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(54) HAND MACHINE TOOL

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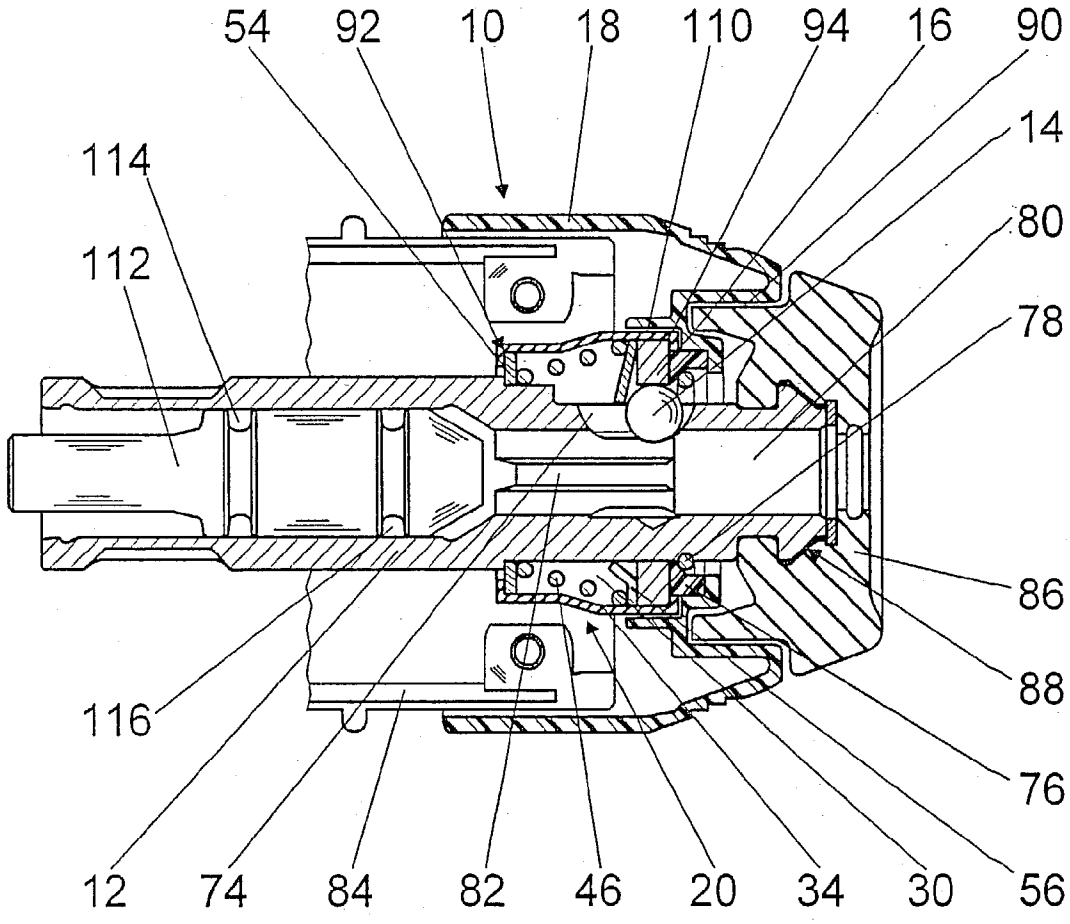
(57) ABSTRACT

A hand-operated machine tool is disclosed that rotationally drills or percussively chips or both. An embodiment of the hand-operated machine tool includes a toolholder that is used to hold tools having a grooved shank. The toolholder has a toolholder body and at least one radially moving locking member, for example a locking sphere, that is insertable into a groove in the tool and the locking member is radially locked in position by a retaining element that may be displaced by an actuating element to a position that radially releases the locking member. In an embodiment of the invention, the toolholder has at least one sealing device that seals at least one chamber outwardly surrounding the locking member. The sealing device includes at least one sleeve-shaped component that is separate from the actuating element and at least partially defines the volume referred to as the chamber.



