May 28, 1963 F. H. WALSH 3,091,149

WRESTPLANKS

Filed Nov. 20, 1959

Fig. 1.

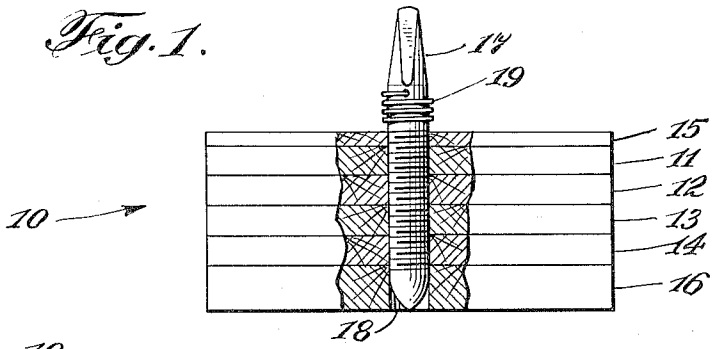


Fig. 2.

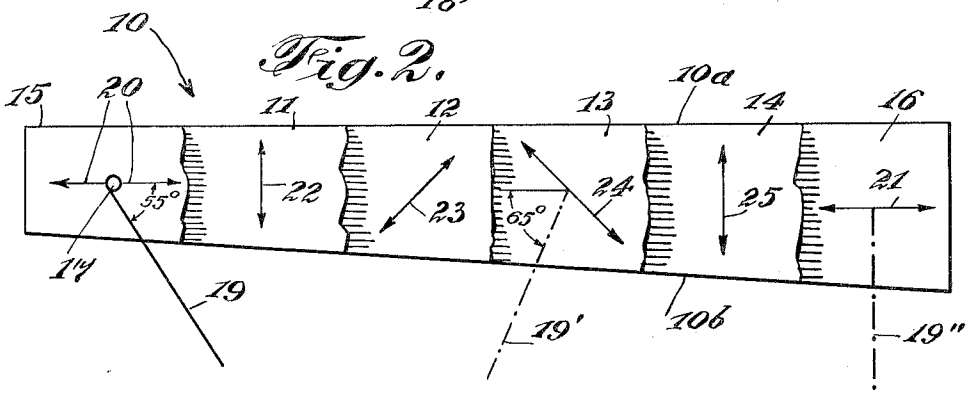


Fig. 3.

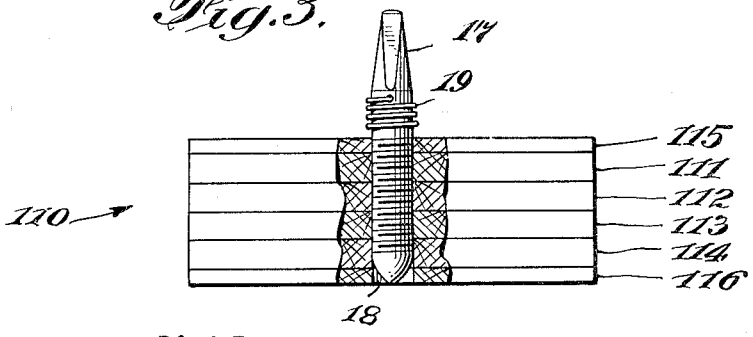
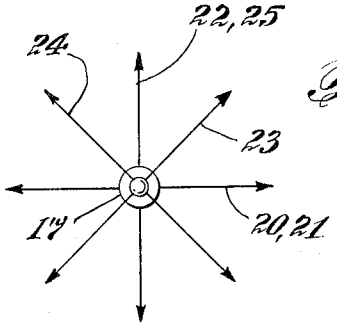


Fig. 4.



INVENTOR

Frank H. Walsh

BY C. P. Goepel

his ATTORNEY

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WRESTPLANKS

Frank H. Walsh, West Hempstead, N.Y., assignor to Steinway & Sons, Long Island City, N.Y., a corporation of New York

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The present invention relates to pin blocks or wrestplanks for tuning pins in pianos and like musical instruments.

