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(54) Refiner disk assembly.

(57) A cartridge assembly (10) for loading into a multiple disk refiner which includes a plurality of coaxially aligned rotor disks (24,25,26), a plurality of coaxially aligned stator disks (28, 33) interleaved with the rotor disks (24,25,26) and an open-ended casing (58) holding the rotor disks (24,25,26) and stator disks (28,33) in axial alignment. A plurality of retaining clips (50) are provided each of which has one end (55) received in a wall (57) of the casing (58) and has a pressure-applying opposite end (53) acting against the outermost stator disk (33) to hold the rotor disks (24,25,26) and stator disks (28,33) in proper alignment for transit and for simplifying installation.

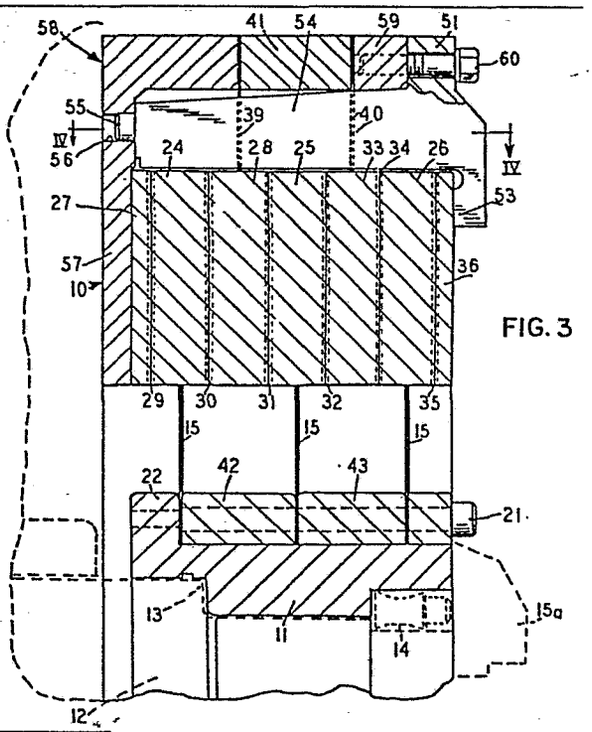

FIG. 3

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The present invention is in the field of rotor and stator disk assemblies for multiple disk refiners and provides a convenient cartridge type assembly for shipping the combination of stator disks and rotor disks without damage and facilitating error-free installation at the refiner site.

When paper stock comes from beaters, digesters, or other pulping machines, it is usually refined by passing it between grinding or refining surfaces which break up the fibrous materials and also serve to cause further separation and physical modification of the fibers.

A typical pulp refiner from the prior art is disclosed in Thomas U.S. Patent No. 3 371 873. This type of refiner includes a rotating disk which has annular refining surfaces on one or both sides. The disk refining surfaces are in confronting relation with non-rotating annular grinding surfaces and provide a refining zone therebetween in which the pulp is worked. The rotating disk and the refining surfaces are made of a substantially inflexible material such as cast iron or a hard stainless steel. The non-rotating grinding surfaces are made of similar material and are rigidly mounted so as to resist the torque created by the rapidly rotating disk and the pressure on the pulp material passing through the refining zone gap. Axial adjustment of the refining zone gaps is accomplished by axial shifting of the shaft on which the disk is mounted.

Rigid disk refiners of this type must be manufactured and assembled to close tolerances in order to set the refining zone gap width correctly. Because the loads applied to the rigid disk are large during the refining process, a large and extremely rugged design is necessary so that the refining surface relationships do not change under load. This results in the rigid disk refiners being very costly due to the necessarily close tolerance machining, the need for large quantities of high strength disk material, the bulky overall

structure, the restrictive machine capacity, and the excessive assembly time requirements.