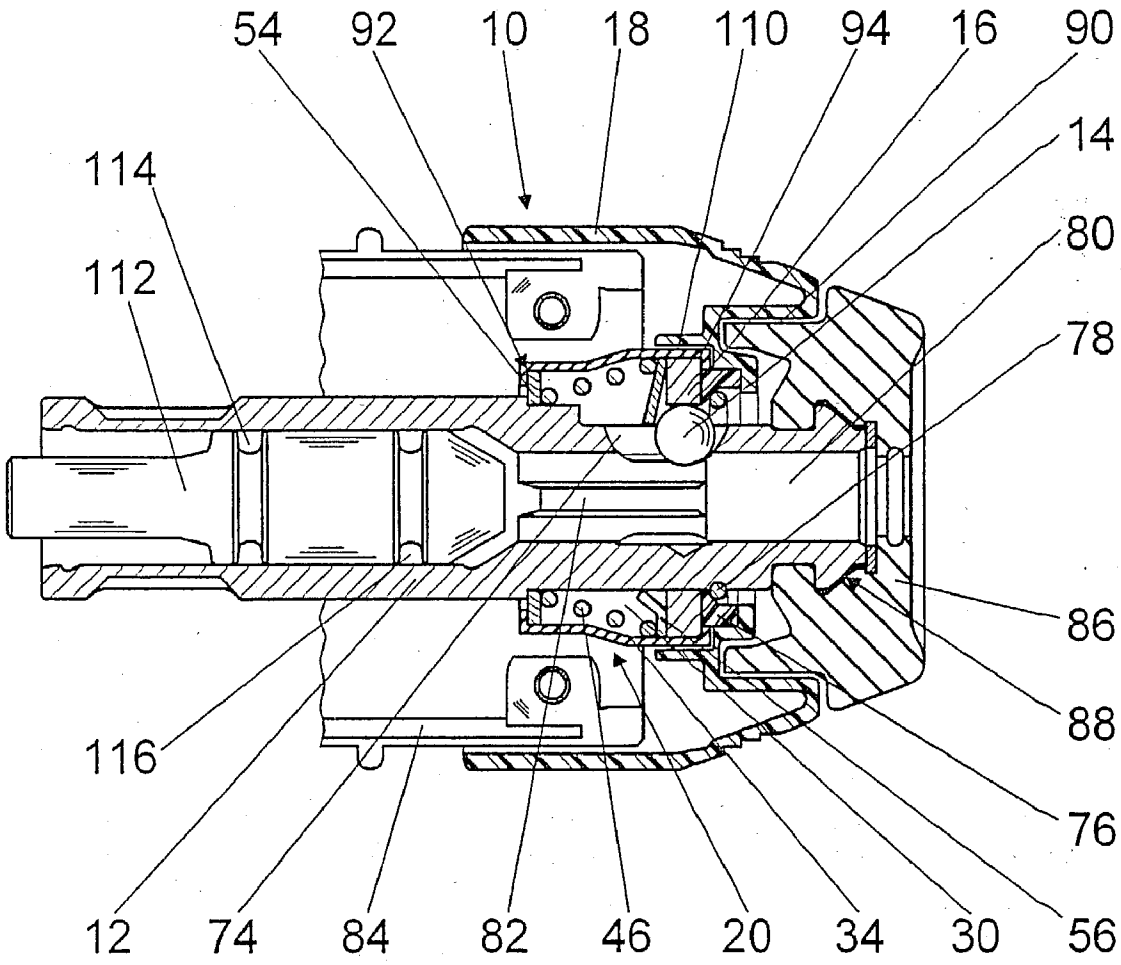

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Fig. 1

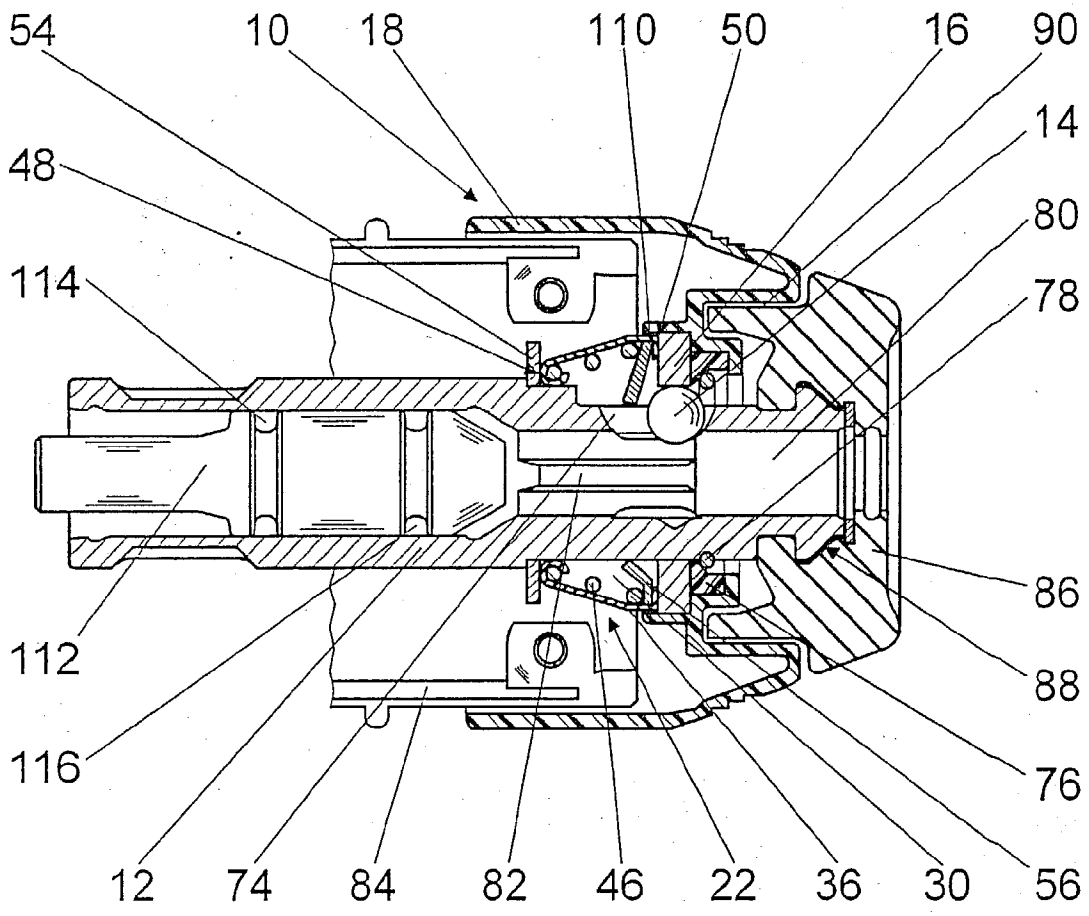
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Fig. 2

