Moulded Ceramic Part with Ribs to Indent a Co-operating Part

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Figs. 1, 2, 3, 4, 5, 6, 7, 8, 9

Identification of Parts

Areas of the patent that may be important:
- Moulded Ceramic Part
- Ribs
- Indent
- Co-operating Part

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This invention relates to methods of and means for making mechanical connections between components of an assembly and more particularly to connections between molded ceramic parts and light weight metal parts or fasteners.

It is a general object of the present invention to provide novel methods of and means for connecting metal parts to ceramic materials.

A specific object of the invention consists in the arrangement of the parts whereby they may be connected by a simple driving or pushing operation.

Another important object of the invention consists in the formation in the ceramic material of a hole extending through a surface thereof and having a longitudinally corrugated or ridged wall for cooperation with a fastener.

Still another object of the invention resides in the use with a longitudinally ridged wall hole in ceramic material of a part of relatively unhardened metal having transversely extending edges, or their substantial equivalent, the part being sized to have said edges spaced a distance not less than the distance between the crests of opposed walls in the hole, but less than the spacing of said walls, whereby on pressing the part into the hole the edges thereof are grooved by the ceramic ridges in the hole.

A further object of the invention resides in the provision of a pilot area in the hole in the ceramic which is unridged whereby the inserted part is guided therein before encountering the longitudinal ridges.

A still further object of the invention resides in the connection between the ridged wall of the hole in the ceramic and the edges on the metal part which results wholly from friction.

An important feature of the invention is the facility with which the metal part may be pressed into the prepared opening in the ceramic part and the greatly increased resistance to withdrawal.

Other further features and objects of the invention will be more apparent to those skilled in the art upon a consideration of the following specification and accompanying drawings, wherein are disclosed several exemplary embodiments of the invention, with the understanding that such changes and modifications may be made therein as fall within the scope of the appended claims without departing from the spirit of the invention.

In said drawings:

FIGURE 1 is a sectional view through a fragment of a porcelain block having a fastening of the screw type attached thereto in accordance with the present invention, the section being axial of the hole in the block and the fastening being shown in elevation;

FIGURE 2 is a view similar to FIGURE 1 with the fastening omitted and illustrating the lands and flutes in the wall of the hole;

FIGURE 3 is a plan view of the block and hole;

FIGURE 4 is a plan view of an assembly of a porcelain block and a nut in accordance with another feature of the invention;

FIGURE 5 is a longitudinal section through FIGURE 4 taken on line 5--5 thereof, showing only the porcelain part;

FIGURE 6 is a view similar to FIGURE 5 but showing the nut secured in position and cooperating with a screw for mounting the porcelain part;

FIGURE 7 is a plan view of a metal contact part mounted in a chamber or recess in a porcelain part in accordance with the features of the present invention;

FIGURE 8 is a sectional view through FIGURE 7 taken on line 8--8 thereof and;

FIGURE 9 is a view similar to FIGURE 8 but showing the contact unit in position.

In many fields of endeavor it becomes necessary to secure fastenings in or attach parts to ceramic materials, and heretofore considerable difficulty has been experienced and in most cases resort is had to the use of through screws, bolts or rivets with the attendant expense and increase in size, weight and number of parts used. The difficulty is particularly serious in the electrical manufacturing industry where certain ceramics, particularly those known as "porcelain," which terminology will be referred to hereinafter, are used as insulating material as well as mechanical supports and components of many devices, of which the electrical socket, switch, insulator, collar form and lighting fixture are among well-known examples. Devices such as these are made in large quantities and in a highly competitive industry where savings of a fraction of a cent per unit are often of considerable importance.

It is impractical to mould metal inserts in porcelain parts, such for instance, as nuts or other fastening means because of the extreme differences in size of the green moulded and the fired porcelain part, the shrinkage being too great to admit of such operations except under extreme difficulties. The present invention is therefore directed to the attachment of metal parts to ceramic bodies, after the latter have been formed to a final predetermined shape, by the simple operation of pressing the metal part into a preformed opening in the porcelain. The invention may also be used to attach other parts to the surface of porcelain elements or in some cases to receive conventional fastening elements used for the purpose.

Reference should now be had to the drawing for a better understanding of the invention. In this drawing the first three figures illustrate means for attaching a fastening, which is the holding equivalent of a screw to a porcelain block. This arrangement may be used for many purposes, such as attaching contacts, terminals or the like to a porcelain switch body, lamp socket or other part made of ceramic or similar material.

In FIGURES 1, 2 and 3, a fragment 12 of such a block of porcelain is indicated, having a face 13 through which passes an opening 14 in the nature of a cylindrical hole modified as later described. Preferably, but not essentially, the axis of the hole is normal to the surface 13 and, in the instance shown, the hole has a depth of the order of five times its diameter, in order to receive a fastening which acts as a substitute for a conventional machine screw or bolt. In prior constructions the opening would in most cases extend through the block and the screw be secured by means of a nut on the rear face thereof.

