April 11, 1961 K. M. GLESZER 2,978,850

TUMBLE FINISHING PROCESS

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FIG. 5

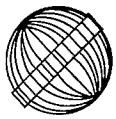


FIG. 10

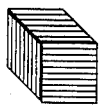


FIG. 15

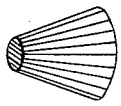


FIG. 4



FIG. 9

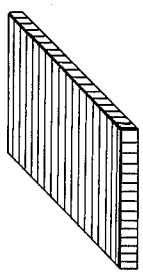


FIG. 14

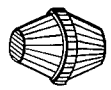


FIG. 19

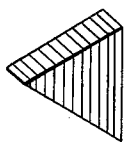


FIG. 3

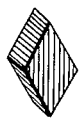


FIG. 8

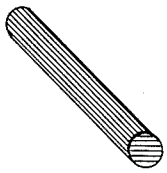


FIG. 13

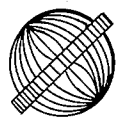


FIG. 18

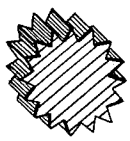


FIG. 2



FIG. 7



FIG. 12



FIG. 17

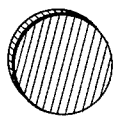


FIG. 1

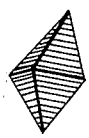


FIG. 6

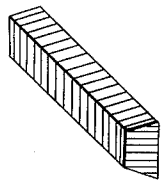


FIG. 11

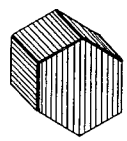


FIG. 16

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TUMBLE FINISHING PROCESS

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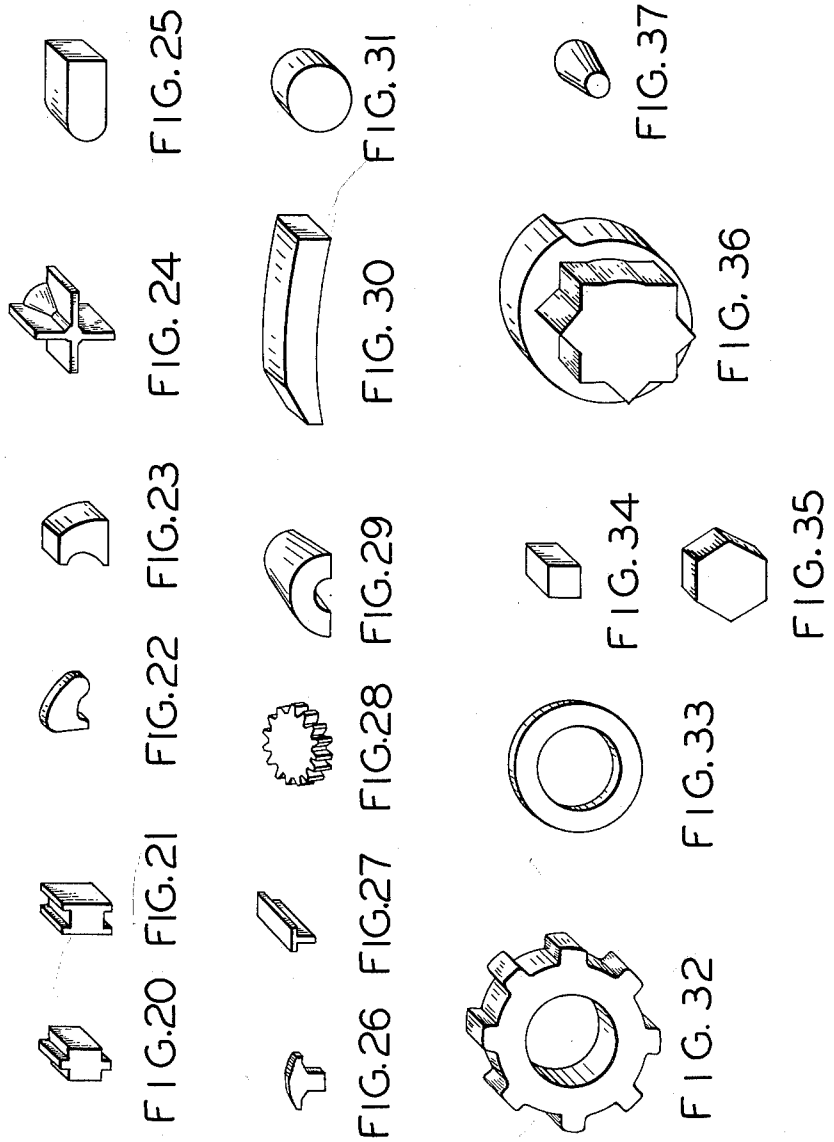


