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### Grinding device and coffee machine equipped therewith

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#### Abstract

Disclosed are a grinding device and a coffee machine equipped therewith. The grinding device includes: a grinding housing, provided with a discharge port on a side thereof; first and second grinding elements, coaxially disposed in the grinding housing, and forming a grinding gap, wherein the second grinding element rotates relative to the first grinding element to grind raw material in the grinding gap; a pushing wheel for pushing ground raw material from the grinding gap to the discharging port; a drive assembly, connected to the pushing wheel. The pushing wheel includes a torque connection portion, the grinding housing is provided with a through hole for it to pass through, the torque connection portion is radially supported on the grinding housing by a fixed support member, a rolling support member is provided between the pushing wheel and the grinding housing and provides at least axial support for the pushing wheel.

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## References Cited

### U.S. PATENT DOCUMENTS

Patent No.	Issued Date	Patentee Name	U.S. Cl.	CPC
7874505	12/2010	Lassota	N/A	N/A
2014/0224910	12/2013	Sahli	241/246	A47J 42/10
2019/0380535	12/2018	Ullmann	N/A	A47J 42/06
2020/0060477	12/2019	Nicholson	N/A	N/A
2022/0192425	12/2021	Nicholson	N/A	A47J 42/38

### FOREIGN PATENT DOCUMENTS

Patent No.	Application Date	Country	CPC
2019324004	12/2020	AU	N/A
101347313	12/2008	CN	N/A
102971078	12/2012	CN	N/A
103767568	12/2013	CN	N/A
103976665	12/2013	CN	N/A
104812278	12/2014	CN	N/A
105167615	12/2014	CN	N/A
204931358	12/2015	CN	N/A
205322053	12/2015	CN	N/A
108784421	12/2017	CN	N/A
109715343	12/2018	CN	N/A
110604485	12/2018	CN	N/A
210169677	12/2019	CN	N/A
111110063	12/2019	CN	N/A
111513587	12/2019	CN	N/A
111712326	12/2019	CN	N/A
112533517	12/2020	CN	N/A

112641349	12/2020	CN	N/A
213309220	12/2020	CN	N/A
213963094	12/2020	CN	N/A
113558498	12/2020	CN	N/A
1539920	12/2015	TW	N/A
M602392	12/2019	TW	N/A
202126244	12/2020	TW	N/A
2021037546	12/2020	WO	N/A

## OTHER PUBLICATIONS

First Office Action issued in counterpart Chinese Patent Application No. 202110948041.3, dated Mar. 18, 2022. cited by applicant

International Search Report issued in corresponding PCT Application No. PCT/CN2022/077368, dated May 25, 2022. cited by applicant

Extended European Search Report issued in counterpart European Patent Application No. 22857221.0, dated Nov. 18, 2024. cited by applicant

First Office Action issued in counterpart Chinese Patent Application No. 202210958999.5, dated Mar. 29, 2025. cited by applicant

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## Background/Summary

CROSS-REFERENCE TO RELATED APPLICATIONS (1) The present application is a continuation of International Application No. PCT/CN2022/077368, filed on Feb. 23, 2022, which claims priority to Chinese Patent Application No. CN202110948041.3, filed on Aug. 18, 2021. The disclosures of the aforementioned applications are hereby incorporated by reference in their entireties.

### TECHNICAL FIELD

(1) The present disclosure relates to a grinding device, in particular, to a grinding device for grinding coffee beans and a coffee machine equipped with the grinding device.

### BACKGROUND

(2) Coffee is a fashionable beverage widely favored by consumers. When making coffee, it is usually necessary to grind coffee beans into coffee powder. However, the coffee powder is prone to losing its aroma due to oxidation. To fully retain the aroma of coffee power, automatic coffee machines grinding coffee beans automatically are increasingly popular with average consumers. These coffee machines typically have a grinding device for grinding coffee beans. However, for mass-produced grinding devices, the graininess of ground coffee powder varies among different devices, resulting in inconsistent graininess of coffee powder ground by different grinding devices. In addition, coffee powder ground by a traditional grinding device often has uneven graininess.

### SUMMARY

(3) The purpose of the present disclosure is to provide a grinding device with high assembly accuracy and more reliable use.

(4) To achieve the above purpose, the present disclosure provides a grinding device, including: a grinding housing, provided with a discharge port on a side thereof; a first grinding element and a second grinding element, coaxially disposed in the grinding housing, wherein a grinding gap is

formed between the first grinding element and the second grinding element, and the second grinding element rotates relative to the first grinding element to grind raw material to be ground in the grinding gap; a pushing wheel, disposed below the second grinding element and connected to the second grinding element to drive the second grinding element to rotate, wherein rotation of the pushing wheel is capable of pushing ground raw material from the grinding gap to the discharging port; and a drive assembly, disposed below the grinding housing, and connected to the pushing wheel in a torque-transmitting manner, wherein the pushing wheel and the drive assembly include a torque connection portion, the grinding housing is provided with a through hole for the torque connection portion to pass through, the torque connection portion is radially supported to the grinding housing by a fixed support member, a rolling support member is provided between the pushing wheel and the grinding housing, and the rolling support member provides at least axial support for the pushing wheel.

