APPARATUS FOR MAKING PIANO DAMPER BLOCKS AND SIMILAR PARTS
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This invention relates generally to the manufacture of piano damper blocks and similar parts and, more particularly, to the manufacture of a piano damper block comprising piano damper blocks and damper block parts. The invention, both as to its structure and mode of operation, will be better understood by reference to the following disclosure and drawings forming a part thereof, wherein:

FIG. 1 is a fragmentary, side elevational view of a portion of a piano action mechanism, showing the damper block which is used in mounting a resilient damper head to a damper lever.

FIG. 2 is a side elevational view of a different segment of the piano action mechanism of FIG. 1, illustrating in particular a regulating rail button and its associated components.

FIG. 3 is a perspective view of a machine constructed in compliance with the principles of the invention for use in making piano damper blocks and similar parts.

FIG. 4 is a top plan view of the machine of FIG. 3;

FIG. 5 is a side elevational view of the machine of FIG. 3;

FIG. 6 is an elevational view taken substantially along the section 6—6 of FIG. 5;

FIG. 7 is a schematic perspective view showing the cutoff saw of the machine of FIGS. 1–6 operative to sever parts elements generated by the end mills from the parts blank.

FIG. 8 is an enlarged plan view showing the engagement between the mills and the parts blank;

FIG. 9 is an enlarged perspective view of an end mill for use in the machine of FIGS. 3–8; and

FIG. 10 is a perspective view of an alternate end mill which may be used in the machine of the invention.

Referring now in detail to the drawings and first to FIGS. 1 and 2, a piano action mechanism will be seen indicated generally in the two figures by the numeral 20. In FIG. 1, the piano action mechanism 20 is shown to include a damper head 22 which includes vertically spaced felt blocks 24; and the damper head 22 is mounted to a damper lever 26 by means of the damper block 28, a damper wire or rod 30 and a set screw 31 whereby the felt blocks 24 may be swung into selective, damping engagement with a piano string 32. In accordance with conventional practice, the piano string 32 is mounted to a piano frame 34, and the damper head 22 is positioned to engage the piano string 32 beneath an upper bridge 36 of the frame 34. The damper head 22 is advantageously attached to the damper block 28 by adhesive or other suitable means; and in compliance with the invention, the damper block 28 is adapted to be fashioned from a solid cylindrical parts element which may be provided with intersecting bores for receiving the damper rod 30 and the set screw 31.

In FIG. 2, the piano action mechanism 20 is shown to include a swingable whip 38 and a fly or jack 40 that is pivotally mounted to the whip 38 by a fly flange 42. The fly 40 includes a laterally offset heald portion 44 which is adapted to engage a regulating rail button 46 upon swingable actuation of the whip 38. The regulating rail button 46 is mounted to a regulating rail 48 by means of an eye screw 50, the regulating rail button 46 comprising a wooden regulating rail button base 52 and a felt pad 54. The regulating rail button base 52 comprises a shallow cylindrical element or disk which is perforated with a central bore that serves as a pilot hole for the threaded shank of eye screw 50.

Turning to a consideration of FIGS. 3 and 4, a machine adapted generally by the numeral 56 is shown to be constructed in compliance with the principles of the invention for making cylindrical parts, elements such as the damper block 28 and the regulating rail button base 52. The machine 56 includes a number of hollow end mills 58, a support arrangement 60 for a parts blank 62, a longitudinal drive 64 for incurring relative converging and separating motion between the mills 58 and the support arrangement 60, and a lateral drive 66 for shifting the relative lateral position of the mills 58 and

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the support arrangement 69. The mills 58 are mounted in a carrier 68 and are adapted to be rotated in a common direction by means of a motor 70 which is mounted in the carrier 68 and which acts through a suitable drive coupling 71. The carrier 68 is slidably mounted on a bridge 72 which, in turn, is slidably mounted in parallel, spaced apart tracks 74 and 76.

Considering FIG. 4 in particular, the lateral drive 66 is seen to comprise a fluid actuated jack 78 having a cylinder 80 which is fixed to the bridge 72 by a bracket 82. Jack 78 additionally has an extensible and retractable piston 84 which is coupled to the carrier 68 by a bracket 86. Jack 78 is thus capable of laterally oscillating the carrier 68 between extreme positions shown respectively in solid outline and in broken outline; and as will be described more fully hereinafter, this lateral shifting of the mills 58 relative to the support arrangement 69 enables the mills 58 to develop overlapping patterns of milling engagement with the parts blank 62.

