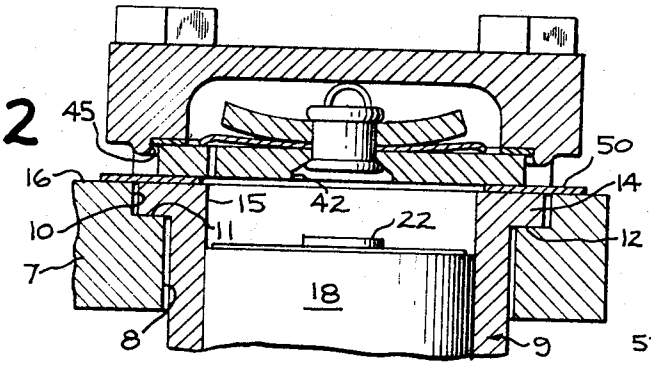
March 26, 1968 O. H. SCHELDORF ETAL 3,374,944

COMPRESSOR UNIT

Filed Aug. 26, 1966

FIG. 2



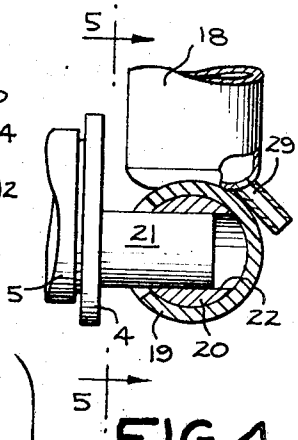


FIG. 4

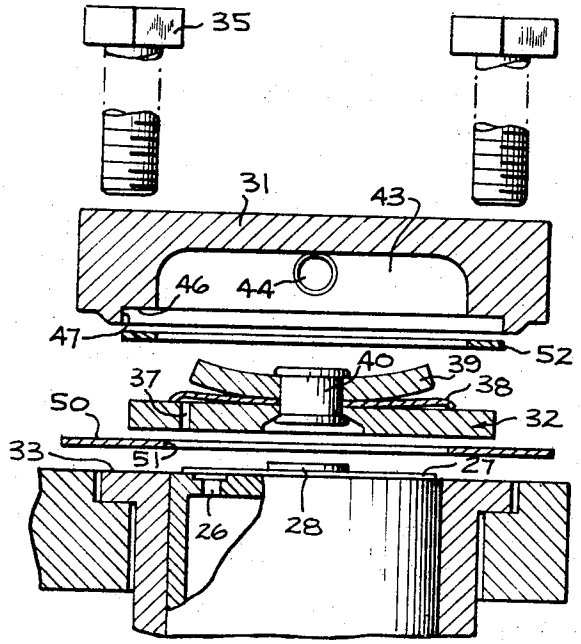
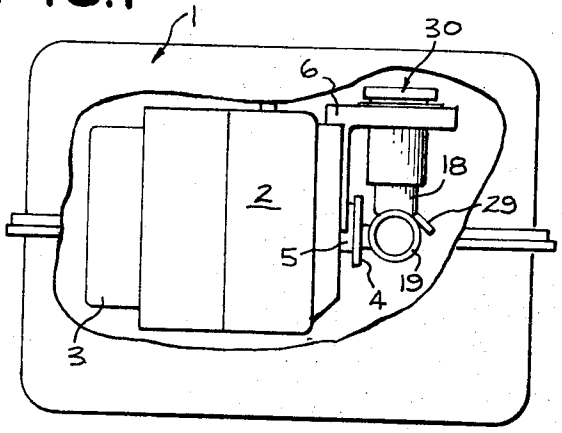


FIG. 3

FIG. 1



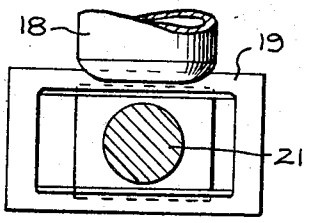


FIG. 5

INVENTORS
OWEN H. SCHELDORF
BY ROBERT E. ROGERS
Walter E. Rule
THEIR ATTORNEY

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COMPRESSOR UNIT

Owen H. Scheldorf, Fern Creek, and Robert E. Rogers, Louisville, Ky., assignors to General Electric Company, a corporation of New York

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3 Claims. (Cl. 230—172)

The present invention relates to a compressor unit and is more particularly concerned with a hermetic Scotch yoke compressor of the type employed in the refrigeration industry.

