A multiple-compliant-bristle, self-centering, self-sizing rotary abrasive hone made of multiple outwardly extending, flexible, extremely compliant plastic bristles (in a preferred form, made of Nylon plastic) having enlarged abrasive globules completely firmly attached to outer ends of the bristles in a non-flaking and non-chipping manner and with the surface configuration defined by the multiple abrasive globules being a cylindrical, conical, frusto-conical, or any of various other desired configurations, usually suitable for insertion into a recess or hole in a workpiece which is to be honed by relative movement of the abrasive hone with respect thereto.

14 Claims, 13 Drawing Figures
MULTIPLE-COMPLIANT-BRISTLE, SELF-CENTERING SELF-SIZING ROTARY ABRASIVE HONE

BACKGROUND OF THE INVENTION

The field of the invention is generally that of abrasive hone and abrasive brushes for abrading, grinding, polishing, and honing usage, usually in a power-driven manner. This general field has included both outside-surface abrading, grinding, and/or polishing tools and inside-surface abrading, grinding, and honing tools and, in the latter case, one of the commonest forms thereof has been for grinding and/or honing substantially cylindrical interior workpiece surfaces, such as engine cylinders or inside surfaces of pipes or tubes, and the like, which are merely representative of a great variety of such prior art applications of such inside-surface-abrading tools. In general, such inside-cylindrical-surface-abrading tools or hones have comprised a power-driven carrier or mounting portion adapted to carry one or more members formed of an extremely hard grinding material which usually is of a relatively brittle or frangible type and of a relatively non-elastic, non-compressible type. This has provided a major prior art difficulty, problem, or disadvantage when honing interior cylindrical surfaces, such as engine cylinders, for example, since it is absolutely essential that such a prior art rigid, cylindrical surface hone be absolutely centrally positioned during honing relative movement thereof with respect to the interior cylindrical workpiece surface which is to be honed or it will be found that uneven pressure is exerted on both the workpiece surface and on the relatively non-elastic, brittle, hard abrasive material of the hone itself. This has produced prior art problems with respect to the honed workpiece surface and also with respect to the hone itself. It is precisely for the purpose of completely overcoming the above-mentioned prior art problems that the present invention was developed, since it provides an abrasive hone which, when used for honing interior surfaces (cylindrical, conical, frusto-conical, or other surfaces of revolution), has none of the above-mentioned prior art problems by reason of the great flexibility of the extremely compliant plastic bristles carrying the enlarged abrasive globules at the outer ends thereof, which allows sufficient flexure to provide a self-centering and self-sizing action with respect to such an interior workpiece surface and yet which does not allow the flaking-away or chipping-away of any of the abrasive material forming the abrasive globules carried by the outer ends of the flexible compliant plastic bristles. These advantages flow from and occur by reason of the specific features of the invention pointed out in greater detail hereinafter.

SUMMARY OF THE INVENTION

The invention is defined in a general way as follows. The invention relates to a flexible, self-centering and self-sizing hone having multiple outwardly extending flexible, extremely compliant plastic bristles (in a preferred form, made of Nylon plastic) having enlarged abrasive globules of a completely firmly attached and consequently non-flaking and non-chipping type carried by the free outer ends of the elastic, flexible, compliant plastic bristles, with the abrasive globules comprising an outer coating of only the plastic bristle tip ends by a combination of a particulate abrasive material and a plastic bonding material (usually an epoxy resin), with said outer coating and each corresponding plastic bristle tip end effectively bridged and joined to each other by an intervening junction-facilitating surface means comprising a plastic junction means characterized by the fact that it can function as such as intervening bridge between the Nylon bristle tip end material and the plastic bonding material (usually an epoxy resin) of each abrasive globule by reason of its great junction affinity for each of the joined materials. Thus, the arrangement just described provides an enlarged abrasive globule carried by a plastic bristle tip end in a manner such that the mounting of the enlarged abrasive globule is of a completely non-chipping and non-flaking type by reason of the intervening adhesive material having a great junction affinity for each of the joined materials whereby to provide a very strongly adhesive junction effectively bridging and strongly mechanically interconnecting the tip ends of the otherwise completely flexible and unaltered bristles and the abrasive globules carried by said bristle tip ends, even though the joined materials are of dissimilar types of plastic (such as Nylon in the case of the bristle tip ends and epoxy resin in the case of the bonding material of the abrasive globules) normally not adapted to strongly adhere to one another. The remaining shaft portions of each of the Nylon bristles, in a preferred form, remain uncoated by the junction adhesive material, the bonding material, and the abrasive material so as to retain unaltered flexibility and compliancy characteristics throughout the length thereof.

