

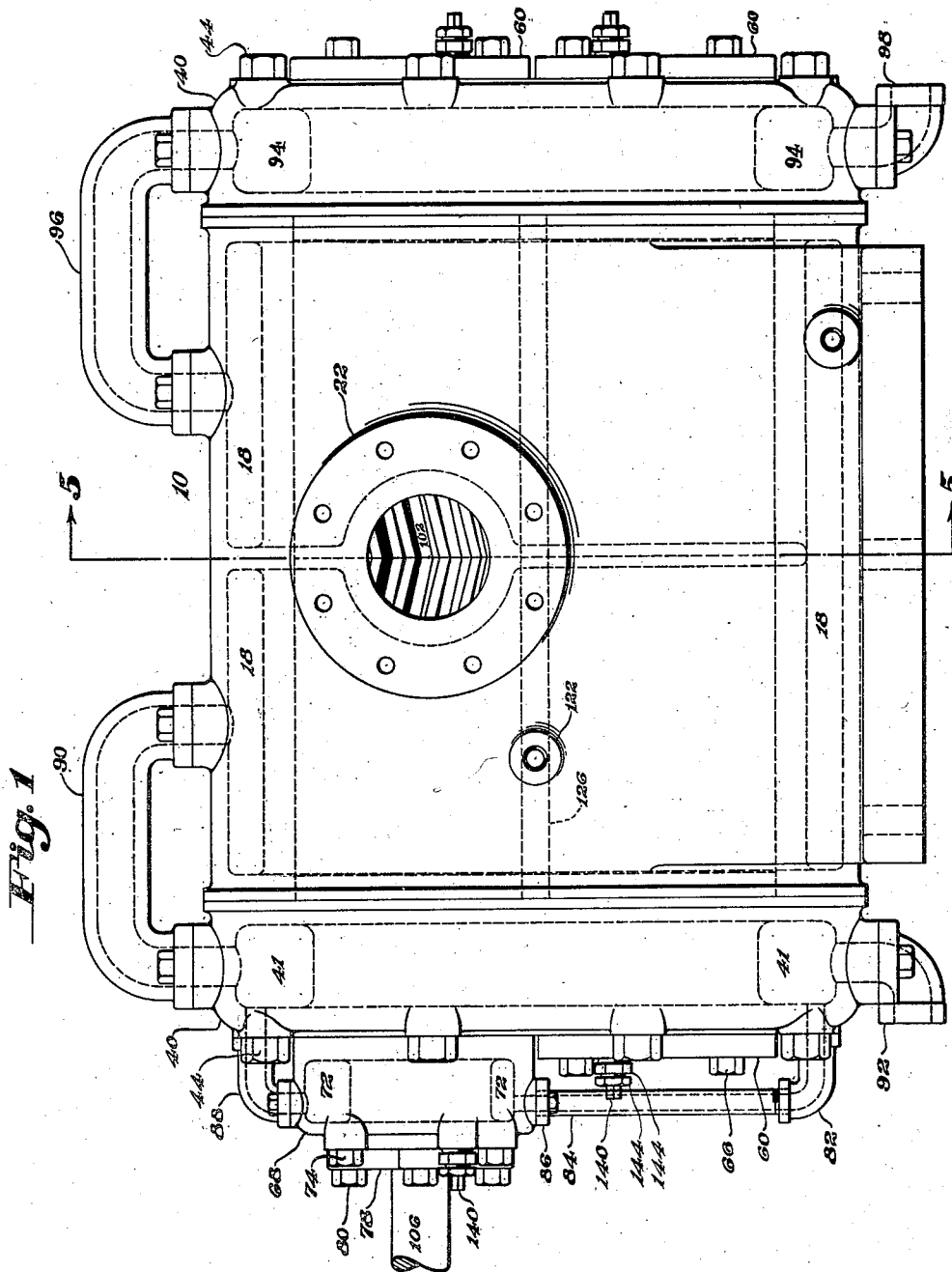
June 1, 1937.

