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(54) **TRANSMISSION SWITCHING DEVICE OF ELECTRIC HAMMER**

ÜBERTRAGUNGSUMSCHALTVORRICHTUNG EINES ELEKTRISCHEN HAMMERS

DISPOSITIF DE COMMUTATION DE TRANSMISSION DE MARTEAU ÉLECTRIQUE

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Description

Technical Field of the Invention

[0001] The present invention relates to a transmission switching device according to the preamble of claim 1. Such a transmission switching device is known from Chinese Utility Model Patent No. 201120173533.1.

Background of the invention

[0002] Chinese Utility Model Patent No. 201120173533.1 disclosed a transmission mechanism for electric tools, comprising: a shaft driven by a driving mechanism of the electric tools, the shaft comprising a first shaft portion, a second shaft portion and a driving portion disposed between the first shaft portion and the second shaft portion; a gear disposed on the first shaft portion, the gear sliding along the extension direction of the shaft with respect to the first shaft portion, driving members fitted with each other being provided between the gear and the driving portion of the shaft; and a pendulum bar bearing disposed on the second shaft portion, the pendulum bar bearing comprising an inner ring and an outer ring, a raceway between the inner ring and the outer ring being incline disposed with respect to the second shaft portion, driving members fitted with each other being provided between the inner ring and the driving portion, a pendulum bar extending in the inclined plane of the slideway being provided on the outer ring.

[0003] In the structure of such transmission mechanism for electric tools, the intermediate shaft is of a split structure. That is, the intermediate shaft is formed by arranging the first shaft portion and the second shaft portion coaxially. A concave-convex fitting structure is provided between two close end parts of the two shaft portions so that the two shaft portions are fitted with each other by the concave-convex fitting structure to achieve power transmission between the first shaft portion and the second shaft portion. The first shaft portion is circumferentially and fixedly sleeved with a gear and a gear toggle mechanism in the transmission mechanism is directly contact-coupled to the gear, so that the gear toggle mechanism toggles the gear to slide axially on the first shaft portion. During the drilling operation of electric tools with such a transmission mechanism, the gear, as the main transmission part, is always rotating, while the gear toggle mechanism contact-coupled to the gear is relatively still. A large amount of heat will be produced because of friction between the gear toggle mechanism and the gear to lead to the increase of the temperature of the lubricant inside the electric tools, while the flowing of the lubricant will lead to the increase of the overall temperature of the electric tools. On one hand, this may deform the plastic shell; on the other hand, this may also affect the overall sealing effect of the electric tools so that the leakage of lubricant is likely to occur, and as a result, the electric hammers may get dirty after used for a period of time. In addition, due to the direct contact between the gearshift and the gear, they will be severely worn over long time operation, thus wearing parts need to be frequently replaced and this will influence the operating sensibility of the gear toggle mechanism.

Summary of the Invention

[0004] To overcome the above drawbacks, a technical problem to be solved in the present invention is to provide a transmission switching device for electric hammer according to claim 1, the use of which may effectively improve the operating reliability of the electric hammers.

[0005] To solve the technical problem, the present invention provides the following technical solutions: a transmission switching device for electric hammers is provided, comprising a transmission mechanism, a gearshift and a knob connected with the gearshift, the transmission mechanism comprising an intermediate shaft provided thereon with an intermediate shaft gear, the intermediate shaft being provided with a transmission gear at one end and a pendulum bar bearing between the transmission gear and the intermediate shaft gear; the intermediate shaft is sleeved with a clearance therebetween with an intermediate shaft sleeve between the transmission gear and the intermediate shaft gear; a side face of the transmission gear, close to the intermediate shaft gear, extends outward to form connection portion sleeved with a clearance therebetween on the outer peripheral side of one end of the intermediate shaft sleeve far away from the intermediate shaft gear; an end of the pendulum bar gear, close to the transmission gear, is sleeved with a clearance therebetween on the outer peripheral side of the connection portion, while the other end of the pendulum bar bearing is sleeved with a clearance therebetween on the intermediate shaft sleeve; keyway fitting structures that fit each other are provided between the inner peripheral surface of the other end of the intermediate shaft sleeve and the intermediate shaft, between the outer peripheral surface of one end of the intermediate shaft sleeve and the inner peripheral surface of the connection portion, and between the inner peripheral surface of the other end of the pendulum bar bearing and the intermediate shaft sleeve; on the peripheral side of the other end of the intermediate shaft sleeve, provided is a displacement bearing, the inner ring of which is the intermediate shaft sleeve while the outer ring of which is provided with a groove inside which the gearshift is connected. The large gear in the electric hammers is connected with the intermediate shaft gear and the drill bit shaft, respectively, and the large gear may drive the drill bit shaft to rotate so that the electric hammers achieve drilling. The pendulum bar on the pendulum bar bearing is axially and obliquely disposed with respect to the pendulum bar bearing and connected to a cylinder rod that is connected with the drill bit shaft of the electric hammers. The rotation of the pendulum bar bearing drives the cylinder to act so as to realize impacting of the electric

hammers. The displacement action resulted from the rotation of the knob causes the intermediate shaft sleeve to move back and forth along the intermediate shaft via the gearshift to change the connection way in the transmission mechanism, so that the electrical hammers are allowed to switch among three operating modes, i.e., impacting, drilling and synchronization of impacting and drilling. The gearshift is contact-coupled to the displacement bearing, regardless of whether the intermediate shaft sleeve rotates, the gearshift and the outer ring of the shifting bearing are always relatively still, so there is no friction or wear and thus no heat. The problems in the prior art are fundamentally overcome.

[0006] Preferably, the outer ring of the displacement bearing axially extends outward along the intermediate shaft; the clearance between the inner peripheral surface of the extended portion on the outer ring and the outer peripheral surface of the intermediate shaft sleeve is far less than the diameter of a roll ball; and the groove is located on the outer peripheral surface of the extended portion. As a result, the outer ring of the displacement bearing is relatively large, facilitating the disposition of a structure for coupling to the gear toggle mechanism on the outer ring. The displacement bearing has good stability on the intermediate shaft sleeve, so that the outer ring in the displacement bearing may maintain good position stability during the rotation of the intermediate shaft sleeve.

[0007] Preferably, the inner diameter of the other end of the intermediate shaft sleeve is less than the outer diameter of the intermediate shaft gear and the outer diameter of the displacement bearings is greater than the inner diameter of the other end of the pendulum bar bearing. This facilitates the limit of the intermediate shaft sleeve when it axially moves back and forth on the intermediate shaft.

