Dec. 30, 1941. M. CARO ET AL 2,268,276

RACKET STRINGING MACHINE

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Fig 1

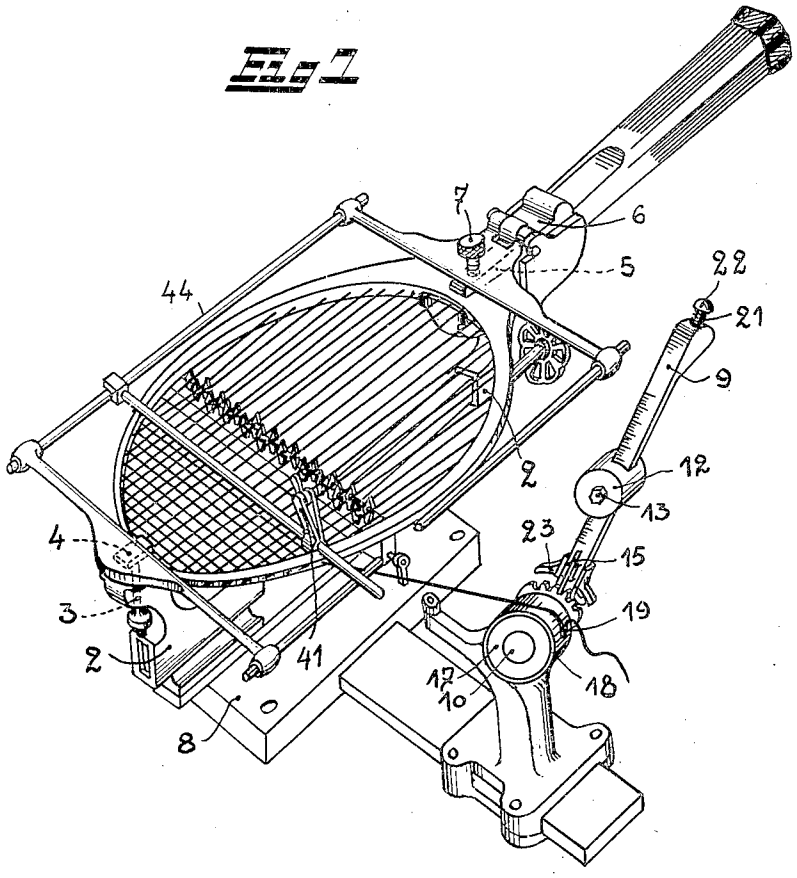
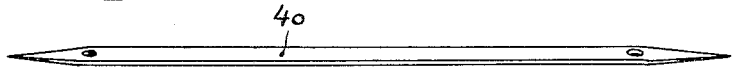


