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METHOD OF CONSTRUCTING A PIANO ACTION

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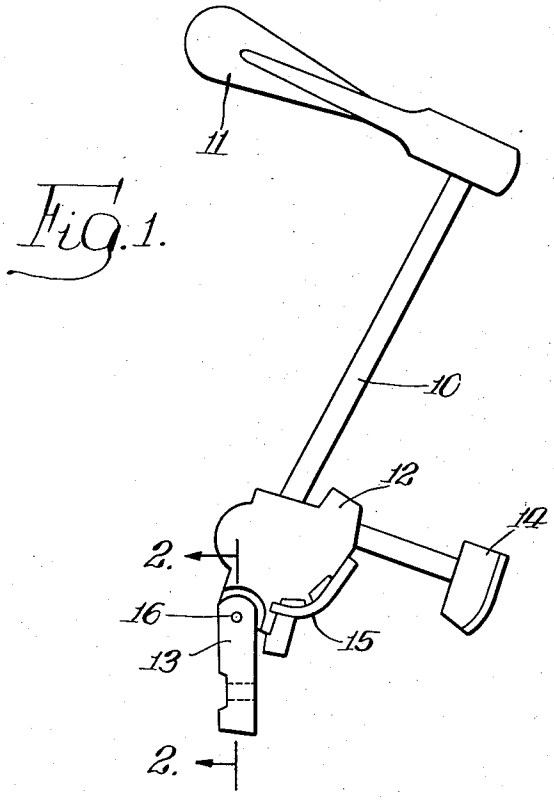

Fig. 1.

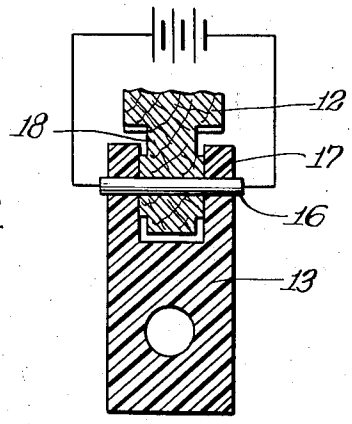

Fig. 2.

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METHOD OF CONSTRUCTING A PIANO ACTION

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5 Claims. (Cl. 29—149.5)

This invention relates generally to piano actions and more particularly to an improved pivotal connection for use in piano actions.

In piano actions, a large number of pivotal connections are required and it is essential that these pivotal connections be carefully made so that they operate satisfactorily and quietly over long periods of use. It has been standard practice to use wooden parts in piano actions and to provide bearings wherein holes are drilled in the wooden parts and are lined with felt or other material. The parts are connected by wires or pins which are positioned in the lined holes in the wooden members to provide the pivotal connections. Although such connections have been generally used, and have provided quiet operation when new, the lining material tends to absorb moisture and is subject to wear. Accordingly, the operating characteristics of such actions change with change in humidity, and also change after long periods of use because of wearing of the felt or other lining material. It has been proposed to use other types of pivotal connections but no satisfactory solution has been found which can be constructed inexpensively so that the action using such connection can be manufactured at reasonable cost.

It is therefore an object of the present invention to provide a simple and improved pivotal connection for piano actions.

A further object of the invention is to provide an effective pivotal connection between a plastic member and a member made of wood.

Another object of the invention is to provide an improved and inexpensive method of making a pivotal connection between a plastic flange member of a piano action and an operating member thereof made of wood.

A feature of this invention is the provision of a pivotal connection for the moving member of a piano action wherein a plastic mounting flange provides a smooth bearing fit with a pin or axle and a wood operating member is tightly secured to the axle.

A further feature of the invention is the provision of a method for making a pivotal connection wherein a wood member and a plastic member have undersized holes formed therein, and an axle somewhat larger than the holes in the members is inserted through the openings to compress the material about the openings and is then heated to a temperature which softens the plastic material to provide a smooth bearing, with the temperature being held at a low value which does not char the wood member. The metal pin or axle may be made of a conducting material and electric current passed therethrough which is accurately controlled to provide the required heating of the plastic material without heating the wood member to the extent that it chars or loosens on the pivot pin.

Further objects, features and the attending advantages of the invention will be apparent from a consideration of

the following description when taken in connection with the accompanying drawings in which:

Fig. 1 shows a pivotal mounting for a hammer of a piano action;

Fig. 2 illustrates the manner of heating the pin to form the pivotal bearing.

In practicing the invention a pivotal connection is made between a plastic member and a wood member by providing openings in each of the members and inserting a pin or axle therein. The openings in both the wood and plastic members are smaller than the diameter of the pin, with the opening in the wood member being preferably smaller than that in the plastic member. The pin is made of a material which is harder than the material of the wood and plastic members and compresses the material about the openings when it is inserted therein. After the pin is inserted through the openings the pin is heated to soften the compressed plastic material so that it flows sufficiently to provide a smooth surface about the pin which in effect provides a smooth bearing engagement with the pin. The temperature of the pin is held at a low value so that the wood is not charred by the heat from the pin. Temperatures in the range from 150 to 225° Fahrenheit may be suitable for this use. This heat may be provided by using an electrically conducting pin and passing a current through the pin which is accurately controlled so that the required softening effect on the plastic material is produced without adversely affecting the wood member.

Referring now to the drawings, in Fig. 1 there is illustrated a hammer **10** for a piano action which includes a head **11** for striking a string and a butt **12** which is pivotally mounted to the flange **13**. The flange **13** may be secured to a fixed rail structure of the piano action. A back check **14** is secured to the hammer butt **12** and a felt **15** is provided thereon for engagement by a flyjack. The construction of the hammer itself is well known and will not be described in detail.