[0008] The keyway fitting structure may be a single-keyway fitting structure, a double-keyway fitting structure or a cotterway fitting structure, preferably, a spline fitting structure. The spline fitting structure facilitates the switch of connection ways between the key and the slot and it is also advantageous to the stationarity of transmission.

[0009] Preferably, the distance from the end face of an inner end of a spline structure on the inner peripheral surface of the connection portion to the outer end face of a spline structure on the inner peripheral surface of the other end of the pendulum bar bearing is less than the maximum distance from the end face of inner end of the spline structure on the inner peripheral surface of the connection portion to the end face close to one end of the connection portion of a spline structure by which the intermediate shaft sleeve is fitted with the pendulum bar bearing, and the space between two opposite end faces of two spline structures on the outer peripheral surface of the intermediate shift sleeve is greater than the length of a spline structure on the pendulum bar bearing. In this way, when the intermediate shaft sleeve moves to be resisted against the intermediate shaft gear, the spline connection between the pendulum bar bearing and the intermediate shaft sleeve may be released to realize simply the drilling mode of the electric hammer.

[0010] Preferably, the minimum distance from the end face of the inner end of the spline structure on the inner peripheral surface of the connection portion to the end face of the other end of the intermediate shaft sleeve is less than the distance from the end face of the inner end of the spline structure on the inner peripheral surface of the connection portion to the end face of one end of the spline structure on the intermediate shaft close to the connection portion. In this way, when the intermediate shaft sleeve moves to be resisted against the pendulum bar bearing, the spline connection between the intermediate shaft sleeve and the intermediate shaft may be released to realize simply the impacting mode of the electric hammer.

[0011] Preferably, the pendulum bar bearing is provided with a positioning bearing on one side close to the transmission gear, the inner ring of the pendulum bar bearing being integrated with the inner ring of the positioning bearing, the outer ring of the positioning bearing extending outward to form a positioning plate that is in fixed connection with a positioning seat of an electric hammer. Then, the outside of the pendulum bar bearing is provided with a positioning bearing sharing the inner ring with the pendulum bar bearing, so that the pendulum bar bearing may rotate circumferentially and meanwhile be effectively positioned axially.

[0012] Preferably, the gearshift comprises a first toggle member, a second toggle member, a clamping member, a pin shaft and a spring; the pin shaft is arranged to be parallel to the intermediate shaft; two ends of both the first toggle member and the second toggle member extend along one side respectively to form side walls, so that both the first toggle member and the second toggle member are U-shaped as a whole; the pin shaft passes through the two side walls of the first toggle member and the second toggle member, respectively, with a clearance therebetween, one side wall of the first toggle member being located between the two side walls of the second toggle member while the other side wall of the first toggle member being located on the outside of one side wall of the second toggle member; the spring is sleeved on the pin shaft with a clearance therebetween, one end of the spring being resisted against one side wall of the first toggle member while the other end of the spring being resisted against one side wall of the second toggle member; one end of the clamping member is sleeved on the pin shaft with a clearance therebetween while the other end of the clamping member is provided with a forked foot fitted with the groove, the forked foot being clamped into the groove, the clamping member being located between the other side wall of the first toggle member and one side wall of the second toggle member; and, the first toggle member extends towards the outside of the other side wall to form a first L-shaped toggle foot and the second toggle member extends towards the outside of one

side wall to form a second N-shaped toggle foot, a toggle rod offset by the knob being connected between the first toggle foot and the second toggle foot. The offset toggle rod generates a displacement due to the rotation of the knob. The displacement of the toggle rod is transferred to the clamping member via the spring to push the intermediate shaft sleeve to axially move back and forth along the intermediate shaft and thus to change the connection relation between the spline structure on the intermediate shaft sleeve and the spline structures on the intermediate shaft, the pendulum bar bearing and the connection portion, further to realize functions of drilling, hammering, and synchronization of drilling and hammering. As the spring has good elasticity controllability and fast response speed so that it may push the intermediate shaft sleeve to act instantaneously, there is no tooth breakage when the spline fitting structures restore to be engaged with each other. Consequently, the service life of various fitting members can be prolonged and no manual adjustment of the operating personnel is required during the gear shifting, so that the working efficiency is improved and the personal safety of the operating personnel is ensured.

[0013] Preferably, between one side wall of the first toggle member and the other side wall of the second toggle member, the pin shaft is also provided with a positioning member, one end of which is sleeved on the pin shaft with a clearance therebetween while the other end of which is provided with a tooth groove fitted with the profile of teeth of the intermediate shaft gear. In the hammering state of the electric hammer, the tooth groove of the positioning member is engaged with the intermediate shaft gear so as to ensure that the intermediate shaft gear will not rotate and thus to improve the quality of work.

[0014] Therefore, the present invention has the following advantages. First, as the intermediate gear has no friction with the gear toggle mechanism during the transmission, the first bearing generates a small amount of friction heat during the rotation so that a large amount of heat will not be generated inside the electric hammer when the electric hammer operates in the drilling mode. This will help maintain the shape of the plastic shell of the electric hammer and the whole electric hammer is not likely to get hot. As the temperature of lubricant will not increase a lot during the operating of the electric hammer, the sealing performance of the liquid sealing structure inside the electric hammer will not be greatly influenced and the electric hammer is no likely to surrfer oil leakage. Therefore, the service life of the electric hammer can be prolonged effectively and thus frequent maintenance to the electric hammer is not required. The gear toggle mechanism will not have friction with the intermediate gear during the operating of the electric hammer, thus the gear toggle mechanism has low wear and the operating sensibility of the gear toggle mechanism can be effectively ensured.

[0015] Second, the present invention has simple structure, rational design and convenient manufacturing, and may complete gear shifting even the electric hammer does not shut down. This may not only avoid tooth breakage, but also ensure the personal safety of the operating personnel. Thus both the productivity and the quality of work are improved.

Brief Description of the Drawings

[0016]

Fig. 1 is a sectional view of an electric hammer with the transmission switching device according to the present invention;

Fig. 2 is a three-dimensional view of the transmission switching device according to the present invention; and,

Fig. 3 is a sectional view of the transmission mechanism according to the present invention.

[0017] In the drawings: 1-Transmission mechanism; 2-Gearshift; 3-Positioning seat; 4-Intermediate shaft; 5-Intermediate shaft gear; 6-Displacement bearing; 7-Intermediate shaft sleeve; 8-Pendulm bearing; 9-Positioning bearing; 10-Transmission gear; 11-Pin shaft; 12-First toggle foot; 13-Forked foot; 14-Seceond toggle foot; 15-Clamping member; 16-First toggle member; 17-Spring; 18-Second toggle member; 19-Positioning member; 20-Tooth groove; 21-Groove; 22-Connection portion; 23-Positioning plate; 24-Extended portion.