An important object of the invention is to provide a multilayer wrestplank which is capable of more securely holding a series of tuning pins regardless of the direction of the stresses to which the pins are subjected by the piano strings, in which the grain of at least one layer is always exactly or nearly parallel with the direction of maximum stress upon the pin, in which a greater percentage of end grain bearing is located in the plane of maximum stress on the pin, and which is equally advantageous for both grand pianos and uprights.

Another object of the invention is to provide a wrestplank of the above outlined characteristics which is of a balanced construction, whose retaining action upon the pins is less dependent upon the moisture content of the surrounding air, and which remains dimensionally more stable under all conditions.

An additional object of the instant invention is to provide a wrestplank for tuning pins in upright pianos, grand pianos and like musical instruments which is so constructed as to eliminate the so-called "stick-slip" phenomenon in that its retaining action upon the tuning pins is more nearly uniform in all directions than in the wrestplanks of presently known construction, and which will provide a better hold on the tuning pin, in that the latter is held tighter in a hole of the same size as before yet turns more smoothly and easily, and sets in desired setting easily, exactly and firmly, thus affording easy yet solid tuning and maintaining these qualities throughout long periods of use.

A concomitant object of the invention is to provide a multilayer wrestplank in which the direction of grain in the various layers or plies is uniformly and symmetrically distributed in the radial directions of each tuning pin, and which requires a lesser number of long-grain plies.

It has been found by extensive experimentation that the deformation of holes or bores in which the tuning pins are held in a wrestplank is greatly reduced if the direction of grain is parallel with the direction of stresses to which the pins are subjected by the piano strings. In other words, it is desirable that at least some end grain should bear against that side of each tuning pin which exerts pressure against the material of the wrestplank. The term "end grain" is intended to describe the exposed fibers cut transversely to the grain, i.e. endwood. The ruptured fibers of the endwood are believed to be primarily responsible for proper retention of the tuning pin. Thus, a satisfactory retention of a tuning pin is insured if the wrestplank is constructed in such a way as to have more end grain bearing on each pin in the location of maximum stress, namely, in the direction of the pull of the string. However, since the stress is applied to the pins at varying angles throughout the piano, the end grain, too, must be arranged at varying angles. For example, in treble strings, the strings usually lie at right angles to the longitudinal direction of the wrestplank, the bass strings may enclose an angle of as little as 55 degrees with the longitudinal direction of the wrestplank, and in the center section the angle is often about 65 degrees.

The advantageous retaining action of endwood or end

grain appears to be due largely to the fact that endwood is dimensionally stable since wood does not tend to expand or contract along the grain but rather across the grain. Data recently compiled by the Forest Products Laboratory, an agency of the U.S. Department of Agriculture, indicate that the compressive strength of hard maple, a material most frequently utilized in the manufacture of wrestplanks, as regards endwood is at least three times greater than as regards side grain, and that the elasticity, too, is ten to twenty times greater. Thus, if the wrestplank offers endwood in the direction of maximum stresses to which it is subjected by the tuning pins, the likelihood of deformation of the tuning pin hole is much smaller than if the stresses would act across the grain, i.e. in a direction at right angles to the grain. By presenting more endwood bearing to the pin in the plane of the greatest load on the pin, a stronger hole wall is provided and the hole will not lose its shape or fit under load as much as in presently known constructions. In addition, such wrestplanks offer more elastic bearing for the pin in their plane, this being the important quality which insures that the pin is held tight and remains tight over many years of use.

As is known, an improperly constructed wrestplank cannot prevent that the hole is deformed from a circular to a slightly oval or egg-shaped form, this being due to improper, non-uniform distribution of endwood around the hole, i.e. to such arrangement of grain that a smaller proportion of endwood is present in line of the maximum pull exerted upon the pin by a piano string. Thus, it is desirable to eliminate side grain bearing on the pin in the maximum stress location since, as mentioned hereinbefore, the compressive strength and elasticity of wood in a direction parallel with the grain is several times greater than across the grain. In addition, side grain on the exposed edge of a lamination in the wrestplank is subject to comparatively greater swelling and shrinking, which also tends to distort the hole. With repeated cycles of swelling and shrinking, the wood will take a compression set and will actually compress the fibers which results in further deformation of the hole out of the round.