In order to reposition the carrier 68 and therefore the mills 58 longitudinally of the machine 56, the drive 64 is arranged to include a pair of fluid actuated jacks 68 having cylinders 90 which are fastened individually to the tracks 74 and 76. The jacks 88 also include extensible and retractable pistons 92 which are attached to the respective opposite ends of the bridge 72 by couplings 94. Accordingly, proper actuation of the jacks 90 is capable of reciprocating the bridge 72 and thereby the carrier 68 and the extreme longitudinal positions shown respectively in solid and broken outline. These extreme positions are associated with cutting penetration of the mills 58 into the parts blank 62 and the withdrawal of the mills from the parts blank.

Continuing with reference to FIGS. 3 and 4, the parts blank 62 is seen to comprise a rectangular body made up of a number of small boards or wooden strips 96 which have been edge-glued together, the long axis of the wood strips 96 being generally disposed transverse the long axis of the blank 62. For positioning the parts blank 62, the support arrangement 69 includes spaced lateral guide bars 98 and 100, an underlying platform 102, best seen in FIGS. 5 and 6, and overlying guide plates 104.

At the discharge end of the support arrangement 69 a pair of stop members 106 are cooperatively situated to stop the parts blank 62 and position it in one direction for engagement by the mills 58. The stop members 106 are also arranged to arrest converging motion between the mills 58 and the support arrangement 69 in order to determine the length of the parts elements generated by the mills from the blank 62. Bumper posts 108 are therefore mounted to the carrier 68 laterally of the mills 58 to engage the stop members 106 for this purpose; and in order to support the far end of the parts blank 62 against the cutting advance of the Mills 58, a backing arrangement indicated in FIGS. 4 and 5 by the numeral 110 is arranged to include an L-shaped bracket 112 which is seated against the rear end of the parts blank 62 to ride in a longitudinal slot 114 fashioned in the platform 102 as is shown in FIG. 6. In order to provide positive backing support for the parts blank 62, the arrangement 110 includes a rearwardly extending bar 116 that is affixed to the bracket 112. The bar 116 is provided with a series of depending teeth 118 best seen in FIG. 5; and the backing arrangement 110 additionally includes means for advancing the bar 116 and thereby advancing the parts blank 62 against the stop members 106. This advancing means includes a fluid actuated jack 120 which incorporates an extensible and retractable piston rod 122, a dog 124 being pivotally mounted to the free end of piston rod 122 by a bracket 126 and a pivot pin 128. Advantageously, a leaf spring 130 is connected to the bracket 126 to bias the dog 124 into engagement with the teeth according to the showing of FIG. 5. As will be recognized, extension of the piston rod 122 causes the dog 124 to engage a tooth 118 and thereby advance the parts blank toward the mills 58; however, retraction of the piston rod 122 results in the dog 124 riding over the teeth 118 due to the particular slope with which the teeth are provided. If desired, an auxiliary pressure plate may be forcibly brought against the upper surface of parts blank 62 to pinch the blank against the platform 102 for holding the same in place against the advance of the mills 58. A fluid actuated jack 134 may be provided for proper reciprocation for the platen 132, the platen 132 being specifically connected to an extensible and retractable piston rod 136 of the jack 134.

