

Description

Field of Invention

[0001] This invention relates to a horizontal shaft impact crusher having a curtain, mounted on a pivot shaft, against which material accelerated by an impeller can be crushed in which the curtain can be adjusted by an adjustment device comprising an axially rotatable member on the pivot shaft.

Background of the Invention

[0002] Horizontal shaft impact crushers are utilized in many applications for crushing hard material such as pieces of rock, ore etc. A horizontal shaft impact crusher is generally made up of a housing having an inlet for material to be crushed, an outlet for material that has been crushed, an impeller, mounted on a horizontal shaft in the crusher housing, operative for rotating around a horizontal axis, a curtain against which material accelerated by the impeller may be crushed, and an adjustment bar for adjusting the position of said curtain relative to the impeller. Pieces of rock are fed towards the impeller and are struck by beater elements mounted on the impeller. The pieces of rock are disintegrated by being struck by the beater elements and are accelerated and thrown against the curtains where further disintegration occurs.

[0003] The action of the impeller thus causes the material fed to the horizontal shaft impact crusher to move freely in a crushing chamber and to be crushed upon impact against the beater elements, against the curtains, and against other pieces of material moving around at high speed in the crushing chamber.

[0004] Furthermore, adjustment of the position of the curtain may be made to compensate for both curtain wear and beater element wear. Adjustment of the position of the curtain may be also made to adjust the size of the crushed material.

[0005] In order to be adjustable, each curtain is generally rotatably mounted at an upper end on pivot shafts which are in turn mounted in pivot points in the housing. In order to adjust the position of the curtain in the pivot points, linear adjustment systems are generally used in which a lower or toe end of the curtain is in contact with adjustment bars located adjacent the toe end of the curtain. Linear movement of the adjustment bars causes the curtain to pivot on the pivot shaft thus repositioning the curtain to alter the closed side setting gap (CSS) and the like. However, the linear adjustment systems of the prior art can take up significant space within the crusher and inhibit safe access to the crusher for maintenance purposes.

[0006] An object of the invention is to overcome at least some of the problems of the prior art.

Summary of the Invention

[0007] According to the invention there is provided horizontal shaft impact crusher comprising:

a crusher housing having an inlet for material to be crushed;
an outlet for material that has been crushed;
an impeller mounted on a horizontal shaft in the crusher housing and being operative for rotating around a horizontal axis;
a curtain, against which material accelerated by the impeller may be crushed, pivotably mounted on a pivot shaft between first and second pivot points on the housing, and
an adjustment device for adjusting the position of the curtain relative to the impeller wherein the adjustment device comprises an axially rotatable driven member on the pivot shaft for effecting rotation of the pivot shaft about its longitudinal axis and a drive engageable with the driven member for rotatably driving the driven member. The adjustment device facilitates safe adjustment of the curtain and improved safety during maintenance operations by being easily accessible whilst also resulting in a significant space saving within the crusher compared with known internally mounted adjustment systems.

[0008] In any embodiment, the adjustment device is attached to the pivot shaft towards a free end of the pivot shaft. The adjustment device does not therefore obstruct the interior of the crusher.

[0009] In one embodiment, the free end of the pivot shaft extends beyond the housing. The adjustment device is therefore externally accessible and operable.

[0010] In any embodiment, the driven member comprises a rotatable plate mounted on the pivot shaft. The rotatable plate can be easily engaged by the drive.

[0011] Suitably, the rotatable plate is an annular plate having a pivot shaft receiving opening. The rotatable plate can therefore be easily mounted on the pivot shaft.

[0012] Advantageously, the rotatable plate comprises a laterally extending protrusion engageable with the drive. The laterally extending protrusion can be abutted by the drive to effect rotation of the pivot shaft.

[0013] In any embodiment, the laterally extending protrusion comprises teeth and the drive comprises a drive gear engageable with the teeth. The drive gear can therefore make effective contact with the laterally extending protrusion.

[0014] In one embodiment, the horizontal impact crusher further comprises a motor for powering the drive gear. The drive gear can therefore be operated independently of the crusher motor to allow for curtain adjustment with the crusher motor switched off.

