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(54) **SCREW COMPRESSOR WITH ECONOMIZER PORT**

SCHRAUBENVERDICHTER MIT ECONOMISER-ANSCHLUSS

COMPRESSEUR À VIS AYANT UN ORIFICE D'ÉCONOMISEUR

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Description

BACKGROUND

[0001] The subject matter disclosed herein relates to refrigeration systems. More specifically, the subject matter disclosed herein relates to screw compressors for refrigeration systems.

[0002] Refrigeration systems typically include a compressor delivering compressed refrigerant to a condenser. From the condenser, the refrigerant travels to an expansion valve, and then to an evaporator. From the evaporator, the refrigerant returns to the compressor to be compressed. To increase efficiency of the system, an economizer is often included between the condenser and evaporator, more specifically between the condenser and expansion valve. The economizer is a heat exchanger that returns a portion of the refrigerant flowing through the system as a gas to the compressor, where it is injected into the compressor at a selected location via an economizer port.

[0003] In some compressors, the economizer port is a slot milled in the rotor housing from an exterior of the housing, or formed in a rotor housing by casting. The typical slot, however, allows for unintended and undesirable leakage between adjacent lobes of the screw rotor as the lobe passes the slot. This leakage negatively impacts compressor performance, and limits slot width and placement of the slot in the compressor. For example, slots are typically only located at the female rotor of a two rotor screw compressor due to a thicker sealing line present in the female rotor, thus reducing a potential for leakage.

[0004] WO2006/041494 discloses a compressor comprising a housing assembly, a male and female rotor, and an end seal having a first surface engaging the female body portion first end, and being asymmetric around a second axis. An economizer port may be present in the housing. WO2006/062741 discloses a compressor comprising an economizer port, the compressor being adapted to limit external sound radiated by the housing.

BRIEF SUMMARY

[0005] The present invention provides a screw compressor in accordance with claim 1.

[0006] The present invention also provides a refrigerant system in accordance with claim 7.

[0007] These and other advantages and features will become more apparent from the following description taken in conjunction with the drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0008] The subject matter, which is regarded as the invention, is particularly pointed out and distinctly claimed in the claims at the conclusion of the specification. The foregoing and other features, and advantages of the in-

vention are apparent from the following detailed description taken in conjunction with the accompanying drawings in which:

FIG. 1 is a schematic view of an embodiment of a refrigerant system;

FIG. 2 is a cross-sectional view of an embodiment of a screw compressor;

FIG. 3 is a cross-sectional view of an embodiment of a screw compressor;

FIG. 4 is a plan view of an economizer port in an embodiment of a screw compressor; and

FIG. 5 is a cross-sectional view of another embodiment of a screw compressor.

[0009] The detailed description explains embodiments of the invention, together with advantages and features, by way of example with reference to the drawing.

DETAILED DESCRIPTION

[0010] Shown in FIG. 1 is a schematic of an embodiment of a refrigerant system 10. The refrigerant system 10 includes a screw compressor 12. An evaporator 14, in some embodiments a flooded style evaporator 14, delivers a flow of refrigerant to the compressor 12 through a passage 16. From the compressor 12, the refrigerant flows through line 18 to a condenser 20. Compressed, gaseous refrigerant is cooled in the condenser 20, transferred into a liquid phase, and passed through an expansion valve 24 on its way to the evaporator 14 through conduit 22.

[0011] An economizer 26 is located between the evaporator 14 and the condenser 20, in some embodiments between the condenser 20 and the expansion valve 24 along conduit 22. The economizer 26 may be, for example, a heat exchange type or flash type economizer 26. Gaseous refrigerant is directed from the economizer 26 to the compressor 12 via economizer conduit 28, where the gaseous refrigerant is injected into the compressor 12 at economizer port 30.

