



(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
03.04.2024 Bulletin 2024/14

(51) International Patent Classification (IPC):
B02C 13/09 (2006.01)

(21) Application number: **22199086.4**

(52) Cooperative Patent Classification (CPC):
B02C 13/095

(22) Date of filing: **30.09.2022**

(84) Designated Contracting States:
**AL AT BE BG CH CY CZ DE DK EE ES FI FR GB
GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO
PL PT RO RS SE SI SK SM TR**
Designated Extension States:
BA ME
Designated Validation States:
KH MA MD TN

(72) Inventors:
• **Forsberg, Andreas**
23381 Svedala (SE)
• **Kjaerran, Knut**
23381 Svedala (SE)
• **Dallimore, Rowan**
23381 Svedala (SE)

(71) Applicant: **Sandvik SRP AB**
233 81 Svedala (SE)

(74) Representative: **Sandvik**
Sandvik Intellectual Property AB
811 81 Sandviken (SE)

(54) **A HORIZONTAL SHAFT IMPACT CRUSHER**

(57) 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 a space-saving adjustment device (20) for adjusting the position of the curtain (70,80) relative to the impeller (50) in which the adjustment device (20) comprises a disc brake (21) engageable with the pivot shaft (90,100) and rotatably movable between a pivot shaft braked position and a pivot shaft rotating position to adjust the position of the curtain (70,80) as required.

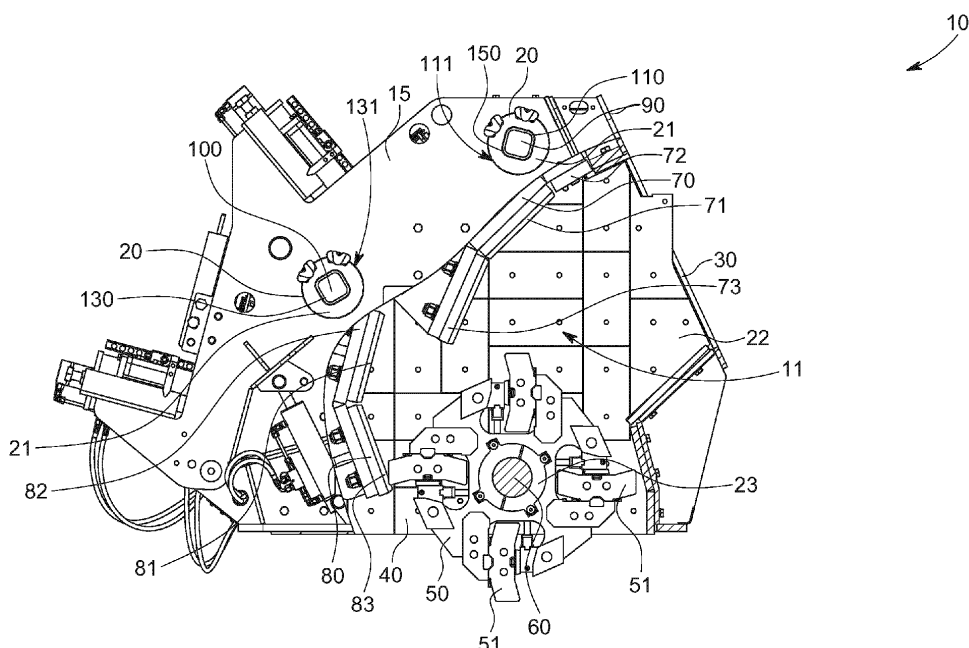


FIG. 1

Description

Field of Invention

[0001] This invention relates to a horizontal shaft impact crusher and more particularly to horizontal shaft impact crusher having a curtain against which material accelerated by an impeller can be crushed in which the curtain is mounted on a rotatable pivot shaft that can be controlled with a brake.

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. 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, such linear adjustment systems can take up significant space within the crusher and inhibit 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] A 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 a disc brake engageable with the pivot shaft and movable between a pivot shaft braked position and a pivot shaft rotating position. The adjustment device is rotatably movable between the shaft braked and rotating positions resulting in a significant space saving compared with linear adjustment systems.

[0008] In one embodiment, the disc brake is attached to the crusher housing. The disc brake is therefore accessibly mounted on the crusher.