Detailed Description of the Invention

[0018] The technical solutions of the present invention will be further described in details as below by preferred embodiments with reference to the accompanying drawings.

Embodiment

[0019] As shown in Fig.1, the transmission switching device for electric hammers of the present invention is disposed in an electric hammer, comprising a transmission mechanism 1, gearshift 2 and a knob connected with the gearshift 2 (not shown).

[0020] As shown in Fig. 2 and Fig. 3, the transmission mechanism 1 includes an intermediate shaft 4 on which an intermediate shaft gear 5 integrated with the intermediate shaft 4 is provided. The intermediate shaft 4 is provided with a transmission gear 10 at one end and a pendulum bar bearing 8 between the transmission gear 10 and the intermediate shaft gear 5. The intermediate shaft 4 is sleeved with a clearance therebetween with an intermediate shaft sleeve 7 between the transmission gear 10 and the intermediate shaft gear 5; one side face of the transmission gear 10, close to the intermediate shaft gear 5, extends outward to form connection portion 22 sleeved with a clearance therebetween on the outer peripheral side of one end of the intermediate shaft sleeve

7 far away from the intermediate shaft gear 5; an end of the pendulum bar gear 8, close to the transmission gear 10, is sleeved with a clearance therebetween on the outer peripheral side of the connection portion 22, while the other end of the pendulum bar bearing 8 is sleeved with a clearance therebetween on the intermediate shaft sleeve 7; keyway fitting structures that fit each other are provided between the inner peripheral surface of the other end of the intermediate shaft sleeve 7 and the intermediate shaft 4, between the outer peripheral surface of one end of the intermediate shaft sleeve 7 and the inner peripheral surface of the connection portion 22, and between the inner peripheral surface of the other end of the pendulum bar bearing 8 and the intermediate shaft sleeve 7. The distance from the end face of an inner end of a spline structure on the inner peripheral surface of the connection portion 22 to the outer end face of a spline structure on the inner peripheral surface of the other end of the pendulum bar bearing 8 is less than the maximum distance from the end face of the inner end of the spline structure on the inner peripheral surface of the connection portion 22 to the end face close to one end of the connection portion 22 of a spline structure by which the intermediate shaft sleeve 7 is fitted with the pendulum bar bearing 8, and the space between two opposite end faces of two spline structures on the outer peripheral surface of the intermediate shift sleeve 7 is greater than the length of a spline structure on the pendulum bar bearing 8; and the minimum distance from the end face of the inner end of the spline structure on the inner peripheral surface of the connection portion 22 and the end face of the other end of the intermediate shaft sleeve 7 is less than the distance from the end face of the inner end of the spline structure on the inner peripheral surface of the connection portion 22 to the end face of one end of the spline structure on the intermediate shaft 4 close to the connection portion 22. The inner diameter of the other end of the intermediate shaft sleeve 7 is less than the outer diameter of the intermediate shaft gear 5. On the peripheral side of the other end of the intermediate shaft sleeve 7, provided is a displacement bearing 6, the inner ring of which is the intermediate shaft sleeve 7. The outer ring of the displacement bearing 6 axially extends outward towards one side of the pendulum bar bearing 8 along the intermediate shaft 4; the clearance between the inner peripheral surface of the extended portion 24 on the outer ring and the outer peripheral surface of the intermediate shaft sleeve 7 is far less than the diameter of a roll ball; the outer diameter of the displacement bearing 6 is greater than the inner diameter of the other end of the pendulum bar bearing 8; and the groove 21 is located on the outer peripheral surface of the extended portion 24.

[0021] As shown in Fig.2, the gearshift comprises a first toggle member 16, a second toggle member 18, a clamping member 15, a pin shaft 11 and a spring 17; the pin shaft 11 is arranged to be parallel to the intermediate shaft 4; two ends of both the first toggle member 16 and the second toggle member 18 extend along one side respectively to form side walls, so that both the first toggle member 16 and the second toggle member 18 are U-shaped as a whole; the pin shaft 11 passes through the two side walls of the first toggle member 16 and the second toggle member 18, respectively, with a clearance therebetween, one side wall of the first toggle member 16 being located between the two side walls of the second toggle member 18, while the other side wall of the first toggle member 16 being located on the outside of one side wall of the second toggle member18; the spring 17 is sleeved on the pin shaft 11 with a clearance therebetween, one end of the spring 17 being resisted against one side wall of the first toggle member 16 while the other end of the spring 17 being resisted against one side wall of the second toggle member 18; one end of the clamping member 15 is sleeved on the pin shaft 11 with a clearance therebetween while the other end of the clamping member 15 is provided with a forked foot 13 fitted with the groove 21, the forked foot 13 being clamped into the groove 21; the clamping member 15 is located between the other side wall of the first toggle member 16 and one side wall of the second toggle member 18; and, the first toggle member 16 extends towards the outside of the other side wall to form a first L-shaped toggle foot 12 and the second toggle member 18 extends towards the outside of one side wall to form a second N-shaped toggle foot 14, a toggle rod offset by the knob being connected between the first toggle foot 12 and the second toggle foot 14. Between one side wall of the first toggle member 16 and the other side wall of the second toggle member 18, the pin shaft 11 is also provided with a positioning member 19, one end of which is sleeved on the pin shaft 11 with a clearance therebetween while the other end of which is provided with a tooth groove 20 fitted with the profile of teeth of the intermediate shaft gear 5.

[0022] As shown in Fig. 1, Fig. 2 or Fig. 3, one side of the pendulum bar bearing 8, close to the transmission gear 10, is provided with a positioning bearing 9, and the inner ring of the pendulum bar bearing 8 is integrated with the inner ring of the positioning bearing 9 while the outer ring of the positioning bearing 9 extends outward to form a positioning plate 23 that is in fixed connection with a positioning seat 3 for the electric hammer.

[0023] In the electric hammer, the intermediate shaft gear 5 is engaged with a large gear that is in fixed connection with the drill bit shaft of the electric hammer, and the pendulum bar on the pendulum bar bearing 8 is connected with a cylinder connected to the drill bit shaft of the electric hammer.