H. E. MORTON
ROTARY COMPRESSOR

2,082,412

Filed Aug. 4, 1932

6 Sheets-Sheet 1



Witness

Witness
Paul F. Bryant

Inventor

Inventor
Harry E. Morton
By his attorneys
Tan Suran, Fish, Kilbuck & May

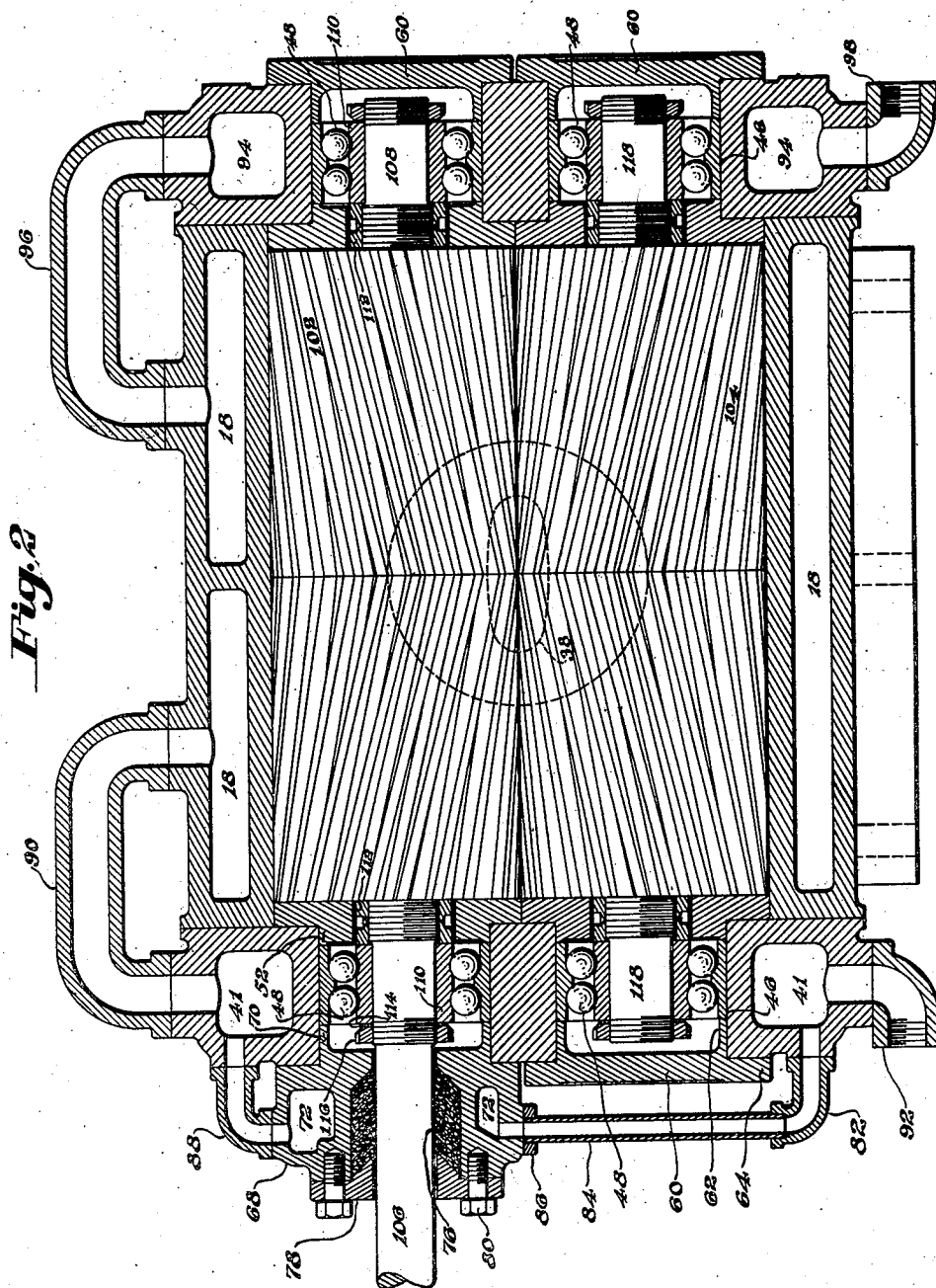
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6 Sheets-Sheet 2



