L. BIAVA.

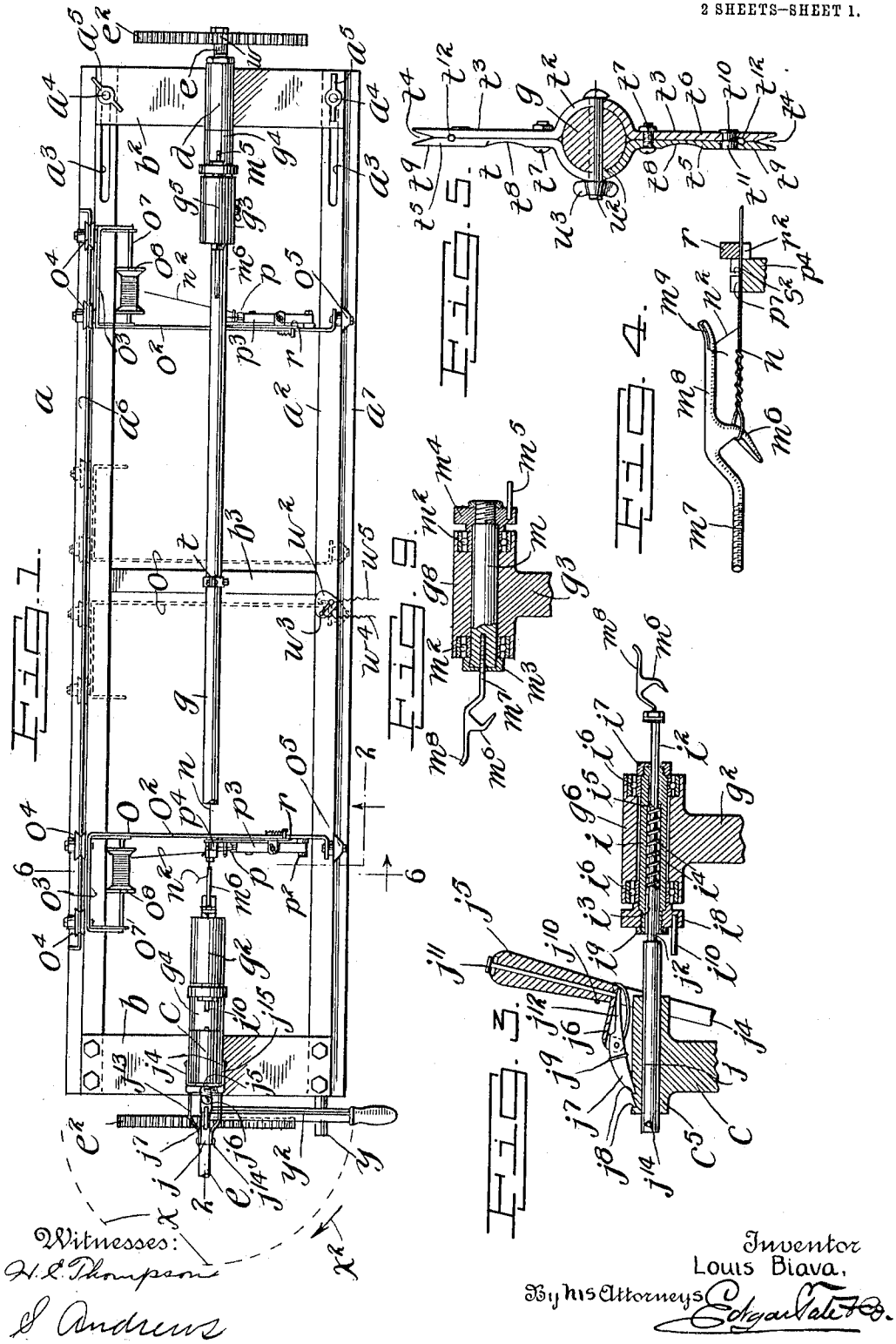
MACHINE FOR MAKING WIRE STRINGS FOR PIANOS AND OTHER MUSICAL INSTRUMENTS.