FIG. 20 FIG. 21 FIG. 22 FIG. 23 FIG. 24 FIG. 25 FIG. 26 FIG. 27 FIG. 28 FIG. 29 FIG. 30 FIG. 31 FIG. 32 FIG. 33 FIG. 34 FIG. 35 FIG. 36 FIG. 37

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2,978,850

TUMBLE FINISHING PROCESS

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Filed May 1, 1958, Ser. No. 732,375

1 Claim. (Cl. 51—282)

This invention relates to improvements in the tumbling art and more particularly to the provision and use of new and improved tumbling media.

Tumbling is an old art which has in recent years grown in importance as a manufacturing process. Basically, tumbling is no more than its name suggests. Manufactured parts or metal articles of manufacture, which require finishing, are put into a tumbling barrel together with a tumbling media and the barrel is rotated, usually about a horizontal axis. The tumbling motion imparted to the manufactured parts, or the work, as it is more commonly referred to, and to the media, causes the work and the media to impact one another repeatedly thereby effecting a burnishing, polishing, or abrading action, as the case may be. Depending upon the operation to be performed on the work and the media employed, the former may be deburred, polished, honed, reduced in size, or its surfaces may be modified in some other desired way.

At present a wide range of materials are used as tumbling media. Examples of such materials are: ground corn cobs, walnut shells, oyster shells, steel shot, brass shot, ball bearings, needle bearings, cold headed shapes, mineral aggregate, sand, lime, special metal shapes, aluminum oxide and the like. As the list indicates, tumbling has been carried out utilizing various available media according to the experience and skill of the operator.

Recently, in order to introduce a degree of certainty to the tumbling art, it has been proposed to make available special abrasive compounds such as silicon carbide, aluminum oxide, or the like, which have been pressed to pyramidal or cylindrical form, or other predetermined shape. But these materials are relatively expensive and although they may do certain jobs well, they wear out rapidly and are broken up by constant pounding in the tumbling barrel.

I have discovered that small metal or metal ceramic pellets of various sizes and configurations, having serrated or file-like surfaces, provide a tumbling media superior to those of the prior art. The serrated or file-like surfaces provide an infinite number of contact surfaces to engage and process the work thereby reducing the time consumed to effect the desired finishing operation. Also, my improved media, in addition to providing an infinite number of contact surfaces, maintains a relatively high impact mass. The surface serrations of the pellets may take the form of knife edges, knurls, helical grooves, or the like.

With the foregoing in mind, an object of my invention resides in the provision of new and improved tumbling media provided with serrated surfaces which are inexpensive to produce and are durable in use.

A feature of the invention which contributes to the accomplishment of the above objects consists in forming the media of powdered metal in dies or molds having serrated members which impart the desired surface to the media being formed. Thereafter, to bind the metal powder into the molded form, the invention contemplates sintering the media.

Another object of my invention is to provide an improved tumbling media which may be charged or loaded

with a finishing substance and will not chip, crumble, or pulverize and will remain of uniform density and surface composition throughout its life.

A feature of the invention which lends itself to the attainment of the foregoing object consists in forming the pellets or media of metal powder in such a manner that the media retains a predetermined porosity and in charging or loading the pores of the media with a preselected finishing substance such as powdered abrasive material, jewelers' rouge, pumice, or the like.