Fig 4



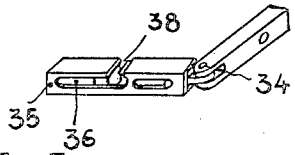


Fig 6

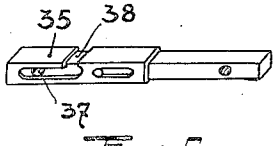


Fig 6a

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Fig. 3

Fig. 5

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Fig. 5

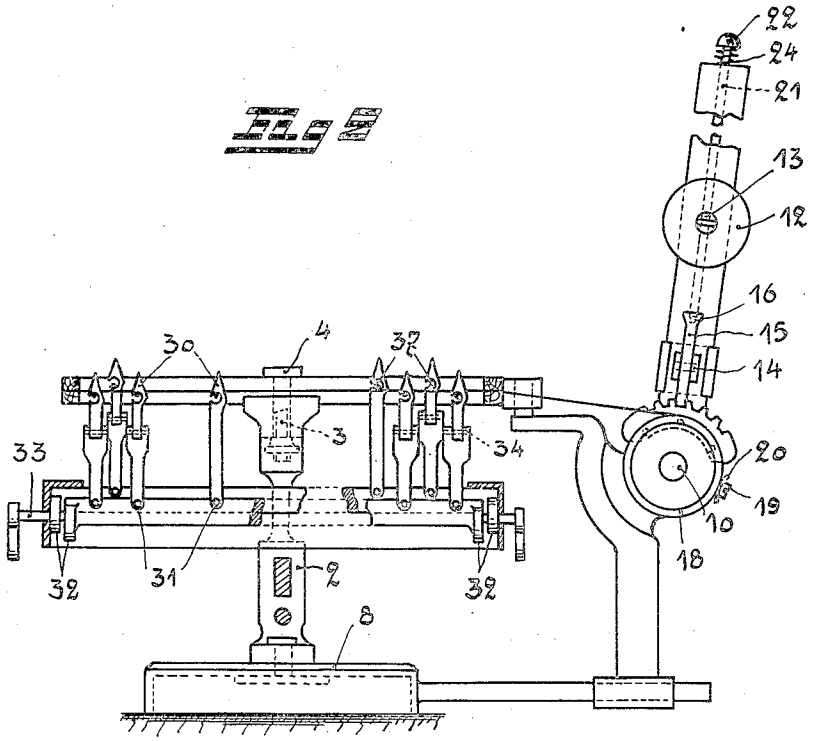


Fig. 7

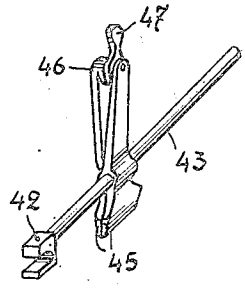
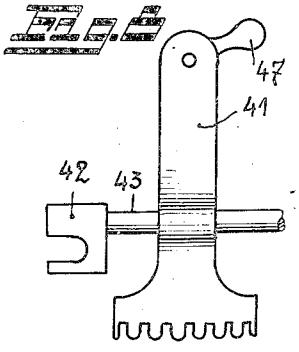


Fig. 6



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UNITED STATES PATENT OFFICE

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RACKET STRINGING MACHINE

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Brussels, Belgium

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In Belgium May 31, 1938

4 Claims. (Cl. 139—33)

This invention relates to a device for stringing tennis, badminton, squash and like rackets.

For stringing rackets a frame is usually used which has two movable jaws which can be moved towards and away from each other and parallel to themselves by means of a screw and nut arrangement so that the frame of the racket to be strung is held along its longitudinal axis and a rigid support for the racket is therefore provided during the stringing.

The machine in accordance with the invention which is very simple and at the same time very strong uses the principle of the above-mentioned frame which allows speed and regularity which are characteristic of mechanical operations to be combined with the numerous advantages of hand stringing.

In accordance with the present invention, the frame in which the racket is held is mounted on a vertical pivot so that the racket can be displaced parallel to itself in a horizontal plane as required.

A tensioning device can be used which consists of a graduated lever provided with a removable sliding counterweight which can be fixed to the lever by means of a screw in any desired position along the length of the lever according to the required tension.

In order to obtain the exact tension which is required, it must be possible to disconnect the lever from the tensioning drum to enable the apparatus to be adjusted so that the lever can reach its horizontal position, that is to say, its position of maximum tension.

To this end, in accordance with the invention, use is made of a device which allows the starting point of the counterweighted lever to be localised relatively to the tensioning drum and by means of an appropriate sector while allowing the lever to make the necessary stroke to allow it to have its maximum effect, that is to say, to reach the horizontal position.

In addition to these improvements made to the stringing machine proper, a device is provided for putting in the cross strings which overcomes the difficulties arising out of the inter-twining of these strings with the mains.

This device comprises rods which are controlled eccentrically and which serve to space the even mains away from the odd mains.

The stringing machine in accordance with the invention relates also to other features which will appear in the course of the following description. The accompanying drawings show by way of example one method of carrying the invention into effect. The latter extends to the various new features to be found in the arrangement shown.

Figure 1 is a perspective view of the machine during the putting in of the cross-strings.

Figure 2 is an end elevation of the machine showing the parts which serve to hold the mains apart while the cross-strings are being passed between them.

Figure 3 is an elevation to a larger scale of the parts through which the strings are tensioned when only a light tension is required. The corresponding parts shown in Figure 1 are those used when a relatively high tension is required.

Figure 4 shows a flexible needle which is used for threading the cross-strings.

Figure 5 shows the disposition of the cams through which the parts shown in Figure 2 are operated.

Figures 6 and 6a show the construction and operation of certain parts shown in Figure 2.

Figure 7 is a perspective view of a clamp used when putting in the mains and

Figure 8 is a view of a clamp used when putting in the cross-strings.