As pointed out above, in a preferred form the bristles may be made of flexible or resilient plastic material such as Nylon or the like, the particulate abrasive material may be made of tungsten carbide or an equivalent material, the plastic bonding material may be made of one or more plastic layers such as epoxy resin or the like, and the intervening junction adhesive material may comprise resorcinol-formaldehyde resin adhesive material, usually of a two-component type capable of having one component thereof applied in liquid form, usually at substantially room temperature, to the exterior of the Nylon bristle tip ends and to then have the second component comprising an additive applied thereto for curing and hardening same in place followed by the application of the plastic bonding material of the coating means (usually comprising an epoxy resin) carrying the abrasive material (such as particulate tungsten carbide or the like) in a desired dissemination pattern which may then be cured in place whereby to provide a preferred form of the invention having each of the extremely strongly bonded-in-place abrasive globules carried by the corresponding outer Nylon bristle tip ends, with the bridging attachment thereof, by means of the bridging, intervening, junction-facilitating adhesive bonding surface means, being such that none of the abrasive globules, or any portion of any of same, will ever become flaked or chipped away or otherwise detached even during the hardest type of grinding, abrading, or honing usage of the novel self-centering, self-sizing hone of the present invention.

OBJECTS OF THE INVENTION

With the above points in mind, it is an object of the present invention to provide a novel, flexible, compliant, self-centering, self-sizing hone embodying any or
all of the features referred to herein, either individually or in combination, wherein a plurality of flexible plastic bristles of substantially unaltered compliance carry at their outer tip ends, in a substantially annularly cylindrically arranged array thereof, a plurality of completely non-flaking and non-chipping abrasive globules mounted on the bristle tip ends in said substantially cylindrically arranged array by novel intervening junction-facilitating plastic adhesive junction means of such great strength and bridging junction affinity for both the plastic material of each bristle tip end and the plastic bonding material comprising the inner surface of each abrasive globule as to render said junction substantially completely inseparable as a result of hard grinding and honing usage of the flexible hone.

A further object of the present invention is to provide a novel, flexible, self-centering, self-sizing hone of the type referred to in the preceding object wherein the compliancy and elasticity of the substantially unaltered bristle shafts (apart from the tip ends carrying the abrasive globules in an undetachable manner) are of such flexibility and compliance as to make it possible to insert the brush axially into a substantially cylindrical hole in a variety of different workpieces of varying diameters ranging from a diameter substantially equivalent to the non-inserted diameter of the flexible hone down to a substantially smaller diameter than the uninserted diameter of the flexible hone and wherein the dispersal and arrangement of the compliant, flexible, plastic bristles are such that the hone is effectively of a self-sizing type (that is, capable of being inserted into a smaller workpiece bore hole than the exterior diameter of the brush before such insertion) and also is of an effectively self-centering type (produced by reason of the even and opposed distribution of the small, centrally directed forces on the center of the hone produced by the compliantly, radially inwardly deflected, flexible plastic bristles when the flexible hone is inserted into a hole in a cylindrical workpiece of smaller diameter than the initial exterior diameter of the flexible hone.

A further object of the invention is to provide a flexible, self-centering, and self-sizing hone of the type referred to herein having a plurality of outwardly directed bristles of thermoplastic material (such as Nylon or the like) so that the outer tip ends of the bristles may be initially enlarged by the application of heat and pressure to define an inner globule matrix, or bristle tip end enlargement, which may be subsequently coated with the previously mentioned intervening adhesive junction-facilitating plastic material and subsequently coated with the previously mentioned outer coating means comprising one or more layers of abrasive material and plastic resin bonding material (usually an epoxy resin) for producing a greatly enlarged abrasive globule.