There have been substantial improvements in pulp refiners accomplished with the development of the multiple disk refiner which operates at a low intensity. For example, in Matthew and Kirchner pending U.S. Serial No. 486 006 entitled "Flexible Disk Refiner and Method" assigned to the same assignee as the present application , there is provided a refining apparatus which includes a plurality of radially extending, relatively rotatable and axially confronting refining surfaces between which the suspension must pass while being refined during relative rotation of the surfaces. Means are provided for effecting flow of the material radially between and across the surfaces. The particular improvement of the application involves using resiliently flexible refining surface supporting means which permit adjustment of the relatively rotating refining surfaces axially relative to each other depending on the operating pressures, thereby obtaining a self-aligning feature and optimum material working results from the refining surfaces.

In a specific form disclosed in the aforementioned application, there is provided a pulp refiner with ring-shaped refining surface plates of limited radial width which are mounted on interleaved margins of axially resiliently flexible or deflectable disk elements. Disk margins spaced from the interleaved margins on one set of the disk elements are secured to a rotor while the margins on another set of disks are secured non-rotatably or counter-rotatably. The refining surface plates are made of a suitably hard, substantially rigid material. The disk elements, on the other hand, are made of axially resilient flexible material which strongly resists deformation in the circumferential direction. Because of the manner in which the axially flexible disk

elements are supported, there is an automatic axial self-adjustment of the refining surfaces during the pulp-refining process to compensate for variations in pressure conditions and resulting in optimum refining action by the relatively rotating refining surfaces.

The multiple disk refiner has made a substantial improvement in the art of refining. It has been shown that with the use of a low intensity, multiple disk refiner, pulp characteristics can be improved considerably over conventional refining techniques. It was found necessary, in practice, to uncomplicate the refining disk changeover procedure. These multiple disk machines can utilize up to 16 refining disks, so the downtime required to change a disk in the conventional manner can be considerable. There is also the additional possibility that the refiner disks could be improperly installed relative to the neighboring disks.

The present invention provides an improved cartridge-type assembly which contains all of the refining disks, preset in their correct locations, and which can be easily loaded into a multiple disk pulp refiner. This reduces the maintenance time considerably as well as eliminating the chances for installation errors.

In accordance with the present invention , we provide a cartridge assembly for loading into a multiple disk refiner which includes a plurality of coaxially aligned rotor disks, a plurality of coaxially aligned stator disks interleaved with the rotor disks, both sets of disks being received in an open-ended casing which holds the rotor disks and stator disks in alignment. A plurality of retaining clips having one end received in a wall of the casing and having a pressure-applying opposite end are provided to act against the outermost stator disk

to hold the rotor disks and stator disks in alignment . Spacer means are provided between the stator disks to provide the proper spacing between consecutive stator disks. In a preferred form of the invention, the bottom wall of the casing has apertures formed therein and the clips have cylindrical end portions which are snugly received in such apertures. A ring is provided between the spacers and the clips, and securing means releasably connect the clips to the ring for applying pressure to the assembled disks. Each of the clips may have an apertured flange portion abutting the ring and securing means are provided to extend through the aperture in the flange portion and threadedly engage with a threaded aperture in the ring. Preferably, each clip has a pressure-applying flat portion opposite the apertured flange portion for applying pressure to the rotor and stator disks confined within the casing.

A further description of the present invention will be made in conjunction with the attached sheets of drawings which illustrate a preferred embodiment thereof:

Fig. 1 is a side elevational view of the cartridge in assembled relation;

Fig. 2 is a view in perspective of one of the clips used in the cartridge of Fig. 1;

Fig. 3 is a cross-sectional view taken substantially along the line III-III of Fig.1 ; and

Fig. 4 is a fragmentary cross-sectional view taken substantially along the line IV-IV of Fig. 3.

In Fig. 1, reference numeral 10 indicates generally a cartridge of the type with which the present invention is concerned. The cartridge contains all of the elements required by the user for simple installation in the multiple disk refiner. The rotating and stationary refining elements are positioned to provide for proper operating clearance once the entire package is installed. The one-piece assembled construction

facilitates handling during installation and provides protection for the refiner disks during transit and storage.