[0012] Referring to FIG. 2, an embodiment of the screw compressor 12 is shown. The compressor 12 includes two compressor rotors 32 disposed in a compressor housing 34. The compressor rotors 32 each include a plurality of helical rotor flutes 36. The compressor rotors 32 are arranged in parallel such that rotor axes 38 are parallel and the rotor flutes 36 intermesh. In the embodiment shown, the compressor 12 includes two compressor rotors 32, known in the art as a male rotor 32 and a female rotor 32. In other embodiments the compressor 12 includes other numbers of rotors 32, for example, three rotors 32. The compressor rotors 32 are located inside of the housing 34, which also includes a suction port 40 through which refrigerant flowed from the evaporator 14, and a discharge port 42 through which compressed refrigerant is discharged toward the condenser 20. In some embodiments, the suction port 40 and the

discharge port 42 are located at opposite axial ends of the housing 34.

[0013] As stated above, the compressor 12 includes an economizer port 30 through which gaseous refrigerant is urged from the economizer 26. Referring to FIGs. 3 and 4, the housing 34 is formed by casting. An integral economizer pocket 44 is formed or cored in the housing 34 during casting of the housing 34. The economizer pocket 44 is a space located radially between a housing inner wall 46 that abuts the rotors 32, and a housing outer wall 48 that forms the exterior of the housing 34. Forming the pocket 44 leaves a relatively thin housing inner wall 46, in some embodiments, 10-15 millimeters in thickness. The economizer port 30 comprises an outer wall opening 50 in the outer wall 48, the pocket 44 and an inner wall opening 52 in the inner wall 46. In alternative embodiments, a metallic housing 34 may be formed from other processes, such as machining, while the housing 34 may also be formed of other, non-metallic, materials such as composites or plastics.

[0014] Referring to FIG. 4, the inner wall opening 52 is slot shaped, with a lateral side 54 of the opening 52 extending substantially parallel to the rotor flutes 36. According to the invention, the inner wall opening 52 has a width between 1/32" and 1/4" (0.79 to 6.35 millimeters). In some embodiments, the inner wall opening 52 has a length between about 1.9 inches and 3.5 inches (about 50 to 90 millimeters). In other embodiments, the inner wall opening 52 may have other shapes, such as circular or triangular. The inner wall 46 is sufficiently thin, due to inclusion of the pocket 44 in the housing 34, to allow the inner wall opening 52 to be formed by a secondary process, such as plasma cutting or water jet cutting. These processes allow an inner wall opening 52 of the economizer port 30 to be significantly narrower than a typical economizer port formed integral with the casting or via profile milling; the narrower inner wall opening 52 resulting in reduced leakage in the compressor 12.

[0015] In another embodiment, as shown in FIG. 5, multiple economizer ports 30 may be included in the compressor 12, at different locations in the compressor 12. For example, economizer ports 30 may be located at either or both of the male or female rotors 32, with the thinner profile of the economizer port 30 allowing for location at the male rotor 32, even though a thinner sealing line typically exists at the male rotor 32. Multiple economizer ports 30 improves compressor performance by allowing the refrigeration system 10 to direct gas from the economizer 26 to selected economizer port(s) 30 depending on the operating conditions.

[0016] While the invention has been described in detail in connection with only a limited number of embodiments, it should be readily understood that the invention is not limited to such disclosed embodiments. Rather, the invention can be modified to incorporate any number of variations, alterations, substitutions or equivalent arrangements not heretofore described, but which are commensurate with the scope of the invention. Additionally,

while various embodiments of the invention have been described, it is to be understood that aspects of the invention may include only some of the described embodiments. Accordingly, the invention is not to be seen as limited by the foregoing description, but is only limited by the scope of the appended claims.