Further objects will be apparent to those skilled in the art after a careful examination and study of the representative exemplary embodiments of the invention illustrated in the drawing and described in detail hereinafter, and all such are intended to be included and comprehended herein as fully as if specifically described and illustrated in detail.

Several exemplary but non-specifically-limiting embodiments of the invention are disclosed in the figures of the drawing as follows:

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a partial side elevation and a partial section, along the plane indicated by the arrows 1-1 of FIG. 2, of one exemplary form of multiple-compliant-bristle self-centering and self-sizing, flexible rotary abrasive hone of the present invention.

FIG. 2 is a left end elevation of the flexible, self-centering and self-sizing hone of FIG. 1.

FIG. 3 is a fragmentary, partially broken-away perspective view of the flexible, self-centering and self-sizing hone of FIGS. 1 and 2.

FIG. 4 is a fragmentary, side elevational view of the outer tip end of a representative one of the multiple compliant flexible bristles of the flexible hone of FIGS. 1-3 before the effective formation of the enlarged abrasive globules on the multiple flexible compliant bristle tip ends thereof.

FIG. 5 is a fragmentary, cross-sectional view showing a representative outer tip end in side elevation of a representative bristle of the multiple flexible bristles, such as the one shown in FIG. 4, in an intermediate attachment condition such as is produced by an intermediate attachment step comprising the firm affixing to the bristle tip end of a junction-facilitating, effective bonding surface means which has a great junction affinity for the plastic material (usually Nylon plastic material) of the bristle tip end and which will have a similar great junction affinity for the wear-attritionable bonding material (usually an epoxy resin) of the outer coating means comprising the enlarged abrasive globule subsequently attached and firmly affixed to the intervening junction-facilitating, effective bonding surface means of FIG. 5 in the manner clearly shown in FIG. 6.

FIG. 5A is a view very similar to FIG. 5, but illustrates one first representative exemplary step in producing the arrangement shown in FIG. 5.

FIG. 5B is a view similar to FIG. 5A, but illustrates one second representative exemplary step in producing the arrangement shown in FIG. 5.

FIG. 6 is a fragmentary, partially cross-sectional view generally similar to FIG. 4 and FIG. 5, but showing the representative, fragmentary, bristle tip end in a final attached condition such as is produced by a final abrasive-globule-attaching step, and clearly illustrates the construction and mode of attachment of the representative enlarged abrasive globule with respect to the bristle tip end, by way of the intervening bridging junction-facilitating bonding surface means, in a firmly attached manner capable of hard abrasive honing usage without flaking, breaking away, or partial detachment of portions of the abrasive globule occurring despite even the hardest type of such honing and abrading usage. In this view the representative form of interventing junction-facilitating, effective bonding surface means is clearly shown in junction-facilitating bridging relationship between the plastic material (usually Nylon) of the bristle tip end and the plastic material (usually epoxy resin) of the bonding material carrying the particulate abrasive particles and comprising together the coating means forming the enlarged abrasive globule.

FIG. 7 is a fragmentary, partially elevational and partially cross-sectional view generally similar to FIG. 6, but illustrating another form of the invention of a laminated, multi-layer construction.

FIG. 8 is a view of aspect similar to FIG. 6, but illustrates another slight variation of the invention wherein
the abrasive globule has the abrasive particles substan-
tially evenly disseminated throughout the bonding ma-
terial of the outer coating means and together compris-
ing the abrasive globule.

FIG. 9 is a view similar in aspect to FIG. 6, but illus-
trates a further slight modification wherein the inner
plastic bristle tip end (usually made of Nylon plastic)
is initially formed in a pre-attachment step into a pre-
attachment inner base enlargement tip prior to attach-
ment of the intervening, junction-facilitating bonding
surface means such as illustrated in FIG. 6 and the sub-
sequent attachment thereto of the plastic bonding ma-
terial (usually epoxy resin) of the outer coating means
comprising the enlarged abrasive globule.