[0015] Suitably, the motor and the drive gear are mounted on the housing. The motor and gear are therefore easily accessible.

[0016] In another embodiment, the drive comprises a linear drive engageable with the laterally extending protrusion. This provides an alternative to the use of a drive gear.

[0017] In one embodiment, the linear drive comprises a hydraulic ram and cylinder. A hydraulic ram and cylinder can be in fluid communication with the hydraulic system of the crusher.

[0018] Preferably, the linear drive further comprises a linkage between the hydraulic ram and cylinder and the laterally extending protrusion. The linkage facilitates rotation of the laterally extending protrusion.

[0019] In another embodiment, the linear drive comprises a pneumatic linear drive. A pneumatic linear drive can be operated independently of the crusher hydraulic system.

[0020] In another embodiment, the linear drive comprises a mechanical linear drive. A mechanical linear drive can also be operated independently of the crusher hydraulic system and can be operated manually if required.

Brief Description of the Drawings

[0021] The invention will now be described, by way of example only, with reference to the accompanying drawings in which:

Figure 1 is a partial cross-sectional side view through a horizontal shaft impact crusher of the invention with a first upper curtain adjustment device mounted at the free end of the pivot shaft of a first upper curtain of the crusher and a second lower curtain adjustment device mounted at the free end of the pivot shaft of a second lower curtain of the crusher;

Figure 2 is a perspective rear view of the crusher of Figure 1, and

Figure 3 is an enlarged perspective view from the rear and one side of the first upper curtain adjustment device of Figure 2.

Detailed Description of the Invention

[0022] Figures 1 and 2 show a horizontal shaft impact crusher 10 of the invention provided with a curtain adjustment device 20.

[0023] As shown in the drawings, the horizontal shaft impact crusher 10 comprises a housing 15 having an inlet 30 for receiving material to be crushed, an outlet 40 for material that has been crushed and an impeller 50 within the housing 15. A crusher motor, not illustrated for reasons of maintaining clarity of illustration, is operative for rotating a horizontal shaft 60 on which the impeller 50 is mounted. As an alternative to the impeller 50 being fixed to the shaft 60, the impeller 50 may rotate around the shaft 60. In either case, the impeller 50 is operative

for rotating around a horizontal axis, coinciding with the centre of the horizontal shaft 60.

[0024] Internally, the housing 15 is provided with a plurality of wear protection plates 22 that are operative for protecting the walls of the housing 15 from abrasion and from impact by the material to be crushed. Furthermore, the housing 15 comprises a bearing 23 for the horizontal shaft 60. A lower feed plate (not shown) and an upper feed plate (not shown) are arranged at the inlet 30. The feed plates are operative for providing the material fed to the crusher 10 with a suitable direction with respect to the impeller 50.

[0025] As shown particularly in Figure 1, the housing 15 houses a first upper curtain 70, and a second lower curtain 80. Each curtain 70,80 comprises at least one wear plate 71,81 against which material may be crushed.

[0026] An upper end 72 of the first curtain 70 is mounted on a horizontal first pivot shaft 90 extending between first and second oppositely disposed pivot points 110,120 defined by respective openings 111,121 in the housing 15 so that the first pivot shaft 90 is suspended in the housing 15.

[0027] Similarly, an upper end 82 of the second curtain 80 is mounted on a horizontal second pivot shaft 100 extending between first and second oppositely disposed pivot points 130,140 defined by respective openings 131,141 in the housing 15 so that the second pivot shaft 100 is also suspended in the housing 15.

[0028] The illustrated impeller 50 has four beater elements 51, each such beater element 51 having a bent shape, as shown particularly in Figure 1. The area formed between the impeller 50 and the first and second curtains 70,80 can be called a crushing chamber 11 of the crusher 10.

