

METHOD OF MANUFACTURING A JACK

This invention relates to a method of manufacturing a jack.

Hitherto, a jack is conventionally manufactured by a process comprising a step of forming an electro-conductive metal sheet conveyed in one direction into multiple contact pieces by using a progressive press and a die, a step of mounting a specified number of these contact pieces on an automatic assembly machine, a step of setting a jack body to predetermined position, and a step of incorporating each contact piece into the jack body by operating the automatic assembly machine.

In such conventional manufacturing method, however, a serious problem exists in that it is necessary to be equipped with the automatic assembly machine which is several times more expensive than the die, considerably increasing the whole equipment cost and, moreover, since it is required to mount a fixed number of contact pieces, which have undergone complicated pressing bending steps, on the automatic assembly machine, the working process as a whole takes much time and labor.

Such being the situation, it has been difficult to automatize completely the manufacturing method, which is yet another problem.

According to the present invention there is provided a method of manufacturing an electrical jack comprising the steps of:-

punching a metal sheet so as to form a plurality of side-by-side contact piece elements interconnected with each other at their sides and each having two portions extending from opposite ends of a center portion and at least one lead extending from a distal end of a respective one of said two portions, the or each lead forming a free end, each of said two portions having punched therein a hole;

bending said two portions together with the lead or leads relative to said center portion;

positioning a jack body adjacent said plurality of side-by-side contact piece elements;

and operating a cutter so as to cut each said contact piece element off from the or each other contact piece element and so as to force each cut-off contact piece element by means of the cutter into or onto the adjacent jack body to become incorporated therewith, causing said holes to become engaged with corresponding projections which are formed on the jack body to retain the contact piece element in or on the jack body.

It is believed possible by means of the present invention to provide a novel method of manufacturing a jack by which a complete automatization is easily attained, thereby improving considerably a productivity and saving the facility cost.

The invention will be described by way of example with reference to the accompanying drawings, wherein:-

Fig. 1 is a plan view of a part of an elongated electro-conductive metal sheet;

Fig. 2 is a plan view wherein said metal sheet is punched and formed into a plurality of contact piece elements arranged side-by-side and in a direction orthogonal to a conveying direction of the sheet metal;

Fig. 3 is a plan view showing how both free ends of each contact piece element are bent downward;

Fig. 4 is a plan view showing by one-dot chain lines where each contact piece element is cut off from other elements;

Fig. 5 is a sectioned front elevation showing a positional relation among each contact piece element, a punch of a cutter and a jack body when cutting each contact piece element by the cutter and forcedly incorporating the element into the jack body;

Fig. 6 is a perspective view showing a positional relation between each contact piece element and the jack body when cutting off each contact piece element and forcedly incorporating into the jack body;

Fig. 7 is a side view showing the positional relation among each contact piece element, the punch of the cutter and the jack body;

Fig. 8 is a perspective view of a jack manufactured by a method in accordance with this invention; and

Fig. 9 is a sectional view of the jack in Fig. 8

Fig. 1 shows a part of an electro-conductive elongated metal sheet 1 which is used as a material in forming contact pieces of a jack, and on which positionally holes 1a are formed at specified distance on both edges of longitudinal sides. Fig. 2 shows a state wherein a plurality of contact piece elements 2 to form finally each individual contact piece of the jack are formed in a direction orthogonal to a conveying direction of the sheet metal 1 and side-by-side with each other by punching said sheet metal 1. These contact piece elements 2 are connected with a remaining outer frame of the metal sheet 1 through connecting pieces 2g, and the contact piece elements 2, 2 adjacent each other are also connected together at their sides through other connecting pieces 2g. A lead 2a for connecting to a printed-wiring board by soldering or the like is integrally formed at one end or each end respectively of each contact piece element 2. Before or after the punching step, a contacting point 2b bulging or being enlarged downward is formed in the center portion 2' of each contact piece element 2. Furthermore, before the

punching step or at the time of punching, circular positioning holes 2d are formed between the centre portion 2' and portions 2h of each contact piece element 2. and in addition two rectangular holes 2e are punched respectively in two portions 2h extending from opposite ends of the center portion 2' (the or each lead 2a extending from the distal end of the associated portion 2h).

Fig. 3 shows a bending step wherein both portions 2h of each contact piece element 2 formed into the state of Fig. 2 are bent downward, each making a right angle at the middle part between the respective circular positioning hole 2d and the rectangular punched hole 2e.

Figs. 4 and 5 show a cutting step wherein each contact piece element 2 is cut off by a punch 5 of a cutter at the portions indicated by one-dot chain line in Fig. 4.

Meanwhile, a jack body 3 is composed of an insulating material such as synthetic resin, and at the center thereof a plug insertion hole 3a running through from the front side to the rear side is formed. Further, on the outside of both side walls, which are parallel with said plug insertion hole 3a, projections 3d for the retention of the contact piece elements are formed, said projections 3d being eventually engaged with the rectangular punched holes 2e of the contact piece

elements 2. The projections 3d are so formed that each upper side thereof is gradually inclined downward, and a projecting piece 3d' projecting downward is formed underneath the outside tip of each projection 3d. Furthermore, in order to individually insert and hold the middle part 2' of each contact piece element 2, grooves 3b corresponding to the width of the middle part 2' are formed on both sides of the upper part of the body 3, and at the upper side of each groove 3b, a positioning projection 3c is formed for engaging with the positioning hole 2d of the respective contact piece element 2 from above. In addition, at the center part of the body 3, openings 3e are formed so as to communicate with the plug insertion hole 3a.