(5) As a further improvement of an implementation of the present disclosure, the fixed support member is configured as a metal shaft sleeve, a bottom of the pushing wheel is provided with an input end extending along an axial direction, the drive assembly includes a torque output member, the torque output member is fixedly connected to the input end in a circumferential direction, and the input end is configured as the torque connection portion.

(6) As a further improvement of an implementation of the present disclosure, the rolling support member is supported between the pushing wheel and the fixed support member.

(7) As a further improvement of an implementation of the present disclosure, the rolling support member includes a plurality of balls, the bottom of the pushing wheel is provided with a first rolling groove, the fixed support member is provided with a second rolling groove, and the plurality of balls move along the first rolling groove and the second rolling groove.

(8) As a further improvement of an implementation of the present disclosure, a seal member is further provided between the pushing wheel and the grinding housing, the seal member is adjacent to a radially outer side of the fixed support member and protrudes upward, so that the seal member is in contact with the pushing wheel.

(9) As a further improvement of an implementation of the present disclosure, the bottom of the pushing wheel is further provided with an annular groove, the annular groove is disposed at an interval with the rolling support member, and the seal member extends into the annular groove.

(10) As a further improvement of an implementation of the present disclosure, the bottom of the grinding housing is provided with a first stepped portion and a second stepped portion which are sunk in turn, the seal member is mounted on the first stepped portion, and the fixed support member is mounted on the second stepped portion.

(11) As a further improvement of an implementation of the present disclosure, the grinding housing is provided with a bottom surface adjacent to the discharge port, the grinding housing includes a stepped portion sunk relative to the bottom surface, and the fixed support member is mounted on the stepped portion and is flush with the bottom surface.

(12) As a further improvement of an implementation of the present disclosure, the rolling support member and the fixed support member are respectively provided on both sides of the through hole at an interval along the axial direction.

(13) As a further improvement of an implementation of the present disclosure, the rolling support member is supported between the pushing wheel and the grinding housing, and a direction along which force is applied to the rolling support member is disposed obliquely with respect to the axial direction.

(14) As a further improvement of an implementation of the present disclosure, a first support portion and a second support portion are respectively provided on both ends, along the axial direction, of the through hole, the rolling support member is supported between the first support portion and the pushing wheel, and the fixed support member is mounted on the second support portion.

- (15) As a further improvement of an implementation of the present disclosure, the bottom of the pushing wheel is provided with an input end extending along the axial direction, and a first arc surface is formed between a bottom plane of the pushing wheel and an outer circumferential surface of the input end, a second arc surface is formed on the first support portion, and the rolling support member is located between the first arc surface and the second arc surface.
- (16) As a further improvement of an implementation of the present disclosure, the drive assembly includes a torque output member fixed, along the axial direction, to the pushing wheel and the second grinding element, a limit member is provided between the torque output member and the grinding housing, and the limit member fills an axial gap between the torque output member and the grinding housing to limit an axial upward displacement of the second grinding element.
- (17) As a further improvement of an implementation of the present disclosure, the limit member is configured as a planar bearing, a rolling member, or a wave washer.
- (18) As a further improvement of an implementation of the present disclosure, the bottom of the grinding housing is provided with a stepped portion that is sunk, the fixed support member is mounted on an inner side of the stepped portion, and the limit member is abutted between the torque output member and an outer side of the stepped portion.
- (19) As a further improvement of an implementation of the present disclosure, a support portion is provided on a side, facing the torque output member along the axial direction, of the through hole, the fixed support member is mounted on the support portion, and the limit member is abutted between the torque output member and the fixed support member.
- (20) As a further improvement of an implementation of the present disclosure, the grinding housing includes an extension wall extending downward along its periphery, the drive assembly includes a motor, a transmission mechanism driven by the motor, and a gear box for accommodating the transmission mechanism, the motor is connected to one end of the gear box, and the other end of the gear box is connected to the extension wall, the bottom of the grinding housing is provided with a stepped portion that is sunk, a cavity is formed between the extension wall and an outer side of the stepped portion, and a plurality of reinforcing rib plates are provided in the cavity at intervals in a circumferential direction.
- (21) The present disclosure further provides a coffee machine, which includes the grinding device above-mentioned.
- (22) According to the grinding device provided by the present disclosure, the radial support and the axial support of the pushing wheel that drives the second grinding element are supported to the grinding housing, so that the parts in the grinding housing can be independent of the drive assembly, thereby reducing the number of parts in the dimension chain. Meanwhile, an independent radial fixed support member is added, thereby effectively reducing cumulative errors of dimension. The pushing wheel is directly cooperated with the grinding housing through the fixed support member, so that the coaxial accuracy of the second grinding element and the grinding housing can be ensured. Meanwhile, the axial rolling support can reduce the support span, and the direction along which force is applied is downward which is consistent with the direction along which force is applied to the second grinding element, so that the problem of creeping of parts caused by stress can be improved.