For ease and clarity in description, the terms "rotor" and "stator" will be used to differentiate the two refining disk sets. It should be understood, however, that the present invention can be used for counterrotating refiners, and all that is required for refiner operation is relative movement between confronting refining surfaces.

The cartridge 10 includes a hub portion 11 which is arranged to provide a slip-on fit to the refiner assembly. The cooperating elements from the refiner have been indicated in dash lines in Fig. 3 and include a shaft 12 having a shoulder 13 thereon as well as a hub locking ring 14 on the opposite side thereof. The hub portion 11 is confined against axial movement by its location between the shoulder seat 13 and the hub locking ring 14. A thrust plate 15a closes off the forward end of the assembly.

The hub 11 is provided with a rotor consisting of spoked portions 15 through 19 as illustrated in Fig. 1. Arcuate depressions 20 extend between the individual spokes to permit the flow of the suspension into the working cavity of the refiner. The spokes 15 through 19 may be composed of a fiberglass reinforced resin such as an epoxy resin or they may be composed of a hard stainless steel.

The spoked rotors are secured to the hub by means of bolts 21 which are received in threaded engagement within a threaded axial bore of a flange portion 22 constituting part of the hub assembly.

The spoked rotors provide a driving connection between the hub 11 and a plurality of spaced refiner rotor disks such as disks 24, 25 and 26 shown in Fig. 3. In place of the spoked rotor, other types of linkage

connections, such as rigid links pivotally connected between the hub and the refining disks, can be used to provide a driving connection while permitting at least limited axial movement of the disks. The type of connection between the hub and the disks is not limiting on the function of the present invention, and the arrangement of the refining disk surface is not effected by the connection used. The spoked rotor shown in the drawings will be described in detail only for clarity in understanding the invention, but should not be considered limiting on the invention. The rotor disk 24 is located between a stationary end plate 27 and a first stator disk 28. The rotor disks 24,25 and 26 are in the form of annular rings having ribs on opposite surfaces thereof which provide an abrading and a fibrillating action. The rotor disk 24 abuts the end plate 27 along an interface 29. When clamping pressure is released, the disk 24 by virtue of its flexibly yielding support can shift slightly axially to provide a gap between the disk and the end plate 27. The other face of the rotor disk 24 has ribs on it which abut corresponding ribs of stator disk 28 along an interface 30 when the refiner disks are clamped together.

Likewise, ribs on the rotor disk 25 confront corresponding ribs on the stator disk 28 along an interface 31. On the opposite side, rotor disk 25 is clamped against a stator disk 33 along an interface 32. In a similar manner, a rotor disk 26 abuts the stator disk 33 along an interface 34, and is clamped against the stator plate 36 along an interface 35. When clamping pressure is released, these disks too can shift axially to provide a refining gap between confronting surfaces.

The stator disks 28 and 33 are clamped in position by means of bolts 37 best seen in Fig. 1. Flexible fingers 39 and 40 are tightly received within recesses

(not shown) in the stator disks and serve to support the stator disks while allowing some degree of axial mobility to compensate for variations in pressure differentials at the various operating gaps. An apertured spacer 41 is provided to fixedly secure the outer ends of the fingers 39 and 40.

Hub spacers 42 and 43 are provided between the individual rotors to provide the proper clearances between the refining disks.

As best seen in Fig. 1, the cartridge is provided with apertures 44 which serve to receive bolts (not shown) or other securing means to secure the cartridge to the stationary head of the refiner.

The cartridge assembly of the present invention makes use of an improved type of clip 50 which is best illustrated in Fig. 2. The clip 50 includes an apertured flange portion 51 having an aperture 52 extending therethrough. Each clip also has a pressure-applying flat portion 53 opposite from the apertured flange portion 51 for applying pressure to the rotor and stator disks. A tapered shank portion 54 connects the annular flange portion 51 with a cylindrical end portion 55. This end portion is snugly received through an aperture 56 in the bottom wall 57 of a generally cup-shaped open-ended casing generally indicated at reference numeral 58. Preferably the clips 50 are positioned in several of the apertures 44, and the number of clips used may be varied, depending to some degree on the size of the refiner.