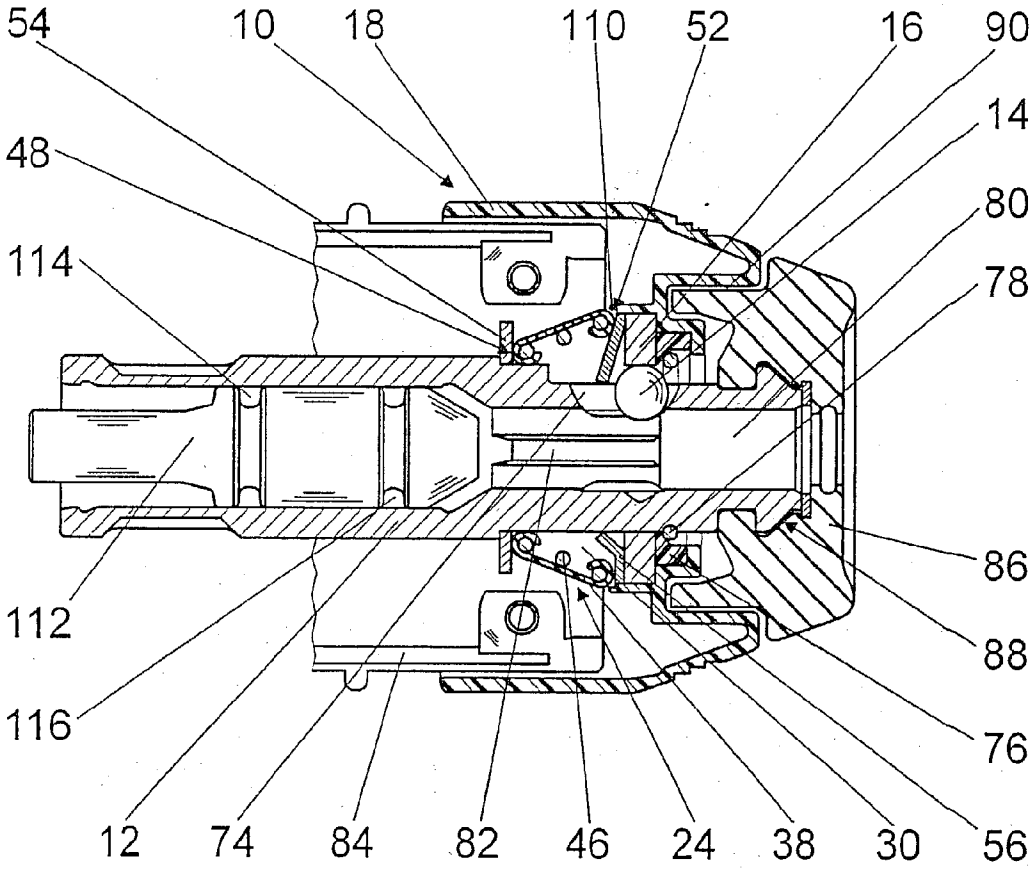
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Fig. 3

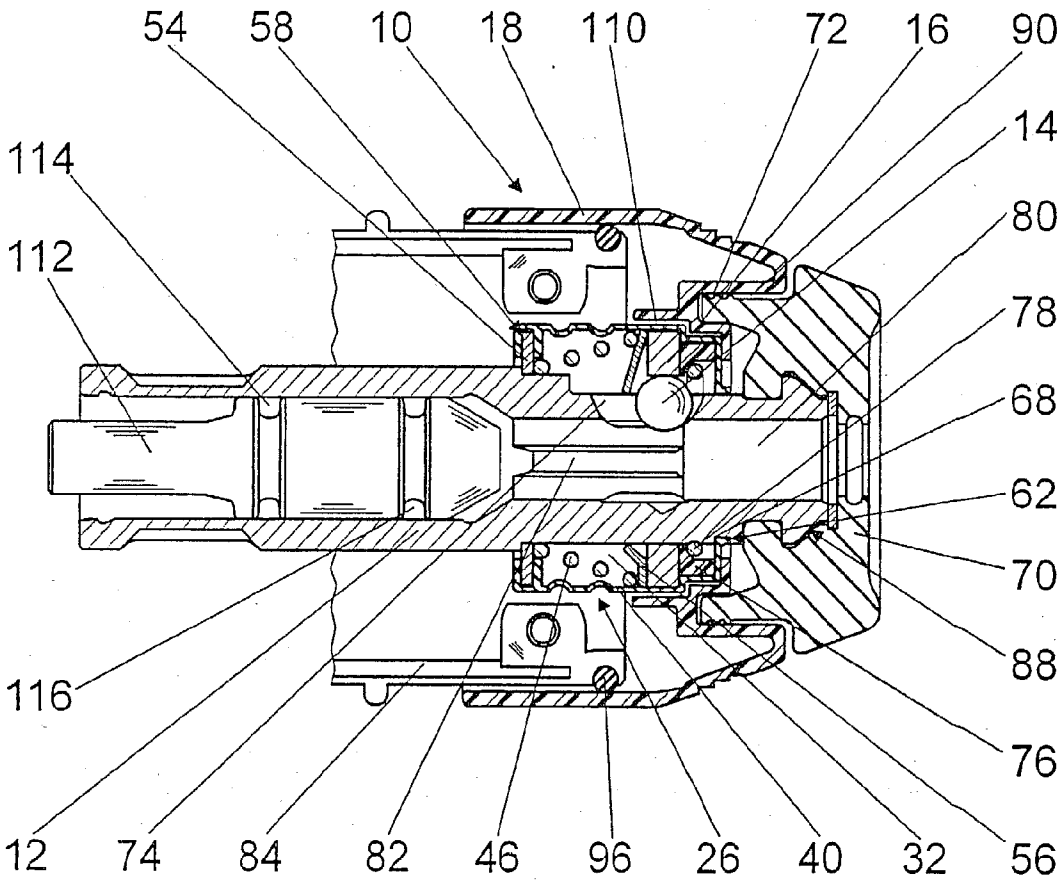
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Fig. 4

