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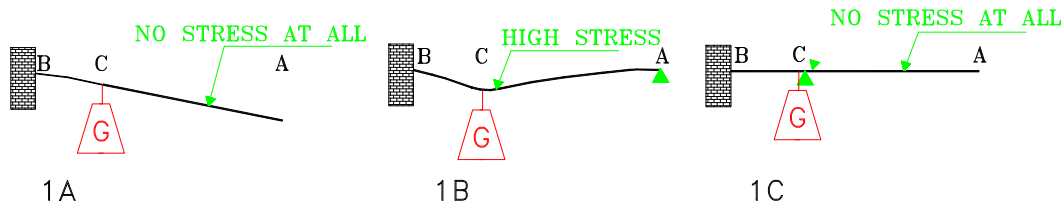
HOW TO CHOOSE A STRINGING MACHINE.

A stringing machine has **3 vital elements** and when purchasing a stringing machine it is important to choose the best possible combination of these 3 parts :

1. The most important part is the **racquet support**, because that must take care that racquets are not damaged or broken during stringing.
2. **Good clamps** are more important than a good tensioner. When the clamps are bad it is impossible to string accurately.
3. **The tensioner**

THE RACQUET SUPPORT SYSTEM

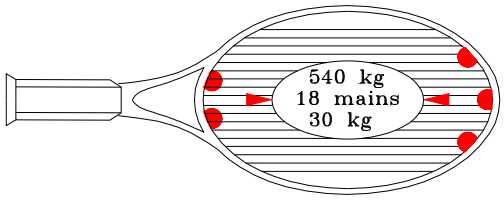
It is primordial to keep the stress in the racquet as low as possible during stringing. When the stress during stringing is too high this will result in micro cracks in the racquet material that could lead to racquets breaking during play.
It is very important to understand that minimum deformation during stringing does not mean minimum stress in the racquet material. (Proof needed?)



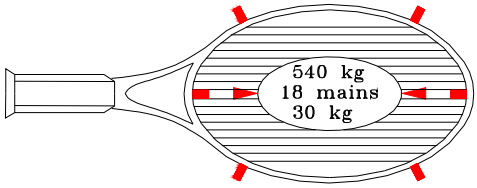
We compare the racquet with a beam in a wall:
Fig 1A shows the beam with the weight hanging in position C. There is no stress between point C and A.
The weight is too heavy so we have to support the beam.
There are 2 ways to support the beam:
- Fig 1B shows an indirect support in position A. The support causes a high stress between point A and point C.
- Fig 1C shows a direct support close to point C. There is no stress between point A and C.

Conclusion:
- The indirect in A does not allow deformation in point A but causes extra stress in the beam between A and C.
- The direct support in C the same effect in A, but does not cause any stress between A a

When all main strings are tensioned the load on the racquet is maximum. The pressure applied by the main strings tries to deform the frame to be shorter and wider.
Stringing machines are offered with 2 different racquet support systems:

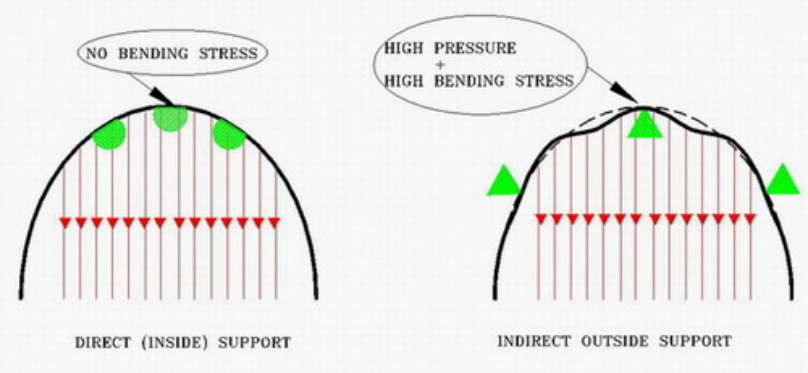


DIRECT RACQUET SUPPORT



INDIRECT RACQUET SUPPORT

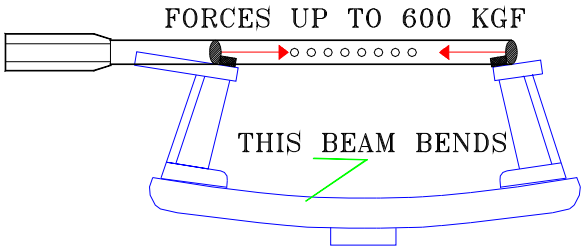
Stress in the racquet in the machine.



