



(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
31.08.2022 Bulletin 2022/35

(51) International Patent Classification (IPC):
D21D 1/30 (2006.01) B02C 7/14 (2006.01)

(21) Application number: **22156132.7**

(52) Cooperative Patent Classification (CPC):
B02C 7/14; D21D 1/30

(22) Date of filing: **10.02.2022**

(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

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(30) Priority: **27.02.2021 US 202163154701 P**

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(54) **DISC REFINER SLIDING HEAD ADJUSTMENT ASSEMBLY**

(57) A disc refiner comprises a rotating disc connected to and driven by a shaft for rotation within a housing, and a sliding head plate within the housing. The sliding head plate has a front face and a rear face, and a non-rotating movable refiner disc is attached to the front face of the sliding head plate. An actuator is attached to the housing, and a guide rod support plate is within the housing. The guide rod support plate has a plurality of spaced apart guide rod openings. A counterweight is connected

to the actuator. The refiner also includes a plurality of spaced apart guide rods, each of which extends through a respective one of the guide rod openings, each guide rod having a first end attached to the rear face of the sliding head plate and a second end attached to the counterweight. An actuator mounting plate is attached to the housing, and a plurality of tie rods attached to and extending between the actuator mounting plate and the guide rod support plate.

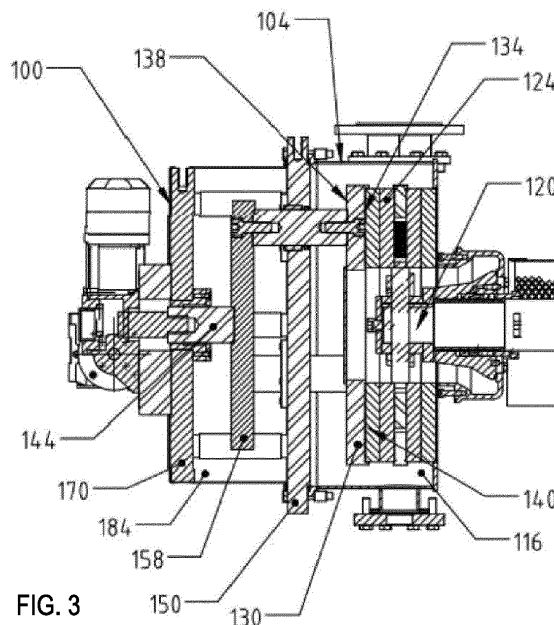


FIG. 3

Description

BACKGROUND

[0001] This disclosure relates to disc refiners including a sliding head that supports a nonrotating movable refiner disc.

[0002] In FIG. 1, wherein like numbers refer to similar parts, a conventional double disc refiner 20 is shown. The refiner 20 has a machine frame 22 on which is mounted a rotating assembly 24 having a shaft 26 mounted by bearings 28 to a shaft case 30. The shaft 26 is connected at a first end 32 to a drive motor (not shown). A second end 33 of the shaft 26 passes into a refiner housing 34 through a circular bulkhead 35 at a removable packing box 36. The second shaft end 33 is machined to form a spline 38 to which the hub 40 of a rotor 42 is mounted.

[0003] The drive side 43 of the refiner housing 34 has a stock inlet 44 which supplies stock to a shroud 46 defining a triangular cross-section passageway between an outer conical shell 48, an inner cylindrical structure 50, and a drive side stationery disc support structure 51. The inner cylindrical structure 50 surrounds the bulkhead 35. The triangular passageway allows stock to enter a stock chamber formed on the inside of the cylindrical structure 50 surrounding the shaft 26. The refiner 20 also includes a first outlet 65 extending upwardly for evacuation of refined pulp.

[0004] The stock chamber accommodates four refining members or discs, a drive side, non-moving, stationery disc 60, a drive side rotating disc 62, movable stationery disc 64 and a door side rotating disc 66. In the illustrated embodiment, the disc has identical outer diameters. In other embodiments (not shown), only two discs can be used. In still other embodiments (not shown), additional disc sets can be used. In still other embodiments (not shown), the refining members may constitute cones or other types of refining members.

[0005] The movable stationary disc 64 is mounted on a sliding head 68. The sliding head 68 is mounted for translation toward and away from the rotor 42. The sliding head 68 is mounted by a bearing ring 72 to a removable door 70 which forms part of the refiner housing 34. The sliding head 68 is balanced by a counterweight 74 and driven by a screw jack mechanism 76 which employs a variable frequency drive motor 78.