Claims

1. A screw compressor (12) comprising:

a screw compressor rotor (32), the rotor including a helical flute extending outwardly from a rotor axis;
a compressor housing (34) surrounding the rotor and including a suction port (40) and a discharge port (42), the housing having an inner housing wall abutting the rotor and an outer housing wall forming an exterior of the compressor, whereby a housing pocket (44) is disposed between the outer housing wall (48) and the inner housing wall (46); and
an economizer port (30) is present extending from the housing pocket through the inner housing wall to direct a flow of gaseous refrigerant into the compressor, wherein the economizer port (30) comprises an outer wall opening (50) in the outer housing wall (48), the pocket (44), and an inner wall opening (52) in the inner housing wall (46),
characterized in that the inner wall opening (52) of the economizer port (30) has a width between 1/32" (0.79 millimeters) and 1/4" (6.35 millimeters).

2. The screw compressor of Claim 1, wherein the economizer port is slot shaped and extends circumferentially parallel to the helical flute.

3. The screw compressor of Claim 1, comprising at least two rotors disposed in the housing.

4. The screw compressor of Claim 3, wherein the helical flutes of the at least two rotors intermesh.

5. The screw compressor of Claim 1, comprising two or more economizer ports extending through the inner housing wall.

6. The screw compressor of Claim 1, wherein the economizer port is formed by one of plasma cutting or water jet.

7. A refrigerant system comprising:

an evaporator (14); and
a compressor (12) operably connected to the

evaporator,
a compressor housing surrounding the rotor and including a suction port to receive refrigerant from the evaporator and a discharge port to convey refrigerant toward a condenser,
wherein said compressor is a screw compressor according to any of claims 1 to 6.

8. The refrigerant system of Claim 7, wherein the economizer is disposed between the condenser and the evaporator.

Patentansprüche

1. Schraubenkompressor (12), umfassend:

einen Schraubenkompressorrotor (32), wobei der Rotor eine Spiralnut beinhaltet, die sich von einer Rotorachse nach außen erstreckt;
ein Kompressorgehäuse (34), das den Rotor umgibt und einen Sauganschluss (40), und einen Entladeanschluss (42) beinhaltet, wobei das Gehäuse eine Gehäuseinnenwand aufweist, die an den Rotor anschlägt, und eine Gehäuseaußenwand, die ein Äußeres des Kompressors bildet, wodurch eine Gehäusetasche (44) zwischen der Gehäuseaußenwand (48) und der Gehäuseinnenwand (46) angeordnet ist; und
wobei ein Vorwärmeranschluss (30) anwesend ist, der sich von der Gehäusetasche durch die Gehäuseinnenwand erstreckt, um einen Fluss gasförmigen Kältemittels in den Kompressor zu lenken, wobei der Vorwärmeranschluss (30) eine Außenwandöffnung (50) in der Gehäuseaußenwand (48), der Tasche (44) und eine Innenwandöffnung (52) in der Gehäuseinnenwand (46) umfasst,
dadurch gekennzeichnet, dass die Innenwandöffnung (52) des Vorwärmeranschlusses (30) eine Breite zwischen 1/32" (0,79 Millimeter) und 1/4" (6,35 Millimeter) aufweist.

2. Schraubenkompressor nach Anspruch 1, wobei der Vorwärmeranschluss schlitzförmig ist und sich umfänglich parallel zu der Spiralnut erstreckt.
3. Schraubenkompressor nach Anspruch 1, der mindestens zwei Rotoren umfasst, die in dem Gehäuse angeordnet sind.
4. Schraubenkompressor nach Anspruch 3, wobei die Spiralnuten der mindestens zwei Rotoren ineinandergreifen.
5. Schraubenkompressor nach Anspruch 1, der zwei oder mehrere Vorwärmeranschlüsse, die sich durch

die Gehäuseinnenwand erstrecken, umfasst.

6. Schraubenkompressor nach Anspruch 1, wobei der Vorwärmeranschluss durch eines von Plasm Schneiden oder Wasserstrahl gebildet ist.

