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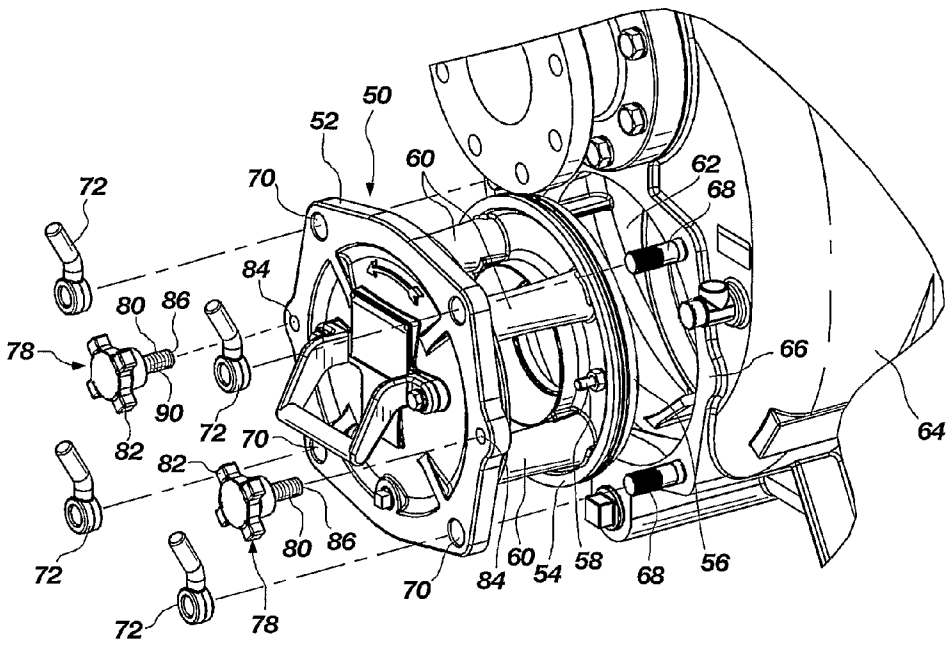
(54) **Title:** TOOL-FREE ADJUSTABLE CLEAN-OUT ASSEMBLY FOR A PUMP



(57) **Abstract:** A clean out assembly for a centrifugal pump, particularly, for example, a self-priming-type of centrifugal pump, is structured to provide easy adjustment of the clean out assembly and axial movement of a wear plate in proximity to the impeller of the pump without the need for tools to effect such movement of the wear plate and clean out assembly.

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TOOL-FREE ADJUSTABLE CLEAN-OUT ASSEMBLY FOR A PUMP

Cross-reference to Related Application: This application is a non-provisional application claiming priority to provisional patent application Serial No. 60/707,006 filed August 10, 2005.

BACKGROUND OF THE INVENTION

Field of the Invention: This invention relates to self-priming centrifugal pumps, and relates specifically to a clean-out assembly for a self-priming pump that facilitates access to the interior of the pump and axial adjustment of the wear plate relative to the impeller.

Description of Related Art: Self-priming centrifugal pumps are well-known and frequently used in industries where processing fluids with entrained solids is required. Self-priming pumps, also known as trash pumps, are characterized as having a casing which houses a suction chamber and a separation chamber divided by a wall or plenum. An impeller positioned in a volute section of the pump receives fluid from the suction chamber and delivers it by centrifugal action into the separation chamber where it is eventually expelled through an outlet.

The impeller of self-primer pumps are generally of the open type, meaning that the impeller has a rear shroud, but an open eye into which fluid flows from the suction chamber. In order for the pump to operate most efficiently, the impeller must be positioned as close as possible to the wall of the volute casing of the pump to minimize recirculation and leakage of fluid out and around the impeller. To accomplish that, a wear plate is typically positioned between the volute casing and the open or suction side of the impeller. The wear plate is positioned in very close proximity to the impeller vanes to assure efficient pump operation.

As the pump is operated, especially in the processing of fluids with entrained solids, the vanes of the impeller and/or the wear plate can become worn down by the solids and the resulting gap or clearance between the impeller vanes and wear plate causes the pump to operate with

less efficiency. It then becomes necessary to adjust the distance or clearance between the impeller and the wear plate to assure a close fit therebetween.