The tuning pins in wrestplanks for pianos and like musical instruments are generally drive-fit, their diameter being normally .281", and the pins are driven into holes or bores of smaller diameter, e.g. .253" or thereabouts.

In accordance with the present invention, the wrestplank preferably comprises four central or working layers or plies of preferably uniform thicknesses, and the layers are arranged in such a way that at least one thereof offers end grain bearing to each tuning pin in line of maximum stress on the pin. When the wrestplank comprises four working plies, the angle enclosed by the grain of two outer working plies with the grain of the adjacent median working plies is less than 90 degrees, and preferably 45 degrees since this alignment is not only symmetrical and balanced but gives maximum contrast of grain direction of adjacent plies and thus maximum stability. It can be said that the grain in the plies assumes a star shape and, consequently, each tuning pin driven into a hole formed in a so constructed wrestplank will always bear against the end grain of at least one layer regardless of the direction in which the pin is pulled by the respective string. In addition, and since the arrangement of grain in the layers constituting the working plies of the improved wrestplank is preferably symmetrical, substantially equal areas of end grain will bear against each pin, which insures that all pins are held with substantially equal force in any given position selected by the tuner regardless of the direction in which a pull is exerted by the piano strings.

Another advantage of arranging the plies or lamina-

tions in such manner that the grain in adjacent plies crosses at angles of less than 90 degrees, and preferably at 45 degrees, is in that shorter cuttings of material may be used. This is a distinct advantage in the manufacture of wrestplanks since the wood most frequently utilized therefor is carefully selected, flawless, quarter-sawn hard maple which is difficult to obtain, especially in longer lengths.

The invention will be described in greater detail with reference to the accompanying drawing, in which:

FIG. 1 is end elevational view of one embodiment of my invention, showing a wrestplank which is particularly suitable for use in upright pianos, with the layers or plies partly broken away to reveal a bore for the tuning pin;

FIG. 2 is a smaller-scale top plan view of the structure shown in FIG. 1 with the layers broken away in stepwise fashion and with double arrows indicating the direction of grain in the layers;

FIG. 3 illustrates, in a view similar to that of FIG. 1, a slightly different wrestplank for use in grand pianos; and

FIG. 4 is a diagrammatic view illustrating the position of a tuning pin with respect to the direction of grain in the improved wrestplank.

Referring now in greater detail to the drawing, and first to FIG. 1, the wrestplank or pin block **10** therein shown comprises six plies or laminations made of a suitable wood, preferably a carefully selected, flawless, quarter-sawn hard maple or an equivalent hard wood. The four central or working plies **11**, **12**, **13** and **14** are of equal thicknesses and are received between a top veneer **15** and a solid hard wood fill piece or bottom layer **16**. The thickness of the top veneer **15** is less than the thickness of the fill piece or bottom layer **16**. Such wrestplank is particularly suitable for use in upright pianos. By way of example, the thickness of the individual working plies **11** to **14** may be about 5/16", the thickness of the top layer or veneer **15** is then about 1/8", and the thickness of the fill piece or bottom layer **16** is about 1/2".

The tuning pin **17** is shown as driven into a hole or bore **18** formed at one end of the wrestplank **10** in the bass section. As is illustrated in FIG. 2, the string **19** encloses an angle of about 55 degrees with the longitudinal direction of the wrestplank **10**. A schematically indicated second string **19'** which is connected to a pin in the central section of the wrestplank **10** encloses with the latter's longitudinal direction an angle of about 65 degrees, and a third schematically shown string **19''** in the treble section extends at right angles from the member **10**. The pin **17** bears with the greatest force against that portion of the wall of bore **18** which is in line with the longitudinal direction of the string **19**.

The direction of grain in the individual plies or layers is also shown in FIG. 2. The members **15**, **16** are long grain, i.e. their grain runs in the longitudinal direction of the wrestplank **10** parallel with the edge **10***a*, as is indicated by the double arrows **20**, **21**, respectively. The wrestplank tapers from the bass section toward the treble section (see the inclined longitudinal edge **10***b*). The grain of the central or working plies **11** to **14** is indicated by the double arrows **22** to **25** in that order. The outermost working plies **11**, **14** are cross grain in the wrestplank, and the grain of the two median working plies **12**, **13** is inclined through 45 degrees with respect to the grain in the plies **11**, **14**, respectively. Thus, the working layer **13** (see the double arrow **24**) presents endwood as a bearing to the pull on the tuning pin **17**, while the layer **12** (see the double arrow **23**) presents endwood bearing to the pull on the pin connected to the string **19'**. The pin connected to the string **19''** in the treble string section bears against the endwood of laminations **11** and **14** in the line of pull (see the double arrows **22**, **25**).

