(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) Publication number: **0 290 200 A2**

(12) EUROPEAN PATENT APPLICATION

(21) Application number: **88303843.2**

(51) Int. Cl.4: **F01P 11/12**

(22) Date of filing: **28.04.88**

(30) Priority: **29.04.87 US 43915**

(43) Date of publication of application:
09.11.88 Bulletin 88/45

(84) Designated Contracting States:
BE DE FR IT

(71) Applicant: **DEERE & COMPANY**
John Deere Road
Moline Illinois 61265-8098(US)

(72) Inventor: **Nelson, James Roger**
621 South Center Street
Geneseo Illinois 61254(US)
Inventor: **Love, Mahlon L.**
Rt. 4, Pine Ridge Addition
Geneseo Illinois 61254(US)

(74) Representative: **Pears, David Ashley**
REDDIE & GROSE 16 Theobalds Road
London WC1X 8PL(GB)

(54) Self-cleaning rotary screen for filtering air.

(57) A self cleaning rotary screen of a combine harvester is provided with a planar circular screen (54) that is secured to an outwardly extending circular flange having an external groove and an internal groove. The screen is rotatably mounted on a hinged door (30) by a plurality of freely rotatable wheels (44-48) which are spaced around an aperture (40) in a door plate (38) and engage in the internal groove of the flange. Also secured to the door are two freely rotatable idler sheaves (66, 68) located adjacent to the hinge axis (P) of the door so that the endless drive belt which runs in the external groove passes from the two idler sheaves to a positionally fixed drive sheave (70) in tangential directions approximately aligned with the hinge axis (P). The drive sheave is driven by the propulsion system of the harvester and its rotational axis intersects the hinge axis (P). The door (30) can thus be opened without uncoupling the belt (64).

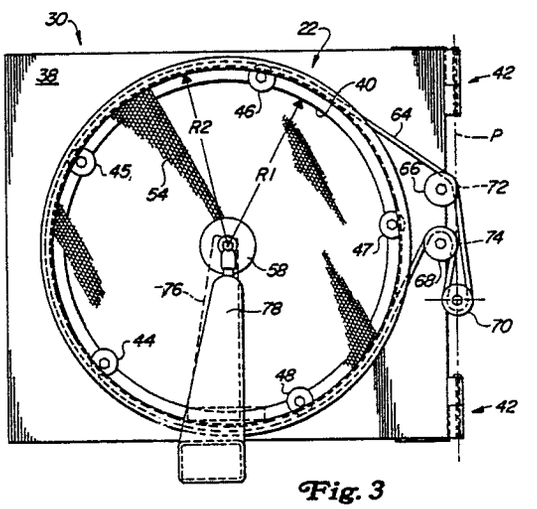

Fig. 3

EP 0 290 200 A2

SELF-CLEANING ROTARY SCREEN FOR FILTERING AIR

This invention relates to a self-cleaning rotary screen as set forth in the introductory part of claim 1, especially for filtering cooling air which is drawn through the screen for cooling an internal combustion engine on an agricultural combine.

In recent years, it has become common practice to enclose the engines of self-propelled agricultural combines. Typically, these enclosures are provided with self-cleaning rotary screens through which a cooling air stream is drawn. Heat exchangers are located behind the screen and include the radiator for cooling the engine, the oil cooler, and the condenser coils for the air conditioning. The screen is used to remove chaff and leaves from the cooling air stream so that they do not block the various heat exchangers located behind the screen.

It is desirable that the screen be automatically and continuously self cleaning to facilitate air flow through the screen. One method of accomplishing this task is to rotate the screen through a stationary chamber which is used to suck off the trash accumulated on the screen. This stationary chamber may be pneumatically coupled to the cooling air stream downstream of heat exchangers for reintroducing the trash collected off the screen into the air stream.