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## Description

### BRIEF DESCRIPTION OF THE DRAWINGS

- (1) FIG. 1 is a structural schematic diagram of a traditional grinding device.
- (2) FIG. 2 is a structural schematic diagram of a grinding device in a first implementation of the present disclosure.
- (3) FIG. 3 is a schematic perspective exploded diagram of the grinding device in FIG. 2.

(4) FIG. 4 is a schematic cross-sectional diagram of the grinding device taken along the A-A line in FIG. 2.

(5) FIG. 5 is a schematic perspective diagram of a grinding housing of the grinding device in FIG. 2.

(6) FIG. 6 is a schematic perspective diagram of the grinding housing in FIG. 5 taken from another view angle.

(7) FIG. 7 is a schematic cross-sectional diagram of a grinding device in a second implementation of the present disclosure.

(8) FIG. 8 is a schematic perspective diagram of a pushing wheel of the grinding device in FIG. 7.

(9) FIG. 9 is a schematic perspective diagram of a grinding housing of the grinding device in FIG. 7.

(10) FIG. 10 is a schematic perspective diagram of the grinding housing in FIG. 9 taken from another view angle.

## DETAILED DESCRIPTION OF THE EMBODIMENTS

(11) For ease of understanding, the following is an example explanation of a traditional grinding device.

(12) As shown in FIG. 1, a traditional bean-grinding device for grinding coffee beans generally includes a motor 11, a gear-box portion 12, and a bean-grinding assembly. The motor 11 outputs power to the bean-grinding assembly through the gear-box portion 12. The bean-grinding assembly includes an upper grinding tool 14 and a lower grinding tool 15 disposed in a coffee powder box 17. The lower grinding tool 15 receives the power and rotates relative to the upper grinding tool 14 to grind coffee beans between the upper grinding tool 14 and the lower grinding tool 15. The gear-box portion 12 includes a planetary gear and a steel-ball fixing seat 13. The steel-ball fixing seat 13 forms a tight fit with the housing of the gear-box portion 12 through a plurality of steel balls rotating on the outer circumferential side of the steel-ball fixing seat 13, so that the coaxiality of the steel ball fixing seat 13 and the gear box portion 12 can be ensured. A propeller 16 is disposed below the lower grinding tool 15, and the propeller 16 is fixed to the steel ball fixing seat 13, the purpose of which is also to make the lower grinding tool 15 fixed to the propeller 16 rotate more stably. The coffee powder box 17 cooperates with the gear-box portion 12, and the upper grinding tool 14 cooperates with the coffee powder box 17. By a series of cooperations, the coaxiality of the upper grinding tool 14 and the lower grinding tool 15 can be ensured, and the consistency of the graininess can be ensured.

(13) To ensure the coaxiality of the upper and lower grinding tools 14,15, it is necessary to ensure the accuracy of all mating parts. Due to the large number of mating parts in the traditional grinding device, the cumulative errors are large which leads to the inability to ensure the coaxiality between the upper and lower grinding tools 14,15. Consequently, the consistency of graininess of mass-produced traditional grinding devices is poor.

(14) Moreover, since the diameter of the steel-ball fixing seat 13 is large, when the steel-ball fixing seat 13 is subjected to an axial force (i.e., when grinding beans), the central portion of the steel ball fixing seat 13 will creep, which will cause the lower grinding tool 15 to rise and sink. The sinking and rising of the lower grinding tool 15 makes the distance between the upper and lower grinding tools 14,15 change, so that the graininess of the ground powder is uneven.

(15) In view of this, the present disclosure provides a grinding device applied to a coffee machine. The present disclosure is described in detail below with reference to the specific implementations shown in the figures. These implementations do not aim to limit the present disclosure. Changes in structure, method, or function made by those of ordinary skill in the art based on these implementations shall fall into the protection scope of the present disclosure.

(16) It should be understood that the terms used herein, such as “upper”, “above”, “lower”, “below” and other terms indicating the relative position of space, are for the purpose of describing the relationship of one unit or feature to another as shown in the figures. The terms of spatial

relative positions may be intended to include different positions of the device in use or operation other than those shown in the figures.

(17) The grinding device in the implementations of the present disclosure may be used in a coffee machine. Below, the grinding device will be described with an automatic coffee machine capable of grinding coffee beans as an example. It should be understood that the grinding device in the embodiments of the present disclosure can also be used alone or applied to other devices.