The wrestplank **110** of FIG. 3 is preferred for use in grand pianos. The central or working plies **111** to **114** are of equal thicknesses, and the thickness of the top layer or veneer **115** equals the thickness of the bottom layer or veneer **116**. By way of example, the thickness of each working ply may be in the range of about 5/16", and the thickness of the veneers **115**, **116** may be in the range of about 1/8". The direction of grain in the plies **111** to **114** and in the layers **115**, **116** is identical with that indicated by the arrows **20** to **25** in FIG. 2.

The arrangement of grain with respect to the tuning pin **17** is illustrated somewhat schematically in FIG. 4 which shows only the direction of grain with the plies **11** to **16** or **111** to **116** omitted. It will be noted that the layers are arranged in such a way that their grain directions run radially with respect to the pin axis; thus, the latter bears at locations of maximum stress against the ruptured endwood fibers of at least one working lamination (double arrows **22** to **25**) regardless of the direction in which the pin is pulled by the piano string. As mentioned hereinbefore, the string **19** subjects the pin **17** to maximum stress in a direction substantially parallel with the double arrow **24** (layer **13** or **113**).

The novel wrestplank features a more uniform distribution of end grain bearing or endwood on each tuning pin and, in fact, the endwood virtually surrounds the pin, as is best shown in FIG. 4. Equal thickness of the working plies **11** to **14** or **111** to **114** also contributes to better distribution of stresses, and the tendency to warp or otherwise deform is less pronounced. This results in a more balanced and thus more stable wrestplank.

The disposition of the central plies **12**, **13** or **112**, **113** at an angle of 45 degrees to the main axis of the wrestplank distributes the internal stresses in a more uniform way. Such stresses arise upon expansion and contraction of the wood under varying conditions of moisture content due to changes in the atmosphere. The uniform distribution of internal stresses results in a more stable construction which, of course, is a major requirement to be met by the wrestplank.

It is well known that wood, even when seasoned, remains hygroscopic and tends to give up moisture to dry air or absorbs moisture from the moist air to either shrink when drying or to expand when becoming wetter. Such dimensional variations are negligible along the grain but are considerable across the grain; therefore, a plied construction with alternating grain directions remains comparatively stable because the adhesive bond between the plies will tend to prevent or at least to reduce the dimensional changes in the piece by locking the expanding plies to the non-expanding plies. It is preferred to arrange the plies symmetrically and to use working plies of equal thicknesses, of the same kind of wood and grain figure in order to equalize the stresses and to thus balance the wrestplank, which will accordingly remain stable.

By using a wrestplank in which the grain of the median working plies **12**, **13** and **112**, **113**, respectively, is inclined with respect to the grain of the outer working plies **11**, **14** and **111**, **114**, respectively, through less than 90 degrees and preferably through an angle of 45 degrees, the stresses are distributed more evenly which results in more uniform and better balanced wrestplank under varied climatic conditions.

The tuning pins driven into the holes formed in a wrestplank constructed in accordance with the present invention will remain tight and will preserve their tightness for long periods of time. As above mentioned, the plies of a wrestplank, like any wood, tend to shrink in dry air and to expand in moist air. When a wrestplank is exposed to dry air, shrinkage will cause side grain exposed to the tuning pin to shrink away from the tuning pin and reduce the overall area of the bearing surface for the pin. Swelling will cause side grain exposed to the pin to bind unduly on the pin and, eventually, through compression set, to reduce the bearing area or tightness still further when the wood again dries and shrinks. The hole tends to become oval. As shown in FIG. 2, the

novel construction in which the grain in the working plies is arranged at various angles, i.e. also in the directions other than longitudinally and transversely of the wrestplank, the detrimental effects of swelling and shrinkage are reduced or completely eliminated. This is due to the fact that more end grain and hence a dimensionally more stable bearing surface surrounds the tuning pin in substantially all directions. Such grain alignment in the working plies results in better dimensional stability and in a stronger, tougher and more elastic bearing for the tuning pin under load.