An additional object of the invention resides in a novel method of coating work pieces during a tumbling operation with a film of dry lubricant, rust inhibitor, or some other form of coating. Frequently, if not generally, the work being tumbled is difficult to dry coat. I have discovered that by loading the pores of my powdered metal media, with the coating material, such as molybdenum disulfide, graphite, a rust inhibitor, or the like, the coating will be transferred, during the tumbling operation, from my improved media to the work in such a way that the crevices, corners, irregularities, and indentations in the latter will be both polished and coated, thereby dispensing with coating as a separate, expensive operation.

Another object of my invention resides in an improved process of tumbling whereby the work is burnished, honed, polished, deburred, abraded or coated, as desired, by means of porous powdered metal media charged with a finishing, abrading or coating substance.

Still another object of my invention resides in an improved process of manufacturing tumbling media which consists in admixing, molding, or pressing, sintering and charging the pores of the media to effect the results described above. Media made according to my process may additionally, without increased cost or inconvenience, be provided with the aforementioned serrated surfaces.

Other objects and features of my invention will become apparent from a reading of the following specification in the light of the accompanying drawings in which:

Figures 1 through 19 show various forms of special shapes adapted to be employed as tumbling media in accordance with my invention; and

Figures 20 through 37 show typical parts or products manufactured and sold commercially, the molds for which may be employed in the practice of my invention.

As already indicated, my invention relates to (*a*) new and improved tumbling media, and (*b*) new and improved methods of (1) making tumbling media, (2) tumbling work pieces and (3) coating work pieces. As shown in Sheet 1 of the drawings, Figures 1 through 19 illustrate typical configurations that may be employed by my tumbling media. For use, the selection of shapes will be suggested by the nature of the work pieces and the type of operation the media will be called upon to perform. As an indication of the size of the shapes, the coin shaped disc of Figure 1 may approximate the size of a dime. It will be appreciated, however, that the size of the pieces may vary widely as desired. In the tumbling operation it may be preferable to employ a media consisting of a mass of articles all of the same shape and size. On the other hand, better results may be obtained by employing articles of different shapes and sizes according to the configuration of the work pieces. In the tumbling operation the media may be employed with a soap solution, or other suitable chemical compound, or the operation may be performed dry, in the absence of liquids.

The tumbling process may be performed for the purpose of deburring machined parts, putting a radius on sharp edges of machined parts, removing flash from die castings and other types of castings, metal or plastic, or

smoothing, polishing, or otherwise modifying the surface finish of parts ranging from crude items to jewelry items. Additionally, as previously mentioned, when properly processed and treated, my improved tumbling media may be used to apply thin coatings of chemical compounds such as molybdenum disulfide or graphite to the surfaces of the work pieces.

Preferably the media of my invention is made by compacting metal powder in dies, subsequently sintering the compact, and in some cases, adding an additional heat treatment in order to achieve the degree of hardness and wear resistance desired. The powdered substances employed, for example, may be steel, copper, brass, bronze, zinc, lead, cobalt, titanium, tungsten, iron, gold, silver, platinum, aluminum, tin, nickel, chromium, manganese, etc., or an alloy, of such metals and combinations of such metals with or without ceramic materials. The powdered metal technique of the invention is conventional practice well known to those skilled in the art and fully described in such texts as "Powdered Metallurgy" by John Woulf, published by the American Society of Metals. I also contemplate making the articles by so-called hot pressing powder metallurgy techniques.

Briefly, the technique consists in mixing metal powders to a desired analysis, charging them into a die and compressing them into a mass of desired configuration. Subsequently, the mass is sintered to bring out inter-atomic diffusion of the compacted metal powders. By this process it is possible to make metals or alloys of any desired degree of porosity, simply and economically, by controlling the pressure applied to the powders in the die, the sintering time and the sintering temperature.