(18) Referring to FIGS. 2 to 6, in a first implementation, the grinding device **200** includes a grinding housing **20**, a discharging port **21** is provided on a side of the grinding housing **20**. A first grinding element **31** and a second grinding element **32** are coaxially disposed in the grinding housing **20**. A grinding gap is formed between the first grinding element **31** and the second grinding element **32**. The second grinding element **32** rotates relative to the first grinding element **31** to grind raw material to be ground in the grinding gap. The grinding elements **31,32** herein may be flat-tool grinders or tapered-tool grinders, which completes the grinding of coffee beans by driving the second grinding element **32** to rotate. In addition, the first grinding element **31** is fixedly connected to the grinding housing **20** in a circumferential direction, and the position, along the axial direction, of the first grinding element **31** may be adjusted through an adjusting ring **33**, so that the size of the ground coffee powder granule can be selected. When the first grinding element **31** is adjusted to ascend, the grinding gap becomes larger to make the ground coffee powder particles bigger; and when the first grinding element **31** is adjusted to descend, the grinding gap becomes smaller to make the ground coffee powder particles smaller.

(19) A pushing wheel **34** is disposed below the second grinding element **32**, and the pushing wheel **34** is connected to the second grinding element **32** to drive the second grinding element **32** to rotate. In this embodiment, an upper surface of the pushing wheel **34** is provided with three positioning columns **341**; correspondingly, the lower side of the second grinding element **32** is provided with three positioning holes **321**. The positioning columns **341** are respectively inserted into the corresponding positioning holes **321** to circumferentially fix the pushing wheel **34** to the second grinding element **32**, so that the pushing wheel **34** is capable of driving the second grinding element **32** to rotate. Rotation of the pushing wheel **34** is also capable of pushing ground raw material from the grinding gap to the discharging port **21**. Specifically, the pushing wheel **34** is provided with a discharging plate **342** arranged in a circumferential direction, and the discharging plate **342** is located on the upper side of the pushing wheel **34** and at the edge of the pushing wheel **34**. For example, the pushing wheel **34** may be provided with a plurality of discharging plates **342**, and the plurality of discharging plates may be disposed at uniform intervals along the circumferential direction of the pushing wheel **34**. The ground raw material in the grinding gap will fall to the edge of the pushing wheel **34**, and the pushing wheel **34** will drive the discharging plates **342** to rotate to push the ground raw material to move to the discharging port **21**.

(20) Further, a drive assembly is disposed below the grinding housing **20**, and the drive assembly is connected to the pushing wheel **34** in a torque-transmitting manner to drive the pushing wheel **34** to rotate. The drive assembly includes a motor **40**, a transmission mechanism **50** driven by the motor **40**, and a gear box **51** for accommodating the transmission mechanism **50**, the motor **40** is connected to one end of the gear box **51**. The transmission mechanism **50** may be a planetary gear reduction mechanism, or other transmission mechanisms, as long as the torque output from the motor **40** can be transmitted to the pushing wheel **34**. In this embodiment, the rotation axis of the motor **40** is disposed to be coaxial with the rotation axis of the second grinding element **32**. In other embodiments, the rotation axis of the motor **40** may be disposed to be parallel or perpendicular to the second grinding element **32**. Herein the pushing wheel **34** and the drive assembly include a torque connection portion, the grinding housing **20** is provided with a through hole **22** for the torque connection portion to pass through, the torque connection portion is radially supported to the grinding housing **20** by a fixed support member **36**, a rolling support member **37** is provided between the pushing wheel **34** and the grinding housing **20**, and the rolling support member **37**

provides at least axial support for the pushing wheel **34**.

(21) By setting the radial support for the torque connection portion of the pushing wheel **34** and the drive assembly, as well as the axial support for the pushing wheel **34**, both associated with the grinding housing **20**, the number of mating parts in the dimension chain is reduced, thereby effectively reducing cumulative errors. The pushing wheel **34** is radially supported to the grinding housing **20** by a fixed support member **36**, so as to ensure the coaxiality between the grinding housing **20** and the second grinding element **32**, and therefore, the consistency of the graininess of the mass-produced grinding devices can be ensured. In addition, the axial support reduces the span of the rolling support member **37**. The radial fixed support member **36** is provided. Due to the low rotational speed of the second grinding element **32** itself, the friction between the second grinding element **32** and the fixed support member **36** may be ignored, so that the coaxial accuracy can be improved and the costs can be reduced while ensuring the stable rotation of the second grinding element **32**. The support direction of the rolling support member **37** is consistent with the direction along which force is applied to the second grinding element **32**, so that the span of the rolling support member **37** can be reduced and the problem of creeping of parts caused by stress can be also improved.

(22) Referring to FIGS. **3** and **4** again, the fixed support member **36** may be configured as a metal shaft sleeve, a bottom of the pushing wheel **34** is provided with an input end **344** extending along an axial direction, the drive assembly includes a torque output member **52**, the torque output member **52** is connected to the output end of the transmission mechanism **50**, and the torque output member **52** is fixedly connected to the input end **344** in a circumferential direction. Specifically, the torque output member **52** may be inserted into the input end **344** for connection, that is, the input end **344** is configured as the torque connection portion, and the fixed support member **36** is in direct contact with the input end **344**, so that the support for the pushing wheel **34** can be more stable. The dimensional accuracy of the metal shaft sleeve is high, and the errors caused by it can be ignored, so that the coaxial accuracy of the second grinding element **32** and the grinding housing **20** can be ensured.