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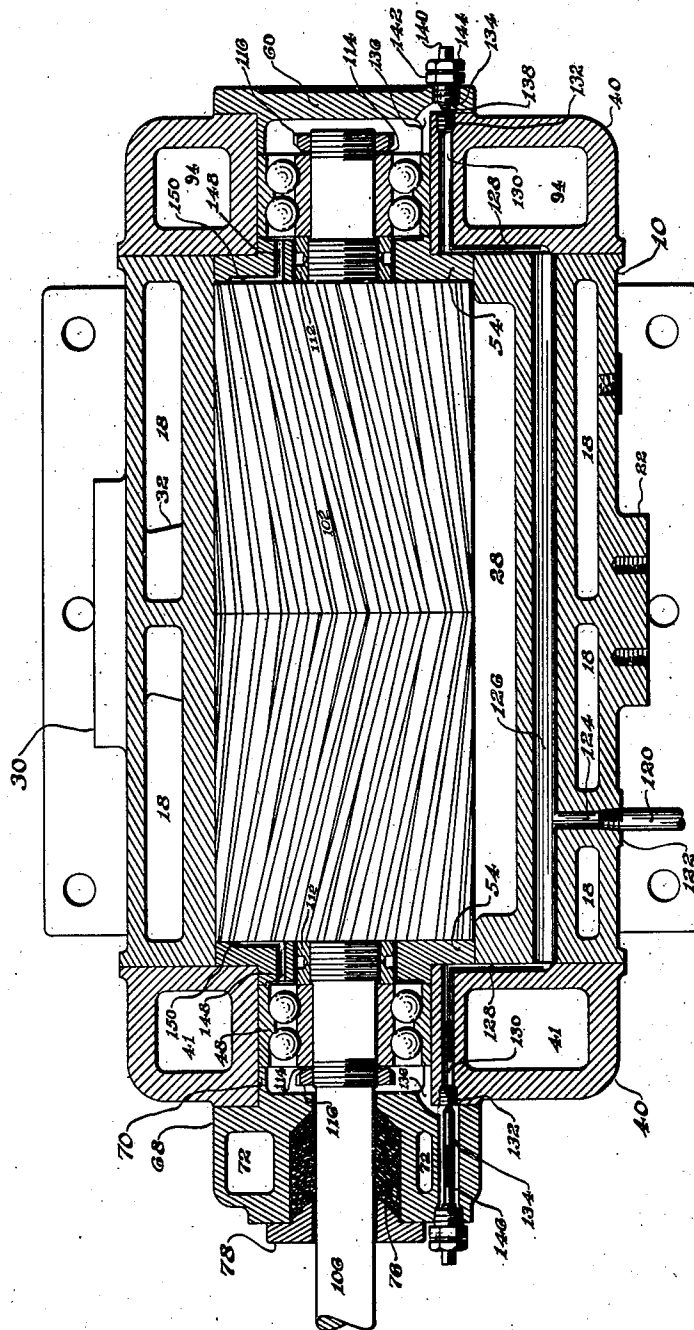
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Fig. 3



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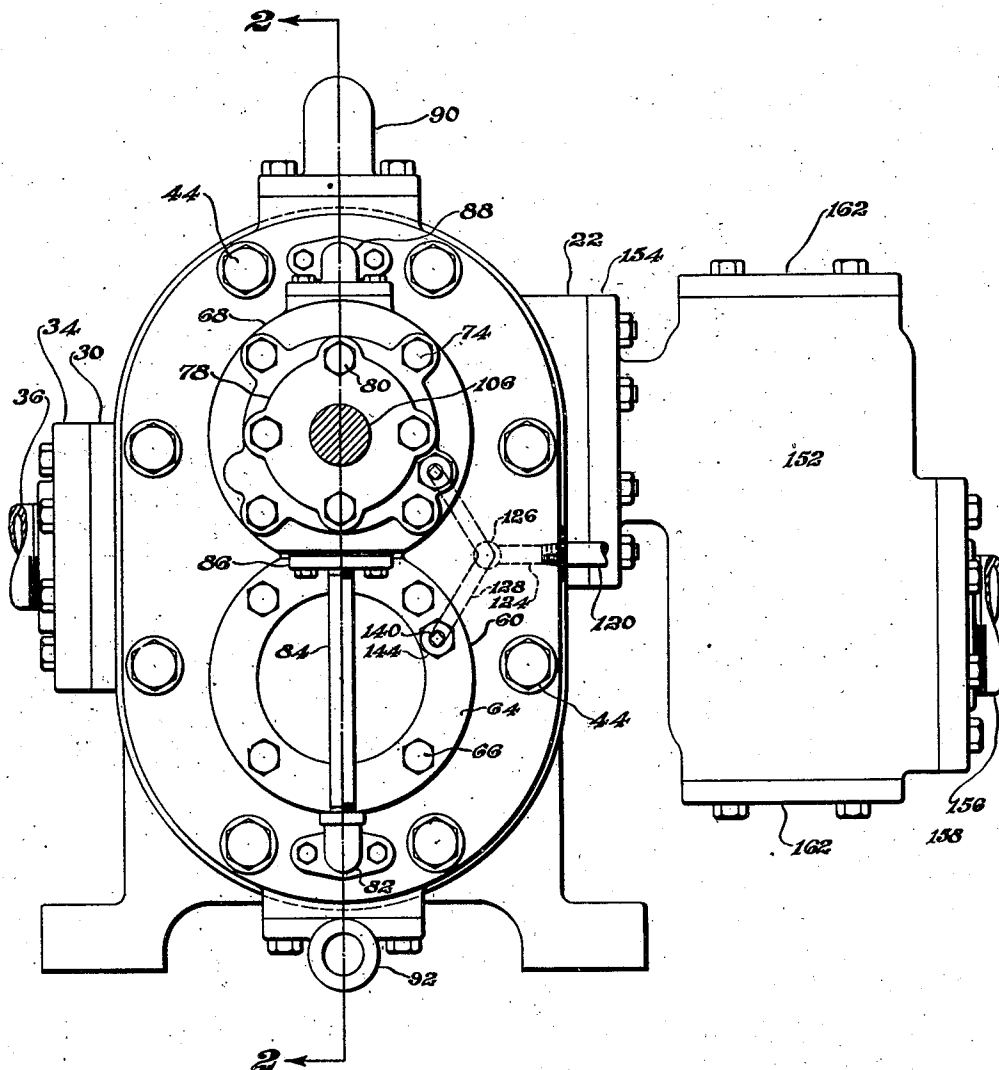
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Fig. 4