FIG. 10 is a reduced size, somewhat diagrammatic
side view, partly in elevation and partly in section, illus-
trating one exemplary form of the flexible self-sizing,
self-centering hone of the present invention prior to the
insertion thereof into the interior of a bore hole, such
as an engine block cylinder, or the like, which is shown
somewhat diagrammatically fragmentarily and in cross-
section and which is of somewhat smaller size than the
initial exterior diameter of the flexible self-centering
and self-sizing hone.

FIG. 11 is a view similar to FIG. 10, but illustrates the
flexible self-sizing and self-centering hone of FIG. 10
after forcible insertion thereof into the interior of the
somewhat smaller diameter bore hole or cylinder, the
inner surface of which comprises a workpiece to be
honed by the flexible self-sizing and self-centering hone
of the present invention. A representative, but non-
specifically-limiting, form of rotary power-driving
tool adapted to grip the effective chuck end of the bris-
tle mounting base of the flexible hone is shown and
indicates the flexible hone as being power-rotated while
in the self-centered bristle-deflected condition clearly
shown in this view for producing a superior honing ac-
tion on the interior cylindrical surface of the work-
piece.

DESCRIPTION OF THE PREFERRED
EMBODIMENTS

The self-centering and self-sizing hone 20 includes
multiple tufts of bristles 22 and a bristle-mounting base
24 in the form of a twisted wire 26 having the inner end
portions 28 of each bristle (or middle portions of dou-
ble-ended bristles) helically twisted therein in a manner
well-known in the brush-making art. The manner of the
mounting of the bristles is exemplary only and other
bristle-mounting modes may be employed within the
scope of the invention. Each bristle 22 is of flexible,
compliant construction and includes a shaft portion
22S and a free outer tip end 22T constructed of a flexi-
able thermoplastic material such as Nylon, which is ex-
tremely effective because of the outstanding flexibility
characteristics thereof, which greatly enhance the self-
centering and self-sizing function of the hone.

An enlarged abrasive globule 30 is adapted to be
formed on and non-detachably mounted on the free
outer tip end 22T of at least certain of the bristles 22
(usually of substantially all of the bristles 22, in a pre-
ferred form of the invention) so as to provide a multi-
ple-compliant-bristle, extremely flexible, self-
centering and self-sizing abrasive hone for honing and
grinding purposes (usually for honing the interior
curved and usually substantially cylindrical surface of
a workpiece). Since the brush is intended primarily for
power-rotation, whereby to hone an interior, substan-
tially cylindrical workpiece surface of a bore hole, or
cylindrical recess, it will be noted that the plurality of
abrasive globules is mounted by the radially outwardly
arranged array of compliant Nylon bristles so as to de-
fine an outer cylindrical, abrasive surface, provided by
the arrangement of abrasive globules 30, which is capa-
ble of being easily resiliently inwardly deflected when
inserted into a somewhat-smaller-diameter cylindrical
workpiece surface in the manner clearly shown in FIG.
11 in what might be termed a self-centering and self-
sizing manner by reason of the substantially equal, op-
positely outwardly directed, radial distribution of the
Nylon bristle shaft portions 22S in a symmetrically ra-
dially directed manner relative to the base 24.