[0006] The rotor 42 is mounted on the spline 38 at the end of the shaft 26. The spline transmits rotary power to the rotor but is not affixed to the rotor 42. Sufficient play between the rotor hub 40 and the spline 38 is provided so that the rotor 42 slides along the spline 38, thus positioning the rotor 42 in response to hydrodynamic forces between the stationary disc mounted on a support structure 51 and the stationary disc 64 mounted on the sliding head 68. A very small amount of tilting of the rotor with respect to the axis of the shaft 26 is also accommodated by the spline hub mount.

[0007] The sliding head 68 supports the door side sta-

tionery disc 64 on a support structure 80. This support structure allows stock to flow behind about thirty percent of the outer circumference of the support 80 which represents approximately fifty percent of the area of the refiner disc 64. Further, the stock which supports the outer thirty percent of the support 80 is at a higher pressure than the stock which flows through the shroud 46, due to the pumping action of the rotor 42. The hydraulic support of the support structure 80 thus supports the most highly loaded portion of the disc because the fluid pressure increases radially as the fluid is pumped by the rotor 42. The support structure 80 has minimal thermal gradients because the disc is either exposed directly to the stock or is remote from the exterior of the refiner 20. Thus, deflections induced by thermal gradients are minimized.

[0008] In a refiner the action on the fibers as they pass between the discs requires that the disc be closely spaced, typically between two and four thousandths of an inch apart. Maintaining this gap uniformly across the entire refiner disc diameter—which may be fifty-four inches across or more—has in the past resulted in massive support structures to resist deflections caused by pressures between the refiner disc.

[0009] By presenting the stock pressure to both sides of the stationery disc support structure 80, the deflection loads on the support structure 80 are reduced, allowing a lighter weight support structure which has lower deflections under load.

[0010] The increased rigidity of the stationary disc mounting structure 80 combined with the ability of the rotor 42 to align itself with the stationery disc 60, 64 results in greater uniformity of the gap between the rotating refiner disc 62, 64 mounted on the rotor 42 and the stationery disc 60, 64. The gap between the refiner disc typically is between two and four thousandths of an inch and is typically maintained and supported by the physical thickness of the pulp fibers as they pass between the refiner disc. Greater uniformity of this gap produces more uniform refining and reduced wear.

[0011] In the refiner 20 of FIG. 1, stock is allowed behind the peripheral edges of the stationary disc mounting structure, only equalizing the stock force on the refining side to a limited degree. As a result, substantial force is still required to keep the movable stationary disc adjacent the rotating disc.

SUMMARY

[0012] Disclosed is a disc refiner comprises a rotating disc connected to and driven by a shaft for rotation within a housing, and a sliding head plate within the housing. The sliding head plate has a front face and a rear face, and a nonrotating movable refiner disc is attached to the front face of the sliding head plate. An actuator is attached to the housing, and a guide rod support plate is within the housing. The guide rod support plate has a plurality of spaced apart guide rod openings. A counterweight is connected to the actuator. The refiner also includes a

plurality of spaced apart guide rods, each of which extends through a respective one of the guide rod openings, each guide rod having a first end attached to the rear face of the sliding head plate and a second end attached to the counterweight. An actuator mounting plate is attached to the housing, and a plurality of tie rods attached to and extending between the actuator mounting plate and the guide rod support plate.

DRAWINGS

[0013]

FIG. 1 is a fragmentary vertical sectional side view of a conventional refiner.

FIG. 2 is a perspective side view of a portion of a refiner according to this disclosure.

FIG. 3 is a longitudinal cross section of a side view of the refiner of FIG. 2.

FIG. 4 is a partially broken away perspective side view of the refiner of FIG. 2.

FIG. 5 is a partially broken away exploded perspective end view of the refiner of FIG. 2.

FIG. 6 is a cross section of an end view of the refiner of FIG. 2 taken through the side of a guide rod support plate.

FIG. 7 is a cross section of an end view of the refiner of FIG. 2 taken through the side of the space between the guide rod support plate and an actuator mounting plate.