- **Direct support** with a number of supports against the inside of the frame. Such a system prevents the racquet from getting shorter so it does not get wider either.
- **Indirect support** with 2 supports on 6 and 12 o'clock and 4 points against the outside (6 point supports). This system prevents the racquet from getting wider. Such a system shows minimum deformation but higher stress in the racquet between the position of the main strings and the outside supports.

Conclusion: A direct support is much better for the racquet and never results in cracked racquets.

A primary demand for both systems is that the support table is very stiff, so that it does not bend under the load of the main strings.



The pressure between the supports and the racquet must be as low as possible.
The wider the supports the better it is for the racquet.

THE CLAMPING SYSTEM

High quality clamps are of major importance for a good stringing machine.
The main criteria for efficient clamps are :
- The clamp must not damage the string.
- The string must not slip through the clamp, because this results in loss of stringing "accuracy".
- The clamp must be adjustable to the diameter of the string.

Stringing machines are supplied with either fixed clamps or with flying clamps.
- Fixed clamps are mounted on a guiding system and clamp one string at the time.
- Flying clamps are double clamps, which clamp the last string to the string before last.

With fixed clamps it is easier to clamp the string and they may loose less tension because they have less "drawback".

How to choose the best clamping system :
* Primary importance is the quality of the clamps themselves, it is better to buy a machine with good flying clamps than with bad fixed clamps.
* When fixed clamps are chosen it is important that the guiding system moves around very easily and is clamped with an easy movement.
* In case of a limited budget it could be good to buy a machine with flying clamps that can be upgraded to fixed clamps later.

THE TENSIONING SYSTEM

The tension unit is the most UNimportant part of a stringing machine. It is useless to have a perfect tension system without a good racquet support system and good clamps.

In general there are 4 types of tension units on the market:
- Drop weights, that create the tension with a weight on a lever arm.
- Electronic machines which have a drive motor to pull tension and a "tension-sensitive- system" that measures the tension.
- Lock out machines, which are hand driven with a handle and have a (disc) brake that locks at the adjusted tension.
- A foot operated machine that has a built in mechanical drive system with a spring.

THE ACCURACY OF A TENSION UNIT

For a tension unit a very simple rule counts:
Tension is a mechanical unit, which is best created with a mechanical system.

The major matter for accuracy of a tension system is that it compensates for the slow elongation of the string. It must be a constant pull unit.

The figure shows the tension during pulling of a constant pull unit and a lockout unit with a string with a lot of elongation:

- Graph 1 shows the tension during pulling with a lock out machine (Ektelon type) when the stringer pulls very fast. The tension drops to 23,1 caused by the slow elongation of the string.
- Graph 2 shows the tension with the lock out system, when the stringer pulls gradually. The tension drops to 25,5.
- Graph 3 shows the tension of a mechanical constant pull unit, the tension does not drop during pulling.

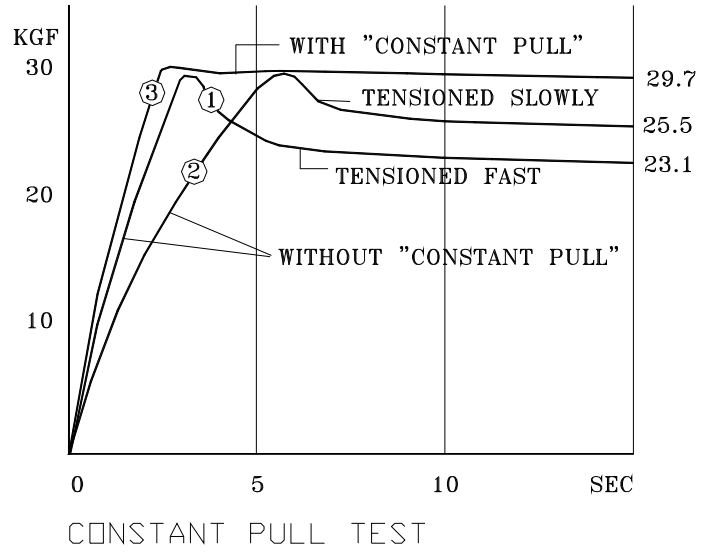
Conclusions:
- A string with lot of elongation needs about 8 seconds to stretch.
- A fast stringer looses more tension then a slow one with a lock out machine.
- A constant pull unit keeps the tension constant until the string is clamped.