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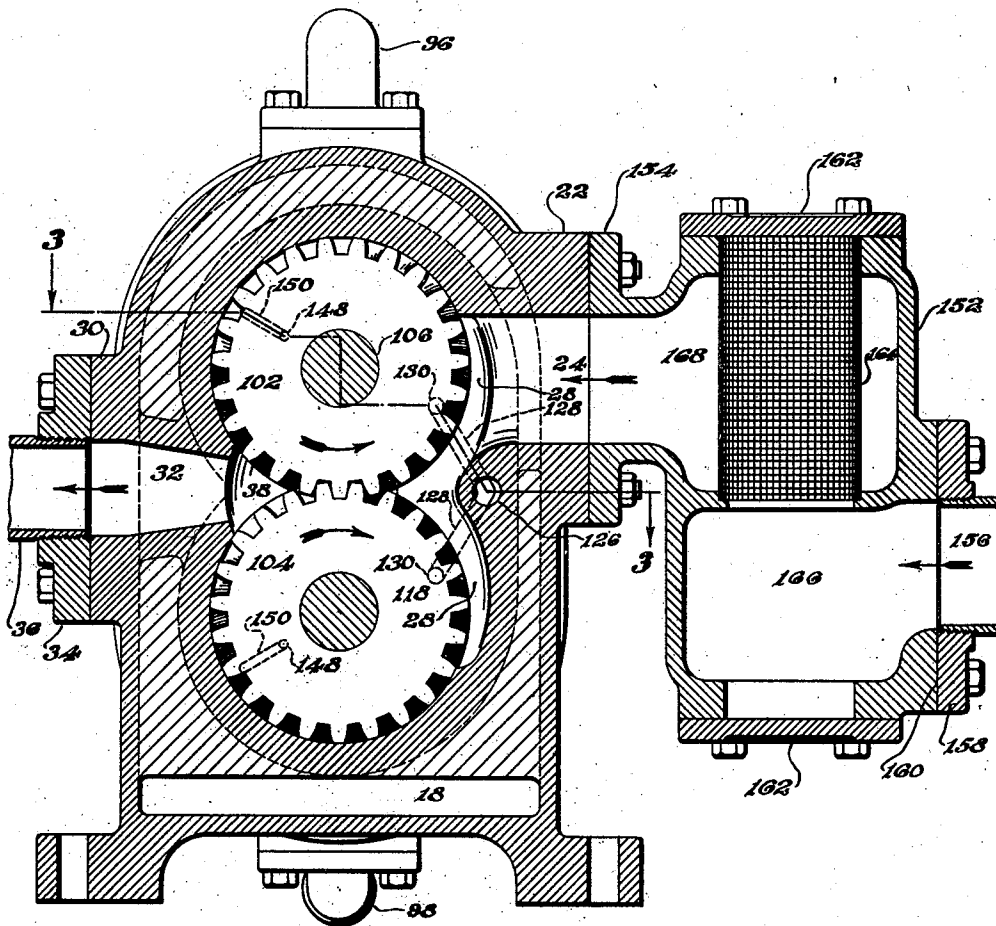
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Fig. 5