APPLICATION FILED MAY 31, 1913.

1,102,233.

Patented July 7, 1914.

2 SHEETS—SHEET 1.



Witnesses:
H. C. Thompson
S Andrews

Inventor
Louis Biava.
By his Attorneys Edgar Tate & Co.

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

L. BIAVA.

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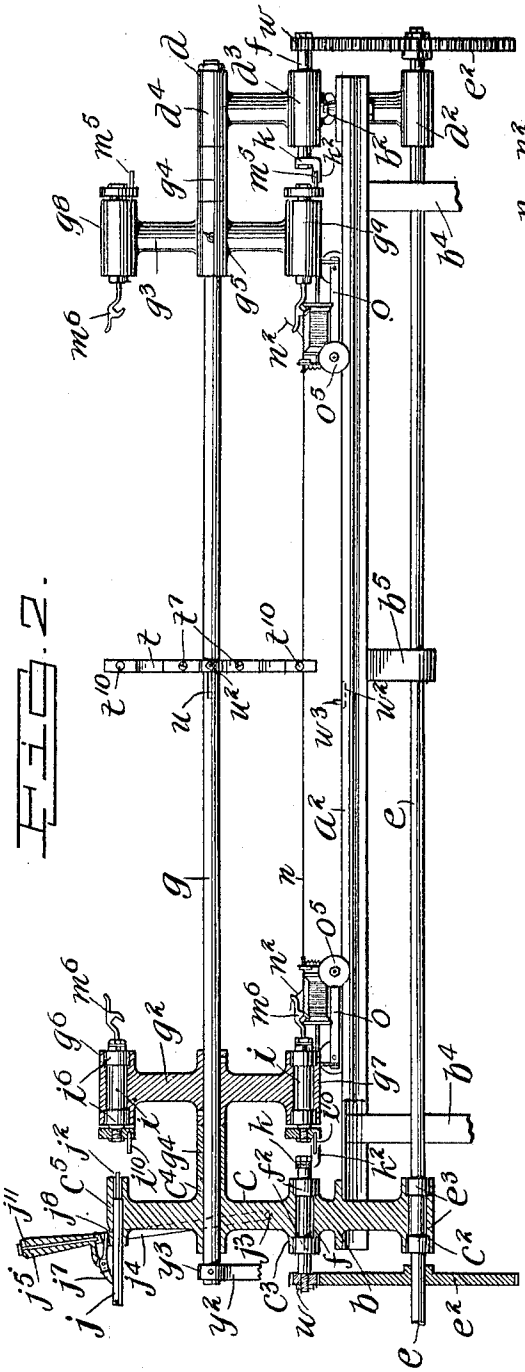


Fig. 2.

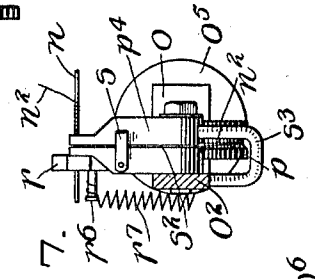


Fig. 7.

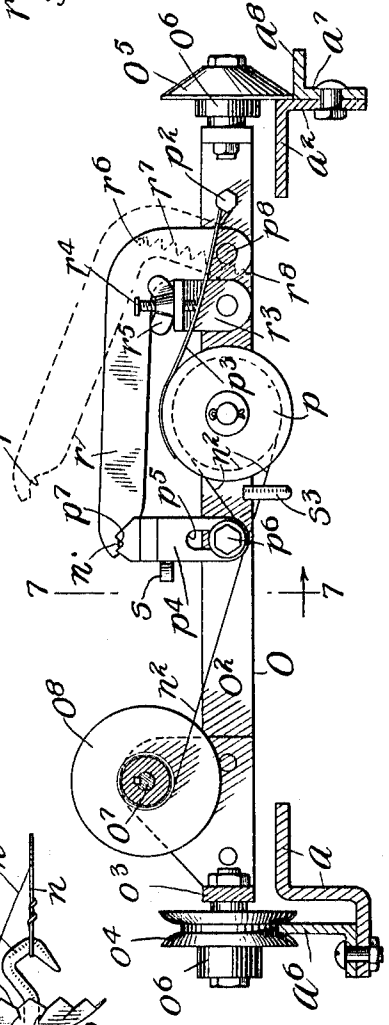


Fig. 6.