Pump manufacturers have dealt with this problem in the prior art by providing various means by which the clearance between the impeller and the wear plate can be adjusted as needed. In old prior art systems, an adjustment was provided for axial movement of the rotating assembly (i.e., impeller and drive shaft) relative to a stationary wear plate or pump casing. However, such adjustment means involved the need to correspondingly adjust the drive shaft relative to the motor, and involved other compensatory adjustments to structural elements of the pump.

In certain types of pumps, exemplified by self-primer pumps, a clean out assembly is provided which serves two essential purposes. First, the clean out assembly provides access to the eye of the impeller through the suction chamber and provides a convenient means for removing solids or other debris that may have clogged the impeller. Second, the clean out assembly has provided a supporting structure for the wear plate and, consequently, a means for adjusting the axial distance between the wear plate and impeller.

In presently known clean out assemblies having means for adjusting the wear plate, the adjustment means or devices are complicated, usually requiring several adjustment and securement devices, and all require tools for removing and/or adjusting the several elements to effect an adjustment of the wear plate. As a result, adjusting the wear plate can be difficult and time consuming, and the several elements that comprise the adjustment mechanism increase the cost of the pump.

Thus, it would be advantageous to provide a clean out assembly that provides adjustment of the wear plate, but which requires no tools to effect the adjustment of the wear plate or to remove the clean out assembly for servicing of the pump, thereby also simplifying manufacture of the pump and reducing the cost of manufacture.

BRIEF SUMMARY OF THE INVENTION

In accordance with the present invention, a clean out assembly for a pump, particularly a self-primer-type centrifugal pump, is structured to provide support for a wear plate and to provide a tool-free means for not only axially adjusting the wear plate relative to the impeller of the pump, but to facilitate removal of the clean out assembly for servicing the impeller of the pump. As used herein, "tool-free" means that no tools are required to effect movement or adjustment of the described elements of the clean out assembly and that such movement is achieved by using one's hand to effect such adjustment or movement.

The clean out assembly of the present invention generally comprises an end cover which provides support for a wear plate and is positioned to cover the access opening in a centrifugal pump axial to the eye of the impeller. The end cover supports a wear plate that is positioned in close proximity to the impeller when the end cover is secured in place within the pump casing. The end cover is attached is the pump casing by securement apparatus.

The end cover, and thus the wear plate, is axially adjustable relative to the pump casing and the impeller by adjustment elements that operate separately from the securement apparatus for attaching the end cover to the pump casing and, in an especially suitable embodiment may be spaced from the securement apparatus. By providing adjustment elements operably separate from the securement means, axial adjustment of the wear plate is significantly simplified over conventionally-known clean out assemblies for pumps.

The adjustment elements comprise a threaded shaft that is threadingly positioned through openings in the end cover. The adjustment elements also have a handle which can be turned by hand to effect adjustment of the end cover relative to the pump casing, and thus effect axial adjustment of the wear plate relative to the impeller. The securement apparatus for attaching the end cover to the pump casing are also each

provided with hand nuts that enable tightening of the securement apparatus by hand. No tools are required to effect attachment or adjustment of the end cover relative to the pump casing, as is conventional in the prior art.

The simplified structures of the present clean out assembly enable axial adjustment of the end cover and wear plate without the need for tools, and enable axial adjustment without removal of any parts. The configuration of the present clean out assembly effectively reduces the manufacturing and operating costs of the pump.

BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWINGS

In the drawings, which illustrate what is currently considered to be the best mode for carrying out the invention:

FIG. 1 is a perspective view of a prior art pump illustrating conventional structure for a clean out assembly;

FIG. 2 is a view in cross section of the prior art clean out assembly shown in FIG. 1;

FIG. 3 is a perspective view of a pump illustrating the clean assembly of the present invention; and

FIG. 4 is a view in cross section of the clean assembly of the present invention as shown in FIG. 3.

DETAILED DESCRIPTION OF THE INVENTION

By way of comparison, a prior art clean out assembly 10 is illustrated in FIGS. 1 and 2 which comprises, in general, an end cover 12 and a supporting ring 14 spaced from the end cover 12 by a plurality of stanchions 16. The supporting ring 14 provides a means for attachment thereto of a wear plate 18, which is connected to the supporting ring 14 by screws 20. The clean out assembly 10 fits into an opening 22 formed in the pump casing 24 so that the wear plate 18 is positioned adjacent the impeller 25, as best seen in FIG. 2.

