MACHINING CENTER WITH ABRASIVE BLASTING SYSTEM

A machining center with an abrasive blasting system is disclosed. The machining center includes a bed, a headstock mounted on the bed, and a carriage having a tool post. The machining center also includes an abrasive blasting system for imparting a predefined roughness to a surface of the work piece. The abrasive blasting system includes a reservoir, a pump, a tool and a nozzle. The tool is coupled to a tool post. The tool includes a conduit extending along a length of the tool for receiving the abrasive material therethrough. The nozzle is formed on a tip surface of the tool. The nozzle is configured to communicate to the conduit. The nozzle is adapted to discharge the abrasive material on the surface of the work piece during the machining of the work piece for imparting the predefined roughness on the surface.
FIG. 3
MACHINING CENTER WITH ABRASIVE BLASTING SYSTEM

TECHNICAL FIELD

[0001] The present disclosure relates to a machining center, and more specifically to the machining center with an abrasive blasting system.

BACKGROUND

[0002] Machining centers, such as lathes, are used for performing various operations, such as turning, cutting, knurling, drilling, and facing on metallic or non-metallic components. Some of the metallic or non-metallic components require a predefined roughness that enables the metallic or non-metallic components to be effective in their respective application. For example, the metallic parts, such as a seal housing usually requires a predefined roughness for providing firm engagement between the seal housing and a seal assembly. Therefore, the firm engagement between the seal housing and the seal assembly avoids a slippage of the seal assembly, reduce a fluid leakage, and decrease the ingress of debris. However, the current machining centers and tooling are unable to provide a predefined rougher surface on the metallic or non-metallic part.

[0003] U.S. Pat. No. 6,604,986 (the ’986 patent) describes a process for working a work piece. In the process, an abrasive liquid is sprayed onto the work piece, via a nozzle, at relatively low pressures which are sufficient to shape and/or polish the surface of the work piece. The work piece can be both shaped and polished in a single working step. Abrasive particles or polishing particles may be contained in the abrasive liquid. The pressure of the abrasive liquid lies below 50 bar, preferably below 20 bar. By arranging two nozzles in such a manner that the liquid jets intersect one another at a point, it is possible to set an accurate working depth.

SUMMARY OF THE DISCLOSURE

[0004] In one aspect of the present disclosure, a machining center is provided. The machining center includes a bed. The machining center also includes a headstock. The headstock is mounted on the bed. The headstock includes a spindle driven by a power source. The spindle is rotatable about an axis. The machining center includes a work piece holder fastened to the spindle. The work piece holder includes a plurality of jaws for holding a work piece. The machining center also includes a carriage mounted on the bed. The carriage is movable along a longitudinal axis defined by the bed. The carriage includes a tool post. The machining center also includes an abrasive blasting system for imparting a predefined roughness to a surface of the work piece. The abrasive blasting system includes a reservoir for storing an abrasive material. The abrasive blasting system also includes a pump which communicates with the reservoir. The pump is adapted to supply the abrasive material at predefined pressure to a surface of the work piece. The abrasive blasting system includes a tool. The tool is coupled to a tool post. The tool includes a conduit extending along a length of the tool. The conduit is adapted to receive the abrasive material therethrough. The abrasive blasting system also includes a nozzle formed on a tip surface of the tool. The nozzle is configured to communicate to the conduit. The nozzle is adapted to discharge the abrasive material on the surface of the work piece during the machining of the work piece for imparting the predefined roughness on the surface.

[0005] Other features and aspects of this disclosure will be apparent from the following description and the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0006] FIG. 1 is a pictorial view of a machining center with an abrasive blasting system, according to concepts of the present disclosure;
[0007] FIG. 2 is a pictorial view of the abrasive blasting system, according to concepts of the present disclosure; and
[0008] FIG. 3 is a block diagram depicting an operation of the abrasive blasting system, according to concepts of the present disclosure.

DETAILED DESCRIPTION

[0009] Reference will now be made in detail to specific embodiments or features, examples of which are illustrated in the accompanying drawings. Wherever possible, corresponding or similar reference numbers will be used throughout the drawings to refer to the same or corresponding parts.