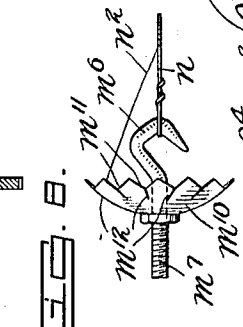


Fig. 8.

Witnesses:

H. E. Thompson.

S. Andrews.

Inventor

Louis Biava,

By his Attorneys

Edgar Tate & Co.

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

UNITED STATES PATENT OFFICE.

LOUIS BIAVA, OF NEW YORK, N. Y., ASSIGNOR TO NATIONAL MUSICAL STRING COMPANY, OF NEW BRUNSWICK, NEW JERSEY, A CORPORATION OF NEW JERSEY.

MACHINE FOR MAKING WIRE STRINGS FOR PIANOS AND OTHER MUSICAL INSTRUMENTS.

1,102,233. Specification of Letters Patent. Patented July 7, 1914.

Application filed May 31, 1913. Serial No. 770,850.

To all whom it may concern:

Be it known that I, LOUIS BIAVA, a citizen of the United States, and residing at New York, in the county of New York and State of New York, have invented certain new and useful Improvements in Machines for Making Wire Strings for Pianos and other Musical Instruments, of which the following is a specification, such as will enable those skilled in the art to which it appertains to make and use the same.

This invention relates to machines for making wire strings for pianos, banjos, guitars, and other musical instruments and particularly strings of this class consisting of a main body wire wound by another wire; and the object of the invention is to provide an improved machine of this class by means of which the operation of making strings for musical instruments of the class specified, may be quickly, easily and economically performed.

The invention is fully disclosed in the following specification of which the accompanying drawings form a part, in which the separate parts of my invention are designated by suitable reference characters in each of the views, and in which:—

Figure 1 is a plan view of my improved machine; Fig. 2 a sectional front side view thereof, the section being on the line 2—2 of Fig. 1; Fig. 3 a view similar to Fig. 2, but showing only a detail of the construction and showing the same on an enlarged scale; Fig. 4 another sectional detail view on an enlarged scale; Fig. 5 a detail view on an enlarged scale of a wire guide which I employ and showing the same partly in section; Fig. 6 a detail view on an enlarged scale showing one of the spool carrying frames which I employ and showing a transverse section of the main frame of the machine on the line 6—6 of Fig. 1; Fig. 7 a section on the line 7—7 of Fig. 6; Fig. 8 a modification of the construction shown in Fig. 4, and; Fig. 9 another sectional detail of a part of the construction shown at the right hand end of Figs. 1 and 2.