As previously stated it is important to have a smooth operating pivotal bearing connection between the flange **13** and the hammer butt **12**. This connection must not produce noise and must provide straight movement with no play in the movement of the hammer butt **12**. The hammer mutt **12** may be made of wood as in the normal construction. The flange **13** may be molded of plastic material as it will be obvious that such a member may be easily molded at very small expense.

Fig. 2 shows in cross-section the pivotal connection between the hammer butt **12** formed of wood and the flange **13** made of a plastic material. The pivot is provided by a pin **16** which passes through openings in the two spaced support arms **17** of the flange and in the pivot bearing portion **18** of the hammer butt **12**.

In accordance with the invention the openings in the plastic flange and in the wood hammer butt are both made of smaller diameter than the diameter of the pin **16** inserted therein. Accordingly, when the pin is positioned in the openings the material thereabout is compressed and a very tight fit is provided both in the plastic flange and in the wood hammer butt. The plastic flange is made of a material which softens at a temperature of the order of 150–200° Fahrenheit. The pin **16** is heated to a temperature in this range to cause the plastic material around the pin to soften and provide a very smooth bearing contact with the pin. The metal pin, of course, expands when heated to further compress the plastic material, and then the pin contracts when it cools to provide a slight clearance with the plastic flange. This permits the pin to turn within the flange to provide a pivot bearing.

It has been found that when the temperature of the

pin is held below the boiling point of water, the moisture in the wood absorbs the heat and no charring effect on the wood is produced. Accordingly, the tight connection between the pin and the wood hammer butt is retained so that the pin moves with the hammer butt. By holding the temperature of the pin below a maximum of 225° Fahrenheit the wood is not substantially affected and does not char or expand or take out the set which causes the wood to grip the pin and remain in tight engagement therewith.

In practical examples which have been tested and found to be highly satisfactory, plastic materials such as cellulose-acetate-butyrate and ethyl-cellulose have been used. The openings in the plastic material are formed by coring or drilling to a diameter of .046". These holes are then reamed to diameters of .049" to .050". The holes in the wooden member are slightly smaller than those in the plastic being drilled to diameters from .0475 to .0495". When using openings in the plastic and wood as specified above, pins having diameters of .05075 to .05100" have been used. The pin diameter may therefore range from .00075" to .002" greater than that of the opening in the plastic member. When the opening has a diameter of .050" and the pin has a diameter of .051", the difference in the diameters is .001" or about 2 percent of the diameter of the pin. The pins have been heated to temperatures which soften the plastic but does not char the wood, and temperatures in the range from 150 to 225° used for very short periods of time have been found to operate satisfactorily. The temperature required will, of course, depend upon the plastic material used and must be sufficient to soften the plastic material. The temperature, however, must not be substantially above the temperature required to boil water as higher temperature will drive the moisture out of the wood and cause the same to char.

In a practical application of the construction it has been found that the use of a current of 50 amperes for a period of two seconds provides the necessary heating to produce a smooth bearing and still does not produce any objectionable effect on the wood to cause the wood to free from the pin. This current has been used in a pin of the diameter of .05100" as specified above, which is made of 8% nickel silver wire.

It is to be pointed out that the pivotal connection described is not limited to use in a piano action for connecting a hammer to a flange but may be used for making other pivotal connections in a piano action, and in other applications. The specific values mentioned above, while providing highly satisfactory results, are to be considered only as examples and other values may be used when using plastic materials of different kinds and also using woods of different kinds. The dimensions specified have been found to be highly satisfactory for piano actions but it may be preferred to use other dimensions for other uses and under other conditions. Although the heat is described as produced by passing current through a conducting pin, it is to be pointed out that the pin can be heated in other ways and that a heat conducting pin may be used to conduct heat from a separate source to soften the plastic material about the pin.

We claim:

1. The method of making a pivotal connection between a wood member and a solid plastic member by using a metal conducting cylindrical pin, said method including the steps of, forming an opening in the wood member having a diameter less than that of the pin, forming an opening in the solid plastic member having a diameter of the order of 2 percent less than that of the pin, inserting the conducting pin in said openings in said wood and plastic members to compress the material thereof about said openings, passing an electric current through the pin to heat the same, conducting the heat from the pin to the plastic member about the pin, heating the pin to a temperature such that the plastic member thereabout softens to provide a smooth bearing surface, with the temperature of the pin being held at a value such that the wood member is not substantially charred and the pin is securely held therein.

2. The method of making a pivotal connection in accordance with claim 1 wherein the plastic member is made of a material which softens at a temperature below 200° Fahrenheit and the pin is heated to a temperature of the order of 225° Fahrenheit.

3. The method of making a pivotal connection in accordance with claim 1 wherein the pin is made of nickel silver material and is heated for a period of the order of 2 seconds.

4. The method of making a pivotal connection between a metal pivot pin and a bearing formed of compressible material including the steps of, forming an opening in the bearing material, inserting in the opening a pin having a diameter of the order of .00075" to .002" greater than that of the opening to thereby compress the bearing material about the pin, heating the pin by providing electric current therein whereby the pin expands, conducting heat from the pin to the bearing material and further compressing the same as the pin expands, and cooling the pin and the bearing material thereabout whereby the pin contracts and provides clearance with the compressed bearing material.

5. In a piano action, the method of making a pivotal connection between a metal pivot pin and a bearing formed of compressible material including the steps of, forming an opening in the bearing material having a diameter of the order of .050 inch, inserting in the opening a pin having a diameter of the order of .051 inch to thereby compress the bearing material about the pin, heating the pin by providing electric current therein whereby the pin expands, conducting heat from the pin to the bearing material and further compressing the same as the pin expands, and cooling the pin and the bearing material thereabout whereby the pin contracts and provides clearance with the compressed bearing material.

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