It is known (US-A 3 938 586) and US-A 4 443 236) to rotate the screen by the air flow therethrough but a more positive drive is obtained with a belt drive. Screens in accordance with the introductory part of claim 1 are known from US-A 3 816 981, US-A 3 837 149 and US-A 4 233 040 and comprise a central hub mounted on bearings and forming a sheave which is engaged by the belt. In such arrangements the central hub inevitably impedes air flow in a central region and the usable part of the screen is restricted to an annular region around the hub.

In addition, the frame on which the screen is mounted may be a hinged door which can be opened to get access to the heat exchangers. To open the door, the endless belt must be disengaged from the driving sheave before the door can be opened (US-A 3 837 149 and US-A 4 233 040).

The main object of the invention is to provide a screen of the kind first referred to above which can have a greater unobstructed air flow area for a given screen diameter.

To this end the present invention provides a self-cleaning rotary screen as defined in claim 1.

A further object of the invention is to provide a screen on a hinged door which does not require the belt dive to be uncoupled when opening the door. This object is met by the inventive features defined in claims 3 and 4.

The preferred embodiment of the invention has a self-cleaning rotary screen which is provided with an outwardly extending flange having an external groove and an internal groove. The external groove is adapted and constructed to receive an endless belt for rotating the screen whereas the internal groove is adapted and constructed to receive a plurality of freely rotatable wheels constituting a rotatable bearing assembly for the screen.

To facilitate opening of the hinged door on which the screen is located, the door is provided with a first and second idler sheaves that are rotatably mounted to the door adjacent to the hinge axis of the door. The centerpoint of the endless belt when coupled to the outer periphery of both sheaves defines a tangent axis that is substantially aligned with the hinge axis. In addition, the centre rotational axis of the driving sheave intersects the hinge axis. The sheaves are provided with semi-circular grooves which are adapted and constructed to receive an endless belt having a circular cross section. In this way, as the door is opened, the endless belt instead of stretching and becoming misaligned from the sheaves, merely twists in the sheaves' grooves, thereby eliminating the uncoupling step necessary with the previous rotary screens.

The invention will be described in more detail, by way of example, with reference to the accompanying drawings, in which

Fig.1 is an overhead view of an agricultural combine illustrating the location of the engine and the position of the rotary screen.

Fig.2 is a top view of the rotary screen.

Fig.3 is a front view of the rotary screen.

Fig.4 is a cross sectional view of the rotary screen and stationary chamber.

Fig.1 illustrates a self-propelled agricultural combine harvester 10 having a harvesting platform 12. The combine is provided with an engine or propulsion means 14 located behind the clean grain tank 16. The propulsion means provides power to the separator means located inside the combine, the harvesting platform, and the front ground engaging wheels 18. An operator in operator cab 20 controls the operation of the combine. Cooling air for the engine is drawn through rotary screen assembly 22 by fan 23 past heat exchangers 24, 26 and 28. These heat exchangers comprise the radiator for cooling the engine, the oil cooler, and the condenser coils for the air conditioner.

The rotary screen is mounted on a hinged door 30 pivotally secured to heat exchanger shroud 32 which is fixed on the harvester. The hinged door is provided with hinge 42 for pivoting the door away

from shroud 32. The hinged door is located behind louvred side panel 34 of the combine which is also pivotally coupled to the chassis. Side panel 34 is provided with ladder 36 for mounting the combine and servicing the engine.

The hinged door 30 comprises a rectangular sheet metal plate 38 having a circular opening 40 having a radius R1 which is less than the radius R2 of rotary screen 22. In this way, cooling air passing through opening 40 to the heat exchangers must pass through screen 22. The door is provided with hinges 42 that extend outwardly from the plane of the metal plate. The two hinges form a pivot axis P around which the door is pivoted. The rotary screen is secured to the door by a bearing means comprising five freely rotatable wheels 44, 45, 46, 47 and 48 which are rotatably mounted at the periphery of opening 40 of plate 38 by fixed axle assemblies 50 having ball bearings 52.

