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(54) **SCROLL COMPRESSOR WITH LUBRICATION OF SEALS IN BACK PRESSURE CHAMBER**

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Related U.S. Patent Documents

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(58) **Field of Classification Search** 418/55.5, 418/55.4, 55.6
See application file for complete search history.

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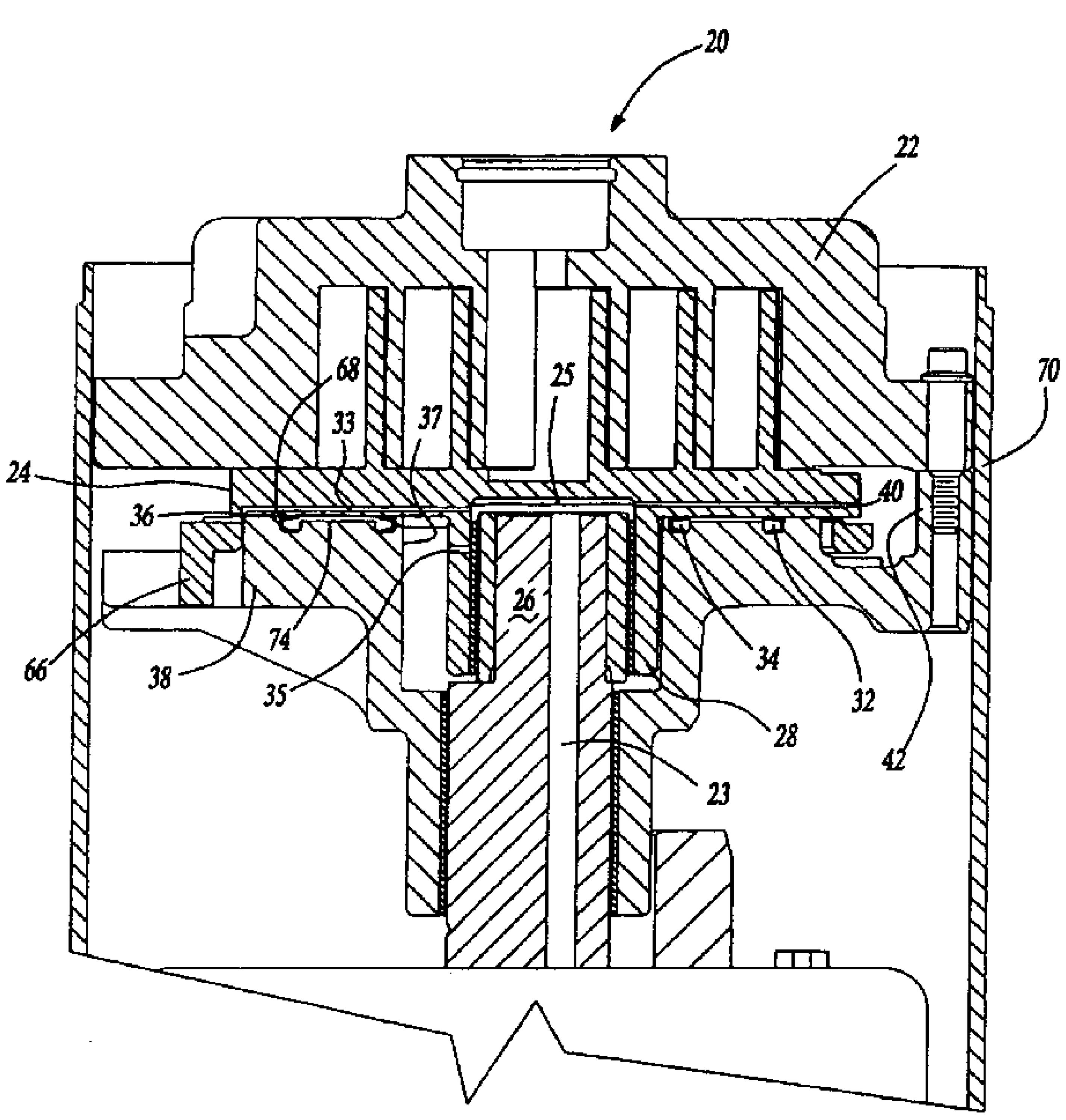
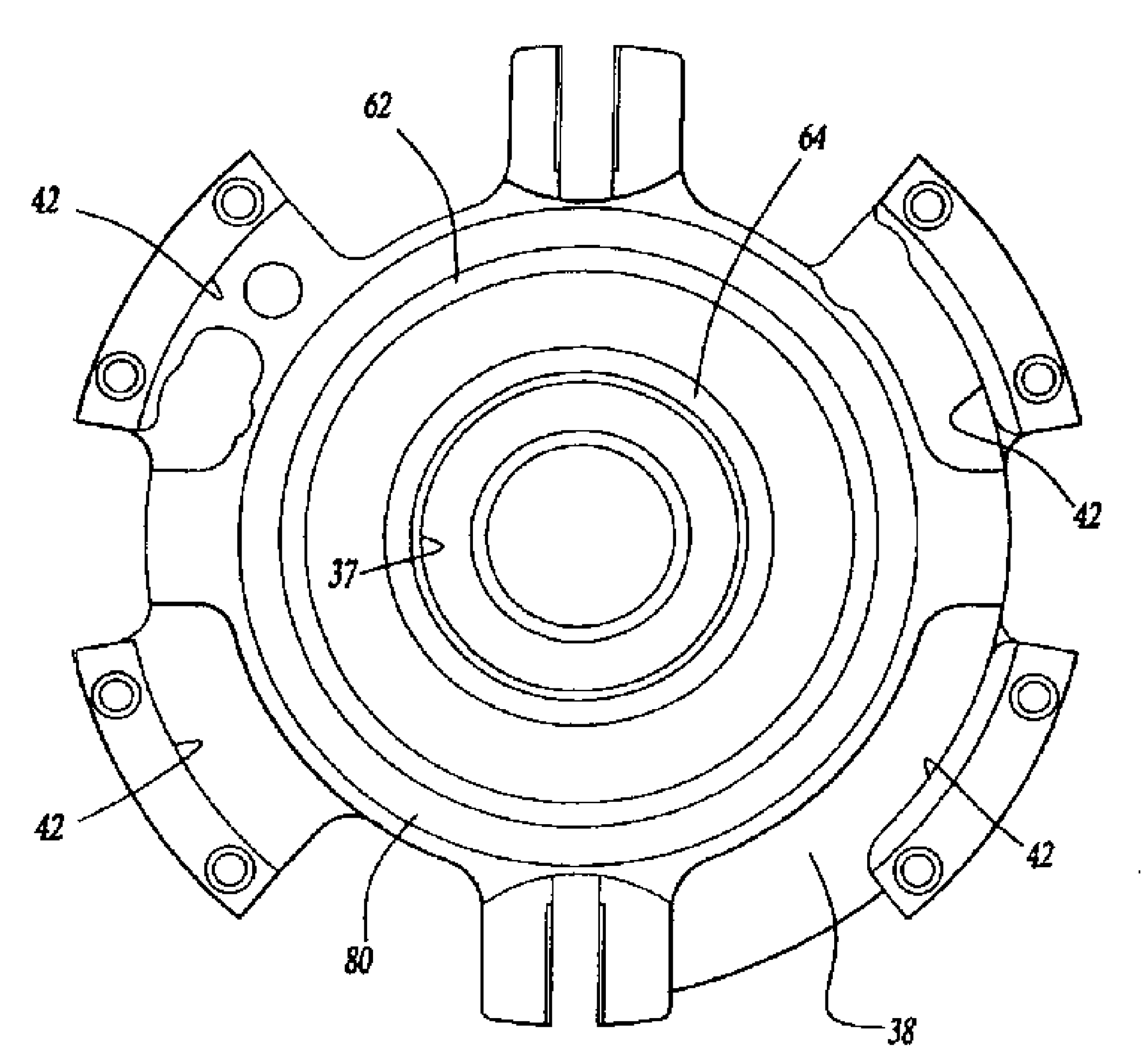
(57) **ABSTRACT**