[0029] Material to be crushed first reaches the first curtain 70, being located upstream of the second curtain 80 as seen with respect to the direction of travel of the material. By means of the feed plates the material is directed towards the impeller 50 rotating at, typically, 400-850 rpm. When the material is hit by the beater elements 51 it is crushed and accelerated against the wear plates 71 of the first curtain 70 where further crushing occurs. The material bounces back from the first curtain 70 and is crushed further against material travelling in the opposite direction and, again, against the beater elements 51. When the material has been crushed to a sufficiently small size it moves further down the crusher chamber 11 and is accelerated, by means of the beater elements 51, towards the wear plates 81 of the second curtain 80, being located downstream of the first curtain 70. Hence, the material moves freely around in the crushing chamber 11 and is crushed against the beater elements 51, against the wear plates 71,81 respectively of the curtains 70,80 and against other pieces of material circling around, at a high velocity, in the crusher 10.

[0030] As shall be explained more fully below, a curtain adjustment device 20 is provided on each pivot shaft 90,100 towards a free end of each pivot shaft 90,100 and

is axially rotatable to adjust and fix the position of the curtains 70,80. Accordingly, by axial rotation of the adjustment device 20 on the pivot shaft 90, the first curtain 70 may be pivoted around the first pivot shaft 90 until an optimum distance between a second lower end or toe 73 of the first curtain 70 and the impeller 50 has been obtained, with respect to the properties, as regards, e.g., size and hardness, of the material to be crushed. Similarly, by axial rotation of the adjustment device 20 on the pivot shaft 100, the second curtain 80 may be pivoted around the second pivot shaft 100 until a desired distance between the impeller 50 and a second end or toe 83 of the second curtain 80 has been obtained.

[0031] As shown particularly in Figure 2, in the present embodiment, the first pivot shaft 90 extends beyond each opening 111, 121 in the housing to define first and second free ends 150, 160 of the first pivot shaft 90 and a curtain adjustment device 20 is mounted on both the first free end 150 and the second free end 160. Similarly, the second pivot shaft 100 extends beyond each opening 131, 141 in the housing 15 to define first and second free ends 170, 180 of the second pivot shaft 100 and a curtain adjustment device 20 is mounted on the first free end 170 and the second free end 180. However, in other embodiments, a curtain adjustment device 20 can be provided at either free end 150, 160 and 170, 180 of the pivot shafts 90, 100 respectively. The free ends 150, 160, 170, 180 can be protected with a protective cover 151.

[0032] Figure 3 shows an enlarged perspective view from the rear and one side of the upper curtain adjustment device 20 of Figure 2 at the pivot shaft 90 - the other adjustment devices 20 being identical in structure. As shown in the drawing, the adjustment device 20 is made up of an axially rotatable driven member 190 mounted on the free end 150 of the pivot shaft 90 so that axial rotation of the driven member 190 by a drive 200 mounted on the housing 15 effects rotation of the pivot shaft 90 to in turn adjust the position of the curtain 70 relative to the impeller 50.

[0033] In the present embodiment, the driven member 190 is an axially rotatable plate 210 mounted on the free end 150 of the pivot shaft 190 and more particularly an annular plate 220 provided with a pivot shaft receiving opening 230 shaped, sized and contoured to receive the free end 150 of the pivot shaft 90 in a mating relationship.

[0034] More particularly, the pivot shaft receiving opening 230 and the first free end 150 of the first pivot shaft 90 are both generally square in shape to prevent rotation of the first pivot shaft 90 relative to the axially rotatable plate 210. The annular plate 220 is shaped to define a cam-like protrusion 240 which extends laterally or radially outwards from the pivot shaft receiving opening 230 and is generally shaped to define a sector of a circle. However, as will be appreciated by those skilled in the art, the annular plate can have alternate shapes.

[0035] The protrusion 240 is provided with peripheral teeth 250 at its outer curved edge 241 which are engage-

able with the drive 200 which in the present embodiment is a drive gear 260 mounted on the housing 15. The drive gear 260 is provided with complementary gear teeth 261 for meshing with the peripheral teeth 250 and is powered by a motor 270 mounted to the housing via a mounting bracket 271 which also serves to cover the drive gear 260.

[0036] In use, the motor 270 is activated to rotate the drive gear 260 to in turn effect axial rotation of the axially rotatable plate 210. As a result, the pivot shaft 90 is rotated about its longitudinal axis to adjust the position of the curtain 70 and hence the CSS and the like as required.