[0010] FIG. 1 is a pictorial view of a machining center 10, according to an embodiment of the present disclosure. The machining center 10 is embodied as a lathe machine, and is adapted to perform a machining operation and an abrasive blasting operation on a work piece 12. The machining operation is a turning operation performed on the work piece 12. The machining center 10 includes a base 14, a bed 16 supported on the base 14, a headstock 18 mounted on the bed 16, a work piece holder 20 attached to the headstock 18 for holding the work piece 12, and a carriage 22 movably mounted on the bed 16. The bed 16 is a horizontal beam defining a longitudinal axis. The bed 16 supports various components of the machining center 10. The bed 16 includes a number of guide ways (not shown) to support the carriage 22, while the headstock 18 is rigidly mounted on the bed 16. The headstock 18 includes a spindle 26 rotatable about axis X'. The spindle 26 is a long bar extending parallel to the bed 16 of the machining center 10. The spindle 26 is driven by a power source 28. In one example, the power source 28 of the machining center 10 may be an electric motor mounted on the base 14. The spindle 26 is powered in order to impart motion to the work piece 12.

[0011] The work piece holder 20 is fastened to the spindle 26 of the machining center 10. The work piece holder 20 rotates together with the spindle 26. The work piece holder 20 includes four jaws 30. However, it may be contemplated that the work piece holder 20 may include any number of jaws 30 to hold the work piece 12 along the axis X'. Further, the jaws 30 are angularly disposed about the axis X'. The jaws 30 are adapted to selectively move radially inward or outward with respect to the axis X'-based on an input from a user.

[0012] The carriage 22 is movable back and forth along the longitudinal axis on the bed 16 of the machining center 10 by using a first hand wheel 32 or a carriage feed mechanism operated by the user. The carriage 22 includes a saddle 34 and an apron 36. The saddle 34 is movably mounted on the number of guide ways of the bed 16, thereby supporting the carriage 22 on the bed 16 of the machining center 10. The saddle 34 supports a cross-slide 38. The cross-slide 38 is independently movable along an axis Z', via a second hand
wheel 40 when operated by the user. In one example, the cross-slide 38 may be used for moving the tool post 44, thereby moving the tool 48 across a surface of the work piece 12. Further, the cross-slide 38 provides support for a compound rest 42. The compound rest 42 is pivotally mounted on the cross-slide 38 in such a manner that the compound rest 42 can be rotated about an axis Y’Y’. In one example, the compound rest 42 may include a circular base graduated in degrees for indicating an angle of rotation of the compound rest 42. The carriage 22 also includes a tool post 44. The tool post 44 is mounted on the compound rest 42. The tool post 44 holds a tool 48 for enabling the tool 48 to be adjusted to a convenient working position. The compound rest 42 may be used to rotate the tool post 44 about axis Y’Y’, thereby rotating the tool 48 about axis Y’Y’ to perform the abrasive blasting operation. The cross-slide 38 and the compound rest 42 can be adjusted to achieve requisite orientation of the tool 48 for performing the abrasive blasting operation.

[0013] The machining center 10 includes a tailstock 46. The tailstock 46 is slidable towards and away from the headstock 18, along a length of the bed 16. The tailstock 46 can be positioned at any location along the length of the bed 16. The tailstock 46 includes a non-rotating barrel 50. The barrel 50 is slidable along the axis X-X’, and is directly in line with the spindle 26. The machining center 10 can alternatively include other components and that are not limited to those described herein. Although the present disclosure is explained in reference to a lathe machine, it should be understood that the teachings of the present disclosure may be applied to other machines such as a grinding machine, a milling machine and other material removal machines known in the art.

[0014] In the present disclosure, an abrasive blasting system 24 is provided with the machining center 10 for imparting a predefined roughness on the work piece 12. FIG. 2 illustrates a pictorial view of the abrasive blasting system 24. The abrasive blasting system 24 includes a reservoir 52, a pump 56 connected to the reservoir 52, the tool 48 mounted on the tool post 44 of the machining center 10, and a nozzle 58 formed within the tool 48 for discharging an abrasive material on the work piece 12. The abrasive blasting system 24 is capable of imparting the predefined roughness on the work piece 12 during the machining operation of the work piece 12. More specifically, the abrasive blasting system 24 performs the abrasive blasting operation, during or subsequently after, the machining operation on the work piece 12. The abrasive blasting system 24 performs the abrasive blasting operation by impinging a stream of the abrasive material on the outer surface (not shown) of the work piece 12. In one example, the abrasive blasting system 24 can be used to perform the abrasive blasting operation on an inner surface (not shown) of the work piece 12.