(23) In this embodiment, the rolling support member **37** is supported between the pushing wheel **34** and the fixed support member **36**. When the pushing wheel **34** drives the second grinding element **32** to rotate, the rolling support member **37** can reduce the friction between the pushing wheel **34** and the fixed support member **36**, and more kinetic energy of the pushing wheel **34** can be used to grind coffee beans. Meanwhile, by the direct contact between the fixed support member **36** and the rolling support member **37**, during the manufacturing of the grinding housing **20**, it is only needed to control the sizes of the portion, of the grinding house **20**, mating with the fixed support member **36** to ensure the coaxiality between the pushing wheel **34** and the grinding housing **20**, so that the manufacturing cost of the grinding device can be reduced.

(24) Specifically, the rolling support member **37** includes a plurality of balls, the bottom of the pushing wheel **34** is provided with a first rolling groove **347**, and the fixed support member **36** is provided with a second rolling groove **361**. The plurality of balls move along the first rolling groove **347** and the second rolling groove **361**. The rotation of the pushing wheel **34** is supported by the plurality of balls, so that the overall torque transmission can be more stable. In addition, to directly form the rolling grooves **347,361** on the pushing wheel **34** and the fixed support member **36** can reduce the size of the axial fit between the pushing wheel **34** and the grinding housing **20**, so that the overall structure of the grinding device can be more compact. Moreover, using the lower surface of the pushing wheel **34** as a part of the rolling bearing can effectively reduce components while meeting the functional requirements.

(25) In addition, to make the fixed support member **36** support the pushing wheel **34** more stable, the axial length of the fixed support member **36** may be between one half and three quarters of the axial length of the output end **344**. In this way, in order to reduce the overall axial size of the grinding device, the depth of the first rolling groove **347** may be set to be greater than the radius of



the rolling member, so that the axial dimension of the grinding housing can be reduced while ensuring the span of the radial support of the fixed support member **36**.

(26) During the process of grinding coffee beans, to prevent coffee powder from entering the torque connection portion (that is, the area where moving parts is located) from the gap between the pushing wheel **34** and the grinding housing **20**, a seal member **38** may be provided between the pushing wheel **34** and the grinding housing **20**. For example, the seal member **38** may be constructed as a felt ring. The felt ring has a good sealing effect and can effectively prevent the entry of coffee powder. Specifically, the seal member **38** may be adjacent to a radially outer side of the fixed support member **36** and protrudes upward, so that the seal member **38** is in contact with the pushing wheel **34**. In this way, the seal member **38** can prevent coffee powder from entering the transmission area, and can prevent lubricating oil or friction debris from the transmission area from entering the coffee powder delivery area in the grinding housing. For example, the fixed support member **36** can also assist in positioning the seal member **38** to ensure the reliable use of the grinding device. Specifically, the bottom of the pushing wheel **34** may be further provided with an annular groove **348**, the annular groove **348** is disposed at an interval with the first rolling groove **347**. The seal member **38** extends into the annular groove **348**, so that a rising movement for coffee powder is required to enter the transmission area, which can better block the entry of coffee powder.

(27) To facilitate mounting of the fixed support member **36**, the grinding housing **20** has a bottom surface **23** which is adjacent to the discharging port **21**. The grinding housing **20** includes a stepped portion sunk relative to the bottom surface **23**, and the fixed support member **36** is mounted on the stepped portion and is flush with the bottom surface **23**, thereby facilitating to control the gap between the pushing wheel **34** and the grinding housing **20**. The seal member **38** may be radially spaced from the fixed support member **36** or may be radially in contact with the fixed support member **36**. Specifically, the stepped portion includes a first stepped portion **24** and a second stepped portion **25** which are sunk in turn towards the bottom side of the grinding housing **20**. The seal member **38** is mounted on the first stepped portion **24**, the fixed support member **36** is mounted on the second stepped portion **25**. In this way, after the fixed support member **36** is mounted, the position of the seal member **38** is simultaneously limited, thereby facilitating the manufacturing of the grinding housing and the assembly of the grinding device.

