6	7	8
G#	51.913	103.826	207.652	415.305	830.609	1661.219	3322.437	
G	48.999	97.999	195.998	391.995	783.991	1567.982	3135.963	
F#	46.249	92.499	184.997	369.994	739.989	1479.978	2959.955	
F	43.654	87.307	174.614	349.228	698.456	1396.913	2793.826	
E	41.203	82.407	164.814	329.628	659.255	1318.510	2637.020	
D#	38.891	77.782	155.563	311.127	622.254	1244.508	2489.016	
D	36.708	73.416	146.832	293.665	587.330	1174.659	2349.318	
C#	34.648	69.296	138.591	277.183	554.365	1108.731	2217.461	
C	32.703	65.406	130.813	261.626	523.251	1046.502	2093.004	4186.009
B	30.868	61.735	123.471	246.942	493.883	987.767	1975.533	3951.066
A#	29.135	58.270	116.541	233.082	466.164	932.328	1864.655	3729.310
A	27.500	55.000	110.000	220.000	440.000	880.000	1760.000	3520.000

The **octave number** across the top of illustration start with the lowest A on the keyboards as "A1" and end with the highest C as "C8". Most European and Asian piano markers, and Yamaha electronic tuning device, use this system for numbering the octaves of a piano. Some American piano technicians, and the Conn, Peterson, and Sanderson Accu-Tuner electronic tuning device made up to the time that this is being written, call the lowest three notes "A0", "A#0" and "B0". The #1 octave runs from C1 up to twelve notes through B1. Throwing the numbers of all A's, A#'s, and B's off by one octave. For example, in the European system, A-440 is "A5", as in illustration. In the American system, A-440 is "A4". To Eliminate confusion in this book, all notes are called by their key numbers, from A1 through C88. If you have a piano with fewer keys in the bass, translate all key numbers into the standard 88-key format.

Another important concept in piano tuning is the division of half steps into **cents**. One cent equals one hundredth of half step; there are 100 cents in any half step. As you go up the keyboard, each higher half step has a greater change in hz than the previous one, but every half step always has 100 cents. In other words, if any note is 100 cents flat, it is a half step flat. This is a very handy way of measuring how sharp of flat a note is, without having to know its vibration in hz.

At this point, don't proceed until you master everything discussed so far, including how wire vibrates, partials, harmonics, beats, cents, the names of all notes, the definition of an interval, sharps and flats, determining the size of an interval given the names of two notes, and how to find the frequencies of all pitches, given the standard pitch of A440.

EQUAL TEMPERAMENT:

Therefore is the most common tuning system actually used to tune pianos .

It is a compromise system of tuning in which there is only one perfect (beatless) interval: The octave, divided into twelve evenly spaced semitones. All other intervals are proportionally "untuned": narrowed fifths, expanded fourths and thirds…..etc.

Equal temperament is a solution to the imperfection demonstrated by the Pythagorean Comma: Amount by which a series of twelve perfect fifths exceeds seven octaves .

=0.98654036

The relationship between the frequencies of any two notes making up an octave is……: 2:1

The relationship between the frequencies of any two notes making up a semitone is……$\sqrt[12]{2}$:1=1.0594631

In this way the musician can use any interval without having intolerable distortion: some intervals sound better than others but none is too bad.

TUNING PROCEDURE: One recommended system.

So, what we do to establish equal temperament is to divide the comma all along the keyboard, for that, we stretch or narrow the fifths, wide the fourths and major thirds, and so on, compromising some intervals with the others.

There are many systems for establishing equal temperament into the piano, and any of them is valid as long as it respects the rules. We establish the scale in the middle of the keyboard from f3 to f4. the reason why we do here and not in other part is because here we can hear better the beat rates; human hear does not appreciate more than 15 beats per second.