[0024] The operating principles of the transmission switching device for electric hammers are as follows: the offset toggle rod generates a displacement due to the rotation of the knob; the displacement of the toggle rod is transferred to the first toggle member 16 via the first toggle foot 12, then transferred from the first toggle member 16 to the second toggle member 18 via the spring 17, and then transferred from the second toggle member

18 to a forked foot 13 via the clamping member 15; and, as the forked foot 13 is clamped into the groove 21 of the displacement bearing 6, the intermediate shaft sleeve 7 is pushed to move towards one side of the pendulum bar bearing 8, and simultaneously, the positioning member 19 moves in a the same direction as the intermediate shaft sleeve 7 under the driving of the second toggle member 18. Alternatively, the displacement of the toggle rod is transferred to the second toggle member 18 via the second toggle foot 14, then transferred from the second toggle member 18 to the first toggle member 16 via the spring 17, and then transferred from the first toggle member 16 to the forked foot 13 via the clamping member 15; and, as the forked foot 13 is clamped into the groove 21 of the displacement bearing 6, the intermediate shaft sleeve 7 is pushed to move towards one side of the intermediate shaft gear 5, and simultaneously the positioning member 19 moves in the same direction as the intermediate shaft sleeve 7 under the driving of the first toggle member 16. When the intermediate shaft sleeve 7 moves to be resisted against the pendulum bar bearing 8, the spline connection between the intermediate shaft sleeve 7 and the intermediate shaft 4 is released, the tooth groove 20 on the positioning member 19 is engaged with the intermediate shaft gear 5, and the intermediate shaft sleeve 7 is engaged with the pendulum bar bearing 8 and the transmission gear 10 only. In this way, the power of the transmission gear 10 is transferred to the pendulum bar 8 only, and the pendulum bar on the pendulum bar bearing 8 thus pushes the drill bit shaft of the electric hammer to realize simply the impacting mode. When the intermediate shaft sleeve 7 moves to be resisted against the intermediate shaft gear 5, the spline connection between the pendulum bar bearing 8 and the intermediate shaft sleeve 7 is released, the tooth groove 20 on the positioning member 19 is disengaged from the intermediate shaft gear 5, and the intermediate shaft sleeve 7 is engaged with the intermediated shaft 4 and the transmission gear 10 only. In this way, the power of the transmission gear 10 is transferred to the intermediate shaft 4 only, and then transferred from the intermediate shaft 4 to the large gear engaged with the intermediate shaft gear 5 via the intermediate shaft gear 5. The rotation of the large gear pushes the drill bit shaft of the electric hammer to realize simply the drilling mode. When the intermediate shaft sleeve 7 is in the intermediate state, the intermediate shaft sleeve 7 is engaged with the intermediate shaft 4, the pendulum bar bearing 8 and the transmission gear 10, respectively, and the tooth groove 20 on the positioning member 19 is disengaged from the intermediate shaft gear 5. In this way, the drill bit shaft of the electric hammer may realize both the hammering mode and the drilling mode. In addition, during the rotation of the intermediate shaft sleeve 7, the outer ring of the displacement bearing 6 and the forked foot 13 are relatively still.

[0025] The embodiments described above are just preferred solutions of the present invention, and shall not be understood to form any limit in any form to the present invention.

Claims

1. A transmission switching device for electric hammers, comprising a transmission mechanism (1), a gearshift (2) and a knob connected with the gearshift (2), the transmission mechanism comprising an intermediate shaft (4) provided thereon with an intermediate shaft gear (5), the intermediate shaft (4) being provided with a transmission gear (10) at one end and a pendulum bar bearing (8) between the transmission gear (10) and the intermediate shaft gear (5), **characterized in that** the intermediate shaft (4) is sleeved with an intermediate shaft sleeve (7) between the transmission gear (10) and the intermediate shaft gear (5) with a clearance therebetween; a side face of the transmission gear (10), close to the intermediate shaft gear (5), extends outward to form a connection portion (22) sleeved with a clearance therebetween on the outer peripheral side of one end of the intermediate shaft sleeve (7) far away from the intermediate shaft gear (5); an end of the pendulum bar bearing (8), close to the transmission gear, is sleeved with a clearance therebetween on the outer peripheral side of the connection portion (22), while the other end of the pendulum bar bearing (8) is sleeved with a clearance therebetween on the intermediate shaft sleeve (7); keyway fitting structures that fit each other are provided between the inner peripheral surface of the other end of the intermediate shaft sleeve (7) and the intermediate shaft (4), between the outer peripheral surface of one end of the intermediate shaft sleeve (7) and the inner peripheral surface of the connection portion (22), and between the inner peripheral surface of the other end of the pendulum bar bearing (8) and the intermediate shaft sleeve (7); on the peripheral side of the other end of the intermediate shaft sleeve (7), provided is a displacement bearing (6), the inner ring of which is the intermediate shaft sleeve (7) while the outer ring of which is provided with a groove inside which the gearshift (2) is connected.

2. The transmission switching device for electric hammers according to claim 1, is **characterized in that** the outer ring of the displacement bearing (6) axially extends outward along the intermediate shaft (4); the clearance between the inner peripheral surface of the extended portion (24) on the outer ring and the outer peripheral surface of the intermediate shaft sleeve (7) is far less than the diameter of a roll ball; and the groove (21) is positioned on the outer peripheral surface of the extended portion (24).

3. The transmission switching device for electric ham-

mers according to claim 2, is **characterized in that** the inner diameter of the other end of the intermediate shaft sleeve (7) is less than the outer diameter of the intermediate shaft gear (5) and the outer diameter of the displacement bearing (6) is greater than the inner diameter of the other end of the pendulum bar bearing (8).

4. The transmission switching device for electric hammers according to claims 1 or 2 or 3, is **characterized in that** the keyway fitting structures are spline fitting structures.

5. The transmission switching device for electric hammers according to claim 4, is **characterized in that** the distance from the end face of an inner end of a spline structure on the inner peripheral surface of the connection portion (22) to the outer end face of a spline structure on the inner peripheral surface of the other end of the pendulum bar bearing (8) is less than the maximum distance from the end face of inner end of the spline structure on the inner peripheral surface of the connection portion (22) to the end face close to one end of the connection portion of a spline structure by which the intermediate shaft sleeve (7) is fitted with the pendulum bar bearing (8), and the space between two opposite end faces of two spline structures on the outer peripheral surface of the intermediate shaft sleeve (7) is greater than the length of a spline structure on the pendulum bar bearing (8).

6. The transmission switching device for electric hammers according to claim 4, is **characterized in that** the minimum distance from the end face of the inner end of the spline structure on the inner peripheral surface of the connection portion (22) to the end face of the other end of the intermediate shaft sleeve (7) is less than the distance from the end face of the inner end of the spline structure on the inner peripheral surface of the connection portion (22) to the end face of one end of the spline structure on the intermediate shaft (4) close to the connection portion (22).