A high quality drop weight tension unit is a very accurate tension system:
- It creates the tension very accurately.
- It can compensate for minimum losses in tension (caused by the slow elongation of the string) very well.
- It does not need calibration.

On the best tension unit there is no ratchet system needed because the tension is independent of the angle of the lever.

It is very difficult for an electronic machine to equal the accuracy of drop weight machine:
- It must have a very accurate tension measuring system.
- The measuring system must stop the drive motor very accurately, when the adjusted tension is reached.
- It is very difficult to compensate for small losses in tension accurately: The motor must start and stop only for a minimum stroke.

Only high quality electronic machines can equal the accuracy of a good quality drop weight system.



CONSTANT PULL TEST

It is very important for an electronic machines to calibrate it regularly. It is an advantage if a stringer can carry out this calibration himself.

A foot operated / spring driven machine is as accurate as a drop weight machine, with the difference that it needs calibration every now and then to check for the accuracy.

A lock out machine is always very inaccurate: It is not constant pull and the resulting tension depends on the elongation characteristic of the string and on the speed of pulling. When the stringer pulls quicker he looses more tension.

THE SPEED OF A TENSION UNIT :

The speed of pulling tension is set by the elongation of a string :

- When a string with more elongation is clamped too quickly it looses more tension.
- So the speed of tension unit is an unimportant matter.

An electronic machine is the slowest of all systems, the foot operated machines is probably the quickest one.
The good thing of a (good) electronic machine is that it always pulls tension gently and on the same adjusted speed. It also shows if the string is still stretching.

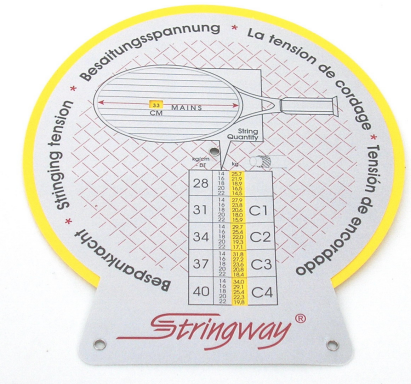
RELIABILITY :

A high quality system is more reliable when it is a more simple in design.
Even a high quality electronic machine can not be as reliable as a high quality drop weight machine because the drop weight is much less complicated. A lock out and foot operated are also more reliable than the average electronic machine.
When an electronic machine is purchased it should be a high quality one.

CONVENIENCE OF A STRINGING MACHINE :

The more racquets have to be strung the more convenience is required.
Drop weight machines require most energy from the stringer because they have to lift the lever every time. Drop weight machines that have a one pull action and do not need a ratchet system are much more convenient than systems with a ratchet system.
The foot operated machine is the more convenient than the drop weight.
Electronic machines are the most convenient for the stringer.

USEFUL ACCESSORIES FOR STRINGING :



*** A tension advisor:**

To choose the right tension for a racquet is very difficult for a stringer. The tension for main- and cross strings must be in the right relation so that the stress in the racquet is minimum. The stiffness of the stringbed must be right for the type of play of the player. The racquet of a harthitter must be strung at a much higher tension than the same racquet for an older person with lower risk of injury.
The tension advisor calculates the right tension for every racquet and for 5 different stiffness classes.

*** A stringbed tester:**

A player feels the stiffness of the stringbed and not the tension that is used on the stringing machine to create that stiffness.
A stringbed tester is a vital tool for every stringer; it checks the functions of the machine and it alarms a stringer when he looses too much tension for other reasons.
A stringer without a stiffness tester is like a carpenter without a ruler.