Steps:

A(440) E .....(FIFTH) **(--<)**

B ....(FOURTH)**(>--)**

F# ....(FOURTH)**(>--)**

C#...........(FIFTH) **(- -<)**

G# ....(FOURTH) **(>--)**

D#.............(FIFTH) **(--<)**

A# ....(FOURTH) **(>--)**

F.................(FIFTH) **(--<)**

C ....(FOURTH) **(>--)**

G ....(FOURTH) **(>--)**

D.................(FIFTH) **(--<)**

A (440) **...**(FOURTH) **(>--)**

→ From down to up
← From up to down

(--<) interval tuned narrow
(>--) interval tuned

Theory and Reality

The above discussion treats strings as if they vibrate according to theory, which they don't. In reality, wire stiffness causes the partials of strings struck by piano hammers to be sharp of their theoretical harmonics, so all numbers in the charts and tables are incorrect by a small amount. The sharpness, or distortion of the partials from the true harmonic series, is called **inharmonicity**.

	Theoretically perfect harmonic series of low C.	Actual series of partials.
6th Partial	196.218	198.435
5th Partial	163.515	164.779
4th Partial	130.812	131.434
3rd Partial	98.109	98.401
2nd Partial	65.406	65.523
Fundamental Pitch	32.703	32.703

Because of the stiffness of piano strings, among other factors, the actual series of partials deviates from the theoretical harmonic series. This table illustrates the inharmonicity in hz of a low C bass string in a fine-quality upright piano, as measured in a laboratory.

5. - BASIC RULES OF PIANO CARE

- **How should I care for my piano's wood finish?**
- **What is the piano's action and why does it need maintenance?**
- **How often should I have my piano fully serviced?**
- **Basic Rules of Piano Care**

As you might expect with any investment of this size, a piano requires periodic servicing to provide outstanding performance year after year. But to understand what maintenance is required, it's important to understand the nature of the piano.

The beautiful, natural sound of a piano is due to the remarkable blending of such materials as wood, metal, buckskin, and wool. Together they create a uniquely timeless sound that no other instrument in the world can duplicate. While electronic synthesizers may approximate the sound of an acoustic piano, they cannot approach the true beauty of the real thing.

- **How should I care for my piano's wood finish?**

As with any piece of fine furniture, keeping drinks off finished wood surfaces is a simple rule always to follow. New piano finishes generally require only occasional cleaning with either a dry or damp cotton cloth. Older piano finishes may benefit from an occasional polishing with a good quality polish, but frequent polishing is not recommended

- **What is the piano's action and why does it need maintenance?**

When a piano leaves the factory, each of its parts is adjusted to a tolerance of a few thousandths of an inch. This process is called *action regulation*. Because the wood and felt parts of the action may change dimension due to humidity and wear, the action must be serviced occasionally to maintain its responsive qualities.

- **How often should I have my piano fully serviced?**

The three components of musical performance that need to be adjusted periodically are **pitch, tone, and touch**. Tone is maintained by voicing, and touch by servicing the piano action, called *regulation*. Piano tuning is the adjustment of the tuning pins so that all the strings are of the proper tension (pitch), to have the correct sounding, musical intervals.

An out-of-tune piano or an unresponsive touch can discourage even novice musicians. Regular maintenance also can prevent expensive repair in the future.

Most manufacturers recommend servicing at least two to four times a year to keep the piano sounding good and working properly each time you sit down to play. This is especially important the first year of your piano's life. Some tuning instability should be anticipated during the first year because of the elasticity of the piano wire, combined with the piano's normal adjustment to the humidity changes in your home. A piano which has gone a long time without tuning may require extra work in pitch raising. But most importantly, be sure the regular servicing of your piano is performed by a qualified piano technician.

Basic Rules of Piano Care

- **Keep your piano in tune.** It was specifically designed to be tuned to the international pitch standard of A-440 cycles per second. Your piano will sound its best and give you and your family the most pleasure when it is tuned regularly and kept in proper playing condition.

- **Keep your piano clean.** Keep the keyboard covered when not in use to prevent dust from accumulating (although ivory keys need some exposure to light to prevent yellowing). Clean keys by occasionally wiping them with a damp cloth and drying them immediately. If accumulated debris can't be removed with a damp cloth, try wiping the cloth on a bar of mild soap or moisten with dishwashing detergent before wiping. Do not use chemicals or solvents to clean piano keys. Call a qualified piano technician to remove anything from the keys you can't wipe away.

- **To maintain the piano's finish**, you may wipe the case with a damp cotton cloth to remove fingerprints, or polish with a reliable emulsion-type, water-based solution following the manufacturer's instructions. Avoid aerosol spray polishes that contain silicone. Your technician may suggest a specific brand name.