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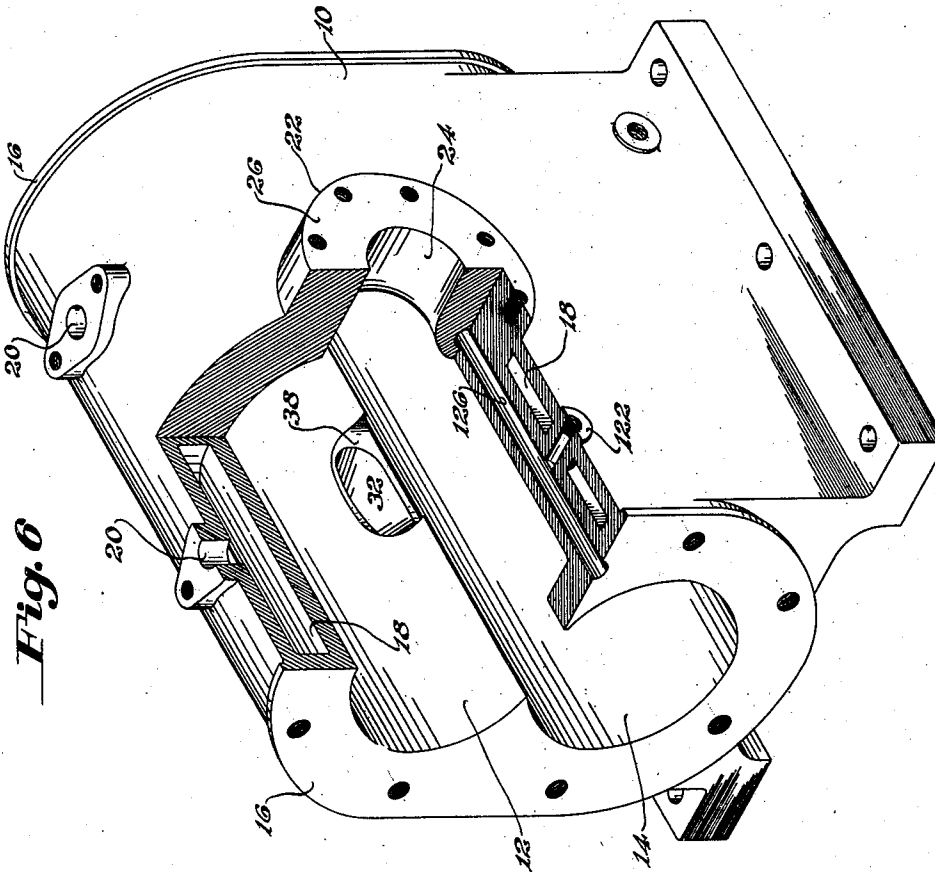


Fig. 6

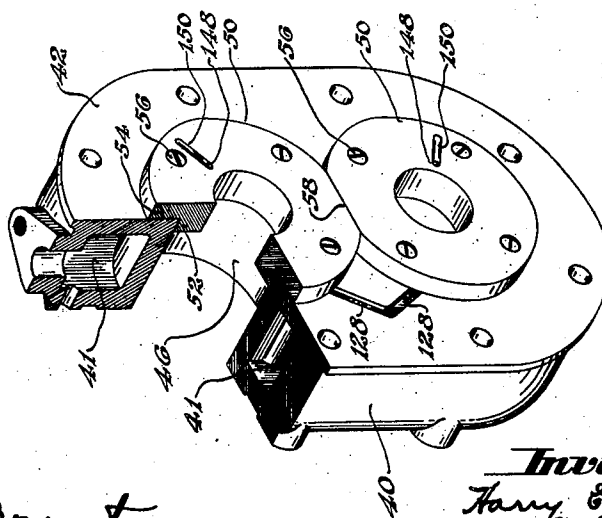


Fig. 7

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UNITED STATES PATENT OFFICE

2,082,412

ROTARY COMPRESSOR

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a corporation of Massachusetts

Application August 4, 1932, Serial No. 627,442

4 Claims. (Cl. 230—141)

The present invention relates to rotary compressors and more particularly to that type of compressor which comprises a pair of intermeshing spiral gears and wherein a fluid is employed for sealing and lubricating the same.

It is the object of the present invention to provide a rotary compressor of the above type which shall be of simple and sturdy construction, inexpensive to build, and efficient and long lived in operation.

With these objects in view the present invention consists of the devices and combinations of devices hereinafter described and more particularly defined in the claims.

In the accompanying drawings in which is illustrated what is now considered the preferred form of the present invention, Fig. 1 is a front elevation of a compressor embodying the invention, viewed on the inlet side with the strainer removed; Fig. 2 is a vertical longitudinal section on line 2—2 of Fig. 4; Fig. 3 is a horizontal longitudinal section on line 3—3 of Fig. 5; Fig. 4 is an end elevation, looking from the left of Fig. 1, showing the compressor with the inlet strainer attached; Fig. 5 is a vertical transverse section on line 5—5 of Fig. 1 looking toward the right; Fig. 6 shown in perspective, with certain parts in section, the main casing or housing of the compressor; and Fig. 7 shows one of the heads or end assemblies for such housing.