Each abrasive globule 30 is limited to being mounted
on the bristle tip end 22T in a manner such that the
major portion of the Nylon bristle shaft 22S is free of
any outer coating such as that forming the enlarged
abrasive globule 30 carried only by the outer bristle tip
end 22T and which includes bonding material 34 and
particulate abrasive material 36. In forming the abra-
sive globule 30, each bristle tip end 22T, such as is
shown in FIG. 4 in an initial condition, is first provided
with an effective junction-facilitating bonding surface
means which, in the case of Nylon bristle tips 22T,
comprises the application of junction adhesive material
35 thereto, as is clearly shown in FIG. 5 (one mode of
application of which will be described in greater detail
hereinafter), followed by the curing of same and, sub-
sequently, by the dipping of the now-cured-in-place
junction adhesive material 35 firmly attached to the
Nylon bristle tip end 22T into temporarily-or-initially-
liquid adhesive bonding material 34, which may be car-
ried in a shallow tray or otherwise positioned for conve-
nient application to the bristle tip end 22T carrying the
cured-in-place junction adhesive material 35, whereby
to produce bristle tip ends coated with the bonding ma-
terial 34, with an intervening junction-facilitating
bonding surface means or bridge made up of the junc-
tion adhesive material 35 positioned therewith. There-
after, and before the hardening or curing of the
bonding material 34 occurs, the coated bristle tip ends
22T may be immersed in finely divided, particulate
abrasive material 36, which may also be positioned in
a tray or otherwise applied to the coated bristle tip ends
22T, thus producing multiple composite abrasive glob-
ules 30, such as shown in FIG. 6, which can then be
cured in place so as to firmly affix and mount each such
abrasive globule 30 on the corresponding bristle tip end
22T and with the intervening junction-facilitating, ef-
efective bonding surface means comprising the above
junction adhesive material 35 acting as an extremely
strong, intervening mechanical bridge between the
Nylon material of the bristle tip end 22T and the bond-
ing material 34 of the composite abrasive globule 30
which, in a preferred form, comprises an epoxy resin
adhesive material, one exemplary form of which may
be that form of epoxy resin adhesive material manufac-
ctured by the Epoxylite Corporation of the United States
of America and identified by said company as "Epoxy-
lite No. 8751", which comprises a dual liquid material
wherein the liquids are mixed prior to use and wherein
the adhesive bonding material is adapted to be air-cured at room temperature for a period of approxi-
ately 24 hours (room temperature being a minimum of
approximately 77° F. for best results).
For even greater strength, the adhesive bonding material 34 can be cured at an elevated temperature of between 200° and 250°F. for a period of approximately 4 hours.

The particulate abrasive material may, in one preferred form, comprise particles of tungsten carbide, carbaborundum, or other equivalent, extremely hard material suitable for honing usage.

In the exemplary arrangement, one preferred form of the intervening junction-facilitating bonding means comprising the junction adhesive material 35 may comprise a two-component resorcinol-formaldehyde resin adhesive including a first component capable of being applied in liquid form at room temperature to the exterior of the Nylon bristle tip ends, and also including a second hardener component comprising an additive to be applied thereto for curing and hardening same in place, and this exemplary form and method are best illustrated in FIGS. 5A and 5B. In FIG. 5A, it will be noted that a first component of such a resorcinol-formaldehyde resin adhesive comprising a partially condensed resorcinol-formaldehyde resin in an alcohol-water solution has been applied to the bristle tip end 22T, as is in FIG. 5A only, and is indicated by the reference numeral 37', after which a second component of the resorcinol-formaldehyde resin adhesive, comprising a hardener in the form of a powder of paraformaldehyde and a cellulosic filler, is added to the first component 37' already carried by the bristle tip end 22T of FIG. 5A. This second step is clearly shown in FIG. 5B, where the hardener is somewhat distorted and is somewhat diagrammatically shown, and is indicated by the reference numeral 37", while the original liquid component applied in the step shown in FIG. 5A is still indicated by the reference numeral 37'. It will be noted that after the application of the second component 37", as shown in FIG. 5B, hardening and curing of the composite resorcinol-formaldehyde resin adhesive material occurs and forms the previously mentioned junction adhesive material designed by the reference numeral 35, which strongly adheres to the Nylon material of the Nylon bristle tip end 22T and also strongly adheres to the subsequently applied and subsequently cured epoxy resin bonding material 34 of the outer coating means 32 forming and comprising the abrasive globule 30b, and that the junction affinity of the junction adhesive material 35 for both the Nylon material of the bristle tip end 22T and the epoxy resin bonding material 34 of the abrasive globule 30 is so great as to completely prevent breaking away or flaking away of all, or any substantial portion, of the abrasive globule 30 from its bridged junction and attachment to the Nylon bristle tip end 22T despite the hardest kind of honing usage of the entire flexible hone such as is illustrated in FIG. 11, for example. The bonding material 34 is wear-attritionable by reason of being softer than the material of the workpiece so that the abrasive particles 36 will project sufficiently to be very effective for honing usage throughout the entire working life of the flexible hone 20 and yet the previously mentioned mounting, by means of the intervening junction-facilitating adhesive material 35, of each abrasive globule 30 is such as to retain, completely unaltered, the flexible character and nature of the Nylon bristle shafts 22S while positively preventing chips or flakes of the abrasive globule 30 from becoming detached during usage of the flexible self-centering, self-sizing hone.