7. Kältemittelsystem, umfassend:

einen Verdampfer (14); und
einen Kompressor (12), der betriebsfähig mit dem Verdampfer verbunden ist,
ein Kompressorgehäuse, das den Rotor umgibt und einen Sauganschluss beinhaltet, um Kältemittel von dem Verdampfer zu erhalten, und einen Entladeanschluss, um Kältemittel zu einem Kondensator zu fördern,
wobei der Kompressor ein Schraubenkompressor nach einem der Ansprüche 1 bis 6 ist.

8. Kältemittelsystem nach Anspruch 7, wobei der Vorwärmer zwischen dem Kondensator und dem Verdampfer angeordnet ist.

Revendications

1. Compresseur à vis (12) comprenant :

un rotor de compresseur à vis (32), le rotor incluant une cannelure hélicoïdale s'étendant vers l'extérieur à partir d'un axe du rotor ;
un carter de compresseur (34) entourant le rotor et incluant un orifice d'aspiration (40) et un orifice de refoulement (42), le carter présentant une paroi de carter interne s'appuyant contre le rotor et une paroi de carter externe formant une partie extérieure du compresseur,
de sorte qu'une poche de carter (44) est disposée entre la paroi de carter externe (48) et la paroi de carter interne (46) ; et
un orifice d'économiseur (30) s'étend depuis la poche de carter à travers la paroi de carter interne de façon à diriger un flux de réfrigérant gazeux vers le compresseur, l'orifice d'économiseur (30) comprenant une ouverture de paroi externe (50) dans la paroi de carter externe (48), la poche (44) et une ouverture de paroi interne (52) dans la paroi de carter interne (46),
caractérisé en ce que l'ouverture de paroi interne (52) de l'orifice d'économiseur (30) présente une largeur comprise entre 1/32" (0,79 millimètre) et 1/4" (6,35 millimètres).

2. Compresseur à vis selon la revendication 1, dans lequel l'orifice d'économiseur se présente sous la forme d'une fente et s'étend circonférentiellement parallèlement à la cannelure hélicoïdale.

3. Compresseur à vis selon la revendication 1, comprenant au moins deux rotors disposés dans le carter.
4. Compresseur à vis selon la revendication 3, dans lequel les cannelures hélicoïdales des au moins deux rotors s'engrènent. 5
5. Compresseur à vis selon la revendication 1, comprenant au moins deux orifices d'économiseur s'étendant à travers la paroi de carter interne. 10
6. Compresseur à vis selon la revendication 1, dans lequel l'orifice d'économiseur est formé par découpage au plasma ou par découpage au jet d'eau. 15
7. Système réfrigérant comprenant :
 - un évaporateur (14) ; et
 - un compresseur (12) fonctionnellement raccordé à l'évaporateur, 20
 - un carter de compresseur entourant le rotor et incluant un orifice d'aspiration pour recevoir un réfrigérant à partir de l'évaporateur, et un orifice de refoulement pour transporter le réfrigérant 25
 - vers un condenseur,
 - dans lequel ledit compresseur est un compresseur à vis selon l'une quelconque des revendications 1 à 6. 30
8. Système réfrigérant selon la revendication 7, dans lequel l'économiseur est disposé entre le condenseur et l'évaporateur. 35