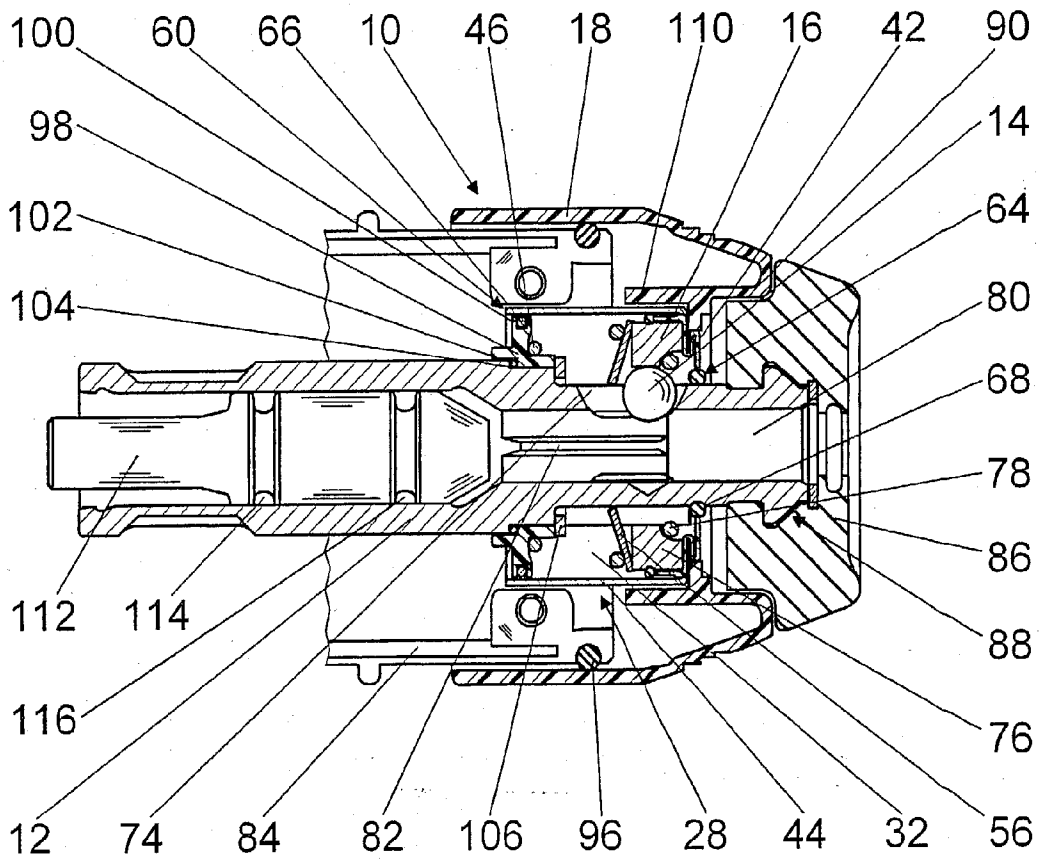
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Fig. 5

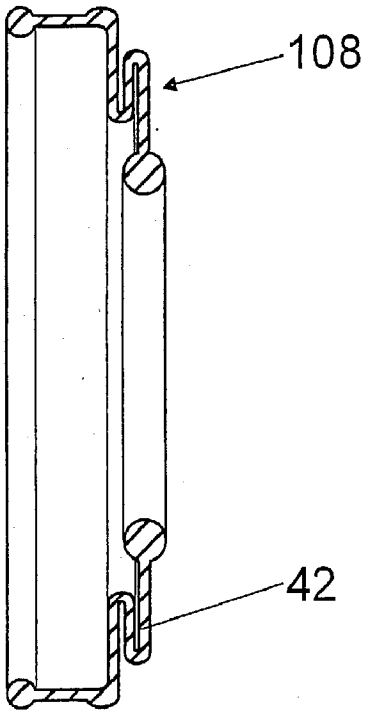

Fig. 6

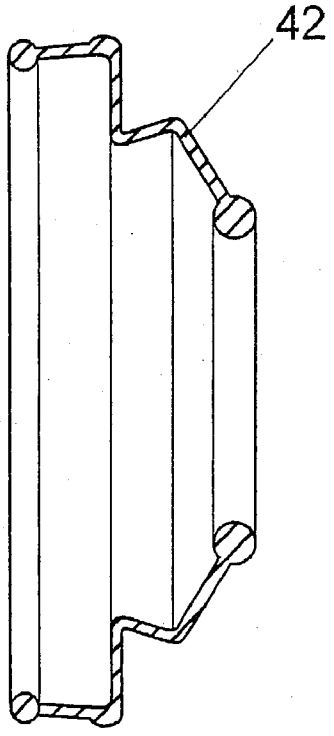

Fig. 7

HAND MACHINE TOOL

FIELD OF THE INVENTION

[0001] The present invention relates to a hand-operated machine tool for percussively chipping, rotationally drilling, or both.

BACKGROUND OF THE INVENTION

[0002] A drilling hammer having a rotationally and percussively driven toolholder is known from German Patent 197 24 532.3. The toolholder has a body that is designed in a single piece with a spindle sleeve. The toolholder body has a seating bore into which a shank of a tool can be inserted and locked in place by a locking device. The locking device has a locking sphere that is provided in an opening in the toolholder body and can be inserted into a groove in a tool that is closed at the shank end.