It has also been found that the improved wrestplank brings about an improved performance of the tuning pins as there is very little variation between the initial torque necessary to start the turning movement of a tuning pin in its seat and the moving torque necessary to move the pin in its seat. It may be mentioned here that the difference between the initial and moving torque is considerable in presently utilized wrestplanks. Moreover, the so-called "stick-slip" phenomenon, undesirable and often causing considerable problems in the wrestplanks of prior construction, is eliminated by the arrangement of working plies in accordance with the present invention. The characteristic of the "stick-slip" is that the tuning pins turn unevenly, at times freely and at times sticking to such an extent as to require considerably increased force to continue the turning of the pin. Such pins are called "creaky" or "jumpy" by expert piano technicians and are difficult to set, or locate precisely and solidly in angular position since small precise movements of the tuning pin are necessary to put the piano string in exact tune. In the novel wrestplank, the tuning pin can be turned smoothly and will hold tight in any desired angular position. There is a better hold of the tuning pins in the wrestplank, the pins are tighter in a hole of the same size as before and, since the elasticity of the wrestplank is preserved, it is not necessary to use a larger hole.

Tuning in the improved wrestplank is not only easy but results in good, solid tuning. Despite the high torque or tightness of the tuning pin in its hole, the pin will move smoothly without creak or jump, and will set firmly at any desired point. The ratio of initial torque or force necessary to move the pin from its seat to the moving torque or force necessary to keep the pin turning is either equal or very close, in the order of 160 to 150 or more inch pounds. At lower torques, the ratio is substantially one-to-one; in other words, the forces are equal. This is a considerable advantage over previous practices in ease and accuracy of tuning.

It has been found that the above enumerated advantages of the improved wrestplank remain unchanged for long periods of time. By the time the piano has its third tuning, 70 to 80 percent of the firmness or torque remains

in the pins. At the end of six months or a year, the firmness or torque no longer drops but remains at a very satisfactory level of up to 80 percent of the original torque. Thus, the drop in tightness is low as compared with that in wrestplanks of presently utilized construction. Torque will drop from about 150 inch pounds to approximately 120 inch pounds, whereas a drop to 80 inch pounds is typical of the presently utilized constructions. Moreover, the advantageous characteristics of tightness, smoothness, equality of initial and moving torque, and lack of creakiness, too, remain unchanged.

Without further analysis, the foregoing will so fully reveal the gist of the present invention that others can, by applying current knowledge, readily adapt it for various applications without omitting features that, from the standpoint of prior art, fairly constitute essential characteristics of the generic and specific aspects of this invention and, therefore, such adaptations should and are intended to be comprehended within the meaning and range of equivalence of the following claims.

What I claim and desire to protect by Letters Patent is:

1. A wrestplank for use in a stringed instrument comprising a first outer working ply, a second outer working ply, and two median working plies, a tuning pin extending through said plies, the grain of said outer working plies being parallel with respect to the transverse dimension of the wrestplank, the grain of said median working plies being substantially perpendicular to each other and enclosing angles of about 45° with the grain of said first and second outer working plies respectively, whereby said tuning pin is substantially surrounded by and in engagement with end wood.

2. A wrestplank for use in a stringed instrument comprising at least four working plies of quarter-sawn lumber, a tuning pin extending through said plies, said working plies including a first outer working ply, a second outer working ply and two median working plies, the grain of said outer working plies being parallel with the transverse dimension of the wrestplank and the grain of said median working plies being substantially perpendicular to each other and enclosing angles of about 45° with the grain of said first and second outer working plies respectively, whereby said tuning pin is substantially surrounded by and in engagement with end wood.

References Cited in the file of this patent

UNITED STATES PATENTS

368,673	Keller	Aug. 23, 1887
2,101,920	Schroeder	Dec. 14, 1937
2,151,505	Elmendorf	Mar. 21, 1939
2,578,781	Brundige	Dec. 18, 1951