7. The transmission switching device for electric hammers according to claim 1, is **characterized in that** the pendulum bar bearing (8) is provided with a positioning bearing on one side close to the transmission gear (10), the inner ring of the pendulum bar bearing (8) being integrated with the inner ring of the positioning bearing, the outer ring of the positioning bearing extending outward to form a positioning plate that is in fixed connection with a positioning seat of an electric hammer.

8. The transmission switching device for electric hammers according to claims 1, 2, 3, or 7, is **characterized in that** the gearshift (2) comprises a first toggle member (16), a second toggle member (18), a clamping member (15), a pin shaft (11) and a spring (17); the pin shaft (11) is arranged to be parallel to the intermediate shaft (4); two ends of both the first toggle member (16) and the second toggle member (18) extend along one side respectively to form side walls, so that both the first toggle member (16) and the second toggle member (18) are U-shaped as a whole; the pin shaft (11) passes through the two side walls of the first toggle member (16) and the second toggle member (18), respectively, with a clearance therebetween; one side wall of the first toggle member (16) being located between the two side walls of the second toggle member (18) while the other side wall of the first toggle member (16) being located on the outside of one side wall of the second toggle member (18); the spring (17) is sleeved on the pin shaft (11) with a clearance therebetween, one end of the spring (17) being resisted against one side wall of the first toggle member (16), while the other end of the spring (17) being resisted against one side wall of the second toggle member (18); one end of the clamping member (15) is sleeved on the pin shaft (11) with a clearance therebetween while the other end of the clamping member (15) is provided with a forked foot (13) fitted with the groove (21), the forked foot (13) being clamped into the groove (21), the clamping member (15) being located between the other side wall of the first toggle member (16) and one side wall of the second toggle member (18); and, the first toggle member (16) extends towards the outside of the other side wall to form a first L-shaped toggle foot (12) and the second toggle member (18) extends towards the outside of one side wall to form a second N-shaped toggle foot (14), a toggle rod offset by the knob being connected between the first toggle foot (12) and the second toggle foot (18).

9. The transmission switching device for electric hammers according to claim 8, is **characterized in that**, between one side wall of the first toggle member (16) and the other side wall of the second toggle member (18), the pin shaft (11) is also provided with a positioning member (19), one end of which is sleeved on the pin shaft (11) with a clearance therebetween while the other end of which is provided with a tooth groove (20) fitted with the profile of teeth of the intermediate shaft gear (5).

Patentansprüche

1. Übertragungsumschaltvorrichtung für elektrische Hämmer, umfassend einen Übertragungsmechanismus (1), einen Schalthebel (2) und einen Drehknopf, der mit dem Schalthebel (2) verbunden ist, wobei der Übertragungsmechanismus umfasst: eine Zwischenwelle (4), die daran mit einem Zwischenwel-

lengetriebe (5) bereitgestellt ist, wobei die Zwischenwelle (4) mit einem Übersetzungsgetriebe (10) an einem Ende und einem Pendelstangenlager (8) zwischen dem Übersetzungsgetriebe (10) und dem Zwischenwellengetriebe (5) bereitgestellt ist, **dadurch gekennzeichnet, dass** die Zwischenwelle (4) mit einer Zwischenwellenhülse (7) zwischen dem Übersetzungsgetriebe (10) und dem Zwischenwellengetriebe (5) mit einem Abstand dazwischen umhüllt ist; sich eine Seitenfläche des Übersetzungsgetriebes (10) in Nähe des Zwischenwellengetriebes (5) nach außen erstreckt, um einen Verbindungsabschnitt (22) zu bilden, der mit einem Abstand dazwischen auf der äußeren Umfangsseite eines Endes der Zwischenwellenhülse (7) entfernt von dem Zwischenwellengetriebe (5) umhüllt ist; ein Ende des Pendelstangenlagers (8) in Nähe des Übersetzungsgetriebes mit einem Abstand dazwischen auf der äußeren Umfangsseite des Verbindungsabschnitts (22) umhüllt ist, während das andere Ende des Pendelstangenlagers (8) mit einem Abstand dazwischen an der Zwischenwellenhülse (7) umhüllt ist; Keilnutbefestigungsstrukturen, die zueinander passen, zwischen der inneren Umfangsoberfläche des anderen Endes der Zwischenwellenhülse (7) und der Zwischenwelle (4), zwischen der äußeren Umfangsoberfläche eines Endes der Zwischenwellenhülse (7) und der inneren Umfangsoberfläche des Verbindungsabschnitts (22) und zwischen der inneren Umfangsoberfläche des anderen Endes des Pendelstangenlagers (8) und der Zwischenwellenhülse (7) bereitgestellt sind; auf der Umfangsseite des anderen Endes der Zwischenwellenhülse (7) ein Verstelllager (6) bereitgestellt ist, dessen innerer Ring die Zwischenwellenhülse (7) ist, während der äußere Ring mit einer Nut darin bereitgestellt ist, mit welcher der Schalthebel (2) verbunden ist.

2. Übertragungsumschaltvorrichtung für elektrische Hämmer nach Anspruch 1, **dadurch gekennzeichnet, dass** sich der äußere Ring des Verstelllagers (6) entlang der Zwischenwelle (4) axial nach außen erstreckt; dass der Abstand zwischen der inneren Umfangsoberfläche des erweiterten Abschnitts (24) am äußeren Ring und der äußeren Umfangsoberfläche der Zwischenwellenhülse (7) viel geringer als der Durchmesser eines Rollballs ist; und dadurch, dass die Nut (21) auf der äußeren Umfangsoberfläche des erweiterten Abschnitts (24) angeordnet ist.

3. Übertragungsumschaltvorrichtung für elektrische Hämmer nach Anspruch 2, **dadurch gekennzeichnet, dass** der Innendurchmesser des anderen Endes der Zwischenwellenhülse (7) kleiner als der Außendurchmesser des Zwischenwellengetriebes (5) ist, und der Außendurchmesser des Verstelllagers (6) größer als der Innendurchmesser des anderen Endes des Pendelstangenlagers (8) ist.

4. Übertragungsumschaltvorrichtung für elektrische Hämmer nach einem der Ansprüche 1 oder 2 oder 3, **dadurch gekennzeichnet, dass** die Keilnutbefestigungsstrukturen Splineanpassungsstrukturen sind.