In the prior art pump of FIG. 1, the clean out assembly 10 is

connected to the pump casing 24 by a plurality of threaded studs 26 that extend through holes 28 formed in the end cover 12. The end cover 12 is secured in place by hand nuts 30 that tighten onto the threaded studs 26.

The means for adjusting the axial position of the wear plate 18 relative to the impeller is also associated with the means for attaching the end cover 12 to the pump casing 24. Specifically, a threaded adjustment member 34 threads into each opening 28 in the end cover 12 and slips onto the threaded stud 26. The adjustment member 34 has a hexagonally-configured head the corners of which engage with teeth formed in a central opening 38 of a locking member 36. The opening 38 of the locking member 36 is sized to receive the head of the adjustment member 34.

The locking member 36 is normally bolted to the end cover 12 by the positioning of a locking bolt 40 and washer 42 through an opening 44 in the locking member 36. The locking bolt 40 then threads into an opening 46 in the end cover 12. When the axial position of the wear plate 18 is to be adjusted (i.e., the axial position of the clean out assembly is to be adjusted relative to the pump casing 24), the hand nut 30 must first be removed from the threaded stud 26. The locking member 36 is then removed from the end cover 12 by using a first tool to loosen and remove the locking bolt 40 and nut 44.

Each adjustment member 34 is then rotated a selected amount to move the end cover 12 toward the pump casing 24. A tool different from the tool used to remove the locking bolt 40 is used for that process. Once the adjustment members 34 are rotated the desired amount, the locking member 36 is replaced about the head of the adjustment member 34 and is locked in place by securement of the locking bolt 40 into place. Each of these steps requires various tools for effecting the adjustment, and the adjustment involves manipulation of several structural elements, all of which results in time-consuming and costly servicing and added cost for manufacturing of the pump.

The clean out assembly 50 of the present invention, shown in FIGS. 3

and 4, solves the problems encountered with prior art clean out assemblies by providing a simplified and tool-free means for attaching the clean out assembly to the pump casing and for effecting adjustment of the wear plate. Further, the clean out assembly of the present invention provides means for attachment of the end cover to the pump casing which is separate from the axial adjustment structure, thereby eliminating the need to remove structural elements associated with attachment of the end cover as is required in the prior art.

The clean out assembly 50 of the present invention comprises an end cover 52 and a supporting ring 54 to which a wear plate 56 is attached by some means, such as bolts 58. The supporting ring 54, and thus the wear plate 56, is spaced from the end cover 52 by a plurality of spacer columns 60. The clean out assembly 50 fits into an opening 62 in the pump casing 64 in the conventional manner to position the wear plate 56 in very close proximity to the impeller 61, as best seen in FIG. 4.

The end cover 52 of the present invention is secured adjacent the shoulder 66 surrounding the opening 62 in the pump casing 64 by securement apparatus comprising a plurality of threaded stud bolts 68 that extend through openings 70 in the end cover 52. A threaded hand nut 72 is attachable to each stud bolt 68 providing a means for tightening the end cover 52 to the pump casing 64.

Axial adjustment of the wear plate 56 in the present invention is effected by providing two or more adjustment elements 78 that comprise a threaded shaft 80 and a handle 82. The threaded shaft 80 of the adjustment element 78 is threaded through a threaded opening 84 in the end cover 52. As best seen in FIG. 4, the adjustment element 78 is set so that the terminal end 86 of the threaded shaft 80 seats against the shoulder 66 of the pump casing 64. As will become apparent for axial adjustment purposes, the end cover 52 is initially positioned relative to the shoulder 66 of the opening 62 in the pump casing 64 such that a space 88 is provided between the shoulder 66 and the end cover 52.