While it is possible to form internal threads during the moulding operation, this is an extremely difficult, time-consuming and costly practice because in the case of fine pitch threads for small diameter holes, the core, which forms the hole in the porcelain as it is being moulded, must be removed by threaded rotation, which with certain consistencies of molding material, is almost impossible. In the present instance the upper portion 15 of the hole, i.e. the outer third or an amount of that order, is a straight cylindrical opening having a diameter only slightly greater than that over the threads of the fast-
that the latter may slip in readily and yet be guided by this pilot hole. Below the cylindrical portion the lands of the fastening element, whereas the tips or crests of the lands extend inwardly a radial distance such that the diameter between opposed ridges is slightly greater than the root diameter of the thread in the fastening. As seen in FIGURES 1 and 2 the lands 17 merge into the cylindrical portion 15 by tapering both in width and thickness to a point as seen at 18. This facilitates the entry of the fastener into the landed area, an operation accompanied solely by pushing or pressing the fastening unit longitudinally without rotation into the position illustrated in FIGURE 1 where its head 20, which may be of any desired configuration, bears on the surface of a metal strap 21 for securing it in position against the face 13 of the porcelain part.

In order that a fastening element may function in accordance with the essential features of the present invention it must have relatively thin edges or be of sufficiently soft metal so that the lands abrade and deform these edges as the latter are forced downwardly over the lands by a straight pushing operation. In the embodiment of FIGURES 1, 2 and 3, these thin edges are further aided most simply by making use of a conventional machine screw having the usual sixty degree threads, a shank diameter somewhat less than the distance across the opposed crests 17 in the hole and a thread crest diameter intermediate of the above mentioned and that across the bottoms of the flutes 16 in the hole.

The fastening means does not have to be a screw, the purpose in using the conventional machine screw being that it is, first, made of a soft or malleable material such as mild steel, brass or the like, and second, that it is conveniently available, although since the units are used in such large quantities the kerf in the head 20 of the fastener may be omitted as a further saving in cost. The head can be of any desired shape but it is preferably flat on top as shown to aid in the inserting operation. It serves in the present instance, as an example, to hold the sheetmetal part 21 in position on the surface 13 of the porcelain.

Obviously, if special parts are to be made, the threads can be converted to circumferential ridges, it being only necessary that relatively thin edges be presented for disposal by the lands 17. Screws, however, are simpler to obtain and are more conventional and have been illustrated as the fastening device used although the helical arrangement of the thread has no bearing on the operation of the invention.

In making the assembly shown in FIGURE 1, the screw is passed through the opening in the sheetmetal part 21 and its end dropped loosely into the pilot opening 15. The parts are then arranged in a suitable press and the screw pushed rapidly to the position shown in FIGURE 1, when the head engages the plate 21 and stops the movement before the screw bottoms in the hole. During this operation the lands are distorted by cooperation with the crests of the lands, which themselves are not appreciably changed in size or shape. Unglazed porcelain has a relatively high abrasive characteristic and this, plus the relative softness of the metal, cuts and bends the thin edges of the threads and displaces a certain amount of material whose position is then occupied by the lands. These latter bear with considerable frictional resistance against the remaining metal in the V-shaped notches 23 which they have formed transversely of the threads, and place the fragile material of the insulation part under "hoop stress." All of the notches in a series as formed by each individual land are in alignment. The resulting assembly is an extremely firm one, it having been found that a No. 8 machine screw arranged in an opening such as shown in FIGURE 2 to an overall depth of contact of about one-half inch resists withdrawing to an average pullout of 125 pounds. Such a screw in general has approximately thirty-two threads to the inch which provides considerable gripping power when coordinated with six lands as shown in FIGURE 3. This type of fastening has proven eminently satisfactory for securing the mounting straps to porcelain switch bodies in wall-type switches and for securing the contacts and terminals to the porcelain body of a switch or other device, and the saving in labor and materials for making the assembly is a substantial one in a small item.

In the embodiment of FIGURES 4, 5 and 6 the intent is to secure a nut in a suitable recess in a porcelain part, where it abuts the bottom of the recess and receives a threaded screw or similar fastening element extending through an opening penetrating said bottom. The recess is non-circular as is the outline of the nut that the latter is prevented from rotating therein. It is desirable that the nut be attached to the porcelain part to save handling it independently during the operation of mounting the porcelain part, such as might occur in attaching a sign lamp receptacle to a sheetmetal sign plate. In this embodiment, as in the previous one, certain of the walls of the recess are fitted with sharp edged lands and the nut is forced down between them and its edges grooved thereby to secure it in tightly in position against displacement by shipping and screw assembly. In this instance, the nut fits against the bottom of the recess in which it is housed and is drawn more tightly therewith by the screw which passes into it so that the nut-porcelain attachment is not called on to resist loosening pulls except possibly during the initial stage of starting the screw.

In the three figures the recess 50 is shown as formed in the ear of a porcelain sign receptacle formed in a block of porcelain 51 having front face 52 which is shown fitted against the back of a metal sign plate 53 suitably apertured in such position, not shown, to permit the lamp base to pass therethrough and be engaged in the screw shell of the socket, also not shown. The recess 50 is substantially square in plan as seen in FIGURE 4 in order to loosely receive the square nut 54, which in this instance is preferably made of brass or some similar copper alloy and suitably bored and threaded as shown to receive an attaching screw or bolt. As shown in FIGURE 6, the washer head 55 and passes through a suitable aperture in sign plate 53 and through passage 56 entering through the bottom of the hole or chamber 50 as seen in FIGURE 6 so that the screw may engage the nut 54 and hold the porcelain lamp socket body against the rear face of the sign plate.