[0037] In other embodiments of the invention, the drive 200 can be a linear drive instead of the drive gear 260 which is engageable with the laterally extending cam-like protrusion 240. A suitable linear drive is a hydraulic ram and cylinder and a linkage can be provided between the hydraulic ram and cylinder to effect rotation of the annular plate 220. Alternatively, the linear drive can be a pneumatic linear drive or a mechanical linear drive.

Claims

1. A horizontal shaft impact crusher (10) comprising:
 - a crusher housing (15) having an inlet (30) for material to be crushed;
 - an outlet (40) for material that has been crushed;
 - an impeller (50) mounted on a horizontal shaft (60) in the crusher housing (15) and being operative for rotating around a horizontal axis;
 - a curtain (70,80), against which material accelerated by the impeller (50) may be crushed, pivotably mounted on a pivot shaft (90,100) between first and second pivot points (110,130,120,140) on the housing (15), and
 - an adjustment device (20) for adjusting the position of the curtain (70,80) relative to the impeller (50)
 - wherein the adjustment device (20) comprises an axially rotatable driven member (190) on the pivot shaft (90,100) for effecting rotation of the pivot shaft (90,100) about its longitudinal axis and a drive (200) engageable with the driven member (190) for rotatably driving the driven member (190).
2. A horizontal shaft impact crusher (10) as claimed in Claim 1 wherein the adjustment device (20) is attached to the pivot shaft (90,100) towards a free end (150,160,170,180) of the pivot shaft (90,100).
3. A horizontal shaft impact crusher (10) as claimed in Claim 2 wherein the free end (150,160,170,180) of the pivot shaft (90,100) extends beyond the housing (15).

4. A horizontal shaft impact crusher (10) as claimed in any of Claims 1 to 3 wherein the driven member (190) comprises a rotatable plate (210) mounted on the pivot shaft (90,100). 5
5. A horizontal shaft impact crusher (10) as claimed in Claim 4 wherein the rotatable plate (210) is an annular plate (220) having a pivot shaft receiving opening (230). 10
6. A horizontal shaft impact crusher (10) as claimed in Claim 4 or Claim 5 wherein the rotatable plate (210) comprises a laterally extending protrusion (240) engageable with the drive (200). 15
7. A horizontal shaft impact crusher (10) as claimed in Claim 6 wherein the laterally extending protrusion (240) comprises teeth (250) and the drive (200) comprises a drive gear (260) engageable with the teeth (250). 20
8. A horizontal shaft impact crusher (10) as claimed in Claim 7 further comprising a motor (270) for powering the drive gear (260). 25
9. A horizontal shaft impact crusher (10) as claimed in Claim 8 wherein the motor (270) and the drive gear (260) are mounted on the housing (15).
10. A horizontal shaft impact crusher (10) as claimed in Claim 6 wherein the drive (200) comprises a linear drive engageable with the laterally extending protrusion (240). 30
11. A horizontal shaft impact crusher (10) as claimed in Claim 10 wherein the linear drive comprises a hydraulic ram and cylinder. 35
12. A horizontal shaft impact crusher (10) as claimed in Claim 11 wherein the linear drive further comprises a linkage between the hydraulic ram and cylinder and the laterally extending protrusion (240). 40
13. A horizontal shaft impact crusher (10) as claimed in Claim 10 wherein the linear drive comprises a pneumatic linear drive. 45
14. A horizontal shaft impact crusher (10) as claimed in Claim 10 wherein the linear drive comprises a mechanical linear drive. 50