When adjustment of the wear plate 56 is required (i.e., when the wear plate 56 needs to be brought into closer proximity to the impeller 61), the hand nuts 72 on the stud bolts 68 are loosened slightly by hand to allow movement of the end cover 52. The handle 82 of each adjustment element 78 is then rotated by hand to effect movement of the end cover 52 in a direction toward the pump casing 64, and thus effect axial movement of the wear plate 56 toward the impeller 61. Movement of the end cover 52 is accomplished by the fact that the threaded shaft 80 of the adjustment elements 78 are threaded into the threaded openings 84 in the end cover 52; consequently, rotation of the handles 82 causes the end cover 52 to move in a direction toward the impeller 61.

Once the wear plate 56 is adjusted to the desired point of proximity to the impeller 61, the hand nuts 72 are then turned by hand to tighten the end cover 52 again to the pump casing 64. The adjustment elements 78 of the invention are structured with self-locking threads that lock the adjustment elements 78 into place after movement. However, a locking element of known structure may also be employed to secure the adjustment elements 78 in place. Indicia 90 may also be provided on the adjustment elements 78 to calibrate the amount by which the axial adjustment is made.

It can be appreciated from the foregoing disclosure that the clean out assembly of the present invention provides an improved and simplified means of securing the clean out assembly to the pump casing and effecting axial adjustment of the wear plate relative to the impeller, while reducing the costs of manufacture and operation of the pump. The structure, configuration and placement of the adjustment elements may vary from that illustrated and described herein. For example, while illustrated and described herein as being spaced from the stud bolts that secure the end cover to the pump casing, the adjustment elements may be located in proximity to the stud bolts, but operate separately from the stud bolts in a manner similarly described herein for effecting axial movement of the end cover, and without the need for tools. Accordingly, reference herein to

particular details of the clean out assembly of the present invention are by way of example, and not by way of limitation.

CLAIMS

What is claimed is:

1. A centrifugal pump having a clean out assembly, comprising:
a pump casing housing an impeller and having an opening oriented axially to the eye of the impeller for receiving a clean out assembly;
a clean out assembly having an end cover attached to and spaced from a wear plate for positioning in proximity to said impeller;
securement apparatus for securing said clean out assembly to said pump housing; and
at least two adjustment elements positioned on said end cover for providing tool-free axial adjustment of said wear plate relative to said impeller, said adjustment elements being separately operable from said securement apparatus such that said adjustment elements effect axial movement of said wear plate without removal of said securement apparatus from said end cover.

2. The centrifugal pump of claim 1 wherein said adjustment elements are configured with handles for effecting tool-free movement of said adjustment elements for axial adjustment of said end cover.

3. The centrifugal pump of claim 2 wherein said adjustment elements are positioned between said end cover and said pump casing.

4. The centrifugal pump of claim 3 wherein said adjustment elements further comprise a threaded shaft threading received through said end cover.

5. The centrifugal pump of claim 1 wherein said adjustment elements further comprise indicia for determining the amount of axial adjustment made to said end cover.

6. The centrifugal pump of claim 1 wherein said securement apparatus further comprises stud bolts connected to said pump casing which are receivable through corresponding openings formed in said end cover, and further wherein said securement apparatus comprise a hand nut for too-free adjustment of said securement apparatus.

7. A centrifugal pump having a clean out assembly, comprising:

a pump casing housing an impeller and having an opening oriented axially to the eye of the impeller for receiving a clean out assembly;

a clean out assembly having an end cover attached to and spaced from a wear plate;

a plurality of threaded studs securing said end cover to said pump casing by means of a hand bolt connected to said threaded studs;

adjustment elements each comprising a threaded shaft for threaded attachment through said end cover and a handle formed to said threaded shaft for effecting tool-free rotation of said threaded shaft by hand, said threaded shaft being positioned in contact with said pump casing.

8. The centrifugal pump of claim 7 further comprising indicia for determining the amount of axial adjustment of said end cover.