The compressor illustrated in the drawings comprises a main casting or housing within which rotate a pair of intermeshing double spiral or herringbone gears. The gas to be compressed is admitted to the interior of the housing on one side of the housing and is delivered to the faces of both gears in a zone adjacent the line of intermesh and extending the length of the gears. The compressed gas is discharged from the gears through a relatively short zone adjacent the point of intermesh of the apices of the gears and thence through the outlet of the housing.

The rotating gears are lubricated and sealed against leakage of gas by means of a lubricating and sealing liquid which passes through the bearings and thence into the interior of the housing. A water-jacket is provided for the housing to absorb the heat generated by the compression of the gases.

Considering now the illustrated construction of the rotary compressor in more detail, the housing 10, as shown in Fig. 6, is of cast construction having two parallel cylindrical bores 12 and 14 which slightly overlap or intersect. Each end of the housing is provided with the attaching face or

flange 16 and around the housing extends the water-jacket 18 with the top openings or connections 20. On one face of the housing termed the front, midway the ends is the boss 22 with the gas inlet passage 24 and attaching face 26. This inlet passage opens into an inlet chamber 28 extending nearly the entire length of the interior of the housing and for about one-quarter of the circumference of each gear from its line of intersection. See Figs. 3 and 5.

The opposite face of the housing is provided with a similar boss 30 through which extends the gas outlet passage 32 and to which is clamped the fitting 34, in turn threaded to receive the outlet pipe 36. See Fig. 5.

The margin of the angular partition between the bores 12 and 14 adjacent the outlet passage is cut away, as shown in Figs. 5 and 6, to form the outlet chamber 38 which extends a short distance on each side of the line of the apices of the gears.

The open ends of the housing are closed by the heads or assemblies shown in Fig. 7, one at each end. Each assembly comprises the elliptically-shaped head 40 with water-jacket 41 and with the face or flange 42 to engage and be secured to the cooperating flange 16 on the housing by means of the tap bolts 44.

Each of the heads is provided with the two cylindrical bores 46, one above the other, within which are mounted the ball-bearings 48 for the gear shafts. At the inner end of each bore is secured the flanged sleeve 50 comprising a sleeve portion 52 fitting snugly within the bore 46 and holding the ball-bearing from inward movement, and the flange or head 54 overlying the inner face 42 of the head and fitting within one of the cylindrical bores 12, 14, of the main housing 10. Screws 56 pass through the flange or head 54 to secure the sleeve fixedly to the head 40. At the bottom of the top flange and the top of the bottom flange a segment is cut away, as shown at 58, to permit the parts to be assembled.

These heads or flanges 54 serve not only as thrust or wear members for the ends of the gears, but also to position the heads 40 accurately on the housing 10 so that the ball-bearing will be exactly centered with their corresponding bores in the casing, thus permitting the gears to operate with a uniform minimum clearance between their teeth and the walls of the bores, a condition which is necessary to efficient operation and the securing of high pressures. Inasmuch as the described parts are positioned with respect to one another by means of cylindrical contacting surfaces, which may be easily and cheaply ma-

chined, the desired accuracy of fit and high efficiency of operation may be secured with a minimum cost of manufacture.

The ball-bearings are held from outward movement by the closures for the outer ends of the bores 46 of the heads 40. Referring to the head for the left end of the apparatus as viewed in Figs. 2 and 3, the closure for the lower bore consists of the circular plate or head 60, having a cylindrical portion or sleeve 62 entering the outer end of the bore 46, and an overlying flange or head 64 secured to the head 40 by means of the bolts 66.

The closure for the top bore includes a stuffing-box surrounded by a water-jacket to prevent unduly high temperature. This closure comprises the main casting 68 having the sleeve portion 70 fitted within the outer end of the upper bore 12, provided with a water-jacket 72, and is secured to the head 40 by means of the bolts 74. The casting 68 is counter-bored in the usual manner to receive the packing 76 which is compressed by the follower 78 by means of the bolts 80.

The water-jacket 72 is arranged in parallel with the water-jacket 41 in the head, being connected with the bottom of such water-jacket by means of the fittings comprising the elbow 82, vertical pipe 84, and flanged fitting 86. A right angled fitting 88 connects the top of the water-jacket 72 with the top of the water-jacket 41 in the head 40. The water-jacket in the head 40 is in turn connected with the water-jacket 18 in the main housing by means of the return bend 90. Water is supplied to the lower portion of the water-jacket 41 of the head 40 through the inlet connection 92.