[0014] Before one embodiment of the disclosure is explained in detail, it is to be understood that the disclosure is not limited in its application to the details of the construction and the arrangements of components set forth in the following description or illustrated in the drawings. The disclosure is capable of other embodiments and of being practiced or being carried out in various ways. Also, it is to be understood that the phraseology and terminology used herein is for the purpose of description and should not be regarded as limiting. Use of "including" and "comprising" and variations thereof as used herein is meant to encompass the items listed thereafter and equivalents thereof as well as additional items. Use of "consisting of" and variations thereof as used herein is meant to encompass only the items listed thereafter and equivalents thereof. Further, it is to be understood that such terms as "forward", "rearward", "left", "right", "upward" and "downward", etc., are words of convenience and are not to be construed as limiting terms.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0015] A new and improved refiner 100 is illustrated in FIGS. 2 through 7. The refiner 100 includes a housing 104 having portions defining a stock inlet 108 and portions defining a stock outlet 112. As illustrated in Fig. 2, a refining chamber 116 is between the stock inlet 108

and the stock outlet 112, and a shaft 120 extends into the housing 104. A rotating disc 124 is connected to and driven by the shaft 120 for rotation within the housing 104. A sliding head plate 130 is within the housing 104, and the sliding head plate 130 has a front face 134 and a rear face 138. A nonrotating movable refiner disc 140 is attached to the front face 134 of the sliding head plate 130. The nonrotating movable refiner disc 140 is adjacent the rotating disc 124 so that a small adjustable refining gap is between the nonrotating movable refiner disc 140 and the rotating disc 124. An actuator 144 is attached to the housing 104 for moving the sliding head plate 130 relative to the rotating disc 124. The refiner 100 improves upon the refiner 20 by including a guide rod support plate 150 within the housing 104, and the guide rod support plate 150 has a plurality of spaced apart guide rod openings. More particularly, in this embodiment, there are only three guide rod openings 152, 154, and 156 (see FIG. 6), but in other embodiments (not shown), more openings can be used. The guide rod support plate 150 also acts as an access door to the refining chamber 116.

[0016] As illustrated in FIG. 3, a counterweight 158 is connected to the actuator 144. In this embodiment, the counterweight 158 is a circular plate, but in other embodiments, a spoke wheel configuration (not shown) as well as other configurations can be used.

[0017] The refiner 100 also includes a plurality of spaced apart guide rods 160 (see FIGS. 4 and 6), each of which extends through a respective one of the guide rod openings 152, 154 and 156, each guide rod 160 having a first end 162 (see FIG. 4) attached to the rear face 138 of the sliding head plate 130 and a second end 164 attached to the counterweight 158. The sliding head plate 130 is on one side of the guide rod support plate 150 and the counterweight 158 is on the other side of the guide rod support plate 150. In the disclosed embodiment, the three guide rod openings 152, 154, and 156 and three guide rods 160 lay in a circle spaced apart from the center of the guide rod support plate 150 (see FIG. 6).

[0018] The refiner 100 also includes an actuator mounting plate 170 attached to the housing 104 and a plurality of tie rods 180 (see FIGS. 4 and 7) attached to and extending between the actuator mounting plate 170 and the guide rod support plate 150. The actuator mounting plate 170 is spaced apart from the guide rod support plate 150, and the counterweight 158 is positioned between the actuator mounting plate 170 and the guide rod support plate 150. In this embodiment, six tie rods 180 are spaced apart around the periphery of the actuator mounting plate 170, but with smaller or larger refineries (not shown), less or more tie rods can be used. In other less preferred embodiments, other structure components such as a cylindrical shell (not shown) attached to and extending between the actuator mounting plate 170 and the guide rod support plate 150 can be used.

[0019] The space 184 between the actuator mounting plate 170 and the guide rod support plate 150 is an area where there are bearings 186 and sensors (not shown)

that require maintenance access. In this design, removable covers 190 make it much easier than existing designs which employ a small access window in a casting (not shown). This space 184 and the removable covers 190 also keep dust and debris from a mill from getting into the space 184.

[0020] The sliding head plate 130 of this disclosure is exposed to fluid pressure on its rear face 138 which helps to counter the fluid pressure applied to the nonrotating movable refiner disc 140. The amount of rear face area exposed to fluid pressure is substantial more than in conventional designs which have only a very large central piston connecting a counterweight to a sliding head plate, such as the conventional refiner shown in FIG. 1. The greater amount of rear face area exposed to fluid pressure helps to reduce stresses on the sliding head plate 130 and reduce the amount of force needed to move the sliding head plate 130. The conventional refiners needed a large central piston to counteract the forces applied to the sliding head plate. In the disclosed refiner, the plurality of spaced apart guide rods spaced apart from the center of the sliding head plate provides the support needed to counteract the forces seen by the sliding head plate 130.