[0003] In a locked position, the locking sphere is covered radially to the outside by a retaining sleeve. The retaining sleeve is mounted on the toolholder body so that it can move in the axial direction. Using an actuating sleeve, the retaining sleeve can be moved axially in the tool insertion direction and against the force of a pre-tensioned helical spring into an unlocked position in which a clearance within the retaining sleeve allows the locking sphere to move radially out of the groove in the tool shank, thereby releasing the tool.

[0004] The spindle sleeve is provided in a machine housing. A sleeve-shaped extension of the actuating sleeve engages with an end of the machine housing on the tool side. To enable the actuating sleeve to move relative to the machine housing, an annular gap is provided between the extension and the machine housing. The actuating sleeve limits a chamber surrounding the locking sphere radially to the outside, with this chamber being limited to the inside by the toolholder body. The chamber is protected against dust on the tool side by a dust cap, which is mounted on the toolholder body and provides a seal radially inward toward the toolholder body and radially outward toward the actuating sleeve. On the machine side, the chamber is protected against the penetration of boring dust by a sealing device.

[0005] The sealing device has a seating ring that supports the helical spring on the machine side and, for this purpose, has a cylindrical guide extension for the helical spring. The seating ring is axially secured on the machine side on a shoulder of the spindle sleeve. Circumferential grooves are provided in the inner and outer circumferences of the seating ring, in each of which is provided a sealing ring. The outer sealing ring provided in the radially outer circumferential groove seals the chamber between the actuating sleeve and the seating ring, while the inner sealing ring provided in the radially inner circumferential groove seals the chamber between the seating ring and the toolholder body.

[0006] German Patent Application 198 05 187 discloses a hand-operated machine that includes a toolholder that is percussively and/or rotationally driven and is used to hold tools having a grooved shank. The toolholder includes a toolholder body having a radially moving locking member that is inserted into the grooved shank of a tool. The locking member is closed at the shank end and is held in its locked position by a retaining element. The retaining element is positioned by an actuating element in an unlocked position that radially releases the locking member. Also, the hand-operated machine tool has a lubricant storage unit that is formed by a sleeve-shaped component and surrounds the toolholder body downstream from the locking member in the direction of machining. The lubricant storage unit is connected by a valve body to a seating area of the toolholder body via a connecting line. A spherical obstruction forms the valve body, and is covered radially by a spring-loaded ring. The spherical obstruction is pressed radially inward toward the seating area against a valve seat, closing the valve body, preventing lubricant in the lubricant storage area from reaching the seating area of the toolholder body through the connecting line.

[0007] The valve body and valve seat of German Pact Application 198 05 187 form a throttle valve for the lubricant. In the locked position, the spherical obstruction projects partially into the seating area. When the tool is inserted, the spherical obstruction is pushed radially outward, and therefore, the valve opens and lubricant passes through the connecting line to the seating area of the toolholder. After the tool has been inserted, the spherical obstruction is located in the groove on the shank of the tool; therefore, the obstruction is reseated in the valve seat of the valve body by the spring-loaded ring, thus closing the valve and sealing off the lubricant storage unit.

SUMMARY OF THE INVENTION

[0008] The invention concerns a hand-operated machine that percussively chips, rotationally drills or both and that includes a toolholder that is driven percussively, rotationally or both. The toolholder is used to hold tools having a grooved shank. The toolholder comprises a toolholder body and at least one radially moving locking member. The radially moving locking member, for example a locking sphere, fits into the groove in the shank of the tool, locking the tool in the toolholder. The locking member is held in its locked position by a retaining element. The retaining element is positioned in its unlocked position by an actuating element that radially releases the locking member. The toolholder includes at least one sealing device. The sealing device at least partially defines a chamber or several chambers, which are at least partially enclosed volumes. At least one chamber is an enclosed volume surrounding the locking member. The sealing device prevents at least a significant amount of dust penetration, reducing wear on the tool and the toolholder body, providing for a longer service life.

BRIEF DESCRIPTION OF THE DRAWINGS

[0009] **FIG. 1** shows a schematic representation of one embodiment of a toolholder for a hand-operated machine according to the present invention.

[0010] **FIG. 2** illustrates another embodiment of the toolholder.

[0011] **FIG. 3** illustrates an alternative embodiment of the toolholder illustrated by **FIG. 2**.

[0012] **FIG. 4** shows yet another embodiment of the invention.

[0013] **FIG. 5** shows still yet another embodiment of the invention.

[0014] **FIG. 6** shows an enlarged view of the elastically deformable sealing sleeve of the embodiment of the invention as illustrated by **FIG. 5**.

[0015] **FIG. 7** illustrates the elastically deformable sealing sleeve of **FIG. 6** in its extended position, when the actuating sleeve of the embodiment shown in **FIG. 5** is deployed axially in the direction of the shank end of the tool, releasing the locking sphere of the toolholder.

DETAILED DESCRIPTION

[0016] According to one embodiment of the invention, the sealing device has at least one sleeve-shaped component that is separated from the actuating element and at least partially delimits, in the radial direction, the enclosed volume that is referred to herein as the chamber. The chamber, in this embodiment is formed independently of the actuating element, and the sealing device seals the chamber via a pair of sealing surfaces that rest against each other at least during operation. The pair of sealing surfaces contact each other even when the actuating element is stationary and the toolholder body is rotating, for example when the actuating element comes into contact with the wall during operation.

[0017] To minimize friction between the actuating element and the sleeve-shaped component when the actuating element is stationary and the sleeve-shaped component is moving, in one embodiment of the invention, there is a space, radially, between at least a portion of the inner surface of the sleeve-shaped component and the actuating element.