In the practice of my invention I provide a strong substantial frame comprising similar parallel side bars a and a^2 connected by cross end members b and b^2 and a central transverse member b^3, and said frame is provided with legs b^4 and a central hanger b^5; and in the form of construction shown, the transverse end member b^2 is made adjustable longitudinally of the frame, this result being accomplished by means of longitudinal slots a^3 in the side members a and a^2 of the frame, and bolts a^4 passed upwardly through said slots and through the end member b^2 and provided with thumb nuts a^5. The end members b and b^2 are in the form of plates and the end member b is provided with a vertical or cross head or support c while the end member b^2 is also provided with a vertical cross head or support d. The cross head or support c is provided below the main frame with a sleeve bearing c^2, above the main frame with a sleeve bearing c^3, above the sleeve bearing c^3 is another sleeve bearing c^4, and above the sleeve bearing c^4 and at the top of said cross head or support is another sleeve bearing c^5. The cross head or support d is provided below the table, with a sleeve bearing d^2 which corresponds with the sleeve bearing c^2, above the table with a sleeve bearing d^3 which corresponds with the sleeve bearing c^3, and at the top thereof and above the sleeve bearing d^3 is another sleeve bearing d^4 which corresponds with the sleeve bearing c^4. A longitudinal drive shaft e is mounted longitudinally below the main frame and passes through the hanger b^5 which forms a bearing therefor and through the bearings c^2 and d^2 and is provided at each end with a gear e^2. The shaft e where it passes through the sleeve bearings c^2 and d^2 is provided with ball bearings e^3 and is also preferably provided with ball bearings centrally thereof where it passes through the hanger b^5.

Mounted in the sleeve bearings c^3 and d^3 are spindles f having ball bearings f^2, and mounted horizontally of and above the main frame is a supplemental shaft g which passes through the sleeve bearings c^4 and d^4 and which is provided with vertical cross heads g^2 and g^3 spaced from the sleeve bearings c^4 and d^4 by collars g^4, and both of the cross heads g^2 and g^3 are secured against rotation on the shaft g while the cross head g^3 is made adjustable longitudinally of said shaft by means of a set screw g^5 or in any other way; this arrangement being necessary to

correspond with the adjustable feature of the cross head d of the main frame. The cross head g^2 is provided at its ends with sleeve bearings g^6 and g^7 and the cross head g^3 is provided at its ends with sleeve bearings g^8 and g^9, and mounted in the sleeve bearings g^6 and g^7 are spindles i, shown in detail in Fig. 3, and said spindles are tubular in form and are provided with pins i^2 movable therethrough and which project in the direction of the center of the main frame, and the inner ends of which are provided with heads i^3, and mounted on said pins are springs i^4 which bear on said heads and on the shoulder i^5 in the tubular spindles i and these springs serve to force the pins i^2 inwardly toward said spindles or outwardly toward the left hand end of the main frame. The spindles i^2 are also provided with ball bearings i^6 similar to the ball bearings c^3 and f^2, and said spindles are provided at their inner ends with cap nuts i^7 and at their outer ends with collars i^8 held in place by nuts i^9, and the collars i^8 are provided with outwardly directed pins i^{10}.

Mounted in and movable longitudinally through the sleeve bearings c^5 of the cross head or support c is a pin j the inner end of which is provided with a reduced inner end portion j^2 adapted to enter the corresponding end of either of the spindles i, and pivoted to said cross head c centrally thereof or above the main frame, as shown at j^3, is a fork lever j^4 having a handle j^5. At the lower end of the handle j^5 of the lever j^4 is a backwardly directed support j^6 under or in which is pivoted a pawl j^7 which is adapted to operate in connection with notches or recesses j^8 in the top of the sleeve bearing c^5, and a yoke-shaped spring j^9 is secured at j^{10} to the lever j^4, or the handle j^5 thereof, and normally serves to force the pawl j^7 into engagement with one of the notches or recesses j^8, and a headed pin j^{11} is movable longitudinally through the handle j^5 of the lever j^4 and operates on a backwardly directed finger j^{12} of the pawl j^7, and by means of which said pawl may be disengaged from the notches or recesses j^8 when necessary. The spindle f in the sleeve bearing c^3 is provided at its inner end with a collar k having a finger k^2 adapted to operate in connection with the pins i^{10} of the collars i^8 of the spindles i, as hereinafter described. The sleeve bearings g^8 and g^9 are each provided, as shown in Fig. 9, with spindles m having ball bearings m^2, and said spindles are provided at their inner ends with cap nuts m^3 and at their outer ends with collars m^4 having outwardly directed pins m^5. Employed in connection with the spindles m are wire hooks m^6 having shanks m^7 passed through the cap nuts m^5 and screwed into the spindles m. and said hooks are provided with outwardly directed fingers m^8, and the pins i^2 of the spindles i in the sleeve bearings g^6 and g^7 are each provided at their projecting ends with wire hooks m^6 similar to those connected with the spindles m and provided with fingers m^8, and the fingers m^8 of the wire hooks m^6 have slotted ends, as shown at m^9 in Fig. 4, and in practice, when the body wires to be wound are mounted in the machine, as hereinafter described, and one of which is shown at n in Fig. 4, the connection of said body wires with the hooks m^6 is in line with the shanks m^7 of said hooks, as clearly shown in said Fig. 4.