5. Übertragungsumschaltvorrichtung für elektrische Hämmer nach Anspruch 4, **dadurch gekennzeichnet, dass** der Abstand von der Endfläche eines inneren Endes einer Splinestruktur auf der inneren Umfangsoberfläche des Verbindungsabschnitts (22) zur äußeren Endfläche der Splinestruktur auf der inneren Umfangsoberfläche des äußeren Endes des Pendelstangenlagers (8) kleiner als der maximale Abstand von der Endfläche des inneren Endes der Splinestruktur auf der inneren Umfangsoberfläche des Verbindungsabschnitts (22) zur Endfläche nahe des einen Endes des Verbindungsabschnitts einer Splinestruktur ist, über welche die Zwischenwellenhülse (7) in das Pendelstangenlager (8) eingepasst ist, und wobei der Raum zwischen zwei gegenüberliegenden Endflächen der zwei Splinestrukturen auf der äußeren Umfangsoberfläche der Zwischenwellenhülse (7) größer als die Länge einer Splinestruktur am Pendelstangenlager (8) ist.

6. Übertragungsumschaltvorrichtung für elektrische Hämmer nach Anspruch 4, **dadurch gekennzeichnet, dass** der minimale Abstand von der Endfläche des inneren Endes der Splinestruktur auf der inneren Umfangsoberfläche des Verbindungsabschnitts (22) zur Endfläche des äußeren Endes der Zwischenwellenhülse (7) kleiner als der Abstand von der Endfläche des inneren Endes der Splinestruktur auf der inneren Umfangsoberfläche des Verbindungsabschnitts (22) zur Endfläche des einen Endes der Splinestruktur auf der Zwischenwelle (4) nahe des Verbingungsabschnitts (22) ist.

7. Übertragungsumschaltvorrichtung für elektrische Hämmer nach Anspruch 1, **dadurch gekennzeichnet, dass** das Pendelstangenlager (8) mit einem Positionierlager auf einer Seite in Nähe des Übersetzungsgetriebes (10) bereitgestellt ist, wobei der innere Ring des Pendelstangenlagers (8) im inneren Ring des Positionierlagers integriert ist, wobei sich der äußere Ring des Positionierlagers nach außen zum Bilden einer Positionierungsplatte erstreckt, die in fester Verbindung mit einem Positionierungssitz eines elektrischen Hammer steht.

8. Übertragungsumschaltvorrichtung für elektrischen Hämmer nach einem der Ansprüche 1, 2, 3 oder 7, **dadurch gekennzeichnet, dass** der Schalthebel (2) ein erstes Kippschaltelement (16), ein zweites Kippschaltelement (18), ein Klemmelement (15), eine Stiftachse (11) und eine Feder (17) umfasst; die Stiftachse (11) parallel zur Zwischenwelle (4) ange-

ordnet ist; sich zwei Enden des ersten Kippschaltelements (16) und des zweiten Kippschaltelements (18) entlang jeweils einer Seite erstrecken, um Seitenwände zu bilden, sodass das erste Kippschaltelement (16) und das zweite Kippschaltelement (18) insgesamt U-förmig sind; die Stiftachse (11) die zwei Seitenwände des ersten Kippschaltelements (16) bzw. zweiten Kippschaltelements (18) mit einem Abstand dazwischen durchläuft; eine Seitenwand des ersten Kippschaltelements (16) zwischen den zwei Seitenwänden des zweiten Kippschaltelements (18) angeordnet ist, während die andere Seitenwand des ersten Kippschaltelements (16) auf der Außenseite einer Seitenwand des zweiten Kippschaltelements (18) angeordnet ist; die Feder (17) an der Stiftachse (11) mit einem Abstand dazwischen umhüllt ist, wobei ein Ende der Feder (17) gegen eine Seitenwand des ersten Kippschaltelements (16) drückt, während das andere Ende der Feder (17) gegen eine Seitenwand des zweiten Kippschaltelements (18) drückt; ein Ende des Klemmelements (15) an der Stiftachse (11) mit einem Abstand dazwischen umhüllt ist, während das andere Ende des Klemmelements (15) mit einem gegabelten Fuß (13) bereitgestellt ist, der in die Nut (21) eingepasst ist, wobei der gegabelte Fuß (13) in die Nut (21) geklemmt ist, wobei das Klemmelement (15) zwischen der anderen Seitenwand des ersten Kippschaltelements (16) und einer Seitenwand des zweiten Kippschaltelements (18) angeordnet ist; und dadurch, dass sich das erste Kippschaltelement (16) zur Außenseite der anderen Seitenwand zum Bilden eines L-förmigen Kippschalterfußes (12) erstreckt und sich das zweite Kippschaltelement (18) zur Außenseite einer Seitenwand zum Bilden eines zweiten N-förmigen Kippschalterfußes (14) erstreckt, wobei eine Kippschaltstange, die von dem Knopf versetzt ist, zwischen dem ersten Kippschalterfuß (12) und dem zweiten Kippschalterfuß (18) verbunden ist.

9. Übertragungsumschaltvorrichtung für elektrische Hämmer nach Anspruch 8, **dadurch gekennzeichnet, dass** zwischen einer Seitenwand des ersten Kippschaltelements (16) und der anderen Seitenwand des zweiten Kippschaltelements (18) die Stiftachse (11) auch mit einem Positionierungselement (19) bereitgestellt ist, dessen eines Ende an der Stiftachse (11) mit einem Abstand dazwischen umhüllt ist, während das andere Ende davon mit einer Zahnnut (20) bereitgestellt ist, die in das Profil von Zähnen des Zwischenwellengetriebes (5) eingepasst ist.

Revendications

1. Dispositif de commutation de transmission pour marteaux électriques, comprenant un mécanisme de transmission (1), un levier de changement de vitesses (2) et un bouton connecté au levier de changement de vitesses (2), le mécanisme de transmission comprenant un arbre intermédiaire (4) prévu sur celui-ci avec un engrenage d'arbre intermédiaire (5), l'arbre intermédiaire (4) étant pourvu d'un engrenage de transmission (10) à une extrémité et d'un palier de barre de pendule (8) entre l'engrenage de transmission (10) et l'engrenage d'arbre intermédiaire (5), **caractérisé en ce que** l'arbre intermédiaire (4) est manchonné avec un manchon d'arbre intermédiaire (7) entre l'engrenage de transmission (10) et l'engrenage d'arbre intermédiaire (5) avec un dégagement entre eux ; une face latérale de l'engrenage de transmission (10), proche de l'engrenage d'arbre intermédiaire (5), s'étend vers l'extérieur pour former une portion de connexion (22) manchonnée avec un dégagement entre eux sur le côté périphérique externe d'une extrémité du manchon d'arbre intermédiaire (7) à distance de l'engrenage d'arbre intermédiaire (5) ; une extrémité du palier de barre de pendule (8), proche de l'engrenage de transmission, est manchonnée avec un dégagement entre eux, sur le côté périphérique externe de la portion de connexion (22), tandis que l'autre extrémité du palier de barre de pendule (8) est manchonnée avec un dégagement entre eux sur le manchon d'arbre intermédiaire (7) ; des structures d'ajustement à rainure de clavette qui s'ajustent les unes aux autres sont prévues entre la surface périphérique interne de l'autre extrémité du manchon d'arbre intermédiaire (7) et l'arbre intermédiaire (4), entre la surface périphérique externe d'une extrémité du manchon d'arbre intermédiaire (7) et la surface périphérique interne de la portion de connexion (22) et entre la surface périphérique interne de l'autre extrémité du palier de barre de pendule (8) et le manchon d'arbre intermédiaire (7) ; sur le côté périphérique de l'autre extrémité du manchon d'arbre intermédiaire (7), est prévu un palier de déplacement (6), dont la bague interne est le manchon d'arbre intermédiaire (7) tandis que sa bague externe est pourvue d'une gorge à l'intérieur de laquelle est connecté le levier de changement de vitesses (2).