The head at the opposite end of the housing, namely, the right-hand end, as viewed from the front as in Figs. 2 and 3, is identical with the head at the left-hand end except that inasmuch as there is no projecting shaft which requires a stuffing-box, the closures for the two bores are identical and like that of the lower bore on the left-hand head. The right-hand head is also provided with a similar water-jacket 94, connected to the water-jacket of the housing by the return bend 96, and having the 90° bottom outlet connection 98.

The gears 102 and 104, within the bores of the housing are of the double herringbone design commonly employed in this type of apparatus. The upper gear, 102, is driven in a suitable manner through its projecting shaft 106, and is provided at its opposite end with the stub shaft 108, both shafts being mounted in the ball-bearing 48, the inner members 110 of which are each secured between a collar 112 and a washer 114 and nut 116 on the threaded sections of the shaft.

The lower or idler gear 104 has stub shafts 118 at each end, similarly mounted in the ball-bearings, with similar collars, washers, and nuts.

As is the practice with this type of apparatus, the gears are sealed and made gas tight by means of a liquid which is supplied to them in proper quantities. Preferably the sealing liquid will also serve as a lubricant, and means are provided for supplying this lubricant first to the ball-bearing, then to the ends of the gear members whence it is carried radially of the same to the gear teeth. The liquid is discharged from the casting with the compressed gas, suitable separating means, not shown, being provided for separating the lubricant for re-use.

The lubricant and sealing fluid is supplied to the housing through the inlet pipe 120 which is

screwed into the boss 122 on the front of the housing and connects through the short transverse passage 124, with the longitudinal passage 126 extending the length of the front wall of the housing. At the opposite ends of this passage the inner faces of the heads 40 are cut or grooved into two diverging oil grooves or passages 128, see Fig. 7. When the head is in place, the open face of these grooves at their outer ends is closed by the end of the housing, and at the inner ends by the flanges 54 of the flanged sleeves 50. Each oil groove connects at its inner ends with a hole 130 in the head 40, (see Fig. 3,) which is provided at the outer end with the screw-threaded valve-seat 132.

In the end closure 60 for the bore in the heads 40 (see Fig. 3, right-hand end) are the openings or passages 134 which communicate through the curved branch 136 with the bore 46 wherein are located the ball-bearings to supply the latter with the lubricating and sealing fluid. The rate of flow is regulated by means of a valve comprising a conical valve face 138 having a square outer end 140 to receive a wrench or handle, the valve being mounted in the plug 142 screwed into the outer end of the passage 134 and provided with a stuffing-box and follower 144 to prevent leakage.

A similar construction is provided for the closure 68, the valve stem 146 being much longer of necessity by reason of the greater axial thickness of the closure. (See Fig. 3, left-hand end.)

The lubricating fluid passes through and around the ball-bearing and thence through the longitudinal passage 148 to the open groove 150, (see Figs. 3, 5 and 7,) in the inner faces of the flanged sleeves 50. The outer ends of these grooves are positioned slightly beyond the bottoms of the gear teeth (see Fig. 5) so that the lubricating and sealing fluid will be delivered not only to the end faces of the gears to lubricate the same, but also into the spaces between the teeth to both lubricate and seal.

The rotation of the gears is such with respect to the inclination of the teeth that the lubricant tends to work inwardly along the teeth toward the middle or apices, at the same time being distributed by the rotation of the gears over the internal surfaces of the main bores 12 and 14.

The lubricating or sealing fluid thrown off by the engagement of the apices of the gears is carried by the compressed gas through the outlet 32 and thence to the usual separator where it is separated from the gas and then returned to the system.

While the compressor herein shown and described may be used for compressing air, it is designed primarily for use in the compression of a refrigerating gas, and for such purpose will be provided with suitable supply connections including a filter or screen to filter out and remove from the gas supply any solid particles of dirt, scale, or other material which would cause damage or excessive wear to the apparatus. Such a filter is shown in Figs. 4 and 5, and comprises a main casting 152, having a bolting flange 154 for attachment to the boss 22 of the compressor housing. The gas supply pipe 156 is connected by means of a flanged fitting 158 bolted to the face 160 of the filter casting. The openings at the top and bottom of the filter are covered by the covering plates 162 and the interior is provided with a cylindrical screen 164 through which the gas passes from the lower chamber 166 to the upper chamber 168.

In the operation of the rotary compressor

herein shown and described power is applied to the shaft extension 106 to drive the gear 102 which in turn drives the gear 104. As the gears pass the inlet chamber 28 the spaces between their teeth are filled with gas which is carried around with the gears in their rotation until their outer ends begin to mesh. This action forces the gas towards the apices of the gears, compressing it at the same time and raising its pressure until the outlet chamber 38 is reached, at which time the gas will have reached the desired pressure and will escape through the chamber and outlet 36, carrying with it some of the lubricating and sealing liquid.