[0015] The reservoir 52 is provided for storing the abrasive material. The reservoir 52 includes an outlet 54. The outlet 54 is connected to the tool 48 through a hose 60, for supplying the abrasive material. The dimension of the reservoir 52 may vary based on, but not limited to, size of the work piece and environmental constraints such as size of shop floor. The pump 56 is connected to the reservoir 52. The pump 56 is provided for supplying the abrasive material from the reservoir 52 to the tool 48 at a predefined pressure. The predefined pressure can be selected based on the amount of roughness required on the surface of the work piece 12.

[0016] The tool 48 includes a first end portion 62 and a second end portion 64 spaced apart from the first end portion 62. The first end portion 62 includes a tip surface 66. The tool 48 is positioned on the tool post 44 in such a manner, that the tip surface 66 faces the surface of the work piece 12 to be roughened. A distance between the first end portion 62 and the second end portion 64 of the tool defines a length L of the tool 48. The tool 48 defines a conduit 70, and the conduit 70 extends along the length L of the tool 48. The conduit 70 includes an inlet 72 and an outlet 74. The inlet 72 receives the abrasive material through the hose 60. The outlet 74 is connected to the nozzle 58 for discharging the abrasive material on the surface of the work piece 12.

[0017] The nozzle 58 is formed on the tip surface 66 of the tool 48. The nozzle 58 is made of, but not limited to, tungsten carbide or synthetic sapphire. The nozzle 58 includes a bore 76 and an orifice 78. The bore 76 includes a first end 80 and a second end 82. The first end 80 of the bore 76 faces the surface of the work piece 12 mounted on the work piece holder 20. The second end 82 is connected to the outlet 74 of the conduit 70. The bore 76 has a variable cross sectional area. The orifice 78 is formed on the first end 80 of the bore 76. The orifice 78 has a circular shape. The nozzle 58 is provided for discharging the abrasive material on the outer or the inner surface of the work piece 12.

[0018] In one example, the machining center 10 may include a primary tool (not shown) for performing machining operations other than the abrasive blasting operation on the work piece 12. The machining operation may include, but is not limited to a turning operation, a cutting operation and a facing operation. The primary tool may include, but is not limited to, a single point cutting tool, a multi point cutting tool or any other material removal tool known in the art. In one example, the primary tool may be made of, but is not limited to, high carbon steel or high speed steel.

[0019] In one example, the machining center 10 may include the tool post 44 with multiple tool pockets (not shown). The tool post 44 may then carry the primary tool and the tool 48 for performing the machining operation and the abrasive blasting operation, respectively. The primary tool and the tool 48 may be positioned on the tool post 44 in such a manner that the machining operation and the abrasive blast operation may be performed in a single working step.

[0020] In an example, the machining center 10 may be a milling machine or any other material removal machine known in the art. Based on application requirements, the machining center 10 may embody one of a horizontal lathe machine or a vertical lathe machine. Further, the machining center 10 may be a woodworking lathe machine, a metal spinning lathe machine, a glass-working lathe machine, a metal working lathe machine, and the like. The machining center 10 may embody a floor mounted lathe or a workbench or a table mounted lathe, based on system requirements. The machining center 10 may be manually controlled. Alternatively, the machining center 10 may be controlled using Numerical Controls (NC) or Computerized Numerical Controls (CNC), as per system requirements.

[0021] In one example, the bed 16 of the machining center 10 may be a vertical beam or an inclined beam for a CNC lathe machine. In one example, the bed 16 may be a rigid casting made of grey cast iron, iron-nodular cast iron or high strength, wear resistance cast iron.

[0022] In one example, the pump 56 may be electronically powered. In another example, the pump 56 may be mechanically powered.
[0023] In one example, the variable cross sectional area of the bore 76 may gradually decrease from the second end 82 to the first end 80 of the bore 76. In another example, the variable cross sectional area may gradually decreases from the second end 82 till a predefined length of the bore 76, and then gradually increases till the first end 80 of the bore 76. In yet another example, the bore 76 may be a straight bore, or a wide throat bore.

[0024] In one example, the tool 48 mounted on the tool post 44 may be adjusted in such a manner that the distance between the nozzle 58 of the tool 48 and the work piece 12 is increased to achieve higher amount of roughness on the surface of the work piece 12.