A ring 59 is positioned between the spacer 41 and the annular flange portion 51 of the clip. The ring 59 has an internal bore which receives a securing means such as the bolt 60 which releasably connects the clip to the ring 51. Additionally, bolts 37 extend through ring 59 and spacer 41 and are threadedly engaged in the sidewall of cup-shaped casing 58. In some embodiments,

such as the pivotal rigid link connection mentioned previously, it may be desirable to form ring 59, spacer 41 and casing 58 as one piece. In such an arrangement, the bolts 37 can be eliminated.

As best illustrated in Fig. 3, each of the clips 50 is positioned to bear against the outer perimeter of the refining plates with a pressure determined by the tightness of the bolt 60. With bolts 37 holding the casing 58, spacer 41 and ring 59 as one unit, the clips clamp the entire disk cartridge assembly together during transit and storage. They act to hold each disk along its proper axis during shipment and assembly. Since the clips 50 are bolted into the outboard ring 59 and clamp all the disks together tightly, they prevent damage to the refining surfaces during handling. They also provide further assurance of proper alignment of the rotating and stationary disks during installation. After installation of the cartridge in the machine, the clips 50 are removed, freeing the rotating and stationary disks to float and seek their proper operating clearances.

The cartridge of the present invention thereby provides all of the refining disks pre-set in their correct locations making it easy to load the entire cartridge into the user's machine. This reduces the maintenance time required as well as eliminating the chances for installation errors. The clips provided with the cartridge act to hold each disk along its proper axis during shipment and assembly. Since the disks are all clamped tightly together, damage is prevented to the refining surfaces during handling. The arrangement is also such that it provides further assurance of proper alignment of the rotating and stationary elements during installation.

When a refiner requires replacement of refining plates, the operation is performed by first opening the refiner door and removing the old disks. The cartridge

of the present invention is inserted into the refiner, sliding hub 11 on shaft 12 and into butting engagement with shoulder 13. The hub locking ring 14 and thrust plate 15a are secured in place, restricting axial movement of the hub. Bolts are inserted in the open holes 44, extending through ring 59, spacer 41, and casing 58, and being secured at the back of the refiner. At this stage the assembly is secured in the refiner and the clips can be removed. Bolts 60 are disengaged and the clips are removed. Plate 36 will fall free and can be attached to the refiner door in known fashion. Additional through bolts are secured through the holes 44 from which the clips 50 were removed, and the refiner door is closed.

It should be evident that various modifications can be made to the described embodiments without departing from the scope of the present invention.

CLAIMS :

1. A cartridge assembly for loading into a multiple disk refiner comprising:

a plurality of coaxially aligned rotor disks,

a plurality of coaxially aligned stator disks interleaved with said rotor disks,

an open-ended casing holding said rotor disks and stator disks in alignment, and

a plurality of retaining clips having one end received in a wall of said casing and having a pressure-applying opposite end acting against the outermost stator disk to hold said rotor disks and stator disks in alignment.

2. A cartridge assembly according to claim 1 which includes:

spacer means between said stator disks providing the proper spacing between consecutive stator disks.

3. A cartridge assembly according to claim 1 wherein : said wall of said casing has apertures formed therein, and said clips have cylindrical end portions snugly received in said apertures.

4. A cartridge assembly according to claim 2 which includes:

a ring located between said spacer means and said clips, and securing means releasably connecting said clips to said ring.

5. A cartridge assembly according to claim 4 wherein each of said clips has an apertured flange portion abutting said ring, and

said securing means extend through the apertures in said flange portion and are threadedly engaged in said ring.

6. A cartridge assembly according to claim 5 wherein each of said clips has a pressure-applying flat portion opposite said apertured flange portion for applying pressure to the rotor and stator disks confined within said casing.

7. A cartridge assembly according to claim 5 wherein each of said clips has a tapered shank portion extending inwardly from said apertured flange portion.