A scroll compressor lubrication system includes a number of embodiments where lubricating oil impinges off surfaces adjacent to the orbiting scroll. The impinged oil creates a lubrication mist, which is deposited on the back surface of the orbiting scroll baseplate. The surface of the orbiting scroll onto which the oil has been deposited rubs against and carries the oil to the back chamber seals and to the back chamber. The seals thus are being lubricated by oil transfer from the back surface of the orbiting scroll to the seals. Sine the oil is deposited on the surface of the orbiting scroll, while it is exposed to suction pressure, only minimal pressurization of oil is required. Thus, there is no damage to the back pressure chamber seals due to over pressurization.

24 Claims, 3 Drawing Sheets





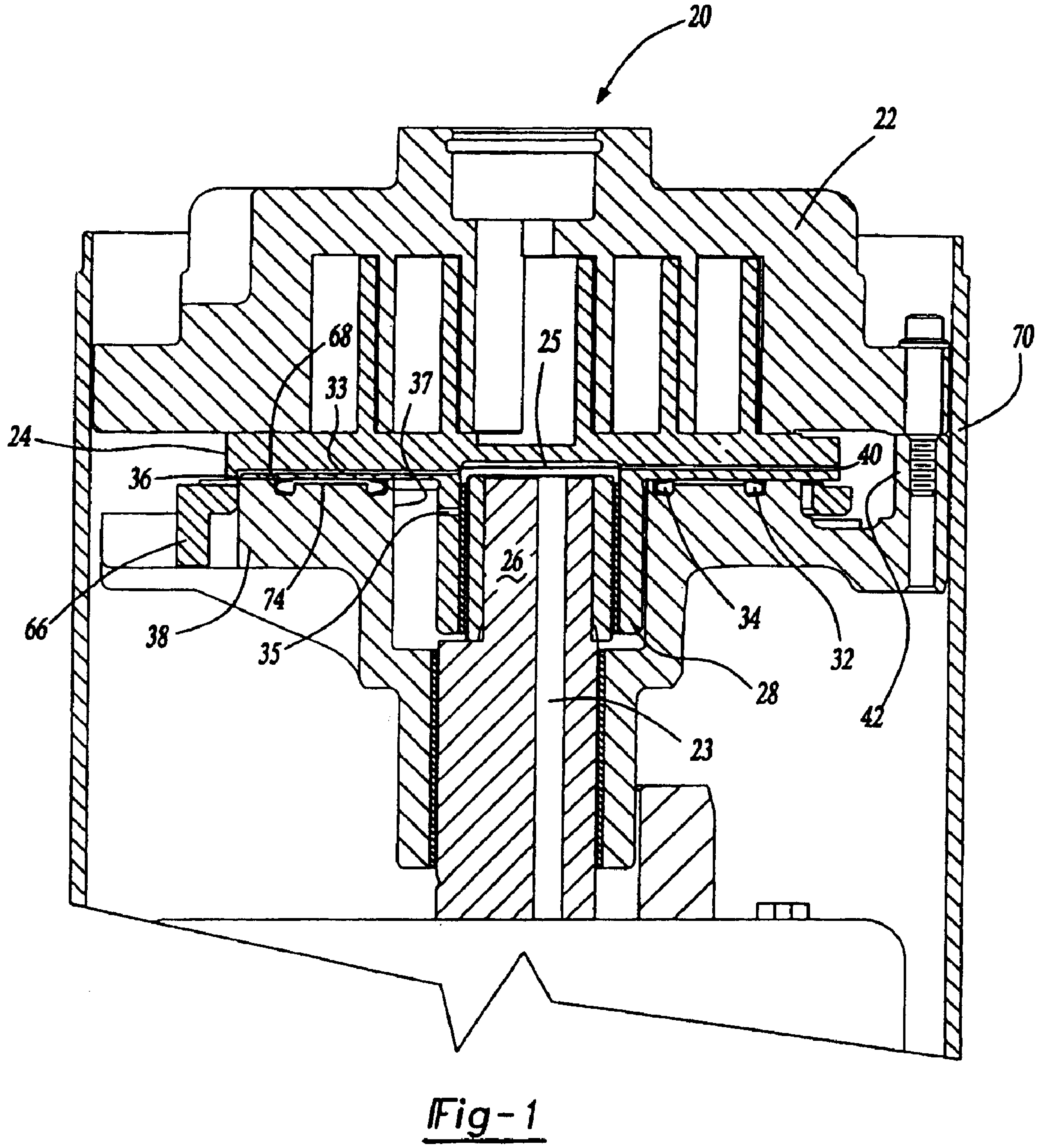


Fig-1

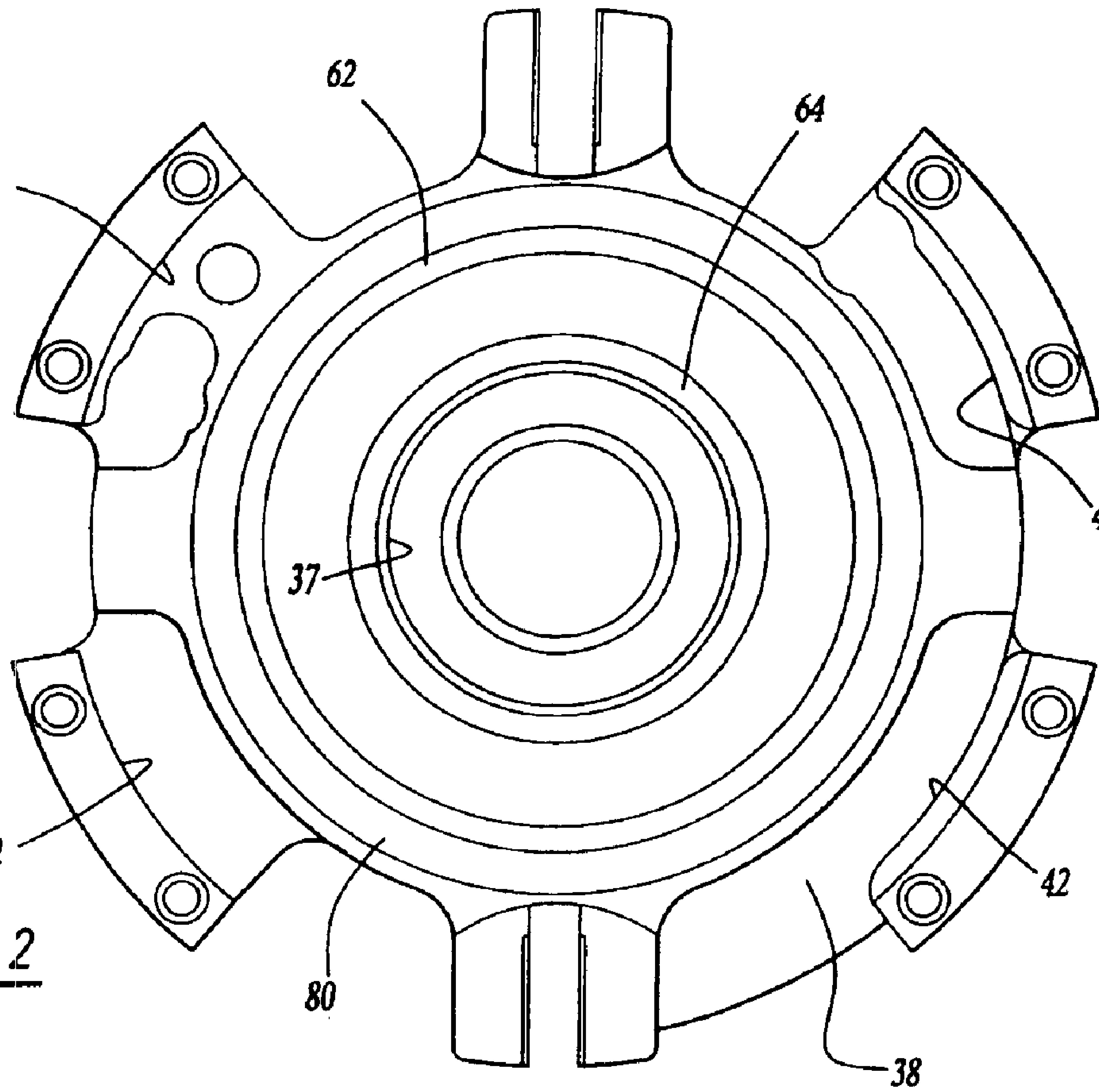


Fig-2

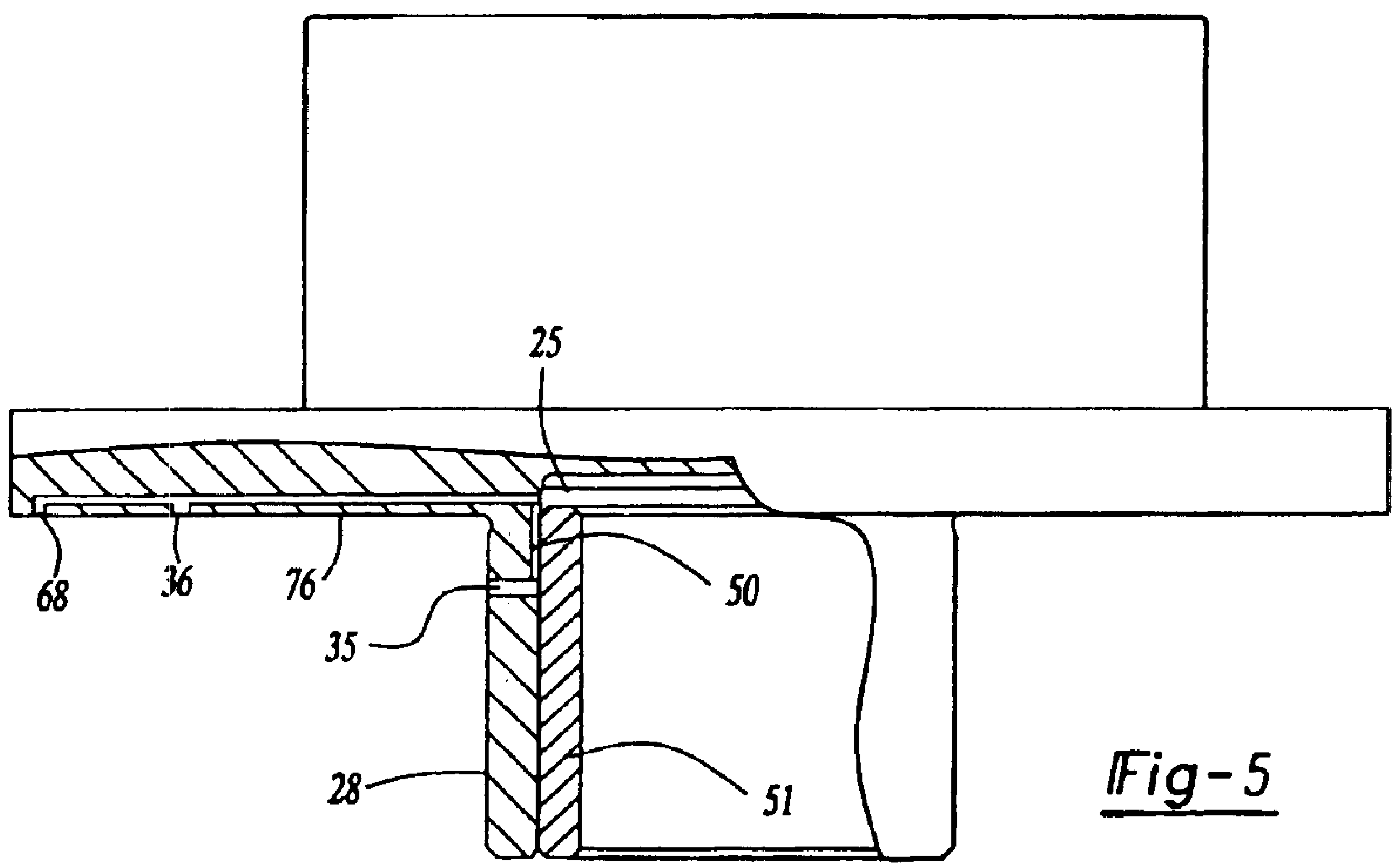


Fig-5

Fig-3

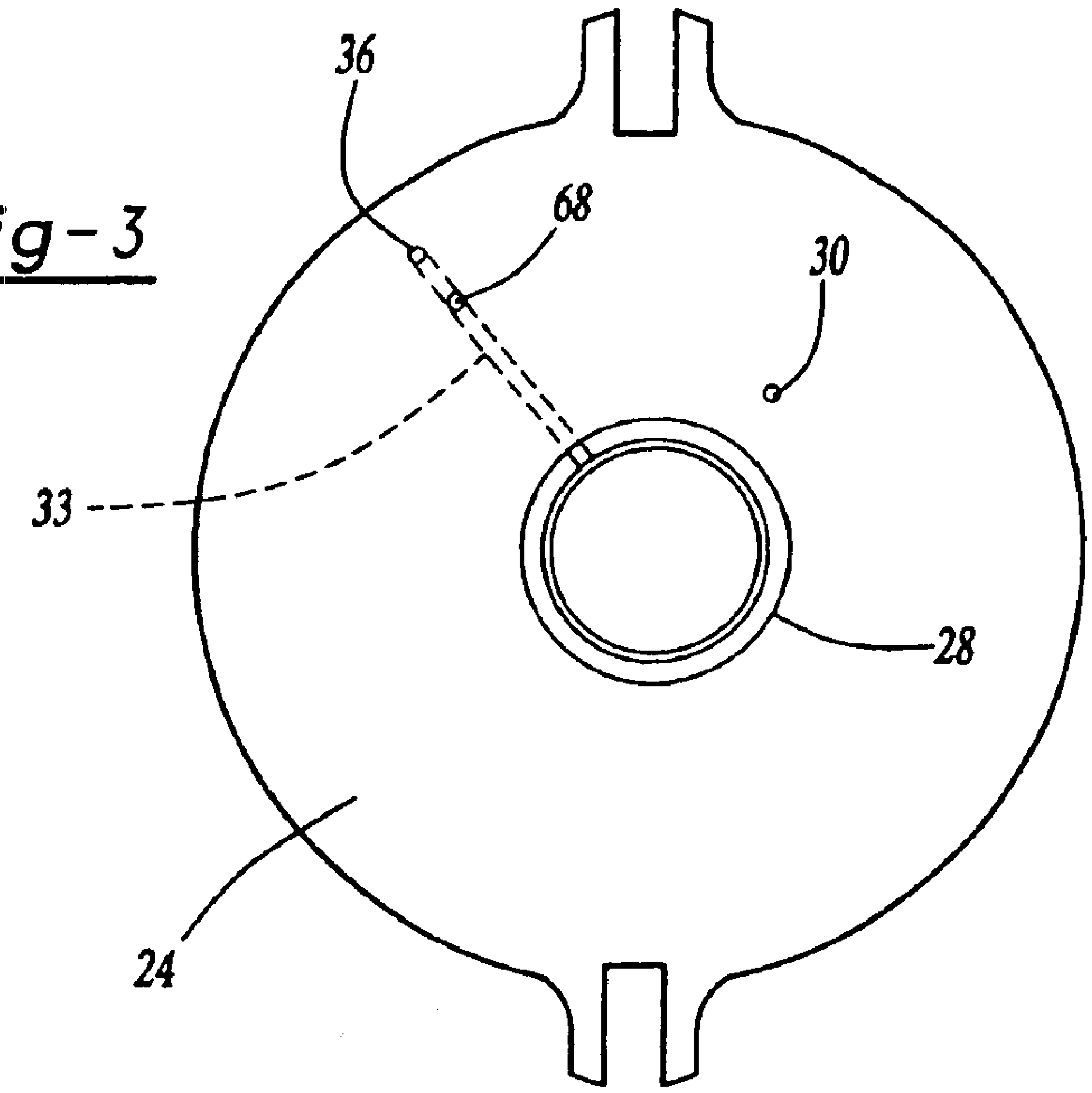
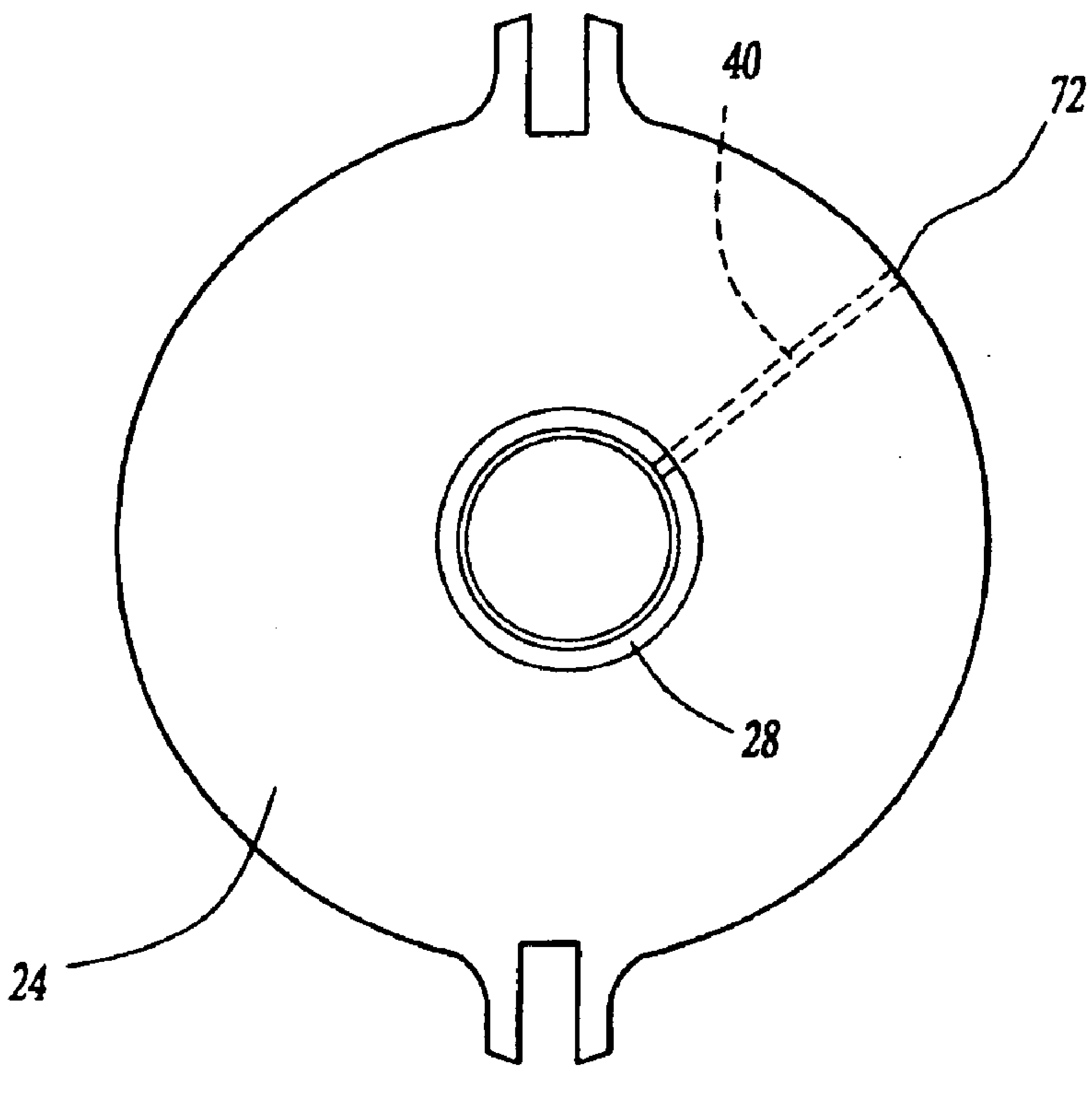