[0018] According to a further embodiment of the invention, the sealing device has at least one elastically deformable, sleeve-shaped component, for example a rubber sleeve, and pairs of sealing surfaces always remain in contact, even when the retaining element is in motion. The pairs of sealing surfaces, according to this embodiment, may be held in contact with large contact forces without hindering movement or generating friction.

[0019] In one specific embodiment, at least one portion of a pair of sealing surfaces is held together by a compression spring that also holds the retaining element in its retaining position, and the large contact forces that create the sealing action are achieved between the pair of sealing surfaces without requiring additional components. In another specific embodiment, the elastically deformable, sleeve-shaped component surrounds the compression spring and seals its ends against neighboring components, allowing the compression spring and the elastically deformable, sleeve-shaped component to be designed as a preassembled unit. In yet another embodiment, an elastically deformable, sleeve-shaped component is injection-molded around the compression spring. In alternative embodiments, a compression spring surrounded by the sleeve-shaped component provides a simple dust sealing arrangement and, alternatively, the sleeve-shaped component may be provided radially within the compression spring or radially outside the compression spring.

[0020] According to a further embodiment of the present invention, one sealing surface pair is provided axially upstream from the locking member and one sealing surface pair is provided axially downstream from the locking member, and, in the case of both sealing surface pairs, one sealing surface is formed by the toolholder body or by a component attached to the toolholder body. The sealing action of the sealing device may be improved, and, in particular, a chamber surrounding the locking member may be provided in which a lubricant is advantageously provided and which may be used not only for initial lubrication, but also for continuous force-feed lubrication. An existing recess for the locking member may be advantageously used to supply lubricant to the chamber and discharge lubricant from the chamber to a seating area of the toolholder, lubricating the seating area of the toolholder and reducing wear. This may eliminate the need for additional recesses and components for force-feed lubrication.

[0021] A good sealing action is achievable through simple design means by having the sleeve-shaped component engage with at least one groove in the toolholder body. An additional cost-effective sealing action is also achievable by providing a labyrinth seal between the actuating element and a neighboring component, for example a protective cap mounted on the toolholder body. A labyrinth seal makes it possible to prevent dust and dirt from penetrating the sleeve-shaped component and lubricant from exiting the chamber to the outside.

[0022] **FIG. 1** shows a cross section of a drilling hammer having a rotationally and percussively driven toolholder **10**, provided in a lower housing shell **84**, for holding tools that have a grooved shank. The toolholder **10** has a body **12** having a radially moving locking sphere **14** that is insertable into a groove in the tool that is closed at the shank end and the locking sphere is held in its locked position by a retaining sleeve **16**, movable within limits in the axial direction, and a holding sleeve **56**.

[0023] The retaining sleeve **16** is loaded via the holding sleeve **56** by a compression spring **46** in the direction of its retaining position (to the right in **FIG. 1**, for example). The compression spring **46** is supported on a seating ring **54** on the machine side (to the left in **FIG. 1**, for example). The retaining sleeve **16** is supported by a ring **76** and a snap ring **78** on the toolholder body **12** on the side facing away from the compression spring **46**. When the locking sphere **14** is in the locked position, the retaining sleeve **16** covers the locking sphere **14** radially, and the holding sleeve **56** secures the locking sphere **14** in the axial direction.

[0024] When the tool is inserted, the locking sphere **14** is pushed in the direction of the machine side by the shank of the tool into a recess **74**. The holding sleeve **56** is pushed over the locking sphere **14** against the compression spring **46**, which produces a clearance between the retaining sleeve **16** and the holding sleeve **56** into which the locking sphere **14** is radially moved outwardly. Therefore, the locking sphere is displaced and the tool may be inserted completely. Then, the compression spring **46** pushes the holding sleeve **56** into its original position, forcing the displacement of the locking sphere **14** into the groove in the shank of the tool. To drive rotation, the toolholder has rotary driving webs **82** provided in a seating bore **80** of the toolholder body **12**, and the rotary driving webs engage with the open grooves at the end of the shank of the tool.

[0025] To remove the tool, an actuating sleeve **18** is displaced in the machine direction, pushing the retaining sleeve **16** against the holding sleeve **56** and against the compression spring **46** that loads the holding sleeve **56**, such that the locking sphere **14** is moved radially outward,

allowing the tool to be removed. The compression spring then presses holding sleeve **56**, retaining sleeve **16**, locking sphere **14** and actuating sleeve **18** back into their original positions.

[**0026**] The toolholder **10** has a sealing device **20** that seals a chamber **30** outwardly surrounding the locking sphere **14**. According to one embodiment of the present invention, the sealing device **20** has an elastically deformable rubber sleeve **34** that is separate from the actuating sleeve **18** and radially defines the volume referred to herein as the chamber **30** and surrounds the seating ring **54**, compression spring **46**, holding sleeve **56** and retaining sleeve **16**. The rubber sleeve **34** seals the chamber **30** to the outside at the seating ring **54** and at the retaining sleeve **16**. At the tool end of toolholder body **12**, a dust cap **86** is fastened in a form-fitting manner by an interlocking connection **88** that seals the tool-side area of the locking sphere **14** against dust via a diaphragm gland **90** in the direction of the actuating sleeve **18**. A rivet set **112**, which seals the seating bore **80** on the machine side via seals (not illustrated in further detail) in grooves **114**, **116**, is also provided in toolholder **10**.