As best seen in FIGURE 5 the recess 50 is moulded with slight draft to the walls thereof to facilitate withdrawal of the core, but in general the walls may be said to be flat and substantially normal to the bottom. On each of a pair of opposing walls, for instance the side walls 57, are provided a pair of spaced parallel lands 58, generally triangular in horizontal cross-section or in plan as seen in FIGURE 4 and having sharp ridges 59 and relatively flat exposed faces. As viewed in FIGURE 4, there are two of these on each of the opposite faces 57 and they are directly opposite of each other. The latter face 57 is not essential. The nut 54 which is square and preferably formed of soft metal is of minimum thickness to provide sufficient holding for the threads on the screw and has a width across opposed edges greater than the distance between lands of a pair but considerably less than the width of the recess 50 so that the nut is approximately 4. These lands are only approximately one-third of the depth of the recess in length and start from the bottom, as shown, having tapered tops 60 as clear from FIGURE 5 and similar to those at 18 in FIGURE 2.

In use the nut is dropped into the opening 50 until it reaches the tops of the lands, when it is forced down by
the use of a suitable press and follower which bears on the nut until the nut bottoms in the recess as seen in FIGURE 6 at which time grooves will have been formed in the edges of the nut by the combined abrasive and displacement actions of the lands on the relatively soft metal of the edges of the nut. The frictional engagement, then, of the edges and ridges of the lands with the cut and distorted surfaces of the nut will securely hold the latter in position ready to receive the screw in the manner indicated in FIGURE 6, thereby achieving a unitary assembly of the socket and the fastening element or nut 54.

In a still further embodiment shown in FIGURES 7, 8, and 9, a recess 70 shaped somewhat like that illustrated in FIGURES 4 to 6 inclusive, is formed in a block 71 of porcelain and provided with somewhat smaller lands 72, more closely spaced toward the centers of opposite side walls 74 of the recess. A passage 76 having one wall coincident with an end wall of the recess extends through the bottom wall of the recess to the rear face 77 of the block.

The recess 70 is intended to engage and hold the substantially rectangular base 78 integral with contact spring 79 which has a sinusoid portion 80 passing through and engaging both walls of the passage 76. This construction, the operation of which will be evident, is substantially identical with that in FIGURES 4 to 6 inclusive, holds the relatively thin spring bronze base 78 in the same manner as does the arrangement in the previous embodiment hold the nut after it is pressed in position. The tang 79, 80 extending from one edge of the base which is not engaged by the lands, is bent into a substantial U-shape at 81 so that the knuckle portion abuts against the wall 82 of the passage 76 which is continuous with the wall of the chamber 70, then extends diagonally across until a portion 83 engages wall 84. Thereafter the portion 79 is disposed as desired for whatever purpose is intended.

In assembling the thin base 78, there may be some tendency not only to cut or abrade grooves in the edges thereof, but to throw up burrs as intended to be illustrated by the ports given the reference character 86. These are in effect turned up portions of the thin metal which assist in providing holding action to insure retention of the contact in position.

I claim:

1. A fastening assembly comprising, in combination, an integral, structural part of brittle, fragile, moulded material having a round hole therein, extending through a surface thereof, and a fastening part of relatively malleable material tightly engaged therein, the wall of said hole having integral, longitudinally disposed continuous alternating flutes and lands for most of its circumference, said fastening part of malleable material being a conventional machine screw whose maximum diameter over the thread crests is intermediate the hole diameters defined by land crests and by flute bottoms whereby the thin thread crests are successively notched by the lands as the screw is pushed longitudinally into the hole and hoop strain is imparted to the fragile material to prevent direct withdrawal of the screw.

2. The fastening assembly as defined in claim 1 in which the hole adjacent the said surface has cylindrical walls and is of a diameter substantially equal to flute base diameter for free initial entrance of the fastening.

3. A fastening assembly consisting of a block of porcelain having naturally abrasive surface characteristics, a moulded chamber extending through one wall of the block and having continuous lands extending from facing walls and parallel to an axis normal to the said one wall, said lands each having a generally triangular cross section providing a sharp crest; a cooperating fastening component formed of metal soft enough to be abraded and deformed by said porcelain having a part pressed into said chamber, said part being originally sized to dimensions greater than the distance between crests of opposing lands having relatively thin edges presented transversely to said lands and abraded and deformed thereby to frictionally engage therewith to solely hold the block and part assembled against separation along said axis.

4. The assembly of claim 3 in which said block chamber is cylindrical where it extends through said wall and is then provided with lands circumferentially spaced thereabout parallel to the axis of the chamber, and the cooperating component is a machine screw whose thread crests only were successively grooved by said lands as the screw was pushed into the chamber nonrotatively.

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