[0009] In any embodiment, the disc brake is mounted on the crusher housing towards a free end of the pivot shaft. The disc brake does not therefore hinder access to crusher curtains for maintenance purposes compared with linear adjustment systems.

[0010] Preferably, the free end of the pivot shaft extends beyond the housing. This facilitates ease of attachment of the disc brake to the pivot shaft.

[0011] In any embodiment, the disc brake comprises a disc and a friction member frictionally engageable with at least one side of the disc to prevent rotation of the pivot shaft in the pivot shaft braked position. Engagement of the friction member with the disc therefore prevents movement of the disc to lock the disc and hence the pivot shaft in position.

[0012] Optionally, the friction member is frictionally engageable with two sides of the disc. This ensures maximum frictional engagement.

[0013] In any embodiment, the disc is mounted over the free end of the pivot shaft to be rotatable with the pivot shaft in the shaft rotating position. This configuration provides for optimal positioning of the pivot shaft.

[0014] Suitably, the disc is a circular disc. The frictional member can therefore be circumferentially positioned as required with respect to the disc.

[0015] In any embodiment, the friction member comprises a calliper. The calliper can frictionally engage with the disc as required.

[0016] Optionally, the calliper is a hydraulically controlled calliper. The hydraulically controlled calliper can be integrated and coordinated with the crusher hydraulic

system as required and can be operated remotely.

[0017] Alternatively or in addition, the calliper is a mechanically controlled calliper. A mechanically controlled calliper can be operated independently of the crusher hydraulic system and can be operated manually if required.

[0018] Alternatively or in addition, the calliper is a pneumatically controlled calliper. A pneumatically controlled calliper can also be operated independently if required.

[0019] In any embodiment, the crusher comprises first and second disc brakes towards opposite free ends of the pivot shaft. The use of two disc brakes on each pivot shaft maximises movement and control of the pivot shaft.

Brief Description of the Drawings

[0020] 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 on the crusher housing at the free end of the pivot shaft of a first upper curtain of the crusher and a second lower curtain adjustment device mounted on the crusher housing 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

[0021] Figures 1 and 2 show a horizontal shaft impact crusher 10 of the invention provided with disc-brake like curtain adjustment devices 20.

[0022] 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 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.

[0023] 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.

[0024] 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.

[0025] 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.

[0026] 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.

[0027] 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.

[0028] 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 51 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.

[0029] As shall be explained more fully below, a curtain adjustment device 20 of the invention is engageable with each pivot shaft 90,100 towards a free end of each pivot shaft 90,100 and is rotationally movable between a pivot shaft 90,100 braked position and a pivot shaft 90,100 rotating position to adjust and fix the position of the curtains 70,80. Accordingly, by adjusting the rotational position of the adjustment device 20 engaged with 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 adjusting the rotational position of the adjustment device 20 engaged with 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. In the present embodiment, as shown particularly in Figure 2, 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 at the first free end 150. 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 at the first free end 170. A curtain adjustment device 20 can be provided at either or both opposite free ends 150,160 and 170,180 of the pivot shafts 90,100 respectively.

[0030] 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 curtain adjustment device 20 is in the form of a disc-brake 21 structure made up of a disc 190, and a friction member 200 frictionally engageable with an outside face 210, inside face 220 (or both faces 210,220) of the disc 190. In this embodiment, the disc 190 is a circular disc 230. However, in other embodiments, discs 190 having alternate shapes may also be employed. In the pivot shaft 90 braked/fixed position, the friction member 200 is frictionally engaged with the circular disc 230 to prevent rotational movement of the circular disc 230 and hence the pivot shaft 90. The upper curtain 70 is therefore locked in position. In the pivot shaft 90 rotating position the friction member 200 is disengaged from the circular disc 230 to allow rotational movement of the circular disc 230 and hence the pivot shaft 90. The position of the upper curtain 70, and in particular the lower toe end 73 of the curtain (see also Figure 1), can therefore be adjusted by rotational movement of the circular disc 230 and hence the pivot shaft 90.

[0031] As indicated above, the adjustment device 20 is mounted at the first free end 150 of the pivot shaft 90. More particularly, the circular disc 230 is mounted over the first free end 150 of the pivot shaft 90 and receives the free end 150 of the pivot shaft 90 in a complementary central opening 91 defined in the circular disc 230. In this embodiment, the central opening 91 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 circular disc 230. The first free end 150 of the first pivot shaft 90 is protected with a protective cover 270 provided on the outside face 210 of the circular disc 230.