[**0027**] Regardless of whether the lock between the tool and toolholder **10** is released by moving the retaining sleeve **16** against the compression spring **46**, using the actuating sleeve **18**, or whether the tool shank is locked in position by the locking sphere, the rubber sleeve **34** is able to elastically deform without causing either of the pairs of sealing surfaces **92**, **94** to either separate or move closer together, for example, between the seating ring **54** and the rubber sleeve **34** and between the rubber sleeve **34** and the retaining sleeve **16**. To prevent either of the pairs of sealing surfaces from either separating or moving closer together, the rubber sleeve **34** is braced by the seating ring **54** and the retaining sleeve **16**, i.e., joined in a force-locking manner.

[**0028**] In a further embodiment, the actuating sleeve **18** is positioned at a radial and axial distance **110** from rubber sleeve **34**. When the actuating sleeve **18** comes into contact with a fixed wall during operation, thus causing the actuating sleeve **18** to come to a standstill, the rubber sleeve **34** can continue to rotate along with the toolholder body **12**. This prevents wear between the rubber sleeve **34** and the actuating sleeve **18**.

[**0029**] The chamber **30** is filled via a recess **74** with a viscous and temperature-resistant lubricant, which is not illustrated in greater detail, for the lubrication of seating bore **80**. When the tool is inserted, the locking sphere **14** is pushed radially to the outside, the volume in the chamber **30** is reduced, and the lubricant is pressed out of the chamber **30** into the seating bore **80**.

[**0030**] **FIG. 2** shows another exemplary embodiment of the invention comprising a sealing device **22**. In the embodiments described herein, similar components, from one example to the next, are identified by the same reference numbers. The sealing device **22** of this embodiment has an elastically deformable rubber sleeve **36** that surrounds a compression spring **46** and a holding sleeve **56** and outwardly seals a chamber **30** against a seating ring **54** and a retaining sleeve **16**. The pairs of sealing surface **48**, **50** between the seating ring **54** and the rubber sleeve **36** and between the rubber sleeve **36** and the retaining sleeve **16**, respectively, are held in contact by the compression spring **46**.

[**0031**] An embodiment of the invention, as illustrated in **FIG. 3**, comprises a sealing device **24** that comprises an elastically deformable rubber sleeve **38**, which forms a preassembled unit together with a compression spring **46**. The rubber sleeve **38** surrounds the compression spring **46** and outwardly seals the ends of a chamber **30** in the direction of a seating ring **54** and a holding sleeve **56**. In this embodiment, the pairs of sealing surfaces **48**, **52** are between the seating ring **54** and the rubber sleeve **38** and between the rubber sleeve **38** and a holding sleeve **56** and are held in contact by the compression spring **46**.

[**0032**] In another embodiment, as illustrated in **FIG. 4, a** sealing device **26** comprises an elastically deformable rubber sleeve **40** that surrounds a seating ring **54**, compression spring **46**, holding sleeve **56**, retaining sleeve **16**, ring **76** and snap ring **78** and seals a chamber **32** toward the seating ring **54** and a toolholder body **12**. On the machine side, the rubber sleeve **40** surrounds the seating ring **54** radially from both axial sides and, on the tool side, engages with a groove **68** of the toolholder body **12**. One pair of sealing surfaces **58** is provided axially in the machine direction and one pair of sealing surfaces **62** is provided axially in the direction of the tool. To achieve a stable seating of the rubber sleeve, as well as high wear-resistance, the rubber sleeve may be reinforced by a fabric in different areas, for example in the area of the seating ring **54**, compression spring **46**, holding sleeve **56** and/or retaining sleeve **16**.

[**0033**] By displacing the actuating sleeve in the machine direction, the retaining sleeve **16** is moved against the compression spring **46** via the rubber sleeve **40** and the ring **76**. The rubber sleeve **40** is thereby elastically deformed, with the sealing surfaces of the pairs of sealing surfaces **58**, **62** always contacting each other.

[**0034**] A viscous and heat-resistant lubricant is provided in the chamber **32** for continuous force-fed lubrication via the recess **74**. For example, when a tool is inserted into the toolholder **10**, the locking sphere **14** is moved radially outward. Then, the volume in the chamber **32** is reduced, and the lubricant is pressed through the recess **74** into the seating bore **80**. In one embodiment, the area around the rubber sleeve **40** is also sealed by an O-ring **96** between the actuating sleeve **18** and the housing shells **84** and by a labyrinth seal **72** between the actuating sleeve **18** and a neighboring component, for example a dust cap **70**.

[**0035**] The embodiment illustrated by **FIG. 5** comprises a sealing device comprising an elastically deformable rubber sleeve **42**, which is folded in multiple layers and which is provided on the tool side, and a sheet-metal sleeve **44** which is provided on the machine side. The sheet-metal sleeve **44** seals the chamber **32** against a circumferential O-ring **66** on the machine side, with the circumferential O-ring being fastened in a circumferential groove **100** in a seating ring **98** for a compression spring **46**. The chamber **32** is sealed between a seating ring **98** and the toolholder body **12** by an seating O-ring **102** via which the seating ring **98** is supported on a shoulder **104** of the toolholder body **12** on the machine side. On the tool side, the seating ring **98** is supported on the toolholder body **12** via a clamping ring **106**. On the tool side, the rubber sleeve **42** seals the chamber **32** between the sheet-metal sleeve **44** and the retaining sleeve **16** at a first end, and the rubber sleeve **42** and the toolholder body **12** at its second end. At its second end, the rubber sleeve **42**

engages with a groove **68** in the toolholder body **12**. The sheet-metal sleeve **44** and the circumferential O-ring **66** forms a pair of sealing surfaces **60** in the machine direction, and the rubber sleeve **42** and the toolholder body **12** forms another pair of sealing surfaces **64** in the tool direction.