A modification of the wire hooks m^6 is shown in Fig. 8 in which modification a collar m^{10} is secured on the shanks m^7 of said hooks, and this collar is preferably concavo convex in form and the edge portion thereof is provided with recesses m^{11} and corresponding radial slots m^{12} which take the place of the slots m^9 in the ends of the fingers m^8 of the form of wire hook shown in Figs. 1, 2, 3, 4 and 9. Either the form of wire hooks shown in Figs. 1, 2, 3, 4 and 9 may be employed, or that shown in Fig. 8, but while I have shown the first named form in use, the latter may be preferable, it being understood that in both of said hooks the slots m^9 in the ends of the shanks m^8 and the radial slots m^{12} in the collar m^{10} are each intended to hold the wire n^2 with which the body wire n is wound.

As shown in Fig. 6, the side member a of the main frame is of double L-shape in cross section, while the side member a^2 is L-shaped in cross section, and the side member a is provided with a vertical track plate a^6, while the side member a^2 is provided with a supplemental L-shaped plate a^7 having an outwardly directed flange a^8, and mounted on the main frame are two L-shaped spool carrying frames o having long arms o^2 which range transversely of the main frame and short arms o^3 which range longitudinally of the back side member a of the main frame, and the short arms o^3 of the spool carrying frames o are provided with grooved wheels o^4 movable on the track a^6, and the front ends of the transverse arms o^2 of the spool carrying frames o are provided with wheels o^5 movable on, or in connection with, the parts of the front side frame member a^2, all as clearly shown in Figs. 1 and 6, and the hubs o^6 of the wheels o^4 and o^5 may be provided with ball bearings similar to those of the spindles f and i if desired. The spool carrying frames o are provided near the back side of the main frame with shafts o^7 for wire spools o^8 on which, in practice, are wound the wires n^2, and mounted on the outer sides of the spool carrying frames o are grooved tension wheels p around which the wires n^2 are passed and secured in front of the wheels p, as shown at p^2, are