With reference to FIG. 9, a mill 58 will be seen fashioned with cutting edges 138 at its exposed end surface, and these cuttings edges cooperate with the hollow character of the mill 58 in generating solid cylindrical parts elements 140 from the parts blank 62 as is shown in FIG. 7. Action of three parallel disposed mills is shown in FIG. 8, where, it will be noted, the axes of the mills are aligned in a common plane and are spaced apart by a distance such that shifting of the carrier 68 between the full and the dotted line positions of FIG. 4 will shift the mill axes axially at least equal to the sum of the inside diameter and the wall thickness of the parts blank 62 in order to permit overlapping patterns of milling engagement with the parts blank 62. One pattern of such milling engagement is shown by the penetrated condition of the mills 58 in FIG. 8 and a second, overlapping pattern is indicated in broken outline in that figure. Returning to FIG. 7, the planar alignment of the axes of the parts element 140 indicates that the overlapping pattern of milling engagement has proceeded in a strictly horizontal direction whereby alternate parts elements 140 are fashioned by the first and second patterns of milling engagement respectively. It is recognized that other types of overlapping patterns may be developed as horizontally overlapping patterns may be developed by adding means for vertical relocation of the carrier 68 for example. Furthermore, it is realized that there is a limit to the closeness in the placement of the drive spindles for the mills 58; and ordinarily, the minimum spindle spacing does not permit close spacing of the parts elements 140. By developing overlapping patterns of milling engagement, it is possible to generate parts elements 140 from the spaces interjecent the first pattern of milling engagement whereby to increase the efficiency of wood utilization.

In order to sever the parts elements 140 from the parts blank 62, the machine 56 includes a cutoff unit which is indicated generally by the numeral 142 in FIGS. 3 and 5–7. The cutoff unit 142 includes a rotating saw blade 144 which is selectively operable in a path transverse of the support arrangement 69 at the discharge end thereof, saw blade 144 being specifically lowerable into engagement with the parts blank 62 for severing the generated parts elements 140 therefrom as is indicated in FIG. 7. Specifically and with reference to FIGS. 3 and 6, the rotary saw blade 144 is mounted on a shaft 146 which comprises the output shaft of a speed reducer 148. The speed reducer 148 is rigidly attached to a carriage plate 150, and a suitably energized drive motor 152 is also mounted to the carriage plate 150 to extend its output shaft 154 into substantial parallelism with an input shaft 156 of the speed reducer 148. A suitable pair of sprockets 158 and 160 may be mounted on the shafts 156 and 154 respectively so that the speed reducer may be drivenly coupled to the output shaft of motor 152 by an endless chain 162 which is disposed in engagement with the sprockets 158 and 160. In order that the rotary saw blade 144 may be reciprocated in a given dog direction, a fluid actuated jack 164 includes an extensible and retractable piston rod 166 which is connected to the carriage plate 150 by a pivot bracket 168. It is recognized that the rotary saw blade 144 may be replaced by axially spaced tandem saw blades where the axial dimension of the part being produced is to be
closely controlled. Advantageously, the carriage plate 150 is pivotally secured to a mounting arm 170 which is bolted or otherwise secured to track 74 as is shown in FIG. 6, mounting arm 170 extending laterally outwardly and upwardly from the track to position the rotary saw blade 144 in generally overlying relationship relative to the support arrangement 60.

Having thus described one construction of the invention, it is important now to state how the illustrated embodiment operates.

Assuming that the parts blank 62 has been advanced into abutting engagement with the stop members 106 as is shown in FIG. 3, the longitudinal drive 64 will be actuated to convey the carrier 68 and the support arrangement 60, specifically drawing the carrier 68 towards the support arrangement to advance the mills 58 into cutting engagement with the confronting edge surface of the parts blank 62 as is shown in FIGS 4 and 8. When a bumper post 108 engages the corresponding stop member 106, advance of the mills 58 will be arrested; and thereafter, the longitudinal drive 64 will be actuated to retract the mills by separating the carrier 68 from its converged position relative to the support arrangement 60. Next, the lateral drive 66 will be actuated to relocate the carrier 68 into the position indicated specifically in broken outline in FIG. 4. From this position, the longitudinal drive 64 may be actuated to advance the carrier 68 towards the support arrangement 60 and thereby urge the mills 58 into cutting engagement with the parts blank 62. This second advance of the mills 58 will generate the parts elements indicated in broken outline in FIG. 8.

Upon withdrawal of the mills 58, the jack 164 of cutoff unit 142 will be actuated to lower the rotary saw blade 144 into incising engagement with the parts blank 62 to sever the several parts elements 140 which have been generated by the mills 58. This action of the rotary saw blade 144 is suggested in FIG. 7. The saw blade 144 is selected to be of such a diameter that its advance into the parts blank 62 not only severs the parts elements 140 but also the end scraps which are indicated in FIG. 7 by the numeral 172, thus squaring the end of the parts blank.