The screen itself comprises a planar circular screen 54 comprising a woven wire mesh. The screen is secured to outwardly extending perpendicular circular flange 56 at edge 57; and inner mounting ring 58 at 59. The flange is provided with at least one external groove 60 and at least one internal groove 62. As illustrated in Fig.4, the rotatable wheels are adapted and constructed to engage internal groove 62 allowing for the rotation of the screen. External groove 60 is adapted and constructed to receive endless belt 64 which is used for transmitting rotational motion to the screen. Belt 64 has a circular cross section and maybe formed out of resilient urethane tubing, such as used in surgical applications.

Extending outwardly from the door are first and second idler sheaves 66 and 68, respectively. Both of these sheaves are freely rotatable and are mounted to the door. Driving sheave 70 comprising a third sheave is operatively coupled to the engine by shaft 71 which is rotatably mounted to shroud 32. Shaft 71 can be rotated by V-belt 73 transmitting rotational movement from fly wheel sheave 75 to shaft sheave 77. Endless belt 64 extends around the screen to first idler sheave 66 where it wraps around the top of this sheave and leaves the sheave at point 72. The belt then wraps around driving sheave 70 and is then directed to second idler sheave 68 at point 74. Points 72 and 74 are located at the outer periphery of the idler sheaves and together form a tangent axis that is substantially aligned with pivot axis P of the door. The points are located at the centre of the belt as it leaves or contacts the idler sheaves.

Driving sheave 70 has a central rotational axis that intersects the pivot axis. By arranging the sheaves in this manner, the belt does not become misaligned from the driving sheave, as the door is opened, but rather twists inside the semicircular grooves of the three sheaves.

Extending radially inwardly from the periphery of opening 40 of plate 38 is mounting bracket 76. This mounting bracket provides a central hub to which stationary chamber 78 is secured. The stationary chamber is triangularly shaped and substantially overlies the mounting bracket. The stationary chamber forms a duct that extends around the outer edge of the door terminating in a converging sleeve at 80. This sleeve is adapted and constructed to mate with a duct that is mounted to the chassis and which is pneumatically coupled to the air stream downstream of the heat exchangers. In this way, the air stream downstream of the heat exchangers forms a vacuum, created by fan 23, in the ducts which is in turn pneumatically communicated to the stationary chamber. Chaff and leaves are vacuumed off the rotary screen in the stationary chamber and reintroduced into the air stream downstream of the heat exchangers. Such a system is identical to the ones disclosed in US-A 3 837 149 and US-A 4 233 040.

Claims

1. A self-cleaning rotary screen for filtering out large particulate matter from air flowing through the screen,wherein the screen (54) is rotatably mounted in a frame (30, 38) and is rotated in its own plane by a belt drive (64) coupled thereto so as to move past a cleaning device (78), characterized in that the screen (54) has a peripheral flange (56) with an external groove (60) in which the belt (64) engages and an internal groove (62) within which engage bearing means (44-48) rotatably mounting the screen (54) on the frame (30, 38).

2. A screen according to claim 1, characterized in that the bearing means comprise freely rotatable wheels (44-48) mounted on the frame (30,38) and engaging in the internal groove (62).

3. A screen according to claim 1 or 2, wherein the frame (30, 38) is a hinged door, characterized in that the belt (64) is so guided in the vicinity of the hinge axis (P) of the door between a positionally fixed drive sheave (70) and the external groove (60) that the door (30, 38) can be opened without disengaging the belt (64).

4. A self-cleaning rotary screen for filtering out large particulate matter from air flowing through the screen, wherein the screen (54) is rotatably mounted in a frame (30, 38) and is rotated in its own plane by a belt drive (64) coupled thereto so as to move past a cleaning device (78), and wherein the frame (30, 38) is a hinged door, characterized in that the belt (64) is so guided in the vicinity of the hinge axis (P) of the door between a positionally

fixed drive sheave (70) and the external groove (60) that the door (30, 38) can be opened without disengaging the belt (64).