The heat generated by the compression is absorbed by the water of the water-jackets of the housing, heads, and closure, thus avoiding excessive temperatures in either the apparatus or the compressed gas.

The lubricating and sealing fluid is delivered from a single source through the several connections in nicely regulated amount, first to the bearing, then to the ends of the gears, and finally to the teeth themselves where they lubricate and at the same time act to seal the apparatus and prevent leakage in operation.

The above described compressor, it will be noted, is of simple, compact, and rugged construction, with close and exact fitting of the parts secured by inexpensive machine operations almost entirely of a turning and boring character. Owing to the method of construction and of fitting the parts, the apparatus may be quickly dismantled for the purpose of examination or replacement, and as quickly reassembled with certainty of proper and exact fitting of the parts.

While the present invention has been shown and described as embodying a particular form of apparatus, it is to be understood that the invention is not necessarily limited thereto, but may be embodied in other forms and constructions within the language of the following claims.

Having thus described the invention, what is claimed is:

1. A rotary compressor comprising a housing having a pair of cylindrical bores, a pair of intermeshing herringbone gears mounted to rotate within the housing in said cylindrical bores, shafts for the gears, one of said shafts being provided with a driving extension, a head for closing the end of the housing and having openings of uniform diameter therethrough adapted to be axially aligned with the bores of the housing, bearings for the shafts in said openings, closures for the inner and the outer ends of said openings, the inner end closures extending into the bores to center the heads and one of said outer end closures being provided with a stuffing-box with packing therein for the driving extension of the gear shaft and with a water-jacket surrounding the packing in the stuffing-box, and means for securing the head to the housing.

2. A rotary compressor comprising a housing having a pair of cylindrical bores, rotary members in the bores provided with intermeshing teeth, a detachable head for the housing, cylindrical openings in the head of less diameter than the bores of the housing and adapted to be aligned coaxially therewith, bearings in the openings in the head, and flanged members having a portion of small diameter adapted to fit closely within an opening in the head between the bearings and the bores of the housing, and a portion co-axial

with the said first mentioned portion and of larger diameter and adapted to fit closely within a bore of the housing and forming end bearings for the rotary members, the housing being provided with a lubricating fluid passage terminating on the end attaching face of the housing and the head being provided with an open groove on its attaching face having a portion adapted to overlap the end of said passage, the open side of the remainder of the groove being closed by the attaching face of the housing and of one of said flange members, the head also being provided with passages between the grooves and the openings for supplying fluid to the bearings, and the flange members being provided with a passage and open slot for delivering lubricating fluid from the bearings to the ends of the rotating members and the teeth thereof.

3. A rotary compressor comprising a housing having a pair of cylindrical bores, intermeshing herringbone gears within the bores, one of said gears being provided with a shaft extending therefrom, a detachable head for the housing, cylindrical openings in the head of less diameter than the bores of the housing and adapted to be aligned co-axially therewith, flanged members having a portion of smaller diameter adapted to fit closely within the openings in the head and a portion co-axially with said first mentioned portion and of larger diameter and adapted to fit closely within a bore of the housing and form end bearings for the rotary members, bearings within the openings in the head, and a combined closure and stuffing-box for closing the outer end of one of the openings and surrounding the shaft, the combined closure and stuffing-box being provided with a cylindrical inner portion to fit closely within the outer end of the opening in the head to center the stuffing-box.

4. A rotary compressor comprising a housing having a pair of parallel cylindrical bores, a pair of inter-meshing gears in said bores having shafts, a detachable head for closing each end of the housing and provided each with a pair of cylindrical openings adapted to be aligned co-axially with the bores of the housing, means for removably fastening said heads to the respective ends of the housing, centering members each having a portion closely fitting within one of said openings in the head and another portion co-axial with the first mentioned portion and closely fitting within the adjacent bore of the housing, each centering member having a central hole through which a shaft extends, means for rigidly fastening these centering members to the respective faces of the heads, so that when the heads are fastened to the ends of the housing the bores of the head will be axially aligned with the bores of the housing, an anti-friction ball-bearing assembly located in each one of the bores of the head, its inner race-way being adjustably mounted on the adjacent shaft and its outer race-way being fitted to the interior of the bore, the inner end of the outer race-way being in abutting relation with that portion of the centering member fitted into the bore and removable cover-means for the outer ends of the two bores of each head, said cover-means being provided with flanges extending into the bores and having abutting relation with the outer ends of said outer race-ways, for the purposes set forth.