[0032] The friction member 200 can be a calliper 240

secured to the housing 15 and movable between the pivot shaft 90 braked/locked position and the pivot shaft 90 rotating position. In the present embodiment, the calliper 240 is a hydraulically controllable calliper 250 operated by the hydraulic system of the crusher 10 with the hydraulic system being omitted from the drawings for clarity. However, in other embodiments, the calliper 240 can be a mechanically or pneumatically controlled calliper if desired.

[0033] The calliper 240 is made up of a housing 260 secured to the housing 15 on which is mounted an outer plate 261 for frictional engagement with the outside face 210 of the circular disc 230 and an inner plate 262 for frictional engagement with the inside face 220 of the circular disc 230. Brake pads 280 are provided between the outer plate 261 and the inside plate 262 and the circular disc 230 to create the frictional contact between the circular disc 230 and the calliper 240. The outer plate 261 and the inner plate 262 are movable towards and away from each to define the pivot shaft 90 braked/fixed position and the pivot shaft 90 rotating position respectively. As indicated above, in the present embodiment this movement is effected hydraulically although in other embodiments the movement can be mechanical or pneumatic.

[0034] As shown in the drawing, in the present embodiment, the disc-brake 21 is provided with two callipers 240 disposed side by side in the upper semi-circle of the circular disc 230. However, in other embodiments, the number and location of the callipers 240 can be varied as required.

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;
a disc brake (21) engageable with the pivot shaft (90,100) and movable between a pivot shaft braked position and a pivot shaft rotating position.

2. A horizontal shaft impact crusher (10) as claimed in

Claim 1 wherein the disc brake (21) is attached to the crusher housing (15).

3. A horizontal shaft impact crusher (10) as claimed in Claim 2 wherein the disc brake (21) is mounted on the crusher housing (15) towards a free end (150,160,170,180) of the pivot shaft (90,100). 5
4. A horizontal shaft impact crusher (10) as claimed in Claim 3 wherein the free end (150,160,160,180) of the pivot shaft (90,100) extends beyond the housing (15). 10
5. A horizontal shaft impact crusher (10) as claimed in claimed in 4 wherein the disc brake (21) comprises a disc (190) and a friction member (200) frictionally engageable with at least one side (210,220) of the disc (190) to prevent rotation of the pivot shaft (90,100) in the pivot shaft braked position. 15
20
6. A horizontal shaft impact crusher (10) as claimed in Claim 5 wherein the friction member (200) is frictionally engageable with two sides (210,220) of the disc (190). 25
7. A horizontal shaft impact crusher (10) as claimed in Claim 5 or Claim 6 wherein the disc (190) is mounted over the free end (150,160,170,180) of the pivot shaft (90,100) to be rotatable with the pivot shaft (90,100) in the shaft rotating position. 30
8. A horizontal shaft impact crusher (10) as claimed in any of Claims 5 to 7 wherein the disc (190) is a circular disc (230). 35
9. A horizontal shaft impact crusher (10) as claimed in any of Claims 5 to 8 wherein the friction member (200) comprises a calliper (240). 40
10. A horizontal shaft impact crusher (10) as claimed in Claim 9 wherein the calliper (240) is a hydraulically controlled calliper (250). 45
11. A horizontal shaft impact crusher (10) as claimed in Claim 9 wherein the calliper (240) is a mechanically controlled calliper. 50
12. A horizontal shaft impact crusher (10) as claimed in Claim 9 wherein the calliper (240) is a pneumatically controlled calliper. 55
13. A horizontal shaft impact crusher (10) as claimed in any of Claims 3 to 12 wherein the crusher (10) comprises first and second disc brakes (21) towards opposite free ends (150,160,170,180) of the pivot shaft (90,100).