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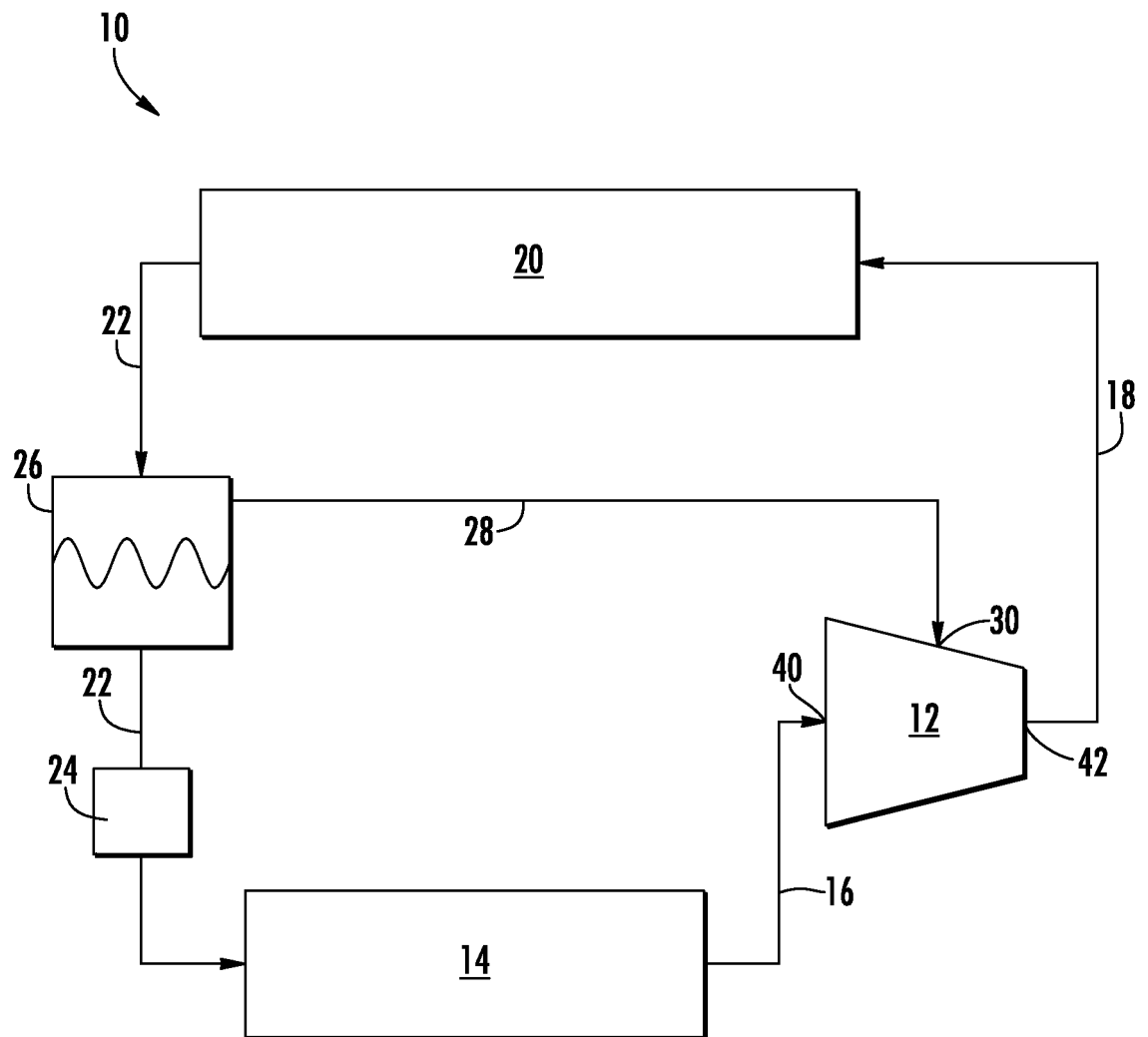