The machine shown in the drawings comprises essentially a frame in which the racket is rigidly held in a constant position during the stringing operation, a device for tensioning the strings, clamps for maintaining the tensioned strings under tension as the stringing progresses, a rigid supporting frame for the said clamps and a device for holding the mains apart while the cross-strings are passed between them.

The frame in which the racket is held during the stringing (see Figure 1) has two jaws 2 which grip the frame of the racket in the direction of its longitudinal axis.

The racket is held in the jaws 2 by means of a screw 3 provided with a tongue 4 and by means of a tongue 5 which is hinged to a part 6 which is removable from the rigid frame. The tongue 5 is held by a bolt 7 which can be screwed into a hole in the member 6.

This frame is pivotally mounted on a fixed base 8 so that it, and therefore the racket, can be turned in different directions in a horizontal plane at different stages during the stringing.

The tensioning device consists of a graduated lever 9 hinged at 10 and provided with a sliding counter-weight 12 which can be fixed to the lever by means of a screw 13.

A pawl 15, pivotally mounted at 14 on one of the faces of the lever 9, engages, under the influence of a spring 16 in the teeth of a sector

fixed to the tensioning drum 17. The periphery of the drum 17 has a rubber coating 18 and is provided with a screw 19 and washer 20 to which the gut is fixed during the tensioning.

The other face of the lever 9 carries a sliding rod 21 which can be displaced by pressing on its end 22 at the free end of the lever.

At the lower end of the said rod there is a sector 23 which is urged into an inoperative position by means of a spring 24. The sector 23 acts on the end of a pawl 25 mounted on a fixed pivot 26. A stop 27 carried by the drum bears against the end 28 of the pawl 25 which is maintained in its locking position by means of a spring 29.

The support for the drum and for the tensioning lever slides along a guide forming part of the framework of the machine.

For facilitating the threading of the cross-strings over and under the mains, a device is provided which lifts every other main and lowers the remaining mains. This device will be referred to as the separating device. It comprises a set of rods 30 which are pivotally mounted at their ends 31 on two connecting members provided with circular collars serving as housings for eccentric cams such as 32.

The even rods are mounted on one of the connecting members and the odd rods are mounted on the other connecting member, the displacements of these connecting members being obtained by means of identical cams which are asymmetrically keyed on a common shaft 33.

A certain number of rods situated at the ends of the separating device are made in such a way that they can be turned down round a pin 34 to allow the number of operative rods to be limited to the number of mains to be separated.

In one possible form of construction, the hinged rods can be provided with a sliding sleeve 35 having an axial groove 36 formed in the faces of the sleeves at right angles to the axis of the openings or housings 37 in the rods. A second groove 38 allows the gut to be introduced into the housing in the rod, the sliding sleeve being provided for preventing any possibility of pivotal movement of the upper hinged part of the rods situated near the ends of the separating device.

It is to be noted that the placing in position of the cross-strings differs only from that of the mains in the use of the separating device. The cross-stringing operation only will therefore be described in full detail.

Before the cross-strings are put in position, the mains are introduced into openings 37 of appropriate shape formed in the rods 30. The apparatus is thus put in place, that is to say, suspended from the mains. By acting on the levers situated at the ends of the shaft 33, the eccentric cams are rotated and the rods of the separating device are simultaneously displaced longitudinally.

The asymmetric arrangement of the cams ensures the proper spacing in the longitudinal direction of the even strings relatively to the odd strings and vice versa.

The reactions caused by this spacing apart of the mains are mutually neutralised owing to the fact that half the rods push upwards while the other half pull downwards.

The end of the gut is introduced into the eye of a flexible needle 40 the displacement of which is guided by the upper and lower mains.

The flexible needle is slipped into the free space provided by the separating device. The end of the string to be tensioned is then introduced into the eye of the needle which is pulled in the opposite direction, thus pulling the string which, after its introduction into the corresponding hole of the frame, can be tensioned in the same manner and with the same effectiveness as the mains without rubbing on the latter because they are drawn apart.

The gut is then wound round the tensioning drum and is wedged between the washer 20 and the flexible coating 18. The lever 19 is then liberated and is turned, carrying with it the tensioning drum 17. The tension in the gut increases until the lever reaches its horizontal position in which the moment of the counterweight 12 is at its maximum.