10

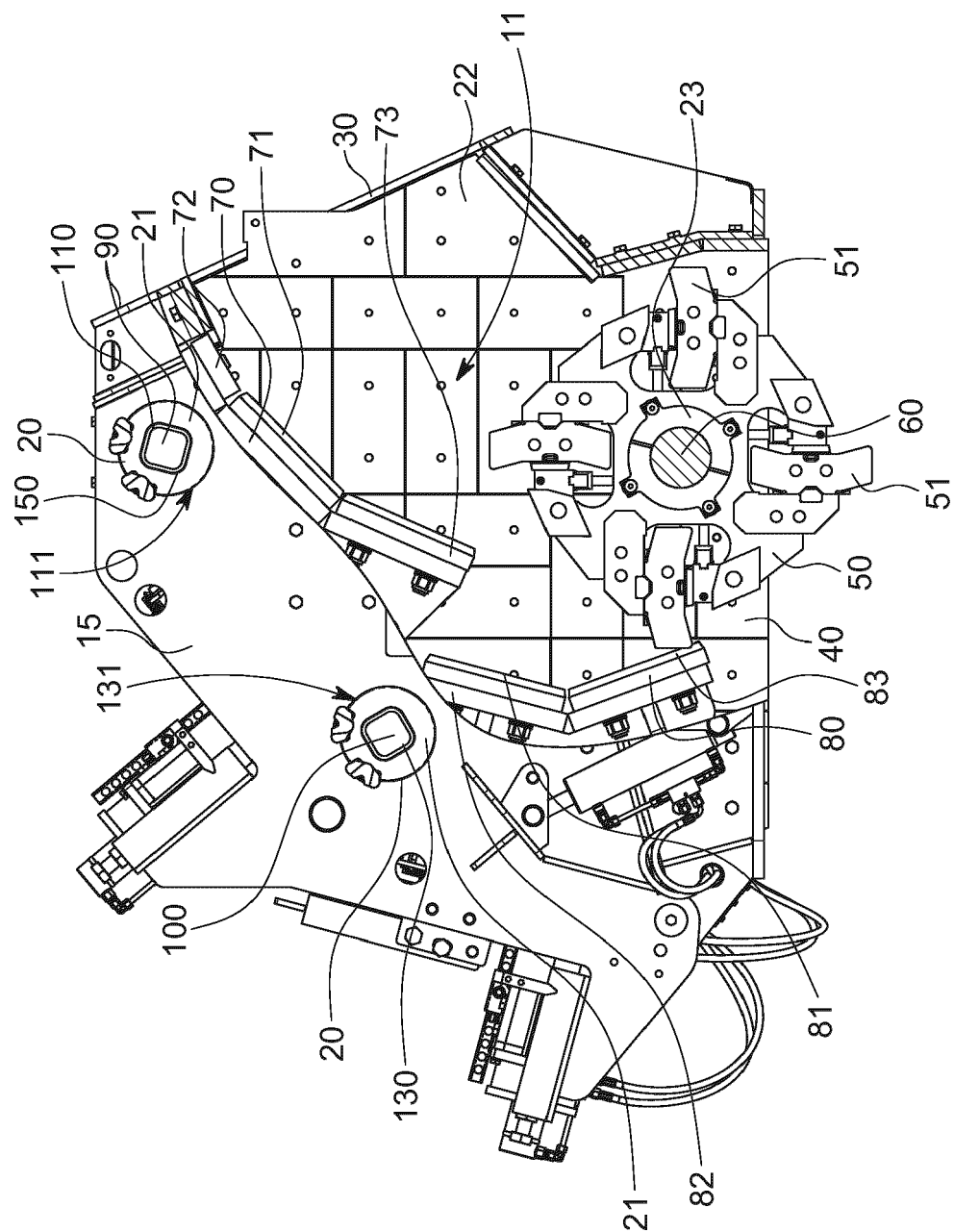


FIG. 1

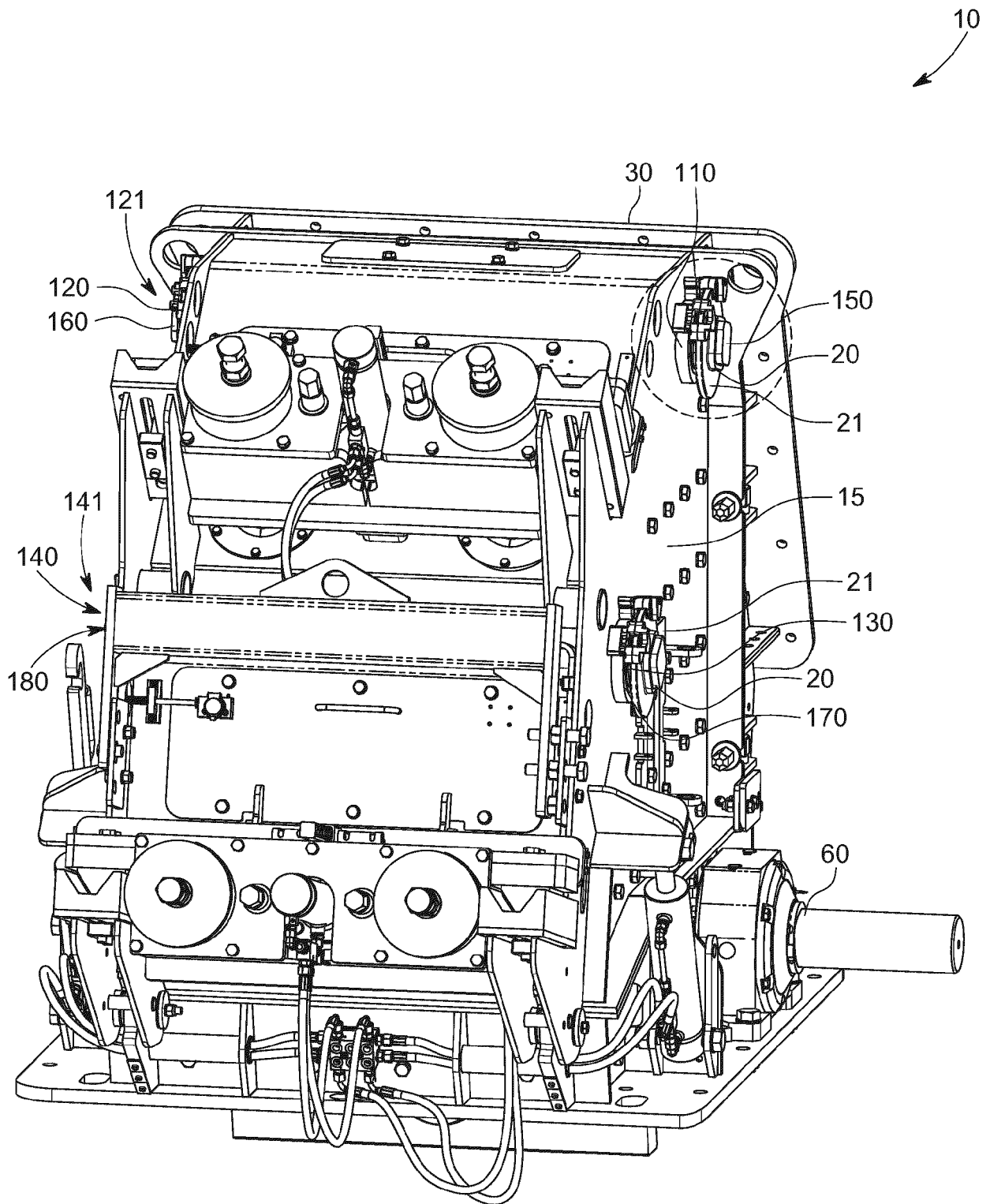


FIG. 2

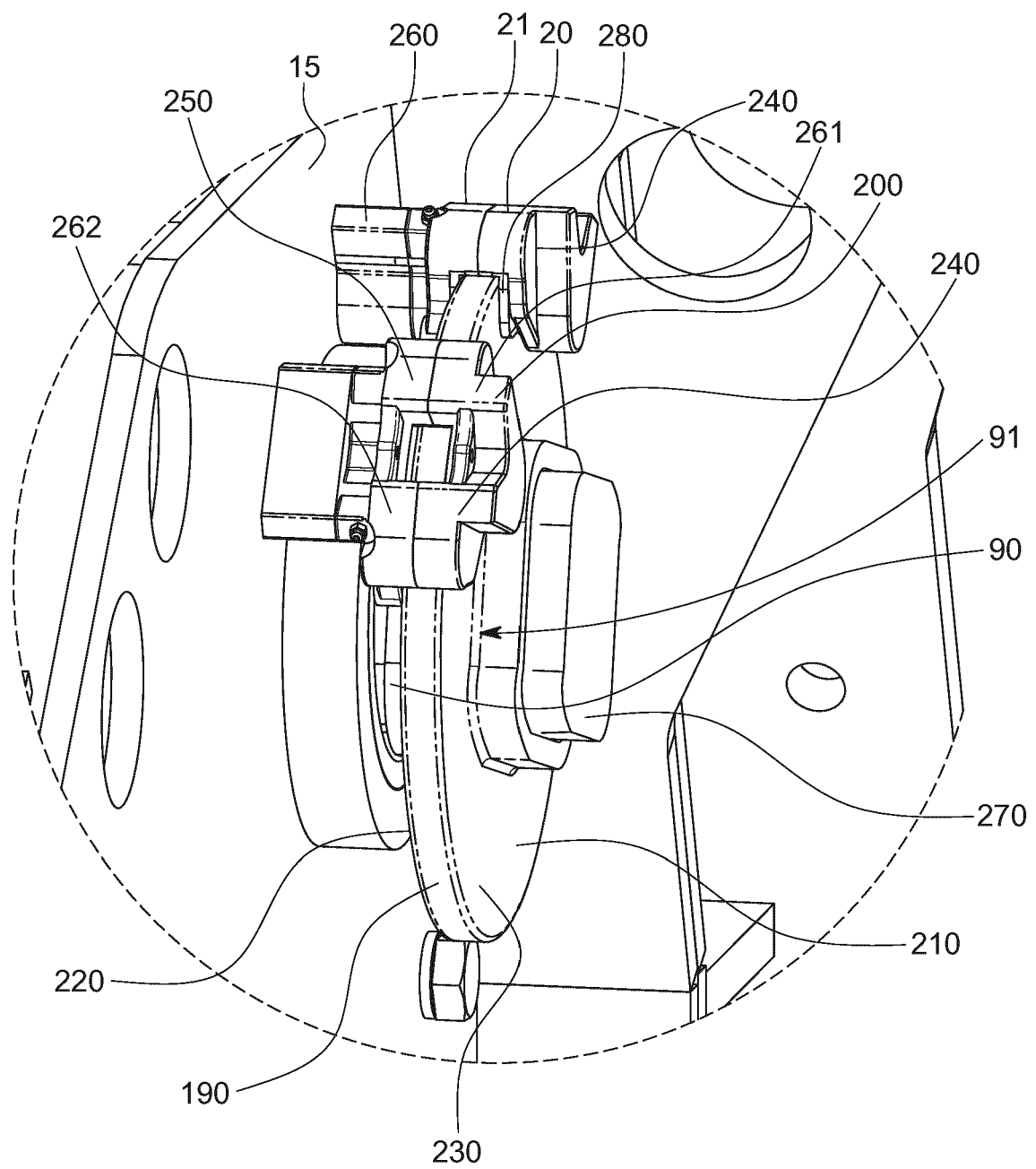


FIG. 3



EUROPEAN SEARCH REPORT

Application Number

EP 22 19 9086

5

10

15

20

25

30

35

40

45

50

55

1

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	FR 2 584 624 A1 (ORENSTEIN & KOPPEL AG [DE]) 16 January 1987 (1987-01-16) * pages 7-8; figures 1,2 *	1-13	INV. B02C13/09
A	US 2022/203374 A1 (ADCOCK JARED [US] ET AL) 30 June 2022 (2022-06-30) * paragraph [0017]; figure 3 *	1-13	
A	DE 88 13 467 U1 (GRONHOLZ, CLAUS, DIPL.-ING., 2000 NORDERSTEDT, DE) 2 February 1989 (1989-02-02) * paragraphs [0033] - [0045]; figures *	1-13	
A	AU 59388 00 A (BARTLEM PTY LTD) 15 February 2001 (2001-02-15) * page 7; figures *	1-13	
			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 9086

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
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

14-03-2023

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
FR 2584624 A1	16-01-1987	DE 3525101 A1	15-01-1987
		FR 2584624 A1	16-01-1987
		GB 2179565 A	11-03-1987
		JP H0210697 B2	09-03-1990
		JP S6214952 A	23-01-1987
		US 4729517 A	08-03-1988

US 2022203374 A1	30-06-2022	NONE	

DE 8813467 U1	02-02-1989	NONE	

AU 5938800 A	15-02-2001	NONE	