FIG. 1

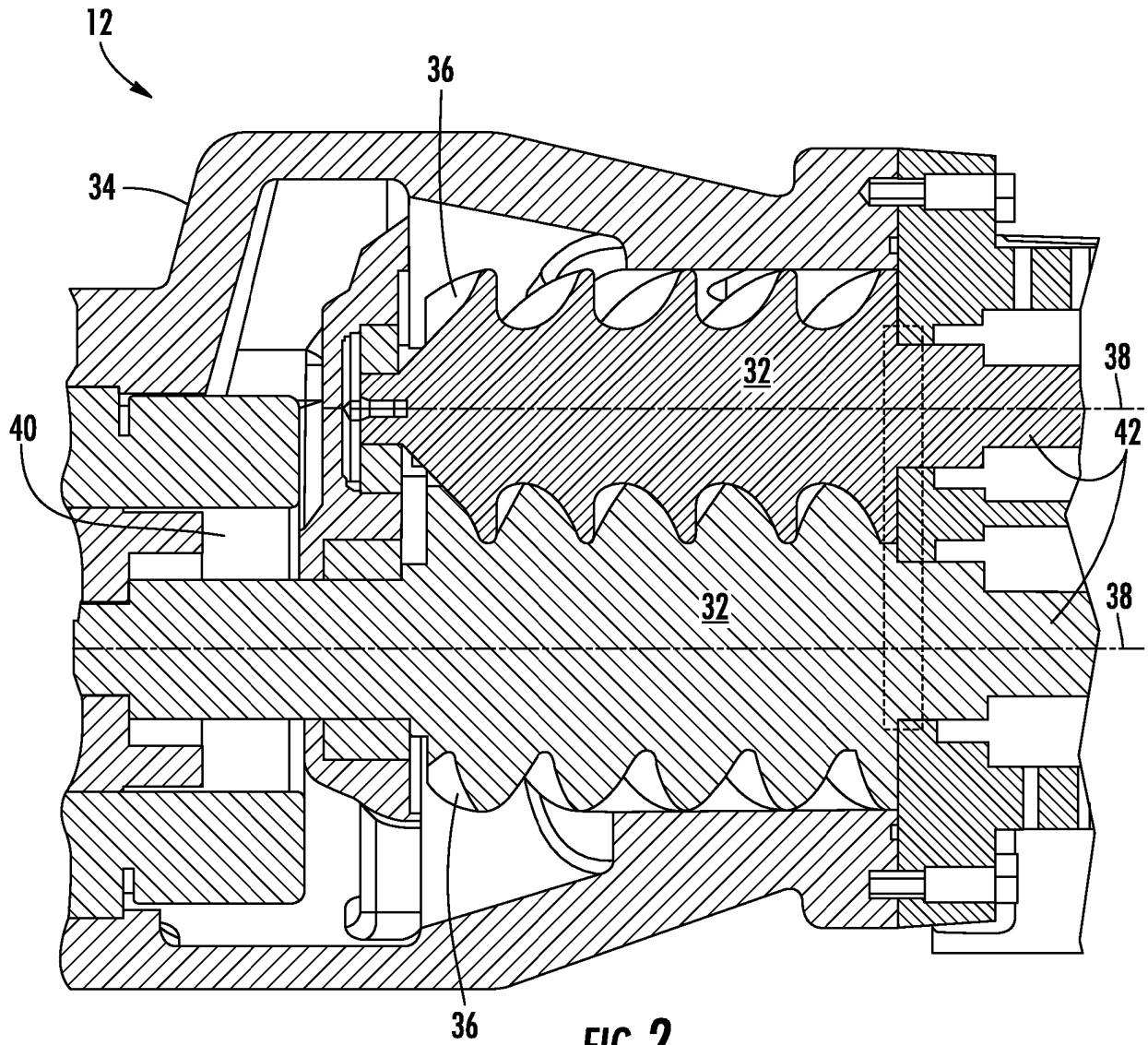


FIG. 2

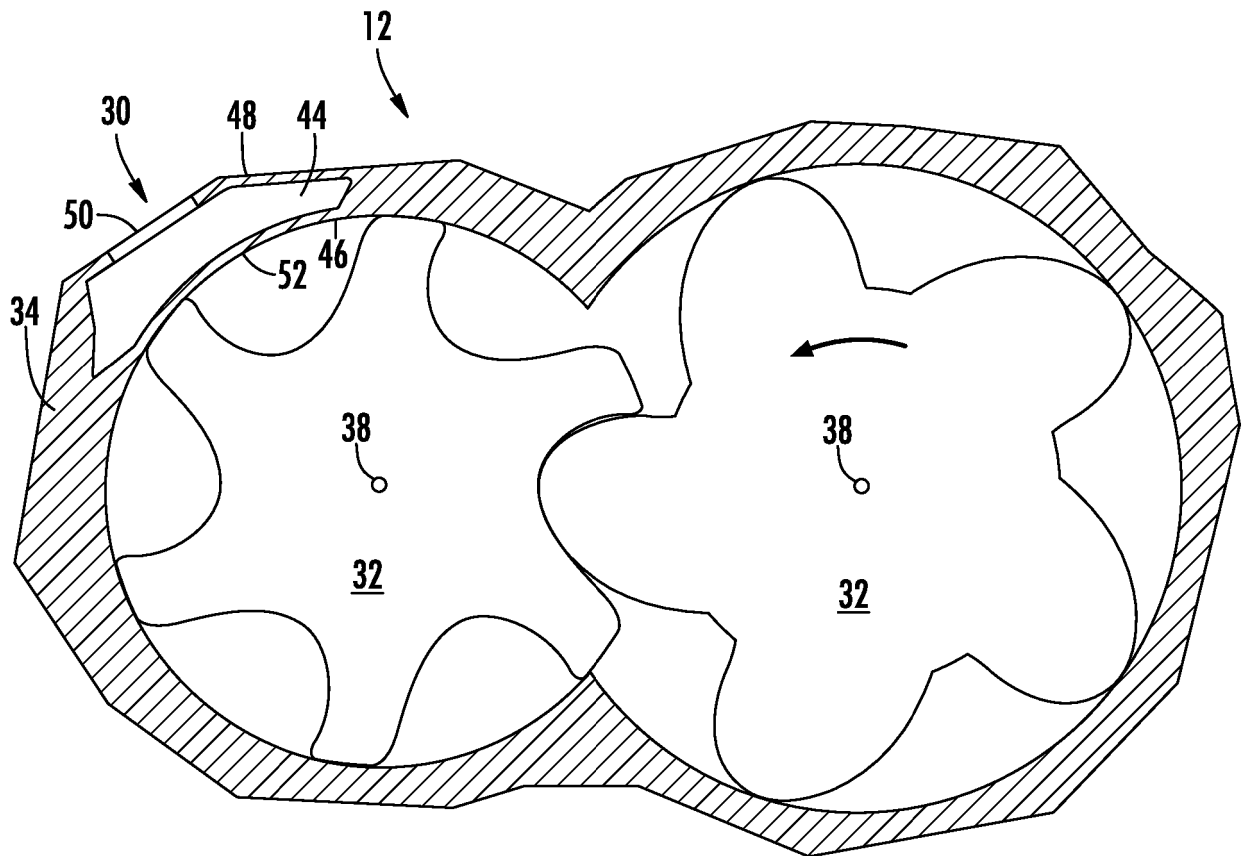