5. A self-cleaning rotary screen according to claim 3 or 4, characterized in that the belt (64) passes over two idle sheaves (66, 68) mounted on the door (30, 38) adjacent the hinge axis (P) so that a line tangential to both sheaves is substantially coincident with the hinge axis (P) and belt runs extend from the tangent points (72, 74) of the idle sheaves (66,68) to the positionally fixed sheave (70).

6. A self-cleaning rotary screen according to claim 5, characterized in that the axis of the positionally fixed sheave (70) intersects the said line.

7. A self-cleaning rotary screen according to claim 6, characterized in that the belt (64) extends from the external groove (60) to the idle sheave (66) remote from the positionally fixed sheave (70), from this idle sheave (66) to and around the positionally fixed sheave (70) and thence over the other idle sheave (68) and back to the external groove (60).

8. A self-cleaning rotary screen according to any preceding claim, characterized in that the belt (64) is a resilient belt of circular cross-section.

9. A self-cleaning rotary screen according to any preceding claim, characterized in that the screen (54) is planar.

10. A self-cleaning rotary screen according to any preceding claim, characterized in that the cleaning device (78) comprises a chamber on the upstream side of the screen for removing material caught by the screen.

11. A self-cleaning rotary screen according to claim 10, characterized in that the chamber (78) is a vacuum chamber for sucking the material off the screen.

12. A combine harvester comprising a self-cleaning rotary screen according to any preceding claim arranged to filter cooling air drawn through the screen to cool the engine of the harvester.