[**0036**] By axially displacing, in the machine direction, the actuating sleeve **18**, the retaining sleeve **16** is moved against the compression spring **46**, and the actuating sleeve **18** engages the rubber sleeve **42**, at a location radially outside of a multiple-fold area **108** of the rubber sleeve **42**, allowing the multiple-fold area **108** to unfold, and enabling the locking sphere to displace, unlocking the tool.

[**0037**] **FIG. 6** shows, for example, the rubber sleeve **42** in the locked position, and **FIG. 7** shows, for example, the rubber sleeve **42** in an unlocked position. For example, the sheet-metal sleeve **44** slides over the circumferential O-ring **66**. As in the exemplary embodiment illustrated in **FIG. 4, a** viscous and heat-resistant lubricant is provided in the chamber **32** for continuous force-fed lubrication via the recess **74**.

[**0038**] Reference numbers

[**0039**] **10** Toolholder

[**0040**] **12** Toolholder body

[**0041**] **14** Locking member

[**0042**] **16** Retaining element

[**0043**] **18** Actuating element

[**0044**] **20** Sealing device

[**0045**] **22** Sealing device

[**0046**] **24** Sealing device

[**0047**] **26** Sealing device

[**0048**] **28** Sealing device

[**0049**] **30** Chamber

[**0050**] **32** Chamber

[**0051**] **34** Component

[**0052**] **36** Component

[**0053**] **38** Component

[**0054**] **40** Component

[**0055**] **42** Component

[**0056**] **44** Component

[**0057**] **46** Compression spring

[**0058**] **48** Sealing surface pair

[**0059**] **50** Sealing surface pair

[**0060**] **52** Sealing surface pair

[**0061**] **54** Component

[**0062**] **56** Component

[**0063**] **58** Sealing surface pair

[**0064**] **60** Sealing surface pair

[**0065**] **62** Sealing surface pair

[**0066**] **64** Sealing surface pair

[**0067**] **66** Component

[**0068**] **68** Groove

[**0069**] **70** Component

[**0070**] **72** Labyrinth seal

[**0071**] **74** Recess

[**0072**] **76** Ring

[**0073**] **78** Snap ring

[**0074**] **80** Seating bore

[**0075**] **82** Rotary driving web

[**0076**] **84** Housing shell

[**0077**] **86** Dust cap

[**0078**] **88** Interlocking connection

[**0079**] **90** Diaphragm gland

[**0080**] **92** Sealing surface pair

[**0081**] **94** Sealing surface pair

[**0082**] **96** O-ring

[**0083**] **98** Seating ring

[**0084**] **100** Groove

[**0085**] **102** O-ring

[**0086**] **104** Shoulder

[**0087**] **106** Clamping ring

[**0088**] **108** Area

[**0089**] **110** Distance

[**0090**] **112** Rivet set

[**0091**] **114** Groove

[**0092**] **116** Groove

What is claimed is:

1. A hand-operated machine tool, in particular a drilling and/or chipping hammer, comprising a percussively and/or rotationally driven toolholder **(10)**, which is used to hold tools having a grooved shank and includes a toolholder body **(12)** having at least one radially moving locking member **(14)**, which in turn is insertable into a groove of the tool closed at the shank end and is held in its locked position by a retaining element **(16)** that may be placed by an actuating element **(18)** in a position that radially releases the locking member **(14)**; and comprising at least one sealing device **(20, 22, 24, 26, 28)** that outwardly seals at least one chamber **(30, 32)** surrounding a locking member **(14)**,

wherein the sealing device **(20, 22, 24, 26, 28)** has at least one sleeve-shaped component **(34, 36, 38, 40, 42, 44)** that is separate from the actuating element **(18)** and at least partially delimits the chamber **(30, 32)** in the radial direction.

2. The hand-operated machine tool according to claim 1, wherein the actuating element **(18)** has least one radial distance **(110)** from the sleeve-shaped component **(34, 36, 38, 40, 42, 44)**.

3. The hand-operated machine tool according to claim 1 or **2**, wherein the sealing device (**20**, **22**, **24**, **26**, **28**) has at least one sleeve-shaped, elastically deformable component (**34**, **36**, **38**, **40**, **42**).

4. The hand-operated machine tool according to one of the preceding claims,

wherein at least one sealing surface pair (**48**, **50**, **52**) is held together by a compression spring (**46**) that holds the retaining element (**16**) in its retaining position.

5. The hand-operated machine tool according to claim 4, wherein the sleeve-shaped component (**38**) surrounds the compression spring (**46**) and seals its ends against neighboring components (**54**, **56**).

6. The hand-operated machine tool according to one of the preceding claims,

wherein one sealing surface pair (**58**, **60**) is situated axially in front of the locking member (**14**) and one sealing surface pair (**62**, **64**) is situated axially behind the locking member (**14**), and, in the case of both sealing surface pairs (**58**, **60**, **62**, **64**), one sealing surface is formed by the toolholder body (**12**) or by a component (**54**, **66**) attached to the toolholder body (**12**).

7. The hand-operated machine tool according to one of the preceding claims,

wherein a lubricant is introduced into the chamber (**30**, **32**).

8. The hand-operated machine tool according to one of the preceding claims,

wherein at least one sleeve-shaped component (**40**, **42**) engages with at least one groove (**68**) in the toolholder body (**12**).

9. The hand-operated machine tool according to one of the preceding claims,

wherein a labyrinth seal (**72**) is situated between the actuating element (**18**) and a neighboring component (**70**).

* * * * *