When the rotary saw blade 144 has been retracted by proper actuation of the jack 164, the jack 120 may be actuated to advance the bar 116 and thereby the parts blank 62. Upon the parts blank 62 once again engaging the stop member 106, the actuation of the jack 120 will be terminated while leaving hold pressure thereon. Under the circumstances wherein the pressure platen 132 is incorporated in the machine 56, the jack 134 will next be actuated to lower the platen 132 for holding the parts blank 62 against the platform 102 to resist shifting of the blank during the cutting advance of the mills 58.

In the embodiment of the machine 56 which has been shown and described with reference to FIGS. 3-9, the stop members 106 have been selected to be of comparatively short dimension along the longitudinal axis of the machine whereby to permit a relatively deep penetration of the mills 58 into the parts blank 62. The mills 58 may thus generate parts elements 140 which are of a corresponding length. This length is suitable to the use of parts elements 140 for the damper block 28 shown in FIG. 1. On the other hand, when it is desired to use the machine 56 for making regulating rail button bases 52, for example, the stop members 106 will be replaced by stop members having a greater dimension along the longitudinal axis of the machine whereby to reduce the penetration of the mills into the parts blank. In addition, the mills 58 will be replaced by a mills such as the mill 58a shown in FIG. 10, mill 58a having a greater inside diameter than the mills 58 whereby to generate a part of correspondingly greater diameter. Moreover, the mill 58a is fashioned to include a small diameter drill bit 174 which is secured coaxially with the mill 58a for simultaneously boring a pilot hole in the resultant parts element upon generation thereof by the cutting edges 138a. If desired and rather than replace the stop members 106 to adjust the depth of milling engagement, the bumper posts 108 may be replaced with bumper posts having a greater length.

Other parts may be made by similar readjustments and replacements of parts in the machine 56. For example, since plate bushings are of a diameter which is similar to the diameter of the regulating rail button base 52, the same means for controlling the depth of cut may be employed when the plate bushings are to be manufactured, however, since plate bushings ordinarily do not include pilot holes, mills which do not incorporate an integral, coaxial drill will be used in the latter instance.

From the foregoing descriptions, it will be apparent that the present invention provides a machine which is capable of producing piano parts of simple shape in a high speed and economical manner. More specifically, the machine of the invention produces parts of this character in groups rather than individually; and moreover, the machine of the invention is capable of using as a starting material short boards that would otherwise be scrapped whereby to enhance the economy of operation.

Therefore, the specific examples herein shown and described are to be considered as being primarily illustrative. Various changes beyond those described will, no doubt, occur to those skilled in the art; and such changes are to be understood as forming a part of this invention insofar as they fall within the spirit and scope of the appended claims.

The invention is claimed as follows:

1. Apparatus for use in making piano damper blocks and similar parts, said apparatus comprising: support means for holding a rectangular parts blank in a predetermined plane; a mill carrier; a plurality of parallel disposed, hollow rotatable mills for cutting edges at corresponding annular end surfaces and mounted on said carrier with their axes aligned with said plane for millingly engaging a parts blank at an edge thereof and at the discharge end of said support means in such spaced relation as to traverse a substantial portion of the width of the parts blank; drive means for incurring relative converging and separating motions between said carrier and said support means whereby to generate solid cylindrical parts elements comprising a portion of the internal dimensions of the mills; means for effecting relative transverse shifting between said carrier and said support means a predetermined increment to shift the mill axes a distance at least equal to the sum of the inside mill diameter and the mill wall thickness for relatively positioning said carrier and said support means to enable said drive means to incur relative converging and separating motions therebetween permitting generation of another set of solid cylindrical parts elements in overlapping patterns of milling engagement; and cutoff means selectively operable in a path transverse of said support means at the discharge end thereof for severing parts elements generated by said mills from said blank.

2. Apparatus as claimed in claim 1, wherein each of said mills includes a relatively small diameter drill bit secured coaxially thereof for simultaneously boring a hole in the parts elements while the same are being generated by the cutting edges of the mills.

3. Apparatus as claimed in claim 1, including a stop means at the discharge end of said support means for arresting converging motion between the mills and the support means whereby to determine the length of the parts elements generated by the mills.

4. Apparatus as claimed in claim 1, including backing means aligned with said support means and said mills for supporting the blank against the cutting advance of the mills.

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