[0025] The selection of the nozzle 58 may be based on a number of operating factors. The operating factors may include, but not limited to, a type of the abrasive material, a size of the work piece, amount of the roughness required on the surface of the work piece. The orifice 78 of the nozzle 58 may have a rectangular shape.

[0026] The abrasive material may include, but is not limited to silica sand, garnet, aluminium oxide, silicon carbide, steel shot, steel grit, stainless steel, plastic abrasive and glass grit. The abrasive material is selected based on factors, such as an amount of roughness required on the surface of the work piece 12, a nature of the work piece 12, and a type of abrasive blasting operation to be carried out, such as a wet abrasive blasting operation and a dry abrasive blasting operation.

INDUSTRIAL APPLICABILITY

[0027] FIG. 3 illustrates a block diagram depicting an operation of the abrasive blasting system 24. The reservoir 52 supplies the abrasive material which flows from the outlet 54 (shown in FIG. 2), through the hose 60, to the pump 56. The pump 56 propels the abrasive material at predefined pressure through the hose 60 to the tool 48. The tool 48 receives the abrasive material in the conduit 70 (shown in FIG. 2). The conduit 70 supplies the abrasive material to the nozzle 58 (shown in FIG. 2) of the tool 48. The nozzle 58 discharges the abrasive material on the work piece 12. The abrasive blasting system 24 can perform both the wet abrasive blasting operation and the dry abrasive blasting operation. The abrasive blasting system 24 can be employed in any of the machining center 10, such as lathe machine or milling machine, for performing the abrasive blasting operation, during or subsequently with, the machining operation.

[0028] The abrasive blasting system 24 can be used for imparting a predefined roughness on an internal surface of a seal housing assembly. The predefined roughness on the internal surface of the seal housing provides sufficient engagement with a elastomeric seal, thereby avoiding seal assembly slippage, fluid leakage, and potential for ingress of debris.

[0029] With the present disclosure, the abrasive blasting system 24 incorporated with the machining center 10, allows the user to perform the abrasive blasting operation, during or subsequently with, the machining operation, on the work piece 12. The abrasive blasting system 24 eliminates the inconvenience related to performing a separate abrasive blasting operation on an abrasive blasting machine in continuation of the machining operation performed on the machining center 10.

[0030] Further, the abrasive blasting system 24 may have a simple design including the reservoir 52, the pump 56, the tool 48, and the nozzle 58. Moreover, shape and dimensions of various components of the abrasive blasting system 24 may be suitably chosen based on a shape and dimensions of the work piece, the type of the machining center 10, and the corresponding operation performed on the work piece 12. Specifically, the abrasive blasting system 24 may be conveniently retrofittable with an existing machining center 10. Therefore, the present disclosure offers the machining center 10 with the abrasive blasting system 24 that is simple, effective, easy to use, economical and time saving.

[0031] While aspects of the present disclosure have been particularly shown and described with reference to the embodiments above, it will be understood by the one skilled in the art that various additional embodiments may be contemplated by the modification of the disclosed remote operating station without departing from the spirit and scope of what is disclosed. Such embodiments should be understood to fall within the scope of the present disclosure as determined based upon the claims and any equivalents thereof.

What is claimed is:

1. A machining center comprising:
a bed;
a headstock mounted on the bed, the headstock comprises
a spindle being driven by a power source and rotatable
about an axis;
a work piece holder fastened to the spindle, the work piece
holder comprises a plurality of jaws for holding a work
piece;
a carriage mounted on the bed and moves along a longitudi-
dinal axis defined by the bed, the carriage comprises a
tool post; and
an abrasive blasting system adapted to impart a predefined
roughness to a surface of the work piece, the abrasive
blasting system comprising:
a reservoir for storing an abrasive material;
a pump in communication with the reservoir, the pump
adapted to supply the abrasive material at a predefined
pressure;
a tool defining a conduit therein, the conduit extends
along a length of the tool and is adapted to receive the
abrasive material therethrough, wherein the tool is
coupled to the tool post; and
a nozzle formed on a tip surface of the tool and to
communicate to the conduit, wherein the nozzle is
adapted to discharge the abrasive material on the sur-
fase of the work piece during the machining of the
work piece for imparting the predefined roughness on
the surface.

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