springs p^3 which bear on the wheels p, and centrally of the main frame and of the spool carrying frames o, said spool carrying frames or the parts o^2 thereof are provided with vertical guides p^4 having vertical slots p^5 in the lower end portions thereof, through which are passed bolts p^6 whereby said guides are secured to the spool carrying frames and whereby said guides are made adjustable both vertically and forwardly and backwardly. The guides p^4 are beveled at the top thereof, as clearly shown in Figs. 6 and 7, and are also provided in the top thereof with notches p^7 through which the body wire n passes, and pivoted to the parts o^2 of the spool carrying frames and in front of the wheels p, as shown at p^8, are L-shaped arms r the longer ends of which extend transversely of the main frame and over the parts o^2 of the spool carrying frame, and said longer ends of said arms are provided in their under sides with recesses r^2 through which the body wires n pass, and secured between the pivots of the lever r and the wheels p are L-shaped supports r^3 through the top portion of which are passed tension screws r^4 provided with thumb nuts r^5, and by means of which the tension of the springs p^3, or the force with which said springs bear on the wheels p, may be regulated. Secured to the elbow portion of the arms r, as shown at r^6 are tension springs r^7 which are secured to the parts o^2 of the spool carrying frames, and said springs normally hold the arms r in their depressed position, as shown in full lines in Fig. 6, and when said arms are raised, as shown in dotted lines in said figure, in the operation of the machine, or beyond the point shown in dotted lines in said figure, they are also held in said position by the springs r^7, this result being accomplished by reason of the method of and position in which the said springs r^7 are secured to the parts o^2 of the spool carrying frames, at r^8. The guides p^4 are provided on their back sides with spring clips s and with vertical grooves s^2 through which, in the operation of the machine, the wires n^2 are passed, and said wires are held in said grooves by the clips s, and connected with the parts o^2 of the spool carrying frames o, between the wheels p and the guides p^4 are downwardly directed wire guides s^3. Mounted on the supplemental shaft g centrally thereof is a wire guide t comprising a central hub portion t^2, and oppositely directed arms t^3 provided in their ends with notches or recesses t^4 and consisting of separate parts t^5 and t^6 connected near the hub t^2 by screws or bolts t^7, and the parts t^5 are weakened at t^8 so that the end portions t^9 thereof have a spring movement, and secured in the parts t^6 are pins t^{10} having head portions t^{11} movable in the parts t^9. The wire guide t is adjustable longitudinally of the supplemental shaft g, and in order to accomplish this result, said shaft is provided with a longitudinal slot u and the hub of the guide with a bolt u^2 passing through said slot and provided with a thumb nut u^3. The outer ends of the spindles f are provided with pinions or smaller gears w which mesh with the gears e^2 on the drive shaft e, and it will be understood that the inward adjustment of the cross end member b^2 of the main frame is necessary only to provide for different lengths of body wires n to be wound, as hereinafter described, and when the said part b^2 is adjusted inwardly, or outwardly, as the case may be, the wire guide t and the cross head g^3 of the supplemental shaft g must be correspondingly adjusted. The front side member a^2 of the main frame is also provided at w^2 with an electric switch having a pivoted arm w^3 and circuit wires w^4 and w^5, and the operation of which will hereinafter appear, the left hand end of the frame is provided at the front side thereof with a stop y, and connected with the left hand end of the supplemental shaft g is a lever y^2 having a forked end y^3, and the connection of the lever y^2 with the shaft g is such that said lever may be swung through half a circle, as indicated by the dotted line x and the arrow x^2, and then swung upwardly and forwardly until it strikes the stop, y, and the forward movement of said lever rotates the supplemental shaft g.

The operation of this machine will be readily understood from the foregoing description when taken in connection with the accompanying drawings and the following statement thereof. In the operation of the machine, the lever j^4 and its connected parts is thrown into the position shown in Fig. 3, which forces the pin i^2 and the corresponding hook m^6 inwardly. A loop is formed on one end of the body wire n and is placed in said hook, and the other end is similarly connected with the corresponding hook m^6 of the cross head g^3, and in this operation the said wire will be passed through one arm of the wire guide t. The lever j^4 or the pawl j^7 thereof is then released, as hereinbefore described, and thrown into the position shown in Figs. 1 and 2, and the spring i^4 of the said pin i^2 of the cross head g^2 will force said hook outwardly as far as the wire n will permit or, in other words, the said spring serves to hold the wire taut. The lever y^2 is then given a half turn as hereinbefore described, and this throws the body wire n into engagement with the vertical wire guides p^4 of the spool, carrying frames o, and the arms r thereof are thrown into the position shown in full lines in Fig. 6. The wires n^2 from the spools o^8 are then passed through the slot m^9 of the hooks m^6, as clearly shown in Fig. 4, or attached, as shown in Fig. 8. At the beginning of the