In the design of relatively small high speed hermetic motor-compressor units of the type employed in the household refrigerator and room air conditioner industries, it is desirable to provide means for compensating for variations in the sizes of the various components within manufacturing tolerances and to keep at a minimum the number of machined or finished dimensions required for the mass production of compressors of uniformly high quality. However, while it is necessary to provide fairly wide manufacturing tolerances in order that the various interfitting parts be interchangeable, it is also desirable that these parts be so designed that they can be easily assembled to provide compressors of uniformly high efficiency at a minimum cost.

It is an object of the present invention to provide a new and improved hermetic compressor adapted to be mass produced and including low cost means for providing a uniformly low clearance volume in the compressor cylinder regardless of manufacturing variations in the components thereof.

Another object of the invention is to provide a Scotch yoke compressor of simplified construction requiring a minimum number of machined or finished dimensions.

Further objects and advantages of the invention will become apparent as the following description proceeds and the features of novelty which characterize the invention will be pointed out with particularity in the claims annexed to and forming part of this specification.

In accordance with the illustrated embodiment of the invention, there is provided a Scotch yoke compressor unit including a bearing and a drive shaft journalled in the bearing and having a crank pin at one end thereof. The frame includes a cylinder support member having an opening therein for loosely receiving the body portion of a cylinder and a shoulder surrounding said opening for supporting a flange on the cylinder in a position such that the cylinder is operatively positioned relative to the crank pin. A hollow piston in the cylinder includes a gas intake at the bottom thereof and a suction valve in the head thereof. Means for operatively connecting the piston to the shaft comprises a yoke rigidly connected to the piston and a cross slide reciprocating in the yoke and having a transverse bore for receiving the crank pin. The piston also includes an axially extending projection on the top thereof adapted when the piston is at the compression end of its stroke to extend beyond the one end of the cylinder. A flat, circular valve plate having a peripheral edge adapted to overlap the one end of the cylinder also includes an axially positioned cavity for receiving the piston projection and positioning the plate relative to the piston and cylinder. The compressor cylinder head including a discharge cavity is provided with an annular relieved area surrounding the cavity for loosely receiving the valve plate. This relieved area is of a depth less than the thickness of said valve plate and includes a shoulder for engaging the upper edge portion of the plate so that when the head is secured to the cylinder support member, it clamps the plate and cylinder flange between the cylinder head and cylinder support member.

For a better understanding of the invention reference may be had to the accompanying drawing in which:

FIGURE 1 is a fragmentary elevational view of a Scotch-yoke compressor incorporating one embodiment of the present invention;

FIGURE 2 is a sectional view of a portion of the compressor of FIGURE 1; and

FIGURE 3 is an exploded view of the components shown in FIGURE 2;

FIGURE 4 is an enlarged sectional view of a portion of the compressor Scotch yoke mechanism; and

FIGURE 5 is a sectional view along line 5—5 of FIGURE 4.

While the invention is applicable to any type of Scotch yoke compressor, it will be particularly described with reference to a hermetic compressor of the fabricated Scotch yoke type. Such a compressor, generally shown in FIGURE 1 of the drawing, is enclosed in a hermetic casing 1 and comprises a cup-like frame 2 for containing and supporting an electric drive motor 3, having a horizontal drive shaft 4 channeled in a bearing contained in the bearing sleeve 5.

A cylinder support member 6 in the form of an L-shaped bracket is rigidly secured to and forms part of the frame 1. The support member 6 includes an arm 7 above and generally parallel to the axis of shaft 4 and having therein an opening 8 for loosely receiving a cylinder 9. For supporting the cylinder 9 on the arm 7, the opening 8 is surrounded by a recessed shoulder 10 having a finished bearing surface 11 adapted to be engaged by the finished lower surface 12 of an outwardly projecting flange 14 on the upper end of the cylinder 9 so that the cylinder bore 15 opens into the upper surface 16 of the arm 7.

A piston 18, slidably or reciprocably received within the cylinder bore 15, is connected to the drive shaft 4 through a Scotch yoke connection including a yoke 19 secured at a right angle to the bottom end of the piston 18. The yoke 19 contains a cross slide 20 horizontally slidable within the yoke and driven by a crank pin 21 eccentrically mounted on the end of the shaft 4 and extending into a transverse bore 22 in the slide 20.