2. Dispositif de commutation de transmission pour marteaux électriques selon la revendication 1, **caractérisé en ce que** la bague externe du palier de déplacement (6) s'étend axialement vers l'extérieur le long de l'arbre intermédiaire (4) ; le dégagement entre la surface périphérique interne de la portion prolongée (24) sur la bague externe et la surface périphérique externe du manchon d'arbre intermédiaire (7) est nettement inférieur au diamètre d'une bille de roulement ; et la gorge (21) est positionnée sur la surface périphérique externe de la portion prolongée (24).

3. Dispositif de commutation de transmission pour marteaux électriques selon la revendication 2, **caractérisé en ce que** le diamètre intérieur de l'autre extrémité du manchon d'arbre intermédiaire (7) est inférieur au diamètre extérieur de l'engrenage d'arbre intermédiaire (5) et le diamètre extérieur du palier de déplacement (6) est supérieur au diamètre intérieur de l'autre extrémité du palier de barre de pendule (8).

4. Dispositif de commutation de transmission pour marteaux électriques selon la revendication 1 ou 2 ou 3, **caractérisé en ce que** les structures d'ajustement à rainure de clavette sont des structures d'ajustement à cannelure.

5. Dispositif de commutation de transmission pour marteaux électriques selon la revendication 4, **caractérisé en ce que** la distance de la face d'extrémité d'une extrémité interne d'une structure de cannelure sur la surface périphérique interne de la portion de connexion (22) à la face d'extrémité externe d'une structure de cannelure sur la surface périphérique interne de l'autre extrémité du palier de barre de pendule (8) est inférieure à la distance maximale de la face d'extrémité de l'extrémité interne de la structure de cannelure sur la surface périphérique interne de la portion de connexion (22) à la face d'extrémité proche d'une extrémité de la portion de connexion d'une structure de cannelure par laquelle le manchon d'arbre intermédiaire (7) est ajusté avec le palier de barre de pendule (8), et l'espace entre deux faces d'extrémité opposées de deux structures de cannelure sur l'autre surface périphérique du manchon d'arbre intermédiaire (7) est supérieur à la longueur d'une structure de cannelure sur le palier de barre de pendule (8).

6. Dispositif de commutation de transmission pour marteaux électriques selon la revendication 4, **caractérisé en ce que** la distance minimale de la face d'extrémité de l'extrémité interne de la structure de cannelure sur la surface périphérique interne de la portion de connexion (22) à la face d'extrémité de l'autre extrémité du manchon d'arbre intermédiaire (7) est inférieure à la distance de la face d'extrémité de l'extrémité interne de la structure de cannelure sur la surface périphérique interne de la portion de connexion (22) à la face d'extrémité d'une extrémité de la structure de cannelure sur l'arbre intermédiaire (4) à proximité de la portion de connexion (22).

7. Dispositif de commutation de transmission pour marteaux électriques selon la revendication 1, **caractérisé en ce que** le palier de barre de pendule (8) est pourvu d'un palier de positionnement sur un côté proche de l'engrenage de transmission (10), la bague interne du palier de barre de pendule (8) étant intégrée à la bague interne du palier de positionnement, la bague externe du palier de positionnement s'étendant vers l'extérieur pour former une plaque de positionnement qui est connectée de manière fixe à un siège de positionnement d'un marteau électrique.

8. Dispositif de commutation de transmission pour marteaux électriques selon la revendication 1, 2, 3 ou 7, **caractérisé en ce que** le levier de changement de vitesses (2) comprend un premier organe de basculement (16), un deuxième organe de basculement (18), un organe de serrage (15), un arbre de broche (11) et un ressort (17), l'arbre de broche (11) étant prévu pour être parallèle à l'arbre intermédiaire (4) ; deux extrémités du premier organe de basculement (16) et du deuxième organe de basculement (18) s'étendant le long d'un côté respectif pour former des parois latérales, de telle sorte que le premier organe de basculement (16) et le deuxième organe de basculement (18) soient ensemble en forme de U ; l'arbre de broche (11) passe à travers les deux parois latérales du premier organe de basculement (16) et du deuxième organe de basculement (18), respectivement, avec un dégagement entre eux ; une paroi latérale du premier organe de basculement (16) étant située entre les deux parois latérales du deuxième organe de basculement (18) tandis que l'autre paroi latérale du premier organe de basculement (16) est située sur l'extérieur d'une paroi latérale du deuxième organe de basculement (18) ; le ressort (17) est manchonné sur l'arbre de broche (11) avec un dégagement entre eux, une extrémité du ressort (17) étant pressée contre une paroi latérale du premier organe de basculement (16), tandis que l'autre extrémité du ressort (17) est pressée contre une paroi latérale du deuxième organe de basculement (18) ; une extrémité de l'organe de serrage (15) est manchonnée sur l'arbre de broche (11) avec un dégagement entre eux tandis que l'autre extrémité de l'organe de serrage (15) est pourvue d'un pied fourchu (13) ajusté avec la gorge (21), le pied fourchu (13) étant serré dans la gorge (21), l'organe de serrage (15) étant situé entre l'a paroi latérale du premier organe de basculement (16) et une paroi latérale du deuxième organe de basculement (18) ; et le premier organe de basculement (16) s'étend vers l'extérieur de l'autre paroi latérale pour former un premier pied de basculement en forme de L (12) et le deuxième organe de basculement (18) s'étend vers l'extérieur d'une paroi latérale pour former un deuxième pied de basculement en forme de N (14), une tige de basculement décalée par le bouton étant connectée entre le premier pied de basculement (12) et le deuxième pied de basculement (18).