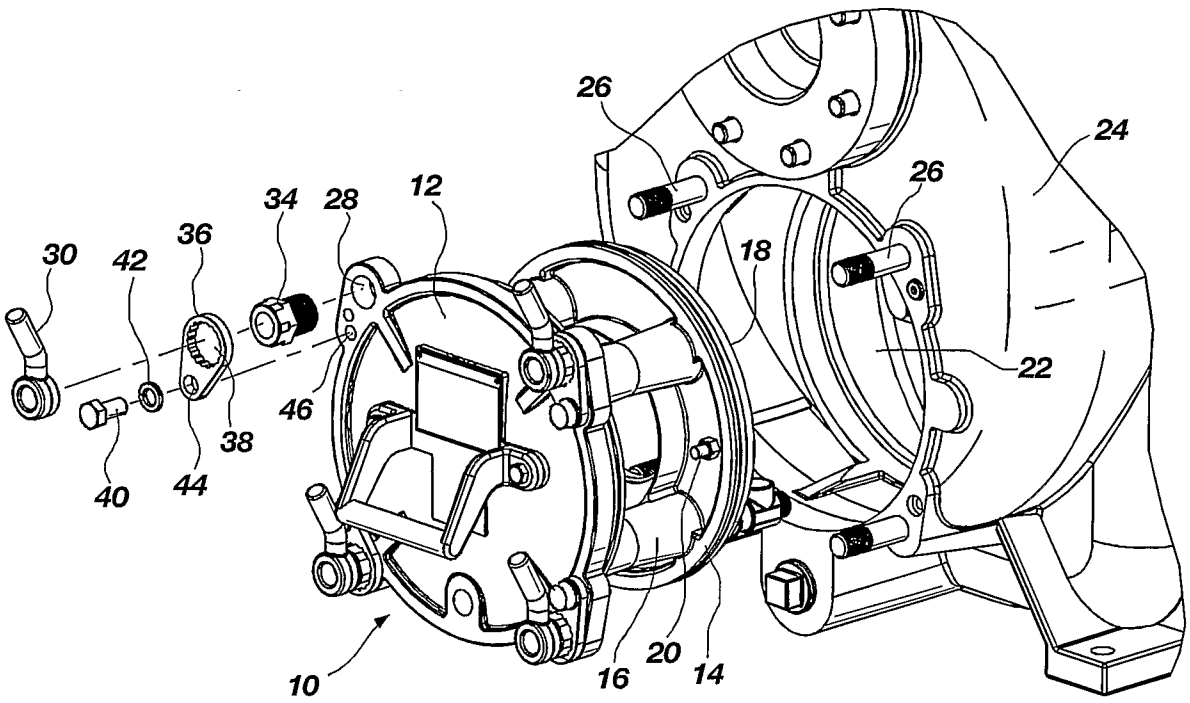

FIG. 1
(PRIOR ART)

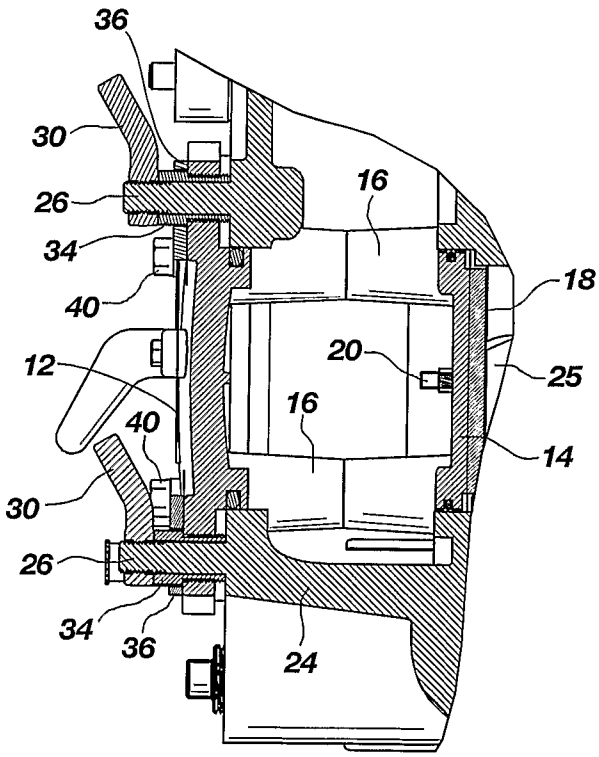

FIG. 2
(PRIOR ART)