It should be noted that experimentation has shown that, in general, the bending flexibility and compliance of each completely uncoated Nylon bristle shaft 225 is at least twice as great as that which would be provided if the multi-phase material applied to the Nylon bristle tip end 22T in the process of mounting each abrasive globule 30 thereon, extended along the length of the shaft portion. Usually the ratio of the unaltered, uncoated bending flexibility and compliance to that of the coated shaft forms thereof is substantially greater than that just described.

FIG. 7 illustrates a modification wherein the intervening junction-facilitating bonding surface means is essentially the same as in the first form of the invention and is indicated at 35a. However, the coating making up the enlarged abrasive globule 30a comprises multiple layers or laminations, each indicated at 32a, and each of which includes a bonding material 34a and a particulate abrasive material 36a bonded to one or more interfaces, such as indicated at 38. This arrangement produces a laminated, greatly enlarged abrasive globule 30a usually made of the same bonding materials and particulate abrasive materials as the first form of the invention and with each layer interface making possible the production of a larger composite abrasive globule than might otherwise be the case.

FIG. 8 illustrates a slight variation wherein the coating 32b of the abrasive globule 30b is prepared in a manner somewhat differently from that previously described in connection with the coating forming the enlarged abrasive globule 30 of FIG. 6 in that the liquid epoxy resin bonding material 34b and the tungsten carbide abrasive particles 36b are initially combined together in an intermixed form prior to the application thereof to the composite junction adhesive material layer, comprising the intervening junction-facilitating bonding surface means 35b, which is of the same type as that shown in FIG. 6 of the first form of the invention. The intermixed relationship of the outer coating means 32b of the abrasive globule 30b may be provided by mixing the liquid epoxy resin bonding material 34b and the abrasive particles 36b in any suitable container instantly prior to application to the bristle tip end 22Tb, carrying the intervening junction adhesive means 35b thereon in a manner similar to the corresponding showing of the junction adhesive means 35 in FIG. 5.

FIG. 9 illustrates a slight variation of the first form of the invention, with similar parts being designated by similar reference numerals, followed by the letter "c", however. The major difference of the FIG. 9 form is the fact that a major part of the enlarged abrasive globule 30c is provided by a preliminary enlargement of the bristle tip end 22T of FIG. 4 to an enlarged Nylon bristle tip end, such as is shown at 22Ec in FIG. 9. Thus a greater exterior surface area is provided for the effective bonding surface means, comprising the junction adhesive material 35c, and a smaller quantity of the outer coating means 32c is required to produce an over-all composite, enlarged abrasive globule 30c of a size comparable to that of the first form of the invention, as best shown in FIG. 6.

FIG. 10 and FIG. 11 merely illustrate the effective self-centering and self-sizing features of the novel flexible hone 20 of the present invention wherein the workpiece, indicated generally at 40, is shown in somewhat fragmentary diagrammatic form in cross-section as
comprising a bore hole or recess having a substantially curved and usually cylindrical inner workpiece surface 42 which is to be honed. It will be noted that the exterior diameter of the flexible hone 20 is greater than the interior cylindrical diameter of the workpiece 42 and that when the flexible hone 20 is forcibly inserted into the smaller-diameter, substantially cylindrical interior workpiece surface 42 in the manner shown in FIG. 11, this is accomplished by reason of the great flexibility of the Nylon bristle shaft portions 22S, which remain completely uncoated and unaltered from their original form and thus retain their full flexibility. Since the Nylon bristles are radially and substantially equally oppositely arranged relative to the base 24, this means that the bending or flexing of each Nylon bristle shaft 22S functions to produce a symmetrically arranged array of equal and oppositely inwardly directed, small biasing forces on the centrally-positioned bristle mounting base 24, which effectively provides a complete self-centering and also self-sizing action to the entire flexible hone 20 which allows it to apply substantially equal honing force to all interior workpiece surfaces 42 to be honed as a result of power-rotation of the flexible hone 20 in a manner which cannot be achieved when using a rigid honing material in the conventional prior art manner.