[0021] Further, in the disclosed refiner 100, the various major plates of the assembly (i.e., door plate, sliding head plate, actuator mounting plate) are held together by means of the guide rods and the tie rods, thereby eliminating all cast components and nearly all weldments. The advantages of this type of construction are that it allows for much easier removal and repair/rebuild of all the components that comprise the assembly. It also provides for a modularity of design in which common components, such as the guide rods and tie-rods, can be used across various refiner sizes. Lastly, it significantly reduces the cost and complexity of the manufacture of sliding head and actuator mechanism as compared to traditional means.

[0022] Various other features and advantages of the invention will be apparent from the following claims.

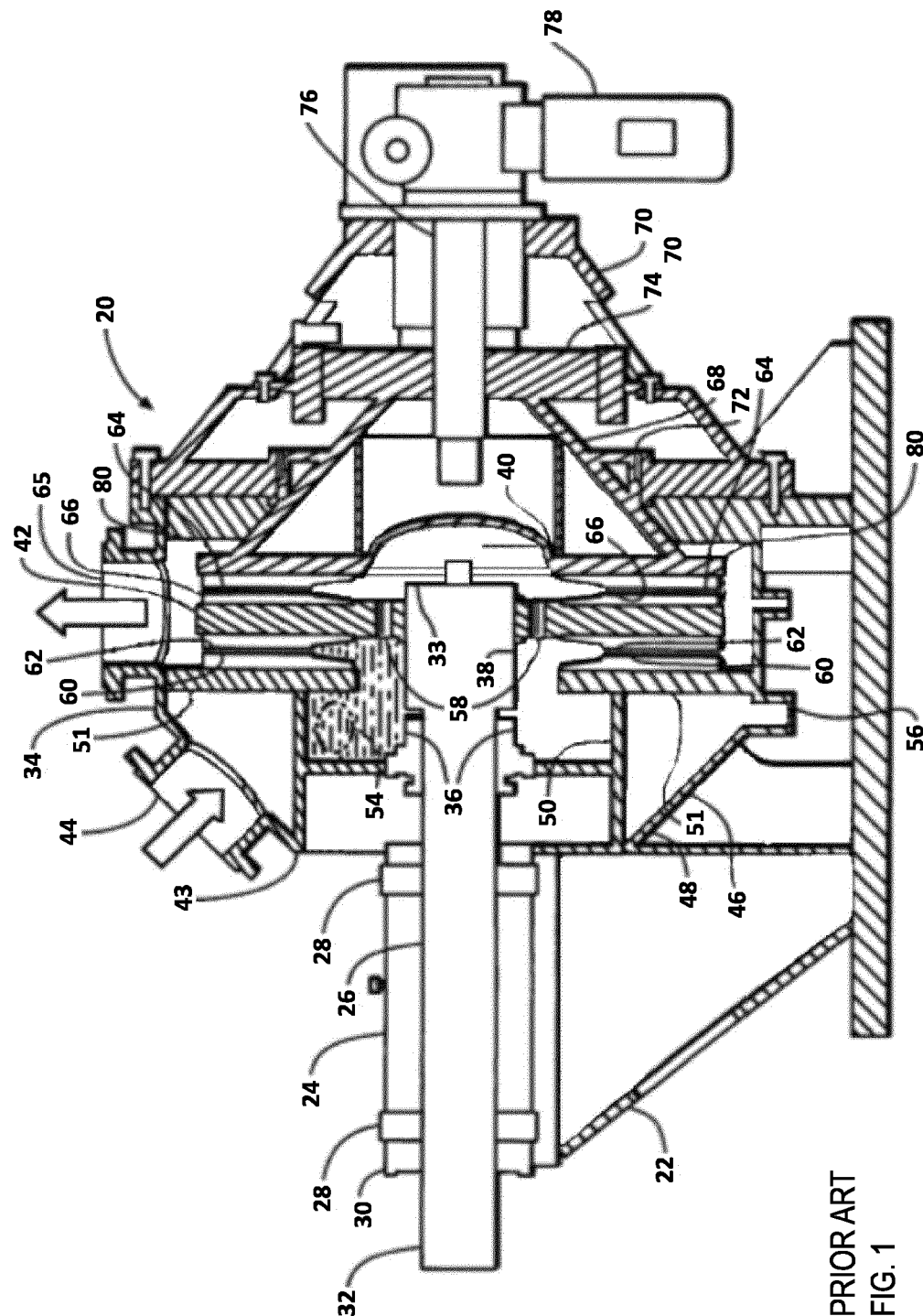
A disc refiner comprises a rotating disc connected to and driven by a shaft for rotation within a housing, and a sliding head plate within the housing. The sliding head plate has a front face and a rear face, and a nonrotating movable refiner disc is attached to the front face of the sliding head plate. An actuator is attached to the housing, and a guide rod support plate is within the housing. The guide rod support plate has a plurality of spaced apart guide rod openings. A counterweight is connected to the actuator. The refiner also includes a plurality of spaced apart guide rods, each of which extends through a respective one of the guide rod openings, each guide rod having a first end attached to the rear face of the sliding head plate and a second end attached to the counterweight. An actuator mounting plate is attached to the housing, and a plurality of tie rods attached to and extending between the actuator mounting plate and the guide rod support plate.