Fig-4



SCROLL COMPRESSOR WITH LUBRICATION OF SEALS IN BACK PRESSURE CHAMBER

Matter enclosed in heavy brackets [ ] appears in the original patent but forms no part of this reissue specification; matter printed in italics indicates the additions made by reissue.

BACKGROUND OF THE INVENTION

This invention relates to a scroll compressor with a lubrication system for indirectly conveying lubricant to the back pressure chamber seals.

Scroll compressors are becoming widely utilized in refrigerant compression applications. Essentially, a scroll compressor consists of two scroll members with one orbiting relative to the other. Each scroll members includes a spiral wrap extending from a base. The spiral wraps interfit to define compression pockets. As the orbiting scroll moves relative to the non-orbiting scroll, the size of compression pockets becomes smaller and fluid trapped inside the pockets becomes compressed. There is a separating force generated from the compressed fluid tending to bias the two scroll members away from each other.

To counteract the separating force, it is known to tap a pressurized fluid to a chamber behind the base of one of the scroll wraps. Two seals typically define the boundaries of the chamber. Pressure in the back chamber acting over the scroll base creates a force tending to bias the scroll members back together, and acts in a direction opposite to the separating force discussed above.

The back pressure chamber seals are subject to many challenges and, in known compressors, often fail. One cause of seal failure is the lack of oil to lubricate seals.

It has been proposed in the past to deliver lubricant directly to the back chamber seals. In such proposals the oil needs to be additionally pressurized, thus creating complications. First, the compressor needs means for pressurizing the oil. Also, the seals may be damaged due to overcompression of the oil in the supply line. Also, the slight axial movement of the orbiting scroll can overcompress oil in the back chamber, creating another cause of seal damage.

SUMMARY OF THE INVENTION

In a disclosed embodiment of this invention, lubricant is indirectly supplied to the outer and inner back pressure chamber seals of the scroll compressor. That is, the lubricant impinges off of a surface adjacent to the back pressure chamber seals, and then is carried to the back pressure chamber seals. In this way, adequate lubrication is provided to the back pressure chamber seals.

In one embodiment, the lubricant is directed to an outer seal by impinging off the crankcase towers or compressor shell, and in a second embodiment, the lubricant is directed to an outer seal by impinging off an end face of the crankcase adjacent to the outer seal or off a surface of an antirotation coupling. In either case, an oil mist is created which is deposited on the rear face of the orbiting scroll plate as the orbiting scroll rotates. As the orbiting scroll continues to rotate the rear face of the orbiting scroll, which is covered by oil mist, is moved over and comes in contact with the stationary back chamber outer seal. Thus, providing effective oil lubrication of the seal.

Lubricant is preferably also supplied to the inner seal. In one embodiment, a passage extends through the hub of the orbiting scroll. The oil expelled through this passage impinges on an inner portion of the crankcase. Again, an oil mist is created by this impingement, and the mist is deposited on the rear face of the orbiting scroll, from which it is carried to the inner seal.

It should be noted that since the oil is deposited on the surface of the orbiting scroll while it is exposed to suction pressure, only minimal oil pressurization is required; just enough to create an issuing jet. Thus, no additional means to pressurize the oil are required except as provided by the existing oil delivery system.

Although the present invention as specifically disclosed has a back pressure chamber disposed behind the orbiting scroll, it should be understood that the invention also extends to a back pressure chamber defined behind the non-orbiting scroll.

These and other features of the present invention can be best understood from the following specification and drawings, the following of which is a brief description.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** shows a cross-sectional view of a scroll compressor incorporating the present invention.

FIG. **2** shows a view of a crankcase according to the present invention.

FIG. **3** shows a view of a rear face of an orbiting scroll according to one embodiment of the present invention.