In accordance with my invention, the porous media thus obtained may be further treated along one of several lines of procedures. If an extremely hard media is required, the material may be hardened by heat treating, carburizing, nitriding, carbonitriding, aluminizing, or the like. In so doing, the hardening agent will penetrate the pores, voids, and interstices of the media, thus gaining access to and intimate contact with all of the sintered particles causing the media to be uniformly processed throughout instead of merely on its outer surface. This assures that as the media is worn away in the tumbling operation the surface will retain the same degree of hardness and afford a uniform action on the work at all times.

As previously mentioned, the pores, voids and interstices may be usefully employed in my process in a different manner. They may be loaded or charged with chemical compounds which are selected according to (*a*) the shape and composition of the work pieces being tumbled and (*b*) the nature of the operation that is to be performed on such work pieces. If the work is to be smoothed or polished the media is loaded or charged with polishing material such as wax, jewelers' rouge and the like. If the work is to be deburred or honed or abraded to reduce its dimensions, abrasive compounds such as tungsten carbide powder, diamond dust or the like may be used to load the pores.

If the problem is to coat the surfaces of the work with a thin film of material such as a dry lubricant or a rust resistant compound, the pores will be charged with molybdenum disulfide, graphite, a rust inhibitor, or the like. Generally, the pores will be charged or loaded by tumbling the sintered media in a barrel containing the chemical compound, although in some instances it will be practical to mix the compound with the metal powder prior to compacting the mass.

In order to enhance the operation of my media in deburring, honing and cutting, I propose to form serrations or file-like teeth on the outer surfaces thereof. In the interests of economy these surfaces, which are diagrammatically illustrated, by means of straight lines, in Figures 1–19, are preferably formed by means of serrations or indentations formed on the members of the molds in which the metal powder is compressed. I have also discovered that unique and desirable results may be obtained by means of my serrated surfaces combined with various chemical compounds charging the pores of my media. Thus the work parts can be smoothed or honed at the same time they are being polished or coated. In this way my improved media is capable of performing a plurality of separate and distinct operations simultaneously.

According to another embodiment of my invention, the individual particles of the metal powder are coated with a binder comprising plastics, resin-type polymers, lacquers or the like. The coated, powdered metal is then pressed into shapes and baked to cure the binder. The metal powder may comprise an admixture of, for example, powdered iron and powdered tungsen carbide, held together by the plastic, resin or ceramic. As the latter wears away in use, new sharp unpolished powdered metal particles appear which in turn will break away from the surface of the media, thus repeating the sequence and providing at all times a sharp unpolished surface on the media. Particles of such materials as tungsten carbide, powdered caramics, and the like, will be used to provide a powdered metal tumbling media having a built-in abrasive. Here again the surfaces of the pieces comprising the media may be formed with serrations or file-like teeth to enhance the abrasive action.

Figures 20 through 37 of the drawings illustrate a number of work pieces of complex shape which have been selected at random from products made and sold by an outstanding manufacturer of powdered metal components. It will be appreciated, that commercial concerns in the powered metal field will have at their disposal dies or molds for use in manufacturing such items as those illustrated. It has been discovered that in many tumbling operations these same commercial molds may be used to produce tumbling media having configurations corresponding to Figures 30 through 37. Thus, the work pieces and the tumbling media can be made in the same molds, in which case only their chemical compositions will differ. Thus, my invention contemplates the use of special molds to produce special shapes such as those illustrated in Figures 1 through 19, as well as commercial molds to produce commercial shapes such as those shown in Figures 20 through 37. When the latter shapes are employed as tumbling media, the selection of one shape in preference to another, or the selection of several different shapes to be used simultaneously will be somewhat a matter of trial and error, depending also on the skill of the operator.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent of the United States is:

An improved process for finishing the surfaces of work pieces which comprises, tumbling the work pieces in a medium of pellets, said pellets made of sintered powdered metal and formed with regular file-like surface serrations thereon.

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