- **The maintenance of the inner working of the piano and regulation should be left to a qualified piano technician**. Resist dusting the inside of your piano, oiling the moving parts, or using moth or insect repellents. Your piano technician will take care of all internal problems.

- Try to maintain a fairly consistent **temperature and humidity control** in the room where your piano is placed. It's important to keep your piano away from a heating register in winter, an air conditioning vent in the summer, a fireplace, a frequently opened window or outside door, and direct sunlight.

- **Play your piano regularly.** You'll get the most enjoyment from it and also reach your potential much faster. A disadvantage to idle pianos, assuming they also suffer a service lapse, is that a detrimental condition or environment can't be identified, and an escalating problem can result in damage that might not have occurred with regular service. Tuning a piano after years of not having been tuned often requires a pitch raise. As a piano ages, it may begin to develop more major problems which your technician can help you assess.

Keep all drinks and standing liquid containers off the piano. Should spilled water reach the action, notify you piano technician immediately. In many case, once liquids are spilled, the damage is irreversible which is why prevention is the safest rule to follow.

Select a piano technician with care. It's not only important that the service person be competent to perform tuning, regulation and repairs, but also that the person be someone you feel comfortable calling with questions concerning your piano's performance. Hiring a Registered Piano Technician who is committed to comprehensive service for your piano, and not just an occasional tuning, is your best assurance.

Do not perform repairs yourself. Though a problem may appear easy to solve (such as replacing a loose key ivory), a qualified technician will have the proper tools and parts to make repairs quickly and correctly. It's important to remember that unsuccessful amateur repairs are usually much more expensive to fix than the initial problem and may decrease the value of your instrument.

Use only a professional piano mover to move your piano. You will avoid injury to yourself, your instrument, and your home.

Humidity Control

How does humidity level affect my piano's tuning?
What is relative humidity?
What can be done to minimize humidity problems?
How will humidity control benefit my piano?

Your piano is made primarily of wood, a versatile and beautiful material ideal for piano construction. However, being made of wood, your piano is greatly affected by humidity. Seasonal and even daily changes in humidity cause wood parts to swell and shrink, affecting tuning stability and touch. Extreme swings in humidity can eventually cause wood to crack and glue joints to fail.

Other materials in your piano also are affected by changes in moisture content in the air. The many felt and leather parts in your piano's action can change dimension, affecting regulation and friction, or stiffness of the touch. Very high humidity can even create condensation on metal parts such as strings, tuning pins and hardware, eventually causing them to rust.

How does humidity level affect my piano's tuning?

Swelling and shrinking of the piano's soundboard is the most immediate and noticeable effect of humidity change. The soundboard, a sheet of wood approximately 3/8 of an inch thick, is made with a slightly crowned shape. The strings pass over the soundboard and are connected to it by a wooden piece called a bridge. The upward crown of the soundboard presses the bridge tightly against the strings.

As the moisture level in the soundboard increases during periods of high relative humidity, the crown expands and pushes the bridge harder against the strings. The strings are stretched tighter and the piano's pitch rises. Because this increase in crown is greater in the center of the soundboard than at the edges, the pitch rises more in the middle octaves than in the bass or treble registers.

During periods of low relative humidity the soundboard shrinks, reducing the crown and decreasing pressure against the strings. The pitch drops, again with the greatest effect noticeable in the center of the keyboard. When relative humidity returns to its previous level, the average pitch of all the strings will return to normal, although the exact pitch of individual strings will be slightly changed from their original settings. Thus, a piano only will stay in tune as long as the relative humidity level in the air surrounding the soundboard remains constant. Extreme humidity changes require making greater changes in string tension to bring the piano into tune.

What is relative humidity?

Wood swells and shrinks in response to changes in the relative humidity of the air around it. Relative humidity (RH) is the amount of moisture contained in the air, compared to the maximum amount of moisture that the air is capable of holding. The moisture content of air is affected by weather as well as conditions and activities within the home, while the moisture- holding capacity of air varies with temperature. One way of thinking about RH is that it is a measure of air's tendency to absorb or release moisture to its surroundings. Thus when the RH of air in a room increases, moisture will tend to transfer from the air to wood and other absorbent materials in the room. When the RH of air decreases, moisture will transfer from other materials back into the air. The RH of the atmosphere is always changing by the hour, and more dramatically, with the seasons. Consequently, the wood and felt parts in your piano are constantly changing dimension as they absorb and release moisture.