(28) In the above embodiments, the pushing wheel **34** is rotationally supported within the grinding housing **20**, which cooperates with the drive assembly outside the grinding housing **20**. The drive assembly includes a torque output member **52** fixed, along the axial direction, to the pushing wheel **34** and the second grinding element **32**. For example, the second grinding element **32**, the pushing wheel **34**, and the torque output member **52** can be connected together from top to bottom through a screw **523**, so as to fix the three together axially. In addition, a screw feeding member **322** may be provided above the second grinding element **32** to guide coffee beans into the grinding gap between the first grinding element **31** and the second grinding element **32**. A convex column **345** extends upward from the pushing wheel **34**, the convex column **345** is inserted into the second grinding element **32**, and the convex column **345** is connected to the screw feeding member **322** in a torque-transmitting manner. For example, the screw **523** may pass through the screw feeding member **322**, so as to cause the screw feeding member **322** to abut against the upper surface of the second grinding element **32**. In this way, the screw **523** can axially fix the screw feeding member **322**, the second grinding element **32**, the pushing wheel **34**, and the torque output member **52** together. For example, the pushing wheel **34** and the torque output member **52** may be connected through splines, which can be the insertion of the torque output member **52** into the pushing wheel **34**, or the insertion of the pushing wheel **34** into the torque output member **52**. In the above embodiments, the torque output member **52** is specifically inserted into the pushing wheel **34**, and radial and axial support can be directly act on the pushing wheel **34** to make the rotation of the pushing wheel **34** more stable.

(29) To prevent the second grinding element **32** from colliding with the first grinding element **31** caused by the upward movement of the second grinding element **32** during grinding, especially during idling, a limit member **61** is provided between the torque output member **52** and the grinding housing **20**, and the limit member **61** fills an axial gap between the torque output member **52** and the grinding housing **20** to limit an axial upward displacement of the second grinding element **32**. By locking the relative position between the torque output part **52** and the grinding housing **20**, it is ensured that the axial position of the second grinding element **32** is fixed. For example, the limit member **61** may be configured as a planar bearing or a wave washer, or of course may be a plurality of rolling members disposed between the torque output member **52** and the grinding housing **20**. The torque output member **52** and the pushing wheel **34** are fixed together by the screw **523**, the second grinding element **32** has no axial movement space, and the planar bearing or rolling member can play a role in reducing friction during the rotation of the torque output member **52**. And the wave washer can maintain a downward trend of the pushing wheel **34** through the torque output member **52** to prevent the second grinding element **32** from colliding with the first grinding element **31** caused by the upward movement of the second grinding element **32** during grinding, especially during idling.

(30) Specifically, the second stepped portion **25** has an inner side on which the fixed support member **36** is mounted and an outer side facing the drive assembly, and the limit member **61** abuts against the torque output member **52** and the outer side of the second stepped portion **25** and located between the two. The second grinding element **32** is fixed to the torque output member **52** by the screw **523**. By limiting the gap between the torque output member **52** and the grinding housing **20**, the limit member **61** can define the axial position of the second grinding element **32** relative to the grinding housing **20**, so that the overall assembly of the grinding device is very convenient and the structure is more reliable.

(31) Further, to facilitate the overall assembly of the grinding device, the grinding housing **20** includes an extension wall **29** extending downward along its periphery, the motor **40** is connected to one end of the gear box **51**, and the other end of the gear box **51** is connected to the extension wall **29**, the torque output member **52** is connected to the output end of the transmission mechanism in a torque-transmitting manner, such as through splines. During assembly, the drive assembly can be connected to the grinding housing **20** as a whole; the components within the grinding housing **20** are connected based on the grinding housing **20**, resulting in small cumulative errors and high assembly accuracy. A cavity is formed between the outer side of the stepped portion at the bottom of the grinding housing **20** and the extension wall **29**, in which a plurality of reinforcing rib plates **291** are provided an interval in a circumferential direction to further enhance the overall strength of the grinding housing **20**.

(32) Referring to FIGS. 7 to 10, it is a second implementation of a grinding device of the present disclosure. In this implementation, components with the same label as the first implementation have the similar structure and function as the first implementation, and for the purpose of simplicity, details are not described herein again. The difference is that the rolling support member **37a** and the fixed support member **36a** are respectively disposed on both sides of the through hole **22** at an interval along an axial direction, that is, both the rolling support member **37a** and the fixed support member **36a** are supported between the pushing wheel **34** and the grinding housing **20**. By separating the axial support from the radial support, the two support points are cooperated, the axial support of the rolling support member **37a** bears downward pressure during grinding, thus reducing the friction between the pushing wheel **34** and the grinding housing **20**. For the radial fixed support member **36a**, the pushing wheel **34** and the grinding housing **20** are both cooperated with it, thereby greatly improving the coaxial accuracy. In this embodiment, it is specific that the direction along which force is applied to the rolling support member **37a** is disposed obliquely with respect to the axial direction, that is, the force bearing angle of the rolling support member **37a** is at a preset angle with the rotation axis of the pushing wheel **34** to ensure the coaxiality of the pushing

wheel **34** and the grinding housing **20**, and to bear the downward pressure during grinding, which can further improve the coaxiality accuracy. By forming a two-point radial support, the axial length of the fixed support member **36a** can be reduced while ensuring the support span, so that the axial length of the fixed support member **36a** can be less than one half of the axial length of the input end **344** of the pushing wheel **34**. Specifically, the axial length of the fixed support member **36a** is between one fourth and one half of the axial length of the input end **344**, so that the overall height of the grinding housing can be reduced.