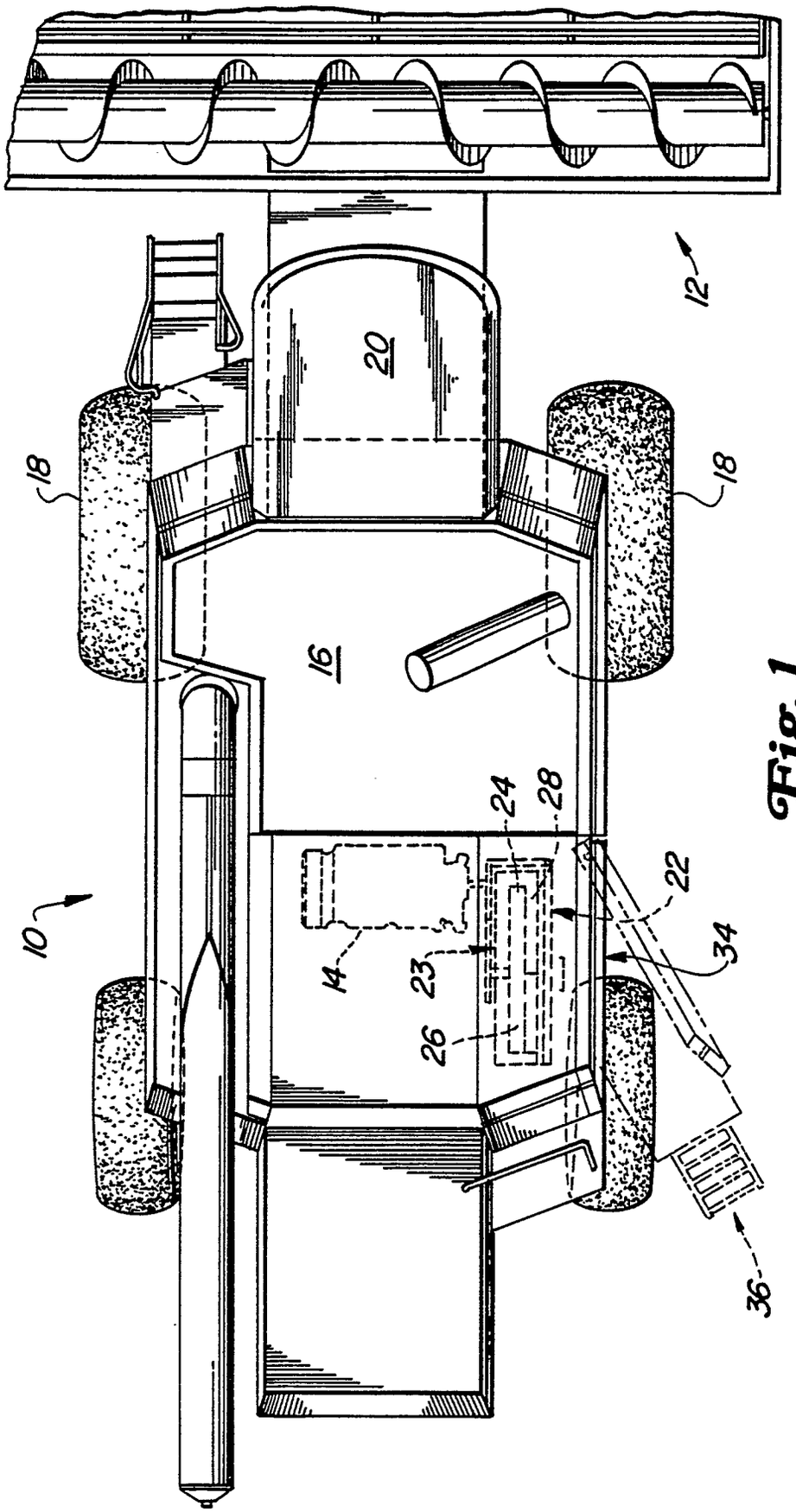

Fig. 1

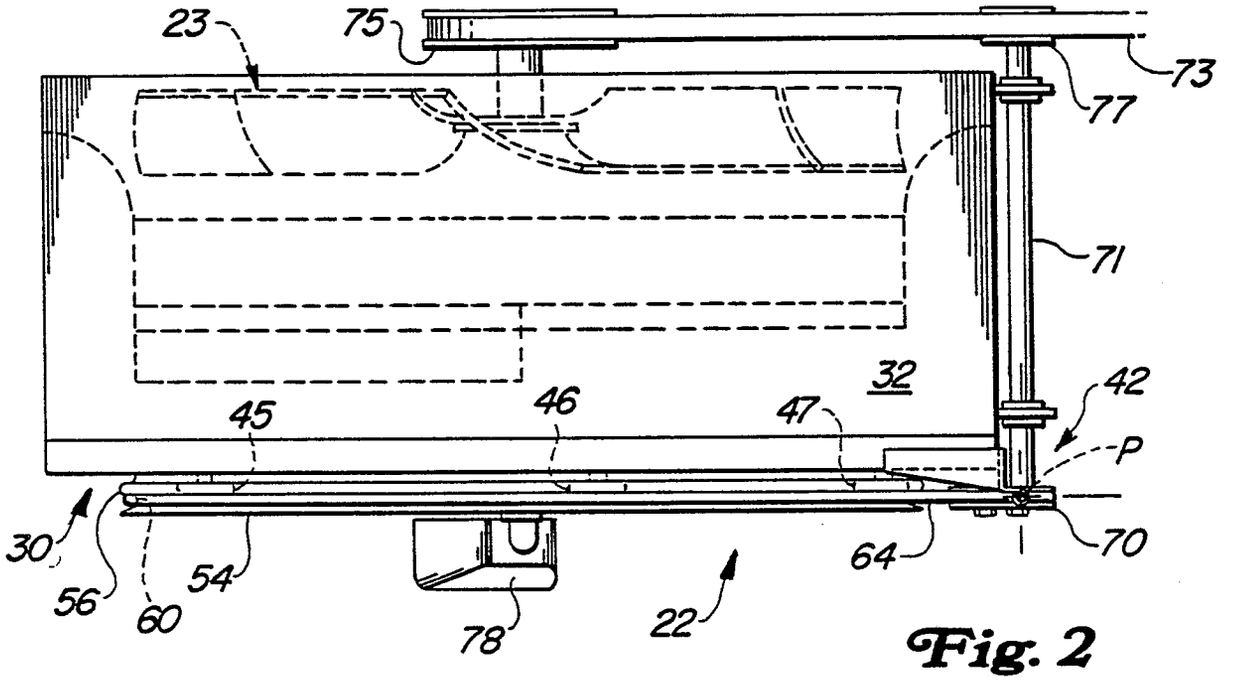
23
75
73
77
71
32
42
45
46
47
P
30
56
60
54
64
70
78
22