8. A cartridge assembly according to claim 5 wherein: said clips are positioned to bear against the outer perimeter of the refining disks.

9. A refiner disk assembly for a multiple disk refiner comprising:

a generally cup-shaped casing defining a refining zone; first and second sets of refiner plates disposed in interleaved, confronting relationship within said casing defined refining zone;

first linkage means connecting said first set of refiner plates to a radially inward support;

second linkage means connecting said second set of refiner plates to a radially outward support;

said first and second linkage means permitting substantially axial movement of said disks; and

a plurality of removable retaining clips for maintaining the relative position and alignment of said plates, and for restricting the axial movement of said disks, said clips including anchor means fastenable relative to said casing and including a pressure applying surface acting against the outermost of said disks.

10. A refiner disk assembly as defined in claim 9 in which said first linkage means connects said first set of refiner plates to a rotatable hub.

11. A refiner disk assembly as defined in claim 9 in which said second linkage means connects said second set of refiner plates to said casing.

12. A refiner disk assembly as defined in claim 9 in which at least some of said clips include a shank extending through said refining zone and having an end portion received in an aperture formed in the bottom of said cup-shaped casing.

13. A refiner disk assembly as defined in claim 12 in which said clips include an anchor flange and a pressure applying flange each extending outwardly from said shank.

14. A refiner disk assembly as defined in claim 12 in which said shank tapers inwardly toward said end portion.

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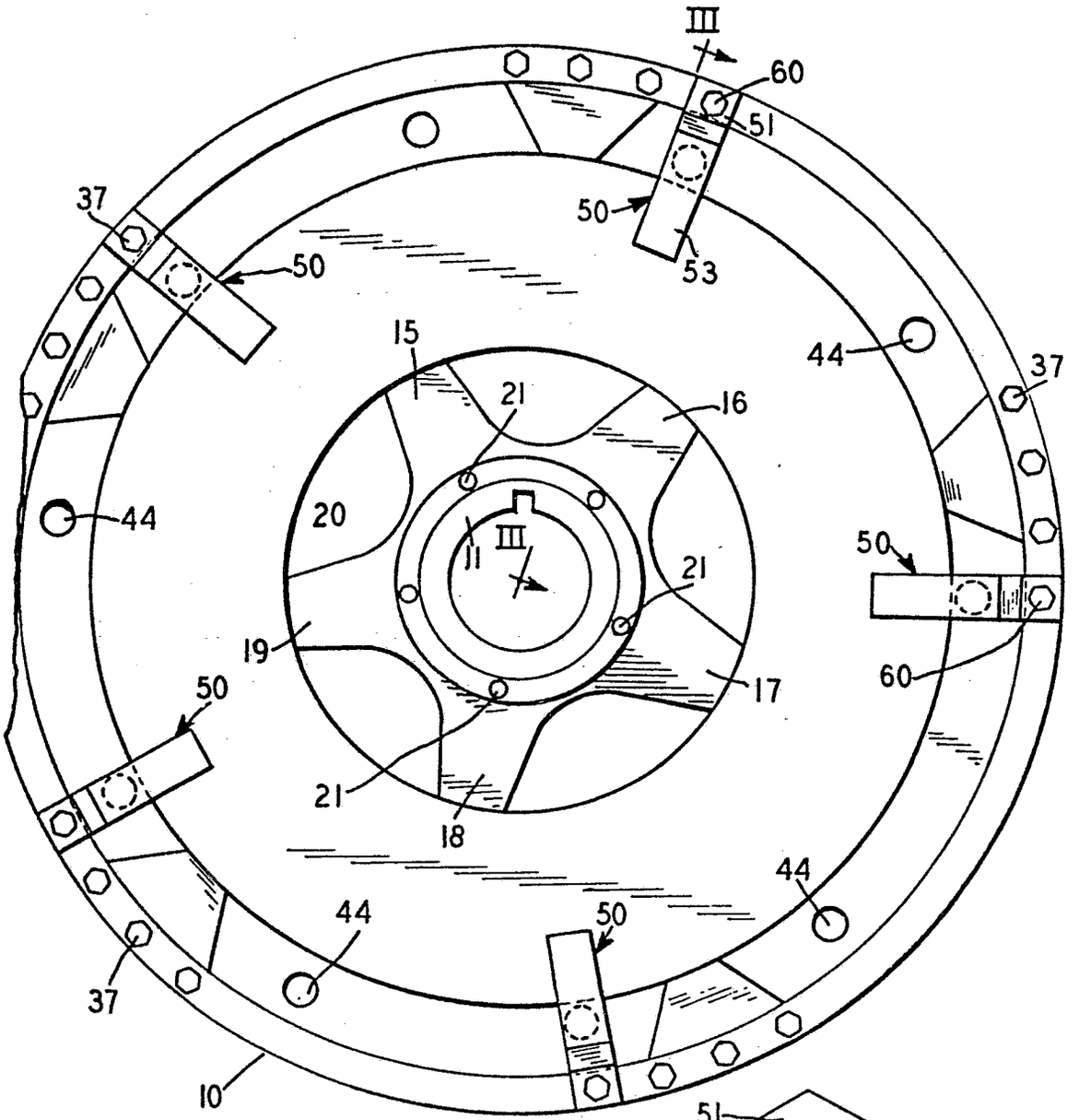