9. Dispositif de commutation de transmission pour marteaux électriques selon la revendication 8, **caracté-**

risé en ce qu'entre une paroi latérale du premier organe de basculement (16) et l'autre paroi latérale du deuxième organe de basculement (18), l'arbre de broche (11) est également pourvu d'un organe de positionnement (19), dont une extrémité est manchonnée sur l'arbre de broche (11) avec un dégagement entre eux tandis que son autre extrémité est pourvue d'une gorge dentée (20) adaptée au profil de dent de l'engrenage d'arbre intermédiaire (5).

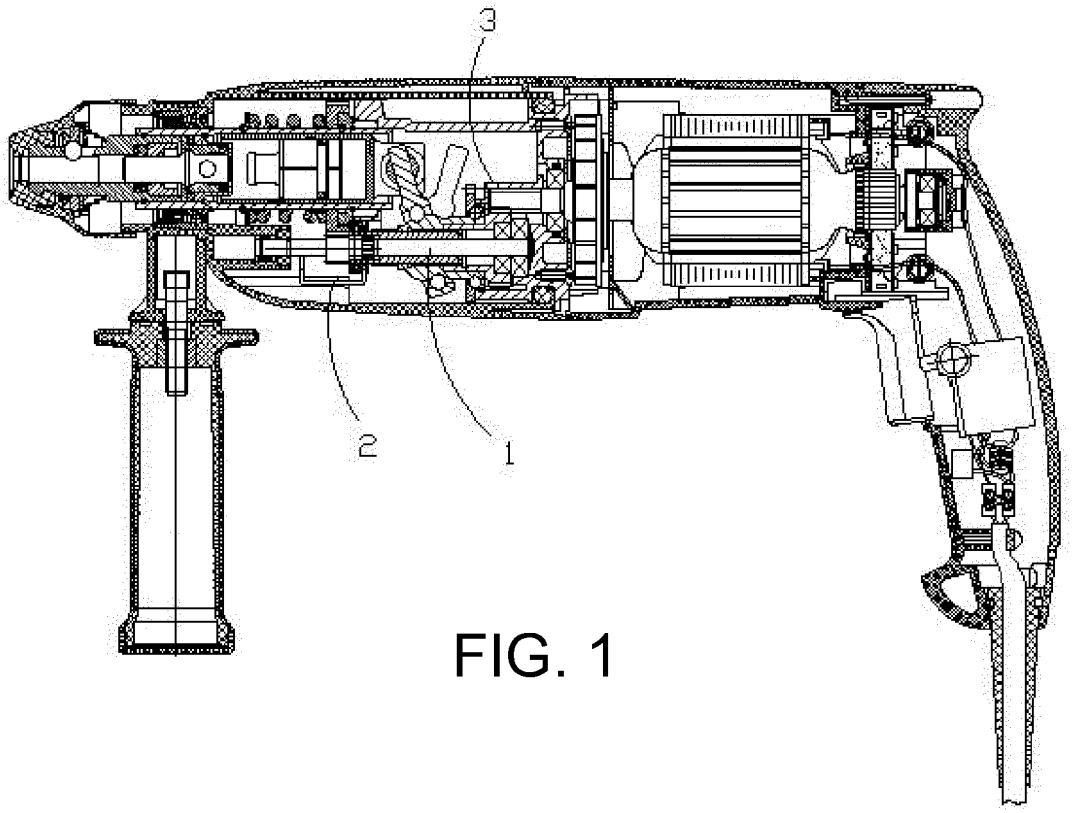

FIG. 1

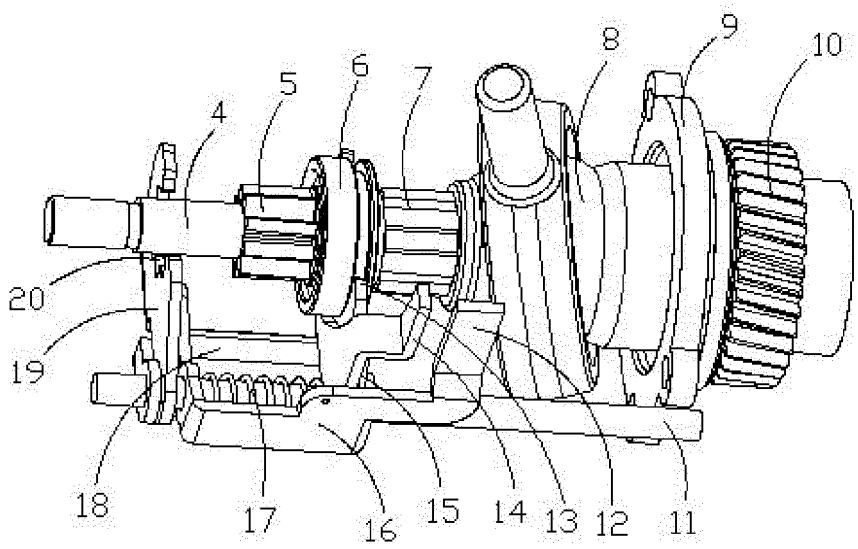

FIG. 2

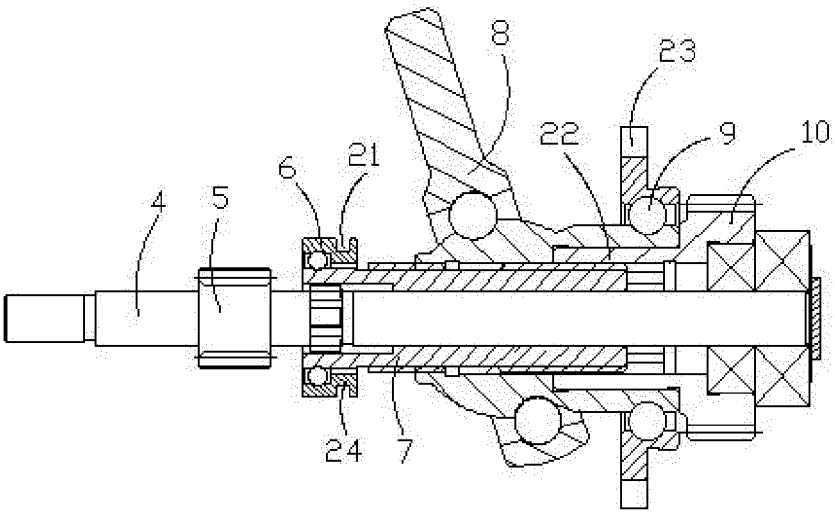

FIG. 3

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

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