Fig. 2

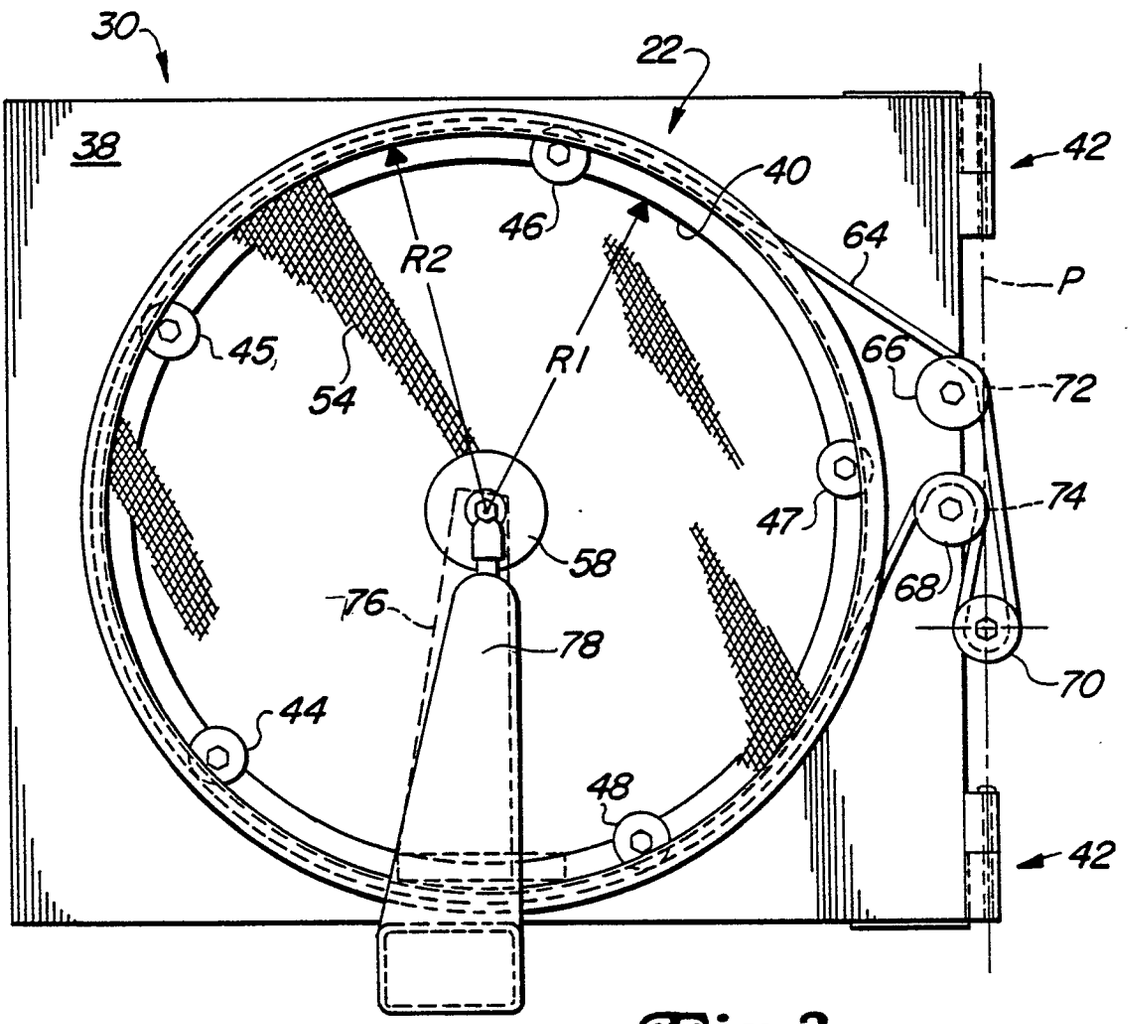
30
22
38
42
40
46
64
R2
P
45
54
R1
66
72
74
47
58
68
76
78
70
44
48
42