Since RH depends upon the temperature and moisture content of the air, it is not possible to maintain a constant RH by controlling room temperature alone. In fact, maintaining an even temperature while moisture content varies will cause RH to change.

What can be done to minimize humidity problems?

Keeping the humidity level around your piano as constant as possible will help it stay in tune longer as well as slow such damage as soundboard cracks, loose tuning pins, and glue joint failures. The first and simplest precaution you can take is to position your piano away from areas where it would be exposed to extremes of temperature and humidity such as heating and cooling vents, stoves, doors and windows. Direct sunlight is especially damaging. If your home is not well insulated, an interior wall is preferable to an outside wall.

Controlling the humidity within the home is another step you can take to preserve your instrument. In most areas of the country the relative humidity is very low during the cold winter season, and very high during the spring and summer. In other areas these humidity cycles are reversed. Wherever you live, you have probably noticed the symptoms of low RH (shocks from static electricity when sliding out of a car or after walking across carpet), and the signs of high RH (limp, soggy feeling newspapers and sticking doors). To monitor RH changes in your home, you may wish to purchase a moderately priced wall **hygrometer** available from most instrument supply companies or electronics stores.

Use of a room humidifier during dry seasons will help somewhat. However, too much moisture added to a room during winter months can cause condensation to form on cold surfaces such as windows, eventually causing mildew, rot, and in extreme cases, damage to the building structure. During the humid season de-humidification is needed. If your humid season is winter, keeping the home evenly heated will help. However, humid summer situations require much more elaborate de- humidification systems. Unfortunately, it is seldom possible to adequately control the relative humidity of a piano by controlling the room environment alone.

A very practical and effective answer to humidity problems is to have a humidity control system installed in the piano itself. These systems consist of three parts: a humidifier for adding moisture to the air, a dehumidifier for eliminating excess moisture, and a humidistat or control unit which senses the RH of the air within the piano and activates the system to add or remove moisture as needed. These systems are designed to maintain the RH of the air within the piano at the ideal level of 42%. The components are installed out of sight, inside the case of a vertical piano or under the soundboard of a grand. They are easy to maintain, and can be installed by your piano technician.

How will humidity control benefit my piano?

While not eliminating the need for regular piano maintenance, humidity control will allow more stable tunings by reducing the radical pitch changes your piano may experience through the seasons. When your piano stays closer to its correct pitch level of A440 (A-440 cycles per second), your technician does not have to perform a large pitch raising or lowering procedure prior to fine tuning. Thus, a balance of forces is maintained between the strings and the frame of the piano, allowing more accurate and stable tunings to be done.

In addition, a stable environment will help to preserve your piano through the years. Wood parts, glue joints, metal parts and your piano's finish will all last longer if not subjected to excessive humidity swings. Maintaining the correct environment will preserve your piano investment for a lifetime of enjoyment.

How often should I have my piano tuned?

Because of the amount of time your piano is in use and because ear training is such an important aspect of any musical education, your piano may require more tunings annually than other pianos. Your piano may also be used to make audition tapes for student scholarship competitions where impeccable intonation is vital for your students to sound their best.

The variations in the relative humidity of a studio or home are generally the most important criteria in determining how often a piano needs to be tuned. Normal homes may experience fairly drastic changes from season to season. Your situation is complicated by constant use which tends to deteriorate a tuning more quickly. A piano functions best under consistent conditions which are neither too wet nor dry, optimally at a temperature of 68 degrees Fahrenheit and 42 percent relative humidity.

You can reduce the severity of these climatic effects by placing your piano in the room so that it is away from windows or doors which are opened frequently. Avoid heating and air conditioning vents, fireplaces, and areas receiving direct sunlight.

While manufacturers' recommendations on the number of annual tunings vary, they generally agree that a piano should be tuned at least two to four times each year, with additional tunings as needed.

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PIANO TOOLS AND MATERIALS PROVIDERS:

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