It should be understood that the figures and the specific description thereof set forth in this application are for the purpose of illustrating the present invention and are not to be construed as limiting the present invention to the precise and detailed specific structure, shown in the figures and specifically described hereinbefore. Rather, the real invention is intended to include substantially equivalent constructions embodying the basic teachings and inventive concept of the present invention.

What is claimed is:

1. A multiple-compliant-bristle self-centering rotary abrasive brush means having enlarged, abrasively coated, outer bristle tip ends of multi-phase material, comprising: a plurality of outwardly directed, flexible, plastic inwardly effectively compressible, elastically bendable bristles mounted in a substantially radially and cylindrically arranged array thereof and provided with an outer coating surface, wherein each of said bristles being formed of flexible, resiliently elastically bendable, compliant non-metallic plastic material having corresponding exteriorly completely uncoated, flexible, compliant shaft portions made of said plastic material and having a free outer end of said plastic material positioned with respect to the corresponding outer ends of the other bristles in a substantially cylindrically oriented array thereof and there being provided with and being coated with outer coating means effectively defining an enlarged abrasive globule carried thereby and effectively forming an outer terminus of composite multi-phase material comprising the bristle tip end and said enlarged abrasive globule, said enlarged abrasive globule comprising a particulate abrasive material and a wear-attritionable, hardenable and curable plastic resin bonding material for effectively bonding the particulate abrasive material into a globule-like assembled formation of a non-flaking, wear-attritionable nature, the outer tip end of each of said bristles carrying a corresponding one of said enlarged abrasive globules being effectively provided on its plastic outer surface and inwardly of said wear-attritionable plastic resin bonding material in an effectively intervening position therebetween with a junction-facilitating, effective bonding surface means having a great junction affinity for the exterior surface of said outer tip end of each such bristle and having a great junction affinity for the inner surface of said wear-attritionable bonding material and thereby functioning as an effective intervening joining bridge means between the surface of the outer tip end of each such bristle and the inner surface of the corresponding wear-attritionable bonding material and of greater junction strength than either of the plastic materials effectively joined together in a bridging manner by said junction-facilitating, effective bonding surface means whereby to positively prevent flaking away of pieces of substantial size of the abrasive globule during hard honing, abrading usage thereof against a workpiece surface, comprising an inner surface of substantially cylindrical configuration, which is harder than said wear-attritionable bonding material and softer than said particular abrasive material, said effective bonding surface means comprising a junction-adhesive material having strongly adhesive junction characteristics insofar as the outer bristle tip end formed of said flexible resilient plastic material are concerned and having strongly adhesive junction characteristics insofar as said wear-attritionable plastic resin bonding material is concerned; each of said enlarged abrasive globules being carried by the radially, substantially cylindrically arranged array of bristles so as to position the plurality of abrasive globules in an annularly cylindrically arranged array thereof with each inner portion of each bristle inwardly of the outer abrasive globule means comprising a major portion of the length of said bristle being substantially entirely free of said outer coating means comprising said abrasive material and said bonding material and also being substantially entirely free of said junction-facilitating, effective bonding surface means whereby to have substantially unaltered, free flexibility and compliance characteristics forming an inwardly deflectable and, thus, effectively self-sizing and self-centering, multiple-compliant-bristle rotary abrasive flexible hone for effectively honing a substantially cylindrical workpiece surface.