Fig. 3

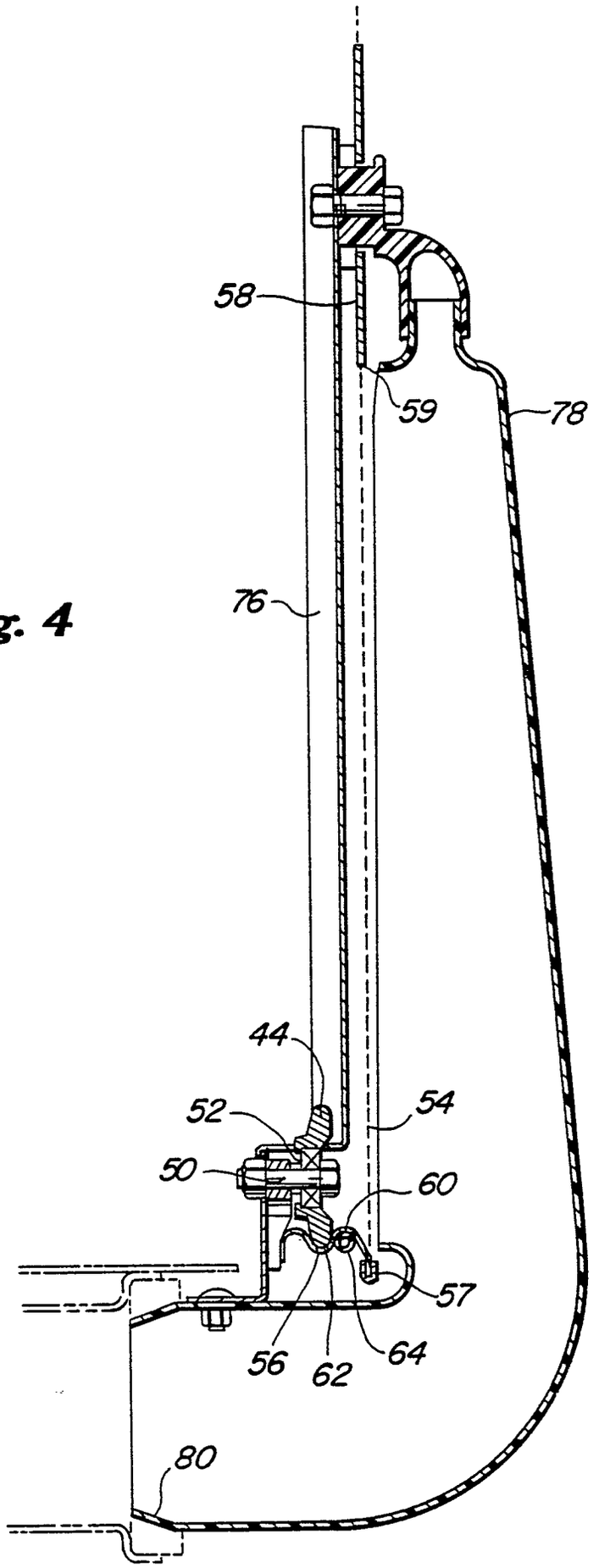

Fig. 4