(33) Specifically, a first support portion **26** and a second support portion **27** are respectively provided on both ends, along the axial direction, of the through hole **22**, the rolling support member **37a** is supported between the first support portion **26** and the pushing wheel **34**, and the fixed support member **36a** is mounted on the second support portion **27**. The first support portion **26** and the second support portion **27** may be configured as two stepped portions respectively disposed on both sides of the through hole **22**, so as to facilitate the manufacturing of the grinding housing **20**. The bottom of the pushing wheel **34** is provided with an input end **344** extending along the axial direction, and a first arc surface **346** is formed between a bottom plane of the pushing wheel **34** and an outer circumferential surface of the input end **344**, a second arc surface **263** is formed on the first support portion **26**, and the rolling support member **37a** is located between the first arc surface **346** and the second arc surface **263**, that is, the first arc surface **346** and the second arc surface **263** cooperate to define a motion track for the rolling support member **37a**. The force angle of the rolling support member **37a** may be adjusted by setting the position of the arc surface, a specific angle of this embodiment is 45 degrees, which is convenient for manufacturing and more stable for the rotational support of the pushing wheel **34**. In addition, to extend the service life of the pushing wheel **34**, a raised stepped surface may be disposed radially from the outside to the inside at the bottom of the pushing wheel **34**, so that the first arc surface **346** can be disposed on a higher stepped surface, and the normal operation will not be affected even if wear occurs during a long-term use.

(34) In this embodiment, to prevent coffee powder from entering the torque connection portion (i.e., the area where moving parts is located) from the gap between the pushing wheel **34** and the grinding housing **20**, a seal member **38a** may also be provided between the pushing wheel **34** and the grinding housing **20**. An annular mounting groove **28** is disposed on the grinding housing **20** at an interval with the first support portion **26**. The seal member **38a** may be inserted into the mounting groove **28** and the upper portion of the seal member **38a** abuts against the bottom surface of the pushing wheel **34**, thereby preventing coffee powder from entering the transmission area through the seal member **38a**. To prevent the sealing failure caused by the rising of the pushing wheel **34** due to a large accumulation of coffee powder, an elastic element may be mounted at the bottom of the seal member **38a**. In this way, the seal member **38a** maintains a trend of abutting against the pushing wheel **34** upward under the action of the elastic element. Even if the pushing wheel **34** rises, the seal member **38a** can still maintain a close contact with the pushing wheel **34**, thereby enhancing the sealing effect.

(35) In this embodiment, to prevent the second grinding element **32** from colliding with the first grinding element **31** caused by the upward movement of the second grinding element **32**, a limit member **61** may abut against the torque output member **52** and the fixed support member **36a** and be located between the two. In this way, the limit member **61** can also achieve axial restraint of the fixed support member **36a**, thus improving the reliability of the overall structure. As in the first embodiment, the drive assembly is integrally connected to the grinding housing **20**. During the grinding process, the motor **40** outputs power to the torque output member **52** through the transmission mechanism **50** to make it start rotating. The torque output member **52** is fixed together with the pushing wheel **34** and the second grinding element **32**, so the second grinding element **32** can be start rotating together. During this process, the fixed support member **36a** cooperates with the pushing wheel **34**, thereby ensuring the stability of the rotation of the second grinding element

32. Meanwhile, the rolling support member 37a and the limit member 61 rotate irregularly during this process, thus reducing the friction between the pushing wheel 34 and the grinding housing 20, as well as the friction between the torque output member 52 and the grinding housing 20.

(36) In the above embodiment, the radial support and the axial support of the pushing wheel 34 that drives the second grinding element 32 are supported on the grinding housing 20, so that the components in the grinding housing 20 can be independent of the drive assembly, thereby reducing the number of parts in the dimension chain. Meanwhile, an independent radial fixed support member is added, thereby reducing errors of dimension. The pushing wheel 34 is directly cooperated with the grinding housing 20 through the fixed support member 36a, so that the coaxial accuracy of the second grinding element 32 and the grinding housing 20 can be ensured. At the same time, the axial rolling support 37a can reduce the support span, and the direction along which force is applied to the rolling support 37a is downward, its direction along which force is applied to is consistent with the direction along which force is applied to the second grinding element 32, so that the problem of creeping of parts caused by stress can be improved.

(37) Other embodiments of the present disclosure provide a coffee machine. The coffee machine includes the grinding device above-mentioned.

(38) It should be understood that although this specification is described under the implementations, not every implementation only contains an independent technical solution. This description is only for the sake of clarity. Those of ordinary skill in the art should take the specification as a whole, and the technical solutions in each implementation can also be appropriately combined to form other implementations that can be understood by those of ordinary skill in the art.

(39) The series of detailed descriptions listed above are only specific descriptions of feasible implementations of the present disclosure, and are not intended to limit the protection scope of the present disclosure. Any equivalent implementations or changes that do not depart from the spirit of the art of the present disclosure shall fall into the protection scope of the present disclosure.