FIG. **4** shows a view of a rear face of an orbiting scroll according to another embodiment of the present invention.

FIG. **5** shows a cross-sectional view of an orbiting scroll with further definition of the features of the present invention.

DETAILED DESCRIPTION OF A PREFERRED EMBODIMENT

A scroll compressor **20** is shown in FIG. **1** incorporating a non-orbiting scroll **22** and an orbiting scroll **24**. As known, a shaft **26** drives the orbiting scroll through a hub **28** to orbit relative to the non-orbiting scroll **22**. As known, an oil passage **23** extends through shaft **26** to deliver oil to a chamber **25**. Oil in chamber **25** is then available for distribution to different locations of scroll compressor.

A tap **30**, shown schematically in FIG. **3**, taps pressurized fluid from chambers between the wraps of the orbiting and non-orbiting scrolls to a back pressure chamber **74** defined between seals **32** and **34**. Seals **32** and **34** are shown to be received in respective circumferentially extending grooves **62** and **64** in crankcase **38**.

A passage **33** receives oil from chamber **25**, and extends from the inner surface of the hub **28** to a downwardly extending tap **68**. Oil leaving tap **68** impinges on end face **80** of the crankcase **38** adjacent to the outer seal **32**.

Another tap **36** can be added. This tap extends downward. Oil leaving tap **36** impinges off the antirotation coupling **66**, adjacent to the outer seal **32**.

Another tap **35** extends from chamber **25** through the inner hub groove **50**, and provides a passage for impinging oil off of a surface **37** on the crankcase. Another passage **40** extends from chamber **25** outwardly through an outer peripheral wall of the orbiting scroll **24**. The oil which leaves the passage **40** through the opening **72** impinges off the crankcase tower **42** or off the scroll compressor shell surface **70**.

In all of the above arrangements, the oil impingement creates a mist, and the mist is delivered onto a rear face **76** of the orbiting scroll. The rear face of the orbiting scroll then carries the mist to the inner and outer seals **32** and **34**, and back chamber **74**. The tap **35** provides lubrication for the inner seal **34** and the tap **68** and **36**, and opening **72** provide lubrication for the outer seal **32**. It should be understood that taps **35**, **36**, **68** or opening **72** can be used singularly, or in combination with each other. Further, by delivering the oil to the rear of the orbiting scroll at even one location, will improve the lubrication of both seals as the movement of the orbiting scroll causes the oil to be distributed to each and around the entire circumference of the respective seals.

Shown in FIG. **2** are surfaces **37** and crankcase towers **42**. Oil expelled from tap **35** impinges on surface **37** and oil expelled from passage **40** through opening **72** which is located in line with crankcase tower **42** impinges on surface of crankcase tower **42**.

As shown in FIG. **3**, oil expelled from tap **36** impinges off end face **80** of crankcase **38** and is directed onto a rear face of orbiting scroll.

FIG. **4** shows passage **40** extending outwardly to an outer peripheral surface of the orbiting scroll **24**. Oil expelled from this passage impinges off crankcase tower **42** or compressor shell **70**.

FIG. **5** shows a detail of the passage **35**, wherein groove **50** is formed on the inner peripheral surface of the hub **28** to pass lubricant from chamber **25** to groove **50** and to tap **35**. The groove **50** is formed between a bearing bushing **51** and the inner surface of the hub.

Preferred embodiments of this invention have been disclosed; however, a worker of ordinary skill in the art would recognize that certain modifications come within the scope of this invention. For that reason, the following claims should be studied to determine the true scope and content of this invention.

What is claimed is:

1. A scroll compressor comprising:

a first scroll having a base and a spiral wrap extending from said base;

a second scroll having a base and a spiral wrap extending from said base;

said spiral wraps of said first and second scrolls interfitting to define compression chambers;

a tap for fluid pressure extending to a back pressure chamber behind said base of one of said first and second scrolls;

seals being positioned at radially inner and outer positions to define inner and outer boundaries for said back pressure chamber; and

a lubricant supply system for supplying lubricant to surfaces adjacent to said inner and outer seals such that said lubricant is delivered outside said back pressure chamber to both said inner and outer seals, there being a first passage delivering oil to a location radially outward of said outer seal, and a second passage delivering lubricant to a position radially inward of said inner seal.

2. A scroll compressor as recited in claim **1**, wherein said first scroll orbits relative to said second scroll, and said back pressure chamber is defined behind said orbiting scroll base.

3. A scroll compressor as recited in claim **2**, wherein a crankcase is positioned rearwardly of said base of said orbiting scroll, and said seals are received in grooves in said crankcase.

4. A scroll compressor as recited in claim **3**, wherein said lubricant supply system includes a passage directing a lubricant jet to impinge off of a face of said crankcase behind said base of said orbiting scroll, and slightly radially outwardly of said outer seal.

5. A scroll compressor as recited in claim **3**, wherein said lubricant system includes a passage extending radially outwardly through an outer peripheral surface of said scroll and for directing a lubricant jet to impinge off a crankcase tower located on an outer periphery of said crankcase and past said base of said orbiting scroll.

6. A scroll compressor as recited in claim **3**, wherein said lubricant system includes a passage extending radially outwardly through an outer peripheral surface of said scroll and for directing a lubricant jet to impinge a portion of a compressor housing shell.