2. A flexible self-centering hone as defined in claim 1, wherein said junction adhesive material comprises a resorcinol-formaldehyde resin adhesive wherein at least one component thereof is of an initially liquid form adapted to be cured and hardened-in-place in the presence of another component thereof to provide a solid junction adhesive material very strongly and effectively adhering to the plastic material of each bristle tip end and also strongly adhering to said wear-attritionable plastic resin bonding material of each enlarged abrasive globule.

3. A flexible self-centering hone as defined in claim 1, wherein each of said bristles is formed of extremely flexible, compliant, bendable, Nylon plastic material, and wherein said junction adhesive material comprises a two-component resorcinol-formaldehyde resin adhesive wherein at least one component thereof is of an initially liquid form adapted to be cured and hardened-in-place in the presence of the other component thereof to provide a solid junction adhesive material very strongly and effectively adhering to the Nylon plastic material of each bristle tip end and also strongly adhering to said wear-attritionable plastic resin bonding material of each enlarged abrasive globule.
4. A flexible self-centering hone as defined in claim 1, wherein said wear-attritional plastic resin bonding material of each enlarged abrasive globule.

5. A flexible self-centering hone as defined in claim 1, wherein each coated bristle tip end is effectively enlarged by the junction, mounting and fastening thereof of said outer coating means acting to effectively enlarge said bristle tip end so as to provide the enlarged composite abrasive globule configuration.

7. A flexible self-centering hone as defined in claim 4, wherein said particulate abrasive material and said plastic resin bonding material are intermixed prior to coating same on the intervening junction-facilitating effective bonding surface means which has been previously applied to and strongly joined to the corresponding tip end of said corresponding bristle.

8. A flexible self-centering hone as defined in claim 4, wherein said coated means comprises an outer layer of particulate abrasive material and an inner layer of epoxy resin bonding material.

9. A flexible self-centering hone as defined in claim 3, wherein the first one of said two components of said resorcinol-formaldehyde resin adhesive comprises a partially condensed resorcinol-formaldehyde resin in an alcohol-water solution, the second component of said resorcinol-formaldehyde resin adhesive comprising a hardener in the form of a powder of paraformaldehyde and a cellulosic filler.

10. A flexible self-centering hone as defined in claim 4, wherein said outer coating means is of effectively laminated construction comprising at least two coating layers, with each such coating layer comprising a thin sheet of said adhesive bonding material provided with and effectively carrying a plurality of particles of said particulate abrasive material.

11. A flexible self-centering hone as defined in claim 10, wherein the innermost coating layer is adhesively bonded to the outer surface of said junction-facilitating, effective bonding surfaces means joined to the outer surface of the corresponding Nylon plastic bristle tip end, and with each succeeding outwardly adjacent coating layer having the innermost surface of the adhesive bonding material thereof adhesively joined to the exterior of the next inwardly adjacent coating layer whereby to form said laminated complete outer coating means.

12. A flexible self-centering hone as defined in claim 11, wherein said adhesive bonding means of each of said coating layers comprises epoxy resin cured in place with said particulate abrasive material being carried and mounted in cured-in-place relationship by said epoxy resin of said coating layer.

13. A flexible self-centering hone as defined in claim 1, wherein each of said bristles, made of said extremely flexible, compliant, bendable plastic material, has a modulus of elasticity of a sufficiently low value as to cause the intermediate uncoated shaft portion of said bristle from an inner end thereof carried by said bristle-mounting brush base to the free outer bristle tip end thereof carrying the enlarged abrasive globule and effectively comprising said multi-phase material, to have a bending flexibility and compliance at least twice as great as that which would be provided by said multi-phase material if said coating means extended along substantially the complete length of said shaft portion.

14. A flexible self-centering hone as defined in claim 4, wherein each of said bristles, made of said extremely flexible, compliant, bendable Nylon plastic material, has a modulus of elasticity of a sufficiently low value as to cause the intermediate uncoated shaft portion of said bristle from an inner end thereof carried by said bristle-mounting brush base to the free outer bristle tip end thereof carrying the enlarged abrasive globule and effectively comprising said multi-phase material, to have a bending flexibility and compliance at least twice as great as that which would be provided by said multi-phase material if said coating means extended along substantially the complete length of said shaft portion.

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