Claims

1. A disc refiner comprising a housing having portions defining a stock inlet and portions defining a stock outlet, a refining chamber between the stock inlet and the stock outlet, a shaft which extends into the housing, a rotating disc connected to and driven by the shaft for rotation within the housing, a sliding head plate within the housing, the sliding head plate having a front face and a rear face, a nonrotating movable refiner disc attached to the front face of the sliding head plate, the nonrotating movable refiner disc being adjacent the rotating disc so that a small adjustable refining gap is between the nonrotating movable refiner disc and the rotating disc, an actuator attached to the housing for moving the sliding head plate relative to the rotating disc,

a guide rod support plate within the housing, the guide rod support plate having a plurality of spaced apart guide rod openings, a counterweight connected to the actuator, a plurality of spaced apart guide rods, each of which extends through a respective one of the guide rod openings, each guide rod having a first end attached to the rear face of the sliding head plate and a second end attached to the counterweight, the sliding head plate being on one side of the guide rod support plate and the counterweight being on the other side of the guide rod support plate, an actuator mounting plate attached to the housing, and a structural component attached to and extending between the actuator mounting plate and the guide rod support plate, the actuator mounting plate being spaced apart from the guide rod support plate, with the counterweight positioned between the actuator mounting plate and the guide rod support plate.

2. The disc refiner of claim 1 wherein there are at least three guide rod openings and at least three guide rods lying in a circle spaced apart from the center of the guide rod support plate.
3. The disc refiner of claim 2 wherein there are only three guide rod openings and three guide rods lying in a circle spaced apart from the center of the guide rod support plate.
4. The disc refiner of claim 1 wherein the counterweight is a circular plate.
5. The disc refiner of claim 1 wherein the structural component comprise a plurality of tie rods attached to and extending between the actuator mounting plate and the guide rod support plate.