FIG. 3

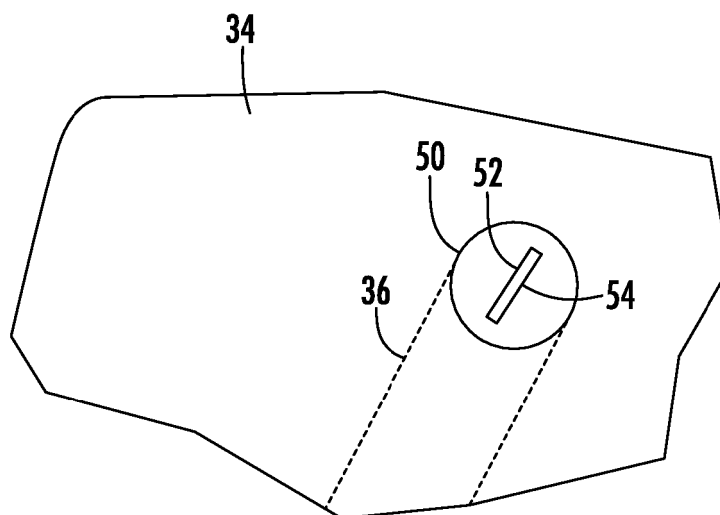


FIG. 4

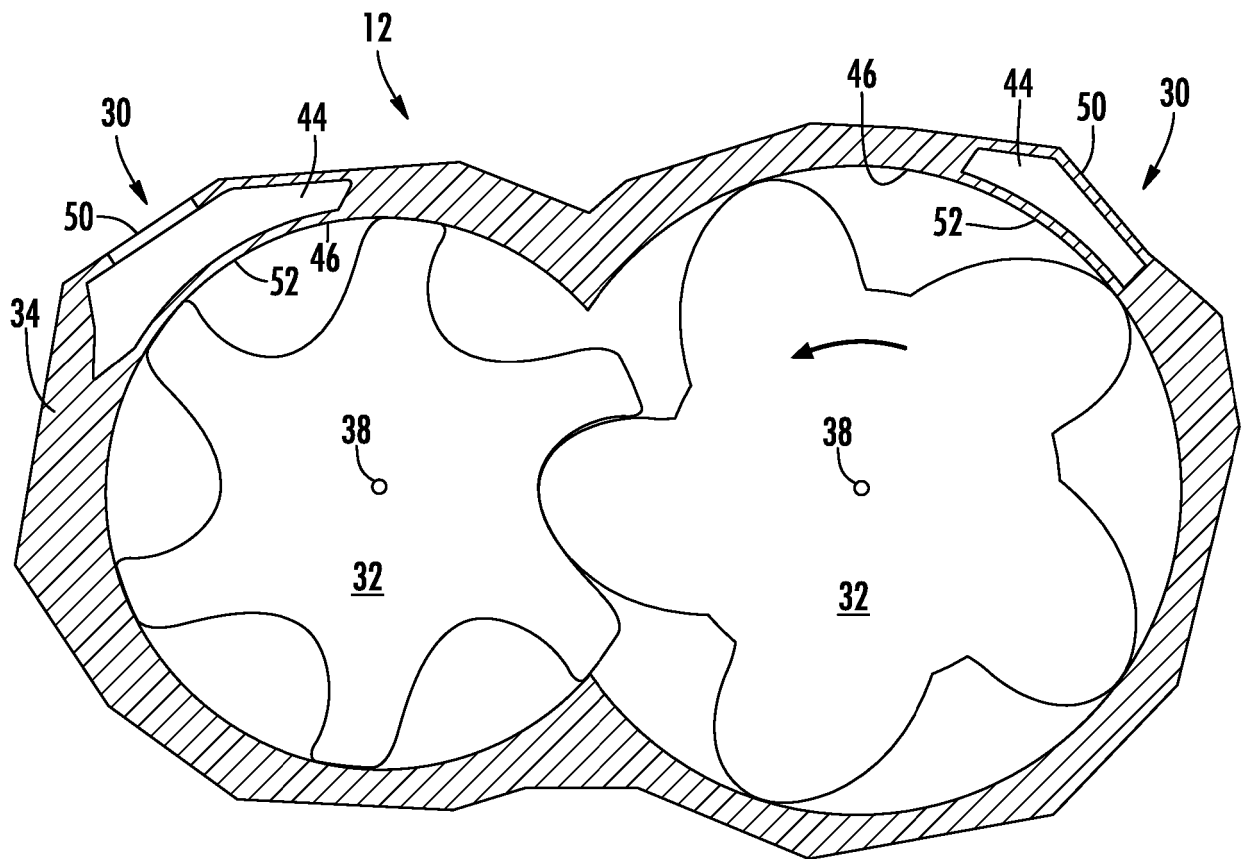


FIG. 5

REFERENCES CITED IN THE DESCRIPTION

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