operation, the spool carrying frames o will be in the position shown in Fig. 2 and in full lines in Fig. 1, and the wires n^2 from the spools o^8 having been passed around the grooved wheels p and the vertical guides p^4 are wound on the body wire n. The extended end of the shaft e at the left will be geared in connection with an electric motor, not shown, and by means of the switch w^2 the power is turned on. The spool carrying frames o will then travel inwardly, as hereinafter described, and stop at the position shown in dotted lines in Fig. 1, and the spool frame o to the left of the machine will engage the switch arm w^3 and shut off the power at the proper time. In practice, I take a main body wire long enough to make two instrumental wires, and when said body wire is wound, it is cut in the middle, and it will be seen from the above that by providing two spool carrying frames o, I make two instrumental strings in one operation, and it will also be seen that the winding of the spool wire n^2 on the body wire n moves the spool carrying frames o from the position shown in full lines in Fig. 1, to the dotted position, and in the above operation, the arms r of the frames o and the supplemental guide t serve to hold the wire steady or to prevent the jumping thereof when the machine is running at high speed. It will also be understood that in this operation, the spindles f in the cross heads c and d are driven by the gears e^2, and the spindles i of the cross head g^2, and the spindles m of the cross head g^3 are driven by the spindles f in the cross heads or supports c and d, this operation being accomplished by the engagement of the fingers k^2 of the spindles f with the pins i^{10} and m^5 of the spindles i and m or the collars i^8 and m^4 connected with said spindles, and the proper and required rotation of the body wire n is due to the fact that when secured in position, as hereinafter described, it is in direct axial line with the spindles i and m with which it is connected. While the above operation is taking place, the operator can place another body wire in the upper hooks m^6 of the cross heads g^2 and g^3, and it will be seen that an operator can, after very little practice, manufacture a large number of instrumental strings in a very short time. It will be further seen that the shutting off of the power independent of the operator, at the proper time, is another advantage and prevents the wasting of improperly wound strings. It will also be understood that the adjustment at the right hand end of the machine will permit of the manufacture of instrumental strings of any length, and in the adjustment above referred to, the switch will be placed according to the same, and it will be further understood that only one of the spool, carrying frames o may be used, if desired, and this will be the case when an exceptionally long instrumental string is required. It will also be seen that the stop y will limit the downward movement of the lever y^2 as hereinbefore described, and said stop will bring the bearing sleeves g^6 and g^7 or the spindles i thereof centrally with the pin j, this being an essential feature in the operation of the machine, and it will be seen that the wire guide t is provided with apertures t^{12} in which the body wire n is free to turn, and the pin t^{10} of said guide prevents the inward movement of said wire, while the spring action of the parts t^5 and t^6 prevents the downward movement of said wire. It will also be seen that the connection between the lever j^4 and the pin j is made by fork-shaped members j^{13} connected with the pin j at j^{14} and with the lever j^4 at j^{15}, as clearly shown in Fig. 1. The wire holding hooks m^6 as shown are triangular in form or are provided with recesses in which the body wire n when attached thereto rests, and these recesses are in exact line with the shanks m^7 of said hooks and with the axial line of the spindles i, and it is this form of the hooks m^6 which permits the body wire n to be supported in axial lines with the spindles i as hereinbefore described.

Although, I have shown and described the preferred form of my construction, my invention is not limited thereto, and changes therein and modifications thereof may be made, within the scope of the appended claims, without departing from the spirit of my invention or sacrificing its advantages.

The operation of winding the body wire with the winding wire n^2, as hereinbefore described, produces a closely wound string in which the coils of the winding wire are all compact and close together, and this makes a better string than can be produced by the methods of operation heretofore produced.

Having fully described my invention what I claim as new and desire to secure by Letters Patent, is:—

1. In a machine for making wound wire strings for musical instruments, a main frame, a shaft mounted centrally and longitudinally thereover and provided at its opposite ends with cross heads having bearings in which are mounted rotatable spindles provided at their inner ends with hooks, spool carrying frames mounted on the main frame and movable toward and from the center thereof, tension devices connected with said spool carrying frames, and a wire holder mounted centrally of said shaft.