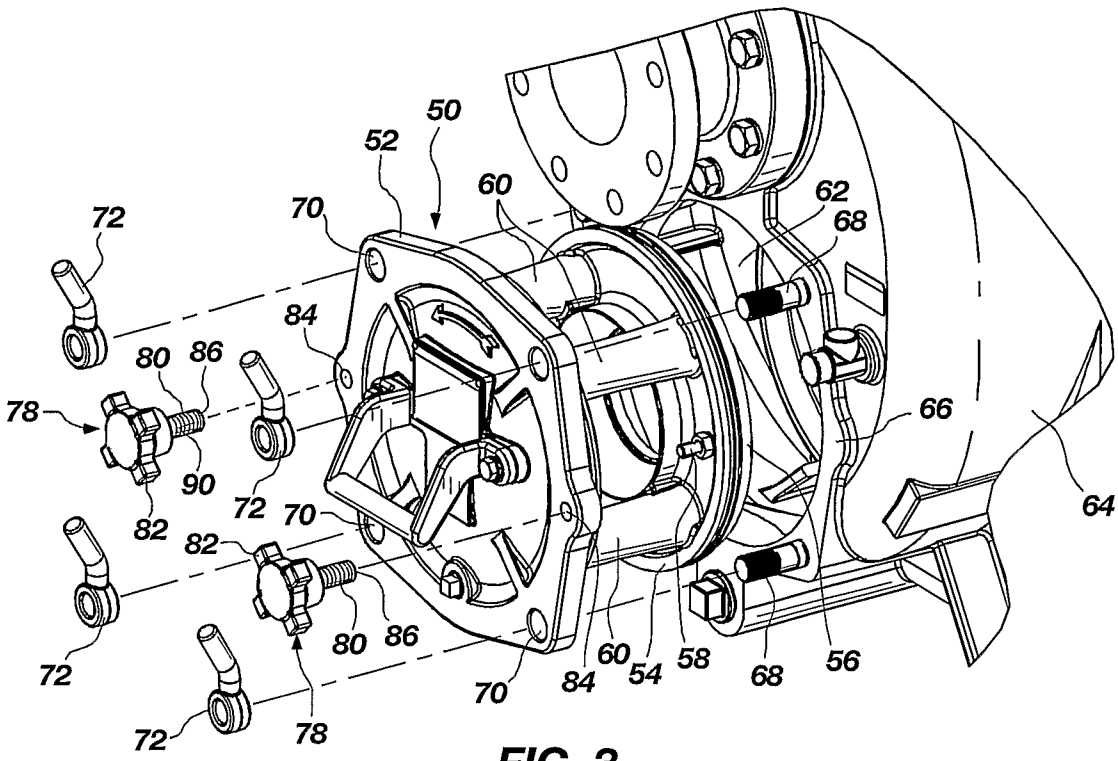
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FIG. 3

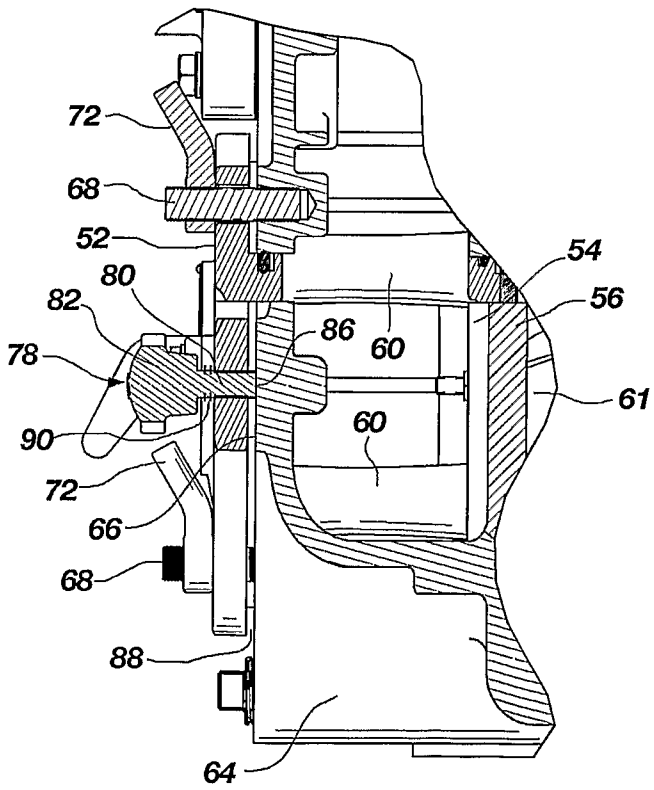
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FIG. 4