The piston is hollow and includes, as shown in FIGURE 3, a head element 25 having a plurality of suction gas passages 26 and an annular flexible suction valve 27 secured to the top of the piston by a rivet 28. The piston is adapted to receive low pressure gas from the casing through a tubular passageway 29 provided in the lower end thereof so that the hollow piston functions also as an intake muffler.

The compressed gas is discharged from the cylinder through a head and valve structure, generally indicated in FIGURE 1 by the numeral 30, which closes the upper end of the cylinder bore 15.

This assembly 30 as shown in detail in FIGURES 2 and 3 of the drawing comprises a muffle box or cylinder head 31 and a valve plate 32 adapted to be clamped in operating position between the head 31 and the finished upper surface 33 of the cylinder by means of a plurality of bolts 35 extending through the head 31 and into threaded openings (not shown) in the bracket arm 7. More specifically, the valve plate 32, which is preferably of a circular shape, is of a diameter such that its peripheral edges overlap the portions of the finished surface 33 surrounding the upper or open end of the cylinder bore 15. This valve plate 32 includes a plurality of discharge ports 37 communicating with the interior of the cylinder bore 15 and a thin resilient metal discharge valve disk 38 positioned on the upper surface of the valve plate 32 with the periphery thereof overlying the outlet ends of the ports 37. The disk 38 and a valve backing member 39 are

secured to the plate 32 by means of a rivet 40 extending through the plate, disk and backing member. The lower end of the rivet 40 is recessed in an axially or centrally positioned cavity 42 adapted to receive the upper end of the rivet 22 when the piston 18 is in its top dead center position.

The cylinder head 31 also includes a discharge cavity 43 for receiving the high pressure gas from the discharge ports 37, the compressed gas flowing from the cavity 43 through a discharge line 44.

An annular relieved area generally indicated by the numeral 45 is provided in the bottom surface of the cylinder head 31 surrounding the periphery of the cavity 43. This relieved area includes a horizontal surface or shoulder 46 overlying the periphery of the valve plate 32 and a vertical wall portion 47 for loosely receiving only the upper portion of the valve plate.

The advantages of the construction and design of the subject compressor will become more apparent from a consideration of the assembly thereof.

In assembling the compressor, the initial operations include mounting of motor 3 and shaft 4 on the cup-shaped frame component 2 including the bracket 6. After inserting cross slide 20 into yoke 19, and before cylinder 9 is placed into the opening 8, the upper end of the piston 18 is inserted upwardly into the opening 8 a distance sufficient to permit the cross slide to be mounted by means of bore 22 on the crank pin 21. Cylinder 9 is then slipped onto the upper end of the piston through the opening 8 until the collar or flange 14 engages the finished surface 11. The finished mating surfaces 11 and 12 accurately position the cylinder 8 in vertical relation to the crank pin 21 although the loose fit between the cylinder 9 and opening 8 permit limited lateral movement of the cylinder. Shaft 4 is then rotated until the piston 18 is in its upper dead center position. The various components of the compressor are so designed and dimensioned that when the piston is in this top dead center position, the upper surface of the suction valve disk 27 will be either flush with or slightly above the finished upper surface 33 of the cylinder. While maintaining a slight upward force on the piston and a downward pressure on the cylinder, the relative position of the upper surface of the suction valve plate 21 to the finished surface 33 of the cylinder is measured by a suitable gauge. Depending on this difference, a copper shim or gasket 50 having an opening 51 slightly larger than the bore 15 and a thickness adapted to provide the desired clearance volume in the cylinder is placed directly on the surface 33 and the valve plate is positioned relative to the cylinder and piston by placing the cavity 42 over the top end of the rivet 40. The cylinder head 31 is then positioned over the valve plate 32 and secured to the cylinder support member by bolts 35. The radial clearance between the periphery of the valve plate and the vertical wall 47 of the relieved area 45 provides the additional tolerances required for proper positioning of the valve plate and the head relative to the cylinder. Preferably a soft metal gasket such as a copper gasket 52 is interposed between the upper surface of the valve plate 32 and the shoulder 46 forming part of the relieved area 45.