2. In a machine for making wound wire strings for musical instruments, a main frame, a shaft mounted centrally and longitudinally thereover and provided at its opposite ends with cross heads having bearings in which are mounted rotatable spin-

dles provided at their inner ends with hooks, spool carrying frames mounted on the main frame and movable toward and from the center thereof, tension devices connected with said spool carrying frames, a wire holder mounted centrally of said shaft, means for turning said shaft and means for turning the spindles in said cross heads.

3. In a machine for making wire wound strings for musical instruments, a main frame having cross end portions one of which is adjustable toward and from the other, a shaft mounted over said frame and longitudinally thereof and provided at its opposite ends with cross heads having bearings in which are mounted rotatable spindles provided at their inner ends with hooks, spool carrying frames mounted on the main frame and movable toward and from the center thereof, tension devices connected with said spool carrying frames, a wire guide or holder mounted centrally of said shaft, means for turning said shaft, and means for turning the spindles in said cross heads, one of said cross heads and the wire guide or holder being adjustable longitudinally of said shaft.

4. In a machine for making wound wire strings for musical instruments, a main frame provided at its opposite ends with vertical stationary supports having longitudinal sleeve bearings arranged one above another, a shaft mounted in two of said bearings, rotatable spindles mounted in the bottom sleeve bearings, and means for rotating said spindles, said shaft being also provided between the bearings in which it is mounted with cross heads provided in their opposite ends with rotatable spindles having inwardly directed hooks, means whereby said spindles may be engaged by the spindles in the stationary supports, the spindles in one of the cross heads connected with said shaft being longitudinally movable and being provided with springs whereby they are normally held at the limit of their outward movement, and means for forcing said spindles inwardly in different positions of said shaft.

5. A machine of the class described, provided with a shaft, means for turning said shaft through half a revolution, cross heads connected with the opposite end portions of said shaft, and rotatable spindles mounted in the opposite end portions of said cross heads and provided at their inner ends with wire holding hooks having laterally directed supplemental wire attaching means, the spindles in one of said cross heads being provided with springs whereby they are normally held at the limit of their outward movement, and means for forcing said spindles inwardly in different positions of said shaft.

6. In a machine of the class described, a horizontal shaft, means for turning said shaft through half a revolution, cross heads connected with the opposite end portions of said shaft and provided in their opposite ends with rotatable spindles having projecting wire holding hooks at their inner ends, the spindles in one of said cross heads being longitudinally movable and being provided with springs which normally hold them at the limit of their outward movement, and means for forcing the said spindles inwardly in different positions of said shaft.

7. In a machine of the class described, a horizontal shaft, means for turning said shaft through half a revolution, cross heads connected with the opposite end portions of said shaft and provided in their opposite ends with rotatable spindles having projecting wire holding hooks at their inner ends, the spindles in one of said cross heads being longitudinally movable and being provided with springs which normally hold them at the limit of their outward movement, and means for forcing the said spindles inwardly in different positions of said shaft, the cross head on one end portion of said shaft being adjustable longitudinally thereof and the central portion of said shaft being provided with an adjustable wire guide and holder.

8. In a machine for making wound wire strings, a main frame, a shaft mounted centrally and longitudinally thereover and provided at its opposite ends with wire attaching devices, spool carrying frames mounted on the main frame and movable toward and from the center thereof, tension devices connected with said spool carrying frames, and a wire holder mounted centrally of said shaft.

9. In a machine for making wound wire strings for musical instruments, a main frame, a shaft mounted longitudinally thereover and provided at its opposite ends with cross heads having wire attaching devices, spool carrying frames mounted on the main frame and movable toward and from the center thereof, tension devices connected with said spool carrying frames, and a wire holder mounted centrally of said shaft.

In testimony that I claim the foregoing as my invention I have signed my name in presence of the subscribing witnesses this 28th day of May 1913.

LOUIS BIAVA.

Witnesses:
C. MULREANY,
S. ANDREWS.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."