The desired tension is obtained by the displacement of the counterweight along the graduated lever.

The momentary releasing of the lever 9 from the drum 17 allows the point from which the lever 9 starts so as to arrive in the horizontal position to be determined. This starting point varies according to the length of the string to be tensioned and its elasticity.

When the string is tensioned, it is held in position by means of a clamp 41 placed as near as possible to the frame of the racket and in such a way that the stirrup 42 of the rod 43 on which the clamp is mounted bears on the rod of the frame 44 opposite the clamp.

The clamps (Figures 7 and 8) comprise two jaws 45 one of which is provided with a ramp 46 on which, according to its position, acts a cam 47. These two jaws are threaded on to a rod 43, one end of which is provided with a stirrup 42 which allows this rod to be placed astride any one of the rods of the rigid frame 44.

By actuating the cam 47, the clamp is fixed on the rod 43 and the string is held between the extreme ends of the jaws 45. When, later on, the spring is liberated, the frame in which the racket is gripped is turned through 180° and brought into a new position relatively to the lever and the operation described above is repeated.

Where a racket has to be specially strung at a low tension, the usual counterweight 12 can be replaced by a lighter counterweight 48 (Figure 3) and a lever 49 can be attached to the tensioning lever for compensating the weight of the lever 9 itself. The lever 49 is provided with a notch which can be adjusted on the hinge pin of the tensioning lever and is driven by the latter through an abutment 50 forming part of the lever.

The invention is, of course, not limited to the particular form of construction described here by way of example but embraces any form of construction falling within the spirit or the scope of the following claims.

What we claim is:

1. In a racket-stringing machine, a mechanism for raising and lowering adjacent longitudinal strings to facilitate insertion of a transverse string, comprising two sets of string-engaging elements, each of said elements having a lower member and an upper member pivotally mounted on the lower member, a sleeve carried by the upper member adapted to slide down over the lower member to maintain the upper and lower members in alignment and means for raising one set of said elements and for lowering the other set.

2. In a racket-stringing machine, a mechanism for raising and lowering adjacent longitudinal strings to facilitate insertion of a transverse

string, comprising two sets of string-engaging elements, each of said elements having a lower member and an upper member pivotally mounted on the lower member, a sleeve carried by the upper member adapted to slide down over the lower member to maintain the upper and lower members in alignment, said sleeve having a longitudinal slot opening on one side at the bottom thereof for receiving a string, said slot being closed upon lowering of said sleeve and means for raising one set of said elements and for lowering the other set.

3. In a racket stringing machine, a mechanism for effecting the spacing of longitudinal strings to facilitate the insertion of transverse strings, comprising two series of string-engaging rods, one series for the even strings and the other series for the odd strings, a support, a shaft carried by said support, two sets of eccentric cams carried by said shaft, two connecting members, circular collars carried by the ends of said connecting members for mounting one member on one set of cams and the other member on the other set of cams, one series of said rods being pivotally mounted on one connecting member and the other series being pivotally mounted on the other connecting member, said string-engaging rods having lower parts and upper parts pivotally mounted on the lower parts, and sleeves slidable on the upper parts adapted to slide partly down on the lower parts to maintain the upper and lower parts of the rods in alignment.

4. In a racket stringing machine, a mechanism for effecting the spacing of longitudinal strings to facilitate the insertion of transverse strings, comprising two series of string-engaging rods, one series for the even strings and the other series for the odd strings, a support, a shaft carried by said support, two sets of eccentric cams carried by said shaft, two connecting members, circular collars carried by the ends of said connecting members for mounting one member on one set of cams and the other member on the other set of cams, one series of said rods being pivotally mounted on one connecting member and the other series being pivotally mounted on the other connecting member, said string-engaging rods having lower parts and upper parts pivotally mounted on the lower parts, and sleeves slidable on the upper parts adapted to slide partly down on the lower parts to maintain the upper and lower parts of the rods in alignment, the upper parts of said rods having a notch in one side for receiving a string and said sleeves having a notch in one side corresponding to that of the upper part of the rods and extending longitudinally of the sleeves to enable the sleeves to be lowered over the lower parts of the rods and secure strings in the notches of the upper parts of the rods.

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