## Claims

1. A grinding device, comprising: a grinding housing, provided with a discharging port on a side thereof; a first grinding element and a second grinding element, coaxially disposed in the grinding housing, wherein a grinding gap is formed between the first grinding element and the second grinding element, and the second grinding element rotates relative to the first grinding element to grind raw material to be ground in the grinding gap; a pushing wheel, disposed below the second grinding element and connected to the second grinding element to drive the second grinding element to rotate, wherein rotation of the pushing wheel is capable of pushing ground raw material from the grinding gap to the discharging port; and a drive assembly, disposed below the grinding housing, and connected to the pushing wheel in a torque-transmitting manner, wherein: the pushing wheel comprises a torque connection portion, the grinding housing is provided with a through hole for the torque connection portion to pass through, the torque connection portion is radially supported to the grinding housing by a fixed support member, a rolling support member is provided between the pushing wheel and the grinding housing, and the rolling support member provides at least axial support for the pushing wheel.
2. The grinding device according to claim 1, wherein the fixed support member is configured as a metal shaft sleeve, a bottom of the pushing wheel is provided with an input end extending along an axial direction, the drive assembly comprises a torque output member, the torque output member is fixedly connected to the input end in a circumferential direction, and the input end is configured as the torque connection portion.
3. The grinding device according to claim 1, wherein the rolling support member is supported between the pushing wheel and the fixed support member.

4. The grinding device according to claim 3, wherein the rolling support member comprises a plurality of balls, a bottom of the pushing wheel is provided with a first rolling groove, the fixed support member is provided with a second rolling groove, and the plurality of balls move along the first rolling groove and the second rolling groove.
5. The grinding device according to claim 3, wherein a seal member is provided between the pushing wheel and the grinding housing, the seal member is adjacent to a radially outer side of the fixed support member and protrudes upward, so that the seal member is in contact with the pushing wheel.
6. The grinding device according to claim 5, wherein a bottom of the pushing wheel is further provided with an annular groove, the annular groove is disposed at an interval with the rolling support member, and the seal member extends into the annular groove.
7. The grinding device according to claim 5, wherein a bottom of the grinding housing is provided with a first stepped portion and a second stepped portion which are sunk in turn, the seal member is mounted on the first stepped portion, and the fixed support member is mounted on the second stepped portion.
8. The grinding device according to claim 3, wherein the grinding housing is provided with a bottom surface adjacent to the discharging port, the grinding housing comprises a stepped portion sunk relative to the bottom surface, and the fixed support member is mounted on the stepped portion and is flush with the bottom surface.
9. The grinding device according to claim 1, wherein the rolling support member and the fixed support member are respectively provided on both sides of the through hole at an interval along an axial direction.
10. The grinding device according to claim 9, wherein the rolling support member is supported between the pushing wheel and the grinding housing, and a direction along which force is applied to the rolling support member is disposed obliquely with respect to the axial direction.
11. The grinding device according to claim 10, wherein a first support portion and a second support portion are respectively provided on both ends, along the axial direction, of the through hole, the rolling support member is supported between the first support portion and the pushing wheel, and the fixed support member is mounted on the second support portion.
12. The grinding device according to claim 11, wherein a bottom of the pushing wheel is provided with an input end extending along the axial direction, and a first arc surface is formed between a bottom plane of the pushing wheel and an outer circumferential surface of the input end, a second arc surface is formed on the first support portion, and the rolling support member is located between the first arc surface and the second arc surface.
13. The grinding device according to claim 1, wherein the drive assembly comprises a torque output member fixed, along an axial direction, to the pushing wheel and the second grinding element, a limit member is provided between the torque output member and the grinding housing, and the limit member fills an axial gap between the torque output member and the grinding housing to limit an axial upward displacement of the second grinding element.
14. The grinding device according to claim 13, wherein the limit member is configured as a planar bearing, a rolling member, or a wave washer.
15. The grinding device according to claim 13, wherein a bottom of the grinding housing is provided with a stepped portion that is sunk, the fixed support member is mounted on an inner side of the stepped portion, and the limit member is abutted between the torque output member and an outer side of the stepped portion.
16. The grinding device according to claim 13, wherein a support portion is provided on a side, facing the torque output member along the axial direction, of the through hole, the fixed support member is mounted on the support portion, and the limit member is abutted between the torque output member and the fixed support member.
17. The grinding device according to claim 1, wherein the grinding housing comprises an extension

wall extending downward along a periphery of the grinding housing; the drive assembly comprises a motor, a transmission mechanism driven by the motor, and a gear box for accommodating the transmission mechanism; the motor is connected to one end of the gear box, and the other end of the gear box is connected to the extension wall, a bottom of the grinding housing is provided with a stepped portion that is sunk, a cavity is formed between the extension wall and an outer side of the stepped portion, and a plurality of reinforcing rib plates are provided in the cavity at intervals in a circumferential direction.

18. A coffee machine, comprising the grinding device according to claim 1.

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