Then, the jack body 3 is placed immediately underneath each contact piece element 2 formed into the state of Fig. 4, as shown in Fig. 5 by lowering down the punch 5 of the cutter from above the metal sheet 1 toward a female form 4, in which an opening permitting each contact piece in the mentioned above to be inserted is formed, every connecting piece 2g is cut off, thus separating the connections among the plurality of contact piece elements 2. By further lowering down the punch 5, by extending the stroke thereof, each cut away contact piece element 2 is forcedly incorporated into the jack body 3 located underneath. In this step, the portion 2h (together with lead 2a if any) of each

contact piece element 2 which is bent downward, making a right angle is diverged outwardly along a tapered face of the projection 3d, then the rectangularly punched hole 2e is engaged with an inside of the projecting piece 3d' of the projection 3d by returning inwardly by the elasticity of the material, and at the same time the circular positioning holes 2d are respectively engaged with the positioning projections 3c. In this manner, each contact piece element 2 can be forcedly incorporated into the jack body 3 while keeping an exact relative position and in such a manner as to be reliably retained. Also in this step, as shown in Fig. 8, since the upper openings of the body 3 are almost completely covered with the intermediate horizontal portions 2' having the contacting points 2b located thereon, entrance of dust from above is virtually completely prevented, while a contact state with a plug (not illustrated) is ensured by protruding the contacting points 2b into the plug insertion hole 3a.

Accordingly, when using the manufacturing method of a jack as described above, an expensive automatic assembly machine is not required at all, automization being easily attained, and moreover cost of dies, working cost, working time, etc are saved.

Thus, in case of the foregoing embodiment, plural contact piece elements 2 are formed by punching so as to

be orthogonal to the conveying direction of the sheet metal and arranged side-by-side with one another, and when each contact piece element 2 is cut off respectively to be forcedly incorporated into the jack body 3, the jack body 3 is conveyed from the direction orthogonal to the conveying direction of the sheet metal so as to be positioned immediately underneath each contact piece element 2 to be separated by cutting.

This invention, however, is not limited to the foregoing embodiment but enables a further embodiment wherein the plural contact pieces are formed by punching in the same direction as the conveying direction of the sheet metal, and when cutting each contact piece element to be incorporated forcedly into the jack body, the jack body 3 is conveyed from the same direction as the conveying direction of the sheet metal so as to be positioned immediately underneath each contact piece element to be separated by cutting.

CLAIMS:-

1. A method of manufacturing an electrical jack comprising the steps of:-

punching a metal sheet so as to form a plurality of side-by-side contact piece elements interconnected with each other at their sides and each having two portions extending from opposite ends of a center portion and at least one lead extending from a distal end of a respective one of said two portions, the or each lead forming a free end, each of said two portions having punched therein a hole;

bending said two portions together with the lead or leads relative to said center portion;

positioning a jack body adjacent said plurality of side-by-side contact piece elements;

and operating a cutter so as to cut each said contact piece element off from the or each other contact piece element and so as to force each cut-off contact piece element by means of the cutter into or onto the adjacent jack body to become incorporated therewith, causing said holes to become engaged with corresponding projections which are formed on the jack body to retain the contact piece element in or on the jack body.

2. A method as claimed in claim 1 wherein the jack body is positioned immediately underneath said one



contact piece element and wherein the cutter is operated downwardly for the cutting-off and forcing steps.

3. A method of manufacturing a jack as claimed in claim 1 or 2, wherein said holes are each rectangular and wherein said projections are formed on outer faces of two side walls which are in parallel with a plug insertion hole of the jack body.

4. A method of manufacturing a jack as claimed in claim 1, 2 or 3, wherein an upper side of each of said projections is so formed as to be gradually inclined downward, and projecting pieces projecting downward are formed on outside ends of a bottom part of each projection, so that said two portions of the cut-off contact pieces are made to diverge on upper inclined surfaces of said projections and so that each of said punched holes is engaged with an inside of the projecting piece of each projection by virtue of elasticity of each contact piece.

5. A method of manufacturing a jack as claimed in any preceding claim, wherein before the cutting step, a bulging contact point is formed in the center portion of each contact piece element, and also an opening is formed on the upper side of the jack body so as to communicate with the plug insertion hole, and said



contact point of each contact piece element is arranged facing said opening so as to be projected into said plug insertion hole.

6. A method of manufacturing a jack as claimed in any preceding claim, wherein at the punching step, positioning holes are formed between the center portion and said two portions of each contact piece element, and wherein positioning projections for engaging respectively with said positioning holes are formed on both edges of an upper side of the jack body, so that each of said positioning holes is engaged with each of said positioning projections when each cut-off contact piece element is forcedly incorporated into the jack body.

7. A method of manufacturing a jack as claimed in any one of claims 1 to 6, wherein at the punching step, the plurality of contact piece elements are formed in a direction orthogonal to a conveying direction of said metal sheet and side-by-side with one another, and when each contact piece obtained by cutting off each contact piece element at the cutting step is forcedly incorporated into the jack body, the jack body is conveyed from a direction orthogonal to a conveying direction of the sheet metal to be positioned adjacent each contact piece element to be cut off.



8. A method of manufacturing a jack as claimed in any one of claims 1 to 6, wherein at the punching step the plurality of contact piece elements are formed in the same direction as a conveying direction of said metal sheet and side-by-side with one another, and when each contact piece obtained by cutting off each contact piece element at the cutting step is forcedly incorporated into the jack body, the jack body is conveyed from a direction the same as the conveying direction of the sheet metal to be positioned adjacent each contact piece element to be cut off.

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