FIG.1

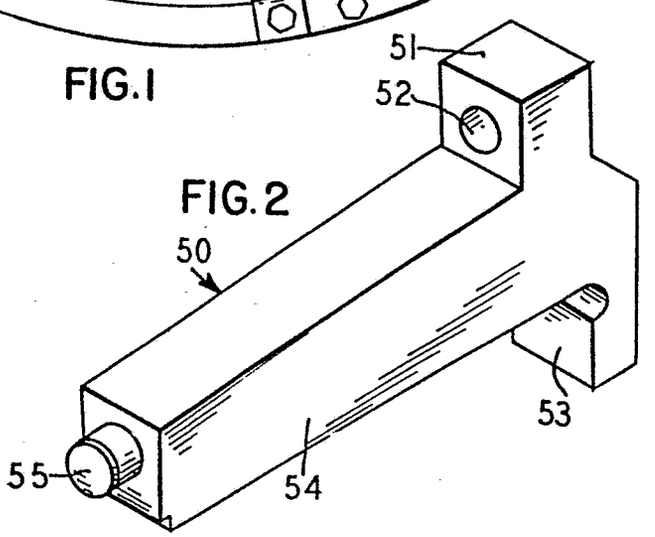

FIG.2

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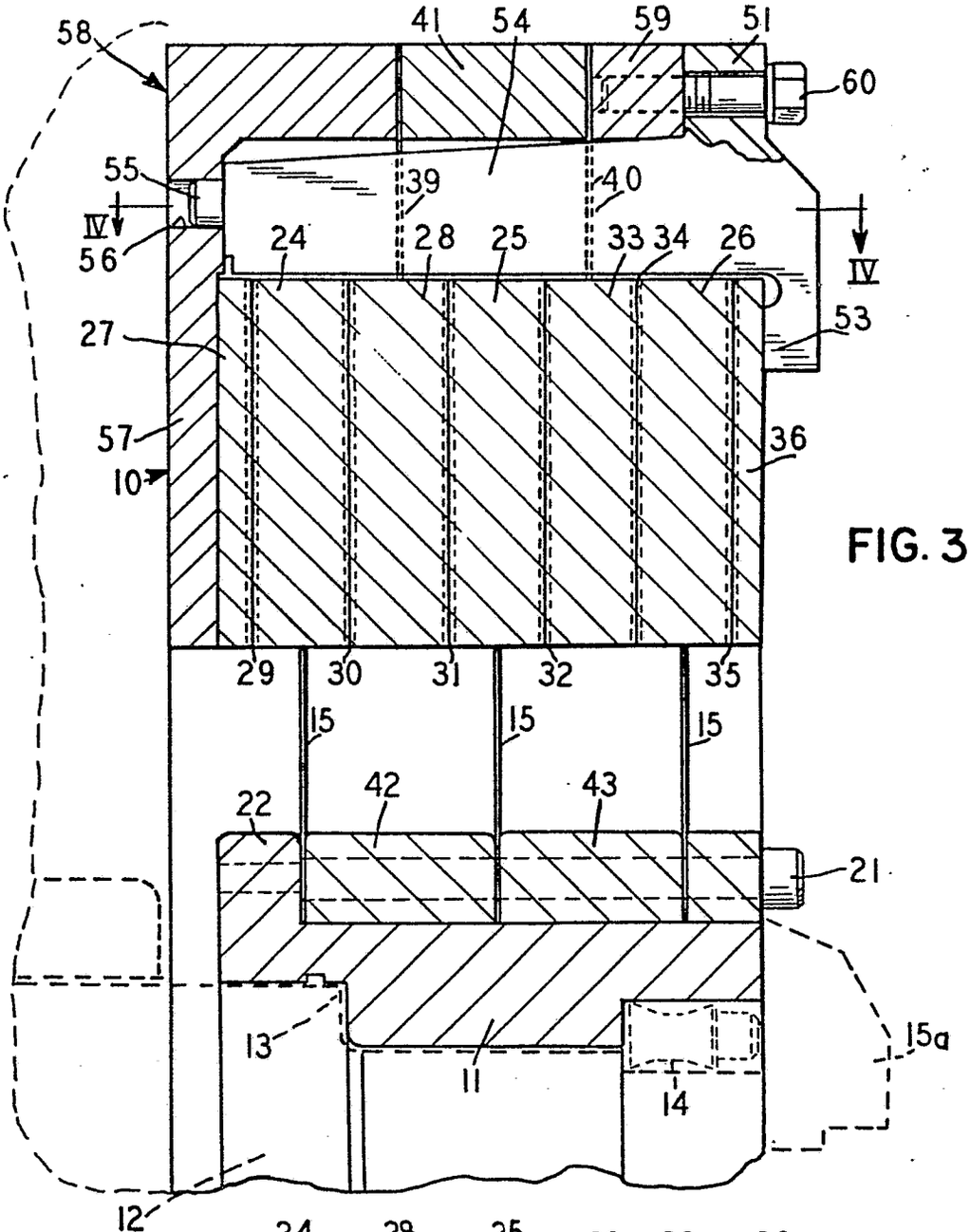

FIG. 3

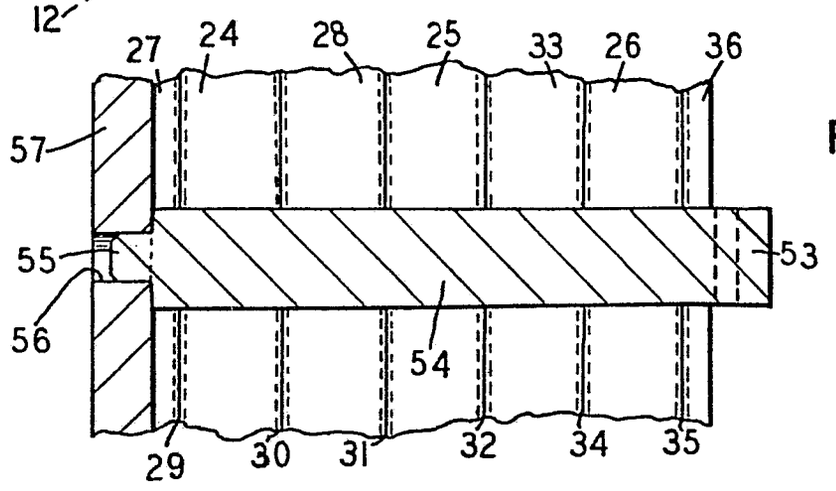

FIG. 4