By the provision of a separate cylinder 9 loosely positioned in opening 8 and a valve plate 32 which is separate from the cylinder head 31 and loosely positioned within the relieved area or recess 45, flexibility of design of the various elements is obtained independently of the remaining components of the compressor. Cylinder 9 requires finished surfaces only on the upper and lower surfaces of the flange portion 14 and the surface defining bore 15. In addition, since it is not metallurgically bonded to its support, this component can be made by power metallurgy techniques. Also, the valve plate 32 is not limited directly in shape or contour to the confining surfaces of the head 31 and only the upper and lower surfaces of the valve plate 32 require the generation of sealing surfaces and these surfaces can be generated without regards to the exact thickness of the plate 32.

While there has been shown and described a specific embodiment of the invention it will be understood that it is not limited thereto and is intended by the appended claims to cover all modifications which fall within the true spirit and scope of the invention.

What we claim as new and desire to secure by Letters Patent of the United States is:

1. A compressor comprising:
a frame,
a drive shaft supported by said frame and having a crank pin at one end thereof,
a cylinder,
said frame including a cylinder support member having an opening therein for loosely receiving said cylinder and means for supporting said cylinder with the axis thereof in the plane of rotation of said crank pin,
a piston in said cylinder,
means for operatively connecting said piston to said shaft comprising a yoke rigidly connected to said piston and a cross slide reciprocating in said yoke and having a transverse bore for receiving said crank pin,
a valve plate having a peripheral edge overlapping said one end of said cylinder,
said plate and piston including a cooperating means for positioning said plate relative to said piston when said piston is at the top of its stroke,
a cylinder head including a discharge cavity and an annular relieved area surrounding said cavity for loosely receiving said valve plate, said relieved area including a shoulder for engaging the upper edge portion of said plate,
and fastening means for securing said cylinder head to said cylinder support member to clamp said plate and cylinder in operative positions relative to said piston.

2. A compressor comprising:
a frame including a bearing,
a drive shaft journalled in said bearing and having a crank pin at one end thereof,
a cylinder having an outwardly extending projection adjacent one end thereof,
said frame including a cylinder support member having an opening therein for loosely receiving said cylinder and a surface adjacent said opening for engagement with said projection to support said cylinder with the axis thereof perpendicular to the axis of said shaft and substantially aligned with the plane of rotation of said crank pin,
a piston in said cylinder,
means for operatively connecting said piston to said shaft comprising a yoke rigidly connected to said piston and a cross slide reciprocating in said yoke and having a transverse bore for receiving said crank pin,
said piston having a projection on the top thereof adapted when said piston is at the top of its stroke within said cylinder to extend beyond said one end of said cylinder,
a valve plate having a peripheral edge overlapping said one end of said cylinder,
said plate including a cavity for receiving said piston projection and positioning said plate relative to said piston,
a cylinder head including a discharge cavity and an annular relieved area surrounding said cavity for loosely receiving said valve plate, said relieved area being of a depth less than the thickness of said valve plate and including a shoulder for engaging the upper edge portion of said plate,
and means for securing said cylinder head to said cylinder support member to clamp said plate and cylinder in operative position relative to said piston.

3. A compressor unit comprising:
a frame including a bearing,
a drive shaft journalled in said bearing and having a crank pin at one end thereof,
a cylinder having a body portion and a flange adjacent one end thereof,
said frame including a cylinder support member having an opening therein for loosely receiving the body portion of said cylinder and a shoulder surrounding said opening for supporting said cylinder flange with said cylinder perpendicular to the axis of said shaft and its longitudinal axis substantially aligned with the plane of rotation of said crank pin,
a hollow piston in said cylinder and including a gas intake at the bottom thereof and a suction valve in the head thereof,
means for operatively connecting said piston to said shaft comprising a yoke rigidly connected to said piston and a cross slide reciprocating in said yoke and having a transverse bore for receiving said crank pin,
said piston having an axially extending projection on the top thereof adapted when said piston is at the top of its stroke to extend beyond said one end of said cylinder,
a flat, circular valve plate having a peripheral edge overlapping the said one of said cylinder,

said plate including an axially positioned cavity for receiving said piston projection and positioning said plate relative to said piston and cylinder,
a cylinder head including a discharge cavity and an annular relieved area surrounding said cavity for loosely receiving said valve plate, said relieved area being of a depth less than the thickness of said valve plate and including a shoulder for engaging the upper edge portion of said plate,
and means for securing said cylinder head to said cylinder support member and for clamping said plate and cylinder between said cylinder head and cylinder support member.

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HENRY F. RADUAZO, *Primary Examiner.*