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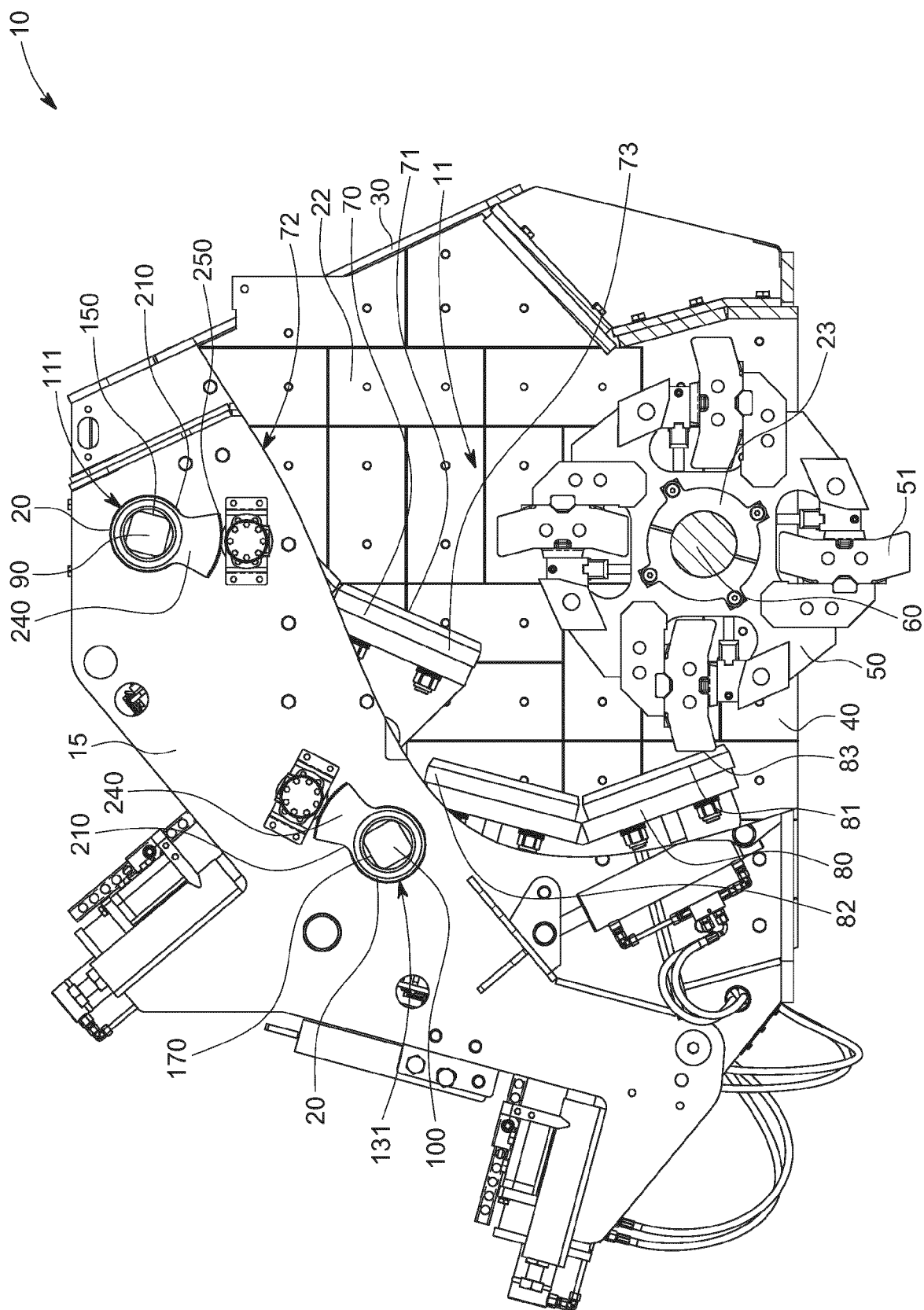