PRIOR ART
FIG. 1

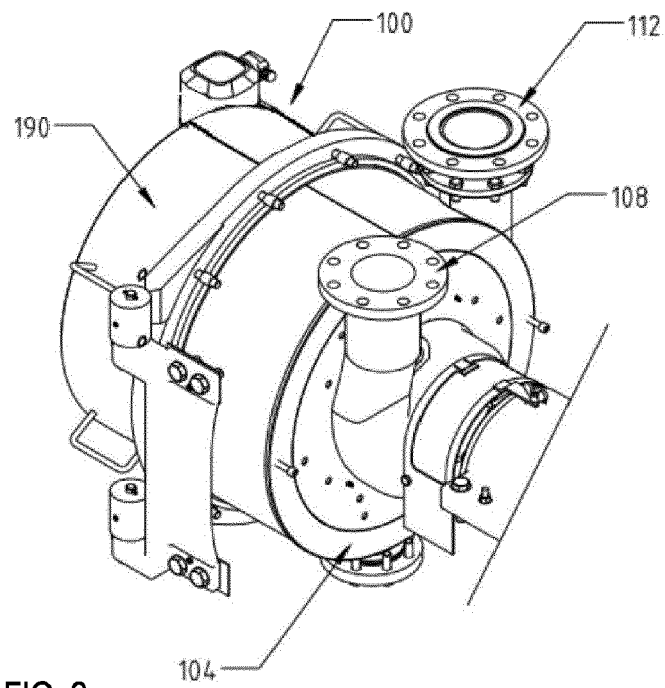


FIG. 2

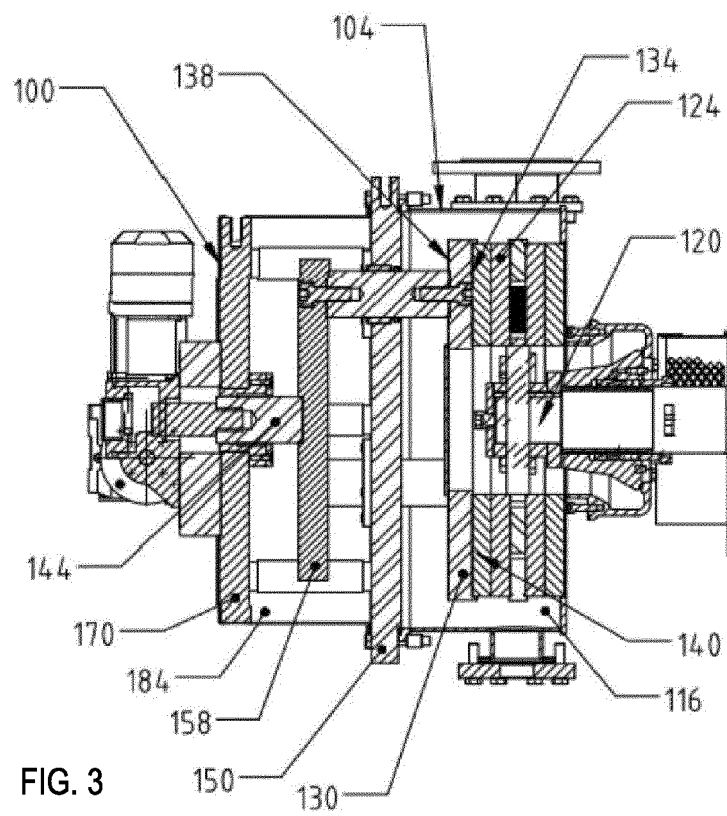


FIG. 3

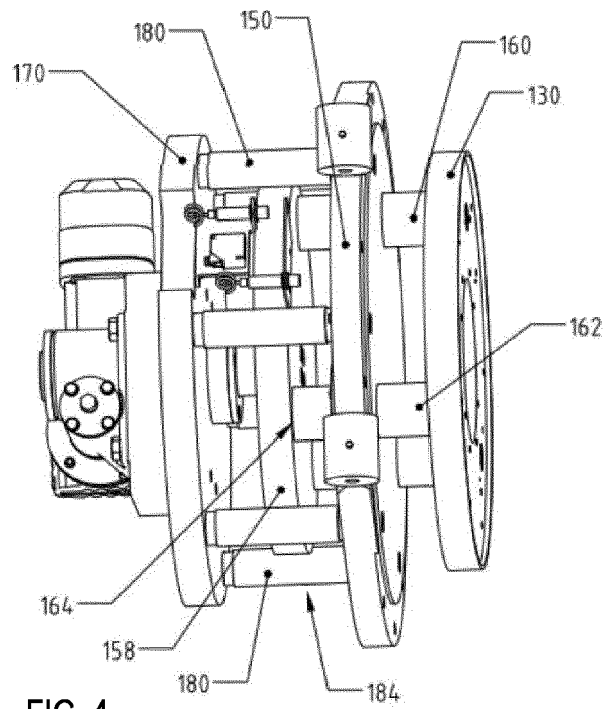


FIG. 4

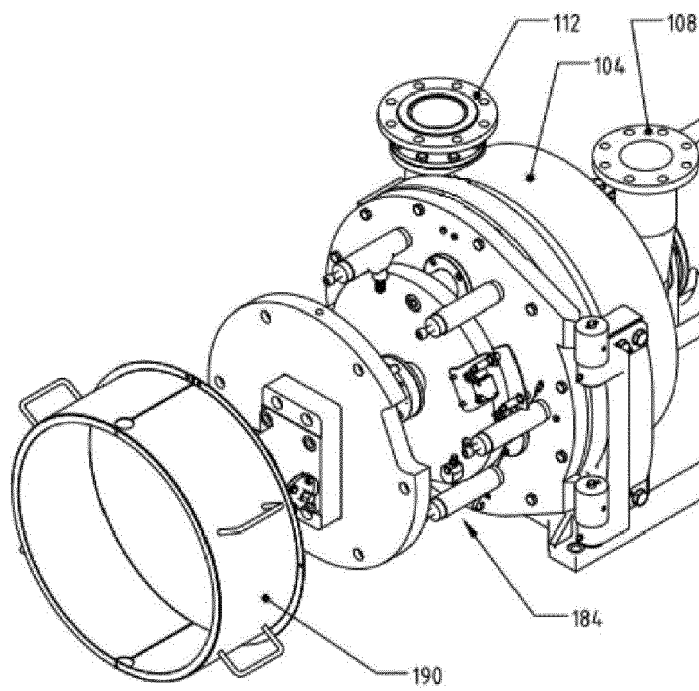
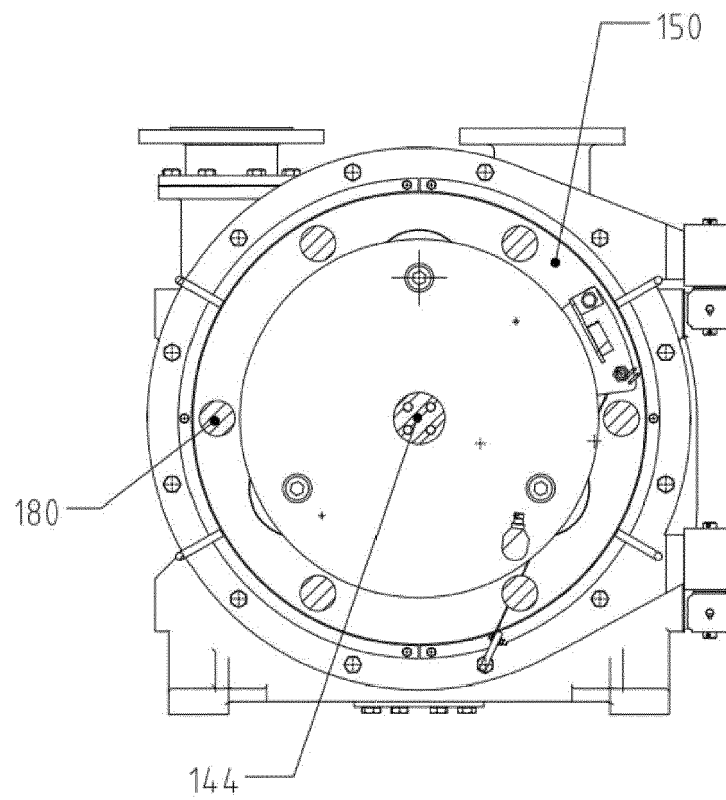
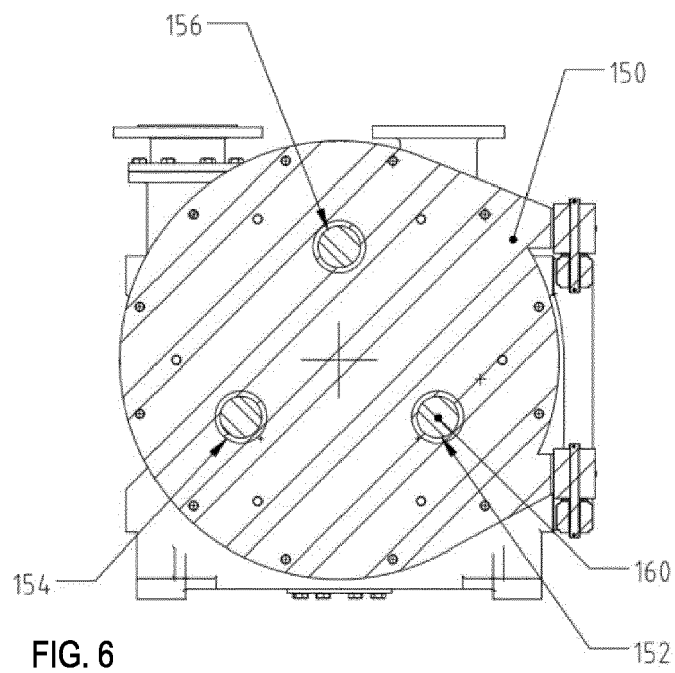


FIG. 5





EUROPEAN SEARCH REPORT

Application Number

EP 22 15 6132

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			TECHNICAL FIELDS SEARCHED (IPC)
			B02C D21J D21D
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 11 July 2022	Examiner Swiderski, Piotr
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	

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