7. A scroll compressor as recited in claim **3**, wherein said lubricant supply system includes a passage extending through a hub of said orbiting scroll and for directing a lubricant jet to impinge off an inner surface of said crankcase to lubricate said inner seal.

8. A scroll compressor as recited in claim **7**, wherein said hub of said scroll compressor includes a groove defined between a hub and bearing bushing, said bearing bushing being positioned between a shaft for driving said orbiting scroll and said groove, said lubricant supply system including a passage extending radially outwardly through said hub and communicating with said groove.

9. A scroll compressor as recited in claim **3**, wherein said lubricant supply system includes a passage directing a lubricant jet to impinge off a surface of an anti-rotation coupling.

10. A scroll compressor comprising:

an orbiting scroll including a base and a spiral wrap extending from said base;

a non-orbiting scroll including a base and a spiral wrap extending from said base;

said wraps of said orbiting and non-orbiting scroll wraps interfitting to define compression chambers;

a shaft extending into a hub in said orbiting scroll and adapted to cause said orbiting scroll to orbit relative to said non-orbiting scroll;

a tap extending through a base of said orbiting scroll to supply fluid to a back pressure chamber behind said base of said orbiting scroll;

a crankcase positioned behind said base of said orbiting scroll, said crankcase having a face facing said base of said orbiting scroll, said crankcase face including two grooves defined at radially inner and outer locations, and there being inner and outer seals in said inner and outer grooves; and

a lubricant supply system for supplying lubricant through said shaft and to each of said inner and outer seals, said lubricant supply system supplying a lubricant to a surface of said crankcase adjacent to said inner and outer seals such that said lubricant does not impinge directly on said seals, but is still delivered to said inner and outer seals, there being a first passage delivering oil to a location radially outward of said outer seal, and a second passage delivering lubricant to a position radially inward of said inner seal.

11. A scroll compressor as recited in claim 1, wherein said lubricant supply system obtains oil to deliver to said first passage from a location on a remote side of said base of said one of said first and second scrolls from a side of said base facing said compression chambers.

12. A scroll compressor comprising:

a first scroll having a base and a spiral wrap extending from said base;

a second scroll having a base and a spiral wrap extending from said base;

said spiral wraps of said first and second scrolls interfitting to define compression chambers;

a tap for fluid pressure extending to a back pressure chamber behind said base of one of said first and second scrolls;

seals being positioned at radially inner and outer positions to define inner and outer boundaries for said back pressure chamber; and

a lubricant supply system for supplying oil to a surface adjacent to said outer seal such that said oil is delivered outside said back pressure chamber to said outer seal, there being a first passage delivering said oil to a location radially outward of said outer seal.

13. A scroll compressor as recited in claim 12, wherein said first scroll orbits relative to said second scroll, and said back pressure chamber is defined behind said orbiting scroll base.

14. A scroll compressor as recited in claim 13, wherein a crankcase is positioned rearwardly of said base of said orbiting scroll, and said seals are received in grooves in said crankcase.

15. A scroll compressor as recited in claim 14, wherein said lubricant supply system includes a passage directing a lubricant jet to impinge off of a face of said crankcase behind said base of said orbiting scroll, and slightly radially outwardly of said outer seal.

16. A scroll compressor as recited in claim 14, wherein said lubricant system includes a passage extending radially outwardly through an outer peripheral surface of said scroll and for directing a lubricant jet to impinge off a crankcase tower located on an outer periphery of said crankcase and past said base of said orbiting scroll.

17. A scroll compressor as recited in claim 14, wherein said lubricant system includes a passage extending radially outwardly through an outer peripheral surface of said scroll and for directing a lubricant jet to impinge a portion of a compressor housing shell.

18. A scroll compressor as recited in claim 14, wherein said lubricant supply system includes a passage directing a lubricant jet to impinge off a surface of an anti-rotation coupling.

19. A scroll compressor as recited in claim 12, wherein said lubricant system includes a main oil supply passage in fluid communication with said back pressure chamber supplying said oil to said chamber.

20. A scroll compressor as recited in claim 19, wherein said first scroll is driven by a shaft to orbit said first scroll relative to said second scroll, and said main oil supply passage is disposed within said shaft.

21. A method of providing lubricant to a seal in a scroll compressor comprising the steps of:

providing a first scroll having a base and a spiral wrap extending from its base and a second scroll having a base with a spiraling wrap extending from said base, said inner fitting said spiral wraps of said first and second scrolls to define a compressor chamber;

providing a tap for fluid pressure from one of said compression chambers to a back pressure chamber to find behind said base of one of said first and second scrolls;

providing seals positioned at both radially inner and outer positions to define radially inner and outer boundaries for said back pressure chamber; and

supplying lubricant to a surface outwardly of said outer seal such that oil is delivered outside said back pressure chamber and to said outer seal, a first passage delivering said oil to a location radially outward of said outer seal.

22. A method as set forth in claim 21, wherein said lubricant supply system further including the steps of also supplying lubricant to a location radially inward of said inner seal.

23. A method as set forth in claim 21 further including the steps of driving said one of said first and second scrolls to orbit, such that said back pressure chamber is defined behind said base of said orbiting scroll.

24. A method as set forth in claim 21, wherein said lubricant is supplied to said first passage from a location on a remote side of said base of said one of said first and second scrolls from a side of said base of said one of said first and second scrolls facings said compression chambers.

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