FIG. 1

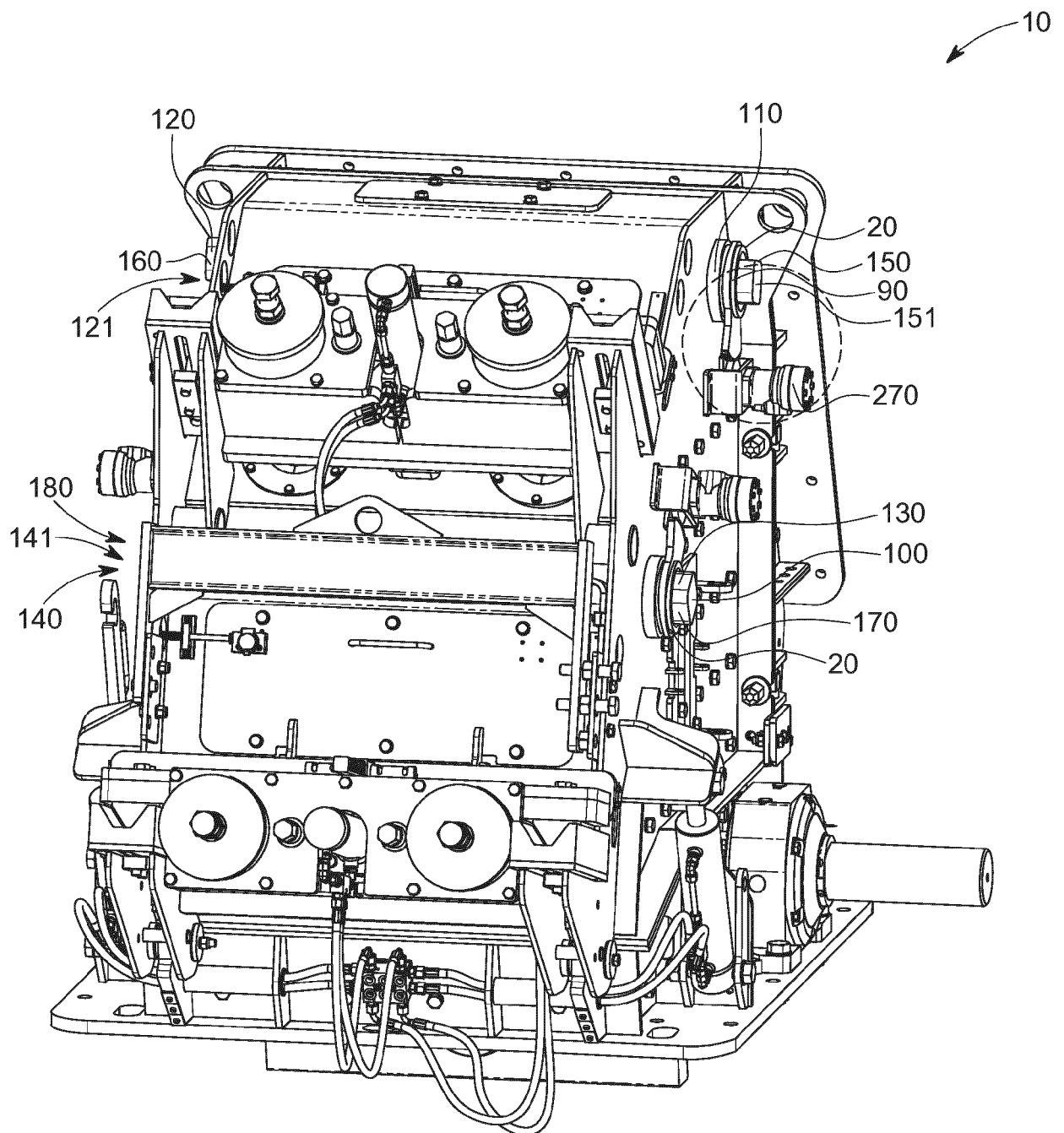


FIG. 2

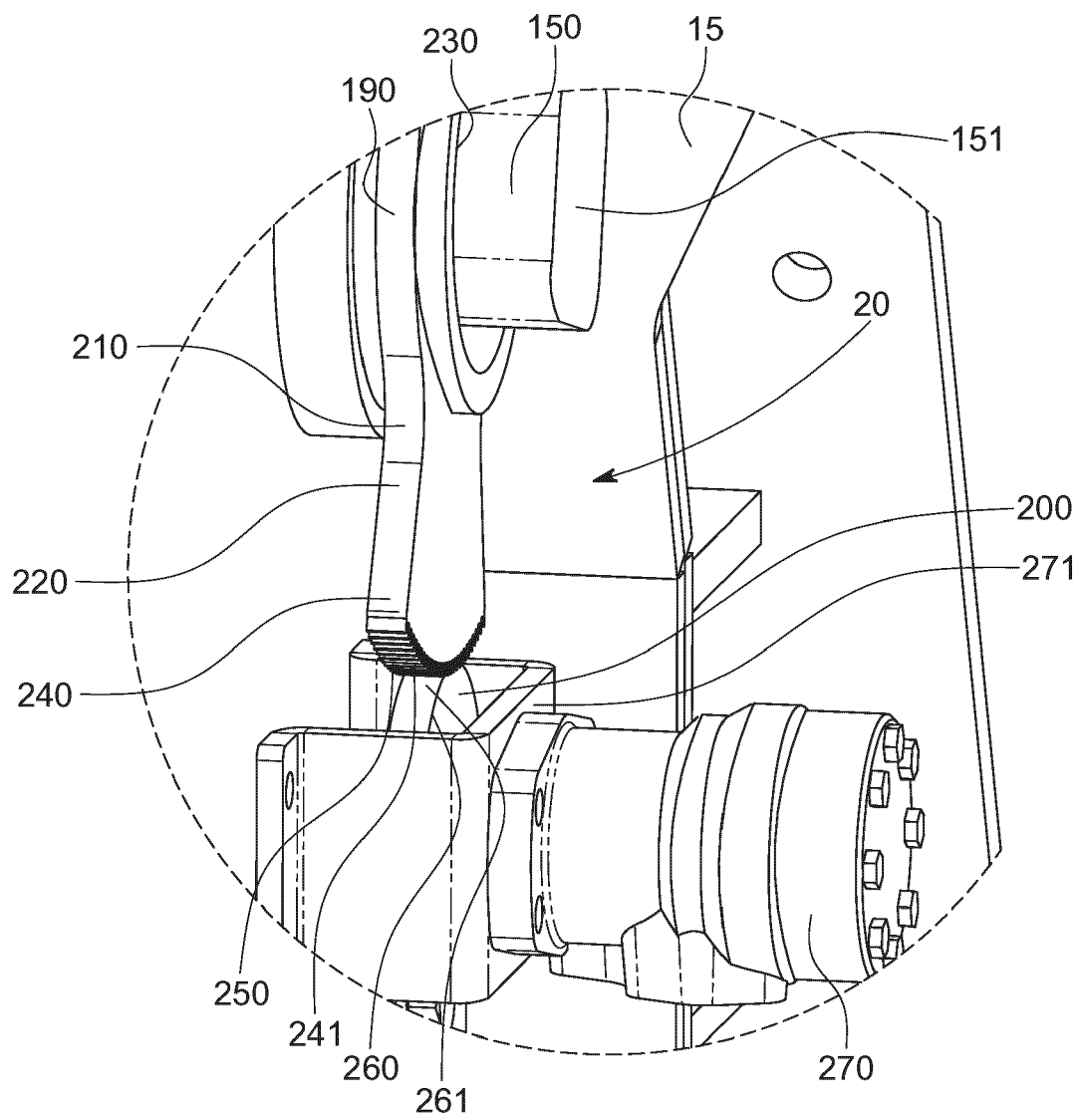


FIG. 3



EUROPEAN SEARCH REPORT

Application Number

EP 22 19 9059

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EPO FORM 1503 03.82 (P04C01)

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	WO 2005/094998 A1 (OHG DI PONZANO VENETO S P A [IT]; ORTONCELLI LUCA [IT] ET AL.) 13 October 2005 (2005-10-13) * pages 1,2,5-8; figure 1 *	1-14	INV. B02C13/09
A	DE 39 11 086 A1 (GRONHOLZ CLAUS [DE]) 12 April 1990 (1990-04-12) * columns 1,3-6; figures 1, 3 *	1-14	
A	EP 3 023 155 A1 (SANDVIK INTELLECTUAL PROPERTY [SE]) 25 May 2016 (2016-05-25) * paragraphs [0021] - [0030]; figures *	1-14	
A	DE 91 06 099 U1 (O & K ORENSTEIN & KOPPEL AG, 1000 BERLIN, DE) 17 September 1992 (1992-09-17) * paragraph [0024]; figures *	1-14	
			TECHNICAL FIELDS SEARCHED (IPC)
			B02C
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 14 March 2023	Examiner von Mittelstaedt, A
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 22 19 9059

5 This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
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14-03-2023

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
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		WO 2005094998 A1	13-10-2005

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